

A microscopic view of red blood cells, showing several biconcave discs in various sizes and orientations, set against a dark red, swirling background that suggests blood flow. The entire image is framed by a thick red border.

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<b>TABLE OF CONTENTS</b> <b>Volume 5, Issue 1, JANUARY 2017</b>		
<b>S. No.</b>	<b>Title of the paper</b>	<b>Page Numbers</b>
<b>1</b>	<b>BIOLOGICAL CONTROL OF SOIL BORNE PATHOGENS (FUSARIUM OXYSPORUM F.SP. CUCUMERINUM.) OF CUCUMBER (CUCUMIS SATIVUS) BY TRICHODERMA SP.</b>	<b>1-9</b>
<b>2</b>	<b>AUTOMATED TRAFFIC COUNTING AND CONTROL.</b>	<b>10-18</b>
<b>3</b>	<b>UNWED MOTHERS IN ODISHA: ISSUES AND CHALLENGES</b>	<b>19-22</b>
<b>4</b>	<b>SCREENING OF RESISTANCE SOURCE AGAINST SPOT BLOTCH DISEASE CAUSED BY BIPOLARIS SOROKINIANA IN TRITICUM AESTIVUM L.</b>	<b>23-28</b>
<b>5</b>	<b>FAMILY ENTREPRENEURIAL BUSINESSES AND NEW VENTURES: FORMATION, CHALLENGES, BEHAVIOR, RELATIONSHIP.</b>	<b>29-47</b>
<b>6</b>	<b>HERNIE INCISIONELLE POST-CŒLIOSCOPIQUE ETRANGLEE : A PROPOS D'UN CAS.</b>	<b>48-50</b>
<b>7</b>	<b>AUTOGENOUS VERSUS COMPOSITE GRAFT FOR THE AUGMENTATION OF ANTERIOR MAXILLA PRIOR TO IMPLANT PLACEMENT – A COMPARATIVE STUDY.</b>	<b>51-56</b>
<b>8</b>	<b>CHARACTERIZATION OF SOLIDUS STRUCTURES OF COMPOSITE MATERIALS.</b>	<b>57-65</b>
<b>9</b>	<b>SYNTHESIS AND EVALUATE OF SOME NEW 1,2,4-TRIAZOLES TO MODIFY EPOXY RESINS IN THE FIELD OF ANTI-MICROBIAL AND ANTI-CORROSIVE ORGANIC COATING.</b>	<b>66-77</b>
<b>10</b>	<b>LOCALISATION INHABITUELLE DE LA TUBERCULOSE OSTEOARTICULAIRE (TALUS) : A PROPOS D'UN CAS.</b>	<b>78-82</b>



11	<b>HISTO-MORPHOMETRICAL STUDY ON KIDNEY GLOMERULI AND CORTICAL TUBULE IN LATE PREGNANCY.</b>	<b>83-88</b>
12	<b>NIGERIAN PUBLIC PRIMARY AND SECONDARY SCHOOL TEACHERS' KNOWLEDGE AND ATTITUDE TOWARDS CARDIOPULMONARY RESUSCITATION.</b>	<b>89-95</b>
13	<b>DISABILITY IN BANK OFFICE WORKERS DUE TO CERVICOGENIC HEADACHE.</b>	<b>96-103</b>
14	<b>CLINICAL PROFILE OF ACUTE ANTERIOR UVEITIS IN A TERTIARY HEALTH CARE CENTRE IN WESTERN ODISHA.</b>	<b>104-107</b>
15	<b>ESTIMATED AVERAGE GLUCOSE, EAG – A MORE INTUITIVE UNDERSTANDING OF GLYCEMIC CONTROL</b>	<b>108-111</b>
16	<b>THE STUDY OF AMINO-ACIDE COMPOSITION OF HELIANTHUS TUBEROSUSE BLOOMS AND ORGANIC SOLVENTS' EXTRACTS BY PHYSIC-CHEMICAL METHODS.</b>	<b>112-117</b>
17	<b>“RADIOMORPHOMETRIC INDICES AND THEIR RELATION TO ALVEOLAR BONE LOSS IN COMPLETELY EDENTULOUSPATIENTS: A PROSPECTIVE STUDY”</b>	<b>118-134</b>
18	<b>SPATIAL AND TEMPORAL ANALYSIS OF WATER QUALITY PARAMETERS OF AHIMALAYANLAKE(DALLAKE)BY MULTIVARIATE STATISTICAL ANALYSIS.</b>	<b>135-143</b>
19	<b>SMOKING PATTERN IN A GROUP OF TUBERCULOSIS PATIENTS, EXPERIENCE OF A MEDICAL COLLEGE HOSPITAL OF BANGLADESH.</b>	<b>144-148</b>
20	<b>IMPACT OF MOBILE PHONE ON THE IRAQI SOCIETY.</b>	<b>149-157</b>
21	<b>ASSOCIATION MINING FROM BIOMEDICAL TEXT WITH NETWORK ANALYSIS</b>	<b>158-169</b>
22	<b>NEARLY QUASI PRIME SUBMODULES</b>	<b>170-180</b>
23	<b>QUANTITATIVE DETERMINATION OF RUBIADIN IN DIFFERENT ACCESSIONS OF RUBIA CORDIFOLIA LINN. BY ISOCRATIC RP-HPLC</b>	<b>181-186</b>



24	THE PREDICTIVE FACTORS OF THE CARDIOVASCULAR INFRINGEMENT IN THE RHEUMATOID ARTHRITIS	187-193
25	DETERMINATION AND QUANTIFICATION OF FLAVONOIDS AND PHENOLIC CONTENT OF WRIGHTIA TINCTORIA R.BR.	194-197
26	EPIDEMIOLOGY AND ETIOLOGY OF CORNEAL ULCER WORLDWIDE SYSTEMATIC REVIEW	198-204
27	LAPAROSCOPY ROLE IN DIAGNOSIS AND MANAGEMENT OF UNEXPLAINED/NONSPECIFIC ABDOMINAL PAIN.	205-209
28	IMPACT OF OLIVE LEAVES CONSUMPTION ON BLOOD SUGAR LEVEL IN ADULTS WITH TYPE-2 DIABETES.A CLINICAL TRIAL:ALMADINAH ALMUNAWARAH, KSA.	210-217
29	CORONARY ARTERY DISEASE IN RHEUMATOID ARTHRITIS – PREVALENCE,PATHOPHYSIOLOGY,RISK AND TREATMENT	218-222
30	ENDOTHELIAL DYSFUNCTION IN RHEUMATOID ARTHRITIS-ROLE OF SYSTEMIC INFLAMMATION, TRADITIONAL CVD RISK FACTORS IN ENDOTHELIAL DYSFUNCTION IN RHEUMATOID ARTHRITIS	223-231
31	PHILOSOPHIE : LA PEUR ET LE DESIR DE VENGEANCE A L'ORIGINE DE LA CONVERSION RELIGIEUSE.	232-244
32	DEFINING DRY SURFACE AREA OF RAZZAH LAKE BY USING GIS.	245-251
33	EFFECT OF PLANT GROWTH REGULATORS ON IMMOBILIZED CELL CULTURE OF ADHATODA VASICA NEES.	252-254
34	COMPLICATION AND OUTCOMES ASSOCIATED WITH SURGICAL MANAGEMENT OF RENAL CELL CARCINOMA: LITERATURE REVIEW.	255-260
35	CONCENTRATION OF CERAMIDE KINASE (CER) AS ASSAY TO MEASURE CELLULAR LEVELS OF CERAMIDE IN SERUM AND TISSUE BY USING ELIZA TECHNIQUE IN BPH, PC, AND HEALTHY MEN IN IRAQ.	261-264



36	IMPRINTS OF PLEISTOCENE SEDIMENTATION IN NARMADA RIFT VALLEY, CENTRAL INDIA.	265-315
37	EFFECT OF BALANCE TRAINING ON POSTURAL CONTROL AND RISK OF FALL IN STROKE PATIENTS.	316-325
38	PHOTOCHEMICAL SCREENING AND ANTIMICROBIAL ACTIVITY OF EUPHORBIA LINEARIFOLIA VAR.NALLAMALAYANA J.L.ELLIS FROM THE NUCLEUS OF EASTERN GHATS.	326-333
39	DEVELOPING SPECIAL RESIDENTIAL ZONE (SRZ) NEAR AN ECONOMICAL MAGNET (SEZ) (A FARMER RESPONSIVE MODEL FOR TARDY PROCESS IN LAND ACQUISITION).	334-335
40	CHECKLIST OF FLOWERING PLANTS SURROUNDING THE WETLANDS IN VADODARA DISTRICT.	336-338
41	INFORMATION SECURITY THREATS: COMPUTER HACKING.	349-356
42	THE IDEA OF PRACTICAL REASONABLENESS.	357-362
43	SOME ASPECTS ON THE TAXONOMY AND IDENTIFICATION OF CORALS.	363-370
44	A KINETIC STUDY OF THE OXIDATION OF NITRITE ION BY PEROXODISULPHATE.	371-377
45	BONE CANCER- CURRENT PHARMACOTHERAPEUTIC APPROACH.	378-391
46	ELIMINATION CONTORTION OR MISS SHAPING EFFECT IN VERTICAL POLE (MAST) OF 50T LEVEL LUFING CRANE.	392-395
47	CANCER CACHEXIA - A REVIEW.	396-401
48	EVALUATION OF BITE FORCE AMONG DIFFERENT AGE GROUPS IN VISAKHAPATNAM DISTRICT.	402-407
49	EVALUATION OF PET/CTROLE IN DIAGNOSIS AND MANAGEMENT OF PEDIATRIC MALIGNANCY	408-419
50	EFFECT OF SERUM COPPER LEVELS IN TYPE 2 DIABETES MELLITUS WITH NEPHROPATHY: A CASE CONTROL STUDY IN NORTH INDIAN POPULATION.	420-424

51	THE INTERSTATE (ASSAM AND GUJARAT) DIFFERENCES IN THE ENVIRONMENTALLY ADJUSTED GSDP	425-431
52	CHROMOSOMAL ANALYSIS OF MULBERRY SILKWORM (BOMBYX MORI. L) FROM JAMMU REGION.	432-440
53	MENTAL STATES IN WOMEN: THE ROLE OF FAMILY	441-449
54	AN APPROACH TO ELLIPTIC CURVES AND DISCRETE LOGARITHMIC PROBLEM.	450-457
55	A STUDY ON PHYTODIVERSITY IN FLOURIDE CONTAMINATED SITE NEAR COROMANDEL AREA IN VISHAKHAPATNAM.	458-466
56	GENETIC POLYMORPHISM OF PARAOXONASE 3 GENE ALA99ALA IN ADJAMMAHETHNIC GROUPS IN BENIN.	467-471
57	MANNU BHANDARI KI KAHANIYO ME NARI : DASHA YAUM DISHA	472-474
58	A STUDY ON SCOPE OF EXTERNAL EQUITY FINANCE IN MSME UNITS IN INDIA.	476-485
59	A STUDY ON MSME PROFITABILITY IN CONNECTION WITH POOR MARKET LINKAGE	486-495
60	ROLE OF SPIRITUAL AND RELIGIOUS PRACTICES IN MODERN MEDICAL THERAPY	496-497
61	10 YEARS PREVALENCE OF HEPATITIS B INFECTION AMONG WOMEN DELIVERING AT KAMC-JEDDAH AND THEIR INFANTS.	498-501
62	BASILINE RENAL DYSFUNCTION IN ACUTE ISCHEMIC STROKE PATIENTS: PREVALENCE AND IMPACT ON EARLY MORTALITY.	502-508
63	INVESTIGATING AN ADOPTION OF SMARTPHONE: A ROAD TO UBIQUITOUS BUSINESS MANAGEMENT.	509-516
64	ADSORPTION STUDIES OF PB (II) FROM AQUEOUS SOLUTION BY USING MODIFIED DATE PALM TRUNK.	517-525
65	EDUCATING ENVIRONMENTAL LITERATE CITIZENS IN ASTRITSI GORGE: A NARRATIVE REFLECTION.	526-534



66	FIBULAR OSTEOSYNTHESIS WITH CANNULATED HIP SCREW FIXATION OF NEGLECTED FEMORAL NECK FRACTURE IN A YOUNG ADULT: CASE REPORT.	536-539
67	IMPACT OF BLOODSTAIN PATTERN ANALYSIS IN CRIME SCENE INVESTIGATION.	540-552
68	TOPICAL ANTISEPTICS IN EAR SURGERIES AND OTOTOXICITY EFFECT: REVIEW ARTICLE	553-558
69	KISSING NEVUS WITH OCULAR MELANOSIS: A CASE REPORT IN HAIL REGION, SAUDI ARABIA.	559-560
70	CARDIOVASCULAR ABNORMALITIES IN HIV INFECTED PEDIATRIC POPULATION IN KERALA.	561-565
71	ASPARTATE AMINOTRANSFERASE TO PLATELET RATIO INDEX VERSUS NEUTROPHIL TO LYMPHOCYTE RATIO FOR PREDICTION OF POST RADIOFREQUENCY ABLATION RECURRENCE OF HEPATOCELLULAR CARCINOMA.	566-572
72	FILLING DEFECT IN ABDOMINAL X-RAY POST RECTAL CONTRAST HELPS TO DIAGNOSE DESCENDING COLON PERFORATION	573-576
73	DESIGN AND IMPLEMENTATION OF HIGH PERFORMANCE ANALOG CMOS BASED CIRCUITS USING PSPICE: AN OVERVIEW.	577-581
74	NANOPARTICLES: NEOTERIC PLATFORM AGAINST MULTI DRUG RESISTANCE TUBERCULOSIS	582-593
75	DIVERSITY, COMPTABILITY AND NITROGEN FIXATION OF WILD LEGMES RHIZOBIA.	594-602
76	EPIDEMIOLOGY OF OBESITY IN ARAR CITY, NORTHERN SAUDI ARABIA.	603-609
77	HEALTH EFFECTS OF LOW LEVEL IONIZING RADIATION COMPARED TO ESTIMATED UV INDEX IN SHARM EL-SHEIKH, EGYPT.	610-624
78	SCREENING OF AGRO-RESIDUES FOR THE PRODUCTION OF MICROBIAL TANNASE.	625-631

79	<b>RARE CAUSE AND PRESENTATION OF SEVERE HYPERTRIGLYCERIDEMIA.</b>	<b>632-638</b>
80	<b>DIAGNOSTIC VALUE OF CONVENTIONAL CYTOGENETIC ANALYSIS IN SELECTED CHILDREN WITH ATTENTION-DEFICIT HYPERACTIVITY DISORDER.</b>	<b>639-646</b>
81	<b>THE ROLES OF LEADERS FOR SUSTAINABLE DEVELOPMENT OF ORGANIZATION</b>	<b>647-654</b>
82	<b>ASSESSMENT OF AWARENESS OF MEDICAL STUDENTS IN THE CLINICAL PHASE IN KSAU-HS,COM, RIYADH TOWARDS ZIKA VIRUS</b>	<b>655-659</b>
83	<b>A UNIQUE CO-RELATION: POSTMENOPAUSAL ESTROGEN DEFICIENCY AND ANEURYSMAL SUBARACHNOID HEMORRHAGE.</b>	<b>660-665</b>
84	<b>DIABETIC CONTROL AND ATYPICAL ANTIPSYCHOTICS: A CASE REPORT.</b>	<b>666-669</b>
85	<b>EVALUATION OF SYSTOLIC DYSFUNCTION IN PATIENTS WITH LYMPHOPROLIFERATIVE DISORDERS AFTER STEM CELL TRANSPLANT: A SINGLE CENTER EGYPTIAN EXPERIENCE.</b>	<b>670-678</b>
86	<b>IMPACT OF ECONOMIC REFORMS IN EXPENDITURE PATTERN OF TAMIL NADU</b>	<b>679-684</b>
87	<b>ASSESSMENT OF CADMIUM TOXICITY ON THE RED BLOOD CELLS OF AQUATIC LIFE.</b>	<b>685-688</b>
88	<b>THE IMPACT OF BOXING EXPERIENCE ON SHOULDER INTERNAL ROTATOR MUSCLES CONCENTRIC AND ECCENTRIC STRENGTH.</b>	<b>689-697</b>
89	<b>IMMUNOHISTOCHEMICAL EXPRESSION OF CYTOKERATIN 20IN COLORECTAL TUMORS AMONG SUDANESE PATIENTS.</b>	<b>698-702</b>
90	<b>PRETERM LABOUR: A STUDY OF ETIOLOGICAL RISKFACTORS AND PERINATAL OUTCOME.</b>	<b>703-707</b>
91	<b>SOME VERY SPECIAL PYTHAGOREAN TRIANGLES WITH THEIR PERIMETERS AS BOTH TRIANGULAR AND PENTAGONAL NUMBERS.</b>	<b>708-714</b>
92	<b>SYNTHESIS AND X-RAY ANALYSIS OF COMPLEX FERRITE BILIFE2O5</b>	<b>715-717</b>

93	CARDIOVASCULAR SYSTEM PROBLEMS AMONG GERIATRIC POPULATION OF ARAR CITY, KINGDOM OF SAUDI ARABIA: PREVALENCE AND DETERMINANTS	718-724
94	ANGIOLEIOMYOMA OF THE NASAL CAVITY AN UNUSUAL TUMOR.	725-729
95	THE KNOWLEDGE AND BEHAVIOUR OF FEMALE SEX WORKERS TOWARDSTHE RISK OF HIV/AIDS: A REVIEW.	730-733
96	THE EFFECT OF INTERFERON/RIBAVIRIN THERAPY ON THE LEVELS OF ANGIOPOETIN-2 ANDTIE-2 IN CHRONIC HEPATITIS C PATIENTS.	734-740
97	EFFECT OF DIODE LASER DEPIGMENTATION ON GINGIVAL TISSUE OF DOGS.	741-750
98	BACTERIA EXTRACT ACTIVITY ASSOCIATED WITH SPONGESHALICLONASP.2 ANDAXINELLID SP.AS ANTIBACTERIAL.	751-759
99	SOCIO-ECONOMIC STATUS OF FARMER'S OF THE BASIS OF FAMILY PROFILE AND MATERIALS POSSESSED INVOLVED IN POTATO CULTIVATION ACTIVITIES.	760-765
100	COMPARITIVE EVALUATION OF SALIVARY IG A LEVELS AND DENTAL CARIES IN OBESE AND NON OBESE CHILDREN.	766-772
101	THE RISK OF EMPHASIS ON ENTREPRENEUR SKILLS AS A DRIVER FOR SUCCESSFUL BUSINESS PERFORMANCE IN BOTSWANA: A CASE STUDY.	773-781
102	ASSESSMENT OF WATER QUALITY IN TERMS OF PHYSICO – CHEMICAL PARAMETERS OF EAST GODAVARI MANGROVE ECOSYSTEM (CORINGA WILDLIFE SANCTUARY) EAST GODAVARI, ANDHRA PRADESH, INDIA.	782-788
103	IMMUNOHISTOCHEMICAL EXPRESSION OF GLUT-1 IN EPITHELIAL OVARIAN TUMORS: CORRELATION WITH THE CLINICOPATHOLOGICAL FACTORS AND TUMOR PROLIFERATIVE MARKER PCNA.	789-800



104	TOXIC EFFECTS OF CU(SO <sub>4</sub> ) ON GILL AND LIVER TISSUES OF FRESH WATER CATFISH CLARIAS BATRACHUS (LINN.).	801-806
105	PRIMARY PULMONARY HYPERTENSION DURING PREGNANCY: A CASE REPORT.	807-812
106	ACUTE PANCREATITIS RELATED TO THERAPEUTIC DOSING WITH COLCHICINE: A CASE REPORT.	813-816
107	OPTIMIZATION OF ALLELE SPECIFIC PCR (AS-PCR) FOR THE EARLY DETECTION OF FLT3 (D835Y) MUTATION IN ACUTE MYELOID LEUKEMIA PATIENTS AT TABUK, SAUDI ARABIA.	817-822
108	TRAUMATIC APPENDICITIS: A CASE REPORT.	823-826
109	COMPARISON OF LABORATORY METHODS FOR THE DIAGNOSTIC OF TRICHOMONASIS.	827-828
110	UTILITY OF AMPLIFICATION REFRACTORY MUTATION SYSTEM PCR FOR THE DETECTION OF JAK2 MUTATION IN CHRONIC MYELOPROLIFERATIVE DISORDERS.	829-837
111	THE DETERMINATION OF THE COLORING CENTERS THROUGH CASTING (C-DCPF )5% - (PMMA) FILM AND NEW OPTICAL COMPARATIVE STUDYING WITH ITS E-ISOMER.	838-848
112	DEVIANT BEHAVIOUR ELICITED BEFORE DETENTION BY THE MALAY FEMALE JUVENILE DETAINEES IN REHABILITATION CENTER	849-856
113	SHOULD INDIAN RAILWAYS BE PRIVATIZED?	857-863
114	TRAITEMENT CHIRURGICAL DE LA RUPTURE DU LIGAMENT CROISE ANTERIEUR CHEZ L'ENFANT SELON LA TECHNIQUE DE MAC-INTOSH MODIFIEE JAEGER (A PROPOS D'UNE SERIE CONTINUE DE 23 CAS).	864-870
115	A STUDY ABOUT AVERAGE CYCLE TIME IN MAINTENANCE OF EQUIPMENT.	871-878
116	LASER DENTISTRY – “Enhancing Dental Perfection”.	879-884
117	SYNTHESIS AND STRUCTURAL PROPERTIES OF ZnO NANOPARTICLES BY ALTERNANTHERA SESSILE LEAVES EXTRACT.	885-899

118	<b>GAP ANALYSIS- A COMPARATIVE ANALYSIS OF CUSTOMER GAP BETWEEN PRIVATE AND PUBLIC SECTOR BANKS IN JAMMU AND KASHMIR.</b>	<b>890-906</b>
119	<b>EDUCATIONAL PHILOSOPHY OF THOMAS GAVAN DUFFY: WITH SPECIAL REFERENCE TO THE METHODS OF TEACHING IN THE PRIMARY SCHOOLS AND ITS SIGNIFICANT IMPACTS ON MODERN EDUCATION.</b>	<b>907-911</b>
120	<b>THE SELF NOMINATED DOCTORS: IRRATIONAL THE PRACTICE; HEADACHE THE PROFESSIONALS; HARMING THE PUBLIC; NATIONAL THE PROBLEM - THE INDUSTRY OF QUACKERY.</b>	<b>912-914</b>
121	<b>COMPARATIVE STUDY OF E-MARKETING IN INDIA &amp; CHINA.</b>	<b>915-918</b>
122	<b>THE ROLE OF MRI IN THE EARLY DETECTION OF MULTIPLE SCLEROSIS.</b>	<b>919-926</b>
123	<b>FACTORS AFFECTING GROWTH OF THE FISHING INDUSTRY IN PUNTLAND: A CASE STUDY OF EYL DISTRICT.</b>	<b>927-935</b>
124	<b>PULSED ND: YAGLASER VERSUS ULTRASOUND IN TREATMENT OF OSTEOPOROSIS.</b>	<b>936-941</b>
125	<b>SOFTWARE TO COMPUTE PILE LOAD CAPACITY IN CASE OF VARIABLE SOIL STRATIFICATION.</b>	<b>942-965</b>
126	<b>DRUG COMPLIANCE AMONG TYPE 2 DIABETIC PATIENTS IN JAZAN REGION, SAUDI ARABIA.</b>	<b>966-974</b>
127	<b>PSYCHO-SOCIAL PROBLEMS OF OBESITY AMONG MALE STUDENTS IN QASSIM UNIVERSITY IN SAUDI ARABIA.</b>	<b>975-979</b>
128	<b>MOTHERS KNOWLEDGE ABOUT THE OTITIS MEDIA RISK FACTORS AMONG CHILDREN: MULTI-CENTRIC SAUDI STUDY.</b>	<b>980-985</b>
129	<b>A DYNAMIC PANEL DATA MODEL FOR ANALYZING THE RELATIONSHIP BETWEEN MILITARY EXPENDITURE AND ECONOMIC GROWTH AND POPULATION IN 54 LESS DEVELOPED COUNTRIES.</b>	<b>986-992</b>

130	ASSESSMENT LEVEL OF AWARENESS TOWARD RADIATION EXPOSURE RISK AMONG COMMUNITY IN MAKKAH CITY.	993-1002
131	LOCATION OF POSTERIOR OCCLUSAL PLANE WITH REFERANCE TO RETROMOLAR PAD IN KASHMIRI POPULATION.	1003-1005
132	A PROPOSED ARCHITECTURAL FRAME WORK FOR SECURE THE CLOUD DATA STORAGE TO PRODUCT MULTIMEDIA DATA.	1007-1011
133	EXISTING AND FUTURE MSW GENERATION NEXUS POPULATION AND GDP GROWTH, THE CASE OF MEKELE CITY, ETHIOPIA	1012-1020
134	RECYCLED POLYPROPYLENE/BOEHMITE ALUMINA NANOCOMPOSITES: ENHANCED STRUCTURE, THERMAL AND MECHANICAL PROPERTIES.	1021-1028
135	PSYCHOLOGICAL STRESS AMONG UNDERGRADUATE MEDICAL STUDENTS OF SAUDI ARABIA: A CROSS SECTIONAL SURVEY.	1029-1035
136	DETERMINATION OF PHYSICOCHEMICAL PARAMETERS AND DIVERSITY PATTERN OF THREE DIFFERENT PLACES OF KANYAKUMARI DISTRICT.	1036-1039
137	CLINICAL CHARACTERISTICS OF GIST AND THE POSSIBLE ROLE OF SMOOTH MUSCLE ACTIN (SMA) AS A PROGNOSTIC FACTOR – INITIAL 5 YEAR EXPERIENCE IN A TERTIARY CARE CENTRE IN DAKSHINA KANNADA DISTRICT.	1040-1042
138	GENDER DISCRIMINATION IN EDUCATION: A VIOLATION OF HUMAN RIGHT.	1043-1047
139	GENETIC DIVERSITY STUDIES IN SIX BIVOLTINE RACES OF BOMBYX MORI L., BASED ON PHENOTYPIC CHARACTERS.	1048-1054
140	PROPERTIES AND APPLICATION OF MICROBIAL TRANSGLUTAMINASE PRODUCED FROM A NEWLY ISOLATED STRAIN OF STREPTOMYCES SP.	1055-1062
141	INTERNET ADDICTION AMONG STUDENTS OF HEALTH FACULTIES IN JAZAN UNIVERSITY, KSA.	1063-1069



142	AN AUTOPSY BASED COMPARATIVE STUDY OF PATTERN OF INJURIES IN PEDESTRIANS INVOLVED IN RAILWAY TRACK DEATHS.	1070-1077
143	SURVEY OF MINOR FOREST PRODUCTS AND THEIR VALUES IN SIRSI TALUK	1078-1086
144	OBSERVATIONAL STUDY OF ETOMIDATE AND THIOPENTONE AS INDUCTION AGENT IN CARDIAC SURGERY PATIENTS	1087-1092
145	IDENTIFYING EPIGENETIC ENDPOINTS OF PESTICIDE EXPOSURE CAN CURTAIL RISK TO DEVELOP CANCER: A REVIEW.	1093-1107
146	“AN OBSERVATIONAL STUDY TO COMPARE THE EFFECTS OF DEXMEDETOMIDINE AND ESMOLOL IN ATTENUATING THE HAEMODYNAMICRESPONSE TO LARYNGOSCOPY AND ENDOTRACHEAL INTUBATION”	1108-1113
147	ALPINIA CALCARATA: A NEW DISTRIBUTIONAL RECORD IN THE ZINGIBERACEAE FLORA OF MANIPUR.	1114-1115
148	EFFECT OF BACKGROUND PLASMA UPON PLASMA STRUCTURE FIRED FROM A PLASMA GUN	1116-1120
149	BIG FIVE PERSONALITY AND PSYCHOLOGICAL CAPITAL AMONG FINAL YEAR MEDICAL STUDENTS.	1121-1126
150	ANTIBACTERIAL ACTIVITY OF MICROORGANISMS ASSOCIATED WITH MARINE INVERTEBRATES FROM THE MOROCCAN ATLANTIC COAST.	1127-1133
151	STRUCTURAL VALIDATION AND HOMOLOGY MODELING OF DIFFERENTIALLY EXPRESSED PROTEINS IN RATTUS NORVEGICUS INDUCED BY BISPHENOL A AND PROBIOTIC TREATMENT	1134-1151
152	SURVEILLANCE AMONG ADULTS TO ASSESS KNOWLEDGE AND ATTITUDE TOWARDS ACNE VULGARIS IN SAUDI ARABIA.	1152-1154

153	EXPRESSION OF CD200 IN CD5 POSITIVE B-CELL LYMPHOPROLIFERATIVE DISORDER (B-CLL AND MCL) AND ITS ROLE IN THE DISCRIMINATION BETWEEN THESE DISORDERS.	1155-1160
154	CRACK TOOTH SYNDROME AND ITS MANAGEMENT.	1161-1166
155	AMELIORATIVE EFFECT OF THE AURELIA AURITA VENOM ON THE MURINE EHRLICH ASCITES CARCINOMA-INDUCED HEPATOTOXICITY AND NEPHROTOXICITY.	1167-1178
156	BACTERIAL CONTAMINATION OF HEALTHCARE WORKERS' MOBILE PHONES IN A TERTIARY CARE CENTER IN SAUDI ARABIA	1179-1183
157	CELL SUSPENSION CULTURE - AN IMPROVED SYSTEM FOR PRODUCTION OF COLCHICINE FROM GLORIOSA SUPERBA L.	1184-1190
158	ENHANCEMENT OF ENERGY EFFICIENT ROUTING PROTOCOL BY MINIMIZING ENERGY CONSUMPTION IN WIRELESS SENSOR NETWORKS.	1191-1194
159	EFFECT OF IMPELLER TYPE AND ROTATIONAL SPEED ON FLOW BEHAVIOR IN FULLY BAFFLED MIXING TANK.	1195-1208
160	PREVALENCE OF ASTHMA AMONG SAUDI CHILDREN IN MAKKAH, SAUDI ARABIA	1209-1214
161	DIABETES MELLITUS AMONG ADULT MALE POPULATION OF ARAR CITY, NORTHERN SAUDI ARABIA.	1215-1220
162	PREVALENCE AND AWARENESS OF OBESITY AMONG SAUDI FEMALE IN RIYADH, SAUDI ARABIA.	1221-1225
163	A STUDY ON CUSTOMER SATISFACTION OF HONDA BIKES WITH REFERENCE TO CHINNAMANUR TOWN, THENI DISTRICT.	1226-1232
164	METASTATIC OVARIAN TUMOR DISCOVERED ACCIDENTALLY DURING CESAREAN SECTION IN A 34-YEAR-OLD WOMAN: A CASE REPORT.	1233-1238

165	ACCELERATION OF DISTANCE COMPUTATION FOR MULTIPLE SEQUENCE ALIGNMENT ON MULTI-CORE ARCHITECTURES	1239-1245
166	ONLY EDUCATION IS NOT ENOUGH: A NECESSITY OF ALL-INCLUSIVE SERVICES FOR TECHNICAL EDUCATION.	1246-1253
167	MINERAL TRIOXIDE AGGREGATE (MTA) FOR APICAL BARRIER FOR IMMATURE NECROTIC PERMANENT TEETH - FOUR CASE REPORTS	1254-1258
168	NARRATING THINGS FALL APART THROUGH THE PRISM OF LANGUAGE	1259-1262
169	CLINICO ETIOLOGICAL PROFILE OF HYPONATREMIA IN IMCU OF KANNIYAKUMARI GOVERNMENT MEDICAL COLLEGE	1263-1270
170	LASER 805NM EFFECTS ON BACTERIAL GENETIC AND SENSITIVITY TOWARD ANTIBIOTICS.	1271-1275
171	HISTOPATHOLOGY OF GALLBLADDER IN IRON DEFICIENCY ANEMIA PATIENTS UNDERGOING CHOLECYSTECTOMY: A PROSPECTIVE STUDY	1276-1282
172	KNOWLEDGE & ATTITUDES TOWARD ELECTROCONVULSIVE THERAPY (ECT) AMONG A SAMPLE OF HEALTH FIELD STUDENT AND THE GENERAL PUBLIC IN SAUDI ARABIA AT "QASSIM"	1283-1289
173	PATCH-WISE IMAGE DE-NOISING TECHNIQUE FOR IMPROVED PMRI USING ITERATIVE BILATERAL FILTER, LRMD AND SVM OF MEDICAL IMAGES.	1290-1296
174	SCRAMBLING FACE IMAGES FOR PRIVACY PROTECTION USING ARNOLD TRANSFORM	1297-1303
175	PREVALENCE OF LOWER BACK PAIN AMONG TAIBAH UNIVERSITY STUDENTS.	1304-1313
176	“COMPARATIVE EVALUATION OF ETOMIDATE AND THIOPENTONE SODIUM WITH ROCURONIUM FOR RAPID SEQUENCE INTUBATION IN PREGNANT PATIENTS UNDERGOING LOWER SEGMENT CAESEREAN SECTION (LSCS)” A COMPARATIVE STUDY.	1314-1319



177	<b>BILATERAL SEQUENTIAL LUNG TRANSPLANT FOR PULMONARY ALVEOLAR MICROLITHIASIS.</b>	<b>1320-1322</b>
178	<b>VARIABILITY OF MESENCHYMAL VEGFR 1, 2, AND 3 PROTEIN EXPRESSION OF HUMANS AND MURINE SPECIES - A COMPARATIVE ANALYSIS.</b>	<b>1323-1333</b>
179	<b>HISTOPATHOLOGICAL ANALYSIS OF BREAST LUMP IN A TERTIARY CARE HOSPITAL.</b>	<b>1334-1337</b>
180	<b>LEVEL OF EDUCATION AMONG DIABETIC PATIENT REGARDING DIABETIC FOOT IN MAKKAH POPULATION</b>	<b>1338-1346</b>
181	<b>NEUROLOGICAL DISEASES AMONG GERIATRIC POPULATION OF ARAR CITY, KINGDOM OF SAUDI ARABIA: A CROSS SECTIONAL STUDY</b>	<b>1347-1354</b>
182	<b>SPATIAL DIMENSIONS OF MULTIPLIERS IN SUMATRA ISLAND ECONOMY: AN INTER-REGIONAL INPUT-OUTPUT ANALYSIS.</b>	<b>1355-1365</b>
183	<b>REVIEW OF USABILITY AND DIGITAL DIVIDE FOR ICT IN AGRICULTURE.</b>	<b>1366-1371</b>
184	<b>“THERE IS MORE TO THE WORLD THAN ONE PLUS ONE”: EXPLORING THE PROCESS OF SELF-ACTUALIZATION IN WALTER MOSLEY’S THE MAN IN MY BASEMENT.</b>	<b>1372-1379</b>
185	<b>GROSS, HISTOMORPHOLOGICAL AND HISTOCHEMICAL STUDY OF JEJUNUM IN VANARAJA AND CARI SHYAMA.</b>	<b>1380-1385</b>
186	<b>EPIDEMIOLOGICAL STUDY OF END STAGE RENAL DISEASE PATIENTS MAINTAINED ON HAEMODIALYSIS IN EL-MINIA GOVERNORATE; EGYPT.</b>	<b>1386-1400</b>
187	<b>THE PRACTICES OF UNIVERSITY STUDENTS REGARDING TESTICULAR SELF-EXAMINATION AND AN EVALUATION ON THE EDUCATION GIVEN TO UNIVERSITY STUDENTS</b>	<b>1401-1406</b>
188	<b>ANTIBACTERIAL MODE OF ACTION OF THE ROSEMARY/EUCALYPTUS OIL COMBINATION ON THE MEMBRANE INTEGRITY OF SELECTED FOOD BORNE PATHOGENS.</b>	<b>1407-1412</b>

189	KNOWLEDGE AND AWARENESS ABOUT OSTEOPOROSIS AMONG SAUDI ADULTS IN RIYADH, SAUDI ARABIA,2016	1413-1420
190	ACUTE HEPATITIS A VIRUS INFECTION PRESENTING WITH MULTIORGAN DYSFUNCTION: A CASE REPORT.	1421-1424
191	ENVIRONMENT AND HEALTH ISSUES ASSOCIATED WITH E-WASTE	1425-1430
192	PSYCHO-SOCIAL PROBLEMS OF OBESITY AMONG MALE STUDENTS IN QASSIM UNIVERSITY IN SAUDI ARABIA.	1431-1435
193	DESIGN AND DEVELOPMENT OF A VERTICAL AXIS LOW SPEED WIND GENERATOR.	1436-1440
194	EVALUATION OF KNOWLEDGE, ATTITUDE AND PRACTICE OF HIV/AIDS IN THE STUDENTS AT TAIBAH UNIVERSITY	1441-1449
195	PREVALENCE OF RAL CANCER IN PERSONS WITH ALCOHOL ABUSE AND ITS CORRELATION WITH SERUM AMINO TRANSFERASE LEVELS – A CASE CONTROL STUDY.	1450-1455
196	IMPACT OF MAHATMA GANDHI NATIONAL RURAL EMPLOYMENT GUARANTEE SCHEME IN HARYANA.	1456-1465
197	SYSTEMIC ANTIOXIDANTS IN MANAGEMENT OF RAL SUBMUCOUS FIBROSIS: A SYSTEMATIC REVIEW OF RANDOMISED CONTROL TRIALS AND META-ANALYSIS.	1466-1479
198	ENHANCED SECURE CLOUD DATA PROTECTION MODEL BY INTEGRATING DUAL SYSTEM ENCRYPTION TECHNOLOGY WITH SELECTIVE PROOF TECHNIQUE.	1480-1488
199	EVALUATION OF GREEN AREAS ACCORDING TO THE DETERMINANTS OF URBAN BENEFITS AND, REFLECTION UPON “GREEN AREA STANDARDS”	1489-1502
200	ARE SOVEREIGN BONDS MORE RISKY THAN SOVEREIGN SUKUK? EVIDENCE FROM MALAYSIAN MARKET.	1503-1513
201	ASSESSMENT OF EXISTING PHYSICAL FEATURES OF RURAL KITCHEN IN KANPUR DEHAT.	1514-1517

202	<b>ARGINASE ENZYMEACTIVITY AND LACTOFERRINPROTEINCONCENTRATION IN EGYPTIAN DIABETIC PATIENTS.</b>	<b>1518-1523</b>
203	<b>SEVERE AND RECALCITRANT CHRONIC URTICARIA RESOLVED AFTER FILLER REMOVAL.</b>	<b>1524-1526</b>
204	<b>CELIAC DISEASE AWARENESS AMONG PHYSICIANS IN SAUDI ARABIA: AN EPIDEMIOLOGICAL STUDY.</b>	<b>1527-1534</b>
205	<b>METABOLIC SYNDROME AND ELEVATEDOSTEOPONTIN: THEIR ASSOCIATED COMORBIDITIES IN PATIENTS WITH PSORIASIS.</b>	<b>1535-1546</b>
206	<b>HELICOBACTER PYLORI ERADICATION EFFECT ON LIVER FAT CONTENT IN PATIENT WITH NON-ALCOHOLIC FATTY LIVER DISEASE.</b>	<b>1547-1553</b>
207	<b>FUNCTIONAL HYPOPARATHYROIDISM AMONG TYPE 2 DIABETIC PATIENTS ON HEMODIALYSIS: IMPACT OF GLYCEMIC CONTROL.</b>	<b>1554-1555</b>
208	<b>IMPLEMENTATION OF MARRIAGE DISSOLUTION BY LI'AN(INVOKING MUTUAL CURSES) IN ISLAM.</b>	<b>1566-1570</b>
209	<b>THE DRAMA OF AUGUST WILSON: FENCING A NEW IDENTITY IN AFRICAN AMERICAN THEATRICAL IMAGINATION.</b>	<b>1571-1578</b>
210	<b>NOVAL TRAITS FOR IDENTIFYING AMARANTHUS SPINOSUS L. USING SYSTEMATIC AND BIOCHEMICAL ANALYSIS.</b>	<b>1579-1584</b>
211	<b>THE ROLE OF AUDITING QUALITY IN NARROWING THE EXPECTATIONS GAP IN AUDITING PROFESSION.</b>	<b>1585-1597</b>
212	<b>THE ROLE OF COMMERCIAL STREETS AS A CHANNEL OF MOVEMENT IN RELATING TO THE SENSE OF PLACE</b>	<b>1598-1607</b>
213	<b>“SUSTAINING A COMPETITIVE EDGE IN THE CHANGING GLOBAL SCENARIO – BALANCED SCORECARD AND INDIAN BUSINESS ENVIRONMENT – AN EXCLUSIVE STUDY”</b>	<b>1608-1616</b>

214	EFFECT OF MCKENZIE EXTENSION BIAS EXERCISES WITH THAT OF STRENGTHENING EXERCISES IN LOW BACK PAIN IN POWER LIFTERS.	1617-1624
215	A STUDY OF TORSIONAL EFFECT ON MULTI-STORIED BUILDING WITH PLAN-IRRREGULARITY.	1625-1632
216	PRIORITY BASED FAIR RESOURCE ALLOCATION AND ADMISSION CONTROL TECHNIQUE FOR MULTICLASS TRAFFIC IN LTE-ADVANCED NETWORK.	1633-1641
217	SYNTHESIS AND CHARACTERIZATIONS OF NEEDLE- SHAPED CUO NANOPARTICLES FOR BIODIESEL APPLICATION.	1642-1648
218	PHILOSOPHICAL ASSUMPTION IN MEASURING AESTHETICS OF A BUILDING	1649-1651
219	TURMERIC: THE GOLDEN AND PRECIOUS GIFT OF NATURE	1652-1655
220	SKIN RASH AND DEVELOPMENTAL DELAY IN A NEWBORN WITH PSEUDOHYPOALDESTRONISM.	1656-1659
221	TITLE OF THE PAPER – PRELIMINARY PHYTOCHEMICAL ANALYSIS OF DIFFERENT SOLVENT EXTRACTS OF LAGENARIA SICERARIA (MOLINA) STANDL. AND LUFFA CYLINDRICA (L.) M.ROEM VEGETABLE PEEL WASTE.	1660-1665
222	IMPACT OF STOCK DIVIDEND/BONUS ISSUE ON RETURNS OF STOCK LISTED IN KARACHI STOCK EXCHANGE.	1666-1678
223	WOMEN EMPOWERMENT AND DEVELOPMENT IN NEW INDIA	1679-1682
224	COMPLETE NUCLEOTIDE SEQUENCE OF A MONOPARTITE TOMATO LEAF CURL NEW DELHI VIRUS AND BETASATELLITE DNA ASSOCIATED WITH LEAF CURL DISEASE OF TOMATO IN INDIA.	1683-1686
225	PYRAMIDAL ROOF THAT HOLDS UP THE BEST.	1687-1691
226	OPTIMUM CONDITIONS OF SUPEROXIDE DISMUTASE EXTRACT FROM TAMARIXAPHYLLA L. (TAMARISK)	1692-1698



227	<b>PREVALENCE OF PARENTAL SELF MEDICATION AND ITS POSSIBLE EFFECT TO THEIR CHILDREN IN AL-MADINAH , KINGDOM OF SAUDI ARABIA.</b>	<b>1699-1707</b>
228	<b>EFFECT OF POMEGRANATE JUICE AND PEEL ON ANTIOXIDANT ENZYMES AND LIPID PROFILE IN CARBON TETRACHLORIDE-INDUCED HYPERLIPIDEMIC RATS.</b>	<b>1708-1714</b>
229	<b>VITAMIN D3 IMPROVES LIVER FUNCTIONS IN EXPERIMENTALLY INDUCED TYPE II DIABETES MELLITUS IN WISTAR RATS</b>	<b>1715-1726</b>
230	<b>AWARENESS OF ANTENATAL CARE IMPORTANCE AMONG SAUDI PREGNANT WOMEN IN MADINA.</b>	<b>1727-1745</b>
231	<b>EFFECT OF INTEGRATED WEED MANAGEMENT PRACTICES ON WEED DYNAMICS,YIELD AND ECONOMICS OF RABI GROUNDNUT(ARACHIS HYPOGAEA) IN SANDY LOAM SOILS OF ANDHRA PRADESH.</b>	<b>1746-1751</b>
232	<b>A STUDY ON SOCIO-ECONOMIC AND CULTURAL PROFILE OF FISHERMEN IN PUDUCHERRY REGION, INDIA.</b>	<b>1752-1761</b>
233	<b>CORRELATION OF CHILD'S AGGRESSIVE BEHAVIOR AND TELEVISION EXPOSURE: A CROSS SECTIONAL STUDY IN AL AHSA, KINGDOM OF SAUDI ARABIA</b>	<b>1762-1770</b>
234	<b>THE EFFECTIVE VALUE OF PET/CT IN DIAGNOSING CARDIOVASCULAR DISEASE AND PEDIATRIC CANCER;A COMPARATIVE STUDY</b>	<b>1771-1783</b>
235	<b>DIVERSITY OF TRUE AND MANGROVE ASSOCIATES OF BHITARKANIKA NATIONAL PARK (ODISHA), INDIA.</b>	<b>1784-1798</b>
236	<b>“A STUDY ON CUSTOMERS AWARENESS AND ADAPTABILITY TO GREEN BANKING WITH SPECIAL REFERENCE TO GRATUDATES IN DAKSHINA KANNADA DISTRICT”</b>	<b>1799-1815</b>
237	<b>RESVERATROL AS AN ALTERNATIVE TO REGULAR BLOOD TRANSFUSION- A NEW FETAL HAEMOGLOBIN INDUCER FROM NATURAL WORLD</b>	<b>1816-1821</b>

238	TRADITIONAL AND MEDICINAL USES OF PLANTS OF DUNYAPUR DISTRICT LODHRAN.	1823-1827
239	THE APPLICATION OF VACUUM-ASSISTED CLOSURE DEVICE IN THE MANAGEMENT OF EMPYEMATHORACIS	1828-1830
240	PROSPECTIVE STUDY OF RESPIRATORY TRACT INFECTION AMONG PILGRIMS VISITING ER AT ALMADINAHALMONAWARRH , 2016 .	1831-1840
241	LE SURDOSAGE ET ACCIDENTS AUX AVK : ETUDE CAS TEMOIN : A PROPOS DE 400 PATIENTS	1841-1845
242	ACUTE INVERSION OF UTERUS.	1846-1848
243	ROLE OF S100P AS A NEW PROGNOSTIC MARKER IN WOMEN WITH METASTATIC BREAST CANCER AND ITS CORRELATION WITH BCL2 AND BAX EXPRESSION.	1849-1868
244	USE OF PLANTS IN TRADITIONAL HEALTH CARE PRACTICE: AN ETHNOMEDICINAL SURVEY AT SUJANAGAR UPAZILA IN PABNA DISTRICT OF BANGLADESH.	1869-1879
245	PROGNOSTIC AND PREDICTIVE SIGNIFICANCE OF PROGRAMMED DEATH LIGAND (PD-L1) AND FOXP3 EXPRESSIONS IN TUMOR CELLS AND TUMOR MICROENVIRONMENT IN OVARIAN CANCER PATIENTS	1880-1901
246	A CRITICAL REVIEW ON PARAMETRIC INFLUENCE OF JOURNAL BEARING	1902-1908
247	COMPARATIVE STUDY BETWEEN SUCCINYLATED GELATIN (GELOFUSINE) VERSUS RINGER'S ACETATE REGARDING SAFETY AND EFFICACY IN ADULT PATIENTS UNDERGOING CARDIAC SURGERY.	1909-1918
248	CONTROL OF ENVIRONMENTAL POLLUTION BY EFFECTIVE UTILIZATION OF FLY-ASH PRODUCED BY THERMAL POWER PLANTS IN CULTIVATED LAND AND BIODEGRADATION OF PLASTIC USING PSEUDOMONAS SP. ISOLATED FROM WASTE WATER	1919-1925

249	COMPUTATIONAL ANALYSIS OF FLAME BEHAVIOR EJECTED FROM UP TO DOWN INSIDE A VERTICAL COMBUSTION CHAMBER OF A BOILER USING IRAQI NATURAL GAS AS A FUEL.	1926-1931
250	PRICE VOLATILITY IN THE INDIAN GOLD SPOT MARKET: AN ECONOMETRIC ANALYSIS	1932-1947
251	THE TRENDS OF GALLSTONE SURGICAL TREATMENT IN SAUDI ARABIAN PROVINCE: IS THE LOCAL PRACTICE UP TO DATE?	1948-1953
252	KNOWLEDGE AND PRACTICE IN CHRONIC PAIN MANAGEMENT AMONG PRIMARY HEALTHCARE PHYSICIANS.	1954-1964
253	TO STUDY THE NECESSITY AND SPECIAL TECHNIQUES USED FOR FORT REHABILITATION.	1965-1970
254	BIOMETHANIZATION OF OLIVE MILL SOLID WASTE WITH TURKEY MANURE AT MESOPHILIC CONDITIONS	1971-1976
255	SPECTROSCOPIC PROPERTIES OF LITHIUM SODIUM BORATE GLASS BY THE ADDITION OF MoO <sub>3</sub>	1977-1983
256	COMPARATIVE STUDIES OF GENETIC VARIABILITY IN SOYBEAN (GLYCINE MAX. (L.) MERRILL) DERIVED GENOTYPES USING MOLECULAR MARKER.	1984-1989
257	PHENOTYPIC AND MOLECULAR ANALYSIS IN TINOSPORA CORDIFOLIA.	1990-1998
258	EFFLUX AS AN ARISING CAUSE OF DRUG RESISTANCE IN E. COLI.	1999-2007
259	AN ONLINE SURVEY OF USING SKIN-LIGHTENING PRODUCTS IN SAUDI FEMALES	2008-2016
260	PHENOTYPIC DETECTION OF BIOFILMS IN CANDIDA SPECIES ISOLATED FROM VARIOUS CLINICAL SPECIMEN	2017-2023
261	PHYSICAL ACTIVITI AMONG MEDICAL STUDENTS OF IMAM UNIVERSISTY AND ITS EFFECT ON THEIR ACADEMIC PERFORMANCE	2024-2028
262	NEW IDENTIFYING SECURITY FEATURES OF INDIAN CURRENCIES	2049-2053

263	<b>“COMPARISON OF SMOKERS AND NON-SMOKERS KNOWLEDGE AND AWARENESS OF SMOKING EFFECTS ON GENERAL and ORAL HEALTH</b>	<b>2054-2060</b>
264	<b>EFFECT OF FRICTION STIR PROCESSING PARAMETERS ON THE TENSILE STRENGTH OF SURFACE COMPOSITE ALUMINUM ALLOY.</b>	<b>2061-2065</b>
265	<b>ASSOCIATION BETWEEN PRIMARY SITE OF MELANOMA AND SURVIVAL OF U.S. ADULT PATIENTS</b>	<b>2066-2073</b>
266	<b>EFFECT OF LIGHT ON VENOM OF BUNGARUSCAERULEUS (INDIAN COMMON KRAIT)</b>	<b>2074-2078</b>
267	<b>METHEMOGLOBINEMIA DUE TO BIOLOGICAL POISONING – CASE REPORT</b>	<b>2079-2082</b>
268	<b>INCIDENCE OF NOSOCOMIAL BLOOD STREAM INFECTION, PNEUMONIA AND URINARY TRACT INFECTION IN PEDIATRIC WARD AT KING ABDULAZIZ UNIVERSITY HOSPITAL, JEDDAH, SAUDI ARABIA 2015- 2016.</b>	<b>2083-2090</b>
269	<b>TRAINING STRATEGIES AS AN ANTECEDENT FOR EMPLOYEE COMMITMENT IN KENYAN SETTING.</b>	<b>2091-2095</b>
270	<b>BUREAUCRATIC REFORM IN INDONESIA: LESSON LEARNED FROM BUREAUCRATIC REFORM MODEL IN JAPAN.</b>	<b>2096-2105</b>
271	<b>EVOLUTION OF WATER QUALITY OF A MOROCCAN DAM AFTER ITS SETUP.</b>	<b>2106-2112</b>
272	<b>MAIN PREDICTORS ON THE USE OF BIOMATERIALS IN IMPLANT DENTISTRY: A REVIEW</b>	<b>2113-2123</b>
273	<b>IMPACT OF EMOTIONAL INTELLIGENCE ON THE ACADEMIC ACHIEVEMENT OF D.E.I.E.D STUDENTS.</b>	<b>2124-2128</b>
274	<b>SCD147: EMMPRIN(EXTRACELLULAR MATRIX METALLOPROTEINASE INDUCER) AS TUMOUR MARKER FOR BLADDER CARCINOMA.</b>	<b>2129-2137</b>
275	<b>EVALUATION OF CD9 &amp; CD56 ANTIGENS EXPRESSION IN ADULT ACUTE MYELOID LEUKAEMIA.</b>	<b>2138-2150</b>



276	PROTECTIVE POTENTIAL OF CYNODON DACTYLON EXTRACT ON LAMOTRIGINE INDUCED BRAIN TOXICITY IN MICE FETUSES.	2151-2155
277	ANOVELAPPROACHFORTHE SOLUTIONOFA CLASS OF URYSOHN INTEGRALEQUATIONSUSING BERNSTEIN POLYNOMIALS	2156-2162
278	INFECTION CONTROL KNOWLEDGE AND PRACTICES AMONG MEDICAL AND DENTAL INTERNS AT TAIBAH UNIVERSITY, SAUDI ARABIA, 2016	2163-2171
279	A STUDY OF NEAR MISS OBSTETRIC EVENTS AND MATERNAL DEATHS IN A TERTIARY CARE HOSPITAL	2172-2178
280	PERIPHERAL GIANT CELL GRANULOMA OF ANTERIOR MAXILLA.	2179-2182
281	TONGUE MALIGNANT MELANOMA	2183-2185
282	INTRADURAL EXTRAMEDULLARY SPINAL CORD TUMORS: A RETROSPECTIVE STUDY OF LOCATIONS, TUMOR TYPES, AND SURGICAL OUTCOME	2186-2190
283	BIOLOGICAL IMPACT OF MELATONIN ON THE HEALING OF ALBINO RATS' TONGUE ULCER	2191-2199
284	RISK PREDICTORS FOR HEART FAILURE IN AL-MADINA AL-MONAWRA	2200-2204
285	ISTIME MANAGEMENTRELATED TO BETTER ACADEMIC PERFORMANCE AND PERCEIVED ACADEMIC SATISFACTION AMONG MEDICAL STUDENTS? ACROSS-SECTIONAL SURVEY IN SAUDI ARABIA	2205-2213
286	ASURVEY AND COMPARISON ON SYNCHRONIZATION METHODS OF CHAOTIC SYSTEMS	2214-2227
287	DESIGNING AN INTERACTIVE EDUCATIONAL WEBSITE USING ASP.NET.	2228-2236
288	ALGERIAN DAIRY INDUSTRY; CAN IT CONTROL BACTERIAL CONTAMINANT INDICATORS OF HYGIENIC QUALITY DEFECTS IN THE PRODUCTION CHAIN OF RAW AND PASTEURIZED MILK?	2237-2245

289	<b>SUBJECTIVE RESPONSE TO RESPIRATOR USE: COMPARISON N95, SURGICAL MASK AND FACE COVER.</b>	<b>2246-2247</b>
290	<b>AGGRESSIVE BREAST CARCINOMA IN A 26 YEARS-OLD LADY: A YOUNG AGE AT DIAGNOSIS</b>	<b>2248-2252</b>
291	<b>THE EFFECT OF VIRECHANA KARMA AND SHIROBASTI IN SCALP PSORIASIS – A CASE REPORT.</b>	<b>2253-2257</b>
292	<b>ETIOLOGICAL PROFILE OF GASTRIC OUTLET OBSTRUCTION AND ITS TREATMENT: A HOSPITAL BASED PROSPECTIVE STUDY IN A TERTIARY CARE CENTER, NORTH-EAST INDIA.</b>	<b>2258-2264</b>
293	<b>HOW MUCH DOES THE INTRA-ABDOMINAL PRESSURE VARY BY NASOGASTRIC DECOMPRESSION IN PATIENTS WITH INTESTINAL OBSTRUCTION???</b>	<b>2265-2269</b>
294	<b>HYPOTHALAMIC CAVERNOMA IN A 28 YEARS OLD SAUDI LADY: CASE REPORT</b>	<b>2270-2274</b>
295	<b>PULMONARY INTERSTITIAL EMPHYSEMA PRESENTING IN A WOMAN ON THE INTENSIVE CARE UNIT: CASE REPORT AND REVIEW OF LITERATURE</b>	<b>2275-2279</b>
296	<b>GROWTH AND YIELD OF UPLAND RICE WITH THE ADDITION OF COMPOST FROM OIL PALM EMPTY FRUIT BUNCHES AND FUNGI MYCORRHIZAL.</b>	<b>2280-2288</b>
297	<b>TRANSPIRATION DYNAMICS OF PEPPER (CAPSICUM CAPSAULARIS) IN RESPONSE TO ATMOSPHERIC DROUGHT AND SOIL TYPE UNDER SEVERAL VAPOUR PRESSURE DEFICIT (VPD) LEVELS.</b>	<b>2289-2297</b>
298	<b>CERVICOFACIAL TERRATOMA IN NEWBORN BABY-AN UNUSUAL TUMOR.</b>	<b>2298-2301</b>
299	<b>POTENTIAL TARGETS FOR ANTI-INFLAMMATORY AND ANTICANCER ACTIVITIES OF MARINE ALGAE GELIDIUM SESQUIPEDALE AND LAMINARIA OCHROLEUCA</b>	<b>2302-2309</b>

<b>300</b>	<b>PREVALENCE OF CHRONIC RHINO SINUSITIS AND IT'S RECURRENT AFTER TREATMENT COMPARE TO ITS RECURRENT AFTER SURGERY AT SAUDI ARABIA , 2016.</b>	<b>2310-2318</b>
<b>301</b>	<b>A STUDY OF CONSUMER PERCEPTIONS AND PURCHASE BEHAVIOUR TRENDS TOWARDS DIGITAL ONLINE BUYING BEHAVIOUR OF CUSTOMERS FROM DIFFERENT AGE-GROUPS.</b>	<b>2319-2329</b>
<b>302</b>	<b>AWARENESS OF COLORECTAL CANCER AMONG INFLAMMATORY BOWEL DISEASE PATIENTS IN A TERTIARY CARE HOSPITAL: AN EPIDEMIOLOGICAL STUDY.</b>	<b>2330-2335</b>
<b>303</b>	<b>PREVALENCE AND CAUSALITY ASSESSMENT OF CUTANEOUS ADVERSE DRUGREACTIONS</b>	<b>2336-2346</b>
<b>304</b>	<b>QUALITY ASSESSMENT ON EMERGENCY MEDICAL SERVICES DOCUMENTATIONS IN TRAUMA CASES</b>	<b>2347-2352</b>
<b>305</b>	<b>INFLAMMATORY BOWEL DISEASES (IBD) : A CASE REPORT</b>	<b>2353-2356</b>
<b>306</b>	<b>THE INCIDENCE OF CHOLELITHIASIS AFTER CORRECTIVE WEIGHT LOSS SURGERY</b>	<b>2357-2361</b>
<b>307</b>	<b>PREVALENCE AND IMPACT ON JOB PERFORMANCE OF PRIMARY HEADACHE AMONG MEDICAL AND PARAMEDICAL STAFF IN THE EMERGENCY DEPARTMENTS OF TAIF HOSPITALS - SAUDI ARABIA</b>	<b>2362-2370</b>
<b>308</b>	<b>DEVELOPMENT OF CHAPPATI, A LOW COSTTRADITIONAL INDIAN FOOD, USING COMMON INGREDIENTS IN DIFFERENT COMPOSITION -A COMPARATIVE STUDY.</b>	<b>2371-2376</b>
<b>309</b>	<b>A REVIEW: COMPARISON OF LINE CLIPPING ALGORITHMS IN 3D SPACE.</b>	<b>2377-2379</b>
<b>310</b>	<b>INTEGRATING IMAGING TECHNIQUES IN DEEP INFERIOR EPIGASTRIC PERFORATOR BREAST RECONSTRUCTION.</b>	<b>2380-2387</b>
<b>311</b>	<b>L'IDE AU MAROC : EFFETS ECONOMIQUES ET ATTRACTIVITE DU TERRITOIRE (ESSAI DE VALIDATION EMPIRIQUE POUR LA PERIODE 1970-2011)</b>	<b>2388-2403</b>

<b>312</b>	<b>THE EFFECT OF ELECTRONIC STORIES ON CLOTHING BEHAVIOR FOR TEENAGE GIRLS.</b>	<b>2404-2411</b>
<b>313</b>	<b>RELATIONSHIP BETWEEN SUDDEN INFANT DEATH SYNDROME AND MOTHER SMOKING.</b>	<b>2312-2318</b>
<b>314</b>	<b>THE USE OF THE MEMBRANE - REDOX POTENTIALS THREE - STATE LINE SYSTEM DEPENDENT - FULL 9 STEPPED CYCLE OF PROTON CONDUCTANCE - RELATED REGULATIONS IN THE ANTICANCER TREATMENT.</b>	<b>2419-2423</b>
<b>315</b>	<b>QUALITY OF LIFE OF MEDICAL STUDENTS AT QASSIM UNIVERSITY.</b>	<b>2424-2425</b>
<b>316</b>	<b>A CASE REPORT OF BERNARD-SOULIER SYNDROME IN DIFFERENTIAL DIAGNOSIS OF IMMUNE THROMBOCYTOPENIC PURPURA.</b>	<b>2426-2435</b>
<b>317</b>	<b>AWARENESS ON AGICULTURAL BUDGETING - AN OVERVIEW.</b>	<b>2436-2441</b>
<b>318</b>	<b>DETERMINANT FACTORS THAT INFLUENCE SUPPLIER SELECTION FOR ONLINE BUSINESS SELLERS IN MALAYSIA.</b>	<b>2442-2453</b>
<b>319</b>	<b>MATERNAL PARENTING STYLE AND CHILDREN'S ELECTRONIC USE AMONG UNIVERSITY FEMALE EMPLOYEES, SAUDI ARABIA.</b>	<b>2454-2467</b>
<b>320</b>	<b>A STUDY ON CUSTOMER PERCEPTION TOWARDS ONLINE SHOPPING, SALEM.</b>	<b>2468-2470</b>
<b>321</b>	<b>OIL-ON-WATER MQL MACHINING OF NICKEL BASED SUPER ALLOY NIMONIC C.263</b>	<b>2471-2486</b>
<b>322</b>	<b>A BRIEF REVIEW ON SAFETY SIGNAL MANAGEMENT PROCESS</b>	<b>2487-2492</b>
<b>323</b>	<b>INTEGRATION OF BEEF CATTLE BREEDING WITH CROP FARMING AT SUSTAINABLE RICEFIELD IN JEMBER REGENCY, EAST JAVA</b>	<b>2493-2503</b>
<b>324</b>	<b>FRACTURE DISLOCATION OF PROXIMAL HUMERUS WITH INTRATHORAIC DISPLACEMENT OF THE HUMERAL HEAD. A RARE PRESENTATION.</b>	<b>2504-2506</b>
<b>325</b>	<b>POTATO PEEL - A COST EFFECTIVE SUBSTRATE FOR PROTEIN ENRICHMENT AND WASTE MINIMIZATION.</b>	<b>2507-2512</b>

326	<b>SEX DIFFERENCES IN TRACE METALS AND DISEASE ACTIVITY IN PATIENTS WITH RHEUMATOID ARTHRITIS.</b>	<b>2513-2518</b>
327	<b>WORK PARTICIPATION OF TRIBAL WOMEN IN GAJAPATI DISTRICT: A STATESTICAL ANALYSIS OF ODISHA.</b>	<b>2519-2523</b>
328	<b>PREVALENCE OF CARIES IN ANTERIOR TEETH IN DAKSHINA KANNADA POPULATION</b>	<b>2524-2528</b>
329	<b>STUDY ON COOLING OF AUTOMOBILES USING AIRJET IMPINGEMENT.</b>	<b>2529-2553</b>
330	<b>THE MODEL OF BEEF CATTLE BREEDING DEVELOPMENT WITH HOUSEHOLD ECONOMIC APPROACH IN JEMBER REGENCY.</b>	<b>2554-2564</b>
331	<b>CORRELATION BETWEEN SERUM ZINC AND GLYCOSYLATED HEMOGLOBIN LEVELS IN TYPE II DIABETES MELLITUS.</b>	<b>2565-2568</b>
332	<b>THE OCCURRENCE AND ASSESSMENT OF AWARENESS ABOUT INTERVENTIONAL COSMETICS AMONG STUDENTS OF COLLAGE OF APPLIED SCIENCES AND COMMUNITY SERVICES IN THE UNIVERSITY OF DAMMAM SAUDI ARABIA.</b>	<b>2569-2577</b>
333	<b>ORAL PEMPHIGUS: CASE REPORT &amp; TREATMENT STRATEGIES</b>	<b>2578-2580</b>
334	<b>ROLE OF WEIGHT REDUCTION VERSUS PHYSICAL THERAPY IN MANAGEMENT OF OBESE PATIENTS WITH KNEE OSTEOARTHRITIS.</b>	<b>2581-2588</b>
335	<b>IMPROVEMENT OF LEAST FREQUENCY USEDWEB CACHE REPLACEMENT TECHNOLOGY USING INTELLIGENT AGENTS.</b>	<b>2589-2599</b>
336	<b>THE EFFECT OF THE METHANOLIC LEAF EXTRACT OF BOSWELLIA DALZIELIIHUTCH ON THE LIVER INTEGRITY OF SELENITE-INDUCED CATARACT PUPS.</b>	<b>2600-2604</b>
337	<b>MICROBIAL DNA EXTRACTION FROM INFECTED SEED POTATO FOR MOLECULAR DIAGNOSTIC APPLICATIONS.</b>	<b>2605-2611</b>



338	A COMPARISON STUDY OF DECISION SUPPORT SYSTEM USING CO-EVOLUTIONARY ALGORITHMS.	2612-2618
339	EXTRACELLULAR L-ASPARGINASE PRODUCTION BY HALOTOLERANT STRAIN OF ENTEROBACTER HORMAECHAEI ISOLATED FROM MARINE FISHES.	2619-2625
340	CARICA PAPAYA, A MAGIC HERBAL REMEDY.	2626-2635
341	PHASE TRANSITION IN $^{40}_{20}\text{Ca}$ AND $^{46}_{20}\text{Ca}$	2636-2639
342	The MYSTERY OF LIFE	2640-2646
343	MONITORING OF HEMATOLOGICAL AND BIOCHEMICAL PARAMETERS IN SHEEP REARING IN NEW RECLAIMED LANDS IN EGYPT.	2647-2652
344	ALENDRONATE SODIUM IN OSTEOARTHRITIS: EFFECTS ON ANABOLIC, CARTILAGE DEGRADATIVE MARKERS AND THE CLINICAL ACTIVITY.	2653-2664
345	PARTIAL PURIFICATION OF PEROXIDASE FROM IRAQI RADISH ROOTS.	2665-2668
346	HAND HYGIENE KNOWLEDGE ASSESSMENT AMONG GRADUATE MEDICAL STUDENTS IN ASIR GOVERNMENTAL HOSPITALS, SAUDI ARABIA.	2669-2674
347	A CRITICAL EVALUATION OF THE IMPACT OF RELIGION ON COLLECTIVIST FAMILIES' MEAL SOCIAL INTERACTION BEHAVIOUR IN SIERRA LEONE	2675-2693
348	STUDY ON CORPORATE SOCIAL RESPONSIBILITY INITIATIVES OF INDIAN COMPANIES.	2694-2700
349	BIOLOGIC AND MORPHOLOGIC MARKERS OF THE THROMBOEMBOLIC RISK IN THE ATRIAL FIBRILLATION	2701-2707
350	MAIN PREDICTORS AND TREATMENTS OF PERI-IMPLANTITE: BRIEF REVIEW	2708-2713
351	HARNESSING ENTREPRENEURIAL SKILLS OF ENGINEERING STUDENTS.	2714-2717
352	SYSTEMATIC REVIEW OF EVIDENCE-BASED IN BENEFICIAL PREVENTING HYPOTHERMIA FOR ADULT TRAUMA PATIENTS IN ACCIDENT	2718-2728

353	PARAMETRIC STUDY AND DESIGN OF ULTRA WIDE BAND PLANAR MICROSTRIP ANTENNA FOR BREAST TUMOR DETECTION	2729-2737
354	EVALUATION OF PARENTS KNOWLEDGE ABOUT THE DANGEROUS EFFECT OF EXCESSIVE USE OF ANTIBIOTICS ON CHILDREN WITH URTIS IN JEDDAH CITY.	2740-2748
355	DIABETIC PATIENTS KNOWLEDGE, ATTITUDE AND PRACTICE TOWARD PERIODONTAL HEALTH.	2749-2753
356	KNOWLEDGE AND ATTITUDES TOWARDS HEPATITIS C VIRUS TRANSMISSION AMONG MEDICAL INTERNS OF KING ABDULAZIZ MEDICAL CITY , RIYADH.	2754-2762
357	SLEEP QUALITY AMONG TYPE 2 SAUDI DIABETICS.	2763-2769
358	USING INTERPRETERS: CAN BLACK FEMINIST THOUGHT AND ANTI -OPPRESSIVE PRINCIPLES BE USED TO IMPROVE INFORMATION GATHERING AND SOCIAL SERVICE EFFICACY IN POPULATIONS THAT ARE CULTURALLY DIVERSE?	2770-2775
359	EVALUATION OF KNOWLEDGE ABOUT THE DANGEROUS EFFECT OF EXCESSIVE USE OF ANTIBIOTICS IN ASIR CITY.	2776-2792
360	ASSESSMENT OF LEVEL OF KNOWLEDGE AND BELIEFS TOWARD PSORIASIS AMONG COMMUNITY IN ALMADINA ALMONAWARA CITY, 2016.	2793-2803
361	MORTALITY OF WATERMELON APHIDS BY NEEM NATURAL OIL AND A CHEMICAL SYNTHETIC PRODUCT.	2804-2808
362	EVALUATION OF A CASE OF RECURRENT RESPIRATORY TRACT INFECTIONS.	2809-2815
363	HEALTH BELIEFS ABOUT OSTEOPOROSIS AND OSTEOPOROSIS RADIOLOGICAL SCREENING IN OLDER WOMEN AND MEN IN JEDDAH CITY 2016.	2816-2829
364	RISK OF OBSTRUCTIVE SLEEP APNEA IN PATIENTS WITH TYPE 2 DIABETES MELLITUS.	2830-2834

<b>365</b>	<b>A BRIEF OVERVIEW OF MYOFASCIAL TRIGGER POINTS.</b>	<b>2835-2838</b>
<b>366</b>	<b>BRICKS FROM WASTE PLASTIC.</b>	<b>2839-2845</b>
<b>367</b>	<b>MULTIPLE ACTIVITY BASED BIO-BOTANICAL WATER DISPERSIBLE GRANULES FORMULATION &amp; THEIR EFFICACY FOR PEST MANAGEMENT IN AGRICULTURE.</b>	<b>2846-2851</b>
<b>368</b>	<b>PRODUCTION OF NUTRITIOUS JAM BY USING AN UNDERUTILIZED FRUIT AVVERHOA CARAMBOLA (STAR FRUIT).</b>	<b>2852-2856</b>
<b>369</b>	<b>POTENTIAL RISK OF STREPTOCOCCUS PNEUMONIAE IN NASOPHARYNGEAL CARRIAGE DURING UMRAH AND HAJJ SEASONS IN MAKKAH, SAUDI ARABIA.</b>	<b>2857-2864</b>
<b>370</b>	<b>AUTONOMOUS EYE.</b>	<b>2865-2869</b>
<b>371</b>	<b>THE PREVALENCE OF HTN AMONG WORKING PERSONNEL, FACULTY OF EDUCATION AT TAIBAH UNIVERSITY.</b>	<b>2870-2873</b>
<b>372</b>	<b>ASSESSMENT OF GLAUCOMA AWARENESS AND KNOWLEDGE AMONG DIABETIC PATINENTS IN HAIL, SAUDI ARABIA</b>	<b>2874-2876</b>
<b>373</b>	<b>THE EFFECT OF DIABETES ON ACETOACETATE METABOLISM IN HEART.</b>	<b>2877-2882</b>
<b>374</b>	<b>EFFECT OF INDEPENDENCE VARIABLES ON EMPOWERMENT OF SHG MEMBERS THROUGH ENTREPRENEURIAL ACTIVITIES AND LOAN PRACTICES ADOPTED</b>	<b>2883-2888</b>
<b>375</b>	<b>INDONESIAN NATIONAL ARMY IN NATURAL DISASTER MANAGEMENT: A CASE STUDY OF THE 2004 KELUD MOUNTAIN ERUPTION.</b>	<b>2889-2897</b>
<b>376</b>	<b>ZIKA VIRUS INFECTION.</b>	<b>2898-2903</b>
<b>377</b>	<b>SMART CONTROL OF WATER FLOW AND DEPTH WITHIN RICE FIELD FOR IMPROVING IRRIGATION MANAGEMENT AND MITIGATING METHANE EMISSION</b>	<b>2904-2910</b>
<b>378</b>	<b>THE DISTRIBUTION OF ABO BLOOD GROUPS AND RHESUS FACTOR AMONG REGULAR BLOOD DONORS IN AL-MADINAH AL-MONAWARAH , SAUDI ARABIA 2016 .</b>	<b>2917-2920</b>

379	<b>“A STUDY ON THE STATISTICAL ESTIMATION OF URANIUM ION IN GROUNDWATER OF CUDDALORE DISTRICT, TAMILNADU, INDIA”.</b>	<b>2921-2929</b>
380	<b>SPECIES DIVERSITY AND DISTRIBUTION OF MOLLUSCAN FAUNA FROM ESTUARY AND MANGROVES (CORINGA WILDLIFE SANCTUARY) OF EAST GODAVARI ESTUARINE ECOSYSTEM, ANDHRA PRADESH, INDIA.</b>	<b>2930-2937</b>
381	<b>EVALUATION TOOL FOR THE FORCASTING INITIAL EVALUATION OF SCHOOL ENVIRONMENTAL PROJECTS: A CASE STUDY.</b>	<b>2938-2948</b>
382	<b>EXPLORING PREVALENCE OF LONG TERM DIABETES MELLITUS VASCULAR COMPLICATIONS IN KING FAHAD GENERAL HOSPITAL</b>	<b>2949-2959</b>
383	<b>SITE SPECIFIC DELIVERY OF ANTI-ARTHRITIC DRUG BY GELATIN SURFACE MODIFIED BOVINE SERUM ALBUMIN MICROSPHERES</b>	<b>2960-2967</b>
384	<b>MAGAGNITUDES OF VARIABILITY IN EARLY INBREEDING GENERATIONS (S1 AND S2) FOR GRAIN YIELD AND ITS COMPONENTS IN MAIZE.</b>	<b>2968-2974</b>
385	<b>STUDY OF TEACHERS’ AND SCHOOL PRINCIPALS’ AWARENESS AND PRACTICES IN FOSTERING CHILDREN CREATIVITY.</b>	<b>2975-2985</b>
386	<b>PATTERN OF THYROID DISEASE IN ALKHARJ PROVINCE, SAUDI ARABIA.</b>	<b>2986-2998</b>
387	<b>RECURRENT VISCERAL LEISHMANIASIS IN AN IMMUNOCOMPETENT PATIENT: A CASE REPORT.</b>	<b>2999-3003</b>
388	<b>DO BLIND PEOPLE HAVE BETTER HEARING LEVELS THAN NORMAL POPULATION?</b>	<b>3004-3009</b>
389	<b>METFORMIN AND ITS SIDE EFFECTS.</b>	<b>3010-3015</b>



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### RESEARCH ARTICLE

#### Utility of Amplification Refractory Mutation System PCR for the detection of JAK2 mutation in Chronic Myeloproliferative Disorders.

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#### Abstract

Detection of the JAK2 V617F mutation is helpful in differential diagnosis, prognosis, and predication of therapeutic response in CMPD disorders. Because the mutation can be present in a small proportion of granulocytic populations in MPD patients, a highly sensitive detection method is required. The study was aimed to optimize ARMS-PCR for the detection of JAK2V617F mutations. This study was conducted at Prince Fahd Bin Sultan Research Chair. Fifty subjects were registered from the King Khaled Hospital of Tabuk -Northwestern part of Saudi Arabia among which 25 newly diagnosed MPD patients and 25 healthy controls. DNA was extracted done using DNA extraction Kit from Qiagen. ARMS was optimized in which a primers were designed in such a way that it is able to discriminate among templates that differ by a single nucleotide residue in one tube reaction. Both cases and controls were tested for JAK2 mutations by ARMS-PCR. Demographic data, spleen size, hemoglobin level, white blood cell and platelet counts were recorded. Independent sample t-test was used to study the correlation of JAK2 mutations with age, haemoglobin, blood counts and spleen size. Fisher's exact test was applied to compare disease progression in mutation positive and negative cases. This study was conducted on 25 newly diagnosed MPD patients among which 17 were polycythemia vera, 5 Essential thrombocytopenia and 3 primary myelofibrosis and 25 healthy controls. Both cases and controls were tested for JAK2 mutations by ARMS-PCR. The JAK2 mutation was detected in 17/25 samples among which 13 were Polycythemia Vera, 02 from Essential thrombocytopenia, 01 from Primary myelofibrosis. The JAK2 mutation was not detected in any of the healthy controls by ARMS-PCR. The main advantage of ARMS was that the amplification step and the diagnostic steps were combined, in that the presence of an amplified product indicates the presence of a particular allele and vice versa. For routine diagnosis, this characteristic of ARMS means that it is a very time-efficient method. It was concluded that the ARMS-PCR assay optimized allows the discrimination between homozygous and heterozygous individuals with the JAK2 V617F mutation and has a key role in acting as a reliable screening test for the presence or absence of the mutation in individuals with MPDs. The test will be potentially useful to follow minimal residual disease when targeted therapies against JAK2 kinase become available. The test is therefore a simple, fast, and inexpensive procedure that does not entail any special equipment other than a thermocycler.

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#### Introduction:-

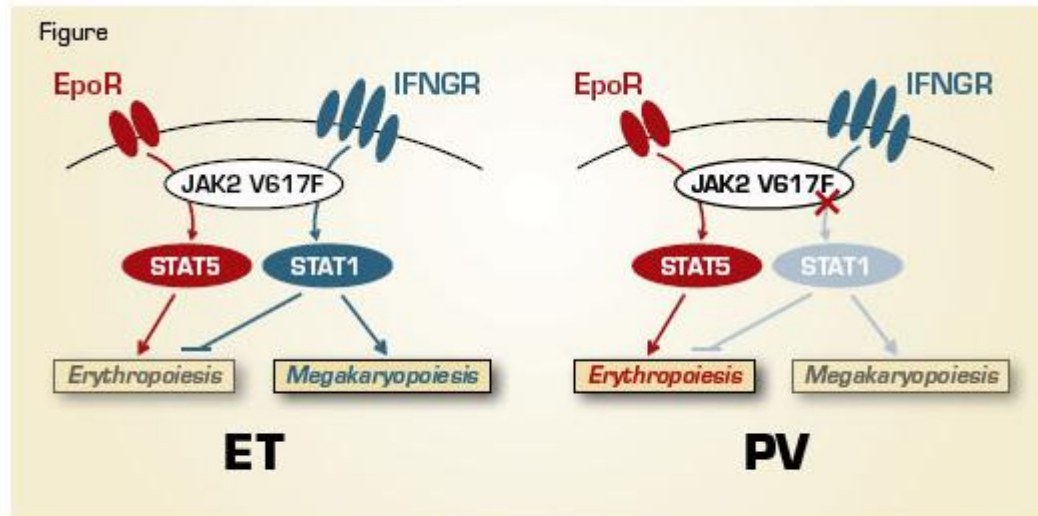
Myeloproliferative neoplasms (MPNs) are multipotent hematopoietic stem cell disorders characterized by uncontrolled proliferation of maturing blood cells<sup>1</sup>. Among its types, Chronic myeloid leukemia (CML) is the most common MPN, followed by polycythemia vera (PV), essential thrombocythemia (ET), and idiopathic myelofibrosis (IMF). The pathogenesis of myeloproliferative disorders (MPD), is still largely unknown except the chronic myeloid leukemia (CML), where the presence of the t(9;22) Ph' chromosome and of the underlying molecular abnormality has been known for decades and ultimately led to the development of target-specific drugs, the molecular lesion(s) at the basis of the other MPD has remained elusive.<sup>2-4</sup> JAK2 is a cytoplasmic tyrosine kinase that plays an essential role in the signaling pathways of cytokines and growth factors. An acquired G → T point mutation in exon 12 of the gene encoding the Janus tyrosine kinase 2 (JAK2), leading to amino acid substitution of phenylalanine for a highly conserved valine (V617F), in

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the JH2 pseudo-kinase domain, renders JAK2 kinase constitutively active and leads to cell proliferation in the absence of the growth factors<sup>5-6</sup>. *In vivo* expression of  $JAK2^{V617F}$  in a murine transplant model induced erythrocytosis<sup>7</sup>. The mechanism of activation of JAK2 kinase activity by mutations in the JAK2 signalling pathway as depicted in figure 1. The  $JAK2^{V617F}$  and JAK2 exon 12 mutant kinases bind cytokine receptors and are phosphorylated in the absence of ligand, and lead to ligand-independent activation of downstream signaling pathways.



**Figure 1** The mechanism of activation of JAK2 kinase activity by mutations in the JAK2 signaling pathway

The  $JAK2$  mutation has been detected in 65 to 97% of patients with polycythemia vera, 23 to 57% of those with essential thrombocythemia (ET), and 30 to 57% of idiopathic myelofibrosis.<sup>7-8</sup>  $JAK2$  mutation is absent in normal individuals, in patients with secondary erythrocytosis and thrombocytosis, or in patients with chronic myelogenous leukemia; detection of the mutation thus aids in differential diagnosis in cases with similar clinicopathological features.<sup>9</sup> Methods for detection of  $JAK2^{V617F}$  mutation based on the analysis of genomic DNA obtained from peripheral blood granulocytes have been devised and already entered the clinical practice. Because V617F is an acquired mutation that can be present in a small proportion of granulocytic populations in some cases, especially of ET, a highly sensitive detection method is essential<sup>10</sup>. Methodologies reported in the literature include direct sequencing,<sup>6</sup> PCR-restriction fragment length polymorphism,<sup>10</sup> allele-specific polymerase chain reaction (PCR),<sup>11</sup> pyrosequencing,<sup>12</sup> and amplification refractory mutation system (ARMS)-PCR.<sup>13</sup> The modified assay detects mutation with a highly reproducible analytic sensitivity of 0.05 to 0.1%, making it suitable for the detection of low levels of  $JAK2$  mutation. The test will be potentially useful to follow minimal residual disease when targeted. The merits and demerits of the various methods used for  $JAK2$  mutation detection have been by studied described for principles and potential clinical utilities of each assay<sup>14</sup>. Some have adapted the use of mRNA as the basis for testing for  $JAK2$  mutations and have shown that RNA allows more sensitive detection of mutations than does DNA at early stages of disease. The use of RNA rather than DNA provides the additional advantage of capturing abnormalities in platelets and detecting alternatively spliced transcripts<sup>15</sup>. The reported frequency of  $JAK2^{V617F}$  mutation is around 80% (range, 65–100%) in PV, 40% (range, 23–57%) in ET and 55% (range, 35–95%) in IM patients<sup>16</sup>.  $JAK2^{V617F}$  mutation is found in either the heterozygote or the homozygote status, the latter arising from mitotic recombination; there are significant differences in the incidence of homozygosity, which involves about 30% of patients in PV and IM and less than 4% in ET.

There are indications that the clinical phenotype might be dependent on the proportion of mutated allele, as the expression levels of some aberrantly regulated genes in MPD, such as *PRV-1* or *NF-E2*, have been found higher in homozygote than in heterozygote patients.<sup>17-18</sup> In a large survey on ET patients, the presence of the mutation was associated to clinical and biological features suggestive of a PV-like disease, thus supporting the view that these two disorders represent a biological continuum; furthermore, according to the presence of the  $JAK2^{V617F}$  mutation, ET patients could be divided into two distinct subpopulations characterized by different disease presentation, clinical complications and response to therapy. We aimed to optimize the diagnostic values of the ARMS-PCR method for detecting mutations in exon 14 of the  $JAK2$  gene to diagnose myeloproliferative disorders.

## Material and Methods:-

### Patients and Controls:-

#### Selection criteria of patients:-

- ❖ The study was carried out at Prince Fahd Bin Sultan Research chair, Cancer Molecular Genetics Lab, Department of Medical Lab technology, University of Tabuk. The study was ethically approved from the Ethics committee, University of Tabuk.
- ❖ The subjects were recruited from the hematology OPD of King Khaled hospital, Tabuk and all the subjects obtained consent form before the sample collection.

#### Inclusion criteria for myeloproliferative disorders:-

- ❖ Myeloproliferative disorders with Ph negative .
- ❖ Clinically confirmed cases of polycythemia vera (PV), essential thrombocytosis (ET), myelofibrosis (MF).
- ❖ All participants were of Saudi origin.

#### Inclusion criteria for controls:-

- ❖ All controls specimens were timed around routine blood draws that are part of routine workout, and hence would not require additional phlebotomy.
- ❖ All participants were of Saudi origin

#### Exclusion Criteria:-

- ❖ Patients with any other significant malignancy.
- ❖ Non-Arab Saudi or recently-naturalized Saudi Arabia were excluded

#### Sample Size:-

- ❖ The study was conducted on 30 specimens .Twenty were healthy controls and 25 were clinically confirmed Myeloproliferative disorders.

### Experimental Design:-

#### Genomic DNA extraction from Blood samples of MPD patients and controls:-

The Blood samples were collected by venipuncture in EDTA tubes from MPD patients and healthy controls .The DNA extraction was done by using DNeasy Blood Kit cat 69506 from Qiagen as per the manufactures instructions. The QIAamp DNA Blood Mini Kit provides silica-membrane-based DNA purification. The QIAamp DNA Blood Mini Kit was designed for processing up to 200µl fresh or frozen human whole blood. QIAamp Mini spin columns can be easily processed in a centrifuge or on vacuum manifolds. Purification of DNA using the QIAamp DNA Blood Mini Kit was fully automated on the QIAcube .The DNA extracted was dissolved in nuclease-free water, and stored at 4°C until use. The DNA quality and yield was assessed using Nanodrop (optical density) and agarose gel electrophoresis

#### Amplification ARMS primers for the JAK2 mutation:-

ARMS-PCR was performed in a final volume of 5 uL containing 2uL of 50ng genomic DNA, 12.5 uL of PCR-master mix purchased from Epigentek (USA),0.25 uL of 25 pmol/L of each primer (Table 1) The Methylamp Taq 5x PCR Mix was premixed ready-to-use solution containing all reagents required for PCR (except template, primers and water). Methylamp Taq DNA polymerase ,5x Reaction Buffer: 1 0.4 M Tris-HCl, 0.1 M (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>, 0.1% w/v Tween-20 ,12.5 mM MgCl<sub>2</sub>: 1x PCR solution – 2.5 mM MgCl<sub>2</sub> ,1mM dNTPs of each and remaining nuclease free ddH<sub>2</sub>O as depicted in Table 2. Finally the 2ul of DNA was added from each patient and control separately. The thermo cycling conditions for the PCR amplification of ARMS primers for JAK2 mutation were initial denaturation at 95°C for 10 minutes followed by 40 cycles 95 °C for 45 sec, 57.9 °C for 45 sec, and 72 °C for 45 sec followed by the final extension at 72 °C for 10 minutes.

**Table 1:-** Primers designed for ARMS PCR

Primer	Sequence	Annealing Temp	PCR product
<b>Forward outer</b>	5'- TCCTCAGAACGTTGATGGCAG- 3'	57.9	463bp
<b>Reverse outer</b>	5'- ATTGCTTTCCTTTTTCACAAGAT-3'		
<b>Forward wt</b>	5'-GCATTTGGTTTTAAATTATGGAGTATATG-3'		229bp
<b>Reverse mut</b>	5'-GTTTTACTTACTCTCGTCTCCACAAA-3'		279bp

**Table 2:-** Preparation of PCR coattail.

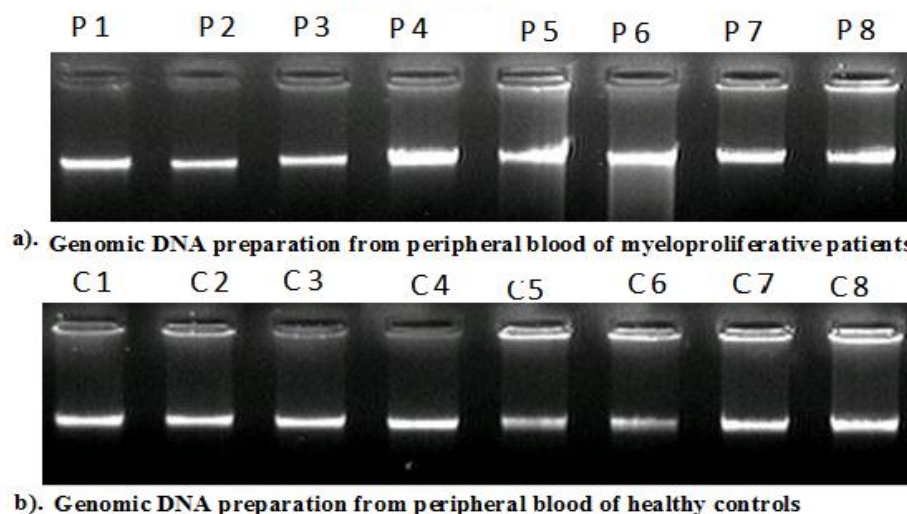
Reagent	1x	5 x
PCR master mix	5ul	25ul
Forward outer	0.25 ul	1.25 ul
Reverse outer	0.25 ul	1.25 ul
Forward wild	0.25 ul	1.25 ul
Reverse mutant	0.25 ul	1.25 ul
Nuclease free water	17.0 ul	85ul
Total volume	23ul	110ul

Finally 2 ul DNA was added.

### Results and Discussion:-

The purity of DNA extracted was checked by using Nanodrop1000 Spectrophotometer from Thermo .All DNA samples were screened for purity by measuring optical density (OD) at 260nm (OD<sub>260</sub>) and 280 nm (OD<sub>280</sub>). DNA concentration (ug/ml) was calculated based on the OD<sub>260</sub> reading .A ratio of ~1.8 was generally accepted as “pure” for DNA .The optimal rang of ratio obtained were 1.7-2 .The DNA 260/230: 1.7-2; Pure DNA must have a 260/280 ratio between 1.8 and 2. The quality of DNA was checked by running in 1% gel electrophoresis as shown in figure 2.

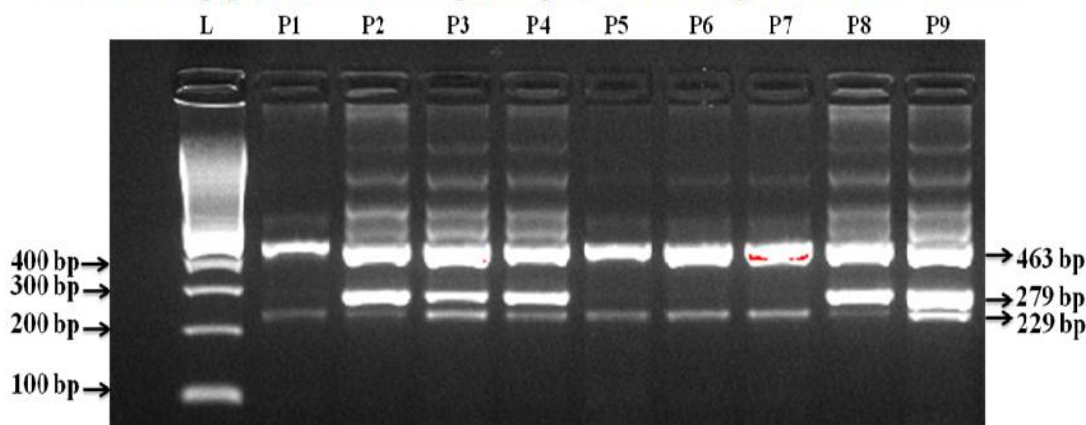
**Figure 2: Genomic DNA preparation from peripheral blood of myeloproliferative patients and healthy controls**



### Amplification Refractory Mutation System (ARMS-PCR) for JAK2V617F mutation:-

Tetra-primer ARMS-PCR was established for the analysis of single nucleotide polymorphisms (SNP), which employs two primer pairs to amplify, respectively, the two different alleles of an SNP in a single PCR reaction. Two forward and two reverse primers are used in different combinations to generate three potential PCR products. Primers FO and RO flank the exon 14 of the *JAK2* gene, resulting in a band of 463bp to control for DNA quality and quantity. Primers Fwt and RO amplify a wild-type allele, generating a band of 229bp, and primers FO and Rmt generate a band of 279 bp from the mutant allele as shown in figure 3.

**FIGURE 3. PCR amplification ARMS-PCR primers for the detection of JAK2V617F Mutation**



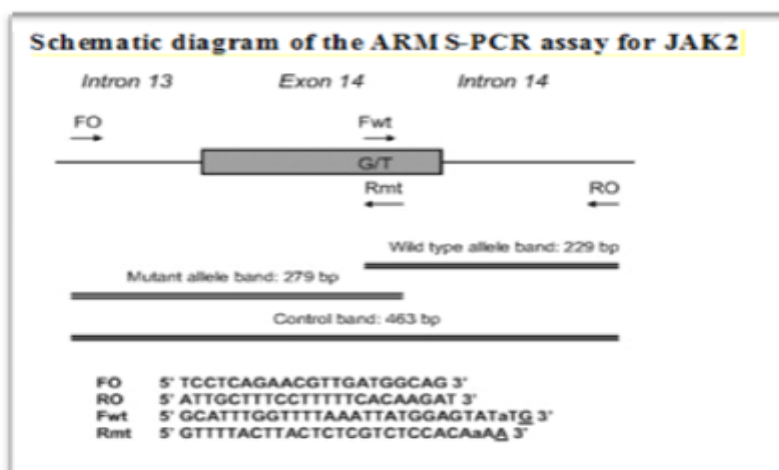
### JAK2 (V617F) mutation analysis by ARMS PCR in leukemia patients:

L= 100bp Ladder.

P1,P5,P6 and P7 = Mutation Negative.

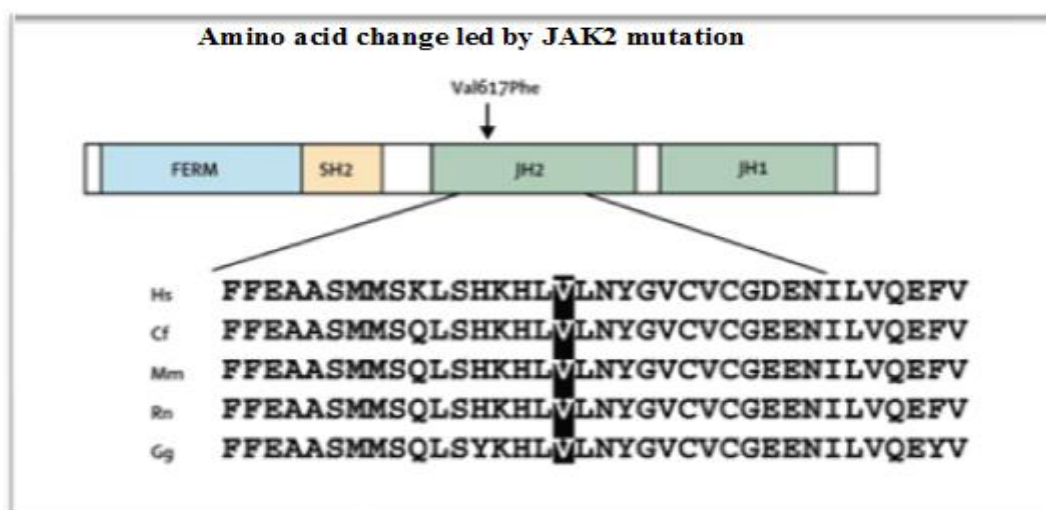
P2,P4,P4,P8 and P9= Mutation Positive.

The intended mismatches in Fwt and Rmt are shown in lowercase, and genotype-specific nucleotides are underlined as shown in figure 4. The amplification Refractory Mutation Screening (ARMS) PCR permits a single base change to be detected under ideal PCR conditions. This is ideal for detection of the single base G  $\rightarrow$  T transversion associated with the JAK2 mutation in question. The ARMS-PCR technique uses 4 primers as shown in figure 4 as follows; a forward outer primer, a reverse outer primer, a forward inner wild type specific primer and a reverse inner mutant specific primer. It requires two temperature programs during the PCR reaction. Due to the positioning of the outer primers at varying distance from the site of the mutation there is the generation of three fragments in this example in a heterozygote: two small allele specific fragments and a large control PCR product. DNA Fragments can be distinguished via electrophoresis on agarose gel.



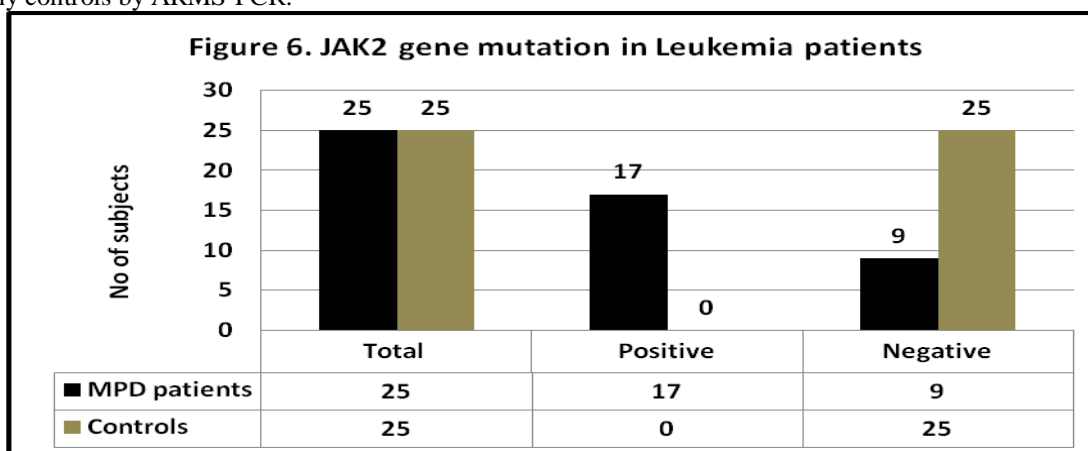
**Figure 4. Primer designing for ARMS-PCR assay of JAK2V617F Mutation**

Performing a dilution series indicates the level of sensitivity of ARMS-PCR to be 1-2 %. The assay allows discrimination between homozygous and heterozygous individuals with the JAK2 V617F mutation and has a key role in acting as a reliable screening test for the presence or absence of the mutation in individuals with MPDs. An acquired mutation in the *JAK2* gene is a cytoplasmic tyrosine kinase that plays an essential role in the signaling pathways of cytokines and growth factors. The mutation 1849 G>T, which leads to amino acid substitution of phenylalanine for a highly conserved valine (V617F), (as shown in figure 5) renders JAK2 kinase constitutively active and leads to cell proliferation in the absence of the growth factors

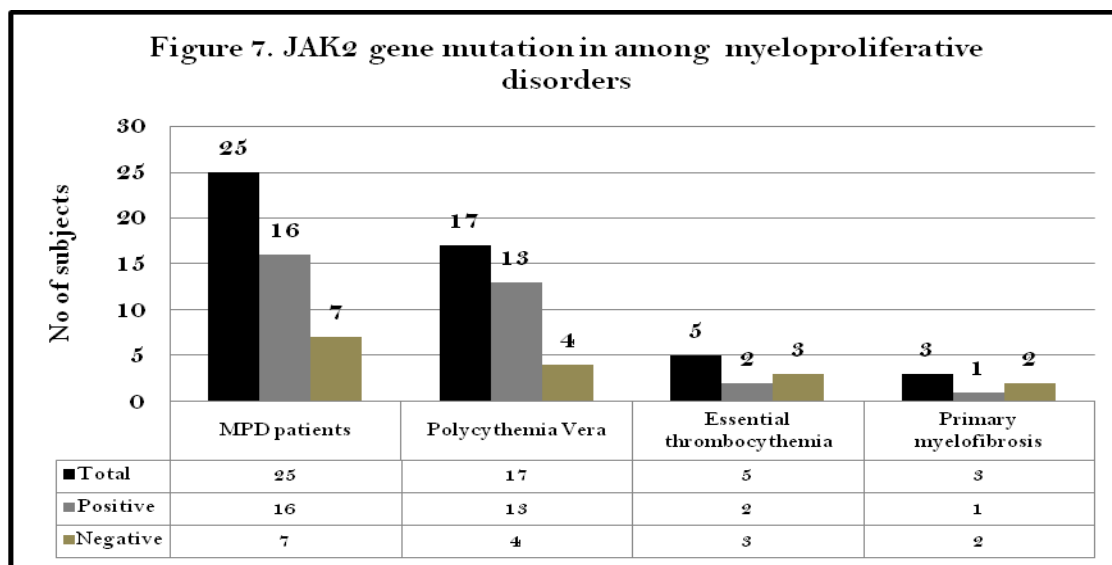


**Figure 5. Primer designing for ARMS-PCR assay of JAK2V617F Mutation**

The study was conducted on 50 specimens 25 were controls and 25 were MPD cases. The 25 newly diagnosed MPD patients among which 17 were polycythemia vera, 5 Essential thrombocytopenia and 3 primary myelofibrosis and 25 healthy controls depicted in figure 6 . Both cases and controls were tested for JAK2 mutations by ARMS-PCR. The JAK2 mutation was detected in 17/25 samples among which 13 were Polycythemia Vera, 02 from Essential thrombocythemia, 01 from Primary myelofibrosis as depicted in figure 7. The JAK2 mutation was not detected in any of the healthy controls by ARMS-PCR.







JAK2 V617F - DNA Reference Standards (Horizon diagnostics) for wild as well as mutant allele were used along with ARMS-PCR assays. ARMS assay proved to be highly sensitive technique and can be used to monitor residual disease after treatment. The JAK2 mutation was discovered using direct sequencing after PCR. However, the method only detects the mutation present in more than 20 to 30% of total DNA. The JAK2 mutation has become an important diagnostic criterion for Philadelphia chromosome-negative myeloproliferative neoplasms (Ph-neg MPN), especially in polycythemia vera (PV).<sup>19</sup> accordingly, it has been included in the World Health Organization diagnostic criteria for Ph-neg MPN<sup>20</sup>. In Jak2 gene new exon 12 mutations involved in the pathogenesis of PV and idiopathic erythrocytosis have been described. These mutations are also important for the diagnosis of PV, as approximately 3% of PV cases have mutations in this exon.<sup>21</sup> In addition, other JAK2 exon 14 mutations that are distinct from JAK2 V617F, such as C616Y, D620E, and C618R, have been detected in patients with myeloproliferative neoplasms (MPN).<sup>22</sup> Despite this, the described JAK2 mutations are neither specific for this group of diseases, nor are they present in all patients with classical Ph-neg MPN (especially in essential thrombocythemia [ET] and primary myelofibrosis). In addition, infrequent occurrence of the JAK2 V617F mutation has been reported in chronic myelomonocytic leukemia, atypical MPN, myelodysplastic syndromes, systemic mastocytosis, and acute myeloid leukemia.<sup>23</sup> Detection of the mutation is helpful in differential diagnosis, prognosis, and predication of therapeutic response.

Amplification Refractory Mutation System (ARMS-PCR) has also been termed allele-specific PCR or PCR amplification of specific alleles (PASA). The amplification refractory mutation system (ARMS) is an amplification strategy in which a polymerase chain reaction (PCR) primer is designed in such a way that it is able to discriminate among templates that differ by a single nucleotide residue. Thus, an ARMS primer can be designed to amplify a specific member of a multi-allelic system while remaining refractory to amplification of another allele that may differ by as little as a single base from the former.

Several laboratory techniques have been developed for JAK2 V617F genotypic analysis. Because JAK2 mutation is an acquired mutation that can be present in a small proportion of granulocytic populations in some cases, especially of ET, a highly sensitive detection method is essential. Different sensitivity of various assay methods partially accounts for the wide range of mutation frequencies reported in the literature.<sup>23</sup> As a matter of fact, re-evaluation of the same cases with a more sensitive technique has increased the detection rate from 73 to 97% in patients with polycythemia vera.<sup>24</sup> In addition, a highly sensitive technique is potentially useful to monitor residual disease after treatment. Methodologies reported in the literature include direct sequencing,<sup>24</sup> allele-specific polymerase chain reaction (PCR),<sup>24</sup> PCR-restriction fragment length polymorphism,<sup>25</sup> pyrosequencing,<sup>26</sup> and amplification refractory mutation system (ARMS)-PCR<sup>26</sup>. The main advantage of ARMS is that the amplification step and the diagnostic steps are combined, in that the presence of an amplified product indicates the presence of a particular allele and vice versa. For routine diagnosis, this characteristic of ARMS means that it is a very time-efficient method. However, this combination of the amplification and diagnostic steps has resulted in a system that may not be as robust as some of the other methods in which these two important steps are separated, e.g., PCR followed by restriction enzyme analysis. Moreover, the data show that direct sequencing is not an adequate technique for exon 12 mutation identification; therefore, appropriate methodology should be considered for using this molecular marker in the process of diagnosis. It has been have demonstrated that this high sensitivity is not

accompanied by any significant compromise in the diagnostic specificity of the assay. In addition, the ARMS-PCR assay shows different patterns for normal, mutant, or mixed genotypes, minimizing the chance of misinterpretation. With simply one tube of PCR reactions and obviation for special equipment and reagents, ARMS-PCR represents a time- and labor-saving as well as cost-efficient method that is readily and broadly applicable in clinical molecular diagnostic laboratories.

#### **Conclusion:-**

It was concluded that the ARMS-PCR assay is an appropriate methodology should be considered for using JAK2 molecular marker in the process of MPD diagnosis and allows discrimination between homozygous and heterozygous individuals with the JAK2 (V617F and in exon 12) mutation and has a key role in acting as a reliable screening test for the presence or absence of the mutation in individuals with MPDs. The test is therefore a simple, fast, and inexpensive procedure that does not entail any special equipment other than a thermocycler.

#### **Competing interests:-**

- ❖ The authors declare that they have no competing interests.

#### **Authors' contributions:-**

- ❖ All authors read and approved the final manuscript. Thanks to all authors for their support and help in this study.

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#### **References:-**

1. Dameshek W. Some speculations on the myeloproliferative syndromes. *Blood* 1951; 6: 372–375.
2. Nelson ME, Steensma DP (2006) *JAK2 V617F* in myeloid disorders: what do we know now, and where are we headed? *Leuk Lymphoma* 47: 177–194.
3. Goldman JM, Melo JV. Chronic myeloid leukemia – advances in biology and new approaches to treatment. *N Engl J Med* 2003; 349: 1451–1464.
4. Deininger M, Buchdunger E, Druker BJ. The development of imatinib as a therapeutic agent for chronic myeloid leukemia. *Blood* 2005; 105: 2640–2653.
5. Greiner, TC. Diagnostic assays for the *JAK2 V617F* mutation in chronic myeloproliferative disorders. *Am J Clin Pathol.* 2006; 125: 651–653
6. Levine RL, Wadleigh M, Cools J, Ebert BL, Wernig G, Huntly BJ *et al.* Activating mutation in the tyrosine kinase *JAK2* in polycythemia vera, essential thrombocythemia, and myeloid metaplasia with myelofibrosis. *Cancer Cell* 2005; 7: 387–397.
7. James C, Ugo V, Le Couedic JP, Staerk J, Delhommeau F, Lacout C *et al.* A unique clonal *JAK2* mutation leading to constitutive signalling causes polycythaemia vera. *Nature* 2005; 434: 1144–1148.
8. Kralovics R, Passamonti F, Buser AS, Teo SS, Tiedt R, Passweg JR, Tichelli A, Cazzola M, Skoda RC. A gain-of-function mutation of *JAK2* in myeloproliferative disorders. *N Engl J Med.* 2005; 352: 1779–1790
9. Vainchenker W, Constantinescu SN. A unique activating mutation in *JAK2 (V617F)* is at the origin of polycythemia vera and allows a new classification of myeloproliferative diseases. *Hematology (Am Soc Hematol Educ Program)* 2005; 195–200.
10. Campbell PJ, Scott LM, Buck G, Wheatley K, East CL, Marsden JT, Duffy A, Boyd EM, Bench AJ, Scott MA, Vassiliou GS, Milligan DW, Smith SR, Erber WN, Bareford D, Wilkins BS, Reilly JT, Harrison CN, Green AR, United Kingdom Myeloproliferative Disorders Study Group, Medical Research Council Adult Leukaemia Working Party, Australasian Leukaemia and Lymphoma Group. Definition of subtypes of essential thrombocythaemia and relation to polycythaemia vera based on *JAK2 V617F* mutation status: a prospective study. *Lancet.* 2005 Dec 3; 366(9501):1945–53.
11. McClure R, Mai M, Lasho T. Validation of two clinically useful assays for evaluation of *JAK2 V617F* mutation in chronic myeloproliferative disorders. *Leukemia.* 2006; 20: 168
12. Jelinek J, Oki Y, Gharibyan V, Bueso-Ramos C, Prchal JT, Verstovsek S, Beran M, Estey E, Kantarjian HM, Issa JP. *JAK2* mutation 1849G>T is rare in acute leukemias but can be found in CMML, Philadelphia chromosome-negative CML, and megakaryocytic leukemia. *Blood.* 2005; 106: 3370–3373

13. Steensma, DP. JAK2 V617F in myeloid disorders: molecular diagnostic techniques and their clinical utility: a paper from the 2005 William Beaumont Hospital Symposium on Molecular Pathology. *J Mol Diagn.* 2006; 8: 397–411
14. Steensma DP. JAK2 V617F in myeloid disorders: molecular diagnostic techniques and their clinical utility: a paper from the 2005 William Beaumont Hospital Symposium on Molecular Pathology. *J Mol Diagn.* 2006;8:397–411
15. Ma W, Kantarjian H, Zhang X, Yeh C-H, Zhang ZJ, et al. Mutation profile of *JAK2* transcripts in patients with chronic myeloproliferative neoplasias. *J Mol Diagn* 2009, 11: 49–53.
16. McClure R, Mai M, Lasho T. Validation of two clinically useful assays for evaluation of JAK2 V617F mutation in chronic myeloproliferative disorders. *Leukemia.* 2006;20:168–171
17. Tefferi A, Sirhan S, Lasho TL, Schwager SM, Li CY, Dingli D *et al.* Concomitant neutrophil JAK2 mutation screening and PRV-1 expression analysis in myeloproliferative disorders and secondary polycythaemia. *Br J Haematol* 2005; 131: 166–171.
18. Vannucchi AM, Guglielmelli P, Antonioli E, Mappa S, Pancrazzi A, Bogani C *et al.* Inconsistencies in the association between the JAK2 mutation and PRV-1 over-expression among the chronic myeloproliferative diseases. *Br J Haematol* 2006; 132: 652–654.
19. James, C, Ugo, V, Le Couedic, JP, Staerk, J, Delhommeau, F, Lacout, C, Garcon, L, Raslova, H, Berger, R, Bennaceur-Griscelli, A, Villeval, JL, Constantinescu, SN, Casadevall, N, and Vainchenker, W. A unique clonal JAK2 mutation leading to constitutive signalling causes polycythaemia vera. *Nature.* 2005;434: 1144–1148
20. Tefferi, A, Thiele, J, Orazi, A, Kvasnicka, HM, Barbui, T, Hanson, CA, Barosi, G, Verstovsek, S, Birgegard, G, Mesa, R, Reilly, JT, Gisslinger, H, Vannucchi, AM, Cervantes, F, Finazzi, G, Hoffman, R, Gilliland, DG, Bloomfield, CD, and Vardiman, JW. Proposals and rationale for revision of the World Health Organization diagnostic criteria for polycythemia vera, essential thrombocythemia, and primary myelofibrosis: recommendations from an ad hoc international expert panel. *Blood.* 2007; 110: 1092–1097
21. Pietra, D, Li, S, Brisci, A, Passamonti, F, Rumi, E, Theocharides, A, Ferrari, M, Gisslinger, H, Kralovics, R, Cremonesi, L, Skoda, R, and Cazzola, M. Somatic mutations of JAK2 exon 12 in patients with JAK2 (V617F)-negative myeloproliferative disorders. *Blood.* 2008; 111: 1686–1689
22. Grunebach, F, Bross-Bach, U, Kanz, L, and Brossart, P. Detection of a new JAK2 D620E mutation in addition to V617F in a patient with polycythemia vera. *Leukemia.* 2006; 20: 2210–2211
23. Tefferi, A and Pardanani, A. Mutation screening for JAK2V617F: when to order the test and how to interpret the results. *Leuk Res.* 2006; 30: 739–744
24. Baxter, EJ, Scott, LM, Campbell, PJ, East, C, Fourouclas, N, Swanton, S, Vassiliou, GS, Bench, AJ, Boyd, EM, Curtin, N, Scott, MA, Erber, WN, and Green, AR. Acquired mutation of the tyrosine kinase JAK2 in human myeloproliferative disorders. *Lancet.* 2005; 365:1054–1061
25. Levine, RL, Wadleigh, M, Cools, J, Ebert, BL, Wernig, G, Huntly, BJ, Boggon, TJ, Wlodarska, I, Clark, JJ, Moore, S, Adelsperger, J, Koo, S, Lee, JC, Gabriel, S, Mercher, T, D'Andrea, A, Frohling, S, Dohner, K, Marynen, P, Vandenberghe, P, Mesa, RA, Tefferi, A, Griffin, JD, Eck, MJ, Sellers, WR, Meyerson, M, Golub, TR, Lee, SJ, and Gilliland, DG. Activating mutation in the tyrosine kinase JAK2 in polycythemia vera, essential thrombocythemia, and myeloid metaplasia with myelofibrosis. *Cancer Cell.* 2005; 7:387–397
26. Jones, AV, Kreil, S, Zoi, K, Waghorn, K, Curtis, C, Zhang, L, Score, J, Seear, R, Chase, AJ, Grand, FH, White, H, Zoi, C, Loukopoulos, D, Terpos, E, Vervessou, EC, Schultheis, B, Emig, M, Ernst, T, Lengfelder, E, Hehlmann, R, Hochhaus, A, Oscier, D, Silver, RT, Reiter, A, and Cross, NC. Widespread occurrence of the JAK2 V617F mutation in chronic myeloproliferative disorders. *Blood.* 2005; 106: 2162–2168

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### RESEARCH ARTICLE

#### The Determination of the Coloring Centers through Casting (C-DCPF)<sub>5%</sub> - (PMMA) Film and New Optical Comparative Studying With its E-isomer.

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#### Abstract

Films of 5% E-dicyclopentyl-methylene-(2,5-dimethyl-3-furylethylidene-succinic anhydride (E-DCPF) doped in PMMA polymer films, [E - (DCPF) - (PMMA) films], were prepared by casting method and then were irradiated with UV light (360 nm) for different exposure time (2- 38 min). The color of the films turned to deep pink after 38 min. The photo-bleaching time was 670 min. The absorbance spectrum was studied in the range from 190 nm up to 650 nm, where that spectrum showed four peaks. The onset one was related to the photo coloration effect at 516.44 nm, where it was increased in height and decreased in its width by the increasing of the exposure time of UV-Irradiation . The other three peaks were at 363 nm, 272.85 and 218 nm respectively. The spectra have an isosbestic point at (417 nm). The optical properties of the films were investigated using the spectrophotometric measurements of both the transmittance and reflectance in the spectral range from 400 to 1500 nm . Both the refractive index,  $n$ , and the absorption index,  $k$ , were calculated before and after coloration. For the first time ; the parameters of the molar extinction coefficient ( $\epsilon_{\text{molar}}$ ), oscillator energy ( $E_{0s}$ ), oscillator strength ( $f$ ), electronic dipole strength ( $q^2$ ) and the concentration of the coloring centers were evaluated. The analysis of the absorption coefficient ( $\alpha$ ) revealed three indirect transitions and only one direct transition for photo - bleached films , while two indirect transitions and only one direct transition for colored films .

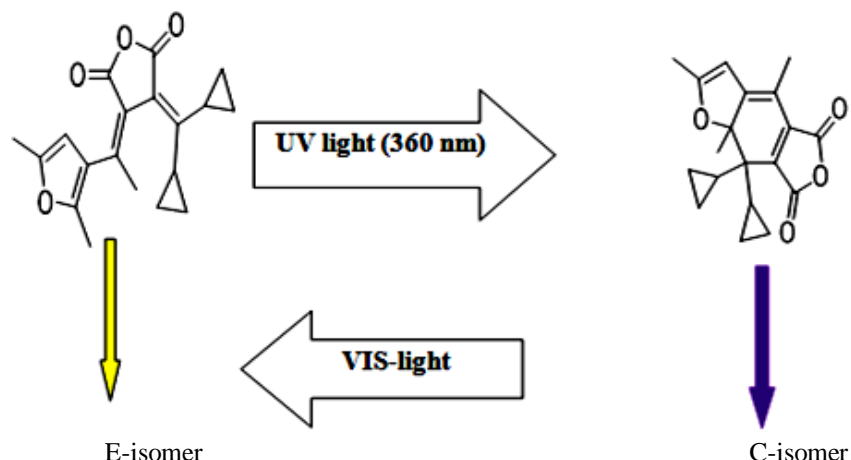
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#### Introduction:-

Dicyclopentyl fulgide (DCPF) has attracted a great attention because it is an important one of the organic photochromic compounds. These compounds are considered as promising candidates in photoswitchable system which require high reversibility [1-11] and in optical memory devices which depending on non -destructive readout stability[5-7]. Through all photochromic candidates; Fulgides showed a reversible photochromism with minimum photochemical fatigue [2,8], thermal stability [9] and nondestructive readout stability .The photochromism of fulgide occurs between the open E-isomer and the photocycle colored form(C-isomer) [2,5-7]. The molecular structure for E&C (isomers) of DCPF is shown in Fig.1(a)

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**Fig. 1(a):** The molecular structures of both E and C - (DCPF) compounds.

The present work is to introduce a new optical comparative studying of casting (C-DCPF) - PMMA film with its E-isomer, determine the concentration of the coloring centers, and many other important optical parameters for more promising photochromic application.

### Experimental Technique:-

films of (5% E-DCPF) doped in (PMMA), with 37.5  $\mu\text{m}$  thickness, were prepared using casting technique. The poly methyl methacrylate (PMMA), was obtained from Aldrich chemical company, while dicyclopropyl-methylene-(2,5-dimethyl-3-furylethylidene-succinic anhydride (E-DCPF) was obtained from TCI company, Japan. Pure chloroform was used as a common solvent for both DCPF and PMMA. The solutions were then mixed by using a magnetic stirrer for about 4.5 hours and under vacuum to reach a suitable viscosity and homogeneity. The solution then was casted on a glass plate and kept in a dry atmosphere at room temperature for 24 hours. UV-VIS absorption spectra of the unirradiated and irradiated films were carried out at room temperature in the wavelength range (190-650 nm). In addition, both the transmittance (T) and the reflectance (R) were measured at normal incidence in the spectral range from 190 to 1500 nm, using a double beam spectrophotometer (JASCO model V-670 UV-VIS-NIR) attached with constant angle specular reflection attachment ( $5^\circ$ ). The analysis of the obtained data of T, R and A were carried out in a similar manner as published before [10,12]. The relative uncertainty in the transmittance and reflectance given by the manufacturer was 1%. Transmittance scans were performed using the air in the reference compartment of the same type as the one used for film deposition. The reflectance was measured at the incidence angle of  $5^\circ$  with an aluminum reference mirror. The absolute values of measured transmittance and reflectance, after correcting for the absorbance and reflectance of the substrates, are given by the following equations;

$$T = \left( \frac{I_{ft}}{I_a} \right) (1 - R_a) \quad (1)$$

where  $I_{ft}$  and  $I_a$  are the intensities of the light passing through the film-air system and the reference air, respectively, and  $R_a$  is the reflectance of air. In addition, if the intensity of light reflected from the sample mirror reaching the detector is  $I_r$  and that reflected from the reflectance reference mirror is  $I_m$ , then;

$$R = \left( \frac{I_{ft}}{I_m} \right) R_m [1 + (1 - R_a)^2] - T^2 R_a \quad (2)$$

From the measured T, R and film thickness, d, the value of the refractive index (n) and the absorption index (k) were computed by a special computer program based on minimizing  $(\Delta T)^2$  and  $(\Delta R)^2$  simultaneously, where

$$(\Delta T)^2 = |T_{n,k} - T_{exp}|^2 \quad (3)$$

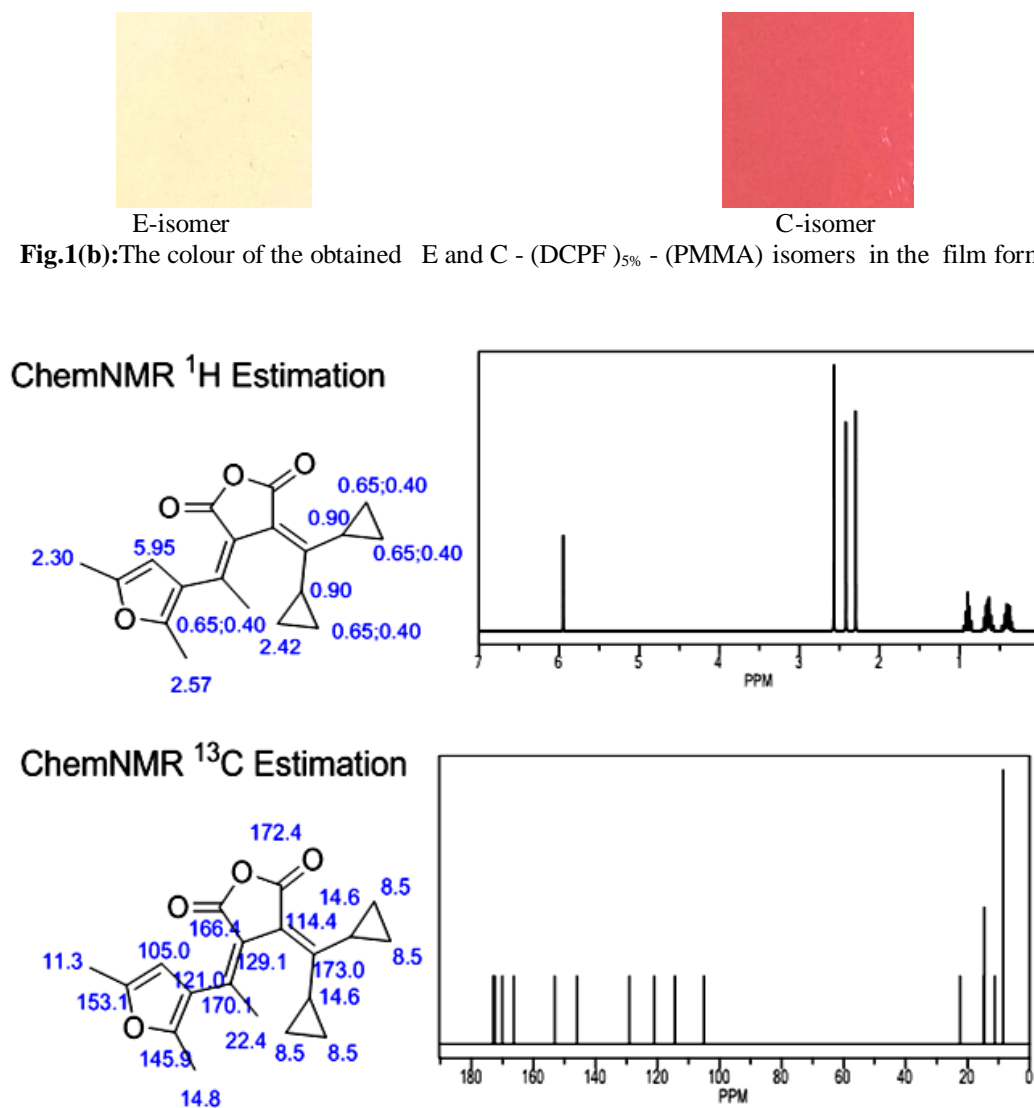
$$(\Delta R)^2 = |R_{n,k} - R_{exp}|^2 \quad (4)$$



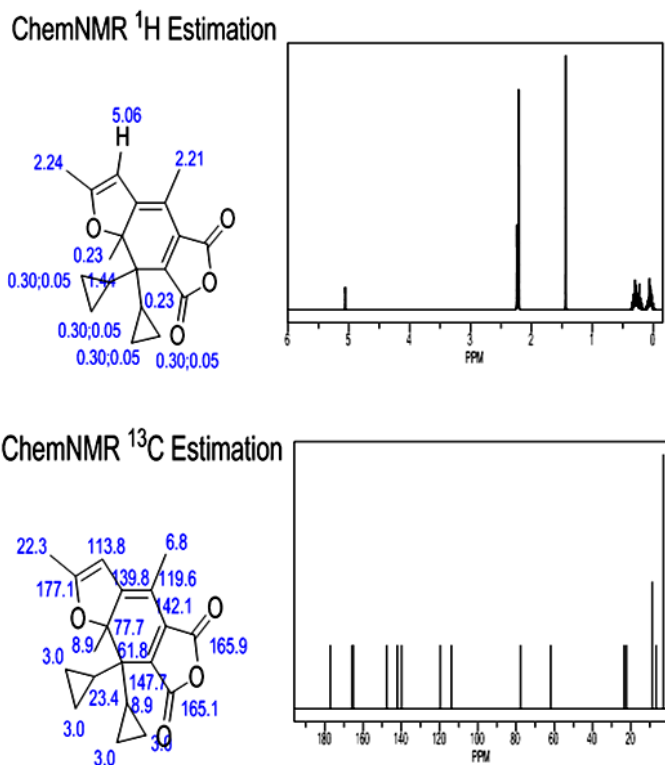
where  $T_{n,k}$  and  $R_{n,k}$  are the calculated values of T and R using the Murmann's exact equations taking into account the experimental error in measuring the film thickness to be  $\pm 2.5\%$  and in T and R to be  $\pm 1\%$ , the error in the calculated values of n and k are estimated to be  $\pm 3\%$  and  $\pm 2.5\%$ , respectively.

## Results and Discussion

Fig.1(b) showed the experimental pictures of the bleached (E-isomer) and colored (C-isomer) (DCPF) 5% (PMMA) films, while Fig.2(a&b) represents the obtained patterns for NMR -  $H^1$  &  $C^{13}$  estimations for both E and C- DCPF films under our estimation.

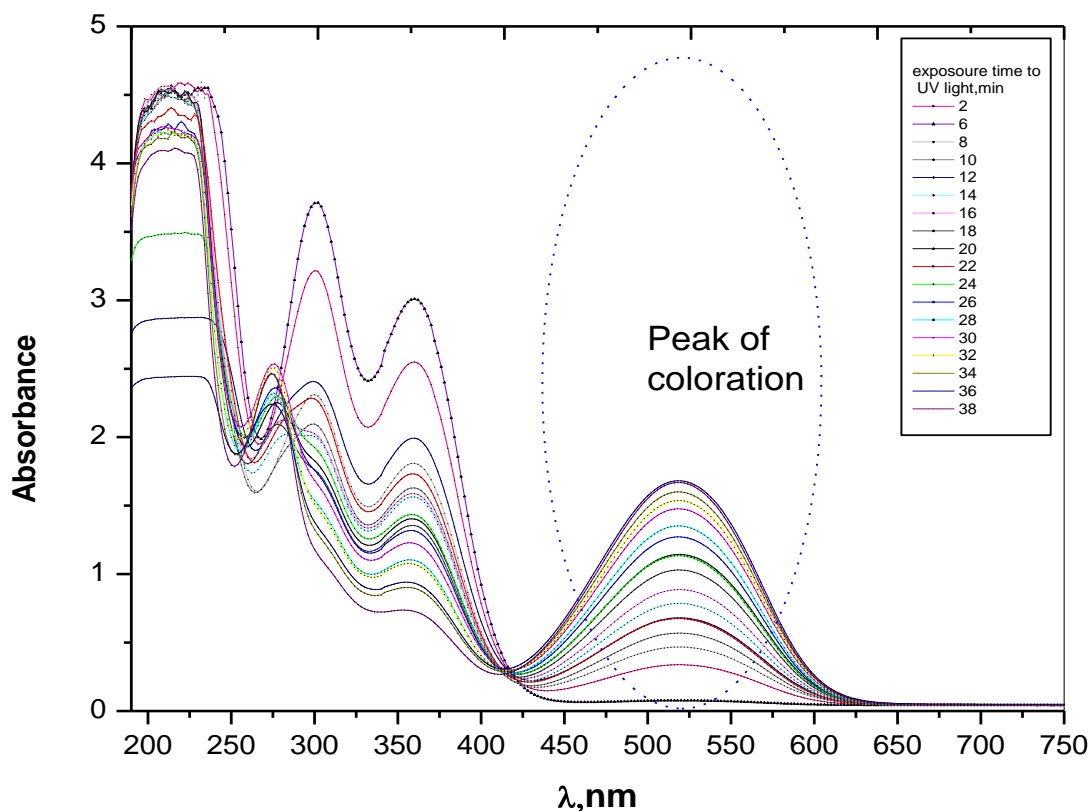


**Fig. 2(a):** The patterns of NMR-  $H^1$  &  $C^{13}$  estimations of (E-DCPF) 5% - (PMMA) film.

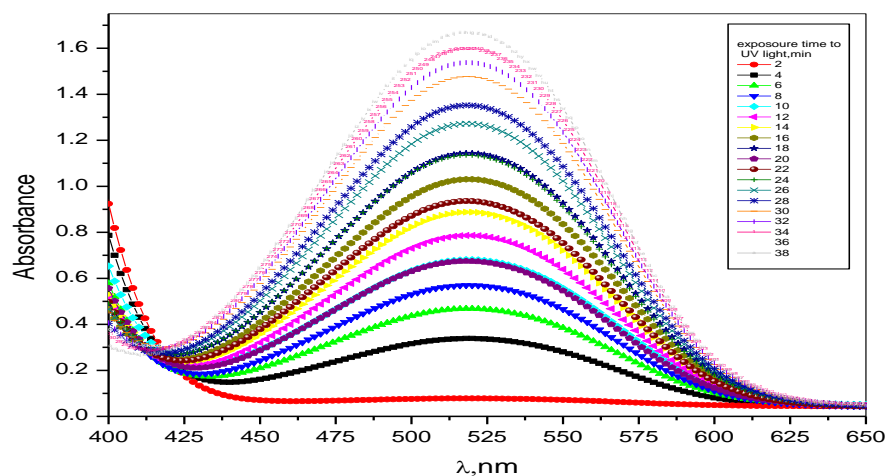


**Fig.2(b):**The patterns of NMR-  $\text{H}^1$  &  $\text{C}^{13}$  estimations of  $(\text{C-DCPF})_{5\%}$  - (PMMA) film.

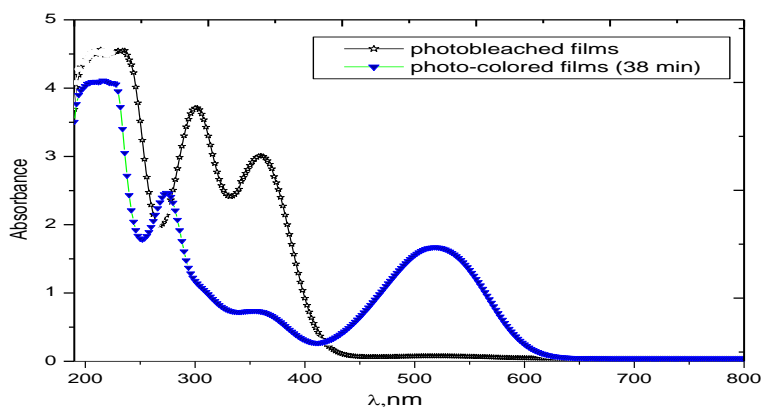
Fig.3 shows the effect of the exposure times to UV light on absorbance spectrum of  $(\text{E-DCPF})_{5\%}$  - (PMMA) films. . The exposure time ranged from 2 to 38 min, where the absorbance reached to a saturation and a stability in its value. The absorption in VIS region increased with increasing of the exposure time up to 38 min then leave off, with photochromic absorption peak at 516,44 nm, see Fig.4(a). The spectra of absorbance in Fig.3 illustrated an isosbestic point at 417.079 nm, where the second absorption band was mentioned with an inverted response to light. The amplitude of the absorption peaks increased with exposure time to UV light. Fig.4(b) represents a comparison between the absorption spectrum of the saturated photo-colored and photo-bleached of  $(\text{DCPF})_{5\%}$  - (PMMA) films at room temperature in the wavelength range. (190-650 nm), while Table.1 involved a comparison between E and C of  $(\text{DCPF})_{5\%}$  - (PMMA) films.. The isosbestic point revealed the presence of only one product in photoreaction[13]. C-isomer product was then photobleaching using a white light. The photo-colored was gradually started disappeared after 670 min, where it returned to the original color which related to E-isomer. This behavior was found to obey a first order reaction with a rate constant,  $k = 0.158. \text{ s}^{-1}$  and a half-life time,  $t_{1/2} = 40 \text{ s}$ .



**Fig. 3:** The absorbance spectra of (DCPF)<sub>5%</sub> - (PMMA) films at room temperature in the wavelength range (190 -750 nm) at different exposure time (2-38 min).



**Fig.4(a):** The time dependence of the absorbance spectra of the coloration peak through (DCPF)<sub>5%</sub> - (PMMA) film in the wavelength range (400-650 nm).



**Fig.4 (b):** A comparison between the absorbance spectra of the photo-colored and photo-bleached (DCPF)<sub>5%</sub> - (PMMA) film.

**Table 1:** The values of the energies(E) of the peaks in the absorbance spectra of both E and C- (DCPF)<sub>5%</sub> - (PMMA) film.

No., of the peak	<u>E(eV)</u>	
	E-isomer	C-isomer
1	-----	2.401
2	3.44	3.416
3	4.129	4.545
4	5.602	5.668

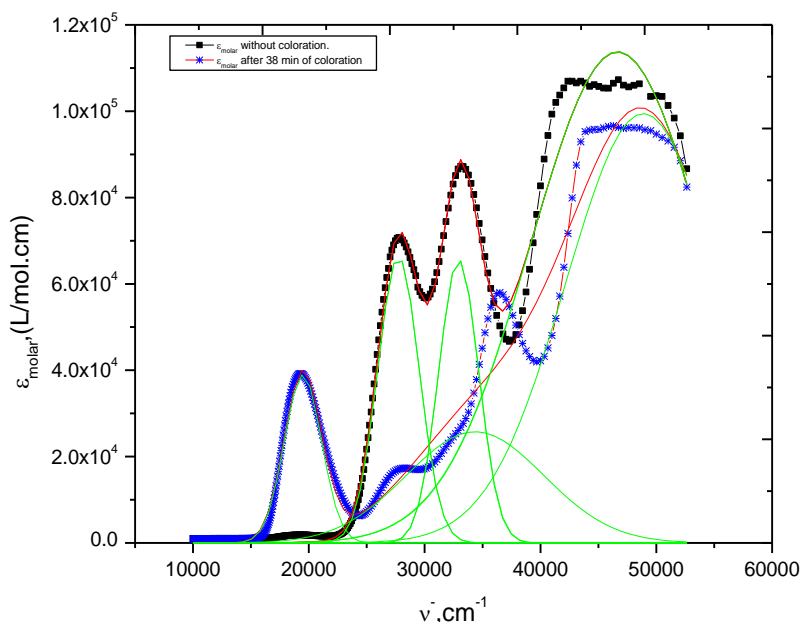
The spectral distribution of the molar extinction coefficient ( $\epsilon_{\text{molar}}$ ) was also determined and it is shown in Fig.5.  $\epsilon_{\text{molar}}$  and its companion parameters meanly, oscillator energy( $E_{\text{os}}$ ), oscillator strength (f) and the electric dipole strength ( $q^2$ ) were determined using the following equations [14].

$$\alpha = 2303 \left( \frac{\rho}{M} \right) \epsilon_{\text{molar}} \quad (5)$$

$$f = 4.38 \times 10^{-9} \int \epsilon_{\text{molar}} d\nu \quad (6)$$

$$q^2 = \frac{1}{2500} \epsilon_{\text{molar}} \Delta\lambda / \lambda \quad (7)$$

Where  $\rho$  is the solid's mass density, M is molecular's weight and  $\alpha$  is absorption coefficient. These parameters have been listed in Table 2



**Fig.5:** The molar extinction coefficient ( $\epsilon_{\text{molar}}$ ) vs., the wave number ( $\nu$ ) for both E and C (DCPF)<sub>5%</sub> - (PMMA) films.

**Table 2:** The Calculated spectral parameters,  $f$  and  $q^2$  of the different peaks for both E and C- (DCPF)<sub>5%</sub> - (PMMA) films.

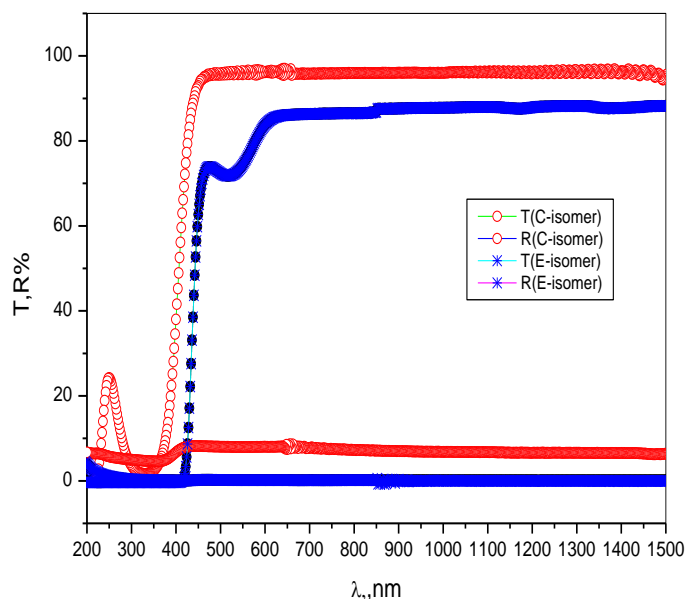
No., of the peak in Fig.(5)	F		$q^2$ (Å)	
	C-isomer	E-isomer	C-isomer	E-isomer
1	0.689	1.3	0.59	0.79
2	1.681	1.75	0.37	0.48
3	0.456	0.94	8.002	11.90
4	0.73	-----	14.63	-----

Also, the concentrations of the coloring centers were calculated by the analysis of the peak of coloration and depending on approximate Smakula's equation, which can be represented by the following formula [ 15 ];

$$N_f = 0.89 \times 10^7 \left[ \frac{n}{(n^2 + 2)^2} \alpha \mu \right] \quad (8)$$

Where  $N$  is the density of the coloring centers,  $n$  is the refractive index of the films,  $\mu$  is the width at the half maximum of the absorption peak. The calculated centers were increased from  $\sim 4.57 \times 10^{10}$  to  $9.18 \times 10^{12} / \text{cm}^3$  as the time of coloration increased from 2 to 38 min.

On the other side, the spectral distribution of both T and R in the wavelength (400 to 1500 nm) for bleached, and colored films are shown in Fig.6. The analysis of both T and R gave us the ability to calculate the mean optical constants, the refractive index,  $n$ , and the absorption index,  $k$ .



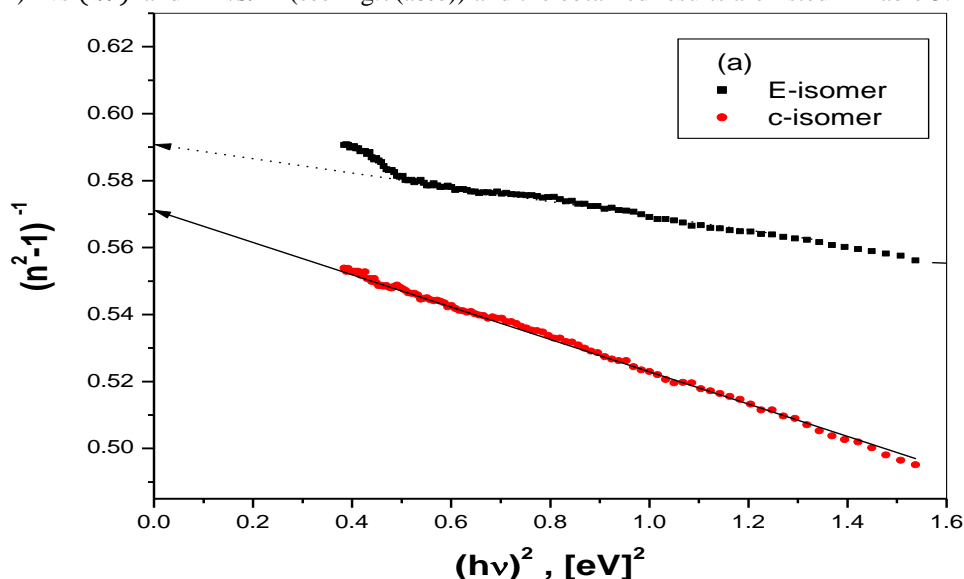
**Fig. 6:** T% and R% vs.  $\lambda$ (nm) for both E and C - (DCPF)<sub>5%</sub> - (PMMA) isomers in the film form.

The refractive index  $n$ , was analyzed using the single oscillator model in the transparent region and all the optical data could be described to a very good approximation, by the following equations[16-17].

$$n^2 = 1 + \frac{E_0 E_d}{(E_0^2 - (h\nu)^2)} \quad (9)$$

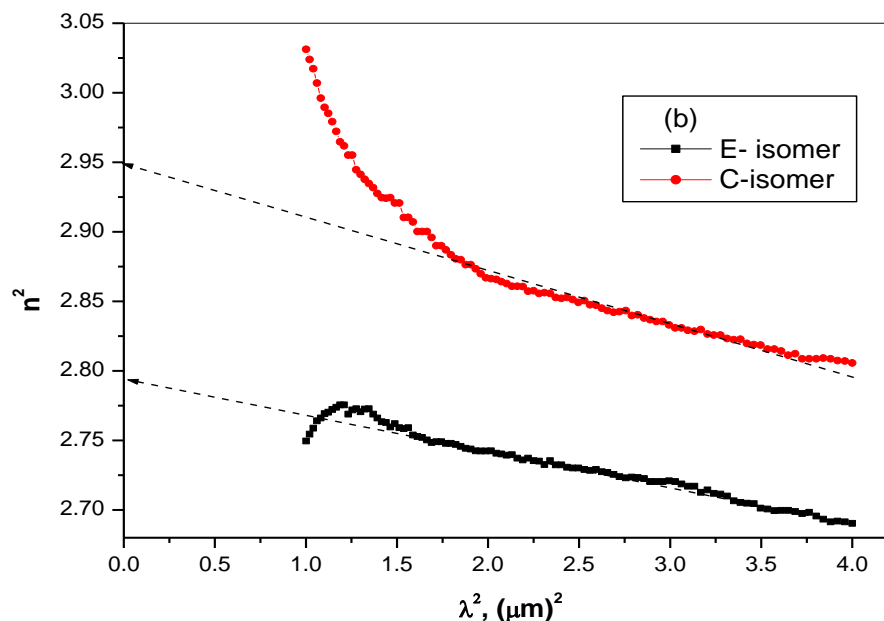
$$n^2(\varepsilon_\infty) = \varepsilon_l - \frac{(e^2 N)}{(4\pi \varepsilon_0 c^2 m^*)} \lambda^2 \quad (10)$$

,where  $h\nu$  is the photon energy,  $E_0$  is the oscillator energy,  $E_d$  is the dispersion energy,  $\varepsilon_\infty$  is the high frequency dielectric constant,  $\varepsilon_l$  is the lattice dielectric constant,  $N/m^*$  is the ratio of the free carrier concentration to the effective mass,  $c$  is the speed of light, and  $e$  is the electronic charge. The dispersion parameters were obtained by plotting  $(n^2 - 1)^{-1}$  vs  $(h\nu)^2$  and  $n^2$  vs.  $\lambda^2$  (see Fig.7(a&b)) and the obtained results are listed in Table 3.



**Fig.7(a):**  $(n^2 - 1)^{-1}$  vs  $(h\nu)^2$  for both E and C - (DCPF)<sub>5%</sub> - (PMMA) isomers in the film forms.



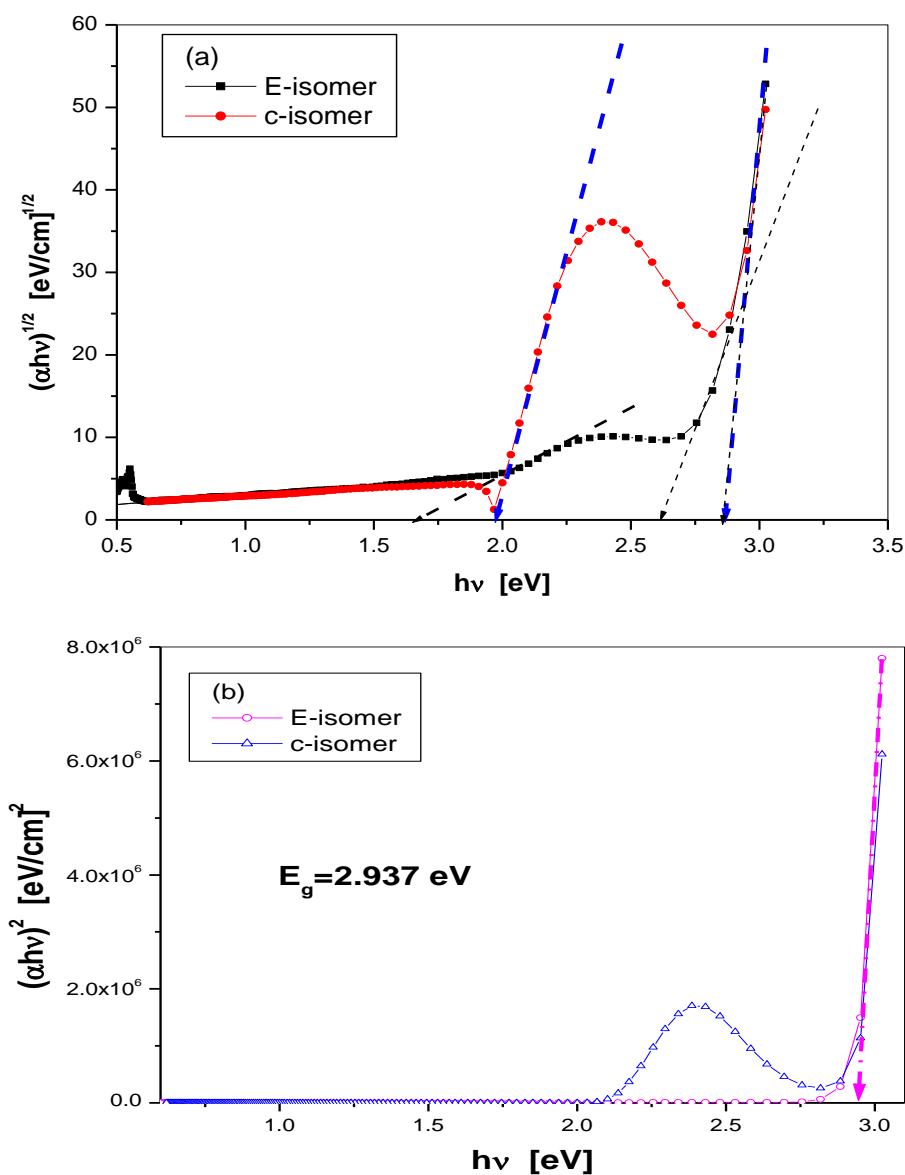


**Fig.7(b):**  $(n^2)$  vs  $(\lambda)^2$  for both E and C- (DCPF)<sub>5%</sub> - (PMMA) isomers in the film form.

**Table 3:** Some Dispersion parameters for both E and C (DCPF)<sub>5%</sub> - (PMMA) isomers in the film form.

The dispersion parameters	E-isomer	C-isomer
$E_0$ , eV	5.107	3.397
$E_d$ , eV	8.626	5.9327
$\varepsilon_\infty$	2.689	2.7465
$\varepsilon_L$	2.794	2.927
$\varepsilon_L - \varepsilon_\infty$	0.105	0.181
$N/m^*$ , /Kg.m <sup>3</sup>	$3.345 \times 10^{46}$	$4.084 \times 10^{46}$

After the analysis of the dispersion curves we converted to determine both the type and the values of the energy gaps depending on the analysis of the absorption coefficient and according to Baradeen et al equation[16] for E and C- (DCPF)<sub>5%</sub> - (PMMA) isomers in the thin film forms. The results are listed in Table 4 and shown in Fig.8(a&b). These results supported the presence of three indirect transitions with 1.669, 2.61, and 2.787 eV for E-isomer, while two with 1.967 and 2.787 eV for C-isomer respectively and only one direct transition for the both isomers, in the thin film forms, with a value equal to 2.937 eV.



**Fig.8:(a)**  $(\alpha h\nu)^{1/2}$  vs.,  $(h\nu)$  and **(b)**  $(\alpha h\nu)^2$  vs.,  $(h\nu)$  for both E and C- (DCPF)<sub>5%</sub> - (PMMA) isomers in the film form.

**Table 4:-** The values the optical energies of both direct and indirect transitions for both E and C- (DCPF)<sub>5%</sub> - (PMMA) isomers in the film form.

The type of the optical transitions	The values of the	Optical energies ( $E_g$ ) in eV	
		E-isomer	C-isomer
Indirect	$E_{g1}^{in}$	1.669	1.967
	$E_{g2}^{in}$	2.61	-----
	$E_{g3}^{in}$	2.787	
Direct	$E_g^d$	2.937	

### Conclusion:-

Casting E- (DCPF)<sub>5%</sub> - (PMMA) isomer in the film form was prepared and then was irradiated with UV light (360 nm) for different exposure time. The film turned to deep pink color after 38 min. The photo-bleaching time was 670 min. The absorbance spectra showed four peaks. The onset one was related to the photo coloration effect at 516.44 nm, where it was increased in height and decreased in its width by exposure time of UV-Irradiation. The other three peaks were at 363.04 nm, 272.848 and 218.819 nm respectively. The spectra have an isosbestic point at (417.079 nm). The photo-coloring effect was gradually disappeared and return to the original color after 670 min, which related to E-isomer. This behavior was found to obey a first order reaction with a rate constant,  $k = 0.158 \text{ s}^{-1}$  and a half-life time,  $t_{1/2} = 40 \text{ s}$ . The analysis of both the transmittance and reflectance in the spectral range from 400 to 1500 nm revealed the presence of three indirect transitions with 1.669, 2.61, and 2.787 eV for E-isomer, while two with 1.967 and 2.787 eV for C-isomer respectively and only one direct transition for the both isomers, in the thin film forms, with a value equal to 2.937 eV. The application of Smakula's equation indicated the increasing of the concentration of the coloring centers from  $\sim 4.57 \times 10^{10}$  to  $9.18 \times 10^{12} / \text{cm}^3$  as the time increased from 2 to 38 min.

### References:-

1. M.Seibold, H.Port,K.Gustav, Chem.Pyhs.Lett. 314(1999)65.
2. R.Matsushima,H.Saka guachi,J.Photochem.Photobiol.A:Chem,108(1997)239.
3. F.Francinic,G.Ottavi,P.Sansoni,B.Tiribilli,Opt.Commun.130(1996)235.
4. Z.Sun, R.S.Hosmance,M.Tadros,Tetrahedron Lett 36(20)(1995)3453.
5. M.A.Wolak,N.B.Gillespi,C.J.Thomas,R.R.Birgre,W.J.Lees,J.Photochem.Photobiol.A:Chem.147(2002)39.
6. Y.Liang,A.S.Dvornikov,P.M.Rentzepis,J.Photochem.Photobiol.A:Chem.146 (2001)83.
7. Y.Yokoyama,T.Yamne,Y.Knrta,J.Chem.Soc.,Chem.Com.(1991)1772.
8. M. Ibrahim, A.A. El-Barbary, M.M. El-Nahass, M.A. Kamel, M.A.M. El-Mansy, A.M. Asiri *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy* 87 (2012) 202
9. H.G.Heller ,R.M.Megit,J.Chem.Soc.,Perkin trans.1(1974)1487.
10. M.M.EL-Nahass ,H.M.Zeyada and A.A.Hendi, Optical Materials 25 (2004)43.
11. A.M.Asiri. J.Chem.Res.5 (1997)302.
12. M.M.El-Nahass ,A.A.Atta,H.E.A.Elsayed and E.F.EL-Zaidia Applied Surface Science (2008)2458.
13. S.H.Wemple,M.D.DiDomenico , Phys.Rev.B3 (1970)1338.
14. A.A. Abu elwafa, M. Dongol, M.M. El-Nahass, T. Soga J. Alloys & Comp. 655(2016) 415
15. S.K.Deb.Philo.Mag.27(1973)801.
16. J.Bardeen,F.J.Blatt,L.T.Hall ,in ;R.Breekenridge,B.Russel ,T.Han(Eds.),proceeding of photoconductivity conference, willy,New York,1956.

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### RESEARCH ARTICLE

## TRAINING STRATEGIES AS AN ANTECEDENT FOR EMPLOYEE COMMITMENT IN KENYAN SETTING.

Bramuel Murgor, Wycliffe kiganane and Muhamed Sheik.

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Training, Commitment, and strategies

### Abstract

Employee training is intended to provide an opportunity for advancement and may be perceived as the organization values their employees and their sense of self-worth, therefore will result to building a stronger affective commitment. Thus also resulting to a function of close psychological attachment to the organization and its goals, (McElroy, 2001). The purpose of this study was to analyse the effects of employee training and development strategies on employee commitment. The research hypotheses for the study were; Ho1 training opportunities have no significant effect on employee commitment. The study employed a case study research design that was conducted at Moi Teaching and Referral Hospital. The target population was three thousand two hundred (3200) respondents were targeted because that was the group highly affected by commitment and turnover issues in the organisation. A sample size of 340 was extracted from the target population and the sampling techniques used were stratified sampling. Data was analyzed using Multiple regression analysis was performed to test the hypothesized relationships. Based on the observed correlation results, training ( $\beta = 0.134$ ,  $p < 0.05$ ) indicated that there was a significant positive correlation between employee training opportunities and employee commitment. This implies that the perceived empowerment of employees by the hospital was likely to impact positively on their commitment to the hospital.

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### Introduction:-

Training is essential for the livelihood of any employee in the public sectors and it is the only way employment can be maintained over careers. (Tomlinson., 2002) suggests that, it is critical that organization keep the leading edge by having their employees stay in organizations that promote career opportunities through learning and the ability to apply their newly acquired skills (Klein and Kozlowski, 2000). Employees might also develop a moral obligation to give the organization its money's worth (normative commitment), particularly if the company finds the training (McElro, 2001). Therefore, the main objective of this study is one fold in determining the extent to which training and development opportunities affect employee commitment.

**Review of literature:-****Employee Commitment:-**

In the competitive environment, most of the organizations have successfully developed, executed, evaluated, refined and perused employee empowerment and improvement as a prime human resource practice with business value (Kandula, 2004). So an employee committed and involved organization starts with the concept of strategic fit between people, tasks, technology, information processes, rewards and organization structure for which all must be in alignment before the organization can work efficiently (Kandula, 2004).

**Training and employee Commitment:-**

Training is defined as the opportunities provide by the organization to advance an individual's carrier prospects, such as challenging assignments, and being kept informed. Employee training is also likely to affect the employee commitment capacity. Continuous professional development is particularly important to knowledge workers. Firms need to offer internal and external training opportunities to develop and nurture required satisfaction and commitment of employees (Jaw and Liu, 2003). Fugate *et al.*, (2004) has encouraged organizations to assist employees to develop their careers through activities that are beneficial for both employees and the organization. Current literature points out variety of activities that are provided by organizations to assist in career development, this includes challenging work assignments, new learning opportunities Kinnieet *al.*, (2005), Career Counseling, (Leung, 2002), and access to information about the organization (Gubbinset *al.*, 2005).

Wetland (2003) asserts that training and development of employees is increasingly recognized as an important aspect of best human resource management practices. Training and development are commonly considered to be different forms of human capital invested for individual and organizational improvement. Organizations invest a large amount of its capital for training purposes and the development of its employees. It is worthy of probing whether the training is advantageous for the trainees, and to what degree can the process of training be enhanced. Stephen *et al.*, (2007) study shows the link between training associated with employee's productivity which further leads toward employee and customer satisfaction. Improvement in performance such as productivity, quality and services are the training outcomes provided that the job is strategically aligned to the organization's needs. Gold (2001) stresses that, the areas where training may be used in the enhancement of job specific skills, the correction of deficiencies in job performance and development may be provided to employees with abilities the organization might need in the future. However, higher degree of training increases employee satisfaction and loyalty towards the firm and decreases the chances of employee terminations and lay-offs (Chooand Bowley., 2007).

Landsman (2004), suggested that training is a valuable activity for enhancing skills and improving staff performance, and that training can address some of the factors contributing to staff retention, such as perceived support for the supervisor, the agency and community. Training can define roles more clearly to employees, thereby minimizing job stress. Organizations with sufficient training opportunities should have higher retention rate. Tomlinson (2002) asserts that, it is critical that organizations keep the leading edge by having their employees well trained in the latest technologies. While considering a training process it is essential to explore who is taking part in trainings, style and design of training and all about the main objectivity of the trainings being achieved or not, (Choo and Bowley., 2007). Stephen *et al.*, (2007) focus on the outcome of capital invested on training processes that further raise the efficiency of the employees and the organization. Employees may stay with an organization which promotes career opportunities, through learning and the ability to apply their newly learned skills (Cataldoet *al.*, 2000; Jiang *et al.*, 2000).

**Methodology:-**

Survey research design was employed in this study to investigate the effect of training and development strategies on employee commitment probability sampling design was used with a sample size of 320 employees from a target population of 3200 employees (Mugenda and Mugenda, 2003) Structured questionnaires were presented to the selected population in the hospital who were the respondents for the study data was done using descriptive statistics specifically mean and standard deviation. Inferential statistics were Pearson correlation coefficient and multiple regression analysis the multiple regression analysis models.

**Results:-****Table 4.1:-** Distribution of Respondents Response.

Sample size	Administrators		Section Heads		Other Employees	
	Number	Percent	Number	Percent	Number	Percent
Total sample size	10	100	30	100	300	100
Total responses	8	80	27	90	264	88.0
Total unusable	1	10	1	3.3	3	1.07
Total usable response	7	70	26	86.7	261	87.0
Description of unusable questionnaires						
Returned blank	1		0		1	
Incomplete questionnaire	0		1		2	

*Source: Survey Data (2015)***Training Strategy and Employee Commitment:-**

The second research objective focused on determining the extent to which training and development opportunities affect employee commitment. The six items proposed to measure this variable were all used in analyzing the prevailing status of training and development in the hospital. Respondents were asked to indicate their level of agreement on the selected items. Once again, responses were elicited on a five point scale ranging from strongly disagree (1) to strongly agree (5).

**Table 4.2:-** Descriptive Data on Prevailing Status of Training

	Mean	Std. Deviation	Skewness Statistic	Std. Error	Kurtosis Statistic	Std. Error
The organization provides employees with job specific training	3.80	1.155	-1.286	.143	.945	.285
Allocation of sufficient time for product and solution training	3.46	1.235	-.688	.143	-.428	.285
Employees can apply the training they receive from the organization	3.96	1.150	-1.162	.143	.578	.285
The organization provides enough development opportunities	3.56	1.229	-.508	.143	-.804	.285
Sufficient money is allocated for product and solution training	2.89	1.303	.064	.143	-1.173	.285
Employees are involved in activities that promote their professional development	4.03	1.140	-1.313	.143	.974	.285

*Source: Survey Data (2015)*

These results clearly show that the Moi Teaching and Referral Hospital underscores the importance of training and development for its employees. From table 4.2 above, it can be seen that in four of the six items, the mean response was approximately 4 which indicates that respondents tended to agree with most of the items. In particular, respondents tended to agree that the hospital provides employees with job specific training (M=3.80, SD = 1.155); that employees can apply training received from the hospital (M=3.96, SD=1.150); that the hospital provides through development opportunities (M=3.56, SD = 1.229) and that employees are involved in activities that promote their professional development (M=4.03, SD = 1.140). The respondents were however, neutral on whether sufficient money was allocated for product and solution training (M=2.89, SD = 1.303); and whether there was allocation of sufficient time for product and solution training. Once again, the responses regarding training and development were normally distributed as indicated by the skewness and Kurtosis statistics which fall in the range -3 to 3.



**Table 4.3:-** Descriptive Data on Prevailing Status of Employee Empowerment.

	Mean	Std. Deviation				
			Skewness Statistic	Std. Error	Kurtosis Statistic	Std. Error
Employees have the opportunity to determine how to do their job	3.59	1.215	-.832	.143	-.207	.285
The work makes good use of employees skills and duties	4.43	.663	-1.182	.143	1.930	.285
Employees make decisions about new ideas when doing their duties	4.08	.992	-1.187	.143	1.070	.285

**Source:** Survey Data (2015)

### Conclusions:-

On the basis of the findings highlighted above, the following conclusions were made. Use of training in the hospital as an employee strategy has a direct effect on employee commitment. A 1% improvement in employee training and development could result in a 0.134% increase in employee commitment.

### Contributions to academic debate and entire body of knowledge:-

These results clearly show that the organization in place underscores the importance of training and development for its employees. Consequently, by offering training and development opportunities, the hospital aims at upgrading the employee's abilities to cope with specific situations and performance of various specific tasks with a certain level of satisfaction. Furthermore, career development opportunities have been shown to result in higher levels of commitment among employees (Bashir and Ramsey, 2008; Paul *et al.*, 2004). Commitment has been proved to enhance employees (Browning, 2006), developing skills and competencies (Mahatanakoon 2007; Pettijohn, *et al.*, 2007; Lee & Bruvold 2003), as well as opportunities for growth (Armstrong *et al.*, 2008; Allen 2003).

### Recommendations for further study:-

The study should use a mediator role in order to study the variables in more detail to enhance the study further.

### References:-

1. Allen, N.J. (2003). Organizational Commitment in the Military: A Discussion of Theory and Practice, military psychology, vol. 5(3): 237-53.
2. Armstrong-Stasser, M. & Scholler, F. (2008). Benefits of a Supportive development Climate for Older Workers, *Journal of Managerial Psychology*, vol. 23(4): 419-437.
3. Bashir, S. And Ramay, M.I. (2008). Determinants of Organizational Commitment: A study of Information Technology Professionals in Pakistan, *Institute of Behavioural and Applied Management*, vol. 1:226-236.
4. Baudrais, Jean-Sebatien, Gaudreau, P., Savoie, A. & Morin, A.J.S. (2009). "Employee Empowerment: From Managerial Practices to Employees' Behavioural Empowerment". *Leadership and Organizational Development Journal*, vol. 30(7): 625-638.
5. Becker, H.S. (1960). Notes on the Concept of Commitment. In *American Journal of Sociology*, Vol.66:32-42.
6. Bergman, M.E. (2006). The Relationship between Affective and Normative Commitment: Review and Research Agenda, *Journal of Organizational Behaviour*, vol. 27:645-663.
7. Fugate, M. Kinicki, A.J. & Ashforth, B.E. (2004). Employability: A Psycho-social construct. Its Dimensions and Application, *Journal of Vocational Behaviour*, vol. 65: 14-38.
8. Gold, M. (2001). "Breaking All the rules for Recruitment and Retention". In *Journal of Career Planning and Employment*. Vol. 61:6-8.
9. Gubbius, M.C. and Garavan, T.N. (2005). Studying HRD Practitioners: a social capital model,
10. Kandula, S. R. (2004), "Employee Involvement and Empowerment for Business Results: A Study of Power Grid, *Indian Journal of Industrial Relations*, Vol 39(4):520-529.
11. Kinnie, N., Hutchinson, S., Purcell, J., Rayton, B. & Swart, J. (2005). Satisfaction with HR Practices and Commitment to the Organization: Why one side does not fit all, *Human Resource Management Journal*, vol. 15(4):9.
12. Kozlowski, S. W. J., & Klein, K. J. (2000). A multilevel approach to theory and research in organizations: Contextual, temporal, and emergent processes.

13. Lee, C.H. and Bruvold, N.T. (2003). Creating Value for Employees: Investment in Employee Development, *International Journal of Human Resource Management*, vol. 14(6):981-1000.
14. Mahatanankoon, P., (2007). Exploring the Impact of Essential IT Skills on Career Satisfaction and Organizational Commitment of Information Systems Professionals, *International Journal of Information Systems and Change Management*, vol. 2(1): 50-68.
15. Mugenda O.M. &Mugenda A.G. (2003): Research Methods: Quantitative and Qualitative Approaches. Nairobi, Kenya – Acts Press, 1999, Revised 2003
16. Paul, A.K. &Anantharaman, R.N. (2004). Influence of HRM Practices on Organisational Commitment: A Study among Software Professionals in India, *Human Resource Development Quarter*, vol. 15(1): 77-78.
17. Pettijohn, C.E., Pettijohn, L.S. and Taylor, A.J. (2007). Does Salesperson Perception of the Importance of sales skills Improve Sales Performance, Customer Orientation, Job Satisfaction and Organizational Commitment, and reduce Turnover? *Journal of Personal Selling and Sales Management*, vol. 27(1): 75-88.
18. Tomlinson, A. (2002). *High Technology Workers Want Respect: Survey*. Canadian Human Resources Reporter, Vol. 15 (3):2.

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### RESEARCH ARTICLE

#### BIOLOGICAL CONTROL OF SOIL BORNE PATHOGENS (*FUSARIUM OXYSPORUM F.SP. CUCUMERINUM*.) OF CUCUMBER (*CUCUMIS SATIVUS*) BY *TRICHODERMA SP.*

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*Cucumerinum*, *Trichoderma sp.*

#### Abstract

*Cucumis sativus* (Cucumber) is very valuable crop plant in India. Direct application of *Trichoderma sp.* has proved effective in controlling the infection by *Fusarium* (soil borne pathogen) one of cucumber plants under greenhouse conditions. A wilt caused by *Fusarium oxysporum f.sp. Cucumerinum* is a major problem in the production of *Cucumis sativus* (Cucumber) plants. In dual culture a significant reduction was observed. Positive correlation between added *Trichoderma* and percentage of healthy cucumber seedlings were detected. Improved seedling vigour was noticed in fungal antagonist filtrate treated seeds evidenced by maximum shoot length (19.5 cm respectively) followed by fungal antagonist suspension treated pot (20 cm) while untreated seeds in inoculated control (respectively). Percent seedling mortality was recovered in untreated seeds in uninoculated soil was 40%, in coated seeds in inoculated soil was 6.25%, in filtrate treated seeds in inoculated soil was 12.5% and untreated seeds in inoculated soil was 87%. Percent disease control was calculated to be 86.99% for antagonist filtrate treated seeds in infected soil and 93.62% for antagonist coated seeds in infected soil over untreated seeds in *Fusarium* infested soil taken as check so the strongly suggest that *Trichoderma sp.* can be exploited for the biological control of soil borne pathogens ( *Fusarium oxysporum f.sp. Cucumerinum* ).

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#### Introduction:-

Plant pathogens are estimated to cause yield reductions of almost 20% in the principal food and cash crops worldwide. Losses may be more severe when highly susceptible varieties are widely grown. Although these losses may be attenuated by the use of disease tolerant cultivars, crop rotation or sanitation practices. Fungicides are often essential to maximize crop yields. The predicted growth of world population from 5.7 billion in 1993 to approximately 8 billion by 2020 presents a major global challenge to meet the necessary increases in food production. Significant yield improvements are potentially achievable in staple food crops such as cereals, rice and maize through optimizing inputs, including fungicides. Fungicides also provide substantial benefits on good quality, which is related to the reduction of mycotoxins and phytotoxins.

Despite the many advantage conferred by fungicides, increasing public concern about environmental health is proving to be major hindrance in the use of the chemical pesticides including fungicides. Their indiscriminate use

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has led to several environmental problems including development of resistance in insects to insecticides, resurgence of non target, pests, and pesticides residues in food, fodder and feed, destruction of beneficial insects like honey - bee, pollinators, parasites and predators. Persistent residues of Dichlorodiphenyltrichloethane and Benzene hexachloride have been detected in vegetables, milk, oil, butter, meat and even in mother's breast milk. Besides impairment of ecosystem the modern chemical input based agricultural technology has also led to poor economic returns. Some of the pathogens and pests of crop have also developed bio-types or strains or races complicating their management with the available tactics. It is therefore, quite essential to continuously monitor the changing scenario of pest, disease and weeds complexes in various cropping systems across the country and also monitors their natural enemies, which keep them under check.

The consumption of technical grade pesticides on crop has gone up from over 7341 MT in 1960 to 80,000 MT in 1989-90. It has further risen beyond 100000 MT during the year 1994-95. The estimated annual growth rate of consumption of pesticide was about 10% in the last decade. More than 60% of the pesticides are consumed in the agriculture sector. Cotton, rice and vegetables consume maximum quantity of pesticide in the country. In case of millets, oil seeds, and pulses pesticide share is only 6-7%. The use of pesticide is also heavy in fruits, vegetables and plantation crops but very moderate in sugarcane. Among the chemicals pesticides, insecticides are used to a large extent of about 80% in India followed by fungicides 10%, herbicides 7% and other chemicals 3%. The level of pesticide residue is very high in India.

The problem of pesticide residue is due to use of recalcitrant pesticides and is particularly serious in case of cereals, pulses, milk, fruit, vegetable etc. It has also affected our export of tea, coffee, rubber, fruits etc.

Ideally a chemical compound should not only be safe to the human beings and other mammals, but also to the harmless resident microflora. It should cause minimum change in microbial balance of the environment. Such concerns have led to the development of novel crop protection chemicals with low use rates, a benign environmental profile and low toxicity to human and wildlife. Use of chemical fungicides has proven hazardous to air, water and soil.

Biocontrol agents are being used as an alternate strategy to chemical pesticides as they are target specific, environment friendly due to higher selectivity and biodegradable nature. For the last few decades, biological control of plant pathogens has been becoming very much popular. Some research workers from different parts of the world have tried to control fungal pathogens by applying other antagonistic microorganisms such as fungi and bacteria. Biocontrol agents form a component of integrated disease management system and can easily be integrated with other effective practices. Biocontrol agents are known as antagonists. The most important well studied antagonists against several plant pathogens are fungi like *Aspergillus sp.* (particularly *Aspergillus niger* and *Aspergillus terreus*), *Chaetomium globosum*, *Coniothyrium maintains*, *Fusarium sp.*, *Gliocladium virens*, *Penicillium citrinum*, *Trichoderma sp.*, particularly *Trichoderma harzianum* and *Trichoderma viride* and *Sporodesmium sp.* and bacteria like *Agrobacterium radiobacter* strain K84, species of *Bacillus*, *Enterobacter*, *Micromonospora*, *Pseudomonas* and *Streptomyces*. Microbial antagonists extensively used for soil-borne disease are species of *Trichoderma*, *Gliocladium virens*, *Coniothyrium maintains*, *Bacillus*, *Pseudomonas* and *Streptomyces*.

The study was conducted to evaluate the antagonistic property of *Trichoderma sp.* isolated from rhizosphere of peepal soil and its efficacy as seed coating in preventing seedling wilt.

## Materials and Methods:-

### Isolation:-

The fungus *Fusarium sp.* was isolated from infected cucumber (*Cucumis sativus*) fruit and fungus *Trichoderma sp.* was isolated from soil. Pure culture was obtained by repeated inoculation in fresh PDA medium. For it fungus mycelium was picked by help of red hot sterilized platinum -nickel alloy wire loop and transferred to the PDA plate under laminar flow. Fungus was allowed to grow for 7 to 8 days and then microscopically examined. Further by hyphal tip method pure culture plates were prepared.

### Soil Sampling:-

Soil sample was collected from the rhizosphere of peepal tree located in the garden of old Botany Department' of Lucknow University. The sample was drawn, demarcated into uniform portion. For soil sample collection 20x30x20 cubic cm pits were dug with sterilized spatula. Upper most 1 cm soil surface was scrapped off and soil surface from

all the sides of the pit in profil was collected in sterilized polythene bag. This sample was sealed to maintain their original moisture.

#### Isolation of Soil Mycoflora:-

100mg of peepal soil was taken in autoclaved eppendorf tube and 1000µl of distilled water was added to it to make stock solution and shake it well and other autoclaved eppendorf tubes were taken and labeled according to concentration  $10^{-1}$ ,  $10^{-2}$ ,  $10^{-3}$ ,  $10^{-4}$ ,  $10^{-5}$ ,  $10^{-6}$ . 900µl of distil water was added to each. Now 100µl of stock solution was added to the eppendorf tube of concentration  $10^{-1}$  and shake it well. 100µl of solution from concentration  $10^{-1}$  -was transferred to the eppendorf tube labeled  $10^{-2}$  concentration so as to make its solution 1000 µl. Now 100µl of solution from  $10^{-2}$  concentration transferred to  $10^{-3}$  labelled eppendorf tube and shake it well. Similarly 100 µl was transferred from  $10^{-3}$  concentration was discarded out. Plate 100µl of aliquots on PDA (Potato Dextrose Agar) plates from concentration  $10^{-2}$ ,  $10^{-4}$ ,  $10^{-6}$  with the help of micropipette and spread it with spreader. Plates were incubated at  $27\pm^{\circ}\text{C}$  for 24 hr. in the dark. There were three replicates for each concentration. The colonies were enumerated after 7 days of incubation. The fungi were isolated as pure cultures on PDA. Fungi were exarlined for colony characteristics and microscopically for morphological studies.

#### Bio-efficacy of *Trichoderma sp* in-vitro by Dual cultures:-

Bio-efficacy of *Trichoderma sp.* against *Fusarium oxysporum* was tested under in-vitro conditions by dual culture technique. Cultures were grown on PDA in Petri plates and incubated at  $27\pm 2^{\circ}\text{C}$  for 7 days in three replications. The colony diameter of test fungus in dual culture with each isolate of *C. globosum* was measured and growth inhibition was expressed as a percentage of the control. In the corresponding control an equal amount of PDA was added. Day by Day we examine the radial growth of test fungi.

Antimicrobial activity was expressed in term of percentage of mycelia growth inhibition & calculated as per formula.

In Petri plate, Percentage of mycelia growth inhibition =  $\frac{dc-dt}{dc} \times 100$

Where

dc= Average Diameter of fungal colony in control

dt= Average Diameter of fungal colony in treatment

#### Pot experiments:-

##### Soil Preparation:-

The culture inoculum of *Fusarium sp*-growing on broth was mixed in the potted sterilised soil at the rate of 1gm per kg. soil. Cucumber plants seeds (3 leaf stage) were shown in each pot two days after infestation with inocula of the antagonist.

##### Preparation of inoculums:-

Pathogen was multiplied on Potato Dextrose broth medium for 15 days at  $27\pm^{\circ}\text{C}$ . A 5mm diameter disc of pathogen was put into the broth medium.

##### Preparation of Antagonist:-

For antagonist preparation antagonist was multiplied on PDA plates for 6 days and in the broth medium (PDB) for 15 days at  $27\pm^{\circ}\text{C}$

##### Coating of Seeds:-

For seed coating the antagonist was multiplied on PDA and PDB medium for 15 days under alternate light (12 hrs.) and dark (12 hrs.) conditions. Spore suspension of the antagonist was prepared in sterile distilled water with .01% Tween 80, to give spore count of  $10^6$  spores per ml. This 100ml of suspension was used to coat about 5gm of seeds. 5gm of seeds were dipped in filtrate of fungal, antagonist broth culture for about 20 minutes. Seeds were dried overnight before sowing. A pot experiment was designed to find out the efficacy of antagonist in the control of 'wilting' disease of cucumber caused by *Fusarium sp*. Untreated cucumber seeds were sown at the rate of eight seeds per pot in sterilised soil. In second set, the biocontrol agent coated seeds were sown in pathogen mixed soil. In third set, the biocontrol agent filtrate treated seeds were sown in pathogenic soil; while in the fourth set untreated seeds were sown in pathogen inoculated Soil. There were three replicates for each set.

The pots were kept in wire house and after seven days and fifteen days the seedlings were observed for percent germination, seedling vigour and percent disease control. (Kharakrang *et. al.*, 2002)

$$Ds\% = \frac{Cm\% - Tm\%}{Cm\%}$$

Where,

Ds% = % Disease Control

Cm % = % mortality in control

Tm% = % mortality in treated seeds in inoculated soil

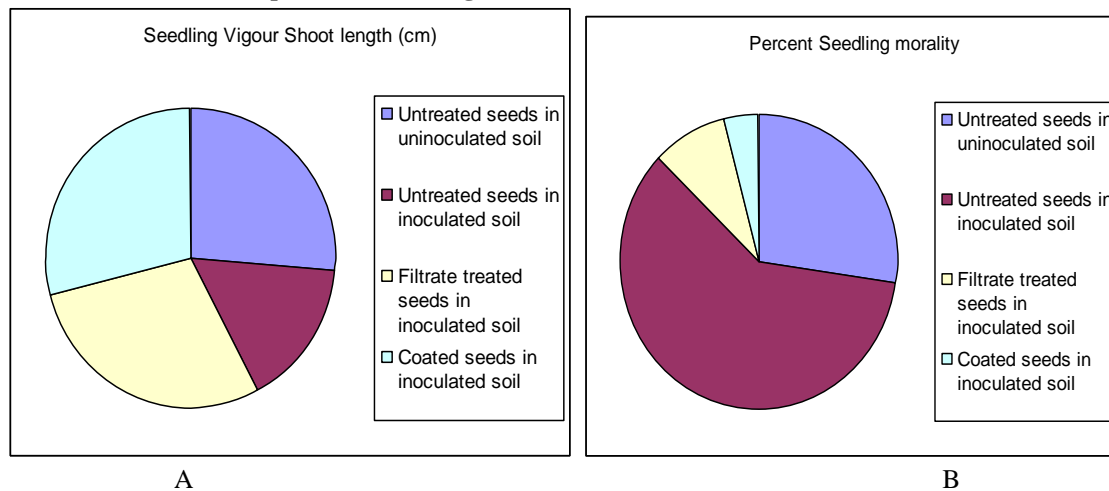
### Result:-

Soil sample collected from Department of Botany, Lucknow University contained higher fungal population (CFU/ml) in  $10^{-2}$  concentration ( $1.75 \times 10^7$  CFU/ml) followed by  $10^{-4}$  concentration ( $5.25 \times 10^5$  CFU/ml) followed by  $10^{-6}$  concentration ( $7.75 \times 10^3$  CFU/ml). Several genera had been isolated from soil including *Aspergillus sp.*, *Cladosporium sp.*, *Fusarium sp.*, *Penicillium sp.*, *Rhizopus sp.*, *Trichoderma sp.*, which were most frequent.

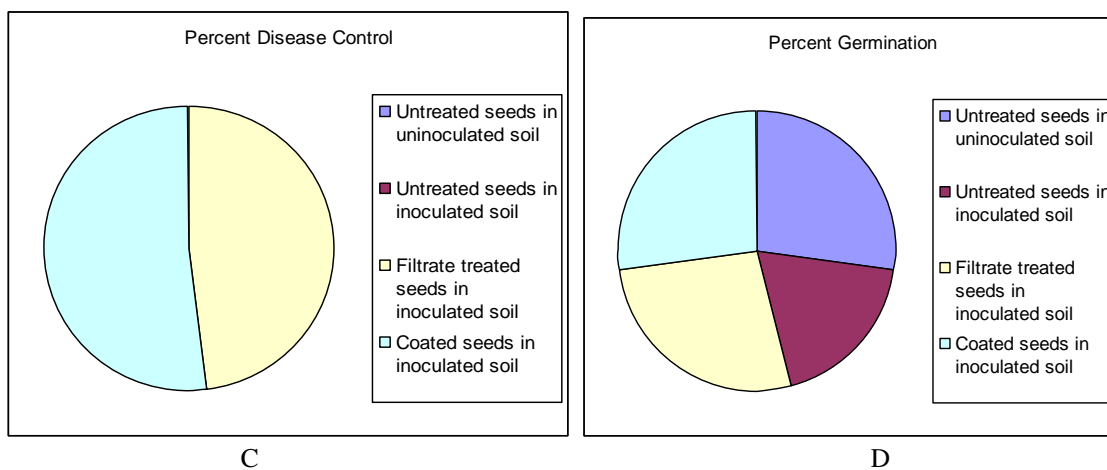
**Table 1:-** Antagonism between *Trichoderma sp.* (T-I) and *Fusarium sp.* in the dual culture test.

Day	Control diameter (mm)		Dual Diameter (mm)	
	<i>Fusarium</i>	<i>Trichoderma</i>	<i>Fusarium</i>	<i>Trichoderma</i>
3 <sup>rd</sup>	32	28	32	28
4 <sup>th</sup>	43	42	42	42
5 <sup>th</sup>	57	42	47	43
6 <sup>th</sup>	57	47	47	46
7 <sup>th</sup>	57	54	48	50
8 <sup>th</sup>	57	57	48	52

**Graph. a,b,c,d,:** Effect of seed treatment with antagonist *Trichoderma sp.* on seedling vigour and percent disease control of *Fusarium sp.* induced wilting disease of Cucumber.







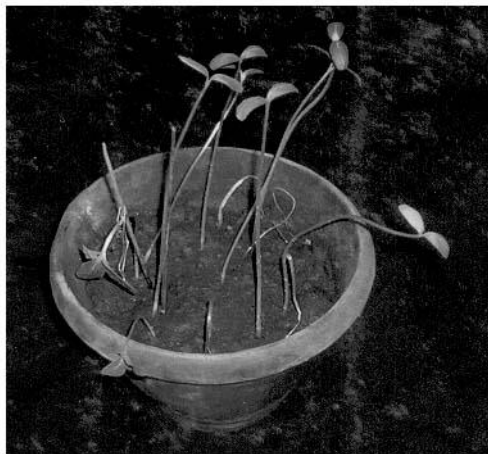
**Fig 1:- a.** In dual culture interaction between *Trichoderma* sp. and *Fusarium* sp.



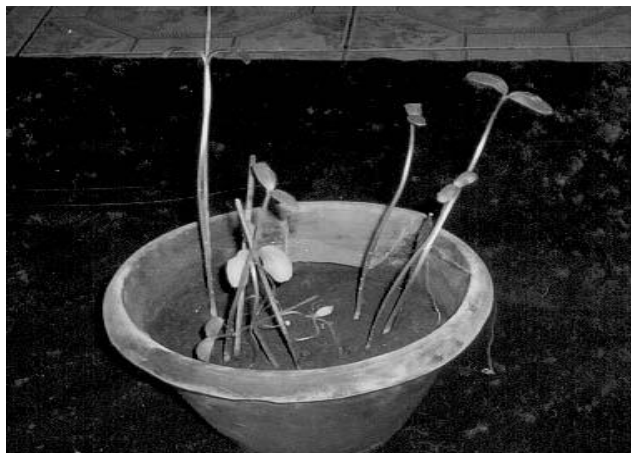
**Fig 1b:-** Directional growth of Hyphal branches of *Trichoderma* sp. towards hyphae of and *Fusarium oxysporum* and coiling of *Trichoderma* sp around that host hyphae.



**Fig 2a:-** Emergent seedling from untreated seed of cucumber in non- pathogenic soil.



**Fig 2b:-** Emergent seedling from filtrate treated seed of cucumber in pathogenic soil T1.



**Fig 2c:-** Emergent seedling from suspension coated seed of cucumber in pathogenic soil T2.

**Description:-**

Identification of taxa was done after consulting the literature (Gilman, 1998). The taxa have been classified to genetic level in accordance to the classification of C.J. Alexopoulos and C. W. Mims.

***Aspergillus Flavous:-***

Colonies lime-green to mignonette green widely spreading. Conidiophores arise separately from the substratum, 400- 700 1000  $\mu$  long x 5. 15  $\mu$  in diameter, broadening upward, walls so pitted as to appear rough or spiny with low magnification, occasionally granular, gradually enlarging upward to form a vesicle 10-30  $\mu$  or 40  $\mu$  in diameter. Heads in every colony vary from small with a few chains of conidia to large columnar masses or both mixed in same area; small heads with small dome like vesicles and single series of few phialides upto 10-15 x 3-5  $\mu$  large head partly with simple phialides and partly with branched or double series or with both in the same head; primary phialides, 7-10x3-4  $\mu$ . Secondary 7- 10x2.5 -3.5  $\mu$ . conidia pyriform to almost globose, colourless to yellow -green sometimes. almost smooth, usually rough varying from 2x3  $\mu$ , 3x4  $\mu$ , 4x5  $\mu$  or 5x6  $\mu$  in diameter, or even larger. Sclerotia at first white, then brown hard, parenchymatous. Clitothecia not found.

***Aspergillus Niger:-***

Colonies black with streaks surrounded by white. From blue yellow coloured and shrinkage of agar medium occurs. Colonies on medium rapidly growing with abundant submerged mycelium. Conidiophores mostly arise directly from the substratum, smooth septate or non septate, varying greatly in length and diameter, 200-400 x 7-10  $\mu$  or several millimeters long and 20  $\mu$  in diameter. conidial heads fuscous, blackish -brown, purple brown, in every shade to carbonous black, varying from small, almost columnar mass of few conidial chains to the more common globose or radiate heads, upto 300-500, or 1000  $\mu$  or long; vesicles globose commonly 20-5  $\mu$  up to 40  $\mu$  in diameter, phialides typically in 2 series thickly covering the vesicles primary varying greatly in length, secondary 6-10x2-3  $\mu$ . Conidia globose, at first smooth, but later spinulose with colouring substances, mostly 2.5 -4  $\mu$  less frequently 5  $\mu$ .

***Cladosporium Sp:-***

Colonies on agar medium appeared greenish-black, large, thick, conidiophores at first erect, then falling, pale-green, conidia two to three celled, olive-green, 10-22  $\mu$  long x 4-6  $\mu$  thick.

***Fusarium Sp:-***

Colonies brownish -white to violet appearance. The lower of the stroma plectenchymatic, chlamydospores intercalary Sporodochia lacking. Conidia scattered on aerial mycelium, spindle or sickle shaped, straight or slightly curved, not pedicellate but often with attachment water on the base. Smaller conidia 0 to 2 septate, larger 3 septate seldom 4-5 septate.

***Penicillium sp:-***

The mycelium is profusely branched with septate hyphae. The cells are thin walled, one to multinucleate. It has smooth walled conidiophore stipes bearing divergent whorls of metulase usually without further branches. Conidia globose to sub-globose, smooth walled not exceeding 3  $\mu$  m diameter. Colonies grow restrictly reaching 2.0-2.5 cm diameter in 10-14 days at 27 $\pm$ °C.

***Rhizopus sp :-***

Colony appears light greyish in colour, the mycelium produces rhizoids formed specially at points where it contacts a hard surface sporangiophores erect it bears columella at upper side. After dehiscing it releases zygospores. Zygospores spherical 95-250  $\mu$  m in diameter.

***Trichoderma sp:-***

Conidia -oblong to ellipsoide, dull green, 3-4.5 x 2.1 -2.8  $\mu$  m Conidiophore -5-10  $\mu$  m diameter near the base, highly branched, primarily branches, relatively short, usually in whorls of 2-5, highly rebranched, ultimate branch one celled, barrel- shaped or short cylindrical, mostly 3.5-7 x 3.5  $\mu$ . Phialides -Sub globose to ellipsoidal or ampulliform, 3.3 - 5.6 x 2.8 -3.5  $\mu$  m arise in crowded whorls of 3-6. Chlamydospores -abundant, 33 x 18  $\mu$  m. Colony characters -Colonies grow moderately rapidly; limited aerial mycelium is floccose, white to grayish.

**Effect of antagonists on growth of *Fusarium* sp by dual culture method:-**

*Trichoderma* sp. T1 isolated from soil exhibited antagonistic activity chiefly through hyperparasitism on *Fusarium* spp. (Plate-3). In the dual culture *Trichoderma* sp. first grew slowly towards the *Fusarium* sp. then grew rapidly and overgrew the colony of *Fusarium* in a span of fifteen days. Interaction region of 20 days old dual culture showed that hyphae of *Trichoderma* sp frequently encircled *Fusarium* hyphae.(Table 1, Fig 1 a.)

**In vitro interaction between *Trichoderma* sp. and *Fusarium* sp:-**

Initial examination of the extent of fungal growth in dual culture revealed that the first apparent contact between hyphae of both fungi occurred 6 days after inoculation (Table-I). Interaction region of fifteen days old dual culture exhibited hyphal interactions between *Trichoderma* sp. and *Fusarium* sp. as seen under light microscope at 40X, *Trichoderma* sp. coiled around the host hyphae. The coiling was either loose or massive and the host hyphae became lysed and disintegrated. (Fig. 1b)

**Effect of *Trichoderma* sp. on plants grown in pot culture:-**

Results recorded for antagonistic effects of *Trichoderma* sp. to the soil borne pathogen, *Fusarium* sp. on cucumber plants revealed that the tested pathogenic fungi was effectively controlled by the antagonists. Percent Germination of plants was highly effective when *Trichoderma* coated seed sown in soil. (Fig2, Graph D).

**Effect on Seedling Vigour:-**

Improved seedling vigour was noticed in fungal antagonist filtrate treated seeds evidenced by maximum shoot length (19.5 cm respectively) followed by fungal antagonist suspension treated pot (20 cm) while untreated seeds in inoculated control (respectively). (Graph A).

**Effect on Percent Seedling Mortality:-**

Percent seedling mortality was recovered in untreated seeds in uninoculated soil was 40%, in coated seeds in inoculated soil was 6.25%, in filtrate treated seeds in inoculated soil was 12.5% and untreated seeds in inoculated soil was 87%.(Graph B)

**Effect on percent disease control:-**

Percent disease control was calculated to be 86.99% for antagonist filtrate treated seeds in infected soil and 93.62% for antagonist coated seeds in infected soil over untreated seeds in *Fusarium* infested soil taken as check (Graph C).

**Discussion:-**

In the present study, *Trichoderma* sp. was found to be very effective in the suppression of mycelial growth of *Fusarium oxysporum* grown on PDA medium. The results obtained in the present study are in accordance with the findings of Jee and Kim (1999), Fernandez (1992) and Elad *et.al.* (1980). Hadar *et.al.* (1979) observed that, an isolate of *Trichoderma* sp. directly attacked the mycelia of *Rhizoctonia solani* when two fungi were grown together on a glucose plus mineral medium. In another study Jee and Kim (1987) observed several mycoparasitism mechanisms such as coiling, penetration, overgrowing and lysis on dual culture of water agar between antagonistic fungi *Trichoderma harzianum*, *T. viride* and *F. oxysporum* fsp. *cucumeum*. Elad *et.al.*, recorded that an isolate of *T. harzianum* was capable of lysing mycelia of *Sclerotium rolfsii* and *Rhizoctonia solani*.

*Trichoderma* sp. was observed as one of the rapid growing fungus and covered most of the surrounding area of PDA plates. Elad *et.al.* (1980) also recorded same properties of mycelial growth of *T. harzianum* when it was grown with *Sclerotium rolfsii*. In their study *T. harzianum* grew better than *Sclerotium rolfsii* and invaded its mycelia under growth conditions adverse to pathogens. According to Moon *et.al* (1988), the mode of mycoparasitism of *T. harzianum* appeared to be coiling around and its attachment on the host or penetration into the host hyphae or breaking septa of both the hyphae and the conidia. While studying the direct application of *Trichoderma* sp. on the infection of *Fusarium* sp. a soil borne pathogen of cucumber plants grown in pots, no plant infection was recorded due to its antagonistic properties. Elad *et.al.* (1980) reported that under green house conditions, incorporation of the wheat bran inoculum preparation of *T. harzianum* in pathogen infested soil, significantly reduced bean disease caused by *Sclerotium rolfsii*, *Rhizoctonia solani* or both. Fernandez (1992) reported that application of *Trichoderma harzianum* to soyabean residue resulted in a significant decrease in the incidence of some wheat, soyabean, black oat pathogens including *Fusarium graminearum* and *Fusarium* sp. According to the study, *T. harzianum* was more effective in colonizing the substrate and in reducing the incidence of pathogen in wheat than in black oat.

The plants appeared more healthier and robust than those of control. These findings are supported by Weindling, *et. al.*, (1934) Cho *et.al.* (1989), Larena *et.al.* (2002). Manoranjitham *et. al.* (1999) reported increased. The germination, shoot length, root length, dry matter production and vigour index compared to control in *T. viride* treated seeds. Kharakrang *et. al.*, (2002) reported significant increase in growth fresh and dry weight of potato plants grown in *T. harzianum* treated soil. Disease control practices, especially those based on potentially hazardous pesticides, biological control measures are gaining support as a practical method for soil borne disease control. The idea to introduce antagonistic organisms to soil as control agents has long been considered. Therefore in our study, direct application of *Trichoderma* sp. has proved effective in controlling the infection by *Fusarium* (soil borne pathogen) one of cucumber plants. Moreover their abundance coupled with their ability to produce some biochemicals such as enzymes, antibiotics or functional inhibitors to inhibit pathogen development and to promote plant growth by virtue of their growth stimulating effect can revolutionize agriculture.

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## Reference:-

1. Cho, C.T, Moon, B.J and Ha, S.Y. (1989). Biological control of *Fusarium oxysporum f.sp. cucumerinum* causing cucumber wilt by *Gliocladium virens* and *Trichoderma harzianum*. *Korean J. of Plant Pathology*. 5:239-249.
2. Elad, Y. Chet, I and Katan, J. (1980). *Trichoderma harzianum*: A bio control agent effective against *Sclerotium rofsii* and *Rhizoctonia solani*. *Phytopathology*. 70: 119-121.
3. Fernandez, M.R. (1992). The effect of *Trichoderma harzianum* on fungal pathogens infested soyabean residue. *Soil Biol. Biochem.* 24:1027-1029.
4. Freeman, S. Zveibil, A. Vintal, H and Maymon, M. (2002). Isolation of nonpathogenic mutants of *Fusarium oxysporum f.sp. melonis* for biological control of Fusarium wilt in cucurbits. : *Phytopathology*. 92:164-168.
5. Hadar, Y. Chet, I and Henis, Y. (1979). Biological control of *Rhizoctonia solani* damping off with wheat bran culture of *Trichoderma harzianum*. *Phytopathology*. 69:64-98.
6. Jee, H.J and Kim, H.K. (1987). Isolation, identification and antagonisms of rhizosphere antagonists to cucumber wilt pathogen, *Fusarium oxysporum f.sp. cucumerinum* Owen. *Korean J. Plant Pathology*. 3:187-197.
7. Khurakrang, L. Kabitarani, A. Upadhyay, S and Upadhyay D.N. (2002). Disease control and growth promotion in tomato, potato and paddy by *Trichoderma viride* and *T. harzianum*. *Indian J. Plant Pathology*. 20(1 and 2) : 25-29.
8. Kim, W.G; Cho, W.D; and Jee, H.J. (1999). Occurrence of sclerotic rot on cucurbitaceous vegetable crops in green houses. Korea. *J. of Mycology*. 27: 198-205.
9. Larena, I. Melgareja, P. and De Cal, V. (2002). Production, survival and evaluation of solid -substrate inocula of *Penicillium oxalicum*, a biocontrol agent against Fusarium wilt of tomato. *Phytopathology*. 92:863-869.
10. Manoranjitham, S.K. Prakasam. V. and Rajappan, K. (1999). Effect of antagonists on *Pythium aphanidermatum* (edson) Fitz and the growth of Chilli seedlings. *J. Bioi. Control*. 13: 101-106.
11. Moon, B.J. Chung, H.S and Cho, C.T. (1988). Studies on antagonism of *Trichoderma* sp. to *Fusarium oxysporum fr. fragariae* Isolation, identification and antagonistic properties of *Trichoderma* species. *Korean, J. Plant Pathology*. 4:111-123.
12. Weindling, R. (1934). Studies on lethal principle effective in parasitic action of *Trichoderma lignorum* on *Rhizoctonia solani* and other soil fungi. *Phytopathology*. 24: 1153-1174.



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## RESEARCH ARTICLE

### AUTOMATED TRAFFIC COUNTING AND CONTROL

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OpenCV, Time prediction algorithms, Geneticalgorithms, Object detection, RoadTraffic, Violations, Traffic management systems.

#### Abstract

Road traffic has become one of the main issues in Sri Lanka. Poor infrastructure facilities are unable to handle the increasing traffic and this resulted in generating higher traffic in town areas. Another reason for the road traffic is the poor traffic management systems implemented as well as the poor traffic management by the traffic police. Inexperienced traffic police handling the traffic might sometimes create more traffic rather than decreasing the traffic. Violation of the road rules and regulations also increase the traffic generated on the roads. The valuable time as well as the money spent on fuel is wasted due to this issue. To address this issue following system will first analyse video footage using object detection algorithms and count the number of cars entered into a particular road. Using the output counts prediction algorithm which the system consist will statistically generate a predicted time that the traffic light should be timed. This green time is the optimal time that the traffic light systems should be programmed in order to minimize the road traffic. Key benefits of this system is the reduction of the traffic thus save the valuable time of the citizens and saving the money which spent on fuel. And in the long run pollution of environment in air and sound forms will reduced as well as the increase of the productivity as a country will utilize the limited time due to the system.

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#### Introduction:-

TODAY ROAD TRAFFIC has become a main issue in Sri Lanka. Sri Lankan government uses manual methods to count the number of cars which enter into a road on a particular date and time. Then the road development authority uses this data to time the traffic lights as well as to decide the size of the road project. In many cases traffic light systems are implemented not using statistical data but just numbers entered randomly and it's not based on the location or the traffic. Due to increased number of vehicles as well as poor traffic management, road traffic has become one of the recent issues Sri Lanka facing. There is no system to help in traffic management and to decrease the road traffic in Sri Lanka. When it comes to traffic police, traffic control is personal biased and lack of experience may cause bigger traffic. When implementing a traffic light system statistical data are collected manually using human resources. False data and incorrectly entered data counts will definitely produce false results thus creating chaos in each junction. Violation of road traffic causes many road accidents. In Sri Lanka, traffic police monitor this issue manually and penalize the drivers. There are many instances where drivers violate rules but no evidence or presence of a traffic police set them free. The purpose of the built system is to ease the road traffic generated due

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low infrastructure facilities in Sri Lanka and poor traffic management systems implemented thus saving the time spent on the road and reduce the number of accidents occur.

### **Background and Related Works:-**

Uke and R. Thool [1] stated that vehicle counts, traffic classifications and speed estimation is done using C++ and OpenCV. Images from video streams are taken and background is extracted from them. Then the background is used to detect the moving traffic as well as classify the vehicle type. Based on the extracted subtraction objects which are not traffic are also detected and added into the counts thus creating false results in some instances.

Shukla and M. Saini[2] stated that in every vehicle detection system there are two stages. Hypothesis generation and verification. Sensing vehicle ahead before creating make it more sensible. Then formulating a dynamic traffic system helps to ease accidents and save time. There are few vehicle tracking approaches. One is region based tracking method. In this method the moving objects are tracked and those are taken for track the vehicles. These regions or area are divided using the subtracting process between the input image and background image which were stored before. For this model images taken from a stable camera was used. Contour tracking methods uses the boundary of the vehicle for detection. Its efficient is much greater than the previous method. 3D model based tracking methods uses 3D geometric shape of vehicles. Feature based tracking method, colour and pattern based tracking method are another two methods used for vehicle tracking.

Sharma et al. [3] proposed various image processing algorithms to detect vehicles. Their algorithm includes five steps in recognizing an object. Initial step would be to input an image then pre-process it, use differential morphology profile then threshold and filter. Algorithm is applied on frames which consist of the still images of the traffic. Then in the pre-processing step the true colour image would be converted in to grey level image according to the luminance converter. Morphology is a nonlinear technique in images processing where it can be used to noise filtering, image segmentation, pattern recognition, shape detection and shape decomposition. A feature vector is created from a single images using differential morphological profile. Then at the threshold stage grey level image is converted in to binary image using an equation. Target image would be extracted using computed shape index at the filtering stage. Finally, the vehicle is detected. The performance of the algorithm then will be calculated using three measures such as true, false and negative rate.

Wang et al. [4] stated that when it comes to vehicle detection algorithm based on deep belief network that there are two sets of categories existing. The first set is about vision based vehicle detection and the second set is on deep learning for object recognition. Vision based vehicle detection approach would be to use vehicle appearance characteristics such as local symmetry, edge, and cast shadow to detect vehicles. Features like Gabor features, scale-invariant feature transform (SIFT) features, speeded up robust features (SURF) are used for vehicle representations. For training vehicle detectors Support vector machines (SVM) and Adaboost are used.

Chien and L. Chen[5] stated that the canny edge detector is used for edge detection and localization in image processing. Edge detectors based on morphological gradient performs well in edge detection. But the edge localization is weak. It can be further improved with erosion operations. Changing the threshold values the user can generate different results.

P. Niksaz [6] conveyed that the road traffic had become a major problem which country faces today because of the increase in number of vehicles. The increase in number of vehicles follow-on to the need of a smart system that could resourcefully handle traffic congestion based on the density of traffic. To estimates the size of traffic in highways by using image processing has been proposed and as a result a message is shown to inform the number of cars in highway and aims to prevent heavy traffic in highways. There are lots of methods that can be utilized for Gamma correction.

Nagaraj et al. [7]mentioned that traffic control system can be built by image processing technique like edge detection to discovery the traffic concentration, based on traffic density can control the traffic signal light. There are current traffic control systems like Microcontroller, Vehicle-Actuated Control, Manual Controlling, and Automatic Traffic Light. Image processing alongside with object detection to sense traffic jam. It involves several steps of image processing to make decision about traffic jam. Main steps are Image Analysis, Object detection, typed object count, Motion detection, and Result representation.

In “Video Image Processing to Create a Speed Sensor”[8] stated that current methods to monitoring congested freeways and had neither the skill nor the expert to set lasting marks on the road. To do this they had used an algorithm for speed extraction first applies a sequence of operators to single images to create a set of boosted images. Then use this set of boosted images to create a speed approximation algorithm.

Hadi [9] mentioned about the main form of transmission & storage for information which has been by paper documents. Several good solutions exist for document processing and analysis, this research will give an outline for processing, analysis and grouping of document images. Today information technology has proved that there is a want to pile, query, search and get large amount of electronic information resourcefully and correctly. So document image processing is very interesting field of research with the continuous development of interest and growing security requirements for the growth of the modern civilization.

Margritet al. [10] stated that the digital image processing will be directing on analysis of remotely recognised images. These images are symbolised in digital form. When showed as numbers, brightness can be visible to statistical controls that are not possible if an image is accessible only as a photograph. Digital image processing of satellite data can be mainly clustered into three groups. Improvement is applied to image data to successfully show data for subsequent visual understanding. Information mining is built on digital classification and is used for making digital thematic map.

M. Kumar[11] stated about a real-time vision system that has been created that inspects color videos on a highway. This system uses a mixture of color, edge, and gesture evidence to identify and track the road limits, lane patterns and other vehicles on the road. Cars are identified by similar templates that are chosen from the input data online and by detecting highway scene features and measuring how they relate to each other. Cars are also identified by temporal differencing and by following gesture limitations that are for vehicles. Experimental results prove robust, real-time car discovery and tracing over thousands of image frames. The data contains video obtained under tough visibility situations. The total purpose of the research is to build a clever, camera-assisted car that is bright to understand its environments automatically, and in real time. Traffic size, driver behavior, lighting, and road conditions are hard to forecast. Their system examines the whole highway. It sections the road apparent from the image using color arrangement, and then identifies and tracks lane patterns, road limitations and vehicles.

Akram et al. [12] recognized that one of the important applications of video-based management systems is the transportation surveillance. Within many years the researches have examined in the Vision-Based Intelligent Transportation System (ITS) Transportation preparation and traffic engineering apps to get valuable and accurate data. It attention on vehicle detection, tracking, and classifying. The research team categorise the traffic monitoring systems built on detailed methods which used for evolving it.

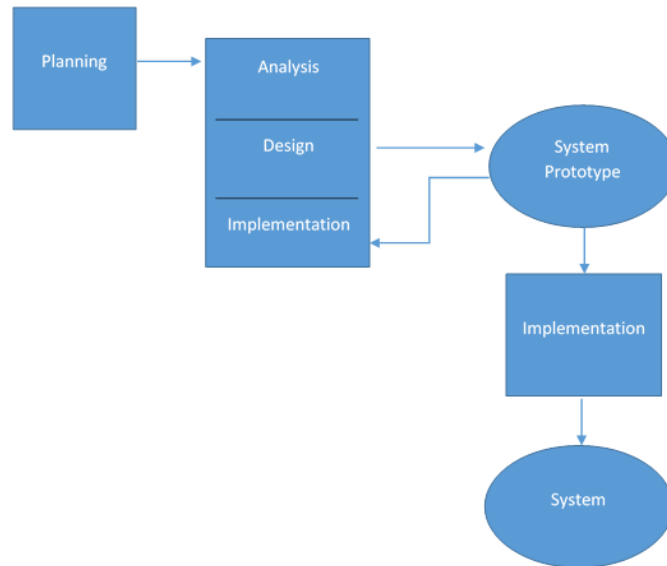
Jain et al. [13] stated that articles in numerous papers it appears rather tough to have straight contrast. The formation of noticing the state of traffic in critical areas can be used to prevent serious blocking. That system supposes specially in night time using density estimation algorithm but they can't find a good solution for it and tells that most suitable for low congestions in night time.

Loureiro et al. [14] founded about that in most of research papers, there are some common problems that can't solve in accurate manner such as shadows and vehicle occlusion. There are some technical problems such as the low quality of the stream available and sometimes the low frame rate. Although some algorithms can tolerate lower frame rates, but that is generally not true for low quality images. They also found some camera related issues such as the depth. Zoom level will also effect on the detection as well.

Atko et al. [15] and Harish et al. [16] mentioned, vehicle tracking, vehicle speed measurement, recognition of license plate of moving vehicles and lane detection can be found in different systems. To do vehicle number plate recognition car should move through the observational zone and recognition program localise the number plate and tracks it while car is in this zone. Symbol recognition module selects frame of the greatest quality and finds it as symbol combination. Vehicle tracking is also built on contour extraction.

### Methodology:-

This project uses prototype development methodology because the end target is to satisfy end user's which will result in a lot of implementations of updated versions of the previous systems that were created. Prototype is built, tested, and then reworked as necessary until an acceptable system is finally achieved from which the complete system or product can now be developed. This model works best in situations where not all of the project requirements are recognized in detail ahead of time. Fig 1, shows the prototype methodology.



**Fig. 1:-** Prototype Methodology

#### Planning:-

The final outcome was considered each and every time at the planning stage. There were many steps involved in planning.

The structure and design of the user interface was one stage of planning. The best user experience delivery was considered even though the project's objective was to predict the traffic. The interface creation was planned to implement using C# and the integrated development environment was the visual studio.

The next step at the planning stage was the data gathering methods for the analysis phase. Then how to design the most crucial parts such as the optimal green time prediction algorithm and object detection were considered.

#### Analysis:-

The second stage of prototyping methodology is analysing. The main objective of the analysis phase is to understand the processing requirement of this system. In the analysis phase the project team continues with gathering requirements about the research and prioritizing the requirements in order to achieve them step by step.

Project team identified the prediction algorithm and image processing as the main requirements and other methods as sub requirements. To analyse the current states information were gathered in many forms.

One of the main forms of information gathering was the interviews with the traffic police and the relevant parties in this field. Current issues when it comes to the traffic were thoroughly recognized and analysed through this method.

Literature review was also used as an information gathering method at the analysing phase. To gather the relevant videos, site visiting was also done. Through site visiting the absolute real scenario was able to recognize and based on that the system was built.

**Design:-**

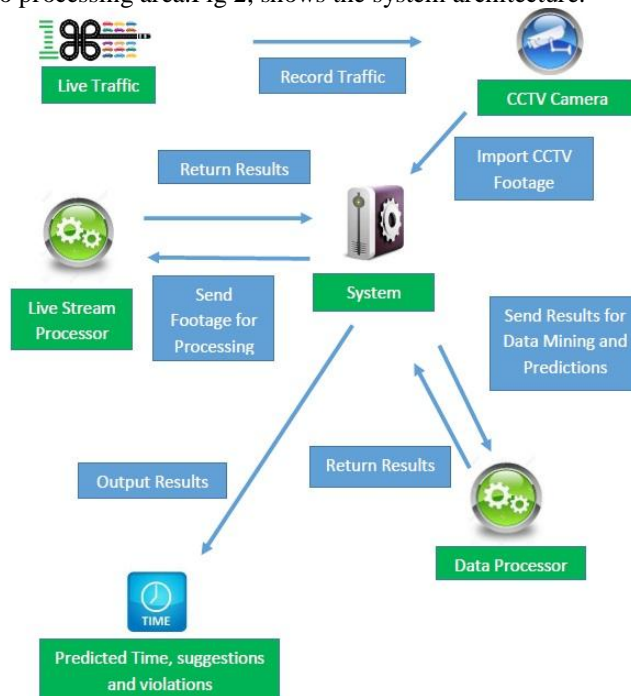
The third stage of prototyping methodology is designing. In this phase the basis of the user interface was designed with the sketch of the entire system.

Then the prediction algorithm with the statistical point was developed taking into many considerations such as the circulation of the traffic lights for each lane, minimizing the waiting time, minimizing the accumulated traffic when the lane is closed and maximizing the traffic reduction of each lanes etc.

MySQL database was used when creating the system's database. MySQL Workbench was used as the visual database platform.

The interfaces for the system was built using visual studio as the integrated development environment. The programming language to do the above was C#.

The main components of the system are the prediction algorithm and the moving object detection algorithm. Both the components were built using C++ and R. For the prediction algorithm statistical methodologies and time prediction functions were also used. As the library OpenCV was thoroughly used for this has many methods and functions in image and video processing area. Fig 2, shows the system architecture.



**Fig. 2:-** System Architecture Diagram.

In fig 2, the upper most side picture is where live traffic is recorded into a video format where at the implementation stage it could be CCTV footage. Those footages are then send to the system and moving objects (vehicles) are then detected and counted. The results are stored on the database for predictions. The data processor represents the prediction algorithm which produces the optimal green time for each lane based on the traffic. The output would be the above predicted time.

**Implementation:-**

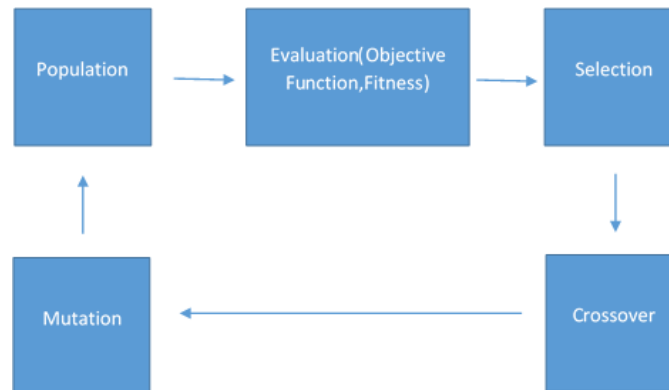
According to the information gathered a prototype of the system was developed. Also implementation was done by according to the requirements which we gathered. Following steps were done in this phase.

- Implementation of the database for the system.
- Implementation of the prediction and object detection algorithms.

- Connecting the interface with the database.
- Connecting the algorithms with the database.

Genetic algorithm is used in order to generate the optimal green time. This process involves several steps. First step is the process of deciding the inputs. Average number of cars are the inputs in this scenario. As the population size a number is selected between 5-20 (rule of thumb). Number of generations are the number of iterations which the process runs. Chromosome size represents the number of green times need to be optimized.

**Fig 3:-** shows the process of genetic algorithm.



**Fig. 3:-** Genetic Algorithm Process

In fig 3, the next step is the generation of initial set of chromosomes (some random numbers that are appropriate for green times.). If the objective is to optimize green times of a four-way intersection, then chromosome size is 4. If you decide to use population size of 10, then in order to generate the first set of chromosomes, generate  $4 \times 10 = 40$  random numbers between 10 and 110 (which are the maximum and minimum green times we initially designed) and arrange it as  $10 \times 4$  matrix (10 population members with chromosome size 4).

Generation 1.

Chromosome 1 : 10|25|30|40  
 Chromosome 2 : 10|30|35|45

Chromosome 10 : 15|35|35|40

Next step is to define our objective function and calculate the “fitness” of our chromosomes based on the objective function values. In our case let’s assume our objective function as following.

Objective function = Total accumulated cars / Total passed cars.----- (1)

Here the total accumulated cars are the number of cars accumulated of three lanes when one lane is opened. We want to minimize this objective function. And to do so the fitness is defined as,

Fitness =  $1 / (1 + \text{Objective function})$  .----- (2)

When objective function is minimized, the fitness will be maximized. Now using each of the 10 chromosomes in the population, fitness is calculated. Then set it aside and carry it into the next generation.

Next step is selecting the chromosome that has the highest fitness. After that the crossover phase begins. This is where new combinations are created from green times which will eventually become the best predictions. Then at the mutation process small changes to the created individual green times are added. Then the best solution will be selected at the end of the above processes.

Fig 4, shows the sample of green time prediction algorithm used in the system to calculate the optimal green time.

```
REngine.SetEnvironmentVariables();
REngine engine = REngine.GetInstance();
int[] avgCars = new int[] { lane1, lane2, lane3, lane4 };
int[] numGenerations = new int[] { 100 };
IntegerVector numGenerationsR = engine.CreateIntegerVector
(numGenerations);
IntegerVector avgCarsR = engine.CreateIntegerVector(avgCars);
engine.SetSymbol("avgCars", avgCarsR);
engine.SetSymbol("numGenerations", numGenerationsR);
engine.Evaluate("source('utils.R')");
NumericVector greenTimes = engine.Evaluate("best.soln <-
run.Genetic.Algorithm(minGreenTime, maxGreenTime,
populationSize, chromosomeSize, numGenerations, avgCars, alpha, cross
overRate, mutationRate)$best.solution").AsNumeric();
double lan1greentime = greenTimes[0];
double lan2greentime = greenTimes[1];
double lan3greentime = greenTimes[2];
double lan4greentime = greenTimes[3];
```

**Fig. 4:-** Green Time Prediction Algorithm Sample

In fig 4, as showed above the code represents the sample of the prediction algorithm which the system uses to predict the optimal green time. The C# code accesses the prediction algorithm written in R language through the Rengine function. The car counts retrieved from the object detection algorithm is passed as the parameters to the avgCars[] array, then the optimal time is calculated to minimize the traffic.

Object detection is accomplished by using C++ as the basic language and OpenCV as the image processing library. First the video file will be read and a line is created in order to detect the cars. Then each moving object is detected and whenever the object passes the above mentioned line car count for that video frame is incremented. This count is sent to the database where finally it will be used to predict the optimal green times.

#### Testing:-

The project team uses Unit testing method & Integration testing. Each member will be assigned separate sessions of testing. Generated results will be then checked for accuracy.

In unit testing the testing is subdivided into the components which the system offers. Image processing, accuracy and working functions of prediction algorithms and database connectivity of each component are separately tested before integration. After the integration of each and every component the system is then tested as a whole to see whether the system generates the accurate results. Finally, stress testing is implemented to figure out the true capacity of the system and to detect bugs.

#### Results and Discussions:-

The accuracy of the prediction algorithm is depending on several values. One is the accuracy of the car counts retrieved by the object detection algorithm. Next is how the prediction algorithm is built to generate the optimal green times.

Fig 5, shows the results of the prediction algorithm generated when the car counts are entered as parameters retrieved from the system's database.

```
[1] "gen = 1 : best soln = 90-104-20-58 : obj val = 0.49716"
[1] "gen = 2 : best soln = 90-104-20-58 : obj val = 0.49716"
[1] "gen = 3 : best soln = 85-80-84-5 : obj val = 0.49488"
[1] "gen = 4 : best soln = 90-39-20-5 : obj val = 0.48739"
[1] "gen = 5 : best soln = 98-93-93-5 : obj val = 0.48661"
[1] "gen = 6 : best soln = 88-50-20-5 : obj val = 0.47491"
[1] "gen = 7 : best soln = 88-50-20-5 : obj val = 0.47491"
[1] "gen = 8 : best soln = 88-50-20-5 : obj val = 0.47491"
[1] "gen = 9 : best soln = 88-50-20-5 : obj val = 0.47491"
[1] "gen = 10 : best soln = 88-50-20-5 : obj val = 0.47491"
[1] "gen = 11 : best soln = 88-50-20-5 : obj val = 0.47491"
[1] "gen = 12 : best soln = 88-50-20-5 : obj val = 0.47491"
[1] "gen = 13 : best soln = 88-50-20-5 : obj val = 0.47491"
[1] "gen = 14 : best soln = 88-50-20-5 : obj val = 0.47491"
```

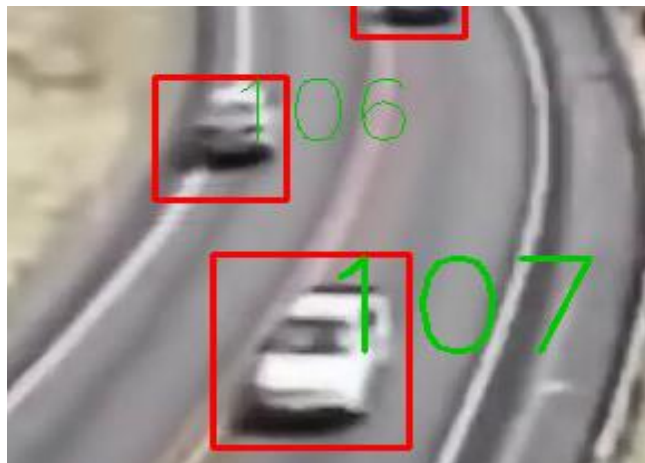
**Fig. 5:-** Green Time Prediction Results

In fig 5, to generate the optimal green times the object value should be minimized. Until an optimal solution is selected the object value will be calculated up to the predefined iterations. The accuracy of the prediction algorithm



various when the maximum and minimum green times are defined. Only values between those values can be taken as answers. If there should be a green time that should be out of the range that correct value would not be taken as the green time. This was taken in order to make the system more realistic rather than trying to archive highest accuracy rate. So the accuracy rate varies from 60% to 70% percent. To check the accuracy of the system assigned green times for a particular junction is used. Based on the number of cars passed and accumulated due to the times allocated to each lane we were able to match the predicted green time versus the green times that particular junction already has. Based on the objective function to minimise the traffic each of the green times needed to be changed from the original value. This value is way off from the original green times assigned but are close to our predicted times. This method was able to calculate the system's accuracy level.

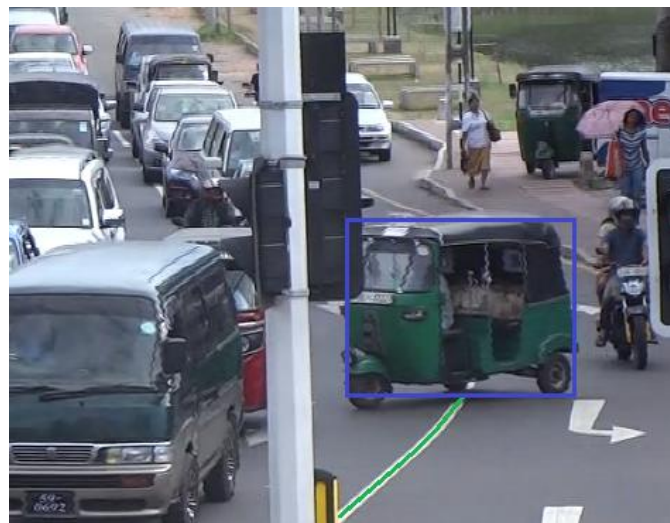
Fig 6, shows the detection of objects, in our instance the vehicles on the road. These are then counted and used for predict the optimal green times.



**Fig. 6:-** Moving Object Detection and Counting

The other feature of the system is to detect the violations. This function is also obtained by the object detection methodology. Same as detecting the vehicles, the system recognises the road lines and whenever the moving object passes the line the object is captured thus this is sent to the database as road violations.

Fig 7, shows a sample of road violation.



**Fig. 7:-** Road Violation

In fig 7, the object passes through the line which makes it a road violation and that image is captured and sent to the database as mentioned above.

### Conclusion:-

This paper describes the process of object detection and creation of prediction algorithm which provides the optimal time that can be used for a traffic light system.

There are several limitations faced throughout this system. Moving objects detection accuracy depends on the quality of the footage thus bad weather conditions create difficulties in detecting and capturing the vehicles. The memory required to process a quality image depends on the memory and the performance of the machine we are using. It is highly recommended to use a super computer or computer with high performance capabilities in order to implement and run the system without crashing or lagging off. The camera should be focused while able to detect more vehicles on the road and not taking other moving objects into the frame in order to maximize the accuracy of the system.

As future implements a feature like remote control can be added to the system. This will enable the authorized user to control the traffic light system from a remote distance based on the incidents occurred at each junction. Data mining component can be added later on when more and more data gathered through the system. This enables the user to identify traffic patterns and later use the information for other purposes.

### Acknowledgement:-

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### References:-

1. N. Uke and R. Thool, "Moving Vehicle Detection for Measuring Traffic Count Using OpenCV", Journal of Automation and Control Engineering, pp. 349-352, 2013.
2. A. Shukla and M. Saini, "Moving Object Tracking of Vehicle Detection": A Concise Review", International Journal of Signal Processing, Image Processing and Pattern Recognition, vol. 8, no. 3, pp. 169-176, 2015.
3. B. Sharma, V. Katiyar, A. Gupta and A. Singh, "The Automated Vehicle Detection of Highway Traffic Images by Differential Morphological Profile", Journal of Transportation Technologies, vol. 04, no. 02, pp. 150-156, 2014.
4. H. Wang, Y. Cai and L. Chen, "A Vehicle Detection Algorithm Based on Deep Belief Network", The Scientific World Journal, vol. 2014, pp. 1-7, 2014.
5. S. Chien and L. Chen, "Reconfigurable Morphological Image Processing Accelerator for Video Object Segmentation", J Sign Process Syst, vol. 62, no. 1, pp. 77-96, 2008.
6. P. Niksaz, "Automatic Traffic Estimation Using Image Processing", Signal Processing, Image Processing and Pattern Recognition, vol. 5, no. 4, pp. 167-174, 2016.
7. U. Nagaraj, J. Rathod, P. Patil, S. Thakur and U. Sharma, "Traffic Jam Detection Using Image Processing", Engineering Research and Applications, vol. 3, no. 2, pp. 1087-1091, 2013.
8. Its.washington.edu, "Video Image Processing to Create a Speed Sensor", 1999. [Online]. Available: <http://www.its.washington.edu/>. [Accessed: 15- Feb- 2016].
9. G. S. a. L. E. G. Raad Ahmed Hadi, "Signal & Image Processing," VEHICLE DETECTION AND TRACKING, vol. 5 no 1, p. 5, 2014.
10. Margrit Betke, Esin Haritaoglu, Larry S. Davis, "Machine Vision and Applications," Real-time multiple vehicle detection and tracking, vol. 12, p. 5, 2000.
11. M. Kumar, "Digital Image Processing", Wamis.org, 2016. [Online]. Available: <http://www.wamis.org>. [Accessed: 13- Feb- 2016].
12. Shazia Akram, Dr. Mehraj-Ud-Din Dar, Aasia Quayum, "Document Image Processing - A Review," International Journal of Computer Applications, vol. Volume 10- No.5, 2010.
13. V. Jain, A. Sharma and L. Subramanian, "Road Traffic Congestion in the Developing World", Cs.nyu.edu. [Online]. Available: <http://www.cs.nyu.edu/>. [Accessed: 20- Feb- 2016].
14. F. Loureiro, R. Rossetti and R. Braga, "Video Processing Techniques for Traffic Information Acquisition Using Uncontrolled Video Streams", Researchgate.net. [Online]. Available: <https://www.researchgate.net>. [Accessed: 20- Feb- 2016].
15. E. Atkoćiunas, R. Blake, A. Juozapavičius and M. Kazimianec, "Image Processing in Road Traffic Analysis", Nonlinear Analysis: Modelling and Control, vol. 10, no. 4, pp. 315-332, 2005.
16. S. Khot Harish, R. Gote Swati, B. Khatal Sonali and P. Sangmesh, "Smart Video Surveillance", Emerging Engineering Research and Technology, vol. 3, no. 1, pp. 109-112, 2015.

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### RESEARCH ARTICLE

#### BUREAUCRATIC REFORM IN INDONESIA: LESSON LEARNED FROM BUREAUCRATIC REFORM MODEL IN JAPAN.

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##### Key words:-

Bureaucratic reform; Weberian model; New public management model; State civil apparatus.

#### Abstract

Since the implementation of decentralization in 1999, Bureaucratic reform has continuously become one of the main issues in the development of Indonesia, that is currently supported by the Grand Design and Roadmap for Bureaucratic Reform. However, the implementation of bureaucratic reform starting from the institutional level to national scale encounters many obstacles. One of the obstacles is the low capacity of bureaucrats who implement related policies regarding various issues such as decentralization and corruption. This study examines the 'gap' between the existing condition in Indonesia that applies the principle of Weberian model and implements New Public Management model stated by Law No. 5 Year 2014 regarding the State Civil Apparatus and what has happened in the bureaucratic reform in Japan to see how the model can be applied effectively in Indonesia.

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#### Introduction:-

The governments of many developing countries, including Indonesia, are confronted with bureaucratic issues as challenges in development. As an institution, bureaucracy essentially runs the governance in the context of daily life and serves as an agent that implements the policies. It is in line with the opinion of Gina Kartasasmita (Kartasasmita, 2007) that bureaucracy is a working system, based on the system of relationship of cooperation between positions (or officials) officially (directly on the problems or the subject), formally (proper, according to relevant procedures and regulations), and impersonally (no sentiment, no emotion or favoritism, no strings attached or without prejudice).

This crucial role of bureaucracy shows the importance of bureaucratic institutions to operate effectively and efficiently and hold the principles of good governance. The implementation of those principles into the bureaucracy will encourage the changes on development paradigm related to the role of the government from the regulator and market participant to facilitator and a place to create a conducive climate for the public.

The inability of the bureaucracy to achieve such situation results in so-called bureaucratic reform, where the bureaucracy is both systematically and institutionally considered underachieved, undergoes a transformation, improvement and reinforcement in hopes that it can function properly and achieve good governance principles. Various problems that consistently occur in the bureaucracy leads to a bureaucratic reform, continuously performed since the end of the New Order in 1998.

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This study examines the model of bureaucratic reform in Indonesia by using a model of bureaucratic reform at international level that has been successfully implemented to be later framed in the national framework of Indonesia.

This study begins with the first section that discusses the model of bureaucratic reform conceptually. The second section discusses the background and the situation of the bureaucracy in Indonesia that still faces the same obstacles despite having undergone bureaucratic reforms. The third section is a study of bureaucratic reform models that can be implemented in Indonesia. The fourth section is the conclusion as well as the closing of the study.

## **Concept and Model of Bureaucratic Reform:-**

### **Concept of Bureaucratic Reform:-**

Reform can be interpreted as an action of improvement for a deficiency without changing the existing institutions (Kristiadi, 2002). Institution is a system of official social behavior, as well as customs and norms that govern the behavior and its entire elements in a variety of human complexity in society. Max Weber (Weber, 1946) characterizes bureaucracy as an efficient institution run by people who are specifically trained, and view their job as a career and a division, whose jurisdiction is structured by the laws and rules, and whose duty is to implement the clear general rules in a particular field.

Bureaucratic reform can be interpreted etymologically as a change in the working system based on the relationship of cooperation between formal and impersonal positions without any damage (to change without destroying). In other words, it is to change while preserving; it is initiated by leaders in a system that is on the verge of destruction based on the awareness that the change is needed to save the system gradually and continuously (Rashid, 2001; Kartasasmita, 2007).

Bureaucratic reform is a process to improve or change the government bureaucracy towards clean (free of corruption, collusion, and nepotism), law-abiding, responsible, professional, ethical and moral bureaucracy (Kartasasmita, 2007). BintoroTjokroamidjojo also emphasizes the same idea in the concept of bureaucratic reform, as the process of improvement or change in the institutions in the governmental system towards good and clean governance (Tjokroamidjojo, 1995).

### **Model of Bureaucratic Reform:-**

The history of bureaucratic reform cannot be separated from its association with the development of economics and public administration theory. Those branches of science are specifically intended to encourage the emergence of bureaucratic models. There are three models most commonly encountered in the history of bureaucracy: 1) the model of patronage; 2) Weberian model; and 3) the model of New Public Management (NPM) (Setiawan, 2014).

The model of patronage is the most common form of bureaucracy during the reign of the monarchy, where the power of management and control of government lies in the hand of a singular person. To ensure the continuity of his power, the king/queen appoints/chooses the closest people to become 'government officials and employees' and help to manage the wheels of the royal government. Allegiance becomes the main indicator in the achievement of bureaucrats, regardless of whether the outcome is good or bad for the people and the country. The stagnation of politic and the state in this period (that triggers some major world events such as the French Revolution and War of Independence of the United States) encourage the abandonment of this bureaucratic model.

The second model is a system model of government administration formulated by Max Weber, called Weberian model, bureaucratic model or traditional model. The efficiency and productivity adopted from the patterns of industrial work of the Weberian model has similarities with the pattern of mass-industrial organizations. The model formulates that the government administration is based on written organized documents. In addition, the decision-making refers to the rules documented and based on the custom of implementation of previous activity. Weber emphasizes the importance of control over input and the decision-making process so that the documented rules allows the wheels of administration to continue to run in stable and permanent manner despite the presence of personnel transfers (Weber, 1946).

However, the model gets criticism, particularly with the advent of the era of knowledge-intensive society and economy where internet penetrates up to the governmental level, leads to the very rapid rate of communication and information. Weber Model is considered an 'obese', sluggish, ineffective and inefficient structure. Due to the design of hierarchical bureaucratic structure, commanding and concentrated in a group of bureaucratic elite, as well as

inflexible and absolute application of the rules, the Weberian model is considered unable to catch up with the dynamics of society and the market that demands rapid changes.

James Buchanan and Gordon Tullock then formulate public choice theory, using economic principles to analyze the behavior of individuals in the market and apply it to the decision-making analysis. The underlying assumption is that the individual has a self-interest motive when doing activities in the market (Buchanan and Tullock, 1962). These assumptions are applied to the model of government and produce what is known as New Public Management (NPM), namely a synthesis of various approaches such as the revitalization of neo-classical economics and new institutional economics, public choice.

There are three main characteristics in the model of NPM, namely (1) disaggregation that encourages breaking the hierarchy of the public sector to be more horizontal followed by adjustment of information, management, and leadership systems, (2) Competition between the providers of internal resources where the diversification of sources of input providers in the internal process of the organization encourages healthy competition in the bureaucratic hierarchy, and (3) remuneration scheme with the transition of the system performance to specific and remuneration-based incentive system in rewarding government officials in the bureaucracy

Market-based bureaucratic reform has some advantages: from an accounting perspective, it shapes the reform of budget transparency, and a bureaucratic organization run by the contract of employment based on performance efficiency. A disaggregated and decentralized bureaucracy allows a performance competition of inter-agency bureaucracy, and it minimizes the size of the bureaucracy yet improves the results in the provision of public services (Budd, 2007).

NPM includes many approaches, ranging from structural reform to the improvement of the accounting system. Therefore, it becomes an interesting word for the political leaders in the world. However, we should note that NPM is not a "magic sword" for government reform. It contains different and even conflicting values. When we try to adopt some measures of NPM, we have to distinguish which are adaptable and valuable for our government and which are not (Koike, 2000).

NPM model has been carried out in the various schemes of international organizations such as the policy transfer and learning of IMF, World Bank and OECD and by some developed countries such as the UK, New Zealand, USA, Canada, and Australia. Indonesia began to adopt this model since the implementation of Law No. 5 Year 2014 regarding the State Civil Apparatus.

## **The Bureaucratic Reform in Indonesia and Japan:-**

### **The Bureaucratic Reform in Indonesia:-**

The bureaucratic reform that has been implemented in Indonesia since 1999 reached a pivotal point in 2004 due to the system of decentralization and direct election of both central and local government leaders and both judicial and legislative representatives of people. The bureaucratic reform that continues to progress today refers to the Grand Design for Bureaucratic Reform, stipulated in Presidential Decree No 81 Year 2010 and Roadmap for Bureaucratic Reform stipulated in Regulation of the Minister of State Apparatus Empowerment and Bureaucratic Reform No 20 Year 2010. They confirm that all the central agencies had undergone a process of bureaucratic reform for agencies and had gradually achieved the increase of performance in 2011 in accordance with the indicators of success that have been outlined in 2014. Both documents provide strategic and operational direction on the implementation of bureaucratic reform at central and local levels.

The first stage of bureaucratic reform in Indonesia (2010-2014) shows bureaucratic improvement using bureaucratic reform model of Max Weber that emphasizes the importance of the control of input and decision-making process. Basically, this transition is a transition into a more complete Weber model since previously (New Order Era) the application is closer to the highly centralized model of patronage (royal bureaucracy) (Setiawan, 2014). In this initial period, the bureaucratic system is rearranged by eliminating aspects of the model of patronage through the preparation of main functions and duties, employment indicators and work capability assessment. The Ministry of Finance is one of the successful examples of bureaucratic reform in this first period. However, problems related to the principles of transparency, bureaucratic system stability (for example the processing time of public services) and the effectiveness and efficiency of the organizational structure ('obesity' in bureaucratic organization) are still encountered.

The bureaucracy in Indonesia still encounters existing problems, such as corruption, collusion and nepotism, not fully effective structure and function, overlapping legal rules and laws and multi-interpretations, abuse of authority, as well as the cultures and perspectives of bureaucrats that have not been in line with expectations.<sup>1</sup>In addition, Indonesian head of Ombudsman DanangGirindrawarna also states the lack of achievement of the performance of the bureaucracy of public services at the local level as well as the absence of a system of penalties for the regional heads (related to decentralization) whose performance is poor in improving the capabilities of local government bureaucracy (Girindrawardana, 2011).

Among the prevalent issues which can be regarded as the factors for such circumstances is the existing politicization of the civil service which is not conducive to the creation of public administration based on the NPM principles (Rajiani & Jumbri, 2011). The current political party system in Indonesia still maintain a strong influence over governance, not only in the executive but also in the civil service/government body itself, which on most cases render the civil service body ineffective and inefficient in terms of budget spending and its capabilities to do the job.

Another factor which arise is the prevalent culture of Javanese practices as a majority in civil service. While there are many other cultures in Indonesia, the influence of attitudes rooted in traditional Javanese practices seem particularly determinative of work attitudes especially in the public sector (Hess, 2001). This implies that non-Javanese Indonesian is demanded to behave as Javanese(Rajiani & Jumbri, 2011).

The society also views that the performance of the bureaucracy is not maximal, as generally stereotyped that Indonesian bureaucracy is slow, convoluted, progress-hindering, procedure-oriented rather than substance-oriented, and inefficient (Romli, 2008).

Criticism on the first phase of bureaucratic reform in Indonesia has become one of the motivating factors for the emergence of Law No. 5 Year 2014 regarding State Civil Apparatus, that in essence is the fundamental legal basis for the transfer of the Weberian model adopted in Indonesia into bureaucratic model of NPM. Within one year of its journey, the implementation of NPM model has started to manifest from the shift in the bureaucracy of the National Development Planning Agency (BAPPENAS) and the Ministry of Finance (Setiawan, 2014). Therefore, observing the implementation of NPM in other countries is important to predict the possibility of outcomes as well as lessons learned for Indonesia, in this case the NPM implemented in Japan as our fellow of significant economic actors in Asia.

#### **The Bureaucratic Reform in Japan:-**

Since the Meiji Restoration, the government of Japan, under the pressure of foreign countries, performs national movement to adopt Western sciences. However, domestic resistance related to the dominance of Japanese culture encourages the adoption of incomplete science. This is expressed in the term *wakonyonsai* defined as 'learning from the West yet still uphold Japanese personality' (Hori, 2004).

Japan has a tradition of "strong state" since the Meiji Era (Silverman, 1996). Although Japan changes from the old regime to the new, more democratic regime after World War II, and strong bureaucratic tradition still survives to lead the recovery of the national economy. As the result, in the 1970s, the United States and European countries had criticized Japanese market that was unfairly closed to foreign capital. In 1981, the Government established the Temporary Commission on Apparatus Utilization to "reconstruct government finances without tax increases" and to prepare for the era of "globalization."Toshio Doko, a well-known business leader, who proposed government reforms and recommending deregulation, decentralization and privatization (Wright & Sakurai, 1987), led the Commission. In 1985, one of the indebted government companies, Japanese National Railways, was privatized and split into several smaller private companies despite the presence of opposition from trade unions. Public opinion supports such idea of business-government.

While maintaining the spirit of Japan, the introduction of bureaucratic model of NPM into the government of Japan began to take place since the 1990s. This process also brought the concept of 'accountability' in the bureaucratic reform process in Japan referred to as *setsumei-sekinin*. *Setsumei* means to explain a new concept or program, particularly regarding the output and outcome of its implementation while the connotative meaning of *Sekinin* is

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<sup>1</sup>The Government of the Republic of Indonesia(2013). Bureaucratic Reform in Indonesia.*APEC Policy Discussion on Bureaucratic Reform* (pp. 1-9). Medan: APEC

accountability. Thus, for Japanese bureaucrats, accountability incorporates elements of being accountable not only for output but also for the outcome of the bureaucracy (Hori, August 2002).

In the late 1990s, reformist Prime Minister Ryutaro Hashimoto formed the Administrative Reform Council, which then adopted the ideas of NPM bureaucratic model and implemented several measures to reform the bureaucracy in Japan (Hori, 2004) by way of:

First, establishing Cabinet Offices. The new Cabinet Office was the staff organization for the Prime Minister. This office coordinated the government policy under the direction of the Prime Minister. Some institutions and independent bodies (Defense Agency, Finance Agency, National Safety Commission, etc.) were transferred to the jurisdiction of the Cabinet Office.

Second, reorganizing the ministries and national agencies. The reorganization of central government agencies was the highest priority of Hashimoto's Government. Under the direction of the Prime Minister, the Council of Reform planned to reduce the number of central ministries and agencies by half. The reduction would be achieved primarily through the annexation of ministries and agencies. In addition, the government also decided to privatize the Ministry of Posts and Telecommunications in 2003.

Third, transforming national bodies into a form of independent administrative cooperation. The Government of Japan transferred 80 government agencies to Independent Administrative Corporation (IAC). This list includes money printing, national hospital, national museum and national laboratory. In IAC, the head of the institution prepared the medium-term performance plan and managed the budget provided by the government. The status of the employees was divided into two categories: public officials and non-public officials. The main objective of the implementation of this policy was to separate the functions of policy formation and policy implementation in the agencies and to improve the quality and efficiency of public services by giving autonomy and responsibility for government agencies.

Fourth, appointing vice-ministers in each ministry. To strengthen the political leadership in the ministry (to avoid the monopoly of political party influence in the ministry), the government introduced the vice-ministers in each ministry of Cabinet to assist ministers. twenty-two vice-ministers would be assigned to ministries in Cabinet. In addition, the government created 26 "parliament helpers" tasked specifically in the policy formulation and ministerial planning under the direction of the minister.

Fifth, conducting decentralization. According to the recommendation of the Committee for the Promotion of Decentralization, the government revised related laws to decentralize centered authority and strengthened stronger local autonomy.

Sixth, reforming public services. In 1999, the Administrative Reform Council submitted a report to reform the national civil service system. The Council proposed reform agenda as follows: revision of the admission-examination system; introduction of remuneration principle; establishment of ethics; extension of retirement; etc. Though it looks ideal, the reform of the civil service system was not fully implemented yet in Japan (Hori, 2004).

During his governance, Hashimoto also triggered Law of Evaluation of Government Policy in 2002, requiring every government agency to be evaluated in two stages by an independent third party (Yamamoto, 2003).

#### **Lesson Learned from Bureaucratic Reform in Japan for Indonesia:-**

Bureaucratic reform with NPM models that Japan has applied in the last decade of the 1990s for nearly 20 years should be a lesson learned for the new Indonesian bureaucratic reform implemented through ASN Law of 2014. From six measures of bureaucracy in Japan, almost half of them have been implemented in Indonesia such as the president's office, decentralization, appointment of vice-ministers, as well as the reorganization of ministries and government agencies. Reform of the civil state apparatus then focuses on other important matters, namely reform of public service and the transformation of national agencies as well as the strengthening of the previous implementation.

One thing that cannot be eliminated from the process of bureaucratic reform in Japan is the principle *wakonyonsai* that carries cultural values of Japan in the bureaucratic reform. In Indonesia, it is currently being encouraged by



President Joko Widodo through Mental Revolution slogan. The motto is basically not a new one, given what is emphasized is a revolution or transfer from mental corruption, collusion and nepotism to the work ethic based on the people that is contained in existing Indonesian cultural values. In addition, integrating the values of Indonesian noble culture into the government bureaucratic system opens the opportunity for adoption of NPM that is more grounded on national character.

With this framework, the model of bureaucratic reform in Indonesia toward the model of NPM by ASN Law of 2014 needs to include elements of democracy compared to the total result oriented that is carried by model of businesses-based NPM, such as what Japan applies by integrating models of NPM with the framework of *wakon yonsai*. The success of Japanese bureaucracy in reforming the system may be the most obvious example for Indonesia: NPM model of bureaucratic reform based on cultural values.

However, another lesson of bureaucratic reform implemented by Japan is the failure of Japan in shaping a transparent democratic element and accountability in the wheels of governance, particularly the bureaucracy. *Setsumei-sekinin* views accountability as a self-evaluation to exclude the public's role in the evaluation process although transparently conducted. To cope with that, Japan implements a two-stage evaluation by a transparent third party. This lesson must be applied by Indonesia in the executed bureaucratic reform process, so that the evaluation of government policies can be more transparent and accountable. The two-stage evaluation of public policies encourages continuous policy improvement and the public constantly monitors it not only in the end of the governance.

Democracy in question means re-integrating the balanced role of the government with NPM's business orientation through ASN Law. The balance of role between the principles of democracy (the government) with business principles can be achieved, for examples, by establishing a framework constructed by the government in collaboration with the private sector for the public services, or re-negotiating the existing cooperation, as described by Kudo (Kudo, 2015):

However, after a decade of outsourcing to private and social sectors experiences, some local governments are starting to distance themselves from the NPM-driven managerial style. After evaluating performance and considering consumer satisfaction, some decided not to renew contracts to the private sector, but to bring the service back into the hands of public administration, or to introduce new forms of collaboration between public and private sectors, mainly based on proposals from the private sector. There is evidence that some local governments have already shifted from NPM-driven management to post NPM or New Public Governance (NPG) orientation, while there is no domestic literature on NPG. In terms of practice, especially in case of childcare and elderly care, some local governments began to re-hire experts in order to develop internal personnel as managers and policy makers in the future.

A shift toward newer approach of NPM-based civil service which balancing the influence of government role and business-minded system should be considered by Indonesian officials with the implementation of Civil Service Apparatus Law of 2014 and beyond. Integrating the populist norm of "*gotong-royong*" and "*musyawarah*" into the already-implemented business model of NPM should be considered because of several factors.

**First, Indonesia still has high level of Uncertainty Avoidance (UA) as argued by Rajiani & Jumbri:-**

*People in low UA cultures are less structured in their activities and enjoy risk-taking, and such societies experience higher labor turnover and have more ambitious personnel. Employees are encouraged to use their own initiative, assume responsibility for their actions, and exercise greater discretion in decision-making (Hodgetts et al., 2006). This militates against the reforms initiated under NPM that aim to broaden managerial discretion and innovation in the interests of achieving substantive results. In terms of a propensity for corruption, high UA cultures are characterized by relationships of dependency and power. The uncertainty associated with such dependency can lead to corrupt, wealth-creating behavior in an effort to relieve the uncertainty (Rajiani & Jumbri, 2011).*

Countries with high level of UA, which can be seen in Indonesia, will face challenging obstacles as a threat and totally depends on superiors, that is, decision makers to solve and lead the civil service sector. It does not encourage initiative and risk-taking, and centrally-distributed power will affect the effectiveness and swiftness of civil service in tackling unexpected problems.

*Second*, Indonesia still has high level of Power Distance (PD) which is understood as how far subordinates in governmental organizations and institutions accept and expect that power within the said institution is unequally distributed. Countries with high level of PD are more prone to subordinates obeying superiors without question. This practices, coupled with the prevalent cultures in civil service is another issue to tackle with the implementation of Civil Service Apparatus Law of 2014 since it is incompatible with the business model of NPM introduced by the law.

Japan's experience shows that after implementing NPM for some time, the Government of Japan re-emphasized the balanced role of the government so that the implementation of public services in some different areas in Japan are based on the combination of business principles and local wisdom. This experience can be used as a study for Indonesia in the development of the two-year-old model of bureaucratic reform through ASN Law so that the process of bureaucratic reform in Indonesia does not have to go through a phase of trial and error as it happened in Japan. The strengthening of ASN Law using NPM model needs to be conducted, particularly by reflecting on the recent studies such as the post-NPM or New Public Governance (NPG), given that the NPM model has already undergone various developments since two decades ago.

A democracy-based effort of strengthening that can be carried out is to involve the citizens of Indonesia into the process of public service (citizen participation), particularly based on the decentralization of public services. The concept starts to emerge in Indonesia with the so-called smart city concepts such as Bandung and Surabaya. The active participation of the people in the public service is not only in terms of feedback on public services but also as a sub-provider for public services (such as cooperation between the government and various communities in Bandung in the construction of Green Open Space/RTH). ASN Law as the basis of the model of bureaucratic reform will be greatly assisted by the even distribution of this concept in Indonesia, such as carried by Japan through The Japan Center for Cities (Nakamura, 2013), as a study center of town-based development to support the national effort of decentralization of public services. This decentralization is one of the main strategies of NPM model, as stated by Nakamura:

In case of decentralisation policy, it is a typical NPM strategy, in which traditional values like “territory” are strongly concerned, while many stakeholders are involved in crucial decision making. The Japanese merger experiences confirm the international literature on public governance and public service delivery, thus confirming to be an example of public governance driven reform process.

Lately, the local governments in various regions in Japan encourage the institutionalization of public participation in local governance. In general, this encouragement arises because of supportive relationship between the principles of market-based bureaucratic reform of NPM with public participation (democracy), as stated by Nakamura:

*Statistical analysis shows that the population and monetary resources of citizens enlarge the demand for participation and encourage institutionalization. It is also shown that the independent and LDP councilors, traditional and alternative routes through which citizens transfer their requests to the public administration, affect the degree of institutionalization of participation (Nakamura, 2013).*

This opinion strengthens the argument that the monetary resources and the population will increase along with the increase of public participation in public services. This is primarily due to a sense of belonging within the society itself in the public services because of its involvement. This sentiment encourages additional resources, both monetary and human resources, coming from the society itself outside APBN/APBD and Civil Servants. In addition to ease the burden of the government, the addition allows the allocation of additional resources for other public purposes.

The second problem that emerges and can be used as a reference is how the administration of Japan experiences an internal resistance, in which the NPM has difficulties in obtaining internal legitimacy than the external legitimacy. One form of this resistance is shown when Yokohama City implements the "Yokohama Revival Plan," that gets skepticism and rejection from bureaucratic internal of the city government, particularly by the seniors (Yorozu, 2014):

*"I have gained the impression from inside the workplace that older staff are allergic to the term 'restructuring.' What is the measure of the success for the 'Yokohama Revival Plan'? To be honest, we have not shared the purpose of that plan though we are familiar with that popular term. There is a gap between the term and actual works.*

*Every time he uses the term, 'reform,' I feel heavy. I think the advances we try to make through daily work are 'reforms.' I do not feel that we need to change. The term, 'reform' has not mentioned what we need to do or change. It is a vague term."*

This view shows that the resistance of the bureaucratic internal is primarily caused by changes in work culture, inequality of vision and understanding, where the younger internal is more accepting to these changes. It is also often found in the effort of bureaucratic reform in Indonesia through ASN Law where a work culture that has been institutionalized for decades changes afterward, leading to resistance at various levels (Haryanto, 2014)

The problems faced by the Government of Japan in implementing bureaucratic reform of NPM model adapted to local values is said to be a common problem that occurs in the process of bureaucratic reform. Indonesia is also experiencing similar problem, particularly the presence of internal resistance associated with the reform of public services and public's lack of understanding in running a new public service model. Internal resistance in Indonesia is mainly related to the number of government organizations that is ultimately resulted in a high number of bureaucrats. The Former Minister of State Apparatus Empowerment and Bureaucratic Reform, Azwar Abubakar, states that:<sup>2</sup>

*Currently, HR of Indonesian state apparatus (Civil Servants) amounts to 4,362,805 people (data BKN per December 2013) consisting of 3,471,296 Regional Civil Servants and 891,509 Central Civil Servants. The main problem of HR of state apparatus is the allocation in terms of quantity, quality, and unbalanced distribution of civil servants by the territorial (regional), and low level of productivity of Civil Servants. The management of human resources has not been implemented optimally to improve the professionalism, employee's performance, and organization.*

According to Azwar Abubakar, this condition embodies the values and the old system that has not completely eroded, such as poorly-managed government management, the culture of corruption, collusion and nepotism (KKN), the ineffective and inefficient quantity-based rather than quality-based recruitment process, as well as the unbalanced distribution of civil servants by territorial (regional). The similarity of problems from the bureaucratic reform in Japan should be the lesson that can be learned to be integrated into the model of bureaucratic reform in Indonesia, particularly to improve Indonesia's competitiveness in the global competition.

Both lessons that can be learned from the implementation of the bureaucratic reform of the public service in Japan show a transition from a model of NPM oriented towards pure business principles into NPM that combines elements of business and local values. According to some experts, this transition is because the model of NPM as a basis of public service emphasizes more on the viewpoint of private sector management techniques in the public sector, so that public participation and democratic decision-making process are marred. Characteristics of the accountability of the public service have changed from the early period of NPM model is introduced. Today, the audit and social control by the society become necessary in the process of public service (Osborne & Ball, 2010).

Some studies show that the focus of the NPM model towards the measurement of business-based performance and monitoring & evaluation (M&E) encourages the strengthening of short-term political interests. However, it can be risky in the long-term ones so that it is not strategic and planned. Moreover, the threat of mismanagement by implementing the principles of NPM purely is proven by the collapse of the Local Government of Yubari, Hokkaido in 2007

<sup>2</sup>Azwar Abubakar. 2014. *Reformasi Birokrasi untuk Meningkatkan Daya Saing*. Scientific Oration for 94th Anniversary of Higher Education of Engineering in Indonesia, Bandung: Institute of Technology. Accessed via <http://www.itb.ac.id/files/12/20140704/orasiIlmiahMenteriMenPanRBPTTI%2094.pdf> on March 2016.

### Conclusion:-

Japan's success in reforming its bureaucracy since the 1990s should be a motivation for Indonesia as a fellow of strong-economic country in Asia. With almost similar span of time and condition (1945 and equally harmed by the war), Indonesia should be able to catch up. The adoption of NPM through ASN Law of 2014 opens such opportunity, and as previously noted, Indonesia can integrate cultural values more quickly into this process given the fact that the bureaucratic reform of NPM model has been running for a year. The lessons given by Japan through the adoption of NPM model for bureaucratic reform by integrating *setsumeiki-sekinin* and *wakon yonsai* values should be a boost for Indonesia who similarly owns different cultures from the NPM of Western World.

Indonesia also needs to thread carefully in implementing the business-centered NPM model because Japan's experience shows that it does not fully compatible with our norms and culture thus leading Japan to implement a mixed approach of re-introducing the government role in public service.

Another issue to tackle is the existing norms which is still embedded in the civil service practice that is the lack of certainty and distant power distribution. These problems also arose in Japan and hampered Japan's government to fully implement the NPM. Unless Indonesian government address the prevalent issues of uncertainty avoidance and power distance which hamper the bureaucratic reformation process, the civil service sector cannot and will not achieve high level of effectiveness as previously planned.

The combination of democratic local values in Indonesia with NPM-style business management principles should be conducted by Indonesia immediately, reflecting on the implementation of NPM in Japan. This is to avoid a setback in the bureaucratic reform in Indonesia based on the ASN Law. Thus, there is a need to strengthen ASN Law based on the combination of these two values so that the bureaucratic reform that has been running in Indonesia can be implemented faster than previous countries.

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### References:-

1. Buchanan, J. M., & Tullock, G. (1962). *The Calculus of Consent: Logical Foundations of Constitutional Democracy*. Ann Arbor: University of Michigan Press.
2. Budd, L. (2007). Post-Bureaucracy and Reanimating Public Governance: A Discourse and Practices of Continuity? *International Journal of Public Sector Management*, 531-547.
3. Girindrawardana, D. (2011). *Public Services Reform in Indonesia*. Jakarta: Ombudsman Republik Indonesia.
4. Haryanto. (2014). Implementasi UU ASN dan Implikasinya Terhadap Manajemen Pengelolaan Jabatan Fungsional. *Simpul*, 22(14).
5. Hori, M. (2004). Japanese Public Bureaucracy in the Era of Globalization. *Ritsumeikan Law Review*(21), 1-18.
6. Hori, M. (Agustus 2002). Japanese Public Administration and Its Adaptation to New Public Management: From An Optimist's View. *98th Annual Meeting of The American Political Science Association*. Boston, MA: American Political Science Association.
7. Kartasasmita, G. (2007). *Reformasi Administrasi Publik*. Malang: Seminar Nasional.
8. Koike, O. (2000). *New Public Management in Japan and Southeast Asia: A Magic Sword for Governance Reform?* Bologna: IIAS/Japan Joint Panel on Public Administration.
9. Kristiadi, J. (2002). *Politikasi, Demokrasi dan Reformasi Menuju Good Governance*. Jakarta: Seminar Nasional.
10. Kudo, H. (2015). Bridging the Gap Between Reform Practices and Literatures: New Public Service Delivery of Japanese Local Governments. *International Public Management Review*, 16(1), 147-164.
11. Nakamura, E. (2013). *Governance Reform in Japanese Local Governments*. Victoria, B.C.: Canadian Political Science Association.
12. Osborne, S. P., & Ball, A. (Penyunt.). (2010). *Social Accounting and Public Management: Accountability for the Public Good*. London & New York: Routledge.
13. Pemerintah Republik Indonesia. (2013). Bureaucratic Reform in Indonesia. *APEC Policy Discussion on Bureaucratic Reform* (hal. 1-9). Medan: APEC.
14. Pollitt, C., & Bouckaert, G. (2011). *Public Management Reform: A Comparative Analysis - New Public Management, Governance, and The Neo-Weberian State*. Oxford: Oxford University Press.
15. Rasyid, R. (2001). *Administrasi Pemerintahan Pusat dan Daerah*. Jakarta: Seminar Otonomi Daerah.

16. Romli, L. (2008). Masalah Reformasi Birokrasi. *Jurnal Manajemen dan Kebijakan PNS*, 2, 1-13.
17. Setiawan, S. (2014). Evolusi Model Birokrasi Dalam Perspektif Ekonomi dan Perkembangan Reformasi Birokrasi di Indonesia. *Warta Fiskal*, 1-12.
18. Silverman, B. (1996). *Cages of Reason*. Chicago: University of Chicago Press.
19. Tjokroamidjojo, B. (1995). *Pembangunan Indonesia Tantangan-Tantangan Dalam Tataran Nasional Global*. Jakarta: CV. Jaya Binangun.
20. Weber, M. (1946). Bureaucracy. Dalam H. H. Gerth, & C. W. Mills (Penyunt.), *From Max Weber: Essays in Sociology* (hal. Bab 8). New York dan Oxford: Oxford University Press.
21. Wright, D. S., & Sakurai, Y. (1987). Administrative Reform in Japan. *Public Administration Review*, 47(2), 121-133.
22. Yamamoto, H. (2003). *New Public Management - Japan's Practice*. Tokyo: Institute for International Policy Studies.
23. Yorozu, C. (2014). The Diffusion of New Public Management Strategy in Japan: To what extent does a Japanese local government organisation change? *Electronic Journal of Contemporary Japanese Studies*, 14(3).



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### RESEARCH ARTICLE

#### UNWED MOTHERS IN ODISHA: ISSUES AND CHALLENGES

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#### Abstract

Unwed Motherhood is emerging as a serious concern in our society where women are sexually exploited and literally left on the streets in a state of unwed pregnancy. The issue of unwed mothers is generating devastation in the conventional Odia society. Odisha is a small culturally rich state of India having 30 districts and many famous tribes like Bonda, Bhumias, Kondhas, Santals, Sauras etc. Although Odisha has witnessed many positive changes resulting in development and growth an increased rate in crime and discriminatory behavior is observed towards its female citizens that is causing great unrest in the state. One such crime is the issue of unwed motherhood within the state especially in tribal areas. But as certain issues are more accepted in tribal areas like unwed motherhood or female headed households and their society has a matrilineal structure rather than a patriarchal one. But the above mentioned facts do not ensure egalitarian towards the tribal women. The notion that tribal women are less discriminated than their rural and urban counterparts is partly true as their society or community is more tolerant but a tribal woman is more discriminated in any given state or nation. Women in Odisha be it tribal women in particular or women in general have been facing discriminatory behavior in all aspects of life especially violence. And recently acts of violence against women have multiplied and are worryingly on the rise. One such issue that stems many times out of violence is unwed motherhood. This issue is plaguing the young female citizens in Odisha and is alarmingly on the rise.

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Odisha has an extraordinary figure of young unwed mothers between the age of 13 to 30. These girls are easy targets for further exploitation as they are not accepted by the society and nor their families and are used for trafficking due to which many women are unaccounted for. This issue is further intensified in Odisha by frequently occurring Natural disasters making many people destitute and increasing their vulnerability. Experts believe there are 40,000 unwed mothers in Odisha, 70% belonging to the tribal areas of Odisha. "Poverty" coupled with ignorance and innocence compound the problem of unwed mothers in tribal Odisha. The unwed mothers are treated as outcasts rejected by the society and are often viewed as prostitutes and even criminals.

A woman loses her dignity, pride and even her most basic human rights when she conceives a child without marriage. A woman usually faces all the problems of pregnancy even though making a child is a two way act the woman is left to take the burn if the child she is carrying is illegitimate, here the norms and culture of our society is

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eagerly sought after where reserving sex for marriage is seen in almost a scientific light solving many problems like sexually transmitted diseases, abortions and children out of wedlock. The women who are raped and sexually abused are left by themselves on the streets once they are discovered to be pregnant. The issue of unwed mothers is perhaps the most unforgivable crime against women. In the third world countries where illiteracy, poverty, poor health and backwardness have a major influence on the populace the ostracism that the unwed mothers attain is quite a phenomenon in determining the status of women in the society. Here not only a woman is mauled for life but her innocent child faces stigma throughout his/her life.

From my research it was revealed that unwed mothers usually belong to lower caste families as out of 200 respondent's majority of them belonged to schedule caste, schedule tribe and other backward classes. ((34.5 per cent) belonged to the Schedule Tribe and (31.5 per cent) belonged to Schedule Caste whereas only 18.5 per cent of them belong to General Category and 15.5 per cent of them belong to the Other Backward Classes.)) Low levels of awareness along with low literacy level were found to be major causes behind the number of unwed mothers among the SC and ST community. Unwed mothers enjoy relatively a better status in tribal societies than in non-tribal ones". This is because tribal society is matriarchal society where bride price system is observed instead of dowry system. Equality of opportunity, equal right, and equal pay for equal work are some of the practices which differentiate the status of tribal women from non-tribal women.

'Poverty' is one of the major factors behind unwed motherhood. Unwed mothers usually come from poor families as 84 per cent of them belonged to the lower income group. This shows that high level of awareness, high literacy rate are some of the reasons for absence of unwed motherhood problem among rich or affluent class or society. It was seen that unwed motherhood usually results from women falling prey to 'false promise to marry' (out of 200 respondents 68% victims of false promise to marry). In such cases, the women very easily succumb to the interest of the man primarily because of the fear of betrayal. The knowledge of contraception and the outcome of unsafe sex were found to be staggeringly low, deliberately ignored or due to unavailability of any such measures. And once discovered to be pregnant their partners assures them of marriage but disappears and the woman is left behind to answer the questions or more often the man responsible denies to the father. These victims are vulnerable to several kinds of exploitation. They are treated as commodities.

This becomes one of the factors responsible for trafficking in women as in many cases the accused tried to sell the victim to some brothels or labour contractors. But false promise to marry is not the sole reason of unwed motherhood. This is evident from the study as many of them (32.9 per cent) were victims of rape and in many cases rape by their relatives. In such type of case the abuser is known to the victim, they are members of the family or its inner circle. Most middle class Indians grow up in large extended families, open households where family and friends come and go thus the accused in such cases are known. The inquiry into domestic violence especially sexual abuse was one of the most complex, controversial challenges to investigate. As the dominance of sexual abuse at the domestic level is rampant. The prevalence of incest is strongly felt in India and is also evident in Odisha. Incestuous conduct is almost never consensual. Instead, it is rooted in physical force as well as familiar and other power which the abuser uses to pressure his victim. This is a terrible truth hidden in our society that we do not discuss let alone own up to. The cases of unwed mothers as a result of incest were very visible in my study. Many times these accused go unpunished as the victims face denial and they are not believed by other family members. These rapes, unless the news becomes public due to unavoidable reasons, are never reported. It is found that the highest numbers of respondents from the rape cases were victims within the family and by the relatives. This shows the growing number of domestic violence in our state.

Women are not safe from physical abuse and torture even within the blood ties and the four walls of her home. Rape or sexual harassment at work place is also seen as a factor responsible for unwed motherhood. Unemployment is rampant these days so to retain a job has become very tough especially in the unorganized sector and it was found that, out of 200 respondents 4.7% were unwed mothers due to rape at work place. In a case study in Kalahandi a 16 year old girl who worked as a daily wage labourer was the victim of rape by the contractor who control these daily wage labourers and took them to distance places to work, the girls who go without any family members are the main targets for sexual assault by these contractors and other daily wage labourers. 25 per cent of unwed mothers' were victimized by strangers, these strangers were mostly found to be migrant workers. Migrant workers are becoming a major threat to the local young women and girls especially at grass root level. The level of awareness to different governmental policies and programmes and institutions for the women in general and destitute women in particular was found to be very low among the respondents as the ICDS programme is the oldest welfare programme for



women. But a large majority of respondents (84 per cent) are not yet aware of this. The Government of India has enacted a number of laws for women's liberty, rights, equality and development, but the respondents were not aware of a number of such laws like the protection of women from Domestic Violence Act". Only 12.5 per cent are aware of this Act and 87.5 per cent are not so. This shows that the government should take extra care to spread awareness about this problem because it is growing very rapidly. The study shows that rural and tribal women usually face the severity of the problem of unwed motherhood. This problem is magnified by poverty, ignorance, social stigma which forces these women towards humiliation which act as a hindrance in the path of their development. These women rarely become members of social, political and professional organizations due to the rigidity of our society in dealing with this problem. The unwed mothers are treated like out casts even their basic human rights are denied by the society, they were not accepted by the women of the same locality with the fear of polluting the public places hence are not allowed to the public places like ponds, river Ghats ect and they were not accepted easily even as an employee. Thus a large number of the respondents (43.2 percent) said that they were driven out of the job immediately after their unwed mother status was disclosed.

The futures of those children who remain with the unwed mothers are a source of primary concern, and attention needs to be given towards their welfare. It is seen that 57 percent of the respondents expressed the desire to put the child up for adoption. Some of the aspects that compel a mother to put her child up for adoption were the negative attitude of the society regarding the identity of the child's father, the possibility of marriage of the victims, financial crunch in raising the child etc. It is seen that 19 percent unwed mothers even blame the child for their present fate; this response especially noted among some of the mentally challenged women. Whereas 12 percent of the respondents wanted to keep the child as a proof of the relationship with the person involved.

### **Suggestions:-**

From the above study two major factors come into focus: the first one to eradicate this problem and the second one is if cases of unwed mothers are found care should be taken to improve not only their life but also the life of their children. From the present study certain suggestions have come into perspective i.e., all efforts should be made to identify and get the accused, and implement stringent laws and strict punishment along with financial penalty. Awareness campaign regarding welfare and legal measure should be given top priority and there should be women police station or Mahila desk in all the villages, special emphasis should be on awareness regarding safety measures like use of contraception, risks factors HIV/AIDs, and Sexually transmitted diseases etc should be imparted.

The society needs to be more sensitized about the problem of unwed mothers, the society should adopt measures to avoid domestic violence, mothers of the young girl along with their daughter should be made aware of the problems and how to protect themselves from such type of crime.

A major problem that cannot be ignored is poverty, thus more number of SHGs and microfinance scheme should be made available to rural women to empower them economically. Land rights to women should be given so that they could have a share on the labour they put in. The welfare schemes like Short Stay Homes and Swadhar Shelter homes for destitute should be available in rural and tribal areas so as to give these victims immediate relief instead of only being available at urban areas. Special attention needs to be given to rehabilitate them within the time span allotted to these homes. And special attention needs to be given to the children who live with these unwed mothers.

Print and electronic media should be active in the rural and tribal areas to spread the message of safe sex and knowledge regarding the risks involved in unprotected sex through pamphlets, showing documentaries on the life of unwed mothers and the life of their innocent children in schools and colleges.

These measures will in still in the youth greater sense of awareness and responsibility. As false promise to marry is one of the most common causes of unwed motherhood women must be educated against this act.

The severe laws and punishments for this crime should be highlighted. And most importantly the DNA test should be made available for such victims and not only to special cases.

Women's commission role should be highlighted and a women cell of representing the Commission should be established in every nook and corner.

Voluntary organizations should actively spread awareness regarding different welfare schemes and developmental programme in the rural areas. They should also identify unwed mothers and try to give them justice with the help of the police. They should provide training programmes to make these women economically independent.

Government hospitals, bus stands and railway stations are the areas where the unwed mothers are generally found. Thus “help desk” should be established in these areas.

It is imperative to initiate these steps not only to improve the conditions of unwed mothers in the state but to eradicate and prevent this problem from taking a strong hold in our society.

**References:-**

1. Afshar, Haleh. (1996) (ed.) Women and Politics in the Third World. Rutledge: London,
2. Agarwal C. M. (1993) Dimensions of Indian Womanhood. Shri Almora Book Depot: Delhi
3. Agarwal, Bina. (1994) A Field of One's Own. Cambridge University Press: Cambridge
4. Ahuja Ram (1998). Violence Against Women. Rawat Publication: Jaipur
5. Das Pragyani (2012). Status of Unwed Mothers in Odisha: An Analysis. Lap Lambert Publications: Saarbrücken, Germany.

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### RESEARCH ARTICLE

#### SCREENING OF RESISTANCE SOURCE AGAINST SPOT BLOTCH DISEASE CAUSED BY *BIPOLARIS SOROKINIANA* IN *TRITICUM AESTIVUM* L.

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#### Abstract

One hundred spring wheat genotypes/ germplasm (*Triticum aestivum* L.) lines related to Indian, CIMMYT, and Chinese were evaluated for spot blotch tolerance against natural epiphytotic conditions, caused by *Bipolaris sorokiniana* at hot spot locations Coochbehar, Kalyani and Karnal (Polyhouse), India Out of 100 screened entries 20 number of genotype showed Highly resistant or Immune to the disease, where as 28 genotype were resistant, 22 genotypes moderately resistant, 15 moderately susceptible and 15 genotypes susceptible. Indian germplasm lines tended to be more susceptible compression to lines originated from CIMMYT and China. Chirya-1, chirya-3, chirya-7, Yangmai#6 and Mayoor, HRLSN lines from CIMMYT and LBRL lines from India showed high degree of resistance to the disease both under field and polyhouse conditions. On the basis of the disease severity under artificial epiphytotic polyhouse conditions, 20 promising lines were find highly resistant in field natural conditions for their genetic analysis & potential for spot blotch breeding. These lines can be used hybridization programmes and since they have different parental background, it will help in diversification of gene pool. Some of these also have better potential for high yield and adaptation.

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#### Introduction:-

Wheat (*Triticum aestivum* L.) is the largest grown and second prominent produced cereal crops worldwide after maize (*Zea mays* L.) with 697.9 million tones every year (Velu and Singh, 2013). Global food production might be increase at least 70% by 2050 when global population may likely to reach 9 billion. In India, wheat production and productivity was 95.6 million tonnes respectively, in 2013-14 which reveal decline tend to comparison year. with previous years Several biotic and biotic stresses such as spot blotch, rust, terminal heat stress and drought stress have adverse impact on wheat productivity in eastern regions of south Asia especially in the eastern gangetic plains of India (Joshi *et al.*, 2007) It's a challenge for us, increasing production and productivity, enhanced level of multiple disease resistance in future genotypes will be very essential. Spot blotch, which is caused by the hemi-biotrophic fungal pathogen *Bipolaris sorokiniana* (Sacc.) Shoem sun. *Drechslera sorokiniana* (Sacc) Subrm and jain (syn. *Helminthosporium sativum*, telomprph Cochliobolus sativus), (Chowdhary *et al.*, 2013), has emerged as a major production constraint in the eastern part of India and south Asia's intensive cropping system (Chatrath *et al.*, 2007; Joshi *et al.*, 2007a). Green revolution played a key role in ensuring food security in this population dense

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region of the world, which mainly comprises of India, Pakistan, Nepal and Bangladesh. Yield losses are significant, and depend on genotype, time of occurrence and severity of the disease, Sowing time, location and stress conditions. Saari (1998) reported that the average yield losses due to leaf blight in the Indian sub continent were as much as 17.5%. They are estimated to average 15-20 % but can be reach 40 to 70% in susceptible genotypes. Satvinder *et al.*, (2002) observed the yield losses ranged from 27% to 56.6% during 1998-99 in north eastern and north western plains of India, losses were estimated up to 15% on several farms over a number of years in Bangladesh (Alam *et al.*, 1994), 23.8% yield loss In Nepal the (Shrestha *et al.*, 1997). Yield losses between 20 and 52% have been reported on susceptible cultivars of south Asia (Sharma and Duveillar 2004). The disease becomes severe during the grain filling stage and causes significantly yield losses and grain quality deterioration in susceptible varieties. *B. sorokiniana* usually induces symptoms on leaves, sheath and stem (Chand *et al.*, 2003). However, under severe conditions it also infects spikelet's resulting in shriveled grains with black point at the embryo end of kernels. Although spot blotch has assumed a status of number one disease in the warmer parts of eastern India, More recently it has been expanded into the cooler, traditional irrigated rice-wheat production areas (Singh *et al.*, 2008, Singh R and Singh VN 2007). It is generally believed that the level of resistance in high-yielding wheat genotypes is still unsatisfactory and needs to be improved significantly in warmer and humid regions of south Asia (Sharma and Duveillar 2006). Resistance to spot blotch in wheat behaves like a Quantitative trait (Joshi *et al.*, 2004b), but until recently little has been known about its genetics and observed that wheat genotypes expressing leaf tip necrosis (LTN) in general showed less spot blotch symptoms and demonstrated a genetic association between this phenotypic marker and spot blotch resistance in a segregating population. Quantitative trait loci (QTLs) for resistance have recently been mapped in the resistance sources 'Yangmai#6' (Kumar *et al.*, 2009), 'Ning 8201' and 'Chirya-3' (Kumar *et al.*, 2010).

In the past 10 years, efforts have been made to identify spot blotch resistant wheat genotypes derived from new resistance source such as synthetic wheat, including *Thinopyrum curvifolium* and *Aegilops tauschii* derivatives (Sharma *et al.*, 2004a). Despite the realization of spot blotch as an important disease of wheat, the progress in breeding for resistance against this disease has not been satisfactory. One of the reasons for this slow progress is the lack of proper knowledge about the variability in the isolates of *B. Sorokiniana*. *Phenotyping and genotyping study on spot blotch disease is already done and in progress at Indian Institute of Wheat and Barley Research, Karnal, Haryana (India)* (Virender Singh *et al.*, 2012, Ashish Ojha *et al.*, 2012, Virender *et al.*, 2015) Therefore, there is a urgent need to exploit the existing genetic variability in wheat for evolving high yielding varieties that have wide adoptability and are highly productive under a changing climatic scenario. Hence present study is concerned to identify disease resistant donor parents for their utilization in wheat breeding and controlling the disease & ultimately provides the cheapest and easiest way of increasing the productivity.

## **Material and Methods:-**

### **Plant Materials and field evolution:-**

The study material comprised 100 (One hundred) Varieties, Genotypes/ germplasm or cultivars which have diverse genetic background and origin. Mostly wheat genotypes exotic to south Asia/Cimmyt and India were included in this study, because these genotypes were specially used as parents for improving spot blotch resistance. All genotype were evaluated during *rabi* season, wheat growing season (December to April) 2011, 2012 and 2013 under field and polyhouse at Indian Institute of Wheat and Barley Research, Karnal, Haryana and Coochbehar (West Bengal), which are identified as a hot spot for the spot blotch disease. The experimental Material was laid out following a randomized complete block design. Each line was sown in single row of 2 mt under polyhouse and row to row and plant to plant distance was 25 cm and 5 cm, respectively.

### **Creation of artificial epiphytotic conditions in the field:-**

To promote disease build up and spread, mixture of highly susceptible genotypes was planted as a border row after 15 lines. To provide maximum disease chance of disease spread during flowering time, late sown was done. The standard agronomic practices were followed while epiphytotic condition was created in the field. Although, Coochbehar and Karnal is a good hot spot for spot blotch of wheat, experimental materials were also provided additional inoculums artificially. A pure culture of Coochbehar isolates (most aggressive isolate) of *B. sorokiniana* was multiplied on sorghum grains and the spore were harvested in water. A spore suspension adjusted to approximately  $10^4$  spores/ml of water was uniformly sprayed at three different growth states (GS), viz., tillering (GS20), flag leaf emergence (GS37) and anthesis (GS65) during evening hours. The field was irrigated immediately after inoculation and total five to six irrigations were given in the entire crop period to provide a favorable environment for the development of spot blotch disease. The first irrigation was given 21 days after sowing.

**Under polyhouse conditions:-**

Out of the 100 genotypes only 20 genotypes which showed field resistance, were used for under polyhouse conditions mechanically inoculated by using hand atomizer under polyhouse conditions at Directorate of Wheat Research, Karnal during *rabi* season 2001, 2012 & 2013. (Table-2) Each genotype was also characterized under artificial inoculation. Each genotype sown by hill planting method consisted 3-5 seeds/hill. A pure culture of Coochbehar isolates of *B. sorokiniana* was multiplied on sorghum grains, and spores were harvested in water. A spore suspension of 50,000 spores/ ml was uniformly sprayed at the four to five leaf stage followed by a second spray after a week to build up sufficient disease pressure.

**Disease Assessment:-**

Assessment of Disease severity (%) was done using double digit scale (DD, 00-99), displayed by all the leaves of each row was recorded at three different growth stages(GS), viz., GS63 (beginning of Anthesis to half complete), GS 69 (Anthesis complete) and GS 77 (late milking). The area under disease progress curve (AUDPC) based on disease severity (GS63, GS 69 and GS77) over time was estimated using the following formula (Roelfs *et al.*, 1992)

**Result and Discussion:-**

One hundred wheat genotypes screened against native isolate of *B. sorokiniana* at the Directorate of Wheat Research, Karnal location on field and polyhouse showed different reactions, indicating that the genetic variability / variations for response to leaf blight among the entries scored at both environments as shown by disease score. Since high spot blotch score occurred in the experimental field and polyhouse, as shown by disease score of 89 (Sonalika and HD 2329) and 79 (HUW 234 and Raj 4015), indicating that the season and environments were compatible for disease screening and there would be low chance to susceptible genotypes to score as resistant lines. Out of these one hundred lines with 4 checks (Highly Susceptible lines) screened for resistance to leaf blight none of them were found totally immune or disease free. Out of total entries tested, 20 were highly resistant, 28 resistant, 22 moderately resistant, 15 moderately susceptible and 15 Susceptible lines (Table-1). Out of the 20 highly resistant lines category, 11 were CIMMYT lines, 05 Indigenous genetic stocks 04 Chinese lines, 01 other and 04 released Indian variety were used for as checks. The exotic lines comprised bred wheat and synthetic wheat lines from CIMMYT and China. The CIMMYT lines were Yangmai #6, Mayoor, HRLSN-2, and 9, 13, 14, 15, 16, 22, 23 and HRLSN 24. The Chinese lines, Chirya-1, 3 and 7 also showed resistance < 13 or 13 score. In addition of these exotic lines, 07 Indigenous genetic stocks LBRL-1, 6,12,13 and LBRL-14 lines which were established genetic stocks of NEPZ and NWPZ parts of India were also identified as highly resistant. All the 04 checks, Sonalika, HUW 234, Raj 4105 and HD 2329 were showed highly susceptible with > 79 and 89 score. Three *Thinopyrum curvifolium* derivatives Chirya-3, Chirya-7 and Mayoor recorded the lowest mean disease 12 score. These lines originate from CIMMYT, Mexico and have introduced in India in 1996. Yangmai#6 line originated from Cimmyt and Indigenous genetic stocks LBRL-1, 6, 12, 13 and LBRL14 also have a lower mean score 12 under artificial epiphytotic polyhouse conditions. These all 20 lines in field natural conditions, showed highly resistant or immune with disease score (00-03) for spot blotch.(Table-3) The distinct resistance in these lines identified here can be used as valuable source in wheat breeding for spot blotch infected areas in India and other countries. Most of the entries classified as resistant had score ranging 13 to 25(28 lines). As the disease progressed from the bottom to the top of the plant, the disease area on the leaf below the flag leaf (F-1) was greater than that of on the flag leaf. There were distinct differences between the lines characterized as resistant with a score between 00-12 and 13-23/25 and moderately resistant and moderately susceptible with the score of 36 to 45 and 56 to 68, susceptible and highly susceptible with the score of 78 to 89 and up to score 89. Twenty most resistant with four most susceptible lines (used as a Check) were selected for genetic analysis to characterize genotypic variations for resistance to spot blotch under artificial epiphytotic conditions created in polyhouse during same *rabi* season. The spot blotch reactions of the selected lines were category under polyhouse conditions as compared to field natural conditions (Table-2). Earlier Chaurasia *et al.*, (1999) had reported that of 1387 wheat lines screened between 1994 and 1997, at spot blotch hot spot location and find most of the resistant lines were represented by CIMMYT materials. Low to moderate level of resistance to spot blotch in international wheat germplasm was reported by Dubin *et al.*, (1998). Recently, Singh *et al.*, (2014) reported a set of recombinant inbred lines were screened for spot blotch disease under natural and artificial epiphytotic polyhouse condition at three hot spot locations in India and find some resistant lines.

**Table 1:-** Categorization of 100 germplasm line of wheat to their disease response to spot blotch caused by B. Sorokiniana during *rabi* season 2011-12, 2012-13 to 2013-14

Category	Double digit score	No of lines	Range of leaf area blighted (%)	
			Flag leaf Min-Max.	Flag-1 leaf Min to Max
Highly resistant (HR)	< 12	20	00	0-05
Resistant (R)	13-25	28	05-10	10-20
Moderately resistant (MR)	36-45	22	10-30	21-40
Moderately Susceptible (MS)	56-68	15	21-50	41-60
Susceptible (S)	78-89	15	41-70	61-80
Highly Susceptible (Hs)	> 89	--	61-80	81-100

**Table 2:-** Pedigree and Source of origin of selected 20 Genotypes/germplasm

S.No.	Genotype/ Germplasm	Pedigree	Resistant Source	Origin Source
1	CHIRYA-1	Chinese Spring/Ag.Cu//Glennson-81/3/Alondra/Pavon76/4/Ningmai-4/Olesen//Alondra/Yangmai-4	HLB	China
2	CHIRYA-3		HLB	China
3	CHIRYA-7		HLB	China
4	HRLSN 2	BL1882=NI297/Oceear-7//BL1022	HLB	CIMMYT
5	HRLSN 9	ZSH12/HLB19//NL 297	HLB	CIMMYT
6	HRLSN13	ZSH/HLB-48//NL297	HLB	CIMMYT
7	HRLSN 14	BL1530/BL1095	HLB	CIMMYT
8	HRLSN 15	(205)/5/BP-10*3/4/	HLB	CIMMYT
9	HRLSN 16	BL1910=ZSH23/HLB15//NL297	HLB	CIMMYT
10	HRLSN 22	NL=AESQ (205)/5/BR12*3/4	HLB	CIMMYT
11	HRLSN 23	NL-750 'S'	HLB	CIMMYT
12	HRLSN 24	MILLAN/SHA-7	HLB	CIMMYT
13	LBRL-1	PBW 343/ CHIRYA-3	HLB	India
14	LBRL 6	UP-262/CHIRYA-7	HLB	India
15	LBRL 12	KANCHAN/NL 721	HLB	India
16	LBRL 13	MILLAN/BH1146	HLB	India
17	LBRL14	NW1012/YM#6	HLB	India
18	BH 1146	PG1//FRTR/MTA	HLB	Brazil
19	YM#6	DAFDAFENG-1087/ZAO-5	HLB	CIMMYT
20	Mayoor	CIGM-84.295	HLB	CIMMYT

**Table 3:-** Reaction of 20 highly resistant selected lines from field of wheat against *B. sorokiniana* under polyhouse conditions.

S. N.	Varieties	POLYHOUSE			**Over all Mean	Varieties	FIELD			**Overall Mean
		2011-2012	2012-2013	2013-2014			2011-2012	2012-2013	2013-2014	
		*Mean HLB	*Mean HLB	*Mean HLB			*Mean HLB	*Mean HLB	*Mean HLB	
1	CHIRIYA-1	13	13	12	13	CHIRYA-1	01	01	01	01
2	CHIRYA-3	13	12	12	12	CHIRYA-3	01	02	01	01
3	CHIRYA-7	12	12	12	12	CHIRYA-7	01	02	01	01
4	HRLSN 2	12	12	12	12	HRLSN 2	01	01	01	01
5	HRLSN 9	13	13	13	13	HRLSN 9	03	03	02	03
6	HRLSN13	12	12	12	12	HRLSN13	02	03	02	02
7	HRLSN 14	13	13	13	13	HRLSN 14	02	03	02	02
8	HRLSN 15	12	12	12	12	HRLSN 15	02	01	01	01
9	HRLSN 16	13	13	12	13	HRLSN 16	03	03	02	03
10	HRLSN 22	12	12	12	12	HRLSN 22	02	01	01	01
11	HRLSN 23	13	13	12	13	HRLSN 23	02	03	02	02
12	HRLSN 24	12	12	13	12	HRLSN 24	02	02	02	02
13	LBRL-1	12	12	12	12	LBRL-1	01	02	02	02
14	LBRL 6	12	12	12	12	LBRL 6	02	01	02	02
15	LBRL 12	12	12	12	12	LBRL 12	02	01	02	02
16	LBRL 13	13	13	13	13	LBRL 13	02	02	03	02
17	LBRL14	12	12	12	12	LBRL14	03	03	03	03
18	BH1146	12	12	12	12	BH1146	02	02	02	02
19	YM#6	12	12	12	12	YM#6	03	02	02	02
20	Mayoor	12	13	13	13	Mayoor	02	02	02	02

\*=Mean value of replicated Trials of each year \*\*= Overall mean values of three years replicated mean value

### References:-

- Sharma, R.C. and Duveiller, E. (2004): Effect of *Helminthosporium leaf blight* on performance of timely and late-seeded wheat under optimal and stresses levels of soil fertility and moisture. *Field Crops Research.*, 89: 205-218.
- Sharma, R. C., Duveiller, E., Ahmed, F., Arun, B., Bhandari, D., Bhatta, M. R., Chand, R., Chaurasiya, P. C. P., Gharti, D. B., Hossain, M.H., Joshi, A.K., Mahto, B.N., Malaker, P.K., Reza, M.A., Rahman, M., Samad, M.A., Shaheed, M.A., Siddique, A.B., Singh, A.K., Singh, K.P., Singh, R.N., Singh, S.P. (2004a): *Helminthosporium leaf blight* resistance and agronomic performance of wheat genotypes across warm regions of South Asia. *Plant Breeding.*, 123:520-524.
- Chaurasia, S., Joshi, A. K., Dhari, R. and Chand, R. (1999): Resistance to foliar blight of wheat: A search on Genetic Research. *Crop Evolution.*, 46:469-475.
- Roelfs, A. P., Singh, R.P. and Saari, E. E. (1992): Rust Disease of wheat: Concepts and methods of disease Management. CIMMYT, Mexico, USA, pp.37-38.
- Velu, G. and Singh, R.P. (2013): Phenotyping of wheat breeding, In: S.K. Panguluri and A.A. Kumar (eds), *Phenotyping for Plant Breeding*: Springer New York, pp.41-71.
- Joshi, A. K., Ortiz-ferrara, G., Crossa, J., Singh, G., Alvarado, G., Bhatta, M. R., Duveillar, E., Sharma, R. C., Pandit, D. B., Siddique, A. B., Das, S.Y., Sharma, R. N. and Chand, R. (2007): Associations of environments in south Asia based on spot blotch disease of wheat caused by *Cochliobolus sativus*. *Crop Science.*, 47: 1071-1081.
- Singh, V. and Singh, V. N. (2007): Management of spot blotch of wheat (*Triticum aestivum*) caused by *Bipolaris sorokiniana*. *Indian Journal of Agriculture Science.*, 77: 323-326.
- Chand, R., Pandey, S. P., Singh, H. V., Kumar, S. and Joshi, A. K. (2003): Variability and its probable cause in natural populations of spot blotch pathogen *Bipolaris sorokiniana* of wheat (*T. aestivum* L.) in india. *Journal Plant Disease Protection.*, 110: 27-35.



9. Chatrath, R., Mishra, B., Ferrara, G. O., Singh, S. K., and Joshi, A. K. (2007): Challenges to wheat production in South Asia. *Euphytica*, 157:447-456.
10. Kumar, U., Joshi, A. K., Kumar, S., Chand, R. and Roder, M. S. (2009): Mapping of resistance to spot blotch disease caused by *Bipolaris sorokiniana* in spring wheats. *Theoretical and Applied Genetics*, 118:783-792.
11. Joshi, A. K., Kumari, M., Singh, V. P., Reddy, C. M., Kumar, S., Rane, J. and Chand, R. (2007a): Stay green trait: variation, inheritance and its association with spot blotch resistance in spring wheat (*Triticum aestivum* L.). *Euphytica*, 153:59-71.
12. Joshi, A. K., Kumar, S., Ferrara, O. and Chand, R. (2004b): Inheritance of resistance to spot blotch caused by *Bipolaris sorokiniana* in spring wheat. *Plant Breeding*, 123:213-219.
13. Chowdhury, A. K., Singh, G., B. S. Tyagi., Ojha, A., Dhar, T. and Bhattacharya, P. M. (2013): Spot blotch disease of wheat – a new thrust area for sustaining productivity. *Journal of Wheat Research*, 5:1-11.
14. Singh, G., Tyagi, B. S., Singh, G. P., Chatrath, R., Singh, D. P. and Jag, Shoran. (2008): Genetic analysis and association of spot blotch resistance caused by *Bipolaris sorokiniana* with morphological and yield attributes in bread wheat (*Triticum aestivum*). *Indian Journal of Agricultural Sciences*. 78:957-61.
15. Kumar, U., Joshi, A. K., Kumar, S., Chand, R. and Roder, M. S. (2010): Quantitative trait loci for resistance to spot blotch caused by *Bipolaris sorokiniana* in wheat (*T.aestivum* L.) lines ‘Ning 8201’ and ‘Chirya 3’. *Molecular Breeding*, 26:477-491.
16. Saari, E. E. and Prescott, J. M. (1975). A scale for appraising the foliar intensity of wheat disease. *Plant Disease Reporter*, 59: 377-380.
17. Satvinder, K., Nanda, G. S., Navneet, G., Kaur, S. and Ghuman, N. (2002): Status of seed health and facultative foliar pathogens of wheat in Punjab from 1992-1999. *Journal of Research, Punjab Agricultural University*. 39(1):28-34
18. Alam, K. B., Shaheed, M. A., Ahmed, A. U. and Malakar, P. K. (1994). *Bipolaris* leaf blight (spot blotch) of wheat in Bangladesh. In: D.A. Saunders and G.P. Hettel (Eds.): *Wheat in Heat Stressed Environments: Irrigated, Dry areas and Rice-Wheat Farming Systems*, pp.339-342. Mexico, D. F. CIMMYT.
19. Shrestha, K. L., Timila, R. D., Mahto, B. N. And Bimb, H. P. (1997): Disease incidence and yield loss due to foliar blight of wheat in Nepal. (Eds.): E. Duviller, H.J. Dubin, J. Reeves and A. McNab. *Helminthosporium blight of wheat: spot blotch and tan spot*. Proc. Int. Workshop held at CIMMYT El Batan, Mexico. 9-14 Feb. 1997. pp:67-72.
20. Singh, G., Sheoran, S., Chowdhury, A. K., Tyagi, B. S., Bhattacharya, P. M., Singh, V., Ojha, A., Rajita. and Sharma, Indu. (2014): Phenotypic and marker aided identification of donors for spot blotch resistance in wheat. *Journal of Wheat Research*, 6:98-100.
21. Ojha, A., Singh, G., Singh, C., Tyagi, B. S., Singh, V. and Sharma, Indu. (2012): Potential donors for improving host resistance against spot blotch disease in wheat. International conference on Sustainable for food and Livelihood Security, Nov. 27-29. *Crop Improvement*, Punjab Agriculture University., pp.897-898.
22. Singh, V., Sheoran, S., Singh, G., Chowdhury, A. K., Ojha, A., Choudhary, R., Rajita, Chaudhury, A. K. and Indu, Sharma. (2012): Molecular Markers Associated with spot blotch resistance in Wheat. International conference on Sustainable for food and Livelihood Security, Nov. 27-29. *Crop Improvement*, Punjab Agriculture University., pp.451-452
23. Singh, V., Singh, G., Chaudhury, A. K., Chowdhury, A. K., Tyagi, B. S., Rajita, Ritu, Ojha, A. and Sonia, Sheoran. (2015): Phenotypic and Genotypic Evaluation of RILs for Spot Blotch Resistance in Wheat. *International Journal of Tropical Agriculture*, 33:1799-1804.
24. Dubin, H. J. (1998): Results of the south Asia regional *Helminthosporium* leaf blight and yield experiment, 1993-94. In: Duveillar, E., Dubin, H.J., Reeves, J., McNab, A. (eds) *Helminthosporium blights of wheat: spot blotch and tan spot*. CIMMYT, Mexico., pp. 182-187.

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### RESEARCH ARTICLE

## FAMILY ENTREPRENEURIAL BUSINESSES AND NEW VENTURES: FORMATION, CHALLENGES, BEHAVIOR, RELATIONSHIP.

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### Abstract

New ventures are frequently started by entrepreneurial teams rather than lone entrepreneurs. Often, team members have family ties. In this research to study the formation and membership of the team, team challenges, behavior and performance of the team, successors of business and family relationships between members of the team. Combined, they suggest that relationships are more important than skill diversity in determining the effectiveness of both family business and new venture teams

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### Introduction: -

Despite the popular legend of the heroic lone entrepreneur, the creation and management of new ventures is often a shared, team effort (Kamm et al., 1990; Gartner et al., 1994; West, 2007). Confronted with the simultaneous challenges of creating a firm that is unique and learning to manage in an unknown arena, new venture teams face what Stinchcombe (1965) describes as the liabilities of newness, which involve the difficulties of establishing market legitimacy in the face of time and financial pressures for survival. The distinctive nature and magnitude of the problems facing new ventures suggest they must be managed differently than established firms (Baron, 2002; Ensley, Pearson, & Amason, 2002; Schjoedt & Shaver, 2007) and that team involvement is often necessary for success. Thus, the formation, composition, and functioning of entrepreneurial teams can have a profound influence on the survival and growth of a firm. Furthermore, as such teams influence the founding conditions, behaviors, and practices that define the new venture, their initial decisions are likely to leave an enduring imprint on the venture's subsequent development (Beckman & Burton, 2008). The same can be said for teams in a family business setting. Such teams face unique challenges as well, because overlaid upon all of the problems normally facing entrepreneurial and/or management teams in nonfamily firms are the family relationships among team members that add materially to the complexity of the decisions made about the business (Mitchell, Morse, & Sharma, 2003).

Organizational teams have been studied extensively in the management literature (Mathieu, Maynard, Rapp, & Gilson, 2008; Stewart, 2010), and important work on teams in the unique contexts of family firms and new ventures has been done. Such work of the latter type has dealt with top management teams and behavioral dynamics (e.g., Ensley & Pearson, 2005; Ensley et al., 2002; West, 2007), team composition (Knockaert, Ucbasaran, Wright, & Clarysse, 2011; Ucbasaran et al., 2003; Zimmerman, 2008), compensation (Ensley, Pearson, & Sardeshmukh, 2007; Monsen, Patzelt, & Saxton, 2010), and performance (Beckman, Burton, & O'Reilly, 2007; Francis & Sandberg, 2000; Hmieleski & Ensley, 2007; Schjoedt & Kraus, 2009). However, there is still much we do not know, and there has been a lack of concerted effort to develop a theory that applies to the specific circumstances and contingencies facing entrepreneurial or family business teams. A notable exception is Harper's (2008) work, but his preliminary

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theory of entrepreneurial teams takes an economic rather than a behavioral perspective, which is the focus of this special issue.

The development and application of a behavioral theory of entrepreneurial teams is dependent upon, among other things, a clear definition, common language, and system of classification. Some scholars use *ad hoc* definitions, while others neglect to define the concept at all (Birley&Stockley, 2000). Indeed, the term “team” has multiple meanings in the academic and popular press (cf. Hambrick, 1994, and Hambrick, 2007), and the proliferation of terminology is evident by the references to new venture teams, family entrepreneurial teams, core teams, top management teams, and, entrepreneurial teams found in the literature and even this special issue.

Extant definitions of groups and teams have similarities but also meaningful differences (Mathieu et al., 2008). For example, Katzenbach and Smith (1993), Kamm andNurick (1993), Cooper and Daily (1997), Cohen and Bailey (1997), and Cooney (2005) generally agree that while both teams and groups involve a relatively small number of people, teams are composed of members with identifiable features that set them apart such as interdependent skill sets, common goals, shared commitment, and mutual accountability. Unfortunately, if we defined and identified entrepreneurial or family business teams based on all of these characteristics, we would not have many teams to study. Aside from the criterion of small numbers, there are few characteristics common to all such teams. Teams can, and often do, differ in terms of the relationships, functional heterogeneity, and demographic diversity of their members (Mathieu et al., 2008).

Indeed, given the diversity of entrepreneurial or family firm teams and the numerous problems they deal with, we suggest that any definition that goes beyond the number of members and their common but possibly unequal concern for a small set of superordinate goals, which are themselves subject to negotiation, is really seeking to distinguish *effective* teams rather than teams. Although superordinate goals pertaining to the survival, growth, and ultimate success of a venture or family firm are held more *or less* in common by team members, the likelihood of differences in both individual and proximal goals for the organization is very large (e.g., Cyert& March, 1963). Differences in goals also imply differences in preferred strategies and variations in the extent of shared commitment. Furthermore, relationship conflicts can also develop both because of differences in goals and strategies and because of the diverse backgrounds, experiences, and personalities of team members that underlie the differences in their goals. Similarly, information asymmetries and the unobservability of intentions and certain behaviors suggest that mutual accountability will not preclude opportunism, even in family firms (Schulze, Lubatkin, Dino, &Buchholtz, 2001).

Therefore, teams, whether of the new venture or family firm variety, are really groups of individuals who attempt to work together to achieve a set of imperfectly overlapping and negotiated superordinate organizational goals, potentially for different reasons and often in spite of conflicts emerging from their backgrounds, personalities, and individual motives. In this respect, new ventures and family firms are two contexts in which teams function, and both contexts lead to a unique set of challenges owing to the nature of the problem, the composition of the team, and the behavioral dynamics that influence the process and content of team decisions. Interestingly, the articles in this special issue suggest that while the challenges may vary, the primary ingredient in effective team functioning, the relationships among team members, is consistent across different types of teams. Thus, it appears plausible that a behavioral theory of management teams for new ventures and family firms may be built on a common foundation. With this in mind, we now turn to the research in this special issue.

As argued by Ling and Kellermanns (2010: 323), the family firm indeed offers “a rich avenue for research on diversity, since the family provides an additional layer of complexity and unique sources of TMT<sup>1</sup>diversity not found in non-family firms.” Yet, although the world economy is dominated by this form of organization (La Porta, Lopez-de-Silanes& Shleifer, 1999) and EO<sup>2</sup>is recognized to be a determinant of family firm resilience and long-term survival (Chrisman, Chua &Steier, 2011; Sharma &Salvato, 2011), only a few studies have empirically explored the effects of TMT diversity on family firms’ EO. Indeed, most of the family business literature focused on the effects of TMT diversity on behavioral dynamics (e.g. Ensley & Pearson, 2005) and financial performance (e.g. Ling &Kellermanns, 2010) rather than EO. In addition, most of the family business scholars considered the horizontal distance among family members (e.g. Ensley & Pearson, 2005) and between family and non-family members (Naldi, Nordqvist, Sjöberg&Wiklund, 2007; Cruz &Nordqvist, 2012) as major source of TMT diversity.

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<sup>1</sup>Top management team

<sup>2</sup>Entrepreneurship orientation

Following Ling and Kellermanns (2010), we focus on the vertical distance among family members as source of TMT diversity: Generational involvement, i.e. the number of family generations simultaneously involved in the firm TMT (Kellermanns&Eddleston, 2006; Ling &Kellermanns, 2010). Specifically, generational involvement produces knowledge diversity (cf. Jehn, Northcraft& Neale, 1999; Milliken & Martins, 1996) due to the different expertise and perspectives that family members belonging to different generations bring to the team (Chirico, Sirmon, Sciascia& Mazzola, 2011; Ling &Kellermanns, 2010). Salvato (2004), Zahra (2005), Kellermanns and Eddleston (2006) and Kellermanns, Eddleston, Barnett and Pearson (2008) argue that generational involvement is positively related to entrepreneurial behavior. However, they hold a position that is somewhat in contrast with most literature, according to which family firms are risk-averse and resistant to change (Jones, Makri& Gomez-Mejia, 2008; Gomez-Mejia, Haynes, Nunez-Nickel, Jacobson &Moyano-Fuentes, 2007; Naldi et al., 2007; Short, Payne, Brigham, Lumpkin &Broberg, 2009).

#### **The Formation of Entrepreneurial Teams: -**

Entrepreneurial teams differ from many other types of teams in businesses, in that they form voluntarily and are not imposed by others. Thus, entrepreneurial teams are naturally forming groups, but in contrast to many other naturally forming groups, they are task oriented (Hellerstedt, 2009): entrepreneurial teams' engagement in the identification, evaluation, and exploitation of opportunities is fundamental to their existence (Cooney, 2005; Wright &Vanaelst, 2009). Kamm and Nurick (1993) illustrate that the formation of an entrepreneurial team can be ignited by the recognition of an opportunity by an individual who then seeks others to pursue the opportunity; or by two or more individuals motivated to work together who then seek an opportunity. In addition, Cooney proposed that entrepreneurial teams might be formed due to a triggering event that entices them to identify and pursue opportunities. In practice, team formation and idea generation may emerge in a dynamic, reciprocal fashion (Beckman, 2006). Entrepreneurial team formation may occur long before the formal founding of a business (Wright &Vanaelst).

#### **The Membership of Entrepreneurial Teams: -**

Entrepreneurial team membership consists of individuals involved in the process to found or acquire a business venture together and its subsequent ownership and management (Cooney, 2005; Kamm et al., 1990; Ucbasaran et al., 2003). Studies have tended to contrast the need to have a variety of skills, experience, and ways of thinking with the desire for affinity and cohesion within the team (Forbes et al., 2006; Ucbasaran et al.). Social capital and diversity of prior affiliations provide entrepreneurial teams with access to ideas, opportunities, and resources (Beckman, 2006; Wright &Vanaelst).

Team members are often selected from preexisting networks of kin, friends, work colleagues, employees, or existing business associates (Anderson, Jack, &DrakopoulouDodd, 2005; Anderson & Miller, 2003; Casson&Giusta, 2007; Iacobucci& Rosa, 2010) and through existing strong relationships (Forbes et al., 2006; Francis & Sandberg, 2000).

The selection of additional team members may be related to the relative power of key stakeholders and interpersonal attractions and not based on a specific need (Forbes et al.). Ruef et al. (2003) pose that trust is paramount and strangers are avoided. Homophily may thus be a stronger driver of entrepreneurial team membership (Ruef et al.) than RBVperspectives indicate. However, Ruef et al. (p. 202) state that "a failure to control for the presence of kinship ties in founding teams may lead to inflated estimates of homophily."

#### **The Formation of FETs: -**

Entrepreneurial teams composed of family members have not been studied to any great extent. The pursuit of opportunities by families is assumed to be concentrated on existing family businesses and motivated by family circumstances such as the development of opportunities for offspring or wider family members; the division of the (existing)business to accommodate the succession of multiple siblings; or the search for alternative income opportunities when the core business faces unfavorable market conditions (Carter& Ram, 2003, p. 375). Hoy and Verser (1994) extend key themes of entrepreneurship to the context of family business and point to the transfer of the owner's vision to other family members, sustaining the innovativeness of the founder, intergenerational strategic thinking, and the influence of the family's values and priorities on the nature of the firm. They suggest that creating value involves "Entrepreneurship, i.e., intergenerational entrepreneurship leading to transformation" (p. 19). They do not expand on this, and it is not clear who or what will be transformed, but it offers an idea that may have the potential to provide an interesting perspective on the complex, dynamic interplay among the different generations, individuals, and businesses they are running.

Studies of portfolio entrepreneurship have examined the motivations and attributes of habitual entrepreneurs but tended to focus on the individual rather than teams (Kolvereid&Bullvag, 1993; MacMillan, 1986; Ucbasaran et al., 2003; Westhead & Wright, 1998). In family business studies, the enactment of opportunities is most often presented as being by individual family members, usually the senior generation (SG). And yet it is widely acknowledged that entrepreneurship is rarely enacted by lone individuals, and throughout the world, there is evidence of family members in a whole variety of transgenerational teams developing portfolios of businesses (Discua Cruz, 2010; Nordqvist& Zellweger,2010; Rosa, 1998).

Family business studies have shown that theories used to explain behavior in nonfamily organizations may be less valid in a family business context, most often because they do not capture the social and relational aspects of families in business. So while the formation of FETs may be driven by portfolio entrepreneurship, it is important to also consider social and relational theories that may be particularly relevant to families in business.

However, there is a danger of overgeneralizing to families in business and assuming that they are internally consistent and externally homogeneous (Westhead &Howorth,2007). Some families will not adopt a stewardship approach to being in business together.

Some families are characterized by rivalries, nepotism, shirking, and destructive behaviors that stem out of self-interest (Schulze et al., 2003). Davis et al. (1997) propose that stewardship relationships are more likely to prevail where individuals are motivated by higher order needs and intrinsic factors. If some family members indulge in opportunistic behavior, others exhibiting a stewardship perspective may feel betrayed and subsequently become more self-serving (Davis et al.). Where individual family members are self-serving but entrepreneurial, they are more likely to form individual businesses than a FET.

The relational dimension of familiness includes trust, norms, obligations, and identity(Pearson et al., 2008). Eddleston, Chrisman, Steier, and Chua (2010) suggest that stewardship theory, along with many of the theories of family business, is underpinned by trust. Where trust, norms, obligations, and identity are strong and focused on the collective, family members will be more committed to each other, and they may be more likely to form entrepreneurial teams. In the following sections, after considering the membership of entrepreneurial teams, we return to the dimensions of familiness in relation to the membership of FETs.

#### **Family Members in Entrepreneurial Teams: -**

Entrepreneurs looking for team members might look to family and friends, but this could provide a less heterogeneous composition of human and social capital, particularly if additional family members' experience, skills, and business-related contacts have been developed within the same family businesses. Family relationships might make it hard to exclude (or reject) members of kin, and altruism could lead junior family members being included with little human capital and to teams of family members that are less qualified.

However, junior family members may be provided with training and experience in specific areas that contribute to the human and social capital of the team (Howorth& Ali, 2001). Structural, cognitive, and relational dimensions of familiness are not consistent across a family and may influence the inclusion or exclusion of different family members in the entrepreneurial team. In particular, the relational dimension has potential for great variation within the family. Pearson et al. (2008, p. 958) state that the relational dimension consists of resources created through personal relationships, namely trust, norms, obligations, and identity.

Theories of trust indicate that trust, norms, obligations, and identity are interdependent (Howorth& Moro, 2006). Höhmann and Welter (2005, p. 4) state that "entrepreneurialbehavior cannot be understood without taking into account the phenomenon of trust." Eddleston et al. (2010) suggest that trust could underpin many of the theories that are used to explain behavior in family businesses and that "families throughout the world offer naturally occurring communities that generate trust relations" (Eddlestonet al., p. 1044). Trust's relevance to FETs is clear from trust's definition: "the willingness of a party to be vulnerable to the actions of another party [who] . . . will perform a particular action important to the trustor, irrespective of the ability to monitor and control that other party" (Mayer, Davis, &Schoorman, 1995, p. 712). Different forms or strengths of trust range from the weakest form, calculus trust, through knowledge-based trust, based on relationships (Lewicki& Bunker, 1996) to the strongest form of unconditional or identification-based trust. Family members may exhibit stronger forms of trust because they are

more willing to be vulnerable to each other's actions; there may be strong identification with each other's ideas, desires, and intentions and a strong reciprocal understanding in terms of values and standards of behavior.

Trust is believed to be important for entrepreneurial teams (Hellerstedt, 2009; Ruef et al., 2003), but trust is multifaceted, and we do not know which factors are most relevant to selection of entrepreneurial team members in family or nonfamily firms. Mayer et al. (1995) suggest that trustworthiness comprises three factors: ability, benevolence, and integrity. Higher levels of perceived integrity may be important because of the difficulty for entrepreneurial team members to control the agency risks of joint financial ownership and management. Membership of FETs may emphasize trust in integrity and benevolence more than ability.

In contexts where institutional trust is low, there may be greater dependence on personal trust (Hörmann & Welter, 2005) and social capital. Honduras is one such context as explained in the following section.

#### **Top Management Team Diversity and Entrepreneurial Orientation: -**

Upper echelon theory asserts that firm outcomes are a "reflection" of the actions of its TMT (Hambrick & Mason, 1984; Finkelstein & Hambrick, 1990). The theory assumes that managers act on the basis of their cognitive frames, through which situations are differently interpreted and different actions are taken. This construal is a function of TMT members' different education, experience, perspectives, values, affiliations and demographic characteristics.

Some scholars support the idea that TMT diversity leads to the consideration of many alternatives and that this enhances the likelihood that innovative decisions will be made (Bantel & Jackson, 1989; Wiersema & Bantel, 1992). TMT diversity should indeed lead to better problem solving and higher creativity and innovation because of the constructive dialogue built around top managers' multiple ideas, knowledge and perspectives not available in homogeneous TMTs (Talke, Salomo & Rost, 2010; Talke et al., 2011). The most prominent benefit of a heterogeneous group is thus related to knowledge diversity (Milliken & Martins, 1996), defined as the different expertise and perspectives possessed by individuals in a given domain to perform a task or activity in a team (cf. Jehn et al., 1999; Postrel, 2002). Knowledge diversity highly stimulates task-related conflicts, i.e. productive debate and criticism about the content of the task being performed (Jehn, 1995; 1997; Jehn et al., 1999), which promote knowledge integration (Grant, 1996; Nonaka, 1994) and thus entrepreneurial action (Boeker, 1997a, 1997b). For instance, Talke et al. (2011: 823) found that "top managers with diverse educational, functional, industry, and organizational backgrounds will combine different views of the world and have more constructive task conflicts, which encourages...a proactive innovation orientation of firm." Also, Boeker (1997a, 1997b) found that heterogeneous TMTs are more likely to be entrepreneurial and enter new product markets than homogeneous teams. Similarly, Simons, Pelled and Smith (1999) suggest diversity in educational background and tenure can create alternative views and foster innovative choices.

However, despite its merits, TMT diversity is also accompanied by costs. For instance, TMT diversity can produce high levels of relationship or emotional conflicts, i.e. "interpersonal incompatibilities among group members, which typically includes tension, animosity, and annoyance" (Jehn, 1995: 258) that undermine consensus and agreement, and thereby the potential entrepreneurial advantages of having a group with different knowledge and perspectives. Miller et al. (1998) for example found that more diverse TMTs make less comprehensive evaluations of opportunities and threats; and Knight et al. (1999) and Hambrick, Cho and Chen (1996: 664) showed that team heterogeneity is negatively related to strategic consensus and leads to "dispersion in the group's perspective", thus constraining or delaying entrepreneurial action. Also, Ancona and Caldwell (1992) and O'Reilly et al. (1993), among others, found that TMT diversity decreases entrepreneurship.

Such mixed results have induced most scholars to argue that TMT diversity is a 'double-edged sword' (cf. Milliken & Martins, 1996) in which the "effect of TMT diversity on innovativeness [and entrepreneurship]" is "mixed and ambiguous because of the dual impact of the benefits and costs associated with TMT diversity" (Auh & Menguc, 2005: 250). TMT diversity apparently brings the necessary knowledge to bear on complex strategic issues, but it is also likely to promote dysfunctional rivalries, impair social integration, and restrict knowledge flows – all of which serve to inhibit EO. In this research we aim to achieve a better understanding of this complexity and of the circumstances in which "potential benefits of diverse teams appear to be highly vulnerable to certain liabilities." (Michie, Dooley & Fryxell, 2006: 131).

**Founder Teams and Human Resource Values: -**

The early decisions made by the leadership team of a new venture are important in establishing the trajectory of development of the firm as it grows and matures, and therefore understanding how teams make these decisions regarding structures and processes will help explain firm behaviors and performance (Baron, Burton, & Hannan, 1996; Beckman et al., 2007; Francis & Sandberg, 2000; Fren, Cardinal, & O'Neill, 2012; Hmieleski & Ensley, 2007; West, 2007). Critical to the investigation of the composition of new venture teams is whether and when team heterogeneity or homogeneity (which includes the degree of diversity and what kind of diversity) is more effective. In the article by Leung, Foo, and Chaturvedi (2013), the assumption is that both can be important in terms of the internal consistency and distinctiveness of human resource values, which are important for the long-term performance of the firm because they will affect strategy implementation. The authors argue that common bonds through shared organizational experience indicate high-quality relationships among team members and therefore will increase the consistency and distinctiveness of human resource values.

Thus, their measure of homogeneity through shared organizational experience is quite similar in its theoretical justification if not its empirical operationalization to the measures of intra-team relationships used by Cruz et al. (2013), Lim et al. (2013), and Sciascia et al. (2013).

The authors also argue that functional diversity can increase or decrease the internal consistency and distinctiveness of human resource values. The former argument is based on the notion that functional diversity represents a firm's cognitive capability, an argument similar to Lim et al. (2013) and Sciascia et al.'s (2013) idea that functional diversity is linked to constructive task conflict and more coherent decision making. However, Leung et al. (2013) recognize that it is possible that functional diversity could reduce the likelihood of strategic consensus, which would negatively impact the internal consistency and distinctiveness of human resource values. Finally, the authors investigate the interaction effects of shared organizational experience and functional diversity, arguing that high levels of both will have the greatest positive impact on the internal consistency and distinctiveness of human resource values.

The findings of Leung et al.'s (2013) are consistent with those of the other studies in this special issue. Using a sample of 60 high-tech firms from Singapore, they find that shared organizational experience increases the internal consistency and distinctiveness of human resource values, but functional diversity only increases distinctiveness. Of more interest are the results of their tests of moderation, which were statistically significant but contrary to the direction proposed in their hypotheses. Thus, venture teams with high shared organizational experience and low functional diversity reported the highest levels of internal consistency and distinctiveness of human resource values.

Combined with the other studies in the special issue, the results of Leung et al.'s work again suggests that strong relationships among team members may be a more important ingredient for success for both family and nonfamily firms than a comprehensive set of skills among team members. Interestingly, these findings seem to be valid across cultures as the results of the various studies in this issue span samples in several different continents.

**Team fault lines and Opportunity Identification: -**

The conceptual article by Lim et al. (2013) reminds us that entrepreneurial teams are not necessarily homogeneous in terms of their goals and preferred strategies, nor are they immune to dysfunctional conflict that can inhibit the smooth development of the venture. Indeed, Lim et al. point out that often, teams devolve into subgroups of individuals who share a common background or orientation or set of demographic attributes that differ from those of other subgroups in the team. The divisions have come to be known in the literature as fault lines (Thatcher & Patel, 2012). Lim et al. apply the fault line concept to the sources and consequences of dissension among idea-conceiving founders and equity-based partners or investors.

Lim et al. (2013) propose that differences in the structure of the venture including the distribution of equity, the power to change the composition of the team, and the preexisting ties among the founders and investors can affect the strength of the fault lines between the two groups. Similarly, those authors argue that the extent to which founders and investors possess similar mental models with regard to the venture will also influence fault line strength. The authors go on to suggest that fault lines will influence the interactions among founders and investors in three ways: by affecting the extent of relationship conflict, task conflict, and knowledge exchange that occurs among the disparate groups. Finally, Lim et al. argue that relationship conflict, task conflict, and knowledge exchange will influence the quality of the opportunities identified by the venture, in effect acting as mediators in the relationship



between fault line strength and opportunity identification. Sciascia, Mazzola, and Chirico (2013, this issue) suggest that family teams can be much larger and more diverse and therefore prone to suffer from fault lines between different coalitions of individuals on the top management team or board of directors. For example, family teams that include in-laws, nonfamily members, different generations, or family members with dissimilar levels of commitment may develop fault lines, whereas family teams based solely on blood and shared values may not (Cruz et al.). This raises the question of whether Lim et al.'s model can be effectively applied to other team situations in its particulars and whether or not a wide variety of different structural and/or cognitive elements can likewise determine fault line strength.

There is also the issue of how fault lines can be diffused or when they exist how they can be used for productive rather than destructive ends. For example, Lim et al. (2013) suggest that task conflict will be low and relationship conflict high when fault lines are strong. However, this does not necessarily need to be the case, particularly with regard to task conflict, if an actual, as opposed to perceived, balance of power can be achieved among the two groups. Furthermore, by channeling disagreements toward material matters, petty strife might be minimized, and decision quality can be enhanced (Kellermanns, Floyd, Pearson, & Spencer, 2008). On the other hand, the ability of a powerful owner-manager to discipline other team members may prevent fault lines from developing, albeit with the risk of sacrificing task conflict (e.g., Ensley & Pearson, 2005). But we need more theory and research to understand if, when, and how the constructive management of conflict across fault lines might occur.

#### **Generational Involvement and Entrepreneurial Orientation: -**

In contrast to the studies of Cruz et al. (2013) and Lim et al. (2013) that deal with teams formed explicitly to seek and exploit entrepreneurial opportunities, Sciascia et al. (2013) deal with the entrepreneurial orientation of preexisting teams in a sample of 199 mature family firms located in Switzerland. However, their arguments and findings are highly congruent with those of the other articles contained in this issue. Sciascia et al. draw on upper echelons theory (Hambrick & Mason, 1984) to suggest that generational involvement is a proxy for knowledge diversity and therefore that entrepreneurial orientation suffers whenever too much or too little generational involvement is present. In the first instance, the involvement of only one generation is expected to lead to groupthink and a more conservative mode of business. Here, the firm suffers from too little task conflict, too few devil's advocates, too few risk takers, and too little creativity. In the second instance, the involvement of multiple generations increases the risk of relationship conflict owing to excessive kinship distance and difficult-to-reconcile disparities in goals and strategies. Here, what might evolve into constructive discussions of alternative courses of action is likely to turn into disagreements centered on personal rivalries, distrust, and deliberate or inadvertent misunderstandings. Consequently, Sciascia et al. hypothesize and find that generational involvement has an Inverted-U shape relationship with entrepreneurial orientation.

As noted above, Sciascia et al.'s (2013) findings can be compared with those of other articles contained in this issue. For example, their study suggests that the number of generations involved in a family firm and the possibility of fault lines emerging may be correlated. Using the work of Lim et al. (2013) as a guide, several explanations are possible including the natural differences that might occur given in congruencies between the current ownership of the older generation and the (often uncertain) residual ownership of the younger generation, as well as the obvious differences in mental models that are likely to occur when individuals representing three or more generations of a family are involved. On the other hand, Sciascia et al.'s study also suggests that fault lines between groups with somewhat different perspectives may be healthier than no fault lines at all, as long as they are not allowed to become too deep. These considerations are in line with research on surface and deep level diversity and on conflict within entrepreneurial teams (Schjoedt & Kraus, 2009), as well as with recent thoughts on how entrepreneurial orientation is not necessarily as homogenous and pervasive throughout the firm as many researchers have assumed (Wales, Monsen, & McKelvie, 2011). Sciascia et al.'s (2013) study also underscores an implicit message from the study of

Cruz et al. (2013); namely that beyond the years of its founding, a family business may only engage in significant entrepreneurial activity when members from the succeeding generation join and, in effect, challenge the leadership of the incumbent generation. Combined, those studies also suggest that significant entrepreneurial activity is less likely to occur when three or more generations become involved owing to a lack of a shared vision, lower trust, and potentially very different conceptions of what family stewardship is all about. Thus, these studies indicate that entrepreneurial activity is dependent on the "right" amount of diversity within the family-based team.

**Family Ties, Teams, and New Venture Creation: -**

Although the potential for relationship conflict among entrepreneurial teams consisting of unrelated individuals is high, having a team composed of family members does not ensure tranquility. In fact, given the extant literature one might conclude that relationship conflict is more likely in family firms than in nonfamily firms (Ensley & Pearson, 2005; Kellermanns & Eddleston, 2004). Moreover, teams of family members would also seem to lack the skill breadth seen as so important to new venture success. As a consequence, one might expect that nonfamily teams would outperform family teams. However, using social identity theory Brannon et al. (2013) suggest that this is not always or even usually the case. They argue that the nature of the relationships among team members matter in determining the effectiveness of family and nonfamily teams in new venture creation, because these influence their ability to adapt to the new roles that venturing requires.

Couples are likely to have the advantages of particularly strong relationships, shared venture goals, and the flexibility to negotiate mutually acceptable roles in the family and in the firm. By contrast, role adjustments are expected to be more difficult in biologically linked teams owing to relationships that are based on a long history of interaction that are both hard to change and prone to contain the seeds of dissension. Brannon et al. (2013) therefore expect that venture teams composed of couples will be more likely, and biologically linked teams less likely, to achieve first sales than teams composed of unrelated individuals. However, they also hypothesize that when biological teams are able to employ mechanisms, such as differential financial investment to reconcile family and firm roles among team members, their ability to achieve first sales will improve relative to teams composed of either couples or unrelated individuals. Using longitudinal data from a sample of 295 venture teams located in the United States, they were able to support all of their hypotheses.

Although their study is suggestive rather than definitive, Brannon et al. (2013) are able to provide evidence that substantiates the implications of the other studies found in this special issue. Brannon et al.'s study shows that relationships are a primary driver of the success of entrepreneurial teams. When relationships are strong and relational conflict can be avoided, the probability of team success is improved. By contrast, poor performing teams appear to lack the mechanisms necessary to overcome relational issues. What they add is a social identity explanation for why the potential for relationship conflict might either be curtailed or aggravated, depending on the circumstances.

While it seems intuitively appealing to argue that the cumulative skills of an entrepreneurial team are more important, none of the studies included in this special issue support that supposition. Cruz et al.'s (2013) work suggests that skills and abilities help determine roles and assignments in family entrepreneurial teams, but this appears to be clearly a secondary function. Furthermore, Leung et al.'s (2013) study indicates that if anything, skill diversity can undermine the utility of team relationships in ensuring the consistency and distinctiveness of the human resource values of a firm. On the other hand, Lim et al.'s (2013) conceptual model and Sciascia et al.'s (2013) empirical study seems to place more equal weightings on relational and task issues. Nevertheless, both suggest that the ability of individuals to function as a team outweighs the individual or collective abilities of the team. In line with previous research (Schjoedt & Kraus, 2009), these studies seem to indicate that deep level diversity (e.g., values) should be limited because of its potential to increase relationship conflict between team members as they engage in problem solving. Conversely, surface level diversity (e.g., educational background), if maintained (e.g., by replacement of team members), enhances the team's decision quality and performance (Schjoedt & Kraus, 2009). Brannon et al.'s (2013) study shows that family teams can be the best or the worst in achieving first sales, leading the authors to suggest that the types of relationships as well as the strength of relationships matter, that the ability of individuals to adapt is important, and that there are mechanisms that can be used to improve the probability of team success.

**Lack of Growth: Folklore and Fact: -**

The notion that family-owned businesses do not grow is supported by folklore as well as fact. The adage "from shirtsleeves to shirtsleeves in three generations" expresses the widespread perception that family firms do not survive over the long term.

As for the facts, a study of the fastest growing companies in the United States by the public accounting firm Coopers & Lybrand (Jones, Cohen, and Coppola, 1988) found that only 1% were firms run by family successors to founders, whereas 80% were led by their entrepreneurial founders. In a 1995 MassMutual Life Insurance survey of more than 1,000 family-business owners, growth was ranked sixth among seven possible business goals, with much

higher priority placed on increasing profitability, reducing debt, and increasing family wealth outside of the business (Greenwald, 1995).

Some of the most frequently quoted statistics on family business come from a 1987 study of a sample of family firms in Illinois (Ward, 1987). It found that over a sixty-year period, only 15% of the sample survived as independent business owners. Two-thirds of those that did survive did not grow at all through the decades. Similar results were found in a more recent study of European firms by the London-based accounting firm Horwath Group (Benson, Crego, and Drucker, 1990).

There are many theories on why family firms do not grow and rarely survive over the long term. The following are those most frequently seen:

- (1) Maturing business life cycles and increasing competition
- (2) Limited capital to fund both family needs and business growth needs
- (3) Weak next-generation business leadership
- (4) Entrepreneurial leadership's inflexibility and resistance to change
- (5) Conflicts among sibling successors
- (6) Disparate family goals, values, and needs

#### **Maturing Business Life Cycles: -**

Although all businesses struggle with Schumpeter's inevitable business life cycle, family-owned firms have some special burdens. Family firms frequently pride themselves on their loyalty to employees and their strong culture and traditions (Dyer, Jr., 1988). Both practices can create resistance to change, however. As an example, family firms carry loyalty too far by retaining long-standing suppliers and advisors who are past their prime and are no longer appropriate to the needs of the business.

Another problem is that most family-business leaders know and own just one business. When it matures, they have few options but to hold on to a declining asset. Most prefer to nurse the business along rather than shift their focus to new growth possibilities because the business is their creation, their identity, and their comfort (Lansberg, 1988). Low profitability reinforces this inherent unwillingness to change by increasing dependence on the historic core business.

#### **Limited Capital: -**

Like all businesses, family firms must satisfy the growing expectations of shareholders. Unlike their non-family counterparts, however, they face the challenge of providing capital to pay their owners' death taxes. Many surveys show that the value of the typical family firm represents about 80% of the family's total assets, and when the senior generation dies, the owning family faces the most onerous death tax rate in the world (Ward, 1987).

#### **Weak Next-Generation Leadership: -**

Many surveys show that one third to one half of all family businesses don't have available next-generation successors (Arthur Andersen, 1995). Those that do still face the reality of unlikely business growth because following in the footsteps of a very successful person who also is a parent or relative is, for many, an intimidating prospect. The next-generation leader must cope with many doubts and pressures:

- How can I make my mark in the land of a legend?
- How can I show respect for predecessors, yet remain my own person and foster change as a leader?
- How do I deflect the notoriety of a famous name and the constant comparisons with my namesake?
- How do I accept the responsibilities of leadership and for the welfare of others when the beneficiaries are my loved ones?
- How do I replace as leader of the family a person of an older generation who had not only the power of a parent or a senior, but also the authority of earned business success?

The odds of personal failure and the inevitability of disappointing others deeply affects the next-generation leader's style and decision making. Often, the result is a reluctance to take risks. Without risk-taking, however, the prospects for business growth wane.

Although many point to the

**Inflexibility and Resistance to Change: -**

Business psychologists have observed that successful leaders with very successful business strategies become fixated on that formula for success (Danco, strategy becomes inflexible, stifling growth. Other classic entrepreneurial characteristics also block growth opportunities.

For example, many entrepreneurial personalities reject planning as a managerial practice, often arguing persuasively that it brings more disadvantages than advantages (Mintzberg, 1994):

- Planning requires sharing information. Entrepreneurs frequently prize secrecy.
- Planning forces entrepreneurs to respond to the ideas of others and to defend their own views. Entrepreneurs often relish ambiguity.
- Planning increases the opportunity for conflict among management and family. Entrepreneurs tend to avoid negatives and conflicts.
- Planning concentrates limited resources in a more focused manner. Entrepreneurs prefer spreading risk among many products, customers, and lines of business.
- Planning implies long-term commitments. Entrepreneurs like to keep as many options open as long as possible.

**Sibling Successor Conflict: -**

Studies show that, more often than ever, U.S. family firms are owned by a team of siblings (Nelton, 1996). Nearly half of all business owners expect to pass on leadership and ownership to two or more of their offspring.

The challenges facing sibling partnership teams are unique. Relationships among siblings are intense, and if serious discord occurs it frequently is fatal to the existing ownership structure. Approximately half of all sibling partnerships result in a split-up (Ward and Aronoff, 1992), which not only disrupts the management process and business climate, but usually consumes tremendous capital and growth potential as one or more partners are bought out by the other(s).

For a sibling partnership to work, the teammates must continually invest in their relationship. They must be able to compromise, talk things through, and follow a code of mutual understanding. Fundamentally, they must “agree to agree,” because it is more vital to preserve the sibling relationship than to make optimal business decisions (Ward and Aronoff, 1992). In fact, it is better to short-change business growth if it preserves the strength of the partnership.

Good partnerships can overcome average business decisions, but bad partnerships will destroy even the best business.

**Disparate Family Goals: -**

Sibling and cousin-owned family businesses share an important challenge: How to reconcile the different goals, needs, and values of several family members. As families expand and grow older, goals and values inevitably become more diverse.

For most non-family-owned businesses, shareholders come and go as the nature of the investment suits their expectations. For most family-owned businesses, on the other hand, the investment is illiquid, carries emotional significance, and represents most of the shareholders’ wealth. Consequently, family shareholders struggle over whether to retain their investment.

If they choose to sell, they feel disloyal to their heritage and worry about getting full value for their shares. If they choose to stay with their investment, they feel they deserve special rewards and acknowledgment (Murdoch and Murdoch, 1991). Rewards may include hefty and consistent dividends, while acknowledgment may include involvement in business governance or extra efforts made to communicate information to them about the business. Both bring challenges to growth. Providing capital for share redemption draws funds from building the business, and paying dividends diverts profits from reinvestment. Time spent earning shareholder commitment diverts energies from day-to-day business.

The most serious threat to growth occurs when some family members feel the business is unfair to their cause or does not exemplify their beliefs. These owners attack management relentlessly. Just as detrimental are family owners who feel mistreated by previous generations and focus their resentments on current family managers who they perceive as unfairly privileged representatives of their forebears.

**Avoiding Stagnation: The Growth Model: -**

For most family-owned businesses, the path to survival is one of stagnation. How do these firms survive when they do not grow for so many years? The answer is in examining two unusual circumstances that benefit non-growing survivors.

First, the non-growing firms that have survived have kept ownership in one person's hands, rather than evolving into sibling partnerships or firms held widely by a variety of family members. In general, ownership by one family member who leads the business significantly increases the chances of growth and survival.

Second, the nature of their businesses and industries have spared them much competitive or technological change. In sum, most of the long-lasting survivors have avoided many of the business and family challenges faced by both family and non-family businesses (Ward, 1987).

In contrast, the family firms that have grown the most over time follow a different but no less predictable path: Each generation of leadership brings to the business new strategic ideas that build on underlying, long-held competencies developed for earlier strategies (Hamel, Jr., 1994). In addition, ownership control rests with one family manager, or if not one, as few as possible (Stoy Hayward, 1989). A good example of this growth model is Rosenbluth Travel, a \$1.3 billion Philadelphia-based firm that is more than one hundred years old. The first generation founder began by arranging steamship passage for immigrants. To succeed, the business developed excellent skills in customer service and in accounting for customers' monies.

A later generation shifted the focus to leisure travel. The same skills were important to success: providing outstanding personal service and applying the data processing and record-keeping talent to analyze customers' needs and rate structures. The current-generation leader added a new dimension, corporate travel. This new strategy draws on the firm's historic skills. Besides providing good customer service to corporate accounts, Rosenbluth maintains excellent recordkeeping and data processing in order to deliver on its "lowest possible fares" promise to its customers.

While the growth model exemplified by Rosenbluth accurately reflects the experience of most long-growing family firms, it does not explain the day-to-day management practices that spark that growth. Nor does it explain the leadership practices necessary to hold together more complicated forms of family ownership, such as sibling partnerships or more widespread family ownership. The next section outlines the best practices needed to make the growth model succeed.

**Best Practices: -**

Family-owned firms that grow through the decades must address each of the following requirements in order to promote expansion and overcome the special challenges inherent in family firms.

**Assure Fresh Strategic Insights.** Long-term growth requires ongoing sources of fresh strategic insights. In most industries, strategies must change every few years, if not continuously. Efforts to stimulate new thinking are particularly important for family-owned firms, because few successors have much breadth or variety of outside experience and most managers and leaders have long tenures. Family-business leaders can create an atmosphere that fosters and welcomes new ideas if they:

**Promote strategic experimentation.** Growing companies constantly test and stretch their current strategic limits (Mintzberg and Waters, 1990). They revise products, explore new markets or channels of distribution, refine the marketing mix of pricing and promotion, and create new ways to add value or differentiation.

New insights come most often from the trial-and-error experiments with current strategy, and experimentation helps jolt family firms out of the complacency that comes so naturally to many successful individuals and firms.

**Budget strategic expenses.** To assure that strategic development is a highly conscious process, successful firms establish a "strategic budget" that clearly identifies initiatives to promote strategic development (Mintzberg and Waters, 1990). Strategic expenses are spent on efforts that, for example, promise to increase market share volume in future years or to build new lines of business.

They do not include costs to maintain and protect the status quo. Many family firms find that setting up a strategic budget provides helpful tension to preserve needed funds in the family business against the temptation to pay increasing dividends or family-member bonuses and perks.

*Provide serendipity capital.* Creative managers need discretionary funds to explore and experiment with new ideas and to react to new circumstances that were not anticipated in the annual operating budget process. Some outstanding growth firms include such discretionary funds for each manager as part of their operating budgets. Managers are encouraged to spend these funds for the sake of the future, which creates a climate of experimentation and motivates creative, dynamic managers to achieve their best.

*Use independent directors on the board to challenge strategic assumptions.* The greatest way to avoid stagnation and decline is to have an absolute business mission. Business leaders who are committed to growth urge their independent outside directors to challenge the relevance of their mission and the validity of the assumptions underscoring it. Successful business leaders know that no one can challenge their thinking and the direction of the business better than highly respected outside directors.

*Encourage global experience for next-generation business leaders.* A famous study by Professor Miguel Gallo (Gallo and Point, 1994) of IESE in Barcelona found that the most successful international family firms were those in which the leaders' offspring had significant work or educational experience outside of their home country. However, most family-owned firms run a high risk of limiting international growth opportunities because successors often do not gain significant outside external experience.

*Attract and Retain Excellent Non-Family Managers.* Long-term growth demands a pool of talented non-family managers, but most family firms do not take this resource fairly enough. They are reluctant to invest in future talent when they are unsure of the effects of strong non-family managers on the family members' career paths. Frequently, business owners are too modest to believe they can attract people of the highest caliber (Tanner, 1994). To combat their tendencies, family business leaders must:

*Emphasize merit in personnel decisions.* The best non-family managers need to feel that they are valued, appreciated, and compensated on the basis of merit.

*Provide opportunities for the best managers to accumulate personal wealth.* Few family firms give stock or stock options to their key executives (Carlson and Nager, 1993). More often, they are given opportunities to participate in "phantom stock" plans or to invest alongside family members in special arrangements such as a new venture or a real estate opportunity.

*Assure career growth opportunities for the best non-family executives.* Talented on-family managers need assurance that they can continue to grow as professionals. Too often, the company's organization chart and the likely career paths of young family members do not give them that assurance. In response, some family firms restrict family members from entry into the business until they have ample, successful external experience. They also work hard to create more top management leadership positions than could be filled by family members alone.

*Create a Flexible, Innovative Organization.* Constant strategic experimentation requires a flexible, innovative organization that can:

*Share business information openly.* As noted earlier, secrecy is a common trait of business owners. They fear disclosing financial success, because it leads to demands by valuable employees, and financial failure, because it drives away good people. But without information and trust, creativity and loyalty are limited. Successful family-owned firms grow by sharing vital information among a large number of managers.

*Champion change and celebrate new ideas.* For innovation and flexibility to flourish, teamwork must be a part of the company's culture. Growing companies de-emphasize heroic leaders as the reasons for success (Danco, 1994). Instead, they credit the organizational team and the habit of past innovation that extends to the founding of the business itself.

*Constantly change some things.* The best way to encourage innovation is to foster positive feelings about change. One popular approach to increasing comfort with ongoing change is to tinker regularly with management systems

and processes, such as compensation bonus systems, information systems, organizational roles and structure, and reporting and personal performance review processes (Nelson, 1994).

**Create and Conserve Capital.** As the family grows, as death taxes arise, and as new strategies require increased financial resources, the demands for more capital are high. However, conserving as much cash as possible for the business is critical for growth. To help resolve the dilemma between family financial needs and growth's fiscal requirements, long-lasting, growing family firms become adept at creating and conserving capital. Among their strategies:

*Use other people's money.* Growing firms use more debt (Tennenbaum and Trien, 1992). They also are creative in securing capital from others who want to invest in the business's success, sometimes by offering ownership shares and opportunities for joint ventures.

*Manage strategy to be less capital intensive.* Over time, long-growing family firms shift their strategy to require less capital for growth (Flamholtz, 1986). They de-emphasize aspects that require significant capital (such as real estate or totally integrated production) and emphasize those that require less capital (such as servicing and franchising).

*Quickly establish a share redemption plan and dividend policy.* The sooner the formula for redemption is established, the less capital it will require. Long established redemption plans usually are less contentious and designed to give the business ample time and favored terms to make payouts. In addition, clear dividend policies usually lead to more content and less demanding shareholders (*Family Business Advisor*, 1994).

*Implement estate plans early.* Family-business experts agree that one of the best ways to conserve capital is to lessen the bite of death taxes by implementing the estate plan and its funding mechanism(s) as soon as possible (Blackman, 1994). The sooner the plan is implemented, the more taxes that can be saved. Prompt action also minimizes the cost of necessary insurance.

**Prepare Successors for Leadership.** Successors to family firms face unique job requirements that require specific skills to maximize their chances of leading business growth. Most of the education for successors is either unsupervised, on-the-job training or formal course work at a university or college (Cohn, 1992). Both neglect some critical aspects of the job of CEO of a family firm. To fill the gaps, family business leaders must:

*Support the successor in developing a culture of change in the business.* For family successors of successful parents, leading organizational change is extremely difficult. Promoting change is usually perceived as an indictment of the past or a criticism of the predecessor. Predecessors can help by focusing on how the company team contributes to the firm's success and by discouraging credit for themselves.

*Promote good mentoring for the successor.* Successors benefit from several mentoring experiences: working elsewhere before entering the family firm; learning how to cope with the expectations of the outside world of civic organizations, charities, and trade associations; and learning how to create a common strategic vision for the company and the owners.

*Set a date to transfer both responsibility and control to the next generation.* Successors can be inhibited by uncertainty over the date of succession. Predecessors who establish the date far in advance usually are more calm and prepared for retirement, and their successors are more motivated and committed to be the leaders the business and its growth require. Nothing frustrates the growth of a family firm more than the unwillingness or inability to empower and to entrust the next generation with control and authority (Jaffe, 1990).

**Exploit the Unique Strategic Advantages of Family Ownership.** Much of the early part of this paper outlined the disadvantages and special challenges to growth for many family firms. Successful family-owned companies know there are special advantages, too, and they strive to shape strategies that exploit them, such as:

*Seeking investments that reward patient capital.* Family firms have a unique opportunity to be long-term oriented. Security analysts can't punish their long term thinking. For a strong family, long-term value is much preferred to short term results. Highly successful family firms can therefore be more consistent in their business-building efforts and react less to bumps in the economy or their industry. Such efforts can include research and development, brand name development, market expansion, and even investments in out-of-fashion businesses, such as savings and loans and metal platers.



*Build strategy around relationships.* For the family-owned business, reputation is all-important (Donnelley, 1964). With the family name on the door and with the realization that future generations will be known, in part, by today's decisions, families in business have every advantage in dealing with each other. Mutual trust can lead to exciting new growth opportunities: More and more global alliances are being established by family firms.

*Concentrate on businesses in which fast decision making is a plus.* While quick decision-making certainly is a function of small firms, it also is a function of family firms. Decreased organizational politics and the resonance of ownership with managerial leadership allow family businesses to respond when quick decision-making is required.

### **Conclusion: -**

The number of family members in TMT certainly affects tending to EO. The findings represent that attending non family members in such teams not only promotes diversity in TMT but also results in rationality and no prejudice in decision making which reflects a significant decrease in family conflicts and increases professionalism level in doing business that finally causes changes and innovation. Non family managers basically improve the quality of strategic decisions and also managerial behaviors. Family managers prefer not to disturb social and financial welfare and family asset of future generations.

The relation between team members is more important than extension of skills in team success regardless of attending family or non-family members in team structure. There may be opportunities missed by focusing excessively on the downside rather than on the upside of competing coalitions in the firm.

A family team work needs altruism of family members, so to be more effective team should avoid family conflicts and its derived risks.

The businesses which established by family entrepreneurial groups are radically in the shade of family relations. Teams in which involve couples reflect completely different behaviors rather than other teams. The relations between the members of a team directly affect their output also investing on start up large family entrepreneurial team's helps improvement of the business and can harmonize both career and family personality of individuals.

The leaders of family businesses who conduct their own businesses by themselves, can produce specific output by utilizing the best methods. There are many specific characteristics for abovementioned leaders which are listed some of them as below: Their personal mission is to build an enduring institution that will last and be even more successful in the future (Tagiuri and Davis, 1992). On the other hand, they believe in responsibility for standing on the top either of the position or of the leadership since they have come to scene.

It is essential for entrepreneurship orientation of family businesses to attend more than one generation in those businesses and it demonstrates that to be successful during the time, they 'd rather strengthen their knowledge acceptability potential.

Family managers and owners are recommended to limit the existence of family generations by two, because attending 3 generations of one family in TMT may lead to lose efficiency of family relations in such companies. The most important factor in long lasting growth of a business is arranging family meetings which support goal and mission of the family, its values, motivations and logical reason for ongoing the ownership of business. By making agreement and desirable satisfaction it would be easier to make a better path toward achieving growth in the long run.

Finally, researchers in this area are suggested to investigate personal characteristics of entrepreneurs of family businesses and also to find methods of training managers among subsequent generation in order to study its impact on permanence of business growth.

**References: -**

1. Baron, J.N., Burton, M.D., & Hannan, M.T. (1996). The road taken: Origins and evolution of employment systems in emerging companies. *Industrial and Corporate Change*, 5, 239–275.
2. Beckman, C.M., Burton, M.D., & O'Reilly, C. (2007). Early teams: The impact of team demography on VC financing and going public. *Journal of Business Venturing*, 22, 147–173.
3. Birley, S. & Stockley, S. (2000). Entrepreneurial teams and venture growth. In D.L. Sexton (Ed.), *The Blackwell handbook of entrepreneurship* (pp. 287–307). Oxford, U.K.: Blackwell Business.
4. Brannon, D.L., Wiklund, J., & Haynie, J.M. (2013). The varying effects of family relationships in entrepreneurial teams. *Entrepreneurship Theory and Practice*, 37(1), 107–132.
5. Bygrave, W.D. (1993). Theory building in the entrepreneurship paradigm. *Journal of Business Venturing*, 8, 255–280.
6. Cohen, S.G. & Bailey, D.E. (1997). What makes teams work: Group effectiveness from the shop floor to the executive suite. *Journal of Management*, 23, 239–290.
7. Cooney, T.M. (2005). What is an entrepreneurial team? *International Small Business Journal*, 23, 226–235.
8. Cooper, A.C. & Daily, C.M. (1997). Entrepreneurial teams. In D.L. Sexton & R.W. Smilor (Eds.), *Entrepreneurship* 2000 (pp. 127–150). Chicago, IL: Upstart.
10. Cruz, A.D., Howorth, C., & Hamilton, E. (2013 this issue). Interfamily entrepreneurship: The formation and membership of family entrepreneurial teams. *Entrepreneurship Theory and Practice*, 37(1), 17–46.
11. Cyert, R.M. & March, J.G. (1963). *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice-Hall.
12. Dess, G.G., Lumpkin, G.T., & McGee, J.E. (1999). Linking corporate entrepreneurship to strategy, structure, and process: Suggested research directions. *Entrepreneurship Theory and Practice*, 23(3), 85–102.
13. Ensley, M.D. & Pearson, A.W. (2005). An exploratory comparison of the behavioral dynamics of top management teams in family and nonfamily new ventures: Cohesion, conflict, potency, and consensus. *Entrepreneurship Theory and Practice*, 29, 267–284.
14. Forbes, D.P., Borchert, P.S., Zellmer-Bruhn, M.E., & Sapienza, H. (2006). Entrepreneurial team formation: An exploration of new member addition. *Entrepreneurship Theory and Practice*, 30, 225–248.
15. Francis, D.H. & Sandberg, W.R. (2000). Friendship within entrepreneurial teams and its association with team and venture performance. *Entrepreneurship Theory and Practice*, 25(2), 5–25.
16. Fren, M.J., Cardinal, L.B., & O'Neill, H.M. (2012). The genesis of strategy in new ventures: Escaping the constraints of founder and team knowledge. *Strategic Management Journal*, 33, 427–447.
17. Hambrick, D.C. (1994). Top management groups: A conceptual integration and reconsideration of the “team” label. *Research in Organizational Behavior*, 16, 171–214.
18. Hambrick, D.C. (2007). Upper echelons theory: An update. *Academy of Management Review*, 32, 334–343.
19. Hambrick, D.C. & Mason, P.A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review*, 9, 193–207.
20. Hmieleski, K.M. & Ensley, M.D. (2007). A contextual examination of new venture performance: Entrepreneur leadership behavior, top management team heterogeneity, and environmental dynamism. *Journal of Organizational Behavior*, 28, 865–889.
21. Kamm, J.B. & Nurick, A.J. (1993). The stages of team venture formation: A decision-making model. *Entrepreneurship Theory and Practice*, 17(2), 17–28.
22. Kamm, J.B., Shuman, J.C., Seeger, J.A., & Nurick, A.J. (1990). Entrepreneurial teams in new venture creation: A research agenda. *Entrepreneurship Theory and Practice*, 14(4), 7–17.
23. Katzenbach, J.R. & Smith, D.K. (1993). *The wisdom of teams*. New York, NY: First Harper Business.
24. Kellermanns, F.W. & Eddleston, K.A. (2004). Feuding families: When conflict does a family firm good. *Entrepreneurship Theory and Practice*, 28, 209–229.
25. Kellermanns, F.W., Floyd, S., Pearson, A.W., & Spencer, B. (2008). The contingent effect of constructive confrontation on the relationship between shared mental models and decision quality. *Journal of Organizational Behavior*, 29, 119–137.
27. Leung, A., Foo, M.D., & Chaturvedi, S. (2013). Imprinting effects of founding core teams on HR values in new ventures. *Entrepreneurship Theory and Practice*, 37(1), 87–106.
28. Lim, J.Y.-K., Busenitz, L.W., & Chidambaram, L. (2013). New venture teams and the quality of business opportunities identified: fault lines between subgroups of founders and investors. *Entrepreneurship Theory and Practice*, 37(1), 47–67.
29. Mathieu, J., Maynard, M.T., Rapp, T., & Gilson, L. (2008). Team effectiveness 1997–2007: A review of recent advancements and a glimpse into the future. *Journal of Management*, 34, 410–476.

30. Pearson, A.W., Carr, J.C., & Shaw, J.C. (2008). Toward a theory of familiness: A social capital perspective. *Entrepreneurship Theory and Practice*, 32, 949–969.
31. Ruef, M., Aldrich, H.E., & Carter, N.M. (2003). The structure of founding teams: Homophily, strong ties, and isolation among US entrepreneurs. *American Sociological Review*, 68, 195–222.
32. Schjoedt, L. & Kraus, S. (2009). Entrepreneurial teams: Definition and performance factors. *Management Research News*, 32, 513–524.
33. Schulze, W.S., Lubatkin, M.H., Dino, R.N., & Buchholtz, A.K. (2001). Agency relationships in family firms: Theory and evidence. *Organizational Science*, 12, 99–116.
34. Sciascia, S., Mazzola, P., & Chirico, F. (2013). Generational involvement in the top management team of family firms: Exploring non-linear effects on entrepreneurial orientation. *Entrepreneurship Theory and Practice*.
35. Thatcher, S.M.B. & Patel, P.C. (2012). Group fault lines: A review, integration, and guide to future research. *Journal of Management*, 38, 969–1009.
36. Ucbasaran, D., Lockett, A., Wright, M., & Westhead, P. (2003). Entrepreneurial founder teams: Factors associated with member entry and exit. *Entrepreneurship Theory and Practice*, 28, 107–127.
37. Wales, W., Monsen, E., & McKelvie, A. (2011). The organizational pervasiveness of entrepreneurial orientation. *Entrepreneurship Theory and Practice*, 35, 895–923.
38. West, G.P. (2007). Collective cognition: When entrepreneurial teams, not individuals, make decisions. *Entrepreneurship Theory and Practice*, 31, 77–102.
39. Arthur Andersen & Co., S.C. (1995). Research Findings. *American Family Business Survey*, Chicago.
40. Aronoff, C. E. & Astrachan, J. H. (1996). How to make better decisions. *Nation's Business*, 84(1), 39–40.
41. Benson, B., Crego, E. T., & Drucker, R. H. (1990). *Your Family Business: A Success Guide for Growth and Survival*. Homewood, IL: Dow-Jones-Irwin.
42. Blackman, I. L. (1994). Two magic bullets . . . or How to beat the tax collector. *National Petroleum News*, 86(2), 44.
43. Carlson, D. K., & Nager, R. W. (1993). Equity compensation for key employees. *Family Business Advisor*. (January).
44. Cohn, M. (1992). *Passing the Torch: Succession, Retirement, and Estate Planning in the Family-Owned Business*. New York: McGraw-Hill.
45. Danco, L. A. (1994). Why few firms outlive their founder. *Tire Business*, 8.
46. Donnelley, R. G. (1964). The family business. *Harvard Business Review*, 42(4), 10–11.
47. Dyer, W. Gibb, Jr. (1988). Culture and continuity in family firms. *Family Business Review*, 1(1), 37–50.
48. *Family Business Advisor*. (1994). Thinking about dividend policies. *Family Business Advisor*, 3(3), 1.
49. Flamholtz, E. G. (1986). *How to Make the Transition From a Entrepreneurship to a Professionally Managed Firm*. San Francisco: Jossey-Bass.
50. Gallo, M. A., & Point, C. G. (1994). Internationalizing family firms. *Family Business Advisor*, 3(4), 1.
51. Greenwald, Matthew and Associates (1995). Research Findings. *MassMutual Life Insurance Company*, 47.
52. Hamel, L. H., Jr. (1994). The first generation. *Family Business Report*, (November), 7.
53. Jaffe, D. (1990). *Working with the Ones You Love*. Berkeley, CA: Conari Press.
54. Lansberg, I. (1988). The succession conspiracy. *Family Business Review*, 1(2), 119–143.
55. Maslow, A. H. (1954) *Motivation and Personality*. New York: Harper.
56. Mintzberg, H. & Waters, J. A. (1990). Tracking strategy in an entrepreneurial firm. *Family Business Review*, 3(3), 285–313.
57. Mintzberg, H. (1994). *The Rise and Fall of Strategic Planning*. New York: The Free Press.
58. Murdoch, M., & Murdoch, C. M. (1991). A legal perspective on shareholder relationships in family businesses: The scope of fiduciary duties. *Family Business Review*, 4(3), 287–301.
59. Nelson, R. (1994). Creating an energized workplace. *Leader to Leader*, 5 (Summer), 34–39.
60. Nelton, S. (1996). Team playing is on the rise. *Nation's Business*, 84(6), 53–55. Stoy Hayward & Associates (1989). *Staying the course: Survival characteristics of the family owned business*. Report conducted by the Graduate Students of the London School of Business, 22–23.
61. Tanner, F. L. F. (1994). Do you have an effective compensation plan for you key employees? *Family Business Forum Quarterly*, 7(3), 8.
62. Tennenbaum, B. H., & Trien, J. W. (1992). How to woo your banker? *Family Business Magazine*, (Summer), 31–36.

66. Ward, J. L. 1987. *Keeping the family business healthy: How to plan for continuing growth, profitability, and family leadership*. San Francisco: Jossey-Bass.
67. Ward, J. L., & Aronoff, C. E. (1992). Sibling partnerships. *Nation's Business*, 80(1), 52–53.
68. Ancona, D.G., & Caldwell, D.C. (1992). Demography and design: predictors of new product team performance. *Organization Science*, 3 321–341.
69. Auh, S., & Menguc, B. (2005). Top management team diversity and innovativeness: The moderating role of interfunctional coordination. *Industrial Marketing Management*, 34, 249–261.
70. Bantel, K.A., & Jackson, S.E. (1989). Top management and innovations in banking: does the composition of the top team make a difference? *Strategic Management Journal*, Summer Special Issue, 10, 107–124.
71. Beckman, C.M. (2006). The influence of founding team company affiliations on firm behavior. *Academy of Management Journal*, 49 (4), 741–758.
72. Beckman, C.M., Burton, M.D., & O'Reilly, C. (2007). Early teams: The impact of team demography on VC financing and going public. *Journal of Business Venturing*, 22(2), 147– 173.
73. Boeker, W. (1997a). Executive migration and strategic change: the effect of top manager movement on product market entry. *Administrative Science Quarterly*, 42, 231–236.
74. Boeker, W. (1997b). Strategic change: the influence of managerial characteristics and organizational growth. *Academy of Management Journal*, 40, 152–170.
75. Chirico F., Sirmon D., Sciascia S., & Mazzola P. (2011). Resource orchestration in family firms: Investigating how entrepreneurial orientation, generational involvement and participative strategy affect performance. *Strategic Entrepreneurship Journal*, 5(4), 307-326.
76. Chrisman, J. J., Chua, J. H., & Steier, L. P. (2011). Resilience of family firms: An introduction. *Entrepreneurship Theory and Practice*, 35, 1107–1119.
77. Cruz, C., & Nordqvist, M. (2012). Entrepreneurial orientation in family firms: A generational perspective. *Small Business Economics* 38(1), 33-49.
78. Ensley, M. D., & Pearson, A. W. (2005). An exploratory comparison of the behavioral dynamics of top management teams in family and nonfamily new ventures: Cohesion, conflict, potency, and consensus. *Entrepreneurship Theory & Practice*, 29, 267-284.
79. Finkelstein, S., & Hambrick, D. C. (1990). Top management team tenure and organizational outcomes: The moderating role of managerial discretion. *Administrative Science Quarterly*, 35, 484–503.
80. Gomez-Mejia, L.R., Haynes, K.T., Nunez-Nickel, M., Jacobson, K.J.L., & Moyano-Fuentes, J. (2007). Socioemotional wealth and business risks in family-controlled firms: Evidence from Spanish olive oil mills. *Administrative Science Quarterly* 52, 106–137.
81. Grant, R. (1996). Prospering in dynamically competitive environments: organizational capability as knowledge integration. *Organization Science*, 7(4), 375-387.
82. Hambrick, D.C., Cho, S.T., & Chen, M.J. (1996). The influence of TMT heterogeneity on firm's competitive moves. *Administrative Science Quarterly*, 41, 659–684.
83. Hambrick, D.C., & Mason, P.A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review*, 9(2), 193–207.
84. Jehn, K.A. (1995). A multimethod examination of the benefits and detriments of intragroup conflict. *Administrative Science Quarterly*, 40, 256–282.
85. Jehn, K.A. (1997). A qualitative analysis of conflict types and dimensions in organizational groups. *Administrative Science Quarterly*, 42, 530–557.
86. Jehn, K.A., Northcraft, G.B., & Neale, M.A. (1999). Why differences make difference: a field study of diversity, conflict, and performance in workgroups. *Administrative Science Quarterly*, 44, 741–763.
87. Jones, C.D., Makri, M., & Gomez-Mejia, L.R. (2008). Affiliate directors and perceived risk bearing in publicly traded, family-controlled firms: The case of diversification. *Entrepreneurship Theory and Practice*, 32(6), 1007-1026.
88. Kellermanns, F. W., & Eddleston, K. (2004). Feuding families: When conflict does a family firm good. *Entrepreneurship Theory and Practice*, 28(3), 209-228.
89. Kellermanns, F.W., & Eddleston, K.A. (2006) corporate entrepreneurship in family firms: A Family perspective. *Entrepreneurship Theory and Practice*, 30(6), 809-830.
90. Kellermanns, F.W., Eddleston, K.A., Barnett, T., & Pearson, A. (2008). An exploratory study of family member characteristics and involvement: Effects on entrepreneurial behavior in family firms. *Family Business Review*, 21(1), 1-14.

91. Knight, D., Pearce, C.L., Smith, K.G., Olian, J.D., Sims, H.P., Smith, K.A., & Flood, P. (1999). Top management team diversity, group process, and strategic consensus. *Strategic Management Journal*, 20(5), 445–465.
92. La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (1999). Corporate ownership around the world. *The Journal of Finance*, 54(2), 471–517.
93. Ling, Y., & Kellermanns, F.W. (2010). The effects of family firm specific diversity: The moderating role of information exchange frequency. *Journal of Management Studies*, 47, 332–344.
94. Michie, S., Dooley, R.S., & Fryxell, G.E. (2006). Unified diversity in top-level teams: Enhancing collaboration and quality in strategic decision making. *International Journal of Organizational Analysis*, 14, 130–149.
95. Miller, C.C., Burke, L.M., & Glick, W.H. (1998). Cognitive diversity among upper-echelon executives: implications for strategic decision process. *Strategic Management Journal*, 19(1), 39–58.
96. Milliken, F.J., & Martins, L.L. (1996). Searching for common threads: Understanding the multiple effects of diversity in organizational groups. *Academy of Management Review*, 21, 402–433.
97. Naldi, L., Nordqvist, M., Sjöberg, K., & Wiklund, J. (2007). Entrepreneurial orientation, risk taking, and performance in family firms. *Family Business Review*, 20 (1), 33–48.
98. Nonaka, J. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 1, 14–37.
99. Postrel, S. (2002). Islands of shared knowledge: Specialization and mutual understanding in problem-solving teams. *Organization Science*, 13, 303–320.
100. Salvato, C. (2004). Predictors of entrepreneurship in family firms. *Journal of Private Equity*, 7(3), 68–76.
101. Sharma, P., & Salvato, C. (2011). Commentary: exploiting and exploring new opportunities over life cycle stages of family firms. *Entrepreneurship Theory and Practice*, 35, 1199–1205.
102. Short, J.C., Payne, G.T., Brigham, K.H., Lumpkin, G.T., & Broberg, C. (2009). Family firms and entrepreneurial orientation: A comparative analysis of the S&P 500. *Family Business Review*, 22(1), 9–24.
103. Simons, T., Pelled, L. H., & Smith, K. A. (1999). Making use of difference: Diversity, debate, and decision comprehensiveness in top management teams. *Academy of Management Journal*, 42, 662–673.
104. Talke, K., Salomo, S., & Rost, K. (2010). How top management team diversity affects innovativeness and performance via the strategic choice to focus on innovation fields. *Research Policy*, 39, 907–918.
105. Talke, K., Salomo, S., & Kock, A. (2011). Top Management Team diversity and strategic innovation orientation: The relationship and consequences for innovativeness and performance. *Journal of Product Innovation Management*, 28, 819–832.
106. Wiersema, M.F., & Bantel, K. (1992). Top management team demography and corporate strategic change. *Academy of Management Journal*, 35, 91–121.
107. Zahra, S.A. (2005). Entrepreneurial risk taking in family firms. *Family Business Review*, 18, 23–40.
108. Anderson, A., Jack, S., & Drakopoulou-Dodd, S. (2005). The role of family members in entrepreneurial networks: Beyond the boundaries of the family firm. *Family Business Review*, 18(2), 135–154.
109. Anderson, A.R. & Miller, C.J. (2003). “Class matters”: Human and social capital in the entrepreneurial process. *Journal of Socio-Economics*, 32(1), 17–36.
110. Beckman, C.M. (2006). The influence of founding team company affiliations on firm behavior. *Academy of Management Journal*, 49(4), 741–758.
111. Carter, S. & Ram, M. (2003). Reassessing portfolio entrepreneurship. *Small Business Economics*, 21(4), 371–380.
112. Casson, M. & Giusta, M.D. (2007). Entrepreneurship and social capital: Analyzing the impact of social networks on entrepreneurial activity from a rational action perspective. *International Small Business Journal*, 25(3), 220–244.
113. Cooney, T.M. (2005). Editorial: What is an entrepreneurial team? *International Small Business Journal*, 23(3), 226–235.
114. Davis, J.H., Schoorman, F.D., & Donaldson, L. (1997). Toward a stewardship theory of management. *Academy of Management Review*, 22(1), 20–47.
115. Discua Cruz, A. (2010). Collective perspectives in portfolio entrepreneurship: A study of family business groups in Honduras. *EDAMBA Journal, Thesis competition*, 8, 91–105.
116. Eddleston, K.A., Chrisman, J.J., Steier, L.P., & Chua, J.H. (2010). Governance and trust in family firms: An introduction. *Entrepreneurship Theory and Practice*, 34(6), 1043–1056.
117. Forbes, D.P., Borchert, P.S., Zellmer-Bruhn, M.E., & Sapienza, H. (2006). Entrepreneurial team formation: An exploration of new member addition. *Entrepreneurship Theory and Practice*, 20(2), 225–248.
118. Francis, D.H. & Sandberg, W.R. (2000). Friendship within entrepreneurial teams and its association with team and venture performance. *Entrepreneurship Theory and Practice*, 25(2), 5–25.

122. Hellerstedt, K. (2009). *The composition of new venture teams: Its dynamics and consequences*. JIBS Dissertation Series 056, Jonkoping: Jonkoping International Business School.
123. Höhmann, H.-H. & Welter, F. (2005). *Trust and entrepreneurship: A West-East perspective*. Cheltenham, U.K.: Edward Elgar.
124. Howorth, C. & Ali, Z.A. (2001). Family business succession in Portugal: An examination of case studies in the furniture industry. *Family Business Review*, 14(3), 231–244.
125. Howorth, C. & Moro, A. (2006). Trust within entrepreneur bank relationships: Insights from Italy. *Entrepreneurship Theory and Practice*, 30(4), 495–517.
126. Hoy, F. & Verser, T.G. (1994). Emerging business, emerging field: Entrepreneurship and the family firm. *Entrepreneurship Theory and Practice*, 19(1), 9–23.
127. Iacobucci, D. & Rosa, P. (2010). The growth of business groups by habitual entrepreneurs: The role of entrepreneurial teams. *Entrepreneurship Theory and Practice*, 34(2), 351–377.
128. Kamm, J.B. & Nurick, A.J. (1993). The stages of team venture formation: A decision-making model. *Entrepreneurship Theory and Practice*, 17(2), 17–27.
129. Kolvereid, L. & Bullvag, E. (1993). Novices versus experienced founders: An exploratory investigation. In S.
130. Birley, I. MacMillan, & S. Subramony (Eds.), *Entrepreneurship research: Global perspectives* (pp. 275–285). Amsterdam, the Netherlands: Elsevier.
131. Lewicki, R.J. & Bunker, B. (1996). Developing and maintaining trust in work relationships. In R.K.T. Tyler (Ed.), *Trust in organizations* (pp. 114–139). Newbury Park, CA: Sage.
132. MacMillan, I. (1986). To really learn about entrepreneurship, let's study habitual entrepreneurship. *Journal of Business Venturing*, 1, 241–243.
133. Mayer, R.C., Davis, J.H., & Schoorman, F.D. (1995). An integrative model of organizational trust. *Academy of Management Review*, 20(3), 709–734.
134. Nordqvist, M. & Zellweger, T. (2010). *Transgenerational entrepreneurship*. Cheltenham, U.K.: Edward Elgar.
135. Pearson, A.W., Carr, J.C., & Shaw, J.C. (2008). Toward a theory of familiness: A social capital perspective. *Entrepreneurship Theory and Practice*, 32(6), 949–969.
136. Rosa, P. (1998). Entrepreneurial processes of business cluster formation and growth by “habitual” entrepreneurs. *Entrepreneurship Theory and Practice*, 22(4), 43–61.
137. Ruef, M., Aldrich, H., & Carter, N. (2003). The structure of founding teams: Homophily, strong ties, and isolation among U.S. entrepreneurs. *American Sociological Review*, 68(2), 195–222.
138. Schulze, W., Lubatkin, M., & Dino, R. (2003). Exploring the agency consequences of ownership dispersion among the directors of private family firms. *Administrative Science Quarterly*, 46(2), 179–194.
139. Schulze, W.S. & Gedajlovic, E.R. (2010). Whither family business? *Journal of Management Studies*, 47(2), 191–204.
140. Ucbasaran, D., Lockett, A., Wright, M., & Westhead, P. (2003). Entrepreneurial founder teams: Factors associated with member entry and exit. *Entrepreneurship Theory and Practice*, 28(2), 107–127.
141. Westhead, P. & Howorth, C. (2007). “Types” of private family firms: An exploratory conceptual and empirical analysis. *Entrepreneurship and Regional Development*, 19(5), 405–431.
142. Westhead, P. & Wright, M. (1998). Novice, portfolio and serial founders: Are they different? *Journal of Business Venturing*, 13(3), 173–204.
143. Wright, M. & Vanaelst, I. (2009). Introduction. In M. Wright & I. Vanaelst (Eds.), *Entrepreneurial teams and new business creation* (Vol. 13, pp. iix–xli). Cheltenham, U.K.: Edward Elgar.



### RESEARCH ARTICLE

#### DEVIAN'T BEHAVIOUR ELICITED BEFORE DETENTION BY THE MALAY FEMALE JUVENILE DETAINEES IN REHABILITATION CENTER

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#### Abstract

The objective of this study is to examine the Malay female juvenile detainees' deviant behavior before detention in rehabilitation institution. This study uses quantitative method. There were 41 respondents participated in this critical case study. Hence, data was collected using self-build instrument with 20 items and the reliability of cronbach alpha is 0.715. The finding of this study shows the most frequent deviant behavior elicited according to category were as follows: school vandalism, beating, harassment and sexual harassment. The places of eliciting deviant behaviour according to highest and lowest score; first, during recess hours in classroom, field or hall; near or under the stairs; and in the students' toilet. Second, during recess hours while taking food. Third, in the classroom while the teacher is teaching. Forth, during recess hour while eating. Fifth, while walking between change of class. Sixth, while walking between to and fro to the praying house; in the classroom before teacher enters the class and while queuing to buy food and seventh, during recess hour while taking food and eating in the canteen. Few unique findings in this study; first, only 1 respondent involved in doing damages to the school's playground facilities. Second, the area which mostly displayed of deviant behaviour was in the open area. Third, the act of deviant behaviour in classroom while a teacher is teaching and low score on deviant behaviour elicited during recess hour while eating, walking between change of classes, walking between to and fro to the praying house; in the classroom before teacher enters the class; while queuing to buy food, while taking food and eating in the canteen.

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#### Introduction:-

Deviant behaviour of young adolescent is seen nowadays as a serious scenario as it hint on the corruption of morality of our younger generations especially in Malaysia which embraces so called the 'Malaysian Culture'. Nonetheless, the Malaysian culture and norms are changing due to the in-flow of other cultures into the society through the medium called 'borderless world' via social media (internet) as a medium of change and the influence of either broadcast and printed media itself (Bassey; Makinde; Rasheed; & Olumide, 2013; Baron, 2003). Nowadays, deviant behavior is seen 'acceptable' to our youngsters and now regarded as the 'trend' (Turner, 1987), that one must agree and follow if to be accepted (in group) in his or her community (Baker, 2006).

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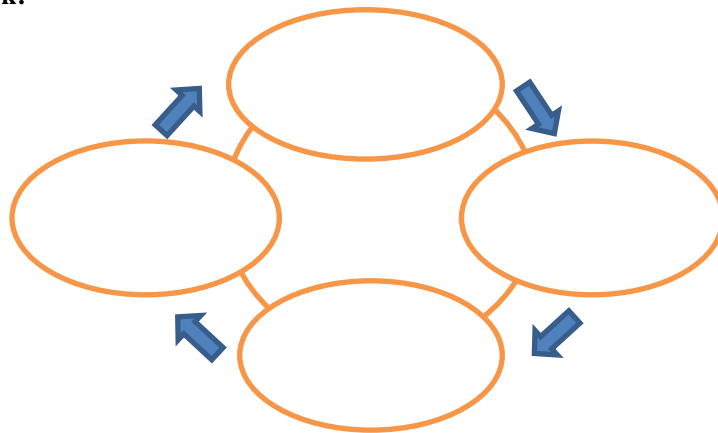


As quoted by Duffy & Nesdale (2004), younger generations tend to behave 'out of their norms' as they are in their development stage of finding and building their own unique personality (traits) especially female (Unruh, Povenmire-Kirk & Yamamoto, 2009). They wanted to have their own unique identity and be acknowledged by their peers (Ojala, Kris & Nesdale, Drew, 2004), whereby normally will involve the factors of power, wealth, strength and popularity (Paluck, Elizabeth Levy & Shepherd, Hana, 2012).

Subsequently, school is a place whereby most of youngsters spend their time and mingling with their own society which in a way acted as a perfect medium in eliciting deviant behaviour (Wan Pung, Pit; Yaacob, Siti Nor; Baharudin, Rozumah & Osman, Shuhaily, 2015), as the internal and external influence factors were so strong (Borum, 2000). Furthermore, school is the common ground for youngsters to show the sense of belonging' and embrace the concept of cohesiveness between group members (Paluck, Elizabeth; & Shepherd, 2012), which is a strong virtue among females (Weerman, F. M., & Hoeve, M., 2012).

Therefore, deviant behaviour if were not controlled can lead to crimes which has made juveniles being arrested and evicted into correctional schools and rehabilitation centers. In Malaysia alone, there were evicted cases of 29,642 juveniles detained into either correctional schools or rehabilitation centers all over the states in Malaysia in 2011 (Statistic Service, Malaysia & Department of Social Welfare, 2013).

#### Study framework:-



#### Research question:-

**There are two research questions explored in this study:-**

1. What are the types of deviant behavior elicited by the Malay female juvenile detainees in school before detention? And
2. The most common places of deviant behaviour elicited in school compound.

#### Main objective:-

The main objective of this study is to determine the Malay female juvenile detainees' deviant behaviour and where does the deviant behaviour elicited in school compound.

#### Specific objectives:-

1. To determine the Malay female juvenile detainees' deviant behaviour in school.
2. To determine the places in school compound that frequently visited by the Malay female juvenile detainees in eliciting deviant behaviour.
3. To examine the relationship between deviant behaviour in each category of school vandalism, beating, harassment and sexual harassment.

#### Hypotheses:-

Hypotheses were built according to the objectives of the study:

1. To determine the Malay female juvenile detainees' deviant behaviour in school.  
Frequencies of Malay female juvenile detainees' deviant behavior according to category:

- i. School vandalism
  - ii. Beating
  - iii. Harassment
  - iv. Sexual harassment
2. To determine the places in school compound that frequently visited by the Malay female juvenile detainees in eliciting deviant behaviour.  
Frequencies of places in school compound which was visited by the Malay female juvenile detainees' before detention in eliciting deviant behaviour.
3. To examine the relationships between deviant behaviour in each category; school vandalism, beating, harassment and sexual harassment.  
H<sub>a1</sub> There were significant relationships between deviant behavior in each category of school vandalism, beating, harassment and sexual harassment.

### **Significant of study:-**

#### **This study is significant to:-**

School and any parties concerned in promoting awareness programme. It is also important to identify the dangerous zone in school compound so that the authorities in school were kept alert on high risk areas and thus take precaution measures such as installing recording equipment ie. closed-circuit television.

#### **Limitation of study:-**

As of security and safety issues; name of the respondents, rehabilitation center and schools involved in this study was kept confidential.

### **Methodology:-**

#### **Population and sampling technique:-**

The population of this present study were Malay female juvenile detainees in a rehabilitation center. As this is a critical case study, there were only n=41 Malay female juvenile respondents involved in this study with (n=11; age 17 years old); (n=8; age 18 years old); (n=7; age 15 years old); (n=5; age 14 years old); (n=5; age 16 years old) and, (n=5; age 19 years old).

#### **Data Collection Procedure:-**

The questionnaires were self-administered by the researcher. Self-build instrument was being distributed and respondents were asked to answer the questions within 20 to 25 minutes.

#### **Instrument:-**

This study uses self-build instrument with 20 items. The reliability of this instrument is 0.715.

#### **Data Analysis:-**

Data was analyzed using the SPSS version 21. Frequency and descriptive analysis was utilized as to determine the Malay female juvenile deviant's behaviour in school compound before detention. Meanwhile, the correlational analysis is used to find the significant relationships between deviant behaviour and places visited by the Malay female juvenile detainees in school compound.

### **Findings:-**

1. To determine the Malay female juvenile detainees' deviant behaviour in school.  
Frequencies of Malay female juvenile detainees' deviant behavior according to category:
  - i. School vandalism
  - ii. Beating
  - iii. Harassment
  - iv. Sexual harassment

**Table 1:-** Frequencies of deviant behaviour according to category

	Mean	sd.
School vandalism	10.0732	1.95436
Beating	6.8293	3.47780
Harassment	5.9268	3.45246
Sexual harassment	0.8780	1.67623

Table 1 summarized the most frequent deviant behaviour elicited by the Malay female juvenile detainees before detention in school compound according to category; the school vandalism ( $\bar{x}=10.0732$ ); beating ( $\bar{x}=6.8293$ ); harassment ( $\bar{x}=5.9268$ ); and sexual harassment ( $\bar{x}=0.8780$ ).

**School vandalism:-****Table 2:-** Percentages of deviant behaviour according to school vandalism category

	Frequency	%
Equipment-facilities	37	90.2
Canteen-facilities	23	56.1
Teacher's transportation	18	43.9
Parent's-other's transportation	2	4.9
Playground facilities	1	2.4

Table 2 reports on deviant behaviour with 37 (90.2%) respondents vandalized on school equipment and facilities; 23 (56.1%) respondents damages on school canteen and facilities; 18 (43.9%) respondents vandalized on teacher's transportation with 2 (4.9%) respondents scratches on parents or other transportation. The lowest score is 1 (2.4%) respondent vandalizing on school's playground facilities.

**Table 3:-** Relationship between deviant behaviour in school vandalism category

	School vandalism1	School vandalism2	School vandalism3	School vandalism4	School vandalism 5
School vandalism1	1				
School vandalism2	-.200	1			
School vandalism3	.125	-.689**	1		
School vandalism4	.089	.200	-.291	1	
School vandalism5	-.140	-.036	.052	.140	1

\*\*p<0.01

\*p<0.05

Table 3 shows the result of correlation analysis to examine the relationship between each deviant behaviour in school vandalism category. There was a significant relationship between vandalizing on school equipment and facilities and, damages on school canteen and facilities ( $r=-.689$ ,  $p<0.01$ ).

**Beating:-****Table 4:-** Percentages of deviant behaviour according to beating category

	Frequency	%
Classmates	27	65.9
Friends-from other class	15	36.6
Other students	8	19.5
Friends-from home	4	9.8
Friends from other areas	3	7.3

Table 4 reports on percentages of deviant behaviour according to beating category with 27 (65.9%) respondents beats their classmates; 15 (36.6%) respondents beats their friends from other classes; 8 (19.5%) respondents beats on

other students; 4 (9.8%) respondents beats on friends from home and 3 (7.3%) respondents beats friends from other areas.

**Table 5:-** Relationship between deviant behaviour in beating category

	Beat1	Beat2	Beat3	Beat4	Beat5	Beat6
Beat1	1					
Beat2	-.094	1				
Beat3	-.165	.137	1			
Beat4	-.110	-.250	-.162	1		
Beat5	-.193	-.019	-.138	-0.92	1	
Beat6	.504*	.082	-.194	.224	-.211	1

\*\*p<0.01

\*p<0.05

Table 5 shows the result of correlation analysis to examine the relationship between each deviant behaviour in beating category. There was a significant relationship between others and friends from other areas ( $r = -.504$ ,  $p < 0.01$ ).

#### Harassment:-

**Table 6:-** Percentages of deviant behaviour according to harassment category

	Frequency	%
Classmates	40	97.6
Friends from other class	5	12.2
Friends from home	4	9.8
Other students	3	7.3

Table 6 reports on percentages of deviant behaviour according to harassment category which indicates physical, verbal and relational bullying. There were a total of 40 (97.6%) respondents harassing their classmates; 5 (12.2%) respondents harassing friends from other classes; 4 (9.8%) respondents harassing friends from home but who were schooling in the same school and 3 (7.3%) respondents harassing other students which is from the same standard/secondary level.

**Table 7:-** Relationship between deviant behaviour in harassment category

	Harass1	Harass2	Harass3	Harass4	Harass5
Harras1	1				
Harras2	.059	1			
Harras3	.044	-.105	1		
Harass4	.052	.129	-.092	1	
Harass 5	-.108	.254	-.211	.224	1

\*\*p<0.01

\*p<0.05

Table 7 shows the result of correlation analysis to examine the relationship between each deviant behaviour in harassment category. There is no significant relationship between each deviant behavior in harassment category.

#### Sexual harassment:-

**Table 8:-** Percentages of deviant behaviour according to sexual harassment category

	Frequency	%
Classmates	8	19.5
Friends from other classes	4	9.8
Friends from other areas	4	9.8

Table 8 reports on percentages of deviant behaviour according to sexual harassments that were mostly on non-verbal gestures and touching inappropriate body parts. 8 (19.5%) respondents sexually harassed their classmate either girls

or boys; 4 (9.8%) respondents sexually harassed friends from other classes and 4 (9.8%) sexually harassed friends from other areas.

**Table 9:-** Relationship between deviant behaviour in sexual harassment category

	Sex harass1	Sex harass2	Sex harass3
Sex harass1	1		
Sex harass2	-.162	1	
Sex harass3	-.162	.169	1

\*\*p<0.01

\*p<0.05

Table 9 shows the result of correlation analysis to examine the relationship between each deviant behavior in sexual harassment category. There is no significant relationship between each deviant behavior in sexual harassment category.

- To determine the places in school compound that frequently visited by the Malay female juvenile detainees in eliciting deviant behaviour.  
Frequencies of places in school compound which was visited by the Malay female juvenile detainees' before detention in eliciting deviant behaviour.

**Table 10:-** Frequencies of location in school compound in which deviant behaviour was elicited

	Frequency	Percentage
During recess(classroom/field/hall)	98	89.1
Near/under stairs	98	89.1
In students' toilet	98	89.1
During recess (while taking food)	88	80
In classroom (while teacher is teaching)	76	69.1
During recess (while eating)	51	46.4
Walking between change of classes	37	33.6
Walking between to and fro to praying house	16	14.5
Walking to and fro to praying house	16	14.5
In classroom (before the entrance of teacher)	16	14.5
During recess (queuing to buy food)	16	14.5
During recess (while taking food)	9	8.2
During recess (while eating)	9	8.2

Table 10 reported on the most frequent places in school compound in which deviant behavior was elicited. The most frequent compound that scores 89.1% was during recess hours in classroom, field or hall; near or under the stairs; and in the students' toilet. Second, is during recess hour while taking food that has a score of 80%. Next is in the classroom while the teacher is teaching with a score of 69.1%. 46.4% score during recess hour while eating followed by walking between changing of classes with a score of 33.6%. Meanwhile, walking between to and fro to the praying house; in the classroom before teacher enters the class; during recess hour while queuing to buy food has the same score of 14.5%. Subsequently, 8.2% score while taking food and eating in canteen during recess hour.

- $H_{a1}$  There were significant relationships between deviant behaviour in each category of school vandalism, beating, harassment and sexual harassment.

**Table 11:-** Relationship between deviant behaviour in each category

	School vandalisme	Beating	Harassment	Sexual harassment
School vandalisme	1			
Beating	.373*	1		
Harassment	.357*	.788**	1	
Sexual harassment	.127	.236	.183	1

\*\*p<0.01

\*p<0.05

Table 11 indicated on the result of correlation analysis to examine the relationship between deviant behaviour in each category of school vandalism, beating, harassment and sexual harassment. Results shows that the most significant relationship can be found between beating and harassment ( $r=0.788$ ,  $p<0.01$ ), followed by between beating and school vandalism ( $r=0.373$ ,  $p<0.01$ ); and between school vandalism and harassment ( $r=0.357$ ,  $p<0.01$ ).

### Conclusion and Discussion:-

The study has shown that the Malay female juvenile detainees were prone to vandalized school and canteen, equipment and facilities. This study also indicates strong vindictive behaviour of the Malay female juvenile detainees towards teaching staff when 43.9% admitted vandalizing their teacher's transportation. One unique finding on this study is that only 2.4% or 1 respondent involved in doing damages to the school's playground facilities. The assumption of this finding is that; the Malay female juvenile detainees had profound belonging awareness and the need to care on things that makes them happy.

Finding of this study also reported on the Malay female juvenile detainees who targeted those who were within their school socialization or communities in inflicting beating behaviour such as classmates, friends from other classes and other students who were schooling in the same school but not in the same standard or secondary level. All of these targeted victims went to the same school but they were not in the same area of residencies with the Malay female juvenile detainees. However, low rate of inflicting beating were to those who were from the same residency areas (where the Malay female juvenile detainees resides) and those who were from other areas.

This was probably, the Malay female juvenile detainees did not want to provoke or steer any unpleasant situation between their families and other families (community members where they resides) that know or who has established relationship with their families. It is the same with harassment behaviour which were mostly inflicted on those who were in the same school as the Malay female juvenile detainees but resides in different residency areas from the Malay female juvenile detainees. Nevertheless, few Malay female juvenile detainees involved in sexual harassment and the score is low as not more than 20% admitted in sexually harassed their classmates, friends from other classes and friends from other areas.

As for dangerous time and places in school compound where deviant behaviour mostly occurs; this study has concluded that the high risk time of eliciting deviant behaviour among Malay female juvenile detainees before detention was during recess hours. Surprisingly, the area which mostly displayed of deviant behaviour was in open area that is in the classroom, on field or at the school hall and in the canteen. The most probable reason; it is where the Malay female juvenile detainees was with their group of friends (in group) which has already retained and practices certain standard of acceptable behaviour such as bullying towards others who were not in their group (out group).

Another dangerous zone is under the stairs and in the student's toilet which is understandable as these is the 'dark' and secluded area where there were not so many visitors. Thus, it is easier for the Malay female juvenile detainees to take the opportunities to inflict deviant behaviour on other students as they felt safe. Furthermore, the chances of having no witnesses to anything that they might do to other students appealed them to go to these places in the first place.

Another interesting finding in this study is the Malay female juvenile detainees who without fear show deviant behaviour in the classroom while a teacher is teaching. It proves that there were changes in the Malay culture which were famously known to have highly respects on elders and to those who has the authority of nurturing and educating people especially in rural areas. It might also be an indicator of these Malay female juvenile detainees experiencing boredom in class as a result of not being able to understand the subjects taught or has not put any kind of interest in the subjects taught by the teacher and thus, creating 'negative event' such as picking on others to amused and entertained themselves.

Another intriguing finding is that the low score of deviant behaviour elicited during recess hour while eating, walking between change of classes, walking between to and fro to the praying house; in the classroom before teacher enters the class; while queuing to buy food, while taking food and eating in the canteen gives the impression that deviant behaviour were less elicited as the Malay female juvenile detainees were mostly busy focusing on the

activity at hand. It has strongly indicated that deviant behaviour can be significantly reduced if the Malay female juvenile detainees were given certain tasks to accomplished especially things which were closely connected to themselves (oneself), or bring benefits and interest to them.

In overlying these study's findings, it is highly suggested that there were further studies in the future especially using qualitative study focusing on the changing phenomenon of Malay younger generation's culture especially in life norms, belief, perceptions and nurturing concepts in explaining the deviant behavior.

### References:-

1. Baker, K. (2006). Understanding violent and antisocial behavior in children and adolescents. *Current Paediatrics*. 16, 472-477. <http://dx.doi.org/10.1016/j.cube.2006.08.011>
2. Baron, S. W. (2003). Self-control, social consequences, and criminal behavior: Street youth and the general theory of crime. *Journal of Research in Crime and Delinquency*, 40(4), 403-425. <http://dx.doi.org/10.1177/0022427803256071>
3. Bassey, Ubangha Monday; Makinde, Bola; Rasheed Ajani, Idowu; & Olumide, Ogunyemi Michael. (2013). Relationship between Drug Abuse and Deviant Behavior among Undergraduate Students of University of Lagos, Nigeria.
4. Borum, R. (2000). Assessing violence risk among youth. *Journal of Clinical Psychology*, 56, 1263-1288.
5. Department of Social Welfare (2013). Laporan statistik 2011. Retrieved from <http://www.jkm.gov.my/>
6. Duffy, Amanda L. & Nesdale, Drew. (2008). Peer Groups, Social Identity, and Children's Bullying Behaviour. *Social Development*. 18. 1, 121-139.
7. Malaysian Adolescents: A cross sectional survey among secondary school students in Negeri Sembilan. *Annals Academy of Medicine*, 36 (3), 169-174.
8. Ojala, Kris & Nesdale, Drew. (2004). Bullying and social identity: The effects of group
9. norms and distinctiveness threat on attitudes towards bullying. *British Journal of Developmental Psychology*. 22, 19-25.
10. Paluck, Elizabeth Levy & Shepherd, Hana. (2012). The Salience of Social Reference: A
11. Field Experiment on Collective Norms and Harrassment Behaviour in a School Social Network. *Journal of Personality and Social Psychology*. 103. 6, 899-915.
12. Statistic Service, Malaysia Welfare Department. <http://www.jkm.gov.my>
13. Turner, J. C. (1987). *Rediscovering the Social Group: A Self-Categorisation Theory*. Oxford: Blackwell.
14. Unruh, Povenmiro-Kirk & Yamamoto, (2009). Unruh D., T. Povenmiro-Kirk and S.
15. Yamamoto, (2009). Perceived barriers and protection factors of juvenile offenders in their developmental pathway to adulthood. *Journal of Correctional Educational*. (60) 3, pp. 201-224.
16. Wan Pung, Pit; Yaacob, Siti Nor; Baharudin, Rozumah & Osman, Shuhaily. (2015). Low Self-Control, Peer Delinquency and Aggression among
17. Weerman, F. M., & Hoeve, M. (2012). Peers and delinquency among girls and boys: Are
18. sex differences in delinquency explained by peer factors? *European Journal of Criminology*. 9 (3), 228-244.



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### RESEARCH ARTICLE

#### CARICA PAPAYA, A MAGIC HERBAL REMEDY.

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##### Key words:-

*Carica papaya*, nutraceutical, medicinal plant, multi faceted plant.

#### Abstract

*Carica papaya* Linn belonging to family Caricaceae. The properties of papaya fruit and other parts of the plant are also well known in traditional system of medicine. Papaya possess excellent medicinal properties for treatment of different ailments. The different parts of the *Carica papaya* plant including leaves, seeds, latex and fruit exhibited to have medicinal value. The stem, leaf and fruit of papaya contain plenty of latex. The latex from unripe papaya fruit contain enzymes papain and chymopapain.

**Background:-** there is no background

**Method:-** there is no method because its focused on review on *Carica papaya* plant.

**Result:-** There is no result because it is a review article on *Carica papaya*

**Conclusion:-** this review focuses on different properties of papaya as a multi-faceted plant. Papaya is commonly known for its food and nutritional values throughout the world.

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#### Introduction:-

*Carica papaya* Linn belonging to family Caricaceae is commonly known as papaya in English, Papita in Hindi and Erandakarkati in Sanskrit. Papaya is a powerhouse of nutrients and is available throughout the year. It is a rich source of three powerful antioxidant vitamin (C, A & E); the minerals (magnesium and potassium); the B vitamin pantothenic acid and folate and fiber.<sup>1</sup> The plant is native to tropical America and was introduced to India in 16th century. Papaya tree is basically a short lived Indian tree. In the historic times, it was considered as an exotic fruit because of its buttery taste and appearance.<sup>2</sup> The plant is recognised by its weak and usually unbranched soft stem and yielding copious white latex and crowded by a terminal cluster of large and long stalked leaves, is rapidly growing and can grow up to 20m tall. Traditionally leaves have been used for treatment of a wide range of ailments, like in treatment of malaria, dengue, jaundice, immunomodulatory and antiviral activity.<sup>3</sup> Young leaves are rich in flavonoids (kaempferol and myricetin), alkaloids (carpaine, pseudocarpaine, dehydrocarpaine I and II), phenolic compounds (ferulic acid, caffeic acid, chlorogenic acid), the cynogenetic compounds (benzylglucosinolate) found in leaves.<sup>4</sup>

Both leaf and fruit of the *Carica papaya* Linn. possess carotenoids namely  $\beta$ -carotene, lycopene, anthraquinones glycoside, as compared to matured leaves and hence possess medicinal properties like anti-inflammatory, hypoglycaemic, anti-fertility, abortifacient, hepatoprotective, wound healing, recently its antihypertensive and antitumor activities have also been established.<sup>3,4</sup> Leaves being an important part of several traditional formulations

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are undertaken for standardization for various parameters like moisture content, extractive values, ash values, swelling index, etc.<sup>5</sup>

### Morphology:-

- **Botanical Name:** *Carica Papaya*
- **Family Name :** Caricaceae
- **Common Name :** Papaya, Paw Paw, Kates, Papaw
- **Flower:** Showy, fragrant
- **Fruit:** Showy, Edible
- **Leaf:** Evergreen
- **Part Used :** Leaves, Fruits, Roots
- **Habitat :** Throughout India , Bangladesh

### Different species of *Carica papaya* Linn:-

- |                                   |                               |
|-----------------------------------|-------------------------------|
| 1. <i>Carica candamarcensis</i>   |                               |
| 2. <i>Carica Mexicana</i>         | 16 <i>Carica weberbaueri</i>  |
| 3. <i>Carica caudate</i>          | 17 <i>Carica omnilingua</i>   |
| 4. <i>Carica cauliflora</i>       | 18 <i>Carica palandensis</i>  |
| 5. <i>Carica chilensis</i>        | 19 <i>Carica parviflora</i>   |
| 6. <i>Carica horovitziana</i>     | 20 <i>Carica spruce</i>       |
| 7. <i>Carica cundinamarcensis</i> | 21 <i>Carica pubescens</i>    |
| 8. <i>Carica dodecaphylla</i>     | 22 <i>Carica pulchra</i>      |
| 9. <i>Carica glandulosa</i>       | 23 <i>Carica quercifolia</i>  |
| 10. <i>Carica goudotiana</i>      | 24 <i>Carica sphaerocarpa</i> |
| 11. <i>Carica heterophylla</i>    | 25 <i>Carica spinosa</i>      |
| 12. <i>Carica candicans</i>       | 26 <i>Carica nana</i>         |
| 13. <i>Carica longiflora</i>      | 27 <i>Carica stipulate</i>    |
| 14. <i>Carica crassipetala</i>    | 28 <i>Carica pentagona</i>    |

### Botanical Description:-

#### Plant:-

Papaya plant is a large, single-stemmed herbaceous perennial tree having 20–30 feet height . The leaves are very large (upto 2½ feet wide), palmately lobed or deeply incised with entire margins and petioles of 1-3 feet in length. Stems are hollow, light green to tan brown in color with diameter of 8 inches and bear prominent of scars.<sup>4</sup>

#### Fruit:-

The fruits are big oval in shape and sometimes called pepo-like berries, since they resemble melon by having a central seed cavity . Fruits are borne axillary on the main stem, usually singly but sometimes in small clusters. Fruits weigh from 0.5 up to 20 lbs, and are green unlike ripe, turning yellow or red orange. Flesh is yellow-orange to salmon (pinkish orange) at maturity. The edible portion surrounds the large central seed cavity. Individual fruits mature in 5-9 months, depending on cultivator and temperature. Plants begin bearing fruits in 6-12 months.<sup>6,7</sup>

#### Flowers:-

Papaya plants are dioecious or hermaphroditic, producing only male, female or bisexual (hermaphroditic) flowers. Papaya as are sometimes said to be “trioecious” meaning that separate plants bear either male, female, or bisexual flowers .Female and bisexual flowers are waxy, ivory white, and borne on short peduncles in leaf axils, along the main stem. Flowers are solitary or small cymes of 3 individuals. Ovary position is superior. Prior to opening, bisexual flowers are tubular, while female flowers are pear shaped. Since, bisexual plants produce the most desirable fruit and are self-pollinating, they are preferred over female or male plants. A male papaya is distinguished by the smaller flowers borne on long stalks. Female flowers of papaya was pear shaped, when unopened whereas, bisexual flowers are cylindrical .<sup>8</sup>

### Geographical Distribution:-

Though the exact area of origin is unknown, the papaya is believed native to Tropical America, perhaps in Southern Mexico and neighbouring Central America. Successful commercial production today is primarily in Hawaii,

Tropical Africa, the Philippines, India, Ceylon, Malaysia and Australia, apart from the widespread but smaller scale production in South Africa, and Latin America. In India, papaya is cultivated in Maharashtra, Bengal, Bihar, Haryana, Punjab, Delhi, Andhra Pradesh and Uttar Pradesh.<sup>9</sup>

#### **Nutritional Value of Papaya:-**

The papaya is a large, tree-like plant, with a single stem growing from 5 to 10 m (16 to 33 ft) tall, with spirally arranged leaves confined to the trunk. The leaves are large, 50-70 cm in diameter, deeply palmately lobed, with seven lobes. The tree is unusually un-branched, unless lopped. The flowers appear on the axils on the leaves, maturing into large fruit. The fruit is ripe when it feels soft and its skin has attained amber to orange hue. Ripe and green papaya has difference in nutritional value.<sup>6,9</sup>

#### **Chemical composition of various part of *Carica papaya* plant are described:-**

##### **Part Constituents:-**

**Fruit:-** protein, fat, fibre, carbohydrates, minerals, calcium, phosphorus, iron, vitamin C, thiamine, riboflavin, niacin, and carotene, amino acid, citric acids and malic acid (green fruits), volatile compounds: linalol, benzylisothiocyanate, cis and trans 2, 6-dimethyl-3,6 epoxy-7 octen-2-ol. Alkaloid,  $\alpha$ ; carpaine, benzyl- $\beta$ -D glucoside, 2-phenylethyl- $\beta$ -D-glucoside, 4-hydroxyl -phenyl-2ethyl-B-D glucoside and four isomeric malonated benzyl- $\beta$ -D glucosides.<sup>6</sup>

**Juice:-** N-butyric, n-hexanoic and n-octanoic acids, lipids; myristic, palmitic, stearic, linoleic, linolenic acids-vaccenic acid and oleic acids.

**Seed:-** Fatty acids, crude proteins, crude fibre, papaya oil, carpaine, benzylisothiocyanate, benzylglucosinolate, glucotropacolin, benzylthiourea, hentriacontane,  $\beta$ -sitosterol, carcin and an enzyme myrosin<sup>8</sup>

**Root:-** Arposide and an enzyme myrosin.

**Leaves:-** Alkaloids carpain, pseudocarpain and dehydrocarpaine I and II, choline, carposide, vitamin C and E.

**Bark:-**  $\beta$ -sitosterol, glucose, fructose, sucrose, galactose and xylitol.

**Latex:-** proteolytic enzymes, papain glutamine cyclotransferase, chymopapain A, B and C, peptidase A and B and lysozymes.<sup>10,11</sup>

#### **Medicinal and Pharmacological properties of various parts of *Carica papaya* leaves.**

Biological activities of papaya are reported with the crude extracts and different fraction from latex, seed, leaf, root, stem bark and fruits.

##### **Leaves:-**

Papaya leaf has a numberless of benefits. In some parts of Asia, the young leaves of the papaya are steamed and eaten like spinach.

- Dengue fever :- Dr. Sanath Hettige, who conducted the research on 70 dengue fever patients, said papaya leaf juice helps increase white blood cells and platelets, normalizes clotting, and repairs the liver.<sup>2</sup>
- Cancer cell growth inhibition :- Recent research on papaya leaf tea extract has demonstrated cancer cell growth inhibition. It appears to boost the production of key signaling molecules called Th1 -type cytokines, which help regulate the immune system.
- Antimalarial and antiparasitic activity:- Papaya leaves are made into tea as a treatment for malaria. Antimalarial and antiparasitic activity has been noted in some preparations of the plant.<sup>8</sup>
- Facilitate digestion. The leaves of the papaya plants contain chemical compounds of carpain, Substance which kills microorganisms that often interfere with the digestive function.
- Antibacterial activity. It contains huge number of enzyme to kill the microorganism.<sup>12</sup>

##### **Fruit:-**

Papaya fruit is a rich source of nutrients such as provitamin A, carotenoids, vitamin C, vitamin B, lycopene, dietary minerals and dietary fibre. Danielone is a phytoalexin found in the papaya fruit.

- a. Laxative;- Ripe papaya fruit is laxative which assures of regular bowel movement
- b. Indigestion;- The milky juice which is tapped from the green, mature fruit while still in the tree contains an enzyme known as "papain". People use this in the preparation of different remedies for indigestion.
- c. Void the heart attack or stroke;- The folic acid found in papayas is needed for the conversion of homocysteine into amino acids such as cysteine or methionine. If unconverted, homocysteine can directly damage blood vessel walls, is considered a significant risk factor for a heart attack or stroke.
- d. Skin diseases;- it contains the vitamins which is used for skin disease.<sup>7</sup>

#### **Seeds:-**

The black seeds of the papaya are edible and have a sharp, spicy taste. They are sometimes ground and used as a substitute for black pepper.

- a. Nephro - protective activity;- In wistar rats nephro-protective activity was observed in dose related manner. Concentration of urine and creatinine were evaluated.
- b. More potent- The papaya seeds are very pungent and peppery, making them almost unpalatable. However the seeds seem to have more potent medicinal values than the flesh.
- c. Papaya seeds may protect the kidneys from toxin – induced kidney failure. Seeds can eliminate intestinal parasites, and help detoxify the liver. Used as a skin irritant to lower fever. Cure for piles and typhoid and anti-helminthic and antiamoebic properties.<sup>14</sup>

#### **Peel:-**

Papaya peel is often used in cosmetics. The papaya peel can also be used in many home remedies.

- a) Sunscreen and soothing slave- The presence of vitamin A helps to restore and rebuild damaged skin. Applied papaya peel used as skin lightening agent. When peel mixed with honey and applied it can act as soothe and moisturizers the skin.
- b) Fight dandruff- The papaya vinegar with lemon juice can be applied to the scalp for 20 minutes prior to shampooing to fight dandruff.
- c) Muscle Relaxant- Adding papaya oil and vinegar to bath water, along with essential oils like lavender, orange and rosemary can be nourishing, refreshing and relaxing, and can work as a pain reliever and muscle relaxant .<sup>15,3</sup>

#### **Roots:-**

Juice from papaya roots is used in some countries of Asia to ease urinary troubles. Papaya leaf when dried and cured like a cigar, is smoked by asthmatic persons. An infusion of fresh papaya leaves is used by person to expel or destroy intestinal worms. Fresh young papaya are also used to remedy colic, a certain stomach disorder or cramp. A decoction formed by boiling the outer part of the roots of the papaya tree in the cure of dyspepsia .<sup>16</sup>

#### **Latex:-**

The milky sap of an unripe papaya contains Papain and chymopapain. chymopapain was approved for intradiscal injection in patients with documented herniated lumbar intervertebra discs and who had not responded to "conservative therapy". Papain is also used to treat commercial beer, to degum natural silk, as a meat tenderizer and in the production of chewing gums. Cosmetically it is used in Shampoos and in a number of face-lifting operations. In humans papain slows down the heart and thus reduces blood pressure. It is also used in Antihelmintic, relieves dyspepsia, cures diarrhea, pain of burns and topical use, bleeding haemorrhoids, stomachic, whooping cough .<sup>17</sup>

#### **Other Uses:-**

- a. Colon cancer- The fiber of papaya is able to bind cancercausing toxins in the colon and keep them away from the healthy colon cells. These nutrients provide synergistic protection for colon cells from free radical damage to their DNA.
- b. Anti-Inflammatory effects- Protein enzymes including papain and chymopapain and antioxidant nutrients found in papaya; including vitamin C, vitamins E, and betacarotene, reduce the severity of the conditions such as asthma, osteoarthritis, and rheumatoid arthritis.
- c. Rheumatoid arthritis- Vitamin C - rich foods, such as papaya, provide humans with protection against inflammatory polyarthritis, a form of rheumatoid arthritis involving two or more joints
- d. Promote lung health- If you are smoker, or if you are frequently exposed to second hand smoke. Eating vitamin A rich foods, such as papaya, help your lung healthy and save your life.

- e. Anti-sickling activity- Current research proves that papaya is having an anti- sickling activity
- f. Prevent prostate cancer- Men consuming lycopene – rich fruits and vegetables such as papaya, tomatoes, apricots, pink grape fruit, watermelon, and guava were 82 % less likely to have prostate cancer compared to those consuming the least lycopene - rich .<sup>14,16</sup>

#### **Pharmacological activities of *Carica papaya* on laboratory animals:-**

##### **Antisickling activity:-**

Sickle cell disease (SCD) results from a mutation in hemoglobin inside the red blood cells, where a glutamic acid at 6th position is replaced by valine. Recent studies showed that unripe papaya fruit extract has anti-sickling activity .[18]. Another study showed the potent antisickling property of *Carica papaya* leaf extract in a dose- dependent manner.<sup>19</sup>

##### **Anthelmintic activity:-**

A wide range of plants and plant extracts has been used traditionally for the treatment of helminthes infections including papaya, which is rich in proteolytic enzymes known to digest nematode cuticles, have low toxicity and have been used in traditional medicine against gastrointestinal nematodes for decades . In 1940, the worm digesting activity of a preparation of papain from *C.papaya* latex was described as they rapidly digest the ascaris.<sup>20</sup>

##### **Antifungal activity:-**

The latex of papaya and fluconazole has synergistic action on the inhibition of *Candida albicans* growth . This synergistic effect results in partial cell wall degradation due to lack of polysaccharides constituents in the outermost layers of fungal cell wall and release of cell debris into the cell culture. Latex proteins appear to be responsible for antifungal action and minimum protein concentration for producing a complete inhibition was reported as about 138 mg/dl.<sup>21</sup>

##### **Antibacterial activity:-**

The seeds of *Carica papaya* were found to possess bacteriostatic activity against several enteropathogens such as *Bacillus subtilis*, *Enterobacter cloacae*, *Escherichia coli*, *Salmonella typhi*, *Staphylococcus*, *Proteas vulgaris*, *Pseudomonas aeruginosa* and *Klebsiella pneumonia*. Among the gram positive and gram-negative bacteria tested the gram negative bacteria were more susceptible to the extract.<sup>22</sup>

##### **Antioxidant activity:-**

reported a study on *Carica papaya* for its antioxidant activity, its phenolic content using the different parts of papaya. The total phenolic content of the extracts was determined by Folin-Ciocalteu method and antioxidant activity was assayed using DPPH method. The total phenolic contents and antioxidant activity of the extracts as Gallic acid equivalents were found to be highest in fresh extract .<sup>23</sup>

##### **Hypoglycemic and hypolipidemic activity:-**

Study show that oral treatment with 0.1 mg/kg/day of glibenclamide and 100-400 mg/kg/day of aqueous seed extract of *Carica papaya* induced significant, steady and progressive hypo-glycemic and hypolipidemic effect.<sup>24</sup>

##### **Antipyretic activity:-**

investigated the platelet increasing property of *Carica papaya* leaves juice (CPLJ) in patients with dengue fever (DF). An open labeled randomized controlled trial was carried out on 228 patients with DF and dengue hemorrhagic fever (DHF). Approximately half the patients received the juice, for 3 consecutive days while the others remained as controls and received the standard management. Their full blood count was monitored 8 hours for 48 hours. Gene expression studies were conducted on the ALOX 12 and PTAFR genes. The mean increase in platelet counts were compared in both groups using repeated measure ANCOVA. There was a significant increase in mean platelet count observed in the intervention group but not in the control group 40 hours since the first dose of CPLJ. Comparison of mean platelet count between intervention and control group showed that mean platelet count in intervention group was significantly higher than control group after 40 and 48 hours of admission. The ALOX 12 (FC=15.00) and PTAFR (FC=13.42) genes were highly expressed among those on the juice. It was concluded that CPLJ does significantly increase the platelet count in patients with DF and DHF.<sup>25</sup>

**Anti-inflammatory activity:-**

The anti-inflammatory property of plant cysteine proteinases were already noted in literature. In a clinical study, the histological severity of inflammatory bowel disease was determined for treatment of chronic inflammatory and related diseases papain has found to be safe and efficacious. Anti-inflammatory activity of papaya seeds were also reported. The anti-inflammatory effect of the leaves extract including the reference drug was very poor when using the carrageenan method, the 100 mg/kg extract produced its highest effect at 3 hr (2.7%) after carrageenan injection while the 200mg/kg extract also produced its effects at 3 hr (6.7%) after injection. The reference drug indomethacin produced time dependant reduction as the effect was more pronounced at 3 hr (11.4%) of carrageenan administration. The results of this investigation revealed that the aqueous extract of the leaves was slightly less effective than that of indomethacin.<sup>26</sup>

**Anti-fertility activity:-**

The anti-fertility effects of *Carica papaya* were investigated by feeding adult and pregnant rat with different components of the fruit. No attempt was made to force feed the animal and the result indicated that the unripe fruit interrupted the estrous cycle and induced abortion. This effect vanished as the fruit became stale or over riped. Chloroform extract of *Carica papaya* seeds induced long term azoospermia in langur monkey.<sup>27</sup> Papaya also showed the anti-implantation and abortifacient effect.<sup>28</sup>

**Anticancer activity :-**

Initially pharmaceutical preparations containing various proteolytic enzymes (papain) have been used as adjuvant in the treatment of malignant diseases, despite lack of knowledge of their mode of action. Experiments indicate that the effects after oral administration of polyezymes preparations are related to the induction of cytokines production by human peripheral blood mononuclear cells. Papaya in vitro study shows that it will treat many cancer cell line and they have anticancer activity. Papain enzyme from papaya effective against cancer. Papain breaks down the fibrin cancer cell wall and protein into amino acid form. Other than papain it also contain lycopene which highly reactive towards oxygen and free radical. Isothiocyanate effective against breast, lung, colon, pancreas, prostate as well as leukemia. These enzymes capable of inhibiting both formation and development of cancer cell.<sup>29</sup>

**Anti-hypertensive activity:-**

Papaya leaves decoction can be used as an anti-hypertensive agent. A study on villagers of Agboville located at 80 km of Abidjan (West Africa), showed the hypotensive activity of papaya plant when administered orally.<sup>30</sup>

**Immunomodulatory activity:-**

Papain induces human eosinophils to degranulate and to produce superoxide anion. The E-64 inhibitors abolished the activation by papain suggesting that the protease activity is required to trigger eosinophil response. It is likely that this action in eosinophils is mediated by protein G linked receptor. As it stands it appears that bromelain and papain depending on the target cell display opposite effects.<sup>31</sup>

**Wound healing:-**

The similarities between latex coagulation in papaya and the mammalian coagulation process led us to propose that some analogous factor may be present in both systems. If putative analogies do occur, it is possible that some plant metabolites intervening during plant healing may also act during the healing process ensuring clot formation in mammals. The proliferative effect of papain attained 15% above control, suggesting that this properly is specific for some proteolytic enzymes. Also one study showed that papain from *C. papaya* latex was effective in protecting histamine-induced ulcer in rat by blocking the acid secretion<sup>17</sup>. Papain major component of papaya latex is nonspecific cysteine proteinase that is capable of breaking down a wide variety of necrotic tissue substrates over a wide pH range from 3.0 to 12.0<sup>18</sup>. This factor may also have contributed to the faster wound healing and was facilitated by the action proteinases. Papain also known to be effective in disloughing necrotic tissue, prevention of infection and the antimicrobial and antioxidant properties related to hydroxyl scavenging and iron chelating properties. Moreover they decrease the risk of oxidative damage to tissue also they show burn healing properties as the increment in hydroxyproline content.<sup>32</sup>

**Anti- HIV agent:-**

Evaluation of anti-HIV-1 effect of *Carica papaya* aerial parts polar extracts and also the investigation of the chemical content from the polar extracts of the plant. The methanol and aqueous extracts of *Carica papaya* were tested for their anti-HIV-1 activity using the syncytia formation assay. Methanol and aqueous extracts of *Carica*

papaya aerial parts showed activity as anti HIV-1 agents, both of the extracts therapeutic index (TI) of 5.51 and 7.13 compared with the standard drug. Phytochemical analysis of both the extracts proves the presence of phytocomponents as flavonoids, tannins, alkaloids, carbohydrates and triterpenes. The results have shown that *Carica papaya* methanol and aqueous extracts have drug ability as anti- HIV agent<sup>33</sup>

#### **Taxonomy, Morphology and Distribution Botanical Classification.**

Domain:	Flowering plant
Kingdom	Plantae
Sub Kingdom	Tracheobionta
Class	Magnoliopsida
Subclass	Dilleniidae
Superdivision:	Spermatophyta
Phylum:	Streptophyta
Order:	Brassicales
Family:	Caricaceae
Genus	<i>Carica</i>
Botanical Name	<i>papaya</i> Linn

#### **Nutritional value:-**

Constituents	Ripe Papaya	Green Papaya
Water	89.1 gm	92.6 gm
Proteins	8.26 gm	10.8 gm
Total lipid	0.93 gm	1.35 gm
Ash	4.59 gm	6.76 gm
Carbohydrates	86.2 gm	81.1 gm
Total DF	11.9 gm	27.0 gm
Sugar		

#### **Mineral Macronutrients:-**

Sodium	128.4 mg	283.8 mg
Potassium	1238 mg	2743 mg
Magnesium	229.4 mg	635.1 mg
Phosphorus	NR	NR
Calcium	146.8 mg	432.4 mg
Iron	12.84 mg	8.11 mg
Copper	0.18 mg	0.14 mg
Zinc	0.92 mg	0 mg
Manganese	NR	NR









### Conculsion:-

Papaya (*Carica papaya* Linn.) is well known for its exceptional and medicinal properties throughout the world. The whole Papaya plant including its leaves, seeds, ripe and unripe fruits and their juices is used as traditional medicine. *Carica papaya* is a nutraceutical plant having a wide range of pharmacological activities. The whole plant has its own medicinal value. The wide range of enzymes, vitamins present in *Carica papaya* makes it a nutraceutical plant.

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### References:-

1. Milind and Gurditta. Basketful benefits of Papaya. International. Research. Journal of Pharmacy. 2011; 2(7)pp : 6-12.
2. Bhowmik, D. Aravind G, Duraivel S, Harish G. Traditional and Medicinal uses of *Carica papaya*. Journal Medical. Plant Studies. 2013; 1(1)pp : 7- 15.
3. Ayurvedic pharmacopeia of India, Govt of India.
4. Arvind G, Debjit B, Duraivel S, Harish G. Traditional and Medicinal uses of *Carica papaya*, J Med Car Pap 2013; 1(1)pp : 2320-3862.
5. Anjum V, Ansari SH, Naquvi KJ, Arora P, Ahmad A. Development of quality standards of *Carica papaya* Linn. Leaves, Sch Res Lib 2013; 5(2) pp : 370-376.
6. Jean Bruneton. *Carica papaya*, In: Pharmacognosy, phytochemistry of medicinal plants, Tech Docu Fra 1999; 2:pp 221-223.
7. The Wealth of India – A dictionary Indian raw materials and industrial products: Raw material series, Ca-Ci, publications and information directorate, CSIR 1992; 3pp : 276-293
8. KM Nadkarni. Indian material medica, Pop Pra Pvt Ltd, Bombay 1954; 1 pp 273-277.
9. Krishna KL, Paridhavi M, Jagruti Patel A. Review on nutritional, medicinal and pharmacological properties of papaya (*Carica papaya* Linn), Nat prod Rad 2008; 7(4)pp: 364-373.
10. Azarkan M, El Moussaoui A, van Wuytswinkel D, Dehon G, Looze Y. Fractionation and purification of the enzymes stored in latex of *Carica papaya*. J Chromatogr B Analyt Tech Biomed Life Sci 2003; 790 pp: 229 – 238.
11. Oloyede O I. Chemical profile of unripe pulp of *Carica papaya* kJl Pak J Nutr 2005; 4: pp 379 – 381.
12. Natarajan Sudhakar, Theivanai @ Vidhya R M. Potential medical properties of *Carica papaya* Linn, Int J Pharm Sci 2014; 6(2)pp: 168-173.
13. Marfo EK, Oke OL, Afolabi OA. Chemical composition of papaya (*Carica papaya*) seeds. Food Chem. 1986; 22: 259–266. doi: 10.1016/0308-8146(86)9008 pp 4-1
14. Ordóñez VP, Vega EM, Malagón AO. Phytochemical study of native plant species used in traditional medicine in Loja province. Lyonia. 2006; 10 pp: 65–71
15. Amri E and Mamboya F., Papain, a plant enzyme of biological importance: a review. Am J Biochemistry and Biotechnology 2012; 8(2) pp: 99-104.
16. Carlos ES, Marco TR, Hernandez M, Mirian TP. Plant cysteine proteinases: evaluation of pharmacological activity, Phytochemistry. 2008; 69 pp: 2263-2269.

17. Yogiraj, V Pradeep Kumar Goyal, Chetan Singh Chauhan, Anju Goyal, Bhupendra Vyas , *Carica papaya* Linn ; an overview ,International journal of herbal medicine. 2014, 2(5) pp; 01- 08
18. Oduola T, Adeniyi FAA, Ogunyemi EO, Bello IS, Idowu TO. Anti-sickling agent in an extract of unripe pawpaw (*Carica papaya*): is it real? Afr J Biotech 2006; 5(20 ) pp;1947-1949.
19. NOA, Gbenle GO, Okochi VI, Akanbi SO, Edeogbon SO, Oigbochie V et al. Antisickling property of *Carica papaya* leaf extract. Afr J Biochem Res. 2009; 3(4) pp:102-106
20. Imaga . Kermanshai R, McCarry B E, Rosenfeld J, Summers P S, Weretilnyk E A, Sorger G J. Benzyl isothiocyanate is the chief or sole anthelmintic in papaya seed extracts. Phytochem 2001; 57: pp 427– 435.
21. Giordiani R, Gachon C, Moulin TJ, Regli P. Asynergistic effect of *Carica papaya* latex sap and fluconazole on *Candida albicans* growth. Mycoses. 1997; 40 (11-12)pp 429-437.
22. Giordiani R, Siepaio M, Moulin TJ, Regli P. Antifungal action of *Carica papaya* latex, isolation of fungal cell wall hydrolyzing enzymes, Mycoses. 1991; 34 (11-12):pp 467- 477.
23. Maisarah A , Antioxidant analysis of different parts of *Carica papaya* ‘ ‘International Food Research Journal’ vol- 1020(3):pp 1043-1048
24. Adeneye AA, Olagunju JA. Preliminary hypoglycemic and hypolipidemic activities of aqueous seed extract of *Carica papaya* Linn. In wistar rats. Biology and Medicine 2009; 1(1)pp:1-10.
25. Soobitha S, Tan CC, Kee CC, Thayan R, Mok BT. *Carica papaya* leaves juice significantly accelerates the rate of increase in platelet count among patients with dengue fever and dengue haemorrhagic fever, Evi Bas Compl Alter Med, 2013,pp-148-15.1
26. Amazu LU et al. Anti-inflammatory activity of the methanolic extract of the seeds of *Carica papaya* in experimental animals. Asi. Pac.J Trop. Med. 2010; pp. 884-886.
27. Sheikh Fauziya, Krishnamurthy R. Papaya (*Carica papaya*): source material for Anticancer, CIB Tech J Pharm Sci 2013; 2(1) pp.25-34.
28. Adeolu AA and Vivian EO. Anti-nociceptive and Anti-inflammatory studies of the aqueous leaf extract of *Carica papaya* in laboratory animals. Asian J Expi Biol Sci2013; 4(1)pp :89-96.
29. Poharkar RD, Saraswat RK, Kotkar S. Survey of plants having anti-fertility activity from western ghat area of Maharashtra state. J Herb Med Toxicol.2010; 4(2) pp:71-75
30. Fauziya S and Krishnamurthy R. Papaya (*Carica papaya*): Source material for anticancer CIB Tech Journal Pharmacy Science.2013; 2(1) pp:25-34.
31. Koffi N, Solange TM, Emma AA, Noel ZG. Ethanobotanical study of plants used to treat arterial hypertension, in traditional medicine. European. J Scient Res. 2009;1(1) pp:1-10.
32. Gomes MTR et al. Isolation of two plant proteinases in latex from carica acting as mitogens for mammalian cells. Planta medica 2005; 71 pp:244-248.
33. Singer AJ and Clark RA Cutaneous wound healing. N Eng J of Med. 1999;pp 738-746.
34. Wright JB and Shi L. Accuzyme papain urea debriding ointment; a historical review. Wounds 2003; 15:pp 25-125.
35. Rashed, Meng-Ting Luo, Lin Tao Zhang, YongTang Zheng. Phytochemical screening of the polar extracts of *Carica papaya* Linn and the evaluation of herAnti-HIV-1 activity, J Appl Ind Sci 2013; 1(3)pp-49-53.
36. Fernandes FA, Rodrigues S, Gaspareto OC, Oliveira EL. Optimization of osmotic dehydration of papaya followed by air drying. Food Research International 2006; 39 pp:492-8.
37. Thomas GE, Rodolfo HG, Juan MD, Georgina SF, Luis CG, Ingrid RB et al. Proteolytic activity in enzymatic extracts from *Carica papaya* L.cv. Maradol harvest by-products. Process biochemistry 2009; 44 pp-77-82.
38. Azarkan M, Moussaoui A, Wuytswinkel DV, Dehon G, Looze Y. Fractionation and purification of enzymes stored in the latex of *Carica papaya*. J Chromatograph B 2003; 790 pp-229-38.
39. Menard R, Khouri HE, Plouffe C, Dupras R, Ripoll D et al. A protein engineering study of the role of aspartate in the catalytic mechanism of papain. Biochemistry 1990; 29 pp-6706-6713.
40. Carlos ES, Marco TR, Hernandez M, Mirian TP. Plant cysteine proteinases: evaluation of pharmacological activity, Phytochemistry. 2008; 69 pp:2263-2269.
41. Gomes MTR et al. Isolation of two plant proteinases in latex from carica acting as mitogens for mammalian cells. Planta medica 2005; 71 pp 244-248.
42. Azarkan M, Wintjens R, Looze Y, Danielle BV. Detection of three wound-induced proteins in papaya latex. Phytochemistry. 2004; 65 pp 525-534.

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### RESEARCH ARTICLE

## RESVERATROL AS AN ALTERNATIVE TO REGULAR BLOOD TRANSFUSION- A NEW FETAL HAEMOGLOBIN INDUCER FROM NATURAL WORLD

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#### Abstract

Recent molecular studies of fetal hemoglobin (HbF) regulation have shown promise for the development of clinical HbF inducers to be used in patients with  $\beta$ -thalassemia and sickle cell disease. However, while numerous promising inducers of HbF, have been studied at past in  $\beta$ -thalassemia patient with limited success resulted no universally effective agents. Increased production of fetal hemoglobin (HbF) can ameliorate the severity of both  $\beta$ -thalassemia and sickle cell disease (SCD), the major disorders of  $\beta$ -hemoglobin. The defective production of the  $\beta$ -globin molecule in patients with  $\beta$ -thalassemia can be compensated for by an increase in the production of the  $\beta$ -like globin molecule,  $\gamma$ -globin, which pairs together with  $\alpha$ -globin chains to form HbF. Here we examined the clinical studies of one HbF inducer Trans-Resveratrol and found Complete Response (52.2%), Partial Response (18.2%) and Non response (15.9%) in patients who, after more than one year of treatment, remained at the different level of transfusion dependency with extended transfusion intervals. The present study is to provide a resource that will be valuable for the design of future studies of HbF inducers in  $\beta$ -thalassemia. According to our knowledge and literature review, probably this could be the first report for resveratrol clinical trial in eastern Indian population.

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#### Introduction:-

Resveratrol (3,4',5-trihydroxystilbene) belongs to a class of poly-phenolic compounds called stilbenes (1) which is effective in response to stress, injury, fungal infection, or ultraviolet (UV) radiation (2). Resveratrol is a fat-soluble compound that occurs in a *trans* and a *cis* configuration in combination to glucose forming glucosides. Resveratrol-3-O-beta-glucoside is called piceid (3). Literature study revealed that, Scientists became interested in exploring potential health benefits of resveratrol in 1992 when its presence was first reported in red wine (4), and more recently, reports on the potentiality of resveratrol to inhibit the development of cancer (5) and extend lifespan (6) in cell culture and animal models have continued to generate scientific interest. From 2005 until the middle of 2010, there have been more than thousands new studies on cells, animals, and humans. Not a single commercially available drug was known to medical science which had the wide range of potential preventative, therapeutic, and quality of life enhancement properties as like as resveratrol. It has been shown to inhibit cancer, kill bacteria, viruses

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and fungal infections, extend life span in animals, improve energy production in cells, quench free radicals, increase glucose tolerance in diabetics, improve cardiac function, enhance physical and mental fitness and concentration, repair damage of DNA, prevent cell damage from nuclear radiation, and much more.

The  $\beta$ -thalassemias are characterized by a very heterogeneous group of inherited mutations causing abnormal expression of globin genes, leading to total absence or quantitative reduction of synthesis of  $\beta$ -globin chains (7-9). This disease is frequent in the Mediterranean area, Middle East, Africa and Asia. More than 200 different mutations have been identified in  $\beta$ -thalassemia patients, including deletions of the  $\beta$ -globin gene region, stop codons leading to premature termination of a non-functional  $\beta$ -globin chain, mutations suppressing correct maturation of the  $\beta$ -globin RNA precursor, most of all need regular blood transfusions. (7-11). In addition to 'direct-costs', blood transfusions require accurate monitoring of the safety of the product which involves expensive technologies. As far as alternative therapeutic approaches are concerned, gene therapy and bone marrow transplantations are very promising strategies but they are expected to be useful for only a minority of patients, selected on the basis of biological/genetic parameters and the economic possibility of affording these therapies. Pharmacological therapy including possible exploitation of HbF inducers, is expected to be crucial. Induction of HbF in patients affected by  $\beta$ -thalassemia and sickle cell anemia (SCA) has been suggested as a very promising approach for the conversion of those patients to an independency from blood transfusion (12-19). On this context, the present study was conducted to detect the efficacy of resveratrol as a potent HbF inducing agent.

## Materials and Methods:-

### Study groups:-

Patients with HPLC-screened documented Sickle cell anaemia, S-beta thalassemia, beta thalassaemia, HbE thalassaemia, HbE-beta thalassaemia, HPFH genotypes have been considered in this primary analysis. Age distribution of Patients, Types of thalassaemia, duration of blood transfusion, duration of treatment of resveratrol was clearly depicted in Table-1, 2, 3 and 4 respectively.

**Table 1:- Age distribution of patients.**

Age group	Percent(%)
1-25 years	94.5
25-50 years	5.5

**Table 2:- Types of Thalassaemia**

Types of Thalassaemia	Percent(%)
HbE-Beta (Intermedia)	71.42
HbE	0.7
Beta	26.19
HbSS	0.7
HbD-S	0.7

**Table 3. Duration of Blood Transfusion.**

Duration	Percent (%)
monthly	17.5
< 1 month	5.6
2 months	5.6
> 2 y – 5 y	14.2
10 y	0.8
No Blood Transfusion	56.3

**Table 4:- Duration of Treatment on Resveratrol.**

Trans-Resveratrol therapy continued	Percent(%)
More than 1 year	35.19
More than 6 months	13.89

More than 3 months	24.07
Less than 3 months	6.48
No treatment	20.37

**Collection of Sample:-**

Sample was collected from OPD of Thalassaemia Foundation, Kolkata. Total 220 patients were evaluated. Among which 142 patients with Hb-E and 69 patients with Beta and HPFH and 11 patients with other hemoglobinopathies were observed.

**Hematological Analysis:-**

Analysis (Hb level / Total WBC / Mean Cell Volume / Mean Cell Hemoglobin / Mean Cell Hemoglobin Concentration / Red Cell Distribution Width / Hematocrit) was done by Automated analysis (Cell Counter : Medonic 530, EMERCK).

**Fetal hemoglobin studies:-**

Hb variants' (HbA / HbA2 / HbF & others) levels was estimated by HPLC (High Performance Liquid Chromatography) (Bio-Rad, USA). Estimation of HbF was also done by using HPLC method.

**Biochemical Analysis:-**

Liver Function test (Serum Alanine aminotransferase concentration / Serum Aspartate aminotransferase Concentration / Total protein levels) & Renal Function test (Serum Creatinine concentration) was performed by Biochemical Analyser [Microlab 300, EMERCK].

**Result:-**

The pre-treatment and post-treatment hematological analysis and fetal hemoglobin analysis about 87 patients with resveratrol therapy revealed that there was significant response in hematological parameters for the increase of transfusion time against control. Different blood parameters and their pre-treatment and post-treatment values in beta and E-beta thalassaemia patients were clearly depicted in **Table-5** and **Table-6**. The toxicity and side effect of resveratrol was evaluated by liver function test (LFT) and the bilirubin, SGOT and SGPT value against control were clearly depicted in **Table -7**. Baseline evaluation (clinical and biochemical) of all the patients result shows that, there was *three categories* of response: a **Complete Response** (52.2%) in patients who can able to maintain at an average Hb level of 6-9 gm/dL without blood transfusion, in this group 12.3% patients are without any previous H/O blood transfusion, others shifted from monthly blood transfusion dependency to a stable transfusion-free condition; **Partial Response** (18.2%) in patients who remained transfusion dependent but at longer intervals (2-3 months or more), and **Non response** (15.9%) in patients who, after more than one year of treatment, remained at the same level of transfusion dependency. [**Table 8**]

**Table 5:- Different blood parameters and their pre-treatment and post-treatment values in Beta thalassaemia patients**

Blood Parameters	Control Initial	Control Final	Pre Therapy	Post Therapy
<b>HbF</b>	82.5±1.36	83.6±2.30	25.36±2.36	55.69±2.36*
<b>HbA2</b>	4.8±1.20	4.2±1.30	9.4±2.60	6.34± 1.25 *
<b>HbA</b>	60.23±2.36	62.35±1.20	6.36±3.60	10.32± 2.36 *
<b>Hb</b>	7.8±2.30	8.5±0.25	5.26±1.77	8.82 ±2.31 *
<b>MCV</b>	80.2±2.36	83.4±1.36	71.68±2.39	79.44 ± 1.07 *
<b>MCH</b>	31.0±1.23	32.0±0.69	24.48± 2.30	27.84±1.08 *
<b>MCHC</b>	38.7±1.36	38.4±2.36	32.66 ± 2.49	37.06 ± 2.07*
<b>Rdw</b>	16.6±1.25	16.36±1.20	42.76±1.20	38.76±2.57 *
<b>Hct</b>	20.1±0.56	22.2±1.30	19.64 ±2.86	24.24±1.55 *

Standard deviation was done in all the result, \*Significant at P<0.05 against Control Final.

**Table 6:- Different blood parameters and their pre-treatment and post-treatment values in E-beta thalassaemia patients**

Blood Parameters	Control Initial	Control Final	Pre Therapy	Post Therapy
HbF	38.94±1.77	52.2±1.50	30.6± 01.36	39.18±5.01*
HbA2	53.44±1.48	43.4±1.25	44.76±5.83	55.34±4.59 *
HbA	4.74±3.32	4.4±1.30	3.72±1.47	7.57±2.70 *
Hb	8.61±0.93	8.31±1.03	5.87±1.17	7.17±0.89 *
MCV	63.31±1.60	63.25±1.78	62.83±2.75	65.28±1.25 *
MCH	22.86±2.59	23.5±2.92	20.72± 2.64	25.87±1.72 *
MCHC	36.1±0.77	35.91±0.46	32.78±0.58	35.56±1.98 *
Rdw	30.03±1.68	30.9±1.57	34.10±2.61	29.40±2.26*
Hct	23.91±2.69	22.96±3.07	16.87±0.72	20.26±1.53*

Standard deviation was done in all the result, \*Significant at P<0.05 against Control Final.

**Table 7: Toxicity/Side effect evaluation of Beta & HbE/Beta thalassaemia patients on Trans-Resveratrol by Liver Function Test**

Type of Thalassaemia	Bilirubin (mg/dl)	SGOT (U/l)	SGPT (U/l)
Beta	2.07±2.5	20.0±3.6	30.5±3.5
E/Beta	2.25±2.3	22.6±2.3	28±6.3
Control	1.50±0.5	<30	<40

\*\* Standard deviation was done in all the result

**Table 8:- Distribution of patients in different categories of response**

Groups of different categories	n (%)	HbE-beta (n=142)	Beta/HPFH (n=69)	Haemoglobino- pathies (HbE, Sickle etc) (n=11)
<b>COMPLETE RESPONSE</b>				
<b>GROUP-I</b> (withdrawal of BT)	88 (%)	Female=24 (%) Male = 46 (%)	Female = 5 (%) Male = 7 (%)	Female = 5 (%) Male = 1 (%)
<b>GROUP-II</b> (No H/O BT)	27 (%)	Female = 9 (%) Male = 12 (%)	Female = 2 (%) Male = 4 (%)	Female = 0 (%) Male = 0 (%)
<b>NON RESPONSE</b>				
<b>GROUP-III</b>	35 (%)	Female = 2 (%) Male = 6 (%)	Female = 5 (%) Male = 22 (%)	Female = 0 (%) Male = 0 (%)
<b>PARTIAL RESPONSE</b>				
<b>GROUP-IV</b>	40 (%)	Female = 9 (%) Male = 11 (%)	Female = 9 (%) Male = 10 (%)	Female = 0 (%) Male = 1 (%)
<b>CONTROL GROUP</b> (without HU)	32 (%)	Female = 9 (%) Male = 14 (%)	Female = 2 (%) Male = 3 (%)	Female = 2 (%) Male = 2 (%)

### Discussion:-

Over the last few years a substantial number of medical schools and research institutions have undertaken studies of resveratrol's ability to prevent or treat disease in humans. The number of such clinical trials is increasing day by day and mostly done on diseases like diabetes, heart disease and thalassaemia. In Thalassaemia, either very few or no red blood cells being produced by the bone marrow after infancy. The treatment is monthly whole blood transfusions and the use of a drug which is extremely toxic and cannot be used safely with children. The disease dramatically impacts the sufferers' quality of life and often results in death around the age of puberty as it is more common in less developed countries where it is virtually impossible for anyone other than the very wealthy to obtain regular supplies of clean whole blood for the required transfusions. So, the fatality rate is high. Even if the patient is able to obtain monthly transfusions and is able to afford the drugs to treat the disease, he or she is constantly anemic and lacking of energy. After the discovery of Transmax resveratrol, the concentrated pure resveratrol supplement used by researchers in most clinical trials, was able to stimulate the production of embryonic red blood cells, the type that are produced when a baby is still in the mother's womb.

Resveratrol has been efficiently inhibiting ribonucleotide reductase as it possesses similar properties to HU toward erythroid differentiation. Resveratrol induces differentiation of K562 cells and augmentation of HbF in erythroid

precursor cells. Comparative analyses demonstrated that resveratrol, as HU, inhibits intracellular adhesion molecule-1 (ICAM-1) and VCAM-1 expression by endothelial cells. In addition, resveratrol possesses other properties similar to HU, including induction of nitric oxide synthase in cultured pulmonary endothelial cells and inhibition of human platelet aggregation in vitro. Interestingly, resveratrol exhibited minimal toxicity on normal hematopoietic cells, as suggested by Clement et al. (20).

In this present study, pre-treatment and post-treatment of resveratrol and evaluation of blood CBC parameters in patients with beta and E-beta thalassaemia shows three categories of response: Complete Response (52.2%; in patients who can able to maintain at an average Hb level of 6-9 gm/dL without blood transfusion, in this group 12.3% patients are without any previous H/O blood transfusion, others shifted from monthly blood transfusion dependency to a stable transfusion-free condition); Partial Response (18.2%; in patients who remained transfusion dependent but at longer intervals : 2-3 months or more) and Non response (15.9%; in patients who, after more than one year of treatment, remained at the same level of transfusion dependency), we observed increase of most of the CBC parameters which strongly indicate that resveratrol is a strong inducer of HbF and a selective stimulator of the expression in  $\beta$ -globin genes.

According to Bianchi et al, when erythroid precursor cells from normal subjects were treated with increasing concentrations of resveratrol, a clear increase in accumulation of  $\gamma$ -globin mRNA content was found. Increase in accumulation of  $\alpha$ -globin and  $\beta$ -globin mRNA was much lower. Taken together these data strongly indicate resveratrol as a strong inducer of HbF and a selective stimulator of the expression in  $\gamma$ -globin genes. (21)

### **Conclusion:-**

For HbF induction therapy to become part of the standard management for patients with  $\beta$ -thalassemia, there needs to be a great deal of work from both basic scientists and clinical researchers. Though several genetic, non-genetic and pharmacological factors reported to influence the Trans-Resveratrol response in different early studies, the response to Trans-Resveratrol is significantly different among good, moderate and non-responders among  $\beta^0$  or  $\beta^+$  thalassaemia mutations. To study whether HbF level has any relation to beta variants responding to Trans-Resveratrol therapy, it has been shown that even among good responders in some cases (8.39 %) patients are not showing high HbF values ( < 20% HbF values are taken). In our study, Trans-Resveratrol therapy completely replaces blood transfusion in 88% cases (79.5% HbE-beta intermedia, 13.6% in beta thalassaemia major and 6.8% in other haemoglobinopathies like HbE disease & Sickle Cell anaemia). Hence it is evident that some other element associated with beta globin gene framework which could related to good response to Trans-Resveratrol, for which further studies required.

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### **Competing Interests Statement:-**

The authors declare that they have no competing interests.

### **Data Sharing Statement:-**

We cannot share any unpublished data with other laboratory or person.

### **Patients Consent Statement:-**

The signed consent from all the patients were taken before test was performed and kept them as official documents. In case of any unusual condition it will be presented in front of the concerned person.

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**References:-**

1. Soleas GJ, Diamandis EP, Goldberg DM. Resveratrol: a molecule whose time has come? And gone? Clin Biochem. 1997;30(2):91-113. (PubMed)
2. Aggarwal BB, Bhardwaj A, Aggarwal RS, Seeram NP, Shishodia S, Takada Y. Role of resveratrol in prevention and therapy of cancer: preclinical and clinical studies. Anticancer Res. 2004;24(5A):2783-2840. (PubMed)
3. Romero-Perez AI, Ibern-Gomez M, Lamuela-Raventos RM, de La Torre-Boronat MC. Piceid, the major resveratrol derivative in grape juices. J Agric Food Chem. 1999;47(4):1533-1536. (PubMed)
4. Siemann EH, Creasey LL. Concentration of the phytoalexin resveratrol in wine. Am J Enol Vitic. 1992;43(1):49-52.
5. Jang M, Cai L, Udeani GO, et al. Cancer chemopreventive activity of resveratrol, a natural product derived from grapes. Science. 1997;275(5297):218-220. (PubMed)
6. Howitz KT, Bitterman KJ, Cohen HY, et al. Small molecule activators of sirtuins extend *Saccharomyces cerevisiae* lifespan. Nature. 2003;425(6954):191-196. (PubMed)
7. Steinberg MH, Forget BG, Higgs DR, Nagel RL. Disorders of Hemoglobin: Genetics, Pathophysiology and Clinical Management. Cambridge, UK: Cambridge University Press, 2001.
8. Thein SL. Genetic insights into the clinical diversity of beta thalassaemia. Br J Haematol 2004;124:264–74.
9. Old JM. Screening and genetic diagnosis of haemoglobin disorders. Blood Rev 2003;17:43–53.
10. Wenzel E, Somoza V. Metabolism and bioavailability of trans-resveratrol. Mol Nutr Food Res. 2005;49(5):472-481. (PubMed)
11. Goldberg DM, Yan J, Soleas GJ. Absorption of three wine-related polyphenols in three different matrices by healthy subjects. Clin Biochem. 2003;36(1):79-87. (PubMed)
12. Lo L, Singer ST. Thalassaemia: current approach to an old disease. Pediatr Clin North Am 2002;49:1165–91.
13. Olivieri NF. Reactivation of fetal hemoglobin in patients with betathalassaemia. Semin Hematol 1996;33:24–42.
14. . Olivieri NF, Rees DC, Ginder GD, Thein SL, Wayne JS, Chang L, et al. Elimination of transfusions through induction of fetal hemoglobin synthesis in Cooley's anemia. Ann N Y Acad Sci 1998;850:100–9.
15. Cao H. Pharmacological induction of fetal hemoglobin synthesis using histone deacetylase inhibitors. Hematology 2004;9:223–33.
16. Lo L, Singer ST. Thalassaemia: current approach to an old disease. Pediatr Clin North Am 2002;49:1165–91.
17. Atweh GF, Loukopoulos D. Pharmacological induction of fetal hemoglobin in sickle cell disease and beta-thalassaemia. Semin Hematol 2001;38:367–73.
18. Olivieri NF, Weatherall DJ. The therapeutic reactivation of fetal haemoglobin. Hum Mol Genet 1998;7:1655–8.
19. Wang HX, Ng TB. Natural products with hypoglycemic, hypotensive, hypocholesterolemic, antiatherosclerotic and antithrombotic activities. Life Sci 1999;65:2663–77.
20. Cle`ment MV, Hirpara JL, Chawdhury SH, Pervaiz S. Chemopreventive agent resveratrol, a natural product derived from grapes, triggers CD95 signaling-dependent apoptosis in human tumor cells. Blood 1998;92:996–1002.
21. Nicoletta Bianchi, Cristina Zuccato, Ilaria Lampronti, Monica Borgatti and Roberto Gambari. Fetal Hemoglobin Inducers from the Natural World: A Novel Approach for Identification of Drugs for the Treatment of  $\beta$ -Thalassaemia and Sickle-Cell Anemia. Advance Access Publication 11 December 2007 & eCAM 2009;6(2)141–151





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### ENVIRONMENT AND HEALTH ISSUES ASSOCIATED WITH E-WASTE

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#### Abstract

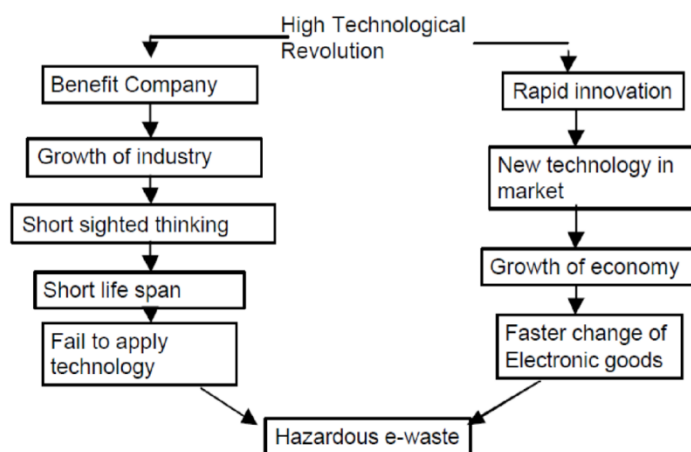
In this paper the environmental problems related with the discarded electronic appliances, known as e-waste. The current and the future production of e-waste, the potential environmental problems associated with their disposal and management practices are discussed whereas the existing e-waste management schemes in Greece and other countries (Japan, Switzerland) are also quoted.

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#### Introduction:-

In recent years, there has been increasing acknowledgment of our impact on the environment due to our fast lifestyle, while the need to adopt a more sustainable approach concerning of our actions, our consumption habits emerges as of particular significance. This trend regards industrial sectors affecting the consumption habits and, especially, electronic industry where the short life cycles and the rapidly developing technology have led to increased e-waste volumes. The majority of e-waste elements are led to landfills. However, their partial recyclability, due to their material composition along with the unavoidable restrictions in landfills, has led to the development of retrieval techniques for their recycling and re-use, highlighting the significance of e-waste recycling, not only from a waste management aspect but also from a valuable materials' retrieval aspect.

#### Electronics Helpful Vs Harmful



#### What is E-Waste:-

The electronics industry is the world's largest and fastest growing manufacturing industry [1]. In the last few years, it has played a significant part in socio-economic and technological growth of societies. The Basel convention

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defines wastes as substances or objects which are disposed of or are intended to be disposed of by the provisions of national laws.

“**Electronic waste** or **e-waste** describes discarded electrical or electronic devices. Used electronics which are destined for reuse, resale, salvage, recycling or disposal are also considered e-waste. Informal processing of e-waste in developing countries can lead to adverse human health effects and environmental pollution.

Electronic scrap components, such as CPUs, contain potentially harmful components such as lead, cadmium, beryllium, or brominated flame retardants. Recycling and disposal of e-waste may involve significant risk to workers and communities in developed and developing countries<sup>[2]</sup> and great care must be taken to avoid unsafe exposure in recycling operations and leaking of materials such as heavy metals from landfills and incinerator ashes.<sup>[3]</sup>”

**List of major Hazardous components of E-waste:-**

E-Waste Component	Processed Used	Adverse Health Effects
Americium	The radioactive source in smoke alarms. <sup>[5]</sup>	It is known to be carcinogenic
Lead	Solder, CRT monitor glass, lead-acid batteries, some formulations of PVC. A typical 15-inch cathode ray tube may contain 1.5 pounds of lead, but other CRTs have been estimated as having up to 8 pounds of lead.	Adverse effects of lead exposure include impaired cognitive function, behavioral disturbances, attention deficits, hyperactivity, conduct problems and lower IQ. These effects are most damaging to children whose developing nervous systems are very susceptible to damage caused by lead, cadmium, and mercury.
Mercury	Found in fluorescent tubes (numerous applications), tilt switches (mechanical doorbells, thermostats), <sup>[8]</sup> and flat screen monitors.	Health effects include sensory impairment, dermatitis, memory loss, and muscle weakness. Exposure in-utero causes fetal deficits in motor function, attention and verbal domains. <sup>[6]</sup> Environmental effects in animals include death, reduced fertility, and slower growth and development.
Cadmium	Found in light-sensitive resistors, corrosion-resistant alloys for marine and aviation environments, and nickel-cadmium batteries. The most common form of cadmium is found in Nickel-cadmium rechargeable batteries. These batteries tend to contain between 6 and 18% cadmium. The sale of Nickel-Cadmium batteries has been banned in the European Union except for medical use. When not properly recycled it can leach into the soil, harming microorganisms and disrupting the soil ecosystem. Exposure is caused by proximity to hazardous waste sites and factories and workers in the metal refining industry.	The inhalation of cadmium can cause severe damage to the lungs and is also known to cause kidney damage. <sup>[7]</sup> Cadmium is also associated with deficits in cognition, learning, behavior, and neuromotor skills in children
Hexavalent chromium	Used in metal coatings to protect from corrosion.	A known carcinogen after occupational inhalation exposure. <sup>[6]</sup> There is also evidence of cytotoxic and genotoxic effects of some chemicals, which have been shown to inhibit cell proliferation, cause cell membrane lesion, cause DNA single-strand breaks, and elevate Reactive Oxygen Species (ROS) levels.

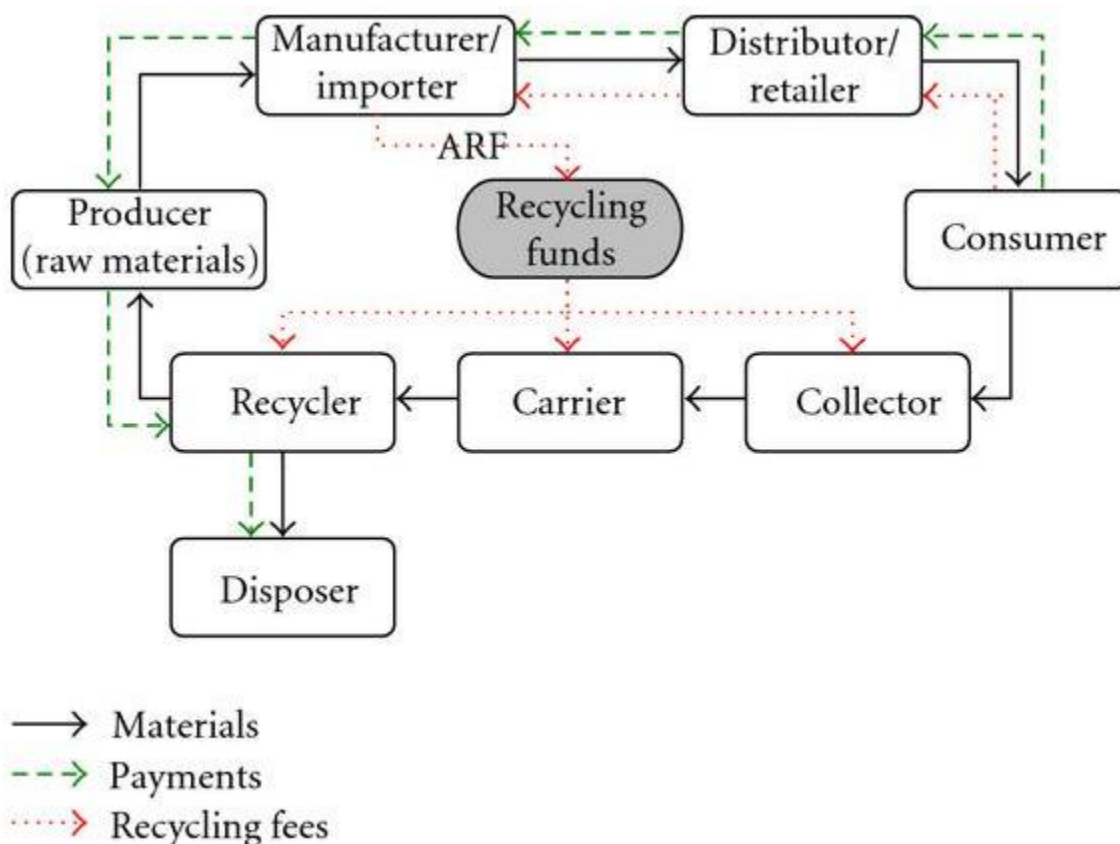
Sulphur	Found in lead-acid batteries.	Health effects include liver damage, kidney damage, heart damage, eye and throat irritation. When released into the environment, it can create sulphuric acid through sulphur dioxide.
Brominated Flame Retardants (BFRs)	Used as flame retardants in plastics in most electronics. Includes PBBs, PBDE, DecaBDE, OctaBDE, PentaBDE.	Health effects include impaired development of the nervous system, thyroid problems, liver problems. <sup>[9]</sup> Environmental effects: similar effects as in animals as humans. PBBs were banned from 1973 to 1977 on. PCBs were banned during the 1980s.
Beryllium oxide	Filler in some thermal interface materials such as thermal grease used on heatsinks for CPUs and power transistors, <sup>[11]</sup> magnetrons, X-ray-transparent ceramic windows, heat transfer fins in vacuum tubes, and gas lasers.	Occupational exposures associated with lung cancer, other common adverse health effects are beryllium sensitization, chronic beryllium disease, <sup>[10]</sup> and acute beryllium disease. <sup>[10]</sup>

**Generally non-hazardous:-**

E-Waste Component	Process Used
Copper	copper wire, printed circuit board tracks, component leads.
Zink	plating for steel parts.
Aluminium	nearly all electronic goods using more than a few watts of power (heatsinks), electrolytic capacitors.
Germanium	1950s–1960s transistorized electronics (bipolar junction transistors).
Gold	connector plating, primarily in computer equipment.
Tin	solder, coatings on component leads.

**The environmental impact of the processing of different electronic waste components<sup>[11]</sup>:-**

E-Waste Component	Process Used	Potential Environmental Hazard
Cathode ray tubes (used in TVs, computer monitors, ATM, video cameras, and more)	Breaking and removal of yoke, then dumping	Lead, barium and other heavy metals leaching into the ground water and release of toxic phosphor
Printed circuit board (image behind table – a thin plate on which chips and other electronic components are placed)	De-soldering and removal of computer chips; open burning and acid baths to remove metals after chips are removed.	Air emissions and discharge into rivers of glass dust, tin, lead, brominated dioxin, beryllium cadmium, and mercury
Chips and other gold plated components	Chemical stripping using nitric and hydrochloric acid and burning of chips	PAHs, heavy metals, brominated flame retardants discharged directly into rivers acidifying fish and flora. Tin and lead contamination of surface and groundwater. Air emissions of brominated dioxins, heavy metals, and PAHs
Plastics from printers, keyboards, monitors, etc.	Shredding and low temp melting to be reused	Emissions of brominated dioxins, heavy metals and hydrocarbons

**Process of E-waste:-**

Source: E-waste Inventory Project in Malaysia Report, 2009

**E-waste Global scenario:-**

As far as global e-waste management is concerned, Switzerland is the first country to implement the organized e-waste management system in the world. Extended Producer Responsibility (EPR) and Advance Recycling Fee (ARF) are the backbone of e-waste management system in Switzerland and other developed countries. Advanced countries like USA, UK, France & Germany generate 1.5 to 3 million tons of e-Waste annually and are among the largest generators of e-Waste. But these countries also have standardized e-waste management processes in place. Proper e-Waste management, from efficient sourcing and collection right upto extraction and disposal of material, has ensured that this huge pile of junk turns into a lucrative business opportunity.

**E-Waste Scenario in India:-**

Increased usage of gadgets, telecom, information and technology and appliances is collectively creating nearly 13 lakh tons of e-Waste annually in India according to an August 2014 report by the industrial body ASSOCHAM. The report also highlighted that Delhi-NCR, Mumbai and the IT capital of India, Bengaluru collectively produce over 2 lakh tons of e-Waste per year. Another January 2015 report from Markets and Research has forecast that the Indian e-Waste market will grow at 26.22% CAGR during 2014-2019. However, with so much electronic waste being generated in the country, a major portion is handled by the informal or unorganized sector using improper processes, which leads to environmental pollution and health hazards.

**Unorganized e-Waste Processing in India – An Environmental Hazard<sup>[12]</sup>:-**

Majority of the e-waste comprises computers, while telecom, electrical gadgets and health equipment account for the remainder. Apart from various toxic substances like lead, mercury and arsenic, electronic waste also contains valuable substances like gold, silver and rare earth elements. When it comes to managing e-waste, India is relying heavily on the unorganized sector which accounts for over 90 per cent of the entire e-waste recycling industry. Unorganized setups generally employ low paid workers, including over 4.5 lakh children (ASSOCHAM report), who are not trained properly to process e-waste. Working conditions in these informal e-scrap processing setups are

gravely hazardous. Dismantling or recycling of e-waste in the informal sector using crude and primitive methods with bare hands and no facemasks, like acid stripping and open air incineration releases numerous lethal components like polyvinyl chloride, chlorofluorocarbons, arsenic, nickel and barium, among others, into the environment causing medical conditions like cancer, asthma, bone diseases and brain diseases. Majority of the global waste is produced by the developed nations. Recycling of e-Waste in western countries is exponentially high as compared to developing nations like India which have abundant space to absorb any kind of waste. It is ten times cheaper to ship electronic waste to Asia than recycling for USA. United States of America (42%) tops the list of nations from which India imports e-Waste followed by China (30%) and European Union (18%) as reported in the ASSOCHAM paper. Import of e-waste for recycling is prohibited in India – however, according to a MAIT-GTZ survey 50,000 tons of electronic scrap is imported annually through miss declaration by companies making India one of the biggest yards of e-waste.

#### **Need for the Guidelines for Environmentally Sound Management:-**

Environmentally sound recycling/re-processing<sup>[14]</sup> of e-waste starts with decontamination/ dismantling where the concentration of hazardous material/chemical is reduced followed by recycling and recovery of the material of economic value and then disposal of the residue in TSDF (Treatment, storage & Disposal facility). The second category equipment like refrigerators, air conditioners and washing machines primarily contain steel plastics and copper wiring. It also contains potentially harmful substance such as CFCs/HCFs gases which have high ozone depletion potential. The compressor oils are hazardous waste that need proper disposal at TSDFs or can be processed in cement kilns. Environmentally sound recycling is required to ensure safe collection and disposal of these substances.

MoEF/CPCB after consulting various stake holders felt the need for preparing a guidance document for implementation of the provisions of the E-Waste (Management & Handling) Rules, 2011 that may help the Producers, Consumer & Bulk Consumer, Collection Center, Dismantler, Recycler and Regulatory agencies (SPCBs/PCCs) for effective compliance/implementation of these rules. This document also provides guidance on setting up collection mechanism, dismantling and recycling operations. As the E-waste Rules place main responsibility of e-waste management on the producers of the electrical and electronic equipment by introducing the concept of “extended producer responsibility”(EPR). The scope of implementing such EPRs is also discussed in these guidelines.

#### **The collection centre has to comply with following legal requirements:-**

- To obtain an authorization from the concerned SPCBs/PCCs
- To ensure that the e-waste collected by them is sent to registered dismantlers or recyclers in a secured manner.
- To maintain records of the e-waste handled in Form 1
- To file annual returns in Form 2
- To make the records available for scrutiny by the SPCBs/PCCs

#### **Conclusion:-**

Despite the various new technologies that are emerging for e-waste disposal, landfilling still remains the most common practice in the society. The establishment and closure of landfills could pose a potential hazard to ground water, due to leachate seepage, and air quality due to gases released. Unless proper maintenance and management is sustained for a fairly long time (30 years), public health may be compromised as a result. Such management is costly and potentially dangerous if faulty. Thus, a safer and more sustainable approach may be used for minimizing the number of landfills constructed and insuring their longevity so as not to continue taking viable land for waste disposal. It is therefore critical to divert waste from landfills through reduction and recycling.

**References:-**

1. Joseph. K, "Electronic Waste Management in India– Issues and Strategies", Eleventh
2. Sakar, Anne. "Dad brought home lead, kids got sick".
3. Sthiannopkao S, Wong MH. (2012) Handling e-waste in developed and developing countries practices, and consequences. Sci Total Environmental initiative
4. Morgan, Russell (21 August 2006). "Tips and Tricks for Recycling Old Computers". SmartBiz. Retrieved 17 March 2009.
5. "Americium, Radioactive". TOXNET Toxicology Data Network.
6. Chen, A., Dietrich, K. N., Huo, X., & Ho, S.-m. (2011). Developmental Neurotoxicants in E-Waste: An Emerging Health Concern. Environmental Health Perspectives , 119 (4), 431–438.[7]"Cadmium (Cd) – Chemical properties, Health and Environmental effects". Lenntech.com. Retrieved 2 June 2014.
7. "Question 8" (PDF)
8. "Brominated flame retardants: Cause for concern?" (PDF). Environmental Health Perspectives. **112**. 2004. PMC 1241790
9. <https://www.osha.gov/SLTC/beryllium/healtheffects.html>.
10. Wath, S. B., Dutt, P. S., & Chakrabarti, T. (2011). E-Waste scenario in India, its management and implications. Environmental Monitoring and Assessment, pp. 172, 249–262.
11. Attero current scenario 2014.
12. GUIDELINES FOR ENVIRONMENTALLY SOUND MANAGEMENT OF E-WASTE (As approved vide MoEF letter No. 23-23/2007-HSMd dt. March 12, 2008)
13. <http://www.cpcb.nic.in/ImplimentationE-Waste>





### RESEARCH ARTICLE

#### HERNIE INCISIONELLE POST-CŒLIOSCOPIQUE ETRANGLEE : A PROPOS D'UN CAS.

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Incisionnal hernia, coelioscopy, diagnosis, prevention.

#### Abstract

The post-laparoscopic incisional hernias are uncommon complications whose incidence has increased with the development and widening of indications for laparoscopy. Their diagnosis must be evoked clinically in front of any atypical parietal signs or occlusive table, confirmed in imaging. Their management depends on the seat and the hernial content. The prevention consists in preventing the worsening of the parietal defect induced by the trocars or the early tensioning of the abdominal wall.

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#### Introduction:-

Le développement de la cœlioscopie et l'élargissement de ses indications, ces dernières années, ont fait largement diminuer le nombre des complications classiques de la laparotomie. Toutefois, les hernies incisionnelles post-cœlioscopiques (HIPC) ou sur orifice de trocart restent peu fréquentes. Nous rapportons le cas d'une observation illustrant cette affection tout en rappelant les éléments de leur diagnostic, les facteurs prédisposant et les moyens de leur prise en charge.

#### Observation:-

Il s'agit d'une patiente âgée de 24 ans qui était opérée, 06 jours auparavant, pour kyste ovarien droit par cœlioscopie et qui présentait un syndrome occlusif. Le bilan biologique montrait un discret syndrome inflammatoire peu spécifique. L'échographie objectivait un épanchement péritonéal de moyenne abondance. La TDM abdominale mettait en évidence l'hernie d'une anse grêlique à paroi légèrement épaissie et rehaussée après injection de PDC iodé à travers un défaut pariétal latéral gauche avec une distension des anses grêliques, des niveaux hydro-aériques de type grêliques et une ascite de moyenne abondance sans signes de d'ischémie intestinales (**figures 1 et 2**). Le diagnostic d'une occlusion grêlique sur hernie incisionnelle étranglée post-cœlioscopique était posé. L'exploration chirurgicale objectivait l'incarcération d'une anse grêlique dans l'orifice du trocart latéral gauche. L'anse était rose sans signes de souffrance ou de nécrose visibles. L'anse avait été réintroduite avec fermeture pariétale. Les suites opératoires étaient simples avec bonne évolution clinique.

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**Iconographies :**

Figure 1:- Hernie d'une anse grélique a paroi légèrement épaissie et rehaussée après injection de PDC à travers un défaut pariétal latéral gauche.

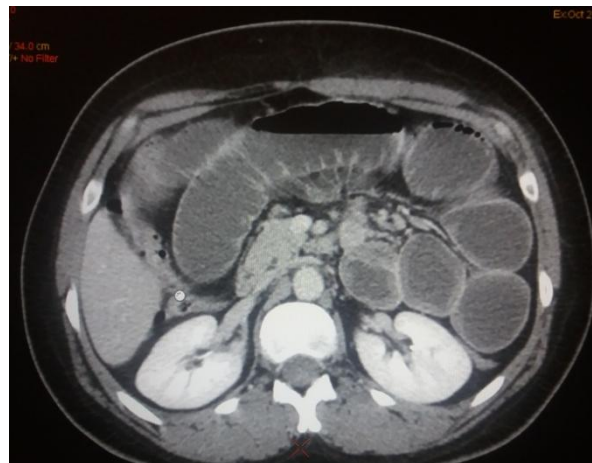


Figure 2:- Aspect TDM d'une distension des anses grêliques avec niveaux hydro-aériques.

**Discussion:-**

Les hernies post-coelioscopiques (HPIC) ou sur orifice de trocart sont des complications peu fréquentes avec une incidence approximative de 1 % [1,2]. Leur survenue est directement liée au diamètre du trocart utilisé [3]. Elles se voient le plus souvent avec des trocarts de diamètre supérieur ou égal à 10 mm [2,4]. Les manipulations répétitives, les interventions prolongées, les manœuvres de repositionnement et les extractions des pièces opératoires par les orifices provoquent des lésions de diamètre supérieur à celui du trocart lui-même [2]. De même, l'utilisation de trocarts coniques entraînerait moins d'HPIC que les trocarts coupants du fait de leur effet délabrant moindre [6]. Les HPIC ombilicales représentent 31 % des cas publiés [6]. Ceci s'explique par la faiblesse de cette zone anatomique et son potentiel herniaire, majorés par la présence d'une hernie ombilicale préexistante à l'intervention chirurgicale. En dehors de l'ombilic et de la ligne blanche, le risque herniaire est moindre. Cependant, l'évolution de la coelioscopie et l'élargissement de ces indications ont poussé vers des procédures plus complexes et une utilisation de trocarts opératoires et donc des manipulations itératives et prolongées dans ces orifices induisant des lésions plus larges [6,7]. Ces HPIC sont dans la plupart des cas symptomatiques et se voient généralement dans les jours ou les semaines qui suivent l'acte chirurgical. C'est le cas chez notre patiente. Le tableau clinique peut correspondre à une douleur pariétale simple, une voussure ou carrément un syndrome occlusif. Ce dernier était le mode révélateur dans notre cas. Toutefois, certains cas peuvent être asymptomatiques, diagnostiqués lors d'un examen systématique. Le contenu intra-herniaire dépend de la position du trocart incriminé. L'intestin grêle est le plus souvent concerné. L'incarcération du grand épiploon vient en seconde position avec 23 % des cas, celle du colon est beaucoup plus rare. Le diagnostic des HPIC est souvent clinique. L'échographie, ou mieux le scanner, permet de confirmer le diagnostic en montrant l'issue du sac herniaire à travers le défaut pariétal incisionnel, d'étudier son contenu et de



chercher d'éventuels signes d'occlusion ou de souffrance imposant une prise en charge chirurgicale [6]. La TDM a permis de poser le diagnostic chez notre patiente, de faire le bilan lésionnel et d'orienter la conduite thérapeutique.

La plupart des cas publiés ont nécessité une réintervention chirurgicale [1,6]. La laparotomie reste la voie d'abord la plus utilisée. Toutefois, des voies coelioscopiques ont été utilisées avec succès [6]. Certaines mesures de prévention ont été préconisées pour éviter la survenue de ces hernies. En préopératoire, la palpation de l'ombilic et la programmation d'une cure chirurgicale de toute hernie ombilicale sont systématiques [8]. En peropératoire, il est préférable d'utiliser des trocars de petit diamètre, d'éviter les manœuvres itératives et de repositionnement ainsi que l'extraction des pièces opératoires par les orifices étroits. Il est aussi souhaitable de s'assurer de l'évacuation du pneumopéritoine, en fin de l'intervention, pour éviter l'expulsion du contenu abdominal avec le CO<sub>2</sub> lors de l'ablation des trocars [2,3, 4]. La fermeture de la paroi semble être l'élément essentiel de cette prévention, elle est généralement admise pour les trocars de diamètre supérieur ou égal à 10 mm [6,9, 10]. Elle consiste couramment en la fermeture de l'aponévrose par un ou deux points. Pour cela plusieurs techniques de fermetures ont été proposées mais aucune n'est approuvée. Il est également recommandé aux patients d'éviter tout effort de port ou de sport dans le mois qui suit l'intervention [11].

### **Conclusion:-**

Les HIPC sont une complication dont l'incidence réelle est méconnue. Leur diagnostic doit être évoqué devant tous signes pariétaux inhabituels ou syndrome occlusif chez un patient ayant subi une intervention récente par coelioscopie. Leur prévention repose sur des mesures évitant d'aggraver le défaut pariétal, induit par le trocar, ou de mettre en tension précoce une paroi cicatricielle.

### **Conflits d'intérêt:-**

Les auteurs déclarent ne pas avoir de conflits avec ce manuscrit.

### **Contributions des auteurs:-**

Tous les auteurs ont lu et approuvé la version finale du manuscrit

### **References:-**

1. Montz FJ, Holshneider CH, Numro MG. Incisionnal hernias following laparoscopy a survey of the American Association of Gynecologic Laparoscopists. *Obstet Gynecol* 1994 ; 84: 881-4.
2. Boike G, Miller C, Spirtos N, Mercer L, Fowler J, Summit R, et al. Incisionnal bowel herniations after operative laparoscopy : a series of 19 cases and review of the literature. *Am J Obstet Gynecol* 1995 ; 172 : 1726-33.
3. Chang FH, Lee CL, Soog YK. Extra-umbilical incisional hernias after operative laparoscopy : prevention and management. *Int J Obstet Gynecol* 1994 ; 45 : 161-2.
4. Hogdall C, Roosen JU. Incarcerated hernia following laparoscopy. *Acta Obstet Gynecol Scand* 1987 ; 66 : 735-6.
5. Leibl BJ, Schmedt CG, Schwarz J, Kraft K, Bittner R. Laparoscopic surgery complications associated with trocar type design : review of literature and own results. *J Laparoendosc ADV Surg Tech A* 1999 ; 9 : 135- 40.
6. Loriau J, Manaouil D, Verhaeghe P. coelioscopie : les éventrations sur orifices de trocars. *Ann Chir* 2002 ; 127 : 252-6.
7. Lajer H, Widecrantz S, Heisterberg L. Hernias in trocar ports following abdominal laparoscopy. *Acta Obstet Gynecol Scand* 1997 ; 76 : 389-93.
8. Azurin D, Go LS, Arroyo LR, Kirkland ML. Trocar site herniation following laparoscopic cholecystectomy and the significance of an incidental preexisting umbilical hernia. *Am Surg* 1995 ; 8 : 718-20.
9. Kiilholma P, Makinen J. Incarcerated Richter's hernia after laparoscopy. *Eur J Obstet Gynecol Reprod Biol* 1998 ; 28 : 75-7.
10. Sauer M, Jarret JC. Small bowel obstruction following diagnostic laparoscopy. *Fertil Steril* 1984 ; 42 : 653-4.
11. Plaus W. laparoscopic trocar site hernias. *J Laparoendosc Surg* 1993 ; 3 : 567-70.



### RESEARCH ARTICLE

## AUTOGENOUS VERSUS COMPOSITE GRAFT FOR THE AUGMENTATION OF ANTERIOR MAXILLA PRIOR TO IMPLANT PLACEMENT – A COMPARATIVE STUDY.

Dr. JADHAV PRANAVI, Dr. DHUSHYANTH PAUL, Dr. ANMOL AGARWAL

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#### Key words:-

Augmentation, Atrophic maxilla, Autograft, Composite graft, Implant.

### Abstract

**Aim:** To evaluate the efficacy of autogenous and composite graft in anterior maxilla for implant placement.

**Material and methods:** A prospective, double blinded, randomised controlled study was conducted among 10 subjects between 2014 and 2015 who sustained injury due to road traffic accident associated with avulsion of anterior maxillary teeth and loss of labial cortical bone. These subjects were randomly categorized into two groups. Group A consisted of 5 subjects in whom autogenous chin graft was used to augment anterior maxilla while in Group B having another 5 subjects, composite graft (mixture of crushed alveolar bone and allograft - Bi-Oss powder) was used. All the patients were evaluated clinically for donor and recipient site morbidity, healing of soft tissue, and amount of bone formed with resorption pattern radiographically.

**Results:** There was no significant recipient site morbidity found in Group B, whereas in Group A all subjects manifested with mild swelling and pain (Visual analog scale score >3 on 10cm scale) and 1 subject has mild paresthesia of lower lip for few weeks.

**Conclusion:** Both the types of grafts used for augmentation of anterior maxilla prior to implant placement presented with the same amount of bone formation, graft resorption and healing of soft tissues. However, there was a difference noticed in recipient site morbidity and torque obtained which was in favour of using a composite graft.

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### Introduction:-

Alveolar bone resorption secondary to extraction or loss of tooth is a natural phenomenon. Intensity of resorption is greater in the cases with traumatic loss of the tooth especially maxillary anterior teeth which is usually associated with the loss of labial cortical bone as well. Such patients seeking for the replacement of their missing teeth, wish to choose an option which is next to natural. Dental implants over a period of last two decades have shown promising results in this field but in most of these cases clinicians encounter inadequate width and depth of the bone required for the successful placement of a dental implant. Normally also when it comes to the replacement of teeth in maxilla, it presents with a cancellous and D3 type of bone density, amount of resorption is also high especially in the maxillary anterior region, which is of more aesthetic concern to the patient. In patients with history of traumatic tooth loss especially in anterior maxilla, the situation is even worst. Initial stabilization of an implant is quite difficult to achieve in such cases.<sup>1,2</sup>

The present study was conducted to weigh merits and demerits of autograft over composite graft in 10 subjects who reported to our unit seeking replacement of missing teeth in anterior maxilla with dental implants.

### Materials and Methods:-

A prospective randomised study conducted in 10 subjects with history of loss of maxillary anterior teeth due to road traffic accident reported to our unit for rehabilitation with dental implant. Their age ranged between 24-32 years and were randomly categorized into Group A and Group B. In Group A, alveolar augmentation was done using autogenous chin block graft while in Group B augmentation was performed using composite particulate graft (mixture of alveolar bone and allograft - Bio-Oss). The parameters evaluated were ease of implant placement, pain, paraesthesia, vitality of associated teeth, cost, amount of bone formed, graft resorption 3 months postoperatively.

### Surgical technique:-

The surgical procedure was performed in sterile surgical field and after obtaining adequate anaesthesia. In Group A patients, for harvesting the graft a vestibular incision extending from mandibular first premolar on either side was given and mucoperiosteal flap is reflected. Piezo-osteotome was used to make osteotomy cuts following Rule of 5 i.e. maintaining 5mm safety margin from mental foramen on both sides, 5mm below apices of teeth and 5mm above lower border of mandible as shown in Figure 01.<sup>3</sup> The recipient site is exposed using a crestal incision and the harvested graft was placed followed by fixation using Titanium screw, perforations were made in the recipient site to induce bleeding and allow rapid take-up of the graft. After 3 months Titanium screws were removed and implant was placed. In Group B after exposing the recipient site, autograft was collected by nibbling or scrapping the adjacent alveolar bone which was then mixed with the allograft. This prepared composite graft is then positioned and secured with a collagen membrane and closure was done.

### Results:-

Among 10 subjects included in the study were randomly categorized into 2 groups. Group A in which autograft was used for augmentation, and Group B where composite graft (Alveolar graft mixed with Bio-Oss and Biomembrane) was used. Demographic data in both the groups was comparable. Mean age in Group A was 27.8 and in Group B 28.2 with no statistical significance. Etiology for loss of teeth in all individuals was road traffic accident involving anterior maxillary alveolus. Amount of bone was measured clinically and radiographically before and after augmentation. Preoperatively the mean available bone when measured clinically was 2-3mm (mean 2.6mm) and when measured radiographically using CBCT was 2-3mm (mean 2.2mm) in both the groups. 3 months postoperatively the amount of bone available was 8-10mm (mean 2.6) in group A and 6-8mm (mean 2.2mm) in group B which may be attributed to the more amount of autogenous bone harvested.

Obtaining alveolar bone mixing with Bio-Oss and Biomembrane was comparatively easily as it consumed less time, machine and manpower. Whereas, Autogenous graft obtained required Piezo-osteotome, consumed time and associated with postoperative morbidity at donor site. Therefore, the need to develop an allograft, alloplast, or xenograft substitute is widely recognized.<sup>4</sup>

To utilise properties of both autograft and allograft we have preferred using composite graft (Alveolar bone along with Bio-Oss and Biomembrane) as a graft material. Bio-Oss and Biomembrane aids in formation of new bone as stated by Banwart JC et al.<sup>5</sup> After 3 months the recipient site was evaluated for amount of bone formed. Adequate bone height and width is formed clinically with mean of 8.8mm and radiographically mean of 8.8mm in Group A. In group B mean bone formed was 7.2mm clinically and 6.8mm radiographically. There was statistically significant difference in both groups clinically and radiographically 0.05mm and 0.02mm respectively as shown in Table 02. Implants were placed after 4 months. Mean torque obtained was 38mm and 33mm in group A and B respectively which was statistically significant (p 0.02) as shown in Table 03.

In all subjects there was ease in placement of implant. Postoperative swelling was measured both at recipient site and donor site 24<sup>th</sup>, 48<sup>th</sup> and 1 week duration. Postoperative swelling at recipient site was not statistically significant in both groups (0.072). There was no difference on 24<sup>th</sup> hr and 1 week postoperatively. However on 48<sup>th</sup> hr statistically significant difference in postoperative swelling at donor site was seen. (P- 0.011) In both the groups implants were placed successfully after 3 months of grafting. Postoperative paraesthesia was measured at both donor and recipient site. Amongst all 10 subjects one among them reported with mild paraesthesia for few weeks at recipient where block graft from chin was harvested for few weeks which was not statistically significant. (P

0.317). Postoperative pain at donor and recipient site was also not significant in either of the groups (P 0.134). Healing of soft tissue in either sites and groups was uneventful. (Table 01).



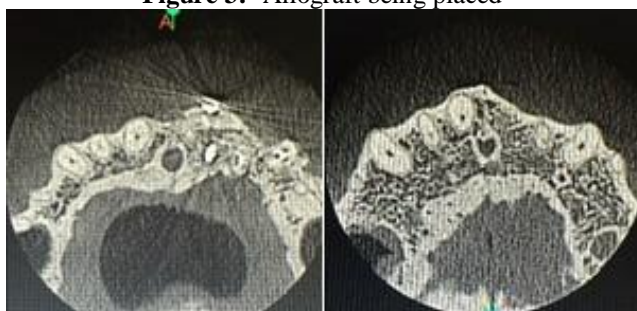
**Figure 1:-** Harvesting chin grafting following 'Rule of 5'



**Figure 2:-** Preparation of recipient site and fixation of graft using Titanium screw.



**Figure 3:-** Allograft being placed



**Figure 4:-** Adaptation of autograft and Composite graft

**Table 1:-** Distribution of subjects according to various parameters.

Variables		Group				p - value
		Autogenous graft		Composite graft		
		N	%	N	%	
Sex	Female	1	20	1	20	1
	Male	4	80	4	80	
Post operative swelling at recipient site	No	1	20	4	80	0.072
	Mild	4	80	1	20	
Post operative swelling at donor site	No	0	0	4	80	0.011*
	Mild	2	40	1	20	
	Moderate	3	60	0	0	
Post operativeparasthesia at donor site	Absent	4	80	5	100	0.317
	Present	1	20	0	0	
Pain at donor site	Absent	3	60	5	100	0.134
	Present	2	40	0	0	

**Table 2:-** Clinical and Radiographic parameters.

Variable	Group				P - value
	Group A		Group B		
	Mean	SD	Mean	SD	
Pre operative bone					
Clinical	2.6	0.54	2.6	0.54	1.00
Radiograph	2.2	0.44	2.2	0.44	1.00
Post operative bone					
Clinical	8.8	1.09	7.2	1.09	0.05*
Radiograph	8.8	1.09	6.8	1.09	0.02*

**Table 3:-** Distribution of subjects according to age and initial torque.

Variable	Group				P - value
	Autogenous graft		Composite graft		
	Mean	SD	Mean	SD	
Age (Years)	27.8	3.34	28.2	3.56	0.859
Initial torque (N-Cm)	38	2.73	33	2.73	0.02*

\*P &lt; 0.05

**Discussion:-**

The bone substitute needed for each bone regeneration procedure must be designated based on the individual's characteristics, and the surgical procedure itself. Features such as the osteogenic potential of the host residual bone, systemic condition of subjects and morphology of the defects, will delimit the ideal bone substitute for each situation. In maxilla, centripetal pattern of alveolar resorption, pneumatization of maxillary sinuses, presence of nasal fossae and nasopalatal duct, poor bone quality (D3) complicate implant placement.<sup>6</sup>

There are several methods available to augment the atrophic maxilla, including onlay bone grafting, sinus/nasal bone grafting, guided bone regeneration, interpositional grafting, ridge splitting, and distraction osteogenesis. The choice of a particular technique depends on the need for horizontal or vertical augmentation, degree of atrophy, type of prosthesis, and clinician or patient preference. Autogenous bone grafting offers a well-proven predictable method for ridge augmentation and defect repair for dental implant placement. There are several advantages of using autogenous bone grafts.<sup>7,8</sup>

Autogenous graft obtained can either be from intraoral sites or extraorally. Intraoral sites include chin, ramus of the mandible, maxillary tuberosity, anterior nasal spine, alveolar ridge, tori etc which can provide upto 3-11cc of bone volume. Extraoral sites include iliac crest, fibula, tibia etc and provides upto bone volume of 25-150cc.<sup>7,9</sup> Composite

graft can be obtained by combination of autogenous graft harvested from any intraoral or extraoral site combining it with Bio-oss and Biomembrane.

The structure of the bone harvested affects how the graft will incorporate into the recipient site. Cortical block grafts heal through creeping substitution which means once the graft is fixed to the site, osteoclasts begin to resorb the graft material through existing Haversian systems which allows ingrowth of fibrovascular tissue and the secretion of osteoid by osteoblasts. Unlike cortical block grafts, particulate grafts begin with apposition of osteoid and fibrovascular ingrowth through the existing particulate scaffold. Apposition is then followed by resorption and replacement of graft material by more organized lamellar bone. Due to increased vascularization, particulate grafts have greater resorption of the transfer bone and a larger percentage of newly formed bone in comparison with cortical grafts.<sup>9</sup> This is in conjunction with the findings of the present study. In group B when particulate composite graft was used the amount of resorption of the graft was more as compared to group A.

Mish CM et al stated advantages of the symphysis graft compared with other bone regenerative methods for implant placement in maxillary alveolar defects and a superior quality of bone was found with shorter healing period. Easy access, availability of greater quantities of bone over other intraoral donor sites, low morbidity, no hospitalization, minimal discomfort, no alteration in ambulation and no cutaneous scar.<sup>8,10</sup>

However there are few limitations and difficulties which the subject may encounter, as stated by Jaime Clavero et al<sup>11</sup> i.e. stiffness and limited mobilization of the vestibule in the anterior mandibular area during the postoperative period. Some subjects also complained of numbness in the anterior mandibular incisors and canines and decreased sensitivity in the innervation area of the terminal mental nerve branches.

Yildirim M et al<sup>12</sup> stated that augmentation using a mixture of Bio-Oss and bone harvested intraorally from the mandibular symphysis, retromolar space, or the tuberosity region and concluded that the combination of osteoconductive Bio-Oss and osteoinductive autogenous bone thus proved to be a material suitable for augmentation.

Grafts harvested from membranous bone show less resorption than endochondral bone grafts. Furthermore, membranous cortical grafts revascularization is more rapid than endochondral bone grafts. Therefore, embryological origin of donor bone is an important factor for a successful recovery period.<sup>13,14,15</sup>

Hising P et al<sup>16</sup> stated that from the time of implant placement and irrespective of loading time, a survival rate of 80.5% for the individual implants was estimated. In most patients (73%), Bio-Oss was mixed with autogenous bone from the chin. However, the results indicated that autogenous bone may be excluded from the Bio-Oss graft.

Healing of bone grafts takes place by either of the biological processes known as osteogenesis, osteoconduction and osteoinduction. Autogenous bone grafts take up by osteogenesis, osteoconduction and osteoinduction while alloplast is taken up by osteoconduction.<sup>9</sup>

In either of the cases postoperative healing of soft and hard tissue was uneventful. Both autograft and composite graft are equally effective with no significant donor site morbidity.<sup>17</sup> However, autograft has an edge over composite graft in providing adequate amount of bone.

### **Conclusion:-**

Dental implants being the most preferred option, has enhanced the usage of bone grafts and its substitutes. Both grafts were ideal in obtaining adequate bone volume, however the autogenous graft provided more bone volume. To conclude a combination of autograft and allograft (composite graft) gives adequate bulk of graft required and larger sample size and follow up is required.

**Conflict of Interest:-** None declared

**Patient consent:-** Informed and written consent taken  
Institutional ethical board committee clearance obtained.

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**References:-**

1. Brinemark P-I, Adell R, Albrektsson T, et al. An experimental and clinical study of osseointegrated implants penetrating the nasal cavity and maxillary sinus. *J Oral Maxillofac Surg* 1984; 42:497-505.
2. Lidstrom RD, Symington JM. Osseointegrated dental implants in conjunction with bone grafts. *Int J Oral Maxillofac Surg* 1988; 47:116-118.
3. Nicholas Toscano, Nicholas Shumaker, Dan Holtzclaw. The Art of Block Grafting A Review of the Surgical Protocol for Reconstruction of alveolar Ridge Deficiency. *J Implant Adv Clin Dent*. 2010;2:2.
4. Jensen OT, Greer R: Immediate placement of osseointegrating implants into the maxillary sinus augmented with mineralized cancellous allograft and Gore-Tex: Second-stage surgical and histologic findings, in Laney WR, Tolman DE (eds): *Tissue Integration in Oral OrthMaxillo Recon*. 1992; 322.
5. Banwart JC, Asher MA, Hassanein. Iliac crest bone graft harvest donor site morbidity: a statistical evaluation. *Spine*. 1995;20: 1055–1060.
6. Sorni Marco, Guarinos Juan et al (2005) Implant rehabilitation of the atrophic upper jaw: a review of the literature since 1999. *Med Oral Patol Oral Cir Bucal* 10:E45–E56.
7. Misch CM. Autogenous bone grafting for dental implants. In: Fonseca RJ, Turvey TA, Marciani RD, editors. 2nd edition. *Oral and maxillofacial surgery*, vol. 1. Philadelphia: W.B. Saunders Co; 2008. p. 344–70. Chapter 24.
8. Misch CM, Misch CE, Resnik RR, Ismail YH. Reconstruction of maxillary alveolar defects with mandibular symphysis grafts for dental implants: a preliminary procedural report. *Int J Oral Maxillofac Implants*. 1992;7(3):360-6
9. Harry Dym, David Huang, Avichai Stern Alveolar Bone Grafting and Reconstruction Procedures Prior to Implant Placement. *Dent Clin N Am*. 2012;56:209–218.
10. Zouhary K. Bone graft harvesting from distant sites: concepts and techniques. *Oral Maxillofac Surg Clin North Am* 2010;22(3):301–14.
11. Jaime Clavero, Stefan Lundgren, Ramus or Chin Grafts for Maxillary Sinus Inlay and Local Onlay Augmentation: Comparison of Donor Site Morbidity and Complications. *Clin Implant Dent Rel Res*, 2003; 5, 3.
12. Yildirim M, Spiekermann H, Handt S, Edelhoff D. Maxillary sinus augmentation with the xenograft Bio-Oss and autogenous intraoral bone for qualitative improvement of the implant site: a histologic and histomorphometric clinical study in humans. *Int J Oral Maxillo Implants*, 2001; 16(1):23-33.
13. Misch CM, Misch CE, Resnik RR. Reconstruction of maxillary alveolar defects with mandibular symphysis grafts for dental implants: A preliminary procedural report. *Int J Oral Maxillofac Implants* 1992; 7:360,
14. DoganDolanmaz, AlparslanEsen, GulsunYildirim, and OzgurInan. The use of autogenous mandibular bone block grafts for reconstruction of alveolar defects. *AnnMaxillofac Surg*. 2015; 5(1): 71–76.
15. Ozaki W, Buchman SR. Volume maintenance of onlay bone grafts in the craniofacial skeleton: Micro-architecture versus embryologic origin. *PlastReconstr Surg*. 1998;102:291–9
16. Hising P, Bolin A, Branting C The Private Clinic of Oral and Maxillofacial Surgery. *Int J Oral Maxillo Implants* 2001; 16(1):90-97.
17. Nicola U. Zitzmann Treatment of Angular Bone Defects with a Composite Bone Grafting Material in Combination with a Collagen Membrane. *J Periodontol* 2003, Vol. 74, No. 5, 687-694.





### RESEARCH ARTICLE

#### PHASE TRANSITION IN $^{40}_{20}\text{Ca}$ AND $^{46}_{20}\text{Ca}$

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Phase transition  
Specific heat.

#### Abstract

Thermodynamic properties of  $^{40}_{20}\text{Ca}$  and  $^{46}_{20}\text{Ca}$  have been calculated using an intergrated nuclear model substituted into the specific heat capacity formula. The transition temperature is obtained from the graphs of specific heat verses temperature. The transition temperature for  $^{40}_{20}\text{Ca}$  is  $1.9 \times 10^9 \text{ K}$  and  $2.31 \times 10^9 \text{ K}$  for  $^{46}_{20}\text{Ca}$ .

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#### Introduction:-

The properties and structure of an atomic nuclei are highly dependent on mass number (A) and on the ratio between the number of protons and the number of neutrons in the nucleus (Kenneth *et al*, 2002) since discovery of atomic nucleus, considerable efforts have been exerted to construct a general theory of the nucleus that would cover the entire range of known nuclei and have strong predictive power.

In infinitely extended nuclear systems such as neutron star matter and nuclear matter, such as neutron star matter and nuclear matter, the study of superfluidity and pairing has a long history (Cooper *et al*, 1959, Emery *et al*, 1960, Migdal 1959, Khanna 1962) even predating the 1967 discovery of pulsars (Hewish *et al*, 1968) which were soon identified as rapidly rotating magnetic neutron stars.

#### Material and Methods:-

The intergrated nuclear model (Ghahramany *et al*, 2001) predicts the binding energy based on some principles proposed by Weizsacker (Greenwood and Cottingham, 2001). It presents nuclear binding energy of all elements based on the following assumptions;

- 1) The nuclear binding energy is of the order of about one percent of the energy of the total rest mass of the constituent nucleons (Greenwood and Cottingham, 2001).
- 2) The nuclear binding energy is proportional to the volume of the nuclides ( $B \propto A$ )
- 3) The nuclear binding energy depends upon the asymmetry between the number of protons and neutrons (specially in heavy nuclides) and also depends upon the coulomb repulsion force between protons.

The binding energy is expressed as

$$B(Z, N) = \left\{ A - \left( \frac{(N^2 - Z^2) + \delta(N - Z)}{3Z} + 3 \right) \right\} \frac{mNC^2}{\alpha}, A > 5, \quad (1)$$

And

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$$\delta(N-Z) = \begin{cases} 0 & \text{for } N \neq Z. \\ 1 & \text{for } N = Z. \end{cases} \quad (2)$$

Where  $\alpha$  is defined as an adjusting coefficient,  $\alpha = 90 - 100$ ,  $\delta$  stands for nuclear beta-stability line condition.

The temperature dependence is introduced by use of thermal activation factor  $e^{-B/KT}$ . The net energy of the nuclei is written as

$$E = Be^{-B/KT} \quad (3)$$

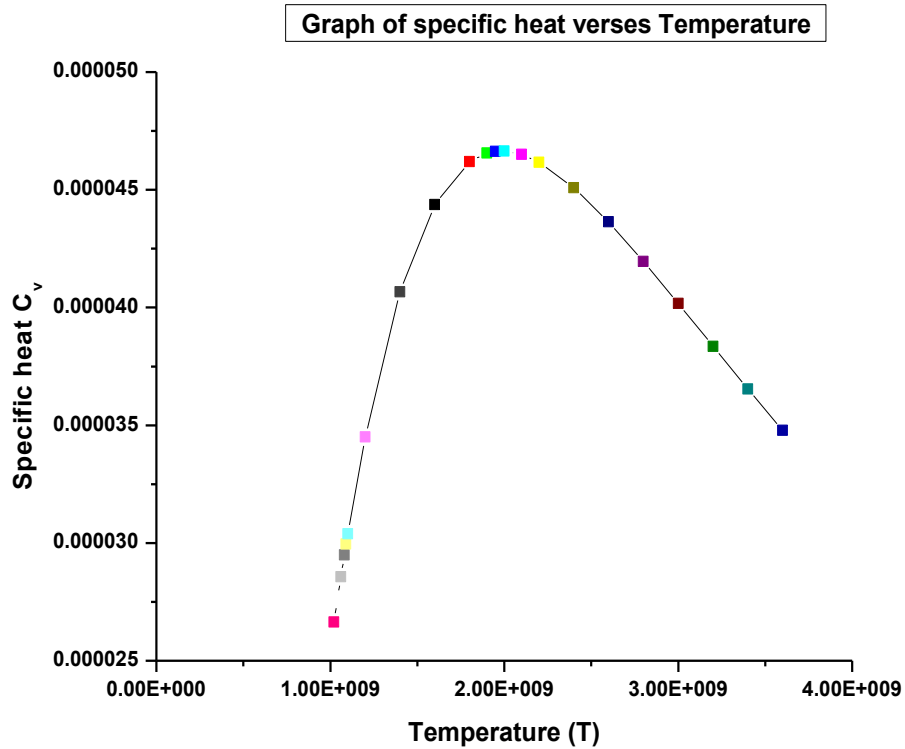
$$\text{The specific heat capacity is given as } C_v = \frac{B^2}{KT^2} e^{-B/KT} \quad (4)$$

$$\text{The transition temperature is derived from equation (4) and is given as } T_c = \frac{B}{2K} \quad (5)$$

### Result and Discussion:-

i)  ${}^{40}_{20}\text{Ca}$

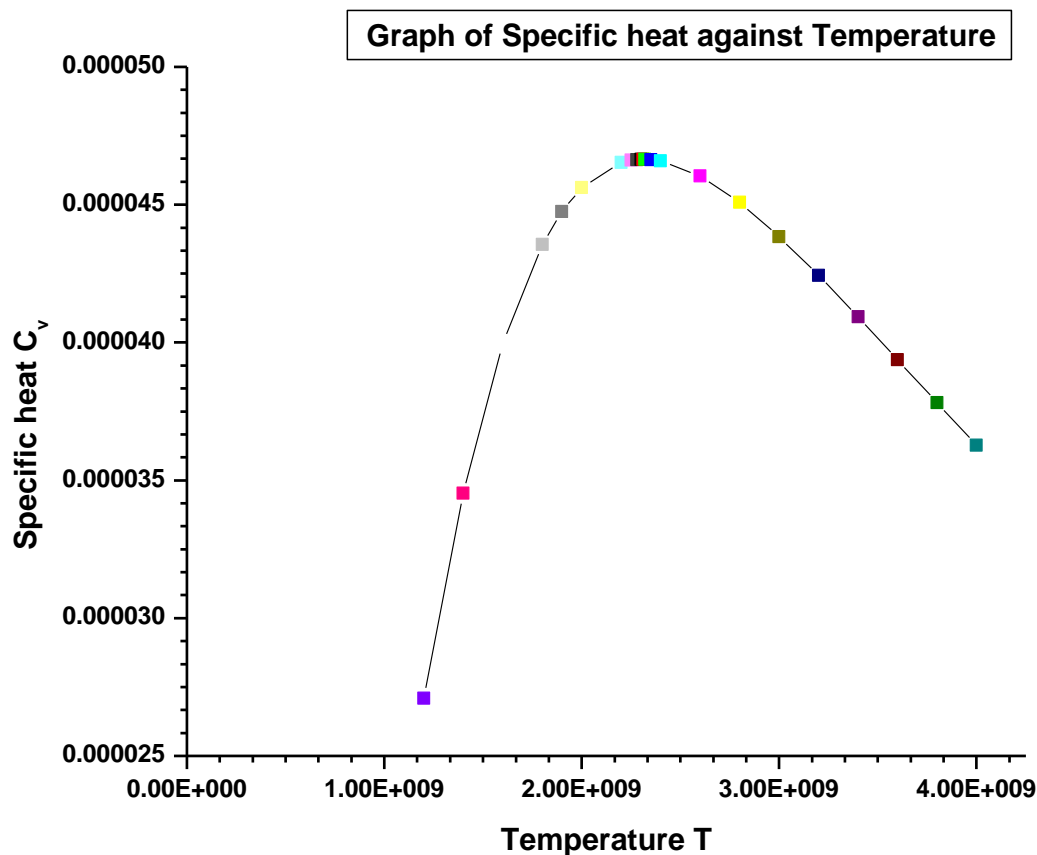
Temperature (T)	Specific heat ( $C_v$ )
1020000000	2.66E-05
1040000000	2.76E-05
1060000000	2.86E-05
1080000000	2.95E-05
1090000000	2.99E-05
1100000000	3.04E-05
1200000000	3.45E-05
1400000000	4.07E-05
1600000000	4.44E-05
1800000000	4.62E-05
1900000000	4.66E-05
1950000000	4.66E-05
2000000000	4.66E-05
2100000000	4.65E-05
2200000000	4.62E-05
2400000000	4.51E-05
2600000000	4.36E-05
2800000000	4.2E-05
3000000000	4.02E-05
3200000000	3.84E-05
3400000000	3.65E-05
3600000000	3.48E-05



The transition temperature is  $1.9848 \times 10^9 \text{ K}$  as depicted from the graph above, this value is the same as one found from equation (5). The shape of the graph resembles an s-shape and is non linear.

ii)  $^{46}_{20}\text{Ca}$

Temperature (T)	Specific heat ( $C_v$ )
1200000000	2.71E-05
1400000000	3.45E-05
1600000000	4E-05
1800000000	4.36E-05
1900000000	4.48E-05
2000000000	4.56E-05
2200000000	4.65E-05
2250000000	4.66E-05
2280000000	4.66E-05
2300000000	4.66E-05
2310000000	4.66E-05
2320000000	4.66E-05
2350000000	4.66E-05
2400000000	4.66E-05
2600000000	4.6E-05
2800000000	4.51E-05
3000000000	4.38E-05
3200000000	4.24E-05
3400000000	4.09E-05
3600000000	3.94E-05
3800000000	3.78E-05
4000000000	3.63E-05



The specific heat capacity versus temperature is a non-linear graph as shown in figure 2. The phase transition happens at  $2.31 \times 10^9 \text{ K}$ , this process is related to a liquid-gas phase transition. The transition temperature of  $^{46}_{20}\text{Ca}$  is slightly higher than that of  $^{40}_{20}\text{Ca}$  this may be attributed by the effect of even-even and even-odd.

### References:-

1. J. Kenneth Shultis and Richard E. Faw, "Fundamentals of nuclear sciences and engineering" 2002
2. Cooper, L. N., R. L. Mills, and A. M. Sessler, 1959, Phys. Rev. 114, 1377.
3. Emery, V. J., and A. M. Sessler, 1960, Phys. Rev. 119.
4. Migdal, A., 1959, Nucl. Phys. 13, 655.
5. Khanna, K. M., 1962, *On Superfluidity and phase transition in Atomic Nucleus*. Progress of theoretical Physics. Japan vol. 28, P205 and Proc of the National Institute of Sciences of India, Vol. 29 (1963) P 294.
6. Hewish, A., J. S. Bell, J. D. H. Pilkington, P. F. Scott, and R. A. Collins, 1968, Nature 217, 709.
7. N. Ghahramany, Sh. Gharaati, M. Ghanaatian. "New approach to nuclear binding energy in integrated nuclear model."
8. Cottingham W. N., Greenwood D. A. "An introduction to Nuclear physics." Cambridge. Cambridge Univ. Press, 2001
9. Von Weizsacker C. F. // Z. Physik. 1935. Vol 96, pp431.

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### RESEARCH ARTICLE

#### CHARACTERIZATION OF SOLIDUS STRUCTURES OF COMPOSITE MATERIALS.

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##### **Key words:-**

Alloy, crystal lamellae, moderate growth, lamellar growth, microstructures.

#### **Abstract**

Growth habits of composite materials from their respective molten states are established by scanning electron microscope and X-ray diffraction studies affirm composite alloys to be a terminal solidus solution of physically distinct and mechanical separable phases. Thermal stability of composite phases is ascertained using DSC. The solidification pattern of the individual constituent phases from the melt is comprehensively viewed and scanned after carefully studying the growth characteristics under scanning electron microscope (SEM). The microscopic observations reveal two types of growth habits of the homogeneous phases; one is edge-wise comprises of the round growth front lamellae distinctively termed nonfaceted lamellae and other is side-wise comprising of sharp growth front lamellae purposefully mentioned faceted lamellae. Evidentially, physical understanding of the single phase solidification predicts that the growth habits of combined constituent phases in binary, ternary and quaternary composite materials are discovered a composite of practically distinct and observable lamellae exploring three possible categories, namely nonfaceted-nonfaceted (nf-nf), faceted-faceted (f-f) and nonfaceted-faceted (nf-f). The classification of composite materials by growth of the lamellae of the homogenous phase in combination, verifies the J. D. Hunt and K. A. Jackson hypothesis.

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#### **Introduction:-**

A new classification of composites is proposed, based on the entropies of melting of the two composite phases. The classification is used to predict suitable transparent analogs of the metallic systems. Experimental confirmation was obtained consistent with the theoretical shape of the lamellar solidus-liquidus interface, for the fault mechanism of lamellar spacing changes, and for the development of low-energy solidus-solidus boundaries between the lamellae. An explanation is presented to account for the irregular and complex regular structures which are found in some composite systems. From experimental observations, single-phase materials can be divided into two groups according to their solidification characteristics, those that grow as faceted crystals and those that do not. Jackson's showed from thermodynamic reasoning that the type of growth depended on a factor  $\alpha$  which is almost the entropy of fusion in dimensionless units. Most non-metals have high entropies of fusion i.e.  $\alpha$  greater than 2 and grow with crystalline facets with sharp growth front. Most metals have low entropies of fusion i.e.  $\alpha$  less than 2 and grow almost isotropically with non facets implying with round growth front.

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The authors propose that multiphase composites may be classified in a similar manner. In binary phase composites there are three groups of composites, those in which constituent phases have low entropies of fusion ( $\alpha < 2$ ), those in which one of the phases has high entropy of fusion ( $\alpha > 2$ ) and the other phase with low entropy of fusion ( $\alpha < 2$ ) and those in which constituent phases have high entropies of fusion ( $\alpha > 2$ ). Exactly, the same hypothesis is adopted in the present work to classify multiphase composites. Lamellar or rodlike structures are formed in systems in which both phases have low entropies of melting. In these alloys dendrites of phases may be formed or when the composite alloy is rich in the relevant component. Examples are Pb-Sn, Sn-Cd, Pb-Cd, Sn-Zn, Al-Zn. Irregular or complex regular, structures are formed in alloys in which one phase has high entropy of fusion and the other phase has low entropy of fusion. Examples binary phase's composites are Al-Si, Pb-Bi, and Sn-Bi. When the alloys are rich in the low entropy of fusion phases, dendrites are formed; when the alloys are rich in the high entropy of fusion phases, faceted primary crystals are produced. These crystals are sometimes called hoppers or pseudo dendrites. In the present work, the term dendrite will only be used to describe nonfaceted primary crystals. Dendrites are not formed during solidification in high entropy of fusion single-phase materials. The third group of composite includes alloys in which the constituent phases have high entropies of fusion. Each phase grows with a faceted solidus-liquidus interface. Since most metals do not have high entropies of fusion, metallic examples in this composite group are rare. However, they may occur between some intermetallics, semiconductors or semimetals such as silicon, germanium, and bismuth. Metals and metal alloys may be strengthened and hardened by the uniform dispersion of several volume percent of fine particles of a very hard and inert material. The dispersed phase may be metallic or non-metallic and oxide materials are often used. Again, the strengthening mechanism involves interactions between the particles and dislocations within the matrix, as with precipitation hardening. The dispersion strengthening effect is not as pronounced as with precipitation hardening; however, the strengthening is retained at elevated temperature and for extended time periods because the dispersed particles are chosen to be unreactive with the matrix phase. For precipitation-hardened alloys, the increase in strength may disappear upon heat treatment as a consequence of precipitator growth or dissolution of the precipitator phase. The high-temperature strength of nickel alloys may be enhanced significantly by addition of about 3 vol% of thoria ( $\text{ThO}_2$ ) as finely dispersed particles; this material is known as thoria-dispersed (TD) nickel. The same effect is produced in the aluminium-aluminium oxide system. A very thin and adherent alumina coating is caused to form on the surface of extremely small (0.1 to 0.2  $\mu\text{m}$  thick) flakes of aluminium, which are dispersed within an aluminium metal matrix; this material is termed sintered aluminium powder (SAP).

## Experimental:-

### Materials and their thermal revelation:-

The composite alloys Al-Cd; Al-Sn; Al-Bi; Al-Pb; Al-Cd-Sn; Al-Cd-Bi and Al-Cd-Pb-Bi were prepared in the pyrex tubes by weighing variable amounts of purity 99.999% Al [Alfa Aesar, AR, mp 949 K,  $\Delta_f H = 10.80 \text{ kJmol}^{-1}$ ], 99.999% Cd [99.5%, Alfa Aesar, AR, mp 597 K,  $\Delta_f H = 6.20 \text{ kJmol}^{-1}$ ], 99.999% Sn [Alfa Aesar, AR, mp 509 K,  $\Delta_f H = 7.30 \text{ kJmol}^{-1}$ ], 99.999% Bi (Alfa Aesar, AR, mp 551 K,  $\Delta_f H = 11.20 \text{ kJmol}^{-1}$ ) and 99.999% Pb [Alfa Aesar, AR, mp 584 K,  $\Delta_f H = 4.70 \text{ kJmol}^{-1}$ ] shots with Al-Cd (60 wt % Al & 40 wt % Cd), Al-Sn (60 wt % Al & 40 wt % Sn), Al-Pb (60 wt % Al & 40 wt % Pb), Al-Bi (60 wt % Al & 40 wt % Bi), Al-Cd-Sn (40 wt % Al, 30 wt % Cd & 30 wt % Sn), Al-Cd-Bi (40 wt % Al, 30 wt % Cd & 30 wt % Bi) and Al-Cd-Bi-Pb (40 wt % Al, 20 wt % Cd, 20 wt % Bi & 20 wt % Pb). The melting temperatures and enthalpies of fusion of the constituent metals, cited in the parentheses, were obtained by thermal analysis approaching very closely to their literature values. The ampoule tubes were sealed under vacuum to avoid oxidation and subsequently infused in a furnace set at a temperature  $\sim 900 \text{ K}$  for alloying Al, Cd, Sn, Bi and Pb metals. Homogeneity of the alloys were ensured by heat-chill process keeping the temperature of the heater (air oven)  $\sim 700 \text{ K}$  and that of the cooler (water bath)  $\sim 300 \text{ K}$ . The liquidus temperatures of the composite alloys Al-Cd (597 K), Al-Sn (505 K), Al-Bi (555 K), Al-Pb (602 K), Al-Cd-Sn (457 K), Al-Cd-Bi (429 K) and Al-Cd-Bi-Pb (370 K) were also ascertained by thermal analysis. The corresponding enthalpies of fusion  $\Delta_f H$  and dimensionless entropies of fusion  $\alpha$ , (where  $\alpha = \xi \Delta S_f / R$ ,  $R$  is the gas constant which equal to  $8.314 \text{ Jmol}^{-1}\text{K}^{-1}$ ,  $\xi$  a crystallographic factor which is slightly less than but almost unity and  $\Delta S_f$ , the entropy of fusion) of the homogeneous materials are provided in the tabular form (Table 1). The computed dimensionless entropy  $\alpha$  is found less than 2 ( $\alpha > 2$ ) for Al, Cd, Sn and Pb metals which grow from their melt as non-faceted (nf) crystallites having round growth fronts, whereas  $\alpha$  is found exceeding 2 for Bi metal that grows from its melt as faceted (f) crystals implying the crystallite with the sharp growth front.

**Table 1:-** Computed  $\alpha$  values of homogeneous materials

Material	Melting point ( $T_m$ )K	$\Delta H_f$ (kJ mol <sup>-1</sup> )		$\Delta S_f = \Delta H_f / T_m$ (Jmol <sup>-1</sup> K <sup>-1</sup> )	$\alpha = \xi \frac{\Delta S_f}{R}$	Growth front
		Experiment	Literature			
		Value	Value			
Al	949	10.80	10.47	11.38	1.35	nf
Cd	597	6.20	6.19	10.39	1.25	nf
Sn	509	7.30	7.03	14.34	1.72	nf
Bi	551	11.20	11.30	20.33	2.45	f
Pb	584	4.70	4.80	8.05	0.97	nf

**Oriented growth:-**

Anisotropic solidification composite of the composite alloys and their constituent metals from respective molten state was achieved in the following experimental setup. An experimental sealed pyrex tube containing half-full melt of a freshly prepared composite or metal, was clamped to the centre of an empty graduated beaker (volume capacity ~1dm<sup>3</sup>) manipulated midmost in an air oven set at a temperature 30K higher than the melting temperature of the samples. The molten mass in the tube was nucleated by circulating silicone oil at 18 different intervals spanned in the time range 50-60 min from the oil reservoir perforated and plugged with a glass tube carrying valve to control the percolation at ~300K. The melt in the tube started nucleating when the rising level of the oil just touched the bottom of the tube. Several samples of the composites and constituent metals were grown anisotropically at different but nearly consistent growth rates determined by circulating approximately the same volume of the oil for the aforementioned intervals.

**Instantaneous solidification:-**

Isotropic growth was performed by immersing an experimental pyrex tube containing the composite or metal melt in an ice bath maintained at ~ 273 K. The growth being instantaneous in nature is presumed of zero order. Likewise, a good many samples of composite phases were solidified for the isotropic growth for observations.

**Non Faceted- Non Faceted (nf-nf, regular) composite materials:-**

Composite materials have low entropy of fusion ( $\alpha < 2$ ).

**Faceted-Faceted (f-f, irregular) composite materials:-**

Composite materials have high entropy of fusion ( $\alpha > 2$ )

**Non Faceted- Faceted (nf-f, complex regular) composite materials:-**

Composites materials in which atleast one of the constituent phases with low entropy of fusion ( $\alpha < 2$ ) or high entropy of fusion ( $\alpha > 2$ ) in comparison to other phases

**Simple lamellar or rod-type structures:-**

Simple lamellar or rod-type structures are only produced in composites in which the constituent phases have low entropy of fusion ( $\alpha < 2$ ).

**Complex regular structures:-**

Complex regular structures are obtained in composites wherein at least one of the constituent phases has entropy of fusion less than two ( $\alpha < 2$ ) and others may have entropies of fusion greater than two ( $\alpha > 2$ ).

**Coupled growth:-**

Coupled growth occurs in composites phases having entropy of fusion less than two ( $\alpha < 2$ ).

**Dendrites:-**

When the alloys are rich in the low entropy of fusion phases ( $\alpha < 2$ ), dendrites are formed.

**Pseudo dendrites:-**

When the alloys are rich in the high entropy of fusion phases ( $\alpha > 2$ ), faceted crystal are produced. These crystals are called pseudo dendrites or hopper.

**Microscopic studies:-**

The specimen grown anisotropically and isotropically were polished at room temperature following a procedure similar to that adopted for analogous problem to reveal the microstructure, a thin layer of the specimen etched in ferric chloride was mounted on stub with gold-coated holder and examined under a scanning electron microscope for micro growth observation. Many samples of each specimen were viewed in this manner and the growth habits of the growing phases during solidification at different growth rates were accordingly photographed.

**X-ray diffraction studies:-**

The X-ray diffraction patterns exhibited by the experimental composite phases were recorded with Diffraction System-XPRT=PRO using  $\text{CuK}\alpha$  radiation of wavelength  $1.5408 \text{ \AA}$  at room temperature. The powder X-ray was recorded in a  $2\theta$  range of  $5^\circ$  to  $90^\circ$  with the step size of  $0.05$  and step time of  $1\text{s}$ .

**Results and Discussion:-****Lamellar growth:-**

In the present work, the growth of composite phases from the melt strictly follows the hypothesis proposed by J. D. Hunt and K. A. Jackson. An individual material having low entropy of fusion ( $\alpha < 2$ ) grows almost with isotropically. For example, pure aluminium metal has low entropy of fusion,  $\alpha = 1.35$  implying less than 2, grows from its melt as nonfaceted crystallites (Fig. 1). On the contrary, bismuth metal has high entropy of fusion,  $\alpha = 2.45$  obviously greater than 2, grows from its melt with crystalline facets (Fig. 2). As is evident from the following microstructures, lamellar or rod like structures are formed in composites in which constituent phases have low entropies of fusion ( $\alpha < 2$ ). The composite Al-Cd-Sn is an example of this structure (Fig. 5e), the constituent phases having entropies of fusion, pure Al ( $\alpha = 1.35$ ), pure Cd ( $\alpha = 1.25$ ) and pure Sn ( $\alpha = 1.72$ ). The lamellar structures proves to be less regular compare to rod type growth which does have a perfect ordered structure, particularly interrod spacing, whereas rod like lamellar structure is the intermediate case. Periodic growth of the composite phases tends to provide rod type growth wherein the values of the microstructure parameters, namely, lamella diameter, lamella length, lamella length distribution, volume fraction of lamellae, and the alignment and packing arrangement of lamellae, are repeating themselves exactly after each crystallographic orientation between the lamellae to generate symmetric relation which governs the consistency of the crystallographic orientation relationship in the microstructure entirety.



**Fig.1:-** Microstructure of pure Al metal (1500 x)





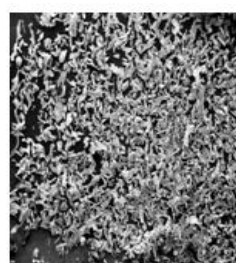
**Fig. 2:-** Microstructure of pure Bi metal (1500 x).



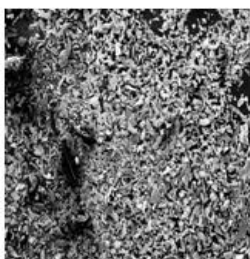
(a) Al-Cd Alloy (1500 x)



(b) Al-Sn Alloy (1500 x)



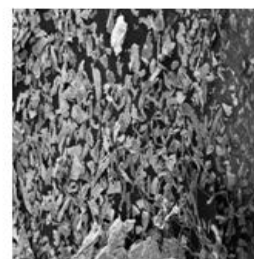
(c) Al-Pb Alloy (1500 x)



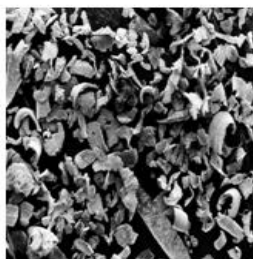
(d) Al-Bi Alloy (1500 x)



(e) Al-Cd-Sn Alloy (1500 x)

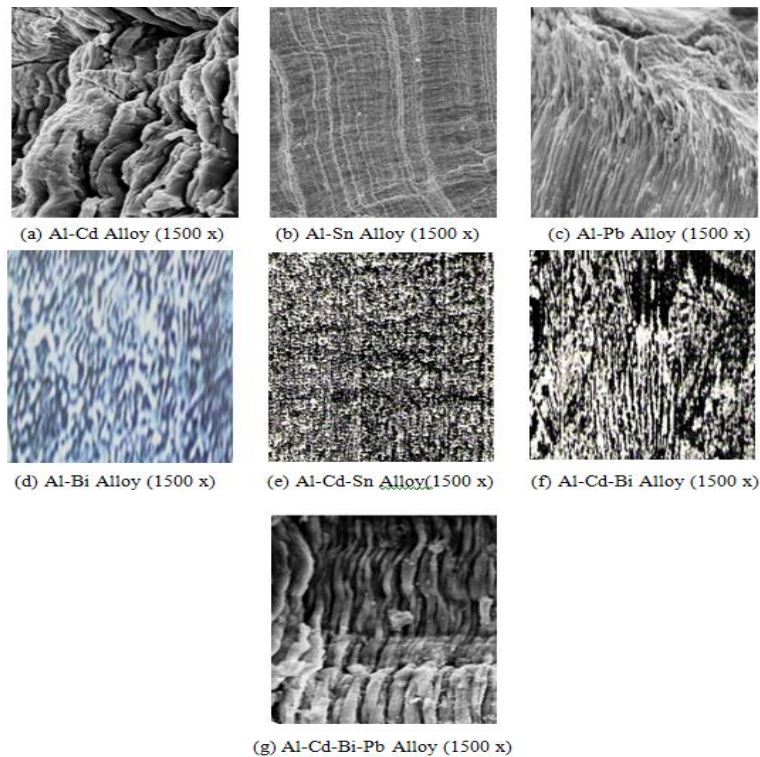


(f) Al-Cd-Bi Alloy (1500 x)

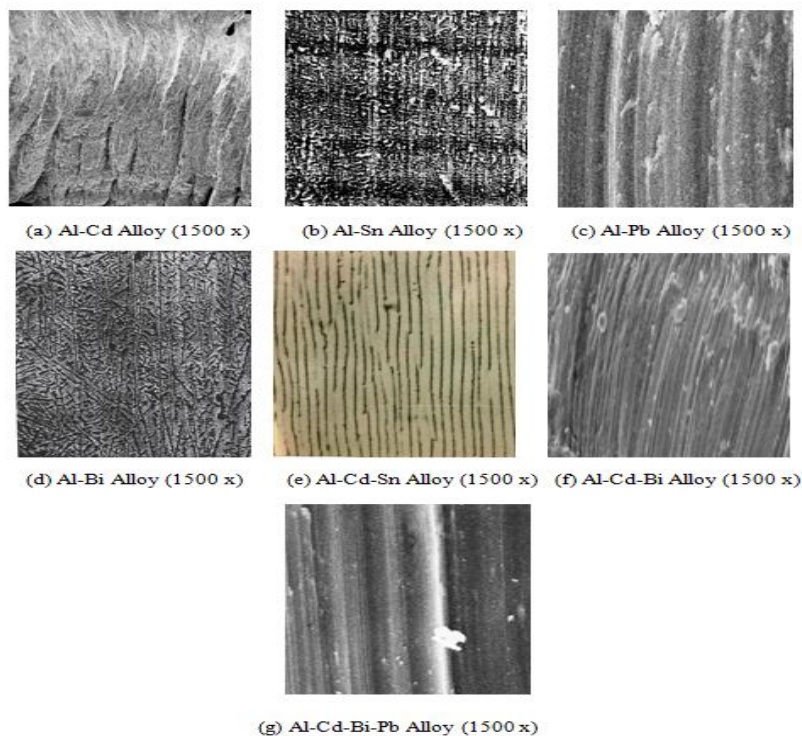


(g) Al-Cd-Bi-Pb Alloy (1500 x)

**Fig. 3:-** Distorted microstructure of composite phases in ice bath at (~273) K (a) Microstructure of Al-Cd (b) Microstructure of Al-Sn (c) Microstructure of Al-Pb (d) Microstructure of Al-Bi (e) Microstructure of Al-Cd-Sn (f) Microstructure of Al-Cd-Bi (g) Microstructure of Al-Cd-Bi-Pb.



**Fig. 4:-** Lamellae of composite phases lamellae in growth direction from bottom to top at fast growth velocity  $8.10 \times 10^{-7} \text{ m}^3 \text{ s}^{-1}$  (a) Microstructure of Al-Cd (b) Microstructure of Al-Sn (c) Microstructure of Al-Pb (d) Microstructure of Al-Bi (e) Microstructure of Al-Cd-Sn (f) Microstructure of Al-Cd-Bi (g) Microstructure of Al-Cd-Bi-Pb



**Fig. 5:-** Lamellae of composite phases in the growth direction from bottom to top at slow growth velocity  $1.71 \times 10^{-7} \text{ m}^3 \text{ s}^{-1}$  (a) Microstructure of Al-Cd (b) Microstructure of Al-Sn (c) Microstructure of Al-Pb (d) Microstructure of Al-Bi (e) Microstructure of Al-Cd-Sn (f) Microstructure of Al-Cd-Bi (g) Microstructure of Al-Cd-Bi-Pb

Complex regular structures are obtained in composites wherein at least one of the constituent phases has entropy of fusion less than two ( $\alpha < 2$ ) and others may have entropies of fusion greater than two ( $\alpha > 2$ ). The composite Al-Cd-Bi is an example of this structure (Fig. 5f). It may be pertinent to mention here that phases with  $\alpha < 2$  always grow in contact called coupled growth which does not occur in composite phases having dimensionless entropy of fusion greater than two ( $\alpha > 2$ ). The ingot microstructure of the composite phases, namely Al-Cd, Al-Sn, Al-Pb, Al-Bi, Al-Cd-Sn, Al-Cd-Bi and Al-Cd-Bi-Pb obtained by different modes of growth are presented in Figs. 3-5. The changes in the movement of the lamellae procedure corresponding changes in the mechanical properties which are made comprehensive in term of the approach adopted in the present work. Nevertheless, the orientation of the lamellae offers the possibilities of achieving optimum final products performance by controlling the microstructure parameters which do strengthen the matrix of the resulting lamina to exhibit maximum load bearing capability. Figure 3(a-g) reveals the distorted growth habits of the composite phases, namely, (a) Al-Cd; (b) Al-Sn; (c) Al-Pb; (d) Al-Bi; (e) Al-Cd-Sn; (f) Al-Cd-Bi and (g) Al-Cd-Bi-Pb experienced in an ice bath ( $\sim 273$  K) that at a large kinetic undercooling the lamellae formed are of short size, aggressive, disconnected, crossing each other and showing no matrix relationship. These lamella habits, in fact, arise from splitting of the main single lamella into separate single lamellae or group of single lamellae, apparently leading to the distorted morphology. However, the growth habits of the composite phases gradually structure themselves to nonaggressive, attaching and parallel to each other reinforcing the matrix with decreasing kinetic undercooling as is evident from Fig. 4 (a-g). An entirely distinct lamellar microstructures of the composite phases Fig. 5 (a-g) are obtained at the anisotropic growth velocity ( $\sim 1.71 \times 10^{-7} \text{m}^3 \text{s}^{-1}$ ) determined by setting the flow-interval of silicone oil at  $5 \times 10^{-4} \text{m}^3$  for 30 min, which enhances the hardness of the alloys to their optimum value in the present investigation. In the lamellar microstructure, some of the unfavorably oriented lamellae in the composite grains with high configuration energy grew out perpendicularly to the solidus-liquidus interface leaving other lamellae with orientation close to low configuration energy to grow in an aligned preferred crystallographic morphology. The growth habits of the composite phases comprising the rod-like lamellar microstructure from the melt present their relationship with the moderate anisotropic growth velocity. In a binary melt when one of the composite phases, usually the rich one, grows, the vicinal melt region acquires richness in the other phase, the first phase continues its growth as a lamella or a whisker unless and until the other phase nucleates at a certain super saturation. This is another supercrescent lamella growing over that of the first phase, which would also continue its growth till another supercrescent lamella of the first phase appears on it. Thus, the supercrescent lamellae growth of the composite phases from the melt produces a complete lamellar microstructure. The growth front contacting solidus-liquidus interface structure inside the experimental tube, and the rising level of silicone oil outside the tube would move upward nearly with the same pace in a single phase, effectively decreasing the kinetic undercooling which balances the undercooling due to composition, and originating lamella length. Likewise, the growth of composite phases from the ternary and quaternary melts would follow the similar pattern. Accordingly, the growth process produces long lamellae with undamaged surfaces Fig. 5 (a-g) which are embedded parallel to each other in attaching and nonaggressive unidirectional laminae. The mathematical model for the rod-like growth of the composite systems has been developed elsewhere. In the directional growth, the metals Al, Cd, Sn, Bi and Pb grow as lamellar cells where each cell crystallize either from the bulk of the melt or through secondary nucleation. Since the complete lamella is an attachment of two-, three and four nonaggressive ductile metal lamellae, the efficiency of the lamellae in stiffening and reinforcing the matrix decrease as the lamella length decrease. Lamella ends play an important role in the fracture of short lamella composites (Fig. 6) and also in continuous lamella composites (Fig. 7), since the long lamellae may break down into discrete lengths. As mention earlier the lamellae are aggressive, non attaching and irregular thin crystals producing distorted microstructures representing Fig. 3(a-g) which attain fragile matrix of the composite phases. The discontinuous change in spacing in absence of faults is the movement of lamellar-faults, which is an evidence for the fault-mechanism. It is this movement, not the formation of faults, which is an important factor in controlling the spacing among lamellae. The lamellar cells of the pure composite phases would acquire dislocations by virtue of their growth by fault-mechanism from the melt and consequently, exhibit fragile matrix.





**Fig.6:-** Short Lamellae (1500 x).



**Fig. 7:-** Long Lamellae (1500 x)

### **Conclusion:-**

The thermal analysis reveals thermal stability and liquidus temperatures of the composites. X-ray diffraction patterns implicitly demonstrate that the composites are terminal solidus solutions comprising of physically distinct and mechanical separable materials because no unique X-ray pattern is observed in the composites other than constituent metals. The growth of composite phases expresses its obedience to the hypothesis proposed by J.D. Hunt and K.A. Jackson that single phase (homogeneous) materials can be divided into two groups according to their solidification characteristics, those that grow as faceted crystals and those that grow as nonfaceted crystals. The homogeneous materials having entropies of fusion less than two ( $\alpha < 2$ ) do grow as nonfaceted crystals marked with regular structures, and those having entropies of fusion greater than two ( $\alpha > 2$ ) do grow with crystalline facets projecting irregular structures. The morphology pattern of the composite alloys may also follow the microstructure classification of the single phase material. The composite alloys that those in which constituent phases have low entropy of fusion ( $\alpha < 2$ ) ; those which comprise constituent phases having high entropies of fusion ( $\alpha > 2$ ) and those in which any constituent phase is inconsistent to the other constituent phases whether low entropy of fusion ( $\alpha < 2$ ) or high entropy of fusion ( $\alpha > 2$ ) . The diversity of the micro morphologies, because of the complex nature of

the phenomenon involved in an anisotropically controlled solidification from the melt, is revealed by examining the crystalline specimens in a scanning electron microscope.

### References:-

1. Arun K Sharma, Parshotam Lal, B K Gandotra, R Kant, B L Sharma (2012 ): J Res Sch Lib, Anisotropic Mechanical Parameters Microscopic, Thermal and XRD Studies of Ternary Eutectic Composite Phases Sn-Pb-Cd, *Arch. Appl. Sci. Res.*, 4, 111-127.
2. B L Sharma (2004): J. Alloys Compd., 385 74
3. Boeing 787 Dreamliner Long-Range, Mid-size Airliner, USA. (2010):Aerospace-Technology.com Net Resources International.
4. B L Sharma (2003): Mater. Chem. Phys. 78 691.
5. B L Sharma, Parshotam Lal (2011): Growth Reinforcing Composite Materials from Liquidus Phases: Mechanical and Microstructural Parameters Relationship Essentially Evincing the Predominance of an Akin Mass Composite over the Domain of Composition, Metal, Ceramic and Polymeric Composite for Various uses, John Cuppoletti (Ed.) ISBN: 1978-953-307-353-8 In Tech
6. B L Sharma, Parshotam Lal, Monika Sharma, Arun Kumar Sharma (2011): Thermoanalysis of Binary Condensed Eutectic Phases Evincing Molecular Interaction. *J. Therm Anal. Calorim* DOI 10-1007/S/0973-011-1673-8
7. B L Sharma, R Jamwal, R Kant(2004): Cryst. Res. Technol. 39 454.
8. B L Sharma, S Tandon, S Gupta (2009): Cryst. Res. Technol., 44, 258-268.
9. B L Sharma, S Gupta, S Tandon, R Kant(2008): Mater Chem. Phys., 111 423-430
10. D Hull, TW Clyne (1996): An Introduction to Composite Materials: 2<sup>nd</sup> edition .
11. D Hull, TW Clyne (2008): An Introduction to Composite Materials: III<sup>rd</sup> edition (Cambridge University Press,
12. D Hull (1985): An introduction to composite Materials, Cambridge University Press, Cambridge.
13. DR Lide (2009): CRC Handbook of Chemistry and Physics, A Ready-Reference Book of Chemical and Physical Data 90<sup>th</sup> ed. CRC Press, London.
14. G R, VD Bhandankav, BM, Suryvansh (2012): J Sch Res Lib, Ultrasonic Study of Molecular Interactions in Binary Mixture at 308K 1-4
15. J D Hunt, K A Jackson (1966), Trans. AIME 236, 843
16. Parshotam Lal , B L Sharma (2012): J Sch Res Lib, Thermostability, Alloying ability, Growth Habits and Micromechanical Parameters of Aluminium Rich Al-Cd-Sn Composite Alloys *Arch. Appl. Sci. Res.*, 5 .
17. Parshotam Lal (2014): J Sch Res Lib, Characterization of Binary Composites by X-ray, Thermal and Microscopic studies *Arch. Appl. Sci. Res.*, 1.
18. Parshotam Lal, Shallu Abrol, BL Sharma (2012): J Sch Res Lib, Essence of Mechanical Properties from Variable Growth Habits of Binary, Ternary and Quaternary Aluminium Rich Alloys, *Arch. Appl. Sci. Res.* 2012, 5 .
19. R Caram, M Banan, WR Wilcox (1991): *J. Cryst. Growth*, 114, 249 .
20. R Caram, S Chandrasekhar, WR Wilcox (1990): *J. Cryst. Growth*, 106, 294.
21. R Caram, WR Wilcox (1992): *J. Mater. Process, Manuf. Sci.* 1, 5
22. R Josephine Usha, J Arul Martinmani, P Sagayaraj, V Joseph (2012): J Sch Res Lib, Synthesis, Growth, Optical, Mechanical ,Thermal and Surface Studies of Ligand Base Single Crystal of Tri-allylthiurea Cadmium Chloride 1545-1552 20
23. T Thaila and S Kumarraman (2012): J Sch Res Lib, Growth and Characterization of Glycine Magnesium Chloride Single Crystal 1494-1501
24. V Renganaki, D Syamala, R Sathyamoorthy (2012): J Sch Res Lib, Growth, Structural, and Spectral Studies on Pure and Doped Ammonium (1453-1461
25. W Albers, in: H Muller (1972): (Ed.), Preparative Methods of Solid State Chemistry, Academic Press, New York
26. W D Callister, G David Rethwisch(1972):Composites: Polymer-Matrix composites. Fundamentals of Materials Science and Engineering, 3<sup>rd</sup> ed. Hoboken, NJ: Wiley (2008).
27. WD Callister (2004): Jr., Materials Science and Engineering: An introduction, John Wiley & Sons, Inc

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### RESEARCH ARTICLE

#### SYNTHESIS AND EVALUATE OF SOME NEW 1,2,4-TRIAZOLES TO MODIFY EPOXY RESINS IN THE FIELD OF ANTI-MICROBIAL AND ANTI-CORROSIVE ORGANIC COATING.

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#### Abstract

Some recent amino triazole derivatives mainly 4-amino-5-(trifluoromethyl)-4H-1,2,4-triazole-3-thiol (I), 4-((4-chlorobenzylidene)amino)-5-(trifluoromethyl)-4H-1,2,4-triazole-3-thiol (II), 4-((furan-2-ylmethylene)amino)-5-(trifluoromethyl)-4H-1,2,4-triazole-3-thiol (III) and Ni [ II ] complex (IV) were synthesized and their chemical structures were confirmed by spectral data. The synthesized amino triazole compounds (I-IV) were physically incorporated into epoxy coating formula by the ratio of 0.5, 1.0, 2.0 and 3.0% by weight, in order to achieve a proper ratio of amino triazole derivatives to produce a green epoxy formulation for surface coating application. The modified epoxy varnishes were evaluated as anti-corrosion performance of mild steel coated specimens by employing salt spray test, also their antimicrobial activity against six different microbial strains mainly are Gram-positive bacteria: Staphylococcus aureus (ATCC25923) and Bacillus subtilis (ATCC6635), Gram – negative bacteria: Escherichia coli (ATCC 25922) and Salmonella typhimurium (ATCC 14028) and Yeast: Candida albicans (ATCC 10231) and Fungus: Aspergillus fumigates were screened.

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#### Introduction:-

The industrial use of thermoset polymers is rapidly growing worldwide due to their high performance capabilities in demanding environments. Epoxy resins are one of the most versatile thermoset polymers and are prevalent because of their ability to polymerize or “cure” under a wide range of conditions. Epoxy resins also offer a good to excellent mechanical properties, good electrical insulating properties and excellent adhesion to a wide variety of substrates, so it has a prevalently uses in a wide range of applications. Additionally, once cured, epoxy resins exhibit excellent chemical resistance as anticorrosive metal coatings<sup>(1-3)</sup>. It is generally believed that most organic coatings adhere to metals via hydrogen bonds or secondary bonds, therefore, these bonds develop when an organic coating and a metallic surface are brought closely together and so the binders with polar groups display excellent adhesion characteristics. The bond strength of epoxy resins on steel is strongly dependent on the hydroxyl group content. It was found that the epoxy compounds were dissociated between the phenoxy oxygen and the aliphatic carbon. The surface interactions were believed to be via the phenoxy and hydroxyl oxygen atoms<sup>(4)</sup>, as illustrated in Fig (1).

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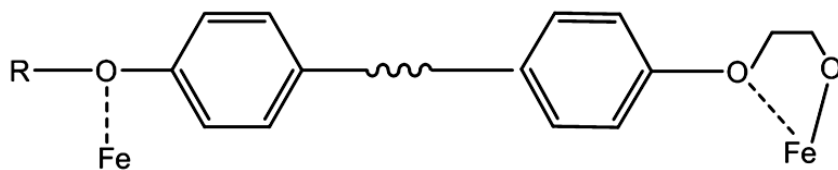


Figure 1: Adhesion of epoxy to steel by interfacial bonds

The three main applications for epoxy resins are coatings, composites, and structural adhesives<sup>(5)</sup>.

Antimicrobial coatings are useful in the development of hygienic surfaces. These are having some antimicrobial agent in their composition that either can kill or inhibit the growth of microorganisms<sup>(6)</sup>. These types of coatings have immense applications in the design of materials and devices in health care sector, hospital surfaces, surgery equipment, health-care products and water purification systems<sup>(7)</sup>. Commonly used antimicrobial surfaces contain some antibiotics, silver ions, quaternary ammonium cations, halogens or some heterocyclic compounds<sup>(8)</sup>.

Triazolic nucleus is nowadays considered an important moiety in the design and synthesis of bioactive compounds that are associated with numerous biological activities such as antibacterial and antifungal<sup>(9-12)</sup>. Also, there are some reviews indicate that 1,2,4-triazoles occupy a distinctive place in the field of medicinal and pharmaceutical chemistry<sup>(13,14)</sup>, as well as in industry<sup>(15)</sup>. Recently some triazole derivatives were added to polyurethane coating which demonstrate an impressive results as antimicrobial<sup>(16)</sup>.

Annual costs related to corrosion and corrosion prevention constitutes a substantial part of the gross national product in the world. Although the value of these numbers is always debatable, but the corrosion has great importance in modern societies in addition to economic costs and technological delay, corrosion can lead to failure of metal structures which have serious consequences for humans and the environment<sup>(17, 18)</sup>. Thus, the study of mild steel corrosion and the inhibition of mild steel corrosion have invited the attention of scientists and technocrats to devise ways to control the corrosion. Between the various corrosion control modes, the use of corrosion inhibitors is a familiar method. Inhibition efficiency always depends upon the number of active adsorption centers of inhibitor molecule may have, and the charge density, molecular size, mode of adsorption, and its capability to form metallic complexes<sup>(19-21)</sup>.

Over the last decades, both organic and inorganic coatings have been widely applied for the protection of metals against corrosion. In many areas of coatings technology, anticorrosive paint gave great attention. Most of the efficient inhibitors used in industry are organic compounds that mainly contain a nitrogen atom, a sulfur atom and multiple bonds in the molecules through which they are adsorbed onto the metal surface. Even though a large number of organic compounds are available, the choice of an appropriate inhibitor for a particular system is very limited, due to the specificity of the inhibitors and the great variety of corrosion-related applications<sup>(22, 23)</sup>. A survey of the available literature reveals that (amongst others) the inhibitive effects of alcohols, amides, amines, anilines, azoles<sup>(24)</sup>, mercaptans, oximes, thioethers, and dithiobiurets<sup>(25)</sup> have been studied.

Triazole-type organic compounds are good corrosion inhibitors for many metals and alloys in various aggressive media<sup>(26-29)</sup>.

In the present work, a study has been conducted on the effect of 1,2,4-triazoles such as 4-amino-5-(trifluoromethyl)-4H-1,2,4-triazole-3-thiol (I), 4-((4-chlorobenzylidene)amino)-5-(trifluoromethyl)-4H-1,2,4-triazole-3-thiol (II), 4-((furan-2-ylmethylene) amino)-5-(trifluoromethyl)-4H-1,2,4-triazole-3-thiol (III) and Ni [II] complex (IV) on biological activity and anti-corrosion performances of epoxy resin varnish.

## Experimental:-

### Materials:-

Epoxy resin was obtained from Pachin Pints Company – Egypt, all other chemicals used are pure grade quality get from Sigma- Aldrich Chemical Co. All the melting points were determined by open capillary method and are uncorrected. Chemical structure of the prepared triazole derivatives were confirmed using, a Perkin-Elmer 240 micro-analyzer at the Micro-Analytical Center of Cairo University, IR spectra were determined as (KBr) pellets on a

Jasco FT/IR 460 plus spectrophotometer at Faculty of Science, Al-Azhar university.  $^1\text{H}$  NMR spectra were recorded using a BRUKER AV 300 MHz spectrometer using in  $\text{CDCl}_3$  or DMSO as an internal standard, MS were measured on a Shimadzu GC/MS-QP5 spectrometer at Faculty of Science, Cairo University and (TGA and DTA) were carried out using TGA-50H and DTA-50H at Ain Shams University Faculty of Science Central Lab.

#### Methods and techniques Synthesis of 1,2,4-triazole derivatives:-

New anti-microbial additives based on 1,2,4-triazole derivatives (I–IV) were prepared as represented in Scheme (1).

#### Synthesis of 4-amino-5- (trifluoromethyl)-4H-1,2,4-triazole-3-thiol ( I )<sup>(30)</sup>.

An equimolar mixture of thiocarbonylhydrazide ( 10 mmol) and trifluoroacetic acid ( 10 mmol) was warmed carefully between 160 – 170  $^{\circ}\text{C}$  until melting occurred, heating lasts for 15 minutes after melting . The reaction mixture was cooled and mixed with 80 ml of water. The precipitate was filtered, washed with water and oven dried. A colorless crystals; m.p:140 - 141 $^{\circ}\text{C}$  ; yield 85% ; IR (KBr)  $\text{cm}^{-1}$ :3314, 3200 (  $\text{NH}_2$  ), 2572 (S-H),1630 (C-S),1460(C=N in triazole),1242,1147 (C-N),1082,1005(C-F);  $^1\text{H}$  NMR (in  $\text{CDCl}_3$ ) ( $\delta$  ppm): 11.64 (s, 1H, SH), 4.83 (s, 2H,  $\text{NH}_2$ );  $^{19}\text{F}$  NMR (  $\delta$  ppm) 66.24 (s, 3F,  $\text{ArCF}_3$ ); MS: m/z (%):184[ $\text{M}^+$ ](100), 126(11), 111(5), 96(8), 85(1), 78(12), 69(30), 60(23), 57(13), 45(8); Anal. Calcd. for  $\text{C}_3\text{H}_3\text{N}_4\text{S F}_3$ : C, 19.57; H, 1.64; N, 30.43% Found: C, 19.45; H, 1.59; N, 30.06%.

#### Synthesis of 4-((4-chlorobenzylidene)amino)-5-(trifluoromethyl)-4H-1,2,4-triazole-3-thiol ( II ):-

In 50 ml round bottom flask a mixture of compound (I) (10 mmol), (10 mmol) of p-chlorobenzaldehyde and (0.5mL) of acetic acid in 30mL of ethanol was refluxed for 5 h. , filtrated on hot , cooling ,the precipitate was filtered and washed with methanol. A pale yellow crystal from ethanol; m.p. 125- 126 $^{\circ}\text{C}$ ; yield 82%; IR (KBr)  $\text{cm}^{-1}$ : 3117 (Ar.H), 2539 (SH), 1508 (C=C), 1630 (C=N Schiff base), 1568 (C=N in triazole), 1298 (C-N in triazole) , 1016 (N-N in triazole);  $^1\text{NMR}$  ( $\delta$  ppm) ( in DMSO): 11.04 (s,1H-SH), 8.63 (s,1H-CH), 7.00-7.85 (m,4H-Ar-H) ;Anal. Calcd.for  $\text{C}_{10}\text{H}_6\text{N}_4\text{S F}_3\text{Cl}$ : C, 39.15; H, 1.96; N, 18.27% - Found: C, 39.76; H, 2.13; N, 17.83%

#### Synthesis of 4-((furan-2-ylmethylene)amino)-5-(trifluoromethyl)-4H-1,2,4-triazole-3-thiol ( III ):-

In 50 ml round bottom flask a mixture of compound ( I ) ( 10 mmol), ( 10 mmol ) of furan-2-carbaldehyde and (0.5mL) of acetic acid in 30mL of ethanol was refluxed for 5 h. , filtrated on hot , cooling ,the precipitate was filtered and washed with methanol. A reddish – brown crystals from *N,N*-Dimethylformamide; m.p.147-148 $^{\circ}\text{C}$ ; yield 91%; IR (KBr)  $\text{cm}^{-1}$  : 2529 (SH), 1613 ( C=N Schiff base), 1551(C=N in triazole), 1480 (C=C), 1290 (C-N in triazole) , 1018 (N-N) ;  $^1\text{NMR}$  ( $\delta$  ppm)(in DMSO): 10.12 ( s,1H-SH), 8.09 ( s,1H-CH), 6.75-7.61( m,3H-Ar-H) ; MS: m/z (%):262[ $\text{M}^+$ ] (5.64),184.04 (59.46), 78.09 (23.64), 69.10 (100), 67.13 (23.55); Anal. Calcd. for  $\text{C}_8\text{H}_5\text{N}_4\text{S O F}_3$ :C, 36.64; H, 1.91; N, 21.37% Found: C, 36.76; H, 2.13; N, 21.52% .

#### Synthesis of Nickel [II] Complex ( IV ):-

A solution of nickel chloride (10 mmol) in absolute warmed ethanol (5mL) was slowly added drop wise to a solution of compound (I) (10 mmol) in absolute ethanol (10 mL). The mixture was stirred for 30 min. at room temperature and refluxed for 2 h. The complex was filtered in a vacuum system, washed with ethanol several times and dried. A pure pale green solid was obtained; m. p. > 300  $^{\circ}\text{C}$ ; yield 62%;

#### Preparation of epoxy paint films containing 1,2,4- triazole derivatives ( I – IV ):-

The epoxy paint compositions were prepared by physically incorporate 1,2,4- triazole derivatives, in the ratio of 0.5%, 1.0%,2.0% and 3.0% by weight into epoxy paint. The samples of different molar ratio were then applied to both steel and glass by means of a brush. All efforts were made to maintain a uniform film thickness of  $50 \pm 5 \mu\text{m}$ . for evaluating the physical and mechanical properties of the paint. The solid content was adjusted at 60%.

#### Physical and mechanical testing of coating films:-

A range of physical and mechanical evaluations of the painted films were conducted according to appropriate American Society for Testing and Materials (ASTM) standard test methods. The color of epoxy resin formulations was measured using the Gardner standard color scale (ASTM D1544). The prepared steel panels (ASTM D 609-95) were used for measuring, the measure of film coating thickness (ASTM D 1005-07), the adhesion 'cross hatch' test (ASTM D 3359-02) and the flexibility 'bend' test (ASTM D 522-93a). Glass plates (100 mm- 150 mm), coated with the individual formulations, were utilized to measure the degree of gloss at an angle of 60 $^{\circ}$  (ASTM D 523-08), and also to measure the film hardness by means of the pencil test (ASTM D 3363-00).



**Antimicrobial screening:-**

The anti-microbial activity of the synthesized triazole derivatives ( I – IV ) was tested against six different microorganisms such as; Gram- positive bacteria: *Staphylococcus aureus* (ATCC 25923) and *Bacillus subtilis* (ATCC 6635), Gram – negative bacteria: *Escherichia coli* (ATCC 25922) and *Salmonella typhimurium* (ATCC 14028), Fungus: *Aspergillus fumigates* and Yeast: *Candida albicans* (ATCC 10231) in nutrient broth medium.

**Paper disk diffusion method for the determination of antimicrobial activity <sup>(31)</sup>:-**

Paper disk diffusion is the official method used in many clinical microbiology laboratories to determine what antibiotics and compounds inhibit bacterial growth, or are bacteriostatic. The paper disks are soaked with a select antibiotic or chemical and then placed on a lawn of bacteria in a petri dish. The zones of inhibition are measured around where the disk was placed to determine whether the bacterium was resistant or susceptible to the particular antibiotic or chemical chosen. The sterilized (autoclaved at 120 °C for 30 min) medium at (40–50 °C) was incubated (1 ml/100 ml of medium) with the suspension ( $10^5$  cfu ml<sup>-1</sup>) of the micro-organism (matched to McFarland barium sulfate standard) and poured into a petri dish to give a depth of 3–4 mm. The paper impregnated with the test compounds (mg/ml<sup>-1</sup>) was placed on the solidified medium. The plates were pre-incubated for 1 h at room temperature and incubated at 37 °C for 24 and 48 h for anti-bacterial and anti-fungal activities, respectively. Chloramphenicol, Cephalothinin and cycloheximide (mg/disk) was used as a standard for Gram – positive, Gram – negative and anti-fungal activities respectively.

**Anti-corrosive performance evaluation of formulations through salt spray Accelerated Testing:-**

The test pieces of mild steel were 20 x 20 x 2 mm. The samples were first mechanically polished with a fine grade emery paper in order to obtain a smooth surface, followed by degreasing with acetone and then rinsed with distilled water, dried between two filter papers. A salt fog chamber was utilized for each of the resin formulations; with a set of three coated panels being placed in the salt spray chamber according to ASTM B117-03. The corrosion resistance was evaluated in terms of blistering, scribe failure and degree of rusting, in relation to ASTM standards, i.e. ASTM D714-02, D1654- 00 and D610-01 respectively.

**Results and Discussion:-**

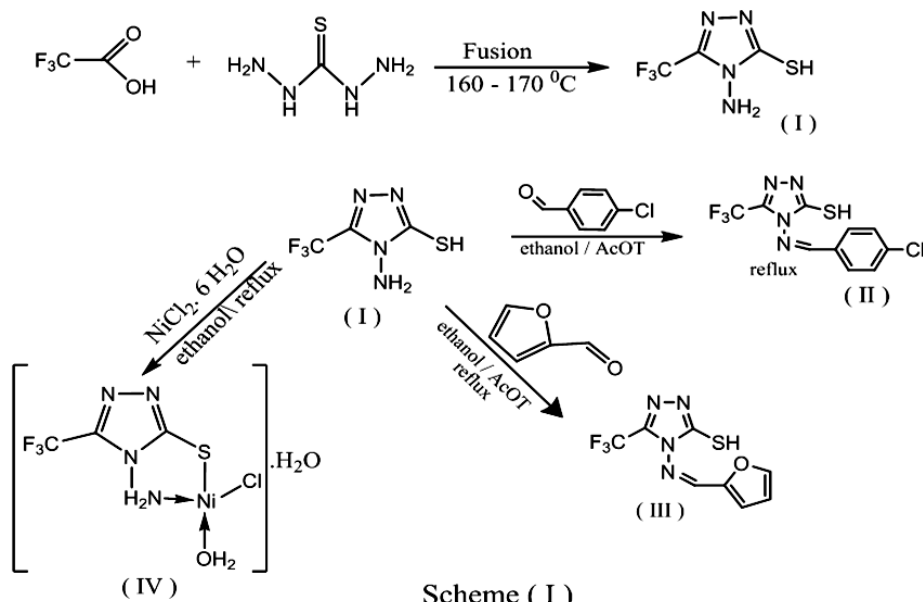
In recent times triazole rich molecules have gained much importance in the field of polymer and material science so it is used prevalent in a wide range of applications because of their excellent properties like strong anti-microbial and anti fouling nature of the triazole ring along with easy synthetic procedures and exceptionally high yield of end product.

**Synthesis and characterization of triazole derivatives and nickel [ II ] complex:-**

In the present study, 1,2,4-triazole derivatives were successfully synthesized aiming to explore their antimicrobial and anticorrosion properties. The synthesis of triazole derivatives ( I-IV ) was performed according to indications mentioned in experimental section and shown in scheme ( 1 ). The compounds were obtained with yields (62- 91%) with high purity, the products confirmed by TLC analysis and evaluation of melting point. The formation of 1,2,4-triazole derivatives was proven by elemental analysis, FTIR and <sup>1</sup>H NMR, as well as by mass spectrometry for the compounds.

**Characterization of nickel [ II ] complex (IV):-**

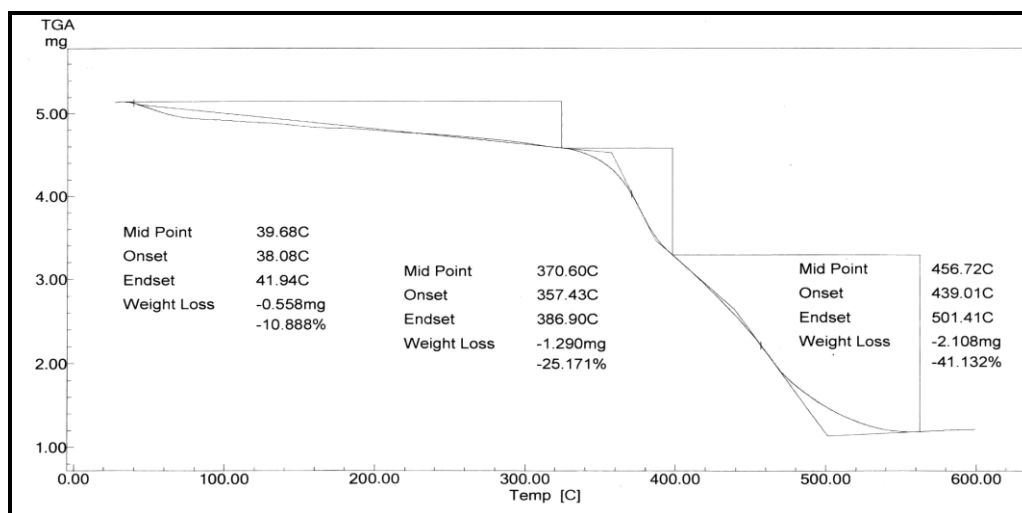
Comparison of IR spectrum of the free ligand with IR spectrum of the nickel [ II ] complex gives an idea about the changes that might occur during complex formation. The IR spectrum of the complex displayed the ligand characteristic bands with appropriate shifts due to complex formation and there are three features in the IR spectrum of the nickel [ II ] complex. The first feature is the shift of the stretching frequencies of the amino group  $\nu(\text{NH}_2)$  in the nickel [ II ] complex to lower frequencies compared with the free ligand band in the region 3309- 3236 cm<sup>-1</sup>, indicating the formation of coordinate bond between nitrogen of amino group and nickel ion. This is consistence with the presence of a new weak band at 410 cm<sup>-1</sup> assignable to  $\nu(\text{M}-\text{N})$  vibration confirming the participation of amino group in coordination as was expected <sup>(32)</sup>. The second feature is that deprotonation of the thiol group as indicated by the absence of a characteristic band in the complex of  $\nu(\text{S}-\text{H})$  of ligand, indicating the formation of new bond between metal and sulfur. This is supported by the appearance a peak at 659 cm<sup>-1</sup> in the metal complexes due to  $\nu(\text{C}-\text{S})$  <sup>(33)</sup>. The third feature is that the appearance of broad band at 3401 cm<sup>-1</sup> which can be assigned to the stretching frequencies of  $\nu(\text{OH})$  of water molecules either in the coordinated or uncoordinated form associated to the complexes which are also confirmed by thermal analyses as well as appearance of the non-ligand band at 554 cm<sup>-1</sup> assignable to  $\nu(\text{M}-\text{O})$  <sup>(34,35)</sup>.



Scheme (I)

The measured effective magnetic moment value (3.36B.M) suggesting the magnetic behavior of the complex, in addition this value was consistent with the two unpaired electrons in tetrahedral geometry<sup>(36)</sup>. Mass spectrometry technique has been carried out to assisting the structural identification of the synthesized nickel [II] complex. The spectrum of this complex showed three important peaks. The first one shows the molecular ion peak with the highest value  $m/z$  (%) at 313.37 (2.29) (Calcd. 313.33 amu), which agree well with the suggested formula weight and indicate the monomeric nature of the complex. The second peak observed at  $m/z$  (%) = 97.14 (33.23) ( Calcd. 96.69 amu) due to degradation of complex into  $\text{NiF}_2$  which decompose to  $\text{Ni}^{2+}$  giving the third peak at  $m/z$  (%) = 57.12 (100.00) (Calcd. 58.69 amu).

Moreover, thermal studies of complex was carried out to complete the characterization process; to get information about the thermal stability of the complex; to suggest a general scheme for thermal decomposition and to ascertain the nature of associated water molecules as well as to determine the final product of decomposition<sup>(37)</sup>. The TG - DTG curve of complex presented in Fig. ( 2 ) and shows three steps of decomposition up to  $500^\circ\text{C}$ . The first one at  $40-42^\circ\text{C}$  with mass loss of 10.89% ( Calc. 11.50% ) due to the liberation of one hydrated and one coordinated water molecules. The second step with a weight loss of 25.17% ( Calc. 24.90% ) between  $371-387^\circ\text{C}$  was attributed to the liberation of by  $\frac{1}{2}\text{N}_2$ ,  $\text{F}_2$  and  $\text{CN}$ . The last step of decomposition corresponded to the liberation of  $\text{N}_2$ ,  $\text{HF}$ ,  $\text{HCl}$  and  $\text{CS}$  with a weight loss of 41.13% ( Calc. 41.03%) between  $457-501^\circ\text{C}$ . The overall mass loss is observed to be 77.19 % ( Calc. 77.43% ) leaving  $\text{Ni}$  and  $\text{C}$  as residue {calculated: 22.57% , found: 22.81% }. Hence, the suggested structure of the complex with the molecular formula  $[\text{NiC}_3\text{H}_2\text{N}_4\text{SF}_3(\text{Cl})(\text{H}_2\text{O})] \cdot \text{H}_2\text{O}$  was given in scheme[1].



**Figure 2 :- TG - DTG Spectrum of Nickel [II] Complex.**

#### **Physical and mechanical testing of modified coating films:-**

Modified epoxy resins were evaluated for some physical and mechanical properties; also their antimicrobial and anticorrosive properties were examined. The effects of adding modifiers triazole derivatives to epoxy resin formulation, were evaluated using a variety of standard test methods. This was done to ascertain any positive or negative aspects that might arise due to the presence of the additives. The color, gloss, hardness, adhesion, flexibility and impact were measured. The resulting data is shown in Table (1).

All films of epoxy paint compositions gave a very clear, transparent and homogeneous appearance and showed an excellent hardness.

#### **Color:-**

Color was measured using the Gardner standard colors, which consists of 18 colors numbered from (1 to 18). The method determines the color by comparison with standards of definite color compositions. It could be seen that addition of compounds ( I ) increased the color level slightly in high percent, while addition of compound ( II ) increased the color levels by increasing the percent. This is obviously a negative result which may be attributed to the introduction of sulfur and nitrogenous base into epoxy coating formulations. Epoxy coating which developed by compound (III) acquired dark color due to the presence of furan ring beside sulfur and nitrogen, also addition of complex (IV) produces a dark paint color.

#### **Adhesion cross hatch test:-**

This test is in conformity according to (ASTM D 3359-02) where adhesion is assessed on a 0 to 5 scale. When studying the hardness property of the neat epoxy and modified epoxy coating films, it was observed that the physical addition of the modifiers (I, II and III) increase hardness of coated films, and increasing the modifier percentage increases hardness value, while complex (IV) has slightly negative effects.

#### **Flexibility (bend) test:-**

The test was performed to determine the adhesion power of the coating to the substrate by bending apparatus. It is clear from the obtained results that the adding of new triazole derivatives didn't affect on the flexibility of the coating film, it can be stated that all the films showed a good flexibility. There was no significant difference between a blank epoxy coating film and modified epoxy coating films.

#### **Gloss:-**

This was measured using a Sheen UK gloss meter, it could be seen that the triazole additives (I, II and III) actually increased the gloss level. This result is attributed to the introduction of aromatic rings and a lone pair of electrons

into the varnish formulations. And vice versa when adding compound ( IV ) the gloss level decreases, this may be due to the presence of nickel complex.

**Table 1 :-** Physical and mechanical characteristics of modified epoxy varnish with new triazole derivatives (compounds I- IV).

Sample	Color	Adhesion	Flexibility	Gloss at 60 °	hardness
Blank epoxy resin	4	4	Pass	83	Excellent
Epoxy with comp. I 0.5%	4	4	Pass	87	Excellent
1.0%	4	4	Pass	85	Excellent
2.0%	5	5	Pass	90	Excellent
3.0%	5	5	Pass	95	Excellent
Epoxy with comp. II 0.5%	4	4	Pass	88	Excellent
1.0%	5	5	Pass	88	Excellent
2.0%	< 6	5	Pass	90	Excellent
3.0%	7	5	Pass	94	Excellent
Epoxy with comp. III 0.5%	>18	4	Pass	89	Excellent
1.0%	>18	4	Pass	90	Excellent
2.0%	>18	5	Pass	90	Excellent
3.0%	>18	5	Pass	96	Excellent
Epoxy with comp. IV 0.5%	14	4	Pass	80	Excellent
1.0%	16	3	Pass	81	Excellent
2.0%	>18	3	Pass	76	Excellent
3.0%	>18	3	Pass	73	Excellent

#### Evaluation of triazole derivatives as antimicrobial and antifungal additives to epoxy paint:-

Biocide additives are commonly used to prolong the life of surface coatings. They prevent, or slow down, the growth of organism on the coating surface. Without biocide additives, the biological species start to adhere to the coating surface and this can eventually lead to disbonding and blistering of coatings, under various conditions.

Some of 1,2,4-triazole derivatives have been reported as antibacterial and antifungal<sup>(38,39)</sup>. In the present study some novel triazole derivatives expected to have a biocide activity were prepared and physically incorporate by the ratios of [0.5%, 1.0%, 2.0% and 3.0%] as biocide against six different micro-organisms such as Gram- positive bacteria (*Staphylococcus aureus*, *Bacillus subtilis*); Gram-negative bacteria (*Escherichia coli*, *Salmonella typhimurium*); Yeast (*Candida albicans*) and Fungus (*Aspergillus fumigatus*). From the data give in the table (2) it is clear that epoxy varnish (blank) hasn't any antibacterial or antifungal activities, epoxy varnishes modified with compound (I) have high sensitivity to Gram - positive bacteria and Yeast and intermediate effect towards Fungi, epoxy varnishes modified with compound (II) may be used as antibacterial and antifungal for all six micro-organisms, while compound (III) the introducing of furan ring to 5-(trifluoromethyl) -1,2,4-triazole-3-thiol lead to reduce biocidal activity. Disappearance of free amino and thiol groups in complex (IV) lead to a lack of bacterial activity, but have a high resistance to fungi and yeast.

**Table 2:-** Antibacterial and antifungal activities of modified epoxy varnish with new triazole derivatives (compounds I- IV).

Organism Sample	Gram - <b>positive</b> bacteria		Gram - negative bacteria		Yeasts and Fungi	
	Staphylococcus aureus	Bacillus subtilis	Salmonella typhimurium	Escherichia coli	Candida albicans	Aspergillus fumigatus
Blank	-	-	-	-	-	-
Epoxy with comp. I 0.5%	14 I	23 H	-	-	30 H	8 L
1.0%	20 I	24 H	-	-	30 H	11 L
2.0%	27 H	30 H	-	-	30 H	14 I
3.0%	29 H	32 H	-	-	32 H	16 I
Epoxy with comp. II 0.5%	12 I	15 I	-	-	-	9 L
1.0%	20 I	18 I	14 I	11 L	-	11 L
2.0%	26 H	26 H	14 I	21 I	12 I	19 I
3.0%	26 H	28 H	15 I	24 I	17 I	23 I
Epoxy with comp. III 0.5%	-	-	-	13 I	-	-
1.0%	-	-	-	20 I	-	-
2.0%	-	-	-	26 H	-	-
3.0%	-	-	-	30 H	-	-
Epoxy with comp. IV 0.5%	-	-	-	-	17 I	9 L
1.0%	-	-	-	-	20 I	13 I
2.0%	-	-	8 L	7 L	25 H	18 I
3.0%	-	-	8 L	10L	28 H	22 I
<b>Control #</b>	35	35	36	38	35	37

Where: - = No effect.

L: Low activity = Mean of zone diameter  $\leq 1/3$  of mean zone diameter of control.

I: Intermediate activity = Mean of zone diameter  $\leq 2/3$  of mean zone diameter of control.

H: High activity = Mean of zone diameter  $> 2/3$  of mean zone diameter of control.

#: Chloramphenicol in the case of Gram-positive bacteria, Cephalothin in the case of Gram-negative bacteria and cycloheximide in the case of fungi.

### Corrosion:-

Since, 1,2,3-triazole compounds are heterocyclic compounds having three nitrogen atoms, when these moieties are adsorbed on the surface of the metal, each molecule covers large surface area and they can block the active sites by forming a co-ordinate covalent bond with the metal substrate, which leads to the decrease the rate of corrosion of the metal<sup>(40)</sup>. And also, the polarity of the triazoles induces an electrostatic attraction on the metal surface so as to protect the metal substrate from corrosive medium.

The epoxy paint compositions were prepared by means of physically incorporating triazole derivatives by ratio of 0.5, 1.0, 2.0 and 3.0% by weight into epoxy paint, were evaluated as the anti-corrosive. The paint formulations were evaluated on coated mild steel panels, the films thickness were adjusted about  $50 \pm 5 \mu\text{m}$ . The coated steel panels were exposed to salt spray tests according to CSN ISO 9227 for (500 h).

Photographic reference standards were used to evaluate the degree of blistering, creepage and rusting. The reference standards highlight the various degrees of blistering that can potentially develop when paint systems are subjected to these specific test conditions. The blistering size is graded from 10 to 0, where 10 represents of no blistering and 0 representative of the largest blister. Blistering frequency is denoted by [(few (F), medium (M), medium dense (MD) and dense (D)]. Coated specimens were subjected to a corrosive environment are also evaluated by recording the average (mean) maximum and minimum creepage from the scribe mark. Scribe failure is also rated on a scale from 10 to 0, with 10 being zero (mm) from the scribe mark and 0 is 16 (mm) from the scribe mark. Finally, visual

comparison of the surface with photographic reference standards, to determine the percentage of the area that has been rusted., is carried out according to Painting Council (SSPC), The rust grade is rated on scale from 10 to 0, where 10 is no rusting and 0 is suffering severe rusting.

The results of corrosion resistance of the painted films of prepared samples are given in (Table 3) and (Fig.3) explains the photo of the painted films after salt spray test (3.5% of NaCl). The results show that the compounds 4-amino-5- (trifluoromethyl)-4H-1,2,4-triazole-3-thiol (I) , 4-((4-chlorobenzylidene)amino)-5-(trifluoromethyl)-4H-1,2,4-triazole-3-thiol (II) and 4-((furan-2- methylene)amino)-5-(trifluoromethyl)-4H-1,2,4-triazole-3-thiol (III) have an excellent anticorrosive properties due to of the presence triazole ring, all samples of compounds (II) and (III) approximately not affected during the probationary period due to the presence of the aromatic ring and imino group in addition to triazole ring, while complex (IV) has a poor anticorrosive properties.

**Table 3:-** Anticorrosive activities of modified epoxy varnish with new triazole derivatives (compounds I- IV).

Sample	Blistering		Scribe failure (mm)	Rust grade
	Size	Frequency		
Blank	2	D	13	3
Epoxy with comp. I 0.5%	5	M	7	5
1.0%	6	M	6	6
2.0%	8	F	4	7
3.0%	8	F	4	8
Epoxy with comp. II 0.5%	6	M	6	6
1.0%	8	M	5	7
2.0%	8	F	4	8
3.0%	9	F	4	8
Epoxy with comp. III 0.5%	8	F	5	7
1.0%	8	F	4	8
2.0%	9	F	3	8
3.0%	9	F	3	8
Epoxy with comp. IV 0.5%	3	D	11	3
1.0%	4	MD	10	3
2.0%	4	D	8	4
3.0%	5	M	7	6

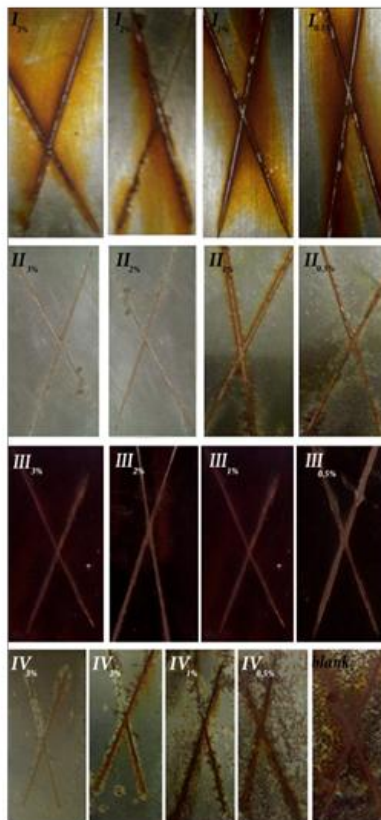


Figure 3: The photo of the painted steel after exposed to solid spray test

### Conclusion:-

This study proved that the adding of triazole modifiers (I, II, III) improved physical properties of modified resins, but compound (IV) has some negative physical properties compared with that of coatings based on the widely used commercial epoxy resin. All modifier epoxy coatings possess antibacterial and antifungal activity by different ratio and also may be used as anticorrosive agents.

### References:-

1. A. Maiorana, B. Subramaniam, R. Centore, X. Han, J. Robert, Linhardt, A. Gross, " Synthesis and Characterization of an Adipic Acid – Derived Epoxy Resin", J. POLYMER SCIENCE, 54 (2016) 2625–2631.
2. N. Abd El-Khalik, "Evaluation of Some Chromene Derivatives as Additives in Fire Retardant and Anticorrosive Coating Composition", The International J. Of Science & Technology, 4 (2016) 140-147.
3. P.A. Sorensen, S. Kiil, K. Dam-Johansen, C.E. Weinell, " Anticorrosive coatings: a review", J. Coat. Technol. Res, 6 (2009) 135-176.
4. M. Nakazawa, " Mechanism of Adhesion of Epoxy Resin to Steel Surface", J. Nippon Steel Technical Report, 63 (1994) 16-22..
5. M. M. Green, H. A. Wittcoff, Organic Chemistry Principles and Industrial Practice; Wiley-VCH: Weinheim; 2003.
6. J. L. Haynes, D. M. James, " Antimicrobial surfaces and inhibition of microorganism growth thereby", US Pat.; 4886505 (1989).
7. E. R. Kenawy, S. D. Worley, R. Broughton, "The chemistry and applications of antimicrobial polymers", J. Biomacromolecules, 8 ( 2007 ) 1359–1384 .
8. M. L. Knetsch and L. H. Koole, "New Strategies in the Development of Antimicrobial Coatings: The Example of Increasing Usage of Silver and Silver Nanoparticles"; J. Polymers, 3 (2011) 340–366.
9. I. Ledet, V. Bercean, A. Alexa, C. Șoica, L. M. Șuta, C. Dehelean, C. Trandafirescu, D. Muntean, M. Licker, A. Fuliș, " Preparation and Antibacterial Properties of Substituted 1,2,4-Triazoles"; J. Chemistry, 2015 (2015) 1-5.



10. Li. Y. Zhang, B. L. Wang, Y. Z. Zhan, Y. Zhang, X. Zhang, Z. M. Li;" Synthesis and biological activities of some fluorine- and piperazine-containing 1,2,4-triazole thione derivatives"; J. Chinese Chemical Letters, 27 (2016) 163–167.
11. S. H. Sumrra, Z. H. Chohan, "Metal based new triazoles: their synthesis, characterization and antibacterial/antifungal activities", J. Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, 98 (2012) 53–61.
12. P. Zoumpoulakis, C. Camoutsis, G. PairasM. Sokovic , J. Glamoclija, C. Potamitis, A. Pitsas , "Synthesis of novel sulfonamide-1,2,4-triazoles, 1,3,4-thiadiazoles and 1,3,4-oxadiazoles, as potential antibacterial and antifungal agents. Biological evaluation and conformational analysis studies"; J. Bioorganic and Medicinal Chemistry, 20 (2012) 1569–1583.
13. S. Maddila, R. Pagadala, S. B. Jonnalagadda, "1,2,4-Triazoles: a review of synthetic approaches and the biological activity"; J. Letters in Organic Chemistry, 10 (2013) 693–714.
14. J. Sharma, S. Ahmad, A. M. Shamsheer, "Bioactive Triazoles: a potential review"; J. Chemical and Pharmaceutical Research, 4 (2012) 5157–5164.
15. M. M. Antonijevic, M. B. Petrovic, "Copper corrosion inhibitors. A review"; International J. Electrochemical Science, 3 (2008) 1 – 28.
16. S.Kantheti, R. Narayan, K. V. S. N. Raju," Development of moisture cure polyurethane–urea coatings using 1,2,3-triazole core hyper branched polyesters"; J. Coat. Technol. Res, 10 (2013) 609–619.
17. F. Frgata, S. Renieri, A. Cristina, A. Elisabete , "Compatibility and Incompatibility in Anticorrosive Painting - The Particular Case of Maintenance Painting); J. Prog. Org. Coat. 56 (2006) 257-268.
18. J. Shah, G.B. Bhagchandani, "Anti Corrosive Rubber Coating"; International J. of Engineering Sciences & Research Technology, 2 (2013) 443-447.
19. J. Copal, P. Dwivedi, S. Sundaram, R. Prakash, "inhibitive effect of chlorophytumborivilianum root extract on mild steel corrosion in HCl and H<sub>2</sub>SO<sub>4</sub> solutions"; J. Ind. Eng. Chem. Res. 52 (2013) 10673–10681.
20. L.C.Kamal, Sethuraman, M.G.Opuntiol , "An active principle of opuntiaelator as an eco-friendlyinhibitor of corrosion of mild steel in acid medium"; J. Sustain. Chem. Eng. 2 (2014) 606–613.
21. K. Adardour, R. Touri, Y. Ramli, R. A. Belakhmima, M. EbnTouhami, C. KalonjiMubengayi, H. El Kafsaoui, E. M. Essassi , " Comparative inhibition study of mild steel corrosion in hydrochloric acid by new class synthesized quinoxaline derivatives: part I"; J. Res ChemIntermed 39 (2013) 1843–1855.
22. S. Tamilselvi, S. Rajeswari "The effect of triazoles and surfactants on the corrosion inhibition of carbon steel in acid solution"; J. Anti-Corrosion Methods and Materials, 50 (2003) 223–231.
23. Schmidt, G. , "Applications of inhibitors for acid media"; J. British Corrosion, 19 (1984) 165-176.
24. B. Mernari, L. El Kadi, S. Kertit, "2,5Bis (2-Thienyl)-1,3,4-oxadiazole as corrosion inhibitor of mild steel in acidic media"; J. Bull. Electrochem, 17 (2001) 115-122.
25. M.A. Quraishi, J. Rawat, M. Ajmal, "Dithiobiurets: a novel class of acid corrosion inhibitors for mild steel"; J. Appl. Electrochem, 30 (2000) 745-751.
26. EL. M. Achouri, S. Kertit, M. Salem, E. M. Essassi, M. Jellal, "3-mercapto 1,2,4-triazole derivatives as corrosion inhibitors for iron in hydrochloric acid solution"; J. Bull. Electrochem. 14 (1998) 462-468.
27. F. Bentiss, M. Traisnel, M. Lagrenee; "Inhibition of acidic corrosion of mild steel by 3,5-diphenyl-4H-1,2,4-triazole,"; J. Applied Surface Science, 161 (2000) 194–202.
28. K. G. Gamal; "Effect of copper cation on corrosion of steel by tolytriazole in acid medium"; J. Chem. Technol., 7 (2000) 300-306.
29. M. A. Quraishi, M. Q. Ansari, S. Ahmad, G. Venkatachari; "Influence of some multifunctional triazoles on corrosion of mild steel in boiling hydrochloric acid solutions"; J. Bull. Electrochem., 14 (1998) 302-305.
30. M. Chen , X. F. Wang , S. Wang, Y. X. Feng , F. Chen , C. L. Yang; " Synthesis, characterization and fungicidal activities of novel fluorinated 3,5-disubstituted-4H-1,2,4-triazol-4-amines"; J. Fluorine Chemistry 135 (2012) 323–329.
31. N.G. Heatley; "A method for the assay of penicillin"; J. Biochem.; 38 (1944) 61–65.
32. A.K. Singh, O.P. Pandey, S.K. Sengupta ; "Synthesis, spectral characterization and biological activity of zinc(II) complexes with 3-substituted phenyl-4-amino-5-hydrazino-1, 2, 4-triazole Schiff bases"; J. Spectrochimica Acta, 85 (2012) 1–6.

33. P. Tyagi, S. Chandra, B.S. Saraswat, D. Yadav,; "Design, spectral characterization, thermal, DFT studies and anticancer cell line activities of Co(II), Ni(II) and Cu(II) complexes of Schiff bases derived from 4-amino-5-(pyridin-4-yl)-4H-1,2,4-triazole-3-thiol"; J. Spectrochimica Acta, 145 (2015) 155–164.
34. S. Rakshit, D. Palit, S. K.S. Hazari, S. Rabi, T. G. Roy, F. Olbrich, D. Rehder, "Synthesis, characterization and biomedical activities of molybdenum complexes of tridentate Schiff base ligands. Crystal and molecular structure of  $[\text{MoO}_2(\text{L}^{10})(\text{DMSO})]$  and  $[\text{MoO}_2(\text{L}^{11})(\text{DMSO})]$ "; J. Polyhedron 117 (2016) 224–230.
35. Z. Asadi, M. Asadi, M. R. Shorkaei, " Synthesis, characterization and DFT study of new water-soluble aluminum(III), gallium(III) and indium(III) Schiff base complexes: effect of metal on the binding propensity with bovine serum albumin in water"; J. Iran. Chem. Soc. 13 (2016) 429–442.
36. M. Jazestani, H. Chiniforoshan, L. Tabrizi, P. McArdle, B. Notash, "Synthesis, crystal structure of nickel (II) complexes of 4-nitro phenylcyanamide: Comparative in vitro evaluations of biological perspectives"; J. Inorganic Chim. Acta, 450 (2016) 402–410.
37. N. Mathew, M. Sithambaresan, M. R. P. Kurup, " Spectral studies of copper (II) complexes of tridentate acylhydrazone ligands with heterocyclic compounds as coligands: X-ray crystal structure of one acylhydrazone copper (II) complex"; J. Spectrochim. Acta, 79 (2011) 1154– 1161.
38. Haythem , Saadeh, Ibrahim M. Mosleh, Amal G. Al-Bakri, Mohammad S. Mubarak " Synthesis and antimicrobial activity of new 1,2,4-triazole-3-thiol metronidazole derivatives"; J. Monatshefte für Chemie, 141 (2010) 471–478 .
39. Nurhan G`UMR`UKC, `UO`GLU, Mevlut SERDAR, Elif C , EL`IK, Ali SEV`IM , Neslihan DEM`IRBAS " Synthesis and Antimicrobial Activities of Some New 1,2,4-Triazole Derivatives "; J. Turk . Chem., 31 (2007) 335 – 348.
40. K. Sasidhar, N. Ramanuj, K. V. S. N. Raju, " The impact of 1,2,3-triazoles in the design of functional coatings"; J. RSC Adv. 5 (2015) 3687–3708.



## RESEARCH ARTICLE

### LOCALISATION INHABITUELLE DE LA TUBERCULOSE OSTEOARTICULAIRE (TALUS) : A PROPOS D'UN CAS.

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Bone tuberculosis, talus.

#### Abstract

The talar tuberculosis is a rare bone localization of Koch bacillus. We report the case of a 50-year-old woman, with no special medical history, who complained of pain in the right foot with chronic evolution. Pathology study of a Bone biopsy led to the diagnosis of talar tuberculosis. A 6-months anti-bacillary treatment was given. The risk of degeneration compromises the functional future of the ankle joint.

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#### Introduction:-

La tuberculose ostéo-articulaire représente environ 35% des atteintes extra pulmonaires et environ 1 à 3% de tous les cas de tuberculoses [1, 2]. La localisation à la cheville et au pied constitue 2% des formes squelettiques [3,4]. La forme talienne est une entité très rare dont le pronostic dépend de la précocité du diagnostic et l'instauration du traitement spécifique.

Nous rapportons l'observation d'une tuberculose ostéoarticulaire de localisation talienne avec revue de la littérature.

#### Observation: -

Il s'agissait de Madame M.R âgée de 50 ans, femme au foyer sans antécédents pathologiques particuliers. Elle s'est présentée dans notre formation pour douleur, tuméfaction et impotence fonctionnelle du pied droit avec une fistule purulente à la face externe de la cheville.

Le début de la symptomatologie remontait à quatre mois, avec l'apparition d'un gonflement douloureux de la cheville qui a été considéré comme une entorse bénigne négligée et traité comme telle. Deux mois plus tard, était apparue une fistule latérale avec issue d'un liquide d'aspect purulent, le tout évoluait dans un contexte d'apyrexie et de conservation de l'état général.

Devant ce tableau, la patiente avait consulté une autre formation hospitalière où elle avait bénéficié d'un bilan biologique standard et d'un examen bactériologique du liquide purulent. Cependant, les résultats n'étaient pas concluants, avec absence d'hyperleucocytose, une protéine-C-réactive négative et un examen direct négatif du prélèvement.

La patiente a été mise sous antibiothérapie à base de pénicilline M, mais sans amélioration notable.

A son admission dans notre service, l'examen clinique retrouvait (*figure 1*), une tuméfaction et une fistule active à la face externe de la cheville qui donnait du liquide séreux et une boiterie à la marche, l'articulation tibio-astragalienn

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était libre. Les radiographies standards de face et de profil de la cheville (*figure 2*), montraient une lésion lacunaire de la partie supéro-médiale du corps du talus, grossièrement arrondie avec ostéosclérose périphérique. La tomодensitométrie de la cheville avait confirmé l'atteinte ostéo-articulaire et avait objectivé la présence d'une lésion ostéolytique du talus (*figure 3*).

La biopsie osseuse fut alors réalisée. L'abord a été latéral avec excision des tissus inflammatoires et nécrotiques, résection du trajet fistuleux et curetage biopsique talien large. Un nétoyage articulaire au sérum physiologique a été pratiqué et une immobilisation par attelle postérieure a été mise en place.

L'histologie permit d'affirmer le diagnostic de tuberculose par la présence de nombreux granulomes épithélioïdes et giganto-cellulaire centrés d'une nécrose caséuse, tandis que l'analyse bactériologique était non contributive avec mise en évidence d'une flore bactérienne polymorphe où prédominait le *Pantoea Agglomerrans*. Un bilan d'extension n'a pas montré de localisation pulmonaire ou extra pulmonaire.

Après un bilan hépatique, rénal et hématologique, un traitement antibacillaire a été instauré pendant six mois à base de Rifampicine (R) : 5mg/kg/j, d'Isoniaside (H) : 10mg/kg/j, de Pirazinamide (P) : 25mg/kg/j et d'Ethambutol (E) : 20mg/kg/j, avec deux mois de RHZE et quatre mois de RH.

La fistule s'est tarie en quatre semaines, mais la patiente garde toujours des douleurs séquellaires à la marche au dernier contrôle.

#### Iconographies:-



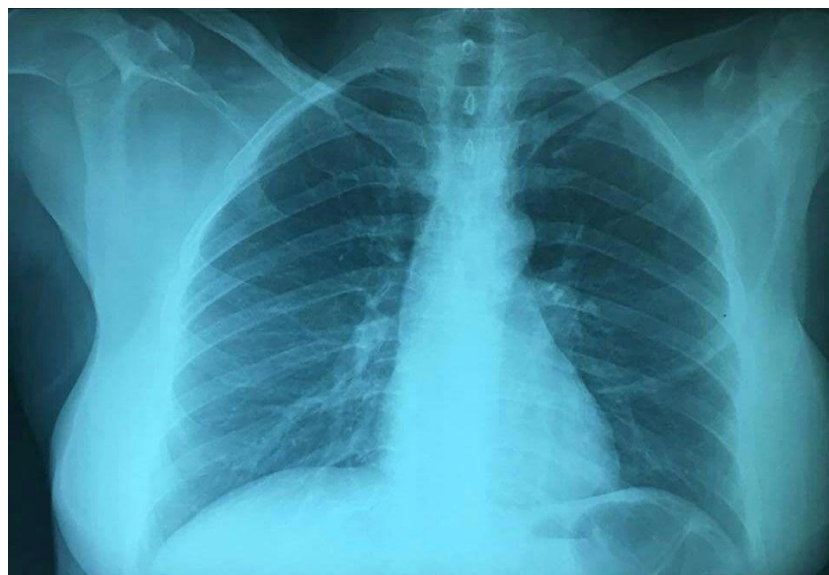
**Figure 1:-** Tuméfaction avec fistule à la face externe de la cheville droite.



**Figure 2:-** Radiographie standard de face et de profil ; lésion lacunaire du talus.



**Figure 3:-** La tomodensitométrie en coupes sagittales ; lésion ostéolytique du talus.



**Figure 4:-** Radiographie du thorax de face normale.

**Discussion:-**

Selon les données de l'Organisation Mondiale de la Santé en 2014, 9,6 millions de personnes ont développé la tuberculose. Au Maroc, un total de 30.636 cas de tuberculose, toutes formes confondues, a été notifié en 2015. La proportion de la forme extra-pulmonaire était la plus élevée en 2015, avec 52% des cas, contre 48% des cas de tuberculose pulmonaire [6].

Les formes extra-pulmonaires sont dominées par l'atteinte rachidienne qui représente plus de la moitié des cas [7]. La localisation à la cheville est très rare et ne représente que 2 % des atteintes squelettiques. Zacharia *et al.* [5] ont revu une série de 14 cas de tuberculoses de la cheville, la localisation talienne et calcanéenne était la plus fréquente. Chez notre patiente l'atteinte était talienne.

La rareté de cette affection et les manifestations cliniques aspécifiques expliquent un retard diagnostique pouvant aller de quelques semaines à plusieurs mois [1]. Les principales manifestations cliniques sont la douleur, le gonflement et l'impotence fonctionnelle. Les signes d'imprégnation tuberculeuse sont rares. A des stades tardifs, on peut observer une fistulisation sur la peau [5].

La radiographie osseuse standard est aspécifique. Au début, la tuméfaction des tissus mous et l'ostéopénie peuvent être présentes avant les signes tardifs de destruction osseuse. La radiographie du thorax n'est pas d'une grande spécificité car plus de 80 % des patients n'ont pas de tuberculose active concomitante [8]. Dans notre étude la radiographie du thorax était normale (*figure 4*). La tomодensitométrie est en retard par rapport à l'imagerie par résonance magnétique pour la détection de l'atteinte osseuse et bien moins performante pour l'atteinte de tissus mous [8].

La biopsie est le seul élément clé du diagnostic, suivie d'une analyse histologique et bactériologique. La culture du prélèvement biopsique n'est pas toujours concluante et peut nécessiter plusieurs semaines à se positiver [9]; l'aspiration du liquide articulaire en cas d'atteinte associée de l'articulation paraît insuffisante pour étayer le diagnostic [10]. Les produits de drainage des fistules sont généralement contaminés par d'autres micro-organismes [10]. Cela a été le cas chez notre patiente où seule l'étude anatomo-pathologique du produit de curetage talien a permis de poser le diagnostic formel de tuberculose du talus.

Le traitement est essentiellement médical par les antibacillaires, il permet de limiter l'évolution vers les séquelles douloureuses et les déformations, la majorité des lésions guérissent en 6-12 semaines sous le traitement médical. Le traitement chirurgical, quant à lui, ne peut en aucun cas remplacer le traitement médical. Il trouve sa place, premièrement, dans l'obtention des prélèvements anatomopathologiques. Deuxièmement, il est indiqué en cas d'insuffisance du traitement médical, lorsque persiste une synovite, une fistule ou un abcès. La chirurgie interviendra enfin dans le cadre des corrections de déformation séquelle importante et douloureuse [11,12].

**Conclusion:-**

La tuberculose ostéoarticulaire, isolée, de la cheville est une entité rarement rapportée dans la littérature, l'atteinte du talus est exceptionnelle. C'est une localisation grave et de diagnostic difficile, pouvant mettre en jeu le pronostic fonctionnel du pied.

**Conflits d'intérêt:-**

Les auteurs déclarent ne pas avoir de conflits avec ce manuscrit.

**Contributions des auteurs:-**

Tous les auteurs ont lu et approuvé la version finale du manuscrit.

**References:-**

1. Yombi JC, Vandercam B, Cornu O, Lecouvet F, Leemrijse T. Ostéoarthrite tarsienne: une localisation rare de la tuberculose. *Rev Chir Orthop Reparatrice Appar Mot.* 2007 Nov;93(7):740–5.
2. Dhillon MS, Nagi ON. Tuberculosis of the foot and ankle. *Clin Orthop.* 2002;398:107–113.
3. Vohra R, Kang HS, Dogra S, Saggarr RR, Sharmua R : Tuberculous osteomyelitis. *J Bone Surg (BR)*, 1997, 79, 562-566.
4. Watts HG, Lifeso RM: Current concepts review. Tuberculosis of bones and joints. *J Bone Surg (Am)*, 1996, 78, 288-298.
5. Zacharia TT, Shah JR, Patkar D, Kale H, Sindhwani V. MRI in ankle tuberculosis: Review of 14 cases. *Australas Radiol.* 2003 Mar;47(1):11–6.
6. Situation épidémiologique de la tuberculose au Maroc - Année 2015, [http://www.sante.gov.ma/Documents/2016/03/Situation\\_%C3%A9pidimio\\_de\\_la\\_TB\\_au\\_Maroc\\_\\_2015%20Fr%20V%2020%20mars.pdf](http://www.sante.gov.ma/Documents/2016/03/Situation_%C3%A9pidimio_de_la_TB_au_Maroc__2015%20Fr%20V%2020%20mars.pdf)
7. VAUGHAN KD: Extrapapinal osteoarticular tuberculosis: a forgotten entity? *West Indian Med J*, 2005, 54, 202-206.
8. Ridley N, Shaikh Mi, Remedios D, Mitchell R. Review: radiology of skeletal tuberculosis. *Orthopedics.*1998;21:1213–1220.
9. Wolfgang GL: Tuberculosis Joint Infection. *Clin Orthop*, 1978, 136, 257-263.
10. Gillespie WJ, Mayo KM, Johnstone V: Skeletal Tuberculosis in New Zealand since the introduction of chemotherapy. *Aust N Z J Surg*, 1987, 57, 727-732.
11. Tuli SM. General principles of osteoarthicular tuberculosis. *Clin Orthop Relat Res.* 2002 May;(398):11–9.
12. Inoue S, Matsumoto S, Iwamatsu Y, Satomura M. Ankle tuberculosis: a report of four cases in a Japanese hospital. *J Orthop Sci.* 2004;9(4):392–8.



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### RESEARCH ARTICLE

#### SHOULD INDIAN RAILWAYS BE PRIVATIZED?

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#### Abstract

FDI plays an important role in developing countries such as India where every sector is developing and the government sometimes faces the shortage of investments. In such situations FDI plays an important role. Indian railways are such an example which has shortage of funds. Our Indian Railways need robust investment which can be met only if private investors are attracted. Indian railways are the ONE single entity that touches lives of all Indians, some more regularly than others. The Indian Railways is known for its turnaround story going from a near bankruptcy in 2001 to strong behemoth in 2007. But now to the losses are increasing every year and operating ratio is also very high when compared the previous few years. Passenger trains are always running in loss which is subsidized by freight trains. Not only this, India loses as much as \$45 billion a year due to poor logistics infrastructure. This wastage could be cut by half and fuel needs could be reduced by 15-20 percent if the country fixes its transport infrastructure and moves more goods by rail. Only 33% of the total electricity route is electrified. Transport by electricity is much more energy efficient than by diesel. Vision 2020 plans to have more than 50% route electrified by 2020.

This paper looks into the problems faced by the Indian Railways and what can be the solution of these problems confronted by Indian Railways.

The objectives of this research are: do we need privatization of Indian railways? And why do we need it? For this secondary data is used and that data has been collected from different sources which is analyzed and interpreted properly.

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#### Introduction:-

Indian railways (IR) started its 53 km journey between Mumbai and Thane on April 16, 1853 and is today one of the largest Railways in the world. The railway network invariably referred to as 'the lifeline of the Indian economy' is spread over 109,221 Km. covering 6906 stations. Now India has the world's fourth largest rail network and also second largest under single management, Operates more than 19,000 trains every day. It has 2,29,381 wagons, 59,713 coaches and 8,417 locomotives.

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Indian Railways have joined the select club of countries comprising Chinese, Russian and United States Railways with an originating freight loading of 1008.09 million tonnes (i.e. one billion plus) in 2012-13. During 2013-14, Indian Railways carried 1.05 billion tonnes of freight and carried 1.1 billion tonnes in 2014-15. Indian Railways is primarily financed through Gross Budgetary Support from the union budget, its own internal resources (freight and passenger revenue, leasing of railway land, etc.) and Extra Budgetary Resources (market borrowings, institutional financing, etc.). The share of internal resources in Railways financing has been declining from past some years. Modernization of Railway infrastructure is a priority. Rail Budget 2015-16 has projected an investment plan of Rs 8,56,020 crore in the next five years, and in this FDI can play a very crucial role. Modernization of railways can be a significant engine of inclusive growth and development for the country and can potentially contribute an additional 1.5% to 2% to GDP (*Ministry Of Railways*). Railways have started many projects from the past two decades which are still incomplete and some projects are as old as 30 years. The progress in work is not happening because of the lack of funds and also the railways are incurring losses every year and the surplus is also decreasing. India needs about 5-8 lakh crore to complete its ongoing projects. But where from this huge money will come. Hence there is a need of FDI in this sector too.

### **Foreign Direct Investment:-**

Foreign direct investment (FDI) is an investment in a business by an investor from another country for which the foreign investor has control over the company purchased. The Organization of Economic Cooperation and Development (OECD) define *control* as owning 10% or more of the business. Businesses that make foreign direct investments are often called multinational corporations (MNCs) or multinational enterprises (MNEs). An MNE may make a direct investment by creating a new foreign enterprise, which is called a Greenfield investment, or by the acquisition of a foreign firm, either called an acquisition or Brownfield investment.

Global FDI inflow's rose by 9 percent to USD 1.6 trillion in 2014, USD 1.75 trillion in 2015 and will raise to USD 1.8 trillion in 2016 (*UNCTAD Report 2014*). India's FDI inflows have increased 26 percent in 2014 reaching \$35 billion which was \$47bn in 2008 and \$35.6 bn in 2009 with maximum growth in service sector, despite macroeconomic uncertainties and financial risks according to an *UNCTAD Report*. This growth is much faster than the rest of developing Asia, which saw a growth of about 15 percent across 40 economies.

FDI in services sector grew up by 46% in 2014-15. With the government taking steps to improve ease of doing business and attracting investments, FDI inflows into the services sector grew by over 46 percent to USD 3.25 billion in **2014-15**. The services sector, which includes banking & insurance, railways, telecom, outsourcing, R&D, courier and technology testing, had received foreign direct investment (FDI) worth USD 2.22 billion in **2013-14**. However, the total foreign inflow in 2014-15 in the services sector was low as compared to **2012-13** when it was USD 4.83 billion, according to the Department of Industrial Policy and Promotion (DIPP) data. So with the growth in FDI in important sectors like services, overall foreign inflows in the country too rose by 27 percent to USD 30.93 billion during the previous fiscal year. The amount was USD 24.29 billion in **2013-14**. Services contribute about 60 percent to India's GDP and it receives high foreign inflows in this sector.

### **Privatization:-**

As Indian Railways are incurring losses every year and there is a need of huge investment. Where from the funds will come when government has no funds to support it and also the earnings of the railways are so less that cannot meet the demands of the projects. FDI is needed in the infrastructure, signaling, doubling and tripling of tracks, logistics etc. Hence FDI in railways will result in increased efficiency of the railways.

### **Some of the major advantages claimed for privatization of railways are:-**

1. Better use of the railways
2. Great responsiveness to the customer; a higher quality of service
3. Greater emphasis on the profitability and better value for money for the public travelling by rail.

Japanese National Railways are evidence to support these claims, which was privatized in 1987. However, because of particular aspects of the operating environment in which the privatized railways in Japan have been functioning, the Japanese experience is not readily transferable to other countries, especially India. A panel was set up for Indian Railways and the key recommendations of the panel are below:

1. Accounting process needs to be simplified and as per international standard.

2. Streamline recruitment & HR processes.
3. Focus on core activities.
4. Decentralization - More authority at Zone level
5. Encouraging Private entity.
6. Indian Railway Manufacturing Company
7. Independent regulator
8. Social costs & JVs to bear them.
9. Changing relationship between government & Railways - Railway budget should be phased out progressively and merged with the General Budget. Merging Ministry of Railways with Ministry of Transport.
10. Raising resources for investments.

Hence the committee has recommended encouraging the private entities which can bring the railways out of ICU. "The radical measures suggested include switching over to commercial accounting, corporatization of production units and involving private sector in manufacturing coaches, wagons and locomotives." No doubt the fares will go up but according to *NCAER Morgan Stanley Report* Indian passengers are ready to pay extra if they are provided the best amenities on rail.

### Review of Literature:-

**Bhati Sonam et al(2014)** in their research article "Foreign Direct Investment In Indian Railways" say FDI is allowed now in Indian Railways which was earlier prohibited . FDI up to 100 per cent is allowed through automatic route for mass rapid transport system in all metropolitan cities. They say FDI is allowed in high speed train projects, infrastructure in industrial parks, mass rapid transport system (MRTS), freight lines, rolling stock, railway electrification, signalling system, freight terminals and passenger terminals. **Rastogi Ankit (2012)** according to him Spanning 64,456 km with more than 7,133 railway stations, India's rail network is the largest in Asia and the second largest in the world (behind the US). However India's rail infrastructure suffers from chronic under-investment, due to which its potential for freight movement remains largely untapped. Rail freight has grown at around 7 % over the past five years. According to him there is a huge opportunity of FDI in Indian railways. **Kaur Manpreet et al.(2010)** According to these authors, the availability of developed infrastructural facilities is a sine-qua-non of progress of the economy. Adequate infrastructure is necessary not only to facilitate domestic investment but also to woo foreign investment. Many sectors are attracting FDI like infrastructure, retail, and transport and there is a great need of FDI in all such sectors. **Dwivedi Priya et al (2013)** in their paper say that in India FDI is allowed almost in all sectors except a few like arms and ammunition, atomic energy, railway transport, coal and lignite, mining of iron, manganese, chrome, gypsum, sulphur, gold, diamond, copper, and zinc. According to them FDI should be allowed in all these sectors especially Indian railways because it is not able to meet the current demand of passenger and freight. **Ramesh Nanaji (2002)** says most of the railway fatalities were accidental in nature and in the bread earning age group particularly among the males. The increasing number of population, overcrowding in the trains, reckless and careless behavior of the passengers, pedestrians and the train drivers towards safety norms are the constant causes of railway fatalities. The high levels of the railway fatalities make a strong case for the necessary accident control interventions. Public as well as the railway authorities must take some measures to bring down these fatalities. In such a case there is a need of huge investment to prevent such fatalities. According to **S. Sriraman in (2009)** complementary nature of the relationship between the two main modes of transportation, rail and road, needs to be promoted. Indian railways showed a huge cash surplus with the figure touching nearly Rs 25,000 crore in 2007-08 (revised estimates) and the operating ratio improving from 84 per cent in 2005-06 to 76 per cent in 2007-08; almost 20 per cent more than last year's figure. Partnership like public-private partnership would go a long way in giving rise to a more optimal modal split when viewed from the perspective of the economy. Though a small beginning has been made by giving licenses to private parties to run container trains, the complementary nature of the relationship between the two modes needs to be promoted in a much more significant way if efficiency and environmental concerns are to be met.

### Statement of problem:-

Indian railways are incurring loss every year. In the previous fiscal year it incurred a loss of about Rs 30,000 cr and the operating ratio is not coming down which is still at 92%. The scheduling process is another problem that has to be considered. Railways lack new coaches and even they do not have capacity to repair old ones at the rate they are being unfit to run. The cleanliness hygiene has been degrading for the past 5-10 years consistently. Billions of

rupees are blocked in projects which are yet to be completed. The waiting list number for the trains during normal times is alarming and during the time of festivals is mind boggling.

### Objectives:-

1. To study the operational efficiency of Indian railways from past 15 years.
2. To study where is the need of privatization in Indian Railways.
3. To study why there is need of privatization of Indian Railways.

### Research Design & Data collection:-

Data collection is a systematic approach to collecting information from a variety of sources to get a complete and accurate picture of an area of interest. For this study the data collected is purely secondary data.

**Secondary data:-** Secondary data is the data that is already collected in the past.

The secondary sources of data for the study are:

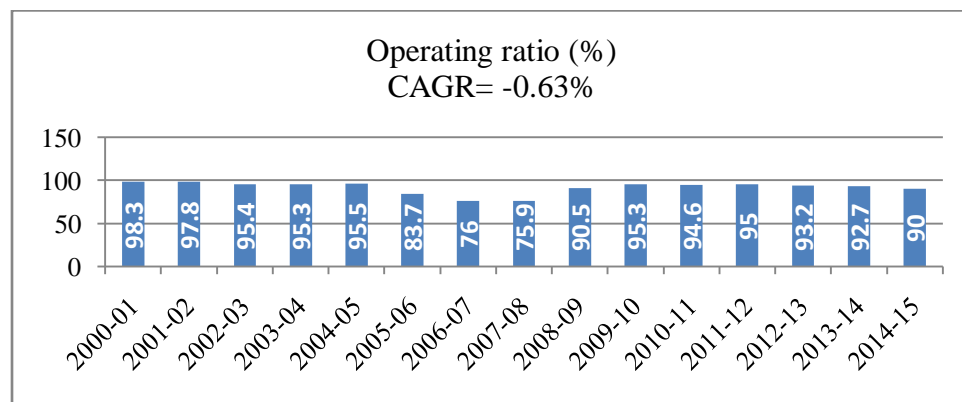
1. Indian railway board.
2. Economic Survey, WTO and RBI Reports, World Investment Reports, World Bank Reports, SIA Newsletter.
3. Secretariat of Industrial Assistance (SIA).
4. Central Statistical Organization (CSO).
5. DIPP.
6. Ministry of Commerce and Government of India.

### Tools Used For Analysis:-

Compounded Annual Growth Rate (CAGR) has been used for the study.

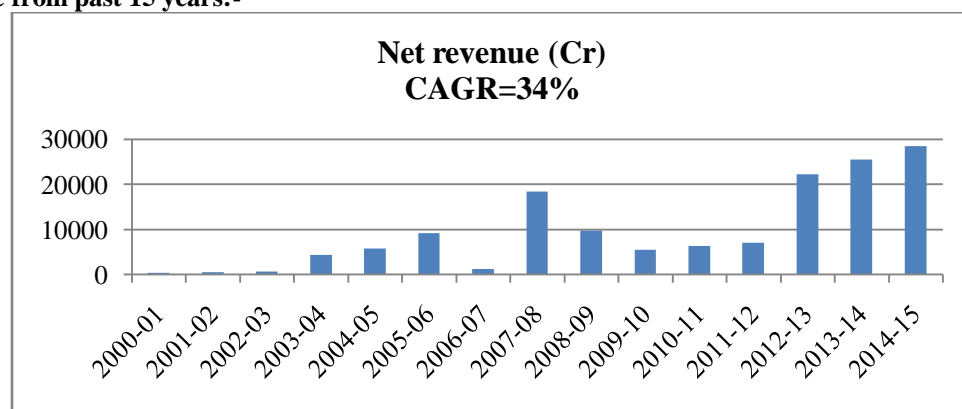
### Data analysis and interpretation:-

#### Operating ratio from past 15 years:-



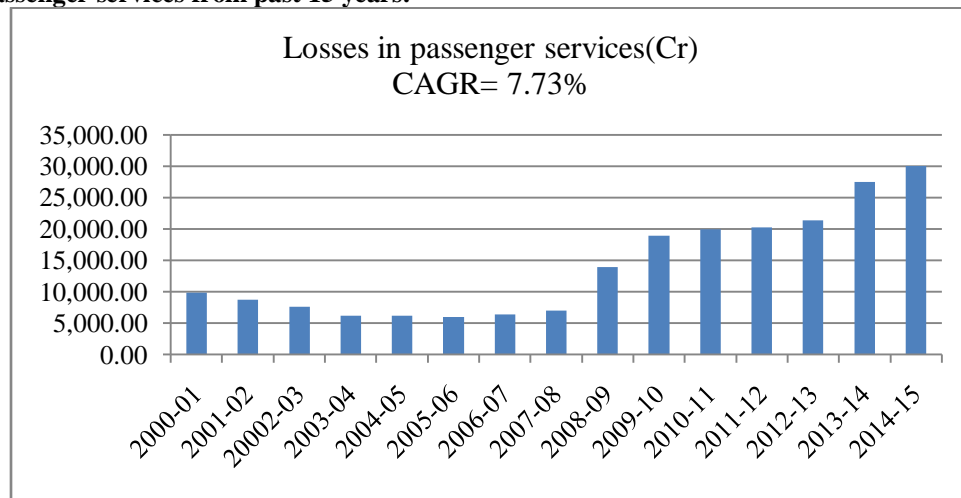
(Source: ministry of railways)

#### Net revenue from past 15 years:-



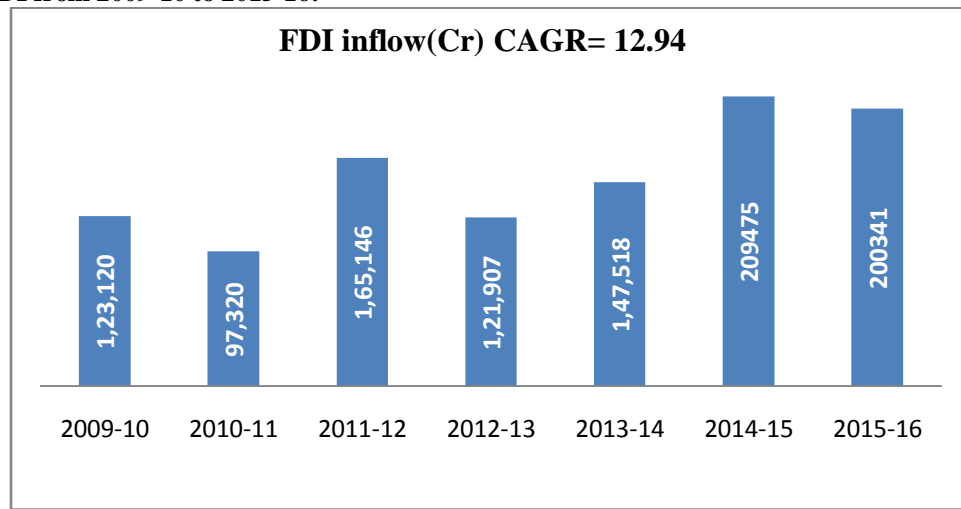
(Source: Ministry Of Railways)

**Losses in passenger services from past 15 years: -**



(Source: Ministry Of Railways)

**CAGR of FDI from 2009-10 to 2015-16:-**



(Source:DIPP)

**Following are a few areas where immediate private investment is required:-**

1. Shut down or sell of loss making low revenue routes in parts to private players.
2. Warehouses and security of the same must be sold to private players.
3. Freight and passenger operations can be privatized partially, with track access charges. This is a perfectly sustainable model, as and when there is a loss, the private player will vanish and govt will takeover.
4. The freight portion can be subcontracted out.
5. Excess land can be handed to a private company for lease management.
6. Manufacturing of locomotives and coaches is one thing that immediately needs to be privatized.

**Rolling stock requirement during the Twelfth Plan:-**

Type of stock	Requirement * on additional account (2012-13 to 2016-17)	Requirement ** on replacement account (2012-13 to 2016-17)	Total requirement (2012-13 to 2016-17)	Anticipated acquisition 2012-2017
Coaches	25,440	7,626	33,066	24,000
Diesel locos	1,500	500	2,000	2,000
Electric locos	1,800	210	2010	2010
Wagons( in vehicle units)	76,396	29,263	1,05,659	1,05,659

\* Requirement of coaches includes EMUs, MEMUs and DEMUs.

\*\* Requirement on replacement account for all rolling stocks are based on actual over age arising and the trend of average condemnation.

**Unexecuted projects as of F2015:-**

Project type	No of projects	Cost(Rs. Bn)
Rolling stock	1,287	1,750
New lines	132	1,336
Road safety works	1,739	437
Doubling	174	396
Gauge conversion	42	245
Metro projects	16	217
Track renewals	2,355	152
Electrification	39	67
Others	2,084	315
Total	7,868	4,914

(Source: Final Report On Mobilization Of Resources For Major Railway Projects)

Looking at these requirements there is need of private funds so that Indian Railways can meet the increasing demand of passengers and freight. If it is not done at the earliest, the higher end passenger will shift to airways and lower end to roads.

**Findings:-**

1. From the analysis of the above data the operating ratio which is as high as 98% in 2000-01. Post to that in 2007-08, Indian Railways had shown an excellent improvement in the net revenue and decrease in the operating expenses. But soon after that it again showed an increase and is still stagnant at 90% which is not good for railways. It has CAGR of -0.63%.
2. From the above graph it is clear that the net revenue is showing a CAGR of 34%. Indian railways was about to bankrupt in 2000 but after that due to certain policy changes it gained back its momentum and now it is doing well when compared to the previous years.
3. From the above graph it is clear that there is an increase in the losses of passenger services. These losses are because of the subsidy in the passenger fares and these losses are increasing at a CAGR of 7.7%.
4. The data related to FDI is collected from past seven years. The FDI inflow is fluctuating but has a satisfactory CAGR of 12.94. There is a need of FDI in Indian Railways because first it is running in losses and second government has no funds to provide support to Indian railways.
5. The unexecuted projects are showing astonishing figures which needs to be addressed soon.

**Suggestions:-**

1. As per the study, increase the investment to increase the speed of freight carriers and passenger trains rather than throwing more number of trains on tracks as our tracks are running above optimal (80%) capacity utilization.
2. There should be transparent accountability.
3. Increasing the electrification of railways as the rate paid by Indian Railways for diesel is 50% higher than the rate paid by US Railways, while the rate at which the Indian railways can get electricity is 45% lower than that paid by US transporters.
4. Policies to shift road freight to rail freight.

5. Attract investment to expand the infrastructure.
6. Shut down Railways running nursing colleges, bottling companies or making electricity boards.
7. Transfer local train services to states or city corporations.
8. Advanced signalling systems like AWS instead of traditional block signalling system.
9. Stations can be operated under contract.

### Conclusion:

In developing countries like India, there is a constant demand for opening new railway services in order to meet the transport needs and Indian Railways is the backbone of the nation as it moves Aam Admi to every corner of the nation. It is not financially viable because of subsidy in passenger fares and is incurring losses in thousands of crores every year. Such loss making services will have to be minimized. Operating ratio is very high which needs to be taken care of in order to improve the financial viability of Indian Railways. There is a need of technology that can be installed or used in order to enhance the speed of rolling stock and passenger trains. As the government has not enough funds to invest in the expansion plans hence it should make the railways attractive for the private investors who can take up different projects and invest in them.

### References:-

- Bhati Sonam et al (2014)** “Foreign Direct Investment In India In Railway Sector” IRJMST Vol 5 Issue 11 [Year 2014] ISSN 2250 – 1959 (Online) 2348 – 9367.
- Kaur Manpreet (2014)** “Impact of Foreign Direct Investment in India” *International Journal of Reviews, Surveys and Research (IJSR) Current Issue - Volume 3 Issue 2 May 2014.*
- Nanaji Wasnik Ramesh (2002)** “Original research paper Analysis of Railway Fatalities in Central India” . J Indian Acad Forensic Med, 32(4). ISSN 0971-0973.
- Priya Dwivedi and Jyoti Badge(2013)** “Impact Of FDI Inflow On Service Sector In India: An Empirical Analysis” *ISSN 2319-345X, Vol. 2, No. 3, July 2013*
- Rastogi Anupam (2004)** “Raising Resources for Railway Projects”. Source: Economic and Political Weekly, Vol. 39, No. 24 (Jun. 12-18, 2004), pp. 2503-2510. Published by: Economic and Political Weekly.
- Sriraman S. (2009)** “Indian Railways: Has It Really Reformed?”. Source: Economic and Political Weekly, Vol. 44, No. 10 (Mar. 7 - 13, 2009), pp. 19-21. Published by: Economic and Political Weekly.

### Reports:-

1. DIPP
2. Ministry of railways.
3. Ministry of finance
4. MORTH
5. Planning commission
6. Twelfth five year plan
7. World bank



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### RESEARCH ARTICLE

## HISTO-MORPHOMETRICAL STUDY ON KIDNEY GLOMERULI AND CORTICAL TUBULE IN LATE PREGNANCY.

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#### Key words:-

Pregnancy, histo-morphometry, kidney.

### Abstract

**Background:** Maternal accommodation to normal pregnancy begins shortly after conception, during pregnancy the anatomical and histological changes occur in the kidney as a maternal adaptation for physiological changes.

**Aim:** Evaluation morphological changes in the kidney glomeruli and tubules during pregnancy, Histomorphometrical assessment of glomeruli and tubular changes with pregnancy.

**Material and Method:** This study carried on 40 mature mice divided into two groups, 20 pregnant mice served as experimental group and 20 non-pregnant mice as a control group, kidneys were removed; the weight is measured and then fixed, dehydrated in ascending grades of alcohol, cleared in xylene and infiltrated with paraffin. The paraffin blocks were made and 5µm thin sections were obtained using a rotary microtome. The sections were stained with H&E stain, PAS examined under light microscope.

**Result:** Under the light microscope, the kidney in experimental group show the many anatomical changes as increase in Wight, elongated and increase in width, and showed many histological changes as a glomerular enlargement with decrease of urinary space and dilation in proximal and distal tubule. A statistically significant differences have been shown in the diameter of renal corpuscle, glomerular tuft and Bowman's space, and also in the renal tubules proximal and distal convoluted tubules ( $p < 0.001$ ). And in Wight, elongation and width as ( $p < 0.001$ ).

**Conclusion:** The results of the present study indicated during pregnancy kidney undergo to anatomic change as increase in size and Wight, and histologic change as elongation in glomeruli, and dilation in diameter of tubule.

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### Introduction:-

Pregnancy causes definite and marked changes in urinary tract. The most important changes as dilation of the ureter and kidney pelvis, this phenomena is common and might well be said normal concomitant of pregnant state<sup>(1)</sup>. All mammalian kidney show a morphohistological feature which describe as a cortex enclosing a pyramid-shaped medulla, the tip of which protrudes into the renal pelvis, the medulla is divided into an outer and an inner medulla;

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the outer medulla is further subdivided into an outer and an inner stripe <sup>(2,3)</sup>. Each kidney has about one million of tiny filters called nephrons. The components of the nephron include the renal corpuscle (glomerulus and Bowman's capsule), the proximal and distal tubules, and collecting tubule. <sup>(4)</sup>

The glomerulus is a spherical structure having a capillary network lined by a thin layer of endothelial cells, in the central region mesangial cells, and the visceral region of epithelial cells podocytes and the parietal epithelial cells of Bowman's capsule and associated basement membrane. These two epithelial layers are separated by a narrow cavity identified as Bowman's space or urinary space. <sup>(5,6)</sup> Proximal and distal tubule are parts of a nephron, proximal tubule is the portion of tubule that starts at Bowman's corpuscle which is highly convoluted and located in cortex, then descending in medulla to become continuous with another tubule. <sup>(7)</sup> Distal tubule is a less convoluted and shorter tubule than proximal and has a smaller diameter. <sup>(8)</sup> Morphometry is a stereological method that has been used to study physiological function of an organ or tissue from the morphological point of view, the words of morphometry include quantification of three-dimensional properties of an object from two-dimensional plans.

### Material and Method:-

The study was performed on albino mice (*Mus Musculus*). Healthy males and females were obtained from the animal house of High Institute of Infertility Diagnosis and Assisted Reproduction Technologies / Al-Nahrain University. 40 healthy mature female mice were divided into two groups equally, Group I non-pregnant served as control group, and Group II pregnant mice in between (15-21) used as experimental group. The kidneys of control and experimental group were removed and washed by normal saline then the weight of the kidneys measured, then fixed in formaldehyde solution for (24-48) hours, dehydrated in ascending grades of ethanol alcohol (70%, 90%, 100%), cleared in xylene and infiltrated with filtered paraffin. The paraffin blocks were made and 5µm thin sections were obtained using a rotary microtome. The sections were stained with (H&E) and (PAS) stain; then sections were examined under light microscope at magnification 10X, 20X, 40X, 100X.

### Morphometric parameter:-

The image analysis program is used to measure the diameter of renal corpuscles, glomerular tuft and Bowman's space in corticomedullary area at magnification 40X and also measure the diameter of proximal and distal convoluted tubules at magnification 100X.

### Result:-

Observation of anatomical criteria of kidney in both groups yielded the facts that both kidneys were found to be situated on the posterior abdominal wall on each side. In control group the measurement of kidney dimensions were as follows: Length 10mm, width 5mm, thickness 2.5mm. This was done by using vernier. While in pregnant group the dimensions showed a slight increase especially in regards to the length where 1-2mm increase was recorded. In regards to kidney weight both kidneys were weighed and the mean weight of kidney in control group was 0.19±0.003 gram, while pregnant group kidneys showed a marked increase in the weight 0.28±0.006 gram. This increase is statistically significant increase was recorded as shown in table (1).

**Table 1:-** Showing the statistically significant increase in length, width and weight of kidney during pregnancy.

Parameter	Control Mean ±SE	Pregnant Mean ±SE	P-Value
Kidney length(µm)	778±3.1	888±7.6	*P≤0.05
Kidney width (µm)	417±3.1	443±4.4	*P≤0.05
Kidney weight (gm)	0.19±0.003	0.28±0.006	*P≤0.05

### The histological aspect of the glomeruli:-

The glomeruli is a tuft of blood vessels located inside the renal corpuscle. Examination of the corpuscle under light microscope revealed the following: Group A: showed normal arrangement and size of renal corpuscle and glomeruli with well identified wide space. That continuous to form proximal convoluted tubule.

Group B: pregnant group showed number of changes both histologically and morphometrically. The glomeruli in pregnant group were enlarged in size, this enlargement was assessed morphometrically using ImageJ software. The glomerular area was calculated and statistically analyzed.

Control group showed a mean glomeruli area of  $658 \pm 19 \mu\text{m}^2$ . While in pregnant group the mean area of glomeruli was  $710 \pm 13 \mu\text{m}^2$ . A significant P value was estimated in between these two group in regards to glomerular area. Figure (2) & Table (2) Bowman's Space (urinary space) showed a marked decrease in pregnant group, Figure (1). Morphometric analysis of this result showed that urinary space area changed from ( $156 \pm 1 \mu\text{m}^2$ ) in control group to ( $72 \pm 1.5 \mu\text{m}^2$ ) in pregnant group, table (2).

Table (2): showing the statically significant increase in glomerular area and urinary space.

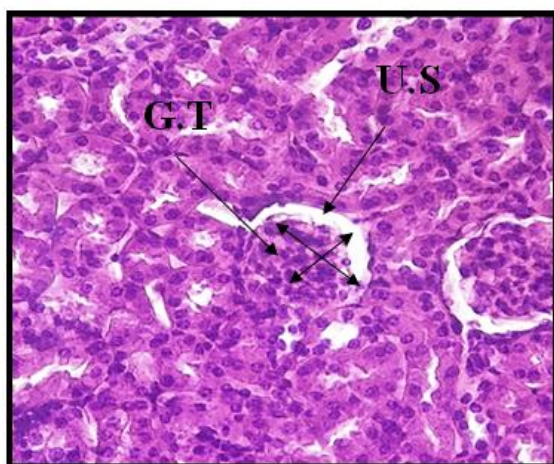
parameter	Control Mean $\pm$ SE	Pregnant Mean $\pm$ SE	P- Value
Glomerular area( $\mu\text{m}^2$ )	$658 \pm 19$	$710 \pm 13$	*P<0.05
Urinary space ( $\mu\text{m}^2$ )	$156 \pm 1$	$72 \pm 1$	*P<0.05

#### Histological observation of proximal convoluted tubule (PCT):-

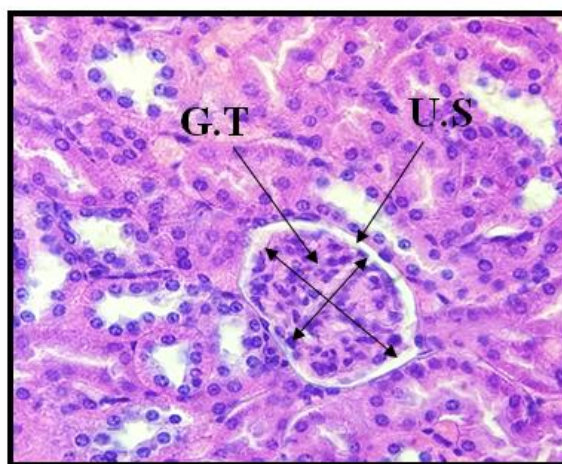
As a part of nephron, proximal tubule poses two different portion as a convoluted part and straight part. Examination of PCT in pregnant group reviewed the following criteria (Figure 3, 4, 5, 6): The size of the tubule where more than seen in group A, The cells forming PCT where long cuboidal, eosinophilic, with large prominent nucleus and densely stained cytoplasm, Brush border of PCT cells was dens, thick, occupies the lumen totally and was densely stained by both H&E and PAS stain, A striking Feature of vaculation was noticed in these cell apical surface. Pregnant group showed a high mean area for PCT ( $545 \pm 14 \mu\text{m}^2$ ) while the control group PCT area was ( $424 \pm 24 \mu\text{m}^2$ ). A statistical analysis of these result showed a significant P value of (\*P<0.05) between these two group.

#### Histological observation of distal convoluted tubule (DCT):-

Distal convoluted tubule were found to be located in between glomeruli and proximal convoluted tubule. They were Small, Wide, Pale type of Tubule with wide clear lumen. The cells form in this type of tubule were low type of cuboidal cell, with fain eosinophilic cytoplasm and small round centrally located nuclei. The Number of DCT in compered to PCT were less in the cortex. Compression in regards to morphological point of view between pregnant and non-pregnant group showed dilation in DCT in pregnant group seen in H&E (Fig 7)& (Fig 8). A morphometrical measurement for the size of DCT was performed using Image J software. A total tubular area was chosen as a criteria to detect the include in size of DCT recorded by visual examination. Pregnant group showed a high mean area for DCT ( $369 \pm 9 \mu\text{m}^2$ ) while the control group DCT area was ( $263 \pm 4.5 \mu\text{m}^2$ ). A statistical analysis of these result showed a significant P value of (\*P<0.05) between these two group.

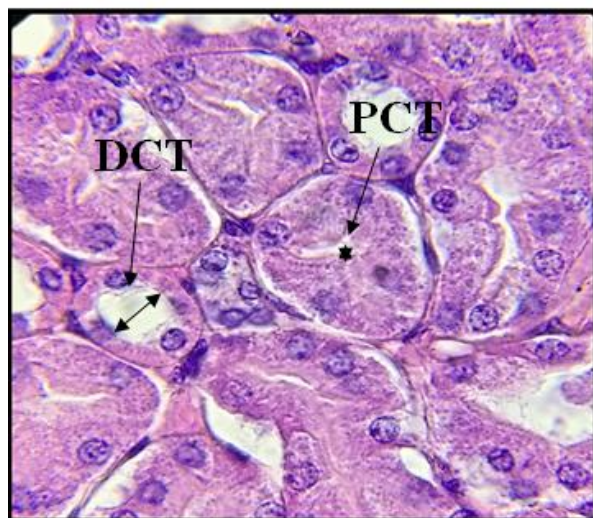


**Figure 1:-** shows the glomeruli tuft (G.T) and glomeruli with urinary space (U.S) in control group. (H&E, control group, 400 X).

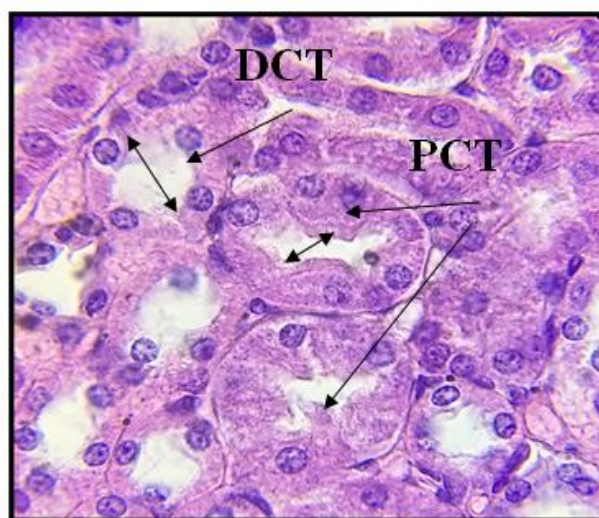


**Figure 2:-** shows the glomeruli tuft (G.T) and narrow urinary space (U.S) in pregnant group. (H&E, pregnant group, 400X).

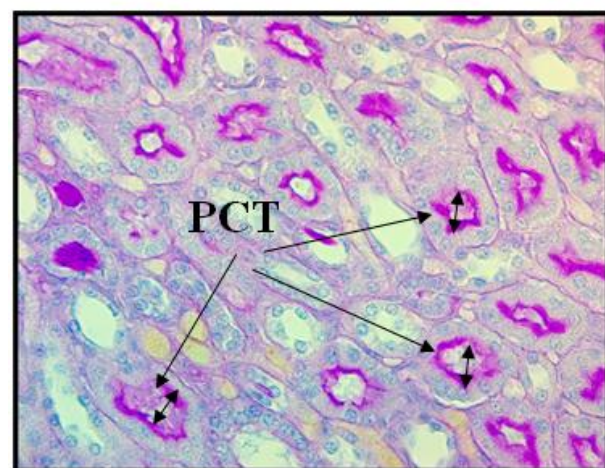




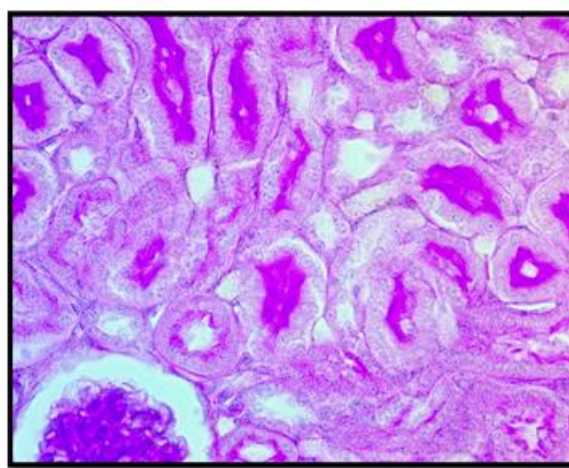
**Figure 3:-** Showing the PCT diameter in control group, H&E, 1000X.



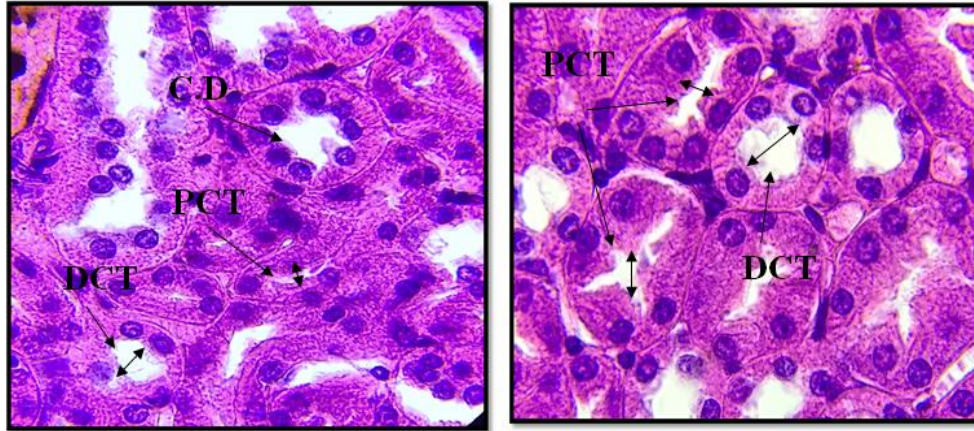
**Figure 4:-** Showing the PCT diameter in pregnant group, (pregnant group, H&E, 1000X)



**Figure 5:-** Showing the PCT in pregnant group and a thin basement membrane (PAS stain, pregnant group 400X).



**Figure 6:-** Showing proximal convoluted tubule PCT with it brush border, thickening in basement membrane (B.M) in control group (PAS stain, control group 400X).



**Figure 7:-** showing DCT with clear lumen, no brush border and thickened in basement membrane, collecting duct (C.D) & PCT. (H&E, control

**Figure 8:-** showing DCT with clear lumen, no brush border, enlarged diameter and less thickened in basement membrane & PCT. (H&E, pregnant group, 1000X).

### Discussion:-

It was reported that the volume of right kidney in normal individuals was significantly smaller than that of the left because the spleen is smaller than the liver so the left kidney has more space for growth.<sup>(9)</sup>

The volume of the kidney is greatly affected by the method of fixation, we used the immersion method in this study but actually the perfusion method was more reliable for calculating the absolute weight and volume of the kidney before processing.<sup>(10)</sup>

From an anatomical view we demonstrated an increase in the weight and size of the kidneys in pregnant group due to increase in two dimensions of three (length & width). These results agree with some previous studies which reported normal increase in size of the kidney up to 30% with 1–1.5cm increase in length in pregnant females mainly due to changes in the vascular and interstitial spaces or hydronephrosis.<sup>(11, 12)</sup>

There were another possible reasons explain the increase in the renal size during pregnancy for example the renal plasma flow might be increased by 25% and the glomerular filtration rate increases up to 50% above normal. The increase of renal function had been attributed to the growth, hormone-like metabolic effects of placental lactogen and to increased free cortisol. Hormone secretion by the fetus might be responsible for the hypertrophy of the maternal organs. From the available evidence the kidneys might take several months to return to normal form of the non-pregnant state. On other hand the change in the renal dimensions might be an indicator of presence or progression of disease.<sup>(13, 14).</sup>

Glomerular size selectivity appeared to be altered in pregnant women and oncotic pressure was decreased because of expansion of the plasma volume, thus contributing to a rise in GFR. There may also be modest changes to glomerular ultrafiltration coefficient due to changes in the surface area for filtration and the hydraulic permeability.<sup>(13)</sup> Even severely hydronephrotic kidney had the normal number of glomeruli, this agrees with our results where it often realized that the glomeruli may be surprisingly well preserved in cases of marked tubular and interstitial changes.<sup>(15)</sup>

In normal adult non pregnant mice the means diameters of the lumen of the proximal convoluted tubules, the distal convoluted tubules, thick, and thin loop of Henle were  $11.5 \pm 4.183 \mu\text{m}$ ,  $16.5 \pm 2.850 \mu\text{m}$ ,  $12.6 \pm 1.596 \mu\text{m}$ ,  $18.6 \pm 1.294 \mu\text{m}$  respectively. These results disagree with ours because we demonstrated larger cross sectional area in proximal convoluted tubule than distal convoluted tubule in control and pregnant groups.<sup>(16)</sup>

This study agree with Bentley et al, who reported that the proximal tubules had large diameters and opaque walls, whereas distal tubules, connecting tubules, and collecting ducts had smaller diameters and less opaque walls.<sup>(17, 18)</sup>

This study reported an increase in the surface area (diameter) of proximal and distal convoluted tubule in pregnant group with respect to control group. The previous studies reported 20% increase in length of the proximal tubule within 5-6 days after mating without further significant changes to term. The increase in length would represent an increased area for reabsorption. While the proximal tubular diameter remains constant during pregnancy. The proximal tubular elongation was not detected at 2-3 days of pregnancy but it occurs later when both the absolute and fractional amounts of salt and water reabsorbed were significantly greater than control values during the high rate of infusion.<sup>(19, 20)</sup>

The pregnancy caused slight changes in shape of the proximal convoluted tubules and over 10% height reduction of the cuboidal epithelium lining the proximal convoluted tubules were observed in the kidney. The changes in the convoluted tubules proceed in a heterogeneous way and lead to a mixture of atrophic and hypertrophic units. The dilatation of the tubules due to accumulation of fluid tends to shortening of the tubules. The increase in the tubular diameter will reduce the number of the tubules profiles counted per section of tissue.<sup>(20, 21)</sup>

## References:-

1. Stephen N. Sturgiss, William Dunlop and John M. Davison. Renal hemodynamics and tubular function in human pregnancy. Baillie's clinical obstetrics and gynecology. 1994; 8(2). 209-232.
2. Keinth L.Moori, Arthur F. Dalley and Anne M.R.Agur. Clinically oriented Anatomy. 6th edition. Philadelphia. wolters Kluwer;2010.
3. Al-Samawy. E.M.R. Morphological and Histological study of the kidneys on the Albino rats, Al-Anbar Journal of Veterinary Sciences, 2012; 5(1).115-119.
4. Weinstein M.A. A mathematical model of the rat nephron. American physiology Society.2015; 308(10): 1098-1118.
5. Pollak R.M. et al. The Glomerulus: The Sphere of Influence. Clinical Journal of the American Society Nephrology. 2014; 9(8): 1461-1469.
6. Ichimura Koichiro. Structural disorganization of pronephric glomerulus in rat. PubMed. 2012; 241(12): 1922-1923.
7. Curthoys P. N. and Moe O.W. Proximal Tubule Function and Response to Acidosis. Clinical Journal of the American Society of Nephrology .2014; 9(9):1627-1638.
8. Gross J.B, Imai M, and Kokko J. P. A functional comparison of the cortical collecting tubule and the distal convoluted tubule. The Journal of Clinical Investigation. 1975; 55(6): 1284-1294.
9. Murlimanju B.V. et al. Morphometric Parameters of the Human Adult Kidney: An Anatomical Study. International Journal of Morphology. 2014; 32(2): 656- 659.
10. Warui C. N. Light microscopic morphometry of the kidneys of fourteen avian species. Journal of anatomy. 1989; 162(1):19-31.
11. Hussein Wael and Lafayette Richard A. Renal function in normal and disordered pregnancy. NIH Public Access. 2014; 23(1): 46- 53.
12. Brown Mark A. Urinary tract dilatation in pregnancy. American journal of obstruct and gynecology.1990; 164(2): 641-643.
13. Cheung Katharine L and Lafayette Richard A. Renal Physiology of Pregnancy. Advance Chronic Kidney Disease. 2013; 20(3): 209- 214.
14. Bailey R. R. and Rollest G. L. Kidney length and ureteric dilation in the puerperium. The Journal of Obstetrics and Gynecology of the British. 1971; 78(1): 55-61.
15. Moiler Jens Chr. Dimensional changes of proximal tubules and cortical capillaries in chronic obstructive renal disease. Virchows Arch A. 1986; 410(1):158-153.
16. Jia L. Zhuo and Xiao C. Li. Proximal Nephron. HHS public access. 2014; 3(3): 1079-1123.
17. Beck JC, Sacktor B. The sodium electrochemical potential-mediated uphill transport of D-glucose in renal brush border membrane vesicles. Journal of Biology and Chemistry. 1978; 253(1):5531-5535.
18. Atherton J. C., and Green R. Renal tubular function in the gravid rat. Baillinre's Clinical journal of Obstetrics and Gynecology. 1994; 8(2):265-285.
19. Atherton J. C., and Piriei Susan C. The effect of pregnancy on glomerular filtration rate and salt and water reabsorption in the rat. Journal of physiology. 1981; 319(1):153-164.
20. Moiler Jens Chr. Dimensional changes of proximal tubules and cortical capillaries in chronic obstructive renal disease. Virchows Arch A. 1986; 410(1):158-153.
21. A. Palasz Czekaaj, et al. Morphological changes in lungs, placenta, liver and kidneys of pregnant rats exposed to cigarette smoke. International Arch Occupu Environ Health. 2002; 75(1):27-35.



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### RESEARCH ARTICLE

#### The MYSTERY OF LIFE

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#### Abstract

The treatment of disease, the relief of suffering and the extension of basic care, according to the principle of fairness and justice, are the basic medical art characters. From this perspective comes the need for humanization of medicine that animates and sustains the very idea of scientific progress and the status of medicine, whose purpose is the person. A disease, or another experience pain and sorrow, can play a sort of "task" or function in a life "significant. the anxiety of the post, the sense of boredom and frustration, existential emptiness, the feeling of inconsistency of all, fear, boredom, sadness. It 's all a path that leads to the annihilation of personality. Experience bears out that there are other dimensions no less real and decisive than empirical science can clarify: the poetic dimension and the aesthetic, the reality of which deals with a philosophical mind or the spiritual

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#### The Concept Of Person:-

The treatment of disease, the relief of suffering and the extension of basic care, according to the principle of fairness and justice, are the basic medical art characters. From this perspective comes the need for humanization of medicine that animates and sustains the very idea of scientific progress and the status of medicine, whose purpose is the person. Many differences are born in the indication of the initial moment of its existence or even in the definition of death or when there is no longer the person failing in some capacity. Boethius said that the person is the individual substance of a rational nature, so an individual of a rational nature which is man. But the person is not a concept, its rationality is linked to human nature regardless of its operations, namely the ability or not to try to be rational. Unlike the concept of utilitarian Peter Singer where every person be rational and self-conscious and therefore the quality of the person is based on the ability to experience pleasure and pain. Undoubtedly self-awareness and rationality are the person indices, but these operations which indicate the person does not identify with it. You can not identify the acts with the subject that produces them. Is there a subject self-conscious, rational and free capable of implementing concepts that would otherwise remain only abstract concepts. Conceive of man as a person means to consider it in its entirety as spirit and body. The transition from power to act never changes the nature of a being, but simply encourages its full manifestation. A being can become what it is by its nature and so nothing can become a person without already being a person. The human individual is ontologically the same substance as a person he was. The substance is not subject to change, but changes its ability to possess certain skills. So all human beings are



persons. We could even say that the person is a unique and unrepeatable individuality of transcendent nature which carries an ontogenetic law of development. The transcendent and spiritual nature of man indicates the sublimity of his being that Christ has revealed himself as the image of God and the source of which is the act of God the Creator: The question of personal identity is reflected in the doctor-patient relationship, as symbolic expression of the human condition marked by the vulnerability. A key issue is the ability to grasp the unity prior to the relationship, namely the experience and living of the person, whose spiritual and psycho-physical integrity, always requires protection, proportionate care, political and social choices based on the principle of Justice. Our person is more of a non-continuous components together: something integrates all the information coming from inside of our bodies both from the outside world, as well as from our personal history, the illusion of being a unique identity. It understands that every human being is a person and that the orderly coexistence for the good implies respect for human rights are grounded in human nature. From the concrete phenomenological existence, you can recognize the dignity of each person, in a universal way. Hence the assumption of responsibility towards their own, but also towards the choices and consequences that decisions and medical actions are likely to cause. In reference to the new biomedical emergencies, together with the challenges of neuroscience, ethics is not enough to restricted regime. The enlargement of the view of the world can promote, through the technological age critical consciousness, a progressive globalization of rights such as the right to life, to subsistence, to the care and protection of persons whose preciousness and beauty transcends the cramped and austere space the individual profit. In the perspective of personalistic bioethics that seeks to reflect on the spiritual integrity, psycho-physical and relational, the ontological status of the person includes a reference to the starting point, that is the original synthetic unity of body and spirit of the human being unit .

The dignity of every person is therefore justified in the same dynamic order of his being. Human dignity resides in the act of the whole person; the presence of the human being stands as question of being and therefore being the person asks as an act of justice Recognition, warmth, hospitality and the defense of its integrity. The transcendent, spiritual dimension of the person has its ultimate roots in the truth of man's creation, intelligent finite being, who lives in a relationship with God in whose image and likeness. Sacred Scripture teaches that man was created "in the image of God" capable of knowing and loving his Creator, and which was formed by Him above all earthly creatures which of them ladies, to govern them and use them for glory of God. And 'within this communion of love that the mystery of all being finds its full meaning.

### **Health and Disease:-**

Reflect on the themes of health and disease, suffering and hope of the human person, it means researching the sense that these experiences have in the personal project of a person's life. I introduce reflection observing what the attitude of contemporary culture in the face of health and pain, in front of the living and dying, has changed in recent decades; a change of the rest are still in place, was so evolution. In a general way we can say that the man of our time has increased the sense of responsibility towards these life situations, from a behavior that accentuated the feeling of passivity and dependence, to a way of being and to manage these conditions in a much more active and responsible. Then the concept of health-illness is then considered in a wider and more articulated. One would say that today's man wants to not only live, but "live fully", attentive to the various dimensions of his being: organic, psychological and social. Against the suffering, it has become more aware of the plurality of causes that can provoke, as well as the variety of ways in which it can express itself. The experience of suffering also is experienced today more as a provocation and challenge not as a reality to accept and to bear patiently. It 'a trend that emphasizes the free and active aspect that arises before the reality with a positive attitude. The result is that every situation of pain, such as illness, failure, and other misfortunes, are seen primarily as a call of freedom and responsibility, as a denunciation of a need, a lack of which it requires the commitment of freedom. And 'then it grew the sense of human responsibility for both the causes that induce suffering and disasters, both man himself must do when a misfortune, suffering is taking place. There is to be borne in mind also the change of the cultural horizon of science and technology of our time, which refers to the evolutionary model of the cosmos and human existence, not without major repercussions on the meaning that illness and pain, health and they have hope for the contemporary man. In science and contemporary culture goes increasingly asserting the dynamic and evolutionary conception of the world and human existence. This conversation begins with a consideration on contemporary medicine. This opening is developing more and more to the totality of the human person. And 'now it entered the common language to talk about a psychosomatic or holistic medicine in order to understand the disease not only as a fact that affects the natural data of the patient, but that affects the existential given, the experience of the subject. No longer considered sufficient to cure the disease, you must get to take care of the sick person, seen in the plurality of its needs that maybe the disease blew chaotically. This is known, in the health sciences of the passage to be implemented by not

only cure, but also to take care of others. It is time to understand the reasons that are driving this transition. I will analyze this aspect taking the concept of health and to disease, trying to bring out the status of the human person when it enjoys the status of good-health and vice versa, when it is in ill-health. In a second step, I propose to raise the interest on the type of rationality suited to the world of health now seen in this broader perspective.

### **Concept of Health:-**

Recently it was Hans Georg Gadamer to draw attention to the difficulty encountered in wanting to define the health condition: We know roughly what they consist of diseases, as they are as it were characterized by the revolt of the fault. They manifest themselves as an object, as something that resists and then must be broken. It 'a phenomenon that one can observe carefully, judging the clinical value, and do it with all the methods provided by a knowledge objectively based on modern science. Health rather curiously exempt from everything, can not be examined, since its essence is precisely to hide. Unlike the disease, health is never a cause for concern, indeed, you are almost never aware of being healthy. It is not a condition that invites or cautions to take care of themselves: In fact implies the amazing ability to be forgetful of themselves. Some help to understand the sense of health as integrity, can be the use of linguistic root of the word "health." Be whole, be identical to themselves it means two things. First, be free from anything that impairs or prevents the integrity; secondly, be intact indicates the implementation of the entire 'potential' available, the achieve the goal using what is proper to man. It reports the conclusion arrived at Jaeger, a scholar of the problems of medicine: the doctor's task is to restore the hidden proportion, when it has been disturbed by the disease. In the state of good health is the very nature that restores or, if you will, is itself the right proportion. The concept so important to 'blend', actually means a kind of balance of body forces, closely connected with that of proportion and symmetry. The nature of work in the sense of a sensible norm. Comment on Real: These concepts of 'proportion', the 'symmetry', as well as those of 'more' and 'less', connecting closely with the concept of "measure", rather than "right size": this is the key concept of Platonic metaphysics, on which it depends to health. Health: "right fit", "harmony", "balance" The concept of health then, for Plato, it depends on the "right fit" or proportion of the parts of the whole organism of the human person, and this is the essential ontological character of reality same.

The conclusion is that you can not treat the human body without addressing the totality of the body. But even you can heal the body, or a part thereof, without even cure his soul, his psyche, ie the totality of man. This is confirmed by the latest medical research, where it is increasingly clear that the explosion of a disease, be it organic or psychological, is always the culmination of a story with complex ramifications and not always easy to decipher, however, where it is clear that the ultimate roots of evil invariably belong to two orders that constitute us, the body and the spirit. There is always a connection between the two dimensions, even if the specific origin is in either dimension. In connection with the plan of life, the person's health is therefore to be considered in a dynamic way, as tension to establish a balance between the different dimensions that make up the human person, and in the multidimensional sense that concerns man in his unit and in 'articulation of its size. Health can still be understood and studied at different levels, from the physical and psychological, to the level of interaction between the body and the psyche, or a good balance between individual and community. It should however be understood in its entirety then targeted on the basis of the "meaning of life" and located a spirit level: human well-being depends essentially on living a meaningful existence. And 'therefore a dynamic-evolutionary condition and not a "state" fixed and stable, but a point of arrival, a route to go, a vocation to answer in dialogue with other experiences of life: joy, suffering, disease, successes and failures, disappointments and achievements. It meets the human subject in the first person, because it is not a condition that just "happens" to the man, an event which should only take note, but it involves a definite stance on the part of man. Also in this case the man is a "you decide", that decides about himself, the manner in which it now intends to handle this situation. And 'note the definition of WHO's health since 1948 as a "state of complete physical, mental and social." Therefore understand properly the condition of man, means inscribe in their personal "biography", ie taking it in his conscience, make it the object of decisions integrated into a framework of values within which be implementing their own existence. Summarizing, I would say that the state of man's integral well-being can be understood in various ways, depending on the level of integration of man's essential dimensions:

- a. at a first level, which depends on the good functioning of the organism. We are in the order of the plant or animal life; this first conception of health is dependent on the condition of well-being of the human person, solely or mainly on the person's well-being. To which the man gets sick when there is a dysfunction in his psychophysical organism. In this case, health is the recovery of the lost wealth, and if it is obtained, it is considered life existentially over, meaningless.
- b. At the second level, health is seen in the order of interaction between body size and mental and moral dimension of man, as well as the good relationship between the individual and the community. The spa at this

level is primarily a condition of equilibrium: within the subject in the first case; Good personal relationships in the second. If that balance is missing, here is the "disease" and "ill-being"; the state of health is in restoring the right proportion.

- c. The third level of the concept of health, refers to the "meaning of life", and is located in the order of the spirit: human well-being now depends on living a meaningful existence. As there are many examples of men and women who have given meaning to their lives while living it in situations of poverty, or suffering, of illness or misfortune! Experience shows, then, that the same condition of illness or suffering of another, does not necessarily exclude the meaning that life continues to have. The subject experiences this inner balance, this paradoxical correspondence between the condition of poverty or pain, and their own life project. Sometimes it even get the impression that the same pain, misfortune, illness or other, play a positive role in conferring an important meaning to life. Not the evil in itself is capable of so much, but rather it is the attitude with which the person lives that experience to confer this sense. It seems therefore that even a disease, or another experience pain and sorrow, can play a sort of "task" or function in a life "significant." In a personalistic conception of health, it is clear that the three levels that I mentioned, are designed in mutual reciprocity: what happens at one level, is reflected in the other, as there is a deep connection between biopsychic size, socio-environmental and ethical -spiritual. The person "healthy", then, is first of all he / she who lives in a harmonious and balanced manner the relationship between these different dimensions of health, in an order that tends to the affirmation of a meaningful existence. And 'therefore also capable of integrating the inherently limited character of man, and does not allow you to isolate health since suffering ... A healthy man should also be able to face suffering, he is called to live it ... you can not detach the subjective experience of a person from the values with which that person faces life. there can be a positive experience if you can not make sense of suffering, to the limit and death.

### **Existential Analysis of the disease state:-**

To the extent that is emerging this conception of good or bad health condition, it understands the need for medicine, having to move from one approach to the person primarily of sick character "natural" and "objectivist", an attitude that embraces "subjectivity" of the patient, her past psychological, social and spiritual. At this stage of our reflection, it is essential that the health care professional is aware of what happens in the sick person. The human sciences and philosophy, especially that attentive to 'Humanum', applied to the world of health, they offer a very thoughtful and provocative description of the existential condition in which people suffering from a serious medical condition. E 'was above all the existential analysis of this situation to describe acutely real and what is happening in the inner space of the person seriously ill. I present concisely the results. In this case, the existential analysis is to describe "how the man in suffering." We must begin by recalling the human figure in his opening to life. Now the man emerges into existence, by asking questions; He is a seeker of meaning. Kant summed up that incessant ask three key questions: What can I know? What should I do? What can I hope? These questions arise on the spur of the desire for life, then he asks to be made true in a specific project. This is then implemented through a network of relationships that the subject establishes with others, with things and with the environment and with himself. Whether it is of a believer, it is also crucial the type of relationship that he lives with God. If we take into account cross this attitude with which the human person is placed in life, you realize what is happening in his inner space when surprise and overrun with a serious illness. That desire for life and the existence of the project are now being questioned, if not crushed. The new condition of life is first lived as a negation of the vital dynamism. Change the attitude towards existence under the pressure of a life form that is especially expressed as a breakdown in communication with the reality of existence. We can clarify this statement by resorting to studies on the disturbance produced by the "disease state". Reflexive analysis the disease is as "a concrete form of existence, not reducible to pure organic accidental." From the point of view of phenomenology, disease status is expressed as pain and weakness. For the sufferer becomes essential anxiety of what will come next. On a purely psychological level, there is a narrowing of his world, a self-centered attitude of tyranny and addiction at the same time. At a deeper level, in the interior and existential space, you can be glimpsed:

- a. the occurrence of a subjective unit break, a fracture between "body" and "cogito". The body degrades in "object representation", is unrelated to the subject of acquiring a condition of otherness and strangeness: psychosomatic states, such as fatigue, fever, pain, showed a rupture personnel unit, an inner disharmony;
- b. towards others and things, the sufferer experiences a crisis of communication and interpersonal relationships. The disease fact compels the sufferer to attention almost exclusively to itself, which in itself implies the darkening of the consciousness of others. The universe shrinks in your room. It has a strong awareness of the dependence on the 'other self, which is the loss of autonomy;

- c. the power of attorney disease a strong experience of limits: it is known that this experience arises fundamentally from the inadequacy of the ego with itself, there is therefore innate and always accompanies our consciousness. But there is a pathological condition in a specific manner, concrete and immediate experience of the radical fragility of one's being. And 'experience of limits of life, in its duration and in its quality. For this reason the idea of death is always present, albeit in different forms and at different levels of consciousness, in every type of disease;
- d. you can then derive a feeling of dereliction especially if the evil is getting worse and branching, or you see a way out. And 'the feel abandoned, "thrown away" from life, as a last and summary accordingly. Have various moods that lead: the anxiety of the post, the sense of boredom and frustration, existential emptiness, the feeling of inconsistency of all, fear, boredom, sadness. It 's all a path that leads to the annihilation of personality. It 'a state of anxiety that threatens to invade the entire inner space of the person. If there is a sense in this situation, it is easy to fall into obscurity, in rebellion or despair and see the disease in view of the totality of the person. Now more and more and the empirical sciences, and humanities and philosophy, they inform us that this patient's state of existence is not a "neutral" condition in respect of organic disease. If health and disease, as I quickly called, must be read and interpreted in the light of the complex and articulated unity of the human person, it is clear that both the diagnosis and treatment should take into account the totality of the subject, the diversity and complementarity of size compose it. You can not, in other words, treating the biological dimension, regardless of "taking care" of the entirety of the person, because "sick" is not so much a "part" of the person, but is the subject that is such. It must therefore implement a shift "from the illness the sick person". In medicine so-called "natural" there is a darkening of subjectivity, which is put in brackets. The new approach that is being born, or which in many ways is re-emerging, asks to introduce the subject in the same biology; short calls attention to what is specifically "human" in sickness and in care. Healing in fact, in this perspective, it is no longer seen as mere reintegration into previous state, but as an existence regain by the patient. By itself the cure always involves a novelty in the patient compared to the previous condition; It includes an increase in the consciousness, of a change in lifestyle, a different understanding of self and others. This type of healing, can not exist without the active participation of the patient: the subject - that is, the sick - is the fundamental unifying moment between the different dimensions: biological, psychological, relational, which then converge on the personal biography of the subject itself. But it is the subject itself which can hinder this dynamism, because they generally prefer to delegate to others "specialists" in the industry, responsible for managing the process of the disease and therapy. The greatest obstacle to the integration of the illness or healing process in the biography of the subject, to say the scholars of the phenomenon, is in not wanting to see the truth in other aspects of our spiritual life. And this concerns both the patient and the physician. Bioethics wants to help deal with this task, in the belief that you can not have a proper orientation toward life, understood in all its forms, even those tiring and painful, if not through the assumption of responsibility in the management of existence . In the case of disease-healing, liability case concerns both the health professional that the patient, to be exercised in a different way by each other, but always in mutual complementarity. Mostly we have the tendency to oppose the two attitudes that they face to the disease: understanding and delete. We just play the first function of the second. And if it happens, it remains in the disease with all the risks that I reported above. As should learn to integrate those two attitudes, identifying the position that healing is still in the very first attitude: in fact understand the meaning of the symptom, in itself it brings in a certain sense to integrate it, to add that in a broader context of meaning of life. And yet it is clear that the doctor is asked to deal with a specific dimension of the human subject, ie organic aspect. Yet, from the perspective of "cure and care" he will constantly present the entirety of the sick person, including attention to the proper subjective dimension of the patient.

### **What is "rational" for the world of health?**

Compared to the promising development of neuroscience, and attention to the marvelous progress of modern medicine, however, it remains perplexed by the emergence in recent years, within the cultivators of the same medical sciences, of a strong trend that refers only the technical-scientific rationality for understanding the reality of life and of human life itself. Recent acquisitions extraordinary understanding of the human brain, are considered by many scholars to such a value to consider them the "turning point" more radical than any change that so far human history has known. And yet, from these acquisitions they originate questionable claims of some scholars of this trend. They believe that only this kind of rationality is capable of understanding the reality of human life, and therefore it can only tell us what human life in its origin, in its development and in its decline; also they claim that only this science can and must address the problems of bioethics and humanization, or there is more to expect reliable answers from philosophy, ethics, religion or human and theological sciences; and it is just this kind of science that can give sensible answers to the questions of "who" or "what" is the man, when and why it actually

becomes "human beings" and when and why you fell from this condition. The reason that justifies these statements are essentially the epistemological status of the techno-scientific rationality: this deals with the given immediate and immediately perceptible, empirically verifiable, while the other rationality remain ambitious and smoky in their results, always postponing to an indefinite "beyond" achieving the goal of happiness. For this, they conclude, the techno-scientific rationality is the only proper use of human reason. And this is where the error: reduce the way of seeing and understanding the human life to what happens in it only biologically, neglecting what is the *proprium humanum*, that man as such. The medicine in the time of modernity If we wanted to trace the origins of this thought, we should take care of two problems: one concerns the history of thought in the West, the other that of knowledge, scientific and philosophical. In fact, we should revisit the eighteenth-century Enlightenment, and some of his deviance in modern and contemporary. These seem to have originated the claims of some researchers, for which reason it is conceived only in the version empirical-positivistic. But we should also analyze the cognitive dynamics of the human person according to what they tell us the sciences, natural and human perception. We should understand what requirements or "prejudices" that allow people to know and to progress in his cognitive capacity. Would emerge as the "mental patterns of perception" that if on the one hand enable man to know and to evolve his mind, on the other hand can also block this dynamism, leaving him "fixed" to previous thought patterns or mental patterns reductive. I do not think that this is the moment to go into these issues. Here it presses rather occur in practice these claims of that kind of rationality applied to health care world. For if now all of Western medicine is committed to recovering his ability to understand the patient's person in the multiplicity of its dimensions for a proper diagnosis and appropriate therapy, doubts inevitably arise in relation to such claims and pretensions

### References:-

1. S. Boezio, *Contra Eutichen et Nestorium*, c. 4. Per Boezio sono persone tutti gli esseri umani , anche quelli che a causa di un grave handicap mentale non indicano operazioni della ragione.
2. Cfr. P. Singer, *Etica pratica*, Liguori, Napoli 1989. In questo caso nella vita vegetativa persistente cessa la vita personale e rimane la vita biologica, che da sola non può dare ad un essere il connotato di persona. Nel malato terminale o nello stato vegetativo c'è la vita biologica ma è cessata la vita biografica. Il corpo è vivo ma la persona non lo è più. Tali esseri vivi soltanto in senso fisico, senza nessuna prospettiva di riacquistare la coscienza, non hanno nessun connotato di persone. Seguendo i presupposti singeriani, il cerchio dell'etica non soltanto lascia fuori gli esseri umani incapaci di soffrire, ma anche tutti quelli che non sono solo in grado di soffrire. Ciò giustifica la soppressione di tutti quegli esseri umani la cui vita sarebbe così penosa da non essere degna di essere vissuta.
3. Cfr. G.Castelli, *Ritorno da Benj Suef*, Editrice Istina, Siracusa 2015.
4. *Gaudium et Spes*, 12.
5. .D'Agostino, *Parole di Bioetica*, Giappichelli, Torino 2003.
6. H.G.Gadamer, *Dove si nasconde la salute*, tr. it., Raffaello Cortina Editore, Milano 1993,107.
7. Si osserva infatti che "sia nella sua forma romanica che in quelle germaniche e slave (rom.: *salus*, salute, salut; got.: *hails*, paleoslava: *celu*), il termine denota radici indogermaniche che stanno a significare 'essere-integro'.
8. Per la cultura occidentale ritengo di notevole interesse, per il tema che ci occupa, un recente saggio di Giovanni Reale: *Corpo, anima e salute. Il concetto di uomo da Omero a Platone*, Raffaello Cortina Editore, Milano 1999 . Vi viene recuperato il senso dell'integrità della persona umana. Propriamente, lo stato di salute è inteso come "giusta misura", equilibrio, armonia e integralità della persona. In un confronto serrato con i testi di Platone, l'Autore dimostra come il grande filosofo greco, partendo dal concetto di salute che gli forniva la medicina del tempo, l'ha poi ampliato e fondato sui principi della sua filosofia, pervenendo ai fondamenti metafisici dell'essere. Il fulcro attorno al quale ruota il concetto di salute, è visto nella "misura e proporzione conveniente"
9. W.Jaeger, *Paideia. La formazione dell'uomo greco*, tr. it., Bompiani, Milano 2003.
10. Cfr. G. Reale, *Corpo anima e salute*, cit.
11. Una buona interpretazione in tal senso è offerta da V. Frankl, *Logoterapia e analisi esistenziale*, Morcelliana, Brescia, 1974.
12. G.Cinà, E.Locci, C.Rocchetta, L.Sandrin, *Dizionario Teologico di Teologia Pastorale Sanitaria*, Ed.Camilliane, Torino 1997, 1081-1082; si veda anche: A.N.Terrin, *L'impotenza di fronte alla sofferenza e l'emergere del concetto salute-salvezza*, in: *Credere oggi* 1 (2005), 25-27. V.Frankl, *Alla ricerca di un significato della vita*, Mursia, Milano 1993; Id., *In principio era il senso. Dalla psicoanalisi alla logoterapia*, Queriniana, Brescia 1995
13. Vedi M.Merleau Ponty, *Il primato della percezione*, Medusa, Milano 2004.
14. Oggi, nello spostamento delle "cure a domicilio" del paziente dimesso dal centro sanitario, è più facile verificare l'inizio di questo "passaggio" si veda in S.Spinsanti, *Curare e prendersi cura*, Ed. CIDAS, Roma

1998, 113-124. Ovviamente, la “riduzione” della razionalità entro l’ambito tecno scienista, non riguarda solo le scienze mediche: oltre ai due discorsi di Benedetto XVI, si può vedere anche: I.Sanna, L’antropologia cristiana tra modernità e postmodernità, Queriniana, Brescia 2004; L.Casula e G.Ancona, L’identità e i suoi luoghi. L’esperienza cristiana nel farsi dell’umano, Edizioni Glossa, Milano 2008.

15. Ibidem

16. Vedi S.Rachamandran, Che cosa sappiamo della mente, Mondadori, Milano 2004; M.S.Gazzaniga, La mente etica, Codice edizioni., Torino 2006.

17. Allport G.W., Psicologia della personalità, PAS-Verlag, Zurigo 1973, pp.220-234; L.M.Rulla, Antropologia della vocazione cristiana, Piemme, Casale Monferrato 1985, pp.89-143. 165-199. La vita dalle fondamenta: “perché, e perché proprio ora, e perché a me? Ha ancora un senso la vita? Valeva la pena di nascere se poi bisognava arrivare a questo?...Alla fine, insomma, chi sono io?”



## RESEARCH ARTICLE

### SYNTHESIS AND CHARACTERIZATIONS OF NEEDLE- SHAPED CUO NANOPARTICLES FOR BIODIESEL APPLICATION

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Biodiesel, Coconut oil, Transesterification, Nanocatalyst, GC-MS

#### Abstract

Biodiesel is a green and clean burning alternative fuel for conventional fuels. This study compares the catalytic transesterification of coconut oil by using CuO nanocatalyst with the conventional base catalyst (NaOH). The needle-shaped CuO nanoparticles were synthesized by simple precipitation method. All the characterization studies (UV-Vis, FTIR, XRD, and FESEM with EDX) were proved the formation of CuO nanoparticles. The XRD study revealed the formation of CuO nanostructures with the monoclinic phase. The crystallite size of CuO was estimated to be 48 nm using Debye-Scherrer's formula. The surface morphology of the obtained CuO nanoparticles is needle-like in shape. The conversions of FAMES were verified by using both FTIR and GCMS analysis. The investigation of producing biodiesel using GC-MS spectroscopy indicated that fatty acids were transformed into corresponding methyl esters. From this study, it has been concluded that CuO nanocatalyst could be a good promising catalyst for the green and eco-friendly production of biodiesel.

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#### Introduction:-

It is an undeniable fact that recently so much of attention is drawn to the field of renewable energy as an alternative to the traditional energy sources [1]. This was necessitated and encouraged due to the issues like shortage of petroleum, hike in fuel price, greenhouse gas emissions and global warming [2-4]. Biodiesel is one of the promising options for the alternative renewable fuels that can be used in existing engines [5]. Adding to the benefits, it is biodegradable, environmentally friendly, non-toxic and has potential in reducing levels of pollutants [6-8].

Vegetable oils are becoming a promising source for the production of biodiesel. Among the available edible oils, coconut oil is considered to be one of the potential sources for the biodiesel production [9]. The transesterification reaction of oil and alcohol with a homogeneous catalyst is the common method for the production of biodiesel. [10-13]. The homogeneous catalysts have many limitations, such as requiring large amounts of water, difficulties in product separation and environmental pollution caused by the liquid wastes etc. [14]. But the heterogeneous catalysts based biodiesel preparation is considered to be a green and environmentally friendly method [15-17].

The focus on the development of new heterogeneous nanomaterials as a catalyst is a novel concept. It has been reported that the main advantage of nano-sized materials is its large surface area [18]. The Nanocatalysts have many

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advantages such as high catalytic activity, reusability, high resistance to saponification reaction and simpler in purification processes etc. [19, 20]. There have been very few studies on nano metal oxides catalysed transesterification to produce FAME (Fatty Acid Methyl Ester) [21-23]. Among the available transition metal oxides, CuO is one of the potential p-type semiconductors and gains considerable attention due to its excellent optical, physical and magnetic properties [24-27].

This study compares the catalytic transesterification of coconut oil by using CuO nanocatalyst with the conventional base catalyst (NaOH). The CuO nanoparticles were synthesized by simple precipitation method. The characterization of CuO nanoparticles was studied using FTIR, UV-Vis spectroscopy, XRD, FESEM and EDX. The obtained biodiesel was examined with Gas Chromatography-Mass Spectrometry (GC-MS) and the infrared spectroscopy (FTIR).

## Materials and Methods:-

### Materials:-

All the reagents were of analytical grade and were used without further purification. Copper acetate [Cu(CH<sub>3</sub>COO)<sub>2</sub>] was obtained from Sigma Aldrich, Germany. Methanol (99.9% purity), ethanol and sodium hydroxide (NaOH) were obtained from Merck, Germany. Coconut oil was purchased from a local market. For the entire experiment, double distilled water was used.

### Preparation of CuO Nanocatalyst:-

CuO Nanocatalyst was synthesized by direct precipitation method using copper acetate and NaOH as precursors. In this work, the aqueous solution (0.2 M) of copper acetate was prepared with deionized water. The NaOH solution was slowly added into the copper acetate solution and mixed together by constant stirring for 30 minutes with the help of a magnetic stirrer. It was kept at room temperature for 4 hours for the completion of the reaction. A large amount of black precipitate was formed. The nanostructures were collected after centrifugation (4000 rpm). The obtained nanoparticles were washed with absolute ethanol and distilled water several times to remove the possible residual impurities. The particles were dried in an oven at 80°C for 3 hours. After grinding, a dark brown nanopowder was obtained.

### Transesterification process:-

The transesterification reaction was performed in Teflon-lined stainless steel autoclave. The sample was loaded (1:4 oil to methanol, 0.75 wt % catalyst) into the autoclave and kept in an oven for 2 hrs. After the completion of the reaction, the mixture was cooled to room temperature and the biodiesel phase was separated. At the end of the experiment, the autoclave was cooled and the catalyst was separated from the reaction mixture by centrifugation and filtration.

## Results and Discussion:-

### Characterization of CuO nano catalyst:-

#### UV-Vis analysis:-

In order to explore the optical properties of CuO nanoparticles, the optical absorption spectra were taken using the UV-Visible spectrophotometer. Fig.1 shows the obtained peak at 380 nm which is assigned to the surface plasmon resonance band of the CuO nanoparticles and is in coincidence with the literature values [28].

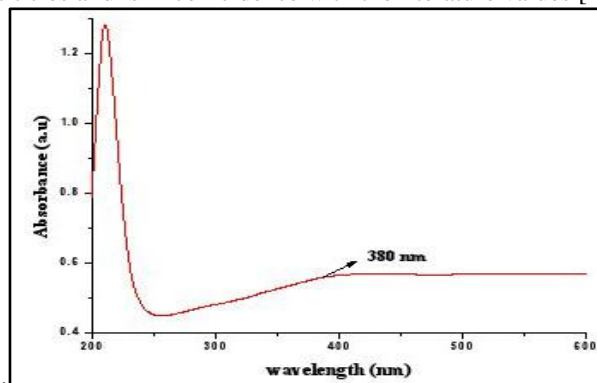


Fig.1:-UV-Vis analysis of CuO nanoparticles

**FTIR Analysis:-**

Fig. 2 shows the peak at  $1606.75\text{ cm}^{-1}$  which indicates the presence of primary amines and the C-H stretches of alkanes appearing at  $1373.34\text{ cm}^{-1}$ . The three infrared absorption peaks reveal the vibrational modes of CuO nano structures. The major peaks were found with  $503.82\text{ cm}^{-1}$ ,  $696.13\text{ cm}^{-1}$  and  $931.76\text{ cm}^{-1}$  respectively. The vibration at the region of  $503.82\text{ cm}^{-1}$  has been attributed to CuO. The EDX analysis was used for further confirmation of the structure.

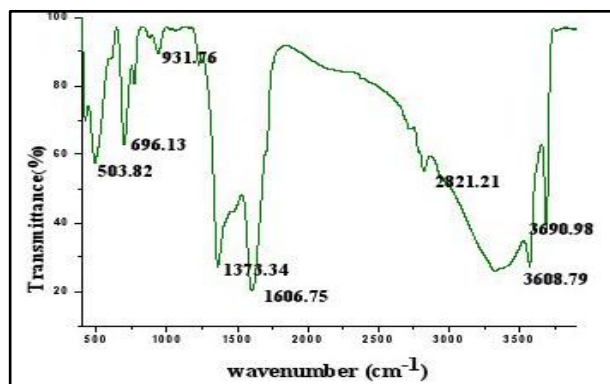


Fig 2:-FTIR pattern of CuO nanoparticles

**XRD analysis:-**

From fig.3 it can be clearly appreciated that all the peaks in the XRD patterns are consistent with the JCPDS data (89-5895) and the results were found to be in agreement with the reported diffraction pattern of CuO nanoparticles [29]. The major peaks located at  $2\theta = 32.47^\circ$ ,  $35.58^\circ$ ,  $38.75^\circ$ ,  $48.81^\circ$ ,  $53.27^\circ$ ,  $58.24^\circ$ ,  $61.47^\circ$ ,  $66.23^\circ$ ,  $68.05^\circ$ ,  $75.05^\circ$  and  $82.92^\circ$  are assigned to (110), (002), (111), ( $\bar{2}02$ ), (020), (127), ( $\bar{1}13$ ), (022), (220), ( $\bar{2}22$ ), ( $\bar{3}13$ ) plane orientation. The spectrum is identical to that of pure CuO, indicating the formation of single-phase CuO with monoclinic structure. The average crystallite size of the CuO nanoparticles calculated by Debye-Scherrer's formula is 48 nm.

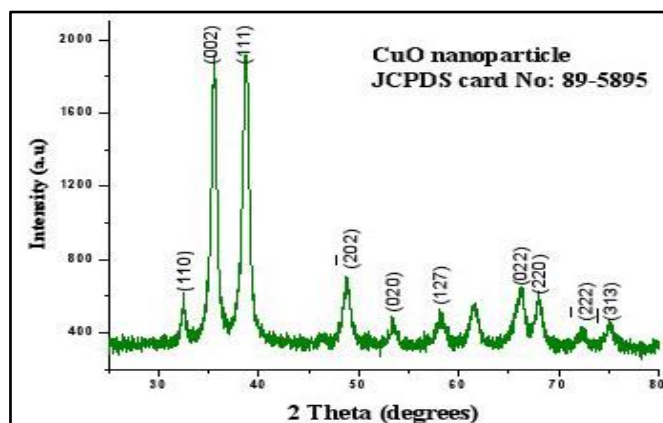
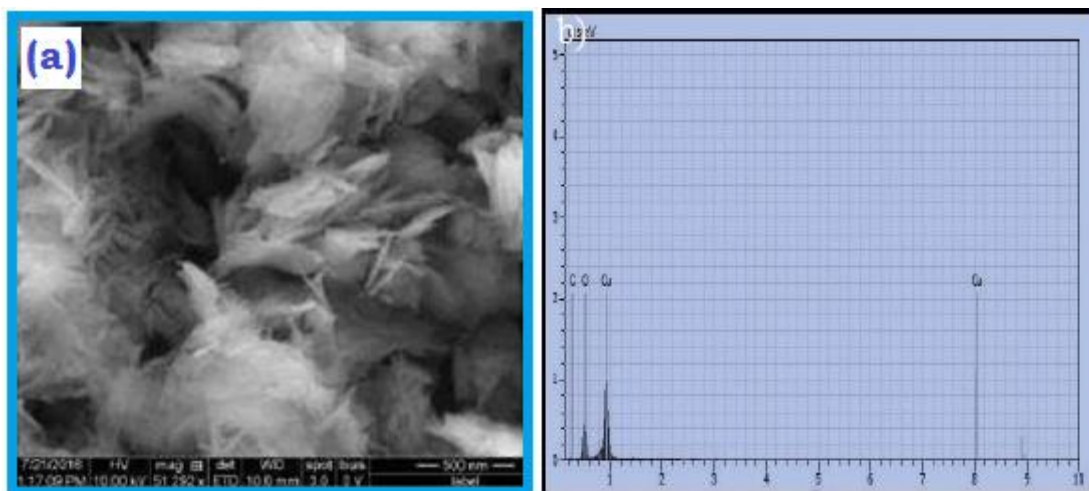


Fig 3:-XRD pattern of CuO nanoparticles

**FESEM with EDX Analysis:-**

Fig.4 (a) illustrates the surface morphology of the obtained CuO nanoparticles. The surface morphology of the obtained CuO nanoparticles is needle like in shape.



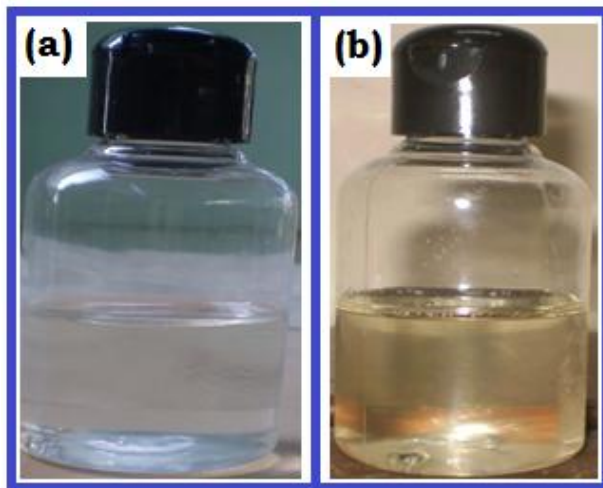
**Fig 4:-FESEM & EDX images of CuO nanoparticles**

The corresponding EDX spectrum is shown in fig.4 (b) which confirmed the elemental presence of Cu (75.92 %) and O (21.60 %) as the major constituent along with C (2.48 %) in fewer amounts.

#### **Analyses of transesterification products:-**

##### **Visual analysis:-**

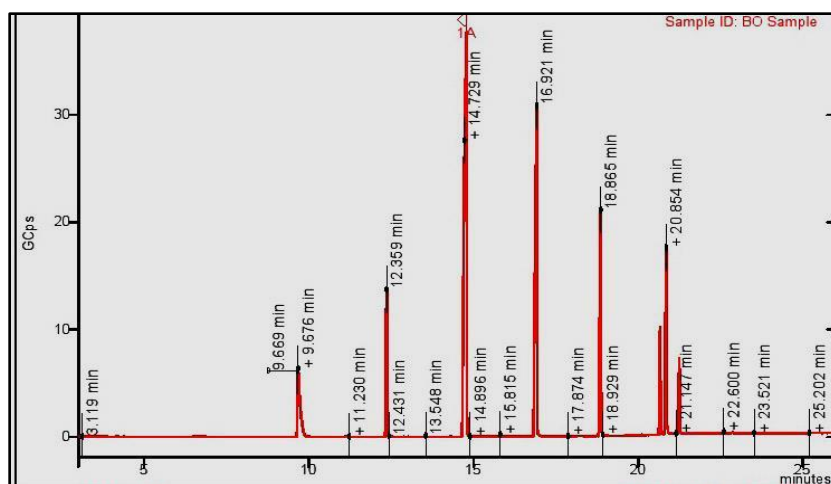
Fig.5 displays the color of synthesized biodiesel with two different catalysts. It is noted that the NaOH (Fig. 5a) biodiesel sample is slightly brighter than that of nano catalyzed based one (Fig.5b). The advantages of using CuO nano catalysts include ease of separation and purification of the reaction products. So, it could be considered as a green and environmental friendly catalyst for biodiesel production.



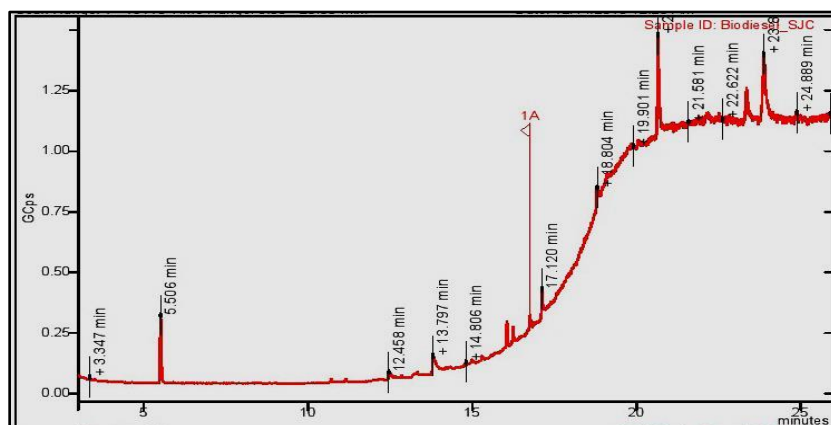
**Fig 5:-Coconut oil biodiesel sample**

##### **GC-MS Analysis:-**

The GC chromatogram of FAME of coconut oil using NaOH and CuO catalyst are visualized in Figs 6 & 7. The FAME conversion has calculated up to 79.52% and 86.56% by using two different catalysts NaOH and CuO respectively. The GC-MS result shows the chemical composition of FAMEs of coconut oil biodiesel in tables 1. In table 2, the GCMS results of produced FAME are compared with previous works.



**Fig 6:-GC Chromatogram of coconut oil using NaOH catalyst**



**Fig 7:-GC Chromatogram of coconut oil using CuO catalyst**

**Table 1:- FAME composition of Coconut oil biodiesel**

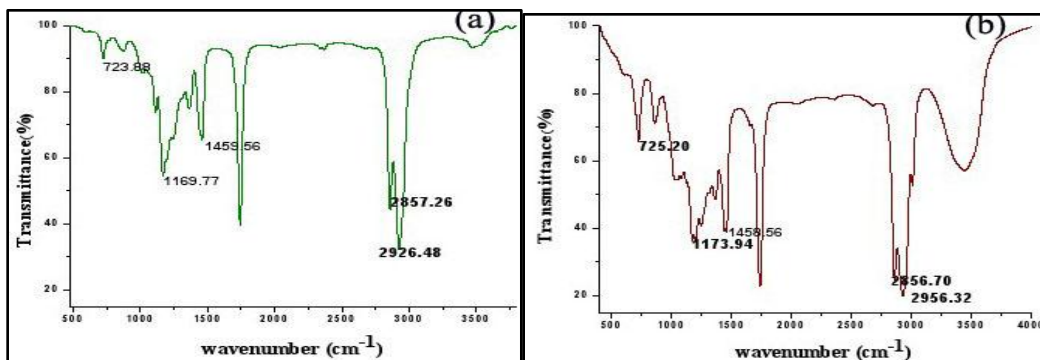
FAMES	Using NaOH catalyst	Using CuO nano catalyst
Total FAME conversion (%)	79.521	86.574
Others	20.479	13.426

**Table 2:- Comparison table of GCMS result with literature**

Catalyst	Oil/methanol	FAME content (%)
KOH	1:7	82.5 [30]
TiO <sub>2</sub> /SiO <sub>2</sub>	1:4	88.44 [31]
ZnO	1:6	98.9 [32]
CaO	Excess	91.5 – 95.7 [33]
NaOH	1:3.5	79.52 (present work)
CuO nanoparticles	1:3.5	86.56 (present work)

#### FTIR Analysis:-

The FTIR spectrum of produced biodiesel from two different catalysts is shown in fig. 8. Biodiesel samples found in table 3 are very much similar to that of standard petro diesel and biodiesel samples [34]. The observed bands at 1459.56 cm<sup>-1</sup> and 1458.56 cm<sup>-1</sup> attribute to methyl group. The bands at 1169.77 cm<sup>-1</sup> and 1173.94 cm<sup>-1</sup> for ester group reveal the formation of biodiesel. The presence of two groups namely methyl (CH<sub>3</sub>) and ester (C-O ester) in samples indicates that the transesterification of coconut oil occurred due to the addition of methanol and CuO nanoparticles [19].



**Figs8:-** a & b. FTIR spectra of NaOH and nano CuO catalysed biodiesel

**Table 3:-** Comparison table for FTIR spectrum peak area data

Petro-diesel (cm <sup>-1</sup> ) <sup>a</sup>	Biodiesel standard (cm <sup>-1</sup> ) <sup>a</sup>	Biodiesel from coconut oil using NaOH catalyst (cm <sup>-1</sup> )	Biodiesel from coconut oil using CuO nano catalyst (cm <sup>-1</sup> )
2915.86	2924.14	2926.48	2956.32
2849.66	2849.66	2857.26	2856.70
1451.03	1732.41	1459.56	1458.56
1376.55	1169.66	1169.77	1173.94
-	741.48	723.88	725.20

<sup>a</sup> Data from Hussain et al [34]

### Conclusion:-

The production of biodiesel from coconut oil was successfully completed by using CuO nano particles as a heterogeneous catalyst. The nano catalyst was characterized using different techniques which were confirming the formation of CuO nanoparticles. From the XRD, the average crystallite size of CuO was estimated to be 48 nm. The surface morphology of the obtained CuO nanoparticles is needle like in shape. From the GC-MS analysis, 86.56% and 79.52% of FAME components were calculated for CuO and NaOH catalysed biodiesel respectively. The presence of two groups, namely methyl (CH<sub>3</sub>) and ester (C-O ester) were verified from FTIR analysis. This study recommends that the CuO nanocatalysts could be a promising option for the production of biodiesel with green and clean technology.

### References:-

- Salvi B, Panwar N. Biodiesel resources and production technologies—A review. *Renewable and sustainable energy reviews* 2012;16:3680-9.
- Kumar A, Sharma S. Potential non-edible oil resources as biodiesel feedstock: an Indian perspective. *Renewable and Sustainable Energy Reviews* 2011;15:1791-800.
- Borugadda VB, Goud VV. Biodiesel production from renewable feedstocks: status and opportunities. *Renewable and sustainable energy reviews* 2012;16:4763-84.
- Atabani A, Silitonga A, Ong H, Mahlia T, Masjuki H, Badruddin IA, et al. Non-edible vegetable oils: a critical evaluation of oil extraction, fatty acid compositions, biodiesel production, characteristics, engine performance and emissions production. *Renewable and sustainable energy reviews* 2013;18:211-45.
- No S-Y. Inedible vegetable oils and their derivatives for alternative diesel fuels in CI engines: a review. *Renewable and sustainable energy reviews* 2011;15:131-49.
- Lopez DE, Goodwin JG, Bruce DA, Lotero E. Transesterification of triacetin with methanol on solid acid and base catalysts. *Applied Catalysis A: General* 2005;295:97-105.
- Silitonga A, Atabani A, Mahlia T, Masjuki H, Badruddin IA, Mekhilef S. A review on prospect of *Jatropha curcas* for biodiesel in Indonesia. *Renewable and sustainable energy reviews* 2011;15:3733-56.
- Banković-Ilić IB, Stamenković OS, Veljković VB. Biodiesel production from non-edible plant oils. *Renewable and sustainable energy reviews* 2012;16:3621-47.
- Varma MN, Madras G. Synthesis of biodiesel from castor oil and linseed oil in supercritical fluids. *Industrial & engineering chemistry research* 2007;46:1-6.
- Li E, Rudolph V. Transesterification of Vegetable Oil to Biodiesel over MgO-Functionalized Mesoporous Catalysts†. *Energy & Fuels* 2007;22:145-9.

11. Demirbas A. Transesterification of beechnut oil into biodiesel in compressed methanol. *Energy Sources, Part A* 2009;31:1501-9.
12. Verziu M, Cojocaru B, Hu J, Richards R, Ciuculescu C, Filip P, et al. Sunflower and rapeseed oil transesterification to biodiesel over different nanocrystalline MgO catalysts. *Green Chemistry* 2008;10:373-81.
13. Lee AF, Bennett JA, Manayil JC, Wilson K. Heterogeneous catalysis for sustainable biodiesel production via esterification and transesterification. *Chemical Society Reviews* 2014;43:7887-916.
14. De Carvalho LM, Abreu WCd, Silva MdGdO, Lima JRdO, Oliveira JEd, Matos JMed, et al. Heterogeneous catalysis afford biodiesel of babassu, castor oil and blends. *Journal of the Brazilian Chemical Society* 2013;24:550-7.
15. Hassani M, Najafpour GD, Mohammadi M, Rabiee M. Preparation, characterization and application of zeolite-based catalyst for production of biodiesel from waste cooking oil. *Journal of Scientific & Industrial Research* 2014;73:129-33.
16. del Remedio Hernández M, Reyes-Labarta JA, Valdes FJ. New heterogeneous catalytic transesterification of vegetable and used frying oil. *Industrial & Engineering Chemistry Research* 2010;49:9068-76.
17. José da Silva M, Lemos Cardoso A. Heterogeneous Tin Catalysts Applied to the Esterification and Transesterification Reactions. *Journal of Catalysts* 2013;2013.
18. Issa B, Obaidat IM, Albiss BA, Haik Y. Magnetic nanoparticles: surface effects and properties related to biomedicine applications. *International journal of molecular sciences* 2013;14:21266-305.
19. Rengasamy M, Mohanraj S, Vardhan SH, Balaji R, Pugalenth V. TRANSESTERIFICATION OF CASTOR OIL USING NANO-SIZED IRON CATALYST FOR THE PRODUCTION OF BIODIESEL. *Journal of Chemical and Pharmaceutical Sciences* ISSN;974:2115.
20. Woodford JJ, Parlett C, Dacquin JP, Cibin G, Dent A, Montero J, et al. Identifying the active phase in Cs-promoted MgO nanocatalysts for triglyceride transesterification. *Journal of chemical technology and biotechnology* 2014;89:73-80.
21. Refaat A. Biodiesel production using solid metal oxide catalysts. *International Journal of Environmental Science & Technology* 2011;8:203-21.
22. Suzuta T, Toba M, Abe Y, Yoshimura Y. Iron oxide catalysts supported on porous silica for the production of biodiesel from crude *Jatropha* oil. *Journal of the American Oil Chemists' Society* 2012;89:1981-9.
23. Anuradhaa S, Rajb KJA, Vijayaraghavanc V, Viswanathanb B. Sulphated Fe<sub>2</sub>O<sub>3</sub>-TiO<sub>2</sub> catalysed transesterification of soybean oil to biodiesel. *Indian Journal of Chemistry* 2014;53:1493-9.
24. Shahmiri M, Ibrahim NA, Zainuddin N, Asim N, Bakhtyar B, Zaharim A, et al. Effect of pH on the synthesis of CuO nanosheets by quick precipitation method. *Wseas Transactions on Environmental and Development* 2013;9:137-46.
25. Song X, Gao L, Mathur S. Synthesis, characterization, and gas sensing properties of porous nickel oxide nanotubes. *The Journal of Physical Chemistry C* 2011;115:21730-5.
26. Zhong M, Zeng D, Liu Z, Yu H, Zhong X, Qiu W. Synthesis, growth mechanism and gas-sensing properties of large-scale CuO nanowires. *Acta Materialia* 2010;58:5926-32.
27. Arockiasamy JSK, Irudayaraj J. Natural dye sensitized CuO nanorods for luminescence applications. *Ceramics International* 2016;42:6198-205.
28. Naika HR, Lingaraju K, Manjunath K, Kumar D, Nagaraju G, Suresh D, et al. Green synthesis of CuO nanoparticles using *Gloriosa superba* L. extract and their antibacterial activity. *Journal of Taibah University for Science* 2015;9:7-12.
29. Wang M, Tang A, Zhu D, Yang C, Teng F. Understanding the roles of metal sources and dodecanethiols in the formation of metal sulfide nanocrystals via a two-phase approach. *CrystEngComm* 2015;17:6598-606.
30. Kumar G, Kumar D, Singh S, Kothari S, Bhatt S, Singh CP. Continuous low cost transesterification process for the production of coconut biodiesel. *Energies* 2010;3:43-56.
31. Pandiangan KD, Simanjuntak W. Transesterification of Coconut Oil Using Dimethyl Carbonate and TiO<sub>2</sub>/SiO<sub>2</sub> Heterogeneous Catalyst. *Indonesian Journal of Chemistry* 2013;13:47-52.
32. Jitputti J, Kitiyanan B, Rangsunvigit P, Bunyakiat K, Attanatho L, Jenvanitpanjakul P. Transesterification of crude palm kernel oil and crude coconut oil by different solid catalysts. *Chemical Engineering Journal* 2006;116:61-6.
33. Velasquez JM, Kang Suk J, Bugay B, Razon LF, Tan RR. Investigation of process yield in the transesterification of coconut oil with heterogeneous calcium oxide catalyst. 2009.
34. Hussain ST, Ali SA, Bano A, Mahmood T. Use of nanotechnology for the production of biofuels from butchery waste. *International Journal of the Physical Sciences* 2011;6:7271-9.





### RESEARCH ARTICLE

## MONITORING OF HEMATOLOGICAL AND BIOCHEMICAL PARAMETERS IN SHEEP REARING IN NEW RECLAIMED LANDS IN EGYPT.

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#### Manuscript History

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### Abstract

Over 200 clinically normal desert Egyptians baladi sheep from multiple geographic areas were sampled. The goals of this study were to develop comprehensive reference intervals for hematologic and biochemical analytes. Because of the large sample size, wide geographic range, and uniform sample and handling protocoling this study, these reference intervals should be robust and applicable to other sheep populations.

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### Introduction:-

Measurement of key hematological and biochemical values can provide objective information about the condition of an animal at the moment of sampling, revealing its nutritional status, disease conditions or stress it has been subjected to (Perez et al., 2003).

Serum bio-chemical and haematological references constitute important panels in the diagnosis, prognosis and treatment of livestock diseases via the investigations of myriads of parameters influencing blood and serum biochemical indices among which are packed cell volume (PCV), total blood (TBC), total protein (TP), urea, creatinine, uric acid, alanine transaminase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), concentration in livestock animals (Yokus et al. 2006).

### Materials and Methods:-

Blood samples of 200 sheep (150 females and 50 males) were collected from randomly selected clinically healthy herds. The sheep were bled through jugular vein and 10 ml of blood was collected from each animal, 4 ml of the blood was collected into plastic tube containing 0.5 M

Ethylene Diamine Tetra acetic Acid (EDTA) for haematological studies and the remaining 6 ml of blood samples was deposited in clot activating

tubes for biochemical studies and allowed to clot at room temperature within 3 hours of collection. The samples were stored at -20 °C for analysis by Hitachi U-1800 spectrophotometer (using Egyptian Biochemical diagnostic kits)

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### Statistical Analysis:-

SPSS statistical package was used for statistical analysis. All the values were expressed as mean  $\pm$  Standard Deviation (SD). One way ANOVA was applied to compare various hematological and serum biochemical parameters. All the measurements were analyzed by generalized linear model results.

### Results:-

The hematological values were: erythrocytes for Male sheep  $9.8 \pm 1.5\% 10^6 \text{cm}^3$  and Female sheep  $9.18 \pm 0.22\% 10^6 \text{cm}^3$ . The haemoglobin for Male sheep  $8.9 \pm 1.1 \text{g/dL}$  and Female sheep  $9.09 \pm 0.22$ ; leukocytes for Male sheep  $8.1 \pm 1.8\% 10^6 \text{cm}^3$  and Female sheep  $9.11 \pm 0.61\% 10^6 \text{cm}^3$ ; and Packed cell volume (PCV) % for Male sheep  $37.08 \pm 0.1$  and Female sheep  $35.82 \pm 0.88$ . Neutrophils (%)  $31.04 \pm 0.85$  for Male sheep and Female sheep  $41.43 \pm 0.84$ . Lymphocyte (%)  $4.06 \pm 0.38$  for Male sheep and Female sheep  $3.93 \pm 0.27$ . Monocytes (%) for Male sheep  $2.05 \pm 0.15$  and Female sheep  $2.78 \pm 0.16$ . Eosinophils (%) for Male sheep  $0.23 \pm 0.07$  and Female sheep  $0.30 \pm 0.05$ . Basophiles (%) for Male sheep  $0.20 \pm 0.05$  and Female sheep  $0.36 \pm 0.05$ .

The values of biochemical parameters were: total protein for male sheep  $6.5 \pm 1.2$  and female sheep  $6.7 \pm 1.5$ ,  $76.4 \pm 6.1 \text{g/L}$ ; glucose for male sheep and female sheep  $2.87 \pm 0.60 \text{mmol/L}$ ; total cholesterol  $1.65 \pm 0.33 \text{mmol/L}$ ; aspartate aminotransferase (AST) for male sheep  $115.5 \pm 6.4$  and female sheep  $155.9 \pm 49.2 \text{U/L}$ ; alanine aminotransferase (ALT) for male sheep and female sheep  $9.36 \pm 0.05$ . creatinine for male sheep  $9.2 \pm 0.05$  and female sheep  $102.0 \pm 2.1 \mu\text{mol/L}$ ; total calcium for male sheep and female sheep  $2.53 \pm 0.25 \text{mmol/L}$ ; phosphorus for male sheep  $2.39 \pm 0.20$  and female sheep  $2.29 \pm 0.21 \text{mmol/L}$ ; magnesium for male sheep  $36.08 \pm 0.1$  and female sheep  $34.82 \pm 0.88 \text{mmol/L}$ ; sodium for male sheep  $140.04 \pm 0.85$  and female sheep  $141.43 \pm 0.84 \text{mmol/L}$ ; potassium for male sheep  $5.20 \pm 0.22$  and female sheep  $5.70 \pm 0.26$ ,  $99.66 \pm 0.70 \text{mmol/L}$ ; chloride for male sheep and female sheep  $99.59 \pm 0.75$ , iron for male sheep  $138.50 \pm 0.15$  and female sheep  $140.50 \pm 0.16$ . copper for male sheep  $10.39 \pm 0.36$  and female sheep  $11.78 \pm 0.37$ .

**Table 1:-** Haematological values of male and female baladi sheep

Parameter	Male sheep (mean $\pm$ SD) n=50	Female sheep (mean $\pm$ SD) n=150
Total erythrocyte count (TEC) $10^6/\mu\text{l}$	<b>8.19 <math>\pm</math> 0.41</b>	<b>9.18 <math>\pm</math> 0.22*</b>
Haemoglobin (Hb) g/dl	<b>8.79 <math>\pm</math> 0.41</b>	<b>9.09 <math>\pm</math> 0.22</b>
Packed cell volume (PCV) %	<b>35.08 <math>\pm</math> 0.1</b>	<b>37.82 <math>\pm</math> 0.88*</b>
Total leukocyte count (TLC) $10^3/\mu\text{l}$	<b>8.13 <math>\pm</math> 0.59</b>	<b>9.11 <math>\pm</math> 0.61</b>
Neutrophils (%)	<b>31.04 <math>\pm</math> 0.85</b>	<b>41.43 <math>\pm</math> 0.84</b>
Lymphocyte (%)	<b>4.06 <math>\pm</math> 0.38</b>	<b>3.93 <math>\pm</math> 0.27*</b>
Monocytes (%)	<b>2.05 <math>\pm</math> 0.15</b>	<b>2.78 <math>\pm</math> 0.16</b>
Eosinophils (%)	<b>0.23 <math>\pm</math> 0.07</b>	<b>0.30 <math>\pm</math> 0.05</b>
Basophiles (%)	<b>0.20 <math>\pm</math> 0.05</b>	<b>0.36 <math>\pm</math> 0.05</b>

Values were expressed as mean  $\pm$  S.E.

\* Means were highly significant at  $< 0.005$

**Table 2:-** biochemical values of male and female baladi sheep.

Parameter	Male sheep (mean $\pm$ SD) n=50	Female sheep (mean $\pm$ SD) n=150
Calcium mg/dl	<b>9.11 <math>\pm</math> 0.2</b>	<b>9.15 <math>\pm</math> 0.19</b>
phosphorus (mEq/l)	<b>2.39 <math>\pm</math> 0.20</b>	<b>2.29 <math>\pm</math> 0.21</b>
magnesium (mEq/l)	<b>36.08 <math>\pm</math> 0.1</b>	<b>35.82 <math>\pm</math> 0.88</b>
copper (mEq/l)	<b>10.39 <math>\pm</math> 0.36</b>	<b>11.78 <math>\pm</math> 0.37</b>
glucose (mmol/L)	<b>3.0 <math>\pm</math> 0.48</b>	<b>2.7 <math>\pm</math> 0.07</b>
sodium (mEq/l)	<b>140.04 <math>\pm</math> 0.85</b>	<b>141.43 <math>\pm</math> 0.84</b>
chloride (mEq/l)	<b>99.66 <math>\pm</math> 0.70</b>	<b>99.59 <math>\pm</math> 0.75</b>
iron	<b>138.50 <math>\pm</math> 0.15</b>	<b>140.50 <math>\pm</math> 0.16</b>
potassium (mEq/l)	<b>5.20 <math>\pm</math> 0.22</b>	<b>5.70 <math>\pm</math> 0.26</b>
ALT/IU	<b>9.36 <math>\pm</math> 0.05</b>	<b>9.2 <math>\pm</math> 0.05</b>
AST/IU	<b>115.5 <math>\pm</math> 6.4</b>	<b>116.3 <math>\pm</math> 6.5</b>

<b>total protein g/dl</b>	<b>6.5±1.2</b>	<b>6.7±1.5</b>
<b>Creatinine (mmo1/l)</b>	<b>101±2.6</b>	<b>100±2.1</b>
<b>urea(mmo1/l)</b>	<b>62.5±2.1</b>	<b>55.4±1.7</b>

Values were expressed as mean ±S.E.

\* Means were highly significant at < 0.005

## Discussion:-

### Hematological parameters:-

The RBC values was observed to be higher in the males than in the females. The difference due to age and sex is a signal of the health status of the various age groups and sex among the sheep breed studied which is in agreement with the findings of (Schalm et al. (1975) and Addas et al. (2010).

The values of leucocyte count (WBC) was higher in adult female sheep than the values obtained for male sheep. The WBC values of the adults are comparable to the young sheep. This finding is similar to the reports of (Egbe-Nwiyi et al. 2000) and (Addass et al. 2010), (Bani et al., 2008). The higher leucocyte count (WBC) is due to infections or toxic substances in the organism and a low count is an indication of pathogenic infection or presence of antigens in the organism (Bradbury et al., 1999) but the higher WBC in female adult sheep was not in agreement with (Schalm et al., 1975). Lymphocytes are slightly high in male than female and neutrophils levels are high in female than male comparable among the breed, age and sex groups of animals. There was significant influence of age, sex and breed on lymphocyte count. The lymphocytes constituted majority of the WBC counts and the cells increased with age in early life in both sexes of sheep and goats this agree with (Egbe-Nwiyi et al., 2000). The high lymphocyte counts in the animals in this study are favoured by the findings of (Milson et al., 1960) and (Wilkins and Hodges, 1962) and it might be attributed to stress and immune response to the environment (Cole, 1980), (Ganong, 2005).

Results present in Table (1) showing the effect of sex on hematological parameters. The PCV in adult female sheep were generally higher than in adult males while it was observed to be higher in the young males than in young females. The result generally showed adult sheep to have higher values in PCV than in lambs. In the sheep, age and sex exhibited remarkable influence on the PCV values.

The packed cell volume (PCV) obtained in the present study was higher in male than the female sheep (Baneejee, 2007). The increase in PCV might be attributed to high environmental temperature. These results were consistent with those obtained by (Pouliot et al. 2009), (Khan (2013).

On the other hand, there were no significant sex differences in HB, PCV and ESR. These results were in agreement with (Tibbo et al., (2004) and (Shumaila et al., 2012). While, (Egbe-Nwiyi et al., 2000) was reported the sex differences in HB and PCV of Nigeria sheep. This result was in agreement with (Tibbo et al., 2004). In contrast, (Egbe-Nwiyi et al., 2000) showed a higher value in male than female. stress and immune response the environment (Coles, 1980)

### Biochemical parameters:-

Results present in Table (2)

#### Protein:-

In the present study variations in physiologic values due to gender were assessed. Total protein is an important factor for blood viscosity, acid-base balance, and supplying necessary enzymes (Keresan Bilal, 2008).

The mean total protein values obtained from sheep males and females used in this study were within). Plasma protein level was slightly higher in male lambs than ewe lambs but the difference was not statistically significant. This finding is in agreement with the results obtained by (Khan et al. (2013) who also reported higher total protein values in ram lambs.

#### Creatinine:-

Plasma creatinine concentration was slightly higher in males than females but the difference was not statistically significant. The amount of creatinine secreted daily is a function of the muscle mass and is not affected by diet, age, sex. Female excrete less creatinine than males because of their smaller muscle mass (Gray and Howarra, 1980) (Alex

and Laverne, 1983). The creatinine values in the present study were within normal range and no differ among male and females (Gray and Howarra, 1980).

#### AST and ALT:-

The results of the present study showed that the effect of gender on both plasma enzymes and electrolytes is not significant. Enzymes are protein catalysts synthesized by all living organisms. They are constantly and rapidly degraded but the supply is renewed by new synthesis (Coles, 1986). ALT is an enzyme found in the highest amount in liver and typically used to detect liver injury (Shumaila et al., 2012). ALT values were slightly higher in males than females. AST is found in practically every tissue of the body, the measurement of the AST levels is helpful for the diagnosis and following case of myocardial infarction, hepatocellular disease and skeletal muscle disorders (Njidda et al., 2013). AST values for males were lower ( $129.6 \pm 47.8$ ) than those of females ( $140.8 \pm 31.9$ ). Higher metabolism and functional status for males compared with females. (Rumosa Gwaze et al. 2012) found that higher plasma AST and female lambs, in male than in female.

#### Minerals:-

Concentrations in the blood of the animal were not influenced ( $p > 0.05$ ) by sex whereas season has significant effect on blood minerals of sheep and goats. Mean mineral concentrations in the blood of the animals are within the normal range (mmol/l) of Ca, P, and K, respectively this agree with (Meyer and Harvey, 1998). (Ramprabhu et al. 2010), (Perez et al. 2003), (Devendran et al., 2008), (Pratt, 2010), but the magnesium of high values in male than females in the present study, this may be due to the increase of magnesium concentration in under water. The iron values in females is higher than males this agree with (Devendran et al., 2008), (Ramprabhu et al. 2010), (Jawasreh K et al. 2010), (Pratt D S (2010), (Piccione et al. 2010).

#### Electrolytes:-

Maintaining electrolytes in appropriate amounts is essential for normal biochemical and physiological functions of the body. Electrolytes are distributed in body fluids and play a key role in all parts of animal life (Kaneko et al., 2008). (Latimer et al., 2004).

The plasma potassium level was higher in females than males and sodium level was also higher in females ( $136.7 \pm 9$ ) than males ( $132.8 \pm 5.5$ ). While the values for chloride were higher in males ( $118.4 \pm 5.8$ ) than females ( $115.1 \pm 1.6$ ) but the difference for all three electrolytes between both genders was not statistically significant. (Al-Hadithy et al. 2012) (Sowande et al. 2008). The results also showed that main effect of sex and interaction between sex and season had no significant effect ( $p > 0.05$ ) on blood plasma mineral concentration of sheep and goats (Sowande et al. 2008).

#### Glucose:-

Also no the results indicated there were significant differences for sex on glucose. The last effects were in agreement with values reported by (Shumaila et al., 2012) whose shows that the age and gender had no significant effects on serum glucose and cholesterol of sheep.

#### Urea:-

Plasma urea level was significantly higher in males than females. Similar observation was reported by (Borjesson et al. 2000), (Oduye and Adedevon 1976).

#### Conclusion:-

Haematological, biochemical parameters and its knowledge can be used to assess the health as well as physiological status of farm animals under consideration. Changes of these parameters have been studied in sheep. There is great variation in the haematological parameters as observed between sex. Moreover, it is important to establish a baseline indices for haematological parameters on the basis of the factors studied and also carry out further studies to determine the effects of other factors on these indices like breed, age and management systems.

**References:-**

1. Alex, K. and L S Laverne. (1983). Clinicalchemistry; interpretation and Techniques 2ndedition seatle, Washington pp:156-339.
2. AL-Hadithy, H AH, N M AL-Badawi, and M MM ahmood. (2012). Status of some serum electrolytes concentrations in Iraqi Awassi
3. Banerjee G.C. (2007). A text Book of AnimalHusbandry. 8th edn. Published by Raju primlanifor Oxford and IBH publishing Co. Pvt. Ltd. NewDelhi. Pp 1079.
4. Bani I Z A, Al-Majali A M, Amireh F and Al-Rawashreh O. F., (2008), "Metabolic Profilein Goat Does in Late Pregnancy with and Without Subclinical Pregnancy Toxemia", Vet Clin. Pathol., Vol. 37, pp. 434-437.
5. Borjesson, D L, M M Christopher, and W MBoyce,(2000). Biochemical and hematologic reference intervals for free-ranging desertbighorn sheep. Journal of Wildlife Diseases36:294–300.
6. Bradbury, M. G; Egan, S. V and Bradbury, J. H(1999). Determination of all forms of Cyanogen in cassava Roots and cassava Products Using Picrate paper kits. J.S. Clinical cases of Small ruminants in Zaria, Nigeria. Bulletin of Animal Heath andProduction in Africa 30, 111-116.
7. Coles, E H. (1986). Veterinary Clinical Pathology 4th ed,W.B.SaundersCo.,Philadelphia.
8. Devendran P, Jayachandran S, VishaP,Nanjappan K and Panneerselvam S (2008),"Hematology and Blood Profile ofCoimbatore Sheep", Indian J. Small Rumin.,Vol. 15, pp. 98-101.
9. during wet and dry seasons. Arch. Zootec57:275-278.
10. Egbe – Nwiyi, T. N; Nwaosu, S. C and salami, H. A.(2000). Haematological Values of ApparentlyHealthy sheep and goats as influenced by age andsex in Arid Zone of Nigeria. Afr J. Biomed. Res. 3:109-115
11. Ganong, W. F. (2005) Review of Medical Physiology22nd edition McGraw Hill Medical Publication Asia Pp. 459- 516-532.
12. Gray, C. H and Howarth, P.J.N. (1980) ClinicalChemical Pathology. 9th Edn. English LanguageBook Society and Edward Arnold (Publishers) Ltd;London.
13. Jawasreh K, Awawdeh F, Bani IZ, Al-Rawasreh O, Al-Magali(2010); A.Normal hematology and selected serum biochemical values indifferent genetic lines of Awassi Ewes in Jorden. Internet J VetMed 7: 124-129.
14. Kaneko J J, J W Harvey, and M L Bruss.(2008). Clinical biochemistry of domestic animals, sixth ed. Academic, London, pp 17–138.
15. Keser, O, and T Bilal. (2008). Effect of different dietary crude protein levels on performance, N digestibility and some blood parameters in
16. Khan K H, K A Ahmed, E H Ahmad, and C.AOmar. (2013). Study of some serum biochemical parameters of Karadi sheep inSulaimani city, Iraq. Res. Opin. Anim. Vet.Sci.3:443-446.
17. Khan K. M. H.(2013),Effect of sex on some growth performance and blood parameters ofHamdani lambs,Al-Anbar J.Vet. Sci., Vol.: 6 No. (1).
18. kivircik lambs. ActaVeterinaria (Beograd)58:87-498.
19. Latimer, K. S., Mahaffey, E.A and Prasse, K.W(2004). Clinical pathology: veterinary laboratorymedicine 4th Ed., Iowa state university press Ames,Iowa USA.
20. Midau, A and babale, D. M (2010).Haemato-biochemical findings of Indigenous GoatsinMubi Adamawa State Nigeria. J. Agric. Soc. Sci.6:14-16.
21. Meyer, D.J. and J.W. Harvey. 1998. Veterinarylaboratory medicine: Interpretation and diagnosis.2nd edition. W. B. Saunders Company. ElsevierScience. Philadelphia, Pennsylvania.
22. Milson, G. C West, L. C and Dew, S. M. (1960).Biochemical and Haematological Observations onthe Blood and cerebralspinal fluid of clinically healthy and scrapie affected goats. J. Camp Path.70:194.
23. Njidda, A A, I T Hassan, and E. A. Olatunji.(2013). Haematological and Biochemical Parameters of Goats of Semi Arid Environment Fed On Natural Grazing Rangeland of Northern Nigeria. IOSR Journal of Agriculture andVeterinary Science 3:1-8.
24. Oduye,O.O and Adedevon,B.K(1976).Biochemical Values of apparently Normal Nigerian Sheep. Nigerian Veterinary Journal 5(1):43-50.
25. parameters of apparently healthy small ruminants from Southern Punjab in Pakistan.Asian Pacific Journal of Tropical Biomedicine304-306.
26. Perez J M, Gonzalez F J, Granados F J,Perez M C, Fandos P, Sorigner R C et al.(2003), "Haematologic and BiochemicalReference Intervals for Spanish Ibex", J.Wildl. Dis., Vol. 39, pp. 209-215.
27. Perez, J., F. Ggozalez, J. Ggranados,. Perez M, P. Fandos, R. Sorigur, E.Serrano (2003): Hematologic and biochemical reference intervals for Spanish ibex. J.Wildl. Dis. 39, 209-215.
28. Piccione G, Casella S, Lutri L, Vazzana I, Ferrantelli V, CaolaG.Reference2010values for some hematological, hematochemical andElectrophoretic parameter in Girgentana goat. Turk J Vet Anim; 34: 197-20

29. Pouliot, E.; Garipey, C.; Theriault, M.; Avezard, C.; Fortin, J. & Castonguay, F. W. 2009. Growth performance, carcass traits and meat quality of heavy lambs reared in a warm or cold environment during winter. *Can. J. Anim. Sci.*, 89(2):229-239.
30. Pratt D S (2010), "Liver Chemistry and Function Test", in Feldman M, Friedman L and Brandt L J (Eds.), *Sleisenger and Fordran's Gastrointestinal and Liver Diseases*, pp. 118-124, Elsevier Publishers, Philadelphia.
31. Ramprabhu R, Chellapandian M, Balachandran S and Rajeswar J J (2010), "Influence of Age and Sex on Blood Parameters of Kanni Goat in Tamil Nadu", *Indian J. Small Rumin.*, Vol. 16, pp. 84-89.
32. Rumosa Gwaze, F., M. Chimonyo and K. Dzama, (2012). Effect of season and age on blood minerals, liver enzyme levels and faecal egg counts in Nguni goats of South Africa. *Czech J. Anim. Sci.*, 57(10):443-453.
33. Schalm, O. W, Jain, N. C and Caroll, E. I (1975) *Veterinary Haematology*. 3rd Edn. Lea and Febiger Philadelphia, P. 144-167. *sheep. I.J.A.B.R.* 2:540-544.
34. Shumaila, K, A M Bhutta, B A Khan, S Durrani, M Ali, M Ali, and F Iqbal. (2012). Effect of age and gender on some blood biochemical parameters of apparently healthy small ruminants from Southern Punjab in Pakistan. *Asian Pac J Trop Biomed.* 2012 Apr; 2(4): 304–306.
35. Sowande, O.S., E.B. Odunfowora, A.O. Adelakun and L.T. Egbeyale (2008), Blood minerals in Wad sheep and goats grazing natural pastures during wet and dry seasons, *Arch. Zootec.* 57 (218): 275-278.
36. Tibbo, M. Aragaw, K. Jibril, Y. Woldemeskkel, M. Dawo, F. Rege, J.E.O (2004). Factors Affecting Hematological Profiles in three Ethiopian Indigenous Goat Breeds. *Intern. J. Appl. Res. Vet. Med.* 2(4):297-309.
37. Wilkins, J. H and Hodges, R.E.D.H. (1962). Observations on Normal Goats Blood. *Royal Army Vet. Corp. J.* 33:7.
38. Yokus, B., Cakir, D.U., Kanay, Z., Gulten, T. and Uysal, E. (2006) Effects of Seasonal and Physiological Variations on the Serum Chemistry, Vitamins and Thyroid Hormone Concentrations in Sheep. *Journal of Veterinary Medicine*, 53, 271-276.

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### RESEARCH ARTICLE

## NIGERIAN PUBLIC PRIMARY AND SECONDARY SCHOOL TEACHERS' KNOWLEDGE AND ATTITUDE TOWARDS CARDIOPULMONARY RESUSCITATION.

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##### Key words:-

CPR, primary / secondary school teachers, Nigeria .

#### Abstract

**Objective:** To assess the Nigerian primary and secondary school teachers' knowledge and attitude towards cardiopulmonary resuscitation (CPR).

**Methodology:** A questionnaire-based cross-sectional study of Post NCE Sandwich students (primary and secondary school teachers) involving 322 – 213(71%) females and 87(29%) males aged 22-60 years from 14 out of the 36 States of the Federal Republic of Nigeria. Originally, 325 copies of the questionnaire were distributed, giving a response rate of 92%. The data was analyzed using both descriptive and non-parametric statistics with statistical significance set at  $P < 0.05$ .

**Results:** 64.29% gave wrong answers to questions on CPR knowledge with rejection of the null hypothesis on their CPR knowledge, meaning that the participants significantly had poor knowledge of CPR ( $P < .05$ ) while 79.9% showed positive attitude towards CPR with the null hypothesis on their attitude towards CPR (meaning that the teachers significantly wanted CPR teaching and training in Nigerian schools,  $P < .05$ ).

**Conclusion/Recommendation:** This first Nigerian study on cardiopulmonary resuscitation in relation to teachers have shown generally poor CPR knowledge of the primary and secondary schools teachers which was statistically significant but very statistically significant positive attitude towards CPR. Nigerian school teachers should be trained in CPR so as to teach their school children while CPR incorporation into the Nigerian schools' curricula should be implemented as soon as possible.

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#### Introduction:-

Globally, the teaching of cardiopulmonary resuscitation (CPR) in schools is encouraged<sup>(1-13)</sup> Although recently few reports in Nigeria have drawn attention to the need to encourage the teaching and eventual incorporation of CPR into the secondary school curriculum,<sup>(14-20)</sup> there is obvious need for more work.

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In the United States of America, according to Compton et al.,<sup>(21)</sup> recent legislation and public policy has placed new responsibilities on public school teachers, requiring that they be trained to respond to medical emergencies, especially cardiac arrest. Recently, it was reported that majority of the teachers in Al-Qassim, Saudi Arabia had a low level of knowledge and skills regarding basic life support techniques, especially CPR but they wanted more training and were willing to take a free course on CPR.<sup>(22)</sup>

It is known that survival of victims of out-of-hospital cardiac arrest (OHCA) is enhanced when there are enough trained bystanders who can perform cardiopulmonary resuscitation when the need arises.<sup>(23-25)</sup> Teachers can be very useful in increasing the number of potential bystanders if they can teach and train their students. According to Al Enizi et al.,<sup>(22)</sup> in order to increase the likelihood of having a CPR-skilled person present at the cardiac event, there must be an adequate number of people trained in the community. School teachers are expected to play a role in teaching cardiopulmonary resuscitation (CPR) to schoolchildren, but little is known about their attitudes, actual knowledge and willingness to do so.<sup>(26)</sup> This statement is very true in Nigeria as there is no published data concerning Nigerian teachers in this respect hitherto. Kanstad et al.<sup>(6)</sup> opined that by providing students with good quality basic life support (BLS) training in school, the upcoming generation in Norway may strengthen the first part of the chain of survival in out-of-hospital cardiac arrest (OHCA).

In pursuit of the goal of encouraging the introduction of CPR teaching and training into the Nigerian secondary school curriculum, there is a need to provide enough baseline data in this respect. Therefore, the aims of this study were to find out the level of CPR knowledge of some Nigerian teachers, as well as their attitudes towards CPR.

### Materials and Method:-

A questionnaire-based cross-sectional study of the teachers, who came for the Post NCE Sandwich Programme at the Faculty of Education of the University of Port Harcourt in September / October, 2015, was conducted. Three hundred and twenty five (325) copies of the questionnaire were distributed to the teachers but three hundred (300) copies were properly filled and returned, giving a response rate of about 92%.

The questionnaire had three (3) sections: Section A (demographic data), Section B (Knowledge of CPR) and Section C (Attitude to CPR) as shown in the Appendix.

The gender distribution of the teachers that participated in the study was as follows: 87(29%) males and 213 (71%) females. Their ages ranged from 22 to 60 years. The teachers came from different primary and secondary schools in the following fourteen (14) States in Nigeria: Akwa Ibom, Cross River, Abia, Anambra, Enugu, Imo, Ebonyi, Rivers, Delta, Edo, Ondo, Ogun, Benue, and Kogi States.

The following two (2) null hypotheses were generated and tested:

**Ho1:** The CPR knowledge of the teachers would not be significantly low

**Ho2:** The attitudes of the teachers towards CPR would be significantly poor

### Statistical Analysis:-

The Statistical Package for Social Sciences (SPSS) was used to analyze the data. Descriptive statistics and non-parametric statistics (One-Sample T-test) were employed in the analysis and the test of the hypotheses with significance level set at  $P < 0.05$ .

### Results:-

Table 1 shows the descriptive statistics of the response of the teachers to the questions on knowledge of cardiopulmonary resuscitation (CPR). This table shows that well over 64% of the teachers gave wrong answers to the questions on CPR knowledge while over 35% were right in the responses.

**Table 1:-** Descriptive statistics of the responses of the teachers to the questions on CPR knowledge

	Questions Testing CPR Knowledge	Right Answer	Wrong Answer
1.	First thing to do if a person collapses	83(27.7%)	217(72.3%)
2.	Why would you shake and shout at a collapsed victim	87(29%)	213(71%)
3.	What action(s) would you use to open airway	58(19.3%)	242(80.7%)
4.	What do you look for in assessing breathing in a collapsed victim	230(76.7%)	70(23.3%)
5.	What does CPR stand for	209(69.7%)	91(30.3%)



6.	For how long does a rescue breathe last?	43(14.3%)	257(85.7%)
7.	Number of chest compressions & rescue breaths /cycle	40(13.3%)	260(86.7%)
	<b>Cluster %</b>	<b>750(35.71%)</b>	<b>1,350(64.29%)</b>

The null hypothesis (Ho1) was tested as shown in Table 2 which was rejected ( $P < .000$ ).

**Table 2:-** Test of the Null Hypothesis (Ho1: The CPR knowledge of the teachers would not be significantly low) using the One-Sample T-test

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
CPR Knowledge	129.764	2099	.000	1.35714	1.3366	1.3777

$P < 0.05$

Table 3 shows the responses of the teachers on questions that tested their attitude to CPR. The positive attitudes to CPR gave 79.9% while the negative accounted for 20.1%.

**Table 3:-** Descriptive statistics of the responses of the teachers to the questions on CPR attitude.

		Agree (Positive attitude)	Disagree (Negative attitude)
1	I would like to learn CPR	285(95%)	15(5%)
2	After learning CPR, I would like to teach others.	277(92.3%)	23(7.7%)
3	I would perform mouth-to-mouth ventilation on a stranger.	160(53.3%)	140(46.7%)
4	I would perform CPR on a trauma victim, if needed.	217(72.3%)	83(27.7%)
5	I would perform CPR on a relative, if needed.	244(81.3%)	56(18.7%)
6	I would perform CPR on an elderly victim, if needed	224(81.3%)	76(25.3%)
7	I would like to perform CPR on a child	235(78.3%)	65(21.7%)
8	I would perform chest compression alone	230(76.7%)	70(23.3%)
9	CPR is just a trial and error	257(85.7%)	43(14.3%)
10	There is increased hope of survival for a victim of sudden collapse who receives bystander CPR	261(87.0%)	39(13%)
11	Sudden Cardiac Arrest victims cannot survive	223(74.3%)	77(25.7%)
12	I believe there could be survival through CPR	241(80.3%)	59(19.7%)
13	CPR should be taught often on Television	221(73.7%)	79(26.3%)
14	CPR should be formally taught in Nigeria Universities	269(89.7%)	31(10.3%)
15	CPR should also be taught to other citizens who are not in schools	253(84.3%)	47(15.7%)
	<b>Cluster %</b>	<b>3,597(79.9%)</b>	<b>903(20.1%)</b>

Table 4 shows that the null hypothesis (Ho2) was also rejected ( $P < .000$ ).

**Table 4: Test of the Null Hypothesis (Ho2: The CPR attitude of the teachers would be significantly poor) using the One-Sample T-test**

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Attitude to CPR	238.566	4499	.000	1.76578	1.7513	1.7803

$P < .05$

## Discussion:-

It has been documented that school teachers can effectively teach CPR to school children. <sup>(27, 28)</sup> Secondary school teachers, previously trained in basic cardiopulmonary resuscitation (b-CPR) could teach the skills effectively to 14-16-year-old students using PROCES. <sup>(29)</sup>

Chew et al<sup>(30)</sup> reported that only 29% of the total 128 participants said that they would offer to perform CPR under any cardiac arrest condition and 69% said that they would just offer to call the ambulance but they would not offer to perform CPR. When analyzed separately, only 16.4% of the school teachers said that they would perform CPR as compared to 45.5% of dental students ( $P < 0.001$ ). They concluded that knowing how to perform CPR did not necessarily translate into willingness to perform CPR. In the present Nigerian study, the teachers consistently showed poor knowledge of CPR generally. However, the general attitude of the teachers to CPR is very positive as reflected in their responses to the questions except the one which said that 'CPR is trial and error' which suggests that they did not interpret that question properly.

In the related study by Mpotos et al,<sup>(26)</sup> it was concluded that although a majority of teachers received previous CPR training, awareness of CPR as a mandatory part of the secondary school's curriculum was poor. Only a minority consisting of mostly primary school teachers felt competent in CPR and was willing to teach it to their students. Unlike in this present Nigerian study where none of the teachers had received any earlier exposure to CPR teaching and training, in the study by Mpotos et al<sup>(26)</sup> 59% of the teachers had previous exposure to CPR training. Meanwhile, Patsaki et al<sup>(31)</sup> reported about 21% had earlier exposure to CPR training in their study. The poor knowledge of the CPR as reflected in their responses to the various questions in the questionnaire as shown in Table 1 is consisted with the report of Patsaki et al<sup>(31)</sup> where the number of incorrect answers to knowledge questions was found to be directly related to the absence of a previous course.

Our current study discovered that 92.3% of the participants indicated willingness to teach others after learning CPR while only 39% were interested in teaching others CPR.<sup>(26)</sup> This Nigerian percentage of participants willing to teach others CPR is a very welcome development as this gives hope for the success of producing many bystanders in Nigeria if the teaching and training in CPR is incorporated in the school curriculum. However, the relatively low percentage (39%) of teachers willing to teach CPR in Mpotos et al<sup>(26)</sup> report was still considered possibly being sufficient because of the option of the teacher being a facilitator for self-learning or blended learning, thereby requiring only minimal changes in their curriculum to implement CPR.

#### **Strength and Limitation of this Study:-**

Although our study sample was a convenient sample and not randomly selected because they were those who came for the long vacation Sandwich programme in our University, the present study has teachers from both primary and secondary school covering 14 out of the 36 States of Nigeria which gives a considerable spread and a fair idea of the true knowledge and attitude of Nigerian teachers towards cardiopulmonary resuscitation (CPR) since there is no other published data on CPR concerning teachers hitherto in Nigeria.

#### **Conclusion:-**

This first Nigerian study on cardiopulmonary resuscitation in relation to teachers have shown generally poor CPR knowledge of the primary and secondary schools teachers (participants) which was statistically significant but very statistically significant positive attitude towards CPR.

#### **Recommendations:-**

1. There is need to get Nigerian school teachers trained in CPR so as to make them ready for the urgent need of training Nigerian school children accordingly, in line with the growing global trend.
2. The need to incorporate the teaching and training in CPR into the Nigerian primary and secondary schools' curricula is re-emphasized, as earlier recommended<sup>(15, 16, 20)</sup>

#### **References:-**

1. Reder S, Quan L. Cardiopulmonary resuscitation training in Washington state public high schools. *Resuscitation*. 2003; 56:283-8.
2. Uray T, Lunzer A, Ochsenholer A, Thanikell L, Zingerle R, Lillie P, et al. Feasibility of life-supporting first-aid (LSFA) training as a mandatory subject in primary schools. *Resuscitation*. 2003; 59: 211-20.
3. Connolly M, Toner P, Connolly D, McCluskey DR. The 'ABC for life' programme – Teaching basic life support in schools. *Resuscitation*. 2007; 72: 270-9.
4. Lorem T, Palm A, Wik L. Impact of a self-instruction CPR kit on 7<sup>th</sup> graders' and adults' skills and CPR performance. *Resuscitation* 2008; 79: 103-8.

5. Naqui S, Siddigi R, Hussain SA, Batool H, Arshad H. School children training for basic life support. *J. Coll Physician Surg Pak* 2011; 21: 611-5.
6. Kanstad BK, Nilsen SA, Fredriksen K. CPR knowledge and attitude to performing bystander CPR among students in Norway. *Resuscitation*. 2011; 82 (8): 1053-9.
7. Lee BC, Lee MJ, Shin SJ, Ryoo HW, Kim JK, Park JB, et al. The current status of cardiopulmonary resuscitation training for school. *J Korean Soc Emerg Med* 2012; 23: 470-8.
8. Hamasu S, Morimoto T, Kuramoto N, Horiguchi M, Iwami T, Nishiyama C, et al. Effects of BLS training on factors associated with attitude toward CPR in college students. *Resuscitation* 2009; 80: 359-64.
9. Nishiyama C, Iwami T, Kitamura T, Ando M, Sakamoto T, Marukawa S, et al. Longterm retention of cardiopulmonary resuscitation skills after shortened chest compression-only training and conventional training: A randomized controlled trial. *Acad Emerg Med* 2014; 21: 47-54.
10. Meissner TM, Kloppe C, Hanefeld C. Basic life support skills of high school students before and after cardiopulmonary resuscitation training: A longitudinal investigation. *Scand J Trauma Resusc Emerg Med* 2012; 20: 31.
11. Plant N, Taylor K. How best to teach CPR to schoolchildren: A systematic review. *Resuscitation* 2013; 84:415-21.
12. Miro O, Diaz N, Diaz JE, Escalada FX, Perez-Puejo FJ, Sanchez M. Cardiopulmonary resuscitation program for secondary school (PROCES): Conclusions after 5 years. *Resuscitation* 2012; 83: e116-7.
13. Colquhoun M. Learning CPR at school – everyone should do it. *Resuscitation* 2012; 83: 543-4.
14. Onyeaso AO, Awareness of cardiopulmonary resuscitation among secondary schools in Port Harcourt, Nigeria. *Journal of Education in Developing Areas*. 2014; 22:137-42.
15. Onyeaso AO, Imogie AO. Attitude towards cardiopulmonary resuscitation among some secondary school students in Rivers State, Nigeria. *Br J Educ* 2014; 2: 37-43.
16. Onyeaso AO, Achalu EI. Knowledge of cardiopulmonary resuscitation among some secondary school students in Nigeria. *J Educ Pract* 2014; 5: 180-3.
17. Onyeaso AO. Retention of cardiopulmonary resuscitation skills in Nigerian secondary school students. *J Educ Pract* 2016; 7(15): 162-8.
18. Onyeaso AO. Age, gender and school class and retention of cardiopulmonary resuscitation knowledge among secondary school students in Nigeria. *BJMMR* 2016; 16(4); 1-7.
19. Onyeaso AO, Onyeaso CO. Effects of age, school class on cardiopulmonary resuscitation skills of Nigerian secondary school students. *J Educ Pract* 2016; 7(18): 44-48.
20. Onyeaso AO, Onyeaso CO. Cardiopulmonary resuscitation skills in some Nigerian secondary school students. *Port Harcourt Med J* 2016; 10 (2): 60-5.
21. Compton S, Swor RA, Dunne R, Weich RD, Zalenski RJ. (2003): Urban Public School Teachers' Attitudes and Perceptions of the Effectiveness of CPR and Automated External Defibrillators. *Am J Health Educ* 34(4): 186-192.
22. Al Enizi BA, Saquib N, Zaghloul MSA, Alaboud MSA, Shahid MS, Saquib J. Knowledge and Attitudes about Basic Life Support among Secondary school Teachers in Al-Qassim, Saudi Arabia. *Int J Health Sci (Qassim)* 2016; 10(3): 415-422.
23. Kleinman ME, Brennan EE, Goldberger ZD, Swor RA, Terry M, Bobrow BJ, ET AL. Part 5: Adult Basic Support and Cardiopulmonary Resuscitation Quality: 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*. 2015; 132 (18 Suppl 2): S414-35.
24. Gates S, Quin T, Deakin CD, Blair L, Couper K, Perkins GD. Mechanical chest compression for out of hospital cardiac arrest: Systematic review and meta-analysis. *Resuscitation*. 2015; 94: 91-7.
25. Hasselqvist-Ax I, Riva G, Herlitz J, Rosenqvist M, Hollenberg J, Nordberg P, et al. Early cardiopulmonary resuscitation in out-of-hospital cardiac arrest. *N Engl J Med*. 2015; 372(24): 2307-15.
26. Mpotos N, Vekeman E, Monsieurs K, Derese A, Valcke M. Knowledge and willingness to teach cardiopulmonary resuscitation: A survey amongst 4273 teachers. *Resuscitation*. 2013; 84: 496-500.
27. Miro O, Jimenez-Fabrega X, Espigol G, Culla A, Escalada- Roig X, Diaz N, Salvador J, Abad J, Sanchez M. Teaching basic life support to 12-16 year olds in Barcelona schools: views of head teachers. *Resuscitation* 2006; 70: 107-16.
28. Toner P, Connolly M, Laverty L, McGrath P, Connolly D, McCluskey DR. Teaching basic life support to school children using medical students and teachers in a 'peer –training' model – results of the 'ABC for life' programme. *Resuscitation* 2007; 75: 169-175.

29. Jimenez-Fabrega X, Escalada-Roig X, Miro O, Sanclemente G, Diaz N, Gomez X, Villena O, Rodriguez E, Gaspar A, Molina JE, Salvador J, Sanchez M. Comparison between exclusively school teacher-based and mixed school teacher and healthcare provider-based programme on basic cardiopulmonary resuscitation for secondary schools. *Emerg Med J* 2009; 26(9): 648-52.
30. Chew KS, Yazid MN, Kamarul BA, Rashidi A. Translating knowledge to attitude: a survey on the perception of bystander cardiopulmonary resuscitation among dental students in Universiti Sains Malaysia and school teachers in Kota Bharu, Kelantan. *Med J Malaysia* 2009; 64(3): 205-9.
31. Patsaki A, Pantazopoulos I, Dontas I, Passall C, Papadimitriou L, Xanthos T. Evaluation of Greek high school teachers' knowledge in basic life support, automated external defibrillation, and foreign body airway obstruction: implications for nursing interventions. *J Emerg Nurs* 2012; 38: 176-81.

## Appendix:-

### QUESTIONNAIRE ON CARDIOPULMONARY RESUSCITATION (CPR)

#### Section A: Personal Data

Please tick as it applies to you.

1. Gender : Male:

☐

Female:

☐

2 Age in Years: -----

3. Official status at workplace-----

4. Name of workplace: -----

5. For how long have you been teaching? -----

6. In which state is your work place ? -----

7. As a Sandwich student, please state your department here in Uniport-----

#### Section B

Concerning a collapsed victim, please tick only one option in questions 5 to 11 below.

5. What is the first thing you should do if you come across a collapsed person?

- ☐ Call an ambulance
- ☐ Try to get the person to respond to you
- ☐ Check to see if the person is breathing normally

6. Why would you shake and shout at a collapsed person?

- ☐ To open the airway
- ☐ To restart the heart
- ☐ To check for response

7. What action would you use to open the person's airway?

- ☐ Tilt the head back and lift the chin
- ☐ Tilt the head and push the chin down
- ☐ Tilt the head down and turn the chin to the right

8. When assessing a person's breathing, what do you look for?

- ☐ Chest movement
- ☐ Movement of the eyes
- ☐ Movement of nose

9. What does CPR stand for?

- ☐ Call Respond React
- ☐ Cardiopulmonary Resuscitation
- ☐ Citizen Please Respond

10. When giving rescue breaths, for how long do you breathe into the person's mouth?

- ☐ 1 second  
☐ 5 seconds  
☐ 10 seconds

11. How many chest compressions and rescue breaths would you give per cycle of CPR?

- ☐ 20 presses and one breathe  
☐ 30 presses and two breaths  
☐ 30 presses and three breaths

### Section C

**For each of the statements, please rate under the following scales: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD).**

		SA	A	D	SD
12	I would like to learn CPR				
13	After learning CPR, I would like to teach others.				
14	I would perform mouth-to-mouth ventilation on a stranger.				
15	I would perform CPR on a trauma victim, if needed.				
16	I would perform CPR on a relative, if needed.				
17	I would perform CPR on an elderly victim, if needed.				
18	I would like to perform CPR on a child.				
19	I would perform chest compression alone				
20	CPR is just a trial and error				
21	There is increased hope of survival for a victim of sudden collapse who receives bystander CPR				
22	Sudden Cardiac Arrest victims cannot survive				
23	I believe there could be survival through CPR				
24	CPR should be taught often on Television				
25	CPR should be formally taught in Nigerian Universities				
26	CPR should also be taught to other citizens who are not in schools.				



### RESEARCH ARTICLE

## TRAITEMENT CHIRURGICAL DE LA RUPTURE DU LIGAMENT CROISE ANTERIEUR CHEZ L'ENFANT SELON LA TECHNIQUE DE MAC-INTOSH MODIFIEE JAEGER (A PROPOS D'UNE SERIE CONTINUE DE 23 CAS).

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- Ligamentoplasty - Fascia lata -

Cartilage growth

### Abstract

Waiting for the end of growth for treating lesions of the anterior cruciate ligament seems to be mistake. Inadequate results of conservative treatment can harm the harmonious development of the child, thus surgical treatment has become a necessity. A conventional ligament as embodied in adults is not possible in children because of the risks of secondary growth disorder. With our experience in adults of mixed tuck the fascia lata using the technique of modified Mac-Intosh amended Jaeger, we have adapted this technique to the child respecting the growth of cartilage. We report the experience of the surgical management of 23 children in our institution between January 2000 and December 2009, according to the technique of Jaeger and their followed and we discuss our results by comparing to literature data recent.

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### Introduction:-

La fréquence et la gravité des lésions du ligament croisé antérieur de l'enfant ont longtemps été minimisées. Devant l'évolution défavorable de nombreuses lésions traitées de manière conservatrices, le traitement chirurgical est devenu une nécessité. Une ligamentoplastie conventionnelle telle qu'elle est réalisée chez l'adulte n'est pas envisageable chez l'enfant du fait des risques de troubles de croissance secondaires. Fort de notre expérience chez l'adulte de la plastie mixte au fascia-lata selon la technique de Mac-Intosh modifiée Jaeger, nous avons adapté cette technique à l'enfant en respectant le cartilage de croissance.

### Méthodes:-

#### Description de la technique [1]:-

L'intervention est précédée d'un examen clinique systématique réalisé sous anesthésie général. Il confirme le diagnostic et précise avec exactitude l'importance des laxités. Il facilite la mise en évidence d'un ressaut rotatoire. Ces recherches peuvent être difficiles sans anesthésie, particulièrement chez l'enfant.

Le jeune patient est ensuite installé en décubitus dorsal, le genou maintenu à 80° de flexion par un appui placé à la racine de la cuisse sous le garrot pneumatique. L'intervention débute par la réalisation d'une mini-arthrotomie antéro-médiale de 3 à 4 cm (*Fig.1*). L'examen de la cavité articulaire permet un bilan lésionnel précis, les ménisques sont testés à l'aide d'un crochet, un geste chirurgical approprié sera réalisé devant une lésion méniscale,

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malheureusement fréquente chez l'enfant, en évitant par tous les moyens une ménisectomie même partielle. Enfin les surfaces du cartilage seront vérifiées.

L'incision est prolongée distalement afin de repérer le cartilage de croissance à l'aide d'aiguilles fines. Le tunnel tibial doit respecter ce cartilage. Son point d'entrée sera proximal par rapport au cartilage fémoral tibial et situé au bord médial de la tubérosité antérieure tibiale. Son trajet aboutit au pied du LCA rompu, son diamètre de 4,5 à 6 mm sera adapté à l'âge de l'enfant (Fig.2).

L'incision cutanée latérale débute en regard du tubercule infra-condylien tibial et se prolonge sur la face latérale de la cuisse (Fig.3). Le transplant du fascia-lata est prélevé en respectant son insertion distale au tubercule infra-condylien tibial, sa largeur est de 10 mm en distal et de 30 à 40 mm en proximal. La longueur du transplant varie de 10 à 15 cm en fonction de la morphologie de l'enfant. La bandelette du fascia-lata est tubulisée sur ses derniers centimètres (Fig.4).

Pour faciliter la fermeture sans tension du fascia-lata, le muscle vaste latéral est décollé du septum intermusculaire latéral, jusqu'à son insertion fémorale, le septum est alors sectionné au raz du fémur. Le ligament collatéral fibulaire est repéré et disséqué. Une rigole condylienne fémorale est réalisée en sous périoste, son point d'entrée se situe en arrière de l'insertion fémorale du ligament collatéral fibulaire, son trajet est réalisé au ciseau de Smilie jusqu'à la face médiale du condyle latéral, cette rigole respecte le cartilage de croissance fémoral distal en étant plus proximal (Fig.5).

Par l'arthrotomie antéro-médiale, on perfore la capsule articulaire postérieure afin de préparer le passage du transplant (Fig.6). Il est ensuite récupéré dans l'articulation à travers la brèche capsulaire postérieure. Le transplant est enfin passé dans le tunnel tibial. Sa tension est réglée par traction manuelle le pied en rotation neutre, genou fléchi à 80°. Sa fixation est assurée par une agrafe métallique crantée, positionnée sous le cartilage de croissance métaphysaire tibial (Fig.7).

Le trajet du transplant comporte donc une partie extra-articulaire et une partie intra-articulaire assurant une stabilisation antérieure optimale tout en respectant le cartilage de croissance. Avant la fermeture, on contrôle l'absence de déficit de mobilité en flexion et en extension. L'absence de tiroir antérieur en flexion et en sub-extension est contrôlée. La fermeture du fascia-lata est réalisée afin de réparer le hauban extérieur fondamental pour la stabilité du genou. Les incisions cutanées sont suturées par surjet intra-dermiques. L'appui complet est autorisé. Le protocole de rééducation sera adapté à l'âge de l'enfant.

#### **Description de la série:-**

Il s'agit d'une étude rétrospective portant sur 23 enfants opérés au sein de notre établissement selon la technique de Jaeger entre Janvier 2000 et Décembre 2009. Notre série se composait de 18 garçons et 5 filles, souffrant d'instabilité post-traumatique du genou retentissant sur leurs activités physiques. 15 patients pratiquaient un sport de type pivot ou pivot-contact, dont 13 en compétition. Les scores préopératoires de Lysholm et de Tegner étaient respectivement de 74 (58 – 90) et 8,1 (4 à 9). Nous avons opéré 17 genoux droits et 5 genoux gauches. Les patients ont été opérés par deux chirurgiens du service selon la même technique, décrite précédemment. Les détails techniques opératoires ont été soigneusement notés, ainsi que les traitements complémentaires et la chronologie de la reprise des activités sportives.

#### **Resultats:-**

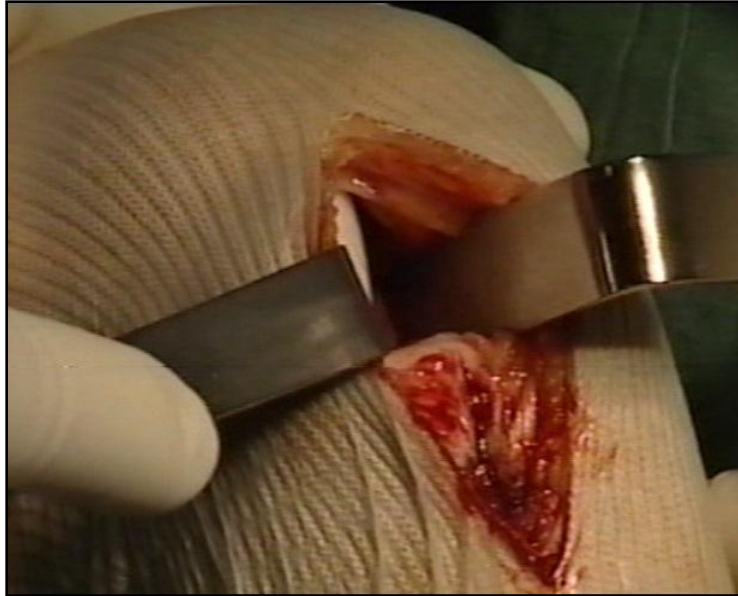
La durée moyenne du garrot a été de 42,5 min (35 – 50). L'exploration articulaire a permis d'objectiver des lésions chondrales chez 1 patient et de traiter 4 lésions méniscales en zone avasculaire (blanche-blanche). La sortie du service s'est effectuée en moyenne au 7<sup>ème</sup> jour post-opératoire (8 – 9) en centre de rééducation pour la majorité des patients ou à domicile directement.

Au premier jour post-opératoire les douleurs sur une échelle visuelle analogique sont en moyenne à 4 (1 – 6). Deux patients se plaignaient de gonflement du genou opéré à l'effort. . Aucun patient n'a rapporté d'épisode d'instabilité. La flexion est supérieure à 130° pour tous les patients à 6 mois post opératoire. A 6 semaines un déficit d'extension chiffré à 1,15° est retrouvé chez 1 patient, sans qu'il y ait de différence avec le programme de rééducation entre les patients. Aucun patient n'a de ressaut rotatoire. Un arrêt dur, retardé, au test de Trillat-Lachman a été retrouvé chez 5 patients (21,7%) à un an. Tous les patients ont bénéficié d'un test isocinétique à trois et six mois. Le score IKDC

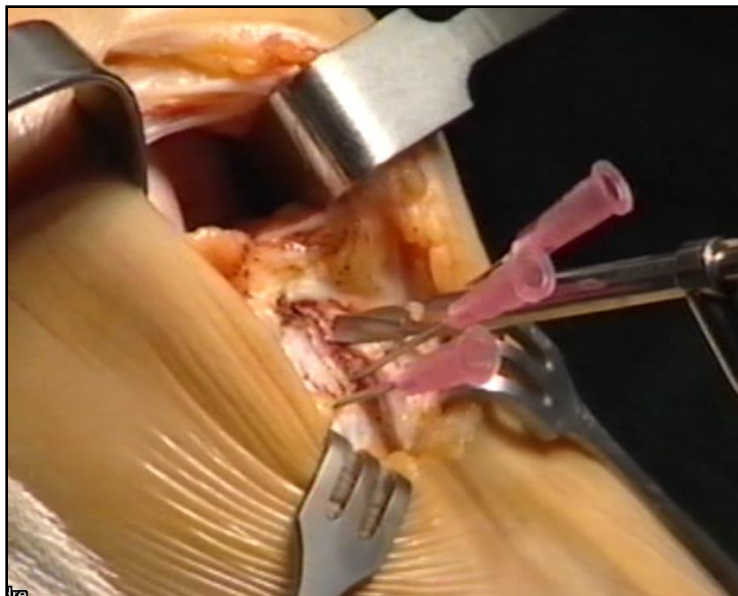


fonctionnel subjectif moyen était de 80,3% (41 à 100%). Le *Lysholm Knee Score* moyen était de 83% (31 à 100%). Tous les patients ont eu une radiographie du genou opéré au 6<sup>ème</sup> mois post-opératoire.

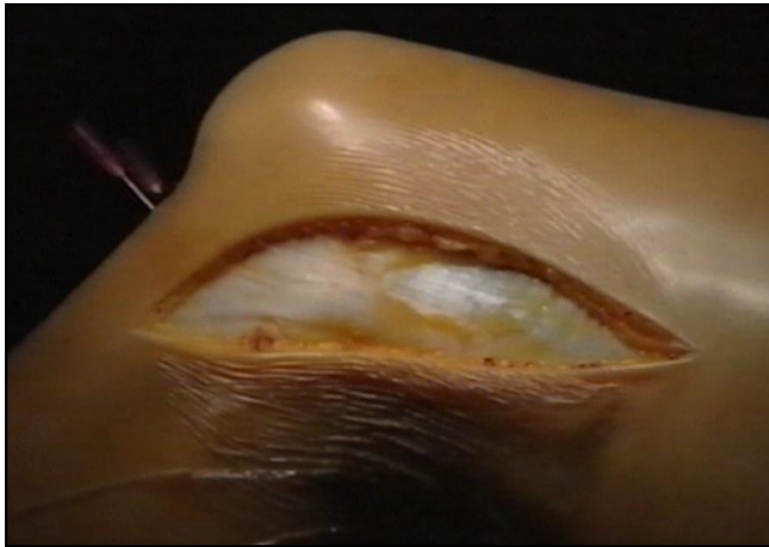
Nous avons recensé un hématome de cuisse qui s'est résorbé spontanément au huitième jour post opératoire, un sepsis superficiel traité par 15 jours d'antibiothérapie per os (Pristinamycine) et soins locaux, La mesure des laxités au KT 2000, chez les 42 patients revus en consultation dont le genou controlatéral était sain, a retrouvé une laxité différentielle moyenne de 2,1 mm (0 à 6 mm).



**Fig.1:-** Mini-arthrotomie antéro-médiale et exploration de la cavité articulaire.



**Fig 2:-** Repérage du cartilage de croissance à l'aide d'aiguilles fines et forage du tunnel tibial.



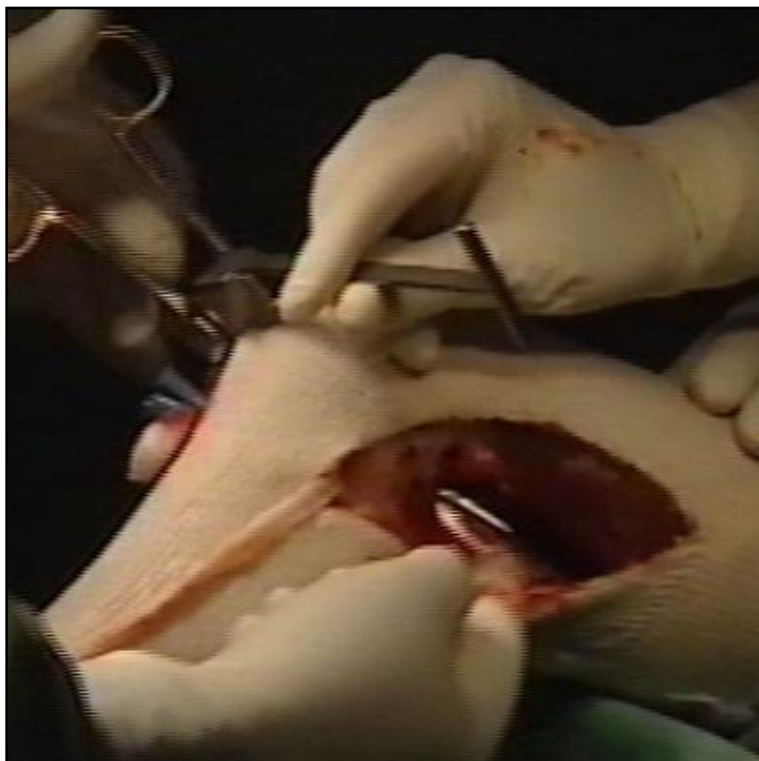
**Fig 3:-** Incision latérale et exposition du fascia-lata



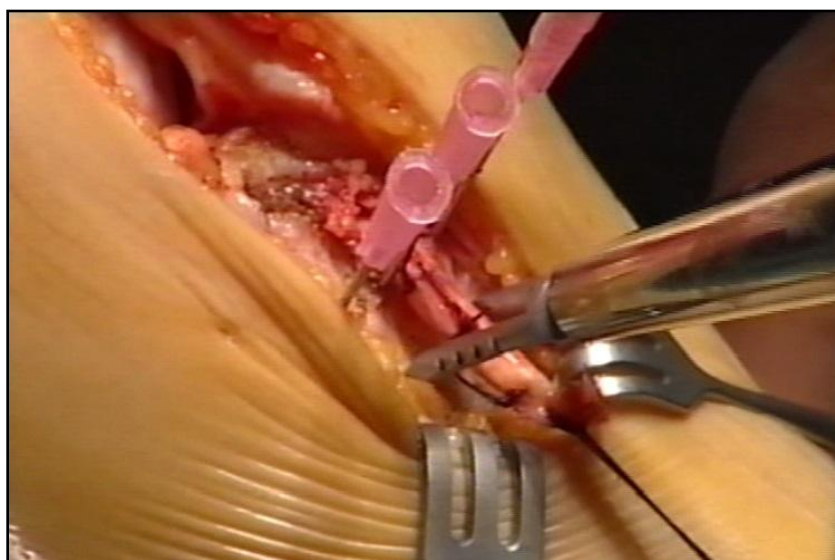
**Fig 4:-** Prélèvement et tubulisation du transplant avec fil tracteur à son extrémité.



**Fig 5:-** Réalisation d'une rigole condylienne fémorale en sous périoste.



**Fig 6:-** Perforation de la capsule articulaire postérieure.



**Figure 7 :** Passage et fixation du transplant par agrafe métallique positionnée sous le cartilage de croissance.

### **Discussion:-**

#### **Resultats cliniques:-**

Il n'y a pas dans notre série de douleur antérieure comme c'est le cas dans les plasties au tendon rotulien où ces douleurs sont estimées entre 19% [2] et 38% [3] selon les séries et rendent dans 53% des cas la marche sur les genoux impossible. Les séries de patients analysées dans le service pour le Mac Intosh au fascia-lata par arthrotomie retrouvaient des mobilités à la 6<sup>ème</sup> semaine de 100° en moyenne [4]. A 6 semaines un déficit d'extension est retrouvé chez 1 patient, il est de 1,15° sans qu'il y ait de différence avec le programme de rééducation entre les

patients. Un arrêt dur, retardé, au test de Trillat-Lachman a été retrouvé chez 5 patients (21,7%) à un an d'évolution. Pour Balabaud [5], le Trillat-Lachman est coté à cinq ans à une croix dans 28% des cas et deux croix pour 10% des patients. Il n'y a pas de ressaut rotatoire à la manœuvre du "Jerk test" à un an. C'est en accord avec les résultats des plasties mixte dans la littérature. Pour la ligamentoplastie au fascia lata selon Mac Intosh modifiée JH Jaeger", le pourcentage de "Jerk test" négatif est de 100% à un an, 96% à cinq ans pour Balabaud [6] et de 98,8% avec 6,7 ans de recul moyen pour Dodelin. De même pour les ligamentoplasties au tendon rotulien avec retour externe, Stapleton *et al.* [7] et Jorgenson *et al.* [8] rapportent 96% d'absence de ressaut rotatoire.

Dans cette dernière série une mesure arthrométrique au KT 2000 a été réalisée et retrouve à 89N une différence inférieure à 3 mm dans 84% des cas à 6 mois et 86 % à 5 ans. Il y a donc une détente de la greffe dans les premiers mois puis une stabilisation qui se maintient dans le temps. Ce petit jeu articulaire constaté lors de tests statiques a toutefois peu d'influence sur les résultats fonctionnels. Noyes *et al.* [9] rapportent que 12% de ces patients ont un jeu de plus de 3 mm par rapport au genou controlatéral alors que plus de la moitié n'a aucune plainte avec un score de Lysholm moyen de 100 points et aucun ressaut. L'évaluation du résultat objectif devrait donc être testée en dynamique plutôt qu'en statique comme le suggère Lefebvre *et al.* [10]. Pour notre étude, la mesure des laxités au KT 2000, chez les 23 patients revus en consultation dont le genou controlatéral était sain, a retrouvé une laxité différentielle moyenne de 2,1 mm (0 à 6 mm) à un an.

#### **Les complications:-**

Un patient a présenté un hématome de cuisse au site du prélèvement, on a relevé un cas de sepsis superficiel. Ces complications ne compromettent pas le pronostic fonctionnel quand elles sont prises en charge à temps. Ainsi ces deux patients ont une mobilité normale et ont pu reprendre leurs activités sportives antérieures au sixième mois post opératoire comme prévu.

#### **La technique chirurgicale:-**

L'affaiblissement du hauban externe, évoqué par certains auteurs, est à nos yeux évité par la réparation systématique du fascia-lata en fin d'intervention [11]. Cette réparation étant devenue toujours possible grâce à la section du septum fémoral latéral proposée par J.H. Jaeger [12]. Le préjudice esthétique a été également mis en avant. Or, actuellement il est possible de réaliser cette technique avec une incision latérale de 6 à 8 cm associée à une mini-arthrotomie. Il n'y a pas d'intervention proposant des cicatrices plus petites qui associe une plastie intra et extra-articulaire.

L'expérience du service en matière de ligamentoplastie nous a conduits à choisir le Mac Intosh au fascia-lata car avec un même transplant nous pouvons réaliser une plastie intra et extra-articulaire équilibrée. En effet le fait que les 2 plasties ne soient pas indépendantes l'une de l'autre évite d'éventuelles différences de tension qui pourraient rendre l'une d'elle inutile.

Le retour externe systématique avec cette technique joue selon nous un rôle fondamental par son effet « anti-jerk » et son rôle protecteur de la plastie intra-articulaire pendant la phase de nécrose des 6 à 12 semaines. Même si Noyes et coll [9], en 2003, n'ont pas montré de différence significative dans les résultats à long terme entre une plastie au tendon rotulien seul et une plastie intra et extra-articulaire, le sujet fait toujours débat puisqu'une conférence de la SOFCOT 2006 y sera consacrée.

Un autre avantage du Mac Intosh au fascia-lata est le diamètre du transplant de 6 mm qui permet :

1. De conserver l'environnement synovial autour du transplant et ainsi de favoriser sa ligamentisation et de préserver les éventuels mécanorécepteurs restés fonctionnels au sein d'un ligament croisé antérieur cicatrisé en nourrice.
2. D'éviter les conflits avec l'échancrure fémorale qui exposent aux risque de distensions secondaires de la plastie ou de raideurs, voire de ruptures ou pour le tendon rotulien de cyclope syndrome.
3. De réaliser des tunnels osseux de diamètre moins important.

En effet , des études biomécaniques faites par moyen et coll. [11] et par Harner et coll. (12) ont montré que le transplant du droit interne et gracilis a une surface de section de presque 2 fois la surface du ligament croisé antérieur. Ce qui accroît le risque potentiel de conflits avec l'échancrure fémorale.

Nous expliquons également nos bons résultats précoces par le fait que nous sommes partisans d'une rééducation « agressive » [13]. En effet les patients débutent la rééducation au 1<sup>er</sup> jour post-opératoire, le travail porte sur les

mouvements actifs et passifs du genou, sur la levée de la sidération du quadriceps permettant le verrouillage actif du genou. 2 à 3 fois par jour les patients sont installés sur des arthromoteurs pour une durée totale d'environ de 2 heures par jour.

### Conclusion:-

L'insuffisance des résultats du traitement conservateur des ruptures du ligament croisé antérieur de l'enfant justifie la nécessité du traitement chirurgical. La procédure chirurgicale réalisée doit respecter le cartilage de croissance. Si la technique est bien conduite, le risque de retentissement sur la croissance est moindre car la majorité des troubles rencontrés dans la littérature est secondaire à des fautes techniques. La technique de Jaeger mérite une place de choix dans la mesure où les résultats sont constamment excellents, lorsque les indications sont bien posées et la technique est conduite de façon rigoureuse.

### Conflits d'intérêts:-

Les auteurs ne déclarent aucun conflit d'intérêts

### References:-

1. **Bergerault F, Bonnard C, Courtivron B.** Rupture du ligament croisé antérieur chez l'enfant. EMC, techniques chirurgicales: Orthopédie-Traumatologie. Elsevier SAS. 2011; 99: 44-786.
2. **Acquitter Y, Hulet C, Locker B, Delbarre JC, Jambou S, Vielpeau C.** Intérêt d'une plastie extra-articulaire dans le traitement des laxités antérieures chroniques du genou par une autogreffe de tendon rotulien. *Rev Chir Orthop Reparatrice Appar Mot.* 2003; 89(23): 413-422.
3. **Bak K, Jørgensen U, Ekstrand J, Scavenius M.** Results of reconstruction of acute ruptures of the anterior cruciate ligament with an iliotibial band autograft. *Knee Surg Sports Traumatol Arthrosc.* 1999; 7(1): 111-117.
4. **Clancy WG, Nelson DA, Reider B.** Anterior cruciate ligament reconstruction using onethird of the patellar ligament, augmented by extra-articular tendon transfers. *J Bone Joint Surg (Am).* 1982; 64(11): 352-359.
5. **Vergis A, Hindriks M, Gillquist J.** Sagittal plane translation of the knee in anterior cruciate deficient subjects and controls. *Med Sci Sports Exer.* 1997; 29(5): 1561-1566.
6. **Meyer-Fleck D, Chapotot D, Balliet JM, Jaeger JH.** Intérêt de l'évaluation isocinétique dans les laxités chroniques du genou traitées chirurgicalement par plastie à l'aide d'un transplant au fascia lata dans Ligamentoplastie du LCA: Mc Intosh FL versus KJ et DIDT. *JH Jaeger, C Lutz, W Van Hille.* Edition Sauramps medical, 2002; 6(2): 85 – 91.
7. **Stapleton TR.** Complications in anterior cruciate ligament reconstructions with patellar tendon grafts. *Sports med an arthroscopy.* 1997; 5(1): 156-162.
8. **Jørgensen U, Bak K, Ekstrand J, Scavenius M.** Reconstruction of the anterior cruciate ligament with the iliotibial band autograft in patients with chronic knee instability. *Knee Surg, Sports Traumatol, Arthrosc.* 2001; 9(5): 137-145.
9. **Noyes FR, Butler DL, Grood ES, Zernicke RF, Hefzy MS.** Biomechanical analysis of human ligament grafts used in knee ligament repairs and reconstructions. *J Bone Joint Surg [Am].* 1984, 66(3): 344-352.
10. **Lefebvre Y.** Etude des propriétés mécaniques de trois transplants utilisables dans la reconstruction du ligament croisé antérieur. Thèse de médecine, université Louis-Pasteur de strasbourg. 2000; 85(A): 36 – 45.
11. **Moyen B.** Biomécanique du tendon rotulien et du complexe semi-tendineux, gracilis. *Annales de la SFA.* 1999; 15(3): 30 – 33.
12. **Harner CD, Xerogeanes JW, Livesay GA, Carlin GJ, Smith BA, Kusayama T, Kashiwaguchi S, Woo SL.** The human posterior cruciate ligament complex: an interdisciplinary study ligament morphology and biomechanical evaluation. *Am J Sp Med.* 1995; 6(2): 736 – 745.
13. **Seynaeve P, Klupczynski D, Ruiz C.** Rééducation après chirurgie ligamentaire du genou : protocole Mac Intosh modifié au fascia lata par JH Jaeger. Livre : Ligamentoplastie du LCA : Mac Intosh FL versus KJ et DIDT, réparation cartilagineuse. Sauramps médical, 2002; 6(2): 56 – 60.



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### RESEARCH ARTICLE

#### ALENDRONATE SODIUM IN OSTEOARTHRITIS: EFFECTS ON ANABOLIC, CARTILAGE DEGRADATIVE MARKERS AND THE CLINICAL ACTIVITY.

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#### Abstract

**Objective:** Osteoarthritis (OA) is a common arthritic disorder and responsible for 2 % of disability in all world. OA affects all joint parts including cartilage, bone and synovium which characterized by degradation of cartilage, subchondral bone turn over and osteophytes formation.

**Aim of the study:** To evaluate the effect of alendronate sodium (ALN) on disease activity and physical function, evaluate the biochemical parameters that are related to OA patients and study the impact of ALN on bone anabolic and degradative marker, and to determine its effectiveness in slowing progression of disease.

**Patients and methods:** 116 OA patients over 45 years old with Kellgren and Lawrence X-ray grade II and more were enrolled in this study. Base line assessment was done, Kellgren and Lawrence X-ray grading, WOMAC scoring, body mass index and the biochemical parameters with enzyme-linked immunosorbent assay (ELISA) analysis of serum TGF (transforming growth factor) beta 1 and C-terminal cross linked -telopeptide of type II collagen (CTXII). They were instructed to take ALN 10 mg daily. Reassessment was done after 3 months.

**Results :** A significant symptomatic improvement in WOMAC scoring regarding pain and stiffness were observed associated with significant reduction in serum CTXII, TGF beta 1. A no significant reduction in serum calcium with no significant changes in serum Alkaline phosphatase C-reactive protein function and joint space width were also reported.

**Conclusion:** ALN in patients with OA has clinical efficacy in reducing symptoms especially pain probably through inhibition of TGF beta 1 with no significant structural improvement despite reduction of CTXII, and may help delay and prevent further disease progression probably through inhibition of TGF β1 activity in the subchondral bone.

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## Introduction:-

Osteoarthritis (OA) is a slowly progressive degeneration of articular cartilage with subsequently joint space width (JSW) reduction (Blagojevic *et al.*, 2010), a common form of arthritic problem (Abramson *et al.*, 2006). In spite of the fact that OA has been believed to be principally a cartilage defect associated with focal articular cartilage degradation (Felson, 2006). It has been found that a solid and stable aspects of subchondral bone is needed for articular cartilage in load-bearing articular joints, which affects the activity of subchondral bone in OA (Mahjoub *et al.*, 2012 ; Suri and Walsh, 2012). the structural changes throughout OA progression including decreased mineralization of the trabecular structure, amplified turnover in the subchondral bone, defects in bone marrow and subchondral plate sclerosis (Karsdal *et al.*, 2014). OA is characterized by a repetitive inflammatory aspect of the articular cartilage due to focal defect or erosion of the cartilage and hypertrophic changes of osteoblastic function or osteophytosis (Esser and Bailey, 2011). These defining abnormalities result in a reduction in JSW leading to painful, immobile, and disabling joint (Ringdahl and Pandit, 2011). Meanwhile, when bone resorption is decreased a range of biochemical investigations has demonstrated positive events on cartilage health (Radin and Rose, 1986). OA is a multifactorial disorders (Berenbaum, 2013). risk factor for OA like age, OA is highly age-related because old cartilage expresses changes in TGF (transforming growth factor)- $\beta$  signaling with decrease protection capacity (Van der, 2014). Other factors like gender (Patricia *et al.*, 2011), race (Cruz-Almeida *et al.*, 2014), over stress (Voelker, 2011) and sex hormone (Jorge *et al.*, 2009). OA can be classified as primary (idiopathic) if its cause is not well defined and secondary when there is a certain events causing OA (Brandt *et al.*, 1986).

Cytokines such as TNF- $\alpha$  and IL-1 increase matrix metalloproteinases (MMP) gene expression and block chondrocyte balancing pathway (Scanzello and Goldring, 2012). IL-4, IL-10, and IL-13 have the ability to reduce synthesis of both TNF- $\alpha$  and IL-1 $\beta$ , and to control MMP activity (Fernandes *et al.*, 2002). IL-1 further affects the action of certain growth factors, such as transforming growth factor-beta (TGF- $\beta$ ) (Alejandro, 2011). TGF  $\beta$  1 responsible for maintaining homeostasis between articular cartilage and subchondral bone (Gehua and Xu, 2014). TGF- $\beta$ 1 is found in high level in subchondral bone from humans with OA (Gehua *et al.*, 2013). High concentrations of TGF- $\beta$ 1 enhance formation of nestin-positive mesenchymal stem cell clusters, which enhances the generation of marrow osteoid islets associated with high levels of angiogenesis (Gehua *et al.*, 2013). It has been found that spinal osteophyte formation is associated with alternation in the TGF- $\beta$ 1 gene in Japanese women (Yamada, 2000; Yamada *et al.*, 2000) and targeting TGF  $\beta$ 1 could be a therapeutic approach to managing OA patients (Gehua *et al.*, 2013).

Findings in OA joints include increase size of bone tissue, crepitus, effusions, and decreased range of motion. Tenderness on palpation and pain on passive movement are also common, even though not exclusive to OA (Joseph *et al.*, 2009). Primary OA is typically diagnosed according to clinical and radiographic imaging findings (Hunter, 2008). Kellgren and Lawrence (K-L) system is the most often used (Kellgren and Lawrence, 1957). It has been discovered that a combination of both pharmacological and non-pharmacological therapies exert a beneficial role in managing patients with knee osteoarthritis (Alshami, 2014).

Alendronate sodium (ALN) is a nonhormonal therapeutic agent, synthetic analogs of pyrophosphate attach to the hydroxyapatite, one of bone contents. It considered as a member of bisphosphonates. ALN is a 4-amino-1-hydroxy-1-phosphonobutyl, hydroxyphosphinate, bisphosphonic acid monosodium salt trihydrate. ALN is a potent antiresorptive agent poorly absorbed from the gastrointestinal tract, eliminated by active secretion of drug by renal transport system, with very long half-life (1 to 10 years) of bisphosphonates in bone, which related to different levels of bone turnover among species (Lin, 1996). The bisphosphonate inhibitory action on bone resorption is resulted from accumulation of bisphosphonate in osteoclasts after released from bone surfaces during bone resorption. Bisphosphonates inhibit farnesyl pyrophosphate synthase. This prevents the synthesis of isoprenoid lipids by disruption normal function. Isopentenyl diphosphate metabolite trapped. Thus, bisphosphonate disrupt osteoclast function leading to reduction of bone resorption (Michael *et al.*, 2011 ; Frank *et al.*, 2011). Bisphosphonates, including ALN were reversing the pathophysiological features, leading to decrease bone turn over and significant increment in mineral density of bone, of postmenopausal osteoporosis (Richard *et al.*, 2011). Animal model of study, it has been demonstrated that ALN protects chondrocyte from OA events induced by IL-1 $\beta$  by increasing Collagen II and reduction of MMP-13 within chondrocytes (Wang *et al.*, 2011).

ALN is used in osteoporotic postmenopausal lady (Nijs *et al.*, 2006 ; Rogers, 2003), corticosteroid-associated osteoporosis (Nijset *et al.*, 2006), paget's disease (Reid and Hosking, 2011) and osteogenesis imperfecta (Evans *et al.*,



2003 ). In spite of the high benefit of ALN, it induces gastric mucosal damages (İşeri *et al.*, 2005), esophageal problem (Naniwa *et al.*, 2008). Osteonecrosis of the jaw (Khosla *et al.*, 2007).

The certain contraindications to ALN are acute inflammations of the gastrointestinal tract (Cryer and Bauer, 2002), hypersensitivity (Naniwa *et al.*, 2008), abnormalities of the esophagus (Naniwa *et al.*, 2008), inability to stand or sit upright for at least 30 minutes (Zentiva, 2016), hypocalcaemia (Zentiva, 2016), renal impairment (Miguel *et al.*, 2013) and osteomalacia (Lenart *et al.*, 2008).

A potential benefit of antiresorptive agents, bisphosphonates, results from experimental studies have shown promising results in treatment of OA (Tim, 2003). ALN intake, in symptomatic hip OA, is effective in pain reduction associated with no significant observation obtained in OA pathology after 2 years treatment (Nishii *et al.*, 2013). ALN was associated with less spinal osteophyte and joint space narrowing progression (Neogi *et al.*, 2008 ; Siebelt *et al.*, 2014).

Animal model of study has suggested that Local elution of ALN acid leads to a dose-dependent increment of bone formation (Boby *et al.*, 2014) and the subcutaneous ALN injections for rabbits OA resulted in reduction of cartilage degeneration, stopping of bone loss with observed improvement in subchondral bone microarchitecture (Mohan *et al.*, 2013). Both in vitro and in vivo studies have found that ALN has the ability to protect chondrocytes by decreasing MMP-13 expression (Hu *et al.*, 2009). ALN has the ability to reduce remodeling of subchondral bone leading to important protective effect on articular cartilage (He *et al.*, 2012 ; Mohan *et al.*, 2013). TGF beta can be defensive as well as harmful for articular cartilage in OA. High levels of active TGF- $\beta$ 1 in subchondral bone leads to initiation of the pathological events of OA (Gehua *et al.*, 2013) and a potential role of TGF beta signaling in OA development were observed, with significant correlation between activin receptor-like kinase 1 (ALK1) receptor, (receptor for action of TGF beta) and MMP-13 expression (van der *et al.*, 2010). In rat with anterior cruciate ligament transection model, bone resorption markedly elevated, ALN inhibit Subchondral bone remodeling, which play a role in the OA pathogenesis, suggesting that ALN or other bone resorption inhibitors could potentially express DMOAD (Hayami *et al.*, 2004). Old cartilage finds to be less protected by TGF- $\beta$  and express significant changes in TGF- $\beta$  signaling pathways. during aging, Loss of the protective Smad2/3 pathway can give an explanation for the relationship between aging and OA (van der, 2014). High-dose ALN leads to complete blockage in the local elevation in MMP-13 and TGF  $\beta$  , which could decrease TGF  $\beta$  enhancement by blocking MMP-13 expression in chondrocytes, important in the pathogenesis of OA, so ALN or other bone resorption inhibitors could potentially be used in OA treatment DMOAD (Tadashi *et al.*, 2004). ALN treatment and physical activity exercised increased cartilage content and reduce OA progression (Siebelt *et al.*, 2014).

### Patients and methods:-

116 OA patients over 45 years old with Kellgren and Lawrence X-ray grade 2 and more will enrolled in this study. The male patients were 32 while the female were 84 giving the male to female ratio of 1:2.63. The patients were habitants of the city of Al-Diwanyhia and Baghdad cities and had the Iraq nationality. Laboratory equipment and reagents were of the highest available grades. Base line assessment were done in form of Kellgren and Lawrence X-ray grading (Kellgren and Lawrence, 1957), WOMAC scoring (Falk *et al.*, 2008), body mass index and the biochemical parameters (serum calcium (Ca), alkaline phosphate (ALK), CTXII (ELISA) and TGF beta 1 (ELISA kit)). OA patients were instructed to take 10 mg alendronate sodium tablet orally at the morning, reassessment was done after 3 months. Statistical analysis: Data were expressed as mean standard deviation. Comparison was done using paired t-test.

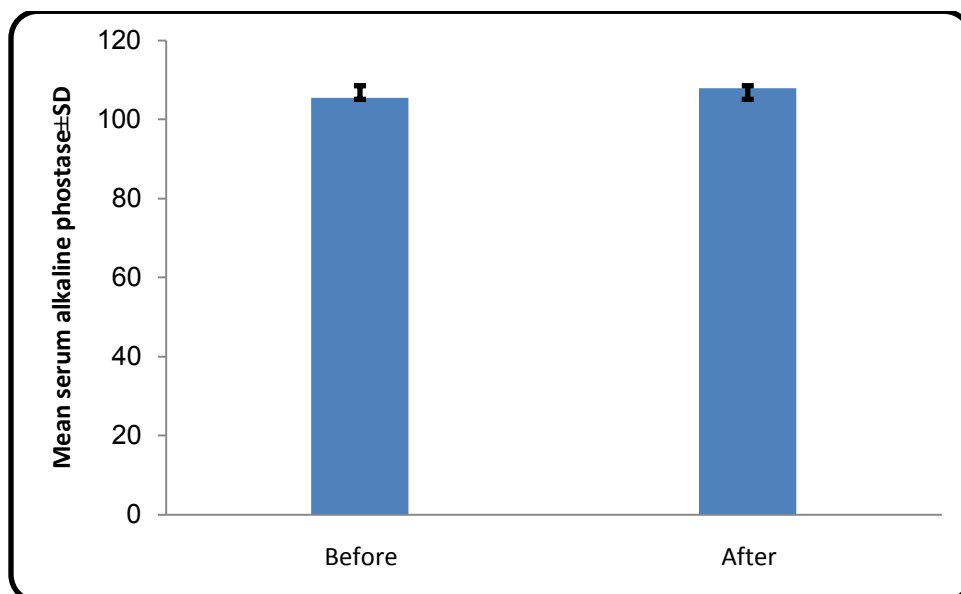
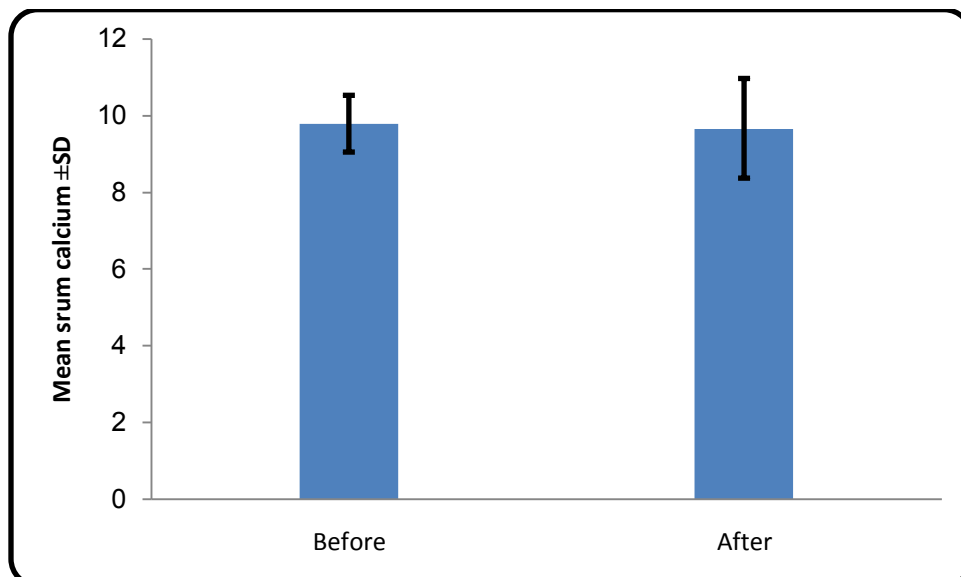
### Results:-

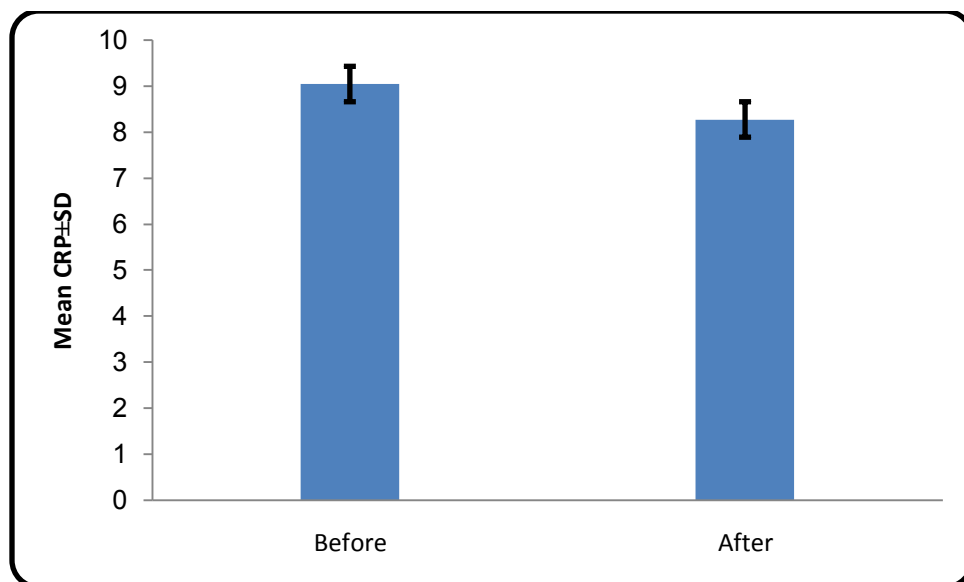
Demographic characteristic of the study population: The total number of cases enrolled in the present study was 116, 32 male and 84 female with a male to female ratio of 1:2.63. mean age of patients was 54.68 $\pm$ 5.16 years and the age range was 45-65 years, whereas the mean body mass index (BMI) was 30.21 $\pm$ 5.91 and it ranged from 21.87 to 37.81 kg/m<sup>2</sup>.

There was no significant change in mean Alkaline phosphatase before and after treatment, with no significant reduction in mean serum calcium and CRP as shown in table (1) and figures (1 and 2) through (3).

**Table 1:-**Biochemical and serological parameters: Comparison of mean serum Alkaline phosphatase, calcium and CRP before and after 3 months treatment with ALN.

Parameter	Before(mg/dl)		After(mg/dl)		P-value
	Mean	SD	Mean	SD	
Alkaline phosphatase	105.64	25.69	108.08	24.05	0.055
Serum calcium	9.79	0.74	9.67	1.30	0.245
CRP	9.05	7.93	8.28	8.21	0.221

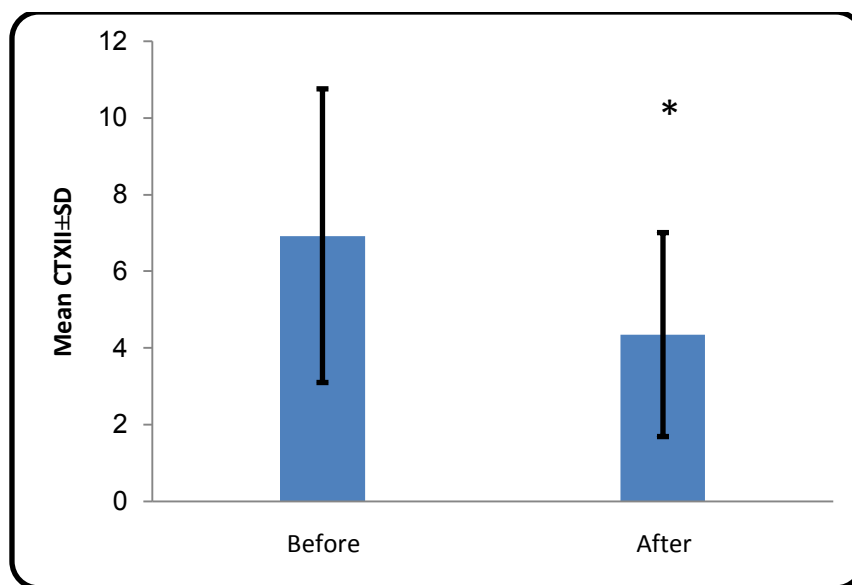
**Figure 1:-** Mean serum Alkaline phosphatase level before and after 3 months treatment with 10 mg ALN.**Figure 2:-** Mean serum calcium level before and after 3 months treatment with 10 mg ALN.



**Figure (3):** Mean CRP level before and after 3 months treatment with 10 mg ALN.

**Table 3:-**Changes in mean markers: CTXII and TGF- $\beta$  levels before and after 3 months treatment with 10 mg ALN.

Parameter	Before		After		P-value
	Mean	SD	Mean	SD	
CTXII	6.93	3.83	4.35	2.66	<0.001
TGF- $\beta$ 1	257.10	219.87	175.12	118.83	<0.001



**Figure 4:-**Mean CTXII level before and after 3 months treatment with 10 mg ALN.

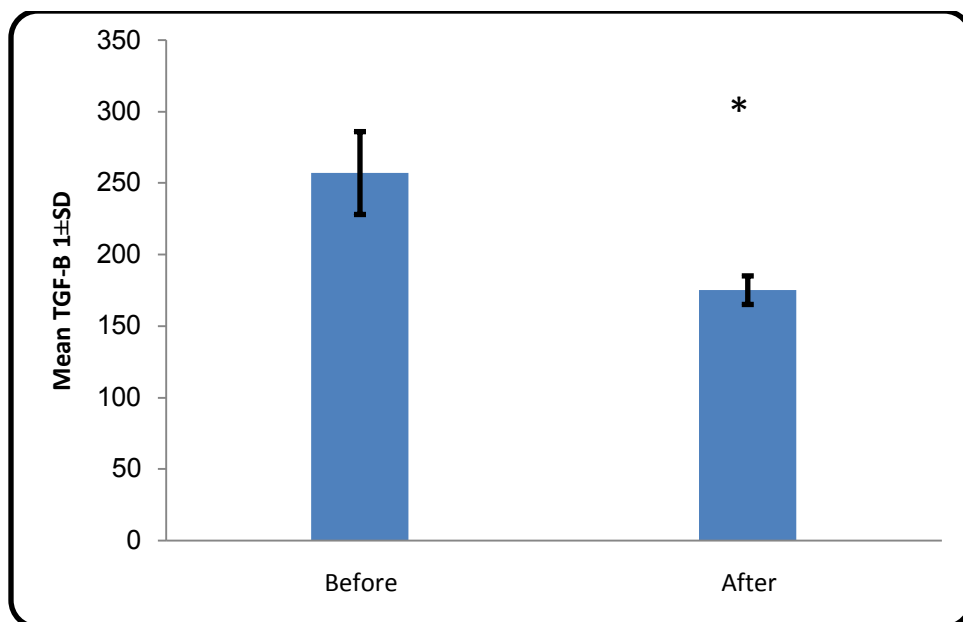


Figure 5: Mean TGF-β1 level before and after 3 months treatment with 10 mg ALN

Table 4:- Clinical parameters including Changes in mean JSW and WOMAC domains before and after 3 months treatment with 10 mg ALN.

Parameter	Before		After		P-value
	Mean	SD	Mean	SD	
JSW(mm)	2.76	0.59	2.80	0.53	0.295
Pain	7.93	1.38	5.41	1.29	<0.001
Function	40.39	6.10	39.54	6.51	0.661

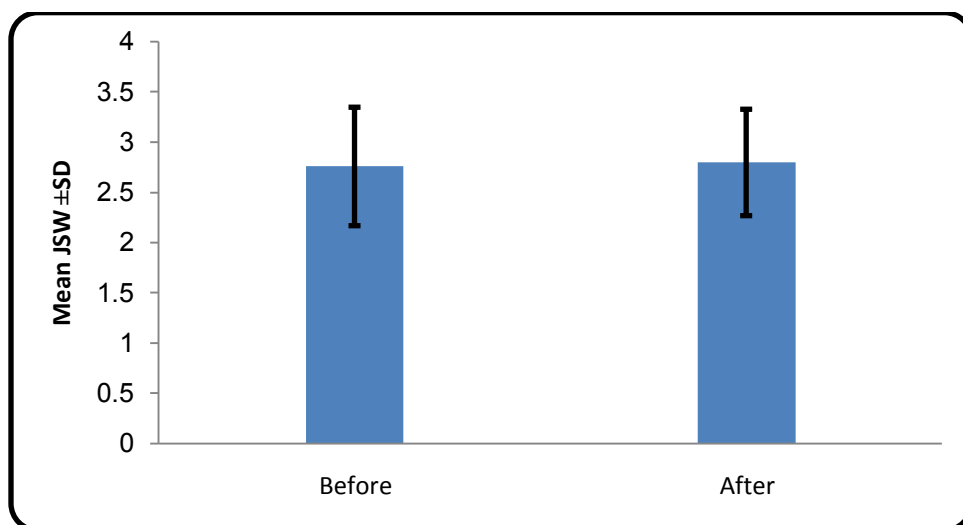
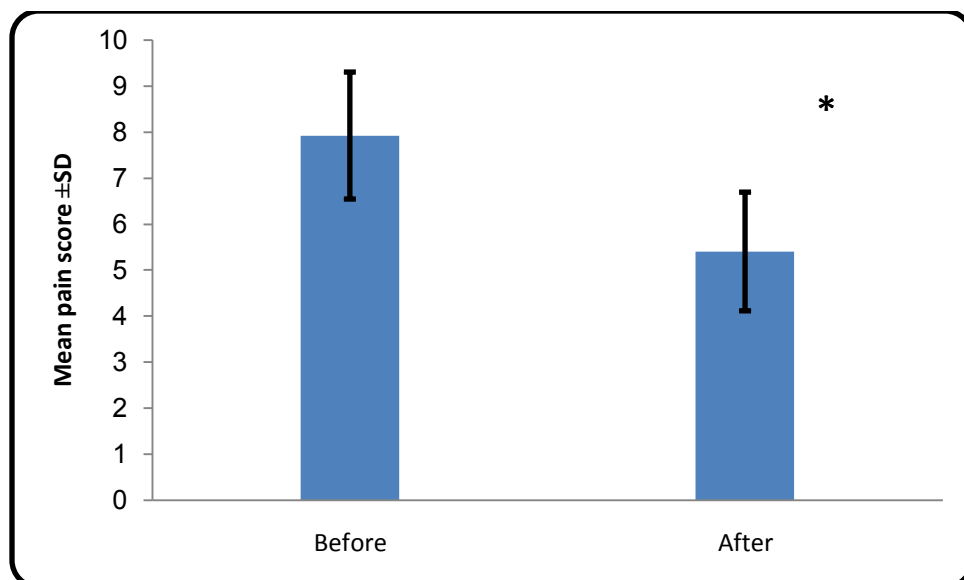
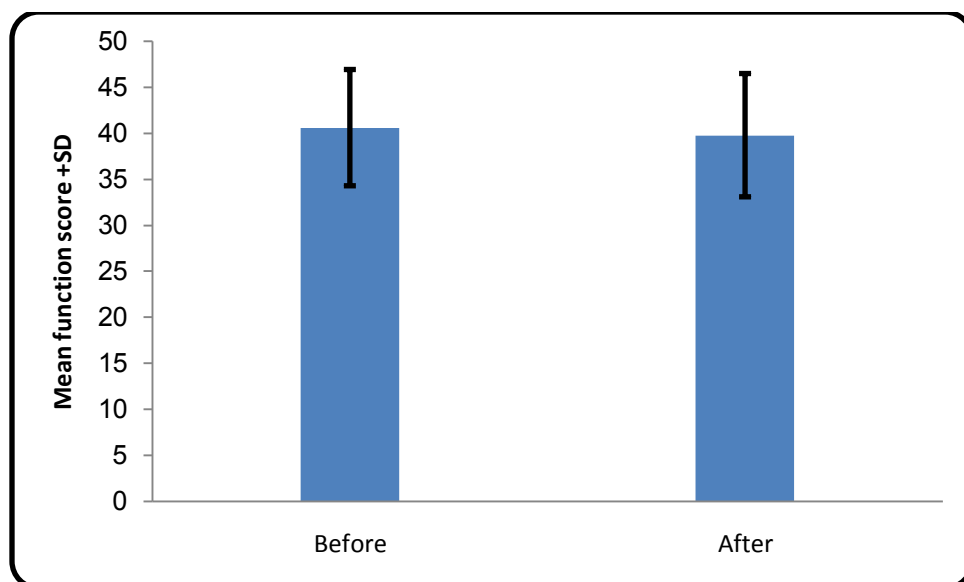


Figure 6:- Mean JSW before and after 3 months treatment with 10 mg ALN.



**Figure 7:-** Mean pain score level before and after 3 months treatment with 10 mg ALN.

\* significant



**Figure 8:-** Mean function score level before and after 3 months treatment with ALN.

### Discussion:-

The mainstay of pharmacological therapy of OA is reducing pain and cartilage protection. Significant improvement in Western Ontario and McMaster Universities (WOMAC) scores together with no significant alteration in Kellgren-Lawrence grade (KL) joint space width (JSW) were stated by the current study. The present study showed that ALN use was associated with reduced knee pain severity as assessed by WOMAC scores. In agreement with our finding, Carbone and coworkers in 2004 reported significant reduction in pain according to WOMAC score in patients with OA after 3 years treatment with ALN. In agreement with current results, placebo control trial has found that there was a substantial improvement in total WOMAC score after ALN treatment and best improvement happened at week 4 (Jokar et al., 2010). Nishii and coworkers in 2013 suggested that 2 years ALN intake is effective in pain suppression associated with no significant alteration obtained in OA changes (radiological JSW). Same advantages for bisphosphonate obtained in reducing pain symptoms were reported with clodronate (Rossini et al., 2015) and risedronate (Spector et al., 2005). Clifton and coworkers in 2006 demonstrated that there was no significant changes in WOMAC between the placebo and risedronate treated groups.

The current study demonstrated that changes in mean serum calcium, three months after treatment with ALN, were not significant despite minor reduction in calcium level. The early prevention of resorption of bone produces a decrease in serum calcium which resulted to raised parathyroid hormone (PTH), and eventually a rise in 1,25-dihydroxyvitamin D. The bisphosphonate induced secondary hyperparathyroidism also resulted in conservation of urinary calcium and phosphaturia, and a decrease in serum phosphate. The rise in the PTH after bisphosphonate treatment is a response to the variation in serum calcium and may happen even in the presence of hypercalcaemia, and this can lead to confusion in the explanation of PTH results (Vasikaran *et al.*, 2001). This finding is go with the results were obtained by Heckbert and coworkers in 2008, Poole and coworkers in 2007, Reid and coworkers in 2002 and Vasikaran and coworkers in 2001.

Regarding C-reactive protein (CRP), the current study showed an insignificant reduction in its level. It has been found that the two main acute-phase proteins reaction are C-reactive protein (CRP) and serum amyloid A, both of which can rise up to 1000 times over normal range following an acute phase reaction (APR) (Ceciliani *et al.*, 2002). The pathogenesis of APR has been disclosed only recently. It has been hypothesized that intravenous bisphosphonate are taken up by endocytic cells, possibly monocytes or dendritic cells, resulting in the inhibition of farnesyl pyrophosphate (FPP) synthase. This inhibition results in a lack of geranylgeranylation and farnesylation of translated little guanosine triphosphate (GTP). GTPase participate with several essential cellular actions for survival. Moreover, the FPP synthase stoppage causes intracellular accumulation of isoprenyl pyrophosphate metabolites upstream of FPP synthase in the pathway of the mevalonate (Roelofs *et al.*, 2006). Especially, this results in the aggregation of dimethylallyl pyrophosphate and isopentenyl pyrophosphate (IPP), that are powerful assists of the gamma delta T-cell receptor (Galluzzo *et al.*, 2007). They are naturally detected by gamma delta T cells with eventual activation and liberation of TNF (tumor necrotizing factor)-beta, IFN (interferon) - gamma and IL (interleukin) - 6, that are the proinflammatory cytokines enrolled in the initiation and maintenance of APR (Galluzzo *et al.*, 2007). The current CRP result is in accordance with finding of Evio in 2006 who found no significant alteration in its CRP level in ALN treated osteoporotic patients and Bertoldo and coworkers in 2010 who stated that CRP shows significant rise within 2 days after intravenous infusion of bisphosphonate then it returns to normal levels.

No significant change in mean alkaline phosphatase (ALP) before and after treatment with ALN was reported in current study. Measurement of serum bone specific ALP may be used for monitoring bone anti-resorption treatment as the reduction in bone turnover is reflected in the form of reduced serum bone specific ALP (Kress, 1998); This may be explained by the fact that measuring serum total ALP may not reflect minor changes in bone specific ALP and also that patients in the current study had no significant osteoporosis. Failure of ALN in reducing bone resorption cannot be accepted as an explanation for the lack of the change of serum ALP because bone density has been shown to increase in studies carried out by Horikawa and coworkers in 2015 and Waikakul and coworkers in 2011. The current finding in agreement with Waikakul and coworkers in 2011, who studied the effect of ALN in patients with osteoporosis for 12 months; Horikawa and coworkers in 2015, who studied the effect of intravenous and oral treatment with ALN in patients with osteoporosis for one year. However, these results are in contradiction to the results obtained by Kress in 1998, who found that, in osteoporosis, there was highly significant reduction in bone specific alkaline phosphatase after three months ALN treatment. However serum total ALP did not show significant reduction neither in the present study nor in the studies carried out by Horikawa and coworkers in 2015 and Waikakul and coworkers in 2011. This is a good indicator that treatment with ALN did not affect liver metabolism.

Significant reduction in serum transforming growth factor beta 1 (TGF- $\beta$ 1) levels following ALN treatment was made in the current study. It has been shown, in an experimental study, that TGF- $\beta$ 1 is activated in the subchondral bone as a response to changed mechanical force in an anterior cruciate ligament transection (ACLT) in mouse model with OA (Zhen *et al.*, 2013). High levels of TGF- $\beta$ 1 caused the existence of nestin positive mesenchymal stem cell (MSC) clusters causing aberrant bone formation associated with increased neovascularization. Stoppage of TGF- $\beta$  activity in subchondral bone reduced degeneration of OA joint cartilage (Zhen *et al.*, 2013). It is worth to mention, deactivation of the TGF- $\beta$  type II receptor (T $\beta$ RII) in nestin-positive MSCs minimized process of OA in ACLT mice (Zhen *et al.*, 2013). Thus, high levels of functioning TGF- $\beta$ 1 in the subchondral bone started the pathological events of OA, blockage of which may be a possible therapeutic approach (Zhen *et al.*, 2013; Livshits *et al.*, 2010). An experimental study has reported that induction of high level of TGF- $\beta$ 1 in bone marrow of mouse leading to abnormal bone remodeling, defects in the subchondral bone, including abnormality in bone mineral density and microstructure (Jiao *et al.*, 2014). However, increase TGF- $\beta$ 1 associated with abnormal reshaping of subchondral

bone which increase the possibility of progressive degradation of mandibular condylar cartilage and OA progression (Jiao *et al.*, 2014). Aberrant functioning of TGF  $\beta$  in the subchondral osseous tissue in response to an aberrant mechanical load induces development of osteoid islets at the starting of OA. Subsequently, modulation of subchondral bone structure varies the distribution of stress on the joint cartilage and causes its degeneration. Thus, stoppage of TGF- $\beta$  activity in the subchondral osseous tissue may give a new approach for treatment of OA (Zhenet *et al.*, 2014). Others, response to aberrant mechanical load, TGF- $\beta$ s were liberated, stimulated and aggregated in subchondral bone to activate abnormal bone synthesis and neovascularization through recruitment of nestin-positive MSCs or osteoprogenitor cells throughout the pathological events of OA; prevention of this process may be a possible therapeutic avenue to treat OA (Jie *et al.*, 2014). In contrary to our results, it has been shown that ALN treatment increased serum TGF- $\beta$ 1 levels in experimental rat one year after treatment (Jia *et al.*, 2013); however, other published articles showed that administration of ALN has markedly reduced TGF- $\beta$ 1 expression. So it is well obvious that reduction of TGF- $\beta$ 1 by ALN, as shown in the present study, is of great help in ameliorating OA.

The current study showed significant reduction in serum CTXII, a cartilage degradative marker. In agreement with Nishii and coworkers in 2013, the importance of reduction in CTX-II on suppression of cartilage degeneration confirmed by other studies (Willemet *et al.*, 2013; Damet *et al.*, 2009) so the reduction in level of CTX-II in the present study may be considered as one of the mode of ALN action in OA.

### Conclusions:-

The use of Alendronate in patients with osteoarthritis has clinical efficacy in reducing symptoms especially pain probably through inhibition of TGF beta 1 with no structural improvement and may help delay and prevent further disease progression probably through inhibition of TGF  $\beta$ 1 activity in the subchondral bone. The reduction in level of CTX-II in the present study may be considered as one of the mode of actions of alendronate in patients with OA.

### References:-

1. Alejandro M. IL1 and its role in osteoarthritis. OpenJournal of medicine Vol 1, No 1 (2011).
2. Alshami A. Knee osteoarthritis related pain: a narrative review of diagnosis and treatment. Int J Health Sci (Qassim). 2014 Jan; 8(1): 85–104.
3. Berenbaum F. Osteoarthritis as an inflammatory disease (osteoarthritis is not osteoarthrosis!). Osteoarthritis Cartilage. 2013, 21: 16-21.
4. Bertoldo F., Pancheri S., Zenari S., et al. Serum 25-Hydroxyvitamin D Levels Modulate the Acute-Phase Response Associated With the First Nitrogen-Containing Bisphosphonate Infusion. Journal of Bone and Mineral Research 2010; 25 (3): 447–454.
5. Blagojevic M, Jinks C, Jeffery A et al. Risk factors for onset of osteoarthritis of the knee in older adults: a systematic review and meta-analysis. Osteoarthritis Cartilage. 2010, 18: 24-33.
6. Bobyn J, Thompson R, Lim L, et al. Local alendronic acid elution increases net periimplant bone formation: a micro-CT analysis. Clin Orthop Relat Res. 2014 Feb; 472(2):687-94.
7. Brandt K, Mankin H, Shulman L. Workshop on etiopathogenesis of osteoarthritis, J Rheumatol 1986, 13, 1126-1160.
8. Carbone L, Nevitt M, Wildy K, et al. The relationship of antiresorptive drug use to structural findings and symptoms of knee osteoarthritis. Arthritis Rheum 2004; 50(11): 3516-3525. Ceciliani F, Giordano A, Spagnolo V. The systemic reaction during inflammation: the acute-phase proteins. Protein Pept Lett. 2002; 9: 211–223.
9. Clifton O, Chris J, Patrick G, et al. Risedronate decreases biochemical markers of cartilage degradation but does not decrease symptoms or slow radiographic progression in patients with medial compartment osteoarthritis of the knee: Results of the two-year multinational knee osteoarthritis structural arthritis study. Arthritis and Rheumatology Volume 54, Issue 11 November 2006 Pages 3494–3507.
10. Cryer B and Bauer D. Oral bisphosphonates and upper gastrointestinal tract problems: what is the evidence? Mayo Clin Proc. 2002 Oct; 77(10):1031-43.
11. Dam E, Byrjalsen I, Karsdal M et al. Increased urinary excretion of C-telopeptides of type II collagen (CTX-II) predicts cartilage loss over 21 months by MRI. Osteoarthritis and Cartilage Volume 17, Issue 3, March 2009, Pages 384–389.
12. Esser S and Bailey A. Effects of exercise and physical activity on knee OA. Curr Pain Headache Rep. 2011; 15:423–30.



13. Evans K, Lau S, Oberbauer A, et al. Alendronate affects long bone length and growth plate morphology in the *oim* mouse model for Osteogenesis Imperfecta. *Bone Volume* 32, Issue 3, March 2003, Pages 268–274.
14. Evio S. Hormone therapy in elderly women; a comparative study with alendronate of the effects on bone, cardiovascular risk factors, periodontal conditions and quality of life. Academic dissertation; Department of Obstetrics and Gynecology, and Division of Endocrinology, Department of Medicine, Helsinki University Central Hospital University of Helsinki, Finland. (2006) Pp 49.
15. Fernandes J, Martel-Pelletier J, Pelletier J. The role of cytokines in osteoarthritis pathophysiology. *Biorheology*. 2002;39(1-2):237-46.
16. Frank H, Anne-Marie L, Shuting S, et al. The relationship between the chemistry and biological activity of the bisphosphonates *Bone Volume* 49, Issue 1, July 2011, Pages 20–33.
17. Fujita T, Fujii Y, Okada SF, Miyauchi A, Takagi Y. Analgesic effect of etidronate on degenerative joint disease. *J Bone Miner Metab* 2001; 19: 251–256.
18. Galluzzo S, Santini D, Vincenzi B, et al. Immunomodulating role of bisphosphonates on human gamma delta T cells: an intriguing and promising aspect of their antitumour activity. *Expert Opin Ther Targets* 2007; 11: 941–954.
19. Gehua Z, Xu C. TGF $\beta$  signaling in subchondral bone and articular cartilage homeostasis. *Trends in Pharmacological sciences* Volume 35, Issue 5, May 2014, Pages 227–236.
20. Gehua Z, Chunyi W, Xiaofeng J, et al. Inhibition of TGF- $\beta$  signaling in subchondral bone mesenchymal stem cells attenuates osteoarthritis. *Nat Med*. 2013 Jun; 19(6): 704–712.
21. He D, Yin M, Luo Y, Wei Q. Research progress of protective effects of alendronate on articular cartilage in osteoarthritis. *Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi*. 2012 Oct;26(10):1187-90.
22. Heckbert S, Li G, Cummings S, Smith N, et al.. Use of Alendronate and Risk of Incident Atrial Fibrillation in Women. *Arch Intern Med*. 2008; 168 (8): 826-831.
23. Horikawa A., Miyakoshi N., Shimada Y., et al. A comparative study between intravenous and oral alendronate administration for the treatment of osteoporosis. *Springer Plus* 2015; 4:675-679.
24. Hunter D. Advanced imaging in osteoarthritis. *Bull NYU Hosp Jt Dis*. 2008. 66(3):251-60.
25. Hu H, Zhang L, Li B, et al. In vitro effect of alendronate on chondrocytes and articular cartilage and subchondral bone in rabbit anterior cruciate ligament transection model. *Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi*. 2009 Dec;23(12):1474-81.
26. Jia J, Yao W, Amugongo S, et al. Prolonged alendronate treatment prevents the decline in serum TGF- $\beta$ 1 levels and reduces cortical bone strength in long-term estrogen deficiency rat model. *Bone* 2013; 52: 424–432.
27. Jinks C, Jordan K, Croft P. Measuring the population impact of knee pain and disability with the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). *Pain* 2002; 100: 55–64.
28. Jorj A, Santos C, Raquel L, et al. Osteoarthritis associated with estrogen deficiency. *Arthritis Res Ther*. 2009; 11(5): 241.
29. Karsdal M, Bay-Jensen A, Lories R, et al. The coupling of bone and cartilage turnover in osteoarthritis: opportunities for bone antiresorptives and anabolics as potential treatments? : *Ann Rheum Dis* 2014;73:336-348.
30. Keefe F, Lefebvre J, Egert J, et al. The relationship of gender to pain, pain behavior, and disability in osteoarthritis patients: the role of catastrophizing. *Pain*. 2000 Sep;87(3):325-34.
31. Kellgren J, Lawrence J. Radiological assessment of osteoarthritis. *Ann Rheum Dis*. 1957;16:494–502.
32. Khosla S, Burr D, Cauley J, et al. Bisphosphonate-associated osteonecrosis of the jaw: report of a task force of the American Society for Bone and Mineral Research. *American Society for Bone and Mineral Research J Bone Miner Res*. 2007 Oct; 22(10):1479-91.
33. Kress B. Bone alkaline phosphatase: methods of quantitation and clinical utility. *J Clin Ligand Assay*. 1998; 21(2):139–148.
34. Lenart A, Lorich G, Lane M. Atypical Fractures of the Femoral Diaphysis in Postmenopausal Women Taking Alendronate *N Engl J Med* 2008; 358(12):1304-1306.
35. Lewis R. knee osteoarthritis: Acetaminophen least Effective Choice in Medscape. Jan 07,2015.
36. Lin J. Bisphosphonates: A review of their pharmacokinetic properties. *Bone Volume* 18, Issue 2, February 1996, Pages 75-85.
37. Link T, Steinbach L, Ghosh S, et al. Osteoarthritis: MR imaging findings in different stages of disease and correlation with clinical findings. *Radiology* 2003; 226: 373–81.
38. Mahjoub M, Berenbaum F, Houard X. Why subchondral bone in osteoarthritis? The importance of the cartilage bone interface in osteoarthritis. *Osteoporos Int*. 2012 ;23(Suppl 8):841–846.

37. McConnell S, Kolopack P and Davis AM. The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC): a review of its utility and measurement properties. *Arthritis Rheum* 2001; 45:453–61.
38. Michael J, Julie C, Fraser P, et al. Biochemical and molecular mechanisms of action of bisphosphonates. *Bone* Volume 49, Issue 1, July 2011, Pages 34–41.
39. Miguel A, Salvador A, Tomas D, et al. Effects of Aminobisphosphonates and Thiazides in Patients With Osteopenia/Osteoporosis, Hypercalciuria, and Recurring Renal Calcium Lithiasis *Urology* Volume 81, Issue 4, April 2013, Pages 731–737. Mohan G, Perilli E, Parkinson I. et al. Pre-emptive, early, and delayed alendronate treatment in a rat model of knee osteoarthritis: effect on subchondral trabecular bone microarchitecture and cartilage degradation of the tibia, bone/cartilage turnover, and joint discomfort. *Osteoarthritis Cartilage*. 2013 Oct;21(10):1595-604.
40. Naniwa T, Maeda T, Mizoshita T, et al. Alendronate-induced esophagitis: possible pathogenic role of hypersensitivity to alendronate. *Intern Med*. 2008;47(23):2083-5. Epub 2008 Dec 1.
41. Neogi M, Ensrud K, Bauer D, et al. The effect of alendronate on progression of spinal osteophytes and disc-space narrowing. *Ann Rheum Dis* 2008;67:1427-1430.
42. Nijs R, Jacobs J, Lems W, et al. Alendronate or Alfacalcidol in Glucocorticoid-Induced Osteoporosis *N Engl J Med* 2006; 355:675-684 August 17, 2006.
43. Nishii T, Tamura S, Shiomi T, et al. Alendronate treatment for hip osteoarthritis: prospective randomized 2-year trial. *Clin Rheumatol* (2013); 32(12): pp. 1759–1766.
44. Patricia A, Tina L, Jesse A, et al. Pain, Disability, and Depression in Osteoarthritis: Effects of Race and Sex *J Aging Health* June 21, 2011.
45. Radin E and Rose R. Role of subchondral bone in the initiation and progression of cartilage damage. *Clin Orthop* 1986; 213: 34–40.
46. Reid I and Hosking D. Bisphosphonates in Paget's disease. *Bone* Volume 49, Issue 1, July 2011, Pages 89–94.
47. Richard E, Jennifer S, Nelson B, et al. Bisphosphonates for postmenopausal osteoporosis. *Bone* Volume 49, Issue 1, July 2011, Pages 82–88.
48. Rogers M. New insights into the molecular mechanisms of action of bisphosphonates. *Curr Pharm Des* 2003;9:2643-2658
49. Rossini M, Adami S, Fracassi E, et al. Effects of intra-articular clodronate in the treatment of knee osteoarthritis: results of a double-blind, randomized placebo-controlled trial *Rheumatol Int*, 35 (2015), pp. 255–263.
50. Saviola G and Santoro L. Clodronate in erosive osteoarthritis of the hand: efficacy for pain and function recovery. *G Ital Med Lav Ergon* 2000; 22: 328–331.
51. Scanzello C and Goldring S. The role of synovitis in osteoarthritis pathogenesis. *Bone*. 2012 Aug; 51(2):249-57.
52. Sharma L. Osteoarthritis year in review 2015: clinical. *OA and cartilage* January 2016 Volume 24, Issue 1, Pages 36–48
53. Siebelt M, Waarsing J, Groen H, et al. Inhibited osteoclastic bone resorption through alendronate treatment in rats reduces severe osteoarthritis progression. *Bone*. 2014 Sep; 66:163-70.
54. Spector T, Conaghan P, Buckland-Wright J, et al. Effect of risenedronate on joint structure and symptoms of knee osteoarthritis: results of the BRISK randomized, controlled trial. *Arthritis Res Ther* 2005; 7: R625-33.
55. Suri S and Walsh D. Osteochondral alterations in osteoarthritis. *Bone*. 2012;51(2):204–211.
56. Tadashi H, Maureen P, Gregg A, et al. The role of subchondral bone remodeling in osteoarthritis: Reduction of cartilage degeneration and prevention of osteophyte formation by alendronate in the rat anterior cruciate ligament transection model. *Arthritis & Rheumatology* Volume 50, Issue 4 April 2004 Pages 1193–1206.
57. Van der Kraan P, Blaney Davidson E, van den Berg W. A role for age-related changes in TGFβ signaling in aberrant chondrocyte differentiation and osteoarthritis. *Arthritis Res Ther*. 2010;12(1):201.
58. Van der P. Age-related alterations in TGFβ signaling as a causal factor of cartilage degeneration in osteoarthritis. *Biomed Mater Eng*. 2014;24(1 Suppl):75-80.
59. Vijaykumar M, Gabriel B, Alison M, et al. A new class of potent matrix metalloproteinase 13 inhibitors for potential treatment of osteoarthritis: Evidence of histologic and clinical efficacy without musculoskeletal toxicity in rat models. *Arthritis and Rheumatology* Volume 60, Issue 7 July 2009 Pages 2008–2018.
60. Voelker R. Few adults with knee osteoarthritis meet national guidelines for physical activity. *JAMA*. 2011;306:1428–30.
61. Wang Z, Wang W, Zhang L, et al. Effect of alendronate on interleukin-1β induced chondrocytes of rat in vitro. *Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi*. 2011 Jan;25(1):50-5.

62. Waikakul S, Sintuvanich N, Assanasuwan T, et al. Efficacy, Side Effects, Safety and Effects on Bone Turnover Markers of once a Week Sandoz Alendronate Sodium Trihydrate 70 mg. *Malaysian Orthopaedic Journal* 2011 Vol 5 No 2: 15-19.
63. Willem E, Bakker K, Floris P. Associations of CTX-II with biochemical markers of bone turnover raise questions on its tissue origin: data from CHECK, a cohort study of early osteoarthritis. *Ann Rheum Dis* 2013;72:29-36.
64. Yamada Y. Association of a Leu(10)→Pro polymorphism of the transforming growth factor-beta1 with genetic susceptibility to osteoporosis and spinal osteoarthritis. *Mech Ageing Dev.* 2000;116:113–123.
65. Yamada Y, Okuizumi H, Miyauchi A, et al. Association of transforming growth factor beta 1 genotype with spinal osteophytosis in Japanese women. *Arthritis Rheum.*2000;43:452–460.Zentiva. Alendronic Acid 70mg Tablets Last Updated on eMC 05-Feb-2016 View changes.[Drug.com](#)Zhen G, Wen C, Jia X, et al. Inhibition of TGF-β signaling in subchondral bone mesenchymal stem cells attenuates osteoarthritis. *Nature medicine.* 2013;19(6):704-A.

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## RESEARCH ARTICLE

### PARTIAL PURIFICATION OF PEROXIDASE FROM IRAQI RADISH ROOTS.

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#### Abstract

Peroxidases (EC 1.11.1.7) are enzymes whose primary function is to oxidize a variety of hydrogen donor at the expense of hydrogen peroxide. In the present study, peroxidase was partially purified from Iraqi radish. Crude extract was prepared by blending and centrifugation of local radish roots. The enzyme was salt precipitated using 80% ammonium sulfate, dialyzed and then partially purified using DEAE-Cellulose ion exchange chromatography. Two fractions of peroxidase activity were eluted; the first was purified 35.62 folds and showed a final specific activity 41.85U/mg with a 51.29% yield. The second was purified 23.45 folds and showed a final specific activity 27.551U/mg with a 42.12% yield.

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#### Introduction:-

Peroxidase (POD) an oxidoreductase is a heme protein, catalyses the oxidation of a wide variety of organic and inorganic substrates using hydrogen peroxide as the electron acceptor (1). Peroxidases are widely distributed in living organisms including microorganisms, plants and animals (2). POD is mainly located in the cell wall (3) and it is one of the key enzymes controlling plant growth and development (4).

From the economical point of view, peroxidase is an important enzyme. POD is widely used for clinical diagnosis and microanalytical immunoassays because of its high sensitivity. It is used in diagnostic kits for enzymatic determination of glucose, uric acid, cholesterol and many other metabolites in biological fluids and is also an important enzyme in ELISA systems (5). Other applications include synthesis of various aromatic compounds and removal of peroxide from foodstuff and industrial wastes (6). It was reported that peroxidase had been used for biotransformation of organic molecules (7). Because of its broader catalytic activity, a wide range of chemicals can be modified using POD. Also, it can be used for the applications such as synthesis of various aromatic compounds, removal of phenolics from waste waters and the removal of peroxides from foodstuffs, beverages and industrial wastes (8).

Although, peroxidases are widely distributed in the plant kingdom, the major source of commercially available peroxidase is roots of horseradish. Many investigators extracted and purified peroxidases from their local radish, in UK (9), Turkey (2), Pakistan (10) and Japan (11) in order to find peroxidases with different specificity for promoting the development of new analytical methods and potential industrial processes (9).

The aim of this work was the extraction and partial purification of local radish peroxidase in order to find a locally available and economical source of peroxidase which can be used for practical application.

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## Materials and Methods:-

### Extraction of local radish roots:-

White radish roots were collected from local market, washed, minced and homogenized in blender 1:1 with 0.1M phosphate buffer pH (7.0), then the homogenate was filtered and centrifuged for 3000rpm/5min, 4°C the supernatant were collected and stored at -20°C until use (10).

### Enzyme Assay and Protein Estimation:-

Peroxidase assay was carried out in a reaction mixture containing: 0.1M phosphate buffer (pH 7.0), 0.02M H<sub>2</sub>O<sub>2</sub> (Substrate), 0.05M guaiacol (chromogen), and water (1:1:1:7). The absorbance of the colored complex was read on spectrophotometer at 420 nm wavelength after 30 sec of reaction interval (fig.1). One unit of activity was defined as the amount of enzyme that causes an increase of 0.001 absorbance per min (2). The protein concentration was determined by lowery method (12) using bovine serum albumin as a standard.

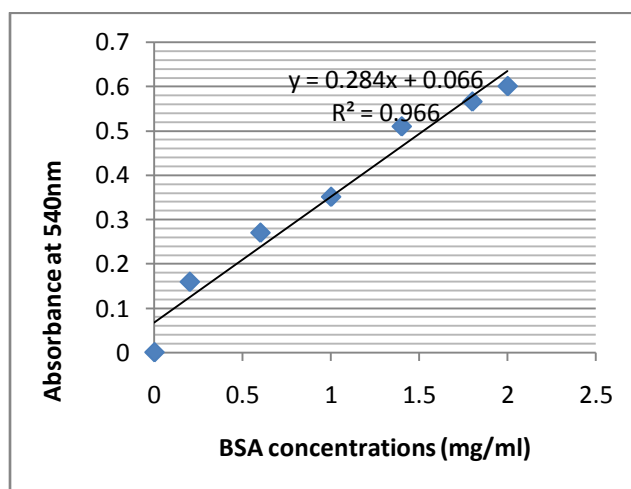


Fig 2:- Bovine serum albumin standard curve using lowery method.

### Ammonium sulfate precipitation:-

Ammonium sulfate precipitation was carried out in homogenate on an ice bath for 20, 30, 40, 50, 60, 70 and 80% salt saturation. Ammonium sulfate was slowly added to the homogenate stirred until complete dissolution. Then the mixture was centrifuged at 3000 x g for 60 min, 4°C and the precipitate was dissolved in 2 ml of 25mM phosphate buffer (pH 7.5). The concentrated sample with maximum specific activity was selected and dialyzed in a dialysis tube three times for 2 days against 1 L above buffer at 4°C for further use (2).

### Ion exchange chromatography:-

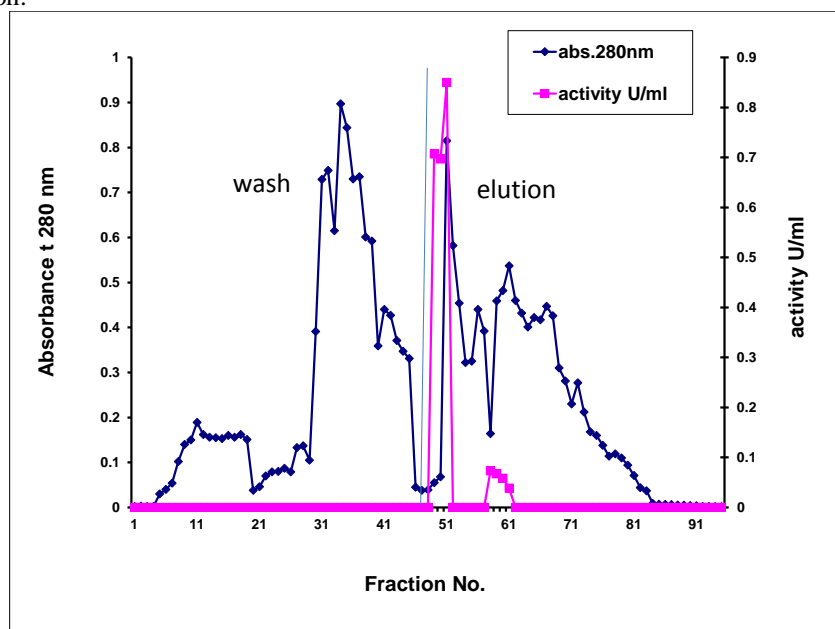
Ion exchange chromatography was done for dialyzed sample using DEAE-cellulose column (2 X 30 cm) equilibrated and washed with 25mM phosphate buffer (pH: 7.5) and eluted with [25mM potassium phosphate buffer (pH 7.0) buffer and 0-300mM KCl gradient], at a flow rate (3ml/5min) (10).

## Results and Discussion:-

The enzyme was extracted by blending the radish roots with time intervals in order to avoid heating up the blended material. Blending is efficient method for breaking plant cells (10). Centrifugation for the blended material was done in order to remove particular materials and intact nuclei.

Several salt saturation percentages were used to precipitate the enzyme, the maximum activity was obtained with 80% salt saturation (fig.3). The fold of purification using ammonium sulfate was 15.28 times. Ammonium sulfate salt is widely used for protein precipitation because of its highly solubility which make the solutions have highly ionic strength (10). Several investigators precipitate peroxidase from their local radish using ammonium sulfate at 90% (13), 85% (10), and 60% (2) saturation. This differences in salt percentages used may be due to the different isozymes of peroxidase which precipitated at these percentages, since it was reported that seven isozymes were eluted from radish (13), the Korean radish roots contain six isozymes (14).

DEAE-cellulose chromatography was mostly used for peroxidase purification (10). Two fractions of peroxidase activity were eluted from DEAE-cellulose column (fig.4), the first was purified 35.62 times and showed a final specific activity 41.851U/mg with a 51.29% yield. The second was purified 23.45 folded and showed a final specific activity 27.551U/mg with a 42.12% yield. Other investigators were used DEAE-cellulose get 14.08 (10) and 9.7 (2) times of purification.



**Fig 2:-** Ion exchange chromatography for peroxidase extracted from radish roots. DEAE-cellulose column (2×30cm) equilibrated and washed with 25mM phosphate buffer (pH: 7.5) and eluted with [25mM potassium phosphate buffer (pH7.5) buffer and 0-300mM KCl gradient], at a flow rate (3ml/5min).

Specific activity of POD in crude extract was 1.175 and increased during purification to 41.85 for the first eluted fraction and 27.55 for second (table1) from DEAE-cellulose column.

**Table 1:-** purification profile of peroxidase extracted from radish root

Purification step		Volume (ml)	Activity (U/ml)	Protein (mg/ml)	Specific activity (U/mg)	Total activity	Yield %	Fold of purification
Crude extract		25	0.141	0.120	1.175	3.525	1	1
Dialysis		10	0.295	0.038	7.763	2.950	83.86	6.61
DEAE-Cellulose Ion exchange chromatography	Peak1	8	0.226	0.0054	41.85	1.808	51.29	35.62
	Peak2	11	0.135	0.0049	27.55	1.485	42.12	23.54

The purification steps in this study seems to be suitable for fractionation of POD from Iraqi radish roots as the purification parameters showed (table1) in comparison with purification processes in other studies.

## References:-

1. Yemenicio\_lu A, Özkan M, Cemero\_lu B (1998). Partial purification and thermal characterization of peroxidase from okra (*Hibiscus esculentum*), J. Agr. Food. Chem., 46: 4158-4163.
2. Sisecioglu, M., Gulsin, I., CanKaya, M., Atasever, A., Hilal, M., Kaya, B., and Ozdemir, H. (2010). Purification and characterization of peroxidase from Turkish black radish (*Raphanus sativus* L.). Journal of Medicinal Plants Research Vol. 4(12), pp. 1187-1196.
3. Chen EL, Chen YA, Chen LM, Liu ZH (2002). Effect of copper on peroxidase activity and lignin content in *Raphanus sativus*. Plant Physiol. Bioch., 40: 439-444.
4. Quiroga M, Guerrero C, Botella MA, Barcelo A, Amaya I, Medina MI, Alonso FJ, Milrad DE, Forchetti S, Tigier H, Valpuesta V (2000). A tomato peroxidase involved in the synthesis of lignin and suberin. Plant Physiol., 122: 1119-1127.

5. Yazdi, T., Khaleghparast, S. and Monse R. (2002). purification and some partial characterization of peroxidase isoenzyme from *BRASSICA OLERACEA CAPITATA L.* Journal of Sciences, Islamic Republic of Iran 13(2): 107-112
6. Aruna N, and Lali A (2001). Purification of a plant peroxidase using reversibly soluble ion-exchange polymer. Proc. Biochem., 37: 431-437.
7. Gülçin A, Yildirim A (2005). Purification and characterization of peroxidase from *Brassica oleracea* var. Acephala. Asian J. Chem. 17: 2175-2183.
8. Torres F, Tinoco R, Vazquez-Duhalt R (1997). Bio-catalytic oxidation of polycyclic aromatic hydrocarbons in media containing organic solvents. Water Sci. Technol., 36: 37-44.
9. Keilin, D. and Hartree, F.(1951). Purification of Horse-Radish Peroxidase and Comparison of its Properties with those of Catalase and Methaemoglobin. Biochemistry, Vol:49, 88-104.
10. Rehman U. K., Yaqoub, M. A. and Arshad, M. (1999).Extraction and evaluation of peroxidases from various vegetable sources. International journal of Agriculture and biology. Vol:1;170-173
11. Gil-Rodríguez, P. and Valderrama, B. (2009). An optimized procedure for the purification of Zo peroxidase (ZoPrx), a low abundance peroxidase from Japanese radish roots. International Journal of Plant Physiology and Biochemistry Vol. 1(2) pp. 9-12.
12. Lowry, O. H., N. J. Rosebrough, A. L. Farr, and R. J. Randall. 1951. Protein measurement with the Folin phenol reagent. J. Biol. Chem. 193:265-275.
13. Shannon, M., L. , Kay, E. and Lew, Y. J. (1966). Peroxidase isozymes from horseradish roots, 1- isolation and physical properties. The journal of biological chemistry. 241, 2166-2172.
14. Yoo, I. W. and Kim, S. S. (1988). Purification and characterization of anionic isoperoxidase from Korean-radish roots. Korean biochemistry journal, 21:207-213.



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### RESEARCH ARTICLE

#### DISABILITY IN BANK OFFICE WORKERS DUE TO CERVICOGENIC HEADACHE.

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##### Key words:-

cervicogenic headache, neck pain, bank office workers.

#### Abstract

**Background:** Headache affects 80-90% of the population.

Approximately 47% of the global population suffers from a headache, and 15-20 percent of those headaches are cervicogenic headache. Epidemiological researchers suggest prevalence of cervicogenic headache in office workers with neck pain. Cervicogenic headache are usually on one side of the head but can occur on both sides. The pain tends to be dull; not throbbing and can become moderate to severe in intensity. The pain is usually caused by awkward or sustained neck positions and can usually be reproduced by applying pressure to the back of the head and neck.

**Aim and objective:** To find the incidence of cervicogenic headache in bank office workers.

**Methodology:** Nationalize bank were downloaded maximum banks were selected. Total 500 subjects were evaluated then concern form was signed and they were assisted for cervical flexion rotation test and Neck disability index.

**Results:** Mean age ( $\pm 40.98$ ) 20% had cervicogenic headache with neck pain in bank office worker Neck disability index is as follow Mild=405, moderate=15, no disability=80

**Conclusion:** 20% cervicogenic headache in bank office workers.

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#### Introduction:-

Chronic headache is a significant medical and socioeconomic problem resulting in severe disability and impairment. The term "cervicogenic headache" was coined by Sjaastad in 1983, who also proposed criteria for its diagnosis. Cervicogenic headache as described by Sjaastad et al is characterized as recurrent, long lasting, severe unilateral headache arising from the neck.

Exact pathoanatomic and pathophysiologic basis for cervicogenic headache is unclear. Numerous authors have proposed various theories ranging from neurophysiologic basis involving ascending fibers from the C1 and C2 nerve roots to multiple pain generators in pain-sensitive structures involved in head movement.

Headache affects 80- 90% of the population. Cervicogenic headache (CEH) is a symptomatic headache characterized by chronic unilateral headache and symptoms and signs of neck involvement(1,2) CEH is often

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worsened by neck movement, sustained awkward head position or external pressure over the upper cervical or occipital region on the symptomatic side (1,2). Cervicogenic headache (CGH) is a challenging complaint that is commonly faced by physiotherapists in clinical practice. The International Headache Society (IHS) placed cervicogenic headache in the secondary headache sub-group. The global prevalence of headache is about 47%, whereas 15% to 20% of those are CGH. Females are four times more prone to CGH than males (3). Persons with chronic CGH experience significant restriction of everyday function and are limited to social involvement, and emotional sufferings. Beside this, the poorer quality of life is seen in these individuals than normal. (4, 5) The IHS defines cervicogenic headache (CGH) as “pain, referred from a source in the neck and perceived in one or more Regions of the head and/or face.” It is often exaggerated by neck movement, constant uncomfortable head position or external force over the occipital region or upper cervical on the painful side. Headache may arise from various structures of the cervical spine, containing the zygapophyseal joints (occiput-C1, C2, C3). (5,6) Key features of CGH usually are unilateral headache without side-shift combined with neck pain and decreased movement. (6) Up to about 70% of frequent intermittent headache are reported with associated neck pain making CGH difficult to diagnose. The C1-C2 segment is considered essential to be examined in CGH diagnosis. The relative importance of C1-C2 as a prime cause of CGH has been well established. The cervical flexion-rotation test (FRT) is used to assist in the diagnosis of CGH and, in particular, C1-C2 segmental dysfunction. This manual test involves moving head to fully flexed position, so that spinal movement is ideally controlled to C1-C2, then measuring cervical rotation in this position. Normal range of movement is 44° to each side. Hall and Robinson have found that subjects with CGH are seemed to have about 17° less rotation toward the pain side in the FRT, as compare to those with no head pain or migraine with aura. FRT has 91% sensitivity and 90% specificity for diagnosis of CGH (7)

The co-occurrence of headache has been found to be 4 times higher in individuals with musculoskeletal symptoms than in those without. In particular, individuals with neck pain have been found to experience headaches more frequently than those with symptoms in other areas. This classification system is mainly based on scientific diagnosis that requires the cervical nociceptive source to be identified via a confirmatory diagnostic block and the headache to have resolved after treatment. In contrast, the diagnostic methods described by the Cervicogenic Headache International Study Group (CHISG) (8,9) are more practical and involve identifying important clinical markers specific for this type of headache. According to the CHISG, the most characteristic aspects of CEH are: 1) unilateral and radiating pain that often starts in the neck or the occipitocervical area and spreads to the oculo-fronto-temporal region 2) temporal pattern of pain that is often continuous but fluctuates in intensity 3) pain induced by improper neck postures or external pressure to the structures in the neck and the occipital region. Neuralgias, such as the greater, lesser, or third occipital neuralgias, affect similar regions at the back of the head. In contrast to patients with CEH, those with neuralgia often use terms such as “stabbing,” “jabbing,” or “shooting” to describe the pain intensity. In addition, neuralgias do not typically present with associated facial or trigeminal-referred pain. The reason for this observation is that the purported mechanism underlying the development and progression of CEH is the convergence of sensory inputs at the trigeminocervical nucleus. (9,10) A connection between the trigeminal and cervical nerves was postulated in the late 1940s (11), but it was only in 1961 that Frederick Kerr hypothesized a pathogenetic model for headache stemming from the cervical region and the posterior fossa. (12) The trigeminal spinal nucleus comprises a rostral sub nucleus oralis, a middle sub nucleus interpolaris and a caudal sub nucleus caudalis (13). The pars caudalis of the spinal tract nucleus of the trigeminal nerve is continuous with the grey matter of the dorsal horns of the spinal cord (14). The spinal terminals of the small sensory fibers enter the cord from the lateral part of the entry zone and have collateral branches that may ascend or descend for up to 3 segments, in the Lissauer’s tract, before synapsing in the dorsal horn laminae (15, 16). Therefore, along with the 3 upper segments, the middle and lower part of the neck may also be involved in the development of CEH (17, 18). These changes in neural connectivity are also evident in the findings of neurophysiological tests. The eye blink reflex (BR) is mediated via the afferent fibers to the trigeminal sensory nuclear complex and their central connections in the trigeminal nucleus. The R1 and R2 components of the BR are mediated via the tactile A $\beta$  afferent fibres. The R3 components are mediated via the thinly myelinated A $\delta$  fibers. Sand et al. (19) compared the BR in patients with CEH, tension-type headache, and migraine with that in the controls. The initial study showed that shorter R1 latencies were found on the symptomatic side than on the asymptomatic side in patients with CEH. In a later study, they reported that stimulation of the symptomatic side in patients with CEH showed a decrease in the R2 duration and the amplitude of the R2 component. These findings point to an associated brainstem hyperactivity (20, 21), possibly involving the ipsilateral trigeminal nucleus. The findings of the quantitative sensory testing (QST) of trigeminal hypersensitivity were consistent with those of the above-mentioned neurophysiological study. La Touche et al. (22) have reported that, compared to the pain-free controls, patients with chronic neck pain showed sensitivity to bilateral mechanical pain over the face. In these patients, pressure hyperalgesia was found over both the masseters

and temporalis muscles, but not over the tibialis anterior muscle (reference area). However, Chua et al (23).have shown that, compared to chronic neck pain patients without CEH, those with CEH showed lateralization of pressure hyperalgesia accompanied by thermal hyperesthesia on the painful side of the face. Their suggestion of a rostral neuraxial spread of central sensitization, probably to the ipsilateral trigeminal spinal nucleus, is consistent with Kerr's (6) hypothesis. Understanding the mechanisms underlying the development of CEH is the first step toward providing these patients with a better treatment outcome. This understanding will help rationalize the proposed mechanistic approaches that target central sensitization, ablative therapies that focus on primary nociceptive sources, and physical therapies that help relieve pain in secondary areas.

#### **Need of study:-**

Headache affects 80-90% of the population.

Approximately 47% of the global population suffers from a headache, and 15-20 percent of those headaches are cervicogenic. Epidemiological researchers suggest a higher prevalence of headache in adults with neck pain. Bank office workers mainly sit in erect posture and work continuously on computer so there is high chances of cervicogenic headache in them. Therefore the purpose is to study the incidence of cervicogenic headache in bank office workers.

#### **Aim and objectives:-**

To find the incidence of cervicogenic headache in bank office workers.

#### **Hypothesis:**

**Null:-** There is no incidence of cervicogenic headache in office workers.

**Alternative:-** There is prevalence of cervicogenic headache in office workers.

#### **Materials and Methodology:-**

**Study design:-** Survey Study setting: nationalize banks.

Target population: office workers in banks.

Sample size: 500

1. Inclusion criteria: bank office-worker, constant or frequently occurring neck pain.
2. Exclusion criteria: specific disorders of the cervical spine, instability.
3. List of nationalised banks around Pune were made.
4. Banks with more than 200 workers were considered and visited.

Sampling: 500 subjects were selected having headache and neck pain irrespective of their gender, age, and working period.

#### **Questionnaire:-**

All persons received a questionnaire with a standard letter containing information about the project. Apart from ensuring confidentiality and emphasizing the importance of participation, it was stated that the object was to study the cervicogenic headache.

#### **Cervical flexion rotation test:-**

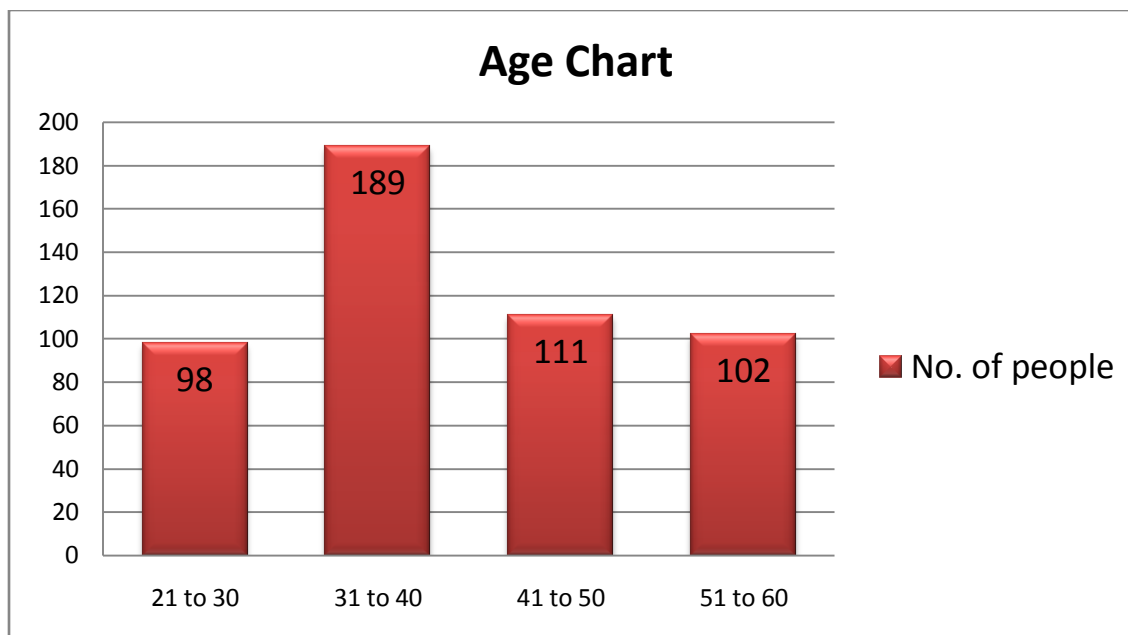
During the Cervical Flexion Rotation Test (CFR), the patient is supine and the examiner flexes the cervical spine fully in order to block rotational movement below the atlanto axial articulation. The examiner then passively rotates the head left and right, determining range of motion (ROM) and end-feel. A firm end-feel with limited ROM presumes limited rotation of the atlas on the axis.

The CFR has been shown to have an overall diagnostic accuracy of 85- 91%.

#### **Results:-**

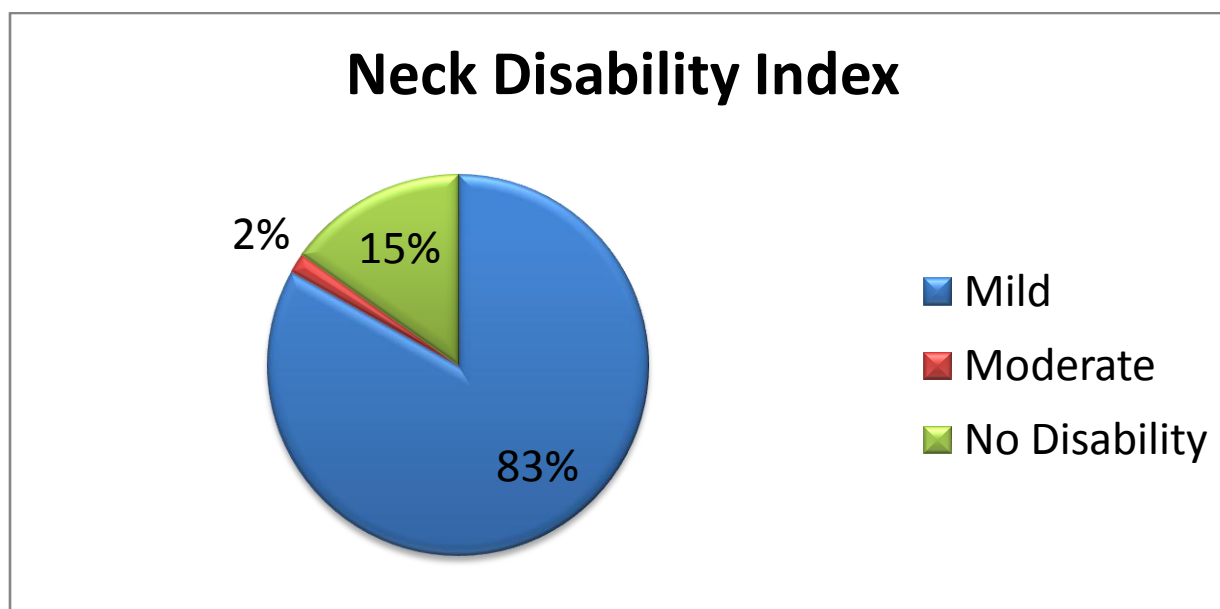
Ages	No. of people
21 to 30	98
31 to 40	189
41 to 50	111

51 to 60	102
total	500



Interpretation: In the sample of 500 people the age group which was mostly affected was in between 31 to 40 (189 peoples) after that 41 to 50(111 peoples); 51 to 60(102 peoples) and are less in age group 21 to 30(98 peoples)

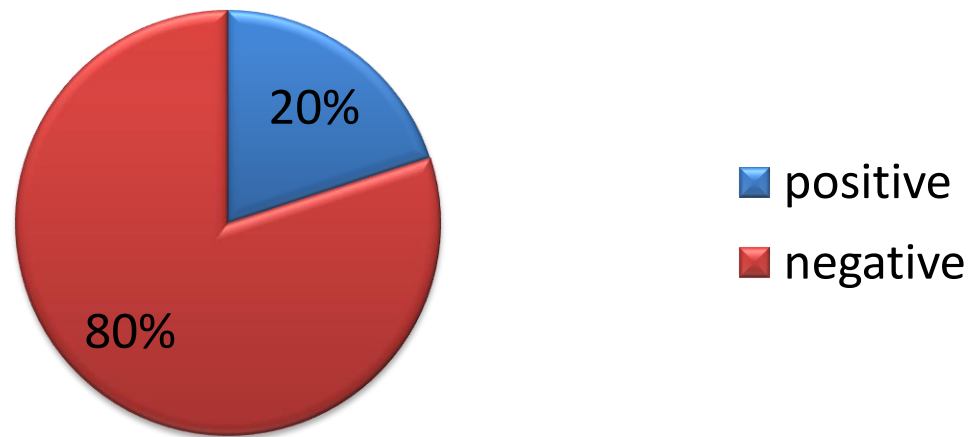
Mild	291
Moderate	6
No Disability	53



**Interpretation:-** In a sample of 500peoples, 291 peoples have mild (81%); 06 peoples have moderate (3%); 53 peoples have no disability (16%)

Positive	Negative
100	400

## Cervical Flexion Rotation Test



Interpretation: In sample of 500 people the cervical flexion rotation test was positive in 100 peoples (20%); and negative in 400peoples (80%)

### Discussion:-

Cervicogenic headache is a complex syndrome caused by a variety of lesions that might reproduce pain on the contralateral side (24). Patients with bilateral headache or neck pain after whiplash injury are diagnosed as cervicogenic headache in many headache centers. It is also difficult to be absolutely sure of how strictly the criterion of unilaterality has been followed in other epidemiological studies. The majority of headache days were characterized by a unilateral moderate/severe pressing/ tightening pain without accompanying symptoms.

#### A study says that cervicogenic headache may occur because of:-

Bad sitting posture, Prolonged periods of sitting or static postures in general , Having an inappropriate workstation, Getting overtired to the point of exhaustion.

As the bank office workers have mainly all of the above conditions so the study was done on them.

Typically, the headache: is recurrent, long-lasting and severe. Arises from the neck . has a unilateral dominance (but can bilateral). is in the low occipital and temporal region (with possible radiation in the face, per orbital, frontal and parietal region and ipsilateral shoulder and arm).Is accompanied with a reduced cervical spine range of motion.Can be precipitated with certain neck motions.

Considering that Cervicogenic headache is a daily chronic pain, surprisingly only 2% had consulted a neurologist and only 10% had consulted a pain clinic. This may be due to moderate pain intensity. The lack of consulting a headache specialist may also contribute to medication overuse.

This study is the first to investigate the incidence of cervicogenic headache in bank office workers.

Determining the etiology of cervicogenic headaches is often frustrating for both the patient and physician. Differentiating between cervicogenic headache and other forms of headache is difficult because not only is there variability in headache presentation, but there is also considerable symptom overlap. Many authors have suggested varying methods to diagnose and differentiate cervicogenic headache from other various forms of headaches. Use of clinical criteria has been strongly advocated (25,26,27). Significant variations in the definition of cervicogenic headache among clinicians have clouded not only the incidence and prevalence of cervicogenic headache, but also its treatment recommendations and outcomes (28).

All the patients in this study were between the age group of 20-60 years.

Cervicogenic headache has an involved biomechanical and neural mechanism with cervical association, which makes the task of studying cervicogenic headache challenging.

In order to grasp the concept of cervicogenic headache, it is important to understand the background. We naturally started our search for such cases among patients in whom headache was the main complaint. We more or less had to start our search from scratch, and when one does not know what one is searching for, the search is going to be characterised by trial and error. A decisive feature in identifying the first case around 1980 was the mechanical precipitation mechanism. Once the first case was identified, other cases followed suit.

Criteria for cervicogenic headache. Unilaterality without sideshift, Pain triggered by neck movement and/or sustained awkward position, Pain elicited by external pressure over the ipsilateral upper, posterior neck region or occipital region, Ipsilateral non-radicular neck, shoulder, and arm pain, Reduced range of motion in the cervical spine, Non-clustering pain episodes, Pain episodes of varying duration or fluctuating, continuous pain, Moderate, non-excruciating pain, usually of a non-throbbing nature, Pain starting in the neck, eventually spreading to oculo-fronto-temporal areas where the maximum pain is usually located, Anaesthetic blockades of the major occipital nerve; C2 root or other appropriate structures on the symptomatic side abolish the pain transiently, provided anaesthesia is obtained, Female sex, Head and/or neck trauma, Nausea, Vomiting, Ipsilateral edema, and - less frequently - flushing, mostly in the periocular area, Dizziness, Phono- and photophobia, Ipsilateral "blurred vision", Difficulties on swallowing

The available studies that can tell something useful about the incidence of Cervicogenic headache can be divided into two groups: (i) regular hospital/outpatient series that compare the incidence of Cervicogenic headache with the incidence of, for example, migraine and tension headache; and (ii) population studies.

Maciel et al. (29) found a 15% frequency of CEH in a headache clinic series (n = 1,229). This frequency is probably far above what can be expected for e.g. cluster headache. Their view that CEH is one of the three major headaches may be defensible.

In Vincent & Luna's series (30), there were 33 CEH patients, 29 episodic tension headache patients, and 65 common migraine patients.

It is remarkable that in two studies both claiming to have used the IHS criteria (31, 32), one (32) found 44 times as many cases of CEH as the other (31). This indicates that the time is ripe for an appreciable upgrading of the IHS criteria (30, 31). In addition, proper population studies with proper criteria must be carried out as regards CEH.

The purpose of study was to find out the incidence of cervicogenic headache in bank office workers. The cervicogenic headache is mostly neglected or left untreated. The bank office workers population was considered for study as they work continuously on computers and have chances of occurring musculoskeletal problems and cervicogenic headache. The aim was to find out the percentage of cervicogenic headache in bank office workers. The study was conducted as survey method. Study was done at various banks around pune city. The data were collected by questionnaire method and cervical flexion rotation test. The Target population was office workers in banks. Samples that have specific disorders of the cervical spine, instability were excluded. In this study the 500 samples were selected based on the inclusion and exclusion criteria. The exclusion criteria was specific disorders of the cervical spine, instability etc. The inclusion criteria considered was bank office-worker, constant or frequently occurring neck pain.

The samples were included in the bases of their willingness of self-participation individually. The investigations were done on the bases of validated scales.

Results show that there is 20% of incidence of cervicogenic headache in bank office workers.

### **Conclusion:-**

In our study 500 bank office workers were assisted for CGH by doing cervical flexion rotation test and neck disability index questionnaire from which we found that 100 peoples were having positive cervical flexion rotation

test with neck disability index in which 291 persons had mild pain, 06 persons have moderate pain and 53 persons had no neck disability.

Therefore there is 20% of incidence in bank office workers.

### **Limitation and scope:-**

#### **Limitations:-**

Duration of working hours were not considered, Ergonomic conditions were not included, Years of working were not considered, Posture analysis was not done.

#### **Scope:-**

Can be done in particular age group. Can be done in any particular gender. Can be done in various types of office workers.

### **References:-**

1. Sjaastad O, Fredriksen TA, Pfaffenrath V. Cervicogenic headache: diagnostic criteria. The Cervicogenic Headache International Study Group. *Headache* 1998; 38: 442-445.
2. International Headache Society. The International Classification of Headache Disorders. 2nd ed. *Cephalalgia* 2004; 24: 1-160.
3. Umar M, Naeem A, Badshah M, Zaidi S. A randomized control trial to review the effectiveness of cervical mobilization combined with stretching exercises in cervicogenic headache. *J Public Health Biolo Sci* 2012; 1(1): 09-13
4. Page P. Clinical suggestion cervicogenic headaches: an evidence based approach to clinical management. *Int J Sports Phys Ther* 2011; 6 (3): 254-66.
5. Hall T, Briffa K, Hopper D. Clinical Evaluation of Cervicogenic Headache: A Clinical Perspective. *J Man Manip Ther* 2008; 16(2): 73-8
6. Penzien DB, Andrasik F, Freidenberg BM, Houle TT, Lake AE 3rd, Lipchik GL, et al. Guidelines for Trials of Behavioral Treatments for Recurrent Headache, First Edition: American Headache Society Behavioral Clinical Trials Workgroup. *Headache* 2005; 45(2): 110-32. <http://dx.doi.org/10.1111/j.1526-4610.2005.4502004.x>
7. Hall T, Briffa K, Hopper D, Robinson K. Long-Term Stability and Minimal Detectable Change of the Cervical Flexion- Rotation Test. *J Orthop Sports Phys Ther* 2010; 40(4): 225-9. <http://dx.doi.org/10.2519/jospt.2010.3100>
8. Sjaastad O, Fredriksen TA, Pfaffenrath V. Cervicogenic headache: diagnostic criteria. The Cervicogenic Headache International Study Group. *Headache*. 1998;38(6):442-5.
9. Evers S. Comparison of cervicogenic headache with migraine. *Cephalalgia*. 2008;28(Suppl 1):16-7.
10. Bogduk N, Govind J. Cervicogenic headache: an assessment of the evidence on clinical diagnosis, invasive tests, and treatment. *Lancet Neurol*. 2009;8(10):959-68.
11. Escolar J. The afferent connections of the 1st, 2nd, and 3rd cervical nerves in the cat; an analysis by Marchi and Rasdolsky methods. *J Comp Neurol*. 1948;89(2):79-92.
12. Kerr FW. Structural relation of the trigeminal spinal tract to upper cervical roots and the solitary nucleus in the cat. *Exp Neurol*. 1961;4:134-48.
13. Olszewski J. On the anatomical and functional organization of the spinal trigeminal nucleus. *J Comp Neurol*. 1950;92(3):401-13.
14. Bogduk N. The anatomical basis for cervicogenic headache. *J Manipulative Physiol Ther*. 1992;15(1):67-70.
15. Kerr FW. Central relationships of trigeminal and cervical primary afferents in the spinal cord and medulla. *Brain Res*. 1972;43(2):561-72.
16. Siddall PJ, Cousins MJ. Pain mechanisms and management: an update. *Clin Exp Pharmacol Physiol*. 1995;22(10):679-88.
17. Michler RP, Bovim G, Sjaastad O. Disorders in the lower cervical spine. A cause of unilateral headache? A case report. *Headache*. 1991;31(8):550-1.
18. Fredriksen TA, Salvesen R, Stolt-Nielsen A, Sjaastad O. Cervicogenic headache: long-term postoperative follow-up. *Cephalalgia*. 1999;19(10):897-900.
19. Sand T, Zwart JA. The blink reflex in chronic tension-type headache, migraine, and cervicogenic headache. *Cephalalgia*. 1994;14(6):447-50; discussion 394-5.
20. Frese A, Evers S. Biological markers of cervicogenic headache. *Cephalalgia*. 2008;28(Suppl 1):21-3.
21. Sand T, Moll-Nilsen B, Zwart JA. Blink reflex R2 amplitudes in cervicogenic headache, chronic tension-type headache and migraine. *Cephalalgia*. 2006;26(10):1186-91.



22. La Touche R, Fernandez-de-Las-Penas C, Fernandez-Carnero J, Diaz-Parreno S, Paris-Aleman A, Arendt-Nielsen L. Bilateral mechanical-pain sensitivity over the trigeminal region in patients with chronic mechanical neck pain. *J Pain*. 2010;11(3):256-63.
23. Chua NH, van Suijlekom HA, Vissers KC, Arendt-Nielsen L, Wilder-Smith OH. Differences in sensory processing between chronic cervical zygapophysial joint pain patients with and without cervicogenic headache. *Cephalalgia*. 2011;31(8):953-63
24. Antonaci F, Bono G, Chimento P. Diagnosing cervicogenic headache. [Review]. *J Headache Pain* 2006; 7: 145–148.
25. Sjaastad O, Saunte C, Hovdahl H et al. “Cervicogenic” headache. An hypothesis. *Cephalalgia* 1983; 3:249-256.
26. Sjaastad O, Fredriksen TA. Cervicogenic headache: Criteria, classification and epidemiology. *Clin Experiment Rheum* 2000; 18(2 Suppl 19): S3-6.
27. Sjaastad O, Fredriksen TA, Pfaffenrath V. Cervicogenic headache: Diagnostic criteria. *Headache* 1990; 30:725-726.
28. Leone M, D’Amico D, Grazzi L et al. Cervicogenic headache: A critical review of the current diagnostic criteria. *Pain* 1998; 78:1-5.
29. MACIEL JA JR., CARMO EC, RUOCCO H, et al.: Cefaleia. Estudio clinico de 1229 casos. *Arch Neuro-Psiquiatria* 1994; 52: (Suppl) OR-030.
30. VINCENT M, LUNA RA: Cervicogenic headache: a comparison with migraine and tension headache. *Cephalalgia* 1999; 19 (Suppl. 25): 11-16.
31. PEREIRA MONTEIRO J: Cefaleias. Estudo epidemiológico e clínico de uma população urbana. [Thesis] University of Porto (Portugal), 1995.
32. NILSSON N: The prevalence of cervicogenic headache in a random population sample of 20-59 year olds. *Spine* 1995; 20: 1884-8.

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### RESEARCH ARTICLE

#### A STUDY ABOUT AVERAGE CYCLE TIME IN MAINTENANCE OF EQUIPMENT.

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Maintenance, cycle time, control chart, quality level, Taguchi method of quality control.

#### Abstract

Maintenance of equipment nowadays has a larger role in the firms as a result of huge development of equipment, and the production shifted from workers to machines, the control chart is a main tool in the statistical process control, it is used to promote quality level of maintenance of equipment, and control chart can assure lower average cycle time of maintenance procedure under using of Taguchi method of quality control, and several mathematical equations in the procedure will be used to find value of average cycle time in maintenance of equipment in the firm, because the role of maintenance increased, and it will force to reduce failure rates and defects amount which are proportional to higher quality level of applied maintenance.

As a new subject, the research will study to combine four factors of maintenance, average cycle time,  $\bar{x}$  control chart, and quality level.

As a new methodology, Taguchi method of quality control was used to obtain the result of aims of the research which are to achieve small average cycle time in the maintenance procedure.

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#### Nomenclature:-

**The following abbreviations and symbols are the list of Nomenclature used in the research:-**

$y_0$ : Failure rate parameter of exponential distribution of the average time for occurrence of assignable cause. It is the average time for occurrence of the assignable cause exponentially distributed with mean  $1/y_0$ .

$y$ : Failure rate parameter of exponential distribution of average interval for occurrence of the assignable cause. It is the average interval for occurrence of the assignable cause exponentially distributed with new mean  $(1/y)$  and  $y = Ar * y_0$ .

$Ar$ : Extension rate in the age of the equipment. It is proportional  $(1/r)$  to the original one.

$\delta$ : Value for the shift of "in-control" process

$\mu$ : Process mean.

$\mu_0$ : Process mean to out-of-control condition

$\mu_1$ : Process mean in the control chart

$w$ : Warning coefficient. It is maintenance threshold or it is warning width, and in this research, we assign  $w$  as two third of the magnitude of control width  $k$ .

$\beta$ : Standard deviation of the process.

$s$ : Sample size

$k$ : Control limit coefficient of control chart or control width.

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$P_w$ : The probability when the process is under control state, and there is no any extra action required.

$P_r$ : The probability when the process is under control state but the process mean falls in the warning zone.

$\Omega(\cdot)$ : A cumulative density function of normal distribution.

$h$ : Sampling interval.

$T_{cm}$ : Average maintenance time. It is required elapsed time for each action of maintenance procedure.

$h_0$ : Expected sampling interval

$\psi$ : Average time of occurrence of the assignable cause within an interval.

$T_0$ : Mean time duration in which the procedure is in the beginning to the first sampling after the process shifts.

$M_p$ : Magnitude of process mean shift if an assignable cause occurs.

$\overline{P}_w$ : Probability that the mean falls inside warning control limit.

$\overline{P}_r$ : Probability that the mean falls between the warning and control limit.

$h_1$ : Expected sampling interval when the process is out-of-control state.

$\theta$ : Error probabilities.

ARL: Average-run length when the process shifts to the out of control state.

$T_1$ : Expected time interval within the faulty process.

$T_{tap}$ : A constant average time to testing the sample, analyzing the results, and plotting which is considered as a consistent time.

$T_{art}$ : A constant average time for repairing but after the assignable cause has been identified, and to bring a process back to an in-control state after assignable cause has been identified.

$T_{com}$ : Complete average cycle time length.

### Introduction and literature Review:-

The control charts are the important tools of statistical process control SPC, they can be used in order to detect process shifts in both line of mean and variance, the tool of x control chart can monitor and indicate average cycle time, and to show if the procedure of maintenance of equipment is not under statistical control, the corrective action will be done in order to prevent further nonconforming products and to be manufactured by defected equipment and to stop losses [1], it means that the maintenance will return production to the corrected condition, the maintenance with SPC is used to achieve an optimal product quality, the x control chart is used for this purpose, therefore it is regarded as a main tool in maintenance procedure in the manufacturing firms, and it can give greater chance to designate a model to value statistical criteria in this procedure, the first model of economic design of x control chart was applied by the researcher, and later he extended his research from single to multiple assignable causes in which the failure mechanism was assumed to be an exponential distribution [2], by its equations, it can really give lower time and minimum cost when compared with other models such as Shewhart's model, because the researcher added an optimum methodology in his research in order to get three design parameters: subgroup size (n), sampling interval (h) and control-limit width (+ k & - k standard deviation), and this initial model was made for minimizing cycle time [3].

### Literature review:-

Several previous studies have been completed in order to improve control charts and determine average cycle time. After Duncan's study, there were many papers proposed an economic design of control charts, therefore an optimization procedure was developed for determining parameters of cycle time for the x-bar control chart [4]. Then a literature review achieved about average cycle time in economic design of control charts between years 1981-1991 [5], they concluded improvements on the models and cycle time. Thus, several other recent studies achieved and made other developments and variable results so as to achieve theoretical development of average cycle time of economic design for control chart subjects. According to the Duncan cost model, the researcher "Engin - 2004" developed an application for the use of economic statistical x chart design in the textile yarn industry as experimental study and searching for the optimum n, h and k the author considered the power of the control chart to be at least 0.95 and the penalty-cost as minimal as possible [6]. An integrated model of control chart and maintenance management was developed, in which the control chart was used in order to monitor the equipment and to provide signals which indicate equipment deterioration, while planned maintenance is scheduled at regular intervals to obstruct equipment failures [1]. In more developed subject, other studies focused on software to detect algorithm for economic design of x-bar charts parameters, and majority applications were carried out by using MATLAB, C, and SAS, it proposed a genetic algorithm for economic design of x-bar charts by using these programs [7&8].

### Taguchi method of quality control:-

The Japanese engineer-statistician Dr. Genichi Taguchi developed Taguchi method which is defined as a quality control methodology because it can combine control charts with process design to achieve a robust total design, this method aims at reducing product variability within a production system to develop design and specifications into the products in firms [9], thus the maintenance of equipment can have their control enforced, Taguchi method of quality control was expanded by many studies so as to be used in various fields of engineering and involve identification of proper control factors to obtain optimum results of the production process [10], therefore the aims of the maintenance of equipment as an engineering service are to gain best results, and it can be applied in manufacturing process. The Taguchi method of quality control recognizes the roles of researches through research development programs, and in reducing the occurrence of defects and failures in maintenance by firms. Figure 1 shows the losses, target value, both lower and upper limits of specifications, and rework and waste areas resulted by any maintenance procedure or manufactured products, they happened when it is out of control, thus, the main contribution of Taguchi method lies in several mathematical formulas with quality improvement technique to gain suitable average cycle time of maintenance of equipment in the firms, a study affirmed consideration of this method that the task of economic design of control charts is important in manufacturing process and quality control, therefore it tries always to eliminate variances in the process before they can occur [11].

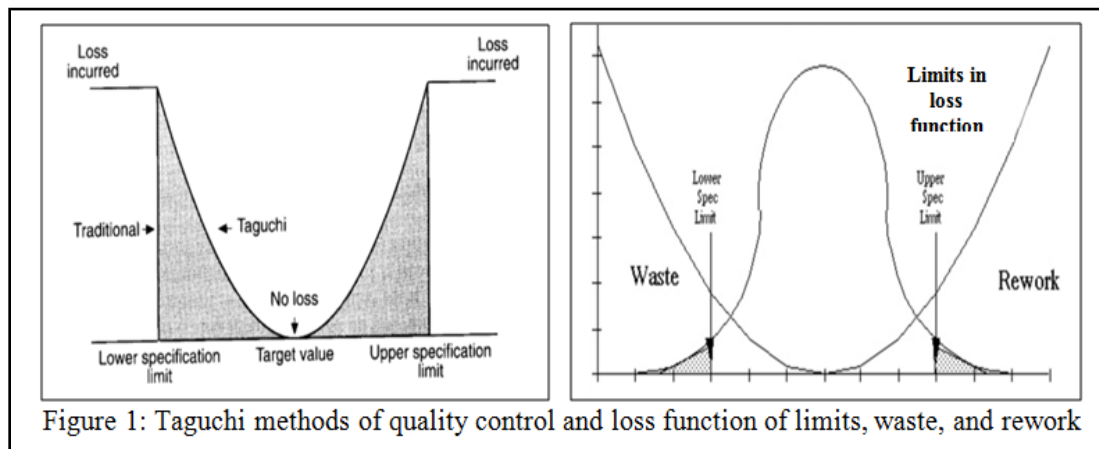


Figure 1: Taguchi methods of quality control and loss function of limits, waste, and rework

Several researches indicated the importance of Taguchi method of quality control, they proved that they can overcome bad design of products and bad plans of maintenance, in addition, it can increase design and inspection features, and focus on robust design during manufacturing process, it uses way of statistical procedures and relies on developed model rather than statistical techniques during manufactured phases [12], in addition, Taguchi presented his views about design of products by a program with three phases such as: system design, parameter design, and tolerance design [13] which can enhance maintenance of equipment during manufacturing process by reducing variations in the process and minimizing average cycle time through robust design of experiments which is a new concept and related to the maintenance procedures, and the method tends not to defect and high quality level of the procedures, Taguchi method of quality control takes place in four steps of defining all factors specific for the optimization problem, selecting suitable control factors, analysis of results, and conducting of the verifiable experiments [14].

### Options of new Developments:-

After great development of technology and production methods and as a result of increased uses of automated machines and robots in the firms, the manufacturing process were shifted from workers to equipment or machines, therefore the number and quantity of maintenance of equipment became bigger and took more importance by the firms.

This new state took an evident role to continual production by equipment and decreasing stoppage, therefore, it takes now a vital role to control main options of quantity, quality, time, and cost of maintenance of equipment, the effects of these options became larger more than ever because the relation among these options and maintenance became more stronger, nowadays most academicians and technicians recognize that there is a strong relationship between product quality and equipment maintenance [15], therefore the interrelation among several options, product's

quality, control chart, and maintenance procedure is the working axle by the firms, but there is another interrelation between control chart and maintenance procedure which was enlarged and still continue, many results of studies affirmed the actual integration between control chart and maintenance procedure, even they approved more benefits to the firms, and they determined jointly optimal design parameters on an  $\bar{x}$  control chart and time of maintenance [16]. Others prepared economic design model of control charts as essential basic to maintenance of equipment in the firms, because of the maintenance frequency that may take a long time in the firm, therefore to reduce unnecessary extra time, they developed an integrated model of control chart and maintenance management [17], the equipment will be accepted by firms when their measurements meet required specifications of maintenance procedures time and there will be no loss of cycle time and there will be no loss of quality according to associated standards, and this is the main objective of all firms. Therefore all aforementioned losses should be minimized until measurements of equipment will accept limits of cycle time in control and take free state of defects, deficiencies, and significant variations, and the average cycle time will be at right value when the results are same target in the maintenance procedure, this concept is used in most models of economic design of control charts, therefore Taguchi suggested that any deviation from value results of target is a loss of cycle time [18].

### Cycle parameters and variables:-

There are several parameters and variables related to cycle time in control chart, they are considered in the economic design of control charts [19], there are 29 of parameters that will be inserted into control chart in order to find average cycle time, they are expressed by symbols as Nomenclature, in addition, there are some decision variables and other parameters noted in other references [16].

There are three variables that should be selected and assumed as decision variables in control chart in order to find average cycle time when designing control chart and to monitor the maintenance of equipment, the variables are: sample size ( $n$ ), interval between successive subgroups ( $h$ ), control limits ( $k$ ), and warning coefficient [20]. Also, it is necessary to mention essential assumptions about maintenance procedure which begins in-control state, and a study [16] suggested as follows:

- The maintenance procedure is either in-control or out-of-control condition, and it will be in-control at beginning of the operation, but later it is shifted and it cannot be back to the start of in-control automatically.
- There is one assignable cause in the maintenance procedure, but there is shifts ( $MP\ \beta$ ) if an assignable cause occurs, also, during repair the procedure will be in continuity as the  $\bar{x}$  are in normal distribution.
- The maintenance procedure will be conducive when the statistic character is located over two third magnitudes of the control width.

### Aims of the Research:-

This research has following aims:

- It tries to find average cycle time of maintenance of equipment in the control chart
- It uses Taguchi method of quality control and several mathematical equations to find value of average cycle time.
- It tries to minimize loss of average cycle time, and to minimize loss of quality according to associated standards.

### Methodology of the Research:-

The methodology consists of several steps, the research will:

- Take parameters and decision variables from analyzing previous and recent studies, then using them in the research after some changes.
- Collect options of quantity, quality, cost, and time of maintenance of equipment, and illustrate strong interrelation among options, maintenance, control chart, and cycle time of control chart.
- Affirm that the actual integration between control chart and maintenance become more beneficial to firms, and to confirm that these interrelation is maximized and developed.
- Use Taguchi method of quality control and mathematical equations to find average cycle time of maintenance of equipment through control chart.

### Average cycle Time:-

The cycle time represents the time of the cycle work of maintenance procedures of equipment, its value determined in control chart by solving several mathematical equations in which they can be inserted within production process

in the firm, the cycle time is regarded as expected average cycle time because it will be defined as the total time length required for maintenance of equipment [19], it will start in-control condition, but if an assignable cause occurs on this stable condition, the cycle will begins to be detected in the procedure in order to be brought back to an in-control state, the cycle time has 4 time intervals [16] such as:

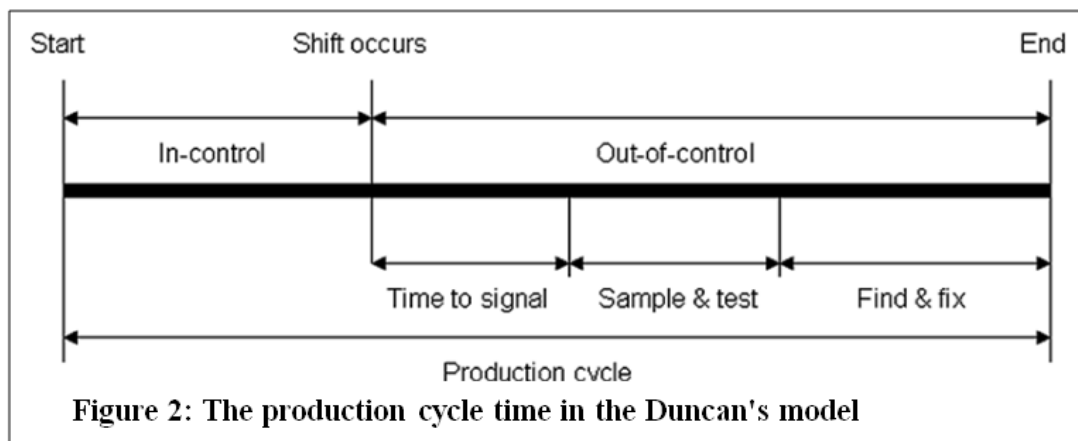
- (1) The interval in which the production process is in-control
- (2) The interval in which the production process is out-of control but still undetected
- (3) The interval between the time at which the assignable cause is detected and identified
- (4) The interval between the time at which the assignable cause is identified and repaired

In many maintenance procedures, the average time for occurrence of assignable cause is exponentially distributed with mean  $(1/y_0)$ , and value of the cycle time can be referred as a good kind after achieving each one of correction actions, but the cycle time cannot be specified as a realistic value state when the failure rate of the maintenance is increased after each action of the maintenance, hence the extension in the age of the equipment inside production process is proportional  $(1/Ar)$  to the original, therefore the average interval for occurrence of assignable cause is exponentially distributed with new mean  $(1/y)$  and  $y = Ar * y_0$ .

The operating of equipment and average cycle time are important factors that should be precisely measured and necessary to produce high quality maintenance of equipment in the firms, they are required to perform inspection about in-operation equipment, but the inspection process has limited time to perform on-control state of related equipment activities, and this will lead to fix each of:

- Value for the shift of "in-control" process  $\delta$
- Process mean to out-of-control condition  $\mu_0$
- Process mean in the control chart  $\mu_1$

Therefore, the selection of corrected value for shift size can be assumed as a difficult decision tackled by the quality practitioner due to the lack of former process knowledge [20], in such case we should have a state in which if the quality characteristic is located between the zone called "warning zone" of  $(\mu + w\beta/\sqrt{s})$  and  $(\mu + k\beta/\sqrt{s})$  or between the zone of  $(\mu - w\beta/\sqrt{s})$  and  $(\mu - k\beta/\sqrt{s})$ , then an action of maintenance of equipment should be taken and to be done, as affirmed by the study [21], the process will start "in-control" at a random time, then a step shifts during research for the assignable cause, but it is allowed to continue in operation, it is considered cycle time as depicted in Figure 2. [6], and it should be mentioned that the major function of control charting is to detect the occurrence of assignable causes so that the necessary corrective action may be taken before a large quantity of nonconforming product is manufactured [22], because the production process by equipment in the firms is assumed as a series of independent cycles over time, and each cycle begins with the production process in the "in-control" state and it will continue until the process changes and its change is detected and identified [23].



**Figure 2: The production cycle time in the Duncan's model**

To find expected sampling interval  $h_0$  when the maintenance procedure is in-control state, it is supposed that both probabilities  $P_w$  and  $P_r$  as mentioned in above Nomenclature, and to find average cycle time, several equations will be used and some of them are presented by a study and as follows [16]:

At first, both probabilities are expressed by:

$$P_w = \Omega(w) - \Omega(-w) \dots \dots \dots (1)$$

$$P_r = 2[(\Omega(k) - \Omega(w))] \dots \dots \dots (2)$$

Later, let  $h$  be the sampling interval and the  $T_{cm}$  is the required in elapsed time for each action of maintenance procedure, then the  $h_0$  will expressed as:

$$h_0 = h * P_w + (h + T_{cm}) * P_r \dots \dots \dots (3)$$

In order to find the time value of occurrence of assignable cause within an interval  $\psi$ , it can be shown as following equation as came by Duncan-1956 [2]:

$$\psi = \frac{e^{y h_0} - (1 + y h_0)}{y (e^{y h_0} - 1)} \dots \dots \dots (4)$$

But in order to find a complete average cycle time length  $T_{com}$ , at first it is necessary to find  $T_0$  and  $T_1$ , and to get their values, the next steps should be followed:

- Equation 5 is ready to find Mean time duration in which the procedure is in the beginning to the first sampling after the process shifts  $T_0$  which expressed as:

$$T_0 = (h_0 * e^{-y h_0} + h_0 * e^{-y 2 h_0} + h_0 * e^{-y 3 h_0} + h_0 * e^{-y 4 h_0} + \dots) \dots \dots \dots (5)$$

- The mean process  $\mu$  will shifts to  $(\mu + M_P \beta)$  when the process fails,  $\overline{P}_w$  and  $\overline{P}_r$  can be shown and expressed as equation 6 and 7:

$$\overline{P}_w = \Omega(w - M_P \beta) - \Omega(-w - M_P \beta) \dots \dots \dots (6)$$

$$\overline{P}_r = \Omega(-w - M_P \beta) - \Omega(-k - M_P \beta) + \Omega(k - M_P \beta) - \Omega(w - M_P \beta) \dots \dots \dots (7)$$

- The expected sampling interval when the process is out-of-control state  $h_i$  can be shown and expressed as equation 8:

$$h_1 = h * \overline{P}_w + (h + T_{cm}) * \overline{P}_r \dots \dots \dots (8)$$

- To find Average-run length when the process shifts to the out of control state  $ARL$  we need to find error probabilities  $\theta$ , it will be as equation 9 and 10:

$$\theta = \overline{P}_w + \overline{P}_r \dots \dots \dots (9)$$

$$ARL = \frac{1}{(1 - \theta)} \dots \dots \dots (10)$$

- To find Expected time interval within the faulty process  $T_1$ , equation 11 assures it:

$$T_1 = h * \overline{P}_w * ARL + (h + T_{cm}) * \overline{P}_r * ARL \dots \dots \dots (11)$$

- It is essential to mention other two times in the maintenance procedure, **such as**: a constant average time to testing the sample, analyzing the results, and plotting which is considered as a consistent time  $T_{tap}$  and a constant average time for repairing but after the assignable cause has been identified, and to bring a process back to an in-control state after assignable cause has been identified  $T_{art}$ , it is necessary to add them into the  $T_{com}$ , then it can be shown by:

$$T_{com} = T_0 + T_1 + T_{tap} * s + T_{art} \dots \dots \dots (12)$$

## Results and Discussion:-

### Results:-

Large development of machinery and technology of production occurred, the process of manufacturing is shifted from workers to equipment, as a result, the maintenance becomes more important to continual production and decreasing stoppage in operated equipment, and the number of maintenance of equipment becomes higher after manufacturing process shifted from workers to equipment. It is resulted that many studies recognized that there is a strong relationship between equipment maintenance and product quality produced by the equipment, as results



indicated interrelation among several options of quantity, quality, time, and cost of maintenance of equipment, and the effects of these options become larger more than ever because the relation among these options and maintenance become more stronger. There are 12 mathematical equations used to find value of average cycle time, the cycle time has 4 time intervals in production process, the cycle time is defined as total time length required for maintenance of equipment and it will start in-control condition, there are 29 parameters that will be used and inserted into control chart, they are mentioned in Nomenclature in this research. The maintenance procedure has two states, it is either in-control or out-of-control condition in the firms and the in-control at the beginning.

**Discussion:-**

The maintenance becomes more important procedure in the firms because large numbers of maintenance are necessary after increasing role of equipment because the manufacturing process is shifted from workers to equipment. The in-operation equipment needs for larger amount of maintenance in order to continue production and generating new condition of higher quality maintenance and an interrelation crucial role to control main options of quantity, quality, time, and cost of manufactured equipment in the firm. If an assignable cause occurs on in-control condition, the cycle time begins to be detected and identified by a model in order to be brought back to an in-control state. The equipment will be accepted by firms when their measurements meet the required specifications of maintenance procedures time and there will be no loss of cycle time and there will be no loss of quality according to associated standards, the average cycle time of maintenance can be found but after using of 12 mathematical equations because it contains 29 parameters.

**Conclusions and Recommendations:-****Conclusions:-**

The control charts are the important tools of statistical process control, they use to detect process shifts in line of mean and variance, the tool of  $\bar{x}$  control chart can monitor and indicate average cycle time, and to show if the maintenance is under control or not, the correction action will be done in case of no control to prevent further nonconforming products.

The cycle time represents time work of maintenance of equipment, its value determine in control chart by mathematical equations, the cycle time is regarded as expected average cycle time as total time length required for maintenance of equipment, to enhance maintenance of equipment during manufacturing process by reducing variations in the process and minimizing average cycle time through robust design of experiments, the equipment will be accepted by firms when their measurements meet required specifications of maintenance procedures, Taguchi method is defined as a quality control methodology because it can combine control charts with process design, Taguchi method lies in several mathematical formulas with quality improvement technique to gain suitable average cycle time of maintenance of equipment in the firms. When designing a control chart and monitor the maintenance of equipment, the variables are: sample size ( $n$ ), interval between successive subgroups ( $h$ ), control limits ( $k$ ), and warning coefficient ( $w$ ). Taguchi method of quality control used in various fields of engineering and involve proper control factors to obtain optimum results of production process, and used in order to continual production by equipment and decreasing stoppage, and to enforce equipment maintenance, this new condition has an evident role and plays vital role to control main options of quantity, quality, time, and cost of maintenance of equipment. After great development of technology of production and the increased uses of automated machines and robots in the firms, the manufacturing process are shifted from workers to equipment or machines, therefore the number of maintenance of equipment became higher, also it took bigger importance for the firm's level.

The maintenance procedure is either in-control or out-of-control condition, it assist to find average cycle time, the effects of options became larger more than ever because the relation among these options and maintenance became stronger, there are strong relationship between product quality and equipment maintenance, and there are many parameters and mathematical equations to find time cycle. The new studies use software programs in order to detect arithmetic state for economic design of  $\bar{x}$ -bar chart parameters, and majority applications are carried out by using MATLAB, C, and SAS.

**Recommendations:-**

The research recommends to use control chart according to Taguchi method of quality control, and to use software programs to find value of average cycle time of maintenance of equipment in the firms.

**References:-**

1. Wen-Hui Zhou, Gui-Long Zhu, Economic design of integrated model of control chart and maintenance management, Mathematical and Computer Modeling, Vol. 47, 2008, pp 1389- 1395.
2. Duncan AJ, The economic design of charts when there is a multiplicity of assignable causes. Journal of the American Statistical Association Vol. 66, 1071, pp 107-121.
3. Ching Pou Chang, Hsiang Chin, Yuan-Du Hsiao, Fong-Jung Yu, Effect of Preventive Maintenance on the Economic Design of  $\bar{x}$ - Control Chart, Proceedings of the 13th IFAC Symposium on Information Control Problems in Manufacturing, Moscow, Russia, June 3-5, 2009, pp 1704-1707.
4. D.C. Montgomery, Economic design of an  $\bar{x}$ -control chart, Journal of Quality Technology, Vo. 14, No. 1, 1982, pp 40- 43.
5. C. Ho and K.E. Case, The Economically-Based EWMA Control Chart, International Journal of Production Research Vol. 32, No. 9, 1994, pp 2179- 2186.
6. Antonio F. B. Costa, Fernando A. E. Claro, Economic Design of  $\bar{x}$ - Control Charts for Monitoring a First Order Autoregressive Process, Brazilian Journal of Operations & Production Management, Vol. 6, No. 2, 2009, pp 07- 26.
7. L. Cheng, And Z. Guo, The economically designed SVSSI  $\bar{x}$ - bar control chart, IEEE International Conference on Computer and management, 4.1.2011.
8. V. S. V. Anasuri, Economic Design of  $\bar{x}$ -bar Control Chart by Ant Colony Optimization, Doctoral Dissertation, National Institute of Technology Rourkela, 2012, India.
9. [www.businessdictionary.com/definition/Taguchi-method.html/definition/quality-control-QC.html /definition/quality-improvement.html /definition/quality criteria.html](http://www.businessdictionary.com/definition/Taguchi-method.html/definition/quality-control-QC.html /definition/quality-improvement.html /definition/quality criteria.html).
10. Srinivas Athreya, Y.D.Venkatesh, Application of Taguchi Method for Optimization of Process Parameters in Improving the Surface Roughness of Lathe Facing Operation, International Refereed Journal of Engineering and Science (IRJES), ISSN (Online) 2319-183X, (Print) 2319-1821, Vol. 1, Issue 3, Nov. 2012, pp 13- 19.
11. <http://www.investopedia.com/terms/t/taguchi-method-of-quality-control>.
12. Aravindan and S.R. Devadasan, B.V. Dharmendra, V. Selladurai, Continuous quality improvement through Taguchi's online quality control methods, International Journal of Operations & Production Management, Vol. 15, No. 7, 1995, pp. 60-77.
13. K. Prakash Babu, P.V.S.S.M.Sai Mahesh, K.S.V.S.Bharadwaj Sarma, Application of Taguchi Technique in Gas Cutting Process- A Case Study, International Journal of Engineering Research, Vol. 2, Issue 2, 01 April 2013, ISSN: 2319-6890, pp 146-151.
14. Jasmina Mikovic, Sandra Velickovic, SrbislavAleksandrovic, Dobrivoje Catic, Application of Taguchi methods in testing tensile strength of polyethylene, 8th International Quality Conference, 23.5. 2014, Center for Quality, Faculty of Engineering, University of Kragujevac, pages 575- 576.
15. Sündüs DA, A Real Application on Economic Design of Control Charts with R-edcc Package, The International Journal of Engineering and Science (IJES), Vol. 4, Issue 10, 2015, ISSN (e): 2319- 1813, ISSN (p): 2319- 1805, pp 54- 65.
16. Wei-Shing Chen, Fong-Jung Yu, Ruey-Shiang Guh, and Yu-Hua Lin, Economic design of  $\bar{x}$ -bar control charts under preventive maintenance and Taguchi loss functions, ISSN (print): 1735-8523, ISSN (online): 1927- 0089 (Online), Journal of Applied Operational Research, Vol. 3, No. 2, 2011, pp 103- 109.
17. Santiago Omar Caballero Morales, Economic Statistical Design of Integrated  $\bar{x}$ -bar-S Control Chart with Preventive Maintenance and General Failure Distribution, PLOS ONE, [www.plosone.org](http://www.plosone.org), , Vol. 8, Issue 3, March 2013, pp 1- 25.
18. Dogan A. Serel, Herbert Moskowitz, Joint economic design of EWMA control charts for mean and variance, European Journal of Operational Research, Vol. 184, 2008, pp 157- 168.
19. [www.businessdictionary.com/definition/Taguchi-method.html/definition/quality-control-QC.html /definition/quality-improvement.html /definition/quality criteria.html](http://www.businessdictionary.com/definition/Taguchi-method.html/definition/quality-control-QC.html /definition/quality-improvement.html /definition/quality criteria.html)
20. Kristina Veljkovic, Halima Elfaghihea, Vesna Jevremovica, Economic Statistical Design of  $\bar{x}$ - Bar Control Chart for Non-Normal Symmetric Distribution of Quality Characteristic, Fil. 29:10, 2015, 2325–2338, DOI 10.2298/FIL1510325V, pages 2327-2329.
21. Giovanni Celano, On the constrained economic design of control charts: a literature review, Producao, Vol. 21, No. 2, jun. 2011, University of Catania, Italy, pages 224-225.
22. Chao-Yu Chou, Chun-Lang Chang, Chung-Ho Chen, Minimum-loss design of  $\bar{x}$ -bar control charts for non-normally correlated data, Journal of the Chinese Institute of Industrial Engineers, 2002, Vol. 19, No. 1, pp. 16-24.
23. Rok Zupančič, Alojzij Sluga, Elan Begunje, Economic Design of Control Charts, Strojniški vestnik - Journal of Mechanical Engineering, 2008, Vol. 54, No. 12, UDC 658.562, pp 855-865.



## RESEARCH ARTICLE

### TRADITIONAL AND MEDICINAL USES OF PLANTS OF DUNYAPUR DISTRICT LODHRAN.

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#### Abstract

The plants being utilized by man for various purposes. In this study 29 families and 62 species are studied people of locality used plant for fodder, stuffing, pickles, sausage and for medicinal remedy. Most plant used in treatment of digestion, diarrhoea, constipation, toothache, flu, hepatitis, skin infection, diabetics.

#### Key words:-

Dunyapur, ethnomedical, fodder, pickle, medicinal remedy.

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#### Introduction:-

Ancient citizens mainly depend on plants for their endurance. They acquired knowledge of remedial plants by methods of trial and error. Subsequently, they became the store-house of knowledge of valuable as well as injurious plants, accumulated and enriched through generations and passed on from one generation to another, after refining and additions. Many people, particularly in the poor, underdeveloped countries, rely on wild plant resources for food, construction materials, fuel wood, medicine and various other uses. Internationally, it is a conventional reality that native societies are very knowledgeable about plants and other natural resources on which they are immediately and intimately dependent. Unluckily, much of this possession of knowledge is very fragile today due to erosion of traditional cultures. Ethnobotanists can play very important roles in saving this disappearing knowledge and returning it to local communities. It is, therefore, important that before this rich unwritten folklore on uses of plants and plant resources becomes lost forever through the recent accelerated 'civilization' of the aborigines (tribal), it should be properly renowned and conserved (Rao & Henry, 1997).

#### Study Area:-

Dunyapur located between (29°-32° N, 71°-38° E) in district Lodhran Punjab province, Pakistan. Its boundaries join with Lodhran, Kahrora Pakka, Melsi, Khanewal, Multan. The average rainfall is 71mm.

#### Methodology:-

Questionnaires and interview method is used to collect data.

#### Result & Discussion:-

The utilization of plants for the survival of human being is as aged as the human race itself. The increase of knowledge of plants uses however co-evolved with human society through the experiential use of plants, generation after generation. People would have stayed rendering to pandemic, common and persistent diseases, as well as severe diseases (Hamayun, 2003). The people of Dunyapur, Punjab, Pakistan have constantly used remedial flora for different ailments and have been reliant on locally available plants. During the survey, information attained regarding the utilization of plants against diverse therapeutic problems practiced by the people. The local area uses 62 species belonging to 29 families for various purposes. They used approximately 17 plants for remedial of different diseases.

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(Table 1). In addition other plants are used for numerous other reasons such as timber, fuel, fruit, furniture, pickles, potherb and fodder (Gul jan *et al.*, 2011; Harish Singh., 2008; Ahmad *et al.*, 2009; Khan *et al.*, 2011). The basic health facilities are accessible but high-priced; so the individuals of the locality mostly depend on plants for the alleviation of diseases. It was observed that old age people are more prone to the use of plants as primary health care in comparison with young generation (Qureshi & Bhatti, 2009; Qureshi *et al.*, 2009, 2010, 2011; Shedyai *et al* 2014; Ahmad *et al.*, 2010).

**Table 1:-** Botanical name, family, common name and uses of plants of Dunyapur district Lodhran

Sr.No	Botanical Name	Family	Common Name	Uses	Remark
1	<i>Aerva javanica</i>	Amranthaceae	bhooi	Use as fuel, fodder for animal, stuffing pillows	Non Cultivated
2	<i>Fumaria officinalis</i> (Hausskn.) Pugsley	Fumariaceae	Fumitory, papra	Soaked in water over night drink for skin infection e.g. pimple	Non Cultivated
3	<i>Leucas capitata</i> Desf.	Lamiaceae	charta	Soaked in water over night drink for skin infection e.g. pimple	Non Cultivated
4	<i>Cichorium intybus</i> L.	Asteraceae	Chicory, Kasni	Leaves soaked overnight in water and water used as remedy against hepatitis	Non Cultivated
5	NA	NA	oak	Used by healer in medicine, fruit milk injurious for eyesight	Non Cultivated
6	<i>Eclipta alba</i> Hassk.	Asteraceae	Babri, naiazbho	Seeds are used to decrease thirst	Cultivated
7	<i>Mentha spicata</i> L.	Lamiaceae	Podina, mint	Used in chatni, boil in water for treatment of cramp and to lose weight	Cultivated
8	<i>Coriandrum sativum</i>	Apiaceae	Coriander, dania	Reduce hypertension(one tea spoon of seed), flavour in cooking, used in chatni	Cultivated
9	<i>Spinacia oleracea</i> L.	Amranthaceae	Spinach, palak	Used in cooking	Cultivated
10	<i>Chenopodium album</i> L.	Amranthaceae	batho	Used in cooking saag	Non Cultivated
11	<i>Sesamum indicum</i> L.	Pedaliaceae	til	Used to increase body temperature in winter, decrease rate of late night urination, bakery, oil used for massage to decrease pain	Cultivated
12	<i>Foeniculum vulgare</i>	Apiaceae	Sonaf	Help to improve eyesight	Cultivated
13	<i>Allium cepa</i> L.	Liliaceae	Onion, piyaz, wasal	Used in cooking, pickles, given to cattle to reduce smell in milk	Cultivated
14	<i>Allium sativum</i> L.	Liliaceae	Garlic, Lasan Thom	Used in cooking, pickels	Cultivated
15	<i>Capsicum frutescens</i>	Solanaceae	Chili, Mirach	Used in cooking, pickles, given to cattle to reduce smell in milk	Cultivated
16	<i>Abelmoschus esculentus</i> L.	Malvaceae	Okra, bindi	Used in cooking	Cultivated
17	<i>Cucurbita pepo</i> var.cylindrica	Cucurbitaceae	Toori	Used in cooking, hard cover of vegetable used to remove dead skin of feet	Cultivated
18	<i>Solanum melangena</i>	Solanaceae	Brinjal, Bangan,	Used in cooking	Cultivated

			Batooue		
19	<i>Cucurbita maxima</i>	Cucurbitaceae	Kadoo	Used in cooking	Cultivated
20	<i>Praecitrullus fistulosus</i>	Cucurbitaceae	Tanda	Used in cooking	Cultivated
21	<i>Momardica charantia</i> L.	Cucurbitaceae	Bitter gourd, Karella, kerla	Used in cooking, its water used to reduce pimples	Cultivated
22	<i>Daucus carota</i> L.	Apiaceae	Carrot, gajar	Used in cooking, pickles, juices, salad, improve eyesight	Cultivated
23	<i>Raphanus satvus</i> L.	Brassicaceae	Raddish, moli	Used in cooking, help in stomach diseases	Cultivated
24	<i>Brassica rapa</i> var. <i>rapa</i> L.	Brassicaceae	Turnip, Shaljam, Gonglo	Used in cooking	Cultivated
25	<i>Solanum tuberosum</i>	Solanaceae	Potato, Aloo	Used in cooking	Cultivated
26	<i>Lycopersicum esculentum</i>	Solanaceae	Tomato, Tamatar	Used in cooking,	Cultivated
27	<i>C. limon</i> L.	Rutaceae	Lemon, Lemoo, nemboo	Used in cooking, pickles, used in skin whitening	Cultivated
28	<i>Mangifera indica</i> L.	Anacardiaceae	Mango, Aam	Fruits edible	Cultivated
29	<i>Citrus sinensis</i>	Rutaceae	Orange, Malta	Edible fruits, peel of fruit mixed with equal volume of milk used in freshens skin	Cultivated
30	<i>Musa acminata</i>	Musaceae	Banana, Kala	Edible fruit, peel of fruit and fruit used by people having oily skin	Cultivated
31	<i>Psidium guajava</i> L.	Myrtaceae	Guava, amrood	Edible fruit, fruit is heated used in flue treatment	Cultivated
32	<i>Syzygium cuminii</i> Skeels	Myrtaceae	Black plum, Jamoo, jaman	Edible fruits, its leaves used in treatment of cattle disease rick (a type diaherea due to indigestion), fruit used to control diabetics and stomach diseases	Cultivated
33	<i>Grewia asiatica</i> L.	Malvaceae	Phalsa	Juices, edible fruits, reduce constipation, Improve digestion, control thrust	Cultivated
34	<i>Punica granatum</i> L.	Puniaceae	Pomegranate, Anar	Juice used to reduce hypertension, dry peel of fruit used in treatment of diaherea in humans	Cultivated
35	<i>Rosa indca</i>	Rosaceae	Rose, gulab	Used in gulcand (a medicine of constipation having equal volume flowers petal and sugar), iraq glub used in eye to reduce irritation and improve eyesight	Cultivated
36	<i>Jasminum officinale</i> L.	Oleaceae	Jasmine, chambali, chamba	Oil,	Cultivated
37	<i>Tagetes erecta</i> L.	Asteraceae	Gota	Used in marriages in traditional occasion myau, ornamental	Cultivated
38	<i>Triticum aestivum</i> L.	Poaceae	Wheat, gandam,	Roti, fodder for cattle,	Cultivated

			kank		
39	<i>Zea mays</i> L.	Poaceae	Corn, maki	Fodder for cattle, Flour	Cultivated
40	<i>Gossypium arboreum</i> L.	Malvaceae	Cotton, kapas	Stuffing pillows and blankets, bnola khal fodder for animal, source of oil	Cultivated
41	<i>Sacchaaram officinarum</i>	Poaceae	Sugarcane, ganna	Juice, local people prepare saker and gour from its juice, fodder for cattle, fule for klin	Cultivated
42	<i>Brassica campestris</i>	Brassicaceae	Sarsooo, Sarue	A special dish saag is prepared from leaves, oil, fodder for animal	Cultivated
43	<i>Cassia fistula</i>	Caesalpiniaaceae	Amaltaas	Legume of plant used in treatment of constipation	Cultivated
44	<i>Acacia nilotica</i> L.	Mimosaceae	Kikar	Bark of plant boil with water used in treatment of bleeding gums, stem used in cleaning teeth, furniture, lecoria treatment	Cultivated
45	<i>Dalbergia sissoo</i>	Fabaceae	Shesham, Tali	Furniture	Cultivated
46	<i>Phoenix dactlifer</i> L.	Arecaceae	Date, Khajoor, Khaji	Edible fruits, soft branches are used in making hand fan	Cultivated
47	<i>Albizzia lebbeck</i>	Mimosaceae	Shri	Plant leaf hang in the room of newborn child	Cultivated
48	<i>Eucalptus citriodora</i> Hook.	Myrtaceae	Safada	Steam of water boil with leaves used in treatment of flu, furniture, roof material	Cultivated
49	<i>Azadirachta indica</i> A. Juss	Meliaceae	Neem	Dry seeds powder mix with oil used to finish lice, boil leaves in water used decrease scabbies	Cultivated
50	<i>Melia azedarach</i> L.	Meliaceae	Bakain		Cultivated
51	<i>Moringa oleifera</i> Lam.	Moringaceae	Sawajna, Bata	Legume used in pickles, flower are used in cooking	Cultivated
52	<i>Bauhinia variegata</i>	Caesalpiniaaceae	Kachnar	Flower are used in cooking	Cultivated
53	<i>Zizyphus jujuba</i> Mill.	Rhamnaceae	Chinee tree, Bari	Edible fruits, Boil leaves in water are used in bathing	Cultivated
54	<i>Medicago sativa</i> L.	Fabaceae	Alfalfa, Looson	Fodder	Cultivated
55	<i>Trifolium alexandrinum</i> L.	Fabaceae	Barseen	Fodder	Cultivated
56	<i>Festuca idahoensis</i>	Poaceae	Grass, Gas, Cha	Fodder	Non Cultivated
57	<i>Ficus religiosa</i>	Moraceae	Pepal		Non Cultivated
58	<i>Brassica oleracea</i>	Brassicaceae	Gobi	Used in cooking	Cultivated
59	<i>Cymosis tetragonolobus</i>	Papilionaceae	Gawar phalli	Used in cooking	Cultivated
60	<i>Horedum vulgare</i>	Poaceae	Joa	Flour of seeds (satoo) used to decrease thrust in summer	Cultivated
61	<i>Sorghaum vulgare</i>	Poaceae	Jawar	Fodder	Cultivated
62	<i>Pennisitum glacaum</i>	Poaceae	Bajra	Fodder, flour	Cultivated

**References:-**

1. Rao R.N. and A.N. Henry. (1997): The Ethnobotany of Eastern Ghats in Andhra Pradesh, India.
2. *Botanical Survey of India.*, 259.
3. Hamayun, M., A. Khan and M.A. Khan. (2003): Common medicinal Local recipes of District Buner, NWFP, Pakistan. *Journal of Ethnobotanical Leaflets*, SIUC, USA.
4. Gul Jan, M. A. Khan, Farhatullah, F.Gul Jan, M. Ahmad, M. Jan, and M.Zafar. (2011): Ethnobotanical studies on some useful plants of Dir Kohistan valleys, Kpk, Pakistan. *Pak. J. Bot.*, 43(4): 1849-1852.
5. Singh, H. (2008): Importance of local names of some useful plants in ethanobotanical study, *Indian J. of Traditional Knowledge.*, 7(2): 365-370.
6. Ahmad, S.S. F. Mahmood, Z.H. Dogar, Z.I. Khan, K. Ahmad, M. Sher, I. Mustafa and E.E. Valeem. (2009): Prioritization of medicinal plants of Margala Hills National Park, Islamabad on the basis of available information. *Pak. J. Bot.*, 41(5): 2105-2114.
7. Khan, N., M. Ahmed, A. Ahmed, S.S. Shaukat, M. Wahab, M. Ajaib, M.F. Siddiqui and M. Nasir. (2011): Important medicinal plants of Chitral Gol National Park (Cgnp) Pakistan. *Pak. J. Bot.*, 43(2): 797-809.
8. Ahmad, S.S. F. Mahmood, Z.H. Dogar, Z.I. Khan, K. Ahmad, M. Sher, I. Mustafa and E.E. Valeem. (2009): Prioritization of medicinal plants of Margala Hills National Park, Islamabad on the basis of available information. *Pak. J. Bot.*, 41(5): 2105-2114.
9. [a] Qureshi R. and G.R. Bhatti. (2009): Folklore uses of amaranthaceae family from Nara desert, Pakistan. *Pak. J. Bot.*, 41(4): 1565-1572.
10. [b] Qureshi, R. A. Waheed, M. Arshad and T. Umbreen. (2009): Medico-ethnobotanical inventory of Tehsil Chakwal, Pakistan. *Pak. J. Bot.*, 41(2): 529-538.
11. [c] Qureshi, R. M. Ahmad, M.Arshad, M. A. Khan and M. Zafar. (2009): Traditional herbal remedies used for the treatment of diabetes from district Attock (Pakistan) *Pak. J. Bot.*, 41(6): 2777-2782.
12. Qureshi, R. G.R. Bhatti and R. A. Memon. (2010): Ethnomedicinal uses of herbs from Northern part of Nara Desert, Pakistan. *Pak. J. Bot.*, 42(2): 839-851.
13. Qureshi R., M. Maqsood, M. Arshad and A.K. Chaudhry. (2011): Ethnomedicinal uses of plants by the people of Kadhi Areas of Khushab, Punjab, Pakistan. *Pak. J. Bot.*, 43(1): 121-133.
14. Shedyai, A. A. Xu, M. and Gulraiz, B. (2014): Traditional medicinal uses of plants in Gilgit-Baltistan, Pakistan, *J. Med. Plants. Res.*, 8(30): 992-1004.
15. Ahmad, I., M.S.A. Ahmad, M. Hussain, M. Ashraf, M.Y. Ashraf and M. Hameed. (2010): Spatiotemporal aspects of plant community structure in open scrub rangelands of submountainous Himalayan plateaus. *Pak. J. Bot.*, 42(5): 3431-344.



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### RESEARCH ARTICLE

## HAND HYGIENE KNOWLEDGE ASSESSMENT AMONG GRADUATE MEDICAL STUDENTS IN ASIR GOVERNMENTAL HOSPITALS, SAUDI ARABIA.

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#### Key words:-

Knowledge Assessment, Hand Hygiene.

### Abstract

**Objectives:** This study aims to assess the knowledge and practice of hand hygiene among graduate medical students in Asir governmental hospitals in Asir region.

**Methods:** A cross-sectional survey design was used to gather data from the graduate medical students who were practicing how to provide care services in Asir region hospitals. A sample of 100 members was selected randomly from the total working individuals in Asir region Hospitals. WHO standard questionnaire for hand hygiene for healthcare workers was used to collect data about workers knowledge.

**Results:** Results regarding the knowledge assessment indicated that there is a Good knowledge of the graduate medical students about the main route of transmission of potentially harmful germs between patients. Moreover, results revealed that this knowledge level must be improved by further Medical educational sessions.

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### Introduction:-

Hand hygiene represents a self vaccination of the workers, since it reduces the infection probability though several efficient means such as scrubbing, rinsing, drying...etc. Effective hand hygiene both before and after the required tasks in the health settings will minimize the gremial population and helps avoiding getting infected by different types of germs.

In hospitals, hand hygiene could be the most common effective way to control the infection caused by the hospital resident microbes. Those infections are believed to kill thousands of people every year.

The World Health Organization (WHO) had worked hardly in the last decades to increase the awareness and importance of hand hygiene in the health care providing sector, and issued specific recommendations regarding this matter. World Health Organization (WHO) recommendations included the purpose of hand hygiene, the correct and effective procedure of hand hygiene and who is required to perform that task.

The purpose of hand hygiene as stated in WHOM standards included controlling the hospital source infections, and avoids transmitting microbial organisms among patients and care givers.

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Hand Hygiene Knowledge Assessment among Graduate Medical Students in Asir Governmental Hospitals, Saudi Arabia

Moreover, WHO determined who is required to be committed to hand hygiene protocols during their jobs, and those included health care workers ,caregivers ,and anyone who is involved in direct or indirect patients care task.

Despite considering hand hygiene as an infection control limiting factor, and a measure for controlling infections related to hospitals, the compliance of the workers in the health sectors with the recommended hand hygiene was under the required satisfying measures.

Specific key factors played a role in the insufficient health workers compliance towards hand hygiene protocols, those factors included lack of knowledge about the importance of following and applying hand hygiene procedures and its role in eliminating resident germs, consequently minimizing the infection opportunity . Another factor is the shortage of hand hygiene facilities when correlated to staff number, and the absence of administrative commitment to hygiene protocols in specific health care providing places.

In 2002, the Centre of Disease Control (CDC) issued a guideline for hand hygiene in health care settings. And recommended the usage of the waterless alcohol based protocols for hand hygiene, because of the efficiency of these materials in eliminating the germs, minimizing the infections, and preventing the transmitting of germs within the health care setting environment.

Three years later, the World Health Organization (WHO) published its hand hygiene guideline which contained the recommendations to the health care settings for establishing effective strategies for promoting hand hygiene approaches. WHO guidelines pointed to the importance of hand hygiene in infection control procedures, as well as recommended of the health care settings administrators commitment of applying the hand hygiene procedures within their institutions. Several studies have indicated that it could improve the hand hygiene compliance by several means such as the application of alcohol based protocols as recommended in CDC guidelines, improving the health workers knowledge, and commitment of the stakeholders in the health sector to hand hygiene guideline application within their setting.

In a study performed by Pittet *et al.*, the application of a hand hygiene program, they concentrated on promoting alcohol based hand hygiene, had resulted in significant improvement in hand hygiene compliance.

The increment of hand hygiene compliance improvement consequently leads to the reduction of both MRSA and nosocomial infections.

Graduate medical students represent one of the largest percentage of health care workers in the health care settings, and they are of the most exposed elements to deal with the patients more compared any other health care workers. Therefore it's important to identify study and assess their knowledge about the suitable hand hygiene strategies and procedures that contribute to promote the hand hygiene compliance.

Saudi Arabia, as a developing country suffers from the spread of nosocomial infections in health care settings, due to the resources limitations.

A study conducted by Basurrah *et al.* , to investigate the hand washing and gloving practice among health care workers in medical and surgical wards in a tertiary care centre in Riyadh city , had found that hand hygiene practice should be improved by multifaceted strategies , and this requires the increasing of hand washing and alcohol based hand rubs settings and providing them in the health care institutions.

## **Methodology:-**

### **Aims of the study:-**

This study aims to assess the knowledge and practice of hand hygiene among graduate medical students in Asir governmental hospital in Asir region.

**Research questions and hypothesis:-**

In light of the purpose of the study, this study will address specific questions:

Q1.	<i>What's the level of knowledge among graduate medical students in Asir region hospitals about hand hygiene?</i>
Q2.	<i>What are the lowest fields of knowledge and what could be done for improvement?</i>
Q3.	<i>Is there any strong indicator of graduate medical students hand hygiene compliance?</i>

**Research Methodology:-**

The methodology of the research indicates the general pattern to valid and reliable data for the problem under investigation.

**Significance of the study:-**

This study is significant for several reasons. Such as providing an overview of graduate medical students' knowledge about hand hygiene in Asir region hospitals , and represents an introduction for other studies to be performed regarding infection control procedures in the same hospital to reduce the nosocomial infections.

**Research Design:-**

The research design used in this study is a cross sectional design. A cross-sectional survey design was used to gather data from the graduate medical students who were providing care services in Asir region hospitals.

**Research Setting:-**

The study was conducted at Asir governmental hospital in Asir region.

**Research population:-**

The population of the study included all the graduate medical students practicing and providing health care services in Asir governmental hospital in Asir region in the kingdom of Saudi Arabia.

**Sample Size:-**

Convenient sampling technique was used. A sample of 100 members was selected randomly from the total working individuals in Asir region Hospitals.

**Data Collection:-**

WHO standard questionnaire for hand hygiene for health workers was used to collect data about workers knowledge. 150 questionnaire were distributed, 119 returned, 19 empty questionnaire were excluded .

The questionnaires were delivered to the respondents in the hospital and were collected soon after. they were provided with envelopes and instructed to drop them at the designated collection point. Data was analysed by SPSS Software.

**Results:-**

It can be seen from table (1) that the majority of the sample was of the age range 19-25 years, which constitutes 45% of the sample, while 35% of the sample was within the second age range that was 26 to 35 years.

The third age range of 36 to 45 years was represented by only 15% of the sample. While the lowest representation was for the age range 46 to 65 years, that was only 5% of the total sample. The second demographic variable was gender, in which females constituted the majority of the sample with a percentage of 82%, while males were only 18%.

The following table represents the demographic variables distribution within the study sample (Table 1)

**Table 1:-** Study sample distribution according to the demographic variables.

Variable	Frequency	Percentage
Age		
19-25	45	45%
26-35	35	35%

36-45	15	15%
46-65	5	5%
<b>Gender</b>		
Male	18	18%
Female	82	82%

### Knowledge assessment results

The following table shows the knowledge assessment results for the respondents (Table 2 ).

**Table 2:-** Study sample responses to Hand Hygiene questionnaire items.

No	Item	Percentage
1.	Which of the following is the main route of transmission of potentially harmful germs between patients? ( Health care workers hands when not clean )	68%
2.	What is the most frequent source of germs responsible for health care associated infections? ( Germs already present on or within the patients )	49%
<b>Which of the following hand hygiene actions prevent transmission of germs to the patients</b>		
3.	Before Touching a patient (Yes)	96%
4.	Immediately after risk of body fluid exposure ( yes)	97%
5.	After exposure to immediate surroundings of a patient ( No )	31%
6.	Immediately before a clean / aseptic procedure (Yes)	90%
<b>Which of the following hand hygiene actions prevent transmission of germs to the health care workers</b>		
7.	After touching a patient ( Yes )	96%
8.	Immediately after risk of body fluid exposure ( yes)	82%
9.	Immediately before a clean / aseptic procedure (No)	53%
10.	After exposure to immediate surroundings of a patient ( Yes )	80%
<b>Which of the following statements , on alcohol-based hand rub and hand washing with soap and water is correct</b>		
11.	Hand rubbing is more rapid for hand cleansing than hand washing ( True )	76%
12.	Hand rubbing causes skin dryness more than hand washing ( True )	42%
13.	Hand rubbing is more effective against germs than hand washing ( False )	39%
14.	Hand washing and hand rubbing are recommended to be performed in sequence ( False )	35%
15.	What's the minimal time needed for alcohol based hand rub to kill most germs on your hands? ( 20 seconds )	41%
<b>Which type of hand hygiene method is required in the following situation</b>		
16.	Before palpation of the abdomen ( Rubbing)	33%
17.	Before giving an injection ( Rubbing)	39%
18.	After emptying a bed pan ( washing)	78%
19.	After removing examination gloves ( rubbing/washing)	73%
20.	After making a patients bed ( rubbing)	39%
21.	After visible exposure to blood ( washing)	63%
<b>Which of the following should be avoided as associated with increased likelihood of colonization of hands with harmful germs</b>		
22.	Wearing jewellery ( Yes )	98%
23.	Damaged skin ( Yes )	96%
24.	Artificial fingernails ( Yes )	93%
25.	Regular use of hand creams ( No )	76%

**Discussion:-**

Results regarding the knowledge assessment indicated that there is a moderate knowledge of the graduate medical students about the main route of transmission of potentially harmful germs between patients, where 68% of the sample answered correctly that the health care workers hands when not clean is the main route while 32% gave incorrect answer and have no knowledge about that item.

Regarding the most frequent source of germs responsible for health care associated infections, 49% answered correctly that germs already present on or within the patient, which indicates to a poor knowledge about that part.

Four items were used to investigate and assess the knowledge level about hand hygiene actions that prevent transmission of germs to the patients.

Items representing the actions were ; before touching a patient and immediately before a clean / aseptic procedure, indicated a very high level of knowledge with a percentage of 96% and 90%, respectively.

While the item concerned with the action of immediately after risk of body fluid exposure, got a moderate to high correct answer response with a percentage of 79%.

The lowest percentage was for the item regarded to ( After exposure to immediate surroundings of a patient ) which got a percentage of 31% .

Next field was to examine the knowledge about the hand hygiene actions that prevent transmission of germs to the health care workers. Four items were examined here ; the first was ( After touching a patient ) that got the highest percentage of 96%, the second was ( Immediately after risk of body fluid exposure ) ,82% answered correctly (Yes).The third item that got the lowest percentage was ( Immediately before a clean/ aseptic procedure ) , was 53% of the total sample.

The last item examines the action (after exposure to the immediate surroundings of a patient ) got a percentage of 80% as a correct answer among the total sample response.

Hand hygiene knowledge assessment also included investigating the sample response whether specific statements about alcohol based hand rub and hand washing with soap and water are correct or not .

First statement stated that hand rubbing is more rapid for hand cleansing than hand washing got 76% agreement to be correct, while the statement that says that hand rubbing causes skin dryness more than hand washing showed low to moderate knowledge indicator with a 43% of the total sample. On the other hand 39% of the sample believed that hand rubbing is more effective against germs than hand washing which is incorrect statement.

Investigating if the hand washing and hand rubbing are recommended to be performed in sequence indicated that a poor knowledge of the graduate medical students about hand hygiene, and that was obvious by the low percentage of the correct answer which was 35%.

Last statement in the field examined the knowledge about the minimal time needed for alcohol based hand rub to kill most germs on your hands, which is 20 seconds, but low knowledge about that was detected by a 41% of the tested sample of graduate medical students.

Furthermore, knowledge assessment examined the most suitable method of hand hygiene in specific situations. Respondents were asked about the suitable methods in six different situations, the first was (Before palpation of the abdomen), only 33% answered correctly by choosing the rubbing method, while the second situation was (before giving an injection), 39% responded correctly by choosing rubbing method. In the third situation ( after emptying a bed pan ) , washing was the right method which was chosen by 78% of the respondents .Fourth item( after removing examination gloves ) , 73% of the respondents had chosen both methods; rubbing and washing , correctly.

Next item regarding the suitable method after making a patient bed, 39% of the respondents had chosen a suitable method which is rubbing. While in the last situation which is ( after visible exposure to blood ) , 63% had chosen the correct method which is washing by soap and water. Last topic to be investigated regarding graduate medical

students knowledge of hand hygiene, was the role of specific items in increasing the likelihood of colonization of hands with harmful germs.

Wearing jewellery, damaged skins, and artificial fingernails, were detected to be the highest associated factors in germs colonization on hands with a percentage of 98%, 96%, and 93%, respectively. While 70% answered correctly on the association of (Regular use of hand creams).

### Conclusion:-

According to the previous results it can be concluded that graduate medical students in Asir region hospitals have a good knowledge about hand hygiene, but this knowledge must be improved in several parts, such as:

1. Frequent source of germs responsible for health care associated infections.
2. Hand hygiene procedure after exposure to surroundings of a patient.
3. Knowledge about hand hygiene immediately before a clean/ aseptic procedure and its importance in preventing the transmission of germs to the health care workers.
4. Knowledge about alcohol-based hand rub and its difference from washing by water and soap.
5. More knowledge about the cases of hand hygiene and the suitable method for each case.

### Future work:-

- ✓ Conducting training programs and workshops about hand hygiene and its importance in minimizing nosocomial infections in hospitals.
- ✓ Activating the infection control team role to educate the graduate medical students regarding hand hygiene protocols.
- ✓ Encouraging the health care settings stakeholders to show more commitment towards WHO guidelines of hand hygiene.

### References:-

1. Abdelaziz KM, Bakr IM. Assessment of knowledge attitude and practice of hand-washing among healthcare workers in Ain Shams University Hospital Cairo. The Egyptian Journal of Community Medicine 2008; 26: 50-54.
2. Albert RK, Condie F. Hand washing pattern in medical intensive care units. N Engl J Med 1981; 304: 1465-1466. <http://dx.doi.org/10.1056/NEJM198106113042404>
3. Al-Hussami MO, Darawad MW, Almhairat I. Predictors of compliance hand hygiene practice among healthcare professionals. Healthcare Infect 2011;16:79-84
4. Balafama A, Opara P. Hand-washing practices amongst health workers in a teaching hospital. Am J Infect Dis 2011; 7(1): 8-15. <http://dx.doi.org/10.3844/ajidsp.2011.8.15>
5. Basurrah M. and Madani T., "Hand washing and gloving practice among health care workers in medical and surgical wards in a tertiary care centre in Riyadh, Saudi Arabia," Scandinavian Journal of Infectious Diseases, vol. 38, no. 8, pp. 620-624, 2006 .
6. Gould D. Infection control. Making sense of hand hygiene. Nurs Times 1994; 90: 63-64.
7. Korniewicz DM, El-Masri M. Exploring the factors associated with hand hygiene compliance of nurses during routine clinical practice. Appl Nurs Res 2010;23:86-90.
8. Nobile C, Montouri P, Diaco E, Villari P. Healthcare personnel and hand decontamination in intensive care units: knowledge, attitudes, and behaviours in Italy. J Hosp Infect 2002;51:226-32.
9. Pittet D, Allegranzi B, Sax H, et al. Consideration for a WHO- European strategy on healthcare associated infection, surveillance and control. Lancet Infect Dis 2005; 5(4): 242-250. [http://dx.doi.org/10.1016/S14733099\(05\)70055-4](http://dx.doi.org/10.1016/S14733099(05)70055-4)
10. Pittet D, Allegranzi B, Storr J, Donaldson L. 'Clean Care is Safer Care': The Global patient safety challenges 2005-2006. Int J Infect Dis 2006; 10(6): 419-424. <http://dx.doi.org/10.1016/j.ijid.2006.06.001>
11. Raman S, Meenakshi S, Vipin K. Hand washing compliance among healthcare staff in intensive care unit of a Multispecialty hospital of north India. J Hosp Administration 2012; 1(2): 27-33.
12. Wandel DD, Maes L, Labeau S, Vereecken C, Blot S. Behavioral determinants of hand hygiene compliance in intensive care. Am J Crit Care 2010;19:230-9.
13. World Health Organization (WHO). Practical guidelines for infection control in health care facilities.
14. Geneva, WHO 2004; Annex 1: 76-80.

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### RESEARCH ARTICLE

#### CLINICAL PROFILE OF ACUTE ANTERIOR UVEITIS IN A TERTIARY HEALTH CARE CENTRE IN WESTERN ODISHA.

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Uveitis, Acute anterior uveitis.

#### Abstract

**Aim:** The aim of our study is to find out the clinical profile of patients presented with acute anterior uveitis attending the Ophthalmology Department in a tertiary health care centre in western odisha.

**Materials and Methods:** A subset of 102 patients presented with acute anterior uveitis attending the Ophthalmology Department of VSS Medical College, Burla, Sambalpur over a period of two years were included.

**Results:** In our study, it was found that acute anterior uveitis is noticed in 2.94% in 10 – 20 years age, 21.57 % in 21 – 30 years age group, 40.20 % in 31 – 40 years age, 14.71% in 41 – 50 years age, 10.78% in 51 – 60 years age, 9.80 % in >60 years age group, males were affected more than females of ratio 1.4:1, unilateral presentation (91.18%) is commoner than bilateral presentation (8.82%), nongranulomatous type of inflammation (93.14%) is more frequent presentation than granulomatous (6.86%). The etiology is found to be idiopathic in 31.37 % cases followed by phacolytic (20.59%) cases, herpetic iridocyclitis (16.67%), blunt trauma (13.73%) cases, iridocyclitis with arthritis (6.86%) cases, tuberculosis (5.88%) cases and inflammatory bowel disease (0.98%) cases.

**Conclusion:** From our study it was concluded that acute anterior uveitis is most commonly involved in middle aged person with increased incidence in males with unilateral and nongranulomatous type of idiopathic etiology.

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#### Introduction:-

Uveitis is one of the most common forms of intraocular inflammation involving the uveal tract and affects mainly children and young adults. It includes a large group of intraocular inflammatory diseases of diverse etiology. On several occasions, it reflects diseases that are developing elsewhere in the body and uveitis may be the first evidence of such systemic diseases<sup>1</sup>. Variation in the spectrum of disease is largely due to complex geographic, ecological, racial, nutritional, and socioeconomic differences. The anterior uveitis is the most common type of all uveitic

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entities. On the basis of overall clinical presentation is acute, unilateral, noninfectious and nongranulomatous forms<sup>2</sup>. The precise cause of anterior uveitis is often obscure and the correct diagnosis is often challenging. The cause of inflammation might be infections agent or trauma, but in most cases the underlying mechanism appears to be autoimmune in nature<sup>3</sup>. In order to enhance understanding and management of ocular inflammation International ocular Inflammation Society (IOIS) has been founded<sup>4</sup>.

The aim of our study is to find out the clinical profile of all patients presenting with acute anterior uveitis attending the Ophthalmology Department of VSS Medical College, Burla, Sambalpur over a period of two years.

### Materials and Methods:-

A prospective clinical study was conducted between December 2012 to October 2014. A standard clinical proforma was filled in all cases, which included salient feature in history, visual acuity using Snellens visual acuity chart, clinical findings, laboratory investigations, and the final etiology. The anterior uveitis associated with penetrating ocular injuries, corneal ulcer, intraocular surgeries, intermediate, posterior or panuveitis and masquerade syndrome were excluded from the study. All patients were examined under slit lamp. Details on disease severity, laterality, chronicity, ocular signs and associated systemic conditions were noted. Presentation was considered as unilateral if active inflammation was present in only one eye and bilateral if both eyes presented with active inflammation. Intraocular inflammation was assigned as anterior uveitis which include iritis, anterior cyclitis, iridocyclitis based on International Uveitis Study Group Criteria. The inflammation was defined as acute if symptoms were present for less than three months, chronic if symptoms were present for three months or more and recurrent if two or more episodes of inflammation separated by a disease free period. A short differential diagnosis was made in each case. Subsequently, a tailored laboratory investigation was carried out. Investigations included, total and differential counts, erythrocyte sedimentation rate, urine and stool examination, Mantoux test, Serological tests for syphilis, HIV, rheumatoid factor were done in all cases. Radiological investigations included x-ray of chest, lumbosacral and knee joints. Other special investigations were considered whenever necessary like skin tests, ELISA for IgG, IgM, etc. Consultation was done with other medical specialities, whenever needed. Final etiological diagnosis was made based on history, clinical features, laboratory investigations and systemic evaluation by other medical specialities. The anterior uveitis was considered to have idiopathic etiology when it was not associated with HLA-B27 haplotype and neither with defined clinical syndromes nor with definitive aetiology<sup>5</sup>.

### Results:-

This study was conducted in the Department of Ophthalmology, V.S.S Medical College & Hospital, Burla, Sambalpur, Odisha between December 2012 to October 2014. 102 patients in the age group of 10 – 80 years were included and during the study following observations were found.

**Table 1:-** Age distribution.

Sl. No.	Age (yrs)	Number	Percentage
1	10 – 20	3	2.94
2	21 – 30	22	21.57
3	31 – 40	41	40.20
4	41 – 50	15	14.71
5	51 – 60	11	10.78
6	> 60	10	9.80

In the present study anterior uveitis accounted to 2.94% in 10 – 20 years age, 21.57 % in 21 – 30 years age group, 40.20 % in 31 – 40 years age, 14.71% in 41 – 50 years age, 10.78% in 51 – 60 years age, 9.80 % in >60 years age group [Table-1].

**Table 2:-** Sex distribution

Sl. No.	Sex	Number	Percentage
1	Male	59	57.84
2	Female	43	42.16

As observed in the [Table-2], males accounted higher (57.84%) than that of females (42.16%).



**Table 3:-** laterality distribution

Sl. No.	Laterality	Number	Percentage
1	Unilateral	93	91.18
2	Bilateral	9	8.82

In the present study unilateral involvement was seen in 91.18 % as compared to bilateral involvement in 8.82 % of cases. [Table 3]

**Table 4:-** Type of inflammation

Sl. No.	Type	Number	Percentage
1	Nongranulomatous	95	93.14
2	Granulomatous	7	6.86

In the present study 95 (93.14 %) patients had non granulomatous inflammation and as compared to granulomatous inflammation 07 (6.86 %) patients. [Table 4]

**Table 5:-** etiology

Sl. No.	Etiology	Number	Percentage
1	Idiopathic	32	31.37
2	Phacolytic	21	20.59
3	Blunt trauma	14	13.73
4	Herpes	17	16.67
5	Tuberculosis	6	5.88
6	Septic focus	2	1.96
7	Iridocyclitis with arthritis	7	6.86
8	Leprosy	2	1.96
9	Inflammatory bowel disease	1	0.98

In this study aetiology remain undetermined in 32 (31.37 %) cases followed by blunt trauma was seen in 14 cases (13.73 %) and phacolytic uveitis was detected in 21 cases (20.59 %). Herpes zoster was responsible in 17 (16.67 %) cases and tuberculosis in 06 (5.88 %) cases. Iridocyclitis associated with arthritis in 07 (6.86 %) cases, Septic focus in 02 (1.96 %) cases, leprosy in 02 (1.96 %) cases and inflammatory bowel disease was observed in 01 case (0.98%) each. [Table 5]

### Discussion:-

The incidence was found to be high between 21 – 40 years of age (61.77%) and less common over sixty years (9.8%) as compared to Rathinam et al<sup>2</sup> age incidence is <16 years (7.34%), 17-59 years (83.37%) and >60 years (9.29%). Alejandro Rodriguez et al<sup>9</sup> reported 31-40 years (35%) followed by 61-70 years (25%), 51-60 years (20%), 71-80 years (10%), 41-50years (5%) and 21-30 years (5%) of age group.

In our study males were affected more (57.84 %) compared to females (42.16 %). This may be because men tend to seek medical attention more often than women and socio-economic habits may put male patients at a greater risk for development of anterior uveitis as compared to Rathinam et al study 61.3% were males and 38.7% were females and Alejandro Rodriguez et al reported 38.9% male and 61.1% female involvement in their study.

In our present study unilateral involvement was seen in 91.18 % as compared to bilateral involvement in 8.82 % of cases. In our study 95 patients (93.14%) had non-granulomatous inflammation and in 7 patients (6.86%) it was granulomatous. Findings are comparable with previous studies.

In the present study idiopathic (31.37%) was the most common cause of anterior uveitis followed by phacolytic (20.59%) aetiology. Although herpes zoster accounted for 16.67% of the cases, which is comparable with other two studies where it stood first, is not the most common in present study. However it was the most common infectious cause in our study. 5.88 % of the patients had tubercular anterior uveitis which is comparable with Rathinam et al and Singh et al<sup>8</sup> study, where as there is no data in Henderly et al<sup>10</sup> study. This difference may be because all other studies were conducted at referral centers, where cases usually chronic and recurrent ones, are referred from primary and secondary centers. Whereas present study was done in a general ophthalmic clinic and most people were from villages.

**Conclusion:-**

In this study it was found that acute anterior uveitis is more common in 21-40 years age group ( 61.77%) and less common over 60 years (9.8%), males were affected more than females of ratio 1.4:1, unilateral presentation (91.18%) is commoner than bilateral presentation (8.82%) and nongranulomatous type of inflammation (93.14%) is more frequent presentation than granulomatous (6.86%). The etiology is mainly idiopathic in 31.37 % cases and specific diagnosis was reached in 68.63% cases. However further research is required with quite sufficient number of cases to reveal definite etiology, management and to decrease the morbidity conditions associated with it.

**References:-**

1. Rathinam SR.CME Series. All India Ophthalmological society. Uveitis made simple work up and management. 2010; 20: 1–42.
2. Rathinam SR, Namperumalsamy P. Global variation and pattern changes in epidemiology of uveitis. Indian J Ophthalmology 2007; 55 (3):173–83.
3. Yanoff M, Duker JS, Augsburger JJ, Azar DT, Diamond GR, Dutton JJ et al. Ophthalmology. 2nd Edn .Vol 2. Missouri (MO): Mosby; 2004: 1105–1112.
4. Alio J, Ben Ezra D. Priority features of intraocular inflammation. Highlights of Ophthalmology 2002; 30(3): 1–2.
5. Martin TM, Smith JR, Rosenbaum JT. Anterior uveitis: current concepts of pathogenesis and interactions with the Spondyloarthropathies. Current opinion Rheumatology 2002; 14 (4): 337–41.
6. Nussenblatt RB, Whitcup SM. Uveitis fundamentals and clinical practice. 3rd edn. Pennsylvania (PA): Mosby; 2004: 273–286.
7. The Changing Pattern of Uveitis in a Major Referral Eye Institute in India, Dr. Vishal Agarwal, Dr Jotirmaya Biswas, 2008.
8. Singh R, Gupta V, Gupta A. Pattern of Uveitis in a referral eye clinic in North India. Indian J Ophthalmol 2004; 52: 121–25.
9. Rodriguez A, Calonge M, Pedroza-Seres M, Akova YA, Messmer EM, D'Amico DJ, et al. Referral patterns of Uveitis in a tertiary care center. Arch Ophthalmology 1996; 114: 593–599.
10. Henderly DE, Genstler AJ, Smith RE, Rao NA. Changing patterns of Uveitis. Am J Ophthalmol 1987; 103(2): 131–136.
11. Acute Anterior Uveitis, By Niaz Islam, Carlos Pavesios.

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### RESEARCH ARTICLE

## ESTIMATED AVERAGE GLUCOSE, EAG – A MORE INTUITIVE UNDERSTANDING OF GLYCEMIC CONTROL

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### Abstract

**Objective:** Glycosylated hemoglobin (HbA1c) is considered as an index of glycemic status over the preceding 2-3 months. Because the HbA1c level is a marker of blood glucose for the previous 60–90 days, average blood glucose levels can be estimated using HbA1c levels. Our aim in the present study was to investigate the relationship between estimated average glucose (eAG) levels, as calculated by HbA1c levels, and fasting plasma glucose (FPG) levels.

**Methods:** Retrospective analysis of 1000 patients in the Department of Biochemistry for FPG and HbA1c was done. The eAG levels were calculated using the following formula:  $(28.7 \times \text{HbA1c}) - 46.7$ . FPG and HbA1c levels were determined using glucose oxidase-peroxidase method and turbidimetric inhibition immunoassay (TINIA), respectively. According to FPG levels, the patients were divided into Group A (FPG < 126 mg/dl), Group B (FPG 126–200 mg/dl) and Group C (FPG > 200 mg/dl).

**Results:** A strong positive correlation between FPG levels and eAG levels ( $r=0.83$ ,  $p<0.0001$ ) was observed. The difference was statistically significant.

**Conclusion:** The discrepancy between HbA<sub>1c</sub> and blood glucose level units is problematic and confusing among patients. So we suggest, eAG which shows strong correlation with FPG, to be reported along with HbA1c. This will help promote positive patient outcomes, as well as enhance each individual's understanding and ability to manage his or her diabetes more effectively.

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### Introduction:-

Diabetes mellitus is a chronic metabolic disorder characterized by rise in blood glucose level and derangement in protein and fat metabolism.<sup>1</sup> Its management requires an accurate evaluation of blood glucose control to assess the efficiency of a particular therapy.<sup>2</sup> HbA1c is the gold standard for assessment of glycaemic control in patients with diabetes.<sup>3</sup> Because the HbA1c level is a marker of blood glucose for the previous 60–90 days, average blood glucose levels can be estimated using HbA1c levels.<sup>2</sup>

Despite its wide international use, there is a substantial lack of standardization among HbA1c determination methods. The desire to standardize the HbA1c results obtained from different techniques led to the development of a

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reference method.<sup>4</sup> However, the new method results in lower values expressed in different units (millimoles per mole of unglycated hemoglobin), which may cause confusion for patients and health care providers.<sup>5</sup>

The relationship between the mean blood glucose level and the level of HbA1c has been investigated in different studies, and various equations have been obtained.<sup>6,7,8</sup>

Using Nathan's regression equation, which has been recommended by the American Diabetes Association (ADA), the estimated average glucose (eAG) level calculation and its relationship to the fasting plasma glucose (FPG) level were investigated in the present study.

### Materials and Methods:-

Retrospective analysis of 1000 patients in the Department of Biochemistry for FPG and HbA1c was done. FPG and HbA1c levels were determined on fully automated analyzer ROCHE MODULAR P 800 using glucose oxidase - peroxidase method and turbidimetric inhibition immunoassay (TINIA), respectively. The eAG levels were calculated using Nathan's regression equation,  $(28.7 \times \text{HbA1c}) - 46.7$  recommended by American Diabetes Association. According to FPG levels, the patients were divided into Group A (FPG<126mg/dl), Group B (FPG 126-200 mg/dl) and Group C (FPG>200 mg/dl).

All statistical analyses were performed using the Statistical Package for Social Sciences (SPSS, version 11.0 for Windows). Data were expressed as the means  $\pm$  standard deviation of the mean (SD). A p-value <0.05 was accepted as significant. The Pearson correlation coefficient was used to test the correlation between FPG, eAG and HbA1c levels, and independent t-test was used to find the difference between male and female.

### Results:-

The mean FPG, eAG, and HbA1c levels in the whole group are presented in Table1. A positive significant correlation was found between FPG and eAG levels for the entire study group ( $r = 0.8364$ ,  $p < 0.0001$ ).

The mean FPG, eAG and HbA1c levels in groups A, B and C are shown in Table1. When the data was split based on FPG it was observed that the three groups showed significant positive correlation with eAG. The eAG levels were higher compared to FPG levels in the three groups.

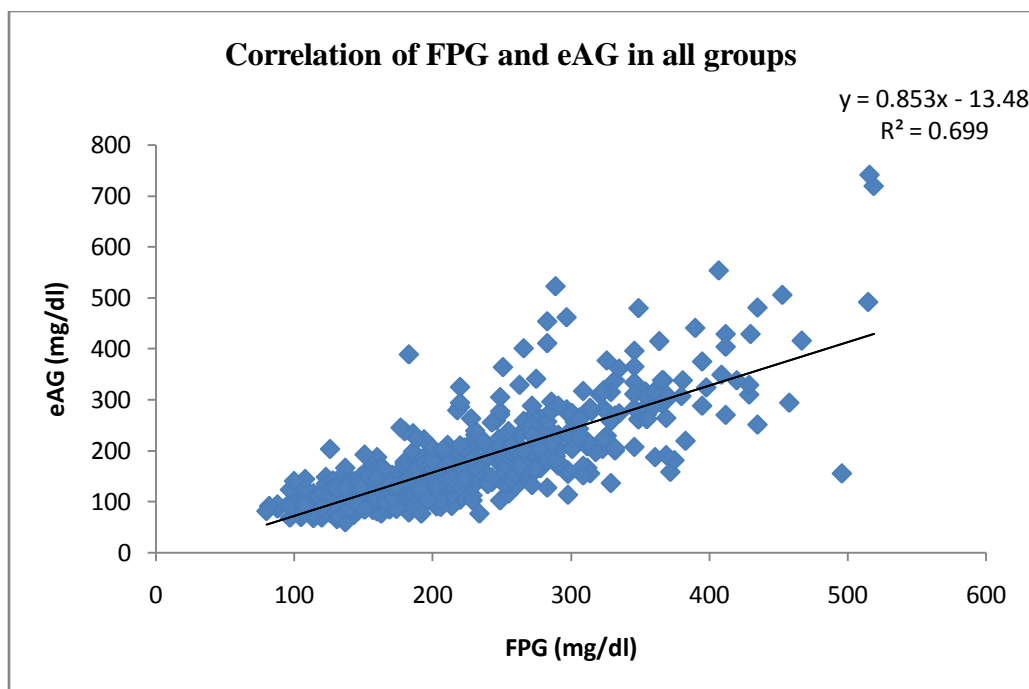
The mean levels of FPG, eAG and HbA1c were higher in males than in females. However, there was no significant gender difference for the following variables (Table2).

**Table 1:-** The levels of the glycemic parameters and the correlation coefficients for all groups (mean  $\pm$  SD)

	Entire Group (n=1000)	Group A (FPG<126mg/dl) (n=558)	Group B (FPG:126-200 mg/dl) (n=272)	Group C (FPG>200mg/dl) (n=170)
<b>FPG (mg/dl)</b>	146.00 $\pm$ 77.99	99.80 $\pm$ 13.34	153.40 $\pm$ 21.08	285.82 $\pm$ 88.67
<b>eAG (mg/dl)</b>	186.80 $\pm$ 76.41	140.38 $\pm$ 26.76	206.22 $\pm$ 54.52	308.11 $\pm$ 69.69
<b>HbA1c (%)</b>	8.14 $\pm$ 2.66	6.52 $\pm$ 0.93	8.82 $\pm$ 1.898	12.36 $\pm$ 2.42
<b>FPG vs eAG</b>	$r = 0.8364$	$r = 0.4103$	$r = 0.4743$	$r = 0.6039$
<b>FPG vs HbA1c</b>	$r = 0.8360$	$r = 0.4118$	$r = 0.4733$	$r = 0.6015$

**Table 2:-** A comparison of glycemic parameter levels in males and females (mean $\pm$ SD)

	Male (n=569)	Female (n=431)	p-value
<b>FPG (mg/dl)</b>	149.46 $\pm$ 77.50	141.92 $\pm$ 79.83	0.1329
<b>eAG (mg/dl)</b>	190.58 $\pm$ 76.03	181.82 $\pm$ 76.69	0.0725
<b>HbA1c (%)</b>	8.27 $\pm$ 2.65	7.96 $\pm$ 2.66	0.0677



### Discussion:-

Monitoring of glycemic status has been considered the cornerstone of diabetes care. The results of monitoring are used to assess efficacy of therapy and to guide adjustments in lifestyle to achieve best possible glucose control. The most common tests used today for this purpose are blood glucose and glycated hemoglobin (HbA1c).<sup>9</sup>

HbA1c results are expressed as the percentage of hemoglobin that is glycated and reflects the average blood glucose control over a period of approximately three months. In contrast, blood glucose levels are expressed in mg/dl and are used for daily monitoring by the patient and healthcare professionals. The discrepancy between HbA1c and blood glucose level units has always been problematic and has created confusion among patients. To eliminate this confusion, a mathematical relationship has been established translating HbA1c results into estimated average glucose (eAG). In using eAG, HbA1c results can be reported to patients in units they are already familiar with from their experience in self-monitoring. Similar to HbA1c, eAG evaluates a patient's overall success at controlling glucose levels and helps patients understand the monitoring of their long-term treatment.<sup>5</sup>

Using the Nathan's regression equation, we calculated the eAG levels of our study group and investigated their relationship with the FPG levels. The eAG levels were positively correlated with the FPG levels. In addition, the decrease in the significant strong correlation coefficient showed that the association depended on the patients' levels of glucose control. As glucose control worsened, the association became stronger. Similar findings were reported by Bozkaya et al.<sup>2</sup>

Most patients who come to the clinic for plasma glucose determination pay more attention to fasting and diet rules. The eAG levels in the study group were higher than the FPG levels (93.3%) not only because patients come to the lab in a fasting state but also because the eAG level is reflective of all plasma glucose levels over the previous three months, including the postprandial glucose levels. Our results were in harmony with the previous studies that showed eAG levels being higher than FPG levels, concluding that the eAG and FPG values cannot be used interchangeably.<sup>2,10</sup>

The effect of gender on eAG, FPG and HbA1c levels was also studied. Our results revealed lower eAG, FPG and HbA1c levels in females than those of males (Table 2), otherwise this decrease was non-significant. In concordance to our results, a previous study has observed that these variables did not differ significantly between males & females.<sup>10</sup> However, a study reported a significant gender difference with respect to eAG and HbA1c levels.<sup>2</sup> The

above reported variation can be explained by the difference in the population studies and possibly, the different laboratory methodologies used.

In concordance to the results reported by other studies<sup>2</sup>, the eAG levels of males and females were found to be higher than the FPG levels in most cases ( 92.6% and 94.2% , respectively), similar to the results found for the group as a whole ( 93.3%).

It is thought that diabetic patients require better strategies to improve self-management.<sup>11</sup> One of these strategies is the use of eAG levels together with HbA1c values.<sup>12,13</sup> Although the clinical usefulness of eAG is not clear, it is believed that every patient's eAG level should be calculated and provided in addition to the HbA1c level. This will help patients better understand the importance of keeping their blood glucose levels within acceptable limits and may rescue them from invasive approaches for glucose homeostasis.<sup>14</sup>

### Conclusion:-

According to our data, patients with good to moderate blood glucose control are not entirely successful at managing their blood glucose, as reflected by their eAG levels, and the association between FPG and eAG levels depends on the extent of glycemic control. The study concludes that there is a positive correlation between eAG and FPG, hence it seems intuitive that the reporting of eAG together with the HbA1c level will assist patients and doctors determine the effectiveness of blood glucose control measures.

### References:-

1. Aaron & Vinik. Diabetes and macrovascular disease. Journal of diabetes and its Complications 2001;16:235-245
2. Bozkaya G, Ozgu E, Karaca B. The association between estimated average glucose levels and fasting plasma glucose levels. Clinics 2010;65(11):1077-1080
3. Lai Leslie C. Global standardisation of HbA1c. Malaysian J Pathol 2008;30(2):67-71
4. Makris K, Spanou L, Sacks DB, Bruns DE, Goldstein DE, Maclaren NK, et al. Guidelines and recommendations for laboratory analysis in the diagnosis and management of diabetes mellitus. Clin Chem 2002;48:436-72
5. Nathan DM, Kuenen J, Borg R, Zheng H, Schoenfeld D, Heine RJ. A1c Derived Average Glucose Study Group. Translating the A1c assay into estimated average glucose values. Diabetes Care 2008;31:1473-8
6. Nathan DM, Turgeon H, Regan S. Relationship between glycated hemoglobin and mean glucose levels over time. Diabetologica 2007;50:2239-44
7. K, Spanou L, Sacks DB, Bruns DE, Goldstein DE, Maclaren NK. Et al. Guidelines and recommendations for laboratory analysis in the diagnosis and management of diabetes mellitus. Cli Chem 2002;48:436-72
8. Rohlfing CL, Wiedmeyer HM, Little RR, England JD, Tennill A, Goldstein DE. Defining the relationship between plasma glucose and HbA(1c): analysis of glucose profiles and HbA(1c) in the Diabetes Control and Complications Trial. Diabetes Care 2002;25:275-8
9. Nathan DM. Long-term complications of diabetes mellitus. N Engl J Med 1993;328(23):1676-85
10. Reddy Raja P, Reethesh RP, Mahesh V. The association between estimated average glucose levels and fasting plasma glucose levels in a rural tertiary care centre. Global Journal of Medicine and Public Health 2013;2(1):1-5
11. Karahan E, Ozkara E, Oner FK, Saatci AO. HbA1c awareness in Turkish diabetic population at a tertiary setting. Turkiye Klinikleri Med Sci 2009;29:927-31
12. Leslie RD, Kilpatrick ES. Translating the A1c assay into estimated average glucose values: response to Nathan et al. Diabetes Care 2009;32:e11
13. Rodriguez-Segade S, Rodriguez J, Paz JM, Camina F. Translating the A1c assay into estimated average glucose values: response to Nathan et al. Diabetes Care 2009;32:e10
14. Miguel GP, Azevedo JL, Gicovate Neto C, Moreira CL, Viana EC, et al. Glucose homeostasis and weight loss in morbidly obese patients undergoing banded sleeve gastrectomy: a prospective clinical study. Clinics 2009;64:1093-8

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### RESEARCH ARTICLE

#### PHILOSOPHICAL ASSUMPTION IN MEASURING AESTHETICS OF A BUILDING

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#### Abstract

The quality of being pleasing is aesthetics. The aesthetic of a building vary in responses to human observers, if it partly follows proportion, if there is symmetry of measurement. In this paper we try to explain domains that are not easily quantifiable and thus can be used to communicate information between individual perceptions.

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#### Introduction:-

##### Definition of aesthetics:-

Is the quality of being pleasing, especially to look at, something that gives great pleasure, when looking at it.

The aesthetic of a building or designs vary in responses in human observers. It is not trivial, however, to relate these responses to particular characteristics of the art. The impacts on our emotional and mental world. In particular, it refers to the responses that indicate the degree of discrimination in perception when confronted with a design. This perception depends on the individual's interpretation, which may arise from emotional responses and/or comparison with previous experiences. The concern for most scholars contemplating aesthetic research is (at least) twofold:

1. How can aesthetic preference are empirically assessed.
2. How can aesthetic preference be compared pan-humans and cross-culturally. In most instances, what counts as empirical data for aesthetic preference relies on overtly expressed or articulated views at the level of verbal discourse (van Damme, 1996).

This paper addresses the issues concerned with variables or parameter use in measuring aesthetics of a building.

##### Aesthetics:-

Aesthetics has been described as dealing with "the philosophy of the beautiful as well as with the standards of value in judging art and other aspects of human life and culture" (Lawal, 1974). The term aesthetics was first used by Baumgarten, a German philosopher, in the mid-1700s. Fay Sudweeks and Simeon J. Simoff. The perception of aesthetics is verbally described by closely interrelated terms like style, taste, originality and beauty.

Taking the example of an aesthetic design again, a style refers to designs that have identifiable common characteristics. For example, 'state style' in Adamawa state (Yola) Nigeria West Africa, building design usually refers to characteristics such as red brick walls with cement mortar, asbestos roof, and veranda columns. Personal preferences in style are connected with individual taste. Style and taste are connected with the originality and individuality of a design, although not everything original is aesthetic. Beauty is an even more abstract term and is

often used to characterise aesthetics. Beauty is sometimes understood as a part of aesthetics, sometimes as a synonym of aesthetics, which introduces additional confusion.

1. Visual aesthetic appeal, according to Berlyne (1971), depends partly on the level of arousal triggered by a stimulus. Arousal is characterised in terms of the related variables of novelty, complexity and fronted with appropriate proportions of these collative variables.
2. Usurprisingness is measured by the degree of exploratory behavioural response in humans when conniversal aesthetics. The possible existence of universal aesthetics has piqued the interest of scholars from many disciplines, including philosophers, psychologists, anthropologists, cultural scientists and sociologists. According to Forge (1973), the existence of a universal human aesthetic is a matter of faith with neither those supporting nor those opposing the notion of a basic or genetic response to certain forms or proportions being able to prove their beliefs.

### **The Vitruvian design principles:-**

Vitruvius (1st century BC) is probably the first person to lay forth systematic and elaborated principles of design. It is not surprising that architecture was the subject of his elaborated writings, being the most salient and complex design discipline, which has affected human. It is not difficult to see that there is much in common for architecture (Brooks, 1975; Hooper, 1986; Lee, 1991; Kim et al., 2002; Visser, 2009).

Considering Vitruvius's three core principles of sound architectural work.

### **Firmitas, which is the strength and durability of the building:-**

utilitas –the utility of the building, its usefulness and its suitability for the needs of its intended inhabitants and users;

venustas - the building's beauty. In architecture, the Vitruvian principles have been influential since their rediscovery in the 15th century (Johnson, 1994; Kruff, 1994). To evaluate the design quality of a building (Whyte et al, 2003).

### **The appearance of a building:-**

Attributes of the choice process were found to moderate the relation between aesthetic evaluation and product choice, especially when users are required to trade-off aesthetic for other system qualities. For example, Ben-Bassat et al (2006) found that system preference or choice were affected by aesthetics under ordinary conditions (e.g., questionnaires) but not when the participants had to bid for a system with which they will perform competitive tasks. Diefenbach and Hassenzahl (2007) showed that under a beauty-usability trade-off, although people may prefer more beautiful products to more usable ones, they choose the more usable product if they cannot justify choosing the more beautiful one.

### **In Accordance With Good Taste:-**

1. Contextual factors, such as domain and type of task are mentioned by Norman (2004) as important considerations for the type of aesthetic design required for users' performance and satisfaction. He argues that in certain domains (e.g., control rooms) attractive design may not necessarily be desired. Ben-Bassat et al (2006) found that people weighed more usability over aesthetic factors when faced with a performance-oriented task, and Van Schaik and Ling (2008) demonstrated that attractiveness ratings were affected by providing context for the evaluation task.
2. Individual factors may also affect how antecedent variables (e.g., objective design attributes) are perceived differently by people with different aesthetic tastes (Hoyer and Stokburger-Sauer, 2011). In the domain of web-site design, Park et al., (2004) found that variability in user tastes is associated with aesthetic fidelity (i.e., the degree to which users felt the target impressions intended by designers). Individual differences were also found to affect the relative importance of aesthetics in people's preference of web-sites (Hartmann et al., 2008).

### **Variables:-**

1. Cross cultural studies have shown that national and professional cultures affect various relationships between aesthetic evaluations, their antecedents and their consequences. Hartmann et al (2007) found that the aesthetic evaluations and the importance of aesthetics are contingent on users.
2. The contingent nature of the aesthetic process is exemplified by Moshagen et al's finding that high visual aesthetics improved performance under poor usability but had no effect under high usability. Consequently, they



quoted Liu's (Liu 2003) principle that ergo-aesthetic design does not imply that workplace or product designers should only use designs that are pleasing or attractive. On the contrary, ergo-aesthetic design advocates the careful and proper selection of aesthetic levels of design to fit the needs and characteristics of the intended use.

### **Conclusion:-**

These paper is on the assumption that beauty is on eye of the beholder, as various philosopher tries to conclude that aesthetic depend on individual perception, the appearance is pleasing and in accordance with good taste.

### **References:-**

1. Alland, A. (1989). Affect and aesthetics in human evolution. *Journal of Aesthetics and Art Criticism*, 97(1), 1-14.
2. Hassenzahl, M. (2003). The Thing and I: Understanding the Relationship between User and Product in Blythe, M., Overbeeke, C., Monk, A.F., and Wright, P.C. (eds.) "Funology: From Usability to Enjoyment" Kluwer, pp.31-42
3. Jordan, P.W. (1999). Pleasure with Products: Human Factors for Body, Mind and Soul" in Green, W.S. and Jordan, P.W. (eds.) "Human Factors in Product Design" Taylor & Francis
4. Kurosu, M. (2012). Three Dimensions of Artifact Design — Meaningfulness, Quality Traits and Kansei (in Japanese). *Human Interface Symposium 2012*
5. Moshagen, M. & Thielsch, M. T. (2013). A short version of the visual aesthetics of websites inventory. *Behaviour & Information Technology*, 32(12), 1305-1311.
6. Simeon, J. S. & Fay, S. (n/d). Quantifying Beauty: An Information System for Evaluating Universal Aesthetics. Retrieved 3th January 2016 from <http://www2.iath.virginia.edu/time/readings/ontology-semantics-metaphor/metaphor-in-human-computer-interface.pdf>
7. Tamar, B. B., Joachim, M. & Noam, T. (2006). Economic and Subjective Measures Of The Perceived Value of Aesthetics and Usability. Article in *journal of ACM Transactions on Computer-Human Interaction*, Vol. 13, No. 2.
8. Wayne, D. H. & Nicola, E. S. S. (2011). The role of aesthetic taste in consumer behavior Article in *Journal of the Academy of Marketing Science* 40(1):167. -180.

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### RESEARCH ARTICLE

#### THE STUDY OF AMINO-ACIDE COMPOSITION OF HELIANTHUS TUBEROSUSE BLOOMS AND ORGANIC SOLVENTS' EXTRACTS BY PHYSIC-CHEMICAL METHODS.

B.M.Izteleu, G.E.Azimbaeva, G.N.Kudaybergenova and B.Zh.Dzhiembaev.

#### Manuscript Info

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##### Key words:-

biological active substances, amino acids, helianthus tuberosuse, gas-chromatographic methods, UV-spectroscopy.

#### Abstract

In this article the definition of Helianthus tuberosuse blooms' amino-acid composition by the gas-chromatographic using "Karlo-Erba-4200" device is given. As a result, 20 amino acids such as glutamine, aspartate, lactic acid, proline, arginine, leucine, serine, isoleucine, tyrosine, etc. were defined. Also, UV-spectra of organic solvents' extracts were made with the usage of "Evolution 600" device. It is determined that the basic components of the extracts are lipochromes (vitamin A) and  $\alpha$ -chlorophyll.

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Biologically active substances are such substances that affect biological processes in a human and animal body. They can be product of primary (vitamins, fats, carbohydrates, albumens) and secondary (alkaloids, glycosidas, tannins) biosynthesis. Plant always contain a complex of biologically active substances, but only one or few of them have therapeutic effect. They are called active substances and used in production of medicinal drugs.

Plants also contain called accompanying substances. This a conventional name of plants' primary and secondary synthesis products (menthol, papaverine, tanning agents). Some accompanying substances positively influence a human body as they have a supplement effect to basic active substances. For example, vitamins, mineral substances, flavanoids increase absorbability of active substances and their useful effect, and decrease a harmful effect of strong bonds [1,5].

Nowadays plants' generating biologically active substances arouses a great interest. Among these are Helianthus tuberosuse composite plants.

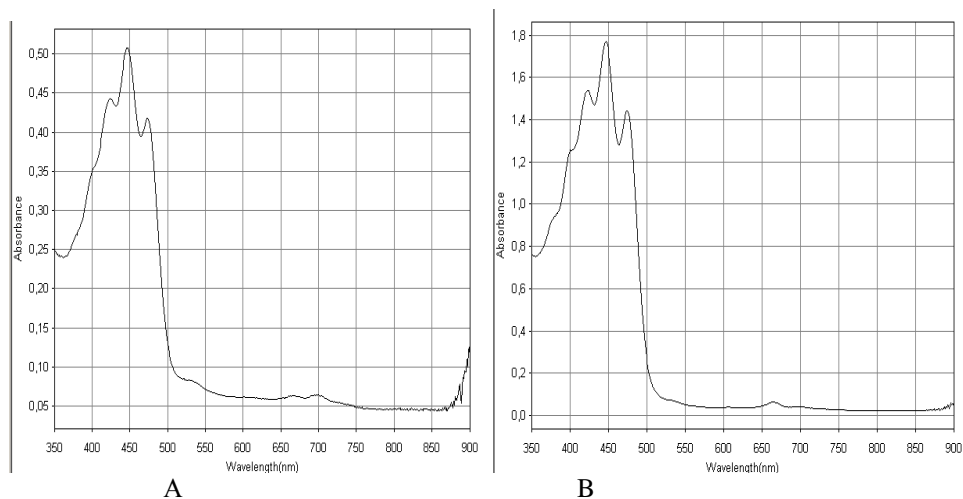
#### Research methods and Materials:-

The purpose of this work is the Helianthus tuberosuse blooms' definition of amino-acid composition and study of their organic extracts by the UV-spectroscopy method.

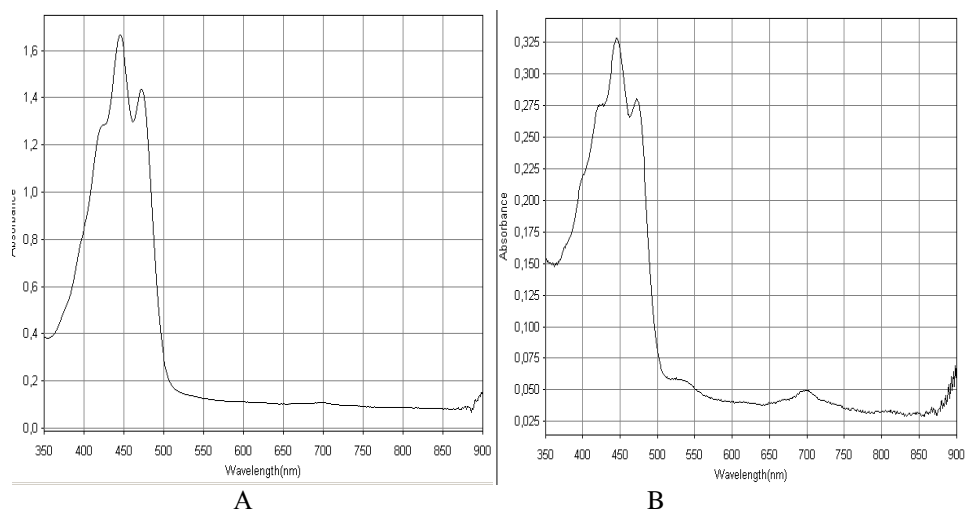
The object of the research is Almaty and Tashkent regions "Interes" cultivar's blooms picked in the end of September-middle of October 2013-2015.

To carry out UV-spectroscopic research the extracts of organic solvents (chloroform, benzole, acetone, hexane) were used, as well as the definition of amino-acid composition by the gas-chromatography with the usage of "Karlo-Erba-4200" device (Italy-USA) [2]. The results of amino-acid composition are listed in table 1.

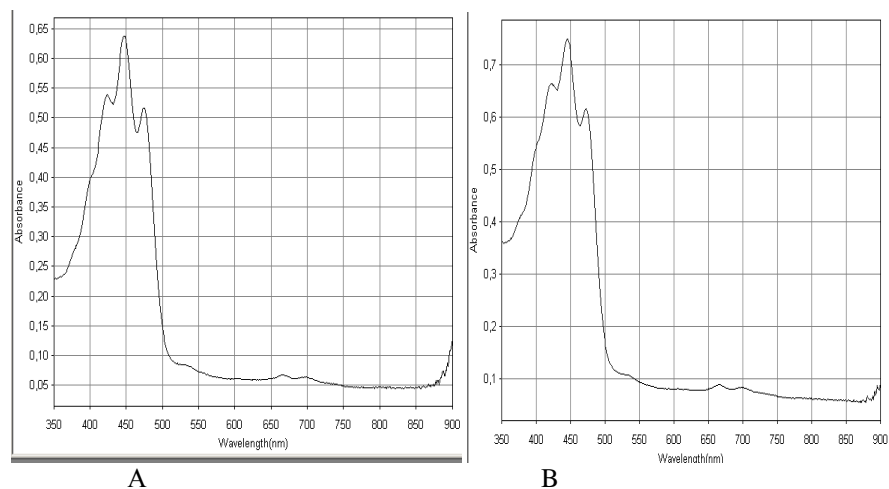




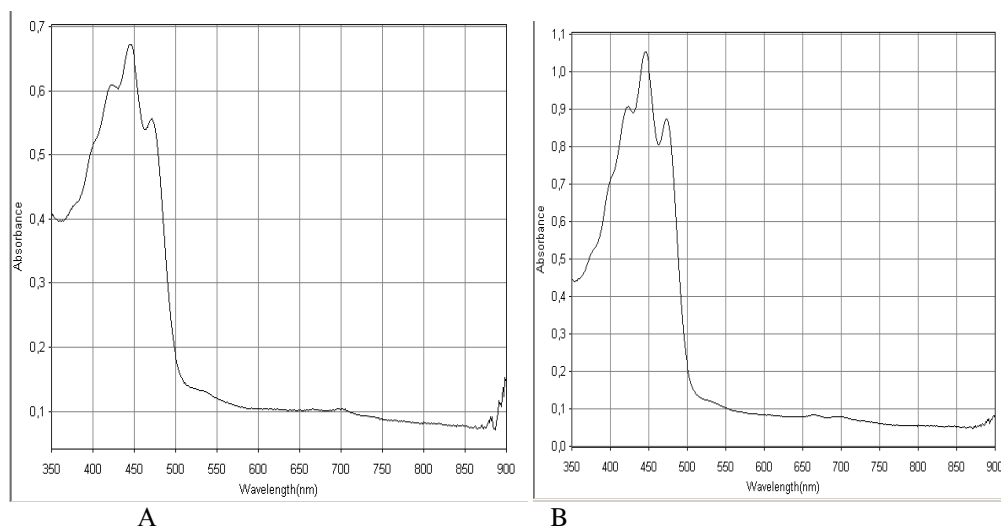
**Picture 1:-** UV -spectra of *Helianthus tuberosus* blooms' acetone extracts in Almaty ( A) and Tashkent (B) regions.



**Picture 2:-** UV -spectra of *Helianthus tuberosus* blooms' hexane extracts in Almaty (A) and Tashkent (B) regions.



**Picture 3:-** UV -spectra of *Helianthus tuberosus* blooms' chloroform extracts in Almaty ( A) and Tashkent (B) regions.



**Picture 4:-** UV -spectra of *Helianthus tuberosus* blooms' benzole extracts in Almaty (A) and Tashkent (B) regions.

**Table 2:-** The UV-spectrum data.

The name of sample	Wave length, nm	Intensity, A	the bond type
1	2	3	4
Spectra of <i>Helianthus tuberosus</i> blooms' chloroform extracts (Tashkent region)	375	0,402	
	401	0,544	
	422	0,664	
	445	0,749	lipochrome
	473	0,615	lipochrome
	536	0,105	
	667	0,087	$\alpha$ -chlorophyll
	700	0,083	
Spectra of <i>Helianthus tuberosus</i> blooms' benzole extracts (Tashkent region)	375	0,510	
	400	0,708	
	424	0,908	
	445	1,053	lipochrome
	474	0,874	lipochrome
	534	0,118	
	667	0,085	$\alpha$ -chlorophyll
Spectra of <i>Helianthus tuberosus</i> blooms' hexane extracts (Tashkent region)	378	0,165	
	398	0,215	
	423	0,276	
	446	0,329	lipochrome
	472	0,280	lipochrome
	539	0,057	
	665	0,041	$\alpha$ -chlorophyll
	679	0,050	
Spectra of <i>Helianthus tuberosus</i> blooms' acetone extracts (Tashkent region)	378	0,931	
	400	1,251	
	423	1,539	
	447	1,773	lipochrome
	475	1,443	lipochrome
	665	0,064	
Spectra of <i>Helianthus tuberosus</i> blooms' chloroform extracts	400	0,396	
	425	0,538	

(Almaty region)	445	0,638	lipochrome
	475	0,516	lipochrome
	535	0,082	
	665	0,068	$\alpha$ -chlorophyll
	698	0,064	
Spectra of Helianthus tuberosuse blooms' benzole extracts (Almaty region)	378	0,422	
	400	0,514	
	424	0,610	
	445	0,673	lipochrome
	472	0,557	lipochrome
	535	0,131	
	700	0,104	
Spectra of Helianthus tuberosuse blooms' hexane extracts (Almaty region)	423	1,282	
	446	1,667	lipochrome
	473	1,437	lipochrome
Spectra of Helianthus tuberosuse blooms' acetone extracts (Almaty region)	402	0,354	lipochrome
	442	0,444	lipochrome
	447	0,508	lipochrome
	473	0,418	lipochrome
	535	0,081	
	667	0,064	$\alpha$ -chlorophyll
	698	0,064	

According to the results of blooms' chloroform extracts in Almaty region, they are characterised by the absorption band's presence of 445-475 nm, and the intensity index is 0,638-0,516 A°; in Tashkent region the absorption band's presence of 445-475 nm, and the intensity index is 0,749-0,615 A°, which corresponds to lipochrome. Blooms' benzole extracts in Almaty region are characterised by the absorption band's presence of 445-472 nm, and the intensity index is 0,673-0,557 A°; in Tashkent region the absorption band's presence of 445- 474 nm, and the intensity index is 1,053-0,874 A°, which corresponds to lipochrome.

Blooms' hexane extracts in Almaty region are characterised by the absorption band's presence of 446- 473 nm, and the intensity index is 1,67-1,42 A°; in Tashkent region the absorption band's presence of 446-472 nm, and the intensity index is 0,32- 0,280 A°, which corresponds to lipochrome.

Blooms' acetone extracts in Almaty region are characterised by the absorption band's presence of 446- 473 nm, and the intensity index is 0,508-0,418 A°; in Tashkent region the absorption band's presence of 447-475 nm, and the intensity index is 1,77-1,44 A°, which corresponds to  $\alpha$ -chlorophyll.

Blooms' chlorophormic extracts in Almaty region are characterised by the absorption band's presence of 665 nm, and the intensity index is 0,068 A°; in Tashkent region the absorption band's presence of 667 nm, and the intensity index is 0,86 A°, which corresponds to  $\alpha$ -chlorophyll [4].

### Conclusion:-

1. The definition of Helianthus tuberosuse blooms' amino-acid composition by gas-liquid chromatography with the usage of "Karlo-Erba -4200" device (Italy-USA) is given. As a result, a considerable amount of glutamate, aspartate, lactamic acid and proline is attained: in Tashkent region it reaches 2194 mg/100g, 1820mg/100g, 1675mg/100g, 1295mg/100g, and in Almaty region it reaches 2015mg/100g, 2015mg/100g, 1550mg/100g, 1248mg/100g.
2. Helianthus tuberosuse blooms' extracts of organic solvents of chloroform, benzole, acetone, hexane by the UV-spectrum methods using "Evolution 600" device are studied. According to research, it is determined that the basic components of extracts are lipochromes (vitamin A) and  $\alpha$ -chlorophyll.

**Literature:-**

1. Yagodka V .S. Medical plants in dermatology and cosmetology. M. 2008. p.98
2. Drozdova I.L., Denisov N.N . The study of Egyptian rose's herb's amino-acid composition// Traditional medicine. 2012. #29. p.49-51
3. Yakube H.D., Eshkayt H . Aminoacids. Peptides. Proteins. M. Mir, 1985. p.82
4. 4.Blinova O.L. The development of rational methods of medicinal vegetative raw materials' and subterraneous organs' herbal medicinal products' identification. Perm. 2000. p.15
5. Stanley J. Kays, Stephen F. Nottingham Biology and Chemistry of Jerusalem Artichoke: Helianthus tuberosus L.August 13, 2007 by CRC Press. Reference - 496 Pages - 30 B/W Illustrations ,9781420044959 - CAT# 44958.

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### RESEARCH ARTICLE

#### AWARENESS ON AGICULTURAL BUDGETING - AN OVERVIEW.

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##### Key words:-

Budget, Awareness, Agricultural budgeting

#### Abstract

Budget is the financial statement for a period of time helps in aiding the plan of actions which may focus for the development. This study entitled "AWARENESS ON AGICULTURAL BUDGETING - AN OVERVIEW" helps to understand about the budget, agricultural budgeting, History of evaluation of budgeting, its role, purpose and importance. Study also focus on statistics of national and international budgeting and contributions of agricultural budgeting to overall budgeting. Agricultural budgeting from the union budget over a five year period was test analyzed and awareness was test among 45 samples includes Farmer, extension officials and students. Suggestion was also sorted and provided to helps in future policies implications and references for future studies.

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#### Introduction:-

The word budget is derived from bowgette, which means 'a leather bag' in French. The budget is announced to disclose the government's future expenditures intended to strengthen the nation's economy and consolidate economic stability through tax proposals.

A **Budget** is a quantitative expression of a plan for a defined period of time. It may include planned sales volumes and revenues, resource quantities, costs and expenses, assets, liabilities and cash flows. It expresses strategic plans of business units, organizations, activities or events in measurable terms. A budget is the sum of money allocated for a particular purpose and the summary of intended expenditures along with proposals for how to meet them. ([www.investopedia.com/university/budgeting/](http://www.investopedia.com/university/budgeting/))

Budgeting makes it easier for people with incomes and expenses of all sizes to make conscious decisions about how they'd prefer to allocate their money ([www.practicalmoneyskills.com/personalfinance/savingspending/budgeting/](http://www.practicalmoneyskills.com/personalfinance/savingspending/budgeting/)). A budget can help you keep track of your spending, prepare for unexpected expenses and find ways to save money ([www.practicalmoneyskills.com/personalfinance/savingspending/budgeting/](http://www.practicalmoneyskills.com/personalfinance/savingspending/budgeting/)). A budget can help you keep track of your spending, prepare for unexpected expenses and find ways to save money ([www.getsmarteraboutmoney.ca](http://www.getsmarteraboutmoney.ca)) > Home > Managing your money)

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The budget is announced to disclose agenda regarding government's future expenditure to strengthen nation's economy and consolidate economic stability through tax proposals. In India budget is prepared by the Budget Division Department of Economic Affairs of the Ministry of Finance annually. This includes supplementary excess grants and when a proclamation by the President as to failure of Constitutional machinery is in operation in relation to a State or a Union Territory, preparation of the Budget of such State. The railway budget is presented separately by the Ministry of Railways. Thus budget is presented in two categories: The General Budget and The Railway Budget. In this paper the trend of agricultural contribution in union budget over the past five years and awareness on agricultural budgeting is analyzed.

### Indian Budget: A Brief History:-

In history of Indian budget, budget was first introduced in India on 7 April, 1860 by the East-India Company to the British Crown. Pre-independence finance minister, James Wilson presented the budget in 1860. India has had 25 finance ministers since Independence. One week prior to the disclosure, publishers of the budget under the finance ministry, are kept isolated from the press and other sources. Earlier budget papers were printed in Rashtrapati Bhavan. The printing venue was shifted to Minto Road in New Delhi. Since 1980, budget papers are printed in the North Block. Shanmukham Chetty, first Finance Minister of India presented the budget in November 1947 without any tax proposals. However, he presented the analysis of the economic scenario of Independent India just 95 days before the budget presentation in 1948. Liaquat Ali Khan was the finance minister of the All India Muslim League from October 1946 to Independence in 1947. Till now there are nineteen finance ministers the list and frequencies are given in the following table.

**Table 1:-** Frequencies of finance minister from Independence.

S.No.	Finance ministers	Frequency
1	Liaquat Ali Khan	1
2	R. K. Shanmukham Chetty	1
3	John Mathai	1
4	C. D. Deshmukh	1
5	T. T. Krishnamachari	2
6	Jawaharlal Nehru	1
7	Sachindra Chaudhuri	1
8	Morarji Desai	1
9	Indira Gandhi	1
10	Yashwantrao Chavan	1
11	Chidambaram Subramaniam	1
12	Madhu Dandavate	1
13	Yashwant Sinha	2
14	Manmohan Singh	3
15	Jaswant Singh	2
16	P. Chidambaram	4
17	I.K. Gujral	1
18	Pranab Mukherjee	1
19	Arun Jaitley	1

### Objective:-

- To understand about the budgeting.
- To analyse the trend of agricultural budgeting in union budgeting .
- To test analyse the awareness of agricultural budgeting among different stake holders.
- To analyse the constraints and provide suggestion for future studies and policy implication

### Budget:-

A budget is the sum of money allocated for a particular purpose and the summary of intended expenditures along with proposals for how to meet them (<https://en.wikipedia.org/wiki/Budget>)

Budgeting is the process of creating a plan to spend your money. This spending plan is called a budget. Creating this spending plan allows you to determine in advance (<http://www.mymoneycoach.ca/budgeting/what-is-a-budget-planning-forecasting>)

#### **Purpose:-**

Budget helps to aid the planning of actual operations by forcing managers to consider how the conditions might change and what steps should be taken now and by encouraging managers to consider problems before they arise. It also helps co-ordinate the activities of the organization by compelling managers to examine relationships between their own operation and those of other departments. Other essentials of budget include:

- To control resources
- To communicate plans to various responsibility center managers.
- To motivate managers to strive to achieve budget goals.
- To evaluate the performance of managers
- To provide visibility into the company's performance
- For accountability

#### **Types:-**

**Sales budget:-** an estimate of future sales, often broken down into both units and currency. It is used to create company sales goals.

**Production budget:-** An estimate of the number of units that must be manufactured to meet the sales goals. The production budget also estimates the various costs involved with manufacturing those units, including labor and material. Created by product oriented companies.

**Capital budget:-** Used to determine whether an organization's long-term investments such as new machinery, replacement machinery, new plants, new products, and research development projects are worth pursuing.

**Cash flow/cash budget:-** A prediction of future cash receipts and expenditures for a particular time period. It usually covers a period in the short-term future. The cash flow budget helps the business determine when income will be sufficient to cover expenses and when the company will need to seek outside financing.

**Marketing budget:-** an estimate of the funds needed for promotion, advertising, and public relations in order to market the product or service.

**Project budget:-** a prediction of the costs associated with a particular company project. These costs include labour, materials, and other related expenses. The project budget is often broken down into specific tasks, with task budgets assigned to each. A cost estimate is used to establish a project budget.

**Revenue budget:-** Consists of revenue receipts of government and the expenditure met from these revenues. Tax revenues are made up of taxes and other duties that the government levies.

**Expenditure budget:-** includes spending data items.

**Corporate budget-** short term financial plan but it not an finished budget

**Event management budget:-** to manage the event

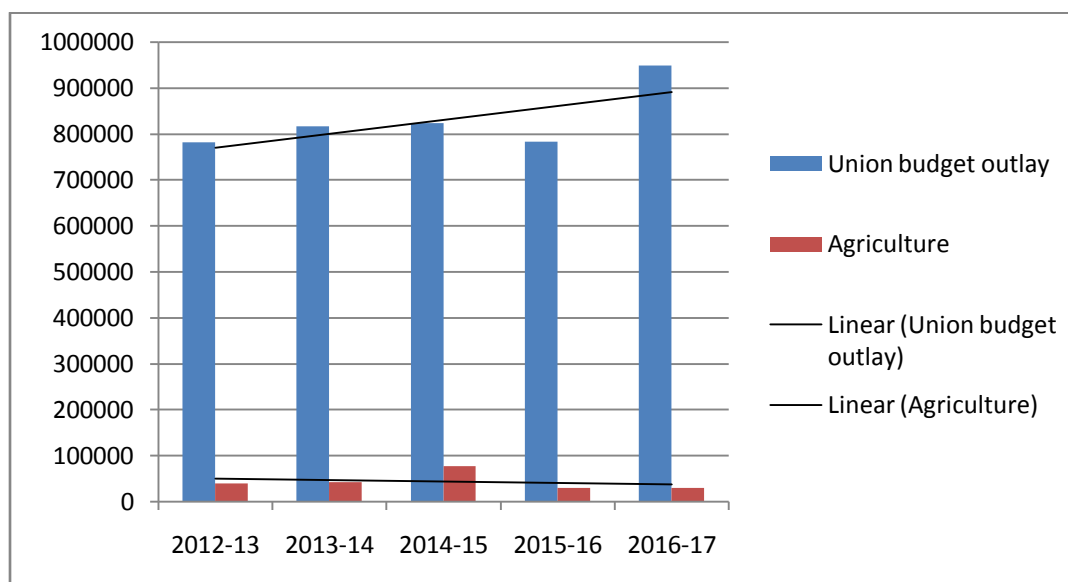
**An analysis of agricultural budgeting–trend and awareness analysis:-**

#### **Methodology:-**

Agricultural budgeting from the union budget over a five year period was test analysed among 45 samples includes Farmer, extension officials and student. To detect the awareness, questioners were developed and asked to fill the respondents and result was calculated using Trend and simple percentage analysis. The awareness on Farmers, student and extension officials was studied, suggestion was also sorted and provided to helps in future policies implications and references for future studies.

### I. Trend analysis - contribution of agriculture in union budget:-

Trend analysis tries to predict a trend. Trend is the general direction taking during a specified period of time, trend can be both rise or fall. Trend analysis is the process of trying to look at current trends in order to predict future ones. Here trend is analyzed in union budget over past five year and their contribution to agricultural sector is analyzed.



**Table 2:-** Contribution of agriculture in union budget for past five years

Year	Union budget outlay	Agriculture	% Contribution
2012-13	781507.3	<b>40243.88</b>	5.14
2013-14	816377.4	<b>43373.02</b>	5.31
2014-15	822940.9	<b>77592.77</b>	9.42
2015-16	783165.7	<b>30747.5</b>	3.92
2016-17	948148.8	<b>30124.06</b>	3.17

The above trend analysis in the union budget shows continuous improvement except in 2015 – 2016 shows slight decrease and improvement. For contribution of agriculture in union budget shows the increase in trend over a three years and decrease thereafter for the remaining two years.

### Finding and Discussion:-

#### Gender

Gender is the range of characteristics pertaining to, and differentiating between, masculinity and femininity. The distribution of respondents according to different gender is presented in Table 3.

**Table 3:-** Distribution of Respondents according to gender (n=45)

S. No.	Category	Number	Per cent
1	Male	26	57.8
2	Female	19	42.2
	<b>Total</b>	<b>45</b>	<b>100.00</b>

Table 3 revealed that 57.8 per cent of the respondents were found to be male and the remaining 42.2 per cent were found female. The higher in female participation is due to higher contribution of female members in PG education.

#### Participation:-

Participation in formal and non-formal community organizations might have paved way to have interaction with varied people which would help an individual to improve his knowledge and behavior. The distribution of respondents according to total participation is presented in Table 4.

**Table 4:-** Distribution of Respondents according to total participation (n=45)

S. No.	Category	Number	Per cent
1	Farmers	15	33.3
2	Extension officials	15	33.3
3	Students	15	33.3
	<b>Total</b>	<b>45</b>	<b>100.00</b>

Table 4 revealed that equal sampling of respondents selected for the study.

**Awareness:-**

Awareness is the degree to test the consciousness on particular topic. The distribution of respondents according to awareness is presented in Table 5.

**Table 5a:-** Distribution of Respondents according to awareness on budgeting (n=45)

S. No.	Category	Number	Per cent
1	Yes	43	95.6
2	No	2	4.4
	<b>Total</b>	<b>45</b>	<b>100.00</b>

**Table 5b:-** Distribution of Respondents according to awareness on agricultural budgeting (n=45)

S. No.	Category	Number	Per cent
1	Yes	44	97.8
2	No	1	2.2
	<b>Total</b>	<b>45</b>	<b>100.00</b>

Table 5a revealed that 95.6 per cent of the respondents were found to be aware on budgeting and the remaining 4.4 per cent were found to be non aware on budgeting. Table 5b revealed that 97.8 per cent of the respondents were found to be aware on agricultural budgeting and the remaining 2.2 per cent were found to be non aware on agricultural budgeting. The higher awareness is seen mainly because of budget reach.

**Usefulness of budgeting:-**

The degree in which the test measures the intent to measure is based on usefulness. The distribution of respondents according to responses based on usefulness of budgeting in the aspect of favouring farmers is presented in Table 6.

**Table 6:-** Distribution of Respondents according to responding usefulness (n=45)

S. No.	Category	Number	Per cent
1	Yes	30	66.7
2	No	15	33.3
	<b>Total</b>	<b>45</b>	<b>100.0</b>

Table 6a. revealed that 66.7 per cent of the respondents told that budgeting was in the aspect of favoring the farmers and the remaining 33.3 per cent were told it not at all favours. As the result majority of the respondents told that the budget is usefull and favours thefarmers.

**Table 6b:-** Distribution of respondents according to usefulness (n=45)

S. No.	Category	Number	Per cent
1	Unfavour	12	26.7
2	Up to 25%	5	11.1
3	25% - 50%	10	22.2
4	50% - 75%	9	20.0
5	75%-100%	9	20.0
	<b>Total</b>	<b>45</b>	<b>100.0</b>

Table 6b revealed that 26.7 per cent of the respondents were told budget unfavour the farmers and 22.2 per cent told that budget favours farmers 25%-50% , the higher responses reveals unfavourness because of some constraints like lack of technology reach to the unreached farmers

**Table 7:-** Sugestions (n=45)

Sugestions	Frequency	Percent	Rank
No idea	2	4.4	-
Extensionist should be a good and effective mediator in transferring the technology	3	6.7	VI
High awareness should be given through practicing improved transfer of technology tools	6	13.3	III
Agri in budgeting should be bottom up approach	9	20.0	I
Should treat all farmers equal while framing budget without segregation of small, medium and large farmers	3	6.7	VI
Improving number of field assistant in agriculture for technology transfer	1	2.2	X
Awariness about budgeting should given through popular channel other than Pothigai etc.,	7	15.6	II
Export, import and marketing aspects in agri in budgeting should be improved	1	2.2	X
Separate agriculture budget in budget is needed	4	8.9	IV
Allocating budget in the form of subsidies should be impressive schemes other than waiving loans	3	6.7	VI
Correct time ,correct delivery of input in the form of subsidy should be monitor properly to rectify the delay reach to the farmers	4	8.9	IV
Entire budget monitoring approaches should be digitalized to reach the effectiveness in reach	2	4.4	IX

\* Multiple responses

Table 7 reveals the sugestion given by the respondents to increase awareness and to reach the unreach farmers

### Conclusion:-

Awareness on agricultural budgeting reveals the awareness level on budgeting and agricultural budgeting aspects at markable level, the trend analyzed for past five years shows increase trend line with slight fluctuations, from the overall study it is clear that the awareness about budgeting and agricultural budgeting is high among the respondents.

### References:-

1. Pleasant. (2013). What is Budgeting? What is a Budget? Retrieved October 06, 2016, from <http://www.mymoneycoach.ca/budgeting/what-is-a-budget-planning-forecasting>
2. Fontinelle, A. (2008). Budgeting Basics. Retrieved September 17, 2016, from <http://www.investopedia.com/university/budgeting/>
3. Budgeting. (2013). Retrieved September 26, 2016, from <http://www.practicalmoneyskills.com/personalfinance/savingspending/budget/>
4. Budget. Retrieved October, 2016, from [www.tnbudget.tn.gov.in/](http://www.tnbudget.tn.gov.in/)
5. Osmond Vitez, & Studio. Why Is it Important for a Business to Budget? Retrieved October, 2016, from <http://smallbusiness.chron.com/important-business-budget-385.html>
6. Union budget (2016). Retrieved from <http://www.unionbudget.nic.in/>
7. Budget. (n.d.), from <https://en.wikipedia.org/wiki/Budget>
8. United States federal budget. (2007.). Retrieved November 07, 2016, from [https://en.wikipedia.org/wiki/United\\_States\\_federal\\_budget](https://en.wikipedia.org/wiki/United_States_federal_budget)
9. World budget. (World Wide Words: Budget. Retrieved November, 2016, from <http://www.worldwidewords.org/topicalwords/tw-bud1.htm>

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### RESEARCH ARTICLE

#### PSYCHO-SOCIAL PROBLEMS OF OBESITY AMONG MALE STUDENTS IN QASSIM UNIVERSITY IN SAUDI ARABIA.

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#### Abstract

**Introduction:** Studies have shown that overweight and obese persons face psycho-social problems. We conducted a cross-sectional study in Qassim university to explore the psycho-social problems faced by male obese students.

**Objectives:** To determine the types of psycho-social problems, and find their prevalence among Qassim University overweight and obese students.

**Research Methods:** A self-administered questionnaire was designed and pretested. The questionnaire consisted of questions regarding age, college, social background and social problems that they encounter. An open ended question was also included so that the study subject may identify some social problems that they encountered which the questionnaire may have failed to list. The participants of the study were selected by convenient sampling. The sample size was 65.

**Results:** In studied overweight and obese students sample, 58(89%) were unhappy about their weight and 52(80%) tried to follow weight reduction program. Fifty-six students (86.2%) considered overweight and obesity as a disease and 44(67.7%) had positive family history. Mood swing and social pressure were reported by 37(56.9%) and 30(46.2%); respectively. low self-esteem and effect on social life reported by 24(36.9%) and 13(20%); respectively. Reporting overeating due to anger, sadness and boredom was 9(13.8%), 11(16.9%) and 37(56.9%); respectively.

**Conclusion and recommendations:** Our study showed a substantial proportion of psycho-social problems among overweight and obese students. The finding of the study cannot be generalized to all Saudi adolescent, since the sample is small and not representative of all Saudi adolescent therefore we recommend that a larger study on the topic should be undertaken to estimate more accurately the magnitude of the problem.

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**Introduction:-**

Obesity is now considered as an epidemic by WHO (world health organization)<sup>[1]</sup>.

The definition of overweight and obesity is:

**Overweight:-** Excessive increase in adipose tissue or in muscle and skeletal tissue.

**Obesity:-** an increase in body weight beyond the limitation of skeletal and physical requirement, as the result of an excessive accumulation of fat in the body.

Overweight and obesity is best measured by calculating body mass index (BMI). This definition lead us to what is the BMI ?

$$\frac{\text{Weight (Kg)}}{\text{Height (m}^2\text{)}} = \text{BMI}$$

**Regarding to BMI the meaning of overweight and obesity will be:**

25.0 to 29.9 = overweight.

30 to 39.9 = obese.

**The risk factors associated with obesity and overweight are:**

- Diet (high fat and carbohydrate with excessive calories).<sup>[2]</sup>
- Sedentary lifestyle.<sup>[3]</sup>
- Genetics.<sup>[4]</sup>
- Illnesses (hypothyroidism, Cushing's syndrome, growth hormone deficiency).<sup>[5]</sup>
- Infectious agent.<sup>[6][7]</sup>
- Others causes of obesity like (insufficient sleep, decreased rates of smoking, increased use of medications that can cause weight gain, pregnancy at a later age).<sup>[8]</sup>

**The Prevalence of Overweight& Obesity in all age groups in KSA<sup>[9]</sup> is:**

14 % in men, and increasing level 30.7 %.

23.6 % in women, and increasing level 28.4 %.

In a study conducted by Wellman Friedberg in USA reports: "currently, the rates of both overweight and obesity in the US are 61% and 14% in adults and children, respectively. About 14% of children and adolescents are now seriously overweight."<sup>[10]</sup>

**There're a lot of medical problems associated with obesity, including:**

**Mortality:-**

Obesity reduces life expectancy by six to seven years.<sup>[11]</sup>

**Morbidity:**

- diabetes mellitus type 2.
- hypertension.
- high blood cholesterol.
- high triglyceride levels.
- ischemic heart disease.<sup>[12]</sup>

**Beside Medical Problems, There're Also Psychological Problems Associated:-**

In a study conducted by Wellman and Friedberg they report that:

"Emotional suffering may be among the most painful aspects of obesity. American society emphasizes physical appearance and often equates attractiveness with slimness, especially for women. Such messages may be devastating to overweight people. Many think that obese individuals are gluttonous, lazy, or both, even though this is not true. As a result, obese people often face prejudice or discrimination in the job market, at school, and in social situations. Feelings of rejection, shame, or depression are common."<sup>[10]</sup>

**Low Self-Esteem<sup>[13]</sup>:-**

Obese teens have significantly lower self-esteem than teens of normal weight. Low self-esteem often appears as loneliness, nervousness and sadness. Teens with low self-esteem may also engage in risky behavior such as

experimenting with drugs, alcohol or cigarettes. Obese teens who experience low self-esteem during childhood and adolescence often carry these feelings into adulthood.

#### **Depression<sup>[13]</sup>:-**

Depression is a common psychological effect of teen obesity. An obese teen who is heavier than her peers may experience feelings of sadness or hopelessness. Signs of depression include changes in sleep patterns, withdrawal from family or friends and loss of interest in activities she previously enjoyed. MayoClinic.com reports that some teens try to hide depression and appear emotionally flat rather than sad.

#### **Anxiety<sup>[13]</sup>:-**

Most children experience anxiety for various reasons throughout adolescence. Obese teens, however, may experience severe anxiety that often results in destructive behaviors or avoidance of friends and family. Overweight teens may also have social anxiety, the result of excessive bullying or teasing. Severe anxiety often interrupts the learning process and may lead to a decline in academic performance. Being an overweight teen can also affect an individual's anxiety level as an adult. Overweight teen girls may have a higher chance of developing anxiety disorders or depression in adulthood.

#### **Poor Body Image<sup>[13]</sup>:-**

Obese teens often experience poor body image as a result of being overweight. This may keep your teen from playing sports or engaging in physical activity, spending time with friends or wearing form-fitting clothing. Poor body image is connected to a number of psychological problems, including depression, anxiety and low self-esteem. Teens with poor body image are also at risk of developing an eating disorder.

#### **Eating Disorder<sup>[13]</sup>:-**

Obese adolescents are at risk of developing disorders such as bulimia, anorexia or compulsive overeating. An eating disorder is often the result of an overweight teen's effort to lose weight through risky and unhealthy behaviors.

A study from US has conclude the following "Obesity is associated with an approximately 25% increase in odds of mood and anxiety disorders and an approximately 25% decrease in odds of substance use disorders. Variation across demographic groups suggests that social or cultural factors may moderate or mediate the association between obesity and mood disorder."<sup>[14]</sup>

**The purpose of this study is to explore the psycho-social problems in obese student in four colleges of qassim university, by doing a Cross-Sectional study:-**

#### **Research Objectives:-**

##### **Goal:-**

To get better understanding of the social and psychological problems that faced by Qassim university obese students.

##### **Objectives:-**

To determine the types of Psycho-social problems, and find the prevalence of it among Qassim University overweight and obese students.

#### **Limitations of the study:-**

1. Since the selection of the study subjects was based on non-probability sampling technique, therefore it cannot be generalized to the entire obese population of students of Qassim university.
2. The study participants consent to participate in the study was voluntary, therefore there is a possibility of overestimation or underestimation of the result.
3. Only the male obese students were included in the study.

#### **Research Methodology:-**

**Research setting:-** The study was conducted in Qassim University, Colleges of Medicine, Dentistry, Pharmacy and Applied Health Sciences.

**Sampling and sample size:-** All male obese students who agree to participate in the study were inducted in the study. Therefore, the sampling method was "convenient sampling". The sample size was 65 male obese student.



**Data collection method:-** For all obese students who agreed to participate in the study, BMI was calculated to confirm obesity. Those who do not fall in the category of obesity were excluded from the study. A self-administered questionnaire was designed and pretested. The questionnaire consisted of questions regarding age, weight, height, college, social background and the psych-social problems that they encounter. An open ended question was also given so that the study subject may identify other social problems that they encounter and were not listed in the questionnaire. The data were collected by the group members. Every 3-4 group members were assigned one college to collect the data.

**Data entry and analysis:-** Before entering the data, the data were cleaned and edited. The data were entered and analyzed in SPSS program. Frequency tables were generated. Each variable frequency was analyzed and cross tabulation.

**Expected problems and their solutions:-** The faculty members may not give the permission to conduct the study. This will be dealt by taking official permission from Deans' of respective Colleges. The students may not cooperate for fear of their names being identified. This will be assured by having the questionnaire as anonymous.

### Results:-

Question	No n (%)	Yes n (%)
1. Are you satisfied with your current weight?	58(89.2)	7(10.8)
2. Have you tried to follow a program to reduce your weight?	13(20)	52(80)
3. Do you believe the obesity is a disease?	9(13.8)	56(86.2)
4. Do any of your family members have obesity?	21(32.3)	44(67.7)
5. Do you feel mood swing?	28(43.1)	37(56.9)
6. Do you feel social pressure due to your weight?	35(53.8)	30(46.2)
7. Does your overweight prevent you from going to public places?	58(89.2)	7(10.8)
8. Does your overweight prevent you from doing sport activity?	41(63.1)	24(36.9)
9. Did you try any dangerous method to reduce your weight?	45(69.2)	20(30.8)
10. Did obesity reduce your self-esteem?	41(63.1)	24(36.9)
11. Did you face difficulty in reduce your diet?	29(44.6)	36(55.4)
12. Did you thought that the obesity will affect you in the future?	9(13.8)	56(86.2)
13. Did you take any drug to reduce your weight previously?	47(72.3)	18(27.7)
14. Did your weight affect your study?	53(81.5)	12(18.5)
15. Did your weight affect your social life?	52(80)	13(20)
16. Did your overweight affect your activity?	30(46.2)	35(53.8)
17. Did you eat as a result of anger?	56(86.2)	9(13.8)
18. Did you eat as a result of sadness?	54(83.1)	11(16.9)
19. Did you eat as a result of boredom?	28(43.1)	37(56.9)
20. Did you eat as a result of frustration?	40(61.5)	25(38.5)
21. Your life style?	11(16.9)	
Lazy,	8(12.3)	
Active,	47(70.8)	
Neutral		

In studied overweight and obese student sample, 58(89%) were unhappy about their weight and 52(80%) tried to follow weight reduction program. Fifty-six students (86.2%) considered overweight and obesity as a disease and 44(67.7%) had positive family history. Mood swing and social pressure were reported by 37(56.9%) and 30(46.2%); respectively. low self-esteem and effect on social life reported by 24(36.9%) and 13(20%); respectively. Reporting overeating due to anger, sadness and boredom was 9(13.8%), 11(16.9%) and 37(56.9%); respectively.

### Discussion:-

In our study 36(56.9%) feels mood swing and 56(86.2%) thinks their obesity will affect them in the future while a study done in USA, shows that 25% obese adults have mood and anxiety disorder<sup>[14]</sup> Another study on psychosocial

aspects of obesity suggest that in obese patients seeking treatment there is an increased prevalence (40-60%) of psychiatric morbidity, most commonly depression<sup>[15]</sup>, which is quite similar to the finding in our study.

### Conclusion and Recommendation:-

Our study showed a substantial proportion of psycho-social problems among overweight and obese students. The finding of the study cannot be generalized to all Saudi adolescent, since the sample is small and not representative of all Saudi adolescent therefore we recommend that a larger study on the topic should be undertaken to estimate more accurately the magnitude of the problem.

### References:-

1. WHO. Body Mass Index (2012). Available from: [http://apps.who.int/bmi/index.jsp?introPage=intro\\_3.html](http://apps.who.int/bmi/index.jsp?introPage=intro_3.html)
2. "EarthTrends: Nutrition: Calorie supply per capita". World Resources Institute. Archived from the original on 2011-06-11. Retrieved Oct 18, 2009.
3. Effects of retirement on lifestyle in relation to changes in weight and waist circumference in Dutch men: a prospective study. Public Health Nutrition / Volume 8 / Issue 08 / December (2005).
4. Poirier P, Giles TD, Bray GA, Hong Y, Stern JS, Pi-Sunyer FX, Eckel RH. "Obesity and cardiovascular disease: pathophysiology, evaluation, and effect of weight loss" Arterioscler. Thromb. Vasc. Biol (Review) 26 (5): 968–76 (2006).
5. Rosén T, Bosaeus I, Tölle J, Lindstedt G, Bengtsson BA. "Increased body fat mass and decreased extracellular fluid volume in adults with growth hormone deficiency". Clin. Endocrinol. (Oxf) 38 (1): 63–71 (1993).
6. DiBaise JK, Zhang H, Crowell MD, Krajmalnik-Brown R, Decker GA, Rittmann BE. "Gut microbiota and its possible relationship with obesity". Mayo Clinic proceedings. Mayo Clinic (Review) 83 (4): 460–9 (April 2008)
7. Falagas ME, Kompoti M. "Obesity and infection". Lancet Infect Dis (Review) 6 (7): 438–46. (July 2006).
8. Putative contributors to the secular increase in obesity: exploring the roads less traveled. International Journal of Obesity 30, 1585–1594. (2006). doi:10.1038/sj.ijo.0803326; published online 27 June 2006
9. Obesity Research Center. Obesity in Saudi Arabia [Internet] (2007). Available from: <http://www.obesitycenter.edu.sa/Patients---Public/Obesity-in-Saudi-Arabia.aspx>
10. Wellman NS, Friedberg B. Causes and consequences of adult obesity: health, social and economic impacts in the United States, Asia Pacific J Clin Nutr (2002) 11(Suppl): S705–S709. Report.
11. Haslam DW, James WP. "Obesity". Lancet (Review) 366 (9492): 1197–209. (2005).
12. Grundy SM. "Obesity, metabolic syndrome, and cardiovascular disease". J. Clin. Endocrinol. Metab. 89 (6): 2595–600. (2004).
13. Adrienne Weeks. Psychological Effects of Teen Obesity [Internet]. (May 26, 2011). Available from: <http://www.livestrong.com/article/353259-psychological-effects-of-teen-obesity>
14. Simon GE, Von Korff M, Saunders K, Miglioretti DL, Crane PK, van Belle G, Kessler RC. Association between obesity and psychiatric disorders in the US adult population. Arch Gen Psychiatry. (2006);63: 824–30.
15. Vaidya V. Psychosocial aspects of obesity. PubMed (2006);27:73-85.



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### RESEARCH ARTICLE

#### “RADIOMORPHOMETRIC INDICES AND THEIR RELATION TO ALVEOLAR BONE LOSS IN COMPLETELY EDENTULOUS PATIENTS: A PROSPECTIVE STUDY”

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Radiomorphometric, edentulous patients, alveolar, panoramic radiograph

#### Abstract

**Statement of problem:** In edentulous patients, alveolar bone loss is a critical factor that affects denture retention, stability, and masticatory function.

**Purpose:** To investigate the influence of age and gender on the mandibular cortical index, panoramic mandibular index, and mandibular cortical width, as well as alveolar bone loss and bone heights in the first premolar and molar region using panoramic radiographs of edentulous patients.

**Material and methods:** Panoramic radiographs of 75 edentulous patients were assessed. In addition to gender and age, the mandibular cortical index, panoramic mandibular index, mandibular cortical width at the mental foramen region, alveolar bone loss, and bone heights of the premolar and molar regions of the mandible were recorded. Statistical comparisons were performed using chi-square and 2-way ANOVA tests.

**Results:** Of the 75 patients, 32 (42%) were men and 43 (57.3%) were women. The association between MCI and age group was not statistically significant in males ( $P > 0.05$ ). In females, the association between MCI and age group was found to be statistically significant ( $P < 0.01$ ). The difference between males and females with respect to mean MCW is found to be statistically significant ( $P < 0.001$ ) indicating that gender is a significant factor influencing MCW.

**Conclusions:** The values of mean cortical width (MCW) at the mental foramen region decreased significantly with age in women ( $P < 0.001$ ). The ratio of the thickness of the mandibular cortex to the distance between the mental foramen and the inferior mandibular cortex (PMI) was not affected by gender or age.

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## Introduction:-

In many phases of prosthetic dentistry, healthy alveolar bone with normal regenerative capacity is essential for a successful treatment outcome. It is important to know the quantity and quality of bone in the jaws when planning prosthetic and pre-prosthetic surgical treatment. The residual ridge influences gingival esthetics and pontic dimensions<sup>1</sup> for fixed partial dentures; it provides support and stability for removable partial dentures and complete dentures; and the underlying bone is a prerequisite for the placement of oral implants. Resorption of residual ridges is a complex biophysical process<sup>2</sup> and is widely recognized as one of the most important factors affecting denture support, retention, stability and masticatory function in edentulous patients.<sup>3</sup>

Reduction of the residual alveolar ridges could be described as a resorptive atrophy, a physiologic reaction to loss of function and inactivity.<sup>4</sup> After dental extractions, the residual alveolar bone undergoes a period of accelerated resorption for about 10 weeks, followed by a slower, but progressive resorption thereafter.<sup>5,6</sup> Due to its progressive nature, the height of the alveolar ridge and basal bone will decrease,<sup>6,7</sup> resulting in alveolar ridge bone loss as great as 1 mm per year in complete denture wearers.<sup>8,9</sup> Loss of alveolar bone from an edentulous ridge is more pronounced in the mandible than the maxilla,<sup>10</sup> particularly in the early 3 months of post extraction period.<sup>11,12</sup>

Age related mandibular bone loss may be due to general thinning and increased porosity of the mandibular cortex. Bone loss occurs more rapidly in the premolar and molar regions of the edentulous mandible, compared to the anterior region. Therefore, bone resorption of the basal bone is more frequent in this region.<sup>13</sup> Most state that women have more advanced bone loss than men, but some have not found such a difference.<sup>14-16</sup>

Previous investigations on the effects of radiomorphometric indices and alveolar bone loss (ABL) have focused primarily on partially or completely dentate women.<sup>17-21</sup> Accordingly, it is logical to assume that a possible relationship exists among bone loss, radiomorphometric indices, and edentulism. The panoramic projection (pantomograph) is a commonly used radiographic view in all disciplines of dentistry, methods of quantifying alveolar bone loss on panoramic films is of great value, particularly in clinical studies.<sup>22</sup> Several authors have attempted to measure and quantify mandibular alveolar bone loss radiographically, most of these studies have used lateral cephalometric radiographs.<sup>23,24</sup> However, the use of lateral cephalograms for this purpose may involve a fairly large error.<sup>23</sup>

A number of qualitative and quantitative indices, including the mandibular cortical index (MCI), mandibular cortical width (MCW), or panoramic mandibular index (PMI), have been used to assess bone quality and to observe signs of resorption on panoramic radiographs.<sup>18,19</sup>

In light of these observations, the purpose of this study is to investigate the influence of age and gender on the mandibular cortical index, panoramic mandibular index, and mandibular cortical width, as well as alveolar bone loss and bone height using panoramic radiographs of edentulous patients.

## Materials and Method:-

**Source of data:** Subjects with completely edentulous maxillary and mandibular ridges in the age group of 50 to 80 years visiting the Department of Prosthodontics at M R Ambedkar Dental College & Hospital, Bengaluru.

### Method of collection of data:-

The study consists of 75 individuals in the age group of 50 to 80 years which are divided into 2 groups i.e., ≤60 and >60 years. Intraoral examination was performed for selection of study subjects.

### Inclusion criteria:-

1. Completely edentulous subjects without root stumps.
2. Subjects without any systemic illness.

### Exclusion criteria:-

1. Subjects suffering from diabetes.

2. Previous history of usage of dentures.
3. Subjects suffering from endocrine disorders.

A written consent was obtained from the subjects selected to be a part of the study and they were explained in detail about the procedure which was carried out. Each subject was made to stand comfortably and the patients maxillary and mandibular jaws were placed within the focal trough of the digital panoramic machine stably and digital panoramic radiographs were obtained. All panoramic images were made with the same digital panoramic radiography unit i.e. Kodak 8000 c digital and cephalometric system (Made in France - 2006).

Gender and age were recorded for each patient. Linear measurements on panoramic images were made using imaging software i.e., TrophyDicom at a correction for 1.27 % magnification. The total duration of study was 1 year 6 months.

The measurements for radiomorphometric indices which included mandibular cortical index (MCI), mandibular cortical width (MCW), panoramic mandibular index (PMI), as well as alveolar bone loss (ABL) and heights in the first premolar and molar region (Hp and Hm) were performed.

#### **Mandibular cortical index (MCI):-**

Mandibular cortical index (MCI) refers to the inferior mandibular cortical thickness and is categorized into the following 3 groups according to the criteria described by Klemettiet al.<sup>17</sup>:

C1: the endosteal margin of the cortex is even and sharp on both sides

C2: the endosteal margin shows semilunar defects (lacunar resorption) and/or seems to form endosteal cortical residues on one or both sides and

C3: the cortical layer forms heavy endosteal cortical residues and is clearly porous.

#### **Mandibular cortical width (MCW):-**

Mandibular cortical width is the measurement of the cortical width at the mental foramen region and is assessed according to the technique described by Ledgerton et al.<sup>38</sup> in which the mental foramen is identified and a line is traced which passes perpendicular to the tangent of the lower border of the mandible and through the center of the mental foramen. The cortical width is measured at this point.

#### **Panoramic mandibular index (PMI):-**

The Panoramic mandibular index (PMI) as described by Benson et al.<sup>29</sup> is the ratio of the thickness of the mandibular cortex to the distance between the mental foramen and the inferior mandibular cortex.

#### **Alveolar bone loss (ABL):-**

Alveolar bone loss<sup>54</sup> (ABL) of the mandible is the ratio of the radiographic mandibular total bone height to the height from the center of the mental foramen to the inferior border of the mandible. The mandibular total bone height (TBH) and basal bone height (BBH; height from the centre of the mental foramen to the inferior border of the mandible) at the site of the mental foramen were measured bilaterally. Mean TBH/BBH ratio on both sides was defined as the degree of alveolar bone loss of the mandible.

#### **Heights in the first premolar and molar region (Hp and Hm):-**

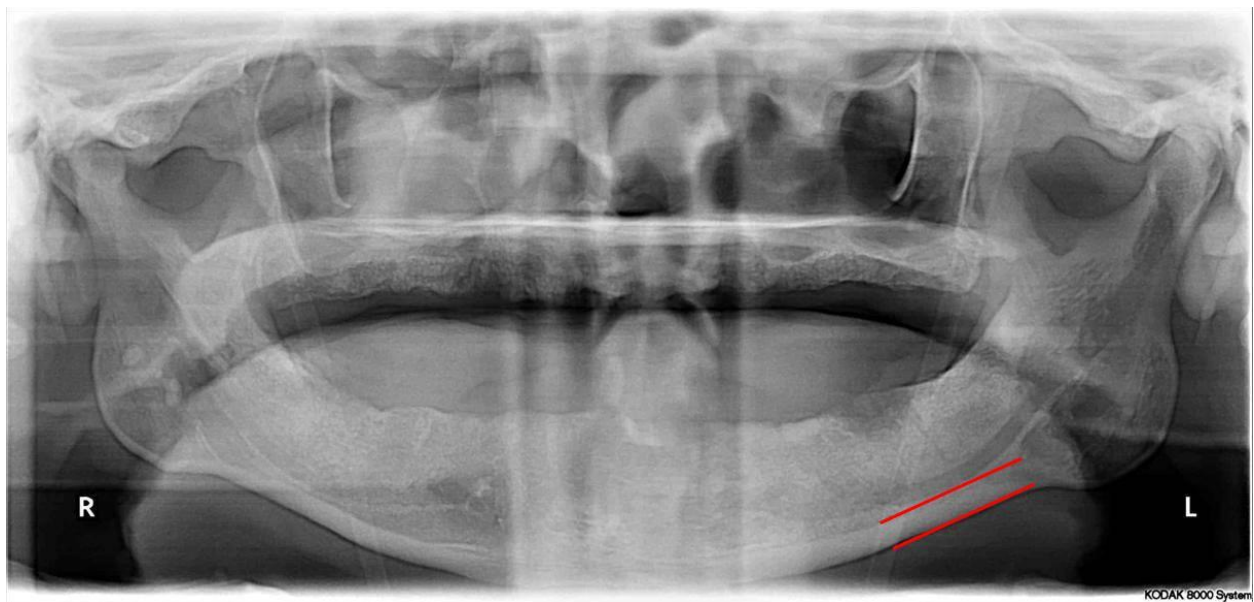
Heights in the first premolar and molar region were measured according to measurement locations described by Guleret al.<sup>46</sup> i.e., by drawing a line tangential to the most inferior points at the mandibular angle and the lower border of the mandibular body. Horizontal lengths of the mandible were measured parallel to the tangent at 10 mm above the lower border of the mandible. According to results from the dentate subjects, the first premolar and the first molar were located approximately 35 and 55%, respectively, of the length of the mandibular body from the midline. The measurements Y1 (midline), Y2 (mandibular first premolar) and Y3 (mandibular first molar) were vertical distances from the interior border of mandible to the alveolar crest.

#### **Statistical Analysis:-**

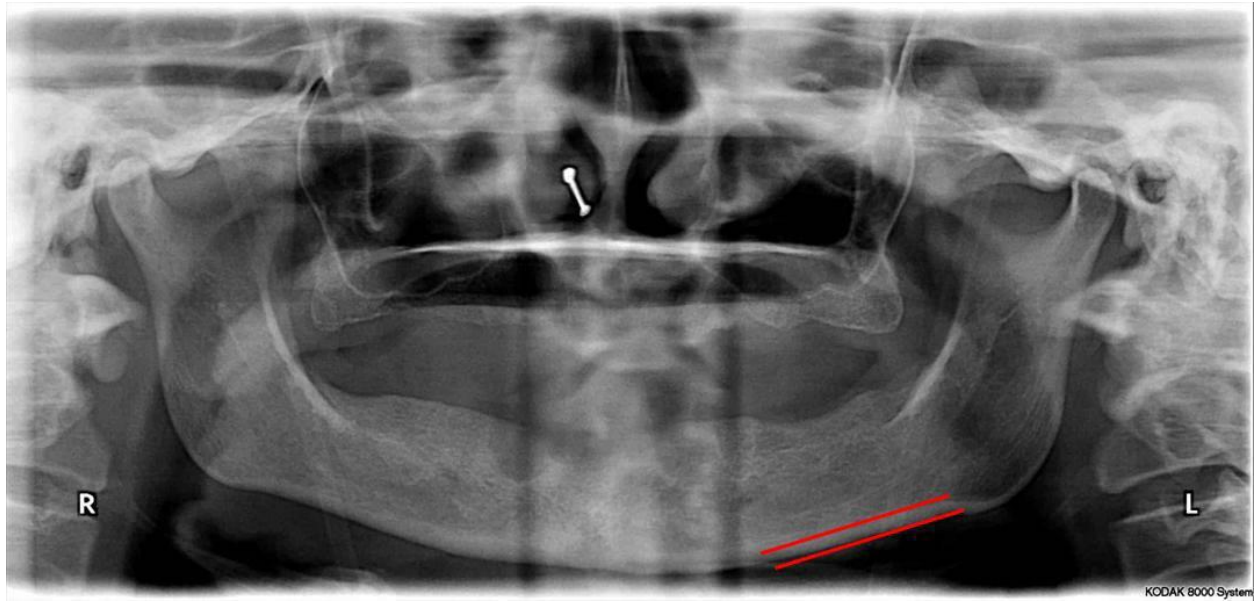
The obtained data will be calculated and subjected to relevant statistical analysis using chi-square and 2-way ANOVA tests for proportions.



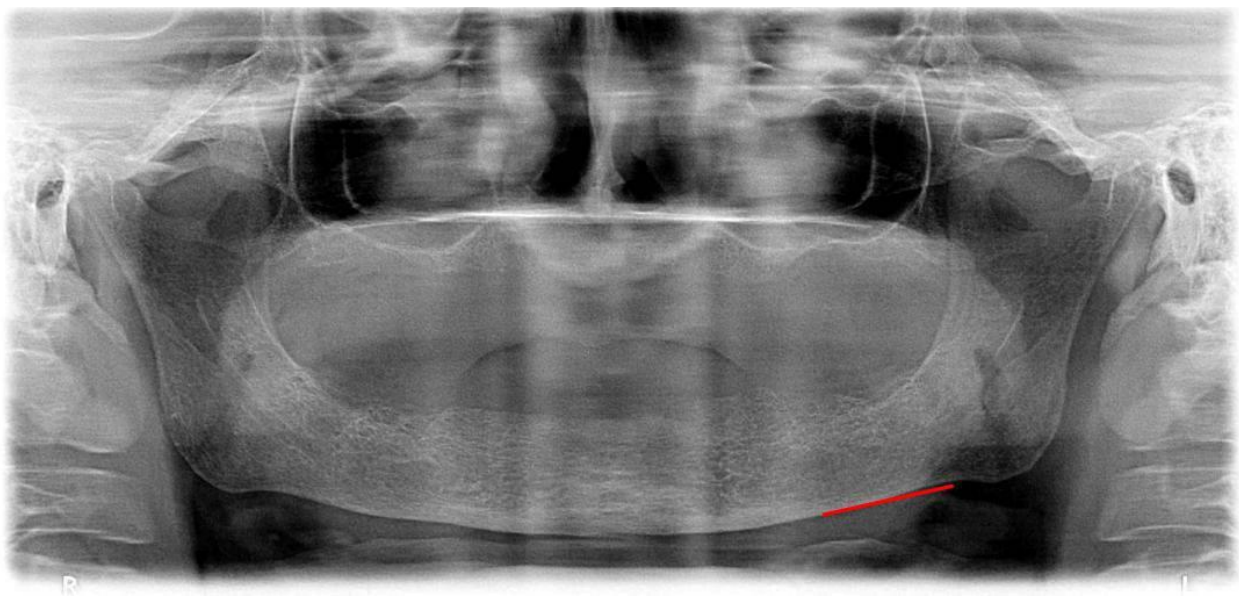
**Figure 1:-**Digital Panoramic Machine



**Figure 2:-** C1 Category of Mandibular cortical Index (MCI)

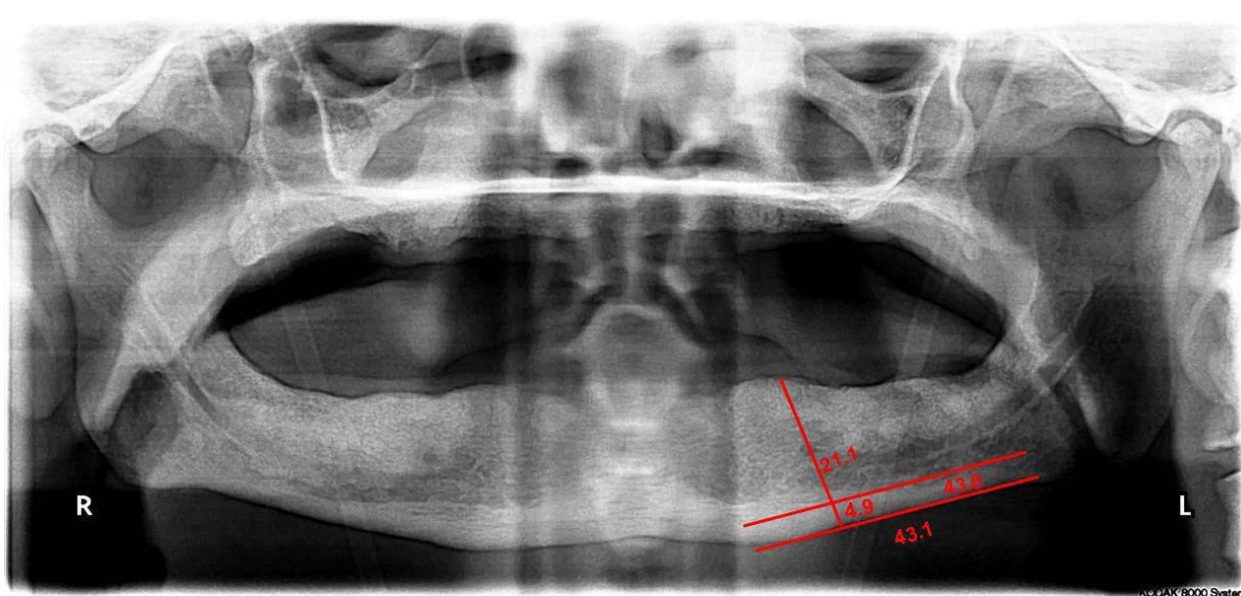


**Figure 3:-C2 Category of Mandibular cortical Index (MCI)**

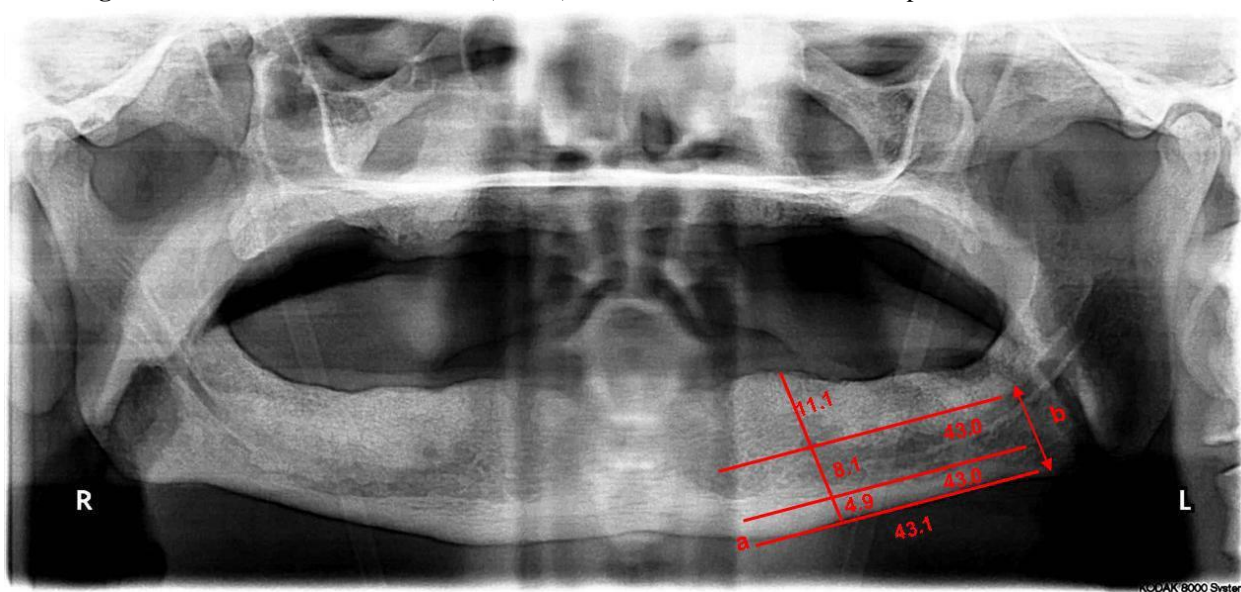


**Figure 4:-C3 Category of Mandibular cortical Index (MCI)**



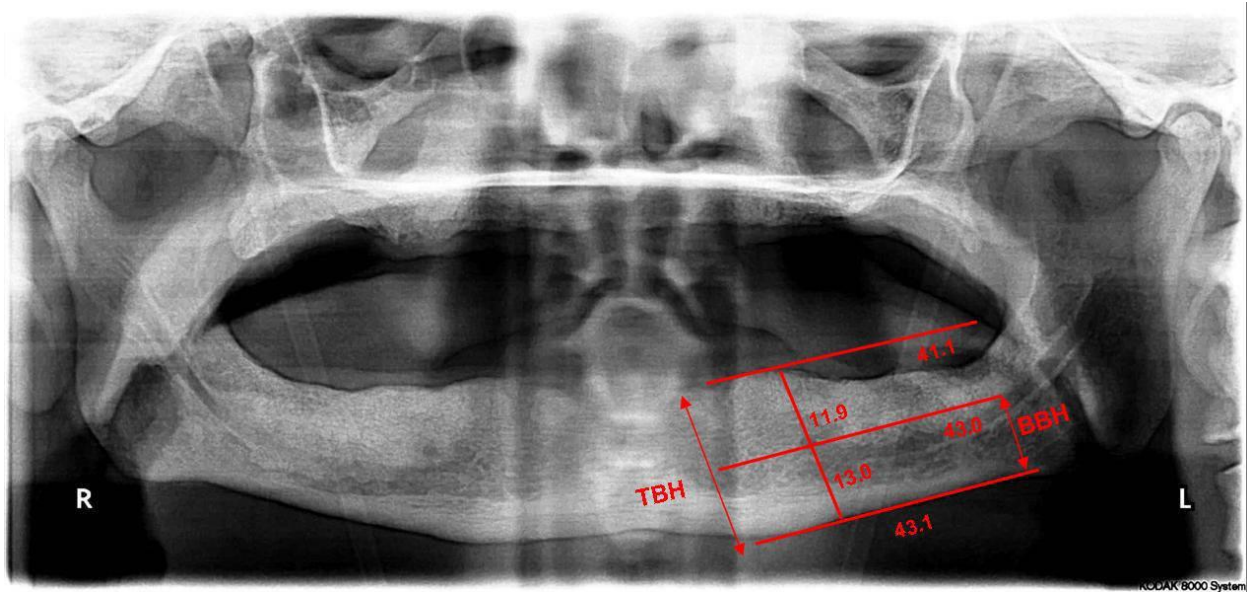


**Figure 5:-**Mandibular Cortical Width (MCW); The distance between the two parallel lines is the MCW

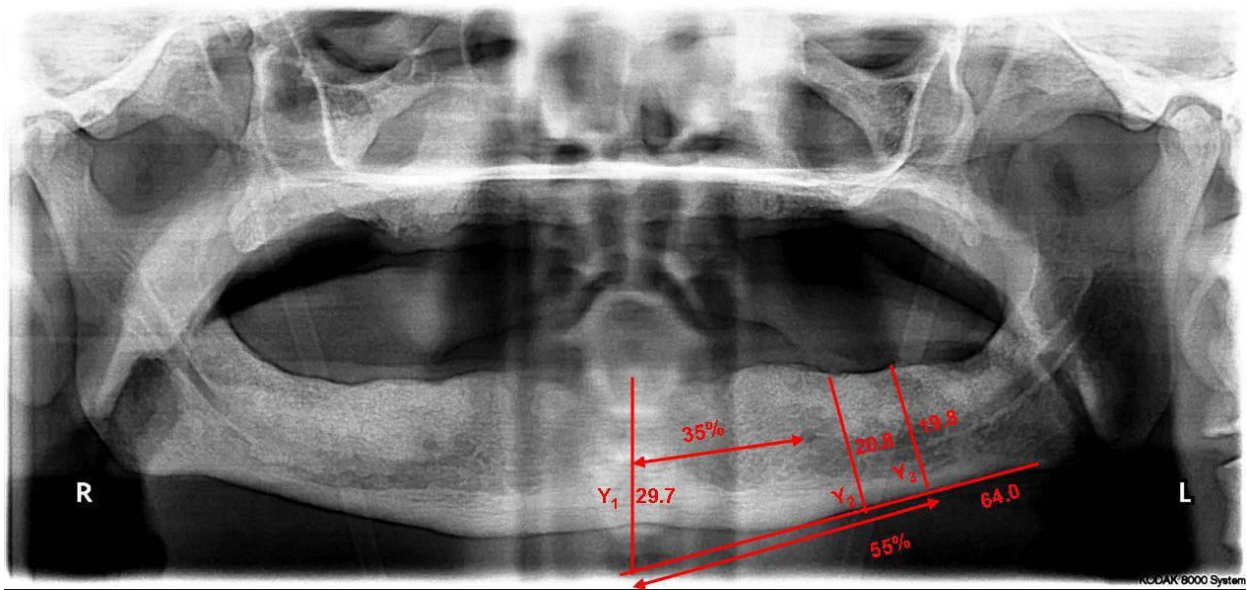


**Figure 6:-**Panoramic Mandibular Index (PMI)





**Figure 7:-Alveolar Bone Loss (ABL)**



**Fig 8:-Heights in the first premolar (Y1) and molar region (Y2)**

### Results:-

In the present study, digital panoramic radiographs of subjects with completely edentulous maxillary and mandibular ridges in the age group of 50 to 80 years were studied to investigate the influence of age and gender on the mandibular cortical index, panoramic mandibular index, and mandibular cortical width, as well as alveolar bone loss and bone height in first premolar and molar region.

Of the 75 patients, 32 (42%) were men and 43 (57.3%) were women. Only 2 categories of MCI (C2 and C3) were detected. The association between MCI and age group was not statistically significant in males ( $P > 0.05$ ).

In females, the association between MCI and age group was found to be statistically significant ( $P < 0.01$ ). Females in  $\leq 60$  years age group were found to be more associated with C2 whereas females in  $> 60$  years age group were found to be more associated with C3. (Table No. 1 and 2)

The difference between males and females with respect to mean MCW is found to be statistically significant ( $P < 0.001$ ) indicating that gender is a significant factor influencing MCW. However, age group is not a significant factor influencing MCW ( $P > 0.05$ ) and the interaction (joint effect) of gender and age group on MCW is not statistically significant ( $P > 0.05$ ). (Table No. 3 to Table No.7)

Neither gender nor age group or the interaction of gender and age group are found to be significantly influencing PMI. (Table No. 3 to Table No.7) Statistically significant difference is observed between males and females with respect to alveolar bone loss. The difference between the two age groups is also found to be statistically significant in females but not in males. (Table No. 3 to Table No.7)

Statistically significant difference is observed between males and females with respect to mean height of premolar ( $P < 0.01$ ). The difference between the two age groups is also found to be statistically significant ( $P < 0.01$ ). But the interaction of gender and age group on height of premolar is not statistically significant ( $P > 0.05$ ). This shows that gender and age group individually influence the height of premolar. (Table No. 3 to Table No.7)

Statistically significant difference is observed between males and females with respect to mean height of molar ( $P < 0.01$ ). The difference between the two age groups is also found to be statistically significant ( $P < 0.01$ ). But the interaction of gender and age group on height of molar is not statistically significant ( $P > 0.05$ ). This shows that gender and age group individually influence the height of molar. (Table No. 3 to Table No.7)

**Table 1:-Comparison of Age group and MCI**

Gender	Age group	C2		C3		Total	$\chi^2$	P Value
		n	%	n	%			
Male	$\leq 60$ yrs	7	78	2	22	9	2.358	0.125
	$> 60$ yrs	11	48	12	52	23		
Female	$\leq 60$ yrs	14	88	2	13	16	11.848	0.001*
	$> 60$ yrs	9	33	18	67	27		

\*de notes significant association

**Table 2:-Distribution (%) of mandibular cortical index (MCI) classifications (category C2, mild erosions; category C3, severe erosions on endosteal margin of mandible) according to Age and Gender.**

Males	C2 (in %)	C3 (in %)
60 years	78	22
> 60 years	48	52
Females	C2 (in %)	C3 (in %)
60 years	88	13
> 60 years	33	67

**Table 3:-Mean of various parameters according to Gender.**

Parameter	Gender	Mean	SD	Median	Min	Max
MCW	Male	4.23	0.67	4.15	2.80	5.50
	Female	3.51	0.85	3.60	2.00	4.80
PMI	Male	0.31	0.04	0.31	0.22	0.40
	Female	0.29	0.06	0.28	0.17	0.48
ABL	Male	1.89	0.20	1.83	1.60	2.40
	Female	1.99	0.06	1.99	1.81	2.08
Height of Premolar	Male	25.93	3.00	26.20	17.10	31.00
	Female	23.28	3.31	23.00	16.00	28.50
Height of molar	Male	24.43	3.07	24.90	14.30	29.50
	Female	22.15	3.23	21.90	14.70	27.70

**Table 4:-**Mean of various parameters according to Age group

Parameter	Age group	Mean	SD	Median	Min	Max
MCW	≤ 60 yrs	3.99	0.78	4.10	2.00	5.50
	> 60 yrs	3.73	0.88	3.85	2.00	5.50
PMI	≤ 60 yrs	0.31	0.05	0.29	0.17	0.42
	> 60 yrs	0.30	0.06	0.29	0.17	0.48
ABL	≤ 60 yrs	1.97	0.09	2.00	1.80	2.08
	> 60 yrs	1.90	0.15	1.91	1.60	2.40
Height of Premolar	≤ 60 yrs	25.70	3.04	26.40	16.00	29.70
	> 60 yrs	23.76	3.45	24.40	17.10	31.00
Height of Molar	≤ 60 yrs	24.47	2.93	25.10	14.70	28.30
	> 60 yrs	22.45	3.36	23.10	14.30	29.50

**Table 5:-**Mean value of various parameters according to age group within Males

Parameter	Age group	Mean	SD	Median	Min	Max
MCW	≤ 60 yrs	4.38	0.63	4.20	3.40	5.50
	> 60 yrs	4.17	0.69	4.10	2.80	5.50
PMI	≤ 60 yrs	0.31	0.03	0.31	0.26	0.37
	> 60 yrs	0.31	0.04	0.31	0.22	0.40
ABL	≤ 60 yrs	1.96	0.12	2.03	1.80	2.06
	> 60 yrs	1.86	0.22	1.81	1.60	2.40
Height of Premolar	≤ 60 yrs	27.22	2.34	26.70	22.40	29.70
	> 60 yrs	25.42	3.12	25.60	17.10	31.00
Height of Molar	≤ 60 yrs	25.97	2.03	25.80	21.70	28.30
	> 60 yrs	23.83	3.24	24.40	14.30	29.50

**Table 6:-**Mean value of various parameters according to age group within Females

Parameter	Age group	Mean	SD	Median	Min	Max
MCW	≤ 60 yrs	3.78	0.78	3.95	2.00	4.70
	> 60 yrs	3.35	0.86	3.50	2.00	4.80
PMI	≤ 60 yrs	0.31	0.06	0.29	0.17	0.42
	> 60 yrs	0.28	0.06	0.27	0.17	0.48
ABL	≤ 60 yrs	1.99	0.07	1.99	1.81	2.08
	> 60 yrs	1.95	0.05	1.93	1.81	2.01
Height of Premolar	≤ 60 yrs	24.84	3.12	25.95	16.00	28.30
	> 60 yrs	22.35	3.12	23.00	17.30	28.50
Height of Molar	≤ 60 yrs	23.63	3.07	24.60	14.70	27.20
	> 60 yrs	21.28	3.04	21.60	16.80	27.70

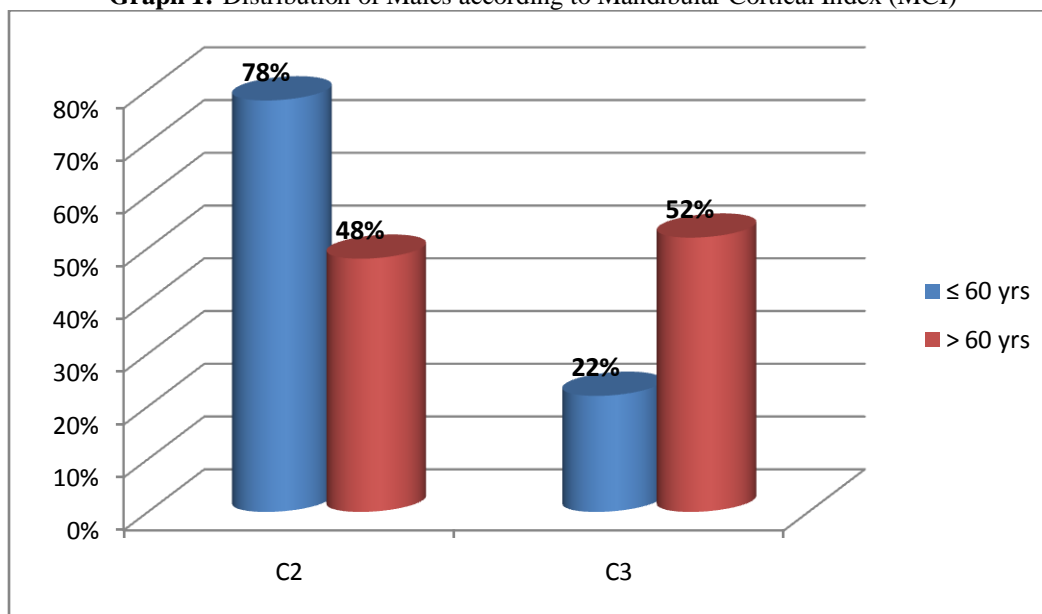
**Table 7:-**Effect of Age & Gender on different parameters

Parameter	Factor	Sum of squares	Mean	F	P value
MCW	Gender	7.940	7.940	13.371	<0.001*
	Age group	1.569	1.569	2.641	0.109
	Gender*Age Group	0.182	0.182	0.306	0.582
PMI	Gender	0.003	0.003	1.057	0.307
	Age group	0.001	0.001	0.389	0.535
	Gender*Age Group	0.002	0.002	0.818	0.369
ABL	Gender	0.024	0.024	1.287	0.260
	Age group	0.076	0.076	4.135	0.046

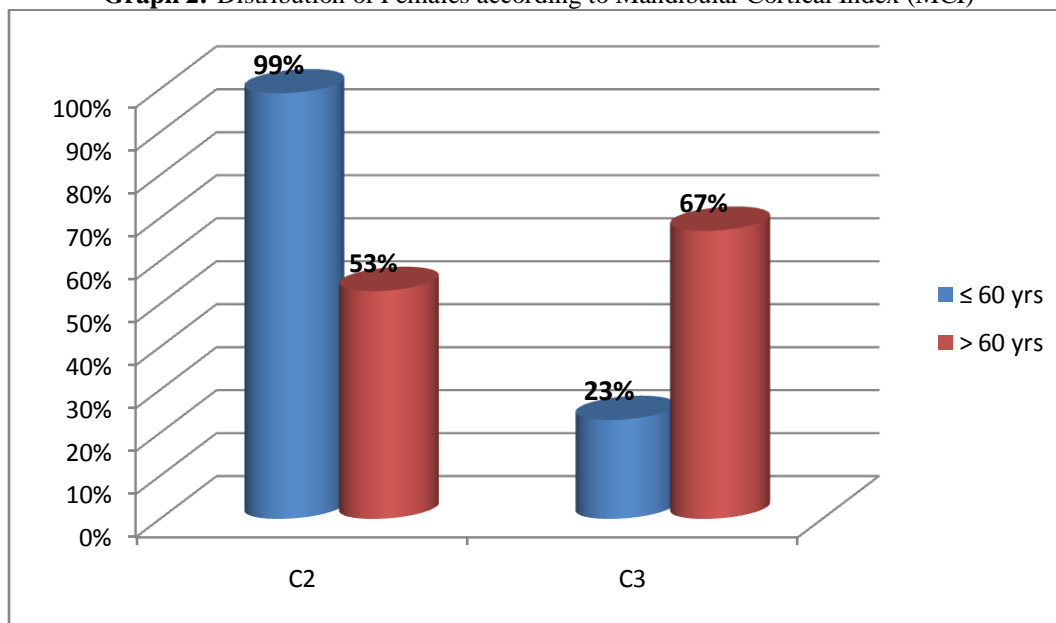
	Gender*Age Group	0.012	0.012	0.665	0.047
Height in premolar	Gender	116.892	116.892	12.653	0.001*
	Age group	72.437	72.437	7.841	0.007*
	Gender*Age Group	1.824	1.824	0.197	0.658
Height in molar	Gender	94.429	94.429	10.382	0.002*
	Age group	78.947	78.947	8.680	0.004*
	Gender*Age Group	0.182	0.182	0.020	0.888

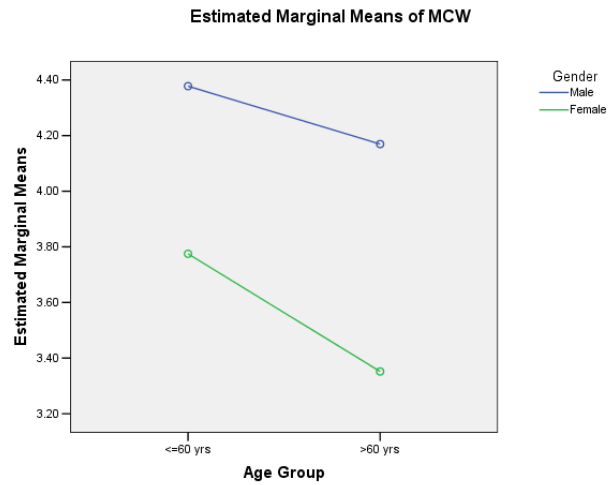
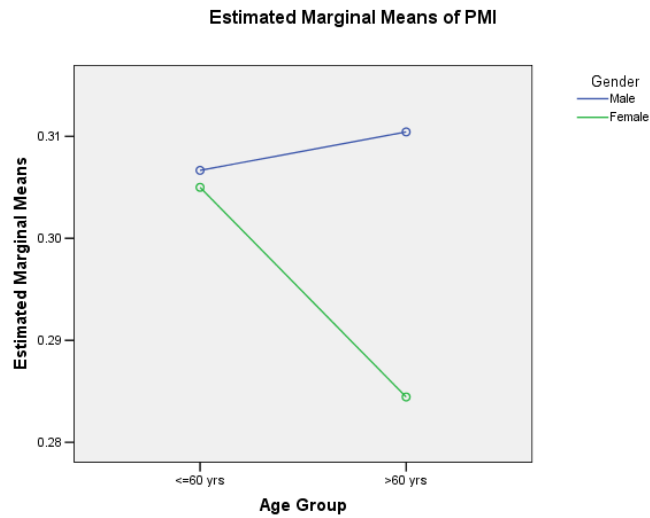
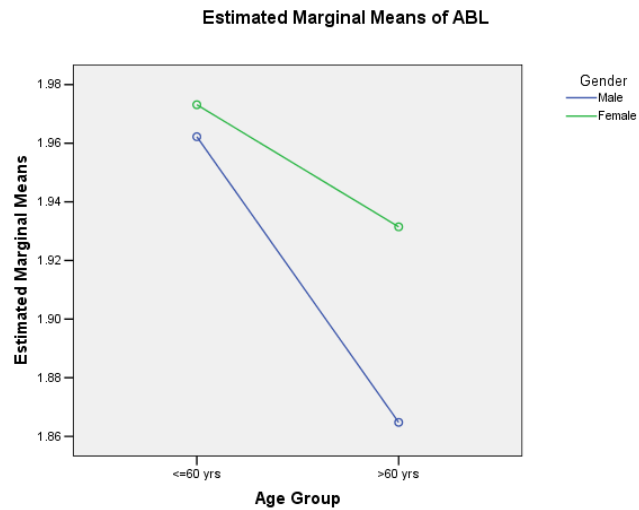
\*de notes significance

**Graph 1:-Distribution of Males according to Mandibular Cortical Index (MCI)**



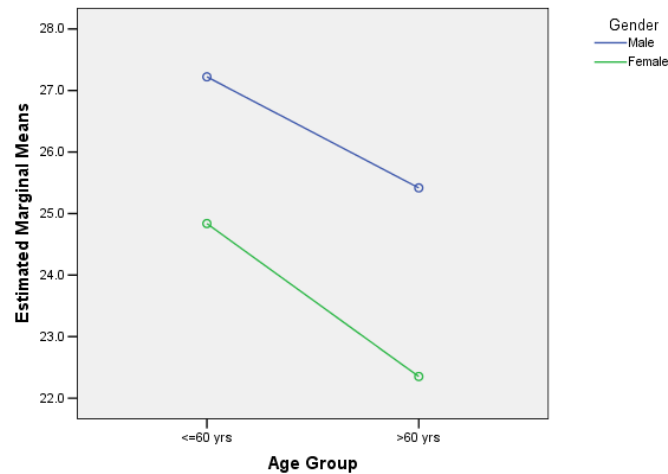
**Graph 2:-Distribution of Females according to Mandibular Cortical Index (MCI)**



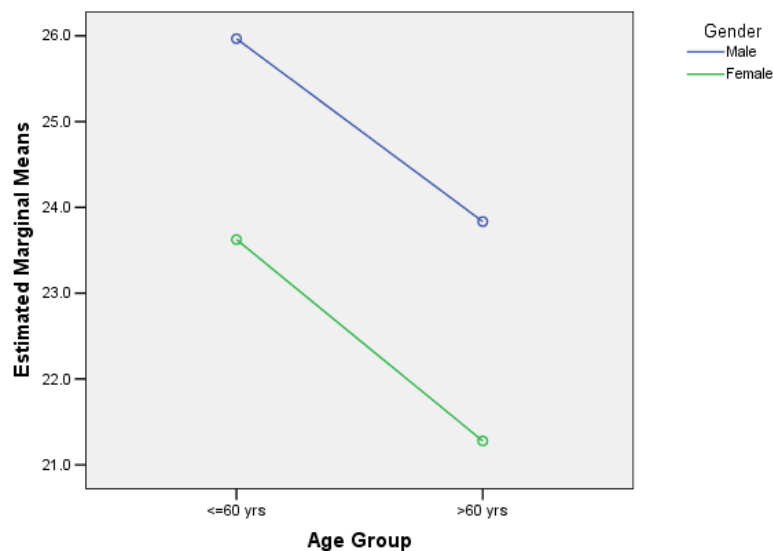
**Graph 3:-**Estimated marginal means of Mandibular Cortical Width (MCW)**Graph 4:-**Estimated marginal means of Panoramic Manibular Index (PMI)**Graph 5:-** Estimated marginal means of Alveolar Bone Loss (ABL)

**Graph 6:-** Estimated marginal means of Height in Premolar (Hp)

Estimated Marginal Means of Height in Premolar

**Graph 7:-** Estimated marginal means of Height in Molar (Hm)

Estimated Marginal Means of Height in Molar

**Discussion:-**

The present study provides new findings on the effects of age and gender on radiomorphometric indices, ABL and bone heights in the first premolar and molar region, all in a group of completely edentulous individuals. Alveolar atrophy after the removal of teeth and the presence of tooth components in both the upper and lower jaws of edentulous patients has always been topics of discussion for dentists. This study attempted to assess the diagnostic validity of panoramic radiomorphometric indices to investigate the influence of age and gender on the mandibular cortical index, panoramic mandibular index, and mandibular cortical width, as well as alveolar bone loss and bone heights in the first premolar and molar region as all these factors have implications on treatment planning, with special regard to reconstructive procedures, subsequent implant treatment, and removable complete dentures.

Previous studies showed that minor anteroposterior shifts and tilts are associated with small variations (less than 2%) in vertical measurements. In the present study, all measurements were reduced to the original size of the mandibular features, according to the magnification of the panoramic machine used i.e., at correction of 1.27% magnification. This compensation allowed for comparison with other studies, because different panoramic machines

have different magnification factors. Additionally, a study<sup>63</sup> showed that mandibular angular measurements in panoramic radiographs revealed a high degree of accuracy when proper patient positioning was achieved.

Recent studies<sup>18,41</sup> indicate that dental panoramic radiography may be one of the tools for detecting a high risk of osteoporotic fracture. In light of these observations, this study attempted to investigate the influence of age and gender on the radiomorphometric indices which included mandibular cortical index, panoramic mandibular index, and mandibular cortical width, as well as alveolar bone loss and bone height using panoramic radiographs of edentulous patients.

#### **Mandibular Cortical Index (MCI):-**

MCI is a simple, qualitative, 3-point index with fairly good reproducibility. In the present study, only C2 and C3 categories were observed in the study group of edentulous patients. This may be attributable to the fact that the group of selected patients was relatively older, in comparison to the age of <sup>30</sup>, when the first signs of bone loss start to manifest radiographically.<sup>6</sup>

The association between MCI and age group was not statistically significant in males. However in females, the association between MCI and age group was found to be statistically significant. Females in  $\leq 60$  yrs age group are found to be more associated with C2 whereas females in  $>60$  yrs age group are found to be more associated with C3. The result in the present study was found to be in accordance with the study carried out by Knezovic Z et al.<sup>39</sup> which stated that the age-related distribution of MCI showed an age-related increase in the numbers of individuals with C3 cortex appearance, and a significantly higher incidence of women who had C3 cortices in an older age group and no difference was found in the distribution of men and women between MCI categories C2 and C3.

In the study conducted by Yuzugullu B et al.<sup>54</sup> (2009) only 2 categories of MCI (C2/56.4% and C3/43.6%) were detected. There were no significant differences in C2 and C3 categories of MCI between age groups in men. Category C2 was more frequently seen in age groups of  $\leq 60$ , and category C3 was more frequently observed in age groups of  $>60$  in women. When compared to our study the MCI categories were found to be similar to the above study. However, Taguchi et al.<sup>32</sup> identified a far greater proportion of C1 cortices in their study of 124 Japanese women in a broad age band ( $33 \pm 68$  years). This may reflect ethnic differences or a difference in the interpretation of the definitions of the MCI groups.

#### **Mandibular Cortical Width (MCW):-**

In the present study, the difference between males and females with respect to mean Mandibular cortical width is found to be statistically significant ( $P < 0.001$ ) indicating that gender is a significant factor influencing MCW. It was found that mean MCW values did not change as age increased in men, the mean MCW values decreased significantly with age in women. The results in the current study for the mean values of MCW demonstrate an age-related decrease in women which was in agreement with the results reported by previous studies.<sup>38,44,54</sup>

The results by Knezovic Z et al.<sup>39</sup> suggested a general decrease of MCW for both genders until the age of 75, when the values begin to decrease sharply for women compared to men. No differences with dental status were assessed. In another study by Robert et al.<sup>59</sup> there was pattern of decrease in mandibular cortical width in women after the age of 42.5 years and in men there was slow linear decrease in MCW after age of 36 years. Only a few studies<sup>39,44,52</sup> have evaluated the changes in MCW for men. The present study revealed that men showed a stable profile concerning MCW values, irrespective of an increase in age.

#### **PMI (Panoramic Mandibular Index):-**

Horner and Devlin<sup>37</sup> have shown that the panoramic mandibular index can be used for evaluation of osteoporosis status however, he also suggested that the PMI has no significant advantage over the MCW whereas, Drozdowska et al.<sup>64</sup> concluded that the PMI might be used as an indicator of bone mineral changes when PMI values deviate markedly from the mean.

According to Benson et al.<sup>29</sup> mean panoramic mandibular index values increase in the elderly. Previous studies<sup>29,38</sup> about PMI values that have been performed primarily on women have found PMI values between 0.31 to 0.38 which are higher than the mean value of 0.27 to 0.29 found in present study. These differences may not only be due to ethnic origins, but may arise due to the inclusion of partially edentulous patients, in addition to completely edentulous individuals. The present mean PMI values for edentulous patients agree with those of Gulsahiet al.<sup>52</sup> who

reported mean PMI values of 0.30, 0.32, and 0.22 for C1, C2, and C3 categories, respectively, in a large, mixed, study population. In the present study the mean PMI values for women were found to be 0.27 to 0.29 and for men it was 0.31 which was in accordance with the studies done by Yuzugullu B et al.<sup>54</sup> and Estin et al.<sup>57</sup>

#### **Alveolar bone loss (ABL):-**

In the present study the alveolar bone loss in the edentulous mandible was more pronounced in women than in men. Ortman et al.<sup>65</sup> and Baat et al.<sup>66</sup> reported similar results. Similarly in the study done by Humphries et al.<sup>28</sup> it was found that the age of the subject had a significant effect on residual alveolar ridge resorption in women, but not in men. Some clinicians have observed that alveolar ridge reduction occurs quickly following the menopause and is accompanied by a more generalized skeletal osteoporosis. However according to study done by Yuzugullu et al.<sup>54</sup> it was found that ABL was not affected by age according to gender. This finding was in agreement with the results of Soikkonen et al.<sup>21</sup> who concluded that in both genders, ABL does not increase significantly with age but in a study done by Cagri et al.<sup>58</sup> it was found that the decrease in the height of the edentulous mandible was more pronounced in women than in men. This may be due to the reason that in postmenopausal women, deficiency of estrogen hormone accelerates skeletal bone loss and may result in rapid alveolar bone resorption.<sup>9</sup>

#### **Height in premolar and Molar region (Hp and Hm):-**

In the present study the measurement value of the mandible at first premolar and first molar regions were greater in men than women, which was in agreement with Guler et al.<sup>46</sup> and Saglam.<sup>40</sup> Residual ridge resorption is usually more rapid in the premolar and molar region than the anterior region of the mandible because of the lower position of the reversal line in the posterior region.<sup>13</sup> The reversal line on the lingual side occurs along the mylohyoid ridge, which is the limit between the resorptive alveolar field and depository field of the basal bone.<sup>13</sup>

However Yuzugullu et al.<sup>54</sup> also evaluated the heights in premolar and molar region and concluded that the heights were similar in men and women, in contrast to the findings of Guler et al.<sup>46</sup> who found that measurements of vertical height in the edentulous women were lower than that of the men which may be due to parameters such as general health, denture wearing habits, nutrition, or medication intake were not included, which may have affected the outcome related to gender. According to the results of Xie et al.<sup>35</sup> and Mercier<sup>13</sup> the most pronounced percentage reduction in total height of the mandibular body was found at the first premolar and first molar sites. In the present study, the findings related to the edentulous mandible were similar to these studies although no comparison was made between dentate and edentulous mandible.

#### **Conclusion:-**

1. Category C3 of the mandibular cortical index, in which the cortical layer forms clearly porous heavy endosteal cortical residues, was more frequently seen in women over 60 years in age whereas, Category C2 was more frequently seen in women below 60 years. However the association between MCI and age group was not statistically significant in males.
2. The values of mean cortical width (MCW) at the mental foramen region decreased significantly with age in women ( $P < 0.001$ ).
3. The ratio of the thickness of the mandibular cortex to the distance between the mental foramen and the inferior mandibular cortex (PMI), was not affected by gender or age.
4. In the present study the measurement value of the mandible at first premolar and first molar regions were greater in men than women.
5. In this study the alveolar bone loss in the edentulous mandible was more pronounced in women than in men.

#### **References:-**

1. Von W N. General and oral aspects of osteoporosis: a review. Clin Oral Investig 2001; 5: 71 – 82.
2. Atwood DA. Some clinical factors related to rate of resorption of residual ridges. J Prosthet Dent 2001; 86: 119-125
3. Wyatt CLL. The effect of prosthodontic treatment on alveolar bone loss: A review of the literature. J Prosthet Dent 1998; 80:362-6.
4. Knezovic Z D, Celebic A. Mandibular bone mineral density changes in complete and removable partial denture wearers: a 6 - month follow-up study. Int J Prosthodont 2003; 16:661-5.
5. Mangos JF. The healing of extraction wounds. An experimental study based on microscopic and radiographic investigations. Br Dent J 1959;71:10-7.



6. Heersche JN, Bellows CG, Ishida Y. The decrease in bone mass associated with aging and menopause. *J Prosthet Dent* 1998;79:14-6.
7. Bianchi A, Sanfilippo F. Osteoporosis: the effect on mandibular bone resorption and therapeutic possibilities by means of implant prostheses. *Int J Periodontics Restorative Dent* 2002;22:231-9.
8. Carlsson GE, Persson G. Morphologic changes of the mandible after extraction and wearing of dentures. A longitudinal, clinical, and x-ray cephalometric study covering 5 years. *Odontol Revy* 1967;18:27-54.
9. Devlin H, Ferguson MW. Alveolar ridge resorption and mandibular atrophy. A review of the role of local and systemic factors. *Br Dent J* 1991;170:101-4.
10. Atwood DA. Reduction of residual ridges: a major oral disease entity. *J Prosthet Dent* 1971;26:266-79.
11. Tallgren A, Lang BR, Walker GF, Ash MM. Roentgen cephalometric analysis of ridge resorption and changes in jaw and occlusal relationships in immediate complete denture wearers. *J Oral Rehabil* 1980;7:77-94.
12. Bairam LR, Miller WA. Mandible bone resorption as determined from panoramic radiographs in edentulous male individuals aged 25-80 years. *Gerodontology* 1994;11:805.
13. Mercier P. Ridge reconstruction with hydroxylapatite. Part 1. Anatomy of the residual ridge. *Oral Surg Oral Med Oral Pathol* 1988;65:505-10.
14. Carlsson GE, Haraldson T. Fundamental aspects of mandibular atrophy. In: Worthington P, Branemark PI. *Advanced osseointegration surgery. Applications in the maxillofacial region*. Chicago Quintessence; 1992:109-18.
15. Narhi TO, Ettinger RL, Lam EW. Radiographic findings, ridge resorption, and subjective complaints of complete denture patients. *Int J Prosthodont* 1997;10:183-9.
16. Xie Q, Ainamo A, Tilvis R. Association of residual ridge resorption with systemic factors in home-living elderly subjects. *Acta Odontol Scand* 1997;55:299-305.
17. Klemetti E, Kolmakov S, Kroger H. Pantomography in assessment of the osteoporosis risk group. *Scand J Dent Res* 1994;102:68-72.
18. Taguchi A, Tsuda M, Ohtsuka M, Kodama I, Sanada M, Nakamoto T. Use of dental panoramic radiographs in identifying younger postmenopausal women with osteoporosis. *Osteoporos Int* 2006;17:387-94.
19. Devlin H, Allen P, Graham J, Jacobs R, Nicopoulou K, Lindh C et al. The role of the dental surgeon in detecting osteoporosis: the OSTEODENT study. *Br Dent J* 2008;204(10):16.
20. Horner K, Devlin H, Alsop CW, Hodgkinson IM, Adams JE. Mandibular bone mineral density as a predictor of skeletal osteoporosis. *Br J Radiol* 1996;69:1019-25.
21. Soikkonen K, Ainamo A, Xie Q. Height of the residual ridge and radiographic appearance of bony structure in the jaws of clinically edentulous elderly people. *J Oral Rehabil* 1996;23:470-5.
22. G. V. Packota, J. N. Hoover, B. D. Neufeld. A study of the height of intact alveolar bone on panoramic radiographs of adult patients. *J Prosthet Dent* 1998;60:504-508.
23. Carlsson GE, Ragnarson N, Astrand P. Changes in height of the alveolar process in edentulous segments. A longitudinal clinical and radiographic study of full upper denture cases with residual lower anteriors. *Odont Tidskr* 1967;75:193-208.
24. Mercier P, Lafontant R. Residual alveolar ridge atrophy: classification and influence of facial morphology. *J Prosthet Dent* 1979;41:90-100.
25. Wical KE, Swoope CC. Studies of residual ridge resorption. Part I. Use of panoramic radiographs for evaluation and classification of mandibular resorption. *J Prosthet Dent* 1974;32:7-12.
26. Bras J, Ooij CP, Abraham L, Kusen GJ, Wilmsink JM. Radiographic interpretation of the mandibular angular cortex: A diagnostic tool in metabolic bone loss: Part I. Normal state. *Oral Surg Oral Med Oral Pathol* 1982;53:541-545.
27. Wilding RJ, Levin I, Pepper R. The use of panoramic radiographs to measure alveolar bone areas. *J Oral Rehabil*. 1987;14(6):557-67.
28. Humphries S, Devlin H, Worthington H. A radiographic investigation into bone resorption of mandibular alveolar bone in elderly edentulous adults. *J Dent* 1989;17:94-96.
29. Byron W, Benson, Thomas J, Prihoda, Birgit J. Glass. Variations in adult cortical bone mass as measured by a panoramic mandibular index. *Oral Surg Oral Med Oral Pathol* 1991;71:349-356.
30. Leong IT, Slabbert JC, Becker PJ. The value of radiographic predictors of the rate of mandibular residual ridge resorption. *J Prosthet Dent* 1992;68:69-73.
31. Karaagaçlıoğlu L, Ozkan P. Changes in mandibular ridge height in relation to aging and length of edentulism period. *Int J Prosthodont* 1994 Jul-Aug;7(4):368- 71.
32. Latifa R, William A, Miller. Mandible bone resorption as determined from panoramic radiographs in edentulous male individuals aged 25 – 80 years. *Gerodontology* 1994 Dec;11(2):80-5.

33. Taguchi A, Suei Y, Ohtsuka M, Otani K, Tanimoto K, Ohtaki M. Usefulness of panoramic radiography in the diagnosis of postmenopausal osteoporosis in women. Width and morphology of inferior cortex of the mandible. *DentomaxillofacRadiol* 1996 Nov;25(5):263-7.
34. Klemetti E and Kolmakow S. Morphology of the mandibular cortex on panoramic radiographs as an indicator of bone quality. *DentomaxillofacRadiol* 1997 26: 22- 25.
35. Xie Q, Wolf J, Ainamo A. Quantitative assessment of vertical heights of maxillary and mandibular bones in panoramic radiographs of elderly dentate and edentulous subjects. *ActaOdontolScand* 1997 Jun;55(3):155-61.
36. Xie Q, Wolf J, Tilvis R, Ainamo A. Resorption of mandibular canal wall in the edentulous aged population. *J Prosthet Dent* 1997 Jun;77(6):596-600.
37. Horner K, Devlin H. The relationship between mandibular bone mineral density and panoramic radiographic measurements. *J Dent* 1998 May;26(4):337-43
38. Ledgerton D, Horner K, Devlin H, Worthington H. Radiomorphometric indices of the mandible in a British female population. *DentomaxillofacRadiol* 1999 May;28(3):173-81.
39. Knezovic ZD, Celebi CA, Lazi CB, Bauci CI, Komar D et al. Influence of age and gender on radiomorphometric indices of the mandible in removable denture wearers. *CollAntropol* 2002 Jun;26(1):259-66.
40. Saglam AA. The vertical heights of maxillary and mandibular bones in panoramic radiographs of dentate and edentulous subjects. *Quintessence Int* 2002 Jun;33(6):433-8.
41. Zlataric DK, Celebic. A Clinical bone densitometric evaluation of the mandible in removable denture wearers dependent on the morphology of the mandibular cortex. *J Prosthet Dent* 2003 Jul;90(1):86-91.
42. Tallgren A. The continuing reduction of the residual alveolar ridges in complete denture wearers: a mixed-longitudinal study covering 25 years. *J Prosthet Dent* 2003;89(5):427-35.
43. Xie QF, Ainamo A. Correlation of gonial angle size with cortical thickness, height of the mandibular residual body, and duration of edentulism. *J Prosthet Dent* 2004 May;91(5):477-82.
44. Dutra V, Yang J, Devlin H, Susin C. Radiomorphometric indices and their relation to gender, age, and dental status. *Oral Surg Oral Med Oral Pathol Oral RadiolEndod* 2005 ;99(4):479-84.
45. Lee K, Taguchi A, Ishii K, Suei Y, Fujita M, Nakamoto T, Ohtsuka M, Sanada M, Tsuda M, Ohama K, Tanimoto K, White SC. Visual assessment of the mandibular cortex on panoramic radiographs to identify postmenopausal women with low bone mineral densities. *Oral Surg Oral Med Oral Pathol Oral RadiolEndod* 2005;100(2):226-31.
46. Guler AU, Sumer M, Sumer P, Biçer I. The evaluation of vertical heights of maxillary and mandibular bones and the location of anatomic landmarks in panoramic radiographs of edentulous patients for implant dentistry. *J Oral Rehabil* 2005 ;32(10):741-6.
47. Dutra V, Devlin H, Susin C, Yang J, Horner K et al. Mandibular morphological changes in low bone mass edentulous females: evaluation of panoramic radiographs. *Oral Surg Oral Med Oral Pathol Oral RadiolEndod* 2006;102(5):663-8.
48. Devlin H, Horner K. A study to assess the relative influence of age and edentulousness upon mandibular bone mineral density in female subjects. *Oral Surg Oral Med Oral Pathol Oral RadiolEndod* 2007;104:117-21.
49. Devlin H, Karayianni K, Mitsea A, Jacobs R, Lindh C, Vander P et al. Diagnosing osteoporosis by using dental panoramic radiographs: the OSTEODENT project. *Oral Surg Oral Med Oral Pathol Oral RadiolEndod* 2007;104(6):821-8.
50. Alkurt MT, Peker I, Sanal O. Assessment of repeatability and reproducibility of mental and panoramic mandibular indices on digital panoramic images. *Int Dent J* 2007 Dec;57(6):433-8.
51. Vlasidis KZ, Skouteris CA, Velegrakis GA, Fragouli I, Neratzoulakis JM, Damilakis J, Koumantakis EE. Mandibular radiomorphometric measurements as indicators of possible osteoporosis in postmenopausal women. *Maturitas* 2007;58(3):226-35.
52. Gulsahi A, Yuzugullu B, Imirzalioglu P, Genc Y. Assessment of panoramic radiomorphometric indices in Turkish patients of different age groups, gender and dental status. *DentomaxillofacRadiol* 2008 ;37(5):288-92.
53. Gulsahi A, Ozden S, Ilker A, Ozlem N, Candan S and Yasemin G. The relationship between panoramic radiomorphometric indices and the femoral bone mineral density of edentulous patients *Oral Radiology* 2009;25 (1):47-52.
54. Yuzugullu B, Gulsahi A and Imirzalioglu P. Radiomorphometric indices and their relation to alveolar bone loss in completely edentulous Turkish patients: A retrospective study. *J Prosthet Dent* 2009;101:160-165.
55. Leite AF, Figueiredo PT, Guia CM, Melo NS, de Paula AP. Correlations between seven panoramic radiomorphometric indices and bone mineral density in postmenopausal women. *Oral Surg Oral Med Oral Pathol Oral RadiolEndod* 2010;109(3):449-56.

56. Dagistan S and Bilge OM. Comparison of antegonial index, mental index, panoramicmandibular index and mandibular cortical index values in the panoramic radiographs of normal males and male patients with osteoporosis. *DentomaxillofacRadiol* 2010; 39:290 -294.
57. Hastar E, Huseyin H, Orhan H. Evaluation of Mental Index, Mandibular Cortical Index and Panoramic Mandibular Index on Dental Panoramic Radiographs in the Elderly. *Eur J Dent* 2011;5:60-67.
58. CagriU,Cihan B, Ismail S , Ali MA, Yusuf ZA. Bone height measurement of maxillary and mandibular bones in panoramic radiographs of edentulous patients. *J ClinExp Dent* 2011;3(1):5-9.
59. Roberts M, Yuan J, Graham J, Jacobs R and Devlin H. Changes in mandibular cortical width measurements with age in men and women. *Osteoporosis International* 2011;22(6):1915-1925.
60. Imirzalioglu P, Yuzugullu B, Gulsahi A. Correlation between residual ridge resorption and radiomorphometric indices. *Gerodontology* 2011;10:55-58.
61. Kim YK, Park JY, Kim SG, Kim JS and Kim JD. Magnification rate of digital panoramic radiographs and its effectiveness for pre-operative assessment of dental implants.*DentomaxillofacRadiol* 2011;40:76-83.
62. Mostafa, RA, Ashiry E, Mohamed K, Farid, Mary M. Effect of age, sex, and dental status on mental and panoramic mandibular indices of the mandible: a retrospective study. *Egyptian Journal of Oral &Maxillofac Surgery* 2011;2(1):22 -26.
63. Drozdowska, Pluskiewicz W, Tarnawska B. Panoramic-based mandibular indices in relation to mandibular bone mineral density and skeletal status assessed by dual energy X-ray absorptiometry and quantitative ultrasound *DentomaxillofacRadiol* 2002;31: 361-367.
64. Ortman LF, Hausmann E, Dunford RG. Skeletal osteopenia and residual ridge resorption. *J Prosthet Dent* 1989;61: 321-5.
65. Baat C, Kalk W, Vant HM. Factors connected with alveolar bone resorption among institutionalized elderly people. *Community Dent Oral Epidemiol* 1993;21: 317-20.



## RESEARCH ARTICLE

### LASER DENTISTRY – “Enhancing Dental Perfection”.

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#### Abstract

Application for and research on lasers in dentistry continues to expand since their introduction to the dental profession. Over time, understanding of lasers has grown among researchers and the lasers themselves have become smaller and better suited to dental tasks, eventually making them accurate and safe enough for procedural use. Lasers (an acronym for “light amplification by the stimulated emission of radiation”) deliver energy and heat in the form of light, and their uses in dentistry ranges from cleaning to removing tooth decay; Laser provides more conservative, less invasive treatment of carious lesion therefore laying the foundation for the “minimally invasive era” in today’s dentistry. Dental lasers also significantly contribute to the field of Aesthetic dentistry. A laser in dentistry has allowed dentists to give state of art treatment to their patients. Speed, comfort and ease of approach are some of the advantages of these techniques. This review is aimed to give an overview of the lasers used in dental practice.

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#### Introduction:-

*“A charming smile can open doors and knock down barriers that stand between you and a fuller richer life”.*  
- DUSTE

Light has been used as a therapeutic agent for many centuries. In ancient Greece, the sun was used in heliotherapy, or the exposure of the body to the sun for restoration of health. The Chinese used the sun to treat conditions such as rickets, skin cancer, and even psychosis. The beneficial effects of the sun in the treatment of rickets became apparent in the late 1700s. This use of light for treatment of various pathologies is referred to as phototherapy.<sup>1</sup>

In today’s world, modern science and technology have undergone rapid changes over the past decade than in the previous 100 years combined. It has helped us in achieving pleasing appearances with the advent of newer treatment options, better materials and innovative procedures.

Otolaryngologists, oral surgeons, and periodontists were among the first practitioners to use medical lasers intraorally to perform a variety of soft tissue surgical application.<sup>2</sup> In May, 1990, the first laser designed specifically for general dentistry, the dLase 300 Nd:YAG laser, developed by Myers and Myers, and was cleared by the Food and Drug Administration.<sup>3</sup>

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The newer treatment procedures are conservative, painless and more reliable and contribute towards better esthetic outcome. A laser in dentistry has allowed dentists to give state of art treatment to their patients. Speed, comfort and ease of approach are some of the advantages of these techniques. Thus, the clinician should learn the use of lasers in dentistry, which has been evolving at a rapid rate, leading to a significant expansion of the worldwide base of knowledge, in turn, resulting in rapid development of new ones for the betterment of the society.

### History Of Lasers:-

The experimental work into the physics of laser light production highlighted the attraction of the use of intense radiation energy, of single wavelength, in many military and communications applications. Maiman's laser used a solid ruby as an 'active medium', which was energised or 'pumped' by an electrical source.

Many other kinds of laser were invented soon after the solid ruby laser – the first uranium laser by IBM Laboratories (in November 1960), the first helium-neon laser by Bell Laboratories in 1961 and the first semiconductor laser by Robert Hall at General Electric Laboratories in 1962; the first working neodymium-doped yttrium aluminium garnet (Nd:YAG) laser and CO<sub>2</sub> laser by Bell Laboratories in 1964, argon ion laser in 1964, chemical laser in 1965 and metal vapour laser in 1966. In each case, the 'name' of the laser was annotated with regard to the active medium (source of laser photons) used.<sup>4,5</sup>

Although Maiman had exposed an extracted tooth to his ruby laser in 1960, the possibilities for laser use in dentistry did not occur until 1989, with the production of the American Dental Laser for commercial use. This laser, using an active medium of Nd:YAG, emitted pulsed light and was developed and marketed by Dr Terry Myers, an American dentist. Though low-powered and due to its emission wavelength, inappropriate for use on dental hard tissue, the availability of a dedicated laser for oral use gained popularity amongst dentists. This laser was first sold in the UK in 1990.<sup>6</sup>

### Types Of Lasers In Dentistry:-

The early 1960s witnessed the beginning of dental laser investigations, with attention devoted to developing basic laser parameters as they related to dental hard and soft tissues. Initial investigator used ruby laser to explore tissue interaction with enamel and dentin, later on other wavelengths such as CO<sub>2</sub>, Nd:YAG, argon, holmium(Ho):YAG, and Erbium(Er):YAG, were investigated. Historically the first laser marketed for the intraoral use generally were CO<sub>2</sub> lasers with otorhinolaryngologic clearance authorized by FDA.<sup>7</sup>

A varied number and variety of lasers are being put to use in dentistry today. On a broad basis, they can be classified as follows:

#### Based on the type of laser medium used:

Gas Lasers	Solid Lasers	Liquid Lasers	Electronic Lasers
Helium Cadmium	Ruby	Liquid dye	Semiconductor
Helium Neon	Rhodamine	Water vapour	Diode
Argon	Neodymium		
Nitrogen	Erbium		
Carbon Dioxide			
Krypton			
Carbon Monoxide			

#### According to the type of tissue being acted upon:-

**Hard tissue lasers** – The hard tissue lasers are used to cut precisely into bone and teeth, to prepare teeth surfaces for bonding, to remove small amounts of tooth structure, and to repair certain worn down dental restorations.

**Soft tissue lasers** – Soft tissue lasers penetrate soft tissue while sealing blood vessels and nerve endings. This is the primary reason why many people experience virtually no postoperative pain following the use of a laser. Also, soft tissue lasers allow tissues to heal faster.

#### Application Of Lasers In Dentistry:-

The uses of lasers in dentistry have revolutionized several areas of treatment in the last three and a half decades of the 20<sup>th</sup> century. Initially it was used for ablating the hard tissues for acid etch treatment. Later lasers were used for cutting,

coagulation and cauterization of the soft tissues. It is also been used for the diagnosis of carious lesions and to test pulp vitality with Doppler. Now there are more than 40 uses for laser.<sup>8</sup>

**A) Diagnosis:-**

- Detection of pulp vitality- Doppler flowmetry, Low Level Laser Therapy
- Laser fluorescence- detection of caries, bacteria and dysplastic changes in the diagnosis of cancer

Laser light can be used in the visible region (blue or red) as a tool for the detection of carious lesions. Techniques developed to date for early caries detection by laser light rely on fluorescence naturally from the tooth material or from bacterial by-products. Fluorescence techniques have been introduced clinically in Europe and show great promise for improved management of dental caries.<sup>9</sup>

Laser Doppler flowmetry (LDF), is a noninvasive, objective, painless, semi-quantitative method, has been shown to be a reliable for measuring pulpal blood flow. This technique has been successfully employed for estimating pulpal vitality in adults and children, differential diagnosis of apical radiolucencies (on the basis of pulp vitality), examining the reactions to pharmacological agents or electrical and thermal stimulation, and monitoring of pulpal responses to orthodontic procedures and traumatic injuries.<sup>10</sup>

Studies were carried out to compare LDF with conventional pulp tests, EPT (electric pulp testing) and thermal tests, in children with certain dental injuries. At the initial assessment at presentation, all tests had poor sensitivity and specificity; however at 3, 6, and 12 months, LDF was significantly better than the other tests. There was no difference between tests at the later time periods, 18 months and 2 years. It was concluded that LDF identified more vital and non-vital teeth correctly at earlier time periods following injury than conventional tests.<sup>11</sup>

**B) Hard tissue applications:-**

- Caries removal and cavity preparation
- Bone recontouring
- Endodontic root canal preparation, sterilization and apicoectomy
- Laser etching
- Root canal restoration for retrograde filling of amalgam or composite

Application of laser in endodontics was introduced by Weilcham in 1971. Studies show that the effects of laser irradiation are dependent on wavelength specificity and energy density. By varying a number of parameters (Pulse mode, irradiation time, frequency and energy outputs), several types of lasers are indicated for use in various fields of dentistry. Clinical investigations into laser, used for apicectomy began with the CO<sub>2</sub> laser. Later Nd:YAG, Er:YAG and Ho:YAG lasers were used. The most promising wavelength has been the Er:YAG at 2.94 micrometers.<sup>12</sup>

The Er,Cr:YSGG laser has several hard-tissue applications like enamel etching, caries removal, cavity preparation, in vitro bone cutting with no burning, melting or alteration of the calcium: phosphorus ratio and root canal preparation.<sup>13</sup>

Clinically, cavity preparation in enamel results in ablation craters with a white chalky appearance on the surface of the crater. In dentine, cavity margins are sharp and dentinal tubules remain open without a smear layer. In a clinical study conducted to evaluate the efficiency and safety of the Er: YAG laser for caries removal and cavity preparation in dentine and enamel, Class I, II, III, IV and V cavities were prepared for amalgam and composite restorations.<sup>14</sup>

A comparison of the desensitizing effects of an Er:YAG laser with those of a conventional desensitizing system on cervically exposed hypersensitive dentine showed that desensitizing of hypersensitive dentine with an Er:YAG laser is effective, and the maintenance of a positive result is more prolonged than with other agents.<sup>15</sup>

**C) Soft tissue applications:-**

- Laser assisted soft tissue curettage and periapical surgery
- Bacterial decontamination
- Gingivectomy and gingivoplasty

- Aesthetic contouring, frenectomy
- Gingival retraction for impressions
- Implant exposure
- Biopsy incision and excision
- Treatment of aphthous ulcers
- Hemostasis
- Tissue fusion- replacing sutures
- Laser assisted flap surgery
- Removal of granulation tissue
- Pulpcapping, pulpotomy, pulpectomy
- Operculectomy and vestibuloplasty
- Incision and drainage of abscess
- Removal of hyperplastic tissue and fibroma

Laser treatment is expected to serve as an alternative or adjunctive to conventional mechanical periodontal treatment. Currently, among the different types of lasers available Er:YAG and Er,Cr:YSGG laser possesses characteristics suitable for dental treatment, due to its dual ability to ablate soft and hard tissues with minimal damage. In addition, its bactericidal effect with elimination of lipopolysaccharide, ability to remove bacterial plaque and calculus, irradiation effect limited to an ultra-thin layer of tissue, faster bone and soft tissue repair, make it a promising tool for periodontal treatment including scaling and root surface debridement.<sup>16</sup>

Er,Cr:YSGG is capable of multiple applications because its interaction with tissues is strongly influenced by variations in the air –to water ratios in the spray. It can be used on soft tissue, enamel, dentin and bone, and its shallow interaction minimizes the risk of collateral damage. Also, the ability to be used for multiple applications improves the economic feasibility of these lasers.<sup>17</sup>

Finkbeiner has suggested the usefulness of argon laser in soft tissue welding and soldering compared to conventional tissue closure methods. Epithelial exclusion using CO<sub>2</sub> laser had been suggested to retard its downgrowth, and studies have shown effective removal of epithelium from gingival tissue without damaging the underlying connective tissue.<sup>18</sup>

Mahmood, Watkinson and Rooney in a study have stated that for clinical situations with peri-implantitis the use of the CO<sub>2</sub> laser would be a safe alternative method provided that the operator chooses the right setting and power output as suggested.<sup>19</sup>

Er:YAG laser was also proposed for the implant maintenance, taking advantage of its bactericidal or decontamination effect. Matsuyama et al. performed debridement of implant abutment surface by Er:YAG laser and reported effective removal of plaque and calculus without producing damage to the implant surface.<sup>20</sup>

#### **D) Laser induced analgesia:-**

In selected patients, using the 660nm laser probe can achieve adequate pulpal anesthesia. Success in primary molars varies from 50% to 75%. Analgesia effect may be affected by things such as pigmentation of the patient's gingival tissues, because the diode may react with the pigment in the tissue rather than be absorbed by the pulpal tissues.<sup>21</sup>

Reports of pain relief mechanisms appear to originate in stimulating oxidative phosphorylation in mitochondria and through modulating inflammatory responses. Another study examined patients receiving both Nd:YAG laser and scalpel surgical techniques: most laser treated sites evoked minimal discomfort without anesthesia, while scalpel surgery required anesthesia.<sup>22</sup>

Jovanović, Mirković&Živković have proposed that soft tissue lasers can be recommended in Herpes Simplex Labialis therapy, for its evident analgesic effects, as well as for shorter disease duration.<sup>23</sup>

#### **E) Laser activation:-**

- Bleaching agent
- Restorations using composite

The objective of laser bleaching is to achieve an effective power bleaching process using the most efficient energy source, while avoiding any adverse effects. The FDA approved standards for tooth whitening has cleared three dental laser wavelengths: argon, CO<sub>2</sub> and the most recent 980-nm GaAlAs diode.<sup>14</sup>

#### F) Others:-

- Removal of root canal restorative material and fractured instrument
- Softening gutta-percha
- Removal of moisture/ drying of canal

#### Conclusion:-

After many false starts, lasers delivering pulsed energies are at last being taken seriously as a tool in the treatment of Conservative, Endodontics and Aesthetic dentistry. We, the dentists, should balance our eagerness to apply these promising new tools with an appropriate measure of caution. These systems are of relatively higher cost and this will undoubtedly limit the extent of their implementation.

Lasers are an impressive treatment modality for a variety of clinical conditions. Hard tissue lasers are being used for a variety of purposes like preparation of enamel, dentin and cementum, and ablation of caries. Many multi-wavelength lasers are also used for polymerizing light activating materials. Laser provides more conservative, less invasive treatment of carious lesion therefore laying the foundation for the “minimally invasive era” in today’s dentistry. Dental lasers also significantly contribute to the field of Aesthetic dentistry. This technology permits us to achieve desirable gingival contour, improved psychological and physical health and tooth whitening. Laser surgery has shown better results as compared to cryosurgery and electrosurgery with faster healing, no requirement of sutures and minimal post-operative bleeding and edema. In laser surgery, the tissue damage is superficial and hence there is less thermal damage to the muscles and tissues.

In the words of Steven Hawking, “Any physical theory is always provisional, in the sense that it is only a hypothesis: you can never prove it. No matter how many times the result of the experiments agree with the theory, you can never be sure that the next time the result will not contradict the theory”.

Lasers are an impressive, potential treatment modality for a variety of clinical conditions. Some clinicians are still wary of entering this exciting field because of the size and cost of equipment. Lasers will continue to get smaller in size and less costly and affordable to every clinician in the near future. This is true of all technology consider the history of computers and pocket calculators. The original lasers were not only large but had six figure price tags. Today's dental lasers are smaller, light weight, highly portable and more reasonably priced.

Laser technology has blossomed in recent years, along with the emergence of new active media and wavelengths. With these impressive advances, potential has increased for further clinical application of lasers in surgery and medicine. Laser dentistry is futuristic in its approach. Laser applications in dentistry opens the door to the modern dentistry, with less pain, better healing, increased patient compliance and patient acceptance. Application of lasers in dentistry will surely increase in the near future.

#### Bibliography:-

1. Miserendino L J. Laser in dentistry. *Quintessence Publishing* London; 1995: pg 17.
2. Robert Convissar. Principles and practice of laser dentistry. 1<sup>st</sup> Ed. *Mosby Elsevier* Missouri; 2011: pg 7.
3. Gupta VK, Jena Ak, Singh SP, Utreja A. Applications of lasers in modern orthodontic practice: A review of literature. 2009 [updated 2009 June]. Available from: <http://orthocj.com/2009/06/applications-of-lasers-in-modern-orthodontic-practice-a-review-of-literature/> [cited on April 19 2014].
4. Parker S. Introduction, history of lasers and laser light production. *Brit Dent J* 2007; 202: 21-31.
5. Newton I, Opticks: or a treatise of the reflections, refractions, inflexions and colours of light. Also two treatise of the species and magnitude of curvilinear figures. London, 1704.
6. Myers TD, Myers WD, Stone RM. First soft tissue study utilizing a pulsed Nd:YAG dental laser. *Northwest Dent* 1989;68:14-17.
7. Mathew B, Prasanth S. lasers in dentistry. *OMPJ*, Jul-Dec 2011;2:148-150.



8. Fred S Margolis, Clinical uses of Erbium lasers, 2010. Available from: <http://www.fredmargolis.com/ErbiumLasers.pdf> [cited April 19 2014].
9. Featherstone JD. caries detection and prevention with laser energy. Dent Clin N Am 2000;44(4):955-969.
10. Jafarzadeh H. laser Doppler Flowmetry in Endodontics: A Review. IntEndod J 2009; 42(6):476-490.
11. Samraj RV, Srinivasan MR, Kumar A. recent Advances in pulp vitality testing. Endodontology 2003;15:14-18.
12. Vasudev SK, Goel BR, Tyagi S. Root end filling material –A review. Endodontology 2003;15:12-16.
13. Dederich DN, Bushick RD. Lasers in dentistry: Separating Science from fiction. J Am Dent Assoc 2004; 135: 204-212.
14. Husein A. Applications of lasers in dentistry: A review. Arch Oro Sci 2006; 1:1-4.
15. Robert PN, Sterilization in root canal treatment: current advances. Hong Kong Dent J 2004;1(2):52-57.
16. Lee D. Applications of lasers in periodontics: A new approach in Periodontal treatment. Hong Kong Medical Diary 2007; 12(10):23-25.
17. Prasad SSV, Reddy RN, Agarwal N. Lasers in periodontics: A review. Ind J Stomatol 2011; 2(3):179-182.
18. Bains VK, Gupta S, Bains R. Lasers in Periodontics: An overview. J oral H Com Dent 2010;4:29-34.
19. Mahmood WA, Watkinson AC, Rooney J. the thermal effects associated with CO<sub>2</sub> laserGingivectomy of tissues surrounding plasma coated titanium implants. A preliminary study. Annal Dent Univ Malaya 2000;7:16-21.
20. Berk G, Atici K, Berk N. Treatment of gingival pigmentation with Er, Cr: YSGG laser. J Oral Laser Application 2005;5:249-253.
21. Lawrence K. Lasers and soft tissue treatments for the pediatric patient. Alpha Omegan; 101(3):140-150.
22. Peter pang et al. Laser energy in oral soft tissue applications. J Laser Dent 2010;18(3):123-131.
23. Jovanovic L, Mirkovic B, ZivkovicB. Soft laser in the treatment of Herpes Labialis Simplex. Medicine and Biology 1998; 5(1): 61-63.

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### RESEARCH ARTICLE

## SPATIAL AND TEMPORAL ANALYSIS OF WATER QUALITY PARAMETERS OF A HIMALAYAN LAKE (DAL LAKE) BY MULTIVARIATE STATISTICAL ANALYSIS.

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### Abstract

Dal Lake is one of the topmost attraction of tourists in Kashmir valley and is subjected to a steadily expanding rate of eutrophication and siltation. Considering the significance of this world acclaimed water body for Kashmiri human advancement and economy, the main objectives of this study was long term assessment of water quality of the Dal Lake by using multivariate statistical tools. The period of water quality assessment was 5 years from September 2010 to August 2015. Significant spatio-temporal variability in most parameters indicated considerable spatio-temporal variations. From the principal component analysis it can be construed that the lake water quality is mainly influenced by waste water discharge and agricultural run-off in the form of proliferation of nutrients like nitrate-nitrogen, ammonium-nitrogen, phosphates and chlorides. From the spatial cluster analysis it is clear that the Central Site Nigeen, Outlet Sites of Habak and Outlet Site of Hazratbal are the most polluted sites of Dal Lake and need immediate remediation strategies. Overall, this study may contribute towards the advancement of knowledge and development of conservation strategies for the Dal Lake.

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### Introduction:-

More than 70% of earth's surface is covered with water in the form of streams, lakes, rivers, and oceans. Water is most essential topographical agent that adjusts the surface morphology of the planet on an exceptionally great scale. Any aperture of extensive size in the surface of the earth that is loaded with water might be characterized as a lake. Unequivocally a lake is an assemblage of stagnant, semi stagnant or new water. Most lakes are impermanent in character. Lakes demonstrate an immense diversity in form. In size lakes may run from a couple square kilometers to a few hundred thousand square kilometers in territory. Likewise in shape lakes appear as round, semi round, half-moon shape, rectangular and triangular. Lakes assume an imperative part in the economy of an area or nation and are of colossal scholarly, societal and financial significance. They go about as characteristic water supplies and store a substantial amount of water, which can be utilized for drinking, modern, water system, stylish and different purposes including era of hydro-power.

Dal Lake, a warm monomictic lake, situated at a height of 1587m above the sea level and at 34°07'N latitude and 74°52'E longitude with a catchment area of 316 square kilometers, is one of a progression of freshwater lakes of Kashmir valley. Dal Lake is a multi-basined, bull bow kind of lake, with shallow saucer-molded bowls framed by the changing course of stream Jhelum. The principle source of water for the lake is TelbalNallah in the

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Dachigam territory, various springs emerging from the base of lake and outwash from encompassing mountains. The surge of lake happens through a weir-n-bolt framework. The greatest depth is 6.5m, while the normal/average depth is under 3m. The pH estimations of the lake fall inside the alkaline range as of not long ago.

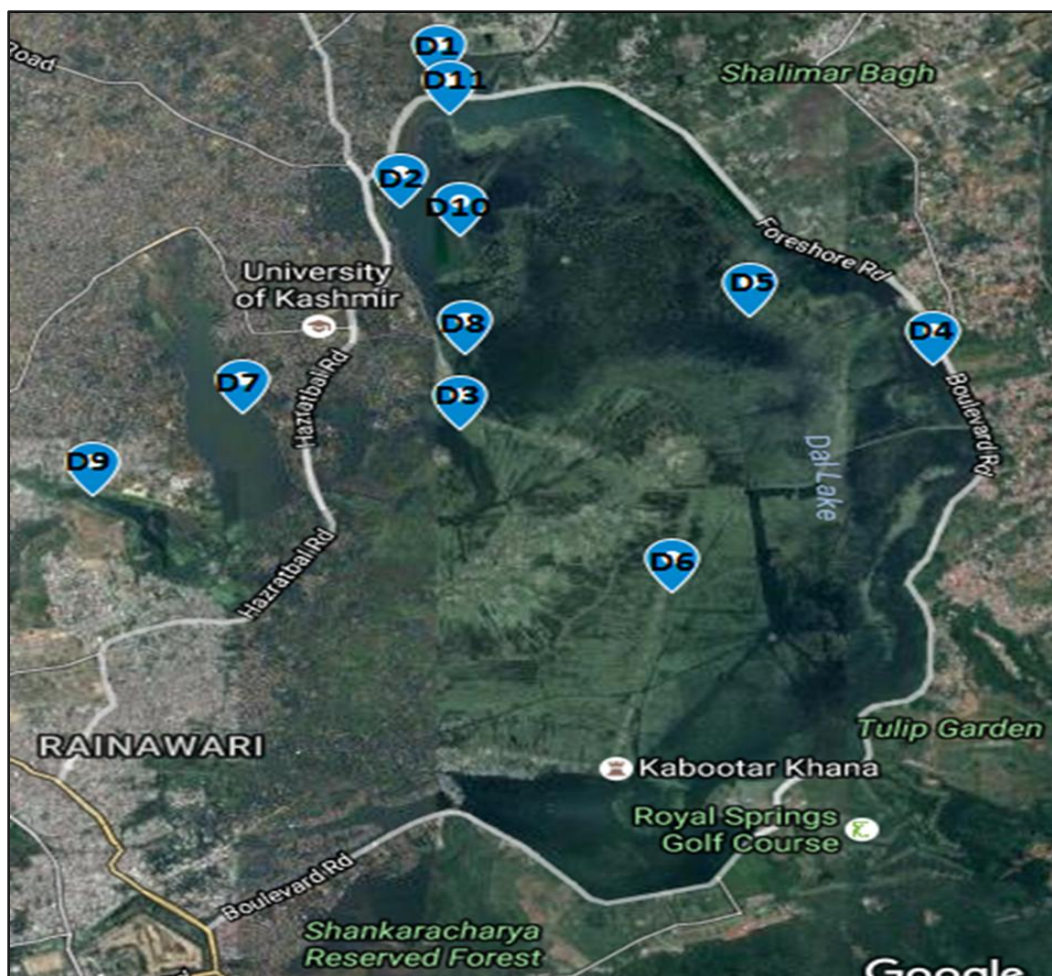
Atmosphere of Kashmir is montane valley atmosphere with a professed icy season from October to March (mean temperature 7.5 degree Celsius) and warm summers mean temperature 19.8 degree Celsius). January is the coldest month (temperature of - 2 degree Celsius to 3 degree Celsius), and July the hottest (34 degree Celsius to 35 degree Celsius). The main proportion of the precipitation is received as snow (December-February). The waters of Dal Lake bolster a changeless drifting populace of somewhere in the range of 7000 individuals, with entire towns having essentially been illicitly made in the lake. The lake underpins an enormous drifting business sector, cultivation industry, an imperative fishery and a blasting traveler industry. Weeds are collected for dairy cattle feed. The lake additionally goes about as a sump for a lot of the waste items from Srinagar. Violations of water from structures and by swelling of floating gardens and installation of lake bed materials and removing weeds on current solid land masses and obviously by transformation of floating gardens in to lasting land masses by way of accumulative weight and mass by planting of materials withdrawn from the lake. Solid waste management in the lake remains a great predicament for the following explanations that in wider terms Dal Lake is a city in itself in the interior of the city with following factors. About 2.5 lac people (source:JKLWDA) living in the surrounding areas discharge wastes which one way or the other reaches into the lake. The population living in the interior of the lake discharges their solid wastes into the lake. Resident population going to the lake, commuters and tourists also discharge their solid wastes straight into the lake.

Dal Lake, subjected to a steadily expanding rate of eutrophication and siltation, has been assessed to thoroughly vanish inside the following 50 years. Siltation has expanded essentially since various streams and rivulets which joined the lake on its western edge were dammed or filled amid the development of a roundabout street around the old city in later past. The volume of nutrients achieves a top amid the mid-year months, when more than 1700 houseboats and many inns bolster an additional 500,000 individuals for every season. Jammu and Kashmir is one of the delightful parts of this planet with rich water assets. Dal Lake is world renowned water body which should be saved. The Government of Jammu and Kashmir has authorized an agency to spare this water body from contamination called Jammu and Kashmir Lakes and Waterways Development Authority (JKLWDA). This lake has truly been the focal point of Kashmiri progress and has assumed a noteworthy part in the economy of the state through its fascination of visitors and additionally its usage as a wellspring of sustenance and water. Considering the significance of this world acclaimed water body for Kashmiri human advancement and economy, the main objectives of this study was long term assessment of water quality of the Dal Lake by using multivariate statistical tools. The period of water quality assessment was 5 years from September 2010 to August 2015.

## **Material and Methods:-**

### **Study area:-**

The study is focused on Dal Lake which is situated in Srinagar city, capital of state Jammu and Kashmir, India (Figure 1). The lake is located at an altitude of 1583m and Lat. 34° – 6' N, 74°-45' E. The main sources of feed to the lake are large perennial channel called TelbalNalawhci carries out runoff from the catchment area of about 145 km<sup>2</sup> and contributes to about 80% of the total inflow to the lake (Jellani 2006). Other streams such as PeshpawNala, Shalimar Nala, MerakhshaNala and Harshikul also contribute to the flow in the lake. These small streams feed to the lake around the shoreline along with some contribution from the groundwater. Kundangar et al. (1995) also reported presence of a number of springs within the lake basin itself acting as a permanent source of water to the lake. The division of the lake is into four basins Hazratbal, Boddal, Nageen and Gagribal. The maximum depth of the lake is approximately 6m which is in the Nageen basin and the shallowest basin is Gagribal basin with a maximum depth of 2.5m. Inside the lake there are floating gardens covering an area of 4.1m<sup>2</sup> where vegetables are cultivated and is a source of income to residents living along its shoreline. The submerged land within the lake is 1.51 km<sup>2</sup> and the marshy area is 2.25 km<sup>2</sup>.



**Figure 1:-** Google map showing the shoreline of Dal Lake and sampling sites.

#### Sample collection and analysis:-

Water quality Data was acquired from the Jammu and Kashmir Lakes and Waterways Development Authority (JKLWDA). The month wise collected data for the lake from the year 2010-11 till 2014-15 was obtained. The collected data is for the following parameters: Electrical conductivity (EC), Calcium, Magnesium, Chloride, Ortho Phosphate, Total Phosphate, Nitrate-Nitrogen, Ammonical Nitrogen, pH, Dissolved Oxygen(DO), Sulphate, Total Alkalinity and Chemical Oxygen Demand(COD). Sampling was generally done monthly from 11 locations as per the standard guidelines. Figure 1 shows the location of sampling sites and the location of sampling sites are shown in Table 1.

**Table 1:-** Location of the sampling sites and their description.

Name of the site	Description of the site
D1	Inside Lake near the entry of TelbalNallah
D2	Dhobi Ghat area
D3	Central site near Sonilank
D4	Near Nishat Pipe line bund (Culvert 1)
D5	Central site near Char Chinari
D6	Near KabootarKhana
D7	Central site Nigeen
D8	Saderabal Area
D9	Pokhribal area
D10	Outlet site of Hazratbal STP
D11	Outlet site of Habak STP

**Principal components analysis (PCA):-**

PCA converts a large dataset of variables to new, uncorrelated variables known as the principal components. These principal components are towards the directions of maximum variance. PCA helps in minimizing the variation in the data (Sarbu and Pop, 2005). It indicates the most important parameters that describe the whole data, and summarizes the statistical correlations among the constituents with minimum loss of original information (Helena et al., 2000).

**Cluster analysis (CA):-**

The CA technique is an unsupervised machine learning classification technique that measures the similarity between different objects. The clusters that are produced through this technique lead to groups or clusters that have high internal homogeneity but high external heterogeneity. The most common CA procedure is hierarchical agglomerative clustering, which provides similarities between a sample and the entire dataset. This is usually shown in a dendrogram or a tree diagram (McKenna, 2003), which provides a visual narrative of the clustering process. It shows the groups, their proximity in the original data. For simple objects, a Euclidean distance is used a similarity parameter between two samples (Otto, 1998). In this study, CA was applied to check the extent of spatial similarity in the data to group sites under the monitoring network. Hierarchical agglomerative clustering was used on the data set, normalized through Ward's method according to Kazi et al. (2009). Further, squared Euclidean distances were used as a measure of similarity.

**Data analysis:-**

Excel 2003, a part of the Microsoft Office Suite and SPSS 10 (IBM Corporation, Windows version) were used for mathematical and statistical computations. Various examiners have reported the significance of standardizing variables for multivariate analysis. Else, variables recorded at dissimilar measures do not add correspondingly for the exploration. For instance, in boundary detection, a parameter that varies from 0 to 100 will overshadow a parameter that varies from 0 to 1. Expending these parameters devoid of standardization in consequence gives the parameter with the greater range a load of 100 in the analysis. Altering the data to equivalent measures can avert this difficulty. Characteristic data standardization measures level the range. The data was therefore standardized to their corresponding z-scores by employing in the following Equation below, in order to achieve the objectives of normal distribution and homogeneity.

$$z = \frac{x - \mu}{\sigma}$$

Where x = Data and

$\mu$  = Mean

**Results and Discussion:-****Seasonal principal component analysis:-**

PCA was applied on the available data after breaking up the acquired/available data into four sets season wise i.e. Spring(March-April-May), Summer(June-July-August), Autumn(September-October-November), Winter(December-January-February). The total number of factors generated from a typical factor analysis indicates the total number of possible sources of variation in the data. Principal Components are hierarchical in order of merit. The first factor or component has the highest eigenvector sum and represents the most important source of variation in the data. The last factor is the least important process contributing to the data variation. The number of factors is determined using a scree plot. A scree plot displays the eigenvalues associated with a component or factor in descending order versus the number of the component or factor. Factor loadings on the factor loadings tables are interpreted as correlation coefficients between the variables and the factors. Factor analysis was performed using Statistical Package for the Social Sciences (SPSS 20).

Kaiser-Meyer-Olkin (KMO) is an index for comparing the magnitude of the observed correlation coefficients to the magnitude of the partial correlation coefficients. The closer the KMO measure to 1 indicates a sizeable sampling adequacy (0.8 and higher are great, 0.7 is acceptable, 0.6 is mediocre, less than 0.5 is unacceptable). Reasonably large values are needed for a good factor analysis. Small KMO values indicate that a factor analysis of the variables may not be a good idea. The measure was more than 0.8 in every season so, this indicates that the sampling size is adequate and the correlation between parameters is generally accepted.

From PCA of summer data, two principal components were obtained having eigen values greater than 1 accounting for 48.653 % of the total variance The first Principal Component PC1 accounts for about 33.644 %. Principal Component two PC2 accounts for about 15.009 % Loadings of the principal components are shown in Table 2. The first Principal Component PC1 shows a significant loading with orthophosphate, total phosphate,

ammonical nitrogen, sulphate, calcium, magnesium, COD, chloride and a negative loading with dissolved oxygen (DO). PC2 shows significant loading with, nitrate, total alkalinity and electrical conductivity. Positive loadings of COD, ammonical nitrogen, chloride and phosphates are associated with anthropogenic pollution. Negative loading of DO in PC1 with other parameters like phosphates and ammonical nitrogen occurs because high levels of dissolved organic matter consume large amounts of oxygen for decomposition. Sources of phosphates, nitrates and chloride may be traced to agricultural run-off, generation of waste water/sewage from the hospitality sector (hotels and houseboats). Calcium, magnesium and sulphates are naturally present in lakes and are representative of catchment geology and would thus exhibit noteworthy contribution to total variance in all seasons. Their proliferation may be due to the anthropogenic activities in the lake catchment.

**Table 2:- Rotated Component Matrix (summer)**

	Component	
	1	2
pH	.004	-.147
conductivity	.266	.642
DO	-.678	-.039
total alkalinity	.333	.686
chloride	.578	.539
calcium	.547	.360
magnesium	.656	.285
sulphate	.706	.327
COD	.583	.047
nitrate nitrogen	-.116	.575
ammonical nitrogen	.632	.298
orthophosphate	.822	-.119
total phosphate	.861	-.056

In winter, total numbers of significant principal components were two accounting for 56.921 % of the total variance, the first Principal Component PC1 accounts for about 31.667 %. Principal Component two PC2 accounts for about 25.254%. And their loadings on various parameters are shown in Table 3. PC1 shows a significant loading with electrical conductivity, total alkalinity, calcium, magnesium, and nitrate nitrogen. Electrical conductivity is an indicator of nutrient enrichment. Lone et al. (2014) had the same findings and has attributed it to the elevated value of total dissolved solids (TDS) in the winter season due to the decreased water levels (water levels are generally highest during summer because of melted glacial inflow) which results in increased concentration of different salts in water. PC2 shows significant loadings with chloride, sulphate, ammonical nitrogen and phosphates. Positive loadings of calcium, magnesium and sulphate relate to catchment geology. Negative loading of DO in PC2 with positive loading of other parameters like ammonical nitrogen and phosphates shows inverse relationship due to nutrient decomposition by phytoplankton.

**Table 3:- Rotated Component Matrix (winter)**

	Component	
	1	2
pH	.170	-.323
conductivity	.830	.036
DO	-.011	-.671
total alkalinity	.787	.088
chloride	.484	.658
calcium	.773	.298
magnesium	.831	.190
sulphate	.064	.801
COD	.439	.020
nitrate nitrogen	.693	.111
ammonical nitrogen	.307	.764
ortho phosphate	.409	.694
total phosphate	.563	.665

In autumn also, three principal components were derived as shown in Table 4 accounting for 63.830% of the total variance. The PC1 accounts for about 32.497%, PC2 accounts for about 16.406% and PC3 accounts for 14.927%. PC1 shows a significant loading with electrical conductivity, total alkalinity, chloride, calcium, magnesium, chemical oxygen demand (COD) and nitrate nitrogen. Electrical conductivity remains significant for the same reason as mentioned earlier for winter season. PC2 shows significant loadings with orthophosphate and total phosphate. PC3 shows positive loadings with sulphate, ammonical nitrogen and a negative loading with dissolved pH again depicting an inverse relationship. This is because of more restrained phytoplankton activity as compared to summer season leading to less consumption of ammonical nitrogen and less consumption of soluble carbon dioxide which lowers pH.

**Table 4:- Rotated Component Matrix (autumn)**

	Component		
	1	2	3
pH	-.191	-.238	.360
conductivity	.729	.148	.034
DO	-.041	-.023	-.758
total alkalinity	.770	.196	.006
chloride	.713	.123	.508
calcium	.793	.113	.238
magnesium	.802	.124	.129
sulphate	.444	.186	.695
COD	.638	-.281	.056
nitrate nitrogen	.667	.200	.059
ammonical nitrogen	.448	.284	.634
ortho phosphate	.095	.929	.066
total phosphate	.160	.935	.089

In spring, four principal components were derived as shown in Table 5 accounting for 68.535% of the total variance. The PC1 accounts for 19.12%, PC2 for 17.38%, PC3 for 16.34% and PC4 for 15.69%. PC1 shows a significant loading with chloride, calcium and magnesium. PC2 shows significant loadings with conductivity and nitrate nitrogen. Also conductivity was observed more in this season which may be caused by high concentration of dissolved solids at lower water levels. PC3 shows positive loadings with sulphate, ammonical nitrogen and a negative loading with dissolved oxygen and pH. This can again be attributed to the opposite relationship between phytoplankton proliferation and availability of dissolved oxygen. More phytoplankton activity means lesser available ammonical nitrogen and vice versa. Thus when dissolved oxygen decreases ammonical nitrogen content increases. PC4 has a significant loading with COD and the phosphate derivatives.

**Table 5:- Rotated Component Matrix (spring)**

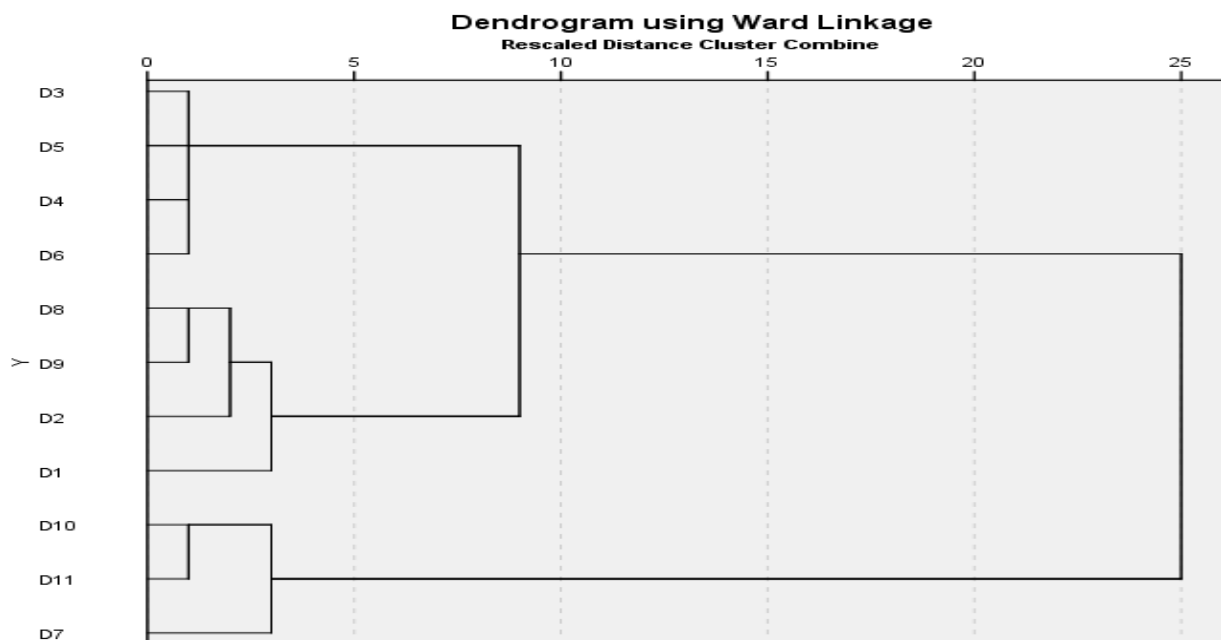
	Component			
	1	2	3	4
pH	-.345	.403	-.447	-.075
conductivity	.075	.729	.136	.154
DO	.026	-.157	-.810	-.178
total alkalinity	.133	.801	.204	.124
chloride	.583	.084	.437	.179
calcium	.814	.334	.100	.131
magnesium	.856	-.040	.137	.087
sulphate	.505	.216	.526	.220
COD	.335	-.431	-.014	.574
nitrate nitrogen	.327	.609	-.281	.311
ammonical nitrogen	.336	.021	.763	-.017
ortho phosphate	.083	.232	.177	.859
total phosphate	.119	.350	.143	.833

### Spatial cluster analysis:-

Cluster Analysis is an unsupervised learning statistical methodology. Cluster analysis is used to organise groups of cases of which the alignment is not known beforehand. Since it is unsupervised it does not make any difference between response and explanatory parameters. The many cluster analysis methods that SPSS 20 provides resources to entertain binary, nominal, ordinal, and scale (interval or ratio) data.

Hierarchical cluster analysis (HCA) was applied to the data after breaking up the data, season wise and also location wise with regards to the sampling locations. Hierarchical cluster analysis is one of the more popular methods of cluster analysis. It divides datasets into hierarchies based on similarity or dissimilarities in the field. In this study HCA grouped seasons and sampling locations into clusters. The method used for clustering was Wards Linkage which is based on a minimum variance criteria.

A hierarchical cluster analysis using Ward Linkage was performed to highlight the spatial inter-relationships and similarities as per the hydrochemical data hydrochemistry between the sampling locations considered in the lake study based on the 5 year average data from September 2010 to August 2015. The Dendrogram shows that the sampling locations have been clustered into four groups as shown in Figure 2. The sites D7, D10 and D11 corresponding to sampling locations near Central site Nigeen, Outlet site of Hazratbal STP, and Outlet site of Habak STP respectively have been grouped together. These are the sites with the highest nutrient and pollution levels due to the anthropogenic nutrient proliferation from the various houseboats at Nigeen and the sewage disposal from STPs at Habak and Hazratbal. The second cluster pertains to sites D2, D8 and D9 which represents sampling locations near Dhobi Ghat area, Saderabal Area and Pokhribal area respectively. All three areas are proximate to high density population centres and thus receive nutrient rich effluents from the same. The third group includes sites D3, D4, D5 and D6 referring to locations around Sona lank, Nishat Pipe line bund, Char Chinari and Kabootar Khana. Sonalank and Char Chinari are tiny islands within the lake which attract lots of tourists and consequent nutrient enrichment. The other two sites (Nishat Pipe line bund and Kabootar Khana) are peripheral sites near the shore of the lake.

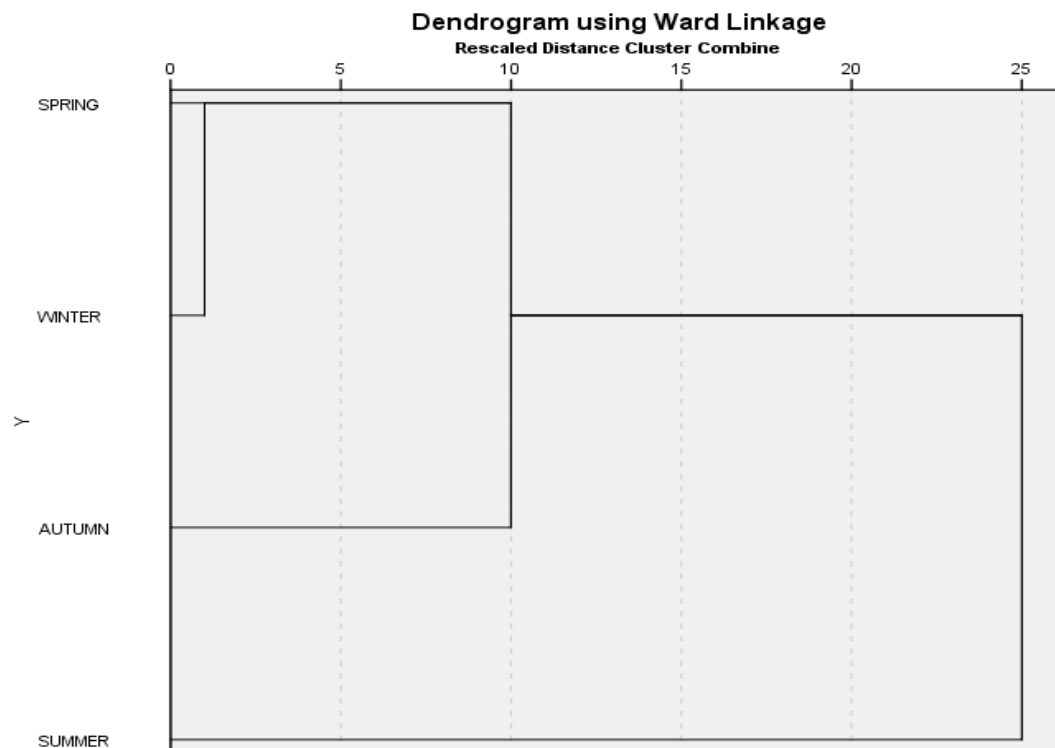


**Figure 2:-**Dendrogram showing clustering of sampling sites

### Seasonal cluster analysis:-

Another hierarchical cluster analysis using Ward Linkage was conducted to depict the temporal relationship and similarities as per the hydro-chemical data between the four weather seasons prevailing in the region based on the 5 year average data from year 2010-11 to 2014-15. Figure 3 shows the seasonal dendrogram. The dendrogram indicates that the hydro-chemical behavior of lake is most similar during spring and winter perhaps because of the comparable metrological conditions followed by autumn but the dissimilarity in autumn was much higher than that of spring and winter. Summer is most dissimilar to all other seasons because of the high anthropological activities and consequent nutrient loadings and also high biological activity of phytoplankton due to elevated temperatures.





**Figure 3:-**Seasonal dendrogram showing clustering of similar seasonal data

### Conclusions:-

The study was conducted to evaluate the water quality of Dal Lake. The outcome of the study was that Dal Lake suffers steady eutrophic deterioration. There is significant spatio-temporal variability as most parameters indicated considerable spatio-temporal variations. From the principal component analysis it can be construed that the lake water quality is mainly influenced by waste water discharge and agricultural run-off in the form of proliferation of nutrients like nitrate-nitrogen, ammonium-nitrogen, phosphates and chlorides. From the spatial cluster analysis it is clear that the Central Site Nigeen, Outlet Sites of Habak and Outlet Site of Hazratbal are the most polluted sites of Dal Lake and need immediate remediation strategies. From the temporal cluster analysis it is clear that spring and winter are the most hydro-chemically similar seasons of the year followed by autumn. Summer is significantly varied in hydro chemical behavior to all other seasons.

On the basis of this study there are some recommendations that may improve the status of the Dal Lake. Gradual dislodgement of houseboats and hotels, and rehabilitation of respective proprietors at a more appropriate locality. Setting up of STPs at all entry channels and immediate up gradation of existing STPs. For instance the STPs at Habak and Hazratbal are the major causes of eutrophic acceleration in the proximate lake area. Systematically regulated application of chemical pesticides by the cultivators in the lake catchment. Strategies to develop biological pest control measures to mitigate pest problem should be encouraged. Systematically regulated application of chemical fertilisers by the cultivators in the lake catchment. Methodologies should be developed to reduce the necessity of chemical fertilisers for agricultural soils near and around the Dal Lake. Overall, this study will contribute towards the advancement of knowledge and development of conservation strategies for the Dal Lake by the authorities of J&K state.

### References:-

1. Aenab AM, SK Singh (2013), Evaluating Water Quality of Ganga River Within Uttar Pradesh by Water Quality Index Analysis Using C++ Program, Intl. Journal of Civil & Environment Research, 3(1), 57-65.
2. Aenab AM, SK Singh (2014), Al-Masab Al-Aam River (Third River) and Surface Water Pollution within Baghdad Division, International Journal of Engineering Innovation & Research (IJEIR) Volume 3, Issue 4 ISSN: 2277-5668, PP 444-451.
3. Alla M. Aenab and S.K. Singh (2012), "Evaluation of Drinking Water Pollution and Health Effects in Baghdad", Iraq Journal of Environment Protection, 2012 (3), 533-537.

4. Deepika and S. K. Singh (2015).” WATER QUALITY INDEX ASSESSMENT OF BHALSWA LAKE, NEW DELHI” , International Journal of Advanced Research 3(5): 1052-1059
5. Helena, B., Pardo, R., Vega, M., Barrado, E., Fernandez, J.M., Fernandez, L., 2000. Temporal evolution of groundwater composition in an alluvial aquifer (Pisuerga river, Spain) by principal component analysis. Water Res. 34, 807–816.
6. Jeelani, G, Shah AQ (2006) Geochemical characteristics of water and sediment from the Dal Lake, Kashmir Himalaya: constraints on weathering and anthropogenic activity. Environ Geol. 50, 12–23.
7. JN Sharma, Raj S. Kanakiya, S.K. Singh (2015) , Limnological study of water quality parameters of Dal lake, India, International Journal of Innovative Research in Science, Engineering and Technology, 4(2): 380-386
8. JN Sharma, Raj Shailesh Kanakiya, SK Singh, (2015), Characterisation Study and Correlation Analysis For Water Quality of Dal Lake, India, International Journal of Lakes and Rivers, 8(1), 25-33.
9. Kazi, T.G., Arain, M.B., Jamali, M.K., Jalbani, N., Afridi, H.I., Sarfraz, R.A., Baig, J.A., Shah, A.Q., 2009. Assessment of water quality of polluted lake using multivariate statistical techniques: A case study. Ecotoxicology and Environmental Safety 72, 301–309.
10. Kundankar MRD, Sarwar SG, Shah MA (1995). Limnological characteristics of Hazratbal basin of Dal Lake 1992-93. Technical Report-submitted to Government of Jammu and Kashmir, India.
11. Lokesh Kumar, S K Singh (2014), Characterization of Rural Drinking Water Sources in Bhiwani District, Haryana: A Case Study, International Journal of Interdisciplinary Research and Innovations, Volume 2, Issue 4, pp. 27-37
12. Lone, S.A., Lori, S.M., Awasthi A.K. (2014), “Limnological studies of a famous Himalayan lake: the Dal lake (Srinagar, India)” International Journal of Current Research ISSN: 0975-833X, Volume 6(1), pp.4357-4361
13. McKenna Jr., J.E., 2003. An enhanced cluster analysis program with bootstrap significance testing for ecological community analysis. Environ. Model. Softw. 18, 205–220.
14. Otto, M., 1998. Multivariate methods. In: Kellner, R., Mermet, J.M., Otto, M., Widmer, H.M. (Eds.), Analytical Chemistry. Wiley/VCH, Weinheim, Germany, p. 916.
15. Raj Shailesh Kanakiya, SK Singh, JN Sharma (2014) Determining the Water Quality Index of an Urban Water Body Dal Lake, Kashmir, India, *IOSR Journal of Environmental Science, Toxicology and Food Technology*; 8 (12): 64-71
16. Sarbu, C., Pop, H.F., 2005. Principal component analysis versus fuzzy principal component analysis. A case study: the quality of Danube water (1985–1996). Talanta 65, 1215–1220.

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### ORIGINAL RESEARCH ARTICLE

## SMOKING PATTERN IN A GROUP OF TUBERCULOSIS PATIENTS, EXPERIENCE OF A MEDICAL COLLEGE HOSPITAL OF BANGLADESH.

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#### Key words:-

Tuberculosis; Smoking pattern; DOTS-  
Directly Observed Therapy.

### Abstract

**Background:** Tuberculosis is among the major causes of illness and death worldwide especially in Asia. Smoking is associated with recurrent tuberculosis and its related mortality. Also, it could affect clinical manifestations, bacteriological conversion and outcome of treatment. This study aimed to evaluate the pattern of tobacco smoking, history of previous quit attempts and attitude towards quitting in tuberculosis patients.

**Materials and Methods:** It was a cross-sectional study done amongst tuberculosis patients coming to DOTS corner of Jahurul Islam Medical College Hospital. 630 patients were included in the study over the period of two years. Data was collected according to the standard questionnaires of smoking pattern.

**Results:** Sixty one percent (61%) patients (n=384) were smoker before the diagnosis of tuberculosis. 50.8% were current smokers at the time of interview and were continuing smoking after the diagnosis of tuberculosis. Only 10.2% discontinued smoking after diagnosis. 68.2% smokes less than 10 cigarettes per day. 53.1% was between 31-50 age group. 21-30 is the commonest age group (62%) to start smoking. To reduce stress was the most common cause to continue smoking (48.9%). 71.9% smokers showed keen interest to stop smoking.

**Conclusion:** Considering the prevalence of smoking in tuberculosis patients, evaluation of tobacco smoking status in these group of patients and motivating them to quit smoking could be considered as important steps in their treatment process.

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### Introduction:-

Tuberculosis is amongst the most common causes of morbidity and mortality in the world especially in Asia. In 2006, 9.2 million new tuberculosis cases and 1.7 million deaths due to tuberculosis were reported globally.<sup>1</sup> On the other hand, cigarette smoking is amongst the most preventable causes of mortality and the second cause of death worldwide. At present, smoking is the cause of one out of every 10 deaths that occur. According to the WHO

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estimates, the rate of morbidity and mortality due to tobacco consumption will reach 8 million by the year 2030.<sup>2</sup> However, the growing trend of tobacco consumption among adolescents and the youth has been worrisome.

A correlation between tobacco smoking and tuberculosis was suggested and confirmed by multiple studies and has become the center of attention during the recent years.<sup>3</sup> Current studies have highlighted several correlations between cigarette smoking and tuberculosis infection.<sup>4</sup> Tobacco consumption is directly correlated with recurrence and disability due to tuberculosis. Also, cigarette smoking impacts clinical manifestations, bacteriologic conversion and treatment outcome of disease.<sup>5</sup> In other words, one of every 5 deaths due to tuberculosis could have been prevented if the patient was not a smoker.<sup>6</sup> That is why tuberculosis patients should be a target of smoking cessation programs. Disease recurrence is one of the most important challenges encountered during the course of treatment in tuberculosis patients. Treatment compliance is another important factor for successful treatment of tuberculosis. Absence from work in smoker tuberculosis patients may be due to their nicotine addiction. So, By Collecting information regarding the pattern of tobacco smoking and prevalence of smoking, our knowledge can be enhanced in order to prevent and control cigarette smoking.

### Materials and Method:-

This was a cross-sectional study conducted over a period of two years time from July 2014 to June 2016. All patients presented to the DOTS Corner of Jahurul Islam Medical College Hospital during this time period entered the study. Data were collected by trained technicians through face to face interview with patients. Only patients who were fully alert and conscious were included in the study after obtaining a written informed consent from them. Data regarding age of initiation of smoking, pattern of smoking, the first experience of cigarette offering, quit attempts and number of cigarettes they smoked per day was collected and entered the questionnaires.

### Statistical analysis:-

Survey data were analyzed using the Statistical Package for Social Sciences (SPSS Inc, Chicago, IL, USA). The numbers of cigarettes smoked were numerically added together to obtain an aggregate score of the quantity smoked daily. Descriptive statistical analyses were performed by using Microsoft Excell 2007 software.

### Results:-

Among the 630 tuberculosis patients coming to DOTS corner for taking drugs, 384 patients (61%) found as smoker before diagnosis of tuberculosis. Despite of diagnosis of tuberculosis almost half of the patients (50.8%) were continuing smoking. Only a few numbers of patients (10.2 %) discontinued smoking after diagnosis of tuberculosis. 246 tuberculosis patients were found non smoker (Table 1).

**Table1:-** Current smokers among tuberculosis patients (n=630).

Current smoking status	Number	Percentage
Continuing smoking	320	50.8%
Discontinuing smoking	64	10.2%
Non smoker	246	39%
Total	630	100%

Among the 384 tuberculosis patients who were smoker before diagnosis of Tuberculosis, 68.2% (n=262) smoked less than 10 cigarettes per day. Other 21.4% smoked more than 10 cigarettes and 10.4% (n=40) smoked more than 20 cigarettes per day (Table 2).

**Table 2:-** Distribution of smokers based on number of cigarettes smoked per day.

Number of Cigarettes	Number of Patients	Percentage
<10	262	68.2%
10-20	82	21.4%
>20	40	10.4%
Total	384	100%

We found that, younger age group are the most vulnerable for smoking in tuberculosis. More than half (53.1%) were in the age group 31-50 years. Older age people (>50 years) had less smoking (10.9%) compared to younger age group (Table 3).

**Table 3:-** Age wise distribution of number of smoker in Tuberculosis.

Age group	Number	Percentage
<30	138	36%
31-50	204	53.1%
>50	42	10.9%
Total	384	100%

Younger age groups are more prone to start smoking habit. 21-30 years age group were the commonest group to start smoking in tuberculosis patients. 28.1% started smoking before the age of 20. Only 14 tuberculosis started smoking after the age 40 (Table 4).

**Table 4:-** Age distribution of smokers based on initiation of smoking.

Starting Age Group	Number	Percentage
<20	108	28.1%
21-30	238	62%
31-40	24	6.3%
>40	14	3.6%
Total	384	100%

Among the 384 tuberculosis patients who were smoker before diagnosis of Tuberculosis, most of the patients smoked for a long period of time before diagnosis of tuberculosis. 66.1% smoked for at least 10 years. 118 patients smoked around 10-20 years. Only 12 patients smoked for more than 20 years (Table 5).

**Table 5:-** Distribution of smokers based on number of years smoked.

Years smoked	Number	Percentage
<10	254	66.1%
10-20	118	30.8%
>20	12	3.1%
Total	384	100%

This study also explored the reasons of continuing smoking after the diagnosis of tuberculosis. Patients said multiple reasons for the smoking. To reduce stress (48.9%) were the commonest cause to continue smoking. 156 patients smoked only to get pleasure. People's influences, self confidence, enhance work performance were the other common causes (Table 6).

**Table 6:-** Reason to continuing Smoking after tuberculosis diagnosis.

Reasons	Number	Percentage
Reduce stress	188	48.9%
To get pleasure	156	40.6%
Peer pressure	108	28.1%
Self confidence	66	17.2%
Enhance work performance	62	16.1%

\*Allowed to answer multiple reasons.

Among the tuberculosis patients who are smoker or continue smoking came to DOTS corner for taking drugs, a good number of patients (71.9%) showed interest to quit smoking after diagnosis of Tuberculosis. 66 (17.2%) patients showed good will to quit smoking in recent days. Only few patients (10.9%) showed no confidence to quit smoking (Table 7).

**Table 7:-** Smokers future plan to quit smoking.

Future plan to quit	Number	Percentage
Interest to quit	276	71.9%
Will attempt to quit	66	17.2%
Not confident	42	10.9%
Total	384	100%

**Discussion:-**

Apart from HIV/AIDS, tobacco smoking is the only major cause of death that is increasing rapidly. It is estimated that smoking will cause about 10 million adult deaths from all causes in 2030 and most of the increased tobacco-related deaths will take place in Asia, Africa and South America.<sup>7</sup> Long term inhalation of tobacco smoke alters a wide range of immunological functions, resulting in significantly increased risk of heart disease, lung cancer, microbial infections and delayed recovery from these diseases.<sup>8</sup> Though the underlying biological mechanism is unclear, strong associations between tobacco smoking and TB have been proved in several areas.<sup>5</sup>

Our study results revealed the fact that many of tuberculosis patients are active or occasional smokers. And they keep continuing smoking even after diagnosis of TB. In a study conducted by Gullón Blanco and colleagues on the impact of smoking on sputum smear of tuberculosis patients, 64% of patients were smokers.<sup>4</sup> In our study 70% of the patients are smoker and 50.8% of them continue smoking after diagnosis of TB under treatment. As a significant number of patients continue smoking, smoking cessation interventions by the medical staff implementing the DOTS seems necessary. In a study conducted in Indonesia it was shown that 72% of tuberculosis patients had tobacco consumption. By using smoking cessation interventions, this rate decreased to 11% at the time of next visit.<sup>6</sup>

The younger age group are the most vulnerable for smoking in tuberculosis in this study. 36% patients are less than 30 years age group with more than half (53.1%) are in the age group of 31-50 years. Younger age groups are more prone to start smoking habit. 21-30 years age group were the commonest group to start smoking in tuberculosis patients. This study also explored the reasons of continuing smoking after the diagnosis of tuberculosis. To reduce stress (48.9%) were the commonest cause to continue smoking. This stress factor may be the cause for starting smoking in the early age group patients as this group is more vulnerable for educational, personal and employment issues. It should be noticed that behavior of tobacco use is very difficult to change, even with medicinal aids for cessation. Only a small proportion of smokers stop smoking successfully on their own.<sup>9</sup> In this study, the patients who are smoker or continue smoking came to DOTS corner for taking drugs, a good number of patients (71.9%) showed interest to quit smoking after diagnosis of Tuberculosis. 66 (17.2%) patients showed good will to quit smoking in recent days.

Considering the prevalence of tobacco consumption among tuberculosis patients, evaluation of the cigarette smoking status and encouraging them to quit play an important role in control and treatment of tuberculosis.<sup>10</sup> Adding behavioral studies and nicotine replacement therapies to the DOTS can result in faster recovery, shorter infectious period and prevent treatment failure.<sup>11</sup> Prevention of tobacco consumption and encouraging people to stop smoking can decrease the incidence of clinical cases of tuberculosis and related deaths.<sup>12</sup>

**Conclusion:-**

Tuberculosis and tobacco smoking epidemics are continuing their growing trend in developing countries. In this respect, merging the two systems suggested by the WHO namely DOTS for tuberculosis and MPOWER<sup>2</sup> for tobacco control and enhancing each one by the other can be a great strategy for controlling these obstacles. By promoting smoking cessation in TB patients, we can increase patients compliance to treatment, improve their interpersonal and social communications, decrease their stress and control their risky behaviors.

**Conflict of interest:-**

All the authors declared no competing interest.

**References:-**

1. WHO report 2008, Global tuberculosis control surveillance, planning, financing. [www.who.int/tb/publications/global\\_report/2008/pdf/fullreport.pdf](http://www.who.int/tb/publications/global_report/2008/pdf/fullreport.pdf).
2. WHO report on the global tobacco epidemic, 2008. The MPOWER Package. <http://www.who.int/tobacco/mpower/en/index/html>.
3. Mohammad K, Noorbala AA, Majdzadeh SR, Karimloo M. Trends of Prevalence of Tobacco consumption in Iran (1370- 78). According to two National Health and disease projects. Hakim Journal. 2000; 197: 290- 294.
4. Gullón Blanco JA, Suárez Toste I, Lecuona Fernández M, Galindo Morales R, Fernández Alvarez R, Rubinos Cuadrado G et al. Tobacco smoking and sputum smear conversion in pulmonary tuberculosis. Med Clin (Barc). 2007; 128 (15): 565- 568.
5. Slama K, Chiang CY, Enarson DA. Educational series: Tobacco and Tuberculosis. Tobacco cessation intervention for tuberculosis patients. Int J Tuberc Lung Dis. 2007; 11(6): 612- 616.
6. Abal AT, Jayakrishnan B, Parwer S, El Shamy A, Abahussain E, Sharma PN. Effect of cigarette smoking on sputum smear conversion in adults with active pulmonary tuberculosis. Respir Med. 2005; 99 (4): 415- 420.
7. Peto R, Chen ZM, Boreham J. Tobacco – the growing epidemic. Nat Med 1999, 5(1):15-17.
8. Soperi M: Effects of cigarette smoke on the immune system. Nat Rev Immunol 2002, 2(5):372-377.
9. Chiang CY, Slama K, Enarson DA: Tobacco use and tobacco control. Int J Tuberc Lung Dis 2007, 11(4):381-385.
10. Gajalakshmi V, Peto R, Kanaka TS, Jha P. Smoking and mortality from tuberculosis and other diseases in India: Retrospective study of 43000 adult male deaths and 35000 controls. Lancet. 2003; 362 (9383): 507- 515.
11. Thomas A, Gopi PG, Santha T, Chandrasekaran V, Subramani R, Selvakumar N et al. Predictors of relapse among pulmonary tuberculosis patients treated in a DOTS program in South India. Int J Tuberc Lung Dis. 2005; 9 (5): 556- 561.
12. El Sony A, Slama K, Salieh M, Elhaj H, Adam K, Hassan A et al. Feasibility of brief tobacco cessation advice for tuberculosis patients: A study from Sudan. Int J Tuberc Lung Dis. 2007; 11 (2): 150155.

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### RESEARCH ARTICLE

## A CRITICAL EVALUATION OF THE IMPACT OF RELIGION ON COLLECTIVIST FAMILIES' MEAL SOCIAL INTERACTION BEHAVIOUR IN SIERRA LEONE

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### Abstract

The symbolism of religion in the Sierra Leonean collectivist society is encouraged to promote increased interdependency and social bonding among families that share similar belief systems. This belief is further accentuated and translated at the dinner table when interacting socially at mealtimes. The concept of religion is very topical in the everyday lives of Sierra Leonean consumers/families, which largely determines their food purchase and consumption behaviour. This study critically evaluates the impact religion has on families and how it affects the way they interact socially at mealtimes. As a consequence, the paper elaborates and highlights the degree of influence Islam and Christianity have on the meal social interaction behaviour of families in Sierra Leone, which is considered as one of the prime factors responsible for the increased drive for collectivism. The authors evaluated the scope of the influence of religion on families' meal consumption behaviour and provided a comparative analysis of its influence on different gender groups.

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### Introduction:-

Religion is predominantly a key influencer of most Sierra Leonean families' food consumption behaviour, especially those inclined to practice the Islamic faith. Despite the symbolism attached to religion by different social groups, it has evidently over the years been influenced by families' cultural values and traditional practices. As a consequence, the mixing up of families' spiritual practices with cultural and/or traditional practices have made it increasingly difficult for Sierra Leoneans, irrespective of their religious faith and conviction, to discern or draw a dividing line between the two (cultural values/traditional practices and spiritual belief). Religion has principally been advanced by many theorists, for example, Cohen and Varnum (2016); and Kassim and Zain (2016), as one of the key influencers of collectivism, as most individuals in such societies are heavily reliant on others or their community in shaping their own identity. Rozman (2014) argued that religion is promulgated in most collectivist societies to foster interdependence and promote group-orientation, which can be used to strengthen new and existing bond between and among people. Ji et al (2016) concluded that religion is one of the most important factors of collectivism, as it can be used to pacify and build harmonious relationship between and among individuals. It is evident from these perspectives and the findings of this study that religion in the Sierra Leonean context is used mainly for building social relationship between and among individuals, as a forum for learning and sharing ideas, a platform for enhancing interdependence, a domain for social integration and an avenue for fostering unity within communities.



This fundamentally influences their meal social interaction behaviour. Sierra Leoneans are surrounded by lots of religious practices such as making sacrifices for ancestral spirits, God's influence of everything in their daily lives and livelihoods, and prayers, which affects their food consumption behaviour as it conveys meaning that are significant to them and which are interpreted based on their understanding. This view was supported by Horta et al (2013); Judd et al (2014); and De Backer et al (2015), who stated that food tastes are shaped by family religious norms and socialisation processes, emphasising that natural tastes are founded on social constructions which have been elaborated over generations. Koenig (2013); Beagan et al (2014); and Delaney and McCarthy (2014), on the other hand, attributed food taste of working class individuals to "a taste of necessity", arising from the lack of choice and enjoyment of the sensation of feeling full. Koenig (2013) suggested that the idea of taste itself is a middle-class concept since it presupposes freedom of choice, whereas the disadvantaged classes can only have a taste for what they are anyway condemned to . . . This argument is glaring in the Sierra Leonean collectivistic culture, where, as a result of religious restrictions certain groups of people refrained from consuming certain type of food products.

It is profoundly important to acknowledge that many of the factors that influence Sierra Leonean families' meal consumption behaviour are largely shaped by their religious and/or cultural beliefs, which fundamentally define their food choice. Consequently, these religious differences provides the driving force for not only families' food choices, but fundamentally influence the degree of socialisation, food ethics and boundaries observed by individuals of different age group at mealtimes. Fisher et al (2016) defined family meal as a forum for promoting positive social interaction with other members of the family as well as contributing to better nutritional well-being of the family. However, family meal consumption in this study was defined as the traditional evening meals shared or consumed together by households as family units, but excludes foods taken away from home by household members or those consumed in restaurants or on the streets. This is because most Sierra Leonean families are less inclined to eat together outdoors with their family as a socialisation practice.

This paper discusses the influence of religion on Sierra Leonean families' meal social interaction behaviour as an arbiter of the increased collectivism experienced by most households and provides the opportunity to mirror the same argument across other parts of Africa. As a consequence, the paper further critically analysed the influence of religious factors such as: spiritual beliefs, cultural values, traditional practices and social bonding have on families' meal social interaction behaviour. This was significant as it helps outline clearly the religious factors stakeholders perceived as influencing families' meal consumption behaviour in the Sierra Leonean context. Perry-Jenkins (2013); and Perez (2014) argued that there is little or no empirical evidence, models or frameworks to explain the influence of religion on family meal social interaction behaviour in the African context. Therefore, this research attempts to bring empirical data that provides evidence on the conceptualisation of religion and its corresponding effect on family social interaction patterns at mealtimes in Sierra Leone. It is against the backdrop of the issues raised that the researchers critically evaluated the influence of religion on family meal consumption behaviour in the Sierra Leonean society. The researchers analysed the information and data obtained from the fieldwork to develop appropriate conclusions.

## **Theoretical Underpinning:-**

### **Definitions of Culture:-**

The answers to these questions vary dramatically from individual to individual as there is no universally accepted definition of culture and it is unlikely that we will be able to progress towards one soon (Hanson, 2013). Culture has been defined in so many ways over the years, but none has been sacrosanct. Usunier and Lee (2009); Du Gay et al (2013) argued that culture is the transmission, creation and patterns of values, beliefs, ideas and symbols that shape human behaviour and the artefacts produced through those behaviours. De Mooij (2013, p. 26) defined "culture as the glue that binds groups together, emphasising that without cultural patterns (organised systems of significant symbols) people would have difficulty living together". Hofstede (2001, p. 9) in an earlier study defined culture as "...the collective programming of the mind, which distinguishes the members of one human group from another". In line with this definition, De Mooij (2013) reiterated that culture is what defines a human community, its individuals and social organisations, which is a set of controlled mechanisms (plans, recipes, rules, instructions, i.e. what computer engineers' call "programmes") for the governing of behaviour. Presenting a similar argument, Helliwell et al., (2014) defined culture as the shared learned behaviour, which is transmitted from one generation to another for purposes of individual and societal growth, adjustment, and adaptation. He suggested that culture is represented externally as artefacts, roles and institutions, and it is represented internally as values, beliefs, attitudes, epistemology, consciousness, and biological functioning. Individuals therefore can be clustered into cultural

groupings based on a number of shared constructs and experiences including schemas (for example, a collectivistic orientation), beliefs (for example, attitudes toward mental health), socialisation practices (for example, controlling parenting), immigration, and language among others (De Mooij, 2013). From these definitions, it is clear that the various theorists (Hofstede, 2001; De Mooij, 2013; and Helliwell et al, 2014) views culture in a similar way, as not only the characteristic of individuals, but rather as one that encompasses a number of people who have been conditioned by the same education and life experience. Hence, they believed that people are conditioned by their socio-cultural environment to act in a certain manner (De Mooij, 2013), and that culture cannot be separated from the individual. They emphasised that culture is learned and reflects what is in the mind of the individual. Consequently, they distinguished two types of cultures – those that are visible such as symbols, rituals and heroes, on the one hand, and classified values as the invisible aspect of culture, and therefore view culture as specific to a particular group, which falls in line with the ‘emic’ perspective.

Supporting this view, Goodenough (1971) defined culture as a set of beliefs or standards, shared by a group of people, which help the individual decide what is, what can be, how to feel, what to do and how to go about doing it. In addition, Côté and Levine (2014) posited that culture is composed of psychological structures which individuals or groups of individuals use to guide their behaviour; and reiterated that culture consists of whatever it is that one has to know or believe in order to operate in a manner acceptable to its members. In a similar manner, Gerson (2013); and Herman (2014) defined culture as controlled human behaviours, suggesting that the totality of human activities, and of their accumulated products is subsumed under culture; noting that artefacts, intangibles such as language, norms and values, rituals, literature, music, science, as well as social and political institutions may be largely culture-oriented. From the perspectives of Goodenough (1971); Gerson (2013); Côté and Levine (2014); and Herman (2014), it is evident they believe that there is no reason for culture to be equated with the whole of one particular society. Goodenough (1971) posited that people switch into the culture that is operational within a given group, which assumes that the individual can choose the culture in which to interact at any given moment or in any given situation, subject to the overriding condition that the culture has been correctly internalised from past experiences, and therefore view culture from the ‘etic’ (universal) perspective.

#### **The effect of religion on culture:-**

Religion is a difficult concept to define (Ferré, 2013; Firth, 2013; and Wulff, 2014), which has resulted in many definitions (McLeod, 2013; and Timothy, 2013). Nevertheless, many researchers described religion as the external or outward expression of the inward spiritual system (Dobratz, 2013; Ivtzan, 2013; and Pompper, 2014). Johnson (2014) provided a contrary perspective to the argument by suggesting that religion is concerned with addressing the crises of human existence. He argues that religion is integral to humanity, as it addresses essential dimensions of life and its circumstances, offering resolutions that will always be in excess of any other rationalistic orientation. Kapferer et al (2009) defined religion as the construct worlds for life that are to be lived in and conditioned by ontological-cosmological ground.

In collectivistic cultures (for example, Hindu India and several East Asian countries), certain religious cultures view social connectivity as an integral part of religious life, and group affiliations are seen as important as they define religious identity (Wald and Calhoun-Brown, 2014). In addition, they noted that in collectivistic religious cultures, people are seen as fundamentally connected with each other and their communities, and pointed out that under such circumstances, people’s religious and spiritual behaviour are tightly regulated through ritual and spirituality. Jiang et al (2016) defined rituals as the verbal language that confers identity, with emphasis placed on how communities are created. Arsel and Thompson (2011) reiterated that the identity of individuals depend in large measure on their feeling of belonging, highlighting that the social experiences of everyday life in the distinctive values of a particular group and in the process, a group acquires a distinctive identity, separate from others. The emphasis placed on rituals, set religion as an obligatory instrument among groups of collectivist religious cultures. This argument was also reinforced by Dörnyei and Ushioda (2013) that collectivism is often seen as relying on obligation and on overcoming one’s internal desires for the good of the collective. Paine (2013) referenced the Jewish religion as one that emphasises the performance of religious duties even when the individual is not intrinsically motivated as it is often seen as praiseworthy to place the religious requirement above one’s own private desire. Cleveland et al (2016) offered a political dimension to the argument by purporting that the Singaporean Government’s approach towards religion is pragmatic, where religious values are seen mainly as instruments to promote national unity and maintain national identity. The view that religion is set as an obligatory instrument among certain social groups is very much opinionated as people’s commitment to religion is dying very fast in most societies and a number of people from certain social groups/settings are hardly ardent followers of religion and/or religious practices, let alone promote

ritualistic tendencies (Niebuhr, 2013). Therefore, these professed claims by the various theorists, for example, Paine (2013); and Wald and Calhoun-Brown (2014) needs a critical review to make the argument concrete and convincing as there are no empirical data to substantiate their proposition.

Reeve (2004); and Cohen and Hill (2007) developed a theoretical framework that distinguishes intrinsic and extrinsic religious values in collectivist cultures and defined 'intrinsic religion' as one that is matured, while referring to 'extrinsic religion' as immature. They further stressed that the use of extrinsic religion as one designed for instrumental purposes, including social integration. Jenkins et al (2013) noted that groups of people that share religious identity can be meaningfully viewed as sharing cultural values. This view was also purported by Han et al (2013); and Miller et al (2014) that the core element of collectivism is the assumption that groups bind and mutually obligate individuals. With so many domains of collectivism, Cohen and Hill (2007) admonished that it is vital to discern in which sense the discussion of collectivism can be viewed as they have tremendous impact on religious and spiritual identity, and motivation. Cleveland et al (2016) referenced a case of two Chinese non-Muslim youths who were convicted in court for posting inflammatory remarks against Muslims and claimed that the two men were jailed for spewing vulgarities at the Muslim Malay community. Cleveland et al emphasised that the incident led to the introduction of the Religious Harmony Declaration to remind all people of their religious obligation and reiterated that harmony is vital for peace, progress and prosperity. This indicates that religion alone cannot be used as an instrument to integrate people (Chang et al, 2013), and therefore undertaking a study that reviews the collectivist religious integration perspective is germane. Furthermore, the notion that people sharing the same religious beliefs have similar cultural values is parochial as most people in collectivist societies share similar religious beliefs, but have different cultural orientations or values (Moran, 2014).

Pirutinsky (2009) stated that the influence of religion on the functioning of humans is not monolithic and tends to fluctuate depending on the attitudes, beliefs, and behaviours promoted by the belief of the individual. A number of theorists, for example, Cohen (2009); and Moran et al (2014) suggest that religion is best understood as a source of cultural influence with a diverse and varied impact on the way family interact with each other and with society, and it is therefore important to examine the importance of religion in the meal social interaction behaviours of certain groups or families, since generalisation may prove inaccurate. On the other hand, it is evident as noted by Cohen (2009); and Moran et al (2014) that even within the broader religious categories such as Muslims, Christians and Jews, there may be within group differences in terms of belief and culture that might alter the importance of religion in the way collectivist families interact at the dinner table. Barrett (2013) noted that it is not all types of religious groups appear to be equally adaptive. For example, Protestants and Catholics place emphasis on different intrinsic and extrinsic religious values, particularly on social aspects of religious motivation (Cohen, 2009).

Cohen and Hill (2007); and Ferraro and Brody (2015) suggested that collectivistic cultures such as those of the Hindu Indians and several East Asian Countries, place greater emphasis on religious cultural values and social connectedness as an integral element of religious life, and proclaimed that under such circumstances group affiliations are seen as important in defining parts of religious identity. This argument was further reinforced by Johnson and Cohen (2013), who concluded that collectivistic religious cultures pay greater credence to connectedness among people and communities. Kitayama and Markus (2014) noted that in a collectivist religious setting individuals are more likely to see themselves as part of an encompassing social network and to act in accordance with what one perceives to be the feelings, thoughts, and actions of the others. Hofstede (2003); and Collar (2013) stressed that schisms within religious communities in collectivist societies are not encouraged, but if they do occur, they are absorbed within the context of the larger religious community. Hofstede (2003) reiterated that human beings' images of God or the gods reflect the values of human society, and professed that polytheist religions are symptomatic of collectivist societies. A number of research studies, for example, Hayton and Cacciotti (2014); Posthuma and Guerrero (2013); and Thornhill and Fincher (2014) conclude that traditional religiosity is positively associated with types of values characteristic of collectivism. It may be that because collectivism emphasises the relation to the in-group, the collectivist person would find more value in benefiting someone closer to her or him. The notion of the theorists, for example, Hofstede (2003); and Collar (2013), that schisms is not encouraged in religion can be viewed as too extreme as people of the same faith/belief may belong to different religious sects, which in itself breeds conflict and antagonism and most times a source of religious tensions (Krishnamurti, 2013).

Wald and Calboun (2014) referenced the distinction between Orthodox (i.e. the premise of acceptance of a divinely originated Torah (Hebrew bible) and adherence to the 613 biblical commandments, as interpreted in the "Talmud")

and applied to all aspects of daily life) and non-Orthodox Judaism (which does not require strict adherence to laws and beliefs, but instead emphasises interpersonal ethics and social action and communal participation). Cohen and Hill (2007); and Kvande (2014) argued that non-orthodox Judaism represents a collectivist religion, which focuses on the expression of religiosity through social interrelation. Pirutinsky (2009); and Argyle and Beit-Hallahmi (2014) reiterated that the Orthodox Jewish doctrine and culture are explicitly centred on religious mental states such as belief in an afterlife; and a personal relationship with God founded upon faith and trust (Rosmarin et al, 2009; and Barrett, 2013). In family social interaction at meal times, most religions view the provision of the food for the family as God given, which can lead to spiritual and religious growth (Burton and Clements, 2013). Rosmarin et al (2009); and Feinson and Meir (2014) posited that despite the paucity of research on Orthodox Jews, religious mental states such as belief in God's benevolence and the utilisation of religious coping strategies are strongly linked with a better mental state, whilst research on non-Orthodox Jews found no relationship between religion, belief and mental health (Feinson and Meir, 2014).

A number of studies, for example, Sussman et al (2013); and Scales et al. (2014), have pointed to the mediating pathways through which intrinsic religiosity exerts these effects, indicating that the mechanisms are not fully known and vary across religious affiliations. A key possibility noted by Bhushan (2014) is that intrinsic religiosity acts as psychological resource that encourages protective mental states. Other researchers have suggested that beyond these mental processes, religious individuals have better social contacts (Argyle and Beit-Hallahmi, 2013; and Pargament and Lomax, 2013). Giddens (2013); and Figley and Kiser (2013) suggested that social support serves as a protection against the way families interact at the dinner table. Consequently, intrinsic religiosity may help to unify the family and influence their degree of closeness through increased social support (Wang et al., 2014). Hovey et al. (2014) posited that although extrinsic religiosity provides increased social contact, intrinsic religiosity provides a more effective social support. This implies that religion is used for instrumental purposes such as social integration as well as for community affiliation, social relationship, tradition and rituals (Cohen, 2009). Ai et al (2014); and Ledbetter and Beck (2014) supported this argument by stating that relationships formed in the context of a shared religious worldview are particularly accessible and protective when families are interacting socially at the dinner table. Consequently, there are chances of potential variation in the spiritual effects of religious beliefs across religious groups or sects and the paucity of research on the impact of religion on family meal interaction behaviour justifies the essence of conducting research on such a topical issue (Koenig, 2013; and Pressman et al, 2014).

### **Individualism/Collectivism:-**

Martin and Manns (2014); and Yolles and Fink (2014) suggest that individualism-collectivism should be theorised along a cultural continuum rather than establishing a cultural divide as there is a tendency for both to exist in the same culture. In an earlier study, Chui and Kwok (2008) concluded that more life insurance policies are sold in individualistic cultures than in collectivistic ones, emphasising that in the former, should one die, one cannot rely on family members to support the dependents. Lu et al (2013); and Roberts (2015) noted that people with strong individualistic values emphasise autonomy, independence, and individual initiative; and the right to privacy, pleasure seeking, financial security, the need for specific friendships, and universalism, whereas individuals with strong collectivistic values tend to favour group solidarity, obligations, security, obedience, duty and personalised relationship; and promotes collective identity, emotional independence, sharing, need for stable and predetermined friendships, group decisions and particularism (Yassine-Hamdan and Pearson, 2014). The individualism-collectivism literature mainly focuses on the differences between the Western cultural values, the Middle Eastern cultural values or the Far Eastern cultural values (De Mooij, 2013; Naor et al, 2013; and Vaiman and Brewster, 2014), and it is assumed that African cultures are also collectivist (Greenfield and Cocking, 2014), which signifies that the African continent has been neglected over the years with no meaningful research conducted to verify the assertions of collectivism (McEwan et al, 2015). Therefore, the notion that collectivist cultures promote collective identity, stability, obligations and group decisions is questionable as there is evidence of the inability of families to hold things together when having social discourse at the dinner table; and Roopnarine and Hossain (2013) noted that a number of homes in Africa are built on nuclear orientation rather than extended families. Also, most collectivist homes in Africa, decisions are not made in collective rather the head of the family is the decision-maker (Kavanaugh et al, 2014).

Oh et al (2014); and Pandey and Joseph (2014) suggested that concern for belongingness leads to a tendency towards collectivism, which is expressed by an individual's identification with the collective goal of his or her group; and Parks et al (2013) recommended that priority should be given to the group as a whole, and referenced the

Chinese cultural values as one that gives credence, importance and continuity to the kinship group (Berger et al, 2014). Slater and Tonkiss (2013); Zhao (2014); and Lee (2015) buttressed this argument by commenting that the primary concern of the majority of Chinese was how to protect and enhance their private kinship interests; and that individual sacrifices may be required in order to gain the benefits that accrue to the group. The concept of collectivism has also been shown to have significant impact on creativity and innovativeness as it has been shown to extinguish the creative spark necessary for innovation (Usunier and Lee, 2009; Anderson, 2014; Kumar, 2014). The concern for belongingness should not be seen as the primary arbiter for collectivism as most family members in Africa are afraid of being ostracised by their kinship network and as a result drives them to embrace collectivistic tendencies (Gaines, 2014). Therefore, such generalisation of collectivism needs to be re-examined in order to determine whether there are discrepancies in the argument purported by the various theorists.

#### **Family meal social interaction behavior:-**

Family meal social interaction behaviour is the meal shared by a family as a social event, which has important cultural meaning in the organisation of the family's social life with culturally specific rhythms, norms, rights, and responsibilities (Conklin et al, 2014). Neumark-Sztainer et al (2008); McIntosh (2013); and Lull (2013) reported the existence of a positive family social discourse atmosphere, when families make mealtimes a priority, and the family structure during meals protect children from disordered eating behaviours. Windram-Geddes (2013) pointed out that lack of genuine concern and disengagement during the meal times has also been associated with overweight conditions in children, as families who interact socially with their children in a direct and clear manner during mealtimes are less likely to have children with internalising symptoms. The notion that family meal social interaction behaviour reduces disorderliness and internalised symptoms is subjective as many families in certain social groups hardly sit together to have a meal, but at the same time have children whose social behaviours are orderly and responsible (Chapman, 2013; Cohen, 2013; and Firth, 2013). As a result, conducting a study to address these shortcomings is essential and significant.

Family mealtime social interaction behaviours are characterised by responsiveness to children's questions, role assignment, and that when behaviour is well regulated, the child adaptations such as enriched language development and academic achievement can be enhanced (John et al, 2013; and Seifer et al, 2014). The parenting style, generally accounts for differences in eating and family meal social intercourse behaviours, particularly when considering outcomes associated with younger children who spend more time overall eating at home with one or more parents (Fraser et al, 2014). Philips et al (2014) noted family meal social interaction behaviour is characterised by over-controlling and restrictive attitudes and behaviours towards food, which can be associated with overweight status in children. A number of research findings, for example, Berge et al (2013); and Drotar (2014), showed that more frequent family meal social interactions are associated with better outcomes among children and adolescents. The notion by the theorists that over-controlling and restrictiveness to children's attitude and behaviour at meal times leads to obesity is questionable as many researchers have pointed to the type of food consumed by the family as the main contributors to obesity (Betoko et al, 2013; Pearce and Langley-Evans, 2013; and Pimpin et al, 2013).

#### **Methodology:-**

This research adopted the constructionist approach as its epistemological perspective, which is reliably linked with the 'lived experiences of families as it is considered an appropriate way for determining how humans make sense of their surroundings. As a consequence, this research used semi-structured face to face interviews, observation, field notes, and archival analysis as the data collection methods. The interviewees were drawn from 20 different Sierra Leonean families (husbands and wives) with differing ethnic and cultural backgrounds, with a sample size of 40. The research was conducted in the four provincial headquarter towns of Bo, Freetown, Kenema and Makeni. The data was collected using snowballing, experiential and convenience sampling techniques. The researcher used qualitative research in explaining the behaviours of families at mealtimes using inductive approach. A pilot study was conducted on four families of differing backgrounds to determine the appropriateness of the semi-structured interview protocols. The initial data collected from the four families were analysed to identify their appropriateness for the study. The initial data obtained during the pilot study were coded and analysed to determine whether the research questions and objectives have been met. This was eventually followed by the primary data collection. All the families were recruited on a voluntary basis by emphasising to them the freedom to withdraw from the research process at any time. Critical attention was given to the religious and marital backgrounds of the interviewees to ensure a fair representation of the sample obtained from the differing social groups. This was done in order to ensure equal proportional representation of the two religious groups (Christians and Muslims), and ensure that the couples interviewed were married in order to achieve the objectives of the research. The data collection process lasted for

about two months (8 weeks). NVIVO 10 was used in transcribing the data obtained from the field as it gave the researcher the ability to forward and rewind the audio recorder. The data was analysed thematically by identifying the frequency at which certain issues or themes appeared in the primary data.

### Results and findings:-

This section of the research discusses how religion as a doctrine affects the families' meal social interaction behaviour by outlining the various antecedents that families view as critical when having social discourse at mealtimes. Spiritual beliefs, cultural values, traditional practices and social bonding were identified as the sub-themes from the data as the main issues affecting religion of the Sierra Leonean families at mealtimes. A detailed discussion of each of the sub-theme is held in the subsequent sections.

#### Spiritual beliefs:-

Spiritual belief in this study involves: the religious beliefs; food ethics; respect and affection; gender distinction; hierarchical credence; socialisation and education espoused by families in their meal behaviours.

<b>Q.1</b>	<b>In what ways does this spiritual belief influence the way your family interact at the dinner table?</b>
	<b>Muslim Females:</b> Themes in common were: prayer; respect; provider; food ethics; food type; gratification; religious beliefs Differences were reflected in the following areas: protection; family unity; gender distinction; obedience; God's presence; fasting; kneeling down; posture; dress code; boundaries
	<b>Christian Females:</b> Themes in common were: prayer; provider; respect; gratification; food ethics; religious beliefs; family unity Differences were reflected in the areas of humility; success; responsibility; direction; God's presence; religious faith; fearing God; way of life; food wastage; relationship building; harmony; love; sharing
	<b>Muslim Males:</b> Themes in common were: prayers; provider; respect; gratification; food type; religious beliefs Differences were reflected in the following areas: truthfulness; cultural beliefs/values; humility; food ethics; religious beliefs; God's presence; love
	<b>Christian Males:</b> Themes in common were: prayer; provider; gratification; religious beliefs; blessing Differences were reflected in the following domain: respect; humility; saviour; responsibility; family cohesion/unity; God's presence; moral beliefs; fasting; fearing God; love; bonding
<b>Observational data</b>	A number of the interviewees observed silence at mealtimes. It was also observed that some of the interviewees said 'bismillahi' or the Lord's prayer in silence before eating. The members of some family used spoons when eating. The children thanked both the mother and father and any elder present after eating
<b>Comparative summary of the findings</b>	<p>In comparing the food religious behaviours of Muslim and Christian females, the results show that commonalities existed in the areas of prayers, God is the provider, respect, food ethics, gratifying God and family religious beliefs as reflected in the views of the 7<sup>th</sup>, 17<sup>th</sup>, 19<sup>th</sup>, 21<sup>st</sup>, 25<sup>th</sup>, 31<sup>st</sup>, 35<sup>th</sup>, 37<sup>th</sup>, and 39<sup>th</sup> interviewees for Muslim females and 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup>, 9<sup>th</sup>, 11<sup>th</sup>, 13<sup>th</sup>, 15<sup>th</sup>, 23<sup>rd</sup>, 27<sup>th</sup> and 29<sup>th</sup> interviewees for Christian females. For example:</p> <p><i>"Well, I teach my children to pray before their meal, I also teach them to pray after their meal and ask God to provide for us and also ask him to provide for the breadwinner. We also ask God to promote my business, and I believe that God is making that provision as it is evident in everything we are currently doing...when we are at the dinner table we expect everybody to be silent and behave appropriately- no talking is allowed during dinner. After praying we sit down quietly and eat..."</i></p> <p>Interviewee 9, Female, Christian</p> <p>Despite the overwhelming similarities shared by Muslim and Christian females, there were marked differences in terms of the type of food consumed by each sect as the Christian females</p>

	<p>were more pragmatic and open to the consumption of all kinds of foodstuffs, whilst the Muslim females were selective and restrictive in their food choice. This is reflected in the following statements:</p> <p><i>“Well, we normal say bismillahi before we start eating. For us as Muslims we believe God is the provider of anything we have in this world. We also believe that without him you will not be able to secure your daily bread and whatever you want in the world without the blessings of the almighty Allah. Also, as Muslims we are not allowed to eat anything uncleaned such as pork, monkey or other bush animals that have not been properly killed with the name of God pronounced on it. so that affects the way we interact at the dinner table”</i></p> <p>Interviewee 21, Female, Muslim</p> <p>Juxtaposing the food religious values of Muslim and Christian males, it was evident that they broadly shared a number of common values such as prayer, God is the provider, gratification and religious beliefs as espoused in the statements of 8<sup>th</sup>, 18<sup>th</sup>, 20<sup>th</sup>, 22<sup>nd</sup>, 34<sup>th</sup>, 36<sup>th</sup>, 38<sup>th</sup> and 40<sup>th</sup> interviewees for Muslim males; and the 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup>, 10<sup>th</sup>, 12<sup>th</sup>, 14<sup>th</sup>, 16<sup>th</sup>, 24<sup>th</sup>, 28<sup>th</sup> and 30<sup>th</sup> interviewees in the case of the Christian males. For example:</p> <p><i>“I believe prayer has a great influence in everything we do, particularly before taking your meal. Calling upon the lord means we are thankful to God for having that meal. The belief we have as a family is that God and Christ has provided for the family because there is a saying in the bible – “provide us with our daily bread” and if that daily bread is provided to you, you have to say thanks and praise to God for what has been given to you”.</i></p> <p>Interviewee 6, Male, Christian</p> <p>Despite the shared similarities, there were marked differences in terms of the type of food consumed as the Christian males just as the Christian females, were more open to variety in their food choices; Muslim males, just as their female counterparts, were more restrictive in the type of food consumed. This is reflected in the following statements:</p> <p><i>“Spiritually, religiously and of course I am a Muslim and as Muslims we have certain believe that there are certain foods we should abstain from such as chimpanzees, monkeys, even though they are delicious and proteinous foods, but we do go away from them, pigs inclusive, we do not take alcohol and even our mode of dressing. If you see your girl child dressed in short shirts in Africa, not only Africa, but more in terms of our religion, we do frown at those sorts of behaviours. So I think it has some effect on the way we interact at the dinner table”.</i></p> <p>Interviewee 22, Male, Muslim</p>
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### Cultural values:-

Cultural values in this study are the generally accepted standard of behaviour expected from each member of a family at mealtimes, including: food ethics; reverence for each other; hierarchy; gender differentiation; affection; and religious beliefs.

<b>Q.2</b>	<b>What cultural values influence your family’s meal social interaction behaviour at the dinner table?</b>
	<p><b>Muslim Females:</b> Themes in common were: respect; gratification; prayer; food ethics; gender distinction Differences were reflected in the following domains: food type; unity; politeness; sense of responsibility; hierarchy; anti-social behaviour; kneeling down; Meal sharing; comportment; lion share; authority</p>
	<p><b>Christian Females:</b> Themes in common were: respect; prayer; food ethics; task distinction; gratification Differences were reflected in the following domains: hierarchy; politeness; obedience; sympathy; meal sharing; peace; greetings; love; lion share; self-identity; spiritual growth; blessing food</p>
	<p><b>Muslim Males:</b> Themes in common were: respect; prayers; authority/control; food ethics; meal sharing</p>

	<p>Differences were reflected in the following areas: sympathy; unity; family image; sense of responsibility; values; love; gratification</p> <p><b>Christian Males:</b>  Themes in common were: food ethics; respect; family unity; meal sharing; prayers  Differences were reflected in the following domain: boundaries; sense of responsibility; obedience; values; hierarchy; gratification; love; comportment; understanding; cordiality; friendliness; spiritual growth; blessing food; revered God</p>
<b>Observational data</b>	<p>Silence was observed at mealtimes by a majority of families. Prayer was also observed by a majority of families. The children of most families thanked their parents after the meal. However, it was observed that a few families do not attach credence to thanking them, as their children did not do so after meal.</p>
<b>Comparative summary of the findings</b>	<p>Comparatively, there was overwhelming commonality in terms of the cultural values shared by each sect on issues such as respect, gratifying God and parents, prayer and food ethics as reflected in the views of the 7<sup>th</sup>, 17<sup>th</sup>, 19<sup>th</sup>, 21<sup>st</sup>, 25<sup>th</sup>, 31<sup>st</sup>, 33<sup>rd</sup>, 37<sup>th</sup> and 39<sup>th</sup> interviewees for Muslim females; and the 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup>, 9<sup>th</sup>, 11<sup>th</sup>, 13<sup>th</sup>, 23<sup>rd</sup>, 27<sup>th</sup> and 29<sup>th</sup> interviewees for the Christian females. For example:</p> <p><i>“Well, culturally we believe in silence during dinner, we expect people to say bismillahi before eating, we expect the children to wash their hands before eating, expect them to say thank you to both parents or any elder present thank you after eating, especially if the elder is contributing to the provision or cooking of the food, we expect everybody to be respectful to each other through the dinner, and we expect women to eat separately from men”.</i></p> <p>Interviewee 33, Female, Muslim  Despite the overwhelming shared commonalities, there were differences in terms of gender distinction and task distinction. The Muslim females (17<sup>th</sup>, 21<sup>st</sup>, 33<sup>rd</sup>, 37<sup>th</sup>, 39<sup>th</sup> interviewees) were emphatic in their views about the separation of males from females at mealtimes, whilst the Christian females (3<sup>rd</sup>, 9<sup>th</sup>, 11<sup>th</sup>, 13<sup>th</sup>, 27<sup>th</sup> interviewees) highlighted task distinction as critical in their food behaviours. This is reflected in the following statement:</p> <p><i>“As Muslims, we are exempted from eating things that the Quran proclaimed that they are forbidden as part of the food or drink we take in such as alcohol or wine at dinner, pork meat, dog meat, cat meat or bush meat. These are seen in Islam as forbidden and uncleaned and anybody that eats it will not see the corridors of heaven. We also expect people to be quiet when taking their meals, to wash their hands before joining the dinner table, though in our family we mostly use spoon at the dinner table, men eat together from a common bowl, while women eat together from a common bowl separate from the men, we expect everybody to say bismillahi when eating”.</i></p> <p>Interviewee 37, Female, Muslim  In comparing the cultural values of Muslim and Christian males, it was evident that respect, prayers and meal sharing were cultural values both denominations shared as reflected in the views of the 18<sup>th</sup>, 20<sup>th</sup>, 26<sup>th</sup>, 32<sup>nd</sup>, 36<sup>th</sup>, 38<sup>th</sup> and 40<sup>th</sup> interviewees for the Muslim husbands; and 2<sup>nd</sup>, 4<sup>th</sup>, 10<sup>th</sup>, 12<sup>th</sup>, 14<sup>th</sup>, 16<sup>th</sup>, 24<sup>th</sup> and 28<sup>th</sup> interviewees for the Christian males. This is reflected in the following statements:</p> <p><i>“The main cultural values in my family are respect for elders. As a result, after dinner the children are expected to say thank you to the giver and preparer of the meal. Secondly, they must say thanks and praise to God for what they have eaten on a specific day. Respect for elders, eating together, no talking when eating and cleanliness at the dinner table – clean hands”.</i></p> <p>Interviewee 6, Male, Christian  Despite the shared commonalities between the two sects, it is evident that a majority of the Muslim males were inclined to emphasise authority/control as a predominant cultural value in their families’ meal behaviour, whilst a majority of the Christian males placed emphasis on family unity as a predominant cultural value in their families’ meal behaviour. This is reflected in the following statement:</p>



	<p><i>“Well, as Muslims the way we eat together is that they dish in a very big bowl where all of us will put our hands together as men and during the process the oldest one among you will control whatever meat or whatever condiments is on top of that food. So you don’t have to reach for that particular meat until it is being divided among you all equally. But you have to respect the rules and regulations of the elders while eating”.</i></p> <p>Interviewee 18, Male, Muslim</p>
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### Traditional practices:-

Traditional practices in this study refer to the customary practices of families that are influenced by their culture or sub-culture and/or their social group or cultural settings/environment, including: food ethics; affection; modernity; respect; family religious values; hierarchy; and gender distinction.

<b>Q.3</b>	<b>What traditional practices influence your family’s meal social interaction pattern at the dinner table?</b>
	<p><b>Muslim Females:</b> Themes in common were: food ethics; gratification; prayer; sense of responsibility; sympathy Differences were reflected in the following domain: family unity; respect; obedience; politeness; gender distinction; peace; kneeling down; Islamic values</p>
	<p><b>Christian Females:</b> Themes in common were: prayers Differences were reflected in the following domains: respect; food ethics; hierarchy; humility; responsibility; kneeling down</p>
	<p><b>Muslim Males:</b> Themes in common were: prayers; food ethics; respect; gratification Differences were reflected in the following areas: control; family unity; provider; truthfulness; togetherness; responsibility; cooperation; fearing God; Islamic values; God provider</p>
	<p><b>Christian Males:</b> Themes in common were: food ethics; respect; control; prayers Differences were reflected in the following domain: sense of responsibility; modernity; sympathy; sharing; family unity; togetherness; appreciation; witchcraft</p>
<b>Observational data</b>	In a majority of families, it was observed that females ate separately from males. Members of the family washed their hands from a common bowl. The families said prayers before eating and silence was observed throughout the dinner. The females were observed bringing food to the dinner table for the males. The children thanked the parents after dinner. Females cleaned and cleared the table of dishes after eating.
<b>Comparative summary of the findings</b>	<p>Comparing the traditional practices of Muslim and Christian females, the findings show that they share commonality only in prayers as most Christian females (1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup>, 9<sup>th</sup>, 13<sup>th</sup>, 27<sup>th</sup> and 29<sup>th</sup> interviewees) indicated that traditional practices do not influence their families’ meal behaviour, whilst Muslim females (7<sup>th</sup>, 17<sup>th</sup>, 19<sup>th</sup>, 21<sup>st</sup>, 25<sup>th</sup>, 31<sup>st</sup>, 33<sup>rd</sup>, 35<sup>th</sup> and 39<sup>th</sup> interviewees) commonly shared food ethics, gratifying parents, prayers, sense of responsibility and sympathy as being central in their traditional practices. For example:</p> <p><i>“Just as I said, the younger ones fetch water to the dinner table before meal, the children say thank you after meal, prayers before eating, quietness is expected from everybody when eating, sympathy and politeness at the dinner table”.</i></p> <p>Interviewee 1, Female, Christian</p> <p>A majority of the Muslim and Christian males share commonalities in the area of prayers, respect and food ethics as reflected in the views of the 18<sup>th</sup>, 22<sup>nd</sup>, 26<sup>th</sup>, 32<sup>nd</sup>, 34<sup>th</sup>, 36<sup>th</sup>, 38<sup>th</sup> and 40<sup>th</sup> interviewees for Muslim males and the 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup>, 10, 12<sup>th</sup>, 14<sup>th</sup>, 24<sup>th</sup> and 28<sup>th</sup> interviewees for the Christian males. This is reflected in the following statement:</p> <p><i>“Well, before eating, we expect everybody to wash their hands, we expect everybody to be silent when eating, we expect everybody to respect each other and particularly elders, and we expect everybody to say bismillahi before putting the food in his/her mouth”.</i></p>

	<p>Interviewee 36, Male, Muslim</p> <p>However, there are marked differences between the two denominations (Christian and Muslim males) in the area of control and parental gratification as a majority of Muslim males are more inclined to expect gratification from their children after a meal, whilst the Christian males are inclined to implement control at mealtimes. For example:</p> <p><i>“I am a Muslim, so we strictly follow Islamic norms. Before eating you have to pray and before you do anything you have to pray first. After eating you say thanks to the almighty God”.</i></p> <p>Interviewee 26, Male, Muslim</p>
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### Social bonding:-

Social bonding in this study is the degree of closeness established by each family either internally within the family or externally with others in their natural settings, including: socialisation; reverence; affection; education; food ethics; and family religious values.

<b>Q.4</b>	<b>In what ways does social bonding influence your family’s social interaction pattern at meal times?</b>
	<p><b>Muslim Females:</b></p> <p>Themes in common were: food ethics; moral education; control</p> <p>Differences were reflected in the following domains: respect; advice source; family image; prayer; participation; happiness; training; preaching; learning; sharing ideas; modern approaches; direction; food type</p>
	<p><b>Christian Females:</b></p> <p>Themes in common were: family unity; respect; affection; prayer</p> <p>Differences were reflected in the following domains: meal sharing; compatibility; sympathy; sense of responsibility; social bonding; love</p>
	<p><b>Muslim Males:</b></p> <p>Themes in common were: cultural values; sharing; family unity; togetherness; prayer</p> <p>Differences were reflected in the following areas: respect; control; family image; social group; understanding; peace; success; food type</p>
	<p><b>Christian Males:</b></p> <p>Themes in common were: family unity; sharing; togetherness; prayer</p> <p>Differences were reflected in the following domain: obedience; values; sense of belonging; social event; community gathering; oneness; cordiality; raising awareness; communication</p>
<b>Observational data</b>	In one of the families, a pastor was observed joining the family at mealtimes. Lengthy prayer before eating was observed. The male child was asked to eat separately from his dad. The pastor and dad ate together and silence was observed throughout the dinner. After dinner a lengthy discussion was held. The wife cleared the table after meal.
<b>Comparative summary of the findings</b>	<p>A majority of the Muslim females (17<sup>th</sup>, 21<sup>st</sup>, 25<sup>th</sup>, 31<sup>st</sup>, 33<sup>rd</sup>, 35<sup>th</sup>, 37<sup>th</sup> and 39<sup>th</sup>) highlighted food ethics, moral education and control as the main ingredients of social bonding, which is contrary to the views of a majority of Christian females (1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup>, 11<sup>th</sup>, 13<sup>th</sup>, 15<sup>th</sup>, 23<sup>rd</sup> and 27<sup>th</sup>), who emphasised family unity, respect, affection and prayers as being central to their families’ meal behaviour. For example:</p> <p><i>“Just as I have said, we are Christians and we expect our children to respect elders, we expect them to pray before taking their meal, to ensure that if there is food, it should be shared among every member of the family as a unit, and the religious aspects of our lives has also been transferred into our family”.</i></p> <p>Interviewee 15, Female, Christian</p> <p><i>“... It normally educates you, which you can transfer to your family at the dinner table. It teaches us what to do and what not to do at the dinner table. Through social bonding we are able to establish control and reinforce religious beliefs at the dinner table. When you associate with people ...you will learn a lot of new things... it is educative and you will learn about what is right</i></p>

	<p><i>and what is wrong and the right way to behave”.</i></p> <p>Interviewee 39, Female, Muslim Family unity, prayer, togetherness and meal sharing are commonalities emphasised by a majority of the Muslim (8<sup>th</sup>, 20<sup>th</sup>, 22<sup>nd</sup>, 36<sup>th</sup>, 38<sup>th</sup> and 40<sup>th</sup> interviewees) and Christian (2<sup>nd</sup>, 6<sup>th</sup>, 12<sup>th</sup>, 16<sup>th</sup> and 24<sup>th</sup> interviewees) males as influencers of their families’ food behaviour. This is reflected in the following statement:</p> <p><i>“...we believe in sharing, because we believe in give and take...it brings us together and gives us the opportunity to interact with other people in the community”</i></p> <p>Interviewee 24, Male, Christian However, there are differences in terms of cultural values as a majority of the Muslim males see social bonding as a way of sharing their values with others as reflected in the following statement:</p> <p><i>“...social bonding plays a great role in shaping the behaviour of the children and it is also a way of teaching the children our cultural values”.</i></p> <p>Interviewee 40, Male, Muslim</p>
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### Discussions:-

Discussion of the impact of religion on families and businesses is sub-categorised into spiritual beliefs, cultural values, traditional practices and social bonding, each of which are discussed in detailed below:

#### The impact of spiritual beliefs:-

Under the perspective of religion, the results show that spiritual beliefs is ingrained in families across Sierra Leone as a majority of interviewees (Muslim and Christian females, and Muslim and Christian males) emphasised that their families have religious values that guide their behaviour; their families held prayers before eating as they believe that God is responsible for providing food for their families; and that God must be respected and thanked at all times (before and after meal) for the food provided for their families. Despite the similarities, a majority of Muslim and Christian females emphasised food ethics such as silence at mealtimes, washing of hands before eating, and the non-wastage of food as fundamental aspects of their families’ spiritual beliefs; a factor less emphasised by a majority of the Muslim and Christian husbands. This may be due to their gender responsibility and the keen attention they pay to the proper functioning of the family as a whole. It is also evident from the results that a majority of the Muslim females and males were more selective in their families’ food choices due to their religious beliefs, whereas the Christian females and males were more pragmatic and open to all kinds of foods. The results also show that even within the same religion and gender classification, for example, Muslim females, differences emerged including: God protects the family; family unity; gender distinction; obedience; God’s presence; fasting; kneeling down; posture at mealtimes; dress code; and food boundaries. Other issues raised by a significant number of the interviewees as spiritually influencing their families’ meal behaviour include: humility; success; responsibility; direction; observing God’s presence; demonstrating the fear of God; building relationship with others; harmony; love; sharing; truthfulness; respect; and God is the saviour. This implies that a majority of the interviewees embraced family religious values; prayers; God makes provision for the family; and respecting and gratifying God as fundamental to their families’ way of life. This further implies that despite the religious divide between the Muslim and Christian families, there are shared commonalities between them, and that the so called ‘division/schism’ between the two sects is man-made or at least blurring; may be due to acculturation. The fundamental role of prayers in families’ meal behaviour emphasised in this study reflects those of Burton and Clements (2013); Dobratz (2013); and Ivtzan (2013), that prayer at family mealtimes brings unity and that difference in the type of food eaten by families are largely influenced by spiritual beliefs. The aspect of family religious values were also emphasised by Cohen and Hill (2007); Reeve (2004); and Cleveland et al (2016) as instruments to promote national unity and maintain national identity. However, this study brings a new dimension to the argument by highlighting specific issues such as gratifying God at mealtimes; food ethics; God protecting the family from social ills; God is the provider of the food eaten by the family; and gender distinction at mealtimes as fundamental factors affecting families’ meal behaviour as well as businesses. This implies that spiritual beliefs largely influence the kind of food families eat and/or drink, which sometimes influences the kind of people they associate with. These

were the gaps the study identified in the literature such as: the generalisation of the impact of spiritual beliefs on families and businesses, as lacking sufficient evidence and argument, and which it sought to fill.

#### **The impact of cultural values:-**

On the issue of cultural value as a religious domain, a majority of the interviewees (Muslim and Christian females, and Muslim and Christian males) emphasised respect for elders, food ethics and prayers before eating as fundamental to their families' meal behaviour. Despite the avowed similarities, a majority of the Muslim and Christian females emphasised the need for gratifying God and parents, and observing food ethics at mealtimes as being symbolic in their families' meal behaviour. In comparison, a majority of the Muslim and Christian males emphasised sharing meals with others as fundamental to their families' religious cultural values. Furthermore, the results showed that a majority of Christian males were emphatic about family unity as a significant cultural value; a majority of Muslim males were emphatic about the symbolism of authority/control as fundamental cultural values; a majority of the Christian females were emphatic about the significance of task distinction as symbolic cultural values; and a majority of Muslim females were more emphatic about gender distinction as fundamental cultural values. It was also evident from the results of this study that even within the same religion and gender group, there were minor differences in cultural values, including: hierarchy; politeness; obedience; sympathy; meal sharing; peace; greetings; love; husband getting the lion share; self-identity; spiritual growth; and blessing of the food. Other issues identified by a minority of all interviewees in relation to cultural values include: food type; unity; sense of responsibility; anti-social behaviour; kneeling down; comportment; authority; family image; family values; gratification; boundaries; obedience; understanding; cordiality; friendliness; and revered God, which they emphasised are important cultural values in their families at mealtimes. This suggests that a majority of the interviewees see respect for elders, food ethics and prayers as essential cultural values in their families' meal behaviour, and that the Muslim and Christian females attached higher importance to the gratification of God than those of their male counterparts (Muslim and Christian males). This argument reflects those of Ferraro, G., & Brody (2013); Cohen and Hill (2007); and Jenkins et al. (2013), who emphasised that cultural values and social connectedness are an integral element of societal religious life. Despite the similarities shared with Ferraro, G., & Brody (2013); Cohen and Hill (2007); and Jenkins et al. (2013) about cultural values which is largely generic, this study was able to specify respect, family religious values, prayers, gratification of God and parents, and food ethics as fundamental cultural values affecting families. This implies that cultural values are becoming an important overlap of religious values, as it is difficult to discern between religion and cultural values in most Sierra Leonean family. The generic description of cultural values by previous studies led the researcher to believe that there were gaps in their findings, which this study helped to address.

#### **The impact of traditional practices:-**

In emphasising the impact of traditional practices as a religious domain, a majority of the interviewees (Muslim and Christian females, and Muslim and Christian males) emphasised prayer as a predominant factor in their families' meal behaviour. Despite the shared similarity, a majority of the Christian females suggested that traditional practices do not influence their families' meal behaviour, which was contrary to the views of Muslim females, a majority of whom posited additional factors, including: food ethics; gratifying parents; sense of responsibility; authority/control and sympathy as major influencers of their families' meal behaviour. This is consistent with the views of a majority of the Muslim and Christian males, who reiterated respect and food ethics as fundamental in their families' meal behaviour. In addition, a majority of Muslim males emphasised gratification of God and parents as symbolic traditional practices, whilst Christian males were emphatic about authority/control as fundamental traditional practices. This suggests that a majority of interviewees were inclined to use traditional practices at mealtimes, and that traditional practices are not predominantly embraced by most Christian females due to acculturation and/or other factors such as urbanisation, though their male counterparts (Christian males) are more inclined to use them. This is consistent with the views of Guerrero (2013); and Thornhill and Fincher (2014), who identified traditional practices as influencers of the behaviour of collectivist societies and proclaimed that, they are positively associated with people's religiosity. It is evident from the findings of this study that the views of Guerrero (2013); and Thornhill and Fincher (2014) are too generic and broad to be meaningful to future researchers as they failed to identify specifically the traditional practices that influenced people's behaviour. As a consequence, this study provides detailed and specific traditional practices that influenced families' meal behaviour, including: prayers; respect and food ethics; sympathy; sense of responsibility; and gratifying parents as symbolic traditional practices shared by a majority of families in Sierra Leone. This implies that despite a majority of Muslim families (males and females) still embrace traditional practices as part of their social interaction at mealtimes, the findings of this study showed that there is a gradual deviation from these practices, and presumably, there are greater tendencies for such deviations to increase

in the future. These were the gaps identified by the researcher as being too broad to be meaningful to future researchers, which are succinctly fulfilled by this study.

#### **The impact of social bonding:-**

In analysing the impact of social bonding as a religious factor on families' meal behaviour, a majority of Muslim females purported food ethics, moral education and authority/control as fundamental in their families' meal behaviour, which is contrary to the views of a majority of Christian females, who emphasised family unity, respect, affection and prayer as intrinsic in their families' meal behaviour. However, a majority of Muslim and Christian males emphasised family unity, prayer, togetherness and meal sharing as essential to the way their families behaved at mealtimes. This indicates that family unity and prayer are central to the family religious values of Christian females, Muslim males and Christian males, but offers distinct set of values/beliefs to the Muslim females, and the way people socialise in society may vary from one group to the other due to cultural, gender, age, regional or religious differences. As a consequence, even within the same family, sometimes bonding is limited to people of the same age group or gender. This implies that a majority of the interviewees view social bonding as a fundamental influencer of their families' meal behaviour. The results also showed that even within the same gender and religious domain of families, a minority of the interviewees demonstrated significant social differences in the way they relate with others, including: advice source; family image; participation; happiness; training; preaching; sharing ideas; direction; social group; understanding; peace; success; compatibility; sympathy; sense of responsibility; love; obedience; values; social event; community gathering; oneness; cordiality; raising awareness; and communication. The same argument was advanced by Arsel and Thompson (2011) that the identity of individuals depend in large measure on their feeling of acceptance, highlighting that the social experiences of everyday life is the distinct values of a particular group, emphasising that in the process, the group acquires a distinct identity, separate from others. This argument was further reinforced by Kitayama and Markus (2014), who noted that, individuals are more likely to see themselves as part of an encompassing social network and to act in accordance with what one perceives to be the feelings, thoughts, and actions of the others. Despite these similarities, this study is the first to specify the various components of social bonding and its impact on families in Sierra Leone, including: food ethics; moral education; control; family unity; respect; affection; prayer; togetherness; neighbours; and meal sharing as fundamental to the way Sierra Leonean families interact at mealtimes. This suggests that irrespective of the commonalities shared about social bonding by families, differing perspectives are bound to emerge either due to their lack of awareness of its symbolism, the upbringing of individuals or the type of social groups they interact with over the years. These gaps were what led the researcher to question the validity of the broad concept of social bonding used by earlier theorists such as: the generalisation of the view that individuals and businesses act in accordance with the feelings, thoughts, and actions of the others, which has been sufficiently filled by this study.

#### **Conclusion:-**

It is evident from the findings of this study that religion transcends the concept of spiritual beliefs and that in fact it is ingrained in the cultural, educational, traditional, ethical and social construct of families, which help fosters a healthy environment and raises children's awareness about the symbolism of God. This profoundly increases humility, respect and obedience among family members at mealtimes, and teaches children moral ethics, prevents families from experiencing health hazards and imbibes sense of responsibility in children. In retrospect, the study highlights religion as a fundamental influencer of the type of food purchased and/or consumed by families as Christians were more pragmatic and open to consuming all types of food unlike their Muslim counterparts. Another fundamental influence of religion is that it promotes the increased drive for gender differentiation and role distinction at families' mealtimes, which is used to showcase male dominance and female subservience. Consequently, this limits the association between males and females at mealtimes, which is increasingly used to define responsibility at the dinner table. The implications of this conclusion are that religion can have both positive and negative influence on families' meal behaviour. This is because it can be used for building the public image of the family, shaping the character of the children for the future good of society and by bringing them closer to God. Contrarily, religion adversely affects families as it can be used to restrict social interaction and connectivity between and among family members due to gender and age differences, which significantly promote biasness at mealtimes.

**Reference:-**

1. Ai, A. L., Weiss, S. I., & Fincham, F. D. (2014). Family factors contribute to general anxiety disorder and suicidal ideation among Latina Americans. *Women's Health Issues*, 24(3), e345-e352.
2. Anderson, E. N. (2014). *Caring for Place: Ecology, Ideology, and Emotion in Traditional Landscape Management*. Left Coast Press.
3. Argyle, M., & Beit-Hallahmi, B. (2014). *The psychology of religious behaviour, belief and experience*. Routledge.
4. Arsel, Z., & Thompson, C. J. (2011). Demythologizing consumption practices: how consumers protect their field-dependent identity investments from devaluing marketplace myths. *Journal of Consumer Research*, 37(5), 791-806.
5. Barrett, J. L. (2013). Exploring Religion's Basement. *Handbook of the Psychology of Religion and Spirituality*, 234.
6. Beagan, B. L., Chapman, G. E., Johnston, J., McPhail, D., Power, E. M., & Vallianatos, H. (2014). *Acquired Tastes: Why Families Eat the Way They Do*. UBC Press.
7. Berge, J. M., Wall, M., Larson, N., Loth, K. A., & Neumark-Sztainer, D. (2013). Family functioning: Associations with weight status, eating behaviours, and physical activity in adolescents. *Journal of Adolescent Health*, 52(3), 351-357.
8. Berger, R., Silbiger, A., Herstein, R., & Barnes, B. R. (2014). Analyzing business-to-business relationships in an Arab context. *Journal of World Business*, 50(3), 454-464.
9. Betoko, A., Charles, M. A., Hankard, R., Forhan, A., Bonet, M., Saurel-Cubizolles, M. J., ...& de Lauzon-Guillain, B. (2013). Infant feeding patterns over the first year of life: influence of family characteristics. *European journal of clinical nutrition*, 67(6), 631-637.
10. Bhushan, B. (2014). Ageing, Religiosity and Mental Health: Some Reflections. *Social Work in Mental Health: Areas of Practice, Challenges, and Way Forward*, 300, 153.
11. Breinlinger, S., & Kelly, C. (2014). *The Social Psychology of Collective Action*. Taylor & Francis.
12. Chang, F. H., Coster, W. J., & Helfrich, C. A. (2013). Community Participation Measures for People With Disabilities: A Systematic Review of Content From an International Classification of Functioning, Disability and Health, Perspective. *Archives of physical medicine and rehabilitation*, 94(4), 771-781.
13. Chapman, D. (2013). *Home & Social Status IIs 111*. Routledge.
14. Chiu, C. Y., & Hong, Y. Y. (2013). *Social psychology of culture*. Psychology Press.
15. Chui, A. C., & Kwok, C. C. (2008). National culture and life insurance consumption. *Journal of International Business Studies*, 39(1), 88-101.
16. Cleveland, M., Rojas-Méndez, J. I., Laroche, M., & Papadopoulos, N. (2016). Identity, culture, dispositions and behavior: A cross-national examination of globalization and culture change. *Journal of Business Research*, 69(3), 1090-1102.
17. Cohen, A. (2013). *Custom and politics in urban Africa: A study of Hausa migrants in Yoruba towns*. Routledge.
18. Cohen, A. B. (2009). Many forms of culture. *American psychologist*, 64(3), 194.
19. Cohen, A. B., & Hill, P. C. (2007). Religion as culture: Religious individualism and collectivism among American Catholics, Jews, and Protestants. *Journal of Personality*, 75(4), 709-742.
20. Cohen, A. B., & Varnum, M. E. (2016). Beyond East vs. West: social class, region, and religion as forms of culture. *Current Opinion in Psychology*, 8, 5-9.
21. Collar, A. (2013). *Religious Networks in the Roman Empire: The Spread of New Ideas*. Cambridge University Press.
22. Conklin, A. I., Forouhi, N. G., Surtees, P., Khaw, K. T., Wareham, N. J., & Monsivais, P. (2014). Social relationships and healthful dietary behaviour: Evidence from over-50s in the EPIC cohort, UK. *Social Science & Medicine*, 100, 167-175.
23. Côté, J. E., & Levine, C. G. (2014). *Identity, formation, agency, and culture: A social psychological synthesis*. Psychology Press.
24. De Backer, C. J., Fisher, M. L., Poels, K., & Ponnet, K. (2015). "Our" food versus "my" food. Investigating the relation between childhood shared food practices and adult prosocial behavior in Belgium. *Appetite*, 85, 60-64.
25. De Mooij, M. (2013). *Global marketing and advertising: Understanding cultural paradoxes*. Sage Publications.
26. Delaney, M., & McCarthy, M. B. (2014). Saints, sinners and non-believers: the moral space of food. A qualitative exploration of beliefs and perspectives on healthy eating of Irish adults aged 50–70. *Appetite*, 73, 105-113.

27. Dobratz, M. C. (2013). "All my saints are within me": Expressions of end-of-life spirituality. *Palliative and Supportive Care*, 11(03), 191-198.
28. Dörnyei, Z., & Ushioda, E. (2013). *Teaching and researching: Motivation*. Routledge.
29. Drogendijk, R., & Martín, O. M. (2015). Relevant dimensions and contextual weights of distance in international business decisions: Evidence from Spanish and Chinese outward FDI. *International Business Review*, 24(1), 133-147.
30. Drotar, D. (Ed.). (2014). *Measuring health-related quality of life in children and adolescents: Implications for research and practice*. Psychology Press.
31. Du Gay, P., Hall, S., Janes, L., Madsen, A. K., Mackay, H., & Negus, K. (2013). *Doing cultural studies: The story of the Sony Walkman*. Sage.
32. Evans, I. M. (2015). *How and Why Thoughts Change: Foundations of Cognitive Psychotherapy*. Oxford University Press.
33. Feinson, M. C., & Meir, A. (2014). Exploring mental health consequences of childhood abuse and the relevance of religiosity. *Journal of interpersonal violence*, 30(3), 499-521.
34. Ferraro, G., & Brody, E. K. (2015). *Cultural Dimension of Global Business*. Routledge.
35. Ferré, F. (2013). *Basic modern philosophy of religion*. Routledge.
36. Figley, C. R., & Kiser, L. J. (2013). *Helping traumatized families*. Routledge.
37. Firth, R. (2013). *Rank and Religion in Tikopia (Routledge Revivals): A Study in Polynesian Paganism and Conversion to Christianity*. Routledge.
38. Fisher, M., Milos, D., Baum, F., & Friel, S. (2016). Social determinants in an Australian urban region: a 'complexity' lens. *Health promotion international*, 31(1), 163-174.
39. Fraser, J., Waters, D., Forster, E., & Brown, N. (2014). *Paediatric Nursing in Australia: Principles for practice*. Cambridge University Press.
40. Gaines Jr, S. O. (2014). *Culture, ethnicity, and personal relationship processes*. Routledge.
41. Gerson, E. M. (2013). Some Problems of Analysing Cultural Evolution. *Developing Scaffolds in Evolution, Culture, and Cognition*, 44, 265.
42. Giddens, A. (2013). *The transformation of intimacy: Sexuality, love and eroticism in modern societies*. John Wiley & Sons.
43. Goodenough, W.H. (1971), *Culture, Language and Society*. Reading MA: Modular publications, 7, Addison-Wesley
44. Greenfield, P. M., & Cocking, R. R. (Eds.). (2014). *Cross-cultural roots of minority child development*. Psychology Press.
45. Han, J., Ling, J., & Lim, A. (2013). Emotional Appeal in Recruiting Advertisement: Unpacking National Cultural Differences. In *Academy of Management Proceedings* (Vol. 2013, No. 1, p. 10743). Academy of Management.
46. Hanson, F. A. (2013). *Meaning in culture*. Routledge.
47. Hayton, J., & Cacciotti, G. (2014). 8 culture and entrepreneurship: empirical evidence for direct and indirect effects. *Handbook of Research On Entrepreneurship: What We Know and What We Need to Know*, 147, 111-112.
48. Helliwell, J. F., Wang, S., & Xu, J. (2014). *How Durable are Social Norms? Immigrant Trust and Generosity in 132 Countries* (No. w19855). National Bureau of Economic Research.
49. Herman, G. (2014). Towards a Biological Re-Interpretation of Culture. *Journal of Law and Social Sciences (JLSS)*, 3(2), 1.
50. Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviours, institutions, and organizations across nations* (2nd ed.). Thousand Oaks, CA: Sage Publications.
51. Hofstede, G. (2003) *Culture's consequences: Comparing values, behaviours, institutions and organisations across nations*, 2<sup>nd</sup> Edition. London, McGraw Hill.
52. Horta, A., Truninger, M., Alexandre, S., Teixeira, J., & da Silva, V. A. (2013). Children's food meanings and eating contexts: schools and their surroundings. *Young Consumers: Insight and Ideas for Responsible Marketers*, 14(4), 312-320.
53. Hovey, J. D., Hurtado, G., Morales, L. R., & Seligman, L. D. (2014). Religion-based emotional social support mediates the relationship between intrinsic religiosity and mental health. *Archives of Suicide Research*, 18(4), 376-391.
54. Ivtzan, I., Chan, C. P., Gardner, H. E., & Prashar, K. (2013). Linking religion and spirituality with psychological well-being: examining self-actualisation, meaning in life, and personal growth initiative. *Journal of religion and health*, 52(3), 915-929.

55. Jenkins, R. (2014). *Social identity*. Routledge
56. Jenkins, R. (2014). *Social identity*. Routledge.
57. Ji, M., Hui, E., Fu, H., Watkins, D., Tao, L., & Lo, S. K. (2016). Effects of a culture-adaptive forgiveness intervention for Chinese college students. *British Journal of Guidance & Counselling*, 44(3), 335-346.
58. Jiang, X., Flores, H. R., Leelawong, R., & Manz, C. C. (2016). The effect of team empowerment on team performance: A cross-cultural perspective on the mediating roles of knowledge sharing and intra-group conflict. *International Journal of Conflict Management*, 27(1), 62-87.
59. John, A., Halliburton, A., & Humphrey, J. (2013). Child–mother and child–father play interaction patterns with pre-schoolers. *Early Child Development and Care*, 183(3-4), 483-497.
60. Johnson, K. A., Li, Y. J., & Cohen, A. B. (2013). Fundamental social motives and the varieties of religious experience. *Religion, Brain & Behavior*, 5(3), 197-231.
61. Johnson, K. A., Li, Y. J., & Cohen, A. B. (2013). Fundamental social motives and the varieties of religious experience. *Religion, Brain & Behavior*, 5(3), 197-231.
62. Johnson, P. L., Knauss, L. G., Faran, M., & Ban, P. (2014). *Military Children and Programs That Meet Their Needs. Care of Military Service Members, Veterans, and Their Families*, American Psychiatric Association Publishing
63. Joyce, J. A., O'Neil, M. E., Stormshak, E. A., McWhirter, E. H., & Dishion, T. J. (2013). Peer Associations and Coping The Mediating Role of Ethnic Identity for Urban, African American Adolescents. *Journal of Black Psychology*, 39(5), 431-454.
64. Judd, S. M., Newton, J. D., Newton, F. J., & Ewing, M. T. (2014). When nutritional guidelines and life collide: family fruit and vegetable socialisation practices in low socioeconomic communities. *Journal of Marketing Management*, 30(15-16), 1625-1653.
65. Kapferer, B., Eriksen, A., & Telle, K. (2009). Religiosities toward a Future—in Pursuit of the New Millennium. *Social Analysis*, 53(1), 1-16.
66. Kassim, N. M., & Zain, M. M. (2016). Quality of lifestyle and luxury purchase inclinations from the perspectives of affluent Muslim consumers. *Journal of Islamic Marketing*, 7(1), 95-119.
67. Katic, P., & Morris, J. (2016). Targeting investments in small-scale groundwater irrigation using Bayesian networks for a data-scarce river basin in Sub-Saharan Africa. *Environmental Modelling & Software*, 82, 44-72.
68. Kavanaugh, K., Nantais-Smith, L. M., Savage, T., Schim, S. M., & Natarajan, G. (2014). Extended Family Support for Parents Faced with Life-Support Decisions for Extremely Premature Infants. *Neonatal Network: The Journal of Neonatal Nursing*, 33(5), 255-262.
69. Kitayama, S., & Markus, H. R. (2014). *Culture and the Self: Implications for Cognition, Emotion, and Motivation. College Student Development and Academic Life: Psychological, Intellectual, Social and Moral Issues*, Routledge.
70. Koenig, H. G. (2013). *Is religion good for your health?: The effects of religion on physical and mental health*. Routledge.
71. Koenig, H. G. (2013). *Is religion good for your health?: The effects of religion on physical and mental health*. Routledge.
72. Krishnamurti, J. (2013). *Facing a world in crisis: What life teaches us in challenging times*. Shambhala Publications.
73. Kumar, V. (2014). Understanding Cultural Differences in Innovation: A Conceptual Framework and Future Research Directions. *Journal of International Marketing*, 22(3), 1-29.
74. Kvande, M. N., Reidunsdatter, R. J., Løhre, A., Nielsen, M. E., & Espnes, G. A. (2014). Religiousness and social support: A study in secular Norway. *Review of Religious Research*, 57(1), 87-109.
75. Ledbetter, A. M., & Beck, S. J. (2014). A Theoretical Comparison of Relational Maintenance and Closeness as Mediators of Family Communication Patterns in Parent-Child Relationships. *Journal of Family Communication*, 14(3), 230-252.
76. Lee, R. (2015). Guardianship of the elderly with diminished capacity: the Chinese challenge. *International Journal of Law, Policy and the Family*, 29(1), 1-14.
77. Lu, L. C., Chang, H. H., & Yu, S. T. (2013). Online shoppers' perceptions of e-retailers' ethics, cultural orientation, and loyalty: an exploratory study in Taiwan. *Internet Research*, 23(1), 47-68.
78. Lull, J. (2013). *China turned on: Television, reform and resistance*. Routledge.
79. Martin, H. B. K., & Manns, H. (2014). *Communication Across Cultures*. Cambridge University Press.
80. McEwan, C., Hughes, A., & Bek, D. (2015). Theorising middle class consumption from the global South: A study of everyday ethics in South Africa's Western Cape. *Geoforum*, 67, 233-243.
81. McIntosh, W. A. (2013). *Sociologies of food and nutrition*. Springer Science & Business Media.



82. McLeod, J. (2013). *An Introduction to Counselling, 5E*. McGraw-Hill International.
83. Miller, J. G., Bland, C., Källberg-Shroff, M., Tseng, C. Y., Montes-George, J., Ryan, K., ... & Chakravarthy, S. (2014). Culture and the role of exchange vs. communal norms in friendship. *Journal of Experimental Social Psychology, 53*, 79-93.
84. Moran, R. T., Abramson, N. R., & Moran, S. V. (2014). *Managing cultural differences*. Routledge.
85. Naor, M., Jones, J. S., Bernardes, E. S., Goldstein, S. M., & Schroeder, R. (2013). The culture-effectiveness link in a manufacturing context: A resource-based perspective. *Journal of World Business, 49*(3), 321-331.
86. Neumark-Sztainer, D., Eisenberg, M., Fulkerson, J. A., Story, M., and Larson, N. I. (2008). Family meals and disordered eating in adolescents. *Archives Pediatric and Adolescent Medicine, 162*, 17-22.
87. Niebuhr, R. (2013). *Moral man and immoral society: A study in ethics and politics*. Westminster John Knox Press.
88. Oh, J. H., Kim, H. S., & Lee, J. H. (2014). Asian Cultural Collectivism, Acculturation, and Life Satisfaction among Ethnic Asian Brides in South Korea. *Asian Women, 30*(3), 23-56.
89. Paine, C. (2013). *Religious objects in museums: Private lives and public duties*. A&C Black.
90. Pandey, V., & Joseph, G. K. (2014). Changing Perceptions of Fairness: Group Identity, Locus of Merit and Need, and the Preference for Norms of Allocation. *International Journal of Social Sciences, 3*, 1.
91. Pargament, K. I., & Lomax, J. W. (2013). Understanding and addressing religion among people with mental illness. *World Psychiatry, 12*(1), 26-32.
92. Parks, C. D., Joireman, J., & Van Lange, P. A. (2013). Cooperation, trust, and antagonism how public goods are promoted. *Psychological science in the public interest, 14*(3), 119-165.
93. Pearce, J., & Langley-Evans, S. C. (2013). The types of food introduced during complementary feeding and risk of childhood obesity: a systematic review. *International Journal of Obesity, 37*(4), 477-485.
94. Pérez, F. M. I. (2014). Cultural Values and their Correlation with Interactional Metadiscourse Strategies in Spanish and us Business Websites. *Atlantis. Journal of the Spanish Association for Anglo-American Studies, 36*(2), 73-95.
95. Perry-Jenkins, M., Newkirk, K., & Ghunney, A. K. (2013). Family work through time and space: An ecological perspective. *Journal of Family Theory & Review, 5*(2), 105-123.
96. Philips, N., Sioen, I., Michels, N., Sleddens, E., & De Henauw, S. (2014). The influence of parenting style on health related behaviour of children: findings from the ChiBS study. *International Journal of Behavioural Nutrition and Physical Activity, 11*(1), 95.
97. Pimpin, L., Ambrosini, G. L., Llewellyn, C. H., Johnson, L., van Jaarsveld, C. H., Jebb, S. A., & Wardle, J. (2013). Dietary intake of young twins: nature or nurture?. *The American journal of clinical nutrition, 98*(5), 1326-1334.
98. Pirutinsky, S. (2009). The terror management function of Orthodox Jewish religiosity: A religious culture approach. *Mental Health, Religion and Culture, 12*(3), 247-256.
99. Pompper, D. (2014). Considering Faith and Spirituality Practices and Worldviews in Organizations. *International Perspectives on Equality, Diversity and Inclusion, 1*, 187-203.
100. Posthuma, R. A., & Guerrero, L. (2013). *Age stereotypes in the workplace: Multidimensionality, cross-cultural applications, and directions for future research*. The SAGE Handbook of Aging, Work and Society, Sage.
101. Pressman, R. M., Owens, J. A., Evans, A. S., & Nemon, M. L. (2014). Examining the Interface of Family and Personal Traits, Media, and Academic Imperatives Using the Learning Habit Study. *The American Journal of Family Therapy, 42*(5), 347-363.
102. Reeve, J., Deci, E. L., & Ryan, R. M. (2004). Self-determination theory: A Dialectical Framework for Understanding Sociocultural Influences on Student. *Big theories revisited, 4*, 31.
103. Roberts, J. M. (2014). *Digital Publics: Cultural Political Economy, Financialisation and Creative Organisational Politics* (Vol. 138). Routledge.
104. Roopnarine, J. L., & Hossain, Z. (2013). *African American and African Caribbean Fathers. Handbook of Father Involvement: Multidisciplinary Perspectives*, Routledge.
105. Rosmarin, D. H., Pirutinsky, S., Pargament, K. I., & Krumrei, E. J. (2009). Are religious beliefs relevant to mental health among Jews?. *Psychology of Religion and Spirituality, 1*(3), 180.
106. Rozman, G. (Ed.). (2014). *The East Asian region: Confucian heritage and its modern adaptation*. Princeton University Press.
107. Scales, P. C., Syvertsen, A. K., Benson, P. L., Roehlkepartain, E. C., & Sesma Jr, A. (2014). Relation of Spiritual Development to Youth Health and Well-Being: Evidence from a Global Study. In *Handbook of Child Well-Being* (pp. 1101-1135). Springer Netherlands.

- 108.Schäfer, I. (2014). A Matrix for Mediterranean (Area) Studies–Towards an Interdisciplinary Approach in the Post-“Arab Spring” Context. *Mediterranean review*, 7(1), 57-89.
- 109.Seifer, R., Dickstein, S., Parade, S., Hayden, L. C., Magee, K. D., & Schiller, M. (2014). Mothers’ appraisal of goodness of fit and children’s social development. *International Journal of Behavioural Development*, 38(1), 86-97.
- 110.Slater, D., & Tonkiss, F. (2013). *Market society: Markets and modern social theory*. John Wiley & Sons.
- 111.Sussman, S., Milam, J., Arpawong, T. E., Tsai, J., Black, D. S., & Wills, T. A. (2013). Spirituality in Addictions Treatment: Wisdom to Know... What It Is. *Substance use & misuse*, 48(12), 1203-1217.
- 112.Tan, F. W. (2014). The Mean Thought of Chinese Traditional Architecture. In *Applied Mechanics and Materials*, Vol. 638, pp. 2261-2264.
- 113.Thornhill, R., & Fincher, C. L. (2014). Human Values Research Prior to the Parasite-Stress Theory. In *The Parasite-Stress Theory of Values and Sociality* (pp. 83-111). Springer International Publishing.
- 114.Timothy, D. J. (2013). *Tourism, war, and political instability*. *Tourism and War*, Routledge.
- 115.Ungar, M. (2015). Practitioner Review: Diagnosing childhood resilience—a systemic approach to the diagnosis of adaptation in adverse social and physical ecologies. *Journal of child psychology and psychiatry*, 56(1), 4-17.
- 116.Usunier, J.C. and Lee, J.A. (2009) *Marketing Across cultures*, 5th edition – Pearson education Limited.
- 117.Usunier, J.C. and Lee, J.A. (2009) *Marketing Across cultures*, 5th edition – Pearson education Limited.
- 118.Vaiman, V., & Brewster, C. (2014). How far do cultural differences explain the differences between nations? Implications for HRM. *The International Journal of Human Resource Management*, 26(2), 151-164.
- 119.Valchev, V. H., Nel, J. A., Van de Vijver, F. J., Meiring, D., De Bruin, G. P., & Rothmann, S. (2013). Similarities and differences in implicit personality concepts across Ethno-cultural groups in South Africa. *Journal of Cross-Cultural Psychology*, 44(3), 365-388.
- 120.Wald, K. D., & Calhoun-Brown, A. (2014). *Religion and politics in the United States*. Rowman & Littlefield.
- 121.Wald, K. D., & Calhoun-Brown, A. (2014). *Religion and politics in the United States*. Rowman & Littlefield.
- 122.Wang, H., Rober, P., Dillen, A., & Enzlin, P. (2014). The Impact of Stressful Life Events on Highly Religious Chinese Christians Living in Belgium. *Journal of religion and health*, 54(2), 495-516.
- 123.Whitman, S., & Liebenberg, L. (2015). Barriers to Resilience Processes: Understanding the Experiences and Challenges of Former Child Soldiers Integrating into Canadian Society. In *Youth Resilience and Culture* (pp. 157-169). Springer Netherlands.
- 124.Windram-Geddes, M. (2013). Fearing fatness and feeling fat: Encountering affective spaces of physical activity. *Emotion, Space and Society*, 9, 42-49.
- 125.Wulff, D. (2014). Psychology of religion. In *Encyclopaedia of psychology and religion* (pp. 1424-1429). Springer US.
- 126.Yassine-Hamdan, N., & Pearson, F. S. (2014). *Arab Approaches to Conflict Resolution: Mediation, Negotiation and Settlement of Political Disputes*. Routledge.
- 127.Yolles, M., & Fink, G. (2014). Changing the Corporate Paradigm: from the Duality of Individualism-Collectivism to Complementarism. *The International Journal of Public and Private Management*, 1(1), 1-51.
- 128.Zhao, B. (2014). Posthumous Reputation and Posthumous Privacy in China: The Dead, The Law, And The Social Transition. *Brooklyn J. Int'l L.*, 39, 269-521.



## RESEARCH ARTICLE

### IMPACT OF MOBILE PHONE ON THE IRAQI SOCIETY.

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#### Abstract

This paper recommends appropriate strategies for harnessing the benefits and mitigating the pitfalls of wireless technologies in a form of strategies. Therefore, these strategies will guide government and policymakers to harness the positive social impact and mitigate the negative social impact.

#### Key words:-

Mobile, Society, Impact, strategies.

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#### Introduction:-

Wireless technologies particular mobile phone has been revolutionizing the way people communicate and managing their personal as well as social lives. This can be seen through the exponential growth in the penetration rate of mobile phone throughout all Middle East countries including Iraq. In Iraq alone, the penetration rate has reached 110 percent as of second quarter of 2016 (Iraqi Ministry of Communication (2016)). The penetration rate of over 100 percent can occur because of multiple subscriptions. This means the total number of subscriptions has outnumbered the total number of population. Given the widespread use of the mobile phone technology across all user groups, understanding the adoption and appropriation pattern of mobile phone is gaining much interest among researchers in the mobile technology communities (Biljon and Kotze (2007)), (Kim (2008)), (Wirth et al (2008)). While technology adoption (Yi et al (2005)) and acceptance model (Davis (1989) ) has been highly cited in research in this pursuit, newly found model such as technology appropriation model of mobile phone use is also gaining acceptance in explaining the mobile phone use phenomena(Wirth et al (2008)). The ubiquitous use of mobile phone in the society may have also resulted in certain benefits and threats to the society at large (Kushchu (2007)), (Mihalic and Tscheligi (2006)). In this regard, understanding use and users of mobile phone technologies in Iraq is important in guiding strategies, policy developments and regulations concerning wireless technology use. This research has made an attempt to provide knowledge and guidance through a national wide survey based on the impact framework of the work of Keating and Kushchu (Kushchu (2007)) in understanding the impact of mobile phone on the Iraqi society.

#### Impact of Mobile Phone:-

The impact has been categorized into positive and negative impact on the society. Positive contributions of mobile phones to society have been described in a report by Kushu (Kushchu (2007)). He categorized the dimensions of positive social impact as contributions to personal and primary relations, contributions to the society in general and contributions to the economies. Contributions to personal and primary relations encompass connection for communication and accessibility, convenience bringing efficiency especially to daily lives, charisma reflecting influence on identity and empowerment of individuals, companionship for helping individuals have fun, care providing safety and care for others, and the establishment of a culture of its own. Contributions to the society in general include the establishment of informative society, connected society, culturally innovative society, participative society and converging society. Contributions to the economies explains the mobile phone's role on

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infrastructure development, better business practices, improvements in the public sector (mobile government) and collective welfare of the individuals via social responsibility (Mihalic and Tscheligi (2006)).

On the opposite end of the spectrum, Keating (Kushchu (2007)) discussed societal problems arising from the integration of mobile phone communication into daily social life. These include the disruptions of established patterns of communication and behaviour, stress on social relationships due to these disruptions and new challenges managing antisocial behaviours. She also highlighted the conflict between “liberation” in mobility and “control” in terms of expectations to be available. The ubiquity of mobile phone contributes to a new dependence on technological connections via cell phone. As a result, new issues emerged such as the management of simultaneous contexts and spaces with different expectations and behaviours, new private vs public boundary issues and problems with the camera phone and the unauthorized transmission of visual information (Bar et al (2007)), (Aoki et al (2003)).

Based on the work of these two authors, the research conceptualize the framework of the impact study into positive impact which comprised of five dimensions and negative impact, which comprised of also five dimension. The dimensions identified as negative impact are informative society, connected society, culturally innovative society, participative society and productive society. Whereas the dimension categorized as negative impact are as follows:

- Socially Disintegrated Society: Individualistic Society, (versus caring society), Socially alienated Society, Social Relationship breakdown: illicit affair via WT, divorce through sms, Backstabbing society
- Technology Addicted Society: Excessively Dependent on Technology
- Security Threatened and Criminal Prone Society: Terrorism, Smuggling, Less Privacy, Threats, Slander, Harassment, Blackmail etc.
- Rude or Less Polite Society: Degradation of Communication Etiquette and Degeneration of language
- Threat to Iraqi Values (gambling, porno sites)

### **Qualitative Methodology:-**

The following processes are followed in the conduct of the qualitative research:

#### **Framework Development:-**

1. Identify Criteria - Brainstorming Workshop - Draft F/work.
2. Interviews: Structured Interviews using analysis template based on Conceptual Framework.
3. Respondents: Fixed Workplace Workers - Mobile Workers - students - Senior Citizens - Housewives - Non-Adopters.
4. Focus Groups: Interactive group discussions on mobile phone adoption, appropriation and impact.
5. Groupings: Academicians - Pre-Teens - Teenagers - University Students - Support Staff - Mobile Workers - Professionals - Analysis - Interviews & focus groups transcribed.

#### **Quantitative Methodology:-**

Due to the decision to apply the Computer Telephone Interview (CATI) technique in the conduct of this research, the restrictions in the procedure has led to the design of two separate surveys: one for adoption and appropriation of mobile phone survey, and the other one for the impact of mobile phone survey. Although CATI provides the benefit of randomization of samples drawn from the population to produce accuracy in prediction and generalizability in the results, the procedures do not allow for lengthy type of survey commonly administered using the Internet or paper-based survey. This issue has led to the breakdown of the survey into two, which were run concurrently during the administration process.

**Survey design:** Computer Assisted Telephone Interview (CATI ) technique by trained interviewers.

**Population:** Users of wireless phone as of May 2016, aged 13 years old and above, and able to understand Arabic or Kurdish language.

**Sample:** 2000 samples were drawn to provide national estimate, 1708 has been successfully acquired and usable for analysis.

**Instrument:** Questions were derived from the conceptualization of Kushu and Keating's work on positive and negative impact of mobile phone.

**Analysis :** Data analysis was conducted using descriptive statistics to chart and tabulate the information about the adoption and appropriation patterns and criteria of the samples. Analysis was also conducted to tabulate the different adoption and appropriation criteria according different cohorts. These cohorts are age, gender, marital status, employment status, ethnicity, and income. However the focus given in this report is given on age and gender: The following are the strategies adopted:

- Descriptive profile of respondents
- Descriptive report on adoption and appropriation criteria
- Analysis of differences on categorical variables for relationships
- Chi-square analysis with significant difference of 95% confidence level
- Cross tabulation between cohort groups and adoption criteria
- Cross tabulation between cohort groups and appropriation criteria

#### **Positive Impact of Mobile Phone to Society:-**

One dimension of impact being conceptualized is POSITIVE IMPACT. The draft instrument used comprised of 26 questions with the following concepts: Informative Society- Connected Society- Culturally Innovative Society - Participative Society- Productive Society.

The table indicates the factor loading of the items which emerged into six different factors. Most of the factors are conceptualized accordingly as: PI2 – connected society; PI1 – informative society; PI4 – participative society; PI5 – productive society; and PI3 – culturally innovative society. All of the factors are found reliable with reliability test of  $\alpha$  greater than 0.7 (Hair et.al., 1998). Factor six is considered unreliable and therefore not considered as measurement of any known concept. Findings from the analysis allows for the refinement of the positive impact dimension to be used further in the actual survey. Table 1 shows the descriptive statistics on positive impact of mobile phone.

**Table 1:-** Descriptive statistics - positive impact of mobile phone.

<b>PI2 - (Connected) <math>\alpha = .762</math></b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>	<b>Std Dev</b>
My mobile phone has improved my overall social connectivity/relationship	1	5	4.42	0.79
My mobile phone has allowed me to keep track and get involved with family and friends' activities	3	5	4.35	0.66
My mobile phone has given me more social freedom than before (I can mix with anybody I like).	2	5	3.66	0.81
I am comfortable with the new cultures, values and behaviours brought by the use of mobile phones.	1	5	3.60	0.84
My social network and social circle have expanded through the use of mobile phones	1	5	3.92	0.78
<b>Average (aggregate value)</b>			<b>3.99</b>	<b>0.78</b>
<b>PI1 - (Informative) <math>\alpha = .788</math></b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>	<b>Std Dev</b>
My mobile phone has improved my ability to access latest social/daily life information	1	5	3.31	1.15
My mobile phone has given me quick access to public information services	1	5	3.52	0.90
My mobile phone keeps me up to date with current issues and information.	1	5	3.48	0.92
My mobile phone has given me convenient access to online information resources	1	5	3.46	1.01
<b>Average (aggregate value)</b>			<b>3.44</b>	<b>0.99</b>

**Table 1:-** Descriptive statistics - positive impact of mobile phone (continued)

<b>PI4 - (Participative) <math>\alpha = .746</math></b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>	<b>Std Dev</b>
I have used my mobile phone to give opinions on social issues	1	5	2.74	0.84
I have used my mobile phone to participate in TV/radio programmes	1	5	2.56	1.11
Through mobile phones I have participated in social/political activities involving the public and groups	1	5	2.73	0.98
The convenient access to various government and business services through my mobile phone makes my work more efficient and productive.	1	5	3.23	0.89
<b>Average (aggregate value)</b>			<b>2.82</b>	<b>0.95</b>
<b>PI5 - (Productive) <math>\alpha = .738</math></b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>	<b>Std Dev</b>
My work performance has improved because of my mobile phone.	1	5	3.18	0.90
My mobile phone has allowed me to become more creative and to do things that I may not be able to do before.	1	5	3.30	0.87
My mobile phone has enabled me to generate more income.	1	5	2.84	1.03
My mobile phone provides me with functions and features that allow me to manage my social and daily life more effectively	1	5	3.61	0.94
<b>Average (aggregate value)</b>			<b>3.23</b>	<b>0.93</b>
<b>PI3 - (Innovative culture) <math>\alpha = .731</math></b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>	<b>Std Dev</b>
I have used 3G/SMS/MMS to be more creative in my communication and activities	1	5	3.74	1.16
I have used unique grammar and expressions (smiley) in text messages	1	5	3.85	0.91
I use my mobile phone to socially connect with my friends and family through sharing of jokes/advice/MMS, etc.	1	5	4.02	0.94
With the use of my mobile phone, time and distance is not an issue for me to make friends and socialise with people	1	5	4.01	0.85
<b>Average (aggregate value)</b>			<b>3.91</b>	<b>0.97</b>

**Negative Impact of Mobile Phone to Society:-**

Negative impact to society was originally measured with 21 questions and conceptualized as follows:

- NI1: Socially Disintegrated Society: Individualistic Society, (versus caring society), Socially alienated Society, Social Relationship breakdown: illicit affair via WT, divorce through sms, Backstabbing society
- NI2: Technology Addicted Society: Excessively Dependent on Technology
- NI3: Security Threatened and Criminal Prone Society: Terrorism, Smuggling, Less Privacy, Threats, Slander, Harassment, Blackmail etc.
- NI4: Rude or Less Polite Society: Degradation of Communication Etiquette and Degeneration of language
- NI5: Threat to Iraqi Values (gambling, porno sites)

Six factors emerged from the principle component analysis. The table indicates how we conceptualize factor 1, 2, 3, and 4 with the corresponding reliability test  $\alpha$  above 0.7. Factor five and six are considered unknown and unreliable. Eventually, the refinement in the concept has been made which is quite different from the original dimensions. There were 16 items retained which can be used for further exploratory descriptive analysis and actual conduct of the survey. Table 2 shows the descriptive statistics on negative impact of mobile phone.

**Table 2:-** Descriptive statistics - negative impact of mobile phone

<b>ANTI-SOCIAL AND CRIMINAL PRONE SOCIETY (NI1)</b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>	<b>Std Dev</b>
To my knowledge, mobile phone is being used for making threats, harassment, blackmail, slander in Iraq	1	5	2.82	1.16
To my knowledge, mobile phone is being used for activities that undermine the law in Iraq.	1	5	2.90	1.04
To my knowledge, mobile phone is being used as a threat to social integration in Iraq (e.g., spread rumours, to instigate racial/religious unrest, etc.).	1	5	3.06	1.02
To my knowledge, mobile phone is used as a means of anti-social services such as gambling, prostitution, etc.	1	5	2.85	1.06
<b>Average (aggregate value)</b>			<b>2.91</b>	<b>1.07</b>
<b>UNCONSCIENTIOUS AND LESS POLITE SOCIETY (NI2)</b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>	<b>Std Dev</b>
I have experienced disturbing others or have been disturbed by other through the use of mobile phones in socially inappropriate places (e.g., places of worship, lecture halls, libraries, cinemas, etc.).	1	5	3.11	1.09
I have experienced being interrupted or disturbed from inappropriate use of mobile phones	1	5	3.66	1.01
On many occasions, events I attended (e.g., meetings, lectures, shows, etc.) have been disrupted by the use of mobile phones (either my phone or others).	1	5	3.45	0.96
Iraqis written communication skills have deteriorated due to abbreviation and other new forms of text messaging.	1	5	3.49	0.95
Iraqis have become a less polite society because of mobile phones.	1	5	3.16	1.16
<b>Average (aggregate value)</b>			<b>3.37</b>	<b>1.03</b>

**Table 2:-** Descriptive statistics - negative impact of mobile phone (continued)

<b>ADDICTION AND DISINTEGRATION IN SOCIETY (NI3)</b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>	<b>Std Dev</b>
I spend a great deal of time speaking on the mobile phone at the expense of those around me.	1	5	2.86	0.99
I have experienced threats to personal relationships through mobile phones.	1	5	3.08	1.04
I find myself occupied on my mobile phone when I should be doing other things.	1	5	2.94	0.85
My life is considered miserable if I don't have my mobile phone with me at all times.	1	5	3.56	1.01
Nothing in my life and my work can be done without my mobile phone with me.	1	5	3.02	1.07
<b>Average (aggregate value)</b>			<b>3.09</b>	<b>0.99</b>
<b>ADDICTION AND DISINTEGRATION IN SOCIETY (NI4)</b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>	<b>Std Dev</b>
I have experienced spending more than my allocated budget for the mobile phone bills.	1	5	3.20	1.13
I have experienced financial problems as a result of over spending on my mobile phone.	1	5	2.89	1.20
<b>Average (aggregate value)</b>			<b>3.04</b>	<b>1.16</b>

### The CATI Survey:-

- Gender: Majority of the respondents (56.4%) are male. 43.6% of the respondents are female.
- Age Range: Majority of the respondent (39.3%) aged between 20 to 30 years old. This is followed by respondents aged 31-40 years old (20.2%). Respondents aged more than 55 are the least (6.3%).
- Marital Status: Single respondent is slightly higher (52.6%) than the married people (47.4%).
- Income Distribution: (13.6%) they earn more than 2000\$, majority of the respondents (50.7%) earn 1000\$ to 2000\$, followed by those who earn less than 1000\$ (31.1%).
- Employment Status: Majority of the respondents (29.1%) are support staff, followed by students (20.9%) and self-employed people (18.9%). (15.1%) were unemployed, (11.9%) were professionals, and the retirees are only 4.1% of total respondent.

### Dimensions of Positive and Negative Impact:-

13 positive impact variables and 13 negative impact variables are included in the CATI survey questionnaire. Analysis of the factors using factor analysis identifies the eight dimensions of social impact of mobile phone. Four dimensions are positive impact and another four are negative impact. The positive impact dimensions conform to the dimensions identified by Kushchu (2007). The negative impact dimensions conform to the dimensions identified by Keating (2005). Figure 1 shows the positive and impact dimensions as a result of factor analysis.

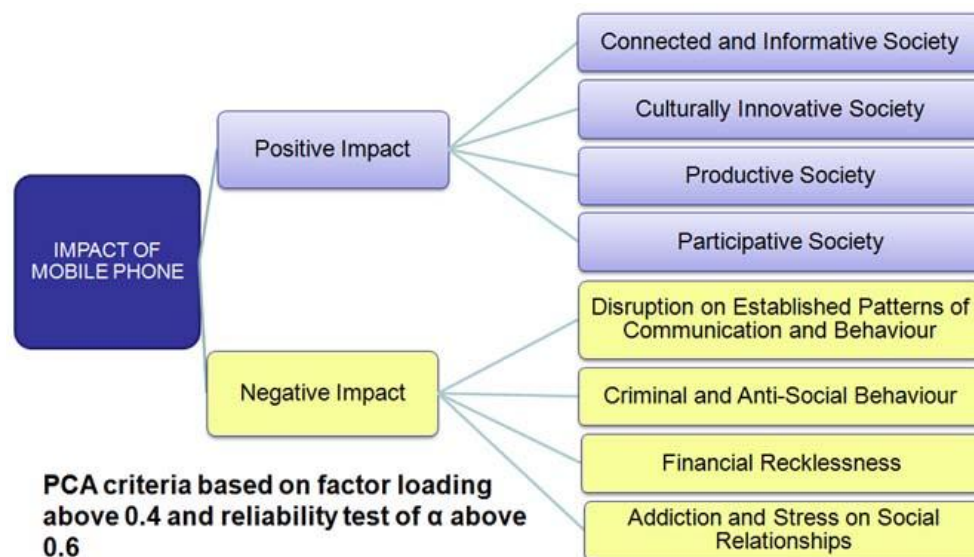


Figure 1:- Positive and negative impact dimensions

### Overall Positive Impact Measured:-

The percentage of agreement for individual indicators suggests that mobile phone gives the biggest positive impact towards contributing to a connected and informative society. This is followed by culturally innovative society, productive society and participative society. Figure 2 shows the positive impact findings highlights.



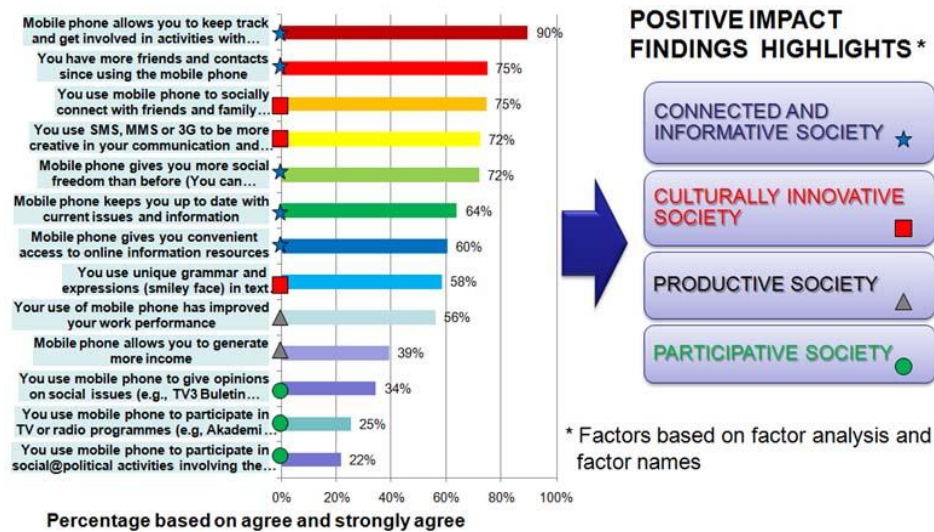


Figure 2:- Positive impact findings highlights.

Analysis on the data set according to mean responses suggests a similar outcome namely contribution to a connected and informative society, followed by culturally innovative society, productive society and participative society. Table 3 shows the aggregated mean based on dimensions.

Table 3:- Aggregated mean based on positive impact dimensions

Positive Impact Dimension	N	Min	Max	Mean	Std. Dev
Connected & Informative Society	1705	1	5	3.7	0.585
Culturally Innovative Society	1707	1	5	3.6	0.735
Productive society	1708	1	5	3.2	0.895
Participative Society	1708	1	5	2.7	0.842

### Overall Negative Impact Measured:-

The percentage of agreement for individual indicators suggests that mobile phone gives the biggest negative impact to the society in relation to the disruption on established patterns of communication and behaviour. This is followed by criminal and anti-social behaviour, financial recklessness and addiction and stress on social relationships. Figure 6.8 shows the negative impact findings highlights.

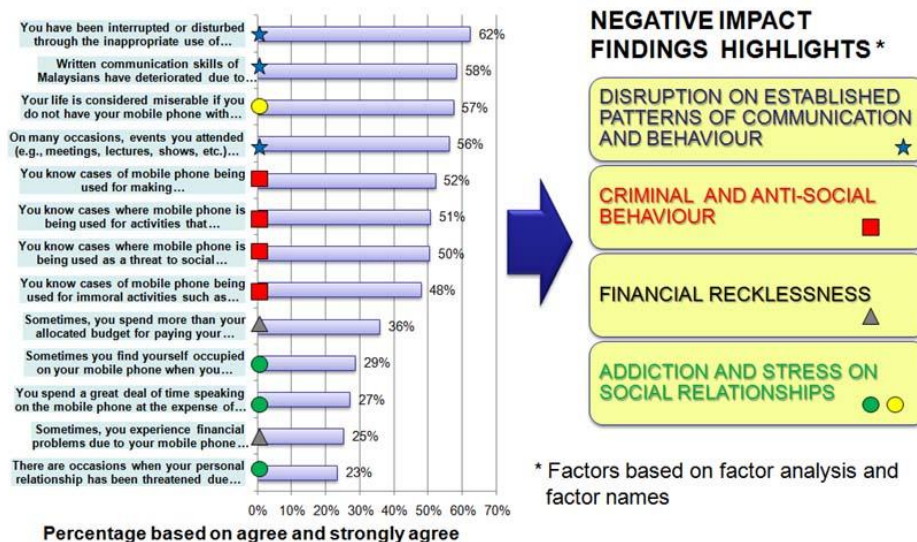


Figure 3:- Negative impact findings highlights

Analysis on the data set according to mean responses suggests a somewhat different outcome namely impact related to the disruption on established patterns of communication and behaviour, followed by financial recklessness, addiction and stress on social relationships, and criminal and anti-social behaviour. Table 4 shows the aggregated mean based on dimensions. Table 4 shows the negative impact findings details based on mean.

**Table 4: - Aggregated mean based on negative impact dimensions**

<b>Negative Impact Dimension</b>	<b>N</b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>	<b>Std. Dev</b>
Criminal and Anti-Social Behaviour	1708	1	4	2.54	0.78
Addiction and Stress on Social Relationships	1708	1	5	2.62	0.79
Financial Recklessness	1708	1	5	2.72	0.92
Disruption on Established Patterns of Communication and Behaviour	1708	1	5	3.40	0.80

### **Conclusion:-**

The variables in the connected society and the informative society dimensions were found to be highly correlated with each other. As a result, the two dimensions were combined. The most significant positive impact of mobile phone is its contribution towards a connected society and informative society. This includes keeping track and involvement with family and friends, expansion of social network, increase in communication social freedom, keeping up-to-date with current issues and communication, and convenient access to online information resources. It also contributes towards a culturally innovative society through the use of unique grammar to communicate and the establishment of new identity, culture and values brought about by mobile phone. To a varying degree, there are differences on how mobile phone impacts the different cohorts in the Iraqi society. In relation to gender, male benefits more than female especially in the use of mobile phone to increase productivity. This is also true for connected and informative society, and participative society. As for age group, the working age of 31-40 is the biggest beneficiary of mobile phone contribution towards a productive society. The 20-30 and 13-19 age groups are more inclined towards a culturally innovative society.

In terms of marital status, the married are more likely to be productive from the use of mobile phone compared to the single group. In contrast, the singles are more likely to be culturally innovative. Regarding employment status, the professional and retiree are the biggest beneficiaries of the mobile phone contribution towards a connected and informative society. The self-employed used the most to participate in society and to be productive. Students are most likely to be culturally innovative. As for income group, productivity using mobile phone increases as income grows. On the contrary, the mobile phone contribution towards a participative society decreases as income grows.

In contrast to the positive impact of mobile phone on society, the percentage of agreement amongst the respondents on negative impact variables is generally lower compared to the positive impact variables. This reflects the general view of the Iraqi society that the positive aspects of mobile phone outweigh the negative. Factor analysis on the survey data suggests four negative impact dimensions, namely disruption on established patterns of communication and behaviour, criminal and anti-social behaviour, financial recklessness and addiction and stress on social relationships. The highest concern amongst the society related to mobile phone is in its use that disrupts established patterns of communication and behaviour, such as interruption through its inappropriate use at certain events and places. The deterioration of written communication skills and overly dependence on mobile phone were also a concern. About half of the respondents perceived that mobile phone is used to aid criminal and anti-social behaviour. Such activities include making threats, harassment, blackmail and slander, undermining the law, spreading rumours and instigating unrest, and aiding immoral activities such as gambling and prostitution. To some extent, mobile phone can also be considered a cause of financial recklessness through overspending more than the allocated budget. About a quarter of the respondents agreed that mobile phone causes addiction and stress on social relationship.

Similar to positive impact, there are differences on how mobile phone impacts the different cohorts in the Iraqi society in relation to negative impact. In relation to gender, there are no significant differences between male and female with regard to any of the dimensions. As for age group, the elderly 55 years and above age group is the least prone to the disruption on established patterns of communication and behaviour caused by mobile phone. The 13-19 age groups are more prone to addiction and stress on social relationships and financial recklessness. In terms of marital status, the singles are more prone to addiction and stress on social relationships, and financial recklessness caused by the use of mobile phone. Regarding employment status, the professional are most likely to be concerned

on criminal and anti-social behaviour caused by mobile phone. The same group are also most likely to experience disruption on established patterns of communication and behaviour. With regard to addiction and stress on social relationships and financial recklessness, students are more likely to experience them. As for income group, the more than 2000\$ income group are most likely to concern on the criminal and anti-social behaviour. With regard to the disruption on established patterns of communication and behaviour, the perception of the negative impact grows as income grows. The 1000\$-2000\$ group are more prone to addiction and stress on social relationships. Finally, the less than 1000\$ income groups are more likely to experience financial recklessness due to mobile phone.

In the strategic view of Iraqi objective, following statements are represented by the following eight values of the Iraqi Vision: Perseverance, Culture of Excellence, Acceptance, Loyalty, Education, Humility, Integrity, Meritocracy. The project which was initially proposed as a single study utilizing the computer assisted telephone interview (CATI) technique, in order to ensure high representation of the information generated from the sample to the population. The accuracy derived from the sample has been calculated with a predetermined type B error of 0.01 or 1 percent. This high accuracy in the sample in representing the population allows for the findings to be used and depended on by the funding agency as well as the government in the formulation of policies and guidelines concerning the users of mobile phone as well as the Iraqi society at large.

### References:-

1. Iraqi Ministry of Communication (MOC). Retrieved August 29, 2016 from <http://moc.gov.iq>.
2. Biljon, V.J., & Kotze, P. (2007). Modelling the Factors that Influence Mobile Phone Adoption. *SAICSIT 2007*, 2 - 3 October 2007, Fish River Sun, Sunshine Coast, South Africa.
3. Kim, S. (2008). Appropriation of wireless technology: Direct impacting factors on Youth's adoption intention and usage of the wireless protocol phone. *Information Technology Journal*, 7 (8), 1116 – 1124.
4. Wirth, W., Von Pape, T., & Karnowski, V. (2008). An integrative model of mobile phone appropriation. *Journal of Computer-Mediated Communication*, 13 (2008), 593 – 617.
5. Yi, Y. D., Wu, Z., & Tung, L. L. (2005). How individual differences influence technology usage behaviour? Toward an integrated framework, *Journal of Computer Information Systems*, 46(2), 52-63.
6. Davis, F.D. (1989) "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly* 13 (3), 318-340.
7. Kushchu, I. (2007). Positive Contributions of Mobile Phones to Society . retrieved December 17, 2007, from <http://www.mgovernment.org/resurces/positivezfinal.pdf>.
8. Mihalic, K. & Tscheligi, M. (2006). Interactional Context for Mobile Applications. Retrieved April 23 2008.
9. Bar, F., Pisani, F. & Weber, M. (2007). Mobile technology appropriation in a distant mirror: baroque infiltration, creolization and cannibalism. Retrieved April 2008 [http://www.arnic.info/Papers/Bar\\_Pisani\\_Weber\\_appropriation-April07.pdf](http://www.arnic.info/Papers/Bar_Pisani_Weber_appropriation-April07.pdf).
10. Aoki, K., & Downes, E. J. (2003). An analysis of young people's use of and attitudes toward cell phones. *Telematics and Informatics*, 20, 349-364.
11. Hair, J.F.J., Anderson, R.E., Tatham, R.L., Black, W.C., 1998. Multivariate Data Analysis, 5th edn, Prentice Hall, Upper Saddle River, New Jersey.

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### RESEARCH ARTICLE

#### ASSOCIATION MINING FROM BIOMEDICAL TEXT WITH NETWORK ANALYSIS

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Association Extraction, Biomedical Literature, Protein-protein Interaction.

#### **Abstract**

Discovery of genes that are responsible for various diseases, becomes an important task. Since the genes are related with many diseases, the gene-disease association should be discovered. To obtain this gene-disease association from available biomedical literature, the relation type between the gene and disease is extracted from the biomedical literature. So, this becomes more and more important to deal with the extraction problem from the biomedical texts in an automatic way. Then the gene-disease association is visualized by network construction and association score matrix is constructed to calculate the gene-disease association score. The gene-disease relation type is identified and then the association score is calculated by integrating disease similarity network and protein-protein interaction network. The candidate genes for the particular disease and the novel genes for various diseases can also be found by calculating the association score and visualizing the dataset network.

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#### **Introduction:-**

Determining gene-disease associations will enhance the development of new techniques for prevention, diagnosis and treatment of the diseases. Given that the amount of biomedical literature regarding the identification of disease genes is increasing rapidly. One of the challenges that scientists in this domain face is that most of the relevant information remains hidden in the unstructured text of the published papers. Hence there is an urgent need for a text mining system that extracts both known and novel GDA (Gene Disease Association) and visualization. A new text mining system with network association capability for the visualization of gene disease association is proposed. Recent studies have proposed several approaches to investigating the relationships between genes and diseases. Some previous studies use protein-protein interactions to predict gene-disease relationships. Some researchers compute the similarity values between genes and diseases based on Gene Ontology (GO) or Disease Ontology (DO) terms. Other controlled vocabularies such as MeSH (Medical Subject Headings) have already been utilized for linking proteins to disease terminologies. Some other information like gene expressions, protein/genome sequences and positional information are also served as the important evidences to relating genes and diseases. For gene-disease association discovery from the biomedical literature using biomedical text mining, the first step is Named Entity Recognition (NER) that is the annotation of gene and disease terms by highlighting the gene and disease terms in the biomedical literature. Then the sentences with gene and disease terms have to be extracted by excluding other sentences in that biomedical literature. After extracting the sentences the relationship between the gene and disease has to be identified. The relationship is identified between the gene and disease based on the semantic

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analysis using relation type dictionary are further included in the network construction phase for identifying the association between them.

Although many approaches have been developed for prioritizing candidate disease-causing genes based on exploiting the protein-protein interaction network and phenotype similarities, most of which deal with the disease-gene association score based on the association between the diseases similar to the query disease and their involved genes independently. In this work, the modular nature of the genetic diseases and the consistency between the disease phenotypic overlap and genetic overlap are fully exploited. For this purpose, the disease similarity network and the protein-protein interaction network are incorporated systematically and comprehensively in a simple and compact manner to formulate the computation of the prioritization scores. As for a single disease gene association score function, both the similar diseases in the disease similarity network and neighboring genes in the protein-protein interaction network are considered because of the modular nature of the genetic diseases. All the association scores between the similar diseases and neighboring genes would be integrated into the iterative computation of this single disease gene association score. And also this system deals with the relation type identification task from the biomedical literature. For constructing disease similarity network, the large-scale disease similarity information is exploited. The disease similarity network and the protein-protein interaction network are coupled in a comprehensive and systematic way for the definition of the disease-gene association score function, and this is well in accord with the consistency between disease phenotypic overlap and genetic overlap. The definition of disease-gene association score makes full use of the information implicated in both disease similarities and neighboring genes comprehensively. On the other hand, not only the noise in the disease similarity information but also the self-loop in the protein-protein interaction network are considered in the computation of the disease-gene association scores. An iterative algorithm is designed for the computation of the disease-gene association score matrix for all the diseases and all the candidate genes in the protein-protein interaction network.

As most of the gene-disease association discovery part depends upon the datasets such as disease similarity network, protein-protein interaction network and the already discovered association dataset from OMIM. Thus the accuracy of the result depends upon the completeness of the datasets. While the calculation of association scores, the correlation between the two networks is calculated. When a candidate gene is prioritized for a disease, the correlation of the two subnetworks are considered separately induced by the neighbors of the gene in the protein-protein interaction network and the neighbors of the disease in the disease similarity network. That is, a single association between a gene and a disease is formulated iteratively by the correlation of the two subnetworks. This constraint can also be described as the fact that a gene is likely to be involved in a disease if the gene's neighbors are associated with the similar diseases. In our method, the association score between disease 'd' and gene 'g' is formulated iteratively as the weighted sum of all the existing association scores between the neighbors of gene 'g' and the diseases similar to disease 'd'. While this calculation, if the dataset does not contain sufficient information then the association score will result in less accurate one. The work is defining about the procedure of finding the association score between gene and disease and also predicting the novel gene for various diseases. And the network construction and visualization using three types of datasets namely disease similarity network, protein-protein interaction network and gene-disease association from OMIM database.

#### **Related work:-**

In PRINCE [11], a novel network-based approach for predicting causal genes and protein complexes that are involved in a disease of interest. The method, which is called PRINCE (PRIoritization and Complex Elucidation), generalizes the network-based approaches by both considering the network signal in a global manner and going beyond single genes to the modules that are affected in a given disease. It receives as input a disease-disease similarity measure and a network of protein-protein interactions. It uses a propagation based algorithm, to infer a strength-of-association scoring function that is smooth over the network (i.e., adjacent nodes are assigned similar values) and exploits the prior information on causal genes for the same disease or similar ones. This scoring is then used in combination with a PPI network to infer protein complexes that are involved in the given disease.

In other network related work they used a plethora of network-based approaches to investigate the underlying molecular mechanisms of various human diseases. They perform a bipartite, topological and clustering graph analysis in order to gain a better understanding of the relationships between human genetic diseases and the relationships between the genes that are implicated in them. For this purpose, disease-disease and gene-gene networks were constructed from combined gene-disease association networks. Collecting and integrating data from three diverse resources, each one with different content covering from rare monogenic disorders to common

complex diseases. Identifying important topological properties of the biological networks and uncover noticeable disease-disease and gene-gene associations. In particular, based on the topological analysis of networks, it is provided that numeric evidence on the assumption that many genes can be causative for a human disease.

A multi-level network model that integrates drugs, diseases and genes together, called a drug–disease–gene network (DrDiGeN)[6]. The network consists of three sub networks, a drug–drug network (DrDrN), a disease–disease network (DiDiN) and a gene–gene network (GeGeN). The statistic characteristics show that node degree in most of the sub networks approximately follows a power-law distribution. The results also indicate that if genes in the GeGeN occupy important topological positions, then their associated drugs and diseases always hold critical roles in the DrDrN and the DiDiN respectively. In addition, most drug target genes and disease-causing genes are always different and nonessential, and the both show a lower likelihood to encode hub proteins in human protein–protein interaction (PPI) network, while a little higher tendency is observed in the GeGeN. Gene modules extracted from the GeGeN are highly enriched in Gene Ontology (GO) terms, but poor co expressed in human tissues compared with that of the PPI network. Furthermore, diseases (or drugs) associated with similar genes highly interact with each other such that tightly related drugs, diseases and genes can easily form co-modules, in which they share a similar pattern. The conserved structures are helpful for the understanding of the interaction mechanisms of drug–disease–gene as well as drug applications and disease treatments in a network-based level.

A work on ‘Text mining and manual curation of chemical-gene-disease networks for the Comparative Toxicogenomics Database (CTD)’[2]. The Comparative Toxicogenomics Database (CTD) is a publicly available resource that promotes understanding about the etiology of environmental diseases. It provides manually curated chemical-gene/protein interactions and chemical- and gene-disease relationships from the peer-reviewed, published literature. Journal articles are prioritized for curation by chemicals of interest. They are identified by querying titles and abstracts from MEDLINE using PubMed and controlled chemical terms and synonyms from the National Library of Medicine's Medical Subject Headings (MeSH). Documents are ranked in date order (the default order from PubMed). Bio curators read abstracts and full-text articles from which they capture chemical-gene/protein interactions and disease relationships. All curated interactions and relationships are captured using controlled vocabularies and ontologies to maximize consistency among biocurators, ensure reproducible data retrieval by users, and enable integration of CTD data with other databases. The CTD chemical vocabulary derives from a modified subset of the chemicals and supplementary concepts in the "Drugs and Chemicals" category of MeSH. For genes and proteins, CTD uses official gene symbols and names from the National Center for Biotechnology Information's (NCBI) Entrez-Gene database. Where possible Entrez Gene entries representing orthologs are merged into a single, cross-species gene entity in CTD. Curators use these cross-species genes in CTD to capture chemical interactions and disease relationships. The CTD disease vocabulary uses terms from MeSH and OMIM. CTD interaction types are described using terms from a hierarchical vocabulary of 50 diverse relational terms (e.g., "binding," "phosphorylation") developed by CTD curators. Organisms in which chemical-gene interactions are curated are specified using terms from the Eumetazoa portion (vertebrates and invertebrates) of the NCBI Taxonomy database.

A hybrid named entity tagger for tagging human proteins/genes [7] that do analysis of scientific literature is the extraction of gene/protein names in biomedical texts. Which includes three processing steps: Conditional random fields (CRF) for initial learning and labelling, rule based tagging to improve the performance of initial tagging process by checking the specific patterns related to human proteins and genes, and a two stage abbreviation identification algorithm which resolves both short form and long form abbreviations. An integrated approach for human proteins and protein kinases normalization [8]. The task of recognizing and normalizing protein name mentions in biomedical literature is a challenging task and important for text mining applications such as protein–protein interactions, pathway reconstruction and many more. In Homo sapiens, a greater number of biological processes are regulated by a large human gene family called protein kinases by post translational phosphorylation. Recognition and normalization of human protein kinases (HPKs) is considered to be important for the extraction of the underlying information on its regulatory mechanism from biomedical literature. ProNormz distinguishes HPKs from other HPs besides tagging and normalization. ProNormz is the first normalization system available to distinguish HPKs from other HPs in addition to gene normalization task. ProNormz incorporates a specialized synonyms dictionary for human proteins and protein kinases, a set of 15 string matching rules and a disambiguation module to achieve the normalization.



## Methodology:-

The system consists of the main modules (i) gene name identification (ii) relation type identification and the other one is (iii) gene-disease association extraction. Fig. 1 depicts the detailed architecture of the system. The initial input of the system is PubMed biomedical abstracts. Because the system is mainly deals with extracting the relation type and association between gene and disease from the biomedical abstracts. Most of the biomedical information's can be extracted for various research purposes to uncover the hidden information's about the gene and disease. Such biomedical abstracts contain various gene names, human proteins and human protein kinases. The first task of this system is identifying the human genes and human protein kinases in the biomedical document .once the gene names are identified further tasks such as relation identification becomes easier. For the gene name and protein name identification task a tool called Pronormz is used. This tool has an in build tool called NAGGNER for performing the named entity recognition task that is highlighting the gene and protein names in the biomedical abstract. The tool Pronormz consists of four major functional components for the recognition of human gene/protein mentions and mapping them to their corresponding EntrezGene unique identifier, A set of string matching rules to compare the tagged entity with all entries in the dictionary, A disambiguation method if tagged entity maps more than one gene in the dictionary.

The next major task of this system is identification of the relation type between the identified gene and the disease mentioned in the biomedical document. The relation type recognition is further helpful to find the association between the particular gene and disease identified in the document abstract. For the relation identification, the dictionary [10] is classified as four categories namely altered expression, genetic variation, and regulatory modification and unrelated. The relation identification in the biomedical abstract is done using the Stanford parser. The abstract is read and parsed. The parsed sentences are compared with the dictionary that is stored in the hash map. If match occurs with the dictionary while matching, then the relation type is tagged in the corresponding sentence.

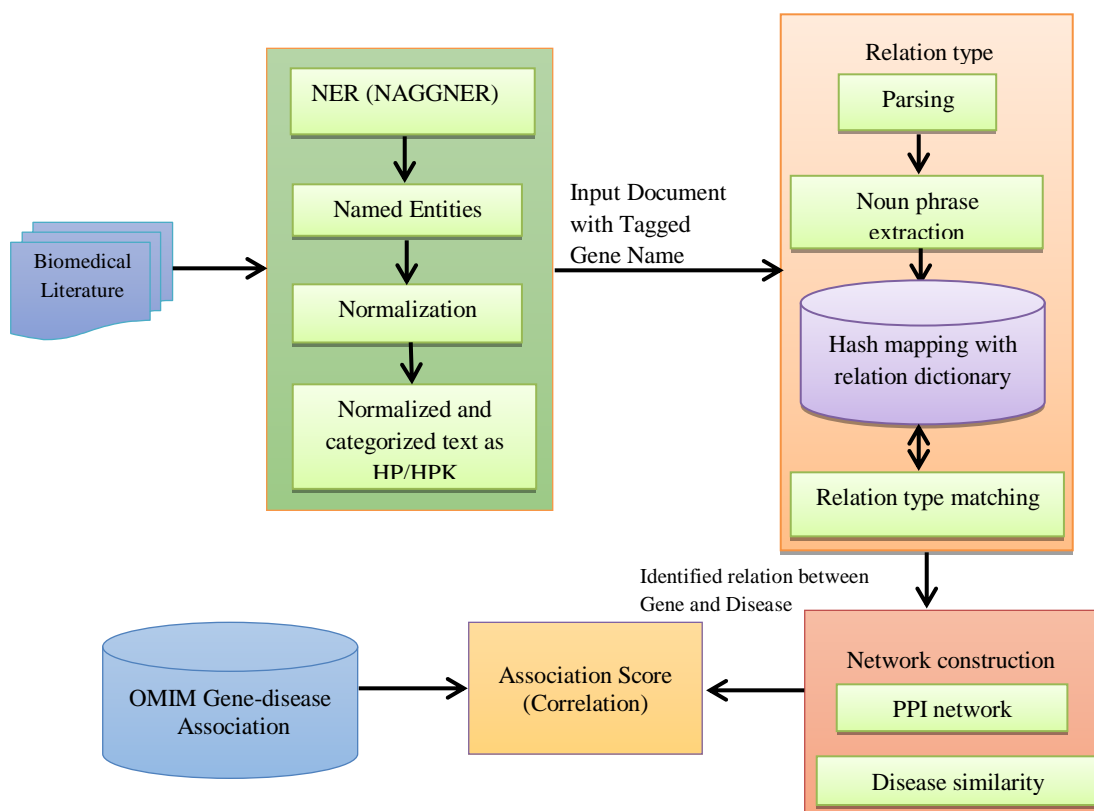


Figure 1 Work flow of the proposed Model

The final major task of the system is association score calculation. After the relation type identification, the association score is calculated between the gene and the disease that is mentioned in the abstract. The major input for the association score module is disease similarity dataset and the protein-protein interaction network. The gene

disease association dataset that contains already found association between gene and disease from OMIM [4]. The association score is calculated in form of matrix using an iterative algorithm. For association score calculation the neighboring genes and the diseases related or similar diseases are also considered. These related genes and diseases are visualized using the software called Cytoscape 3.4.0 that is used for biomedical network construction tasks.

### Gene Name Identification:-

The database of biomedical abstracts contains scientific knowledge about thousands of interacting genes and proteins. Automated text processing can aid in the comprehension and synthesis of this valuable information. The fundamental task of identifying gene and protein names is a necessary first step towards making full use of the information encoded in biomedical text. This remains a challenging task due to the irregularities and ambiguities in gene and protein nomenclature. The task of recognizing and normalizing protein name mentions in biomedical literature is a challenging task and important for text mining applications such as protein-protein interactions, pathway reconstruction and many more. so, a tool called ProNormz is used, an integrated approach for human proteins (HPs) tagging and normalization. In Homo sapiens, a greater number of biological processes are regulated by a large human gene family called protein kinases by post translational phosphorylation. Recognition and normalization of human protein kinases (HPKs) is considered to be important for the extraction of the underlying information on its regulatory mechanism from biomedical literature. ProNormz distinguishes HPKs from other HPs besides tagging and normalization. ProNormz incorporates a specialized synonyms dictionary for human proteins and protein kinases, a set of 15 string matching rules and a disambiguation module to achieve the normalization.

For the gene name tagging module the input is a bio medical literature documents. ProNormz is different from other GN systems in two different ways. First, it is specific system to normalize human proteins and also distinguishes human protein kinases. Second, ProNormz has two in built named entity taggers, NAGGNER and BANNER for GM task. So, it can process and normalize text with pre-tagged protein/gene mentions (GM text) as well as raw text.

**Input:** Biomedical abstracts (PubMed)

### Steps:-

1. Named Entity Recognition (NER) using in build tool Naggner
2. Applying dictionary rules and entity rules on NER text
3. Disambiguation task on NER text
4. NER text is normalized using the specialized synonyms dictionary for human protein (HP) and human protein kinases (HPK)

**Output:** The normalized biomedical abstract with highlighted gene and proteins

### Relation Type Recognition:-

Current biomedical research needs to leverage and exploit the large amount of information reported in scientific publications. Automated text mining approaches, in particular those aimed at finding relationships between entities, are key for identification of actionable knowledge from free text repositories. The relationship identification is mainly based on identifying relationships between biomedical entities with a special focus on genes and their associated diseases. The relation type is identified using the relation type dictionary, in which the relation type is categorized as four types namely altered expression, genetic variation, regulatory modification and unrelated which is given in Table 1. Biomedical text relation type keywords occur as noun phrases but in special cases they occur as verb phrases. The relation type recognition is performed using Stanford parser.

**Table 1:-**Relation Type Dictionary Feature

Relation Type	Feature
Regulatory Modification	Dephosphorylation, Demethylation, Epigenetic, Methylation, Hyper methylation, Hypo methylation, Phosphorylation, Hyper phosphorylation.
Genetic Variation	Allele, Alteration, Autosomal, Biallelic, Amino Acid, Carriers Of, Exchanges, Frameshift, Genotypes, Genotype-Phenotype, Duplication etc.,
Altered Expression	Activation Of, Alternative Splice, Co-Expression, Cross-Regulation, Differentially Expressed, Down-Regulate, Co-Regulate, Expressions, Immunoexpression, Inactivate, MRNA etc.,
Unrelated	But not, No, Neither, Nor, Independently, Not likely, Unlikely that, Unrelated, Does not etc.,



**Input:** Biomedical document (PubMed abstracts)

**Steps:**

1. Loading the relation dictionary using hash map
2. Hash Map <String, String>relation\_dict = load Relation()
3. Read the input document
4. String content = new Scanner(new File(filename))
5. Load the Stanford parser model
6. Lexicalized Parser lp = Lexicalized Parser .load Model(parser Model)
7. Load Treebank Language Pack tlp = lp. Treebank Language Pack()
8. Parsing tree to insert relation id

**Output:** sentences of abstracts with relation id tagged in it

### Gene-Disease Association Extraction:-

A disease-gene association matrix in favor of computing and storing the association scores. The disease similarity network and the protein-protein interaction network are also constructed and incorporated into the formulation of the disease gene association matrix in a simple and compact manner of matrix multiplication. As a result, an iterative algorithm is designed for the computation of the disease-gene association matrix. The disease similarity network and the protein-protein interaction network are coupled in a comprehensive and systematic way for the definition of the disease-gene association score function. Third, an iterative algorithm was designed for the computation of the disease-gene association score matrix for all the diseases and all the candidate genes in the protein-protein interaction network

**Input:-** Identified gene-disease relationship

**Steps:-**

1. Construct matrix  $psim[i, j]$ , the disease similarity network
2. Construct matrix  $G[i, j]$ , the protein-protein interaction network
3. Calculate  $adg$ , where  $Adg = psim * adg^0 * G$

for ( $k - th$  iteration)

$$adg^k = (1 - \alpha) \times psim \times adg^{k-1} \times G + \alpha \times adg^0.$$

where  $\alpha \in (0, 1)$

for ( $k + 1 - th$  iteration)

$$adg[i, j]^{k+1} = \sum_{l=1}^G \left( \sum_{k=1}^{|psim|} psim[i, k] \times adg[k, l^k] \right) \times G[l, j]$$

**Output:** The association score between the gene and disease

### Knowledge Discovery:-

Knowledge discovery is the task of determining whether the discovered association between the gene and disease is new, inferred or already known association. This is determined by the visualization of the network which is constructed by integrating the disease similarity network and protein-protein interaction network. The association type can be visualized using the network construction software Cytoscape 3.4.0. The network contains direct link between the gene (4049) and the disease (607507), this network is constructed from the already available dataset. So the association already exist, thus this belongs to known association. If the associations are not exists in databases but inferred by network analysis of first neighborhood association between genes/diseases and newly retrieved from the literature, then that type of association is called inferred association. If there is no direct or inferred association from the network, then that type of associations are called novel association that are newly retrieved from the literature.

### Experimental Results:-

Two disease related vocabulary resources: Online Mendelian Inheritance in Man (OMIM) and Comparative Toxicogenomics Database (CTD). An OMIM based human disease synonyms dictionary is incorporated. The

relation type dictionary developed by Bundschuh et al is used for relation type identification. (i) Human Disease-Disease similarities (D2D) from MimMiner ii) Protein-Protein interactions (PPI) from Human Protein Reference Database (HPRD) and iii) Gene-Disease associations (G2D) from OMIM morbid map.

**Table 2:-** Datasets Description.

Dataset	Description	Number Of Items
Relation type dictionary	Four types of relations namely altered expression, genetic variation, regulatory modification and unrelated.	197
Disease similarity	Similarity score between two disease	27092
Protein-protein interaction	Two genes that interacts with each other	39142
Gene-disease association	Already found association between gene and disease	4456

### Disease Similarity Network:-

The disease similarity network is introduced, where the node in the network represents a disease, the edge connecting two nodes indicates that the two diseases are similar, and the weight of the edge indicates to what extent the two diseases are similar. A disease similarity matrix  $Psim$  to model this network, in which  $Psim[i, j]$  is the similarity score between disease  $i$  and disease  $j$ . Table 3 defines about the similarity score ranges.

**Table 3:-** Disease Similarity Dataset Feature.

Disease Similarity	Similarity Score Range
Most similarity	0.9 - 1.0
Moderate similarity	0.6 - 0.8
Least similarity	0 - 0.5

Fig. 2. Represents the matrix for disease similarity dataset, in which both column and row represents same set of diseases and each cell value represents the similarity score of the two set of diseases in the respective row and column. In fig.2. Column A and row 1 both represents the same disease.

	A	B	C	D	E	F	G	H	I
1	1	0.535411	0.999943	0.999986	0.503653	0.767047	0.999943	1	0.500497
2	0.535411	1	0.535668	0.535547	0.500146	0.546096	0.535668	0.535411	0
3	0.999943	0.535668	1	0.999986	0.50359	0.767177	1	0.999943	0.50092
4	0.999986	0.535547	0.999986	1	0.503628	0.767123	0.999986	0.999986	0.500716
5	0.503653	0.500146	0.50359	0.503628	1	0	0.50359	0.503653	0
6	0.767047	0.546096	0.767177	0.767123	0	1	0.767177	0.767047	0
7	0.999943	0.535668	1	0.999986	0.50359	0.767177	1	0.999943	0.50092
8	1	0.535411	0.999943	0.999986	0.503653	0.767047	0.999943	1	0.500497
9	0.500497	0	0.50092	0.500716	0	0	0.50092	0.500497	1
10									

**Figure 2:-** Matrix for Disease Similarity Dataset

### Protein-Protein Interaction Network:-

The protein-protein interaction network is modelled as matrix  $G$  fig. 3. In which the value of  $G[i, j]$  indicates whether the interaction between proteins  $i$  and  $j$  exists. The value “1” denotes that the interaction exists, and “0” denotes that the interaction does not exist. In this method, with regard to the association between disease ‘ $d$ ’ and gene ‘ $g$ ’, the associations between the diseases similar to ‘ $d$ ’ and the neighbors of ‘ $g$ ’, the associations between the diseases similar to ‘ $d$ ’ and the neighbors of ‘ $g$ ’, and the associations between ‘ $d$ ’ and the neighbors of ‘ $g$ ’ all need to be considered. So, the protein-protein interaction network is extended by adding the self-interactions of all the proteins into the interaction network. In fig. 8 each row defines the two types of genes that interact with each other in the protein-protein interaction network. Column A and C defines the gene name or symbol, column B and D defines the genes id.

	A	B	C	D	E	F	G	H	I
1	1	0	0	0	1	0	0	0	0
2	0	1	1	0	1	0	0	0	0
3	0	1	1	0	1	1	0	0	0
4	0	0	0	1	1	0	1	0	0
5	1	1	1	1	1	1	1	1	1
6	0	0	1	0	1	1	0	0	0
7	0	0	0	1	1	0	1	0	0
8	0	0	0	0	1	0	0	1	0
9	0	0	0	0	1	0	0	0	1

**Figure 3:-Protein-protein Interaction Network as a Matrix Model**

#### Disease-Gene Association Network:-

The gene disease association dataset consists of already discovered gene-disease association data from OMIM. The disease-gene association network is constructed such as the one where the node in the network can be either a disease or a gene and the weighted edge connecting a disease and a gene indicates to what extent the gene is involved in the disease. This network can also be regarded as a bipartite graph. In this method the disease-gene association network is expressed by a disease-gene association matrix  $Adg$ , in which the element  $Adg[i, j]$  stores the association score of gene 'j' and disease 'i' indicating the association strength between the gene and the disease. The gene-disease association dataset consists of gene name or symbol, gene id and the disease OMIM ID that is associated with the respective gene.

#### Gene Name Tagging:-

The gene name tagging module involves named entity recognition of gene/protein in the text which is accomplished by tools NAGGNER for gene mention (GM) task and Pronormz for gene normalization (GN) task. For Pronormz, PubMed biomedical abstract is given as input and the correct gene name tagging is compared with other tools. Precision, recall and F-score are used as evaluation metrics. TP denotes numbers of true positives, FP denotes the number of false positives and FN denotes the numbers of false negatives. The F-score is the harmonic mean of recall and precision.

**Table 4:- Gene Normalization Task Evaluation of PRONORMZ**

Gene Normalization Task	Precision%	Recall%	F-Score%
PRONORMZ	86.66	80.25	83.33
BANNER	65.14	74.52	69.52
NAGGNER	66.19	71.33	68.66

The evaluation of pronormz and its in build tools namely BANNER and NAGGNER for gene normalization task are shown in Table 4. The evaluation of the pronormz and its in build tools are done using the test set of BioCreAtIvE-II Gene Normalization. Pronormz shows comparatively higher precision and recall value than other tools namely BANNER and NAGGNER. Table 5 shows the comparison of Pronormz tool with other tagging tool, in which pronormz shows comparatively better precision and recall value.

**Table 5:- comparison of PRONORMZ with other tools.**

Tool Name	Precision	Recall	F-Score
Hybrid Named Entity Tagger	80.47	71.60	75.77
Abner	86.93	51.49	64.68
Ling Pipe	76.61	83.64	79.97
Memm(Mallet)	84.12	81.75	82.91
Pronormz	86.66	80.25	83.33

#### Relation Type Identification:-

The relation type is tagged in the biomedical abstract using the relation type dictionary using the Stanford parser packages. To identify the relation keyword between the gene and disease. We have used the relation type dictionary

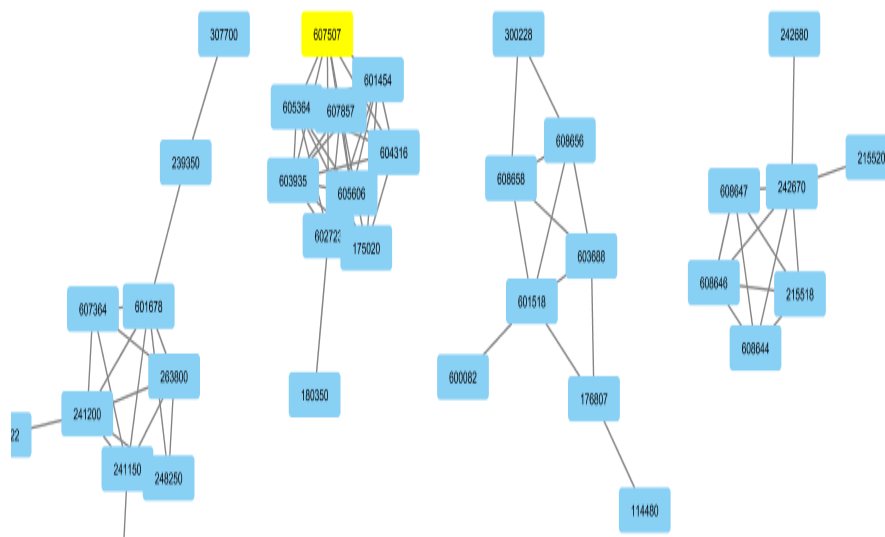
developed by Bundschus [10]. The relation dictionary synonyms are grouped into four relation types namely altered expression, genetic variation, and regulatory modification and unrelated. Table 6 shows the evaluation for relation type identification module.

**Table 6:-** Relation Type Identification Evaluation.

Evaluation Metrics	Relation Type Identification
Precision (%)	94.32
Recall (%)	66.83
F-score (%)	78.23

#### Association Score:-

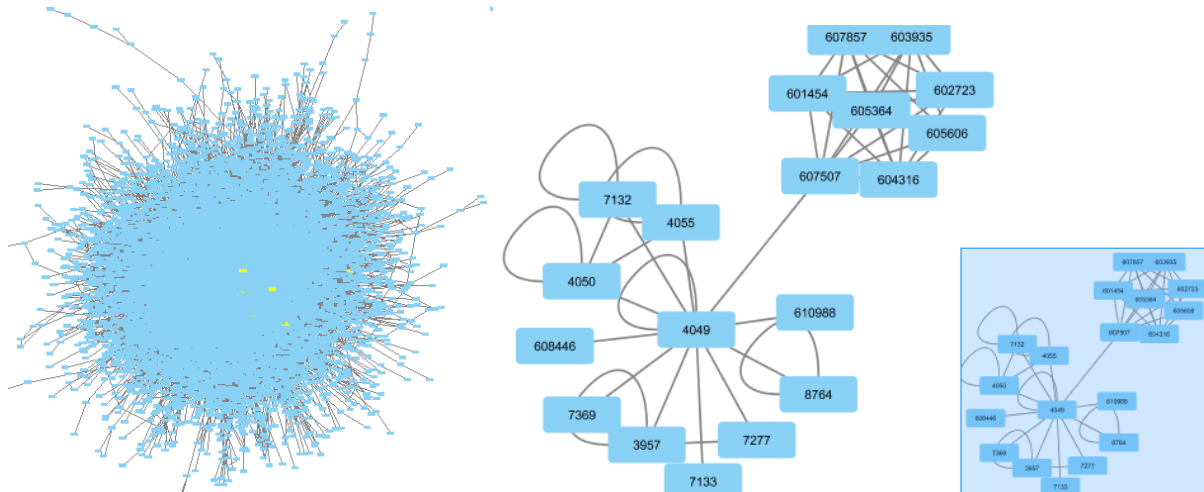
The association score is calculated as a matrix by giving the disease similarity matrix and protein-protein interaction matrix as input. The association score is calculated using the iterative algorithm which defines the correlation between the disease similarity network and protein-protein interaction network. In fig.4, the disease similarity network for psoriasis disease is constructed in the form of matrix. In disease similarity network each cell represents the similarity score between two diseases. The disease that are similar to the disease psoriasis are discovered from the network visualization in Cytoscape 3.4.0 which is depicted in fig. 4 and the disease similarity matrix is constructed. The matrix row and column both contains the disease names that are similar to the disease psoriasis. The matrix cells contain values of only “0” and “1”. “0” represents that there is no interaction between two genes and “1” represents that interaction exist between two gene. The row and column both contains genes that are responsible for disease psoriasis and the genes that interact with the gene LTA. The association score is calculated using an iterative algorithm by including the disease similarity network for psoriasis and the protein-protein interaction network for the gene LTA. Each matrix cell represents the association score between the gene and disease in which the row contains diseases and column contains genes. The association score value defines the association strength between the corresponding gene and disease.



**Figure 4:-** Disease similarity network visualization

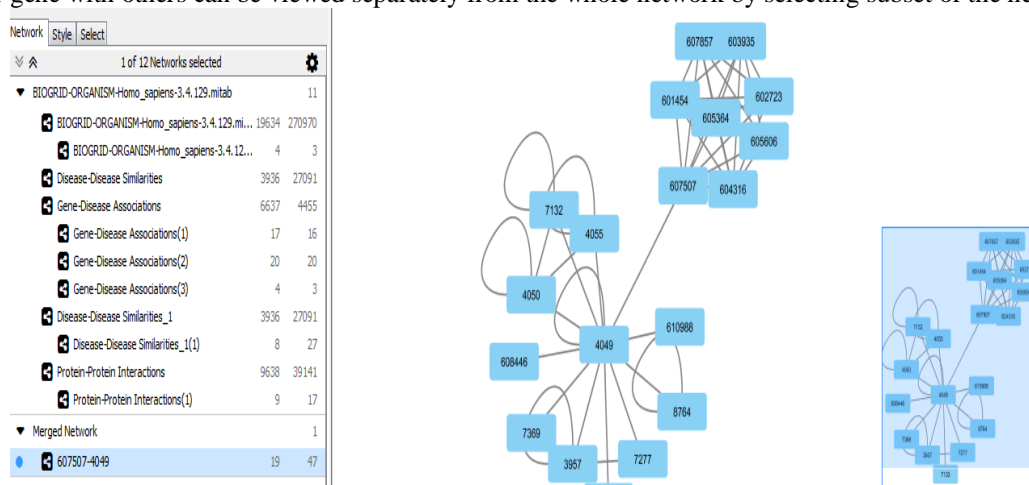
#### Network Construction:-

The network construction is visualized using Cytoscape 3.4.0 software which is a software used for biomedical network construction tasks. The network is constructed by giving the disease similarity network and protein-protein interaction network as input. It will merge the two networks and give the visualization of combined network for the given dataset. From that we can select the subset of network. Fig.5 depicts the Cytoscape network visualization of the disease similarity network which is constructed from the disease similarity dataset. The information provided in the dataset of disease similarity network is constructed as the network by converting the various diseases as nodes and the similarity score information as edges. From this network the subset of the network can be selected for any particular disease.



**Figure 5:-** Protein-protein interaction network visualization

Fig. 6 defines the network construction task of the protein-protein interaction dataset. The network nodes represents the various genes in the dataset and the edges represents the interaction between the two genes. The interaction of a particular gene with others can be viewed separately from the whole network by selecting subset of the network.



**Figure 6:-** Network Construction for protein-protein interaction

### Precision:-

Precision is the fraction of retrieved instances that are relevant. In this system the precision value is calculated for namely three tasks gene identification, relation type identification and association extraction which is plotted as bar chart in fig. 7. The precision value for gene identification task is calculated as the number of genes correctly highlighted in the given input abstract by the tool Pronormz. For the relation type identification task the precision value defines the correctly tagged relation types in the paragraph of abstract.

$$\text{Precision} = \frac{TP}{(TP + FP)}$$

(1)

True Positive (TP) measures the proportion of positives that are correctly identified as such. A False Positive (FP) is an error in some evaluation process in which a condition tested for is mistakenly found to have been detected.

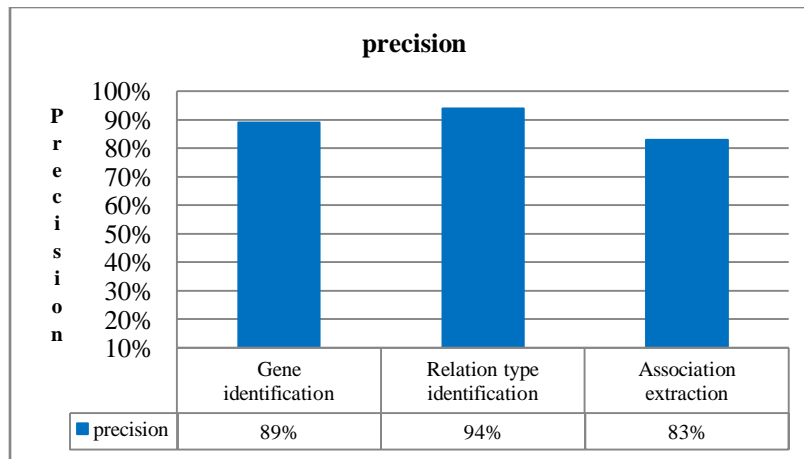


Figure 7:- Precision

**Recall:-**

Recall is the fraction of relevant instances that are retrieved. In fig. 8 the recall value is plotted for gene tagging, relation type identification and association extraction module. Both precision and recall value depends upon the datasets used for this system namely relation dictionary, disease similarity network and protein interaction network. It is the ratio of the number of relevant records retrieved to the total number of relevant records in the database.

$$Recall = TP / (TP + FN)$$

(2)

True Positive (TP) measures the proportion of positives that are correctly identified as such. False Negative (FN) is result that appears negative when it should not.

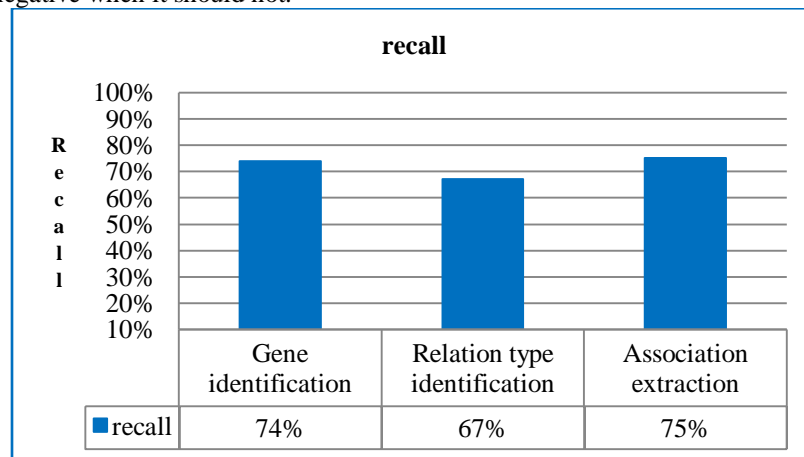


Figure 8:- Recall

**F-score:-**

F-score is a measure of a test's accuracy, interpreted as a weighted average of the precision and recall

$$F = 2 \times (precision \cdot recall) / (precision + recall)$$

(3)

Fig. 9 defines the F-score value, which is the calculated mean value of both precision and recall. F-score is a measure of a test's accuracy. It considers both the precision P and the recall R of the test to compute the score. P is the number of correct positive results divided by the number of all positive results, and r is the number of correct positive results divided by the number of positive results that should have been returned. The F-score can be interpreted as a weighted average of the precision and recall, where an F- score reaches its best value at 1 and worst at 0.

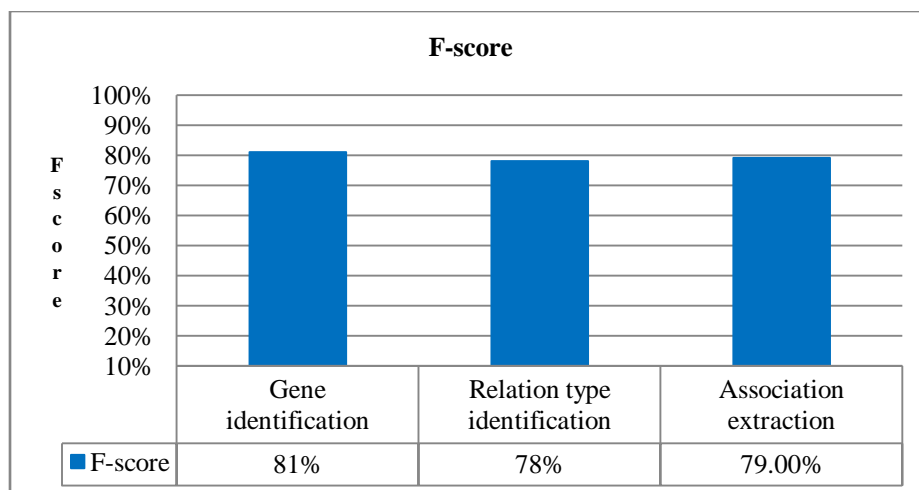


Figure 9:- F – Score

**Conclusion:-**

The proposed system deals with the gene-disease association extraction along with gene and disease name tagging in the biomedical literature and also the relationship identification between the disease and gene also discovered from the biomedical literature. The gene name tagging and normalization is done using a tool called Pronormz which has an in build tool Naggner for gene name tagging. For association discovery, the disease similarity network and the protein-protein interaction network are coupled together. The association score is calculated using a neighborhood iterative algorithm by constructing three matrices namely disease similarity matrix, protein-protein interaction matrix and the gene-disease association matrix. The definition of disease-gene association score makes full use of the information implicated in both disease similarities and neighboring genes comprehensively. The self-loop in the protein-protein interaction network are considered in the computation of the disease-gene association scores. Advantages of this method are, the prioritization score for candidate genes can give some suggestions for further investigation. Second, the prioritization score can be exploited to identify disease-causing protein sub networks, which are valuable for the study of the multifactorial diseases. In future, the system is going to constructed in such a way that predicting more number of novel genes and also the identification of gene and disease along with the drugs and identifying gene to drug relation and the link prediction concept can also be included in the future work.

**References:-**

1. Allen PD., Wiegers TC., Johnson RJ., Lay JM., Lennon-Hopkins K., Saraceni-Richards C., Sciaky D., Murphy CG and Mattingly CJ. (2013), 'Text mining effectively scores and ranks the literature for improving chemical-gene-disease curation at the comparative toxicogenomics database', PLoS One., pp 8, e58201.
2. Hamosh A., Scott AF, Amberger JS. Bocchini CA and McKusick VA. (2005), 'Online Mendelian Inheritance in Man (OMIM), a knowledgebase of human genes and genetic disorders', Nucleic acids research, pp 33, D514-517.
3. Kalpana Raja, Suresh Subramani and Jeyakumar Natarajan (2014) 'A hybrid named entity recognition for tagging human proteins/genes', International journal of data mining and bioinformatics 10.3, pp 315-328.
4. Markus Bundschuh, MathaeusDejori, Martin Stetter, VolkerTresp and Hans Peter Kriegel (2008), 'Extraction of semantic biomedical relations from text using conditional random fields', BMC Bioinformatics., pp 9, 207.
5. Panagiota I. Kontou, Athanasia Pavlopoulou, Niki L. Dimou, Georgios A. Pavlopoulos and Pantelis G. Bagos (2016), 'Network analysis of genes and their association with diseases', Gene 590, pp 68–78.
6. Peng Gang Sun (2015), 'The human Drug–Disease–Gene Network', Information Sciences 306, pp 70–80
7. Suresh Subramani, Raja Kalpana and Jeyakumar Natarajan (2014), 'ProNormz – An integrated approach for human proteins and protein kinases normalization', Journal of Biomedical Informatics 47, pp 131–138.
8. Suresh Subramani and Jeyakumar Natarajan (2015) 'An integrated text mining system based on network analysis for knowledge discovery of human gene-disease associations (GenDisFinder)', Proceedings of the fifth BioCreative challenge workshop 2015.
9. Vanunu O., Magger O., Ruppin E., Sholomi T., and Sharan R. (2010), 'Associating genes and Protein Complexes with Disease via Network Propagation', PLoS Comput Biol 6(1): e1000641.
10. Xingli Guo, Lin Gao, Chunshui Wei, Xiaofei Yang, Yi Zhao, Anguo Dong (2011) 'A computational method based on the integration of heterogeneous networks for predicting disease-gene associations'. PLoS One., 6, e24171.



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### RESEARCH ARTICLE

#### STUDY ON CORPORATE SOCIAL RESPONSIBILITY INITIATIVES OF INDIAN COMPANIES.

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#### Abstract

The purpose of this study is to explore the various definitions and descriptions of Corporate Social Responsibility (CSR); elaborate upon development of CSR in India; study the theoretical concepts expounded by various researchers and study the deployment of current CSR practices in India. This paper examines how India's top companies view, and conduct their CSR, identifies key CSR practices and maps these against Global Reporting Initiative standards. The study is divided into various sections: After giving a genesis and background of the subject, the next section gives a review of literature covering various facets and areas, which are touched upon by corporate social responsibility, including the arguments put forward both for and against CSR. Further sections deal with the methodology adopted for the study. The fourth section talks about the Indian experience in the area. The fifth section presents the main findings of the study, collected through the questionnaires sent to all the companies and collated by the research team. The last section enumerates the concluding observation and lessons for future.

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#### Introduction:-

The role of business in society has been debated in economic literature for a long time. By the term 'Corporate Social Responsibility' (CSR), what is generally understood is that business has an obligation to society that extends beyond its narrow obligation to its owners or shareholders. This idea has been discussed throughout the twentieth century, but it was Howard R. Bowen's book on "Social Responsibilities of Businessman" published in 1953, which was the origin of the modern debate on the subject. Bowen reasoned that there would be general social and economic benefits that would accrue to society, if business recognized broader social goals in its decisions.

Corporate Social Responsibility is nothing but what an organization does to positively influence the society in which it exists. It could take the form of community relationship, volunteer assistance programmes, healthcare initiatives, special education / training programmes and scholarships, preservation of cultural heritage and beautification of cities. The philosophy is, basically to give back to the society, what it (business) has taken from it, in the course of its quest for creation of wealth.

On the one hand experts have argued that shareholders put their risk capital in a Joint Stock Company (or business) and therefore, companies should be managed in the interest of the owners or the shareholders. This primacy of

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treatment given to the shareholders is being justified on the grounds of ownership and shareholding. It is felt that maximisation of profits or the bottom line should be the ultimate objective of the management. On the other hand, a number of experts will not agree with this position. For example, in Japan employees are treated as family. It is felt that an employee who devotes his or her life to the company has a bigger stake in it as compared to a shareholder. Germany is another nation where stakeholder recognition is high. Prominent among the experts who has taken a broader view is Minks who has argued that any company with a short term view, only maximizing profits for the shareholders, will destroy value in the medium to long run.

It is felt that the moot point here is the time frame. And that in the long run, the sustainability of the enterprise will be of paramount importance. In the long run, interests of both the stakeholders and the shareholders are not only likely to converge, but also have to be balanced.

The more the concepts of CSR are fostered and integrated into the business process, the easier it will be to benefit from alternative thinking and perhaps handle the occasional problems that for certain will occur. The more integrated the business process within the value chain, the more opportunity there will be for organizations to influence the approaches of others on whom they depend. The concept of CSR includes the openness or transparency of companies as well as taking into consideration the will and expectations of their stakeholders.

Social responsibility means a doctrine that claims that an entity whether it is government, Private Corporation or public organization has a responsibility to society. CSR is a concept that reduces costs and risks, increases the brand value and reputation, effectiveness and the efficiency of employees, improves transparency, and clarity in the working environment of the business house.

The main drivers for CSR have been the shrinking role of government, demands for greater disclosure, increased customer interest, growing investor pressure, competitive labor markets, and supplier relations. The companies enjoy several benefits like improved financial performance, lower operating costs, enhanced brand image and reputation, increased sales and customer loyalty, product safety, material recyclability, and greater use of renewable resources etc.

## **CSR in India:-**

### **CSR History:-**

India has a long rich history of close business involvement in social causes for national development. In India, CSR is known from ancient time as social duty or charity, which through different ages is changing its nature in broader aspect, now generally known as CSR. From the origin of business, which leads towards excess wealth, social and environmental issues have deep roots in the history of business. India has had a long tradition of corporate philanthropy and industrial welfare has been put to practice since late 1800s. Historically, the philanthropy of business people in India has resembled western philanthropy in being rooted in religious belief.

Business practices in the 1900s that could be termed socially responsible took different forms: philanthropic donations to charity, service to the community, enhancing employee welfare and promoting religious conduct. Corporations may give funds to charitable or educational institutions and may argue for them as great humanitarian deeds, when in fact they are simply trying to buy community good will. The ideology of CSR in the 1950s was primarily based on an assumption of the obligation of business to society.

In initial years there was little documentation of social responsibility initiatives in India. Since then there is a growing realization towards contribution to social activities globally with a desire to improve the immediate environment (Shinde, 2005). It has also been found that to a growing degree companies that pay genuine attention to the principles of socially responsible behavior are also favored by the public and preferred for their goods and services. This has given rise to the concept of CSR.

After Independence, JRD Tata who always laid a great deal of emphasis to go beyond conducting themselves as honest citizens pointed out that there were many ways in which industrial and business enterprises can contribute to public welfare beyond the scope of their normal activities. He advised that apart from the obvious one of donating funds to good causes which has been their normal practice for years; they could have used their own financial, managerial and human resources to provide task forces for undertaking direct relief and reconstruction measures. Slowly, it began to be accepted, at least in theory that business had to share a part of the social overhead

costs of. Traditionally, it had discharged its responsibility to society through benefactions for education, medical facilities, and scientific research among other objects. The important change at that time was that industry accepted social responsibility

### Review of Literature:-

**Tulsi Jayakumar (2013)** considered whether CSR correspondence issues are diverse in rising economies rather than Western created economies, requiring an alternate worldview of CSR Communication. An inside and out investigation of an Indian MNC auxiliary Hindustan Unilever Ltd. also, an Indian multinational, ICICI, uncovers that both organizations have been rehearsing CSR for quite a while and utilizing an Endorsed system of correspondence instead of the Expert Communication favored by Western standards. This is by virtue of the complex socio social milieu of such EDE resembles India which posture particular imperatives on the Communication procedure. All things considered, they either don't take after/are late participants into the field of corporate reporting utilizing GRI/UNGC standards.

**M Indira & Siddaraju V G (2009)** analyzed the CSR of TVS Motor organization by taking after a contextual analysis strategy. TVS Motor organization is situated at Nanjanagud, Mysore locale of Karnataka. The organization's revelations propose that it is taking up a few activities to enhance the states of the underprivileged in the general public and have a constructive outcome in their lives. Notwithstanding the group activities, TVS Company has been working with the NGOs, nearby powers and organizations, and neighborhood pioneers and government offices. They examined the CSR goals of TVS Company, their ability to recognize social issues, usage of methodologies and changes in the techniques after globalization, social pertinence of the issues tended to by the organization, and the state of mind of the chiefs in the organization towards CSR.

**V Ashotosh et al (2014)** studied the expenditure pattern of corporates towards CSR activities in the period of voluntary spending and based on the results, evaluated whether insertion of such a provision in the Act was necessary or not. They took sample consists of thirty companies included in BSE Sensex from 2001 to 2012. The analysis was done on the basis of number of companies spending on CSR, details of CSR expenditure, amount of CSR spending as percentage of sales and profits for each year and on an overall basis. The analysis showed that the CSR spending has been very low as percentage of revenue and profits during the phase of voluntary spending. The results also suggested that spending on environment and pollution control is not on the priority list of companies. Though, impact of CSR activities cannot always be evaluated in terms of fund allocations, still it is one of the most important indicators of the engagement of companies with society. Therefore, based on the findings, they concluded that insertion of this provision was an appropriate step by the regulators to make corporates socially more responsible.

**B Prema (2009)** analyzed the impact analysis of microfinance programme which was undertaken a decade ago by Forbes Marshall India Ltd, Pune. The analysis was based on primary data collection of 217 SHG members of SHGs formed by the company through the interview technique.

Study suggested that the microfinance has resulted in increasing the economic empowerment of SHG members belonging to weaker socio economic class. The paper also concluded that the level of economic empowerment of SHG members increases with the number of years of association with the SHG. At the end some suggestions were incorporated to give new directions to microfinance programme to fulfill new aspirations of SHG members.

**J Tulsi (2013)** analysed the CSR practices followed by HUL in its unit in DoomDooma, Assam in the period 2001-2004, a period which was one of the most tumultuous periods in the history of HUL operation in India. The largest personal care products factory set up in DoomDooma to take advantage of the government's concessions to encourage the region's development, witnessed serious challenges in the form of local bandhs (closures) and followed by an attack by the militant group, ULFA. Yet, the productivity contribution of the Assam factory was one of the highest and in fact was responsible for the company's top line growth.

She suggested that the financial performance was due in no small measure, to the corporate responsibility measures undertaken internally and externally by the company. The former consisted of the measures undertaken vis à vis the key stakeholders, viz. employees, consumers, ecosystem, and business partners while the external CR measures were with respect to the specific CSR initiatives undertaken keeping in mind the needs and expectations of the local community. Thus, the company's CR initiatives helped in sustainable growth.

She investigated whether firms operating in conflict zones can survive and sustain profitable business operations in the midst of a conflict using the tool of CSR. The objective was to see if an MNC can, through the employment of CSR, gain acceptability of a community which is confronted with social challenges and conflict, and in turn, can use such legitimacy for enhancing the value of its stakeholders. It does so by carrying out an in depth study of one of the oldest MNCs and the largest Fast Moving Consumer Goods (FMCG) company operating in India – Hindustan Unilever Limited (HUL), following the case study method of analysis. The case pertained to the CSR initiatives undertaken by HUL in its unit in Doom Dooma, Assam in the period 2001-2004.

**C Barnali & G Neeran (2013)** examined the CSR initiative of Coca Cola India through public private partnership method for contribution towards Water Management in Kaladera region by involving the government and the local community. They concluded that Setting up the plant in Kaladera resulted in strong resistance and protests of local residents. The company transformed the resistance into enormous popularity through its CSR activities and by involving the stakeholders in the execution and implementation of its plan. Coca Cola – India now enjoys local favor as it succeeded in translating the issues of the local community of Kaladera. The action plans had done wonders for boosting up the confidence level of the villagers and changing the perception about the company. Initially skeptical, the villager's apathy gradually gave way to mutual trust and cooperation.

**W Philippa et al (2013)** tried to explore the matter of whether such directors are influencing corporates in their sustainability and CSR policies. Within a framework shaped by Institutional theory, and via an examination of the publicly available published reports and other documented information on the Top 50 companies on the New Zealand Exchange (the NZX), they explored this question. The initial findings from this examination suggested that the reporting and performance record for these New Zealand corporates was both disappointing and limited. The finding was all the more interesting in light of the country's global "100% pure" marketing mantra and the environmentally responsible image and reputation the country seeks to cultivate internationally.

**Sumona Ghosh (2015)** investigated the pattern of communication of CSR information among the private sector companies in India, she pointed out that as reflected in the corporate websites taking absolute profit as the parameter and show that the corporate sector in India is yet to fully recognize the value of open communication about CSR practices to meet the needs of an increasingly transparent marketplace and to help build corporate reputation.

They concluded that companies belonging to higher deciles reported more substantial information about their CSR activities, than those belonging to the lower deciles, but the companies preferred to report more on pursuit of CSR activities with/through the help of foundations/ trusts/NGOs/government partnerships than crucial issues like disclosure of financial information on CSR activities. Thus, *richness of the content* with respect to disclosure of the number of beneficiaries that were benefitting from their CSR activities and the disclosure of financial information on CSR activities in the official websites was very shallow.

**N.K.Nair & J.S. Sodhi (2012)** analyzed the major findings of five case studies on the best CSR practices by Indian SMEs prepared by a team of researchers from Shri Ram Centre for Industrial Relations & Human Resources, New Delhi. They recommended that a lead institution may be nominated in each district to serve as a mediator. They also pointed out that supply chain pressures/opportunities to induce increasing number of SMEs to resort to CSR initiatives have been found missing. Finally they suggested that all the case examples presented in their study bear testimony to the need for the local community's involvement /support, directly or indirectly, to the full/partial success of SMEs' CSR initiatives. The least that could be done by the Ministry of Micro, Small & Medium Enterprises (MSME) is to recognize the CSR initiatives by SMEs through a suitably designed scheme of national awards.

### **Objectives of the Study:-**

1. To study the CSR Initiatives of leading companies in India.
2. To analyze and comparison of CSR practices and Ethics of various companies in India.
3. To study and explore the various areas of CSR activities done by Indian Companies.

### **Research Methodology:-**

The present study is based on data / information collected from large sized Indian companies, more specifically from those companies that were included in the National Stock Exchange's broad based index - S&P CNX NIFTY, during

January 2014-15. This represents fifty companies, with issued capital of Rs. 96,108 million and market capitalisation of Rs. 3,024,720 million.

A structured questionnaire was sent to all the companies through post, explaining the background and objectives for undertaking the study.

Despite close, rigorous follow-up, spread across two months, through e-mail, letters, telephone calls and even personal visits, response was received from only 19 companies. Two of the companies responded by saying the information was confidential and regretted their inability to share it with us. This was despite our assurance in writing that data would be consolidated and companies' names would not be revealed. Data for an additional 11 companies was culled out from other published sources as detailed in section on the main findings of the study later.

The purpose of the documentation is to bring out the similarities and differences of social responsibility initiatives, their decision making process, implementation modes and review mechanisms.

The review of literature as also the section on Indian experience is an attempt to put the entire gamut of discussions, developments on the CSR front in a perspective against which our own data is analysed and interpreted.

#### **IV Indian Experience:-**

There has been very little systematic documentation of Social Responsibility initiatives of corporates in India in the past, other than the brochures and publicity material brought out by the companies themselves. But in the last 3-4 years, 2 important surveys have been conducted, which have some significant macro level conclusions about India Incorporated and their journey on the social responsibility front.

Serious and committed approach to corporate responsibility practices is increasing its reach, but there is a vast ground yet to be covered. Corporate sector is slowly realising the positive aspects of corporate responsibility practices (good for business is good business). There is growing collaborative work between NGOs and companies. All stakeholders are increasingly becoming aware of the diverse facets of corporate responsibility practices. Due to various internal and external pressures, the climate is conducive for the growth of corporate responsibility practices in India.

Although many companies, NGOs and trade unions were aware of corporate responsibility practices, the study findings suggest that the concepts have yet to become part of core business strategy in most companies in India. Almost all companies, irrespective of size and sector had some awareness of corporate responsibility and its potential benefits. While most companies also had policies in place related to labour issues, community relations and environmental practices, they were for the most part not backed up by comprehensive implementation and monitoring systems.

Community programmes or social development initiatives, in most cases, were philanthropic and/or ad hoc in nature and not integrated into core business activities such as marketing and brand management.

#### **Analysis & Findings of the Study:-**

A structured questionnaire, specially designed for the study, was sent to all the fifty companies included in the NSE NIFTY Index.

It is appropriate to mention here that despite rigorous, consistent and close follow up with the companies through courier, telephone, e-mail and at times through personal visits, the response to the questionnaire has not been encouraging at all. Out of the 50 companies, only 19 companies have responded to the questionnaire. To make the sample more representative, we have been able to extract some / most of the information pertaining to the subject for an additional 11 companies from a) the published annual reports, b) director's reports, c) brochures published by the companies from time to time and d) other articles etc published about the CSR initiatives of these companies in reputed journal and financial dailies and weeklies. Thus, the total number of companies for which the data is available is 30, which is 60 % of the companies selected for the analysis. Considering the response to some of the earlier attempts made to document / study the area, by Chambers of Commerce, along with some multilateral agencies, the response may be considered reasonable.

The following table gives the sector wise composition of the NIFTY companies and similar analysis for the responding companies:

Sector	Composition of	
	All NIFTY Cos	*Responding Cos
Private Sector Indian Cos	72 %	89.5 %
Multi National Cos	12 %	3.5 %
Public Sector Cos	16 %	7 %
Total	100 %	100 %

\*Refers to only those companies that responded to the questionnaire.

The following are some general observations on the responding companies, which may be useful to keep in view while analysing the response:

- None of the computer software / hardware companies have responded to the questionnaire, with just one exception.
- Only two public sector undertakings have responded to our questionnaire. This is despite the well-known fact that many of them are active in the social responsibility areas.
- Out of the seven Tata Group companies included in the NIFTY list, as many as five have responded.
- Responses have come from different departments and offices within the companies, like the Office of the Company Secretary, Human Resource Department, and Department of Corporate Communications and in couple of cases from Ethics Counselors and specially created Department for Social Initiatives.

**The important findings of the study are discussed in the following paragraphs:-**

I) About 57 % of companies in the sample have a formally adopted ethics code. The nomenclature for these codes varies from company to company: Some companies call it 'Code of Conduct', others 'Core Statement of Values' and still others by some other name.

All these companies are treated, for the purpose of our analysis as having an Ethics Code.

One third of the companies do not have a formally adopted code, while for 10 % of the companies the information is not available.

About the process through which the code has been evolved, most companies have chosen to remain silent. Few companies have offered the following information and comments:

- Historically evolved
- Before adoption discussed among senior management and board of directors
- Before adoption discussed with present as well as past employees
- Studied & attempted to incorporate international standards and best practices
- Democratically evolved

Just one third of the companies have an Ethics Officer or an Ethics Counselor. Another 40 % of the companies do not have a specifically designated officer, but many of these companies have indicated that other departments and/or offices look after this function. 27 % of the companies have not given any information.

	Cos having one		Cos Not having one		Information NA	
	Number	%	Number	%	Number	%
Formal Ethics Code	17	57	10	33	03	10
Ethics Officer / Ethics Counselor	10	33	12	40	08	27

II) As far as the areas of interventions or content of the social responsibility initiatives is concerned, these have been classified into seven major areas as listed in Table below. Most companies are active in more than one area and therefore, the total does not add up to 100 per cent, but is more than that.

Sr.	Area of CSR Interventions	Number of Cos	No Percentage of Cos @
1	Education / Training	24	80
2	Health Care	20	66
3	Environment	18	60
4	Religious / Spiritual	Nil	Nil
5	Welfare of Under privileged Sections	17	57
6	Rural Development	7	23
7	Natural & Other Calamities	14	46
8	Any Other	12	40

Areas in which large proportions of the sample companies are active are Education & training ( 80 % ), Healthcare ( 66 % ), Environment ( 60 % ), Welfare of under privileged sections of the society ( 57 % ) and Rural development ( 23 % ).

There are two surprising results, which emerge out of the above analysis –

Firstly, none of the companies have said that they are doing anything actively in the area of religion and spiritual development. While it is well known that a number of companies, some of them belonging to some particular industrial groups, are doing a lot in this area. One probable reason for this could be that these activities are being undertaken by trusts formed specifically for the purpose, though under the umbrella of the group.

Second, surprising finding is that less than half (more specifically only 46 %) of the companies in the sample have mentioned natural & other calamities as part of the area in which they are active. One would have probably expected all companies to be doing their bit in this area.

### References:-

1. JTulsi (2013), “CSR Communication in Emerging Economies: Need for a New Paradigm: A Case Study of a Multinational and an Indian Trans National’s CSR Communication in India”, IJBIT, volume 6 issue 4 April, pp 6677.
2. M Indira & Siddharaju V G (2009), “Do Corporates Have Social Responsibility? A Case Study of TVS Motor Company”, The Icfai University Journal of Corporate Governance, Vol. VIII, Nos. 3 & 4, pp 131138.
3. V Ashotosh & C. V. R. S. Vijaya Kumar (2014), “An Analysis of CSR Expenditure by Indian Companies”, Indian Journal of Corporate Governance, Volume 7, No. 2, July-December 2014, pp 8294.
4. B Prema (2009), “Economic Empowerment Through Microfinance, An Assessment of CSR Activity run by Forbes Marshall Ltd.”, International journal of business insights & transformation, October 08 – March 09, pp 64 74.
5. J Tulsi (2013), “MNC CSR in Emerging Economy Conflict Zones A Case Study of HUL’s North East Operations in India”, VIKALPA, VOLUME 38, NO 4, OCTOBER – DECEMBER 2013, pp 69 82
6. C Barnali & G Neeran (2013), “Efficient Water Management through Public Private Partnership Model: An Experiment in CSR by Coca Cola India, VIKALPA, VOLUME 38, NO 4, pp 97 14
7. W Philippa et al (2013), “Corporate Sustainability/CSR and the Influence of the Independent Director: “100% Pure” New Zealand, European Conference on Management, Leadership & Governance, pp 372380.
8. Sumona Ghosh (2015), “Proactive Communication of CSR in India: A Distant Dream or Reality?”, Paradigm, 19(2) 115–136, SAGE Publications, DOI: 10.1177/0971890715609845, <http://par.sagepub.com>.
9. N.K.Nair & J.S. Sodhi (2012), “CSR Practices by SMEs in India: Lessons from Five Case Studies” The Indian Journal of Industrial Relations, Vol. 47, No. 4, April 2012.



## RESEARCH ARTICLE

### NEARLY QUASI PRIME SUBMODULES

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#### Abstract

Let  $R$  be a commutative ring with identity and  $M$  be a unitary of  $R$ -module. A proper submodule  $N$  of  $M$  is called a quasi-prime if whenever  $bx \in N$ ;  $a, b \in R, x \in M$ , implies that either  $ax \in N$  or  $bx \in N$ . In this paper we say that  $N$  is a nearly quasi prime, if whenever  $abx \in N$ ;  $a, b \in R, x \in M$ , implies that either  $ax \in N + J(M)$  or  $bx \in N + J(M)$ , where  $J(M)$  is the Jacobson radical of  $M$ . Some of the properties of this concept will be investigated. Some characterizations of nearly quasi prime submodules will be given, and we show that under some assumptions quasi prime submodules and nearly quasi prime submodules are coincide.

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#### Introduction:-

A submodule of an  $R$ -module  $M$  which Birkenmeier [1] was named prime submodules that they are generalized of prime ideals, which get big importance at last years, many studies and searches are published about prime submodules by many people who care with the subject of commutative algebra and some of them are C.P .Lu, P.F .Smith, J .Dauns. The definition comes in [1] as following we say that a proper submodule  $N$  of  $M$  is called prime if whenever  $r \in R, m \in M, rm \in N$  implies either  $m \in N$  or  $r \in [N:M]$  where  $[N:M] = \{r \in R : rM \subseteq N\}$ . Many generalizations of primesubmodules were studied such a nearly prime, weakly prime, quasi prime, pseudo – prime and on almost prime, see [2, 3, 4, 5]. In this article, we give another generalization of prime submodule it is nearly quasi prime submodule if  $abm \in N$  for  $a, b \in R$  and  $m \in M$ , then either  $am \in N + J(M)$  or  $bm \in N + J(M)$ . We give some characterizations for this concept. Also, we look for the relationships between nearly prime submodules and other well knowssubmodules.

#### Basic PropretiesOf Nearly Quasi Prime Submodules:-

In this section we introduce the concept of nearly quasi prime submodule as a generalization of a prime submodule.

##### Definition(2. 1):-

A proper submodule  $N$  of an  $R$  – module  $M$  is said to be a nearly quasi prime submodule if whenever  $r_1.r_2x \in N$  for  $r_1, r_2 \in R$  and  $x \in M$ , then either  $r_1x \in N + J(M)$  or  $r_2x \in N + J(M)$ . Equivalently, a proper submodule  $N$  of an  $R$  – module  $M$  is said to be a nearly quasi prime if and only if  $[N + J(M):Rx]$  is a prime ideal of  $R$ , for each  $x \in M$ .

**Remarks and Examples (2.2):-**

Let  $M$  be the  $Z$  – module  $Z \oplus Z$  and  $K = 6Z \oplus \langle 0 \rangle$ . Then  $K$  is not nearly quasi prime submodule of  $M$ , since  $2.3(1,0) \in K$  but  $2(1,0) \notin K + J(M)$ ,  $3(1,0) \notin K + J(M)$ .

Let  $N, K$  be two submodules of an  $R$  – module  $M$  and  $N \subseteq K$ . If  $N$  is a nearly quasi prime submodule of  $M$  and  $J(M) \subseteq J(K)$ , then  $N$  is nearly quasi prime submodule of  $K$ .

**Proof:** Let  $a, b \in R, m \in K$  such that  $a.bm \in N$ . Since  $N$  is nearly quasi prime submodule of  $M$ , so either  $am \in N + J(M)$  or  $bm \in N + J(M)$ . But  $J(M) \subseteq J(K)$ , so either  $am \in N + J(K)$  or  $bm \in N + J(K)$ . Therefore  $N$  is nearly quasi prime submodule of  $K$ .

A submodule of a nearly quasi submodule need not be a nearly quasi prime submodule : For instance,  $N = \langle \bar{3} \rangle$  is a  $Z$  – submodule of the  $Z$  – module  $Z_{12}$ . It is clear that  $N$  is a nearly quasi prime of  $Z_{12}$ , but  $K = \langle \bar{6} \rangle$  is not a nearly quasi prime submodule of  $M$  since  $[K + J(M) : (\bar{1})] = [\langle \bar{6} \rangle + \langle \bar{6} \rangle : (\bar{1})] = 6Z$ , which is not a prime ideal of  $Z$ .

It is clear that every quasi prime submodule is a nearly quasi prime, but the converse is not true in general for examples:

The submodule  $Z$  of the  $Z$ - module  $Q$  is a nearly quasi prime submodule since for each  $m \in Q$ ,  $[Z + J(Q) : (m)] = [Z + Q : (m)] = [Q : (m)] = Z$ , which is a prime ideal of  $Z$ . But it is not quasi prime submodule of  $M$  by [3, remark (2.1.2,(4))].

The submodule  $Z \oplus \langle \bar{4} \rangle$  of the  $Z$  – module  $Z \oplus Z_8$  is a nearly quasi submodule since for each  $m \in Z \oplus Z_8$ ,  $[Z \oplus \langle \bar{4} \rangle + J(Z \oplus Z_8) : (m)] = [Z \oplus \langle \bar{4} \rangle + J(Z) \oplus J(Z_8) : (m)] = [Q : (m)] = Z$ , which is a prime ideal of  $Z$ . But it is not quasi prime submodule by [3, Rem.2.1.2, (5)].

Consider the  $Z$  – module  $M = Z \oplus Z_2$  and the  $Z$  –submodule  $N = (0) \oplus (0)$ . Then, for any  $x \in M$  implies  $[N + J(M) : (x)] = [(0) \oplus (0) + J(Z \oplus Z_2) : (x)] = [(0) + Z_2 : (x)] = 2Z$ , which is a prime ideal of  $Z$ . Therefore,  $N$  is a nearly quasi prime submodule of  $M$ .

It is clear that every prime submodule is a nearly quasi prime submodule.

**Proof:** Let  $N$  be a prime submodule of an  $R$  – module  $M$ . Then  $N$  is a quasi prime submodule of  $M$  by [3,remark(1)]. Therefore  $N$  is a nearly quasi prime submodule of  $M$ .

But, the converse is not true in general for example  $(0) \oplus (0)$  is not prime submodule of  $Z \oplus Z_2$ , see [3, remark(1.1.3,(8))], but  $(0) \oplus (0)$  is a nearly quasi prime submodule of  $Z \oplus Z_2$ , by (2.2,(5)).

An ideal  $I$  is a nearly quasi prime ideal of  $R$  if and only if  $I$  is a nearly quasi prime  $R$  – submodule of  $R$  –module.

Consider the  $Z$  – module,  $= Z \oplus Z$ . The submodule  $N = 2Z \oplus \langle 0 \rangle$  is a nearly quasi prime submodule of  $M$  since for any  $m \in M$ ,  $[N + J(M) : (m)] = [2Z \oplus \langle 0 \rangle + (0) \oplus (0) : (m)] = \langle 0 \rangle$ , which is a prime ideal of  $Z$ .

1. It is clear that every maximal submodule is a nearly quasi prime submodule. But the converse is not true in general for example. Let  $M = ZP \oplus Z$  as  $Z$  – module,  $N = ZP \oplus \{0\}$  is a nearly quasi prime submodule (since  $N$  is a prime). But  $N$  is not maximal by [19,example (2), chapter].
2. If  $M$  is a simple  $R$  – module, then the zero submodule is a nearly quasi prime submodule of  $M$ . Hence  $\langle \bar{0} \rangle$  is the only nearly prime submodule of  $Z_p$  ( $p$  is prime number).
3. Let  $N$  and  $W$  be two submodules of an  $R$  – module  $M$  such that  $N \cong W$ . If  $N$  is a  $N$  – prime submodule, then it is not necessary that  $W$  is a nearly Prime submodule as the following example explains this :

Consider the  $Z$  – module  $Z$ , the submodule  $2Z$  is a nearly quasi prime submodule of  $Z$  and  $2Z \cong 30Z$ . But  $30Z$  is not a nearly quasi prime submodule of  $Z$ . Since  $6.5(1) \in 30Z$ , but  $5(1) = 5 \notin 30Z + J(Z) = 30Z + 0 = 30Z$  and  $6(1) = 6 \notin 30Z + J(Z) = 30Z + 0 = 30Z$ .



Consider the  $Z$  – module  $M = Z \oplus Z$ . The submodule  $N = 8Z \oplus 9Z$  is not nearly quasi prime since  $2.4(1,9) = (8, 72) \in 8Z \oplus 9Z$ ,  $2(1,9) \notin 8Z \oplus 9Z + J(Z \oplus Z) = 8Z \oplus 9Z$  and  $4.(1,9) \notin 8Z \oplus 9Z + J(Z \oplus Z) = 8Z \oplus 9Z$ .

The following theorem gives some characterizations for nearly quasi prime submodule

**Theorem (2.3):-**

Let  $N$  be a proper submodule of an  $R$  – module. Then the following are equivalent:

1.  $N$  is a nearly quasi prime submodule of  $M$ .
2.  $[N + J(M): K]$  is a prime ideal of  $R$ , for each submodule  $K$  of  $M$ .
3.  $[N + J(M): (rx)] = [N + J(M): (x)]$ , for each  $x \in M, r \in R$  and  $r \notin [N + J(M): (x)]$ .

**Proof:**

(1)  $\rightarrow$  (2): Let  $N$  be a nearly quasi prime submodule of  $M$ . Then  $[N + J(M):_R (x)]$  is a prime ideal of  $R$  for each  $x \in M$ . So  $[N + J(M):_R (x)]$  is a prime ideal of  $R$  for each  $x \in K$ . And by [3, lemma(1.2.5)],  $[N + J(M): K]$  is a prime ideal of  $R$ .

(2)  $\rightarrow$  (3) It is clear that  $[N + J(M): (x)] \subseteq [N + J(M): (rx)]$ . Let  $m \in [N + J(M): (rx)]$  for  $r \notin [N + J(M): (x)]$  and  $x \in M$ . Hence,  $m(rx) \subseteq N + J(M)$ . It follows that  $mr \in [N + J(M): (x)]$ , which is a prime ideal by (2). But  $r \notin [N + J(M): (x)]$  so  $m \in [N + J(M): (x)]$ . Thus,  $[N + J(M): (rx)] \subseteq [N + J(M): (x)]$ . Therefore,  $[N + J(M): (rx)] = [N + J(M): (x)]$ .

(3)  $\rightarrow$  (1): Let  $x \in M$  and  $a, b \in R$  such that  $ab \in [N + J(M): (x)]$ , suppose  $b \notin [N + J(M): (x)]$ , hence by (3),  $[N + J(M): (bx)] = [N + J(M): (x)]$ . But  $a \in [N + J(M): (bx)]$ , so  $a \in [N + J(M): (x)]$  and hence  $N$  is a nearly quasi prime submodule of  $M$ .

The following is an immediate consequence of (2.3.).

**Corollary (2.4):-**

Let  $N$  be a submodule of an  $R$  – module  $M$ . If  $N$  is a nearly quasi prime submodule of  $M$ , then  $[N + J(M): M]$  is a prime ideal of  $R$ .

The converse of corollary (2.4) is not true in general for example: Let  $M = Z \oplus Z$  as a  $Z$  – module and  $N = 6Z \oplus 0$ , then  $[6Z \oplus 0 + J(Z \oplus Z): Z \oplus Z] = (0)$  is a prime ideal of  $Z$ . But  $N$  is not a nearly quasi prime submodule of  $M$  see (Rem.2.2,(1)).

**Corollary (2.5):-**

Let  $N$  be a submodule of an  $R$  – module  $M$ . If  $N$  is a nearly quasi prime submodule of  $M$ , then  $[N + J(M): rM] = [N + J(M): M]$ ,  $\forall r \notin [N + J(M): M]$ .

**Proof:-**

Let  $a \in [N + J(M): rM]$  so  $arM \subseteq N + J(M)$  which means that  $ar \in [N + J(M): M]$ . But  $N$  is a nearly quasi prime submodule of  $M$ , so by corollary (2.4),  $[N + J(M): M]$  is a prime ideal of  $R$ . Hence either  $a \in [N + J(M): M]$  or  $r \in [N + J(M): M]$ , but  $r \notin [N + J(M): M]$ . So  $a \in [N + J(M): M]$ , thus  $[N + J(M): rM] \subseteq [N + J(M): M]$ . But it is clear that  $[N + J(M): M] \subseteq [N + J(M): rM]$ , so we obtain the result.

The converse of corollary (2.5) is not true for instance: Let  $M = Z$  as a  $Z$  – module, let  $N = 8Z, r = 5, 5 \notin [8Z + J(Z): Z] = [8Z + (0): Z] = 8Z$  and  $[8Z + J(Z): 5Z] = 8Z$  so  $[N + J(M): rM] = [N + J(M): M] = 8Z$ . But  $N = 8Z$  is not nearly quasi prime submodule of  $Z$ .

Let  $R$  be any ring. A subset  $S$  of  $R$  is called multiplicatively closed if  $1 \in S$  and  $ab \in S$  for every  $a, b \in S$ . We know that every proper ideal  $P$  in  $R$  is prime if and only if  $R - P$  is a multiplicatively closed subset of  $R$ , [7, p.42]. And if  $N$  a submodule of an  $R$  – module  $M$  and  $S$  be a multiplicatively closed subset of  $R$ , then  $N(S) = \{x \in M : \exists t \in S, \text{ such that } tx \in N\}$  be a submodule of  $M$  and  $N \subseteq N(S)$ .

However, the following proposition gives a partial converse of corollary (2.4).

**Proposition(2.6):-**

Let  $N$  be a proper submodule of an  $R$  – module  $M$ . If  $P = [N + J(M): M]$  is a prime ideal of  $R$  and  $N(S) = N + J(M)$  (where  $S = R - P$ ), then  $N$  is a nearly quasi prime submodule of  $M$ .

**Proof:-**

Since  $P$  is a prime ideal, so  $R - P$  is a multiplicatively closed subset, see[7,p.42]. Let  $a, b \in R, m \in M$  such that  $abm \in N$ . Suppose that  $am \notin N + J(M)$  so  $a \notin [N + J(M): R(m)]$ , hence  $a \notin [N + J(M): RM] = P$ , then  $a \in S$ . Similarly  $b \in S$ . So  $bm \in N + J(M)$  which mean that  $N$  is a nearly quasi prime submodule of  $M$ .

**Proposition(2.7):-**

Let  $K$  and  $N$  be two submodules of an  $R$  – module  $M$ . Then  $N$  is a nearly quasi prime submodule of  $M$  if and only if  $abK \subseteq N$  implies either  $aK \subseteq N + J(M)$  or  $bK \subseteq N + J(M)$ .

**Proof:-**

Let  $abK \subseteq N$  and suppose  $aK \not\subseteq N + J(M), bK \not\subseteq N + J(M)$ . So there exists  $m_1, m_2 \in K$  such that  $am_1 \notin N + J(M)$  and  $bm_2 \notin N + J(M)$ . Since  $N$  is nearly quasi prime and  $abm_1 \in N$  and  $am_1 \notin N + J(M)$ , so  $bm_1 \in N + J(M)$ . Also  $abm_2 \in N$  and  $bm_2 \notin N + J(M)$  so  $m_2 \in N + J(M)$ .

The converse is clear.

The intersection of any collection of nearly quasi prime submodules of an  $R$  – module not necessarily nearly quasi prime submodules,  $N_1 = \langle 2 \rangle$  and  $N_2 = \langle 3 \rangle$  are nearly quasi prime submodules of  $Z_{12}$  as a  $Z$  - module. But  $N_1 \cap N_2 = \langle 6 \rangle$  is not nearly quasi prime submodule of  $Z_{12}$ , since  $2 \cdot 3 \cdot 1 = 6 \in N_1 \cap N_2 = \langle 6 \rangle$  but  $2 \cdot 1 \notin \langle 6 \rangle + J(Z_{12}) = \langle 6 \rangle$  and  $3 \cdot 1 \notin \langle 6 \rangle + J(Z_{12}) = \langle 6 \rangle$ .

Recall that a ring  $R$  is said to be a good ring if  $J(M) = J(R)M$  for each  $R$  – module  $M$ , equivalently,  $R$  is a good ring if and only if  $J(N) = J(M) \cap N$  for each submodule  $N$  of an  $R$  – module  $M$ , [8, p.236]. And a ring  $R$  is called a regular ring if each of its elements is regular, where an element  $a \in R$  is said to be regular if  $\exists x \in R$  such that  $axa = a$ , [8,p.184]. It is known that if  $R/J(R)$  is a regular ring, then  $R$  is a good ring.

Hence, we have the following Result:-

**Proposition(2.8):-**

Let  $R$  be a good ring. If  $N$  is a nearly quasi prime submodule of an  $R$ - module  $M$  and  $K$  be a submodule of  $M$  such that  $J(M) \subseteq K$  and  $K$  is not contained in  $N$ , then  $K \cap N$  is a nearly quasi prime submodule of  $K$ .

**Proof:-**

Since  $K \not\subseteq N$ , then  $K \cap N$  is a proper submodule of  $K$ . Let  $r_1, r_2 \in R$  and  $x \in K$  such that  $r_1 r_2 x \in K \cap N$ , so  $r_1 r_2 x \in N$ . But  $N$  is a nearly quasi prime submodule of  $M$  so either  $r_1 x \in N + J(M)$  or  $r_2 x \in N + J(M)$ . Since  $x \in K$  implies that either  $r_1 x \in (N + J(M)) \cap K$  or  $r_2 x \in (N + J(M)) \cap K$ . Since  $J(M) \subseteq K$  implies that either  $r_1 x \in (N \cap K) + (J(M) \cap K)$  or  $r_2 x \in (N \cap K) + (J(M) \cap K)$  by [8]. But  $R$  is a good ring, so either  $r_1 x \in (N \cap K) + J(K)$  or  $r_2 x \in (N \cap K) + J(K)$  by [24]. Therefore  $K \cap N$  is a nearly quasi prime submodule of  $K$ .

**Corollary(2.9):-**

Let  $R$  be a good ring. If  $N$  is a nearly quasi prime submodule of an  $R$ - module  $M$  and  $K$  is a maximal submodule of  $M$  is not contained in  $N$ , then  $N \cap K$  is a nearly quasi prime submodule of  $K$ .

**Proof:-**

Since  $K$  is a maximal submodule of  $M$ , so  $J(M) \subseteq K$ . Hence the result follows by proposition(2.8).

**Corollary(2.10):-**

Let  $R/J(R)$  is a regular ring. If  $N$  is a nearly quasi prime submodule of  $M$  and  $K$  is a maximal submodule of  $M$  is not contained in  $N$ , then  $N \cap K$  is a nearly quasi prime submodule of  $K$ .

**Proposition (2.11):-**

Let  $N, K$  be two nearly quasi prime submodules of an  $R$  – module  $M$ . If  $J(M) \subseteq K$  or  $J(M) \subseteq N$ , then  $N \cap K$  is a nearly quasi prime submodule of  $M$ .

**Proof:-**

Let  $r_1, r_2 \in R$  and  $m \in M$  such that  $r_1 r_2 m \in N \cap K$ , so  $r_1 r_2 m \in N$  and  $r_1 r_2 m \in K$ . But  $N, K$  are nearly quasi prime submodules of  $M$ , so either  $r_1 m \in N + J(M)$  or  $r_2 m \in N + J(M)$  and either  $r_1 m \in K + J(M)$  or  $r_2 m \in K + J(M)$ . Thus either  $r_1 m \in (N + J(M)) \cap (K + J(M))$  or  $r_2 m \in (N + J(M)) \cap (K + J(M))$ . If  $(M) \subseteq K$ , then either  $r_1 m \in (N + J(M)) \cap K = (N \cap K) + J(M)$  by [8]. If  $J(M) \subseteq N$ , then  $r_2 m \in (K + J(M)) \cap N = (N \cap K) + J(M)$  by [8]. Therefore  $K \cap N$  is a nearly quasi prime submodule of  $M$ .

**Proposition (2.12):-**

Let  $M$  and  $M'$  are  $R$ -modules and  $f: M \rightarrow M'$  is an epimorphism such that  $\text{Ker } f \ll M$ . If  $N$  is a nearly quasi prime submodule of  $M'$ , then  $f^{-1}(N)$  is also a nearly quasi prime submodule of  $M$ .

**Proof:-**

Let  $r_1, r_2 \in R$  and  $m \in M$  such that  $r_1 r_2 m \in f^{-1}(N)$  so  $r_1 r_2 f(m) \in N$ . But  $N$  is a nearly quasi prime submodule of  $M'$  so either  $r_1 f(m) \in N + J(M')$  or  $r_2 f(m) \in N + J(M')$ . Thus, either  $r_1 m \in f^{-1}(N + J(M'))$  or  $r_2 m \in f^{-1}(N + J(M'))$  and this implies that either  $r_1 m \in f^{-1}(N) + f^{-1}(J(M'))$  or  $r_2 m \in f^{-1}(N) + f^{-1}(J(M'))$ . But  $\text{Ker } f \ll M$ , so either  $r_1 m \in f^{-1}(N) + J(M)$  or  $r_2 m \in f^{-1}(N) + J(M)$ , [8]. Therefore  $f^{-1}(N)$  is a nearly quasi prime submodule of  $M$ .

**Proposition (2.13):-**

Let  $\phi: M \rightarrow M'$  be an  $R$ -epimorphism. If  $N$  is a nearly quasi prime submodule of an  $R$ -module  $M$  containing  $\text{Ker } \phi$  and  $\text{Ker } \phi \ll M$ , then  $\phi(N)$  is a nearly quasi prime submodule of  $M'$ .

**Proof:-**

$\phi(N)$  is a proper submodule of  $M'$ . If not suppose  $\phi(N) = M'$ , let  $m \in M$  such that  $\phi(m) \in M' = \phi(N)$ ,  $\exists n \in N$  such that  $\phi(n) = \phi(m)$  hence  $\phi(n - m) = 0$ , then  $n - m \in \text{Ker } \phi \subseteq N$ , then  $m \in N$ , hence  $N = M$  (contradiction), since  $N \subsetneq M$ . Let  $r_1, r_2 \in R, m' \in M'$  such that  $r_1 r_2 m' \in \phi(N)$ , we want to show that either  $r_1 m' \in \phi(N) + J(M')$  or  $r_2 m' \in \phi(N) + J(M')$ . Since  $\phi$  is an epimorphism and  $m' \in M'$ , then there exists  $n \in N$  such that  $\phi(n) = r_1 r_2 m'$ . But  $m' = \phi(m)$  for some  $m \in M$ , so  $r_1 r_2 \phi(m) = \phi(n)$  which implies that  $r_1 r_2 m - n \in \text{Ker } \phi$ . But  $\text{Ker } \phi \subseteq N$  so that  $r_1 r_2 m - n = n_1$  for  $n_1 \in N$ . Hence,  $r_1 r_2 m \in N$ . But  $N$  is a nearly quasi prime submodule in  $M$ , so either  $r_1 m \in N + J(M)$  or  $r_2 m \in N + J(M)$ . Thus, either  $r_1 m' \in \phi(N) + J(M')$  or  $r_2 m' \in \phi(N) + J(M')$ . Since,  $r_2 \phi(m) \in \phi(N) + \phi(J(M))$ . But  $\text{Ker } \phi \ll M$  and  $\phi$  is an epimorphism, so either  $r_1 m' \in \phi(N) + J(M')$  or  $r_2 m' \in \phi(N) + J(M')$ , [8]. Therefore,  $\phi(N)$  is nearly quasi prime submodule of  $M'$ .

Recall that a submodule  $K$  of an  $R$ -module is called small in  $M$ , if every submodule  $L$  of  $M$  with  $K + L = M$  implies  $L = M$  notationally  $K \ll M$  [8, p.106].

An  $R$ -epimorphism  $\phi: M \rightarrow M'$  is called small epimorphism if  $\text{Ker } \phi \ll M$ , [8].

By using these concept, we have the following:

Let  $\phi: M \rightarrow M'$  is small epimorphism. If  $N$  is a nearly quasi prime submodule of an  $R$ -module  $M$  containing  $\text{Ker } \phi$ , then  $\phi(N)$  is a nearly quasi prime submodule of  $M'$ .

Recall that an  $R$ -module  $M$  is called hollow module if and only if every submodule in  $M$  is small [9].

**Corollary (2.15):-**

Let  $M$  be a hollow  $R$ -module and  $\phi: M \rightarrow M'$  be an epimorphism. If  $N$  is a nearly quasi prime submodule of an  $R$ -module  $M$  containing  $\text{Ker } \phi$ , then  $\phi(N)$  is a nearly quasi prime submodule of  $M'$ .

Recall that an  $R$ -module  $M$  is called local if  $M$  has unique maximal submodule, [10].

**Corollary (2.16):-**

Let  $M$  is a local  $R$ -module and  $\phi: M \rightarrow M'$  be an epimorphism. If  $N$  is a nearly quasi prime submodule of an  $R$ -module  $M$  containing  $\text{Ker } \phi$ , then  $\phi(N)$  is a  $N$ -prime submodule of  $M'$ .

**Proof:-**

Since  $M$  is local  $R$ - module, so  $M$  is hollow  $R$ - module by [11 ,Th.2.6], then the result follows from corollary(2.15).

**Corollary (2.17):-**

Let  $N$  be a submodule of an  $R$ - module  $M$  and  $K$  be a small submodule of  $M$  contained in  $N$ . Then  $N / K$  is a nearly quasi prime submodule of  $M / K$  if  $N$  is nearly quasi prime submodule of  $M$ .

**Proof:-**

Let  $\pi: M \rightarrow M / K$  be the natural epimorphism, then the result follows from proposition (2.13).

**The Relation Between Nearly Quasi Prime Submodules And Other Submodules:-**

We study in this section the relationships between nearly quasi prime submodules and other submodules such as quasi prime submodules,  $N$  –semiprime, prime submodules.

As we have mentioned in section one, that quasi prime submodule is nearly quasi prime submodule and the converse need not be true in general.

In the following proposition, we give a condition under which the converse is true.

**Proposition (3.1):-**

If  $N$  is a nearly quasi prime submodule of an  $R$  – module  $M$  and  $J(M) \subseteq N$ , then  $N$  is quasi prime submodule of  $M$ .

**Proof:-**

It is clear.

Recall that an  $R$  – module  $M$  is called fully semiprime if for each proper submodule is semiprime. And  $M$  is called an almost fully semiprime if each nonzero proper submodule is semiprime, [12].

**Proposition (3.2):-**

Let  $M$  is an almost fully semiprime  $R$ -module which is not fully semiprime. If  $N$  is a nearly quasi prime submodule, then  $N$  is a quasi prime submodule of  $M$ .

**Proof:-**

Let  $M$  is an almost fully semiprime module and not fully semiprime. Then by [12, lemma (2.10), p.312],  $J(M) \subseteq N$ . Hence  $N$  is a quasi prime submodule of  $M$  by proposition (3.1).

Recall that an  $R$  – module  $M$  is called co – semisimple if each proper submodule of  $M$  is an intersection of maximal submodules, [12].

**Proposition (3.3):-**

Let  $M$  is an almost fully semiprime  $R$ - module which is not co-semisimple. If  $N$  is nearly quasi prime submodule of  $M$ , then  $N$  is a quasi prime submodule of  $M$ .

**Proof:-**

Let  $M$  is an almost fully semiprime  $R$ - module and not co- semisimple. Then by [12, lemma (2.10), p.312],  $J(M) \subseteq N$ . Hence  $N$  is a quasi prime submodule of  $M$  by proposition (3.1).

**Proposition (3.4):-**

If  $N$  is nearly quasi prime submodule of an  $R$  – module  $M$  and  $J(M) = 0$ , then  $N$  is quasi prime submodule of  $M$ .

**Proof:-**

It is clear.

Recall that a ring  $R$  is called a  $V$  – ring if every simple  $R$  – module is injective, [13].

**Corollary (3.5):-**

If  $N$  is nearly quasi prime submodule of an  $R$  – module  $M$  and  $R$  is a  $V$  – ring, then  $N$  is quasi prime submodule of  $M$ .

**Proof:-**

Since  $R$  is a  $V$ -ring, so  $J(M) = 0$  by [13, Theorem. (VILLAMAYOR), p.236]. Hence the result follows by proposition (3.4).

Next, an  $R$ -module  $M$  is said to be  $F$ -regular if each submodule of  $M$  is pure, [13].

By using this concept, we have the following:

**Corollary (3.6):-**

If  $N$  is a nearly quasi primesubmodule of  $F$ -regular  $R$ -module  $M$ , then  $N$  is a quasi prime submodule of  $M$ .

**Proof:-**

Since  $M$  is a  $F$ -regular  $R$ -module, then  $J(M) = 0$ , [15]. Hence the result follows by proposition (3.4).

**Corollary (3.7):-**

If  $N$  is nearly quasi prime submodule of an  $R$ -module  $M$  and  $R/ann(x)$  is a regular ring for every  $0 \neq x \in M$ , then  $N$  is quasi prime submodule of  $M$ .

**Proof:-**

Since  $R/ann(x)$  is a regular ring for every  $0 \neq x \in M$ , then  $M$  is a  $F$ -regular  $R$ -module by [16, Theorem. (2.2), p. 196]. Hence the result follows by Corollary (3.6).

Recall that an  $R$ -module  $M$  is called  $Z$ -regular if  $\forall m \in M, \exists f \in M^* = Hom(M, R)$  such that  $m = f(m) \cdot m$ , [15].

**Corollary (3.8):-**

If  $N$  is a nearly quasi prime submodule of  $Z$ -regular  $R$ -module  $M$ , then  $N$  is a quasi primesubmodule of  $M$ .

**Proof:-**

Since  $M$  is a  $Z$ -regular  $R$ -module, then  $M$  is a  $F$ -regular  $R$ -module by [17, proposition (2.3), p. 158]. Hence the result follows by Corollary (3.6).

Now, because of the fact that if  $M$  is semi-simple  $R$ -module, so  $J(M) = 0$  by [8, theorem 9.2.1, p.218], then the following is a consequence of proposition (3.4), where an  $R$ -module  $M$  is called semi-simple if and if only every submodule of  $M$  is a direct summand of  $M$ , [8].

**Corollary (3.9):-**

If  $N$  is a nearly quasi prime submodule of a semi-simple  $R$ -module  $M$ , then  $N$  is a quasi prime submodule of  $M$ .

Now, because of the fact that if  $R$  is semisimple then every right and left  $R$ -module is semi-simple by [8, corollary (8.2.2), p.196], then the following is a consequence of corollary (3.9).

**Corollary (3.10):-**

If  $N$  is nearly quasi prime submodule of an  $R$ -module  $M$  and  $R$  is a semi-simple ring, then  $N$  is quasi prime submodule of  $M$ .

Now, because of the fact that if  $M$  is a pseudo regular  $R$ -module, so  $J(M) = 0$  by [17, proposition 11, p.4], then the following is a consequence of proposition (3.4), where an  $R$ -module  $M$  is called pseudo regular if and if only every finitely generated submodule of  $M$  is a direct submodule, [17].

**Corollary (3.11):-**

If  $N$  is a nearly quasi prime submodule of a pseudo regular  $R$ -module  $M$ , then  $N$  is quasi prime submodule of  $M$ .

In the following result, we give another condition for which a nearly quasi Prime submodule be a quasi-primesubmodule

**Corollary (3.12):-**

If  $N$  is a nearly quasi prime submodule of an  $R$  – module  $M$  and  $J(N) = J(M) \cap N$  for each  $N$  submodule of  $M$ , then  $N$  is quasi prime submodule of  $M$ .

**Proof:-**

Since  $J(N) = J(M) \cap N$ , so  $J(M) = 0$  by [25, proposition(33-1),p.22]. Hence the result follows by proposition (3.4).

Now, because of the fact  $R$  is a good ring if and only if  $J(N) = J(M) \cap N$  for each submodule  $N$  of an  $R$  – module  $M$ , then the following is a consequence of proposition (3.4).

As another consequence of proposition (3.4), we have the following result:

**Corollary (3.13):-**

If  $N$  is a nearly quasi prime submodule of an  $R$  – module  $M$  and  $R$  is a good ring, then  $N$  is quasi prime submodule of  $M$ .

**Proof:-**

Since  $R$  is a good ring, then  $J(N) = J(M) \cap N$  for each submodule  $N$  of  $M$  by [8]. Therefore,  $J(M) = 0$  by [25] and hence  $N$  is a prime submodule of  $M$ .

Now, we can give the following:-

**Corollary (3.14):-**

If  $N$  is a nearly quasi prime submodule of an  $R$  – module  $M$  and  $R/J(R)$  is a regular ring, then  $N$  is quasi prime submodule of  $M$ .

**Proof:-**

Since  $(M) = J(R)M$ , then  $R$  is a good ring. Hence the result follows by corollary (3.13).

Recall that an  $R$  – module  $M$  is called divisible if and only if  $rM = M$ ,  $\forall 0 \neq r \in R$ , [8].

By using this concept, we have the following:

**Proposition (3.15):-**

Let  $R$  is PID and  $M$  is a divisible  $R$  – module such that  $J(M) \neq M$ . If  $N$  is a nearly quasi prime submodule, then  $N$  is a quasi prime submodule of  $M$ .

**Proof:-**

Since  $M$  is a divisible  $R$  – module and  $J(M) \neq M$ , so  $J(M) = 0$  by [25, prop.(1-4), p.12]. Hence the result follows immediately from proposition (3.4).

**Corollary (3.16):-**

Let  $M$  be an injective  $R$ - module and  $J(M) \neq M$ . If  $N$  is a nearly quasi prime submodule, then  $N$  is a quasi prime submodule of  $M$ .

**Proof:-**

Since  $M$  is an injective  $R$  – module, so  $M$  is a divisible  $R$  – module by [8]. But  $J(M) \neq M$ , so  $J(M) = 0$  by [25, prop.(1-4), p.12]. Hence the result follows immediately from proposition (3.4).

Now, we can give another consequences of proposition (3.4). But first we need the following definition: Let  $M$  and  $N$  be two modules.  $M$  is said to be essentially pseudo –  $N$  – injective if for any essentially submodule  $A$  of  $N$ , any monomorphism  $f : A \rightarrow M$  can be extended to some  $g \in \text{Hom}(N, M)$ .  $M$  is called essentially pseudo – injective if  $M$  is essentially pseudo –  $M$  – injective, [18].

**Corollary (3.17):-**

Let  $M$  be an essential pseudo –  $A$  – injective for any cyclic module  $A$  and  $J(M) \neq M$ . If  $N$  is a nearly quasi- prime submodule, then  $N$  is a quasi-prime submodule of  $M$ .

**Proof:-**

Since  $M$  be a essential pseudo –  $A$  – injective for any cyclic module  $A$ , so  $M$  is an injective by [18, corollary 1, p.4] and so  $M$  is a divisible  $R$  – module and  $J(M) \neq M$ , so  $J(M) = 0$  by [25, prop.(1-4), p.12]. Hence the result follows immediately from proposition (3.4).

Now, we can give another consequences of proposition (3.4). But first we need the following definition: Recall that an  $R$  – module  $M$  is direct injective, if given any direct summand  $A$  of  $M$ , an injection:  $i: A \rightarrow M$  and every  $R$  – monomorphism  $f: A \rightarrow M$ , there is an  $R$  – endomorphism  $g$  of  $M$  such that  $g \circ f = iA$  [19].

**Corollary (3.18):-**

Let  $M$  be a direct injective  $R$  – module and  $J(M) \neq M$ . If  $N$  is nearly a quasi-prime submodule, then  $N$  is a quasi-prime submodule of  $M$ .

**Proof:-**

Since  $M$  be a direct injective  $R$  – module, so  $M$  is a divisible  $R$  – module by [25]. Hence the result follows immediately from proposition (3.4).

Recall that an  $R$  – module  $M$  is called ic – pseudo – injective, if it is ic – pseudo –  $M$  – injective. Where an  $R$  – module  $M$  is said to be ic – (pseudo)-  $N$  – injective, if for each ic – submodule  $A$  of  $N$ , every  $R$  – homomorphism ( $R$  – monomorphism) from  $A$  to  $M$  can be extended to an  $R$  – homomorphism from  $N$  into  $M$ . And a submodule  $N$  of  $M$  is called ic – submodule, if  $N$  is isomorphic to a closed submodule of  $M$ , [21].

**Corollary (3.19):-**

Let  $M$  is an ic – pseudo – injective  $R$  – module and  $J(M) \neq M$ . If  $N$  is nearly quasi prime submodule, then  $N$  is quasi prime submodule of  $M$ .

**Proof:-**

Since  $M$  is an ic – pseudo – injective  $R$  – module, so  $M$  is a divisible  $R$  – module by [21, proposition (2.11), p.259]. Hence the result follows immediately from proposition (3.4).

Now, we study the relation between  $N$  – prime submodules and  $N$  – semi prime submodules. But first we need the following definition:

Recall that a submodule  $N$  of an  $R$  – module  $M$  is said to be  $N$  – semi prime, if whenever  $r^n \cdot x \in N$ ,  $r \in R$ ,  $x \in M$ ,  $n \in \mathbb{Z}^+$ , implies  $rx \in N + J(M)$ , [22].

**Remark (3.20):-**

Every nearly quasi prime submodule is  $N$  – semi prime submodule.

**Proof:-**

Suppose  $N$  is nearly quasi prime submodule of an  $R$  – module  $M$ . If  $r^2x \in N$  for  $r \in R$  and  $x \in M$ , then by definition of nearly quasi prime submodule implies that  $rx \in N + J(M)$ . Hence,  $N$  is  $N$  – semi prime submodule of  $M$ .

The converse is not true for example: Let  $M = Z$  as a  $Z$  – module and  $N = 6Z$ .  $6Z$  is nearly semi prime submodule of  $Z$  (since  $N$  is a semi prime). But  $6Z$  is not nearly quasi prime submodule of  $Z$ , since  $2 \cdot 3 \cdot 1 \in 6Z$ . But  $2 \cdot 1 = 2 \notin 6Z + J(Z) = 6Z$  and  $3 \cdot 1 = 3 \notin 6Z + J(Z) = 6Z$ .

In the following proposition, we give a condition under which the two concepts are equivalent. But first we need the following definition:

Recall that a submodule  $N$  of an  $R$  – module  $M$  is called irreducible if for each submodules  $L_1, L_2$  of  $M$  such that  $L_1 \cap L_2 = N$ , then either  $L_1 = N$  or  $L_2 = N$ , [23].

**Proposition (3.21):-**

Let  $N$  is an irreducible submodule of an  $R$  – module  $M$  and  $J(M) \subseteq N$ . If  $N$  is a  $N$  – Semi prime, then  $N$  is a nearly quasi prime submodule of  $M$

**Proof:-**

Since  $J(M) \subseteq N$  and  $N$  is  $N$ - semi prime submodule, then  $N$  is a semi- prime submodule by [22]. But  $N$  is an irreducible submodule of  $M$ , so by [ 26 ]  $N$  is a prime submodule of  $M$  and hence  $N$  is quasi prime submodule of  $M$ . Therefore  $N$  is nearly quasi prime submodule of  $M$ .

In the following proposition, we give other conditions under which the two concept are equivalent. But first we need the following definitions:

A non – zero  $R$  – module  $M$  is called secondary module provided that for every element  $r \in R$ , the endomorphism  $m \rightarrow rm$  is either surjective or nilpotent, [4].

Recall that a submodule  $N$  of an  $R$  – module  $M$  is said to be  $N$  – prime, if whenever  $x \in N, r \in R, x \in M$ , implies that either  $x \in N + J(M)$  or  $r \in [N + J(M) : M]$ , [24].

**Proposition (3.22):-**

Let  $N$  be a submodule of a secondary  $R$  – module  $M$  and  $J(M) \subseteq N$ . If  $N$  is a  $N$  – semi prime, then  $N$  is a nearly quasi prime submodule of  $M$ .

**Proof:-**

Let  $r \in R, m \in M$  such that  $rm \in N$ . Since  $M$  is a secondary module, then either  $rM = M$  or  $r^n M = 0$ , then  $r^n M \subseteq N$ , but  $N$  is a  $N$  – semi prime submodule of  $M$ , hence  $rM \subseteq N + J(M)$ . If  $rM = M$ , then  $m = ry$  for some  $y \in M$ . Thus,  $r^2 y = rm \in N$  and hence  $y \in N + J(M)$ . This implies that  $m \in N + J(M)$  and therefore  $N$  is a  $N$  – prime submodule of  $M$ . But  $J(M) \subseteq N$  so  $N$  is a prime submodule of  $M$  by [24] and hence  $N$  is a nearly quasi prime.

As we have mentioned in section one that prime submodule is nearly quasi prime submodule and the converse need not be true in general.

In the following proposition, we give a condition under which the converse is true.

**Proposition (3.23):-**

Let  $N$  is an irreducible submodule of an  $R$  – module  $M$  and  $J(M) \subseteq N$ . If  $N$  is a nearly quasi prime submodule of  $M$ , then  $N$  is a prime submodule of  $M$ .

**Proof:-**

Since  $J(M) \subseteq N$  and  $N$  is a nearly prime submodule, then  $N$  is a quasi prime submodule and so  $N$  is a semiprime submodule of  $M$  by [3, remark (2.1.2, 7)]. Hence  $N$  is a prime submodule of  $M$  by [26, prop.1.10, Ch.2].

**References:-**

1. Birkenmeier C.F.1976 .On The Cancellation of Quasi –Injective Modules .*Commutative InAlgebra*, 49(2), pp: 101-109.
2. Behboodi, M. Kooly. H.2004.Weakly Prime Modules. *Vietnam J Mathematics*, 32(3), pp: 303-317.
3. Abdul- Razak H.M., 1999. Quasi-prime Modules and Quasi-prime Submodules. M.D. Thesis, University of Baghdad.
4. KursatHakan Oral.2010.Pseudo Prime and Pseudo IrrducibleSubmodule.*World Applied Sciences Journal*, 9(12),pp :1350-1352.
5. Hani A. Khashan. 2012 .On Almost Prime Submodule. *Acta Mathematica Scientia*, 32B (2),pp :645-651.
6. C.P.Lu, .1999 . The Zariski Topologu on the prime Spectrum of aModule, *HoustomJ.Math.* 25(3) , 417-432.



7. Larsen M.D. and Mccarthy P.J.1971. Multiplicative Theory of Ideals ,Academic Press, New York and London
8. Kasch, F.1982. Modules and Rings , Academic Press Ins, London .
9. Wisbauer, R 1991. Foundations of Modules and Rings Theory, Gonrdan and Berach Reading.
10. Naoum, A.G. 1995. Regular Multiplication Modules. Periodica Mathematica Hungarica Vol. 31(2), pp.155-162.
11. Majid Mohammed , AbdGhafur Bin Ahmad , .2013. On some properties of hollow and hollow dimension modules. Pure and Applied Mathematics Journal. 2(15), 156-161.
12. Behboodi, M. Karamzadeh, O.A.S, and Koochy, H.2004. Modules Whose Certain Submodules Are Prime, Vietnam Journal of Mathematics ,32:2,303-317.
13. Byrd, K.A.,1972. Rings Whose Quasi- Injective Modules Are Injective, Proceedings of the American Mathematical Society ,Volume33,Number 2,June
14. Fieldhouse, D.J., 1969. Pure Theories. Math. Ann. 184,1-18.
15. Zelmanowitz, J.,1973. Regular Modules .Trans.Amer.Math.Soc.,163,341-355.
16. Naoum, A.G. and Yaseen, S.M., 1995. The Regular Submodules of a Module. Annales Societatis Mathematicae Polonae.
17. Zhu Zhanmin ,2010. Pseudo FQ- injective Modules. Dep. Mathematics ,Jiaxing University.
18. Al- Ahamadi<sup>1</sup>, N.Er<sup>2</sup>, S.K.Jain<sup>3</sup>, 2003. Modules Which are Invariant under Monomorphisms of their Injective Hulls .Ohio University, Athens, Ohio.
19. W. K. Nicholson , 1975 . Semirregular Modules and rings ,Canad . J. Math. 180 , 1105-1120.
20. C. W. Han , S.J Chio, 2009. Generaliation of the quasi – injective modules ,comm. Korean , 811-813. Math.soc. Vol.10. NO.1
21. Mehdi S.A. and Samir M.S.,2012.IC-Pseudo- Injective Modules. International Journal of Algebra ,Vol.6,no. 6,255-264.
22. Mohammed B.H, 2016. Nearly Semiprime Submodules .M.Sc. Thesis ,College of Science ,University of Baghdad.
23. Dauns , J. ,1980. Prime Modules and One- Sided Ideals in "Ring Theory and Algebra III", (Proceeding of the Third Oklahoma Conference), B.R.
24. Quasi-Injective Modules, Comm .Korean Math. Soc. Vol.10.No.1,811-813.
25. Nuhad S. and Adwia J.A.,2015. Nearly Prime Submodules .International J. of Advanced Scientific and Technical Research .Vol.6,2246-9954.

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### RESEARCH ARTICLE

#### QUANTITATIVE DETERMINATION OF RUBIADIN IN DIFFERENT ACCESSIONS OF *RUBIA CORDIFOLIA* LINN. BY ISOCRATIC RP-HPLC

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#### Abstract

*Rubia cordifolia* L. (common name-Indian Madder, Majith, Manjistha) from the family Rubiaceae is commonly known as is widely dispersed throughout the lower hills of India. The plant is famous drug in the Ayurvedic treatments. Extracts of this plant have shown many important medicinal properties. In this study, we quantified the amount of rubiadin in both roots and aerial part of the plant. The amount of the active principle is affected by the geographical areas. So, we also compared the amount of rubiadin in different accessions of the *R. cordifolia* Linn. that have been collected from different geographical areas of the India.

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#### Introduction:-

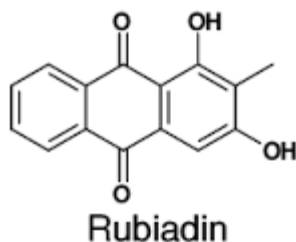
*Rubia cordifolia* L. (common name-Indian Madder, Majith, Manjistha) from the family Rubiaceae is commonly known as is widely dispersed throughout the lower hills of Indian Himalayas (Shekhar et al., 2010; Radha et al., 2011). The plant is important and famous drug in the Ayurvedic treatments. Extracts of this plant have shown hepatoprotective, antineoplastic properties and is also useful in the disintegration and elimination of urinary stones (Gilani and Janbaz, 1995; Divakar et al., 2010). Anti-inflammatory, anti-ulcer and anti-dysenteric activities are also found in the roots of *Rubia cordifolia* Linn. (Deoda et al., 2011). It is also used in the treatment of diuretic, liver complaints, joint pains, uterine pains, in rheumatoid arthritis (Shekhar et al., 2010).

The major compounds of this plant are anthraquinones, alizarin, purpurin and their derivatives. It also contains ruberythric acid (alizarin-primeveroside), pseudopurpurin and lucidinprimeveroside, rubiadin(1,3-Dihydroxy-2-methylantracene-9,10-dione), munjistin, quinizarin, lucidin and 1,8-dihydroxyanthraquinone (Banyal et al., 2006).

Rubiadin(1,3-Dihydroxy-2-methylantracene-9,10-dione), a dihydroxy anthraquinone, possesses effective antioxidant property and prevents lipid peroxidation (Tripathi et al., 1997). It also has hepatoprotective and anti-bacterial activity (Rao et al., 2006; Comini et al., 2011). For estimation of specific compounds in a sample HPLC is one of the several chromatographic techniques that are being generously utilized in laboratories all over the world (Mythili et al., 2011).

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Although, HPLC method for determination of rubiadin in the roots of *Rubia cordifolia* Linn. has been reported in literature. But quantitative determination of rubiadin in different accessions of the plant has not been reported yet. Further we also quantified rubiadin in both roots and aerial parts of *Rubia cordifolia* Linn. which has also not been reported yet. Present study deals with the quantitative determination of rubiadin by RP-HPLC in methanolic extracts of root and aerial parts of the different accessions of the plant. Briefly, in this study we verified the RP-HPLC method for the quantification of the rubiadin in different accessions of the plant.

## Material and Methods:-

### Plant material:-

Six different accessions of *Rubia cordifolia* Linn. were used in this study. Roots and aerial parts of plant were collected from six different geographical areas (Table. 1) of India. These samples were identified by Prof. M. P. Sharma, Head, Dept. of Botany, Jamia Hamdard. Voucher specimen is deposited at the herbarium of Department of Botany, Jamia Hamdard, New Delhi.

### Extraction of Plant material:-

The plant samples were air dried and ground into a fine powder using a grinder. Then, the plant material was extracted using different solvent system in a soxhlet apparatus and by other methods as well. 20g dried plant material was extracted using 200 ml of each solvent system of increasing polarity like petroleum ether, chloroform, acetone, ethanol (80%), methanol ethyl acetate, n-butanol and water respectively in a soxhlet assembly for 12 h. Each extract was concentrated by distilling off the solvent and then evaporating to dryness on water bath or using Rotary evaporator. Extracts were also used directly for various tests. Extracts were collected and used for different phytochemical tests (Results in Table. 2)

### HPLC chemicals and reagents:-

HPLC grade standard compound rubiadin was purchased from Natural Remedies (India). All the solvents and reagents used in the experiments were of HPLC grade. HPLC grade methanol and water were purchased from Merck, India. HPLC analysis was carried out on a Waters HPLC system (Binary Pump 600 controller), Waters PDA detector (996) and an auto sampler (2707). Empower 2 software was used to control the system and for monitoring and analysis of results. For chromatographic separation  $R_pC_{18}$  column (250×4.6 mm, particle size 5  $\mu$ m) was used. Further, a sonicator, rotary evaporator (R-200/205/V (Buchi), a pH meter and hot air oven were also used.

### Preparation of sample solution for HPLC analysis:-

Powdered samples of *R. cordifolia* (roots and aerial part), plant sample (1g, accurately weighed) were extracted with methanol (2×25mL) for 24h at room temperature in sonicator. The combined extracts were filtered through Whatman Filter paper No 42. Extracts obtained were concentrated on rotary evaporator (R-200/205/V (Buchi) ) in vacuum to 10mL.

### Preparation of Standard Solutions:-

A stock solution of rubiadin (1000  $\mu$ g/mL) was prepared by dissolving 2.0 mg of standard rubiadin accurately weighed in 2 mL methanol in an eppendorf tube. Standard solution of 200  $\mu$ g /mL was prepared from the stock solution by transferring 200  $\mu$ L of stock solution, and diluting to volume with methanol (800  $\mu$ L). Appropriate quantities of this standard solution was injected to obtain rubiadin in the range of 200-1000 ng.

### HPLC Conditions:-

Chromatography was performed using Waters system (Miford, MA, USA), 616 pump and 996 PDA detector. The volume injected was 20 $\mu$ L. Quantitative determination of rubiadin was performed at 295nm on a  $R_pC_{18}$  column (250×4.6 mm, 5  $\mu$ m). The mobile phase consisted of methanol: water (80:20, v/v) (Khodke et al, 2010) . The flow-

rate was 1 mL/min. The solvent was filtered through a nylon membrane (0.45µm) and degassed by sonication before use. UV spectra was recorded from 210-400nm at a rate of 1.00 spectrum/sec and a resolution of 1.2 nm.

#### Calibration:-

Standard solutions of 10-200 µg/mL of rubiadin were prepared in methanol from the stock solution of 1 mg/mL and were used for the preparation of calibration graph. 20 µL of each of the standard solution was injected by the auto sampler with concentrations mentioned above and the linearity of response for rubiadin was determined. Calibration curve was drawn by plotting the peak areas rubiadin against the corresponding concentration.

#### Results & Discussion:-

The separation of rubiadin by RP-HPLC was carried out under optimized conditions. Optimization of mobile phase was carried out using various concentrations of methanol and water. Three different compositions of methanol and water were used, 75:25, 85:15 and 80:20. The optimum mobile phase was found to be Methanol: Water (HPLC grade) in the ratio of 80:20 it is the same as reported in the Khodke et al, 2010 method. Retention time of rubiadin was found to be 7.920 min as shown in Fig.1. A linear relationship between peak areas and concentrations was obtained in the range of 10-50µg/ml. This shows that method is linear. Repeatability studies show %RSD to be less than 2%. This shows that method is precise. %RSD for inter-day precision was higher than that of intra-day precision. Excellent recoveries were obtained at each level of added concentration as the mean recovery found to be within 98% to 102% for rubiadin. The limit of detection and limit of Quantitation of method was found to be 55.75ng/ml and 200ng/ml (Table.3). As it was found that rubiadin peak gets well resolved from peaks of other chemical constituents, hence we conclude that method is selective. Further, the quantification of rubiadin in different samples of *R. cordifolia* was also successfully done (Fig. 2; Table. 4)

Quantification of rubiadin in roots of *R. cordifolia* has been reported in the previous study (Khodke et al., 2010). This analysis showed that rubiadin is present in roots only but in our study we quantified the rubiadin in both roots and aerial parts of this plant. This study not only supports the previous study that roots are good source of rubiadin but also revealed that significant amount of rubiadin is also present in the aerial part of this plant. Thus, the whole plant can be utilized to extract rubiadin. Further, we also quantified the rubiadin in aerial and roots of the *R. cordifolia* collected from different geographical areas which has not been reported earlier. Among all the six accession that has been used in the study the accession no.5 has the higher amount of rubiadin in its roots.

**Table 1:-** List of Plant materials (*Rubia cordifolia* Linn.) used in this study.

Plant name	Explant	Sample	Locality
<i>Rubia cordifolia</i> Linn.	Aerial part	Rb-1	IHBT(Palampur)
	Aerial part	Rb-2	Indus nursery (Bangalore)
	Root	Rb-3	Chopta forest (Himalyas)
	Root	Rb-4	University of Kashmir (Srinagar)
	Root	Rb-5	Chamba (Himachal Pradesh)
	Root	Rb-6	Hamdard laboratory (Ghaziabad)

**Table 2:-** Phytochemical screening of *Rubia cordifolia* Linn.

Constituent	ME	PF	CF	EAF	WF
Anthraquinones	+	+	+	+	+
Glycosides	+	-	+	+	+
Tannins	+	-	-	-	-
Saponins	+	+	+	+	+
Triterpenoids	+	+	+	-	-
Alkaloids	-	-	-	-	-

ME: Methanol Extracts, PF: Petroleum ether fraction, CF: chloroform fraction

EAF: Ethyl acetate fraction and WF: Water fraction: + = present, - = absent

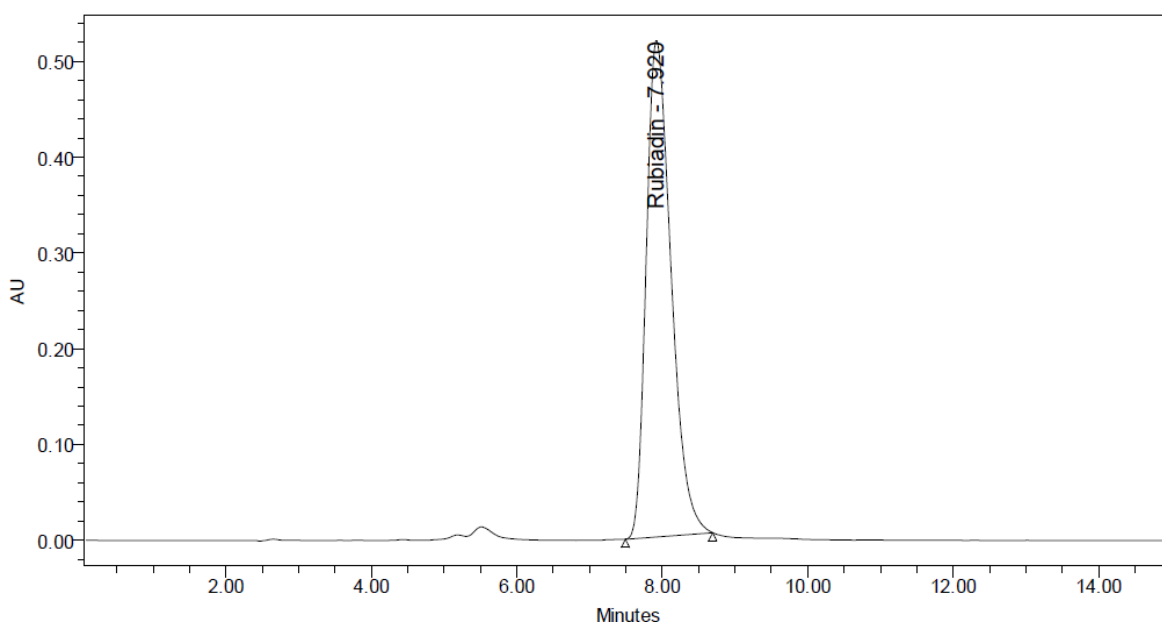
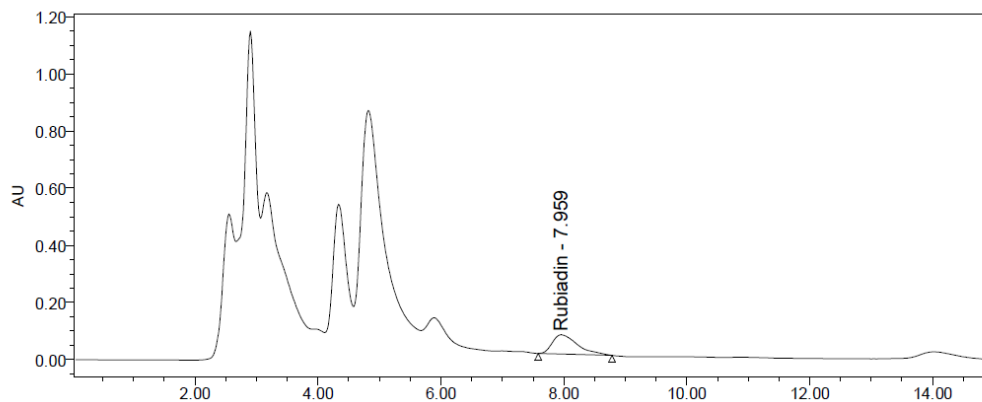
Anthraquinone and glycosides are present in almost all fractions of *Rubia cordifolia* Linn. and roots are rich in anthraquinones but alkaloids were not present.

**Table 3:-** Calibration data

Parameter (Units)	Rubiadin
Regression equation	$Y=8580X + 26481$
Linearity range ( $\mu\text{g/mL}$ )	10-200
$r^2 \pm \text{SD}$	$0.993781 \pm 0.0005$

**Table 4:-** Quantitative estimation of rubiadin in methanolic extracts of *Rubia cordifolia* Linn.

Accession no.	Plant part	Content of rubiadin (% w/w) of sample Mean $\pm$ SD
1	Aerial part	$0.12 \pm 0.091$
2	Aerial part	$0.15 \pm 0.091$
3	Root	$0.48 \pm 0.070$
4	Root	$0.27 \pm 0.073$
5	Root	$0.54 \pm 0.071$
6	Root	$0.38 \pm 0.070$

**Figure1:-** Chromatogram showing presence of rubiadin standard**Figure 2:-** Chromatogram shows the presence of rubiadin in mixture of compounds in root extract of *R. cordifolia* Linn.

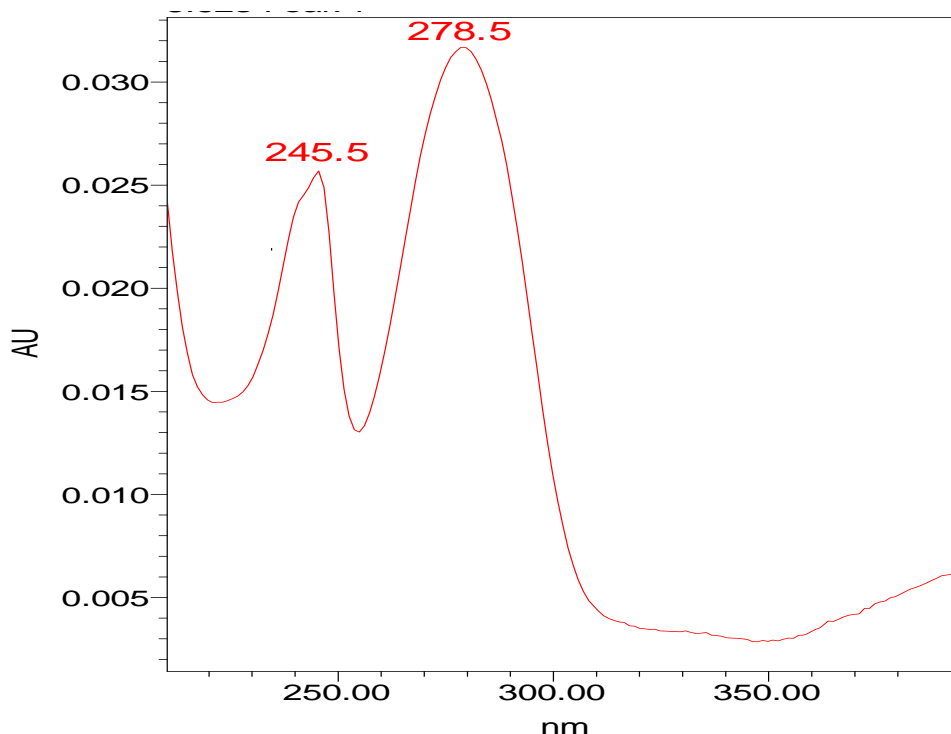


Figure3:- Spectra of peak of rubiadin in standard

### Conclusion:-

In our study, we compared the amount of rubiadin in different samples of the *R. cordifolia* plant that have been collected from the different geographical areas.

### Conflict of interest:-

The authors have no conflict of interest.

### Acknowledgment:-

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### References:-

1. Banyal, P., Kuzovkina, I., Kursinszki, L., Szoke, E. (2006). HPLC Analysis of Alizarin and Purpurin produced by *Rubia tinctorum* L. Hairy Root Cultures. *Chromatographia*, 63: S111-S114.
2. Comini, L.R., Montoya, S.C., Pérez, P.L., Argüello, G.A., Albesa, I., Cabrera, J.L. (2011). Antibacterial activity of anthraquinone derivatives from *Heterophylla apustulata* (Rubiaceae). *Journal of Photochemistry and Photobiology. B, Biology*, 102: 108-114.
3. Deoda, R.S., Kumar, D., Bhujbal, S.S. (2011). Gastro protective Effect of *Rubia cordifolia* Linn. on Aspirin Plus Pylorus-Ligated Ulcer. *Evidence-Based Complementary and Alternative Medicine*. Article ID 541624, 5 pages.
4. Gilani, A.H., Janbaz, K.H. (1995). Effect of *Rubia cordifolia* extract on acetaminophen and CCl<sub>4</sub>-induced hepatotoxicity. *Phytother Res.*, 9: 372-375.
5. Khodke, A.S., Potale, L.V., Patole, S.M., Damle, M.C. (2010). A Validated Isocratic RP-HPLC Method determination for Rubiadin in the roots of *Rubia cordifolia* Linn. *Int.J. Chem. Tech. Res.*, 2: 1955-1958.
6. Mythili, K., Gayatri, S., Koya, R.T., Chitra, K., C.Uma, M.R. (2011). Development and validation of RP-HPLC method for the estimation of Strontium ranelate in sachet. *International Journal of Pharma & Biosciences*, 2: 258-263.
7. Radha, R.K., Shereena, S.R., Divya, K., Krishnan, P.N., Seenii, S. (2011). In vitro Propagation of *Rubia cordifolia* Linn., A medicinal plant of the western Ghats. *International Journal of Botany*, 7: 90-96.

8. Rao, G.M., Rao, C.V., Pushpangadan, P., Shirwaikar, A. (2006). Hepatoprotective effects of rubiadin, a major constituent of *Rubia cordifolia* Linn. Journal of Ethnopharmacology, 103: 484-490.
9. Shekhar, T.C., Bahuguna, Y.M., Vijender, S. (2010). Anti-Inflammatory activity of ethanolic stem extracts of *Rubia cordifolia* Linn. in Rats. IJRAP, 1: 126-130.
10. Tripathi, Y.B., Sharma, M., Manickam, M. (1997). Rubiadin, a new antioxidant from *Rubia cordifolia*. Indian Journal of Biochemistry & Biophysics, 34: 302-306.

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### RESEARCH ARTICLE

#### THE PREDICTIVE FACTORS OF THE CARDIOVASCULAR INFRINGEMENT IN THE RHEUMATOID ARTHRITIS

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#### Abstract

Cardiovascular disease incidence is increased in patients suffering rheuma-toid arthritis, The latter is a risk factor so important as the diabetes. In a prospective study, 40 patients with RA were compared with age- and sex-matched controls

**Results:-** The intima-media thickness was significantly higher in patients with RA higher than control patients (0.759 mm vs 0.558 mm;  $P < 0.001$ ). We found a higher TR, in patients with RA. But, C-HDL and C-LDL were are not significantly different between the both groups

**Conclusion:-** Increased attention to cardiovascular risk in RA will be necessary to reduce the excess CV mortality and morbidity in RA patients. It appears that the excess risk that is observed in the RA population can be explained, in part, by promotion of CV disease through increased systemic inflammation associated with RA.

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#### Introduction:-

La mortalité dans la polyarthrite rhumatoïde (PR) est multipliée par deux par rapport à la population générale, cette surmortalité s'expliquant dans la moitié des cas par des événements cardiovasculaires (CV). Récemment, une surmortalité a été associée à la PR avec une espérance de vie réduite de cinq à dix ans (1). Plusieurs travaux ont mis l'accent sur la place prépondérante des événements cardiovasculaires qui expliqueraient en moyenne 50 % de cette surmortalité liée à la PR (2); Les facteurs de risque CV traditionnels n'expliquent pas seuls la majoration du risque CV, même si le tabagisme et les modifications du profil lipidique semblent impliqués. Le risque CV dans la PR est essentiellement lié à l'état inflammatoire chronique qui entraîne de nombreuses modifications métaboliques. D'autres paramètres comme les traitements utilisés jouent également un rôle. Le but de notre étude est de rechercher chez les patients atteints de PR les facteurs prédictifs pour développer un accident cardiovasculaire et cela de façon indépendante des autres facteurs de risque cardiovasculaires classiques.

#### Patients et Methodes:-

Nous avons mené une étude prospective, incluant 80 patients dont 40 sont atteints de PR (groupe PR) et 40 témoins (groupe des témoins). La durée totale de l'étude est de 24 mois allant de janvier 2013 au mois de janvier 2015. Afin d'obtenir une population la plus homogène possible, nous avons inclus dans l'étude

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les patients dont l'âge est supérieur à 20 ans présentant une PR répondant aux critères de l'ACR sans antécédents cardio-vasculaires cliniques. Nous avons exclu de l'étude les patients ayant déjà présenté une complication cardiovasculaire : cardiopathie ischémique (angor ou infarctus du myocarde [IDM], accident vasculaire cérébral [AVC] transitoire ou constitué), artériopathie oblitérante des membres inférieurs, les patients présentant les facteurs de risque cardiovasculaire classiques et les pathologies associées suivantes : pathologie hépatique, syndrome néphrotique, dysthyroïdie, et alcoolisme. Les patients atteints de PR ont été comparés à 40 témoins appariés par l'âge et le sexe. Les sujets témoins ont été soumis aux mêmes critères d'exclusion que les sujets PR. Ces témoins ont été recrutés dans la consultation du service de traumatologie de l'Hopital militaire de Laayoun. Ils sont atteints de lombosciatalgies commune ou arthrose indemnes de toute pathologie inflammatoire, infectieuse ou tumorale. Un questionnaire (HAQ) a été rempli et le DAS28 a été calculé. Tous les patients ont bénéficié d'un bilan biologique comportant : le dosage de la glycémie à jeun et HbA1c, l'acide urique et la créatinine sanguine, de la C-réactive protéine (CRP), la vitesse de sédimentation (VS) ainsi qu'un bilan lipidique réalisé après un jeun de 12 heures comportant : le cholestérol total (CT), triglycérides (TG), cholestérol-HDL (C-HDL), Tous les patients ont bénéficié en outre d'une recherche échographique des plaques d'athérome avec mesure de l'épaisseur intima media (EIM) des carotides communes et d'une échocardiographie transthoracique et enfin d'une mesure de l'IPS au niveau des membres inférieures.

### Analyse Statistique:-

Les différentes données ont été analysées par le logiciel SPSS. L'analyse a comporté deux volets

#### Un volet Descriptif:-

Cette analyse a comporté un calcul des moyennes et des écarts-types pour les variables quantitatives et un calcul des fréquences pour des variables qualitatives. Le seuil de signification a été fixé à 0,05. Une différence est dite significative si p est compris entre 0,05 et 0,01. La différence est très significative si p est compris entre 0,01 et 0,001. La différence est hautement significative si  $p < 0,001$ .

#### Un volet analytique:-

Cette analyse a consisté à étudier des corrélations entre les variables

### Resultats:-

Nous avons recueilli l'âge actuel, le sexe, l'IMC ainsi que l'ancienneté de la PR par rapport au début de notre étude. L'activité de la maladie rhumatoïde a été évaluée grâce au calcul des indices fonctionnels : DAS 28 et le HAQ (Tableau 1). Concernant le bilan inflammatoire dans le groupe PR, nous nous sommes basés sur l'étude de la VS et de la CRP afin de refléter l'activité de la PR (tableau 2). Concernant les traitements symptomatiques, nous nous sommes intéressés essentiellement à la prise ou non de corticoïdes. 90% des patients étaient sous corticothérapie. Quant aux traitements de fond, la majorité des patients (36 patients, soit 90 % des cas) ont bénéficié d'un traitement de fond à base de méthotrexate (MTX) et 10% sous salazopyrine

**Tableau 1:-** Caracteristiques épidémiocliniques du groupe polyarthrite rhumatoïde (PR)

	Groupe PR (40)
Age moyen (mois)	52.7±19.4
Sexe ratio (F/H)	3
IMC (kg/m <sup>2</sup> )	25,42 ± 4,27
Durée moyen d'évolution de la PR (mois)	91,2 ± 84,72 [10 mois–25 ans]
DAS (28)	2.9±1.6
HAQ	0.92±0.94

**Tableau 2:** Parametres biologique dansle groupe PR.

	Moyennes	Valeurs normales
Cholestérol Total	4,9± 1,1 [2,89 – 8,2]	5,2 à 6,4 mmol/L
LDL	3,3± 0,9 [1,61 – 5,20]	< 3,3
HDL	1,4± 0,3 [0,91 – 2,64]	1,0 à 1,65 mmol/L
Triglycérides	1,3± 0,4 [0,59 – 2,77]	0,6 à 1,7 mmol/L

Glycémie	5,7± 0,9 [4,3 – 8,29]	4,5 – 6, 2mmol/l
HbA1c	5,3±0,8 [4,5 – 8,5]	6%
CRPus	13,3± 19,9 [1 - 95]	<6mg/l
Acide urique	276,1± 70,5 [149 - 415]	200 et 415 µmol/

Dans le groupe PR La durée moyenne de l'évolution de la PR : 7.6±7.06 ans (42% des cas ont une durée< 5 ans), Les patients de sexe féminin ont une atteinte athérosclérotique significativement plus importante par rapport hommes. Le taux moyen des TG est significativement plus élevé chez les patients ayant un EIM ≥ 0.7mm (tableau 3). Concernant le traitement : L'étude de l'EIM en fonction de la dose administrée n'a pas montré de différence significative et la présence des plaques n'est pas corrélée à la prise de fortes doses de corticothérapie

**Tableau 3:** Correlation enter les parameters lipidiques et l'EIM dans le groupe PR.

	EIM ≥ 0.7mm	EIM < 0.7 mm	P
CT (mmol/l )	4.98	4.87	0.798
HDL-c ( mmol/l)	1.30	1.54	0.561
LDL-c ( mmol/l)	3.01	2.95	0.565
TG ( mmol/L)	1.64	1.02	0.015

Il n'existe pas de différence statistiquement significative de l'âge, du sexe, de la masse corporelle entre les deux groupes. Seule la pression artérielle et systolique et diastolique est significativement plus élevée dans le groupe PR (tableau 4). Concernant les marqueurs biologiques de l'inflammation, la VS ainsi que la CRP sont significativement plus élevées dans le groupe présentant une PR par rapport aux témoins (Tableau 4 )

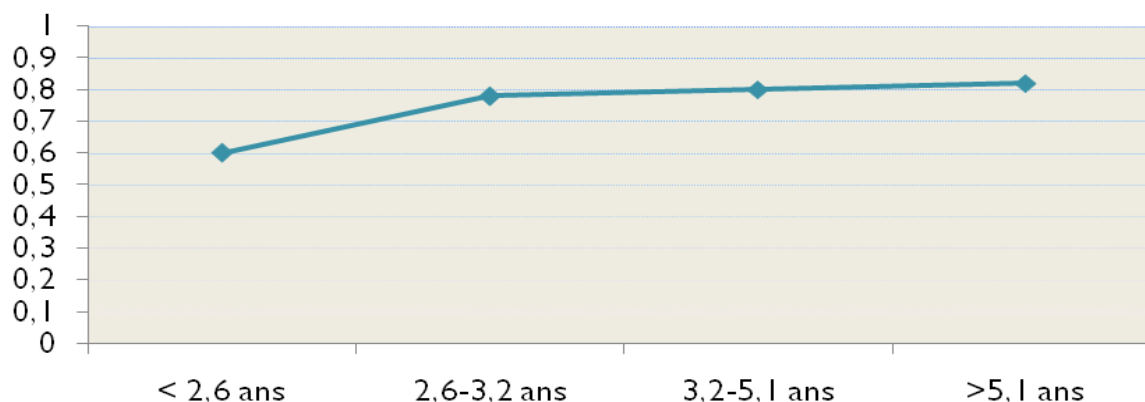
**Tableau 4:-** Comparaison des caracteristiques epidemiocliniques et biologiques enter le groupe polyarthrite rhumatoide (PR) et la population temoin.

	Groupe PR (40)	Groupe témoin (40)	P
Age	52.7±19.4	51 .8±18.3	0.665
Sexe ratio (H/F)	3	2.5	0.570
PAS (mmhg)	145.82	141.22	0.007
PAD (mmhg)	79.26	74.55	0.006
IMC (Kg/m2)	25,42 ± 4,27	26,42 ± 5,30	0.445
VS (mm/h)	40.18	10.76	0.000
CRP (mg)	13.31	2.60	0.001
Glycemie a jeun( mmol/l)	5,7± 0,9 [4,3 – 8,29]	5,1± 0,7 [3,2 – 7,29]	0.992
HbA1c %	5,3±0,8 [4,5 – 8,5]	5,2±0,3 [4,5 – 7,01]	0.998
Ac urique (µmol/)	276,1± 70,5 [149 - 415]	270,1± 60.2 [138 - 460]	0.774

L'EIM est plus élevée dans le groupe PR que dans le groupe témoin : 1,1 mm vs 0,558 mm (p < 0,01) (Tableau 5), l'EIM est corrélée avec la durée de l'évolution de la PR et non pas avec l'âge de son début (figure 1). La comparaison des moyennes des paramètres lipidiques a montré une augmentation significative des taux triglycérides dans le groupe PR, le taux du CT ainsi que le C-LDL et de C-HDL n'ont pas montré de variation significative (Tableau5).

**Tableau 5:-** Comparaison des different parameters du profil lipidique ainsi que l'épaisseur Intima media (EIM) entre le groupe polyarthrite rhumatoide (PR) et la population temoin.

	Groupe PR	Groupe témoin	P
TR (mmol/l)	1,3± 0,4 [0,59 – 2,77]	1,04± 0,4 [0,30 – 2,60]	0.001
CT (mmol/l)	4,5± 1,1 [2,89 – 8,2]	4,4± 1,2 [2,86 – 8,1]	0.254
C-HDL (mmol/l)	1,2± 0,3 [0,91 – 2,64]	1,3± 0,3 [0,94 – 2,66]	0.886
C-LD L ( mmol/l)	3,3± 0,9 [1,61 – 5,20]	3,1± 0,6 [1,50 – 5,10]	0.776
EIM mm	<b>1.1±1.1</b>	0,558	p < 0,001



**Figure 1:-** Correlation Enter l'EIM et Das 28.

### Discussion:-

L'augmentation de la mortalité des patients ayant une PR par rapport à la population générale est bien établie(3). La pathologie cardiovasculaire rend compte d'une augmentation d'environ 50% de la mortalité au cours de la PR par un accroissement du risque de mortalité cardiaque et neurologique (4). Une analyse du registre des médecins généralistes anglais a montré une mortalité globale supérieure de 60 % dans le groupe PR par rapport aux patients ayant une arthrose ou n'ayant aucune affection ostéo-articulaire. La mortalité liée à la pathologie cardiovasculaire est supérieure de 30 à 60 % par rapport aux deux groupes témoins (5). Les facteurs de risque classiques y contribuent certes mais il semble aussi que des éléments propres à la PR notamment l'existence d'une inflammation systémique, y participent (6). En outre, les lymphocytes T impliqués dans la pathogenèse de la PR joueraient également un rôle important dans les syndromes coronariens aigus et dans l'instabilité de la plaque d'athérome (7).

La morbidité cardiovasculaire est également augmentée, avec un sur-risque attribuable à la PR aussi important que celui du diabète (3,8). L'étude la plus démonstrative est celle réalisée à partir de la population générale danoise (8). Plus de 4 millions de personnes ont été suivies (4 311 022 personnes) de 1997 à 2006 : 10 447 ont développé une PR et 130 215 un diabète. Le risque d'IDM est de 1,7 [1,5-6,9] chez les patients atteints de PR, similaire à celui des diabétiques : 1,7 [1,6-1,8] ( $p = 0,64$ ) (3,9). Le risque d'IDM au cours de la PR est similaire à celui de sujets normaux, mais plus âgés de 10 ans (8). L'augmentation du risque d'IDM par rapport à l'évolution de la PR est controversée : elle pourrait précéder le diagnostic, apparaître dès le diagnostic, dans l'année suivante ou seulement 7 ans après (9). L'atteinte coronaire, plus souvent asymptomatique, est également plus grave que dans la population générale, puisqu'elle est plus couramment multitrunculaire avec un risque augmenté de récurrence et de décès après un premier IDM (3). De nombreuses études concernant des marqueurs précoces et infracliniques ont été réalisées dans la PR (10). L'altération de la fonction endothéliale et l'augmentation de la rigidité artérielle et de l'épaisseur intima-média, qui sont des facteurs prédictifs d'accident cardiovasculaire, ont été retrouvées chez les patients ayant une PR par rapport aux sujets contrôles dans des études transversales ou longitudinales (10). Il existe également une augmentation de la morbi-mortalité cardiovasculaire dans le rhumatisme psoriasique et la spondylarthrite ankylosante (SPA), du même ordre que celle observée dans la PR (11, 12).

La maladie athéromateuse peut rester plusieurs années silencieuse avant l'apparition de symptômes cliniques. Actuellement, grâce au développement de nouvelles méthodes d'évaluation comme l'ultrasonographie en mode B à haute résolution en particulier au niveau de l'artère carotide, l'athérosclérose peut être dépistée très précocement et cela en mesurant l'EIM. Cette mesure échographique de l'EIM constitue un nouveau marqueur du risque cardiovasculaire ayant une valeur prédictive positive. Nos résultats concernant l'EIM sont concordants avec ceux d'autres études qui ont comparé l'EIM des patients atteints de PR à celle de témoins et ont retrouvé une EIM plus élevée chez les patients PR que chez les sujets témoins. Dans l'étude de Park et al. (13) concernant 53 femmes souffrant de PR n'ayant aucun antécédent cardiovasculaire et 53 témoins appariés par l'âge, il existe une augmentation significative de l'EIM dans le groupe PR. Dans cette même étude, l'augmentation de l'EIM est positivement corrélée à la durée d'évolution de la maladie. En effet, les PR de moins d'une année d'évolution sont associées à une moindre augmentation de l'EIM.

Dans l'étude de Kumeda et al. (14) qui a porté sur 138 PR et 94 témoins matchés par l'âge, le sexe et les facteurs de risque cardiovasculaires, l'EIM est significativement plus élevée dans le groupe PR. La durée d'évolution de la maladie ainsi que sa sévérité sont positivement corrélées à l'EIM. Mary et al. (13) ont étudié de façon prospective 98 patients souffrant de PR et ne présentant aucune maladie cardiovasculaire ni autres facteurs de risques vasculaires classiques. Ils ont été comparés à 98 témoins appariés par l'âge, le sexe et l'ethnie et obéissant aux mêmes critères d'exclusion que les patients atteints de PR. Ils ont retrouvé une prévalence significativement plus élevée des plaques d'athérome dans le groupe PR par rapport au groupe témoin (44 % vs 15 % ;  $p < 0,001$ )

La dyslipidémie observée dans la PR illustre les intrications entre l'inflammation et les facteurs de risque traditionnels. Lorsque la PR est actif, le cholestérol total et le LDL-C sont diminués, alors que contrairement à la population générale, le risque de mortalité CV est augmenté (3). Cela traduit un processus inflammatoire non contrôlé malgré le traitement. Toutefois, même si le cholestérol total est diminué, il existe dans la PR une dyslipidémie caractérisée par une réduction encore plus importante du HDL avec une augmentation de l'indice athérogène (15). En outre, le taux du C-HDL est plus élevé chez les patients en rémission que chez ceux ayant une maladie rhumatoïde active. Dans notre étude, nous n'avons pas noté une baisse significative du taux du C-HDL dans le groupe PR par rapport aux sujets témoins. Quant au LDL-C, son rôle prédictif vis-à-vis de la mortalité et des événements coronariens a été très bien documenté dans plusieurs études dans la population générale (17). Dans la PR, les études sont controversées : dans certaines le taux de LDL-C est élevé et corrélé à l'activité de la maladie [18] contrairement à d'autres où la concentration de C-LDL est plutôt vers la baisse. Nos résultats ont retrouvé une légère augmentation du taux du C-LDL dans le groupe PR par rapport aux sujets témoins mais sans atteindre le seuil significatif (2,96 mmol/L vs 2,86 mmol/L ;  $p = 0,562$ ). La triglycéridémie est très variable. Souvent elle évolue sur le versant athérogène [18] et d'autrefois elle est de concentration normale ou même abaissée (17). Dans notre étude, la triglycéridémie est légèrement plus élevée dans le groupe PR par rapport à la population témoin (1,32 mmol/L vs 1,04 mmol/L) de façon significative, de même dans le groupe PR il ressort une corrélation statistiquement significative entre l'augmentation de l'EIM et l'hypertriglycéridémie. Au cours de la PR, la CRP est non seulement un outil précis pour le suivi de la maladie mais elle est devenue maintenant un facteur de risque cardiovasculaire à prendre en compte. En effet, la CRP constitue un dénominateur commun entre la PR et l'athérosclérose. Quant à son action sur le profil lipidique au cours de la PR, de nombreuses études ont retrouvé que l'élévation de la CRP était associée à une diminution des facteurs protecteurs notamment l'ApoA1 et le C-HDL (19) d'une part, et d'autre part à une élévation des facteurs athérogènes. L'influence des traitements de la PR sur le système artériel est très importante à considérer. Certaines études ont pointé le doigt sur la corticothérapie en l'associant à une augmentation de la prévalence des maladies cardiovasculaires et ainsi à une surmortalité cardiovasculaire (20). En effet, les corticoïdes pourraient favoriser l'athérome en raison de leur effet délétère sur le métabolisme lipidique, glucidique et la tension artérielle, d'une part, et d'autre part, la prise de corticoïdes pourrait traduire également l'existence d'une maladie plus sévère aux risques cardiovasculaires plus importants. L'étude de Del Rincon (21) réalisée chez 647 patients ayant une PR, a consisté en une étude échographique de l'artère carotide. Après appariement sur les facteurs de risque cardiovasculaires, les PR ayant reçu une corticothérapie supérieure à 16,4 g avaient plus souvent des plaques carotidiennes et des artères incompressibles que les PR n'ayant jamais reçu de corticothérapie.

Un meilleur contrôle de l'activité de la PR par les traitements de fond, notamment le MTX, permet de réduire la mortalité cardiovasculaire. Choi et al. (2) ont étudié 191 patients décédés sur une cohorte de 1240 patients suivis en ambulatoire pour une PR. Dans cette étude, les décès par maladie cardiovasculaire sont réduits à 70 % sous MTX comparés aux patients qui n'étaient pas sous MTX. Cette réduction de maladie cardiovasculaire résulte probablement de l'amélioration de la mobilité et du contrôle du processus inflammatoire. Actuellement, plusieurs études ont démontré qu'un traitement par les statines permettrait de réduire la morbidité et la mortalité cardiovasculaires tant en prévention primaire que secondaire et cela par le biais non seulement de leur effet hypocholestérolémiant mais aussi leur effet anti-inflammatoire puisque les statines diminuent la synthèse de la CRP de 15 à 25 % (23). Le risque de récurrences d'infarctus du myocarde est ainsi moins important chez les patients qui ont à la fois une diminution du C-LDL et de la CRP lors du traitement par statines.

### Conclusion:-

La PR est une maladie systémique responsable d'une augmentation de la mortalité essentiellement d'origine CV. Les événements CV sont en effet plus fréquents mais également plus graves au cours de la PR comparé à la population générale. L'augmentation du risque CV ne peut pas être expliquée que par les facteurs de risque CV traditionnels, elle est essentiellement liée à l'état inflammatoire chronique qui entraîne de nombreuses modifications métaboliques. Ces constatations nous ont amenés à nous pencher sur l'étude des facteurs prédictives de l'atteinte cardiovasculaire au cours de la PR à travers une comparaison du profil lipidique et de la mesure échographique de l'EIM de l'artère carotide avec des sujets témoins appariés par l'âge et le sexe. Nos résultats ont montré en accord avec la littérature une augmentation significative de l'EIM chez les sujets atteints de PR par rapport à la population témoin, les perturbations lipidiques dans la PR rapportées dans la littérature et l'augmentation de l'EIM justifient un contrôle strict de l'activité de la maladie et la réalisation périodique d'un bilan lipidique ainsi que la prescription des statines selon les recommandations en vigueur en considérant la PR comme un facteur de risque cardiovasculaire à part entière.

### Reference:-

1. Wallberg-Jonsson S, Ohman ML et al (1997), *J Rheumatol* 1997;24:445-5
2. Navarro-Cano G, Del Rincon I et al (2003), . Association of mortality with disease severity in rheumatoid arthritis, independent of comorbidity. *Arthritis Rheum* 2003;48:2425-33
3. Symmons DP, Gabriel SE( 2011) . Epidemiology of CVD in rheumatic disease, with a focus on RA and SLE. *Nat Rev Rheumatol* 2011 ; 7 : 399-408
4. Avina-Zubietta JA, Choi HK, Sadatsafavi M, *et al* (2008). Risk of cardiovascular mortality in patients with rheumatoid arthritis : a meta-analysis of observational studies. *Arthritis Rheum* 2008 ; 59 : 1690-7
5. Watson DJ, Rhodes T, Guess H(2003). All-cause mortality and vascular events among patients with rheumatoid arthritis in the UK general practice research database. *J Rheumatol* 2003;30:1196-202
6. Solomon DH, Curhan GC et al (2004). Cardiovascular risks in women with and without rheumatoid arthritis. *Arthritis Rheum* 2004;50:3344-9
7. Weyand CM, Gornzy JJ et al (2001). T cell immunity in acute coronary syndromes. *Mayo Clin Proc* 2001;76:1011-20
8. Lindhardsen J, Ahlehoff O, Gislason GH, *et al* (2011). The risk of myocardial infarction in rheumatoid arthritis and diabetes mellitus : a Danish nationwide cohort study. *Ann Rheum Dis* 2011 ; 70 : 929-34.
9. Kerola AM, Kauppi MJ et al (2012). How early in the course of rheumatoid arthritis does the excess cardiovascular risk appear ? *Ann Rheum Dis* 2012 ; 71 : 1606-15.
10. Sandoo A, Veldhuijzen van Zanten JJ, *et al* (2011). Vascular function and morphology in rheumatoid arthritis : a systematic review. *Rheumatology* (Oxford). 2011 ;50 : 2125-39.
11. Nurmohamed MT, van der Horst-Bruinsma I et al (2012). Cardiovascular and cerebrovascular diseases in ankylosing spondylitis : current insights. *Curr Rheumatol Rep* 2012 ; 14 : 415-21.
12. Jannitski A, Symmons D, Peters MJ, *et al* (2013). Cardiovascular comorbidities in patients with psoriatic arthritis : a systematic review. *Ann Rheum Dis* 2013 ; 72 : 211-6.
13. Park YB, Ahn CW et al (2002). Atherosclerosis in rheumatoid arthritis: morphologic evidence obtained by carotid ultrasound. *Arthritis Rheum* 2002;46:1714-9
14. Kumeda Y, Inaba M, Goto H et al (2002). Increased thickness of the arterial intima-media detected by ultrasonography in patients with rheumatoid arthritis. *Arthritis Rheum* 2002;46(6):1489-97
15. Mary J, Moeller E, Davis A, et al (2006). Preclinical carotid atherosclerosis in patients with rheumatoid arthritis. *Ann Intern Med* 2006;144:249-56
16. Soubrier M, Bruckert E (2010). Should rheumatologists prescribe statins ? *Rev Rhum* 2010 ; 77 : 115 7.
17. Boers M, Nurmohamed MT, Doelman CJ, et al (2003). Influence of glucocorticoids and disease activity on total and high density lipoprotein cholesterol in patients with rheumatoid arthritis. *Ann Rheum Dis* 2003;62:842-5
18. Georgiadis AN, Papavasiliou EC et al (2006). Atherogenic lipid profile is a feature characteristic of patients with early rheumatoid arthritis: effect of early treatment—a prospective, controlled study. *Arthritis Res Ther* 2006;8:1-7
19. Wallberg-Jonsson S, Backman C et al (2001). Increased prevalence of atherosclerosis in patients with medium term rheumatoid arthritis. *J Rheumatol* 2001;28:2597-602
20. Flipo RM(2007). Glucocorticoids and cardiovascular events in rheumatoid arthritis. A population-based cohort study. *Arthritis Rheum* 2007;56: 820-30

21. Del Rincon I, O'Leary DH, Haas RW (2004). Effect of glucocorticoids on the arteries in rheumatoid arthritis. *Arthritis Rheum* 2004;50: 3813–22.
22. Choi HK, Hernan MA et al (2002). Methotrexate and mortality in patients with rheumatoid arthritis: a prospective study. *Lancet* 2002;359:1173–7
23. McInnes IB, McCarrey DW, Sattar N (2004). Do statins offer therapeutic potential in inflammatory arthritis? *Ann Rheum Dis* 2004;63: 1535–7



### RESEARCH ARTICLE

## BIOLOGIC AND MORPHOLOGIC MARKERS OF THE THROMBOEMBOLIC RISK IN THE ATRIAL FIBRILLATION

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### Abstract

Atrial fibrillation (AF) is the most common arrhythmia. In certain cases he can expose to systemic thrombo-embolic complications. Antithrombotic treatment, with anticoagulant or antiplatelet agents is guided by the evaluation of the ischaemic and haemorrhagic risk based on validated clinical risk scores. However, these scores have limitations and their diagnostic performances are variable, which limit their use in daily practice; Many biomarkers and morphologic markers have been studied to refine the stratification of thrombo-embolic risk, and should be able to predict a more focused and more rational prescription of anticoagulant treatment.

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### Introduction:-

La fibrillation auriculaire est l'arythmie la plus fréquente en pratique clinique associée à une augmentation significative de la morbi-mortalité cardiovasculaire. Son incidence et sa prévalence augmentent avec l'âge, faisant de cette pathologie une véritable épidémie avec un fort impact économique. Il existe au cours de la FA un état prothrombotique, se caractérisant par un taux sanguin élevé de différentes protéines procoagulantes, mais également pouvant être marqués par des marqueurs morphologiques à l'échocardiographie. Les scores cliniques CHADS2 et CHA2DS2-VASc sont simples et pratiques en utilisation quotidienne, et la question se pose de savoir si l'on peut améliorer cette approche par la prise en compte de ces biomarqueurs ou de données échographiques (« échomarqueurs »).

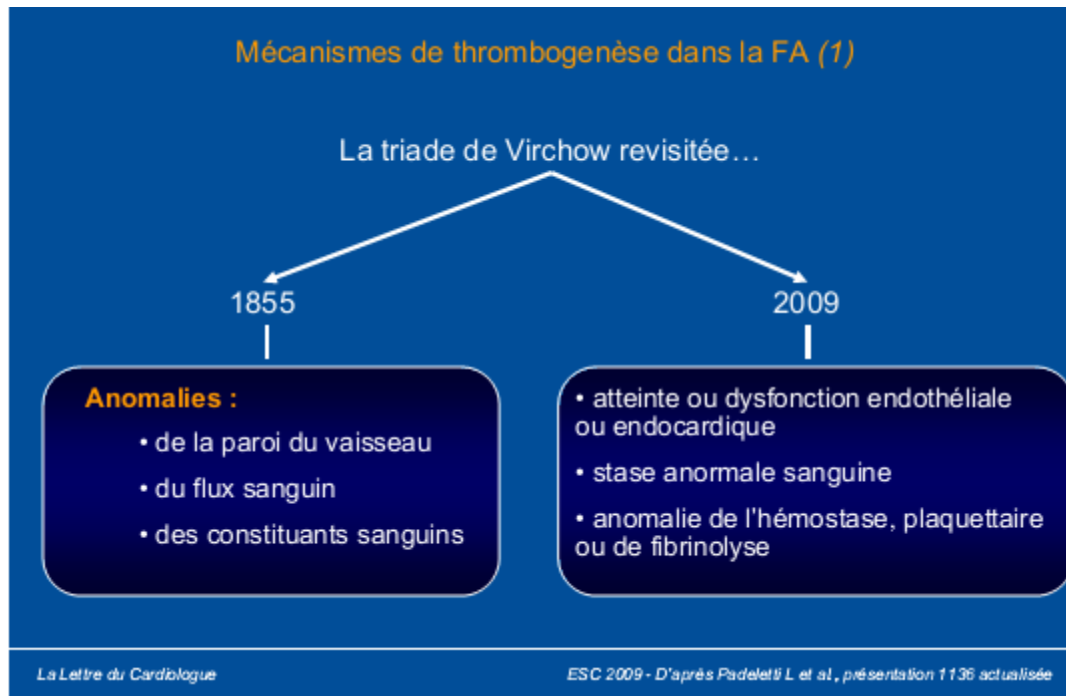
### Mécanisme de la thrombogénèse dans la fa:-

La pathogénie de la thrombose au cours de la FA ne relève pas seulement de la stase sanguine au niveau de l'auricule gauche. La FA serait en elle-même un état d'hypercoagulabilité et obéirait à la triade de Virchow : stase sanguine (perte de la systole auriculaire), altérations de la paroi vasculaire (documentées notamment par des études en microscopie électronique des parois auriculaires) et anomalies de la crase sanguine. Un état d'hypercoagulabilité correspondant à cette troisième composante a été identifié dans l'HTA, la pathologie coronaire, vasculaire cérébrale et le diabète. Plusieurs études ont suggéré le rôle d'une composante inflammatoire dans l'initiation et la pérennisation de la FA, d'autres travaux ont permis de soupçonner un lien entre l'inflammation et la thrombose.

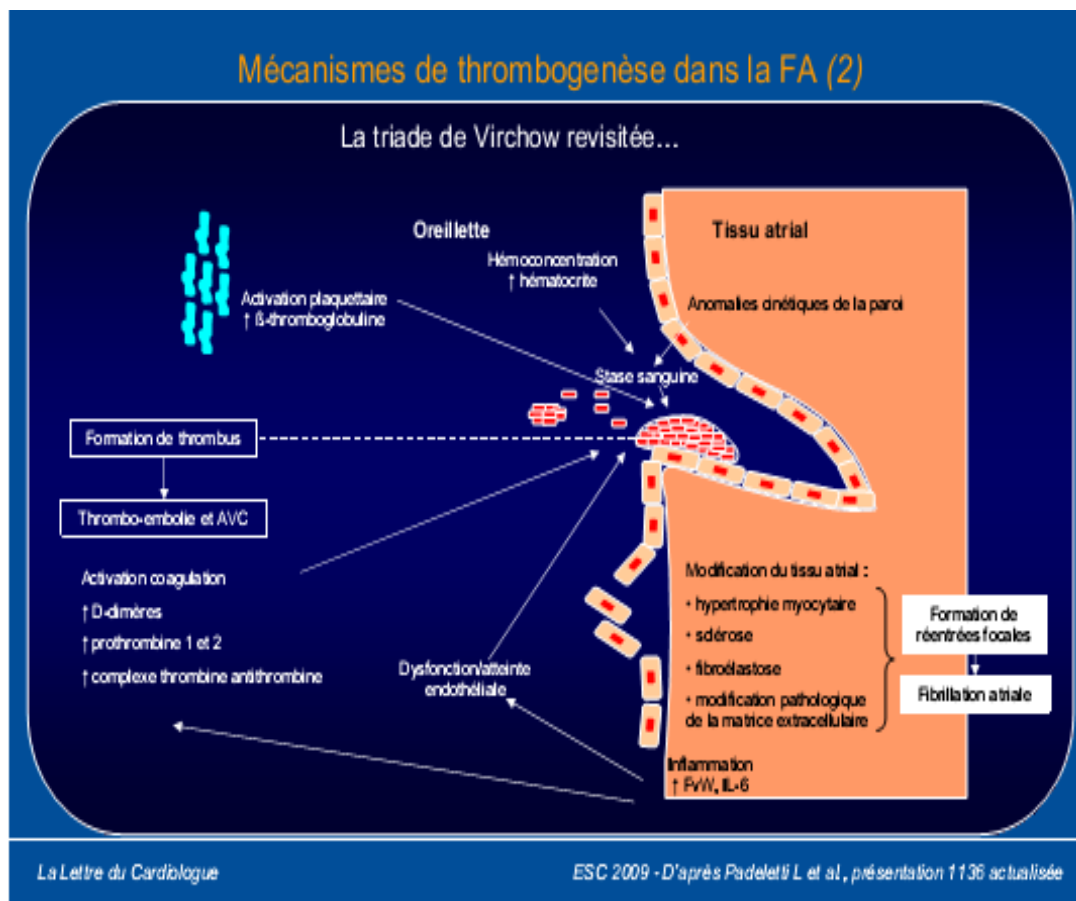
Les mécanismes physiopathologiques ont évolué depuis la classique triade de Virchow décrite en 1855 ce qui a amené à une révision de cette dernière comme le montre ce schéma ci-dessous :

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L'ensemble des mécanismes possiblement impliqués dans le développement de la fibrillation atriale sont illustrés dans le schéma suivant :





### Score de risque et risque embolique artériel dans la fa:-

De nombreuses approches ont successivement été proposées au cours des 20 dernières années, basées sur des études épidémiologiques ou des revues de la littérature, ayant intégré plusieurs facteurs de risque, mais à des degrés variables : âge, sexe féminin, antécédent d'infarctus cérébral ou AIT, hypertension artérielle, insuffisance cardiaque, diabète et pathologie vasculaire, cette dernière dernièrement intégrée dans le score CHA2DS2-VASc.

Cependant, ces scores sont imparfaits car issus de cohortes évaluant certes le risque embolique lié à ces facteurs, mais moins de 10 % des patients triés et éligibles ont été inclus dans les essais, qui ont par ailleurs exclu de nombreux patients ayant une contre-indication au traitement anticoagulant, ce qui explique que certains facteurs de risque n'ont pas été pris en considération. Ainsi, l'extrapolation de ces données est difficile à envisager dans le monde réel.

Faut-il calculer le score C-statistique pour déterminer le meilleur score, prédicteur des événements ischémiques, ou faut-il au contraire proposer une reclassification des patients, puisqu'il a été indiqué que le score C-statistique validé dans une étude ne peut être comparé à une autre étude, du fait de l'hétérogénéité des populations incluses et du profil de risque embolique particulier [1]. De plus, la prescription d'un traitement anticoagulant oral, basé sur des recommandations consensuelles, ne correspond pas à ce qui est réellement observé, puisque la proportion de patients sous anticoagulant est souvent indépendante de la stratification du risque en faible, intermédiaire ou élevé [2]. Ces différentes considérations doivent également être mises en perspective avec d'autres observations telles que, en particulier, la diminution du taux de prescription de l'aspirine chez les patients en FA.

Les scores cliniques CHADS2 et CHA2DS2-VASc sont simples et pratiques en utilisation quotidienne, et la question se pose de savoir si l'on peut améliorer cette approche par la prise en compte des biomarqueurs ou de données échographiques (« échomarqueurs »).

### Marqueurs biologiques de l'hémostase:-

Le dosage de marqueurs plasmatiques explore spécifiquement chacune des étapes de l'hémostase. Un état d'hypercoagulabilité peut concerner l'hémostase primaire (lésion ou dysfonction endothéliale, activation plaquettaire augmentée), la cascade de la coagulation (activité thrombine, fibrinogenèse augmentées) ou la fibrinolyse (hypofibrinolyse) (tableau 1).

**Tableau 1:-** Marqueurs de la coagulation (dosages, abréviations, métabolisme)

	Marqueurs (unités de dosage)	Abréviations	Métabolisme
Plaquettes	Facteur plaquettaire 4 (ng/mL)	PF4	Chimiokine stockée dans les granules alpha
	Bêta-thromboglobuline (U/mL)	BTG	Chimiokine stockée dans les granules alpha
	P-sélectine soluble (ng/mL)	sP-Sel	Protéine transmembranaire des granules plaquettaires (et endothéliaux)
	et membranaire (CD 62P) (% /plaquette)	mP-Sel	Expression sur la membrane cytosolique, interactions avec leucocytes et c. endothéliales
	Glycoprotéine V soluble (ng/mL)	sGPV	Protéine transmembranaire cytosolique
Endothélium	Facteur von Willebrand (U/dL)	Wb	Fragment soluble libéré après hydrolyse par la thrombine
			Glycoprotéine stockée dans les granules endothéliaux (et plaquettaires)
			Liaison au sous-endothélium et à la GPIb
			Liaison plasmatique au VIII
Activité thrombine	Thrombomoduline (ng/mL)	STM	Protéine transmembranaire cytosolique
			Liaison à la thrombine pour activer la protéine C
	Fragments 1 et 2 de la prothrombine (nmol/L)	P 1 + 2	Sous-unités de la prothrombine libérées lors de son hydrolyse en thrombine
	Complexes thrombine-antithrombine III (ng/mL)	TAT III	Complexes formés par la liaison de la thrombine à son inhibiteur, l'AT III
Fibrinogenèse	Fibrinopeptide A (ng/mL)	FpA	Peptide issu du clivage du fibrinogène par la thrombine
	Fibrinogène (g/l)	Fb	Précurseur de la fibrine
	D-dimères (ng/mL)	Ddi	Produits de dégradation de la fibrine stabilisée par le facteur XIII
Fibrinolyse			Reflet du turn over de la fibrine
	t-PA (ng/mL)	-	Protéine circulante sécrétée par les cellules endothéliales
			Clive le plasminogène en plasmine
	PAI-1 (U/dL)	-	Inhibiteur du t-PA
	Complexes plasminogène-alpha2-antiplasmin (ng/mL)	PAP	Complexes formés par la liaison de la plasminogène à son inhibiteur

Plusieurs études ont montré l'intérêt de ces biomarqueurs pour confirmer les scores cliniques [3-4]. Il s'agit de marqueurs d'hypercoagulation, d'inflammation, d'activation plaquettaire ou endothéliale, de facteur Willebrand, d'index d'atteinte endothéliale. Les plaquettes sont également activées dans la FA, mais l'activation plaquettaire pourrait ne refléter que l'association entre comorbidité et FA (par exemple, HTA et pathologie vasculaire) plutôt qu'être liée à l'état prothrombotique dans la FA [5]. Les concentrations du facteur Willebrand plasmatique constituent un facteur de risque indépendant d'événements cardiovasculaires, incluant la mortalité et le saignement majeur chez des patients sous anticoagulants du fait d'une FA permanente [5]. L'élévation des D-dimères est associée à un excès de risque chez les patients en FA, Plusieurs travaux [6-7] se sont intéressés à l'évaluation de la valeur prédictive des d-dimères sur le risque de survenue d'un événement thromboembolique. Nozawa et al. [6] ont constaté que le risque thromboembolique chez les patients à faible risque clinique d'accident thromboembolique était faible quand le taux de d-dimères était inférieur à 150 ng/mL (0,7 %/an). Ce risque n'était plus négligeable lorsque le taux de d-dimères était supérieur à 150 ng/mL (3,8 %/an).

L'élévation de la CRP est associée à un excès de risque de décès, mais pas à un risque accru d'infarctus cérébral chez des patients en FA, confirmant l'intérêt de la CRP chez des patients ayant une pathologie vasculaire. Lip (8) a montré que le facteur Willebrand plasmatique permettait d'améliorer la prédiction du score CHADS2 en ce qui concerne celle du risque d'AIC et d'AVC chez les patients en FA inclus dans l'étude SPAF-III. Plus récemment, la troponine et le BNP ont été validés comme associés à un surrisque d'événements dans la population RE-LY traitée par anticoagulants [9].

La fonction rénale, la clairance de la créatinine, la protéinurie, le débit de filtration glomérulaire ont également été considérés comme associés à un excès de risque d'événement cardiovasculaire, L'insuffisance rénale est associée au risque d'insuffisance cardiaque et d'HTA, augmente avec l'âge, la présence d'un diabète ou la pathologie vasculaire, tous composants des scores CHADS2 et CHA2DS2-VASc. En attendant des validations, le score CHA2DS2-VASc pourrait être implémenté par la prise en compte de un ou deux points supplémentaires en cas d'insuffisance rénale. Deux publications récentes ont permis de montrer qu'un score R2-CHADS2 ou R-CHA2DS2-VASc [10] pouvait améliorer la prédiction des événements cardiovasculaires chez ces patients.

#### **Marqueurs morphologiques ou echomarqueurs:-**

L'échocardiographie est une technique largement utilisée et versatile et qui peut apporter des informations complémentaires dans la stratification du risque des patients en FA, Cependant, la préconisation de la réalisation de cet examen chez tous les patients en FA pourrait accroître la complexité d'évaluation du risque thromboembolique.

#### **'échographie transthoracique:-**

Une fraction d'éjection ventriculaire gauche (FEVG) normale est associée à l'absence de formation de thrombus dans l'auricule gauche [11]. L'évaluation de la FEVG améliore la capacité de discrimination dans l'utilisation des scores CHADS2 et CHA2DS2-VASc en ce qui concerne la détection d'un thrombus atrial gauche [12] et d'autres marqueurs de la stase atriale gauche.

La masse VG indexée aurait une valeur discriminante intéressante pour prédire les thrombi dans l'auricule gauche avec un score C-statistique à 0,98, bien plus élevé que pour le contraste spontané (0,73-0,75) [13]. Dans l'étude SPAF [14], la taille de l'OG mesurée en mode M était un prédicteur indépendant du risque thromboembolique et améliorerait la valeur discriminante de la seule approche clinique, La surface atriale gauche et la FEVG augmentent la capacité de discrimination des scores CHADS et CHADS-VASc en ce qui concerne la détection des thrombi dans l'auricule gauche, le contraste spontané intense et les basses vitesses auriculaires gauches mais La combinaison de la taille de l'OG et de la FEVG a été proposée comme approche ayant une bonne capacité de discrimination des patients sans thrombus auriculaire gauche à l'ETO. Un rapport FEVG/volume atrial gauche indexé supérieur à 1,5 exclut la présence d'un thrombus dans l'auricule gauche chez les patients en FA, candidats à une ablation ou à une cardioversion [12].

Le strain longitudinal pourrait constituer une information indépendamment du volume de l'oreillette gauche indexée. Le volume atrial gauche est une mesure statique, alors que le strain longitudinal est un paramètre dynamique qui reflète les variations de dimension de l'oreillette gauche en phase de remplissage. Ce caractère dynamique des variations de dimensions de l'oreillette gauche pourrait influencer la stase atriale gauche, le temps de transit sanguin sur la surface endocardique, et donc la plus ou moins grande propension à thromboser. Une réduction

du strain longitudinal atrial gauche a été associée à la présence d'une fibrose myocardique [90], et ainsi la fibrose atriale gauche, détectée par IRM, a été associée au risque d'infarctus cérébral chez les patients en FA [91].

#### **'échographie transoesophagienne:-**

La plupart des études qui se sont intéressées aux données d'échocardiographie transoesophagienne (ETO) montrent que la présence d'un contraste spontané, de basses vitesses auriculaires gauches, d'un thrombus atrial gauche ou l'existence d'athérome aortique complexe de l'aorte descendante seraient des prédicteurs indépendants du risque embolique artériel. Dans l'étude de Zabalgoitia M [16], l'âge, les vitesses auriculaires gauches, le diamètre atrial gauche mesuré en mode M, la présence d'un athérome aortique et le taux de fibrinogène plasmatique sont associés de façon indépendante à la présence d'un contraste spontané atrial gauche, tandis que des vitesses auriculaires gauches antérogrades, < 20 cm/s, et des facteurs de risque clinique sont associés de façon indépendante à la présence d'un thrombus atrial ou auriculaire gauche [95]. Une étude ayant inclus 500 patients avec infarctus cérébral en rythme sinusal ou en FA [96] a montré que le risque de thrombose dans l'auricule gauche, avec présence de contraste spontané, augmentait de façon significative lorsque la vitesse auriculaire gauche était inférieure à 57 cm/s. Lorsqu'elle est  $\geq 55$  cm/s, le risque de thrombose atrial gauche est minime, de même que le risque de contraste spontané est très faible avec une valeur prédictive négative respectivement de 99 et 100 %. En analyse multivariée, la vitesse auriculaire gauche est le meilleur prédicteur de l'apparition d'un thrombus ou d'un contraste spontané.

#### **corrélation entre les marqueurs biologiques et morphologiques:-**

Heppellet al. [17] et Pongratzet al. [18] ont trouvé des marqueurs d'activation plaquettaire (BTG, P-sélectine et PF4) significativement plus élevés en présence de contraste spontané ou d'un thrombus et Heppellet al. un facteur de Willebrand plus élevé en présence d'un thrombus. Pour les marqueurs de la coagulation, les résultats sont divergents, sans explication claire : en présence d'un thrombus, complexes TAT III et D-dimères plus élevés pour Heppellet al. [17], non significativement élevés pour Pongratzet al.[36]. Un travail préliminaire de Somloiet al. [19] chez 73 patients bénéficiant d'une ETO avant cardioversion, a rapporté une valeur prédictive négative des D-dimères de 98 %, pour éliminer la présence d'un thrombus auriculaire gauche. Nakagawa et al.[20] ont trouvé, en présence d'un contraste spontané aortique, des D-dimères, des complexes TAT III et complexes plasmine-a2-antiplasmine (PAP) significativement plus élevés. On ne dispose pas de recherche de corrélation entre les marqueurs biologiques et l'athérome aortique

Les données échographiques pourraient donc apporter une précision supplémentaire pour évaluer le risque thromboembolique artériel, une perspective d'intégration de ces échomarqueurs en plus des biomarqueurs serait intéressante à envisager dans le contexte de la FA (Fig. 1).

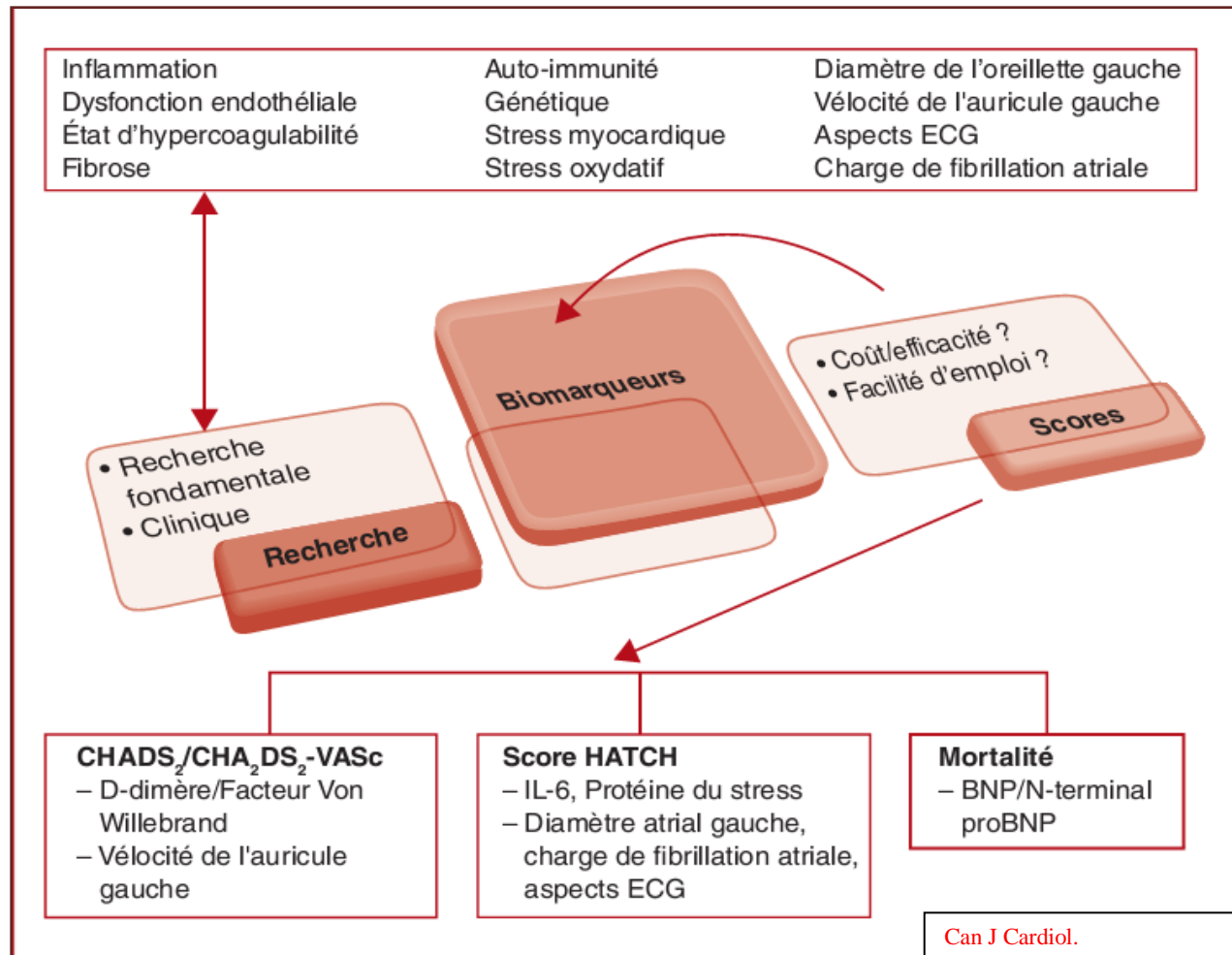


Schéma intégrant les différentes approches clinique, biologique et morphologique

**Conclusion:-**

La prise en charge thérapeutique de la FA s'avère souvent difficile. Cependant, les dernières années ont été marquées par un progrès dans l'évaluation du risque embolique artériel et hémorragique, ainsi que les possibilités thérapeutiques des antivitaminés K et des anticoagulants oraux directs (anti-IIa et anti-Xa), ce progrès a permis d'améliorer la prévention du risque d'infarctus cérébral, en particulier chez les patients ayant au moins un facteur de risque. Les approches complémentaires morphologiques et biologiques demandent à être validées afin de contribuer à une meilleure stratification du risque et peut-être aboutir à une aide au traitement, surtout chez les patients jugés à faible risque ou ceux ayant un risque hémorragique accru.

**Reference:-**

1. Fang MC, Go AS, Chang Y et al (2008). Comparison of risk stratification schemes to predict thromboembolism in people with nonvalvular atrial fibrillation. J Am Coll Cardiol 2008;51:810–5
2. Wilke T, Groth A, et al (2012). Oral anticoagulation use by patients with atrial fibrillation in Germany. Adherence to guidelines, causes of anticoagulation under-use and its clinical outcomes, based on claims-data of 183,448 patients. Thromb Haemost 2012;107:1053-65.
3. Sadanaga T, Kohsaka S, Ogawa S (2010). D-dimer levels in combination with clinical risk factors can effectively predict subsequent thromboembolic events in patients with atrial fibrillation during oral anticoagulant therapy. Cardiology 2010;117:31-6.
4. Roldan V, Marin F, Garcia-Herola A, Lip GY (2005). Correlation of plasma von Willebrand factor levels, an index of endothelial damage/dysfunction, with two point-based stroke risk stratification scores in atrial Fibrillation. Thromb Res 2005;116:321-5

5. Watson T, Shantsila E, Lip GY(2005). Mechanisms of thrombogenesis in atrial fibrillation: Virchow's triad revisited. *Lancet* 2009;373:155-66.
6. Nozawa T, Inoue H, Hirai T, et al(2006). d-dimer level influences thromboembolic events in patients with atrial fibrillation. *Int J Cardiol* 2006;109:59-65
7. Sadanaga T, Sadanaga M, Ogawa S(2010). Evidence that d-dimer levels predict subsequent thromboembolic and cardiovascular events in patients withatrial fibrillation during oral anticoagulant therapy. *J Am Coll Cardiol* 2010;55:2225-31
8. Lip GY, Patel JV, Hughes E, Hart RG(2007). High-sensitivity c-reactive protein and soluble CD40 ligand as indices of inflammation and platelet activation in 880 patients with non valvular atrial fibrillation: relationship to stroke risk factors, stroke risk stratification schema, and prognosis. *Stroke* 2007;38:1229-37.
9. Hijazi Z, Oldgren J, Andersson U, et al(2012). Cardiac biomarkers are associated with an increased risk of stroke and death in patients with atrial fibrillation: a randomized evaluation of long-term anticoagulation therapy (RE-LY) substudy. *Circulation* 2012;125:1605-16.
10. Barra S, Almeida I, Caetano F, et al(2013). Stroke prediction with an adjusted R-CHA2DS2VASc score in a cohort of patients with a Myocardial Infarction. *Thromb Res* 2013;132:293-9.
11. Barra S, Almeida I, Caetano F et al(2013). Stroke prediction with an adjusted R-CHA2DS2VASc score in a cohort of patients with a Myocardial Infarction. *Thromb Res* 2013;132:293-9
12. Kleemann T, Becker T, et al(2009). Prevalence and clinical impact of left atrial thrombus and dense spontaneous echo contrast in patients with atrial fibrillation and low CHADS2 score. *Eur J Echocardiogr* 2009;10:383
13. Boyd AC, McKay T, Nasibi S,et al(2013). Left ventricular mass predicts left atrial appendage thrombus in persistent atrial fibrillation. *Eur Heart J Cardiovasc Imaging* 2013;14:269-75.
14. The Stroke Prévention in Atrial Fibrillation Investigators. Predictors of thromboembolism in atrial fibrillation: II. Echocardiographic features of patients at risk. *Ann Intern Med* 1992;116:6-12
15. Daccarett M, Badger T et al(2011). Association of LA fibrosis detected by delayed-enhancement magnetic resonance imaging and the risk of stroke in patients with atrial fibrillation. *J Am Coll Cardiol* 2011;57:831-8.
16. Zabalgaitia M, Halperin JL, Pearce L et al(1998). Transesophageal echocardiographic correlates of clinical risk of thromboembolism in nonvalvular atrial fibrillation. *Stroke prevention in Atrial Fibrillation III Investigators. J Am Coll Cardiol* 1998;31:1622-6.
17. Heppell RM, Berkin KE, Mc Lenachan et al(1997). Haemostatic and haemodynamic abnormalities associated with left atrial thrombosis in non-rheumatic atrial fibrillation. *Heart* 1997 ; 77 :407-11.
18. Pongratz G, Brandt-Pohlmann M, Henneke KH, et al(1997). Platelet activation in embolic and preembolic status of patients with nonrheu-matic atrial fibrillation. *Chest*1997 ; 111 : 929-33
19. Somloi M, Tomcsanyi J, Nagy E, et al(2003). D-dimer determination as a screening tool to exclude atrial thrombi in atrial fibrillation. *Am J Cardiol*2003 ; 92 : 85-7.
20. Nakagawa K, Hirai T, Shinokawa N, et al(2002). Aortic spontaneous echocardiographic contrast and hemostatic markers in patients with non rheumatic atrial fibrillation. *Chest*2002 ; 121 : 500-5

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### RESEARCH ARTICLE

#### DETERMINATION AND QUANTIFICATION OF FLAVONOIDS AND PHENOLIC CONTENT OF *WRIGHTIA TINCTORIA R.BR.*

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#### Manuscript Info

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##### Key words:-

*Wrightia tinctoria*, Rutin, Catechol, flavonoids.

#### Abstract

*Wrightia tinctoria* have been studied for their chemical constituents. The powder of fruit of *W. tinctoria* was subjected to hot extraction with methanol, petroleum ether and ethyl acetate and subjected to chromatography. The flavonoids in form of Rutin and Catechol were isolated from fruit extract of *W. tinctoria*. The results revealed that, methanol fruit extracts of *W. tinctoria* contains maximum amount of flavonoids as 90 mg/g of Rutin equivalent and the phenolic content as 3.0 mg/g of Catechol equivalents. While, fruit extract of ethanol and petroleum ether has been found minimum, whereas, fruit extract of *W. tinctoria* was found highest presence of catechol equivalents.

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#### Introduction:-

India. (Kirtikar and Basu, 1994; Naik 1998, Wadood Khan 1985, Zate B. R. 1983, S. R. Shinde 2008).

The whole plant and its specific parts such as, bark, leaf, seed fruits, roots are known to have high medicinal properties have a back history of use indigenous communities in India. (Nadkarni K. M., 1976).

The medicinal value of *W. tinctoria* for the treatment of a large number common ailments of human being which were reported in Ayurveda, Siddha, Unani and folk medicine (Kirtikar and Basu 1975, Warriar et.al. 1996) and screening of scientific data revealed that a large number of various drugs of indigenous drug have been investigated (Khare C. P. 2007 and Niir board 2008).

Apart from that, *W. tinctoria* also provide comprehensive information on the traditional use of mankind. Such as, ethnopharmacology, phytochemistry and pharmacological study. Present study helpful to determination and quantity content of flavonoids and phenolic compounds such compounds is useful for producing safer drugs for the treatment of common various ailments of human beings (Bharat N. S. 2015).

#### Materials and Methods:-

##### Determination of flavonoids from fruits extracts of *Wrightia tinctoria R.Br.*:-

Rutin was used as standard flavonoid. Different concentrations (20 to 100 µg/ml) of rutin were analyzed at 510 nm and a calibration curve was plotted as absorbance versus concentration. 10 µg/ml of each test substance (Extracts of *Wrightia tinctoria R.Br.* was analyzed by using the similar procedure and quantity of flavonoids in mg per gram of rutin equivalent was determined for each extract.

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**Procedure:-**

- Known volume of samples was pipetted out in series of test tubes and volume was made up to 0.5 ml with distilled water.
- Sodium nitrite (5%; 0.03 ml) was added to each tube and incubated for 5 minutes at room temperature.
- Aluminum chloride solution (10%; 0.6 ml) was added and incubated for 5 minutes at room temperature.
- Sodium hydroxide solution (1 M; 0.2 ml) was added and total volume was made up to 1 ml with distilled water.
- Absorbance was measured at 510 nm against a reagent blank.
- Standard curve using different concentrations of rutin was prepared.
- From the standard curve, concentration of flavonoids in the test samples was determined and expressed as  $\mu\text{g}$  of rutin equivalent.

**Determination of Phenolic compounds from fruit extracts of *Wrightia tinctoria* R.Br:-**

Catechol was used as standard phenolic compound. Different concentrations (0.5 to 2.5  $\mu\text{g/ml}$ ) of catechol were analyzed at 650 nm and a calibration curve was plotted as absorbance versus concentration. 1  $\mu\text{g/ml}$  of each test substance (extracts of *Wrightia tinctoria* R.Br. were analyzed by using the similar procedure and quantity of phenolic compounds in mg per gram of catechol equivalent was determined for each extract.

**Procedure:-**

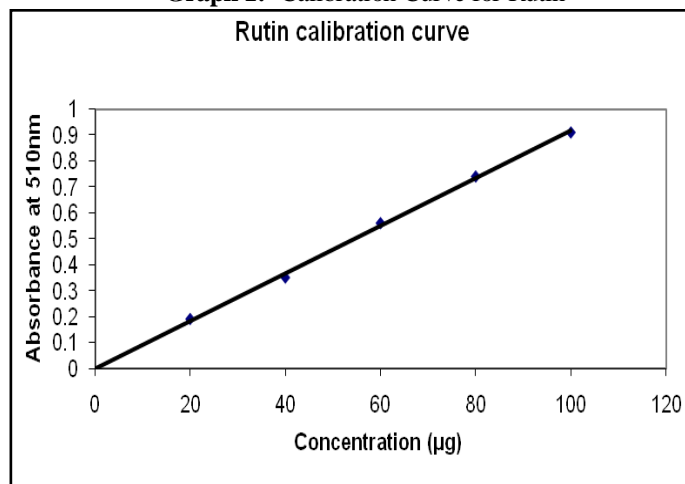
- Aliquot of each sample was pipette out in series of test tubes and volume was made up to 3 ml with distilled water.
- Folin-Ciocalteu Reagent (0.5 ml) was added to each tube and incubated for 3 minutes at room temperature.
- Sodium carbonate (20%; 2 ml) solution was added, mixed thoroughly and the tubes were incubated for 1 minute in boiling water bath.
- Absorbance was measured at 650 nm against a reagent blank.
- Standard curve using different concentrations of standard phenolic catechol was prepared.
- From the standard curve, concentration of phenols in the test samples was determined and expressed as  $\mu\text{g}$  of catechol equivalent.

**Results and Discussion:-****Determination of flavonoids:-**

In order to investigate quantity of flavonoids by using absorbance of different concentrations (20 to 100  $\mu\text{g/ml}$ ) of Rutin and the results are summarized in the table- 1. A calibration curve shows linear correlation at measured concentrations. Table- 2 represents the quantity of flavonoids in mg per gram of Rutin equivalent determined for test extract. The results indicate that methanol fruit extracts of *W. tinctoria* R.Br was contain maximum amounts of flavonoids as 90 mg/g and 88 mg/g of Rutin equivalents while minimum amount of flavonoids was in extract of petroleum ether.

**Table 1:-** Absorbance table for different concentrations of rutin

Sl. No.	Concentration of Rutin (in $\mu\text{g}$ )	Optical Density (at 510nm)
1	Blank	0
2	20	0.19
3	40	0.35
4	60	0.56
5	80	0.74
6	100	0.91

**Graph 1:- Calibration Curve for Rutin****Table 2:-** Quantity of Flavonoids (Rutin equivalents) found in each extract.

Sl. No.	Test Sample	mg/g of Rutin equivalents
1	Methanolic extract of <i>W. tinctoria R.Br</i>	90 mg/g
2	Petroleum ether extract of <i>W. tinctoria R.Br</i>	14 mg/g
3	Ethyl acetate extract of <i>W. tinctoria R.Br</i>	22 mg/g

**Determination of phenolic compounds:-**

In order to determine the quantity (quantity) of phenolic compounds by using the absorbance of different concentrations (0.5 to 2.5 µg/ml) of Catechol and the results are given in the table- 3. A calibration curve shows linear correlation at measured concentrations. Table- 4 represents the quantity of phenolic compounds in mg per gram of Catechol equivalent determined from the tested extracts. The results indicate that, ethyl acetate fruit extracts of *W. tinctoria R.Br* contain maximum amounts of phenolic compounds as 3.0 mg/g and catechol equivalents. While, other tested extracts were found to be minimum. Among the tested samples ethyl acetate extracts of *W. tinctoria R.Br* was found to be highest count of Catechol equivalents.

**Table 3:-** Absorbance table for different concentrations of Catechol

Sl. No.	Concentration of Catechol (in µg)	Optical density (at 650nm)
1	Blank	0
2	0.5	0.175
3	1	0.325
4	1.5	0.48
5	2	0.64
6	2.5	0.81





Graph 2:- Calibration curve for Catechol

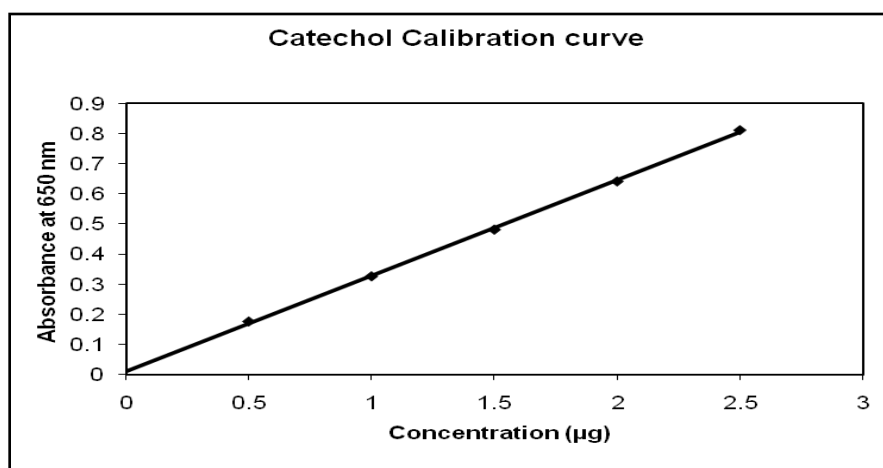


Table 4:- Quantity of phenolic compounds (Catechol equivalents) found in each extracts

Sl. No.	Test sample	mg/g of Catechol equivalents
1	Methanolic extract of <i>W. tinctoria</i> R.Br	2.25 mg/g
2	Petroleum ether extract of <i>W. tinctoria</i> R.Br	1.0 mg/g
3	Ethyl acetate extract of <i>W. tinctoria</i> R.Br	3.0 mg/g

## References:-

1. **Anonymous.** The wealth of India. New Delhi: Publication and Information Directorate, CSIR; 1976, p. 588-590.
2. **Khare C. P.** Indian Medicinal plants. Berlin/ Heidelberg. Springer Science and Business Media, 2007, P. 720.
3. **Kirtikar KR and Basu BD.** Indian medicinal plants. Delhi: Jayyed Press; 1975, p. 1581.
4. Nadkarni KM. Indian material medica. Bombay: Popular Prakashan; 1976, p. 1296
5. **Naik, V. N.** (1998). Flora of Marathwada. vol. I, II. Amrut Prakashan, Aurangabad. **Naik, V. N.** (1998). Marathwadyatil samanaya vanoushadhi.
6. **Shinde S.R.** (2008) Ph.D. thesis submitted to Swami Ramanand Teerth Marathwada University, Nanded.
7. **Wadood Khan, M.A.** (1985). Flora of Bhokar and Hadgoan Range forests of Nanded district, Ph.D. thesis submitted to Marathwada University, Aurangabad.
8. **Zate, B. R.** (1983). Flora of Kinwat and Mahur Range forests of Nanded district. Ph.D. thesis submitted to Marathwada University, Aurangabad.
9. **Niir board of consultants and Engineers,** Handbook on Unani medicine with formulae, processes, use and analysis: Delhi National Institute of Industrial Research 2008. P. 170-177.
10. **Warrier P. K., Nambiar V. P., Ramankutty C.** Indian medicinal plants, Madras orient Langman Ltd. 1996 p. 417-419.

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### RESEARCH ARTICLE

#### MAIN PREDICTORS AND TREATMENTS OF PERI-IMPLANTITE: BRIEF REVIEW

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##### Key words:-

Peri-implantite, Osteointegration, Mucositis and Implants.

#### Abstract

**Background:** About 3 million Americans have dental implants, and this number is growing at 500,000 every year. In this context, the microorganisms that reside on the surfaces of the implants and their prosthetic components are considered the main etiological factor for the peri-implantite.

**Objective:** was to do a brief literary review, pointing out the main predictors of peri-implantite and treatments. **Methods:** This study is in the literature review focusing on the main predictors and treatments of peri-implantite. To this end, a survey was conducted in scientific articles in PubMed, Medline, Scielo, Lilacs and books.

**Discussion:** Several uncertainties remain regarding peri-implant disease. Long-term follow-up of consecutively treated cases appears to be a realistic path for accumulating more information. The current clinical recommendations are that there is no consensus on the protocol for the treatment of mucositis or peri-implantitis due to the heterogeneous characteristics of different implant systems, implant position and other factors related to the patient. Thus, there is no individual treatment option. **Conclusion:** In the implant, if plaque accumulation is allowed for longer periods and the patient is at risk, peri-implant mucositis can progress to lesions with peri-implantite alveolar bone loss. The most important treatment of peri-implantitis is to interrupt progressive bone loss by plaque control, even restoring the bone lost through regenerative surgical procedures.

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#### Introduction:-

About 3 million Americans have dental implants, and this number is growing at 500,000 every year. In addition, the number of biological complications is also increasing. Among them, peri-implant disease is considered the most common cause of implant loss after osseointegration. In this context, the microorganisms that reside on the surfaces of the implants and their prosthetic components are considered the main etiological factor for peri-implantite [1,2].

Periodontal and peri-implant soft tissues have many characteristics in both clinical and histological [1-3]. For proper control and maintenance of these tissues, a better understanding of the differences and similarities that exist between

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them is needed. Thus, biofilms are formed on all adherent surfaces in a fluid system, both in teeth and in oral implants. As a result of bacterial presence, the host responds by developing a defense mechanism that will lead to soft tissue inflammation [3,4]. In the dento-gingival unit, the results are gingivitis lesions [3].

Furthermore, experimental research has shown that mucositis can progress to peri-implantitis, depending on the factors and risk indicators, affecting the peri-implantar support bone circumferentially [5,6]. Although the supporting bone is lost coronally, the implant will still remain integrated bone and therefore clinically stable. This is the reason why mobility represents a diagnostic characteristic of peri-implantitis that is not sensitive but more specific [6].

More sensitive and reliable parameters of the development and presence of peri-implant infections are bleeding probing, depth of probing and radiographic interpretations of radiographs, aiming to detect the peri-implant lesions as early as possible, thus enabling the treatment, which in this review is described as a cumulative procedure, starting with simpler procedures until the most advanced, aiming to paralyze and prevent the progression of these lesions, which would inevitably result in failure of the implant [5,6].

In this context, most publications from 2011 to 2015 evaluated the effect of implant surface roughness on long-term bone loss as a substitute for peri-implantitis risk. 87 of the 2,566 studies reported average bone loss after at least 5 years. The prevalence of implants with bone loss ranging from 1.0 to 3.0 mm was estimated. Bone loss was used as a surrogate parameter for peri-implantitis, since the prevalence of peri-implantitis was not reported in most studies or when reported, the diagnostic criteria were unclear or of doubtful quality [1- 6].

Peri-implant bone loss around minimally harsh implant systems was statistically less significant compared to moderately rough and rough implant systems [2]. There was no statistically significant difference between moderately rough and rough implant systems [2]. Studies comparing implants with comparable design and different surface roughness, showed lower peri-implantar mean bone loss around the less rough surfaces in the meta-analysis. In addition, when considering 3.0 mm of bone loss after at least 5 years to represent the presence of "peri-implantite", less than 5.0% of the implants were affected. Still, periodontal history and smoking habits were the most important predictors of bone loss [4].

Therefore, the present work aimed to make a brief literary review, pointing out the main predictors of peri-implantitis and treatments.

#### **Methods:-**

This study is in a literature review focusing on principal predictors and treatments of peri-implantitis. To this end, a survey was conducted in scientific articles in the databases PubMed, Medline, Scielo, Lilacs and books. The key words used were Peri-implantitis, Osteointegration, Mucositis and Implants, which are registered in the Health Sciences Descriptors. Selected papers passed criteria for inclusion and exclusion.

#### **Main Predictors Continuous or Categorical:-**

The main predictors are periodontal history, smoking habits, osteoporosis, diabetes mellitus.

#### **Main Predictors Answer:-**

The main predictor of response was peri-implantitis.

#### **Literature Review:-**

The peri-implantitis is developed from mucositis lesions, while others remain resistant and present only mucositis in response to the accumulation of plaque microorganisms [1-3]. The term peri-implantitis is used because of clinical, histological and microbiological similarities with periodontitis. Several studies suggest that destruction of peri-implant tissues is caused by a bacterial infection and that the concomitant inflammation observed is similar to periodontal disease [7,8]. Peri-implantitis is defined as an inflammatory process that affects the tissues around an osseointegrated implant as a result of the progressive loss of peri-implant bone support accompanied by inflammatory soft tissue disease [6-9].

As the tissues around teeth and implants have many characteristics in common it is inevitable that the host bacterium interaction also plays a potential role in peri-implant complications, as well as in periodontitis [6]. Gualini and

Berglundh (2003) [9] investigated the histochemical characteristics of the peri-implant tissues during mucositis and periimplantar disease. In order to do so, they selected two groups of studies: in group A (mucositis) ten patients partially treated with branemark implants as a function of +/- five years. In group B (periimplantite) six patients partially restored also with branemark type implants in use at +/- eleven years. In each group at sites with peri-implant disease, biopsies (4 / mm of soft tissue) were performed and analyzed. Before the biopsies, patients were not on any periodontal treatment program.

In addition, restorations supported by dental implants have been added substantially to the clinical treatment options presented to patients [3]. However, complications with these treatment options also arise due to inadequate patient selection and inadequate planning of treatment combined with poor follow-up care [4]. Complications related to the presence of inflammation include perimucositis, peri-implant bone loss, and peri-implantitis. The prevalence rates of these complications were reported to be as high as 56.0% [4]. Treatment options that have been reported include non-surgical therapy, the use of antibiotics administered locally and systematically, and surgical protocols aimed at regenerating lost bone and soft tissue around implants [5].

In another study Esposito et al. (1997) [10], studied the peri-implant soft tissues of implants lost after being in use for a certain period. They described the cellular composition of soft tissues that were around implants, which lost osseointegration (they were soft) and were removed the stable and healthy implants were used as control. In the research the lost implants were divided into two groups: those that were lost with infection and those without infection. The group with infection (periimplantite) were characterized by an intense inflammatory and immunological response [10].

The connective tissue had an inflammatory infiltrate containing a large number of plasma cells (predominant cells) and mono-nuclear cells (B and T lymphocytes, monocytes and macrophages). There was migration of the sulcular epithelium and in its interior the presence of neutrophils PMNs and in some cases the apical migration of the epithelium circumvented every implant [4,11]. Because of these characteristics, the authors suggest that peri-implant soft tissues react to bacterial invasion with similarity to periodontal tissues. The presence and distribution of soft tissue macrophages around lost implants were similar to those found in the control group of healthy implants [12-15].

Thus, the presence of macrophages around the tissues of the implant is a phenomenon related to the presence of a biomaterial. The macrophage is the most common cell type detected on the implant surface, regardless of the type of material, and has been suggested that it plays a key role during the inflammatory and repair phase after implantation [3,7]. According to Liljenberg et al. (1994) [11] the presence of a large number of macrophages seems to be different in periodontal disease active or inactive in humans as well as experimentally in animals.

Experimental evidence has shown us that failed implants do not appear to be distributed randomly in the population, but concentrated in a small percentage of the population. Weyant and Burt (1993) [13] studied the survival of dental implants in a group of five hundred and ninety-eight consecutive patients from the U.S. dental implant veterinary administration file, totaling two thousand ninety-eight implants. Their results indicate that, of all the group, a total of eighty-one implants of forty-five individuals were removed between five and a half years.

Smoking that alter immune functions and tissue repair or endogenous or intrinsic factors such as genetic predisposition for a hyper cytokine production, low antibody production or a decrease in the number of neutrophils can cause large changes in the disease process [14]. These factors that can modify the host response, alter the susceptibility of the individual to infection by the periodontal microorganisms are the risk factors.

## **Main Predictors:-**

### **Smoking:-**

Smoking alters the balance between the microbial load on the implants and the host response, negatively impacting the longevity of oral implants [2]. The mechanisms by which smoking affects peri-implant tissues are immunosuppressive effects in the host. Smokers also have low levels of neutrophils [14]. Pathogenic periodontii may now escape the specific and nonspecific mechanisms of immune cleansing, allowing them to establish themselves as peri-implant subgingival inhabitants. Thus, the alteration in the subgingival physical environment and the decreased oxygen tension will allow the growth of an anaerobic microbiota. In addition, smoking increases

bacterial adhesion to epithelial cells. However, it is not surprising that smokers in general have higher levels of periodontopathogens and may be considered microbiologically compromised [15].

Thus, in an effort to evaluate possible risk factors that would contribute to implant failure, Bain and Moy (1993) [16] conducted a retrospective evaluation on two thousand ninety-four Branemark implants, installed by a surgeon between one thousand Nine hundred and eighty-four and one thousand nine hundred and ninety-one. Values considered included length, location, diabetes, medication with steroids age and sex, time placed along the "learning curve" and use of cigarette. It soon became clear that of all factors considered, smoking took the most significant part in the high failure rate of implants. Their results showed an overall failure rate of 4.76% in nonsmokers versus 11.3% in smokers.

In addition, when only the maxilla was considered, there was a failure of 17.90% in smokers and only 7.3% in nonsmokers. The difference in the mandible was lower, with 4.64% of failure in smokers and 2.4% in non-smokers, with significant difference only in the anterior mandible [16]. The failure rates of implants decreased with their increased length, but in the maxilla there was a more significant failure rate in smokers of up to 15 mm [17]. Haas et al. (1996) [18] evaluated the maxillary gingival bleeding index, a periimplantar probing rate and peri-implantar inflammation, as well as mesial and distal bone loss, higher in smokers than in nonsmokers.

Moreover, Lindquist et al (1997) [17] found that the marginal loss was higher in smokers than in nonsmokers and correlated with the amount of cigarette consumption. Smokers with poor oral hygiene showed greater marginal loss around lower implants than those with good oral hygiene.

#### **Oral hygiene:-**

The oral hygiene of the patient has an important significance in the stability of the marginal bone around osseointegrated implants. A higher prevalence of peri-implant problems has been reported in patients with low oral hygiene index. Even in fully edentulous patients with dental implants, ineffective oral hygiene has been linked to increased peri-implant bone loss especially in smokers [18].

#### **Susceptibility to periodontitis:-**

Implants can be affected by periodontal conditions comes from two evidences: similarity in the microflora that colonizes teeth and implants in partially edentulous patients and identification of a hyperinflammatory phenotype in partially edentulous patients with peri-implant lesions [3]. Fardal et al. (1999) [19] described an unsuccessful therapy with implants in a partially edentulous patient suffering from aggressive periodontitis. However, authors try to prove the opposite and point out that some implant and surface configurations may be even more resistant to "insertion" loss than teeth. Thus installed implants, especially those with rough surfaces, in patients prone to aggressive periodontitis may lead to a high risk of implant loss [20].

#### **Osteoporosis:-**

Osteoporosis may be a risk factor for oral bone loss, including the alveolar process associated with periodontal infection [5]. Wowren et al. (1994) [21] showed a relationship between periodontal disease and osteoporosis, comparing twelve women with fractures due to osteoporosis with fourteen normal women, and found more loss of periodontal insertion in women with osteoporosis than in those without osteoporosis.

Although some studies Wactawski et al. (1996) [22] point to the possibility of osteoporosis without a risk factor for periodontal disease and peri-implantar disease and other studies are needed especially those on a large scale where multiple risk factors affect both osteoporosis and periodontal disease.

#### **Diabetes:-**

It is well established that diabetic patients are more prone to healing complications even in clean wounds [2,3]. There is a number of evidences supporting the association between diabetes mellitus and periodontal disease. Taylor et al. (1998) [23] in a longitudinal study showed that type II diabetes was a significant risk factor for periodontal disease.

**Table 1:-** Main considerations regarding the treatment of peri-implantitis [6].

1.	Non-surgical treatment appears to be more effective for the treatment of mucositis than peri-implantitis.
2.	Peri-implantite treated with non-surgical therapy results mainly in decreased bleeding probing and depth of probing (usually less than 1 mm).
3.	Personal hygiene care or the professional maintenance program have a positive effect on the prevention of peri-implant mucositis that begins in peri-implantitis.
4.	The implant of non-regenerative surgical therapy should be established based on the diagnosis and risk profile.

**Table 2:-** Prediction of improvement of clinical parameters that apply peri-implantite regenerative surgical treatment [6].

1.	The evaluation of the systemic and local factors of the patients affected by the perimplantite should be taken into consideration in the application of the regenerative surgical treatment.
2.	Regenerative surgical treatment may be chosen for the reconstruction of intra-auricular defects, while the non-regenerative approach and implantoplasty of the implant component are recommended.
3.	Adequate maintenance phases of pre and post-surgical hygiene and effective decontamination of the implant surface are required for the successful surgical procedure.
4.	There is no fundamental advantage of using the membrane to cover the bone graft in the final result of the regeneration of peri-implant defects.
5.	Immersion of the implants during the healing period does not appear to influence the final outcome of the regenerative treatment.

### Discussion:-

Several uncertainties remain regarding peri-implant disease. Long-term follow-up of consecutively treated cases appears to be a realistic path for accumulating more information [1]. This can be useful in establishing the magnitude and stability presitivity on the improvements that can be made. Although not generally reported, it appears that bandage-induced defects are scintillating and funnel-shaped [2].

The current clinical recommendations are that there is no consensus on the protocol for the treatment of mucositis or peri-implantite due to the heterogeneous characteristics of different implant systems, implant position and other factors related to the patient 3. Thus, there is no individual treatment option. Table 1 lists the main considerations regarding peri-implantite treatment [6].

There is still no consensus on a particular protocol or biomaterial selection in the peri-implantite regenerative surgical treatment due to the high heterogeneity and bias among the investigated studies. However, several clinical recommendations can be elaborated according to the data available in the current literature. A predictable improvement of the clinical parameters that apply to the peri-implantite regenerative surgical treatment can be predicted, as shown in table 2 [6]. In light of the peri-implant microbial etiology, the motivation and instruction of the patient together with the surgical therapy envelope are an integral part of the peri-implantite treatment. No specific clinical recommendation can be made as to which specific method of non-regenerative surgical therapy is to be implemented [6].

The formation of new bone in the apical part of the defects may have occurred against a surface that was not contaminated prior to treatment [24]. However, the magnitude of the new bone formation obtained in some studies suggests that new bone can be formed in direct contact with a previously contaminated implant surface [25,26]. There is a consensus that correct oral hygiene should be established and that occlusal forces should be assessed and corrected by occlusal adjustment when deeply traumatic [26].

### Conclusion:-

In the implant, if plaque accumulation is allowed for longer periods and the patient is at risk, peri-implant mucositis can progress to lesions that extend more apically, with associated alveolar bone loss (peri-implantite). Due to the infectious nature of mucositis and peri-implantitis, preventive procedures should be performed in a control program and reassessed to ensure adequate supportive therapy for a lifetime. The most important treatment of peri-implantitis is to stop progressive bone loss by plaque control and purging, even restoring the bone lost through regenerative surgical procedures.

**Competing Interests:-**

The authors declare que they have no competing interests.

**References:-**

1. Tavares LJ, Pavarina AC, Vergani CE, de Avila ED. The impact of antimicrobial photodynamic therapy on peri-implant disease: What mechanisms are involved in this novel treatment? PhotodiagnosisPhotodynTher. 2016 Dec 6;pii: S1572-1000(16)30164-8. doi: 10.1016/j.pdpdt.2016.11.016.
2. King E, Patel R, Patel A, Addy L. Should implants be considered for patients with periodontal disease? Br Dent J. 2016 Dec 9;221(11):705-711. doi: 10.1038/sj.bdj.2016.905.
3. Kanwar IL, Sah AK, Suresh PK<sup>1</sup>. Biofilm-mediated Antibiotic-resistant Oral Bacterial. Curr Pharm Des. 2016 Nov 24.
4. Doornewaard R, Christiaens V, De Bruyn H, Jacobsson M, Cosyn J, Vervaeke S, Jacquet W. Long-Term Effect of Surface Roughness and Patients' Factors on Crestal Bone Loss at Dental Implants. A Systematic Review and Meta-Analysis. Clin Implant Dent Relat Res. 2016 Nov 15. doi: 10.1111/cid.12457.
5. John V, Shin D, Marlow A, Hamada Y. Peri-Implant Bone Loss and Peri-Implantitis: A Report of Three Cases and Review of the Literature. Case Rep Dent. 2016; 2491714. Epub 2016 Oct 19.
6. Del Amo F SL, Faria E Almeida R, Cicciù M, Daugela P, Ramanauskaite A, Saulacic N, Tervonen T, Wang HL, Yu SH. The 1st Baltic Osseointegration Academy and Lithuanian University of Health Sciences Consensus Conference 2016. Summary and Consensus Statements: Group III - Peri-Implantitis Treatment. J Oral Maxillofac Res. 2016 Sep 9;7(3):e16.
7. Lindhe, J. Et al. Experimental breakdown of pen-implant and periodontal tissues. A study in beagle dog. Clinical oral impints research. v.3 p. 9-16, 1992.
8. Mombelli, A. et al. Microbial aspects of implant dentistry. Periodontology 2000. v.4, p.74-80, 1994.
9. Gualine, F, Berglundh T. Immunohistochemical characteristics of inflammatory lesions at implants. J. Clin. Periodontol. v. 30 p. 14-18, 2003.
10. Esposito, M. et al. Immunohistochemistry of soft tissues surrounding late failures of branemark implants. Clinical oral impints research. v. 8 P. 352-366, 1997.
11. Leljenberg, B. et al. Some microbiological, histopatological and immunohistochemical characteristics of progressive periodontal disease. J. Clin. Periodontol. v.21 p.720-727, 1994.
12. Branemark et al. "Close to the Edge – Brånemark and the Development of Osseointegration" – McClarence, Elaine – Quintessence Books, cap. 1, Berlim, Alemanha, 2003).
13. Weyant, RJ, Burt, BA. An assesment of survival rates and within-patient clustering of failures for endosseus oral implants. J. dent. Res. v.72, p.2-8, 1993.
14. Pauleto, NC. et al. Effect of cigarette smoking on oral elastase ativity in adult periodontitis patients. J. periodontol. v.71, p.58-62, 2000.
15. Winkelhoff, V. et al. Smoking affects the subgigival microflora in periodontitis. J. periodontol. v.72, p. 666-671, 2001.
16. Bain CA, Moy PK. The association between the failure of dental implants and cigarette smoking. International J. of Oral and Maxilofacial Implants. v.8, p. 609-615, 1993.
17. Lindquist, LW et al. Association between marginal bone loss around osseintegrated mandibular implants and smoking habits. J. dent. Res. v.76, p.1667-1674, 1997.
18. Haas, R. et al. The relationship of smoking on pen-implant tissue. J. prosthodont. v.76, p.592-596, 1996.
19. Fardal, O. et al. Severe, rapidly progressing peri-implantitis. J. din. Periodontol. v. 26, p. 313-317, 1999.
20. Quirynen, M. et al. Pen-implant health around screw-shaped c.p. titanium machined implants in partially edentulous patients with or without ongoing periodontitis. Clin oral implants res. v.12 p.589-594, 2001.
21. Wowren, W. N., Symptomatic osteoporosis. J.prosther dent. v.67, p.656-660, 1992.
22. Wactawski et al. The role of osteopenia in oral bone loss and periodontal disease. J. periodontol. v.67, p.1076-1084, 1996.
23. Tailor GW. et al. Non-insulin dependent diabetes mellitus and alveolar bone loss progression over two years. J. periodontol. v. 69, p.76-83, 1998.
24. Ericsson, I. et al. Radiographical and histological characteristics of submerged and nonsubmerged titanium implants. An experimental study in the labrador dog. Clinical Oral Implants Research, Copenhagen, v.7, n.1, p.20-26, 1996.
25. Lang, N. P., et al. Biological complications with dental implants; their prevention, diagnosis and treatment. Clin oral impl. Res. 2000.,v.11, p. 146-155, 2000.
26. Behneke, A. Et al. Treatment of peri-implantitis defects with autogenous bone wafts International J. of Oral and Maxilofacial Implants v.15, p. 125-138. 2000.

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### RESEARCH ARTICLE

## SYNTHESIS AND STRUCTURAL PROPERTIES OF ZnO NANOPARTICLES BY ALTERNANTHERA SESSILE LEAVES EXTRACT.

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#### Key words:-

ZnO nanoparticle, Green synthesis, capping and reducing agent, Alternanthera Sessile

### Abstract

Green synthesis is environmentally friendly technique for synthesis of metal Oxide nanoparticles. In this present work, synthesis of ZnO nanoparticles were prepared by Green Synthesis method. Here Leaf extract of Alternanthera Sessile can be used as reducing and capping agent for synthesis of stabilized ZnO nanoparticles. ZnO nanoparticles were characterized by X-ray diffraction (XRD), Scanning Electron Microscope (SEM), Energy dispersive analysis of X-rays (EDAX) and Fourier transform infrared spectroscopy (FTIR). From X-ray diffraction studies it is observed that (101) phase obtained at  $36.68^\circ$  2theta value. The size of the nanoparticle is 22nm at this peak. It was observed that the shape of the ZnO particles is agglomerated spherical by SEM attached with EDS analysis. From FTIR analysis, it was observed that Alkenes and Nitriles functional groups in this leaf extract used as reducing agent for synthesis of ZnO nanoparticles. It was proved by peaks were obtained at wave numbers  $809\text{cm}^{-1}$ ,  $909\text{cm}^{-1}$ ,  $2331\text{cm}^{-1}$  and  $2361\text{cm}^{-1}$ .

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### Introduction:-

ZnO is one of the most promising materials for analyse optical and electrical properties. The superiority of ZnO photocatalytic activity and semiconductor property because it is direct band gap semiconductor of, bandgap of 3.37 eV. ZnO has a wide range of applications in optoelectronic devices such as light-emitting diodes, photodetectors, and p-n homojunctions lasers. ZnO has higher luminescence efficiency of the emitted light even at room temperature. Many techniques including chemical vapor deposition, pulsed laser deposition, molecular beam epitaxy, sputtering, hydrothermal synthesis, and oxidation of metallic zinc powder have been used to prepare ZnO in different forms and structures for various applications. Nanoparticulate form enhances the catalytic activity due to its large surface area and the presence of vacancies and uncoordinated atoms at corners and edges. The photocatalytic activity is also improved by bandgap engineering, as a result of the quantum confinement effect. A well-controlled synthesis process at room temperature is needed for the economical use of ZnO in catalytic applications such as water treatment and other environmental applications. Plant crude contains novel secondary metabolites such as phenolic acid, flavonoids, alkaloids and terpenoids in which these compounds are mainly responsible for the reduction of ionic into bulk Metallic nanoparticles formation. Plant metabolites involved in the bioreduction i.e Amine, Nitrile, Carboxyl and Alkene group in the Leaf extract of Alternanthera Sessile which one responsible for reducing ionic compounds into Metal oxide nanoparticles. Nano particles synthesised by green synthesis method, can be used for Anti oxidant

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and antimicrobial activity. From biological approach using leaf extract of *Alternanthera Sessile* has been used for the first time as a reducing material as well as surface stabilizing agent for the synthesis of spherical-shaped ZnO-NPs. The structure, phase, and morphology of synthesized product were investigated by the standard characterization techniques.

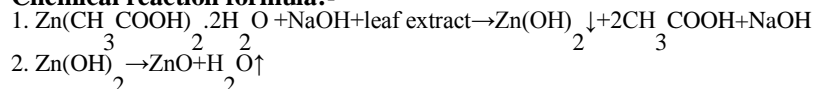
### Experimental:-

#### Synthesis of ZnO-NPs:-

Zinc acetate dihydrate and glassware was purchased from Indian scientific company, tirupati. All glassware was washed with sterile distilled water and dried in an oven before use.

ZnO NPs can be synthesized by using the leaves extract of plant *Alternanthera sessile*. In this procedure, 600 ml of distilled water is taken and aqueous zinc acetate dihydrate is added into it under constant stirring and make it 0.1M solution. Then after 10 min stirring the aqueous leaf extract of *Alternanthera sessile* is introduced into the above solution. 2M NaOH is also added to make pH 12 resulting in a pale white aqueous solution. It is then placed in a magnetic stirrer for 2 hrs. After stirring, pale white precipitate is centrifuged and washed many times with distilled water followed by ethanol to make it free from impurities. Then after drying in vacuum oven overnight, a pale white powder of ZnO nanoparticles will be obtained at 100°C temperature.

#### Chemical reaction formula:-



### Result and Discussions:-

From X-Ray Diffraction (XRD) Analysis of The ZnONp powdered sample was examined by a CuKα1- X Ray Diffractometer for confirming the presence of ZnO and its structure. Main peaks corresponding to 2θ values of 32.14°, 34.83°, 36.68°, 47.98°, 56.91°, 63.32°, 68.38°, 69.58°, 77.40°, 90.07° and 95.86° in the multi-plot have observed from the graph as shown in Fig . The observed peaks of the graph are in good agreement with the JCPDS data card no:36-1451, proved that ZnO NPs has Wurtzite structure. Peaks was compared to standard literature values and the presence of zinc oxide particles was confirmed. The average size of the particles was calculated as 22nm using Debye-Scherrer's formula:

$$D = \frac{k \times \lambda}{\beta_{hkl} \times \cos \theta}$$

where k is Scherer constant=0.9.

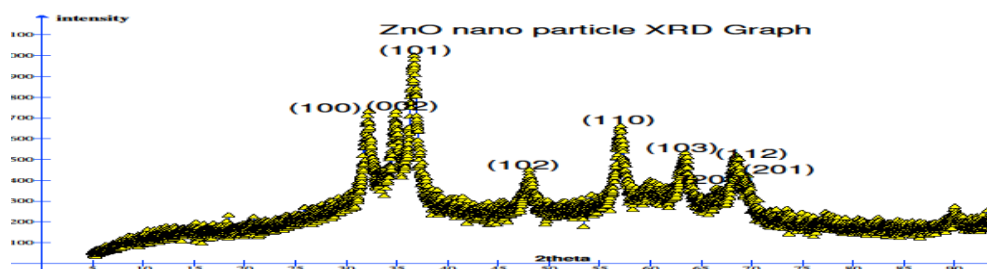
the wave length of the source  $\lambda = 15.406\text{nm}$ .

Lattice parameters are calculated from the following equations  $a = \frac{\lambda}{\sqrt{3} \sin \theta_{100}}$

$$c = \frac{\lambda}{\sin \theta_{002}}$$

$$V = \frac{\sqrt{3}a^2c}{2}$$

$$\text{Interplanar spacing } d_{hkl} = \frac{1}{\sqrt{\frac{4(h^2+k^2+hk)}{a^2} + \frac{l^2}{c^2}}}$$



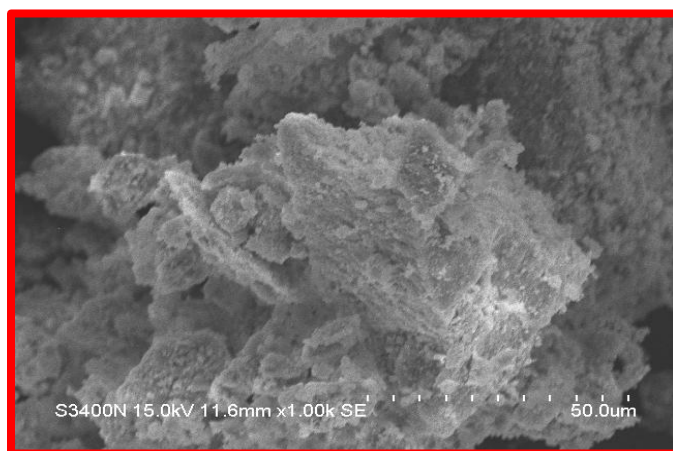
**Fig 1:-** XRD graph of Alternanthera Sessile leaves ZnO nanoparticles

**Table 1:-** The structural parameters of Alternanthera Sessile leaves ZnO nanoparticles

data	2θ	hkl	$d_{hkl}$ (Å)	Structure	Lattice parameters(Å)	$V$ (Å <sup>3</sup> )
sample	32.14 34.83	(100) (002)	2.783 2.582	Hexagonal	$a=3.213$ $c=5.152$ $c/a=1.6035$	46.05
Jcpds(36-1451)	31.770 34.422	(100) (002)	2.814 2.603	Hexagonal	$a=3.250$ $c=5.207$ $c/a=1.6021$	47.63

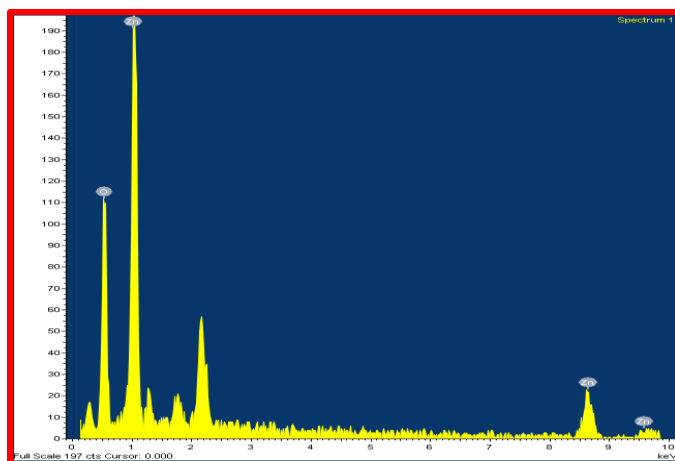
#### SEM &EDAX analysis:

From the SEM analysis observed that ZnO nanoparticles were agglomerated spherical in shape. In reported journal they have stated that agglomerated spherical shape ZnO nanoparticles formed by Green synthesis method. The particle size roughly estimated as 15-30nm from SEM analysis.



**Fig 2:-** SEM image of Alternanthera Sessile leaves-ZnO nanoparticles

**EDAX:** The sample contains only Zinc and Oxygen and no other impurity are present in the sample. This was conformed by the EDAX study.



**Fig 3:-** EDAX graph of ZnO nanoparticles of Alternanthera Sessile leaves

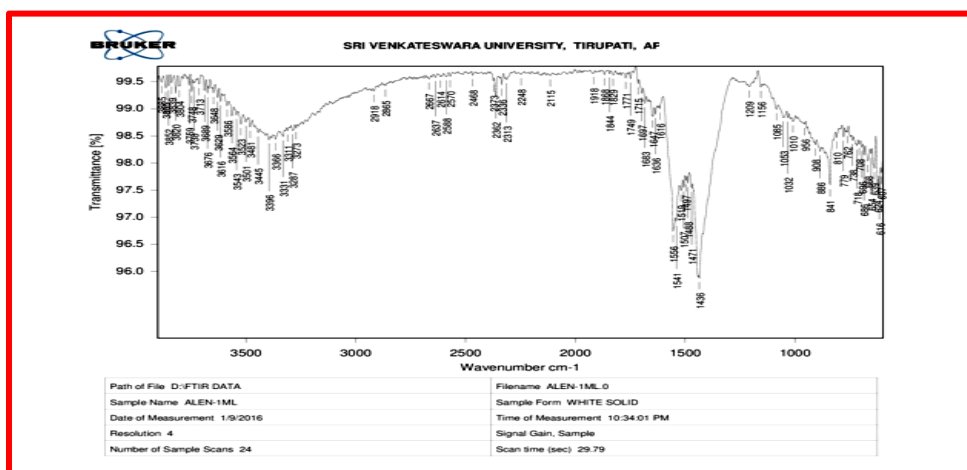
**Table-2:** Atomic Weight percentage of Alternanthera Sessile leaves ZnO nanoparticles from EDAX graph

tnemeIE	egatnecrep thgieW	egatnecrep cimotA
K O	35.76	69.46
K nZ	64.24	30.54
Total	100	100

#### Fourier Transform Infrared Spectroscopy (FTIR):-

The FTIR spectrum of ZnO nanoparticles is shown in Figure . For the IR spectra of unannealed samples (Fig-4), a series of transmission peaks from 500 to 4000 $\text{cm}^{-1}$  can be found, corresponding to the carboxylate and hydroxyl impurities in materials. The O-H stretching mode of hydroxyl group has confirmed by peaks observing at 3501 and 1206  $\text{cm}^{-1}$  wave numbers due to water adsorption by ZnO nanoparticles. The peaks assigned at 1630 and 1384  $\text{cm}^{-1}$  are due to the asymmetrical and symmetrical stretching of the zinc carboxylate, respectively. As the size of the nanoparticles increases, the content of the carboxylate ( $\text{COO}^-$ ) and hydroxyl ( $-\text{OH}$ ) groups in the samples decreased. The hygroscopic nature of ZnO causes to form zinc carboxylate and zinc hydroxide .

The fundamental mode of vibration at 1647 $\text{cm}^{-1}$  which correspond to the  $\text{C}=\text{O}$  stretching vibration, 3396  $\text{cm}^{-1}$  which correspond to the N-H bend, 1556  $\text{cm}^{-1}$  which corresponds to  $\text{N}=\text{O}$  stretching vibration were confirmed Amide group present in Alternanthera Sessile leaves. Peaks at 909 and 809 $\text{cm}^{-1}$  which correspond to O-H bend, 2331 and 2361 $\text{cm}^{-1}$  which correspond to  $\text{C}\equiv\text{N}$  stretch were conformed that carboxylic acid ,Alkenes and Nitriles present in the Alternanthera Sessile leaves. Amides , carboxylic acid, Alkenes and Nitriles groups in this leaves serves as the reducing agents for minimal of particle size becomes few nano meters.



**Fig 4:-** FTIR graph of ZnO nanoparticles of Alternanthera Sessile leaves.

### Conclusions:-

The Green synthesis of zinc oxide nanoparticles using leaf extract of *Alternanthera Sessile* provides an environmental friendly, easy and effective route for synthesis of nanoparticles. From the use of plant extracts eliminates bad effects from the usage of harmful and toxic reducing and stabilizing agents. The nano crystallites of ZnO are in the range of 18-30nm. The operating temperature and  $P^H$  of the solution will affect the stability of nano particle and agglomerates are formed. The Green synthesis of ZnO nano particles is still in its Research progress for focusing in the fields of pharma, optical energy conversion and spintronics by tuning its size over few nanometers.

### Reference:-

1. "Green Synthesis of Zinc Oxide (ZnO) Nanoparticles Using *Ocimum Tenuiflorum* Leaves"-Sagar Raut, Dr. P. V. Thorat, Rohini Thakre-International Journal of Science and Research (IJSR)-Volume 4 Issue 5, May 2015, page no-1225-1228.
2. "Green synthesis, characterization and optical properties of zinc oxide nanosheets using *Olea europaea* leaf extract"-Akl M. Awwad\*, Borhan Albiss, Ahmad L. Ahmad-Adv. Mat. Lett. 2014, 5(9), 520-524.
3. "X-ray Peak Broadening Analysis of ZnO Nanoparticles Derived by Precipitation method"-Hiten Sarma\*, K.C. Sarma-International Journal of Scientific and Research Publications, Volume 4, Issue 3, March 2014 1, page no-1 - 7.
4. Nadiabebiana Djaja, Rosari Saleh, "characteristics and photocatalytic activities of Ce-Doped ZnO Nanoparticles" Materials sciences and applications, vol4, 145-152, 2013. [5] N. Duran, P.D. Marcato, O.L. Alves, G. Souza, J. Nanotechnol. 3 (2005) 1-7.
5. Riteshkumar, Induvarma, Nidhi Verma, "synthesis and characterization of Mn doped ZnO particles prepared by a co-precipitation method", international journal of advanced technology & engineering research, vol2, issue3, may 2012.
6. George Varughese, K.T. Usha, A.S. Kumar, "zinc sulfide nonmaterial doped with rare earth Neodymium-an optical study" international journal of engineering science and innovative technology, vol3, issue4, july 2014
7. Radhouane Bel-Hadj-tahar, Abdellatif Belhadj mohamed "sol-gel processed Indium -doped zinc Oxide Thin Films and their electrical and optical properties" new journal of glass and ceramics, vol4, 55-65, 2014.
8. Nitin Pandey, Rajneesh Kumar, Srivastava & S.G. Prakash "study of photoelectret effect in dysprosium doped zinc oxide" indian journal of pure & applied physics, vol50, 260-264, april 2012.
9. Khalid T. Al-Rasoul, Nadak. Abbas, Zainab J. Shanan, "structural and optical characterization of Cu and Ni doped ZnS Nanoparticles", international journal of electrochemical science, vol8, 5594-5604, 2013.
10. Bappaditya Pal, Soumendhara, P.K. Giri, D. Sarkar "Room temperature ferromagnetism with high magnetic moment and optical properties of Co doped ZnO nano rods synthesized by a solvothermal route". Journal of alloys and compounds, vol-615, pages -378-385, 2014
11. Ratulkumardas, Nayanmoni Gogoi, Punuri Jayasekhar Babu, Pragya Sharma Chandan Mahanta, Utpal Bora, "The synthesis of Gold Nanoparticles Using *Amaranthus Spinous* Leaf Extract and Study of their Optical Properties." Advances in materials and chemistry, 2012, 2, 275-281.
12. Niranjana Bala, S. Saha, M. Chakraborty, M. Maiti, S. Das, R. Basu and P. Nandy "Green synthesis of zinc oxide nanoparticles using *Hibiscus subdariffa* leaf extract :effect of temperature on synthesis, anti-bacterial activity and anti-diabetic activity", 5, 2015, 4993-5003



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### RESEARCH ARTICLE

#### EPIDEMIOLOGY AND ETIOLOGY OF CORNEAL ULCER WORLDWIDE SYSTEMATIC REVIEW

Lama H. Saleh.

#### Manuscript Info

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#### Abstract

**Background:** Infectious keratitis (corneal ulcer) is defined as a corneal characterized as a corneal inflammatory process connected with an overlying epithelial damage and it's a vision-threatening medical condition displaying in all age population and either sex that changes in morbidity rate through worldwide, its caused by bacteria, fungi, protozoa or viruses, and presents with pain, photophobia and redness. If left untreated, apart from scar formation, it can lead to endophthalmitis and even corneal perforation and blindness.

**Objectives:** The aims of this corneal ulceration study was therefore to establish the incidence of different types infectious corneal ulcers and to discuss the evidence based treatment that were approved in different world wide studies.

**Methodology:** we conducted a systematic review study that performed through Comprehensive literature search was performed in MEDLINE/PubMed and Cochrane Central Register of Controlled Trials using combinations of the following search terms: "corneal diseases, corneal keratitis" or "corneal ulcer. Epidemiology, Etiology, treatment" our search was ended on 14th of July 2016.

**Conclusion:** Corneal Keratitis is an important cause of ophthalmic disorders worldwide. Most common causes of corneal ulceration include including the infectious keratitis which is caused by bacterial, fungal, viral, and protozoan, the diagnosis of which is made on clinical examination aided by microbiological demonstration in smears or cultures from corneal tissues.

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#### Introduction: -

Corneal ulceration is defined as a corneal infiltrate associated with an overlying epithelial defect and it's a vision-threatening medical condition presenting in all age groups and either sex that varies in morbidity worldwide. It might resolve with no medical intervention, advancement to aperture and its resultant outcomes, or leave behind an opacity which if focal may prompt loss of vision. Variety in occurrence of infectious keratitis is a multi-factorial issue that includes a tight mix of different factors, for example, geological and other area related elements<sup>(1)</sup>, degree of development of the country concerned, the predominant predisposing factors and the type of infection commonly present in this community<sup>(2)</sup>. However, varieties in frequency of corneal keratitis have been accounted for in various keratitis trails in various nations despite the fact that these were comparative in the level of development, topographical area, and the most common sort of corneal contamination and related inclining components. Also, within the same nation, France for instance, varieties have been accounted for in the rate of serious types of irresistible keratitis that required healing facility confirmation<sup>(3-5)</sup>.

According to some studies it is generally acknowledged that bacterial and fungal keratitis have far higher rate in the developing world than that in the developed world <sup>(22,23)</sup>. Also it is thought that viral keratitis is more prevalent in developed countries, such as the United States where Herpes Simplex Keratitis (HSK) is considered the leading cause of corneal blindness <sup>(24,25)</sup>. However, predominance of bacterial <sup>(3)</sup> and fungal <sup>(26,27,28)</sup> keratitis in developed countries has been reported.

#### **Objectives: -**

The aims of this corneal ulceration study was therefore to establish the incidence of different types infectious corneal ulcers and to discuss the evidence based treatment that were approved in different world wide studies. And to highlight the most common causes of corneal ulcers in different populations. In contrast this review was aimed to give the chance for healthcare professional and patients to understand the epidemiology, predisposing factors, etiology and the outcome of management of corneal ulcers.

#### **Methodology: -**

We conducted a systemic review study that performed through Comprehensive literature search was performed in MEDLINE/PubMed and Cochrane Central Register of Controlled Trials according to the validated methods of the Preferred Reporting Items for Systematic Reviews (RRISR) <sup>(40)</sup> (using combinations of the following search terms: "corneal diseases, corneal keratitis, Corneal Infiltrate, Corneal Inflammations, Microbial Keratitis" or "corneal ulcer. Epidemiology, Etiology, treatment" our search was ended on 14th of July 2016. Extracted data from individual studies were summarized according to the main objects that our study is concerning about Epidemiology and Etiology of corneal ulcer.

This search was limited to English languages studies, we excluded all case reports, comments, reports, and we included reviews, cross sectional studies and all randomized control studies which met the criteria of our search which are every study discussing the incidence and causes of corneal ulcers from different populations worldwide published in English language.

#### **Data collection: -**

Using a structured data abstraction form, different authors extracted the data from the included studies, and another independent author checked the extracted data. Disagreements were resolved through discussion and if necessary by involving another independent author.

#### **Results and Discussion: -**

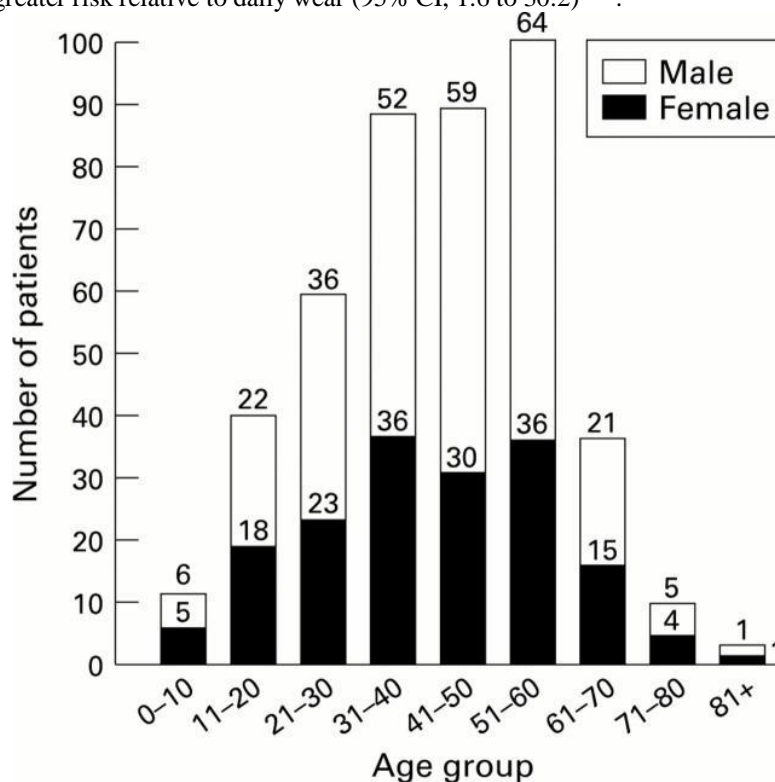
Our search identified 89 studies concerning the corneal ulceration and we have and included only 12 studies for the epidemiology concerning corneal ulceration, and 19 studies included in the Etiology of corneal ulcer.

#### **Epidemiology of corneal ulceration: -**

Corneal ulceration was not considered as imperative reason for corneal visual deficiency. Both injury and ulceration are normally monocular and influenced people, consequently, not portrayed as thoroughly visual impairment but rather just as outwardly incapacitated. Nonetheless, as general health programs have turned out to be more compelling in lessening the predominance of conventional reasons for corneal visual impairment, for example, corneal ulceration have turned out to be moderately more critical. In 1992, Thylefors et al, attracted regard for the way that injury is regularly the most imperative reason for corneal ulcer and one-sided loss of vision in creating nations and that up to 5% of all respective visual deficiency after corneal ulcer is an immediate consequence of injury <sup>(6)</sup>. The implication is that well over half a million people in the world are blind as a result of eye injuries <sup>(7)</sup>. A careful analysis of the world literature by Negrel & Thylefors in 1998 brought to light a global epidemic of ocular trauma with some 55 million eye injuries occurring annually, of which 750 000 cases required hospitalization and 200 000 were open-globe injuries <sup>(8)</sup>. They further estimated that approximately 1.6 million people were blind from their injuries, 2.3 million had bilateral low vision, and 19 million were unilaterally blind or had low vision. Even though ocular trauma is a global problem, the burden of blindness from eye injuries falls most heavily on developing countries, especially those where war and civic unrest have left a legacy of eye trauma from weapons such as land mines <sup>(9)</sup>. A country-wide population-based survey in Nepal a country with a peaceful history reported that trauma was responsible for 7.7% of all monocular blindness <sup>(10)</sup>. A more recent population-based prospective study in Bhaktapur District in Kathmandu valley, Nepal, revealed that the annual incidence of ocular injury is 1788 per 100 000 people, with 789 of the injuries due to corneal abrasions <sup>(11)</sup>. In other words, 1.8% of the residents of Bhaktapur

District experience some form of ocular injury every year. In Nepal and other developing countries, injuries are usually associated with agricultural work, but a much higher rate of ocular trauma can occur in specialized situations, such as foundries: an 11% eye-injury rate was reported in foundry workers in Saudi Arabia <sup>(12)</sup>. Corneal ulceration in developing countries has only recently been recognized as a “silent epidemic” <sup>(13)</sup>. Gonzales et al. found that the annual incidence of corneal ulceration in Madurai District in South India was 113 per 100 000 people, see figure 1 <sup>(14)</sup>, 10 times the annual incidence of 11 per 100 000 reported from Olmsted County, Minnesota, in the United States of America <sup>(15)</sup>. By applying the 1993 corneal ulcer incidence rate in Madurai District to all of India, there are an estimated 840 000 people a year in the country who develop an ulcer. This figure is 30 times the number of corneal ulcers seen in the United States <sup>(14)</sup>. Extrapolating the Indian estimates further to the rest of Africa and Asia, the number of corneal ulcers occurring annually in the developing world quickly approaches 1.5–2 million, and the actual number is probably greater. Invariably corneal blindness is the end result in the majority of these infections; outcomes may be even more disastrous such as corneal perforation, endophthalmitis, or phthisis. In a prospective population-based study by Upadhyay et al.2001 in Bhaktapur District, Nepal, the annual incidence of corneal ulceration was found to be 799 per 100 000 people <sup>(11)</sup>.

Glynn RJ et al 1992, in his study showed that the annualized incidence of ulcerative keratitis among aphakic persons using contact lenses was estimated to be 52 cases per 10,000 aphakic contact lens wearers (95% confidence interval (CI), 31.1 to 86.9). The risk of ulcerative keratitis varied substantially by lens use, with extended wear having an estimated sevenfold greater risk relative to daily wear (95% CI, 1.6 to 30.2) <sup>(16)</sup>.



**Figure1:** -Age and sex distribution of patients with corneal ulceration in south India.

A recent trial that was targeting population of 1 093 210 patients in Northern California performed by (Jeng BH et al. 2010), found that out of this large population number 302 developed ulcerative keratitis. The incidence of ulcerative keratitis was 27.6 per 100 000 person-years (95% confidence interval, 24.6-30.9). The incidence of corneal ulceration in contact lens wearers was 130.4 per 100 000 person-years (95% confidence interval, 111.3-151.7), with an adjusted relative risk of 9.31 (7.42-11.7;  $P < .001$ ) compared with non-contact lens wearers, who had an incidence of ulcerative keratitis of 14.0 per 100 000 person-years (11.7-16.6). Seven of 2944 people known to be infected with human immunodeficiency virus developed ulcerative keratitis, with 5 being contact lens wearers. The incidence of ulcerative keratitis in human immunodeficiency virus-positive patients was 238.1 per 100 000 person-years. <sup>(18)</sup>

**Etiology: -**

The regular danger variables for corneal keratitis incorporate visual injury, contact lens wear, recent visual surgery, previous visual surface disease, dry eyes, lid deformity, corneal sensation impairment, chronic use of topical steroids and systemic immunosuppression<sup>(32,33,24)</sup>.

**Microbial keratitis (infectious corneal ulceration): -**

Microbial keratitis is an infection of the cornea that is associated with a risk of permanent visual impairment<sup>(3,24,25,27,29)</sup>. It can be caused by bacteria, virus, fungus, protozoa and parasites.

Wong et al. (2003)<sup>(29)</sup> stated that infective keratitis represented about 2% of annual ophthalmic services in Auckland, New Zealand. In the Hong Kong study<sup>(30)</sup> 223 patients with different types on infectious keratitis were recruited in a 17-month period, giving an average of 157 patients per year.

A study that was conducted by T Bourcier et al, 2003 in Quinze-Vingts National Center of Ophthalmology, Paris, France included 300 cases, showed that in 207 eyes (68.2%), bacteria were identified from the corneal cultures. the hospital culture grew an identifiable organism in 58% of cases. Gram positive bacteria were predominant (83% of all positive cultures), mainly coagulase negative *Staphylococcus* species; Gram negative bacteria (17%) were mostly *Pseudomonas* and *Serratia* species. Polybacterial infection was noted in six cases (2%). Twenty-eight per cent of culture positive isolates were detected on smears<sup>(17)</sup>.

In contact Lenses wearers group, 63.3% of the corneal scrapings were positive. Thirty per cent of isolated bacteria were Gram negative, mostly *Pseudomonas aeruginosa*. Contact lens and/or storage cases cultures were performed in 67 cases (Table 1). An organism was identified in 83.6% (56) of cases. Ninety-seven per cent of the organisms were Gram negative bacteria. The bacteria isolated were similar to the organism recovered by corneal scraping in 14 cases<sup>(17)</sup>.

**Table 1: -** Contact lenses bacteriological study, T Bourcier et al, 2003<sup>(17)</sup>

Gram negative bacteria	
<i>Pseudomonas aeruginosa</i>	22
<i>Serratia marcescens</i>	18
<i>Serratia liquefaciens</i>	11
<i>Klebsiella pneumoniae</i>	3
<i>Klebsiella oxytoca</i>	8
<i>Stenotrophomonas maltophilia</i>	7
<i>Alcaligenes xylosoxidans</i>	5
<i>Enterobacter cloacae</i>	3
<i>Shewanella putrefaciens</i>	2
Others	11
Gram positive bacteria	
<i>Staphylococcus epidermidis</i>	3
Negative	11
Total	104

The spectrum of micro-organisms responsible for corneal ulceration varies according to geographical location. a very old reports from the northern parts of the United States of America show predominantly Gram-positive organisms<sup>(19)</sup>. While the southern parts show a striking number of fungal and Gram-negative isolates<sup>(20)</sup>. A study from London in 1989 also showed predominantly Gram-positive isolates. Variations such as these are probably worldwide.

Over the period of 7 years (Ibrahim YW et al 2012) have conducted retrospective study that detected linear trend pathogens causing corneal ulcers which was mainly related to the bacterial rather than viral ulcers. The rate of bacterial ulcers showed gradual increase over the period between 1997 and 2003 compared with viral keratitis that showed an initial increase between 1997 and 2000 followed by progressive decline till 2003. In 2006 the overall rate of infectious keratitis was lower than that in the retrospective study due to the significant decrease in viral keratitis (p=0.0003) as it shows in Table 2<sup>(21)</sup>.

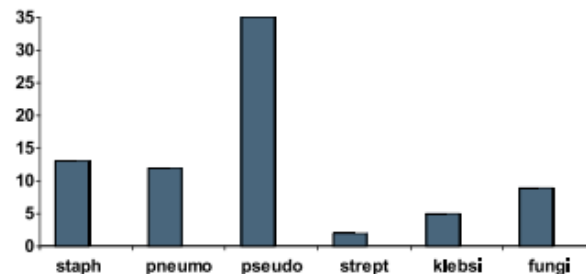


**Table 2:** - Incidence and annual distribution of infectious corneal ulcers in the retrospective and prospective studies, (Ibrahim YW et al 2012) <sup>(21)</sup>

Particulars	Number of patients	Population*	Incidence*	Bacterial ulcers** NO. (%) Incidence	Viral ulcers** NO. (%) Incidence	Fungal ulcers** NO. (%) Incidence	Protozoal ulcers** NO. (%) Incidence	Chlamydial ulcers** NO. (%) Incidence
<b>Retrospective study</b>								
1997	208	488,400	42.6	102 (49) 20.9	50 (24) 10.2	2 (1) 0.4	1 (0.5) 0.2	2 (1) 0.4
1998	257	488,600	52.6	106 (41.2) 21.7	76 (29.6) 15.6	0 (-) ---	3 (1.2) 0.6	2 (0.8) 0.4
1999	264	487,700	54.1	110 (41.7) 22.6	82 (31.1) 16.8	1 (0.4) 0.2	1 (0.4) 0.2	1 (0.4) 0.2
2000	236	487,942	48.4	109 (46.2) 22.3	98 (41.5) 20.1	1 (0.4) 0.2	2 (0.8) 0.4	2 (0.8) 0.4
2001	268	489,000	54.8	110 (41) 22.5	77 (28.7) 15.7	0 (-) ---	2 (0.7) 0.4	2 (0.7) 0.4
2002	272	490,900	55.4	113 (41.5) 23	77 (28.3) 15.7	1 (0.4) 0.2	1 (0.4) 0.2	1 (0.4) 0.2
2003	281	493,200	57.0	128 (45.6) 26	68 (24.2) 13.8	3 (1.1) 0.6	1 (0.4) 0.2	2 (0.7) 0.4
Total	1786	489,391**	52.1	778 (43.6) 22.7	528 (29.6) 15.4	8 (0.4) 0.2	11 (0.6) 0.3	12 (0.7) 0.4
<b>Prospective study</b>								
2006	201	499,100	40.3	117 (58.2) 23.4	40 (19.9) 8.0	3 (1.5) 0.6	1 (0.5) 0.2	2 (1) 0.4

\* Population of Portsmouth area includes population of Portsmouth town and the catchment areas served by QAH  
 \* Incidence is given per 100,000 persons of population in every given year  
 \*\* Some of these values are not pure (mixed with other micro-organisms)  
 \*\* Average population in 7 years

(Keshav et al. 2008) performed his study among 188 patients treated for corneal ulcers in Sur regional hospital in Oman through duration of 6 years. When microbiological isolation was evaluated it was found that in 76 patients (43.18%) bacteria/fungi. Among the isolates, 9 cases (11.84%) were fungi and the rest (88.26%) were bacteria. Of the bacterial isolates, pseudomonas was found in 35 cases (53.84%), staphylococci were found in 13 cases (20%), streptococcus pneumonia was found in 12 cases (18.46%), streptococci were found in 2 cases (3%) and klebsiella was found in 5 patients (7.69%) <sup>(31)</sup>. figure 2

**Figure 2:** - Shows the proportion of patients with specific microbial isolates in positive cultures (Keshav et al. 2008) <sup>(31)</sup>

(Shojaet al, 2004) conducted a trail in Shahid Sadoughi Hospital, School of Medicine, Yazd, Iran, identified 80 cases of microbial keratitis from March 1999 to March 2001. And they found 32 patients (40%) had positive cultures, 22 of which were gram-positive. The most common strains were Staphylococcus epidermidis, Staphylococcus aureus and Streptococcus pneumonia and in the gram-negative group, pseudomonas was the most common isolate. In 21% of gram-negative and 13% of gram-positive cultures, the patients had used one or more topical antibiotics before admission. Keratitis caused by pseudomonas strain (10 cases) had the largest diameter, the highest mean number of days of hospital stay, and the poorest final VA. Two of the 5 patients with fungal keratitis, developed corneal perforation <sup>(35)</sup>. Table 3

**Table 3:** -Distribution of the patients according to age and predisposing factors (Shoja et al, 2004) <sup>(35)</sup>

Age groups	Predisposing factors					Total
	Trauma	Ocular disease	Previous ocular surgery	Contact lens	Systemic disease	
0-20	12 (66.7)	3 (16.7)	1 (5.5)	2 (11.1)	0 (-)	18
20-50	11 (40.8)	7 (25.9)	3 (11.1)	6 (22.2)	0 (-)	27
50-80	9 (25.7)	18 (51.5)	4 (11.4)	0 (-)	4 (11.4)	35

Data are given as number (percentage)

*Non infectious corneal ulcer (Idiopathic keratitis)***Peripheral ulcerative keratitis:-**

according to (Mondino BJ et al, 1988) Noninfectious/inflammatory keratitis can be subdivided into micro-ulcerative and macro-ulcerative. Micro-ulcerative peripheral keratitis includes marginal catarrhal ulcer, phlyctenulosis and peripheral rosacea keratitis. Macro-ulcerative peripheral keratitis is generally a manifestation of systemic, immune-mediated disease. Peripheral ulcerative keratitis has been associated with nearly all connective tissue diseases or vasculitis. However, the most common entities associated with are rheumatoid arthritis, Wegener's granulomatosis and polyarthritidenodosa. When associated with systemic disease, Peripheral ulcerative keratitis represents a local vasculitis affecting the limbal arcades. Circulating immune complexes deposit in the limbal vessels inciting local inflammation, which include diffusion of immune complexes, components of complement system, and inflammatory cells into the peripheral cornea. Loss of stromal collagen leading to descemetocoele formation has been reported <sup>(36)</sup>.

**Corneal ulcer following the use of non-steroidal anti-inflammatory agents: -**

Topical non-steroidal anti-inflammatory drugs have been reported to be the cause of corneal melting and perforation <sup>(37)</sup>. Impairment of wound healing, neurotrophic effect and activation of matrix metalloproteinase are responsible for the melting. (Gokhale *et al.* 2010), have reported a case of diclofenac-induced acute corneal melt after collagen cross linking <sup>(38)</sup>. The surrounding cornea of perforation showed regenerative changes with large epithelial cells. The adjacent stroma showed edema, keratocyte loss, myofibroblastic transformation of keratocytes, and few neutrophils and round cell infiltrate this was according to study by (O'Brien et al, 2001) <sup>(39)</sup>.

**Conclusion:-**

Corneal Keratitis is an important reason for ocular morbidity worldwide. A substantial part of the standard etiology for corneal keratitis integrate bacterial, fungal, viral, and protozoan, the analysis which is made on scientific assessment supported by microbiological presentation in smears or cultures from corneal tissues. Non-infectious keratitis can likewise be seen in a number of conditions where swelling happens in the cornea due to other etiologies, causing corneal vascularization, scarring and visual loss.

**References: -**

1. Ibrahim YW, Boase DL, Cree IA (2007) Factors affecting the epidemiology of Acanthamoeba keratitis. *Ophthalmic Epidemiology* 14: 53-60.
2. Bharathi MJ, Ramakrishnan R, Meenakshi R, Shivakumar C, Raj DL (2009) Analysis of the risk factors predisposing to fungal, bacterial & Acanthamoeba keratitis in south India. *Indian J Med Res* 130: 749-757.
3. Bourcier T, Thomas F, Borderie V, Chaumeil C, Laroche L (2003) Bacterial keratitis: predisposing factors, clinical and microbiological review of 300 cases. *Br J Ophthalmology* 87: 834-838.
4. Kerautret J, Raobela L, Colin J (2006) Serious bacterial keratitis: a retrospective clinical and microbiological study. *J Fr Ophtalmol* 29: 883-888.
5. Ancele E, Lequeux L, Fournie P, Chapotot E, Douat J, et al. (2009) Severe bacterial keratitis. A clinical, epidemiologic, and microbiologic study. *J Fr Ophtalmol* 32: 558-565.
6. Thylefors B. Epidemiological patterns of ocular trauma. *Australian and New Zealand Journal of Ophthalmology*, 1992, 20: 95-98.
7. Anderson JDC, Foster A. Ocular trauma. *Tropical Doctor*, 1989, 19: 35-40.
8. Negrel AD, Thylefors B. The global impact of eye injuries. *Ophthalmic Epidemiology*, 1998, 5: 143-167.
9. Jackson H. Bilateral blindness due to trauma in Cambodia. *Eye*, 1996, 10: 517-520.
10. Brilliant LB et al. Epidemiology of blindness in Nepal. *Bulletin of the World Health Organization*, 1985, 63: 375-386.
11. Upadhyay M et al. The Bhaktapur Eye Study: Ocular trauma and antibiotic prophylaxis for the prevention of corneal ulceration in Nepal. *British Journal of Ophthalmology*, 2001 (in press).
12. Ballal SG. Ocular trauma in an iron forging industry in the eastern province, Saudi Arabia. *Occupational Medicine*, London, 1997, 47: 77-80.
13. Whitcher JP, Srinivasan. Corneal ulceration in the developing world — a silent epidemic. *British Journal of Ophthalmology*, 1997, 81: 622-623.
14. Gonzales CA et al. Incidence of corneal ulceration in Madurai District, South India. *Ophthalmic Epidemiology*, 1996, 3: 159-166.

15. Erie JC et al. Incidence of ulcerative keratitis in a defined population from 1950 through 1988. *Archives of Ophthalmology*, 1993, 111: 1665–1671.
16. Glynn RJ, Schein OD, Seddon JM, Poggio EC, Good fellow JR, Scardino VA, Shannon MJ, Kenyon KR. The incidence of ulcerative keratitis among aphakic contact lens wearers in New England. *Arch Ophthalmology*. 1991;109(1):104-107. doi:10.1001/archophth.1991.01080010106041.
17. T Bourcier, F Thomas, V Borderie, C Chaumeil, and L Laroche. Bacterial keratitis: predisposing factors, clinical and microbiological review of 300 cases. *Br J Ophthalmology*. 2003 Jul; 87(7): 834–838.
18. Jeng BH, Gritz DC, Kumar AB, Holsclaw DS, Porco TC, Smith SD, Whitcher JP, Margolis TP, Wong IG. Epidemiology of ulcerative keratitis in Northern California. *Arch Ophthalmology*. 2010 Aug;128(8):1022-8. doi: 10.1001/archophthalmol.2010.144.
19. Liesegang TJ, Forster RK. Spectrum of microbial keratitis in South Florida. *AmJ Ophthalmology* 1980; 90: 38-47.
20. Thomas PA. Keratomycosis (mycotic keratitis). Bailliere's clinical tropical medicine and communicable diseases. London: Bailliere, 1989; 4: 269-86.
21. Ibrahim YW, Boase DL, Cree IA (2012) Incidence of Infectious Corneal Ulcers, Portsmouth Study, UK. *J Clinic Experiment Ophthalmology* S6:001. doi:10.4172/2155-9570.S6-001.
22. Poole TR, Hunter DL, Maliwa EM, Ramsay AR (2002) Etiology of microbial keratitis in northern Tanzania. *Br J Ophthalmology* 86: 941–942.
23. Upadhyay MP, Srinivasan M, Whitcher JP (2007) Microbial keratitis in the developing world: does prevention work? *Int Ophthalmology Clin* 47: 17-25.
24. Liesegang TJ (1989) Epidemiology of ocular herpes simplex. Natural history in Rochester, Minn, 1950 through 1982. *Arch Ophthalmology* 107: 1160-1165.
25. Liesegang TJ (2001) Herpes simplex virus epidemiology and ocular importance. *Cornea* 20: 1-13.
26. Liesegang TJ, Forster RK (1980) Spectrum of microbial keratitis in South Florida. *Am J Ophthalmology* 90: 38–47.
27. Kaufmann C, Frueh BE, Messerli J, Bernauer W, Thiel MA (2008) Contact lens-associated fusarium keratitis in Switzerland. *Klin Monbl Augenheilkd* 225: 418-421.
28. Proenca-Pina J, Ssi Yan Kai I, Bourcier T, Fabre M, Offret H, et al. (2010) Fusarium keratitis and endophthalmitis associated with lens contact wear. *Int Ophthalmology* 30: 103-107
29. Wong T, Ormonde S, Gamble G, McGhee CN (2003) Severe infective keratitis leading to hospital admission in New Zealand. *Br J Ophthalmology* 87: 1103-1108.
30. Lam DS, Houang E, Fan DS, Lyon D, Seal D, et al. (2002) Incidence and risk factors for microbial keratitis in Hong Kong: comparison with Europe and North America. *Eye* 16: 608-618.
31. Keshav BR, Zacheria G., Ideculla T., Bhat V., Joseph M. Epidemiological Characteristics of Corneal ulcers in south sharqiya Region. *Oman Medical Journal* 2008, Volume 23, Issue 1, January 2008.
32. Green M, Apel A, Stapleton F. Risk factors and causative organisms in microbial keratitis. *Cornea*. 2008;3:22–27.
33. Saeed A, D'Arcy F, Stack J, Collum LM, Power W, Beatty S. Risk factors, microbiological findings, and clinical outcomes in cases of microbial keratitis admitted to a tertiary referral center in Ireland. *Cornea*. 2009;3:285–292.
34. Jeng BH, Gritz DC, Kumar AB, Holsclaw DS, Porco TC, Smith SD WJP, Margolis TP, Wong IG. Epidemiology of ulcerative keratitis in Northern California. *Arch Ophthalmology*. 2010;3:1022–1028.
35. M. R. Shoja and M. Manaviat .Epidemiology and outcome of corneal ulcer in Yazd Shaghid Sadoughi Hospital. *Acta Medica Iranica*, 42(2): 136-141; 2004.
36. Mondino BJ. Inflammatory diseases of the peripheral cornea. *Ophthalmology*. 1988;95:463–72.
37. Guidera AC, Luchs JJ, Udell JJ. Keratitis, ulceration, and perforation associated with topical nonsteroidal anti-inflammatory drugs. *Ophthalmology*. 2001;108:936–44.
38. Gokhale NS, Vemuganti GK. Diclofenac-induced acute corneal melt after collagen crosslinking for keratoconus. *Cornea*. 2010;29:117–9.
39. O'Brien TP, Li QJ, Sauerburger F, Reviglio VE, Rana T, Ashraf MF. The role of matrix metalloproteinases in ulcerative keratolysis associated with perioperative diclofenac use. *Ophthalmology*. 2001;108:656–9.
40. Moher D, Liberati A, Tetzlaff J, Altman DG. PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Int J Surg* 2010;8:336-41.



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### RESEARCH ARTICLE

#### LAPAROSCOPY ROLE IN DIAGNOSIS AND MANAGEMENT OF UNEXPLAINED/NONSPECIFIC ABDOMINAL PAIN.

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laparoscopy, abdomen, diagnosis

#### Abstract

**Background:**unexplained/nonspecific abdominal pain makes up a high percentage of surgical admissions to hospitals, both in emergency department, and as elective admissions,with a substantial diagnostic dilemma.

**Objective:** The aim of this study was to determine if laparoscopy has any significant role in the diagnosis and management of unexplained/nonspecific abdominal pain.

**PatientsandMethods:** All patients who presented to the hospital with abdominal pain with no identifiable etiology and after clinical examination, assessment and investigations were labeled as unexplained/nonspecific abdominal pain, and after that underwent diagnostic laparoscopyto reach a definitive diagnosis were included in the study.

**Results:**127 patients were included in the study. Females accounted for 67% (n=85) and males33% (n=42). The mean age was 28 years (ranged from18-58 years).Out-patient department was the commonest mode of admission,99 (78.4%) patients. Patients who presented with unexplained/nonspecific abdominal pain in the lower part of abdomen accounted for 29% (n=37), followed by 25% (n=32) with right lower abdominal pain, and 22% (n=28) with periumbilical pain radiating to right lower abdomen. Diagnosis was established in 85%(n=108) of patients. In 15% (n=19) no pathology was found. The most common diagnosis was pathology of appendix in 33% (n=42) of patients followed by pelvic pathology in 20% (n=25), and abdominal tuberculosis in 16% (n=20) of patients. Most of the patients (42%, n=53) stayed in the hospital for 24 h. There were no major postoperative complications and no readmissions.

**Conclusion:** Laparoscopy has a definitive role in the diagnostic dilemma associated with unexplained/nonspecific abdominal pain. It has at the same time a role in treatment, decreasing mortality, morbidity, cost, hospital stay, and improving quality of life relative to observation; hence laparoscopy is an effective diagnostic and therapeutic modality in the management of patients with unexplained/nonspecific abdominal pain.

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**Introduction:-**

Abdominal pain is a common complaint both in general practice and in hospitals, with which patients present to emergency department. <sup>(1)</sup>Nonspecific abdominal pain (NSAP), is generally defined as acute abdominal pain of under 7 days' duration, and for which there is no diagnosis after examination and baseline investigations, is a common cause of emergency surgical hospitalization. <sup>(1)</sup>Nearly 25% of patients have nonspecific abdominal pain. <sup>(2)</sup>More than 38% of the patients with chronic abdominal pain have no specific etiological diagnosis made at the end of the diagnostic workup. <sup>(3), (4)</sup> Many organic and functional diseases can cause abdominal pain. The most common organic conditions include intestinal adhesions, <sup>(5), (6)</sup> biliary causes, <sup>(7), (8)</sup> and appendicular causes, <sup>(9)</sup> while functional conditions include irritable bowel disease, <sup>(10)</sup> functional dyspepsia, <sup>(11)</sup> and various motility disorders. Many of patients have ongoing symptoms and cannot be discharged, undergo multiple, often expensive, unneeded investigations and have repeated readmissions. A lot of cases of NSAP are mimicking acute or chronic appendicitis. Most patients with NSAP are referred as possible cases of acute appendicitis, frequently with periumbilical pain and tenderness that radiates to right iliac fossa (RIF). A number of these may erroneously undergo operation for suspected appendicitis, some are put on anti-tuberculosis therapy, while females mostly end up taking anti-androgens. <sup>(12)</sup> One study showed that, NSAP was diagnosed in 30% of 135 patients who are undergoing appendectomy operations. <sup>(1)</sup>Patients may undergo unnecessary appendectomy operations and may reiterate with symptoms even after surgery. A definite diagnosis is not always achievable, however, with noninvasive imaging modalities including contrast radiology, computed tomography (CT), magnetic resonance imaging (MRI), and ultrasonography. <sup>(13)</sup> In addition, minimally invasive procedures like paracentesis, endoscopy fail to reach a diagnosis as well at times. Laparoscopy is a minimally invasive surgical procedure in which the peritoneal cavity and intrabdominal organs can be visualized in order to detect pathology. It has both a diagnostic as well as a therapeutic potential and it is especially useful in patients with equivocal signs and those who are hemodynamically stable not requiring urgent surgical intervention. It is a safe and effective tool and can establish the etiology and allows for appropriate interventions in such cases. <sup>(14)</sup>After giving symptomatic treatment to patients, normal diagnostic laparoscopy may allow the surgeon to discharge patients early from hospital. This study was conducted to highlight the role of laparoscopy in unexplained/nonspecific abdominal pain.

**Materials and Methods:-**

This study was conducted out in Department of Surgery, King Khalid University Hospital (KKUH), Riyadh, Saudi Arabia for a period of 3 years, from July 2011 to June 2014. All patients of either sex and age, who were admitted through emergency department or as an elective through outpatient department and presented with acute or chronic nonspecific abdominal pain which was of unclear etiology, in whom medical history, clinical assessment, routine laboratory investigations and radiological evaluations failed to make a definite diagnosis, were included. After acquiring detailed history and clinical examination, relevant blood investigations taken, X-ray abdomen, ultrasound, and CT scan were performed when indicated. Laparoscopy was performed, after completion of all the necessary hematological, biochemical, radiological, and ascetic fluid analysis, endoscopic evaluation, imaging techniques, and Tuberculin sensitivity test, in any chronic abdominal condition in which the etiology was unknown. Depending on the underlying pathology, therapeutic intervention was performed with either open laparotomy or laparoscopic technique. A form was used to keep a record of all the patients' data in terms of medical history, clinical examination, laboratory investigations and laparoscopic findings. The time for hospital stay was defined as time from moment of admission until patient discharge. A single antibiotic for prophylaxis was given preoperatively. Patients informed-consent form approved by our Institution's Ethics Committee was taken before operation. Also, patients were informed about the possibility of conversion of laparoscopic surgery to an open procedure depending on preoperative findings. Pneumoperitoneum was established using veress needle in periumbilical region. After establishment of the pneumoperitoneum, a standard three-trocar technique was used (10-mm optic via periumbilical trocar and two 5-mm lateral trocars), followed by insertion of additional ports where therapeutic intervention was required. The findings and results of laparoscopy were recorded. Biopsy specimens were sent for histopathology to confirm the diagnosis. Outcome measures included diagnosis made, duration of surgery, duration of hospital stay and postoperative complications. Data were analyzed using Statistical Package for the Social Sciences Version 20.0 (SPSS Inc., Chicago, IL, USA) and Microsoft Excel 2010. Categorical data was presented as frequency and percentage, and numerical data as means and standard deviations.

**Results:-**

The common mode of admission to hospital was through outpatient department ( $n = 99$ , 78.4%). The common clinical presentations were as follow: nonspecific abdominal pain in the lower part abdomen in 29% ( $n=37$ ) patients, with right lower abdominal pain in 25% ( $n=32$ ) and 22% ( $n=28$ ) with periumbilical pain radiating to right lower abdomen.(detailed in **Table 1**).

**Table 1:-Clinical presentations**

Site of abdominal pain	Number of patients (N)	Percentage (%)
Pain in lower abdomen (RIF, hypogastrium, LIF)	36	28.4
Pain in RIF	30	24
Pain in periumbilical/central abdomen	28	22
Pain in hypogastrium	9	6.8
Pain in LIF	9	6.8
Pain in right lumbar region	7	5.6
Pain in RIF and hypogastrium	4	3.4
Pain in left lumbar region	3	2.5
Total	127	100

In 43% ( $n=55$ )of patient's abdominal ultrasound was normal. A common finding that was noted on abdominal and pelvic ultrasound, was distended bowel loops in right iliac fossa. Benign prostatic hypertrophy was reported in three patients. Pelvic ultrasound in 81 of 85 females was normal. In the remaining patients, minimal free fluid in cul-de-sac was reported. All subjects underwent CT scanning, out of which, 52.5% ( $n=66$ ) patients had a change in findings when compared with the findings on ultrasonography. The CT scan was better able to show retroperitoneal/mesenteric lymphadenopathy and dilatation of gut loops. Thirty-four subjects out of 127 cases (27.2%) had altogether new findings, while 92 (72.7%) cases had findings similar to the radiological means. Thirty-six out of these 64 had new findings along with the previous findings. Therefore, 70 out of the 127 subjects had new findings. After diagnostic laparoscopy, tissue diagnosis was achieved in 108 of the 127 subjects (85%).Laparoscopic results showed inflamed appendix, appendicular faecaliths, mesenteric lymphadenitis,enlarged mesenteric lymph nodes, salpingitis, omentum at deep inguinal ring, adhesions in peritoneal cavity and pelvis, fluid in cul-de-sac and ovarian cysts, diverticulitis(as indicated in **Table 2**).

**Table 2:-Laparoscopic findings**

Laparoscopic findings	Number of patients (N)	Percentage (%)
Inflamed appendix	22	17
Adhesions/bands (postoperative/cong.)	16	12.5
Appendicular faecaliths	12	10.2
Enlarged mesenteric lymph nodes	12	10
Salpingitis with fluid in cul-de-sac	10	7.5
Ovarian cysts	9	6.8
Caesating mesenteric nodes with ileal adhesions	9	6.8
Fibrous/kinked appendix	7	5.6
Strictured terminal ileum with lymph nodes	4	3.4
Omentum/viscus in deep ring	4	3
Meckel's diverticulitis	1	1.1
Fimbrial cyst	1	1.1
Worm in appendix	1	1.1
No pathology found	19	15
Total	127	100

Final diagnosis was made in 108 (85.2%) patients. In 19 patients (14.7%) diagnosis could not be established. All laparoscopic findings were confirmed by histopathology. Inflamed appendix was the most common diagnosis made in 22 (17%) patients with rest of diagnoses detailed in **Table 3**.

**Table 3:-** Final diagnosis

Final diagnosis	Number of patients (N)	Percentage (%)
Appendicular pathology	42	33
Pelvic pathology	26	20.4
Abdominal tuberculosis	20	16
Mesentericadenitis	6	4.5
Postoperative adhesions	4	3.4
Early inguinal hernia	4	3.4
Congenital bands	3	2.2
Lymphoma	1	1
Meckel's diverticulitis	1	1

The average length of the operative time was 58.7 minutes and the maximum duration was 96minutes. Among the postoperative complications 10 (8%) patients developed wound inflammation/infection, 8 (6.8%) had post-operative fever and chest infection, 6 (4.5%) with post-operative fever alone. Follow-up was done weekly for 1 month, then seen once monthly for 3 months. No major complications were reported and seven patients came back with complaints of recurrent pain who were subjected to further investigations and imaging modalities like CT, MRI, MRCP (magnetic resonance cholangiopancreatography) to reach a definite diagnosis.

### Discussion:-

Unexplained/nonspecific abdominal pain still remains a diagnostic dilemma. In many cases, despite all the routine laboratory investigations and imaging modalities, a diagnosis could not be achieved. The challenge posed by patients with NSAP is extensive and noticeable. It accounts for an estimated 15-40% of all emergency-department surgical admissions.<sup>(1)</sup> The abdominal disease is complicated, and patients usually undergo a lot of costly investigations and even exploratory laparotomy for definite diagnosis. In such conditions, diagnostic laparoscopy is a better choice for the patient. It can directly give a high-field visualization of the abdominal cavity, provide adequate tissue sample for histopathological assessment, and in expert hands is an excellent therapeutic tool with cosmetic acceptable scars. When reviewing the literature, it reveals various outcomes of diagnostic laparoscopy in patients of undiagnosed abdominal pain to support its use in recurrent nonspecific abdominal pain. Some studies clearly support diagnostic laparoscopy role in such challenging situations and have shown a good accuracy in reaching a diagnosis in NSAPs.<sup>(15), (16)</sup> Some other studies were not as supportive.<sup>(17)</sup> In our study, the overall success was 88% which supports use of this diagnostic modality. A study done by Lippert *et al.* showed that diagnostic difficulties are more experienced in young females with lower abdominal pain and inconsistent features of appendicitis.<sup>(18)</sup> It seems to be a better option to evaluate nonspecific lower abdominal pain in this gender class by diagnostic laparoscopy. This is similar to the study carried by Ou and Rowbotham in which diagnostic laparoscopy provided a definitive diagnosis in 76 of the 77 cases (99%).<sup>(19)</sup> In our study, more than half (85 out of 127) of patients were females. This strengthens the observation that nonspecific abdominal pain was common diagnostic problem in this group. Diagnostic laparoscopy provided a definitive diagnosis in 73 (86.4%) out of 85 female patients in our study. In a similar study appendicular pathology was found in 75% cases, whereas in another study it was found in 40% patients.<sup>(20), (21)</sup> These numbers were higher in our study in which appendicular pathology was found in 33% (n = 42) of patients. In majority of cases in our study, the appendicular pathology was inflamed appendix with pelvic appendix as a common position, along with subserosal and retrocecal appendix. Females with findings of pelvic pathology and pelvic inflammatory disease (PID) were the second most common diagnosis reached with 26 (20.4%), and abdominal tuberculosis was found in 20 (16%) patients in a study which is similar to our results.<sup>(22)</sup> Five male patients in the present study presented with a complaint of right groin pain that radiated to right iliac fossa. On diagnostic laparoscopy, findings were protrusion of omentum into deep inguinal ring in two patients and small bowel along with omentum in three others. Transabdominal preperitoneal repair was done in all the five patients with no postoperative complications. Our results were in concordance to a study revealing similar results.<sup>(4)</sup> Early laparoscopy also has the benefit that a number of therapeutic options were available.<sup>(23)</sup> In this study, diagnostic laparoscopy has become therapeutic in many cases. Ovarian cysts could be drained and treated with immediate relief of symptoms.<sup>(24)</sup> Purulent fluid collections secondary to pelvic inflammatory disease or diverticulitis could be drained. Early recognition of PID is crucial and enables early treatment that was important if

complications such as infertility were to be minimized. Patients with an inflamed appendix can be dissected safely and effectively laparoscopically. Laparoscopic adhesiolysis was possible. <sup>(25)</sup>In our study, there were some minor postoperative complications noted including wound inflammation/infection and post-operative fever, while the laparoscopy failed to make any diagnosis in 17 patients, which were put on follow-up for further assessment to reach a diagnosis. Seven were females (unmarried) of child bearing age, five were males <12 years of age, whereas the other females had a history of cesarean section with normal imaging studies. All of these patients attended the follow-up clinic for 8 weeks and then were being evaluated with other modalities during follow-up.

### Conclusion:-

In conclusion, laparoscopy has an effective diagnostic role in evaluating patients with acute unexplained/nonspecific abdominal pain, in whom conventional methods of investigations have failed to reach a definitive cause. The therapeutic value of laparoscopy is also accepted and appreciated.

### References:-

1. Sheridan WG, White AT, Havard T, Crosby DL. Non-specific abdominal pain: The resource implications. *Ann R CollSurgEngl* 1992; 74:181-5.
2. Kamin RA, Nowicki TA, Courtney DS, Powers RD. Pearls and pitfalls in the emergency department evaluation of abdominal pain. *Emerg Med Clin North Am* 2003; 21:61-72, vi.
3. Heafield R, Roe AM, Watkins R, Brodribb AJ, Brown C. Outcome of emergency surgical admissions for non-specific abdominal pain. *Gut* 1990;31: A1167.
4. El-Labban GM, Hakkam EN. The efficacy of laparoscopy in the diagnosis and management of chronic abdominal pain. *J Minim Access Surg* 2010; 6:95-9.
5. Peters AA, Van den Tillaart SA. The difficult patient in gastroenterology: Chronic pelvic pain, adhesions, and sub occlusive episodes. *Best Pract Res ClinGastroenterol.* 2007; 21:445-63.
6. Van Goor H. Consequences and complications of peritoneal adhesions. *Colorectal Dis.* 2007; 9:25-34.
7. Dumont RC, Caniano DA. Hypokinetic gallbladder disease: A cause of chronic abdominal pain in children and adolescents. *J PediatrSurg.* 1999; 34:858-61.
8. Johnson CD. ABC of the upper gastrointestinal tract. Upper abdominal pain: Gall bladder. *BMJ.* 2001; 323:1170-3.
9. Fayez JA, Toy NJ, Flanagan TM. The appendix as the cause of chronic lower abdominal pain. *Am J ObstetGynecol.* 1995; 172:122-3.
10. Mertz HR. Irritable bowel syndrome. *N Engl J Med.* 2003; 349:2136-46.
11. Tack J, Lee KJ. Pathophysiology and treatment of functional dyspepsia. *J ClinGastroenterol.* 2005;39: S211-6.
12. Galili O, Shaoul R, Mogilner J. Treatment of Chronic Recurrent Abdominal Pain: Laparoscopy or Hypnosis? *J LaparoendoscAdvSurg Tech A.* 2009; 19:93-6.
13. Cuesta MA, Borgstein PJ, Meijer S. Laparoscopy in the diagnosis and treatment of acute abdominal conditions. Clinical review. *Eur J Surg* 1993; 159:455-6.
14. nders RP, Mittendorf EA. Utility of laparoscopy in chronic abdominal pain. *Surgery* 2003; 134:549-52.
15. Domínguez LC, Sanabria A, Vega V, Osorio C. Early laparoscopy for the evaluation of nonspecific abdominal pain: A critical appraisal of the evidence. *SurgEndosc* 2011; 25:10-8.
16. Kapshitar' AV. The indications for performing diagnostic and therapeutic laparoscopy in emergency surgery on the abdominal organs. *KlinKhir* 1998;12-4.
17. Aslam MN, Ehsan O, Ali AA, Gondal KM, Choudhry AM. Diagnostic laparoscopic surgery: A good surgical tool. *Pak J Surg* 2001; 17:31-4.
18. Lippert V, Zaage J, Pilz F. Diagnostic laparoscopy and laparoscopic appendectomy in the diagnosis and therapy concept of abdominal pain of unknown origin. *ZentralblChir* 1998;123 Suppl 4:46-9.
19. Ou CS, Rowbotham R. Laparoscopic diagnosis and treatment of nontraumatic acute abdominal pain in women. *J LaparoendoscAdvSurg Tech A* 2000; 10:41-5.
20. Al-Bareeq R, Dayna KB. Diagnostic laparoscopy in acute abdominal pain: 5-year retrospective series. *Bahrain Med Bull* 2007; 29:1-5.
21. McCartan DP, Fleming FJ, Grace PA. The management of right iliac fossa pain-is timing everything? *Surgeon* 2010; 8:211-7.
22. Hossain J, al-Aska AK, al Mofleh I. Laparoscopy in tuberculous peritonitis. *J R Soc Med* 1992; 85:89-91.
23. Salky BA, Edye MB. The role of laparoscopy in the diagnosis and treatment of abdominal pain syndromes. *SurgEndosc* 1998; 12:911-4.
24. Gaitán H, Angel E, Sánchez J, Gómez I, Sánchez L, Agudelo C. Laparoscopic diagnosis of acute lower abdominal pain in women of reproductive age. *Int J GynaecolObstet* 2002; 76:149-58.
25. Poulin EC, Schlachta CM, Mamazza J. Early laparoscopy to help diagnose acute non-specific abdominal pain. *Lancet* 2000; 355:861-3.



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### RESEARCH ARTICLE

#### IMPACT OF OLIVE LEAVES CONSUMPTION ON BLOOD SUGAR LEVEL IN ADULTS WITH TYPE-2 DIABETES. A CLINICAL TRIAL: ALMADINAH ALMUNAWARAH, KSA.

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#### Abstract

**Aim of the Research:-** The purpose of this research was to study the effect of drinking boiled olive leaves extracts on blood sugar level among adults with type-2 diabetes (both males and females) in Al-Madinah Al-munawarah, KSA. The following research questions guided the study:

- Is there a relationship between olives leaves consumption and blood sugar level?
- Can olive leaves reduce high blood glucose level?

**Materials and Methods:-** Seventy-three participants (29 males & 44 females) were chosen from 120 applicants according to the inclusion and exclusion criteria. Each patient was given a box that contains (3 disposable cups, 3 packs containing 5 gram grounded olive leaves, 18 lancets & strips for measuring blood glucose, follow-up card & instruction card and diabetes education book). Participants were asked to measure blood glucose level for 6 days (Before the main meal, after 1 hour of eating and after 3 hours of eating). The last three days they added drinking boiled olive leaves powder immediately after the main meal. Comparison of blood glucose levels in the three reading times before and after olive leave powder consumption.

**Results:-** Reduction in mean blood glucose level after drinking boiled olive leave extracts was found in all measurements during the 3 days of consumption but the only significant reduction in blood glucose was found on the third day one hour after meal.

**Conclusion:-** Hypoglycemic effect of olive leaves was found in the study with minor side effects. Further studies are recommended to identify the ideal dose, duration, preparation and timing of consumption to produce the maximum impact on blood glucose.

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#### Introduction:-

Diabetes mellitus (DM) is one of the major ailments globally.<sup>1</sup> "DM is a chronic metabolic disease that occurs when the pancreas is not able to produce enough of the hormone insulin or when the body cannot effectively use the

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insulin it produces.”<sup>2</sup>

Globally Saudi Arabia has the seventh highest rate of DM and the second highest rate in the Middle East according to the World Health Organization (WHO).<sup>3</sup>

Diabetes has become an epidemic health problem in several economically developing countries.<sup>4</sup> By 2015 it was estimated that 3.4 million people in Saudi Arabia were diagnosed with DM.<sup>5</sup> This prevalence of diabetes in Saudi Arabia might be due to various influences but most researches speculate that obesity and lack of exercise are very prominent factors.<sup>1</sup> Proportion of people diagnosed with type 2 diabetes accounts for 90% of all the diagnosed cases of DM.<sup>6</sup>

The number of people diagnosed with diabetes around the world is 336 million, which is expected to reach 550 million people by the year 2030. Almost five million people die of diabetes each year corresponding to one victim every 7 seconds. Diabetes is one of the major 10 causes of disability.<sup>2</sup>

For countless years, human beings have used the curative power of nature to live healthier lives. Conventional medicines and herbal remedies are woven through every nation and society. In specific Olive plant leaves have been used for eras all over the world. Several researchers have been investigating for the subproducts of olive leaves that might have positive outcome on human health.

Complementary and alternative medicine (CAM) refers to a wide range of clinical therapies outside of conventional medicine, the term “complementary” refers to therapies that are used in conjunction with conventional medicine, whereas “alternative” medicine includes therapies that are used in place of conventional medicine.<sup>7</sup>

One of the commonly used CAM herbs in Saudi Arabia is olive leaf. However, until recent time, the use of olive leaf as a potential diabetes treatment had not been appropriately examined.

Olive leaf plus olive leaf extracts (OLE), are currently promoted as anti-aging, immunostimulator, antioxidant, anti-inflammatory and antibiotic agents.<sup>8</sup>

The antioxidants oleuropein and hydroxytyrosol are assumed to be the main functional composites in unprocessed olive leaf, along with a number of other polyphenols and flavonoids, including oleocanthal.<sup>9</sup> Oleuropein the primarily active component is highly bioavailable, comprising nearly 60-90mg/g (6-9%) of the leaf dry weight.<sup>10</sup>

“Studies on olive leaf extract have failed to notice any significant side-effects when doses up to 1000mg daily for 8 weeks<sup>11</sup> or lower doses.<sup>12</sup>” Overall, olive leaf extracts in supplemental dosages are not associated with any major side effects.<sup>13</sup>

The purpose of this research was to study the effect of olives leaves on blood sugar level among type-2 diabetic adults (both male and female) in Al-Madinah Al-munawarah. The following research questions guided the study:

1. Is there a relationship between olives leaves consumption and blood sugar level?
2. Can olive leaves drink reduce high blood glucose level?

The general objective is to examine the short-term safety and efficacy of drinking boiled olive leaves on glycemic control among adults with type-2 diabetes living in Al-Madinah Al-munawarah. Furthermore the specific objectives were to assess blood glucose level before and after consumption of olive leaves among diabetic adults and to determine acceptability and immediate side effects of consumption of olive leaves (diarrhea, hyperacidity ...etc.).

The hypothesis was that the Consumption of olive leaves drink can reduce elevated BG level (to a normal range).

### **Methodology:-**

The study Design was a clinical trial conducted to achieve the research objectives; furthermore the setting was in Taibah University and community in Almadinah Almunawarah.

This study was conducted on 73 diabetic adults (29 males & 44 females) with type 2 diabetes who were enrolled according to the inclusion and exclusion criteria

**Inclusion Criteria:-**

- Agree to participate.
- Having type 2 diabetes.
- Able to measure BG using home device and accurately record results.
- Living in Al-Madinah Al-Munawarah

**Exclusion Criteria:-**

- Pregnancy and lactation.
- Blood glucose  $\leq 70$
- Using Insulin treatment.
- Presence of diabetic complication or poor metabolic compensation.
- Following a diet to change weight or lifestyle during the trial days.
- Changing medical therapy during the trial days.

Subjects were recruited by advertisements at the University female section, flyers, Internet survey and face-to-face promotion of the study. Signing written consent was a pre-requisite to enrollment.

The active preparation was a commercial olive leaves powder; they were packed in empty bags for tea.

An Internet questionnaire was distributed, One hundred and twenty diabetic patients responded but upon phone calling them, we found that only 80 fulfill the inclusion criteria and were enrolled in the study. Another 7 subjects did not complete all the required measurements and were excluded from the study. 73 participants were enrolled according to the inclusion and exclusion criteria.

Each patient was given a box that contains (3 cups, 3 olive leaves bags, 18 lancets & strips for measuring BG, follow-up card, instruction card and Diabetes education book from the ministry of health).

Instructions to the patients were given to drink olive leaves immediately after the main meals. Measuring blood glucose level was done according to the following schedule:

1. Immediately before the main meal and drinking the olive leaves powder.
2. After 1 hour of eating.
3. After 3 hours of eating.

The patients were asked to complete a symptom questionnaire including any possible unexpected side effects e.g. GIT troubles.

In this study, the control group was of utmost importance. Due to the great variability of glycemic control among patients, patients were used as their own control so every patient repeated the test for 3 days under the same conditions but without using olive leave drink. Patients started with the 3 days with no olive leave drink and after that they added the drink for 3 more days.

The techniques, tools and equipment's were forms designed to record participants' information such as; personal data of the patient, medical history, treatment history and usual BG level, to ensure that the participants were suitable for the study, home monitoring BG measuring devices (freestyle optimum), follow up cards used to assess participants' BG level throughout the trial and finally questionnaires used to review the participants' side effects, tolerability and acceptance.

Pre-testing was done before the start of the study on 20 participants and the following problems were encountered:

1. Long fasting period
2. No compliance with the exact described methodology due to patients having to eat CHO (20 gram CHO biscuit).

**So methodology was changed from:-**

**Measuring blood glucose level after at least 2 hours fasting according to the following schedule:-**

- Before the study
- 1/2 hr after eating a biscuit containing 20g carbohydrates and drinking the olive leaves powder.
- Two hours after eating a biscuit containing 20g carbohydrates and drinking the olive leaves powder.

**If blood glucose level is >140 the participant will drink olive leaves powder alone:-**

If blood glucose level is <140 the participant will eat 20g biscuits then drink olive leaves powder.

To the current described method.

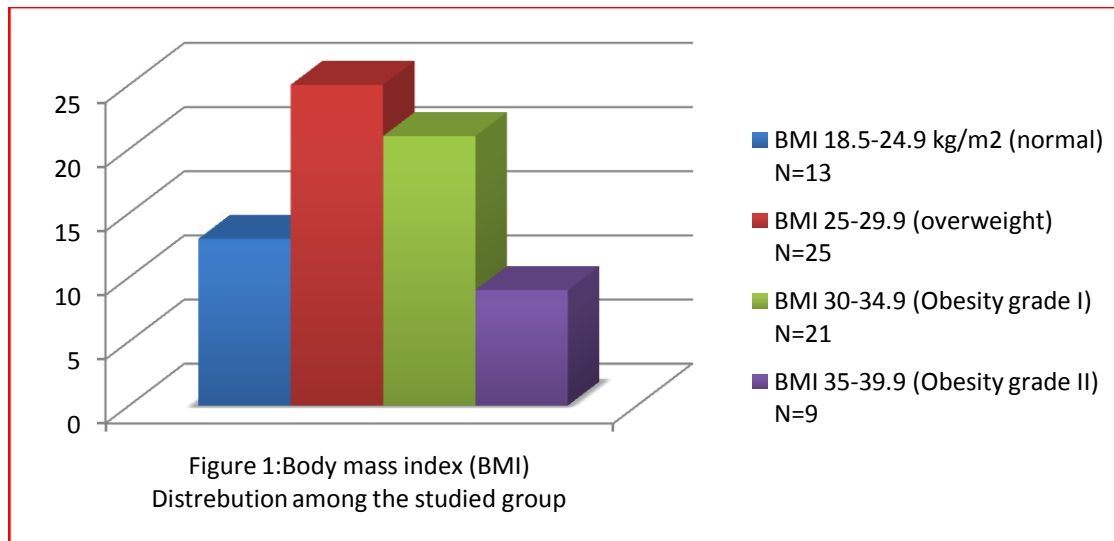
Ethical permission to conduct the current study was obtained from the Vice-Dean at the faculty of Applied Medical Sciences. Also permission was sought from The Medical directory of Taibah University (female section). Consent was obtained from all participants prior to the start of the study. The research explained to the participants in simple language, all data was kept confidential and patients were free to withdraw from the study.

Statistical Analysis was done by entering the encoded answers into Microsoft Excel and coping it to SPSS program. Descriptive analysis was done using statistical package for social sciences (SPSS17) and the comparative outcomes of results were analyzed by using T-test for paired samples for continuous data. The minimal level of significance was set at  $P < 0.05$ .

## Results:-

The study included 73 subjects suffering from type 2 diabetes, the majority were females (60.3%,  $n=44$ ), males represented 39.7% of the subjects ( $n=29$ ), and Mean age was 49 years with range from 19-65.

Mean level of BMI was  $30.46 \pm 5.548$ . Distribution of BMI category among the studied group is presented in figure 1.



Blood glucose level was compared time by time (before meal, 1 & 3 hours after meals) between the control days (no intake of boiled olive leaves) and after the intake of olive leaves. Results showed that there is reduction in mean level of blood sugar three hours after consumption of boiled olive leaves. The third day showed borderline significance. However, the only significant reduction in BG was found on the third day of consuming olive leaves 1 hour after meal. Results are shown in table 1.

**Table 1:-** Statistical comparisons in mean blood sugar level (mg/dl) between patients before and after olive leave intake (n=73):

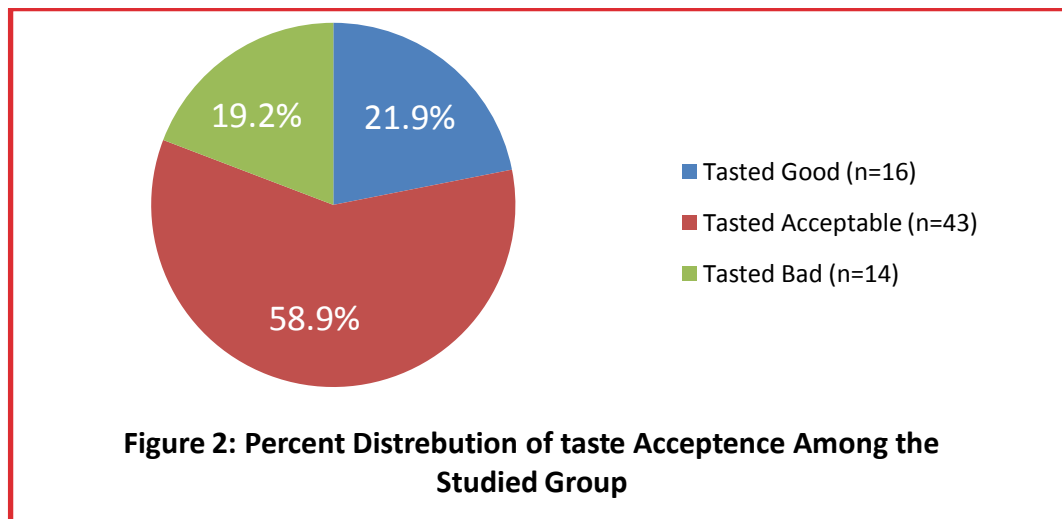
Measurements	Timing	Mean blood sugar level (mg/dl) $\pm$ SD		P value
		Before olive leave intake (Control days)	After olive leave intake (Therapy days)	
First day	Before meal	180.52 $\pm$ 70.44	189.67 $\pm$ 75.48	.450
	1 hour after meal	238.63 $\pm$ 77.165	239.25 $\pm$ 85.448	.964
	3 hours after meal	207.84 $\pm$ 71.518	193.96 $\pm$ 66.588	.227
Second day	Before meal	186.44 $\pm$ 67.044	191.6 $\pm$ 70.816	.649
	1 hour after meal	236.88 $\pm$ 74.857	231.45 $\pm$ 70.858	.654
	3 hours after meal	206.90 $\pm$ 73.660	199.41 $\pm$ 74.417	.542
Third day	Before meal	189.97 $\pm$ 74.119	177.60 $\pm$ 72.205	.309
	1 hour after meal	242.16 $\pm$ 79.757	216.00 $\pm$ 68.302	.035*
	3 hours after meal	210.74 $\pm$ 79.617	188.99 $\pm$ 59.739	.064

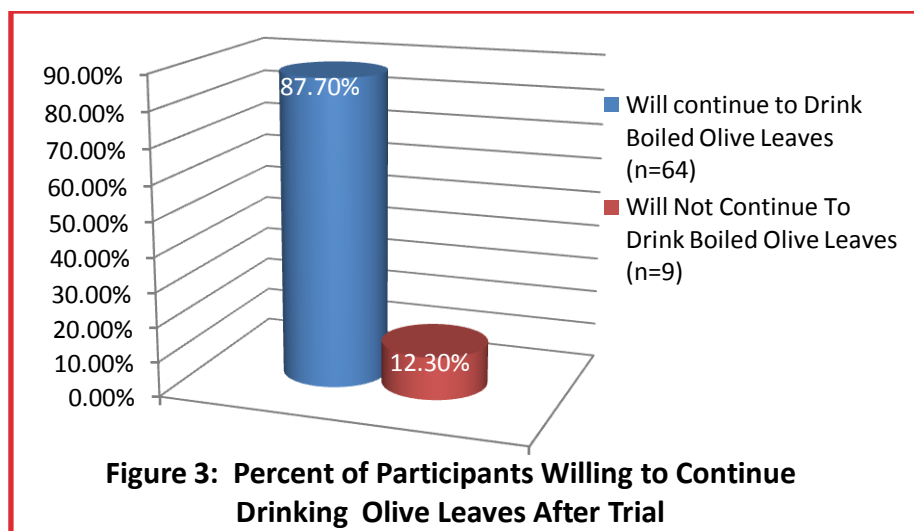
\*Significant difference

The side effects experienced by the studied group during trial were: Hyperacidity and GIT disturbances reported by only 19 subjects (26%) and diarrhea among 13 subjects (17.8%). Diarrhea was reported by 13 subjects (17%) and constipation was reported by only 2 subjects (2.7%) of the studied group.

Although olive leaves drink has a very bitter taste, yet the majority of participants 58.9% (n=43) reported that they could accept its taste, 21.9% (n=16) of participants reported that the taste was good and bad taste was reported by only 14 subjects (19.2%), Figure 2.

However, only 9 subjects (12.3%) stated that they would not continue to use it after the end of the trial, figure 3.





### Discussion:-

Up until today there's no known cure for DM.<sup>14</sup> Management concentrates on keeping blood sugar levels as close to normal as possible, which can be achieved through eating a healthy diet, being physically active, having a normal BMI and using diabetic medications.

One of the commonly used complementary and alternative medicine herbs in Saudi Arabia is olive leaves, few human studies were available about the hypoglycemic effect of drinking boiled olive leaf therefore, this study was aimed to examine its effect.

In our study and with using 5 gram OLE dose once per day for three days which were preceded with three control days, the blood glucose level started to show significant reduction at the third day and that effect was significant one hour after the meal. We believe that drinking olive leaf extracts was responsible for reduction of blood glucose from mean level of  $242.16 \pm 79.757$  mg/dl to  $216.00 \pm 68.302$  mg/dl one hour after meal ( $P=0.035$ ), and from  $210.74 \pm 79.617$  mg/dl to  $188.99 \pm 59.739$ , three hours after meal ( $P=0.064$ ).

**Pre-testing was done before the start of the study on 20 participants and the following problems were encountered:-**

1. Long fasting period
2. No compliance with the exact described methodology due to patients having to eat CHO (21gram CHO biscuit)

**So methodology was changed from:-**

**Measuring blood glucose level after at least 2 hours fasting according to the following schedule:-**

- Before the study
- 1/2 hr after eating a biscuit containing 20 g carbohydrates and drinking the olive leaves powder.
- Two hours after eating a biscuit containing 20 g carbohydrates and drinking the olive leaves powder.

If blood glucose level is  $>140$  the participant will drink olive leaves powder alone.

If blood glucose level is  $<140$  the participant will eat 20 gm biscuits then drink olive leaves powder.

To the current method.

The results from this study were supported by the results from previous studies. Results of improved blood glucose level of (79 middle aged, overweight men with type 2 diabetes) were shown after conducting human studies on hypoglycemic effect of consumption of olive leaf and during a longer period with higher concentrations<sup>15</sup>

A controlled clinical trial was conducted in New Zealand, 46 participants were given olive leaf polyphenols supplements for 12 weeks results revealed significant enhancement in insulin sensitivity by 15% ( $p=0.02$ ) in comparison to placebo furthermore pancreatic  $\beta$ -cell secretory capacity improved by 28% ( $p=0.01$ ) in overweight

middle-aged men who were at risk of developing the metabolic syndrome.<sup>12</sup>

An experimental study in Al-Mustansiriyah University, Baghdad where oleuropein was given to diabetic rabbits for a period of 16 weeks with a dose of 20 mg/kg body weight found that it inhibit hyperglycemia and oxidative stress induced by diabetes and propose that oleuropein might be useful in the prevention of diabetic complications associated with oxidative stress.<sup>16</sup>

The University of Grenada researchers conducted a study In rats with alloxan-induced diabetes, doses of 16 and 32 mg/kg had a significant hypoglycemic effect and an increased peripheral glucose uptake depending on the dose given.<sup>17</sup>

The majority of the participants in our study were females 60.3% (n=44), males represented 39.7% of the subjects (n=29). Mean age was 49 years with a range from 19-65. Mean level of BMI was  $30.46 \pm 5.548$ .

Descriptive analysis was done using statistical package for social sciences (SPSS17), mean and standard deviation of BG levels among studied group of each measurement each day before and after consuming olive leaves were determined, statistical significant difference between BG level before and after olive leaves intake was found on the third day of consuming olive leaves 1 hour after the meal ( $216.00 \pm 68.302$ ) (where P value =0.035) where in the control days Mean blood sugar level (mg/dl) in the third day 1 hour after meal was  $242.16 \pm 79.757$ . And the measurement in the third day 3 hours after the meal were  $210.74 \pm 79.617$  for the control day and Mean blood sugar level (mg/dl) after olive leaf intake  $188.99 \pm 59.739$  (where P value =0.064).

Previous literature suggests that blood glucose may be lowered by two mechanisms: (1) enhanced insulin release, and (2) amplified glucose uptake.<sup>18</sup>, and some animal studies showed that reducing starch digestion and absorption might facilitate the hypoglycemic effect of olive leaf extract.<sup>15</sup>

The potential health promoting effect of Olive leaf appear to be related to its antioxidant activity, which was found in previous literature to be beneficial in the prevention of diabetic complications associated with oxidative stress.

Our result was independent of lifestyle factors (such as dietary intakes and physical activity levels). Hence, the result of our study may have been stronger if we have instructed the participants to engage in regular physical activity and to consume a healthy diet.

At the end of the study the participants were asked to complete a symptom questionnaire regarding any unexpected side effects, the amount of olive leaves taken and if they were going to continue taking olive leaf.

There was no significant side effect to taking olive leaf; with only minority reporting hyperacidity 26% (n=19), diarrhea 14% (n=12), constipation 2.7% (n=2).

Other studies conducted even at higher concentration and when taken for longer periods showed also no side effects.<sup>15</sup>

Only 5% (n=4) of the participants didn't drink the whole cup with olive leaf while others took the whole 100ml amount with a 5 mg of olive leaf.

Despite these reported side effects and even though olive leaf had a very bitter taste yet the majority of participants (87.7%) reported that they would continue to drink olive leaves.

### **Conclusion and Recommendations:-**

Olive leaf extract may represent an effective therapy that normalizes glucose homeostasis in individuals with diabetes. Hypoglycemic effect of olive leaves was approved in the third day of use and minor side effects were reported, and the majority accepts this therapy.

Pharmaceuticals and drug companies should separate and investigate the impact of individual ingredients of olive leaves on blood glucose level with the objective of finding a safe, effective and cheap cure for diabetes. This could be a milestone in modern medicine.

However, more research into the possible hypoglycemic effects of olive leaf extract is needed before it can be recommended for use as a natural safe treatment. This could be a millstone in modern medicine.

### **Dedication and Acknowledgment:-**

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### **References:-**

1. Al-Nozha M. Al-Maatouq M. Al-Mazrou Y. Al-Harthi S. Arafah M. Khalil M, et al. Diabetes mellitus in Saudi Arabia. Saudi Med J 2004 Nov;25(11):1603-1610.
2. World Health Organization, Diabetes fact sheet N312, 2016. URL: <http://www.who.int/mediacentre/factsheets/fs312/en/> (Accessed on 3 November 2015).
3. Dawish A, Robert A, Braham R, Hayek A, Saeed A, Ahmed R, and Sabaan A. Diabetes Mellitus in Saudi Arabia: A review of the recent literature, Current diabetes review 2016;12(4):359-368.
4. International Diabetes Federation. Diabetes Atlas sixth edition 2013 Available at: [https://www.idf.org/sites/default/files/EN\\_6E\\_Atlas\\_Full\\_0.pdf](https://www.idf.org/sites/default/files/EN_6E_Atlas_Full_0.pdf) (Accessed: 3 November 2015).
5. The International Diabetes Federation, Saudi Arabia 2014 Available at: <https://www.idf.org/membership/mena/saudi-arabia> (Accessed: 2 September 2015).
6. World Health Organization. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: Diagnosis and classification of diabetes mellitus. Geneva, 1999.
7. Gurjeet S. Birdee, G. and Yeh, G. Complementary and Alternative Medicine Therapies for Diabetes: A Clinical Review. Clinical Diabetes 2010 Oct;28(4):147-155.
8. Kilham, C. The healing power of olive leaf. Fox News Health journal, Jan 2013. Available at: <http://www.foxnews.com/health/2013/01/23/healing-power-olive-leaf/> (Accessed: 1 September 2015).
9. Official Journal of the International Olive Council, Olive Jul 2014: 119.
10. Omar, S. Oleuropein in olive and its pharmacological effects. Scientia pharmaceutica, 2010 Apr-Jun; 78(2): 133-154.
11. Susalit, E., Agus, N., Effendi, I., Tjandrawinata, R., Nofiarny, D., Perrinjaquet-Moccetti, T et al. Olive (*Olea europaea*) leaf extract effective in patients with stage-1 hypertension: Comparison with Captopril. Phytomedicine international journal of phytotherapy and phytopharmacology, 2011 Feb 15;18(4):251-8.
12. De Bock M, Derraik, J, Brennan C, Biggs J, Morgan P, Hodgkinson S, et al. Olive (*Olea europaea* L.) leaf polyphenols improve insulin sensitivity in middle-aged overweight men: A randomized, placebo-controlled, crossover trial, PloS one 2013;8(3):e57622.
13. Kim J., Kwon C. and Son K. Inhibition of alpha-glucosidase and amylase by luteolin, a flavonoid, Bioscience, biotechnology, and biochemistry, 2000 Nov;64(11):2458-61.
14. WebMd. Is there a diabetes cure, 2005. Available at: <http://www.webmd.com/diabetes/guide/is-there-a-diabetes-cure> (Accessed: 26 November 2015).
15. Wainstein J, Ganz T, Boaz M, Dayan B, Dolev E, Kere, Z, et al. Olive leaf extract as a hypoglycemic agent in both human diabetic subjects and in rats, Journal of medicinal food, 2012 Jul;15(7):605-10.
16. Al-Azzawie, H. and Alhamdani. Hypoglycemic and antioxidant effect of oleuropein in alloxan-diabetic rabbits, Life sciences, 2006 Feb 16;78(12):1371-7.
17. Gonzalez, M., Zarzuelo, A., Gamez, M., Utrilla, M., Jimenez, J. and Osuna, I. Hypoglycemic activity of olive leaf, Plantamedica, 1992 Dec;58(6):513-5.
18. El, S. and Karakaya, S. Olive tree (*Olea europaea*) leaves: Potential beneficial effects on human health. Nutrition reviews, 2009 Nov;67(11):632-8.



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### RESEARCH ARTICLE

## CORONARY ARTERY DISEASE IN RHEUMATOID ARTHRITIS – PREVALENCE,PATHOPHYSIOLOGY,RISK AND TREATMENT

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### Abstract

Coronary Artery Disease (CAD), is a significant contributor morbidity and mortality in Rheumatoid Arthritis (RA).<sup>1</sup> Familiarity with the pathophysiology of coronary atherosclerosis will have important practical implications for patient care. Insights into the mechanisms of thrombosis will give further insight into the concomitant therapy used during acute revascularization.<sup>2</sup> The purpose of this review is thorough understanding of the connection between atherosclerosis and RA and stress in accurate risk stratification in RA patients and timely intervention to improve outcomes. The review also highlights comprehensive collaboration between Rheumatologist and cardiologist to help in prevention of cardiovascular diseases in RA patients and improve patient care in a total spectrum.

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### Introduction:-

Rheumatoid Arthritis (RA), is the most common autoimmune articular disease with systemic manifestations. It affects 2.1 million Americans and 1.5 million women. It is more common in females. The reduced life span of RA patients is possibly explained by the cardiovascular diseases.<sup>3</sup>

Coronary Artery Disease (CAD), is a significant contributor morbidity and mortality in RA.<sup>4</sup> Rheumatoid arthritis patients have increased risk of Myocardial Infarction. Hence aggressive interventional prevention strategies are implicated in RA patients with cardiovascular diseases.

There is a deep connection between CAD and RA. Thorough understanding of this connection will help in accurate risk stratification in RA patients and timely intervention will improve outcomes. Comprehensive collaboration between Rheumatologist and cardiologist will help in prevention of cardiovascular diseases in RA patients and will improve patient care in a total spectrum.

Atherosclerosis has inflammatory origin.<sup>5</sup> Similarity has been observed between pathology mechanism underlying in the synovium of joints of RA patients and endothelium of arteries in atherosclerosis. In both atherosclerosis and RA, there is infiltration of inflammatory cells, dysfunctioning of endothelial cells and synovial cells, smooth cell proliferation. The hallmark mechanism underlying both diseases is Inflammation.<sup>6</sup>

Chief contributors of atherosclerosis in RA are Endothelial dysfunction caused by immune complexes, antibody-mediated, cytokine-mediated, Autoantibodies, hypercoagulability, dyslipidemia. Other traditional

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risk factors of consideration are hypertension ,diabetes,raised body mass index ,hyperhomocystinemia. There is also association of the HLA-DRB1 gene with premature death, particularly from cardiovascular disease, in patients with rheumatoid arthritis.<sup>7</sup>

Previously,our understanding of atherosclerosis was different as it is today .Earlier it was considered a cholesterol storage disease ,but now our understanding about its pathophysiology has remarkably evolved and now its considered an inflammatory disease .CAD causes stenosis hence need of revascularization to relieve ischemia..Besides treatment of stenosis through revascularization ,aggressive management of modifiable risk factors is also important .Disrupted plaques are the stimulus for thrombosis .Its a solid state stimulus .Changes in levels of circulating prothrombotic or antifibrinolytic mediators in blood predispose to acute coronary syndrome .Widespread inflammation and multiple high risk plaques predispose to ACS ,ACS is no more a localized or segmental disease .The goal of treatment should be treating early lesions and stabilizing other plaques to prevent recurrent events in the future .Treatment of stenosis should include mechanical revascularization and further preventive interventions to prevent future events.<sup>8-10</sup>

## Discussion:-

### Pathophysiology of chronic cad:-

Atherogenesis is a complex interaction of risk factors ,cells of the arterial wall and inflammatory mediators and proinflammatory cytokines .Inflammation plays role in all stages of atherosclerosis<sup>1</sup>

Inflammation also plays role in blood vessel ,cardiac and systemic complications of atherosclerosis .

The chief key players involved in the pathomechanisms are circulating cytokines,tissue necrosis factor alpha.,INFgamma,interleukin 1 ,interleukin 6,hyperhomocysteinemia,ESR,CRP .

Endothelial dysfunction first marks the first step of atherosclerosis.<sup>11</sup>It is the earliest event that signals the beginning of atherosclerosis.Exposure of arterial endothelium to proinflammatory cytokines derived from excess adipose tissue ,products of glycooxidation associated with hyperglycemia ,vasoconstrictor hormones in hypertension,dyslipidemia and bacterial products ,leads to expression of adhesion molecules .<sup>12</sup>These adhesion molecules allow blood leukocytes to stick to the inner surface of the arterial wall .Next step is the transmigration of the adherent leukocytes .The leukocytes reside in the intima and communicate with the endothelial cells and smooth muscle cells .<sup>12</sup>Mediators of inflammation that are involved in this process are prostanoids ,leukotrienes ,histamine cytokines,protein mediators and complement components .<sup>14,16</sup>As a next sequel ,SMC s migrate from the tunica media to the intima .These secrete extracellular matrix .,SMC ,endothelial cells and monocytes secrete MMP in response to hemodynamic stresses .MMP s play vital role in regulating functions of vascular cells ,angiogenesis,healing ,destruction of extracellular matrix of arteries.Proteoglycans of extracellular matrix binds to lipoproteins ,prolong their residence in the intima ,render them susceptible to glycation and oxidative modifications .Lipoprotein modification gives products such as oxidized phospholipids and advanced glycation end products .They propagate inflammatory response .Next step of progression is the calcification and the bone formation .<sup>15</sup>There is both proliferation and death of lipid laden macrophages .The extracellular lipid coalesce in the intima and form lipid rich necrotic core of atherosclerotic plaque .

The atherosclerotic lesion grows outward rather than inward .Thus stenosis is the last stage of atherosclerosis .By the time stenosis is diagnosed and treated ,atherosclerosis already had a widespread and diffuse distribution .Thus the prevalence of atherosclerosis is still underscored and underdiagnosed specially in adolescent and young adult Americans .<sup>17</sup>

Complications in plaques like disruption of plaque, superficial erosion ,intraplaque hemorrhage and erosion of calcified nodule account for all acute coronary thromboses.Disrupted plaques lead to thrombosis .When the plaque disrupts ,collagen is exposed and this exposed collagen in the extracellular matrix triggers platelet activation .Smooth muscle cells and macrophages secrete TF and it activates the coagulation cascade .Thus disrupted plaque is a stimulus to both thrombosis and coagulation .Thrombin amplifies platelet activation .Fibrinogen is converted to fibrin .Activated platelets release vWF.vWF helps in the formation of white arterial thrombus which is a dense mesh of fibrin network in which platelets are entrapped.This is the solid state of the disrupted plaque .In addition to this we have the fluid phase also which predisposes to coronary thrombosis .Raised levels of plasminogen activator

inhibitor -1, specially in diabetes, obesity and hypertensive patients is responsible for fluid phase changes. Disrupted plaque secrete particulate TF which increase thrombogenicity of blood.<sup>18-19</sup>

Plaques with thin fibrous cap and a large lipid core with numerous inflammatory cells and few SMCs are prone to rupture. These are high risk plaques. Patients with high risk plaques and wide spread inflammation are prone to acute coronary syndrome. Plaques with outward remodeling lead to hidden lesions that lack angiographic detection but harbor a substantial burden of atherosclerosis. They do not cause symptoms nor do they cause ischemia. Myeloperoxidase is a marker of inflammation and is raised in ischemia. Diffuse arterial inflammation is responsible for focal lesions and clinical presentations

### Signs and symptoms:-

The key clinical manifestations of CAD are stable angina pectoris, unstable angina pectoris, MI. Chest discomfort is the first symptomatic episode.<sup>20</sup> Sometimes the first coronary artery diagnostic presentation is acute plaque rupture or acute myocardial infarction. Cardiac dysrhythmias represent underlying electrical instability. Angina pectoris is a cardinal symptom developed due to inadequate oxygen supply to the myocardium. Cardinal angina symptoms are discomfort in arm, throat, jaw, exertional fatigue, shortness of breath, heartburn. Angina Pectoris is said to be stable when its pattern of duration, intensity, frequency are not changed over time. Administration of sublingual nitroglycerin can help to differentiate stable and accelerating pattern.

Accelerating Angina shows a change in pattern of stable Angina. Easy provocation, more prolonged episodes, more intensity, longer recovery and more often use of nitroglycerin. It's a transitioning stage from stable to unstable angina. Transition from Stable Angina to accelerating pattern warrants medical attention.

Unstable Angina, pattern of chest discomfort changes abruptly. Chest pain at rest, increase in frequency, discomfort with minimal activity. Unstable Angina occurs when there is sudden rupture of atherosclerotic plaque or abnormal occlusion of coronary artery. MI follows as a sequelae of unstable angina. Immediate medical attention is warranted.

Clinical symptoms pertaining to metabolic syndrome should also be evaluated and be a part of work up plan.<sup>21</sup>

### Diagnosis:-

Key diagnostic approach is detail patient history, through physical examination, EKG, laboratory blood tests, stress test and cardiac catheterization. Imaging methods help to assess the regional myocardial perfusion and function. New imaging technologies that provide risk of progression and further cardiovascular events are optical coherence tomography, thermography, Infrared spectroscopy, electron beam computed tomography, MRI.<sup>22</sup>

### Treatment:-

The aim of treatment is to reduce myocardial oxygen requirements and increase the myocardial blood flow. Medications that reduce oxygen requirements are nitroglycerin, nitrates, Beta blockers and calcium channel blockers. Revascularization procedures thrive on the concept of restoring forward coronary artery blood flow. New procedures of revascularization include arteriogenesis stimulation by cells, protein and gene. Besides treatment of flow limiting lesions, non obstructive plaques should also be addressed. Angiography helps to assess the severity of lesions. Ischemia is the end result of dynamic obstruction superimposed on fixed stenosis. Sudden rapid progression of the lesion leads to poor prognosis. Fixed stenosis progress in sudden spurts.<sup>23</sup> There is discontinuous progression of plaques. Sudden increase in the severity of the obstruction is due to episodes plaque disruption, thrombosis and healing. Revascularization procedures relieve ischemia but do not protect against future acute thrombotic events. Modification of risk factors delay disease progression. Thus for atherosclerotic patients combination of treatment strategies are used, revascularization procedures, lifestyle modifications and pharmacological measures. Modification of risk factors include –reduction in blood pressure, reduction in LDL, smoking cessation. Diabetes Mellitus, Metabolic syndrome lead to adverse lipid profile and dyslipidemia leading to CVD events.<sup>24</sup>

Primary prevention of cardiovascular disease is lifestyle modification. The heart protection study promotes the use of statins in individuals with total cholesterol >135 mg/dl and with traditional risk factors. The physician's health study, showed aspirin significantly reduces MI in men aged 40-80 yrs.<sup>20</sup> EUROPA study showed that ACE inhibitor significantly reduce CVS events. Besides pharmacological therapies, lifestyle modification carry equal importance. Biomarkers linked to inflammation have been studied and it was found that they predict coronary events better than traditional risk factors.<sup>24</sup> These markers include acute phase reactants, cytokines, MMPs. Patients with elevated CRP

at baseline are benefited most by aspirin and statin therapy in primary prevention trials .They reduce CRP and other markers of inflammation .This supports the beneficial use of anti-inflammatory in atherosclerosis.<sup>25</sup>

Bypass surgery and percutaneous revascularization treat localized segmental disease .The goal of treatment should be to restrict thrombosis and embolism both ,maintain perfusion and limit loss of cardiomyocytes..Severe ischemia leads to ST-T segment abnormalities and release of troponin T or I .These are signs of poor prognosis .Aggressive management should include platelet inhibition ,inhibition of thrombin generation revascularization of culprit lesions .This approach will improve outcome in high risk patients.Best combination recommended for high risk patients is oral aspirin ,clopidogrel and intravenous glycoproteinIIb/IIIa during angioplasty during angioplasty .<sup>26</sup>

Through understanding of pathophysiology of ACS will help to reduce plaque atherogenicity ,achieve rapid control of disease process,prevent future recurrences.Use of statins helps to prevent recurrences of ACS in the future by reducing cholesterol levels and by anti-inflammatory actions.COX-2 inhibitors also retard atherosclerosis

Management of ACS should aim to stabilize lesions .Stabilization of lesions reduce recurrent events .Systemic factors that cause plaque disruption should be adequately controlled ..Statins by affecting the biology of the plaque reduce recurrent coronary events.<sup>55</sup>Inflammation underlies the mechanism of plaque formation hence anti inflammatory will have beneficial effects <sup>56</sup>.Statins reduce CRP levels ,hence improve outcomes in ACS .

Prime aim of treatment should be to stabilize lesions and control all systemic factors adequately that leads thrombotic complications of atherosclerosis .Both size of the plaque and composition of the plaque decides future complications .Larger plaques cause stenosis and ischemia .Smaller plaques could grow oblong towards the outer wall and can be silent killers and cannot be detected on the angiogram. Sturdier extracellular matrix skeleton are less likely to rupture and less likely to trigger clot formation .

### Conclusions:-

Our understanding about CAD has significantly changes in the last few decades .Now atherosclerosis is not merely just a cholesterol storage disease but its more of an inflammatory disease .Familiarity with the pathophysiology of coronary atherosclerosis will have important practical implications for patient care .Insights in to the mechanisms of thrombosis will give further insight into the concomitant therapy used during acute revascularization .Therapies should be individualized based on patient's specific characteristics..Preventive therapy should be emphasized in more efficient and cost effective manner.LDL should be targetized to reduce risk of atherosclerotic complications.Lifestyle modifications with drug treatments should be used patients with obesity,metabolic syndrome and diabetes.

### References:-

1. Solomon DH, Karlson EW, Rimm EB, et al: Cardiovascular morbidity and mortality in women diagnosed with rheumatoid arthritis. *Circulation* 2003;107:1303-1307.
2. Edwards CJ, Syddall H, Goswami R, et al: The autoantibody rheumatoid factor may be an independent risk factor for ischaemic heart disease in men. *Heart* 2007;93(10):1263-1267.
3. Heliövaara M, Aho K, Knekt P, et al: Rheumatoid factor, chronic arthritis and mortality. *Ann Rheum Dis* 1995;54(10):811-814.
4. Wallberg-Jonsson S, Ohman ML, Dahlqvist SR: Cardiovascular morbidity and mortality in patients with seropositive rheumatoid arthritis in Northern Sweden. *J Rheumatol* 1997;24:445-451.
5. Libby P: Inflammation in atherosclerosis. *Nature* 2002;420(6917):868-874.
6. Jawien J: New insights into immunological aspects of atherosclerosis. *Pol Arch Med Wewn* 2008;118(3):127-131.
7. Farragher TM, Goodson NJ, Naseem H, et al: Association of the HLA-DRB1 gene with premature death, particularly from cardiovascular disease, in patients with rheumatoid arthritis and inflammatory polyarthritis. *Arthritis Rheum* 2008;58(2):359-369.
8. Harvey EJ, Ramji DP: Interferon-gamma and atherosclerosis: Pro- or anti-atherogenic? *Cardiovasc Res* 2005;67(1):11-20
9. Shah PK: Role of inflammation and metalloproteinases in plaque disruption and thrombosis. *Vasc Med* 1998;3(3):199-206.

10. Aubry MC, Riehle DL, Edwards WD, et al: B-Lymphocytes in plaque and adventitia of coronary arteries in two patients with rheumatoid arthritis and coronary atherosclerosis: Preliminary observations. *CardiovascPathol* 2004;13(4):233-236.
11. Pober JS: Effects of tumour necrosis factor and related cytokines on vascular endothelial cells. *Ciba Found Symp* 1987;131:170-184.
12. Pasceri V, Willerson JT, Yeh ET: Direct proinflammatory effect of C-reactive protein on human endothelial cells. *Circulation* 2000; 102(18):2165-2168.
13. Aziz M, Yadav KS. Atherosclerosis: An extra articular Manifestation of Rheumatoid Arthritis *AnnClin Lab Res.* 2016, 4: 4.
14. Aziz M, Yadav KS (2016) Role of Traditional Risk Factors, Inflammation and DMARDs in Cardiovascular Diseases in Rheumatoid Arthritis and Management of Lipid profile *J Autoimmune Disord* 2: 3. doi: 10.21767/2471-8513.100026
15. Aziz M, Yadav KS. Pathogenesis of Atherosclerosis. *Med Clin Rev.* 2016, 2:3.
16. Chung CP, Oeser A, Solus JF, et al: Inflammation-associated insulin resistance: Differential effects in rheumatoid arthritis and systemic lupus erythematosus define potential mechanisms. *Arthritis Rheum* 2008;58(7):2105-2112.
17. Yalamanchili K, Aronow WS, Kilaru R, et al: Coronary artery disease is more severe in older persons with rheumatoid arthritis than in older persons without rheumatoid arthritis. *Cardiol Rev* 2006;14(2):55-56.
18. Turesson C, McClelland RL, Christianson TJ, Matteson EL: Severe extra-articular disease manifestations are associated with an increased risk of first ever cardiovascular events in patients with rheumatoid arthritis. *Ann Rheum Dis* 2007;66(1):70-75.
19. Aubry MC, Maradit-Kremers H, Reinalda MS, et al: Differences in atherosclerotic coronary heart disease between subjects with and without rheumatoid arthritis. *J Rheumatol* 2007;34(5):937-942.
20. Asanuma Y, Chung CP, Oeser A, et al: Serum osteoprotegerin is increased and independently associated with coronary-artery atherosclerosis in patients with rheumatoid arthritis. *Atherosclerosis* 2007;195(2):e135-e141.
21. Chung CP, Oeser A, Solus JF, et al: Prevalence of the metabolic syndrome is increased in rheumatoid arthritis and is associated with coronary atherosclerosis. *Atherosclerosis* 2008;196(2):756-763.
22. Omland T, Ueland T, Jansson AM, et al: Circulating osteoprotegerin levels and long-term prognosis in patients with acute coronary syndromes. *J Am CollCardiol* 2008;51(6):627-633.
23. Kao AH, Krishnaswami S, Cunningham A, et al: Subclinical coronary artery calcification and relationship to disease duration in women with rheumatoid arthritis. *J Rheumatol* 2008;35(1):61-69.
24. Dessein PH, Norton GR, Woodiwiss AJ, et al: Influence of nonclassical cardiovascular risk factors on the accuracy of predicting subclinical atherosclerosis in rheumatoid arthritis. *J Rheumatol* 2007;34(5):943-951.
25. Avalos I, Chung CP, Oeser A, et al: Increased augmentation index in rheumatoid arthritis and its relationship to coronary artery atherosclerosis. *J Rheumatol* 2007;34(12):2388-2394.
26. Ciftci O, Yilmaz S, Topcu S, et al: Impaired coronary microvascular function and increased intima-media thickness in rheumatoid arthritis. *Atherosclerosis* 2008;198(2):332-337.



### RESEARCH ARTICLE

## ENDOTHELIAL DYSFUNCTION IN RHEUMATOID ARTHRITIS-ROLE OF SYSTEMIC INFLAMMATION, TRADITIONAL CVD RISK FACTORS IN ENDOTHELIAL DYSFUNCTION IN RHEUMATOID ARTHRITIS

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### Abstract

Rheumatoid Arthritis (RA), is a inflammatory joint disease of chronic nature with predominant articular symptoms of pain ,swelling and stiffness. The most common extraarticular manifestation is cardiovascular disease which accounts for 50 % mortality in RA patients . Complex interplay between traditional CVD risk factors ,systemic inflammation and vascular function in RA are the reasons behind the scene worse outcome in RA patients .5

The MCC of mortality in Rheumatoid Arthritis patients is cardiovascular disease .1,2 Endothelial dysfunction is directly related to RA associated systemic inflammation

The aim of the review is to discuss Endothelium ,its morphology and normal physiology ,consider endothelial dysfunction (ED ) in RA patients and relate endothelial dysfunction to systemic inflammation and traditional CVD risk factors and also consider the effect of drugs on vascular function.

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### Introduction:-

Rheumatoid Arthritis (RA), is a inflammatory joint disease of chronic nature with predominant articular symptoms of pain ,swelling and stiffness. 1RA patients have extra articular manifestations ,the most common is cardiovascular disease which accounts for 50 % mortality in RA patients .1,2RA patients have a worse outcome not from joint disease but due acute CVD events3,4.Complex interplay between traditional CVD risk factors ,systemic inflammation and vascular function in RA are the reasons behind the scene worse outcome in RA patients .5,6,7

The MCC of mortality in Rheumatoid Arthritis patients is cardiovascular disease .1,2 Endothelial dysfunction (ED) is directly related to RA associated systemic inflammation .8 RA patients ED in both microvasculature and microvasculature.9,10Anti inflammatory medications improve endothelial function 9,10

The aim of this review is -To discuss Endothelium ,its morphology and normal physiology ,consider endothelial dysfunction in RA patients and relate endothelial dysfunction (ED ) to systemic inflammation and traditional CVD risk factors and also consider the effect of drugs on vascular function.

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## Discussion:-

### Endothelium and its role:-

Endothelium is a dynamic organ that lines the entire blood vessel system and acts as a barrier between blood and vessel wall. <sup>11</sup> Endothelium responds to hormones, neurotransmitters and vasoactive factors. It controls vascular functions like vasomotion, thrombosis, platelet aggregation and inflammation, fibrinolysis, coagulation, vascular growth, vasoregulation, vasoprotection. Vasoactive factors balance is important for atheroprotection. Damaged endothelium disrupts this balance. This imbalance causes endothelial dysfunction which is a precursor for atherosclerosis. <sup>12</sup>

Endothelial cells line the inner wall of the vessels and are located in the intima. Endothelial cells in arteries and veins are more thicker and continuous while in capillaries they are thinner and fenestrated to allow exchange of gases and metabolites. <sup>14</sup> Endothelial cells responses are varied in different vascular beds and different sections of the same vascular bed. Endothelial dysfunction marks the start of atherosclerosis.

Blood vessels are the main link between the heart and tissues. The vascular wall has three layers-tunica intima, media and externa. Intima is the inner layer made of endothelial cells and is responsive to hormones and vasoactive factors. The tunica media is a thick layer made of smooth muscle cells, collagen, elastic tissue. This layer is responsible for vasoconstriction and vasi dilation and gives vessel structural integrity. Tunica externa made up of loose connective tissue which adheres vessels to the surrounding organs.

Endothelium releases vasoactive factors. Vasodilators such as nitric oxide (NO), Prostacyclin (PGI<sub>2</sub>) and endothelium derived hyperpolarizing factor (EDHF). Vasoconstrictors such as thromboxane (TXA<sub>2</sub>) and endothelin-1 (ET-1).

### Vasodilator (NO) and underlying mechanism of vasodilation:-

Nitric Oxide (NO) is released by the endothelial cells and causes vasodilation of the smooth muscle cells of the tunica media. It was first identified by Furchgott and Zawadzki <sup>15</sup>. It also plays role in maintaining the basal vasodilator tone of the blood vessels <sup>16</sup>. L arginine, amino acid is converted to NO by the nitric oxide synthase (NOS). NOS exists in 3 isoforms –Neuronal isoform (n-NOS) acts as a neuronal messenger regulates synaptic neurotransmitter release. Inducible isoform only expressed in cells exposed to injurious stimuli. Endothelial NOS e-NOS produces nitric oxide in the vasculature. Blood vessel dialation is more dependent on e-NOS. Inactive eNOS is located in small invaginations in the cell membrane called caveolae. The inactive form is bound to protein caveolin. <sup>17</sup>

NO Agonists like bradykinin, acetylcholine, ATP, ADP, Acetylcholine, substance P, thrombin, <sup>18</sup>. NO agonists release Ca<sup>2+</sup> from the endoplasmic reticulum. When intracellular levels of Ca<sup>2+</sup> increase, eNOS detaches from caveolin and is activated. Once intracellular calcium is depleted, a signal sent to membrane receptors open Ca<sup>2+</sup> channels allowing extracellular calcium into the cell. This process is called capacitative Ca<sup>2+</sup> entry. Ca<sup>2+</sup> attaches to protein calmodulin in the cytoplasm of the cell, it undergoes structural changes and bind to eNOS and then eNOS convert L arginine to NO. Hence its well evident that NO production is dependent on intracellular Ca<sup>2+</sup> sores and extracellular calcium. When Ca<sup>2+</sup> levels decrease it causes calcium-calmodulin complex to dissociate from eNOS, which in turn binds with caveolin and becomes inactivated again. Release of NO relies on intracellular Ca<sup>2+</sup>.

Shear stress, by the action of protein kinases causes eNOS phosphorylation and increases NO production. Shear stress allow transfer of blood borne agonists to attach to endothelial cell receptors and stimulate them and increase intracellular Ca<sup>2+</sup>. Shear stress also activates specialized Ca<sup>2+</sup> activated K<sup>+</sup> channels on the endothelial cell surface causing K<sup>+</sup> efflux and Ca<sup>2+</sup> influx into the cells. Duration of shear stress determines the proportion of contribution from Ca<sup>2+</sup> and eNOS phosphorylation to NO production. NO production in short duration shear stress depends on intracellular Ca<sup>2+</sup> and in long duration shear stress, it depends on eNOS phosphorylation.

Once NO is synthesized in the endothelial cells, it diffuses across the endothelial cell into the adjacent smooth muscle cells and bind to the enzyme soluble guanylyl cyclase. This activated enzyme convert GTP to CGMP. This decreases smooth muscle contraction and also CGMP reduces Ca<sup>2+</sup> release from sarcoplasmic reticulum. Both these actions reduce smooth muscle contraction. NO is responsible for resting vasodilator tone.

Other functions of NO are –prevent platelet activation, leukocyte activation and also prevent adhesion to the vessel wall. Endothelial damage initiates inflammatory cascade. It begins with recruitment of leukocytes at the damaged site.

#### **Role of PGI-2 and TXA<sub>2</sub> in regulation of vascular function:-**

PGI-2 and TXA<sub>2</sub> regulate vascular function. They are produced by COX enzymes. COX-1 is expressed in endothelial cells and COX-2 is expressed when endothelium gets damaged and is exposed to inflammatory cytokines.

Arachidonic acid is converted to PGH<sub>2</sub> by COX-2, which is converted to PGI<sub>2</sub> by prostacyclin synthase. PGI<sub>2</sub> binds to prostacyclin receptors located on platelets and vascular smooth muscle cells. Activation of platelet IP receptors lead to inhibition of platelet aggregation. PGI<sub>2</sub> binds to prostacyclin receptors on vascular smooth muscle cells activate adenylate cyclase and induce synthesis of cAMP. cAMP then activates protein kinase A and causes smooth muscle relaxation. Thus both NO and PGI<sub>2</sub> are responsible for dilation of blood vessel.

TXA<sub>2</sub> is responsible for platelet aggregation and vasoconstriction. Arachidonic acid is converted to PGH<sub>2</sub> by COX-1, after which TXA<sub>2</sub> is formed by thromboxane synthase. TXA<sub>2</sub> acts on thromboxane –prostanoid receptors located on platelets and cause their activation and cause platelet aggregation. TXA<sub>2</sub> acts on thromboxane –prostanoid receptors located on vascular smooth muscle cells, activate phospholipase C. This causes increase in intracellular Ca<sup>2+</sup> levels in the smooth muscle cells causing vasoconstriction. Balance in levels of PGI<sub>2</sub> and TXA<sub>2</sub> maintain homeostasis in the healthy vessel.

Endothelial dysfunction (ED) marks the initial stage in atherosclerosis. It's a good prognostic marker of future cardiac events in patients with CVD. Drugs used in CVD diseases such as anti hypertensives and statins have beneficial effect on endothelial function by decreasing oxidative stress and lipid accumulation.

Endothelium is atheroprotective and ED leads to atherosclerotic lesion formation and subsequently to cardiac events.

#### **Techniques to assess endothelial function:-**

Endothelial function are most commonly assessed in the peripheral circulation and it helps in assessing the endothelial function in the coronary arteries. Patients who have established CVD or at risk of CVD assessment of endothelial function is a good predictor of future cardiac events. Assessment involves measurement of dilation in response to stimulus. Impaired vasodilation is indicative of poor endothelial function. Assessments of microvascular endothelial function can be done with LDI with iontophoresis, and assessments of macrovascular endothelial function using FMD with Doppler Ultrasound [19,20-22].

**Iontophoresis**–The assessment of NO bioavailability in the microvasculature is conducted using Iontophoresis.

**Forearm blood flow and venous occlusion Plethysmography** –Assesses Endothelial function of the forearm resistance vessels

**Nailfoldcapillaroscopy**– helps to assess capillary morphology. It helps to diagnose changes in size of capillaries, changes in numbers and also structural impairments.

**Flow Mediated Dilatation (FMD)** –FMD, checks NO bioavailability, it quantifies dilation.

**Strain gauge plethysmography**–Another method to quantify dilation.

**Pulse wave analysis and Pulse wave velocity** –evaluate coronary microvascular endothelial function. It also assesses arterial stiffness from the peripheral circulation. PWA is the single measurement of radial artery pressure waveforms.

**Carotid intima –media thickness** –Carotid intima –media thickness is assessed by B mode ultrasound. It detects thickening of the medial layer of the vascular wall. It helps to predict cardiac events in patients of early atherosclerosis and also restenosis in patients who undergone PCI.



Overall IMT is increased in RA patients as compared to the healthy controls . Longitudinal assessment of ESR and CRP revealed CRP was related to IMT ,but not to ESR .Hence more research is needed to determine why CRP is related to IMT and not ESR.

#### **Endothelial dysfunction in ra:-**

Endothelium plays vital role in homeostasis and prevention of atherosclerosis .Turbulence leads to ED and if left untreated leads to atherosclerosis and cardiac sequele.

There is substantial evidence to support the fact that there is ED in RA ,a precursor to cause atherosclerosis as a sequele. 23,24Therefore assessment of ED in RA patients with traditional risk factors is vital to identify vascular abnormalities and plan strategies to improvise endothelial function and lower CVD risk 61

*Cardiovascular diseases contribute a major cause of mortality in Rheumatoid Arthritis patients.* 1,2.Inflammation and severity of RA are the major determinants of ED in RA patients. 27 There is also evidence that high grade inflammation associated with RA induces accelerated atherosclerosis 28,30

.As compared to healthy control group ,RA patients have poorer endothelial function in both the microvasculature and the macrovasculature 31-35.Anti-inflammatory agents improve endothelial function in different vascular beds 32, highlighting the role of inflammation on the vasculature in RA .

The pathogenesis mechanisms behind articular inflammatory process in RA and the inflammatory process in blood vessels of atherosclerotic CVD are similar.Also raised levels of inflammatory mediators ( CRP,IL-6,TNF –ALPHA ) are seen in both the conditions ,so it has been speculated that RA disease related inflammation might contribute to accelerated atherosclerosis.28These proinflammatory molecules promote endothelial dysfunction (ED). In RA both microvascular and macrovascular endothelial functions are affected Adequate control of disease activity and inflammation in RA patients can lead to improvements of CVD outcomes in RA patients.36.Non invasive assessments of vascular function and structure in RA patients will help in screening these patients at an earlier stage and plan a management .

.Inflammation is evaluated by measuring CRP ,ESR . CRP is directly linked to arterial stiffness and vascular dysfunction .37,38 The acute phase response is attributed to TNF-ALPHA and IL-6.

There is a noted trend for an association between microvascular endothelial-dependent function and CRP. Continuous long-term high levels of inflammation play vital role in ED in RA.CRP duration is a better predictor of ED in RA than current CRP and ESR levels .ESR/CRP duration affect arterial stiffness39-40 and so is for cIMT41-43

Disease activity and x ray scores are used to assess disease state and response to treatment .Hingori et al 44proved direct proportionality between high levels of disease-relatedinflammation at the time of the assessments may have contributed to the impairments in endothelial function. acute inflammation can result intransient impairments in endothelial function 44.Disease duration has a lesser influence on endothelial function than current disease-related inflammation.45,46.The link between inflammation and vascular function was demonstrated in RA patients without established CVD disease ,47.Vascular function is progressively affected in course of RA .Patients with long disease duration of RA have significantly impaired endothelial function .Long term inflammatory burden associated with vascular function 49 In the context of RA, various disease related parameters may exert differential effects in different sized vessels .In RA ,systemic inflammation has significant impact on the vasculature and is a significant contributor of atherosclerosis.

Both of RA disease duration and greater frequency of inflammatory fluctuations which could impact on endothelial function. It is possible that cyclical fluctuations of high and low disease activity which could acutely impact on the vasculature 50 could be more critical than disease duration on impacting endothelial function.

However, cIMT has been reported to be associated with disease duration 52 and represents a later stage of atherosclerosis .There is evidence that structural defects in the vessel as determined by carotid intima-media thickness are present in patients newly diagnosed with RA 51

Radiographic damage using sharp score is a marker of inflammatory activity in the joints was found related to arterial stiffness. They provide better reflection of burden of RA

CVD risk factors such as ageing, smoking, hypertension, dyslipidemia cause arterial stiffness. CVD risk factors are known to impair endothelial function in the general population. Their contribution to impairments in endothelial function in RA is worth exploration. Global CVD risk was greater in the RA patients. Role of traditional risk factors in the context of systemic inflammation as key players of impairing endothelial function in RA requires further exploration. Inflammation has been reported to independently contribute to CVD [13].

Stiffening is caused due to a reduction in NO production from endothelial cells, loss of smooth muscle tone, degeneration of elastin fibres, increased collagen deposition in the vascular wall. Morphological changes in the vasculature cause arterial stiffness and affects the function of the blood vessels.

Arterial stiffness is increased in RA compared to control group. Inflammatory burden, ESR, joint assessment and physician global assessment are predictive of arterial stiffness. [39] Further, ESR was only found to associate with cIMT in the presence of classical CVD risk factors.

Further analysis revealed that age was the main contributor for these associations, and most likely accounted for the higher FRS and TC SCORE in RA patients relative to healthy controls. A limitation of global CVD risk is that they only incorporate classical CVD risk factors. It should include inflammation as a factor also. [13]. It has also been suggested that incorporating coronary artery calcification into the FRS algorithm would increase the accuracy of estimating future risk of CVD, as high FRS score independently associates with coronary artery calcification in RA [53].

Microvessels because of their widespread area and large proportion have greater exposure to injurious stimuli. Small changes in global CVD risk could have a greater effect on microvascular endothelial-dependent function. Microvascular dysfunction is common in diabetes and hypertension and may even contribute to the development of macrovascular disease [54]. Hence assessments which examine both vascular beds may provide more meaningful clinical information on vascular risk in RA.

High disease-related inflammation and inflammatory fluctuations both have significant affect on microvascular and macrovascular endothelial function in patients with RA. ED is also dependent on FRS, metabolic syndrome, parameters of insulin resistance, SBP, presence of high cholesterol and hypertension as well as the total number of CVD risk factors. CVD risk factors may differentially affect endothelial cell and smooth muscle function. [56, 57] and cause smooth muscle dysfunction. [74, 75]

In RA patients which reported that components of the metabolic syndrome such as insulin resistance, were strongly associated with cIMT. These metabolic parameters cause ED and lead to carotid atherosclerosis subsequently Carotis atherosclerosis is calibrated by measurement of cIMT.

Besides disease-related inflammation and individual classical CVD risk factors, other RA specific factors such as physical inactivity [58], rheumatoid cachexia [59] and genes [60] that may also affect endothelial function in RA. Hence further research is needed to identify other RA specific factors

#### **Targeting Different Inflammatory Pathways:-**

Treatment of RA with disease-modifying anti-rheumatic agents (DMARDs) such as methotrexate exert beneficial effects both in terms of RA disease progression as well as CVD risk factors, endothelial function and eventual CVD outcome [61, 62]

However, in patients who are DMARDs non responders, biologic agents such as the anti-TNF- $\alpha$ , anti-IL6 receptor, anti-CD20 and selective co-stimulation modulators are often used. These agents target different pathways of inflammation, and hence improvements are seen in RA symptoms and endothelial. [63-65] These medications by affecting inflammatory pathways, thus effect the CVD outcomes in RA patients.

#### **Conclusion:-**

Rheumatoid Arthritis patients have impaired vascular function and structure. A correlation between RA and accelerated atherosclerosis has been well established [24]

A number of studies have reported impaired microvascular endothelial function in the coronary circulation of RA patients 66-68 which can be reversed with anti-inflammatory therapy 66,67

In RA patients, both RA disease-related inflammation and classical CVD risk factors have a greater impact than on the vasculature. High grade inflammation in RA is the cause of accelerated atherosclerosis 30. This fact become more evident with a number of studies that have reported impaired microvascular endothelial function in the coronary circulation of RA patients 67,68, which can be reversed with anti-inflammatory therapy 66,67

There is differential impact on microvascular and macrovascular endothelial function. Several studies in patients suspected of CVD and those with established CVD report that poor microvascular and macrovascular endothelial function at baseline are good predictors of atherosclerotic progression and future cardiac events 70,71

Assessment of endothelial dysfunction in Rheumatoid Arthritis patients with CVD risk patients will help to identify vascular abnormalities and help to plan a management with strategies and interventions that can improve endothelial function and cut down CVD risk.

More research is needed to confirm whether CVD risk factors affect vascular function and to determine parameters to predict long-term CV outcomes in RA.

#### **Future Research:-**

Few studies have analyzed the effect of traditional CVD risk factors on endothelial function in RA 72,73. More research is required to explore the interplay of traditional risk factors and endothelial function in RA patients. We have ample evidence for ED in RA patients but its correlation to disease activity and synergist role of traditional CVD risk factors still has to be explored further.

Longitudinal studies are required to examine the concept of accelerated atherosclerosis. Studies are needed to assess the effect of fluctuations in disease activity on vascular changes over time. High levels of IMT are predictive of cardiac events in RA. Vascular functions are predictive for cardiovascular events but detailed longitudinal studies are further required. Once the causes of ED are clear, interventions can be developed to improve vascular function and structure in RA.

#### **Reference List:-**

1. Kitas GD, Erb N. Tackling ischaemic heart disease in rheumatoid arthritis. *Rheumatology (Oxford)* 2003; 42(5):607-13.
2. DeMaria AN. Relative risk of cardiovascular events in patients with rheumatoid arthritis. *American Journal of Cardiology* 2002; 89 (suppl):33D-8D.
3. Goodson NJ, Wiles NJ, Lunt M, Barrett EM, Silman AJ, Symmons DP. Mortality in early inflammatory polyarthritis: cardiovascular mortality is increased in seropositive patients. *Arthritis Rheum* 2002; 46(8):2010-9.
4. Wallberg-Jonsson S, Johansson H, Ohman ML, Rantapaa-Dahlqvist S. Extent of inflammation predicts cardiovascular disease and overall mortality in seropositive rheumatoid arthritis. A retrospective cohort study from disease onset. *J Rheumatol* 1999; 26(12):2562-71. 175
5. Del Rincon I, Freeman GL, Haas RW, O'Leary DH, Escalante A. Relative contribution of cardiovascular risk factors and rheumatoid arthritis clinical manifestations to atherosclerosis. *Arthritis Rheum* 2005; 52(11):3413-23.
6. Stevens RJ, Douglas KM, Saratzis AN, Kitas GD. Inflammation and atherosclerosis in rheumatoid arthritis. *Expert Rev Mol Med* 2005; 7(7):1-24. 180
7. Bacon PA, Stevens RJ, Carruthers DM, Young SP, Kitas GD. Accelerated atherogenesis in autoimmune rheumatic diseases. *Autoimmun Rev* 2002; 1(6):338-47.
8. Cleland SJ, Sattar N, Petrie JR, Forouhi NG, Elliott HL, Connell JM. Endothelial dysfunction as a possible link between C-reactive protein levels and cardiovascular disease. *ClinSci (Lond)* 2000; 98(5):531-5.
9. Hurlimann D, Forster A, Noll G, Enseleit F, Chenevard R, Distler O, et al. Anti- Tumor Necrosis Factor- $\alpha$  Treatment Improves Endothelial Function in Patients With Rheumatoid Arthritis. *Circulation* 2002; 106(17):2184-7.
10. Datta D, Ferrell WR, Sturrock RD, Jadhav ST, Sattar N. Inflammatory suppression rapidly attenuates microvascular dysfunction in rheumatoid arthritis. *Atherosclerosis* 2007; 192(2):391-5.
11. Galley HF, Webster NR. Physiology of the endothelium. *Br J Anaesth* 2004; 93(1):105-13.

12. Lerman A, Zeiher AM. Endothelial Function: Cardiac Events. *Circulation* 2005; 111(3):363-8.
13. Maradit-Kremers H, Nicola PJ, Crowson CS, Ballman KV, Gabriel SE. Cardiovascular death in rheumatoid arthritis: a population-based study. *Arthritis Rheum* 2005; 52(3):722-32.
14. Rhodin JAG. Architecture of the vessel wall. In: Bohr DF, Somlyo AP, Sparks JR HV, Gieger SR, editors. *Handbook of Physiology: The Cardiovascular System*. The Williams and Wilkins Company; 1980. p. 1-31. 188
15. Furchgott RF, Zawadzki JV. The obligatory role of endothelial cells in the relaxation of arterial smooth muscle by acetylcholine. *Nature* 1980; 288(5789):373-6.
16. Vallance P, Collier J, Moncada S. Effects of endothelium-derived nitric oxide on peripheral arteriolar tone in man. *Lancet* 1989; 2(8670):997-1000.
17. Bucci M, Gratton JP, Rudic RD, Acevedo L, Roviezzo F, Cirino G, et al. In vivo delivery of the caveolin-1 scaffolding domain inhibits nitric oxide synthesis and reduces inflammation. *Nat Med* 2000; 6(12):1362-7.
18. Moncada S, Higgs EA. The discovery of nitric oxide and its role in vascular biology. *Br J Pharmacol* 2006; 147 Suppl 1:S193-S201.
19. Kuvin JT, Patel AR, Karas RH. Need for standardization of noninvasive assessment of vascular endothelial function. *Am Heart J* 2001; 141(3):327-8.
20. Kubli S, Waeber B, le-Ave A, Feihl F. Reproducibility of laser Doppler imaging of skin blood flow as a tool to assess endothelial function. *J CardiovascPharmacol* 2000; 36(5):640-8.
21. Jadhav S, Sattar N, Petrie JR, Cobbe SM, Ferrell WR. Reproducibility and repeatability of peripheral microvascular assessment using iontophoresis in conjunction with laser Doppler imaging. *J CardiovascPharmacol* 2007; 50(3):343- 9.
22. Ramsay JE, Ferrell WR, Greer IA, Sattar N. Factors critical to iontophoretic assessment of vascular reactivity: implications for clinical studies of endothelial dysfunction. *J CardiovascPharmacol* 2002; 39(1):9-17.
23. Gonzalez-Gay MA, Gonzalez-Juanatey C, Martin J. Rheumatoid arthritis: a disease associated with accelerated atherogenesis. *Semin Arthritis Rheum* 2005; 35(1):8-17.
24. Haskard DO. Accelerated atherosclerosis in inflammatory rheumatic diseases. *Scand J Rheumatol* 2004; 33(5):281-92.
25. Kitas GD, Erb N. Tackling ischaemic heart disease in rheumatoid arthritis. *Rheumatology (Oxford)* 2003; 42(5):607-13.
26. DeMaria AN. Relative risk of cardiovascular events in patients with rheumatoid arthritis. *American Journal of Cardiology* 2002; 89 (suppl):33D-8D.
27. Cleland SJ, Sattar N, Petrie JR, Forouhi NG, Elliott HL, Connell JM. Endothelial dysfunction as a possible link between C-reactive protein levels and cardiovascular disease. *ClinSci (Lond)* 2000; 98(5):531-5.
28. Sattar N, McCarey DW, Capell H, McInnes IB. Explaining how "high-grade" systemic inflammation accelerates vascular risk in rheumatoid arthritis. *Circulation* 2003; 108(24):2957-63.
29. Leoncini G, Viazzi F, Parodi D, Ratto E, Vettoretti S, Vaccaro V, et al. Mild Renal Dysfunction and Cardiovascular Risk in Hypertensive Patients. *J Am SocNephrol* 2004; 15(90010):S88-S90.
30. Blake GJ, Ridker PM. Novel clinical markers of vascular wall inflammation. *Circ Res* 2001; 89(9):763-71.
31. Wong M, Toh L, Wilson A, Rowley K, Karschikus C, Prior D, et al. Reduced arterial elasticity in rheumatoid arthritis and the relationship to vascular disease risk factors and inflammation. *Arthritis and Rheumatism* 2003; 48(1):81-9.
32. Hurlimann D, Forster A, Noll G, Enseleit F, Chenevard R, Distler O, et al. Anti- Tumor Necrosis Factor- {alpha} Treatment Improves Endothelial Function in Patients With Rheumatoid Arthritis. *Circulation* 2002; 106(17):2184-7.
33. Bergholm R, Leirisalo-Repo M, Vehkavaara S, Makimattila S, Taskinen MR, Yki- Jarvinen H. Impaired responsiveness to NO in newly diagnosed patients with rheumatoid arthritis. *ArterioThrombVascBiol* 2002; 22(10):1637-41.
34. Vaudo G, Marchesi S, Gerli R, Allegrucci R, Giordano A, Siepi D, et al. Endothelial dysfunction in young patients with rheumatoid arthritis and low disease activity. *Ann Rheum Dis* 2004; 63(1):31-5. 205
35. VanDoornum S, McColl G, Jenkins A, Green DJ, Wicks IP. Screening for atherosclerosis in patients with rheumatoid arthritis: comparison of two in vivo tests of vascular function. *Arthritis Rheum* 2003; 48(1):72-80.
36. Oguz FM, Oguz A, Uzunlulu M. The effect of infliximab treatment on insulin resistance in patients with rheumatoid arthritis. *ActaClinBelg* 2007; 62(4):218-22. 206
37. Maini R, Feldman M. Immunopathogenesis of Rheumatoid Arthritis. *Oxford Textbook of Rheumatology*. 2nd ed. 1998. p. 983-1004.
38. Silman AJ, Newman J, MacGregor AJ. Cigarette smoking increases the risk of rheumatoid arthritis. Results from a nationwide study of disease-discordant twins. *Arthritis Rheum* 1996; 39(5):732-5.

39. Wallberg-Jonsson S, Caidahl K, Klintland N, Nyberg G, Rantapaa-Dahlqvist S. Increased arterial stiffness and indication of endothelial dysfunction in longstanding rheumatoid arthritis. *Scand J Rheumatol* 2008; 37(1):1-5.
40. Crilly MA, Kumar V, Clark HJ, Scott NW, Macdonald AG, Williams DJ. Arterial stiffness and cumulative inflammatory burden in rheumatoid arthritis: a dose-response relationship independent of established cardiovascular risk factors. *Rheumatology (Oxford)* 2009.
41. Kumeda Y, Inaba M, Goto H, Nagata M, Henmi Y, Furumitsu Y, et al. Increased thickness of the arterial intima-media detected by ultrasonography in patients with rheumatoid arthritis. *Arthritis Rheum* 2002; 46(6):1489-97.
42. Park YB, Ahn CW, Choi HK, Lee SH, In BH, Lee HC, et al. Atherosclerosis in rheumatoid arthritis: morphologic evidence obtained by carotid ultrasound. *Arthritis Rheum* 2002; 46(7):1714-9.
43. Ciftci O, Yilmaz S, Topcu S, Caliskan M, Gullu H, Erdogan D, et al. Impaired coronary microvascular function and increased intima-media thickness in rheumatoid arthritis. *Atherosclerosis* 2008; 198(2):332-7.
44. Hingorani AD, Cross J, Kharbanda RK, Mullen MJ, Bhagat K, Taylor M, et al. Acute Systemic Inflammation Impairs Endothelium-Dependent Dilatation in Humans. *Circulation* 2000; 102(9):994-9.
45. Arosio E, De MS, Rigoni A, Prior M, Delva P, Lechi A. Forearm haemodynamics, arterial stiffness and microcirculatory reactivity in rheumatoid arthritis. *J Hypertens* 2007; 25(6):1273-8.
46. Cardillo C, Schinzari F, Mores N, Mettimano M, Melina D, Zoli A, et al. Intravascular tumor necrosis factor [alpha] blockade reverses endothelial dysfunction in rheumatoid arthritis[ast]. *ClinPharmacolTher* 2006; 80(3):275-81.
47. Rantapaa-Dahlqvist S, de Jong BA, Berglin E, Hallmans G, Wadell G, Stenlund H, et al. Antibodies against cyclic citrullinated peptide and IgA rheumatoid factor predict the development of rheumatoid arthritis. *Arthritis Rheum* 2003;48(10):2741-9.
48. Cotran RS, Kumar V, Collins T. *Pathologic Basis of Disease*. Philadelphia, USA: W.B. Saunders Company; 1999.
49. Klareskog L, Stolt P, Lundberg K, Kallberg H, Bengtsson C, Grunewald J, et al. A new model for an etiology of rheumatoid arthritis: smoking may trigger HLA-DR (shared epitope)-restricted immune reactions to autoantigens modified by citrullination. *Arthritis Rheum* 2006; 54(1):38-46.
50. Veldhuijzen van Zanten JJ, Kitas GD. Inflammation, carotid intima-media thickness and atherosclerosis in rheumatoid arthritis. *Arthritis Res Ther* 2008; 10(1):102.
51. Hannawi S, Haluska B, Marwick TH, Thomas R. Atherosclerotic disease is increased in recent-onset rheumatoid arthritis: a critical role for inflammation. *Arthritis Res Ther* 2007; 9(6):R116.
52. Schott LL, Kao AH, Cunningham A, Wildman RP, Kuller LH, Sutton-Tyrrell K, et al. Do carotid artery diameters manifest early evidence of atherosclerosis in women with rheumatoid arthritis? *J Womens Health (Larchmt)* 2009; 18(1):21-9.
53. Chung CP, Oeser A, Avalos I, Gebretsadik T, Shintani A, Raggi P, et al. Utility of the Framingham risk score to predict the presence of coronary atherosclerosis in patients with rheumatoid arthritis. *Arthritis Res Ther* 2006; 8(6):R186.
54. Scognamiglio R, Negut C, de Kreutzenberg SV, Tiengo A, Avogaro A. Postprandial myocardial perfusion in healthy subjects and in type 2 diabetic patients. *Circulation* 2005; 112(2):179-84.
55. Stokes KY, Granger DN. The microcirculation: a motor for the systemic inflammatory response and large vessel disease induced by hypercholesterolemia? *J Physiol* 2005; 562(Pt 3):647-53.
56. Adams MR, Robinson J, McCredie R, Seale JP, Sorensen KE, Deanfield JE, et al. Smooth muscle dysfunction occurs independently of impaired endothelium-dependent dilation in adults at risk of atherosclerosis. *J Am Coll Cardiol* 1998;32(1):123-7.
57. Ghiadoni L, Magagna A, Kardasz I, Taddei S, Salvetti A. Fixed Dose Combination of Perindopril and Indapamide Improves Peripheral Vascular Function in Essential Hypertensive Patients. *Am J Hypertens* 2009; 22(5):506-12.
58. Metsios GS, Stavropoulos-Kalinoglou A, Panoulas VF, Wilson M, Nevill AM, Koutedakis Y, et al. Association of physical inactivity with increased cardiovascular risk in patients with rheumatoid arthritis. *Eur J Cardiovasc Prev Rehabil* 2009;16(2):188-94.
59. Metsios GS, Stavropoulos-Kalinoglou A, Panoulas VF, Sandoo A, Toms TE, Nevill AM, et al. Rheumatoid cachexia and cardiovascular disease. *Clin Exp Rheumatol* 2009; 27(6):985-8.
60. Gonzalez-Juanatey C, Testa A, Garcia-Castelo A, Garcia-Porrúa C, Llorca J, Vidan J, et al. HLA-DRB1 status affects endothelial function in treated patients with rheumatoid arthritis. *The American Journal of Medicine* 2003; 114(8):647-52.

61. John H, Kitas G, Toms T, Goodson N. Cardiovascular co-morbidity in early rheumatoid arthritis. *Best Pract Res Clin Rheumatol* 2009; 23(1):71-82.
62. Toms TE, Panoulas VF, John H, Douglas KM, Kitas GD. Methotrexate therapy associates with reduced prevalence of the metabolic syndrome in rheumatoid arthritis patients over the age of 60- more than just an anti-inflammatory effect? A cross sectional study. *Arthritis Res Ther* 2009; 11(4):R110.
63. Ikonomidis I, Lekakis JP, Nikolaou M, Paraskevidis I, Andreadou I, Kaplanoglou T, et al. Inhibition of interleukin-1 by anakinra improves vascular and left ventricular function in patients with rheumatoid arthritis. *Circulation* 2008; 117(20):2662-9.
64. Gonzalez-Juanatey C, Llorca J, Vazquez-Rodriguez TR, az-Varela N, Garcia-Quiroga H, Gonzalez-Gay MA. Short-term improvement of endothelial function in rituximab-treated rheumatoid arthritis patients refractory to tumor necrosis factor alpha blocker therapy. *Arthritis Rheum* 2008; 59(12):1821-4.
65. Syngle A, Vohra K, Kaur L, Sharma S. Effect of spironolactone on endothelial dysfunction in rheumatoid arthritis. *Scand J Rheumatol* 2009; 38(1):15-22.
66. Banks M, Flint J, Bacon PA, Kitas GD. Rheumatoid arthritis is an independent risk factor for ischaemic heart disease [abstract]. *Arthritis and Rheumatism* 2000; 43(suppl. 9):S385.
67. Turiel M, Tomasoni L, Sitia S, Cicala S, Gianturco L, Ricci C, et al. Effects of Long-Term Disease-Modifying Antirheumatic Drugs on Endothelial Function in Patients with Early Rheumatoid Arthritis. *Cardiovasc Ther* 2010.
68. Recio-Mayoral A, Mason JC, Kaski JC, Rubens MB, Harari OA, Camici PG. Chronic inflammation and coronary microvascular dysfunction in patients without risk factors for coronary artery disease. *Eur Heart J* 2009; 30(15):1837-43.
69. Schachinger V, Britten MB, Zeiher AM. Prognostic impact of coronary vasodilator dysfunction on adverse long-term outcome of coronary heart disease. *Circulation* 2000; 101(16):1899-906.
70. Suwaidi JA, Hamasaki S, Higano ST, Nishimura RA, Holmes DR, Jr., Lerman A. Long-term follow-up of patients with mild coronary artery disease and endothelial dysfunction. *Circulation* 2000; 101(9):948-54.
71. Gokce N, Keaney JF, Jr., Hunter LM, Watkins MT, Nedeljkovic ZS, Menzoian JO, et al. Predictive value of noninvasively determined endothelial dysfunction for long-term cardiovascular events in patients with peripheral vascular disease. *J Am Coll Cardiol* 2003; 41(10):1769-75.
72. Kerekes G, Szekanecz Z, Der H, Sandor Z, Lakos G, Muszbek L, et al. Endothelial dysfunction and atherosclerosis in rheumatoid arthritis: a multiparametric analysis using imaging techniques and laboratory markers of inflammation and autoimmunity. *J Rheumatol* 2008; 35(3):398-406.
73. Rojas-Villarraga A, Ortega-Hernandez OD, Gomez LF, Pardo AL, Lopez-Guzman S, rango-Ferreira C, et al. Risk Factors Associated with Different Stages of Atherosclerosis in Colombian Patients with Rheumatoid Arthritis. *Seminars in Arthritis and Rheumatism* 2008; In Press, Corrected Proof.
74. Aziz M, Yadav KS. Atherosclerosis: An extra articular manifestation of Rheumatoid Arthritis *Ann Clin Lab Res*. 2016, 4: 4.
75. Aziz M, Yadav KS. Pathogenesis of Atherosclerosis. *Med Clin Rev*. 2016, 2:3.

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## RESEARCH ARTICLE

### HARNESSING ENTREPRENEURIAL SKILLS OF ENGINEERING STUDENTS.

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#### Manuscript Info

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#### Abstract

The handout 'Men wanted to sell fried- ground nuts, monthly salary Rs.10,000, boarding free' advertised by a budding, not the Hovered educated Entrepreneur down in the streets of T.Nagar, a busy bazaar in Chennai with its round the clock hustle and bustle is graphical enough to display the amount of unexplored Entrepreneur Potential that remains latent in TamilNadu, and by extension the cities, villages across the nation as a whole. one can't deny the fact that an engineering graduate after spending his or her Capitation fee that runs into few lakhs, has to settle down for a paltry 'package' as it were Rs.8000 odd amount, should think twice before pursuing higher studies any more if this is what his exacting educational destiny prepares him or her to be. The wisdom of practical experience as it is encapsulated in the Tamil adage 'Kai tholil ondrai Katrukol Kavalai Unakillai Othukol' the translation of which is 'Learn a Craft( vocational training in entrepreneurial parlance) and bother no more' serves it right for the tens and thousands of the so called 'Engineering' folks to not only aspire big in life but also expand the horizon of professional advancement, economic prosperity, and contributions to the national Development and growth as responsible citizens. The present paper undertakes to study the untapped entrepreneurial potency that our nation has in terms of its educated youth, especially among the engineering students, the unemployability crisis that the country wrestles with and finally the hitherto unexplored domains of entrepreneurial excellence that the country needs to zero in on. This paper also endeavors to demystify the concept of Entrepreneurship, the need and scope of entrepreneurship in India, and finally unearths some of the potential domains which could be capitalized with proper leverage.

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#### Introduction:-

A professional body builder with bulging muscles saw an advertisement that read 'Trainers wanted at circus' and went to meet the owner of the circus. To his utter dismay the owner told that there was no vacancy in the circus and that they needed someone to impersonate a monkey since the chimpanzee in the circus was dead. He also added that a lot of school children were going to visit the circus the next day. If he desperately wanted a job, all that he could do is to slip in to the outfit of a monkey, swing between branches, and eat bananas and pee-nuts whenever they were fed to him. As the bodybuilder was down and out, in the hopes of getting over his financial crisis, he succumbed to his words and played the part of a monkey. He displayed a masterful dexterity in all the said skills for few hours but

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a little later the bananas got the better of him. He felt nauseated and while swinging over to another branch slipped and fell into the lion's den. As the lion came closer, he shouted for help, 'help'. The lion leaned over and said 'shut up your mouth you fool else both of us will be caught'

Later, the man learnt most of the animals found in the circus were university rank holders and that out of jobs, were forced to take up what they were offered. Since he was an average student, he was offered a monkey's role as against the university topper that was offered to play the lion king.

This may be gag joke, but calls for both scrutiny and diligence while pondering over the employability status of Indian students especially 1.5 million the engineering graduates that go out from different colleges across the Indian sub-continent which is reckoned to be the second youngest country in the world. As per the recent survey of NASSCOM, over 80% of engineering graduates are 'unemployable' in terms of the "skill set" that the industry demands. It's evident from this fact our education system and the academia does not prepare our students to be 'industry-ready' rather mechanically prepares them to be 'marks- producing- engines'. This abysmal state of affairs need a radical revamp, a clean revamp in the way education, career, and life has been perceived by our policy makers, parents, and the educational enthusiasts down the ages.

In a country that is bulging with 1.2 billion people and 64% of whom are well educated, where cut-throat competition thrives, getting a placement for every student largely of whom lack the required 'basic skill set' leave alone the much hyped "people skill" and 'Domain expertise' is a Herculean job. Be that as it may, the abounding Entrepreneur potential that the country is demographically vested with should not be ignored. By the way India ranks third in terms of the Entrepreneurial potential and dividend it has in the world. With stable and sustainable economic growth, that too direct foreign investments, Make in India, India has opened a chapter in its gallant march to words becoming 'the supreme power' by 2020. Fresh ground has been made in the efforts of bridging the alarming gap that exists between industry and academic institutions and by extension, converting the untapped potentials hitherto into national assets.

#### **Defining entrepreneurship:-**

Defining what it means to be an entrepreneur is no easy task. The term 'Entrepreneur' originally is derived from the combination of two words 'entre' to swim and 'prendes', to grasp, understand or capture. It was coined and popularized by French-Irish Economist Jean-Baptiste Say. The Business dictionary.com defines Entrepreneurship as 'the capacity and willingness to Develop, Organize and manage a business venture along with any of its risks in order to make a profit'. A recent World Economic Forum report into entrepreneurship education defines an entrepreneur as 'someone who is creative, innovative and risk taking, and has an ability to translate 'ideas into action' (Volkman et al 2009, p. 18).

Dana (2001, p. 405) maintains the fact that 'there is no universally-accepted definition of Entrepreneurs or of Entrepreneurship' in the literature. This evident lack of a comprehensive and widely accepted definition does not detract from the reality that entrepreneurship possesses distinctive features including 'a capacity for innovation' (Bruni, Gherardi & Poggio 2004, p. 258). By and large, it is quite evident from the above said definitions that 'Entrepreneurship' or 'Entrepreneur' is characterized by a spirit of organizing, managing, innovating and risk taking in any area of business enterprise and is an integral part of national development in an ever changing and increasingly competitive global marketplace.

#### **The Need and Scope Of Entrepreneurship:-**

It is universally acknowledged that India has an enormous demographic dividend. By 2026, nearly 65% of our population will be between 15-64 years (with 35% being below 35). Given that, the country is poised to become the world's single destination for skilled human resources, the home truth that 25% of India's graduates, less than 10% of India's MBA graduates and 17% of Engineering graduates are employable (i.e., they have the necessary skill set to be employed by industries across sectors) is less palatable for a nation bestowed with such an astounding Demographic Dividend. Moreover, a vast majority of our population works in the informal sector, with little quantifiable skills. This needs serious attention. India needs to aggressively invest in providing skills to its youth to capitalize on this untapped potential. On demand side, a skill gap study has been conducted by National Skill development Cooperation in 2014, which indicates that there is an additional net requirement of 11.92 crore skilled manpower in twenty four key sectors by 2022.



The analysis based on results of 66th and 68th round of NSSO, Appendix-I observes that the total workforce in the country today is estimated at 48.74 crore, of which approximately 51% is in the non-farm sector. Of these 24.9 crore non-farm workers, a maximum of 10% would be formally trained and skilled (4.69% is based on 2011-12 NSSO survey and is including both farm & nonfarm). Approximately 22.4 crore would be either skilled through non formal channels or unskilled. Out of these, it is estimated that approximately, 15.7 crore would be in the age group 15-45 years. This workforce will need to be mapped with recognition of existing skills and then provided with necessary up-skilling or re-skilling for increasing productivity and providing a livelihood pathway. Similarly, in farm sector, this figure works out to be 15 crore. Given this context, the need and the scope of Entrepreneurship in India is very bountiful.

#### **Tourism:-**

Tourism is certainly a blooming and booming industry in India. With the number of domestic and international tourists visiting the country steadily on the rise every year, Tourism is one lucrative sector entrepreneurs must focus on. India with its diverse culture and rich heritage could be a mine of wealth for the foreign tourists to explore and excavate in terms of cross cultural learning. India with its Beaches, hill stations, caves, heritage sites, wildlife, rural life, peculiar religious dogmas and practices, the Mother India has everything that captivates, gravitates the attention of tourists from all over the world. The lack of trained professionals in the tourism and hospitality sectors raises alarm that this potential field could possibly be a prey of perpetual neglect.

Moreover, any business in this sector will thrive in the long run as the demand continues to grow every year. The arrival of Foreign tourists during January-March were estimated to be over 15.63 lakh with a growth rate of 12.8 percent, compared to 13.86 lakh during the first three months last year. This is a standing testimony that tourism development is the Order of the day so far as the expansion of entrepreneurial development is concerned in India.

#### **Automobile:-**

India is now a hot spot for automobiles and auto-components. A cost-effective hub for auto components sourcing for global auto makers, the automotive sector is potential sector for entrepreneurs. The automobile industry recorded a 26 per cent growth in domestic sales in 2009-10.

The strong sales have made India the second fastest growing market after China. India being one of the world's largest manufacturers of small cars with a strong engineering base and expertise, there are many segments that entrepreneurs can focus on in India's automobile and auto components sector. In addition, international automobile giants like Ford, Mercedes, Audi, Volvo and other potential counterparts pitching in the Indian Market establishing their manufacturing units in different parts of the country is also evident of the impending surge the automobile gamut has.

#### **Education and Training:-**

Education is the back bone of any country and is undoubtedly the visa to growth and economical prosperity. In an educationally young country like India There has never been a dearth for educational and online tutorial services. With good facilities at competitive rates, India can attract more students from abroad. Unique teaching methods, educational portals and tools can be used effectively to make the sector useful and interesting.

#### **Food processing:-**

India's mainstay is agriculture. Entrepreneurs can explore many options in the food grain cultivation and marketing segments. Inefficient management, lack of infrastructure, proper storage facilities leads to huge losses of food grains and fresh produce in India. Entrepreneurs can add value with proper management and marketing initiatives. The processed food market opens a great potential for entrepreneurs be it fast food, packaged food or organic food. Fresh fruits and vegetables too have a good demand abroad. A good network of food processing units can help potential exporters build a good business.

#### **Ayurveda and organic farming:-**

India is well known for its herbal and Ayurvedic products. With increasing awareness about the ill-effects of allopathic medicines, there will be a huge demand for cosmetics, natural medicines and remedies. Together with this, organic farming has been in India since a long time. The importance of organic farming will grow at a fast pace, especially with many foreigners preferring only organic products. Entrepreneurs can focus on business opportunities in this sector. There are many small-time farmers who have adopted organic farming but the demand is

still unmet, offering many opportunities for those who can promote organic farming on a large scale. Organic farming has gone well in the downtown of Chennai with people experimenting the same on terraces, roof top gardens, and private yards etc.

#### **Floriculture and Energy solutions:-**

India's floriculture segment is small and unorganized. There is a lot to be done in this lucrative sector. The global trade in floriculture products is worth \$9.4 billion. With 8 per cent growth, it is expected to grow to \$16 billion by 2010. India's share in world trade is just 0.18 per cent. This is a huge market to be tapped considering the rising demand for fresh flowers. More awareness and better farming and infrastructure can boost exports.

In a power starved nation, the need to develop cost effective and power saving devices is gaining more significance. There is a huge demand for low-cost sustainable energy saving devices as well. The government has already unveiled the National Solar Mission which has set a target of 20,000 MW of solar generating capacity by the end of the 13th Five Year Plan. The Prime Minister, Mr.Narendra Modi too has been urging the industries in and overseas to zero in on the huge business opportunities in India and set up 'Solar Vallies' on the lines of the Silicon Vallies. This scheme is very well implemented in the state of Gujarat with astounding success. Such solar valleys can become hubs for solar science, solar engineering and solar research, fabrication and manufacturing. So there is a big opportunity for entrepreneurs in this sector as well.

#### **Conclusion:-**

It is squarely evident that, India has been recording a steadfast economic growth ever since the advent of Globalization and been making fresh inroads in various fields of economic stability. The growth is very encouraging even in the face of Global Economic Meltdown which had a punctuated blow in the western economy. However, the issues of unemployment, underemployment, low educational levels, high rates of drop outs, lack of proper vocational training and more importantly, the shortage of skilled work force shackle India's valiant march in the global economic arena. Such areas which demands instant remedy, if addressed foresightedly could prove to be a world of wealth to the nation. It's highly unlikely that India will capitalize on its demographic dividend (more than 50% of population below the age group of 25) if the current state of only 10% of youth population being trained in vocational training and skill development continues. The fact that the 11<sup>th</sup> five year plan identified India as the potentially emerging global player in Skill Development sector is in itself an illustrious testimony that the Indian subcontinent can make significant strides in Entrepreneurial development. According to NASSCOM India is the 3<sup>rd</sup> largest base for start-ups in the world at present with over 3,000 startups present in India and over 800 setting up annually. By 2020, India is expected to be a home of 11,500 start-ups employing over 250,000 people.

Creation of Mass awareness among school children and educating engineering graduates in specific, by highlighting positive aspects of entrepreneurship as a career option using ICT, folk, traditional and electronic media, would empower the young minds to fearlessly give birth to the budding entrepreneurs in them. Inception of Consortium (of entrepreneurs below 30 years of age) at all levels (district, state and national levels) to promote entrepreneurship in their areas by organizing various events around the theme of entrepreneurship and development work would make a world of difference in providing entrepreneurial facilitation and guidance to youth.

Above all inception of Awards for young achievers (for both men and women entrepreneurs separately) at all levels viz., district, state and national levels to recognize the achievements of entrepreneurs below the age of 30 years would establish an Entrepreneurial eco-system in India, so that the Grand Dream of 1.2 billion people of India to be the supreme economic power that it once was, will be gloriously realized and retained.

#### **Reference:-**

1. Franco, M & Haase, H 2009, 'Entrepreneurship: an organizational learning approach', Journal of Small Business and Enterprise Development, vol. 16, no. 4, pp. 628-641.
2. Gulati, S 2008 'Technology-enhanced learning in developing nations: a review', International Review of Research in Open and Distance Learning, vol. 9, no. 1, pp. 1-16
3. Harding, R 2006, 'Entrepreneurs: the world's lifeline?' Business Strategy Review, winter, pp. 4-7.
4. Draft national policy for skill development and entrepreneurship 2015, Ministry of Entrepreneurship and Sustainability, vol. 2, no. 1, pp. 1-41.

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### RESEARCH ARTICLE

## SYSTEMATIC REVIEW OF EVIDENCE-BASED IN BENEFICIAL PREVENTING HYPOTHERMIA FOR ADULT TRAUMA PATIENTS IN ACCIDENT

Ahmad Abdullah Alghamdi, Hamdan Mujri Alaklabi, Khalid Mansi Alanazi and Mohammed Nasser Makeen.

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### Abstract

Accidental hypothermia increases mortality and morbidity in trauma patients. Various methods for insulating and wrapping hypothermic patients are used worldwide. Prevention and early correction of cold exposure is important because hypothermia is an independent predictor of increased morbidity and mortality in injured patients. Systematic review was conducted evidence based studies were searched in Pubmed, Embase, Cochrane central database, all to July, 2016. Every type of studies including reviews, prospective studies and retrospective studies with prospective collected data were included. Qualities of included studies were assessed by a standardised scale previously reported for observational studies. It is difficult to determine whether admission hypothermia occurs because of prolonged patient exposure to ambient temperatures, heat loss from open body cavities, or because of aggressive fluid resuscitation with room temperature IV. Passive re-warming strategies and an effective first step on slowing the rate of deterioration, although these measures used in isolation are often insufficient to prevent hypothermia in severely injured patients.

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### Introduction:-

Major or severe trauma is the primary cause of death in up to 10 % of all deaths worldwide. It is defined as having an Injury Severity Score (ISS) of 15 or greater<sup>(1)</sup>. Inadvertent injuries are the sixth leading cause of death and the fifth leading cause of severe disability internationally<sup>(1)</sup>. It is also the commonest cause of death for persons aged from 18-44 years<sup>(2)</sup>. In the developed countries, injury constitutes the leading causes of death among people aged 15-44 years and is increasingly a leading cause of death in the low-and middle-income countries, where death due to infection is also high<sup>(3)</sup>.

Trauma victims often suffer from hypothermia on arrival at hospital and, even when the hypothermia is moderate; it can be associated with a poorer prognosis and an increase in mortality rate<sup>(4-11)</sup>. Hypothermia is commonly found in injured victims and occurs in about 57% trauma admission in Accident & Emergency Department<sup>(16)</sup>. The definition of hypothermia is core temperature below 36 °C in healthy subjects, or heat loss exceeds the heat production ability; but it is defined as temperature less than 36.5 °C in injured victims<sup>(16)</sup>.

Early diagnosis of hypothermia is thus essential<sup>(4)</sup>. However, although the mechanisms of the deleterious effects of hypothermia are well known, its causes are not clear. Most published data on hypothermia victims are hospital registry data or data from retrospective studies<sup>(6-13)</sup>.

A possible cause of hypothermia is the severity of the injury<sup>(4,6-11,14)</sup>. Both severe head injury and hypovolemic shock affect body temperature regulation. Although protecting the victim from the cold or warming them, whether passively or actively, might have a positive effect on body temperature, treatment such as vascular filling might impact negatively<sup>(15)</sup>.

Hypothermia is felt to be primarily a secondary event, that is, due to the injury itself. Animal models have shown a decrease in core body temperature correlating with blood pressure and not the level of resuscitation<sup>(18)</sup>. Human studies, while observational in nature, give a more mixed picture<sup>(19,20,21,22)</sup>. Physiology and injury severity seem to be the primary predictors of hypothermia, and these findings often correlate with the volume of resuscitation. In the studies to date, the majority of risk factors discussed appear to be secondary to the injury itself and the underlying changes to physiology. Factors commonly cited for hypothermia in trauma patients include extremes of age, environmental stresses, impaired neurological state or mobility, and subsequent care by health services<sup>(23)</sup>.

Hypothermia following traumatic injury, on the other hand, represents a failure of the body's compensatory mechanisms for thermoregulation. The body responds to heat loss by shivering, which increases oxygen consumption in skeletal muscles by 40% to 400%. This high metabolic demand places some organs at risk of developing ischemia. By the time hypothermia develops, the energy reserves of the body are depleted and the system is showing signs of exhaustion. Hypothermia interferes with the clotting mechanisms of the blood by disrupting platelet function, slowing the chemical reactions that ultimately produce the protein strands necessary to build blood clots and by suppressing the immune system. A drop in body temperature of 1 degree Celsius results in a 6% to 7% decrease in cerebral blood flow, which could be dangerous for patients with traumatic brain injury<sup>(22,23)</sup>.

In trauma, several retrospective studies have found an association between higher death rate and an increasing degree of hypothermia, even accounting for differences in the severity of injury<sup>(7,11)</sup>. Jurkovich et al<sup>(7)</sup> found that no trauma patient whose core temperature fell below 32 °C survived, and they regarded this as the critical temperature for survival. Hypothermia is recognized as one pillar of a "lethal triad" (hypothermia, acidosis and coagulopathy) of homeostatic failure that is believed to mark the limits of ongoing intervention, and necessitates an "abbreviated" laparotomy<sup>(26-30)</sup>.

Routine monitoring of temperature in severely injured patients is considered basic, but most techniques have not been validated in trauma patients. The most reliable core monitoring sites include the pulmonary artery, distal esophagus, nasopharynx, and tympanic membrane.

Swan and Ganz introduced the pulmonary artery catheter (PAC) in 1971 for measuring cardiac pressures. The PAC is the most accurate monitor and correlates to within 0.1 °C of core temperature<sup>(17, 24)</sup>. However, its routine use is often precluded in trauma patients because it is technically cumbersome to insert and is associated with its own complications, including arrhythmias, perforation, and pericardial tamponade<sup>(41)</sup>. The PAC has not been shown to improve clinical outcomes and has fallen out of favor for routine use in most noncardiac intensive care situations<sup>(42)</sup>.

The oral temperature probe has existed since 1805 and has since gone through multiple iterations including the electronic clinical thermometer in 1954<sup>(43,44)</sup>. The oral probe is sensitive when placed correctly into the sublingual pouch next to the sublingual artery<sup>(45)</sup>. It can be altered by salivation, previous intake of hot or cold food, smoking, and rapid breathing<sup>(45)</sup>. Giuliano et al.<sup>(46)</sup> evaluated the Welch-Allyn oral thermometer (model 670; Welch Allyn, Inc., San Diego, CA, USA) in 72 ICU patients and found a significantly lower variability in temperature values compared with the tympanic probe. They concluded that oral monitoring should be considered a first-choice device if a PAC is not warranted.

The tympanic infrared probe should be considered next since it is easily accessed from two identical sites and optimally located 3.5 cm from the hypothalamus. However, the temperature of the tympanic membrane, and not the brain, can be influenced by convective air currents generated during resuscitation efforts<sup>(47)</sup>. Tympanic temperatures should only be considered for monitoring when oral temperature is not feasible.

A noninvasive, disposable, medical thermometer, based on zero-heat-flux thermometry technology (3 M, St. Paul, MN, USA) is now available in North America. The probe's temperature is controlled to perfectly insulate the skin under the probe, which allows the warmer core tissue to warm the adjacent skin. In a study by Eshraghi et al.<sup>(48)</sup>, the

zero-heat-flux thermometry technology matched the PAC within 0.2 °C during cardiac surgery. This device has not been studied in trauma and requires further evaluation.

Cork et al. <sup>(49)</sup> evaluated the use of seven temperature monitors during anesthesia and compared their accuracy with tympanic measurements. Esophageal and nasopharyngeal temperatures were the most accurate while axillary temperatures were consistently 1.5–1.9 °C below tympanic temperatures. Precision of measurements using the nasopharynx, esophagus, and bladder was found to be superior to those obtained in the axilla, forehead, or rectum.

Rectal, bladder, and axillary measurement techniques are each less accurate than the methods already discussed <sup>(50)</sup>. Rectal values have been shown to lag behind core temperature in cardiopulmonary bypass (CPB). As such, using the rectal temperature is considered an “intermediate” measuring technique because it is not representative of the true core temperature <sup>(50,51)</sup>. Bladder probes and axillary measurements are even less consistent, up to almost 1 °C in variability <sup>(52)</sup>. Each technique can be disturbed by external temperatures, local blood flow, and incorrect placement <sup>(53)</sup>. Many measurements are considered insensitive and therefore the most practical technique with the best precision should be applied.

### **We demonstrate here some of the physiological effects of hypothermia on human body systems.**

#### **Cardiovascular effects:-**

Mild hypothermia (<36 °C) causes increased sympathetic tone, heart rate, blood pressure, and cardiac output while moderate hypothermia will depress cardiac activity <sup>(52,55)</sup>. At 34 °C, hypothermia impairs diastolic relaxation. By 28 °C, bradycardia develops with a prolonged PR interval, Osborne waves, and T-wave inversions followed by ventricular fibrillation at 25 °C <sup>(55)</sup>.

#### **Respiratory effects:-**

Mild hypothermia can increase the respiratory rate, causing a decrease in the partial pressure of carbon dioxide ( $P_aCO_2$ ). At moderate levels, airway reflexes are reduced, predisposing a patient to aspiration. At 32 °C, the medullary center becomes depressed, leading to a decrease in minute ventilation, increased secretions, and atelectasis <sup>(52,57)</sup>. Gas exchange is not affected, but there is an increase in pulmonary vascular resistance and ventilation–perfusion mismatch.

#### **Renal effects:-**

The initial increase in cardiac output, peripheral vascular resistance, and mean arterial pressure can lead to an increase in renal blood flow and cold-induced diuresis <sup>(57)</sup>. With further heat loss the glomerular filtration rate decreases, reaching 50 % of normal at approximately 30 °C. Urine output does not decrease until 20 °C <sup>(57)</sup>.

#### **Hematological effects:-**

Clotting factor enzymes and platelets work optimally at 37 °C. Hypothermia impairs platelet function between 33 and 37 °C and the activity of clotting factors and fibrinogen synthesis below 33 °C <sup>(58)</sup>. Rohrer and Natale investigated the effects of temperature on coagulation. Partial thromboplastin time levels increased from 36.0 s at 37 °C to 39.4, 46.1, and 57.2 s at 34 °C, 31 °C, and 28 °C, respectively <sup>(59)</sup>. Temperatures below 33 °C also inhibit thrombin, glycoprotein Ib–IX complex, platelet aggregation, and thromboxane B2 production. One study investigated the reversibility of these effects in whole blood flow cytometric analysis and the complications were shown to resolve with rewarming back to 37 °C <sup>(60)</sup>.

#### **Hypothermia and trauma-induced coagulopathy:-**

Trauma-induced coagulopathy (TIC) is present in one-quarter of all severely injured patients and carries a 46 % mortality rate <sup>(61)</sup>. Several important processes, including the release of heparanoids from the endothelial glycocalyx, protein C activation, tissue plasminogen activator, hyperfibrinolysis, and platelet dysfunction, have been implicated <sup>(61)</sup>. The concept of early TIC is a new model that has not yet been entirely elucidated. However, several recent trials have identified a prolonged prothrombin time and therefore coagulopathy in the early time period after initial trauma in 25 % of patients <sup>(62)</sup>. There are seven mechanisms involved in its development: shock, tissue trauma, inflammation, acidemia, hemodilution, massive transfusion, and hypothermia <sup>(61)</sup>. Bukur et al. <sup>(63)</sup> retrospectively reviewed 21,023 trauma patients and found 44.6 % of prehospital patients had significant hypothermia, which can exacerbate all other mechanisms.

While shock is thought to be the primary driver of coagulopathy, tissue injury is still required for its initiation. Hypoperfusion causes tissues to become hypoxic and leads to lactic acidosis, which along with hypothermia decreases the activity of the coagulation cascade and increases fibrinolysis<sup>(64)</sup>. Sustained hypoperfusion increases thrombomodulin, which can increase thrombomodulin-bound thrombin that activates protein C, a systemic anticoagulant<sup>(64,65)</sup>.

### **Objective:-**

Physicians commonly ignore hypothermia and its relation with mortality in trauma patients, in general due to its prevalence and belief that it is secondary to the injury itself (secondary hypothermia). Over the past several decades, hypothermia in trauma has been studied concerning its effects on mortality; however, very little has been done to identify the beneficial effect of preventing hypothermia among adult traumatic patients, and the different procedures and strategies. Thus this study aimed to systematically review the evidence of prevention hypothermia in traumatic patients and its beneficial effect on their health.

### **Methodology:-**

#### **Study design:-**

Systematic review of literature.

#### **Search strategy:-**

Systematic review was conducted evidence based studies were searched in we searched three electronic databases (Pubmed, EMBASE and ISI Web of Science) using the following search strategy: (hypothermia OR temperature) AND (trauma OR accident OR injury), Search was to July, 2016. Every type of studies including reviews, prospective studies and retrospective studies with prospective collected data were included. Qualities of included studies were assessed by a standardised scale previously reported for observational studies. The effects of individual studies were combined with the study quality score using a previously reported model of best-evidence synthesis. The hazard ratios of strong evidence predictors were combined only by high quality studies. The inclusion and exclusion criteria are identified after a systematic research of six electronic databases. Among these articles, four of them are randomized controlled trials while the remaining one is quasi-experimental design with prospective randomized assignment. The quality of these identified articles is evaluated with the methodology checklist for randomized controlled trials which is developed by Scottish Intercollegiate Guideline Network (SIGN). All studies of medium and high quality would be considered as sufficient evidence to support the proposed innovation in preventing hypothermia for trauma patients in Accident.

### **Results:-**

Trauma patients are at great risk of accidental hypothermia (body temperature [BT] < 36 degrees C). Hypothermia influences the functioning of all organ systems and can lead to pathological changes, which in turn additionally complicate the trauma. Furthermore, hypothermia can, e.g., by influencing blood coagulation (reduction of thrombocyte aggregation, increased fibrinolysis) have a markedly unfavourable impact upon the in-hospital surgical treatment of the trauma patient. If the patient begins to shiver, it means that hypothermia is beginning to occur. Shivering increases oxygen consumption by the muscle cells by as much as 400 percent.

Therefore, the goal of prehospital care is to avoid the onset of shivering. Basic passive heating measures such as covering the patient and turning on the patient compartment heater until it is uncomfortably warm can slow down the loss rate.

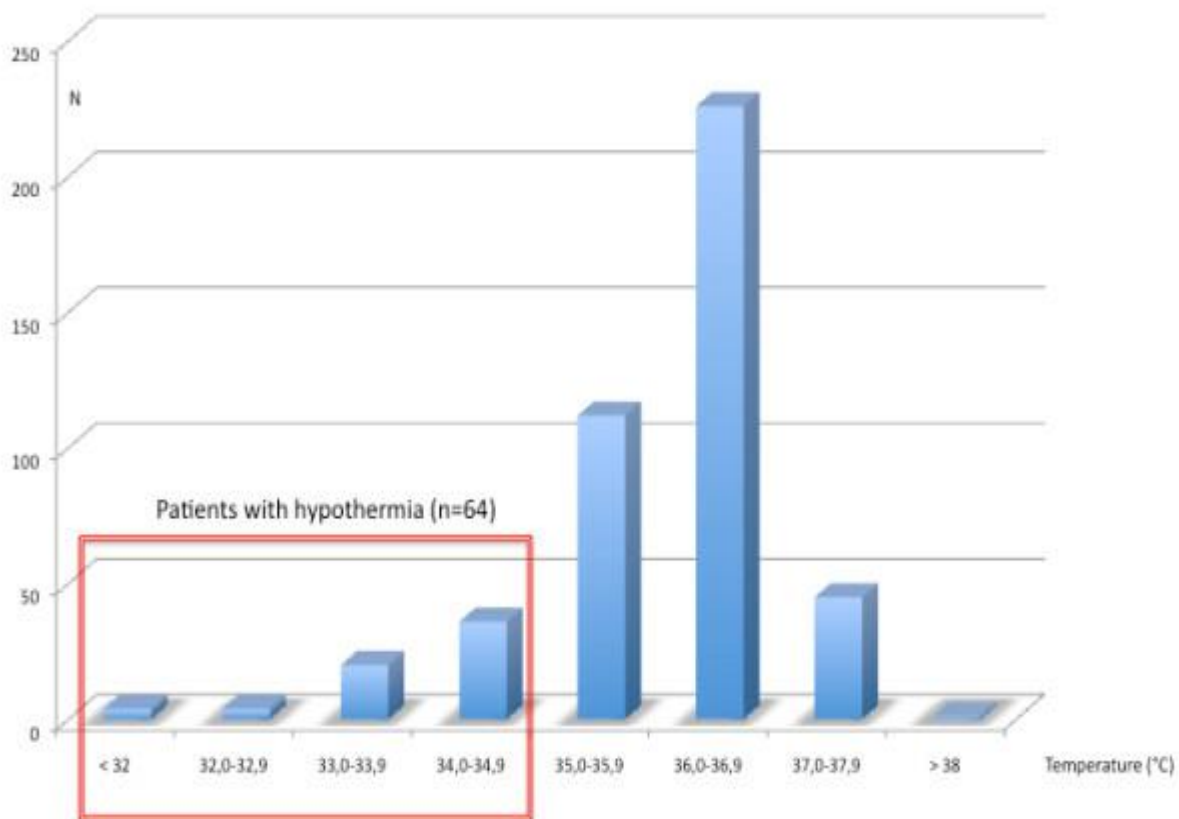
#### **Different risk factor associated with hypothermia in traumatic patients:-**

The prevalence of hypothermia in trauma victims on arrival at hospital was high (14%) and was associated with several risk factors as it was stated in Danzl et al<sup>(13)</sup>. The most significant factor was the severity of the injury as given by the RTS. The relationship between hypothermia and severity of injury is known<sup>(13)</sup>. Different study by Luna et al showed that not only blood loss and spine or head injury impair body temperature regulation, even if not always immediately. Intubation was also a significant risk factor. It was no doubt a sign of the severity of the injury<sup>(11)</sup>. Head injury, RTS, and intubation were all three, severity criteria independently associated with hypothermia<sup>(11)</sup>.

However some other studies have showed that the infusion fluid temperature was noticed, for the first time, to be a significant risk factor for the onset of hypothermia<sup>(33,34)</sup>. The temperature of the fluid infused on resuscitation of

75% of the patients with hypothermia on arrival at hospital was below 21°C and close to air temperature. Infusion temperature was a more important risk factor than infusion volume, maybe partly because of the small infusion volumes used. Another significant factor was mobile unit temperature. In order to minimize hypothermia in trauma victims, therefore some studies have recommend that infusion fluid temperature be controlled, that small infusion volumes be used for resuscitation, that the mobile unit be heated, and that trauma victims preferably remain clothed (33,34,35).

We identified observational study<sup>(35)</sup> carried out by the mobile EMS of eight French hospitals between 1 January 2004 and 10 November 2007, that included Body temperature measurements on arrival at hospital were available for 448 patients. The distribution is shown in **Figure 1**. Hypothermia (body temperature <35°C) was present in 64 of these 448 patients (14%). and therefore they for patients safety they recommended that Optimal patient management could contribute to limit heat loss or even to increase the patient's temperature when required. Undressing patients should be avoided. Mobile unit temperature and fluid infusion temperature were independently associated with hypothermia. They should be routinely measured. Adapted tools are available.



**Figure 1:-** Temperature distribution in the 448 trauma victims on arrival at hospital<sup>(35)</sup>.

#### **Hypothermia Prevention among adults traumatic patients:-**

We identified five <sup>(36,37,38,39,40)</sup> clinical randomized trials, the sample size of two studies were 100 participants<sup>(37)</sup> and 298 patients<sup>(36)</sup>. The other two studies had sample sizes of 30 patients<sup>(38)</sup> and 48 patients<sup>(40)</sup>. One study was within subject design and had sample sizes of 10 <sup>(39)</sup>. three out of those studies included patients which were all minor to medium level trauma with abdominal trauma, fractures, contusion, hematoma and injury severity scored <sup>(36,37,38)</sup>. One of the studies<sup>(39)</sup> recruited patients who suffer burn accidents with total burn surface area greater than 20% (ranged from 20% to 87%). The other article was patients with blunt trauma who were under cold stress <sup>(40)</sup>. The age of the subjects were from 20 to 78 with mean age of 38-58 in the four articles except one of them failed to provide the age of subjects <sup>(36)</sup>.

Two studies<sup>(37,38)</sup> of the previous mentioned investigated the effect of carbon fiber heating blanket with temperature set to 42°C when compared to the control group which was same carbon fiber heating blanket without switching on the electricity and the duration of warming devices applied was about one hour in both studies<sup>(37,38)</sup>. The device was portable and easy to implement which contained batteries of 0.5 kg and could last for 30-40 minutes.

One of the five articles<sup>(36)</sup> investigated and compared the thermal efficiency among reflective blanket, prewarmed cotton blanket and forced-air inflatable blanket without specifying the control groups<sup>(36)</sup>. Another one article investigated the effect of using large chemical heat pad 16 applied to upper torso and passive warming blankets when compared to passive warming blankets only as control group, the mean of warming duration was 35 +/- 26 minutes<sup>(40)</sup>. The remaining one compared the effect among temperature regulating water circulating mattress + infusion heater, temperature regulating air circulating mattress + infusion heater, and conventional heating which were radiator ceilings, bed warmers and infusion heater<sup>(39)</sup>.

Three articles used aural probe which was gently placed in aural canal and occluded with cotton as measuring tool for continuous core temperature measurement (Kober et al, 2001; Scheck et al, 2004; Ludgren et al, 2011)<sup>(37,38,40)</sup>. In Cohen et al (2002)<sup>(36)</sup>, electronic 17 thermometer either orally or rectally were used as measuring tool for core temperature measurement if urinary catheter thermistor was not feasible. In the article (Kjellman et al, 2011)<sup>(39)</sup>, an indwelling (bladder) thermistor was used as a tool to measure core temperature.

Our review included a cohort study<sup>(41)</sup> that involved 2848 Adults traumatic patients; 18% were hypothermic (temperature < 36 degrees C). Hypothermia was significantly ( $P < .05$ ) correlated with admission Glasgow Coma Scale (GCS), tachycardia, hypotension, lower hematocrit, and acidosis. Hypothermic patients had a significantly higher blood product and factor VIIa requirement. Hypothermia was an independent predictor of operative management of injuries, and overall mortality ( $P < .05$ ). This study stated that Combat trauma patients have a high percentage of penetrating injuries with variable evacuation times. Hypothermia was a pre-hospital physiologic marker, and independent contributor to overall mortality. Concluded that the prevention of hypothermia could reduce resource utilization and improve survival in the combat setting<sup>(41)</sup>.

In concern with the prevention of hypothermia in adult patients we identified a prospective, randomized study<sup>(25)</sup>. Mentioned study involved 61 physical status of adults undergoing major surgery and general anesthesia with isoflurane which consider a type of intention traumatic procedures. Patients were divided into two groups the temperatures measured showed, Lowest and final intraoperative distal esophageal temperatures were higher ( $p < 0.05$ ) in Group 1 (mean +/- SEM: 35.8 +/- 0.1 degrees C and 36.6 +/- 0.1 degrees C) versus Group 2 (35.4 +/- 0.1 degrees C and 36.1 +/- 0.1 degrees C, respectively). Compared with Group 1, more Group 2 patients were hypothermic at the end of anesthesia (10 of 26 patients, or 38.5% vs. 4 of 30 patients, or 13%;  $p < 0.05$ ). And the results showed After 30 minutes in the recovery room, there were no differences in temperature between groups (36.7 +/- 0.1 degrees C and 36.5 +/- 0.1 degrees C in Groups 1 and 2, respectively). Intraoperative cessation of convective warming because of core temperature greater than 37 degrees C was required in 33% of Group 1 patients (vs. 11.5% in Group 2;  $p = 0.052$ ). All patients received convective warming. Group 1 patients received warmed fluids (setpoint 42 degrees C). Group 2 patients received room temperature fluids (approximately 21 degrees C). Therefore this study showed the combination of convective and fluid warming was associated with a decreased likelihood of patients leaving the operating room hypothermic. However, average final temperatures were greater than 36 degrees C in both groups, and intergroup differences were small. Care must be taken to avoid overheating the patient when both warming modalities are employed together<sup>(25)</sup>.

Another retrospective trail<sup>(8)</sup> was identified which was analysis of data total of 2182 patients from the Queensland Trauma Registry, Australia, and included all patients admitted to hospital during 2003 and 2004 with an injury severity score (ISS)>15. Demographic, injury, environmental, care and clinical status factors were considered. 124 (5.7%) of patients had hypothermia on admission to the definitive care hospital, while a further 156 (7.1%) developed hypothermia during hospitalisation. Factors associated with hypothermia on admission included winter, direct admission to a definitive care hospital, an ISS> or =40, a Glasgow Coma Scale of 3 or ventilated and sedated, and hypotension on admission. Hypothermia on admission to the definitive care hospital was an independent predictor of mortality. Hypothermia during definitive care hospitalisation was independently associated with mortality (OR=2.52; 95% CI 1.52-4.17), intensive care admission (OR=1.73; 95% CI 1.20-2.93) and hospital length of stay (IRR=1.18; 95% CI 1.02-1.36). This study has stated that Trauma patients in a predominantly sub-tropical



climate are at risk of accidental and endogenous hypothermia, with associated higher mortality and care requirements, the study highlighted that prevention of hypothermia is important for all severely injured patients<sup>(8)</sup>.

The last study<sup>(31)</sup> which was included to our study was aimed determined the efficacy of three hypothermia prevention strategies: the ChillBuster warming blanket, ChillBuster with a reflective blanket, and two wool blankets. A quasi-experimental design was used to compare changes in core temperature. Following resuscitation from hypovolemic shock, 20 swine were assigned to one of the three interventions, placed in an environmental chamber set to reproduce in-flight conditions onboard a military cargo aircraft (50 degrees F/airspeed 0.2 m/s), and monitored for 6 hours. A repeated measures analysis of variance and least-squared difference post hoc were performed. The ChillBuster/reflective blanket group was significantly warmer than the ChillBuster only group and the wool blanket group ( $p < 0.01$ ). After 6 hours of cold exposure, the ChillBuster/reflective blanket group remained warm while the ChillBuster only and wool blanket groups developed mild hypothermia. Combined use of a warming blanket and reflective blanket was effective in preventing hypothermia over 6 hours and is feasible in a deployed military environment<sup>(7,39)</sup>.

#### **Important differences in rewarming techniques:-**

Because patients remain threatened for as long as they're hypothermic, rapid and efficient rewarming is crucial. A variety of methods are used to gain normothermia in the trauma patient. They are generally divided into three groups: passive external rewarming, active external rewarming, and active internal rewarming. The patient's temperature and condition, and your hospital's resources, govern which maneuver to use. For more severe hypothermia, more aggressive rewarming techniques are warranted<sup>(39)</sup>.

Passive external rewarming is used when there's minimal heat loss. Heat is regained by means of the body's intrinsic ability to generate heat. Examples of passive external rewarming include bringing the patient indoors and providing him with warm blankets and hats.

Active external rewarming is used when there's moderate heat loss. Radiant rewarmers, fluid-filled blankets, and convection warming units are among the devices used. Monitor the patient's core temperature closely, as he can continue to lose heat or fail to rewarm despite active external devices if he is significantly cold at the onset of therapy<sup>(66)</sup>.

Fluid-circulating blankets make contact with only 20% – 30% of the body surface area, which can hamper their efficiency. They should always be placed on top of the patient to prevent tissue necrosis and further heat loss<sup>(66)</sup>.

Convection blankets circulate air at 109.4° F (43° C) at a flow rate of 400 cubic feet per minute. But air has very little thermal energy, which means these blankets are able to prevent further heat loss but are slow in active rewarming. They're best augmented by covering the patient's head<sup>(66)</sup>. Active internal rewarming is indicated for patients with moderate to severe hypothermia. The use of entrained warmed gas into the endotracheal tube is the least invasive internal maneuver. Oxygen can be warmed to 107.6° – 114.8° F (42° – 46° C) without damage to the pulmonary parenchyma<sup>(66)</sup>.

Another method of active internal rewarming is the use of rapid infuser fluid warmers, which have been the mainstay of resuscitation of hypothermic trauma patients. Fluids and blood can be warmed to 104° F (40° C) and infused at a rate of about one liter per minute. These devices maintain a steady state with rate and temperature regulation. Unlike rapid infuser fluid warmers, standard fluid warming devices have been found to be ineffective in keeping fluid temperatures warm, as they pass through coils of tubing at a rate of 125 ml/hour or less<sup>(66)</sup>.

Irrigation of body cavities with warmed fluids is another method of active internal rewarming. The amount of heat transfer depends on the difference between the inlet and outlet of water temperatures. The pleural cavity and peritoneal cavity are equally effective for rewarming. These cavities first need to be checked carefully to make sure they're intact. Diagnostic studies should be performed to rule out pneumothorax or diaphragmatic injury before beginning fluid administration. This technique can increase body temperature 1° – 2° C per hour<sup>(66)</sup>.

Cardiopulmonary bypass (CPB), which diverts the flow of blood via a pump oxygenator and heat exchanger to avoid both the heart and lungs, is considered to be the "gold standard" therapy for a hypothermic patient with cardiovascular instability. CPB is usually reserved for those with a body temperature lower than 82.4° F (28° C) and

can increase body temperature at a rate of 10° – 12° C per hour. In addition to rewarming, CPB can help oxygenate and perfuse organs despite ventricular fibrillation or asystole<sup>(5,39, 66)</sup>.

### Conclusion:-

Normal human body temperature is 35.6–37.8 degrees C with hypothermia being defined as a core temperature < 35 degrees C. In many of our reviewed study, it was found that almost half of EMS-transported trauma patients had a temperature < 36 degrees C on arrival to the ED. Important to note is that there was no association between season of the year and frequency of hypothermia. At highest risk were those patients older than 65 and those who had been entrapped. In addition, hypothermia in trauma has been associated with a significantly increased mortality compared to patients with the same body temperature from environmental exposure alone. Most of these studies trauma victims, a core temperature < 32 degrees C was associated with 100% mortality independent of the presence of shock, injury severity or volume of fluid resuscitation. Because hypothermia in a trauma patient predicts such a poor outcome, the traditional classification system of hypothermia has been revised for use in this vulnerable patient population. It is difficult to determine whether admission hypothermia occurs because of prolonged patient exposure to ambient temperatures, heat loss from open body cavities, or because of aggressive fluid resuscitation with room temperature IV. Medics often disrobe trauma patients early in the assessment, thereby enhancing radiant heat loss that occurs when there is a significant temperature gradient between the environment and the patient's skin. Reversing hypothermia is an effective strategy for improving outcome. However, once hypothermia develops, it is not resolved quickly or easily.

One of the easiest ways to begin combating the harmful effects of hypothermia is to undertake passive warming strategies such as removing the trauma patient from the cold environment as quickly as possible, raising the temperature in the back of the ambulance, and covering the patient with a blanket. Although passive interventions are effective for mild hypothermia if the patient's thermoregulatory mechanisms are intact, this strategy will still allow trauma patients to cool.

### References:-

1. Soreide K. Epidemiology of major trauma. *Br J Surg.* 2009;96:697–8. doi: 10.1002/bjs.6643.
2. McLarty, C.D. (2012). Hypothermia in the Trauma Patient. How Vital Is This Sign?
3. Krug EG, Sharma GK, Lozano R. The global burden of injuries. *Am J Public Health* 2000;90:523-6.
4. Waibel BH, Durham CA, Newell MA, Schlitzkus LL, Sagraves SG, Rotondo MF. Impact of hypothermia in the rural, pediatric trauma patient. *Pediatr Crit Care Med.* 2010;11:199–204. doi: 10.1097/PCC.0b013e3181b80500.
5. Waibel BH, Schlitzkus LL, Newell MA, Durham CA, Sagraves SG, Rotondo MF. Impact of hypothermia (below 36 degrees C) in the rural trauma patient. *J Am Coll Surg.* 2009;209:580–588. doi: 10.1016/j.jamcollsurg.2009.07.021.
6. Beilman GJ, Blondet JJ, Nelson TR, Nathens AB, Moore FA, Rhee P, Puyana JC, Moore EE, Cohn SM. Early hypothermia in severely injured trauma patients is a significant risk factor for multiple organ dysfunction syndrome but not mortality. *Ann Surg.* 2009;249:845–850. doi: 10.1097/SLA.0b013e3181a41f6f.
7. Jurkovich GJ, Greiser WB, Luteran A, Curreri PW. Hypothermia in trauma victims: an ominous predictor of survival. *J Trauma.* 1987;27:1019–1024. doi: 10.1097/00005373-198709000-00011.
8. Aitken LM, Hendrikz JK, Dulhunty JM, Rudd MJ. Hypothermia and associated outcomes in seriously injured trauma patients in a predominantly sub-tropical climate. *Resuscitation.* 2009;80:217–223. doi: 10.1016/j.resuscitation.2008.10.021.
9. Shafi S, Elliott AC, Gentilello L. Is hypothermia simply a marker of shock and injury severity or an independent risk factor for mortality in trauma patients? Analysis of a large national trauma registry. *J Trauma.* 2005;59:1081–1085.
10. Wang HE, Callaway CW, Peitzman AB, Tisherman SA. Admission hypothermia and outcome after major trauma. *Crit Care Med.* 2005;33:1296–1301. doi: 10.1097/01.CCM.0000165965.31895.80.
11. Luna GK, Maier RV, Pavlin EG, Anardi D, Copass MK, Oreskovich MR. Incidence and effect of hypothermia in seriously injured patients. *J Trauma.* 1987;27:1014–1018. doi: 10.1097/00005373-198709000-00010.
12. Martin RS, Kilgo PD, Miller PR, Hoth JJ, Meredith JW, Chang MC. Injury-associated hypothermia: an analysis of the 2004 National Trauma Data Bank. *Shock.* 2005;24:114–118. doi: 10.1097/01.shk.0000169726.25189.b1.
13. Danzl DF, Pozos RS, Auerbach PS, Glazer S, Goetz W, Johnson E, Jui J, Lilja P, Marx JA, Miller J. et al. Multicenter hypothermia survey. *Ann Emerg Med.* 1987;16:1042–1055. doi: 10.1016/S0196-0644(87)80757-6.

14. Mitra B, Al Jubair J, Cameron PA, Gabbe BJ. Tram-related trauma in Melbourne, Victoria. *Emerg Med Australas.* 2010;22:337–342. doi: 10.1111/j.1742-6723.2010.01309.x.
15. Gregory JS, Flancbaum L, Townsend MC, Cloutier CT, Jonasson O. Incidence and timing of hypothermia in trauma patients undergoing operations. *J Trauma.* 1991;31:795–798; discussion 798-800. doi: 10.1097/00005373-199106000-00009.
16. Stewart, S.K. (2003). Hypothermia in Trauma. North Central Texas Trauma Regional Advisory Council. Vol 5, No. 2
17. Milewski A, Ferguson KL, Terndrup TE. Comparison of pulmonary artery, rectal, and tympanic membrane temperatures in adult intensive care unit patients. *Clin Pediatr.* 1991;30(4 Suppl):13–6. doi: 10.1177/000992289103000405.
18. Bergstein JM, Slakey DP, Wallace JR, Gottlieb M. Traumatic hypothermia is related to hypotension, not resuscitation. *Ann Emerg Med.* 1996;16:39–42. doi: 10.1016/S0196-0644(96)70294-9.
19. Gregory JS, Flancbaum L, Townsend MC, Cloutier CT, Jonasson O. Incidence and timing of hypothermia in trauma patients undergoing operations. *J Trauma.* 1991;16:795–8. doi: 10.1097/00005373-199106000-00009.
20. Bernabei AF, Levison MA, Bender JS. The effects of hypothermia and injury severity on blood loss during trauma laparotomy. *J Trauma.* 1992;16:835–839. doi: 10.1097/00005373-199212000-00007.
21. Ireland S, Endacott R, Cameron P, Fitzgerald M, Paul E. The incidence and significance of accidental hypothermia in major trauma--a prospective observational study. *Resuscitation.* 2011;16:300–306. doi: 10.1016/j.resuscitation.2010.10.016.
22. Waibel BH, Newell MA, Durham CA, Barrett MR, Schlitzkus LL, Rotondo MF. Predictors of hypothermia in trauma patients. *Crit Care Med.* 2010;16(12 Suppl):208.
23. Kirkpatrick AW, Chun R, Brown R, Simons RK. Hypothermia and the trauma patient. *Can J Surg.* 1999;16:333–343. [
24. Nierman DM. Core temperature measurement in the intensive care unit. *Crit Care Med.* 1991;19:818–23. doi: 10.1097/00003246-199106000-00015.
25. Smith CE, Desai R, Glorioso V, Cooper A, Pinchak AC, Hagen KF. Preventing hypothermia: convective and intravenous fluid warming versus convective warming alone. *J Clin Anesth.* 1998 Aug;10(5):380-5.
26. Ferrara A, MacArthur JD, Wright HK, Modlin IM, McMillen MA. Hypothermia and acidosis worsen coagulation in the patient requiring massive transfusion. *Am J Surg* 1990;160:515-8.
27. Stone H, Strom P, Mullins R. Management of the major coagulopathy with onset during laparotomy. *Ann Surg* 1983;197:532-5.
28. Burch JM, Ortiz VB, Richardson J, Martin RR, Mattox KL, Jordan GL. Abbreviated laparotomy and planned reoperation for critically ill patients. *Ann Surg* 1992;215:476-83.
29. Hirshberg A, Walden R. Damage control for abdominal trauma. *Surg Clin North Am* 1997;77:813-9.
30. Mattox KL. Introduction, background, and future projections of surgery. *Surg Clin North Am* 1997;77:753-9.
31. Schmelz JO1, Bridges EJ, Wallace CM, Sanders SF, Shaw T, Kester N, Bauer S, Sylvester JC. Comparison of three strategies for preventing hypothermia in critically injured casualties during aeromedical evacuation. *Mil Med.* 2007 Mar;172(3):322-6.
32. Arthurs Z1, Cuadrado D, Beekley A, Grathwohl K, Perkins J, Rush R, Sebesta J. The impact of hypothermia on trauma care at the 31st combat support hospital. *Am J Surg.* 2006 May;191(5):610-4.
33. Gregory JS, Flancbaum L, Townsend MC, Cloutier CT, Jonasson O. Incidence and timing of hypothermia in trauma patients undergoing operations. *J Trauma.* 1991;31:795–798; discussion 798-800. doi: 10.1097/00005373-199106000-00009.
34. Farkash U, Lynn M, Scope A, Maor R, Turchin N, Sverdlik B, Eldad A. Does prehospital fluid administration impact core body temperature and coagulation functions in combat casualties? *Injury.* 2002;33:103–110. doi: 10.1016/S0020-1383(01)00149-8.
35. Frédéric Lapostolle, Jean Luc Sebbah, James Couvreur, François Xavier Koch, Dominique Savary, Karim Tazarourte, Gerald Egman, Lynda Mzabi, Michel Galinski, and Frédéric Adnet. Risk factors for onset of hypothermia in trauma victims: The HypoTraum study. *Crit Care.* 2012; 16(4): R142. doi: 10.1186/cc11449.
36. Cohen, S., Hayes, J. S., Tordella, T. & Puente, I (2002). Thermal Efficiency of Prewarmed Cotton, Reflective, and Forced—Warm Air Inflatable Blankets in Trauma Patients. *International Journal of Trauma Nursing.* 8(1) 4-8.
37. Kober, A., Scheck, T., Fulesdi, B., Lieba, F., Vlach, W., Friedman, A. & Sessler, D.I. (2001). Effectiveness of Resistive Heating Compared with Passive Warming in Treating Hypothermia Associated With Minor Trauma: A Randomized Trial. *Mayo Clinic Proceedings.* 76(4) 369-375.

38. Scheck, T., Kober, A., Bertalanffy, P., Aram, L., Andel, H., Molnar, C. & Hoerauf, K. (2004). Active warming of critically ill trauma patients during intrahospital transfer: A prospective, randomized trial. *Wien Klin Wochenschr.* 116(3): 94-97.
39. Kjellman, B.M., Fredrikson, M., Glad-Mattsson, G., Sjoberg, F. & Huss, F.R. (2011). Comparing ambient, air-convection, and fluid-convection heating techniques in treating hypothermic burn patients, a clinical RCT. *Annals of surgical Innovation and Research.* 5:4,1-8.
40. Lundgren, P., Henriksson, O., Naredi, P. & Bjornstig, U. (2011). The effect of active warming in prehospital trauma care during road and air ambulance transportation—a clinical randomized trial. *Scandinavian Journal of Trauma, Resuscitation & Emergency Medicine.* 19(59): 1-7.
41. Elliott CG, Zimmerman GA, Clemmer TP. Complications of pulmonary artery catheterization in the care of critically ill patients. A prospective study. *Chest.* 1979;76:647–52. doi: 10.1378/chest.76.6.647.
42. Bender JS, Smith-Meek MA, Jones CE. Routine pulmonary artery catheterization does not reduce morbidity and mortality of elective vascular surgery: results of a prospective, randomized trial. *Ann Surg.* 1997;226:229–36. doi: 10.1097/0000658-199709000-00002.
43. Jefferies S, Weatherall J, Young P. A systematic review of the accuracy of peripheral thermometry in estimating core temperatures among febrile critically ill patients. *Crit Care Resusc.* 2011;13:194–9.
44. Barringer LB, Evans CW, Ingram LL, Tisdale PP, Watson SP, Janken JK. Agreement between temporal artery, oral, and axillary temperature measurements in the perioperative period. *J Perianesth Nurs.* 2011;26:143–50. doi: 10.1016/j.jopan.2011.03.010.
45. Erickson R. Oral temperature differences in relation to thermometer and technique. *Nurs Res.* 1980;29:157–64. doi: 10.1097/00006199-198005000-00004.
46. Giuliano KK, Scott SS, Elliot S, Giuliano AJ. Temperature measurement in critically ill orally intubated adults: a comparison of pulmonary artery core, tympanic, and oral methods. *Crit Care Med.* 1999;27:2188–93. doi: 10.1097/00003246-199910000-00020.
47. Patel N, Smith CE, Pinchak AC, Hagen JF. Comparison of esophageal, tympanic, and forehead skin temperatures in adult patients. *J Clin Anesth.* 1996;8:462–8. doi: 10.1016/0952-8180(96)00103-1.
48. Eshraghi Y, Nasr V, Parra-Sanchez I, Van Duren A, Botham M, Santoscoy T. An evaluation of a zero-heat-flux cutaneous thermometer in cardiac surgical patients. *Anesth Analg.* 2014;119:543–9. doi: 10.1213/ANE.0000000000000319.
49. Cork RC, Vaughan RW, Humphrey LS. Precision and accuracy of intraoperative temperature monitoring. *Anesth Analg.* 1983;62:211–4. doi: 10.1213/0000539-198302000-00016.
50. Ash CJ, Cook JR, McMurtry TA, Auner CR. The use of rectal temperature to monitor heat stroke. *Mo Med.* 1992;89:283–8.
51. Robinson JL, Seal RF, Spady DW, Joffres MR. Comparison of esophageal, rectal, axillary, bladder, tympanic, and pulmonary artery temperatures in children. *J Pediatr.* 1998;133:553–6. doi: 10.1016/S0022-3476(98)70067-8.
52. Tsuei BJ, Kearney PA. Hypothermia in the trauma patient. *Injury.* 2004;35:7–15. doi: 10.1016/S0020-1383(03)00309-7.
53. Sund-Levander M, Grodzinsky E. Time for a change to assess and evaluate body temperature in clinical practice. *Int J Nurs Pract.* 2009;15:241–9. doi: 10.1111/j.1440-172X.2009.01756.x.
54. Lichtenbelt W. Brown adipose tissue and the regulation of nonshivering thermogenesis. *Curr Opin Clin Nutr Metab Care.* 2012;15:547–52. doi: 10.1097/MCO.0b013e3283599184.
55. Aslam AF, Aslam AK, Vasavada BC, Khan IA. Hypothermia: evaluation, electrocardiographic manifestations, and management. *Am J Med.* 2006;119:297–301. doi: 10.1016/j.amjmed.2005.09.062.
56. Goila AJ, Pawar M. The diagnosis of brain death. *Indian J Crit Care Med.* 2009;13:7–11. doi: 10.4103/0972-5229.53108.
57. Reuler JB. Hypothermia: pathophysiology, clinical settings, and management. *Ann Intern Med.* 1978;89:519–27. doi: 10.7326/0003-4819-89-4-519.
58. Hess JR, Brohi K, Dutton RP, Hauser CJ, Holcomb JB, Kluger Y, et al. The coagulopathy of trauma: a review of mechanisms. *J Trauma.* 2008;65:748–54. doi: 10.1097/TA.0b013e3281877a9c.
59. Rohrer MJ, Natale AM. Effect of hypothermia on the coagulation cascade. *Crit Care Med.* 1992;20:1402–5. doi: 10.1097/00003246-199210000-00007.
60. Michelson AD, MacGregor H, Barnard MR, Kestin AS, Rohrer MJ, Valeri CR. Reversible inhibition of human platelet activation by hypothermia in vivo and in vitro. *Thromb Haemost.* 1994;71:633–40.
61. Brohi K, Cohen MJ, Davenport RA. Acute coagulopathy of trauma: mechanism, identification and effect. *Curr Opin Crit Care.* 2007;13:680–5. doi: 10.1097/MCC.0b013e3282f1e78f.

62. MacLeod JBA, Lynn M, McKenney MG, Cohn SM, Murtha M. Early coagulopathy predicts mortality in trauma. *J Trauma*. 2003;55:39–44. doi: 10.1097/01.TA.0000075338.21177.EF.
63. Bukur M, Hadjibashi AA, Ley EJ, Malinoski D, Singer M, Barmparas G, et al. Impact of prehospital hypothermia on transfusion requirements and outcomes. *J Trauma Acute Care Surg*. 2012;73:1195–201. doi: 10.1097/TA.0b013e31826fc7d9.
64. Maani CV, DeSocio PA, Holcomb JB. Coagulopathy in trauma patients: what are the main influence factors? *Curr Opin Anaesthesiol*. 2009;22:255–60. doi: 10.1097/ACO.0b013e32832922be.
65. Martini WZ. The effects of hypothermia on fibrinogen metabolism and coagulation function in swine. *Metabolism*. 2007;56:214–21. doi: 10.1016/j.metabol.2006.09.015.
66. Frisch, D. E. (1995). Hypothermia in the trauma patient. *AACN Clin Issues*, 6(2), 196.
67. Peng, Y., & Bongard, F. S. (1999). Hypothermia in trauma patients. *J Am Coll Surg*, 188(6), 685.

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### RESEARCH ARTICLE

## PHILOSOPHIE : LA PEUR ET LE DESIR DE VENGEANCE A L'ORIGINE DE LA CONVERSION RELIGIEUSE.

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#### Abstract

The man uses the reason to distinguish the truly of the forgery. Yet, he is identified again like an emotional being. Besides, psychoanalysts and psychologists revealed that the emotion is the basis of the human existence. It releases by the fear and the desire of vengeance that push to the religious conversion. One knows that the fear is a violent fear facing a reality and that the desire is tension toward an object, source of satisfaction. In this sense, the role of the imagination is not to demonstrate anymore. Of the cruel gods to a merciful God, of the capricious gods to a God who frees, of idols to a God-mind, the convert leaves from these representations to encourage himself and to satisfy his desires.

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#### Introduction:-

La religion est un effort pour maintenir la paix au sein de l'humanité. On sait qu'étymologiquement, le mot religion dérive du latin « *religare* » qui veut dire « *respecter* » et que par extension, il désigne le fait de vouer un culte. Dans le même ordre d'idées, il vient du verbe latin « *religare* » qui signifie « *relier* », pour exprimer le lien qui unit l'homme à Dieu le créateur ou à d'autres divinités, qu'il s'agisse de « *religions du livre* » ou de « *religions de la coutume* » pour reprendre les expressions d'Edmond Ortigues. De cette définition, il ressort que la conversion religieuse désigne l'adoption d'une nouvelle religion. Elle est souvent marquée par l'entrée dans un groupe de croyants et est accompagnée d'un acte symbolique comme par exemple, le baptême chez les Chrétiens, la profession de foi chez les Musulmans, l'initiation, suivie de la profession de foi dans les religions traditionnelles. Autrement dit, la conversion religieuse est le processus par lequel l'individu s'évertue à suivre une nouvelle voie en décidant d'abandonner les mauvaises pratiques ou les idées jugées fausses qu'il avait autrefois reçues. En se convertissant donc, l'individu passe par la foi pour rejoindre une communauté religieuse réputée dans la pratique et la transmission des valeurs préférées. Bien qu'étant une œuvre de la foi, même si quelquefois la raison peut intervenir dans les limites qu'on lui reconnaît, toutes les conversions religieuses se caractérisent par l'émotion. D'ailleurs, les recherches en psychologie et en psychanalyse ont révélé que l'émotion est la base même de la vie humaine. Elle est un phénomène psychologique qui pousse l'organisme à réagir face à une situation agréable ou désagréable.

Dans le présent article, nous voulons attirer l'attention du lecteur sur la peur et le désir de vengeance, deux émotions inconscientes et nocives pour la conversion religieuse. Il s'agit alors de mettre l'accent sur la connaissance et la maîtrise de soi pour que cesse la violence au sein des religions et que la paix soit une réalité, surtout dans les pays d'Afrique où le **Boko Haram** dicte sa loi. Car, la peur et le désir de vengeance suscitent chez les convertis, l'agressivité qui, à son tour, conduit à la violence ou à la guerre des religions.

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## A- La peur à l'origine de la conversion religieuse:-

### La peur des phénomènes naturels:-

Dès son apparition dans le monde, l'homme a eu peur des phénomènes naturels. Alors, il s'est posé la question que se pose Leibniz dans *Principes de la nature et de la grâce fondés en raison* : Pourquoi il y a eu quelque chose plutôt que rien ? Pour Leibniz en effet, le rien serait plus facile à comprendre que quelque chose. C'est ce dernier qui met en œuvre la raison pour aider l'homme d'une manière ou d'une autre à comprendre et à expliquer tout ce qui existe. C'est alors qu'il aurait compris que les phénomènes naturels ont leur cause dans l'existence d'une autre chose dont ils sont l'effet. On comprend dès lors qu'à ses débuts, l'humanité ne pouvait pas conceptualiser directement et rationnellement l'idée de Dieu. Cela veut dire qu'en fait, la peur des phénomènes naturels serait à l'origine de la conception de Dieu et par conséquent, aurait conduit à la conversion religieuse. Ainsi, au départ, les hommes savaient qu'il y avait une vie et qu'ils en faisaient partie ; mais ils ne comprenaient pas les phénomènes naturels. C'est donc la peur de ces derniers qui poussait spontanément les premiers hommes à l'animisme. Ces phénomènes qu'ils ne comprenaient pas étaient entre autres : le soleil, le vent, les eaux, les plantes, les animaux, le feu, la foudre, les éruptions volcaniques, le tonnerre etc.

En marge de ces phénomènes, nous pouvons parler de la mort qui constitue pour l'homme une source d'angoisse. La peur liée à la mort provient de l'événement lui-même et des conséquences qui peuvent en découler. Pour un individu qui meurt, on sent la souffrance et la solitude chez les membres de sa famille. Après la mort, la question se pose encore de savoir si l'individu peut jouir d'une vie éternelle, en allant au Paradis. De plus, chacun se demande si après sa mort, quelqu'un pourrait s'occuper de sa famille et de ses biens. Blaise Pascal l'a bien compris quand il montre dans son œuvre *Pensées*, la peur qui nous anime au sujet de la mort. Dans le monde, tout se passe comme si les hommes sont enchaînés et condamnés à la mort. Certains étant chaque jour égorgés à la vue des autres, ceux qui restent, c'est-à-dire les vivants, voient leur propre condition dans celle de leurs semblables. En attendant leur tour, ils ont peur et se regardent avec douleur et sans espérance. S'inspirant de cette image de la condition humaine, Freud nous apprend la même chose quand, parlant de la mort des hommes, il affirme : « *Leur mort fait naître la conscience douloureuse.* »<sup>1</sup> De ces points de vue, la mort apparaît comme un phénomène qui pousse à réfléchir, en ce sens qu'elle conduit à la conversion religieuse à travers la peur qu'elle suscite.

Cela se comprend dans la mesure où l'homme est le seul animal qui sache qu'il doit mourir. De tous les êtres vivants, il possède de manière privilégiée la conscience ; une faculté qui le renseigne sur sa propre mort à partir de la mort d'autrui. Ainsi, il se plaint toujours d'avoir été créé mortel. C'est pourquoi, pour notre part, il ne serait pas exagéré de dire que l'homme est devenu religieux quand il a commencé par enterrer ses morts. Toutefois, il faut reconnaître que la mort ne doit pas être une source de peur, en ce sens qu'elle est un phénomène biologique. Elle n'est donc ni un accident, ni une réalité contingente ; mais une partie intégrante du système vivant. Dans *La logique du vivant*, François Jacob fait d'ailleurs remarquer que la mort est inhérente au monde animal et à son évolution. Elle est une nécessité inéluctable et une exigence de la vie.

La même idée se retrouve chez Heidegger qui, dans *Introduction à la métaphysique* soutient que l'homme est un être-pour-la-mort. Si tel est le cas, il serait stérile et vain de passer le temps à penser à notre finitude. L'essentiel pour le converti et pour tout homme est de bien agir pour améliorer ses conditions de vie. En fait, la saisie de notre finitude et de notre mort n'aura de sens que si elle nous pousse à de bonnes actions. Car, s'il est vrai que la mort est considérée comme la destruction du corps, il faut néanmoins reconnaître que quelque chose résiste à cette destruction. Il s'agit des œuvres que nous avons accomplies au cours de notre existence. C'est là notre revanche sur la mort et en même temps, l'espoir de toutes les victimes de la méchanceté humaine. Même si la vie ici-bas est éphémère, le fait de la vivre est à notre avis, un fait éternel.

Par ailleurs, ne pouvant pas comprendre pourquoi la nature pouvait se déchaîner dans des orages, des ouragans, des sécheresses et des inondations qui pouvaient tout détruire, l'homme est obligé de chercher une protection auprès de l'être suprême. En outre, dans une existence harassante où l'homme est confronté à des difficultés, la recherche de Dieu serait pour lui la solution adéquate. A l'instar de l'homme « primitif », l'homme des sociétés modernes croit en Dieu pour lutter contre la peur des phénomènes naturels et pour obtenir un bon niveau de vie. D'ailleurs, le fait d'observer la nature, de voir le jour, la nuit et les saisons se succéder ; de voir les fleurs s'épanouir périodiquement et les plantes se débarrasser de vieilles feuilles pour porter de nouvelles a amené les hommes à concevoir une force animée ; mieux, un esprit dans chacun des phénomènes de la nature. On comprend dès lors que c'est la peur des

<sup>1</sup> Sigmund FREUD, *Essai de psychanalyse*, Paris, Payot, 1972, p.215

phénomènes naturels qui a poussé les hommes à imaginer un dieu de la pluie, de la terre, des cieux, du soleil, de l'air, du feu, de l'eau, etc.

Contrairement à ce que nous dit Placide Tempels dans *La philosophie bantoue*, la raison n'est pas à l'origine de la conversion religieuse. Pour notre part, la peur des phénomènes naturels pousse les hommes à se tourner vers Dieu pour l'adorer. Il s'agit là d'une réalité qui ne laisse aucun peuple indifférent. Qu'il s'agisse de « *peuples civilisés* » ou de « *non-civilisés* », les réalités sont les mêmes. C'est pourquoi, bien que Raoul Allier ait montré que la conversion religieuse relève de l'émotion, nous ne sommes pas d'accord quand il nous parle seulement des « *peuples indigènes* », des « *peuples primitifs* » ou des « *peuples non-civilisés* ».

Dans le paganisme comme dans les religions révélées, la peur des phénomènes naturels pousse les hommes à penser qu'ils peuvent influencer sur les humeurs des dieux, des esprits ou des génies afin de leur plaire pour qu'ils deviennent favorables. Dans le même ordre d'idées, ils pensent que ces dieux, ces esprits et ces génies doivent agir selon leurs humeurs et leurs caprices. Ils ont très tôt compris qu'il fallait les écouter et les respecter pour se faire exaucer et pour se faire libérer de la peur des phénomènes naturels. Nous pouvons dès lors comprendre l'apparition des rituels de toutes sortes pour invoquer les puissances célestes. Par les rituelles, les hommes, de toute société, de toute langue et de toute culture apaisent les phénomènes naturels, en honorant les dieux et en les amenant à satisfaire à leur demande. On comprend alors le sens des rituels de naissance, d'initiation, de réconciliation, de protection, de mort qui s'observent à travers toutes les religions.

### **La peur des malédictions ancestrales:-**

Dans les sociétés africaines modernes, la conversion religieuse se justifie de plus en plus par la peur des malédictions ancestrales. En effet, pour la plupart des personnes qui se convertissent, les ancêtres sont désormais identifiés comme la source de toutes malédictions, ou de toutes difficultés. Autrement dit, pour ceux qui se convertissent, il faut rompre le lien avec les ancêtres pour échapper aux difficultés de l'existence. De ce point de vue, le converti se fait une conception persécutrice du mal qui se transmet à travers les liens de sang et à travers les générations. Les nombreuses conversions enregistrées depuis plusieurs années dans les religions monothéistes comme le Christianisme et l'Islam s'expliquent par la peur des malédictions ancestrales. Les difficultés de l'existence étant souvent attribuées à la sorcellerie ou aux esprits ancestraux, l'individu se convertit pour rompre avec le passé.

Dans les sociétés traditionnelles, pour échapper à l'échec, à la maladie et à la mort, il faut fréquemment apaiser les puissances persécutrices en choisissant les rites propitiatoires les plus appropriés afin de resserrer les liens avec les ancêtres du lignage et les ascendants immédiats. Mais dans les religions du livre (L'Islam et le Christianisme), les personnes converties rompent le lien avec les esprits ancestraux pour se libérer de la peur des malédictions ancestrales et se laisser conduire par le Dieu créateur. C'est justement ce que nous apprend le couple Ortigues par l'affirmation suivante : « *Dans l'islamisme ou le christianisme on exorcise, on expulse la puissance du mal qui vous possède.* »<sup>2</sup>

Il s'agit le plus souvent d'une rupture qui pousse à briser les liens familiaux. Car le converti pense que le démon œuvre à travers les liens de sang et que le Dieu créateur du ciel et de la terre est capable de rompre ces liens pour lui permettre de jouir du bonheur à travers sa bénédiction. Pour lui, la conversion garantit la protection contre le pouvoir maléfique des ancêtres. Depuis quelques décennies, la multiplication des Eglises Evangéliques et Pentecôtistes sur le continent africain donne la preuve de l'intention de rompre avec le lien ancestrale chez la plupart des personnes converties. De tels exemples nous donnent la preuve que la conversion religieuse en Afrique relève de l'émotion comme le souligne Raoul Allier dans *La psychologie de la conversion chez les peuples non-civilisés*. De plus en plus, on constate que les pratiques relatives aux religions traditionnelles sont abandonnées au profit de celles qui s'observent dans les religions monothéistes. Il n'est pas rare de voir les Eglises Evangéliques et Pentecôtistes lutter jour et nuit contre la sorcellerie, le démon et surtout contre les malédictions ancestrales ; car les génies, les esprits des morts anciens et nouveaux qui peuplent les maisons, les forêts, les rivières, les arbres sont désormais identifiés comme les causes de tout blocage chez l'individu qui aspire à la conversion religieuse.

<sup>2</sup> M.C.- E. ORTIGUES, *Œdipe africain*, Paris, L'Harmattan, 1966, p. 129



Précisons avec intérêt que la peur des malédictions ancestrales et le désir de rompre les liens avec les ancêtres s'expliquent par le fait que les conséquences des péchés commis par ces derniers retombent selon les convertis, sur les générations présentes et futures. Les effets de la malédiction ancestrale sur une personne se traduisent par des maladies chroniques, des psychopathologies (névroses et psychoses), des excès émotifs, des pertes financières répétées, une succession de morts non naturelles dans l'entourage de la personne, des troubles de comportement, des problèmes de stérilité et d'impuissance sexuelle, des divorces répétés, des excès de colère etc.

Ces aléas de la vie quotidienne sont souvent interprétés comme des conséquences ou comme des effets de la malédiction ancestrale. Autrement dit, ils sont considérés comme les plans de l'ennemi ou du diable pour éprouver les individus et les détourner du salut de Dieu. C'est pourquoi, dans *Sorcellerie et prière de délivrance*, Meinrad Hebga nous donne son point de vue sur la question du rapport entre l'individu et les ancêtres : « *De toute façon, les mânes des ancêtres ont chez nous un statut spécial, unique ; nous leur vouons un culte religieux si important que la religion traditionnelle africaine a pu être appelée parfois ancestralisme. Mais un théologien comme Boladji Idowu, d'Ibadan, conteste une telle appellation. Selon lui, c'est finalement au dieu suprême que l'on offre sacrifice et libations.* »<sup>3</sup>

Les différents blocages de la vie des chrétiens ou des musulmans sont attribués à une maladie spirituelle qui affecte directement ou indirectement leur relation à Dieu. Car, bien qu'étant convertis, les fidèles peuvent encore être poursuivis et tourmentés par les esprits ancestraux. Mais précisons au passage que tous les esprits ancestraux ne poursuivent pas et ne tourmentent pas. Chez les Mossi comme chez beaucoup d'Africains, un ancêtre bienveillant peut apparaître dans le rêve afin de prévenir d'un danger imminent. Cela veut dire que les ancêtres peuvent se révéler bienveillants ou persécuteurs, selon les circonstances. A ce sujet, voici encore ce que nous apprend Hebga : « *Ne devraient être regardés comme bons et bienveillants que ceux qui, véritables anges tutélaires nous témoigneraient leur sollicitude sans nous réduire en esclavage, et sans nous imposer des conditions qui blessent notre conscience morale et notre foi religieuse.* »<sup>4</sup>

### La peur des ennemis:-

Une autre raison qui conduit à la conversion religieuse est la peur des ennemis. Pour la plupart des personnes converties, l'ennemi représente un individu asocial et mauvais, en ce sens qu'il veut le mal des autres. Autrement dit, l'ennemi est un persécuteur qui fait peur au converti et à sa famille. Sa seule présence peut être considérée comme une source de peur et de blocage. Il s'agit de la peur psychologique et de blocage dans la réussite des affaires : maladies, dépérissement, réduction de l'énergie vitale, échec, stérilité, mort etc. qui sont attribués à l'action malveillante des ennemis, surtout dans les sociétés africaines.

D'ailleurs dans *Edipe africain*, Marie-Cécile et Edmond Ortigues ont montré que ces maux et d'autres encore sont souvent l'objet des délires de persécution dans les sociétés africaines. Ils nous donnent l'exemple de Fari, un jeune lycéen originaire de Dakar. Fari est un musulman et candidat au baccalauréat technique. Il souffre d'insomnie et de céphalées violentes. Il faisait les pires rêves qui le poussaient à la folie. Son père avait décidé d'inscrire à l'école un de ses cadets. Mais puisque ce dernier était trop jeune et que Fari était plus âgé, il est entré à l'école à la place du cadet. Pour Fari en effet, son frère cadet serait à l'origine de sa maladie, en ce sens qu'il lui avait ravi la position qui devait être la sienne. Alors, la réussite scolaire pour Fari consiste à tuer son frère cadet. Ainsi, il ne souffrirait plus d'aucune maladie et il réussirait brillamment ses études. Dans le cas d'espèce, le sentiment de culpabilité est externe et l'agressivité s'exprime principalement sous la forme de réactions persécutives. Dans les cultures africaines, les rapports interpersonnels sont colorés par le fait que chacun se perçoit facilement comme persécuté par l'autre. Cela se comprend dans la mesure où l'individu qui souffre d'un mal, accuse le plus souvent un ennemi au sein ou en dehors de sa famille. Il est donc trop facile d'attribuer à l'action de l'ennemi, tous les maux dont on souffre.

A partir de ce constat, il serait intéressant de relever au passage une analogie entre la conversion dans les religions traditionnelles et celle qui s'observe dans les religions monothéistes. Dans *La philosophie bantoue*, Placide Tempels

<sup>3</sup> Meinrad HEBGA, *Sorcellerie et prière de délivrance : réflexion sur une expérience*, Paris, Présence Africaine, 1982, p. 134

<sup>4</sup> Ibidem, pp. 136 - 137

a fait remarquer que la peur de l'ennemi fait retourner les Bantous superficiellement convertis au Christianisme, à la religion de leurs ancêtres. Car dans les sociétés africaines traditionnelles, l'ennemi est le plus souvent considéré comme l'auteur du malheur ou plus précisément celui qui réduit l'énergie vitale, en ce sens qu'il est capable de conduire à la mort. La même conception se retrouve chez les personnes converties au monothéisme (Christianisme et Islam). Pour ces derniers en effet, la conversion religieuse apparaît comme la solution à la peur de l'ennemi. Nombreuses sont d'ailleurs les chansons religieuses qui véhiculent une telle idée. Dieu apparaît dès lors comme le vainqueur de l'ennemi. Quiconque se convertit au Christianisme ou à l'Islam n'a plus rien à craindre.

Dans le psychisme des personnes converties aux religions bibliques, tout se passe comme si l'ennemi n'était à leurs yeux qu'un monstre mythique qu'il faut nécessairement abattre pour avoir la paix. Son action destructrice a, selon eux, une nature spirituelle. Pourtant, dans les Evangiles, le Seigneur Jésus nous invite à étendre son commandement d'amour jusqu'aux ennemis. Dans l'*Evangile selon Saint Matthieu*, nous avons les propos suivants : « *Vous avez entendu qu'il a été dit : tu aimeras ton prochain et tu haïras ton ennemi. Eh bien ! Moi je vous dis : aimez vos ennemis et priez pour vos persécuteurs, afin de devenir fils de votre Père qui est aux cieux, car il fait lever son soleil sur les méchants et sur les bons, et tomber la pluie sur les justes et les injustes. Car si vous aimez ceux qui vous aiment, quelle récompense aurez-vous ? Les publicains eux-mêmes n'en font-ils pas autant ? Et si vous réservez vos saluts à vos frères, que faites vous d'extraordinaire ? Les païens eux-mêmes n'en font-ils pas autant ? Vous donc, vous serez parfaits comme votre Père céleste est parfait.* »<sup>5</sup>

En fait, Jésus nous donne comme leçon d'aimer le pécheur ou l'ennemi, tout en détestant le péché. Autrement dit, nous devons agir comme un médecin qui combat la maladie en aimant le malade qui a besoin de guérison. En d'autres termes, nous devons lutter contre le mal que commettent nos ennemis tout en manifestant à leur égard, une immense charité. On peut dans cet ordre d'idées se référer au conseil de l'apôtre Paul dans l'*Epître aux Romains* : si nous aimons nos ennemis, nous serons vainqueurs du mal par le bien.

### La peur des punitions ici-bas:-

Dans l'*Evangile selon Saint Matthieu*, Jésus nous met en garde contre la recherche effrénée du bonheur et du bien-être à travers les moyens non recommandables : « *Cherchez avant tout le royaume de Dieu et sa justice, et le reste vous sera accordé par surcroît.* »<sup>6</sup> En s'inspirant de ce propos de Jésus, saint Paul, dans la *Deuxième Epître aux Corinthiens* souligne que la recherche du bonheur, sous toutes ses formes ne doit pas être la première préoccupation du converti ou de l'homme en situation dans le monde. L'essentiel est de connaître Dieu, de l'adorer et de faire sa volonté. C'est pourquoi, pour l'apôtre Paul en effet, la souffrance doit être acceptée par le converti, comme une participation à celle de Jésus. En d'autres termes, le converti doit être capable de boire avec Jésus, à la coupe d'amertume. Il doit être capable de souffrir et de mourir avec Jésus pour ainsi entrer avec lui dans son royaume. De ce point de vue, la souffrance ne doit plus être vue comme une punition ici-bas. Cela veut dire qu'en réalité, le converti ne doit plus avoir peur de quoi que ce soit. Tout ce qu'il vit en bien ou en mal doit être vécu en Dieu, pour Dieu et avec Dieu.

A partir de cette considération, une question pourrait venir à l'esprit du lecteur averti : doit-on accepter la souffrance sans rien faire pour y échapper ? A notre avis, la réponse à cette question doit être négative. Pour notre part, Dieu n'est pas injuste et ne cautionne jamais l'injustice. De plus, il n'a jamais voulu le mal, mais toujours le bien de l'humanité. C'est d'ailleurs pourquoi il nous a dotés des facultés intellectuelles telles que : la conscience, la volonté, la liberté, la responsabilité, la raison, l'intelligence, la mémoire, l'imagination, pour ne citer que celles-là, afin de bien penser pour bien agir en faisant des choix libres et responsables pour notre bonheur et pour notre bien-être. Cela veut dire qu'en réalité, notre bonheur peut dépendre de nous-mêmes, si nous œuvrons vraiment dans ce sens et si nous agissons de façon responsable dans la société. Restons dans la même logique pour dire que le malheur peut dépendre de nous si nous n'exerçons pas bien nos facultés intellectuelles pour opérer des choix en vue d'une existence heureuse.

En résumé, si le bonheur peut dépendre de nos choix, le malheur peut en dépendre aussi. Nous n'ignorons certes pas la question du déterminisme, mais nous voulons souligner avec rigueur qu'il est inutile que les convertis se réfugient dans les églises, dans les mosquées et dans les religions traditionnelles pour échapper aux punitions ici-bas. En fait, Dieu reste égal à lui-même et n'est jamais responsable du mal de l'homme. Tant que l'homme ne changera pas de mentalité et de comportement ; tant qu'il ne va pas travailler avec une bonne conscience pour améliorer sa condition

<sup>5</sup> Mt 5, 43- 48

<sup>6</sup> Mt 6, 33 - 34

de vie et celle des autres, il ne peut échapper aux punitions ici-bas. Cela signifie qu'en réalité, Dieu ne met pas fin aux punitions ou à la souffrance de l'homme après son adhésion à une religion. Ce qui importe pour Dieu et qui passe par-dessus tout, c'est la recherche de son royaume et de sa justice à travers le respect des commandements. Si cela est compris et bien compris, nous pouvons prétendre échapper aux punitions ici-bas. Toutes les personnes converties qui n'auront pas compris cette leçon prendront la vie comme un fardeau dont il faut se débarrasser en passant d'une religion à une autre ou de certaines religions à d'autres.

Ainsi, à l'instar du tradithérapeute qui soumet son client à de nombreux interdits, Dieu lui aussi nous soumet à des interdits. Chez le tradithérapeute, enfreindre les interdits, c'est s'exposer à ne pas guérir du mal dont on souffre et de mourir par conséquent, de sa maladie. Dans la même logique, chez le croyant, l'ataraxie (absence de trouble ou tranquillité de l'âme) comporte elle aussi des exigences, c'est-à-dire des interdits qui se retrouvent dans les commandements de Dieu, du moins, sous leur forme prohibitive. Par exemple, si le converti comprend qu'il doit aimer son prochain comme lui-même, il peut éviter la violence et les conflits sociaux en favorisant ainsi la paix en lui et autour de lui. S'il comprend qu'il ne doit pas corrompre ou se faire corrompre, qu'il ne doit pas voler ou détourner le bien public, il doit travailler avec une bonne conscience pour satisfaire ses besoins fondamentaux (se nourrir, se soigner, s'instruire, se loger, et se vêtir), pour rendre service à la société et pour développer son pays. Cela ferait d'ailleurs de lui un patriote et un modèle à suivre. S'il sait qu'il doit s'occuper de ses enfants et bien les éduquer, il aura une famille heureuse, épanouie et contribuera ainsi à la formation de bons citoyens pour son pays. En agissant de la sorte, le converti n'aura plus peur des punitions ici-bas. Il saura que pour lui, le Paradis de Dieu commence déjà ici-bas, parce qu'il est devenu un bon converti. Dans ce sens, nous pouvons nous référer à cette formule de Ludwig Feuerbach : « *Exister veut dire être sujet.* »<sup>7</sup>

Dans le même ordre d'idées, nous pouvons nous référer à ce que nous dit Lucrèce (philosophe latin, 98 à 55 avant Jésus Christ), dans *De la nature* : si, en sentant sur leur cœur le poids qui les accable, les hommes pouvaient aussi connaître l'origine de leur mal et d'où vient leur lourd fardeau de misère, ils ne vivraient pas comme ils vivent trop souvent, en ignorant ce qu'ils veulent, cherchant toujours une place nouvelle comme pour se libérer de leur charge.

### **La peur des punitions dans l'au-delà:-**

Jusqu'ici, nous avons constaté que toute religion propose à ses adeptes, le système de la carotte et du bâton : punition divine, en cas de mauvaises actions et récompense, en cas de bonnes actions. En habituant les hommes à une telle logique il est clair que leur conversion religieuse ne peut relever que de l'émotion et non de la raison. Plus on médite cette idée, plus on en sent la vérité. Plus on la conteste, plus on donne l'occasion de l'établir encore par de nouvelles preuves.

En effet, dans les religions traditionnelles, le rapport existant entre la morale, la religion et la manière dont les jugements se font sur terre amènent les hommes à se faire une idée du jugement dans l'au-delà. En d'autres termes, l'homme se fait une conception de l'autre vie, c'est-à-dire de l'au-delà qu'il se représente généralement comme une continuation de la vie terrestre. Dans l'imaginaire collectif, le pays des morts est fort semblable au pays des vivants, en ce sens que l'on pense que les bons seront récompensés, tandis que les mauvais seront punis ou châtiés, exactement comme cela se fait dans le monde ici-bas. On pense que dans l'au-delà, se trouvent les mêmes habitudes, les mêmes usages, le même genre de vie. Dès lors, le traitement réservé à ceux qui ne sont plus de ce monde et qui vont dans l'au-delà dépend du genre de vie qu'ils ont mené sur cette terre, c'est-à-dire dans ce monde. Autrement dit, selon la logique humaine, le jugement et le traitement réservés à l'individu dans l'au-delà relèvent du rang qu'il occupait dans sa famille, dans sa tribu. Cela dépend aussi de sa situation sociale, de sa richesse, de sa puissance magique, de son intelligence, de sa vigueur, de sa capacité à faire le bien ou le mal. La même idée est exposée dans *La psychologie de la conversion chez les peuples non-civilisés* où Raoul Allier montre que, selon la logique des « *peuples primitifs* » ou « *peuples indigènes* », le roi demeure roi, au pays des morts, l'esclave demeure esclave, celui qui a été malade ou malheureux voit se poursuivre sa maladie et sa misère, tandis que le bonheur suit au-delà du tombeau, l'homme qui en a joui sur cette terre. A notre avis, la peur des punitions dans l'au-delà serait encore à l'origine de la conversion religieuse.

<sup>7</sup> Ludwig FEUERBACH, *Principes de la Philosophie de l'avenir*, Paris, P.U.F., 1842, p. 220

Dans les religions traditionnelles par exemple, on pense que les dieux châtent les malfaiteurs qui ont agi sur terre contre leurs serviteurs dévoués ou contre leurs adorateurs fidèles. Autrement dit, les dieux doivent punir dans l'au-delà, ceux qui agissent mal sur terre après leur mort. De ce point de vue, les dieux qui habitent le pays des morts apparaissent dans les religions traditionnelles comme des juges qui étendent leur juridiction sur tous les actes des hommes, qu'ils agissent en bien ou en mal. Mentionnons avec intérêt que dans les religions traditionnelles, les dieux n'ont pas seulement pour rôle de juger les morts et de les châtier. Ils sont aussi pourvoyeurs de récompenses. Ils sont considérés encore comme des réparateurs des injustices commises dans le monde ici-bas. Car, on pense que ceux qui subissent l'injustice de la part des ennemis ou des plus forts de ce monde sont aussi consolés.

S'agissant des religions révélées (l'Islam et le Christianisme), la peur des punitions dans l'au-delà ou plus précisément, la peur de l'Enfer serait aussi l'une des raisons pouvant pousser les individus à se convertir. D'ailleurs, le discours sur la peur de l'Enfer est assez présent dans l'histoire des religions monothéistes. Tout porte donc à croire que ceux qui se convertissent craignent le jugement de Dieu et l'entrée en Enfer pour se conduire droitement. La figure de l'Enfer est bien l'image de la sanction des fautes. Les Saintes Ecritures, témoignent que Dieu jette dans l'Enfer ceux qui, sur cette terre, se sont éloignés de la justice pour choisir les voies tortueuses du mal. On se rappelle à juste titre du sermon de Jésus sur la montagne exposé dans l'*Evangile selon saint Matthieu*. Ici, Jésus nous parle de la géhenne de feu qui détruira le malfaiteur qui aura librement choisi de mener une existence en désaccord avec la loi de Dieu.

La même idée se retrouve dans le *Coran* : « *Ceux qui font le mal et qui se font cerner par leurs péchés, ceux là sont les gens du feu où ils demeureront éternellement.* »<sup>8</sup> Une telle idée entraîne chez l'homme, la peur des sanctions dans l'au-delà. Dans le même sens, elle amène l'homme le plus mauvais à se convertir pour chercher refuge dans la foi en Dieu, dans l'espoir d'être sauvé de ses fautes. Cela veut dire qu'en réalité, dans les religions monothéistes, la peur de l'Enfer tient en respect un nombre important de personnes converties. En craignant le jugement de Dieu et l'Enfer après la mort, le converti est obligé de vivre selon les préceptes de la foi ; car, il sait que là haut, c'est-à-dire dans l'au-delà, les comptes seront faits et que son âme sera jugée si, ici-bas, il s'est livré au péché.

L'idée de la peur de l'Enfer est encore développée dans *Gorgias* de Platon où Socrate tente longuement de faire entendre à Calliclès qu'il vaut mieux être tempérant et intègre ici-bas, au lieu de prendre le parti de l'intempérance et de l'immoralisme. Mais, puisque Calliclès ne voulait pas entendre la voix de la raison, Socrate tire sa dernière cartouche et emploie un langage religieux en tenant un discours menaçant relatif à la sanction des âmes après la mort. Pour Socrate en effet, la peur de l'Enfer doit nous obliger à bien agir ici-bas.

Mais, mentionnons que pour le converti, la peur de l'Enfer n'est qu'une erreur en ce sens qu'elle relève de l'imagination. Déjà, dans l'antiquité, des voix se sont élevées contre la religion, notamment dans l'épicurisme. En effet, si beaucoup de religions pensent détenir la vérité au sujet de la peur de l'Enfer qui pousse le converti à vivre selon les règles morales ici-bas, afin d'entrer dans le Paradis, tel n'est pas le cas chez Epicure qui nie totalement l'existence d'un au-delà après la mort. Si tel est le cas, pourquoi le converti doit-il encore avoir peur de l'Enfer ? Car, pour Epicure, la mort est la privation totale de la sensibilité. Celui qui meurt n'a plus conscience de rien. Il ne connaît ni joie, ni peine, ni Enfer, ni Paradis. C'est pourquoi, dans sa *Lettre à Ménécée sur la morale*, Epicure nous apprend que personne ne peut expérimenter la mort. Tant que nous existons, elle ne nous concerne en rien et pendant qu'elle est là, nous n'existons plus.

La peur de l'Enfer est encore rejetée par Nietzsche qui refuse toute tentative de faire de Dieu un bourreau et de considérer l'Enfer comme le lieu du châtement et de la faute. En battant en brèche la thèse de Schopenhauer selon laquelle le salut de l'homme consiste à s'affranchir du « *vouloir vivre* » et donc de la douleur qui en est l'expression, Nietzsche condamne aussi la morale du péché pour faire l'éloge de l'instinct. Pour lui, cette peur que prônent les religions conduit à la fuite de responsabilité face à l'existence. Cela se comprend dans la mesure où la religion relève de la « *mentalité du troupeau* » ; puisqu'elle fait diminuer la force des instincts naturels qui sont refoulés dans l'inconscient et qui finalement se transforment en cruauté et en rancune souvent difficiles à oublier. Dans *Généalogie de la morale*, Nietzsche prend le converti qui a peur de l'Enfer et qui considère Dieu comme un

<sup>8</sup> *Coran*, Al-Madinah Al-Munawwarah, Complexe Roi Fahd pour l'impression du Noble Coran 1410,

bourreau pour une bête triste et folle. Dans cet ordre d'idées, il refuse d'inventer une autre vie ; une vie différente de celle dans laquelle nous sommes. Dans *Le gai savoir*, il nous apprend que l'homme doit aimer la vie et œuvrer pour le bonheur. Il faut donc cesser d'être un fabricant de dieu et de projeter en lui toutes ses intentions. Il doit plutôt devenir un « *surhomme* », c'est-à-dire un être supérieur, grâce à la « *volonté de puissance* ». La peur de l'Enfer ne stimule donc pas notre « *volonté de puissance* », mais la diminue. De ce point de vue, Nietzsche a voulu obliger ses lecteurs à s'interroger sur eux-mêmes et sur leur foi.

## **B- Le désir de vengeance à l'origine de la conversion religieuse.**

### **Vengeance contre le diable:-**

En affirmant que Dieu existe, les hommes ne disent pas la même chose et ils ne sont pas nécessairement du même avis. En fait, le mot « *Dieu* » peut renvoyer à des idées très différentes. Chez certains convertis, Dieu peut être appelé au secours pour se venger contre le diable, parce qu'il est considéré comme un être tout puissant, c'est-à-dire, celui qui possède la force par lui-même et qui est capable de tout. C'est justement ce qui fait l'objet de notre réflexion dans la présente section.

En effet, les Saintes Ecritures nous enseignent que parmi les anges que Dieu a créés pour qu'ils soient près de lui et contemplent sa gloire, certains, à la suite du premier d'entre eux que l'on nomme le diable se sont rebellés contre lui. Cela signifie qu'ils ne peuvent plus rester près de Dieu et qu'ils sont rejetés dans l'Enfer préparé pour le diable et ses anges. C'est justement ce que nous apprend Jésus dans l'*Evangile selon Saint Matthieu* : « *Alors il dira encore à ceux de gauche : allez loin de moi, maudits, dans le feu éternel qui a été préparé pour le diable et ses anges.* »<sup>9</sup> Dès lors, les convertis pensent que le diable et ses anges viennent dans le monde des hommes pour apporter le mal ; qu'ils détournent les hommes de Dieu et les entraînent au péché. Sachant alors que le diable peut être la source du mal, mais qu'il n'est pas puissant et que seul Dieu est capable de tout, les personnes converties appellent Dieu au secours pour se venger contre le diable. Cela veut dire qu'en fait, les hommes seraient perdus si Dieu ne les aimait et ne les protégeait pas. D'ailleurs, selon la *Sainte Bible*, le diable est identifié comme le contradicteur de Dieu. Plusieurs noms lui sont attribués pour exprimer ses mauvaises actions. Selon les circonstances, il est appelé Satan ou Belzébuth. C'est le prince des ténèbres, le père du mensonge, le prince de ce monde.

Dans l'intention de nous montrer que seul, Dieu est capable de venger le converti contre le diable, l'apôtre Pierre, dans sa première épître, nous montre la nécessité de résister au diable par la foi en Dieu : « *Soyez sobres, veillez. Votre partie adverse, le diable, comme un lion rugissant, rôde, cherchant qui dévorer. Résistez lui, fermes dans la foi.* »<sup>10</sup> Alors, nous comprenons que Dieu n'abandonne pas le converti qui croit en lui. Il le garde, le gouverne avec sa divine providence et constitue en même temps celui qui le rend fort contre le diable et ses anges. Autrement dit, en Dieu, se trouve la confiance inébranlable qui lui permet de résister au diable ou de se venger contre lui.

Mais, à notre humble avis, une telle compréhension des Saintes Ecritures ne doit pas nous faire perdre de vue la réalité. L'homme peut lui-même choisir d'avoir le statut du diable, s'il décide de penser et d'agir contre la volonté de Dieu. Bien qu'étant converti à une religion, il est toujours libre. Par ses actes, il peut ressembler à Dieu ou au diable. S'il ressemble à Dieu, il écouterait sa parole et collaborerait avec lui comme un fils bien aimé. S'il ressemble au diable, il deviendrait son partenaire et ferait le mal pour lui-même et pour autrui. Car, bien que la loi de Dieu soit exigeante, elle laisse néanmoins à chaque homme, la liberté de faire ce qu'il veut. Dans certaines circonstances, il peut faire ce qu'il veut, ce qui lui plaît ou ce qu'il juge bon. Il peut dès lors ressembler à Dieu s'il veut ou ressembler au diable. Cela veut dire qu'en réalité, Dieu ne peut pas venger le converti contre le diable s'il décide lui-même, par ses actes, de ressembler au diable. Jean-Paul Sartre l'a bien compris quand il dit : « *L'homme est responsable de ce qu'il est.* »<sup>11</sup> Chaque converti, par ses actes, propose donc des valeurs. De ce point de vue, il peut prendre l'apparence de Dieu ou du diable, selon les circonstances. Cela veut dire qu'en réalité, le diable n'est pas nécessairement en dehors de l'homme. D'ailleurs, personne ne l'a jamais vu. C'est l'homme qui, selon les circonstances, prend l'apparence du diable par ses actes ou par ses comportements. Si les hommes pouvaient changer de mentalité et s'aimer entre eux, l'on ne parlerait plus de diable et l'on ne se vengerait plus contre lui.

<sup>9</sup> Mt 26, 41

<sup>10</sup> I P, 8-9

<sup>11</sup> Jean-Paul SARTRE, *L'existentialisme est un humanisme*, Paris, Nagel, 1970, p.24

### Vengeance contre l'ennemi:-

Il est clair que l'homme partage avec l'animal, l'instinct d'agressivité. C'est une tendance à déployer sa puissance qui peut impliquer la neutralisation de tout obstacle, y compris l'être humain, qui, d'une manière ou d'une autre, peut être considéré comme un ennemi. Dans ce sens, on comprend que l'agressivité est naturelle chez l'homme, quelle que soit la morale ou la religion et qu'il serait illusoire de la supprimer, mais de l'atténuer. C'est pourquoi le Coran recommande que la lutte soit engagée contre l'ennemi : « *Combattez dans le sentier d'Allah ceux qui vous combattent, et ne transgressez pas. Certes, Allah n'aime pas les transgresseurs !* »<sup>12</sup> D'ailleurs, philosophes et penseurs d'horizons les plus divers n'avaient pas attendu les travaux de Freud avant de montrer que la violence en général et le désir de vengeance contre l'ennemi, en particulier, est chez l'homme une tendance naturelle. Par exemple, dans *Le citoyen ou les fondements de la politique*, Thomas Hobbes nous apprend que l'homme porte en lui le désir de recourir aux moyens les plus extrêmes pour se venger contre son ennemi, en vue de sa propre conservation. De ce point de vue, il n'est pas étonnant que la religion soit pour le croyant un moyen pour se venger contre l'ennemi. Voilà ce que nous apprend Hobbes en ces termes : « *Il s'en suit que, puisque chacun a droit de travailler à sa conservation, il a pareillement droit d'user de tous les moyens et de faire toutes les choses sans lesquelles il ne se pourrait point conserver.* »<sup>13</sup>

Partout et toujours, on voit donc l'homme exercer la violence contre ses semblables, en se vengeant contre ses ennemis. Cela veut dire qu'en ayant peur des phénomènes naturels comme nous l'avons montré dans la première section du chapitre précédent, les hommes ont encore peur d'eux-mêmes, quelle que soit leur confession religieuse. La crainte réciproque que les fidèles d'une même religion ou de religions différentes éprouvent vis-à-vis de l'autre, conditionne le rapport de chaque homme ou de chaque croyant envers son semblable et s'explique par le désir de vengeance contre l'ennemi. C'est pourquoi, dans *Léviathan*, Hobbes justifie l'existence d'une « *crainte réciproque et une défiance universelle parmi les hommes.* »<sup>14</sup> Même dans les religions, il n'est pas rare de voir des convertis agir pour détruire ou pour dominer leurs prochains, considérés comme leurs ennemis, afin que ceux-ci ne puissent en aucun cas empêcher la réalisation de leurs désirs.

S'inscrivant dans la même logique, Sigmund Freud a révélé, grâce à la psychanalyse (science de l'inconscient), l'existence de l'agressivité, une pulsion destructrice chez l'homme. A travers *Malaise dans la civilisation*, le père de la psychanalyse soutient : « *L'homme est, en effet, tenté de satisfaire son besoin d'agression aux dépens de son prochain, d'exploiter son travail sans dédommagements, de l'utiliser sexuellement sans son contentement, de s'approprier ses biens, de l'humilier, de lui infliger des souffrances, de le martyriser et de le tuer.* »<sup>15</sup>

En parlant de la vengeance contre l'ennemi, nous pouvons encore nous référer à ce que nous dit René Girard dans *La violence et le sacré*. Pour cet auteur en effet, le sacré est l'organisation de la violence inhérente à la nature humaine. Autrement dit, loin de supprimer la violence primitive, le sacré la transforme en moyen de cohésion du groupe. Dans tous les cas, nous constatons que la violence et le sacrifice sont toujours mêlés dans l'acte fondateur des religions. Pour justifier sa thèse, Girard se fonde sur la notion de « *victime émissaire* » qui permet à une société ou à une religion de se décharger de son agressivité sur l'être toujours choisi comme un bouc émissaire que l'on sacralise afin de détourner la culpabilité provoquée par le meurtre rituel. Dès lors, nous pouvons parler de la religion en tant qu'un ensemble d'individus formant une communauté qui se réconcilie en Dieu ou en une autre divinité, aux dépens de la « *victime émissaire* ». Pour René Girard, la violence est une caractéristique religieuse propre à toute société. Cela se traduit par la formule suivante : « *Le religieux est tout entier orienté vers la paix mais les moyens de cette paix ne sont jamais dénués de violence sacrificielle.* »<sup>16</sup>

A analyser de près, nous ne pouvons pas ne pas donner raison à Hobbes, à Freud ou à Girard. Dans *La philosophie bantoue*, Placide Tempels a reconnu le totémisme comme un fondement de la religion chez les peuples primitifs. Une telle pratique met en relief l'idée du bouc émissaire ou de la victime émissaire dont nous parle René Girard dans *La violence et le sacré*. Dans le même ordre d'idées, nous pouvons justifier ces différentes thèses par ce que nous apprend Raoul Allier dans *La psychologie de la conversion chez les peuples non-civilisés* où il nous parle abondamment des pratiques relatives au sacrifice humain dans le paganisme. Ces pratiques étaient faites pour se

<sup>12</sup> Coran, op. cit, S. 2, V. 190

<sup>13</sup> Thomas HOBBS, *Le citoyen ou les fondements de la politique*, Paris, Ed Sirey, 1981, p. 84

<sup>14</sup> Thomas HOBBS, *Léviathan*, Paris, Ed Sirey, 1971, p.122

<sup>15</sup> Sigmund FREUD, *Malaise dans la civilisation*, Paris, P.U.F., 1930 p.64

<sup>16</sup> René GIRARD, *La violence et le sacré*, Paris, Grasset, 1972, p. 41

venger contre les ennemis et pour protéger les peuples afin de détourner d'eux, les fléaux. Marc Augé s'est lui aussi intéressé à la question de la vengeance contre l'ennemi quand il parle de « *la guerre des frères ennemis à la mort du roi régnant*. »<sup>17</sup> Tous ces phénomènes nous donnent la preuve que la conversion religieuse relève de l'émotion et non de la raison.

Mais, loin d'encourager la violence à travers le fait religieux, nous voudrions par ces différentes considérations attirer l'attention de toute personne convertie sur la recherche d'une paix véritable à travers la conversion religieuse. Car, puisque Dieu est unique, tous les membres d'une même religion ou de différentes confessions religieuses doivent s'unir et s'aimer comme des frères pour faire échec à la violence ou du moins, pour l'atténuer.

Ainsi, dans la *Catéchèse bantoue*, un des premiers écrits pastoraux de Tempels, il a eu le mérite de souligner l'universalité du Christ. Pour l'auteur en effet, le Christ est venu sauver les hommes de toute race, de toute langue et de toute culture. Cela veut dire qu'en fait, le Christ n'est pas seulement venu pour la race blanche ou pour les peuples occidentaux. Que l'on soit un Africain ou un Européen, un Américain ou un Asiatique, on est appelé à aimer Dieu et son prochain comme soi-même pour bâtir un monde plus humain et mériter l'entrée au Paradis. A vrai dire, la foi en Dieu n'est pas une affaire de race, de culture de langue ou de classe sociale. Que l'on soit pauvre ou riche, jeune, adulte ou vieillard, on doit bien agir pour vivre en Dieu. Dans ce sens, le respect des commandements doit être une obligation et une réalité, conformément à la logique de Tempels. Dans le même ordre d'idées, il faut dire que l'appartenance à une religion ou à une autre ne garantit pas le salut de Dieu. Ce qui importe, c'est d'accomplir sa volonté. Dans ce sens, nous disons ici et maintenant que la guerre des religions n'est qu'une barbarie ; puisqu'en réalité, nul ne peut se servir de la violence pour justifier la foi. Le Dalaï Lama a donc raison quand il affirme qu'il croit fermement aux valeurs de la non-violence.

### **Vengeance contre le plus fort:-**

La présente section nous oriente vers la question du plus fort ; une question qui, depuis l'Antiquité Grecque, est au centre de la réflexion philosophique en général et de la philosophie morale et politique en particulier. En effet, le plus fort désigne un individu qui possède une puissance d'action physique ou symbolique résultant d'une pluralité de sources. Chez le plus fort, la force peut se manifester par des techniques d'exploitation des plus faibles à travers l'agression physique ou la mise en œuvre des moyens rationnels pouvant permettre la destruction d'un homme ou d'un groupe d'hommes. Autrement dit, le plus fort a le pouvoir d'exercer une action sur quelqu'un pour l'amener à faire quelque chose, indépendamment de sa volonté. Depuis Calliclès, il est clair que le plus fort attaque le plus faible pour avoir tous les droits. D'ailleurs, l'histoire nous révèle que le droit du plus fort est le plus constant de tous les droits. Dans *Le loup et l'agneau*, La Fontaine souligne que le plus fort a toujours raison, en ce sens qu'il a le pouvoir d'exploiter le plus faible et d'obtenir de lui tout ce qu'il veut, quand il veut et où il veut.

Par contre, dans *Du contrat social*, Jean-Jacques Rousseau a mis en relief la contradiction inhérente au prétendu droit du plus fort. Pour Rousseau en effet, la force ne doit en aucun cas faire le droit. Car, selon les circonstances, elle peut s'affaiblir pour faire place à une autre force supérieure. Nous pouvons nous référer à la formule suivante : « *Le plus fort n'est jamais assez fort pour être toujours le maître*. »<sup>18</sup> Aussi longtemps qu'un individu est le plus fort, c'est cette force qui est la source de son pouvoir. Si quelqu'un lui obéit, c'est parce qu'il est plus faible que lui et qu'il le craint, en ce sens qu'il ne peut faire autrement. Dieu est l'être puissant qui a la force par lui-même. C'est encore lui qui donne sa force à celui qui en a et qui domine les autres. Mais, pour l'auteur de : *Du contrat social*, la force peut prendre fin et redevenir faible en face d'une force supérieure. Car, seul Dieu est le plus fort ; tandis que la force humaine est limitée.

Dans cet ordre d'idées, nous pouvons comprendre comment la religion peut permettre aux plus faibles de se venger contre le plus fort. Dans la première partie de notre thèse, nous avons défini la religion, conformément à la formule de Durkheim. Dans la religion, les plus faibles se mettent ensemble pour former une communauté qui s'enracine dans une histoire commune et qui repose sur un patrimoine commun. De ce point de vue, toute religion engendre

<sup>17</sup> Marc AUGÉ, *Pouvoirs de vie, pouvoirs de mort : introduction à une anthropologie de la répression*, Paris, Flammarion, 1977, p. 129

<sup>18</sup> Jean-Jacques ROUSSEAU, *Du contrat social*, Paris, Garnier-Flammarion, 2001, p.44

entre ses membres ou entre ses adeptes, un sentiment naturel de solidarité. Il s'agit d'une solidarité à travers laquelle les faibles se réunissent ou s'assemblent pour se venger contre le plus fort.

Dans la religion, l'intérêt particulier et l'intérêt général semblent être confondus. En tout cas, on constate que leur rapport est immédiatement senti. Quiconque attaque un membre a affaire à toute la communauté. Dans ce sens, nous pouvons paraphraser Rousseau pour dire que la religion constitue une forme d'association dont le but est de défendre et de protéger la personne et les biens de chaque associé. Car, les membres d'une religion se considèrent le plus souvent comme des fils et filles d'un même père. C'est pourquoi, ils se vengent contre leurs ennemis en croyant puiser dans la force de Dieu pour agir. Dieu a un pouvoir qui permet à ses fidèles de briser toutes les résistances que l'ennemi leur oppose. Il est lui-même la force suprême à laquelle aucune autre ne peut résister.

### **Vengeance contre l'incrédule:-**

Dans l'imaginaire collectif, tout se passe comme si les convertis ont un important compte en banque, en ce sens qu'ils se croient plus aimés de Dieu par rapport à l'incrédule. Autrement dit, la foi en Dieu apparaît comme un synonyme de garantie ou d'assurance. Elle est la manifestation de la confiance absolue en Dieu, une confiance fondée sur des témoignages dont la raison ne saurait totalement garantir la valeur. Ainsi, pour Gérard Durozoi et André Roussel, « la foi désigne alors une croyance ferme, une certitude qui ne s'appuie pas sur des preuves rationnelles. »<sup>19</sup> En d'autres termes, elle est l'adhésion aux dogmes qui sont considérés comme des vérités révélées.

Toutefois, on note chez le converti un certain sentiment de vengeance à l'égard de l'incrédule, c'est-à-dire, à l'égard de celui qui ne croit pas en Dieu. Pourtant, à travers les Saintes Ecritures, on constate que Dieu s'est révélé aux hommes de toute race, de toute culture et de toute langue, de manière progressive et pédagogique. S'il est vrai qu'au départ, il s'est choisi et façonné un petit groupe, c'est-à-dire le peuple d'Israël, pour contracter une alliance avec lui, il faut néanmoins reconnaître qu'à travers ce peuple, ce sont en même temps tous les peuples de la terre qui doivent bénéficier de son salut. Autrement dit, Dieu n'accorde pas seulement ses bienfaits à ceux qui appartiennent à une religion particulière, mais à tous les hommes. Que l'on soit un fidèle ou un adepte d'une religion ou non, il est avec nous et exauce nos prières comme celles des autres. Cela veut dire qu'en réalité, le salut de Dieu s'étend à toute l'humanité. L'essentiel n'est pas d'appartenir à une religion pour prétendre être sauvé. Pour notre part, ce qui est important dans la question du salut de Dieu, c'est de bien penser pour bien agir, conformément aux lois morales de la société ; une société qui tient son existence de Dieu.

Si vraiment l'individu s'évertue à respecter avec une bonne conscience les lois justes de la société, il est déjà en accord avec Dieu et il peut jouir de son salut, au même titre que le fidèle ou l'adepte d'une religion. Cela veut dire qu'en réalité, il y a un rapport très étroit entre les commandements de Dieu et les lois de la société. Voilà ce que nous apprend Durkheim dans ce sens : « *D'une manière générale, il n'est pas douteux qu'une société a tout ce qu'il faut pour éveiller dans les esprits, par la seule action qu'elle exerce sur eux, la sensation du divin ; car elle est à ses membres ce qu'un Dieu est à ses fidèles.* »<sup>20</sup> De ce point de vue, nous comprenons dès lors que la société revêt un pouvoir important. On pourrait même dire qu'il s'agit d'un pouvoir qui vient de Dieu, en ce sens qu'elle nous aide à prendre conscience de nous-mêmes et des règles morales adéquates à respecter pour être de bons citoyens. Or, à dire toute pensée, le bon citoyen est déjà un bon converti ; tandis que le mauvais citoyen n'est qu'un mauvais converti. Car, l'influence que la société exerce sur nos consciences tient beaucoup de l'autorité morale dont elle est investie. En obéissant aux lois de la société par l'accomplissement de nos devoirs, nous aimons déjà le prochain et nous aimons déjà Dieu. Ainsi, nous ne sommes plus des incrédules, mais plutôt des vrais convertis. Pour ceux qui nous reprochent d'égaliser Dieu à la société, nous contestons par l'affirmation suivante : Nous ne posons pas l'équation selon laquelle la société représente Dieu ou que Dieu est égal à la société. Au contraire, nous invitons les hommes de toute race, de toute culture et de toute langue à mieux connaître Dieu pour mieux l'adorer.

<sup>19</sup> Gérard DUROZOI - André ROUSSEL, *Dictionnaire de philosophie*, Paris, Nathan, 2002, p.153

<sup>20</sup> Emile DURKHEIM, *Les formes élémentaires de la vie religieuse : le système totémique en Australie*, Paris, P.U.F., 1998, p.295



**Vengeance contre le pécheur:-**

Chez les personnes converties, l'émotion consiste encore à se venger contre les pécheurs, c'est-à-dire, ceux qui font du mal et qui refusent de se convertir. Pourtant, dans l'Evangile, saint Jean nous parle des Scribes et des Pharisiens qui amènent une femme adultère à Jésus en lui disant : « *Maître, cette femme a été surprise en flagrant délit d'adultère. Or, dans la loi, Moïse nous a prescrit de lapider ces femmes-là. Toi donc, que dis tu ?* »<sup>21</sup> Puisque ces Scribes et Pharisiens persistaient pour connaître la réponse de Jésus sur cette question, il leur a répondu en ces termes : « *Que celui d'entre vous qui est sans péché lui jette le premier une pierre !* »<sup>22</sup> Après avoir entendu et compris la réponse de Jésus, les accusateurs s'en allaient, l'un après l'autre, à commencer par les plus anciens. S'étant finalement retrouvé seul avec la femme, Jésus lui demande où sont passés ses accusateurs. Ensuite, il lui demande si personne ne l'avait condamnée. Alors, la femme répond en disant que personne parmi ses accusateurs ne l'avait condamnée. C'est alors que Jésus lui dit : « *Moi non plus, je ne te condamne pas. Vas, désormais ne pèche plus.* »<sup>23</sup>

Cette rencontre de Jésus avec la femme adultère nous donne la preuve que Dieu ne veut pas que l'on se venge contre le pécheur et qu'il ne veut pas non plus sa mort. A vrai dire, la souffrance éternelle est quelque chose que personne ne doit jamais souhaiter, même à son pire ennemi. C'est un malheur inimaginable qui, en réalité, ne doit pas être pensé, quelles que soient les circonstances. Même si le fidèle sent un désir de vengeance dans les propos des chefs religieux (prêtres, pasteurs, imams ou chefs religieux traditionnels), il doit lui-même se poser des questions. Car, tant que l'on arrive à croire simplement à ce que dit son chef religieux sans se poser de question, tout va bien. Mais lorsqu'on commence à réfléchir par soi-même, surtout au sujet de la vengeance contre l'ennemi ou contre le pécheur, on a de la matière à passer des nuits blanches. Jésus ne condamne pas et n'évite pas non plus le pécheur. Les Saintes Ecritures révèlent qu'il va même au-devant d'eux pour les amener à la conversion. Plusieurs fois, il a fréquenté les pécheurs et a mangé avec eux. L'exemple de Matthieu le Publicain, l'illustre mieux. Mais, reconnaissons que Jésus ne cautionne pas le péché. Il veut plutôt que le pécheur se convertisse pour devenir un homme nouveau.

En d'autres termes, Dieu n'enfoncé jamais le clou de la culpabilité. Par sa miséricorde, il soulage de leur fardeau, ceux que le poids du péché a fait tomber à terre, afin qu'ils se redressent pour continuer à vivre. Autrement dit, Dieu ne veut pas que le pécheur soit puni, mais qu'il revive tout en reconnaissant son œuvre dans sa vie. A notre avis, si nous évitons de nous venger contre le pécheur en lui montrant ce qu'il doit faire et comment y parvenir, il mènera une vie plus juste. Car la bonté et le pardon de Dieu sont sans limite. Soulignons que la vengeance contre le pécheur ne peut en aucun cas permettre au converti d'avoir la paix. Comme nous l'apprend saint Augustin, pour avoir la paix, il faut aimer. D'ailleurs, il serait impossible d'identifier au sein de l'humanité, les pécheurs de ceux qui ne pêchent pas. Alain a donc raison quand il dit que, ce sont les mêmes hommes qui font la guerre qui aiment encore la paix. Pour notre part, il vaut mieux travailler pour sa propre sainteté et contribuer à celle des autres que de penser à l'existence d'un Dieu vengeur qui doit torturer dans l'Enfer, ceux qui pêchent ici-bas.

**Conclusion:-**

La promotion de la paix au sein des religions doit nécessairement passer par la maîtrise des émotions chez les personnes converties. On sait qu'il y a des émotions nocives, c'est-à-dire négatives et des émotions positives. En fait, la religion devrait délivrer le converti des émotions négatives telles que la peur et le désir de vengeance. Elle devrait donner au converti, la joie de se sentir membre d'une communauté de fidèles qui doivent véritablement aimer Dieu et leurs prochains comme eux-mêmes. Puisque l'homme est un être ambivalent, c'est-à-dire capable du meilleur et du pire, la paix doit dépendre de l'homme véritablement transformé par la Parole de Dieu ; un homme prêt à lutter contre la peur et le désir de vengeance pour aimer ses semblables. En réalité, il serait illusoire de croire que, pour être un bon converti, on doit devenir l'ennemi des incrédules ou des fidèles d'autres religions. Etre un bon converti, c'est lutter contre la peur et le désir de vengeance en souhaitant par la raison le bien pour autrui et pour soi-même. Si tel n'est pas le cas, le converti doit se poser des questions sur sa foi. Car, bien que le rôle de la raison dans la conversion religieuse soit limité, elle doit néanmoins permettre de distinguer le vrai du faux, voire le bien du mal. Autrement dit, la raison doit permettre au converti de savoir s'il est en accord ou en désaccord avec la Parole de Dieu.

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<sup>21</sup> Jn, 8, 4

<sup>22</sup> Jn, 8, 7

<sup>23</sup> Jn, 8, 11

**Bibliographie:-**

1. **ALLIER R.**, *La psychologie de la conversion chez les peuples non-civilisés*, Paris, Payot, 1925
2. **AUGE M.**, *Pouvoirs de vie, pouvoirs de mort : introduction à une anthropologie de la répression*, Paris, Flammarion, 1977
3. **CORAN**, Al-Madinah Al-Munawwarah, Complexe Roi Fahd pour l'impression du *Noble Coran*, 1410.
4. **DALAI LAMA**, *Au-delà des dogmes*, Paris, Albin Michel, 1994
5. **DURKHEIM E.**, *Les formes élémentaires de la vie religieuse : le système totémique en Australie*, Paris, P.U.F., 1968
6. **DUROZOI G.- ROUSSEL A.**, *Dictionnaire de philosophie*, Paris, Nathan, 2002
7. **EPICURE**, *Lettre à Ménécée sur la morale*, Paris, Hatier, 1984
8. **FEUERBACH L.**, *Principes de la philosophie de l'avenir*, Paris, P.U.F., 1843
9. **FREUD S.**, *Malaise dans la civilisation*, Paris, P.U.F., 1930
10. **FREUD S.**, *Essai de psychanalyse*, Paris, Payot, 1972
11. **GIRARD R.**, *La violence et le sacré*, Paris, Grasset, 1972
12. **HEBGA M.**, *Sorcellerie et prière de délivrance : réflexion sur une expérience*, Paris, Présence Africaine, 1982
13. **HEIDEGGER M.**, *Introduction à la métaphysique*, Paris, Gallimard, 1953
14. **HOBBS T.**, *Léviathan*, Paris, Ed Sirey, 1971
15. **HOBBS T.**, *Le citoyen ou les fondements de la politique*, Paris, Ed Sirey, 1981
16. **HOUNTONDI P.**, *Sur la philosophie africaine : critique de l'ethnophilosophie*, Paris, Maspero, 1977
17. **JACOB F.**, *La logique du vivant*, Paris, Gallimard, 1978
18. **LA BIBLE DE JERUSALEM**, Paris, Cerf, 2001
19. **LEIBNIZ G.-W.**, *Principes de la nature et de la grâce fondés en raison*, Paris, P.U.F., 1986
20. **LUCRECE**, *De la nature*, Paris, Les Belles Lettres, 1924
21. **NIETZSCHE F.**, *Le gai savoir*, Paris, Gallimard, 1972
22. **NIETZSCHE F.**, *La généalogie de la morale*, Paris, Nathan, 1981
23. **ORTIGUES M.-C - E.**, *Œdipe africain*, Paris, L'Harmattan, 1966
24. **ORTIGUES E.**, *Religions du livre et religions de la coutume*, Paris, Les éditions le Sycomore, 1981
25. **PASCAL B.**, *Pensées*, Paris, Gallimard, 1976
26. **PLATON**, *Gorgias*, Paris, Garnier-Flammarion, 1967
27. **PLATON**, *Gorgias*, Paris, Garnier-Flammarion, 1967
28. **ROUSSEAU J.-J.**, *Du contrat social*, Paris, Garnier-Flammarion, 2001
29. **SARTRE J.-P.**, *L'existentialisme est un humanisme*, Paris, Nagel, 1970
30. **SCHOPENHAUER A.**, *Le monde comme volonté et comme représentation*, Paris, P.U.F., 1966
31. **TEMPELS P.**, *La philosophie bantoue*, Elisabethville, Lovania, 1945

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### RESEARCH ARTICLE

## PARAMETRIC STUDY AND DESIGN OF ULTRA WIDE BAND PLANAR MICROSTRIP ANTENNA FOR BREAST TUMOR DETECTION

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#### Abstract

In this work, we focus on the design of a rectangular patch antenna for use in Ultra Wide Band ( UWB ) in breast cancer detection. After modeling and validation of the base antenna, we perform the parametric study on the choice of the dielectric substrate, the height of the ground plane, the transition between the patch and the microstrip line. This is in order to optimize these parameters to meet the standards set by the Federal Communications Commission (FCC) for UWB communications in terms of bandwidth, standing wave ratio (SWR ) and antenna input impedance.

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#### Introduction:-

With the development of wireless communications, Ultra Wide Band (UWB) systems has recently attracted attention of scientists because of the benefits they offer. Thanks to a much wider bandwidth, this new technology is very robust in complex environments. Furthermore, the transmission power being of the same level as the noise, the technique can coexist with narrowband systems<sup>(1)</sup>.

The Federal Communications Commission (FCC) has established in February 2002, Terms of use the frequency spectrum between 3.1 and 10.6 GHz and emission power limits allocated to the various UWB applications<sup>(2)</sup>. Given its characteristics (low power, narrow pulses) even noticed, we begin to realize the benefits of UWB technology in many areas of research. These include medical microwave imagery that has generated considerable interest in recent years. This technique could be a very effective means for detection of malignant tumors including breast cancer<sup>(3)</sup>.

We propose in this work to perform parametric study and design of a planar antenna patch for application on Ultra Wide Band UWB. After modeling and validation of the base antenna, there follows the parametric study consisting on the choice of dielectric substrate, height of the ground plane, form of transition between the patch and the microstrip line. This is in order to optimize these parameters to meet the standards set by the Federal Communications Commission FCC for UWB communications in terms of bandwidth and SWR standing wave ratio.

#### Theorecal study:-

The transmission-line model representing the microstrip antenna is defined by two slots, separated by a low impedance ZC transmission line of length L. Since the dimensions of the patch are finite along the length and width, field lines suffer the edge effects on both sides of the patch. These effects are a function of the patch dimensions and the height h of the substrate<sup>(4)</sup>.

The signal transmission is not dispersive if the mode of propagation is TEM (Transverse Electro- Magnetic). This is possible if the electromagnetic field that propagates through the line meets one type of material. For the microstrip line of Figure 1, which the field lines are shown in Figure 2. A portion of the electric field lines are reflected in the substrate and a part in the air <sup>(5)</sup>. Many studies have shown that such a transmission line is the seat of a wave propagating in quasi-TEM mode. We must therefore consider not only the dielectric constant of the substrate but rather  $\epsilon_{\text{eff}}$  workforce.

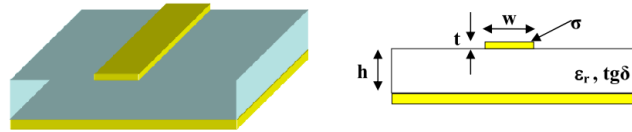


Fig 1:- Microstrip Line

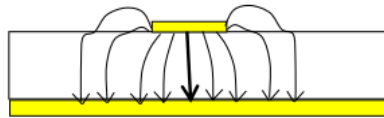


Fig 2:- Electric field lines

A good approximation was proposed by EO Hammerstad in <sup>(6)</sup> and <sup>(7)</sup> giving the values of the effective dielectric constant  $\epsilon_{\text{eff}}$  and characteristic impedance  $Z_c$  for a microstrip line that the width is  $W$  and the height of the substrate is  $h$ . For calculation, we adopt the approximation given in equations (1), (2), (3) and (4).

In the case of  $W/h \leq 1$  :

$$\epsilon_{\text{reff}} = \frac{\epsilon_r + 1}{2} + \frac{\epsilon_r - 1}{2} \left[ \left( 1 + 12 \frac{h}{W} \right)^{-\frac{1}{2}} + 0.04 \left( 1 - \frac{h}{W} \right)^2 \right] \quad (1)$$

$$Z_c = \frac{60}{\sqrt{\epsilon_{\text{reff}}}} \ln \left[ \frac{8h}{W} + \frac{W}{4h} \right] \quad (2)$$

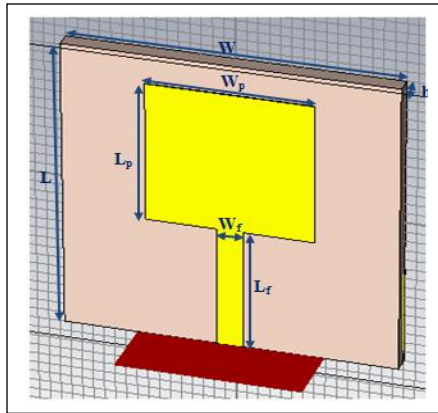
In the case of  $W/h \geq 1$  :

$$\epsilon_{\text{reff}} = \frac{\epsilon_r + 1}{2} + \frac{\epsilon_r - 1}{2} \left[ 1 + 12 \frac{h}{W} \right]^{-\frac{1}{2}} \quad (3)$$

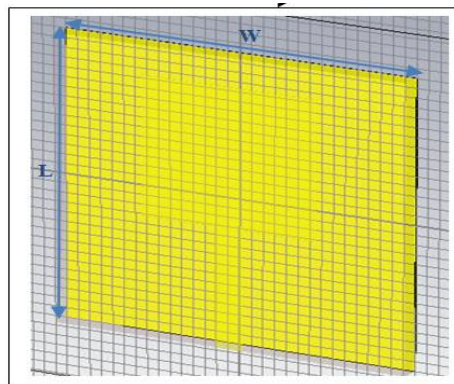
$$Z_c = \frac{120\pi}{\sqrt{\epsilon_{\text{reff}}}} \left[ \frac{W}{h} + 1.393 + 0.667 \ln \left( \frac{W}{h} + 1.444 \right) \right]^{-1} \quad (4)$$

#### Modeling antenna base:-

The structure of the antenna considered as a first step will be DM sheen antenna's mentioned by P. Wang in <sup>(8)</sup>. It is a rectangular planar antenna made up of a ground plane, a dielectric substrate of permittivity  $\epsilon_r$  value of 2.2 and a rectangular patch showed. respectively, in Figures 3 and 4 and whose dimensions are showed in Table 1.



**Fig 3:-** Front face of the planar rectangular antenna base (Substrate and patch)

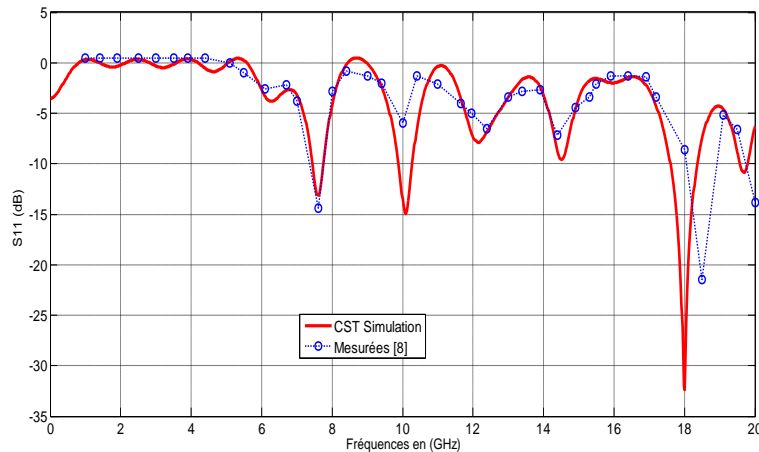


**Fig 4:-** Back face of the planar rectangular antenna base ( ground plane )

**Table 1:-** base antennadimensions

Greatness	Value in (mm)
L	30
W	30
$L_p$	16
$W_p$	12,45
$L_f$	4,00
$W_f$	2,46
h	0,795

The patch with dimensions  $W_p \times L_p$  is fed by a microstrip line whose dimensions are  $L_f$  and  $W_f$  selected in order to have a value of 50 Ohm for input impedance. We had choose CST MWS (Computer Simulation Technology - Microwave Studio ), as a simulation tool based on the Finite Integration Method FIT. Other methods exist , we have used in a previous work <sup>(9)</sup>, the Finite Difference Time Domain FDTD for modeling a planar antenna microstrip.



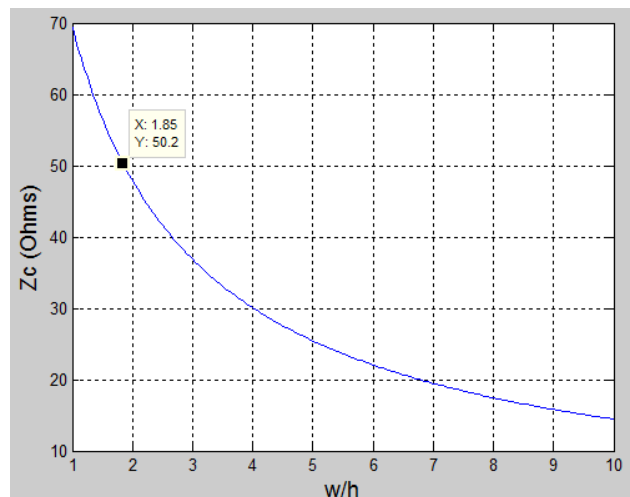
**Fig 5:-** Simulated and measured return loss  $S_{11}$  versus frequency for planar base antenna.

Figure 5 illustrates the return loss versus frequency of this antenna. Simulation results on red color are compared with measurements results referred to P. Wang <sup>(8)</sup> drawn on blue points. We find good agreement between the two results including first and second resonant frequencies of 7.6 GHz and 10 GHz. For higher frequency beyond 18 GHz a slight difference was remarked but no effect since the frequency range of the ultra wide band UWB is between 3.1 and 10.6 GHz. We can confirm and validate the method used for this study. This antenna will be improved through a parametric study to satisfy the ULB requirements set by the Federal Communications Commission FCC.

## Parametric study:-

### A. Substrate choice:-

We use a substrate with relative permittivity value of 4.6. On the other hand in <sup>(5)</sup>, for microstrip technology the characteristic impedance  $Z_c$  of a microstrip line, with  $w$  for lying on a substrate with a height  $h$ , varies versus ratio value of  $w/h$  as illustrated in Figure 6. To have a characteristic impedance matched at 50 Ohms and a substrate relative permittivity of value 4.6, the  $w/h$  ratio must be taken equal to value 1.85. So for the most common and inexpensive substrate with value height of  $h = 1.5$  mm, width microstrip line must have a value of  $w_f = 2.8$  mm which we will use for the microstrip line to feed the patch of the microstrip antenna.



**Fig 6:-** Impedance characteristic versus ratio  $w/h$  in microstrip technology for relative permittivity value 4.6

### Effect of ground plane size:-

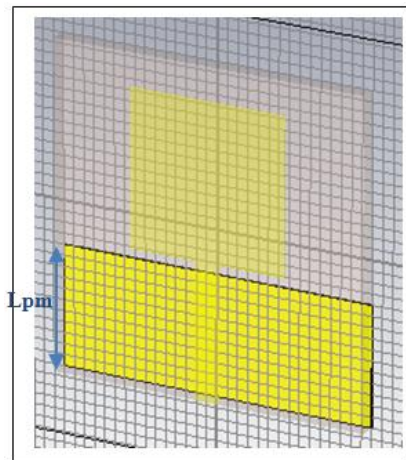
The choice has been set for an FR-4 substrate with relative permittivity 4.6 and 1.5 mm for substrate height.

The patch of microstrip antenna has dimensions values of  $14.5 \times 15 \text{ mm}^2$  and the starting area ground plane is  $30 \times 30 \text{ mm}^2$  as mentioned in Table 2.

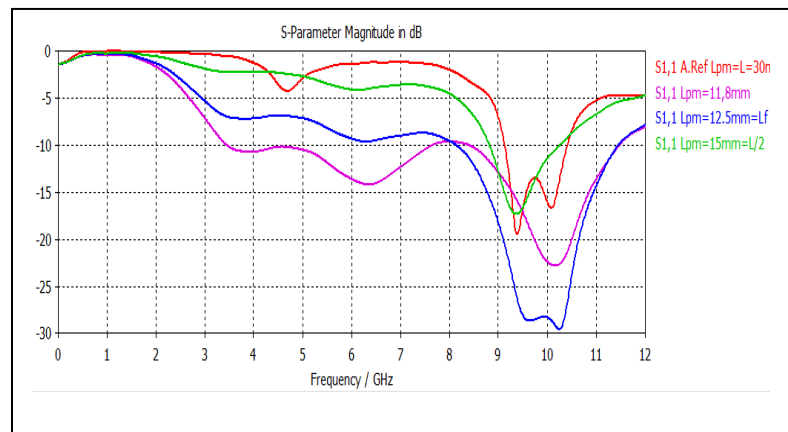
**Table 2:-** Starting planar microstrip antenna dimensions

Greatness	Value in (mm)
L	30
W	30
$L_p$	14,5
$W_p$	15
$L_f$	12,5
$W_f$	2,8
h	1,6

We simulate this first structure. After we change the ground plane size on reducing its length  $L_{pm}$ , as shown in Figure 7.



**Fig 7:-** Reducing the length  $L_{pm}$  of planar microstrip antenna ground plane



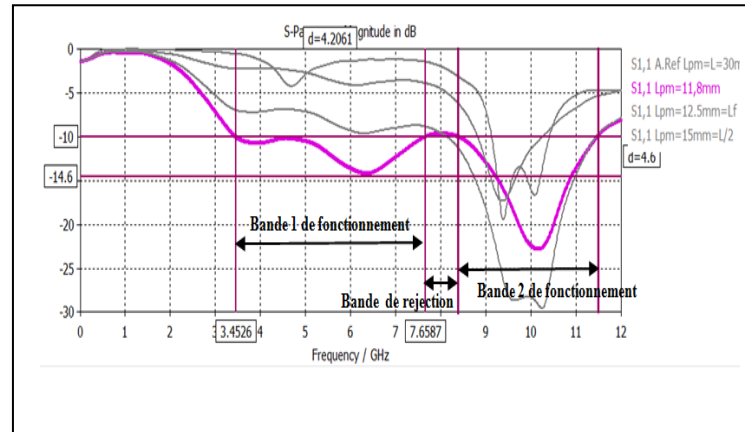
**Fig 8:-** Return loss  $S_{11}$  versus frequency After Reducing the length  $L_{pm}$  of planar microstrip antenna ground plane

Figure 8 shows the return loss versus frequency for four structures of planar microstrip antennas identical but whose height ground plane is different. The red curve represents return loss  $S_{11}$  versus frequency for the starting antenna with a full ground plane  $30 \times 30 \text{ mm}^2$ . The bandwidth at -10 dB in this case is [ 9,1Ghz ; 10,4Ghz ] with a width of 1.3 Ghz. The others curves show the effect of the reduction the length of the ground plane on the frequency bandwidth for planar microstrip antenna. The results are summarized in Table 3. We see that the reduction of the ground plane allows the increase of the width of bandwidth for planarmicrostrip antennas studied.

**Table 3:-** Bandwidths versus length ground plane of the planar microstrip anntenna

Ground plane width	Ground plane length $L_{pm}$	Bandwidth at -10 dB
30 mm	30 mm	1,30 Ghz
30 mm	15 mm	1,44 Ghz
30 mm	12,5 mm	3,30 Ghz
30 mm	11,8 mm	4,2Ghz and 3 Ghz
30 mm	10,8 mm	4,30 Ghz
30 mm	10,5 mm	4,25 Ghz
30 mm	10 mm	4,20 Ghz

Other hand, we see in case of ground plane length value  $L_{pm} = 11.8$  mm, Figure 9, the antenna can operate on two frequency bands . The first [3,4 GHz ; 7.6 GHz ] with width 4.2 GHz band and the second [ 8.4 GHz ; 11.4 GHz ] with width 3 GHz. In this case, this antenna can be regarded as ultra wide band UWB antenna operating in two bands of frequencies and that return loss reaches a maximum absolute value respectively 14.6 dB and 23 dB . Furthermore, this antenna has a rejection band [ 7.6 GHz ; 8.4 GHz ] .

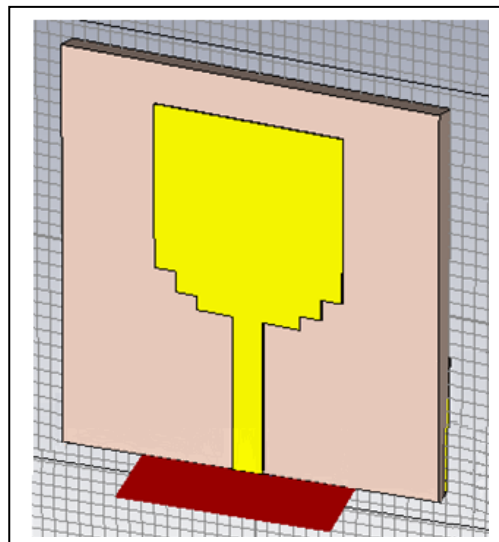


**Fig. 9:-** Return loss  $S_{11}$  versus frequency for the length  $L_{pm}$  of planar microstrip antenna ground plane.

So reducing the length of ground plane for rectangular planar microstrip antenna, has allows us to expand bandwidth from an initial value of 1.3 GHz to 7.2 GHz. This last value is divided into two width 4,2 GHz and 3 GHz corresponding onto two operating bands .

#### Effect of the transition between the patch and themicrostrip feed line:-

In order to improve the frequency band and increase the absolute value of return loss, we modify the transition between the patch and the microstrip feed line. The passage of the rectangular shape of the patch to the linear shape of the microstrip feed line, instead of brute, will be done progressively as it is shown in figure 10.



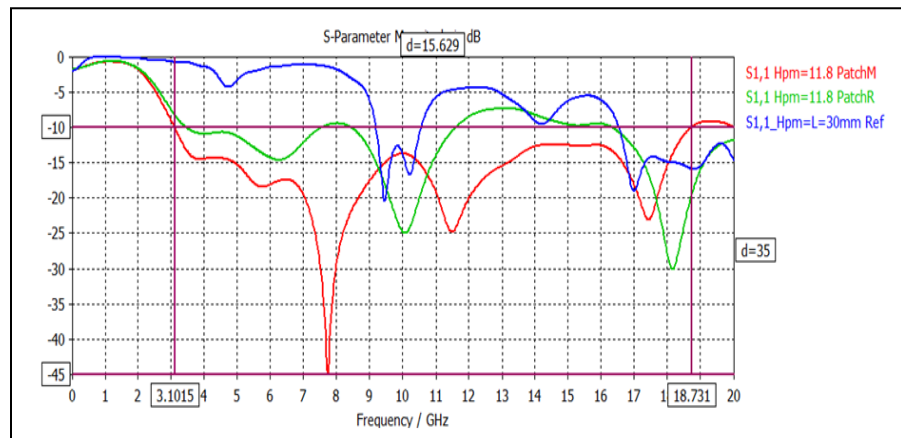
**Fig 10:-** Shape of the planar microstrip antenna according to modification of the transition between the rectangular patch and themicrostrip feed line.



Therefore, the rectangular planar microstrip antenna having two frequency bandwidths respectively width of 4.2 GHz and 3 GHz, and with the transition between the patch and the microstrip feed line was brute, can be improved by adopting a gradual transition staircase from the patch to the microstrip feed line. In Figure 11, red curve shows the improvement in the bandwidth that becomes [ 3,1 GHz ; 18.7 GHz ], which gives a best width value of 15.6 GHz for bandwidth.

### Results:-

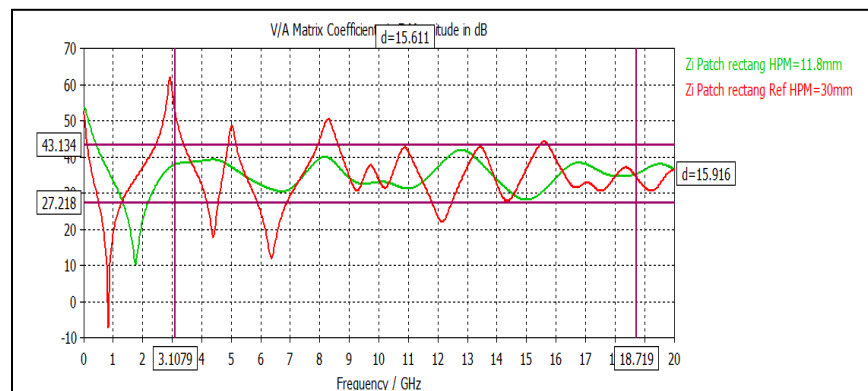
Comparing the return loss  $S_{11}$  versus frequency of the three structures of planar microstrip antennas shown in Figure 11, we notice a large improvement of bandwidth for final structure designed antenna on red curve.



**Fig. 11:-** Return loss  $S_{11}$  versus frequency for three antennas : starting antenna, without and with gradual transition between planar patch and microstrip feed line.

Indeed the blue curve of base antenna with area ground plane of  $30 \times 30 \text{ mm}^2$  has a width bandwidth of 1.3 GHz which increases to 7.2 GHz divided into two bands of 4.2 GHz and 3 GHz on the green curve for reducing the ground plane to  $30 \times 11.8 \text{ mm}^2$ . While the red curve shows a clear improvement in the bandwidth of the final structure of planar microstrip antenna modified by adopting a gradual transition between the microstrip line feed and the rectangular patch, which gave us a bandwidth [ 3,1GHz ; 18.7 GHz ] and a width of 15.6 GHz. On the other hand, return loss is also enhanced in maximum absolute value from 25 dB to 45 dB. This result meets the standards set by the Federal Communications Commission FCC for Ultra Wide Band UWB communications with the frequency band is [ 3.1 GHz ; 10.6 GHz ].

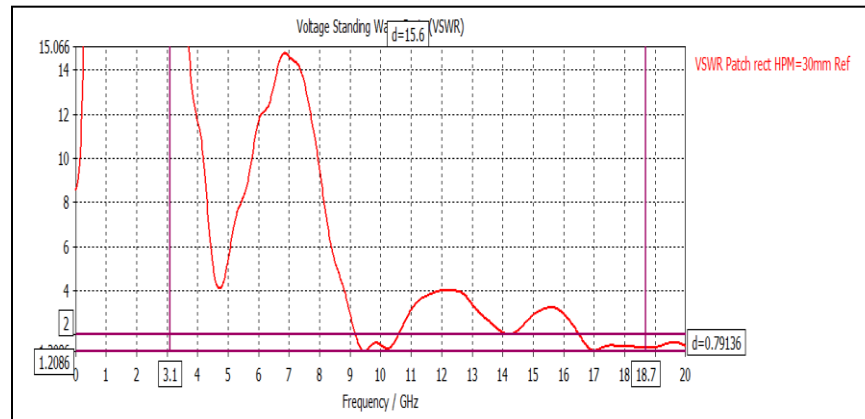
Other hand, Figure 12 allows comparison of antenna input impedance versus frequency for base antenna on red curve and final structure of microstrip antenna adopted on green curve. The first varied between  $12 \Omega$  and  $60 \Omega$  and the second is between  $27 \Omega$  and  $43 \Omega$  over the entire bandwidth of the antenna [3.1 GHz ; 18.7 GHz]. This stable result is obtained after reducing area ground plan and adopting a gradual transition between the microstrip line feed and the rectangular patch of final antenna.



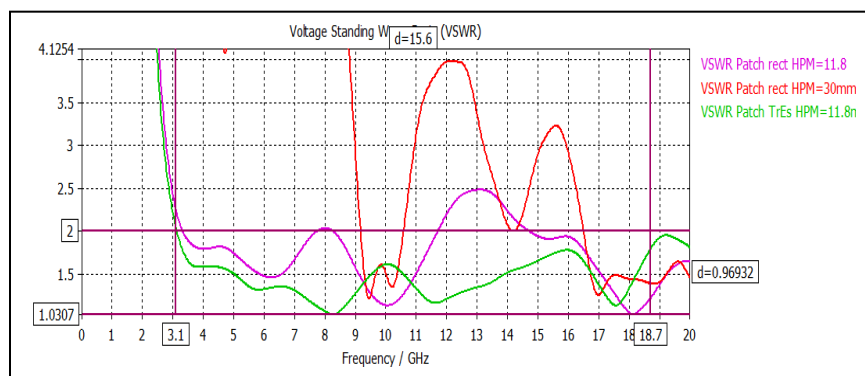
**Fig 12:-** Antenna input impedance versus frequency for two cases, with total ground plan and second with reducing height ground plan at 11,8mm and gradual transition.

Standing Wave Ratio SWR can also allow to characterize the impedance mismatch. The ideal value of this ratio must be less than or equal to 2 over the entire antenna frequency band.

For the base antenna with area ground plane  $30 \times 30 \text{ mm}^2$ , the standing wave ratio, Figure 13, have very large values for the low frequencies and reaches a value of 15 at frequency 6.8 GHz and a value of 4 at both frequency of 4.7 GHz and 12 GHz.

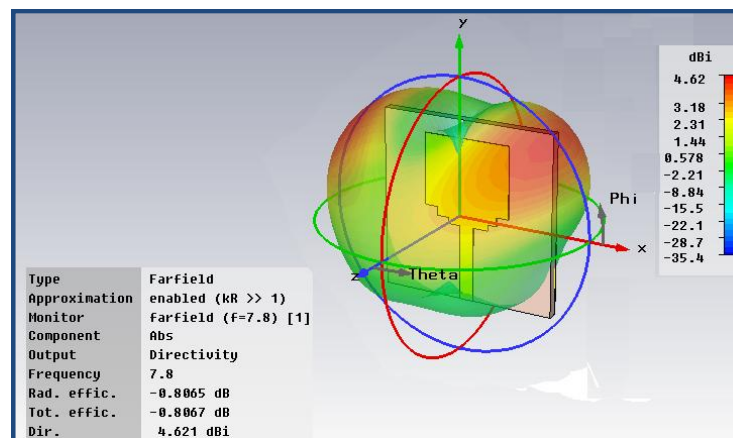


**Fig. 13:-** Standing Wave Ratio SWR versus frequency for starting antenna with total ground plan dimensions  $30 \times 30 \text{ mm}^2$



**Fig. 14:-** Standing Wave Ratio SWR versus frequency for three antennas : starting antenna, without and with gradual transition between planar patch and microstrip feed line.

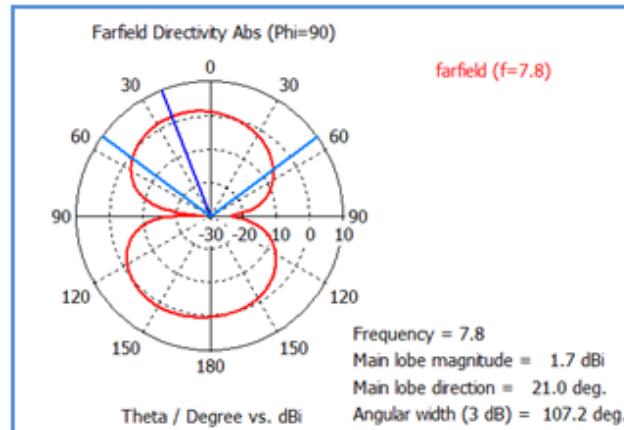
Figure 14, shows an improvement of the Standing Wave Ratio SWR for the final structure of the planar microstrip antenna. Indeed, the green curve shows that SWR factor remains below a value 2 over the entire frequency band [3,1GHz ; 18.7 GHz ].



**Fig. 15:-** Three-dimensional radiation diagram at the 7.8 GHz frequency of the ULB planar antenna designed

The chosen final structure of the planar antenna chosen for use in Ultra Large Band has a radiation pattern which is represented in FIG. 15 in three dimensions. At the frequency 7.8 GHz, a maximum gain of 4.6 dBi is obtained with respect to an isotropic antenna.

In FIG. 16, we represent the same two-dimensional radiation pattern in the plane E. The angle of opening of this half-power antenna ( $-3$  dB of the maximum power) is equal to 107.2 deg.



**Fig. 16:-** Two-dimensional radiation diagram of the ULB planar antenna at the 7.8 Ghz frequency in E plane (variable theta and constant phi).

### Conclusion:-

The parametric study allows us to explore the effects of reducing ground plane area and the gradual transition between the microstrip line feed and rectangular patch. This enabled us to design a rectangular planar microstrip antenna meets the requirements of the Ultra Wide Band UWB set by The Federal Communications Commission FCC. This final structure antenna can be used for breast cancer detection. For future work, performance of this antenna can be improved in matters of gain by networking this structure.

### References:-

1. G.Clementi, G. Kossiavas "Conception et caractérisation fréquentielle et temporelle d'antennes réseaux planaires à très large bande passante" LEAT, Sophia antipolis, pp.6, Novembre 2011.
2. N.Seladji, F.Z. Marouf, L.Merad, "Antenne Microruban Miniature Ultra Large Bande ULB pour Imagerie Micro-onde", Revue Méditerranéenne des Télécommunications, vol.3, n°1, pp.21-25, february 2013.
3. J. Vrba, L. Oppl, R. Zagicek, K. Novotna & D. Vrba "Medical Imaging and Diagnostics Based on Microwaves", PIERS Proceeding, Hangzhou, China, pp.890-892, March 2008,
4. C. A. Balanis, "Antenna Theory Analysis and Design", John Wiley & Sons, Inc. Publication, Hoboken, New Jersey, Chap 4, pp. 814-816, Third Edition, 2005.
5. C. Algani, "Passive Components", consulted in
6. [http://www.easytp.cnam.fr/algani/images/MMIC\\_ESCPI\\_CNAM\\_5.pdf](http://www.easytp.cnam.fr/algani/images/MMIC_ESCPI_CNAM_5.pdf), accessed October 30, 2016
7. E. O. Hammerstad, "Equation for Microstrip Circuit Design," R. A. Pucel, D. J. Masse, and C. P. Hartwig, Proc. Eur. Microwave Conf., pp. 268-272, 1975.
8. C. Nguyen, "Analysis Methods for RF, Microwave, and Millimeter-Wave", Microwave Technology & Engineering, pp.62-64, 2003.
9. P. Wang, "Analysis of planar antennas", a thesis for degree of Master, department of Electrical and Computer Engineering, University of Toronto, pp. 47-48, 1997.
10. Y. El hajibi, A. El hamichi, "Simulation and Numerical Modeling of a Rectangular Patch Antenna Using Finite Difference Time Domain (FDTD) Method", ARIPD publication, Journal of Computer Science and Information Technology, Vol. 2, No. 2, pp. 01-08, June 2014.

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### RESEARCH ARTICLE

#### DESIGN AND DEVELOPMENT OF A VERTICAL AXIS LOW SPEED WIND GENERATOR.

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##### Key words:-

vertical axis wind turbine, wind turbine,  
wind generator, low speed turbine,  
fabrication technology.

#### Abstract

Mostly Bangladesh is a flat land with average wind speed of around 3.5 m/s. However in the coastal areas wind speed reaches up to 7-9 m/s. The potential of deploying low speed wind turbines is promising. With these view, a low speed vertical axis wind turbine together with a wind generator have been designed which can work at low speed of wind available in Bangladesh. The wind turbine and wind generator have been fabricated using locally available materials and fabrication technology. The output of the generator should be 250 W and usable watts should be at least 200 W at low cost. The generator will produce power at 450 rpm. A pulley system power drive is used to rotate the generator.

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#### Introduction:-

The civilization is dependent on electric power. There is a relationship between GDP growth rate and electricity growth rate in a country [1]. It will therefore, be necessary to tap all sources of renewable energy and to use these in an efficient converted form for benefit of the people of Bangladesh. Primarily this will be done in remote inaccessible un-electrified area in a standalone system which is environment friendly and also save cost of grid expansion. This type of energy conversion will reduce pressure on the national power supply system. Generation of electricity through wind turbine, using available low speed of wind in Bangladesh is very much effective to provide electricity to the rural people. Because only 10% of these users have electricity connection and there are some parts of Bangladesh which will not get connected to the national grid within next 30 years [2]. Bangladesh Centre for Advance Studies (BCAS) and Local Government Engineering Department (LGED) with assistance from Overseas Development Administration (ODA) of UK launched the Wind Energy Study Project (WEST) Project in 1995 at seven places in Bangladesh [3]. These sites are Potenga, Cox's Bazar, Tecknaf, Noakhali, Charfassion, Kuakata and Kutudia. It was found that average annual mean wind speed in meter per second are 3.95, 3.34, 2.94, 2.96, 2.96, 4.07, 4.52 and 4.21 respectively. Later on LGED and BUET jointly studied the wind speed at 15 different places in Bangladesh. Their findings were not so satisfactory for high power wind generation. Since wind speed in Bangladesh is low, therefore low wind speed generator might be feasible. During the months starting from late October to February wind speed remains either calm or too low. This period is called lull period. The remaining seven months wind speed is quite good [4, 5] for this type of low speed wind generator. The peak wind speed occurs during the months of May, June and July. It will be an efficient way to generate electricity by using a newly designed wind generator for a low speed vertical axis wind turbine which can work at the available low speed of wind in Bangladesh. To meet the situation, a wind generator have been designed, fabricated and operated with capacity 100W- 200 W at low cost.

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### Theory of wind Turbine:-

To estimate performance of a particular wind turbine [6], one should theoretically asses the matter as bellow. For total production of energy from a turbine in one year-

$$AEO = 1.64 d^2 V^3$$

Where,

AEO =Annual energy output, KW/year,

d =Rotor diameter, meters and

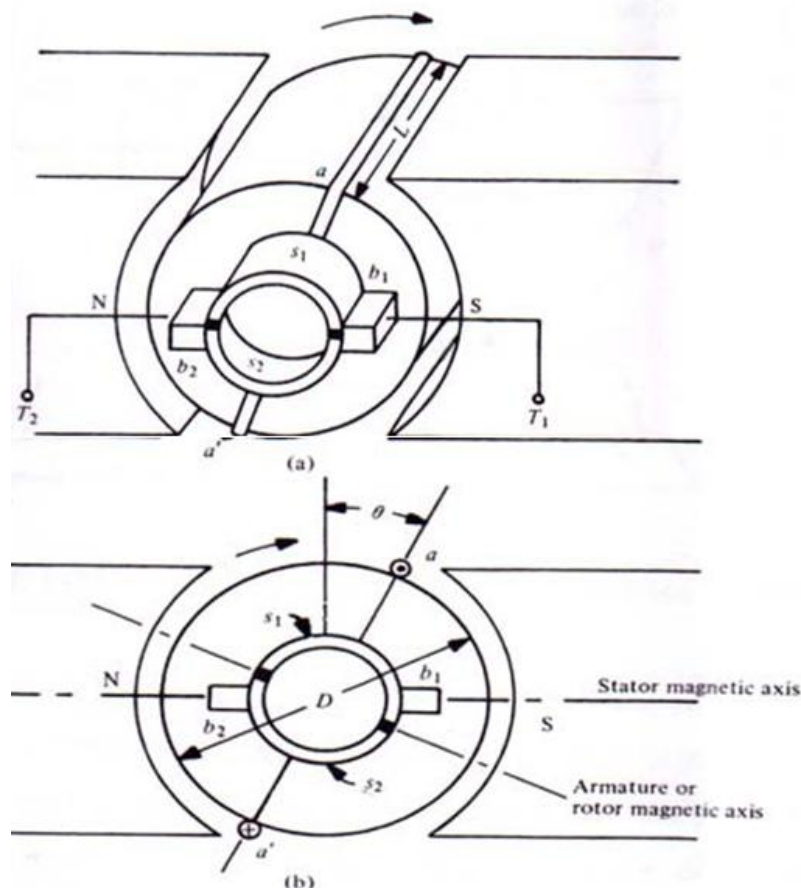
V =Annual average wind speed, m/s

If it is required to reduce the cost of the turbine for an energy efficient one, it is necessary to reduce the size of peak demand electrical loads.

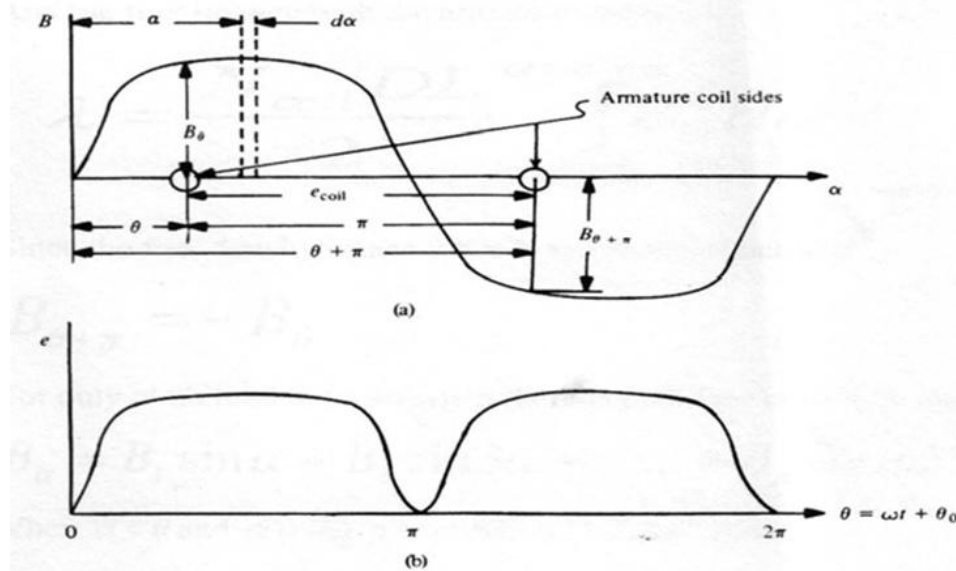
To design a wind generator, let us consider the elementary two pole dc machine in the figure2 (A).

The polarity of the induced emf for clockwise rotation, follow Lenz's law, figure 2(b).When angle  $\theta$  (angle between magnetic axis of the stator and rotor) is zero or  $\pi$ , the voltage induced in the armature coil is zero. It is assumed that, for polarities of the field poles and direction of rotation, brush b1 always positive and brush b2 always negative.

A full pitch armature coil of one or more turns is one that spans a pole pitch. In a two pole machine a full pitch coil spans the diameter and in a P-pole machine it spans a chord that subtends an angle of  $2\pi/P$  on the armature periphery.



**Figure 2 A:-** Elementary two-pole dc machine. (a) Partial view (b) Simplified view



**Figure 2 (B):-** (a) Flux-density space wave (b) Rectified no-load voltage in a full-pitch coil.

Figure 2(B) shows the approximate flux density distribution curve for a dc machine at no load with the effect of the armature slots neglected. The armature current is zero and the flux is entirely due to the field current. Average voltage induced in the coil of a generator is given by-

$$E_{(coil)avg} = (2PN_{coil} / d n) / 60$$

Where  $E_{(coil)avg}$  = Average voltage induced in the coil

P = Number of poles in a machine

$N_{coil}$  = Number of coils

d = Flux per pole

n = Speed in rpm

### Design of wind generator:-

To generate 200 W , different parameters of wind generator have been calculated. The vertical axis wind rotor diameter is about 2M. Five to seven half circle or NACA -0018(NACA-National Advisory Committee for Aeronautics) profile, curved thin aluminum blades are being fixed vertically at the outmost diameter of the wind rotor. The rotor rotates around the vertical axis shaft which is fitted at 20 to 30 feet height. The rotor shaft is extended to the ground platform where two gears or pulleys are arranged to increase rotor RPM at 600 from 30 -40 RPM. Sixteen poles consisting of 32 permanent magnets size of Ø28mm x 6mm are used to generate 100W- 200W power. For each magnet 100 turns, 15 gauge copper wire is used around each core material. Main components of wind generator and their measurements are given in the table below-

**Table:-** Main components of wind generator and their specification.

Sl. No.	Name of the components	Diameter (mm)	Thickness/ Length(mm)	Material	Quantity (Pieces)
1	Permanent magnet	28	3	Ferro-magnet	2x16
2	Disc for permanent magnet	300	10	Nylon fiber	2
3	Disc for copper coil	382	15	Nylon fiber	1
4	Flange bush	108	30	Nylon fiber	2
5	SS shaft	20	350	SS	1
6	Copper wire for coil	16 gauge	-	Copper	-
7	Screw	6	12.7	SS	10
		6	254.4	SS	4
8	Cover	400	20 gauge	SS	Body area

### Construction of wind generator:-

A wind generator is constructed to extract energy by a vertical axis low speed wind turbine using low speed of the wind. The steps of construction are as bellow-

- The principle to construct a wind generator is, in an electrical generator, conductor cuts magnetic flux which induced e.m.f. in it.
- In the present design two discs used for permanent magnet which are rotating and one stationary disc for copper coil or winding.
- Copper coil disc is placed between two permanent magnets.
- There is flange bush in the centre of the magnet disc through which the shaft will pass. The diameter of the flange bush is 108 mm in one side and 32 mm in another side and thickness is 30 mm. It is attached to magnet disc by screw. Instead of flange bush, one can use 30 mm thick magnet disc which is costly and make the disc heavy. Another reason to use this flange bush is that, in case of any damage of the disc due to rotation, we need to change the flange bush only. Magnet disc also fixed with shaft by flange bush using screw.
- There is one coil disc between two magnet discs which contains the winding. Shaft is passed through the center of the disc but they do not touch each other. This disc is attached with cover and makes it stationery.
- The SS shaft is passed through the center of the discs. Magnet disc rotate on this axis. This shaft is coupled with the wind turbine to rotate the disc and make electricity.
- Whole arranged component system is surrounded by a cover case made of SS sheet.

### The matching procedure:-

The matching procedure of the wind rotor to the wind generator implies that the following three conditions should be satisfied-

- Field energy or cut in energy is produced at  $V = V_{\text{cut-in}}$
- Tip speed ratio remain close to  $\lambda_0$  for  $V_{\text{cut-in}} < V < V_{\text{rated}}$
- Rotor start turning at  $V_{\text{start}} < V_{\text{cut-in}}$

For the first case, when required data of the generator and the transmission are known and even for the maximum power co-efficient of the rotor (matching procedure ensures that at  $V = V_{\text{cut-in}}$  the rotor operates at  $C_{p\text{max}}$ ) this expression gives a value for  $V_{\text{cut-in}}$ . If this calculated value turns out to be higher than the value chosen in the calculation, the generator choice was wrong. We need to repeat the procedure. The simplest solution of this problem is to increase the area  $A$  of the rotor, in that case  $P_{\text{rated}}$  also increased and it should not exceed maximum power of the generator. If to increase  $A$  is not possible, higher value for  $V_{\text{cut-in}}$  has to be accepted, implying number of operating hours per hour.

In practical case for our country,

Wind velocity at which wind generator starts its maximum power output,  $V_{\text{start}} = 2.5$  m/s,

Wind velocity at which wind generator starts producing net electricity,  $V_{\text{cut-in}} = 3.0$  m/s,

Average wind velocity is defined as  $V_{\text{cut-in}}/0.7$  i.e.  $V_{\text{avg}} = 3/0.7 = 4.28$  m/s,

Wind speed at which wind generator obtained its maximum power output,  $V_{\text{rated}} = 1.5 \times 4.28 = 6.4$  m/s

To calculate area  $A$  of turbine for power  $P_a = 250$  W and  $V = V_{\text{rated}} = 6.4$  m/s using the equation of power  $P_a = 0.1AV^3$ , we get  $A = 9.53\text{m}^2$  and radius of the turbine is  $R = 1.75$  m.

So to generate 250 W power the radius of the turbine blade should be 1.75 m. The starting torque of the generator depends on the pressure of the brushes on the commutator (or on the slip rings) and on the value of the field current. It can easily be measured by means of a spring balance and a rope wound the shaft of the generator.

### Results and Discussion:-

Discussion on results obtained from the present research work is described in this section. The total result obtained from this work is aiming to provide electricity to the needy families who live in the remote corners of Bangladesh without any touch of modern development and far away from the reach of national grid. By using this generator, this group of people can turn on light to increase brightness in their daily life.

- A wind generator for a vertical axis wind turbine of 250 W generation capacity has been designed.
- This designed generator has been fabricated with the locally available low cost raw materials.



- C. The wind generator which works at low speed of wind like our country (where average wind speed is 3.5 m/s) is costly and these generators are imported. So this development of wind generator is very much helpful for local operation and production of wind turbines.
- D. This generator is suitable for producing electricity in remote areas of Bangladesh and capable to Provide electricity to full fill the demand of five to six families.

### Conclusion:-

Under this circumstances one can draw the following conclusion regarding the present research work.

- a. Life is directly depending on use of electricity and energy crisis is a threat for economical development of Bangladesh. This type of wind turbine and wind generator may be a solution of these power crisis by connecting it to the grid or using it separately in the remote areas where grid connected supply is not possible.
- b. Production cost of solar energy is 4 to 5 times greater than the production cost of wind energy. So wind energy is suitable to produce, economically viable for people of low earning group and it is also environment friendly.
- c. Unit cost of electricity produced by wind turbine is comparatively low when it is produced at a capacity of over 650 MW. As a result, in the remote areas of Bangladesh, multiple number of family can make a group for producing and dissemination of this type of energy.
- d. To give a magical touch of modernization to the people of remote areas of Bangladesh, use of renewable energy like wind energy may be a viable option.
- e. So Government and private sectors should give emphasis on wind power generation as a effective solution of power crisis in the perspective of Bangladesh.

### References:-

1. Nasima Akter, "Alternative Energy Situation in Bangladesh", URL:[http://www.bracresearch.org/reports/alt\\_energy.pdf](http://www.bracresearch.org/reports/alt_energy.pdf)
2. Khairul Anam, "Power Crisis & its Solution through Renewable Energy in Bangladesh", Cyber Journals, Vol. 02, Sep 2011.
3. M.J. Khan, M.T. Iqbal, S. Mahboob, "A wind map of Bangladesh Renewable Energy", Volume 29, Issue 5, Pages 643-660, April 2004.
4. A. C. Mandal, " Aerodynamics and Design Analysis of Vertical Axis Darrieus Wind Turbines", Ph.D. Thesis, Vrije Universiteit Bruueesl, Belgium, 1986.
5. M. F. Rahman, " Prospects of Wind Energy in Bangladesh", Proceedings of WorldRenewable Energy Congress (WREC), Denver, Colorado, USA, PP: 806-809, June 15-21, 1996.
6. A. C. Mandal, M. Q. Islam, " Aerodynamics and Design of Wind Turbines", Publication Cum Information Office, DAERS, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh, September 2001.



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### RESEARCH ARTICLE

#### DEFINING DRY SURFACE AREA OF RAZZAH LAKE BY USING GIS.

**Prof Zuhair Abdul Wahab Al jawahery.**

College of Engineering, University of Karbala Dec 2016

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#### Abstract

Razzah Lake is considered the second largest water depression in Iraq and Euphrates is considered the main feeder through Warar Barrage which connects it to Habaniya Lake which receives water directly from Euphrates. The drop in Euphrates water level has led to a continuous drop in Razzah Lake water level. The research involves specifying the water surface area of the lake for the period 2007, 2010, 2013 using aerial photos of the lake which lies within the administrative boundaries of Karbala Province. A GPS model has been used to locate the dry areas during these periods, It was found that the lake dry surface area during the period 2007-2010 was 175,901 sq km while the dry area between 2010 and 2013 was 53,147 sq km, that is three times more.

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#### Introduction:-

Razzah Lake, is located almost in the center of Iraq as shown in Figure (1). It is within the administrative boundaries of Karbala and Anbar, it is fed with water from Habaniya Lake through Warar Barrage. Both receive water from Euphrates. Its northern part lies in Anbar Province and southern part within Karbala Province. Figure illustrates the Lake shape



**Figure 1:-** Razzah Lake relative to Iraq

Source: Internet



**Figure 2:-** Razzah Lake shape

**Source:** Internet

The surface area of Razzah Lake varies with water level. When the water level increases, the surface area increases and vice versa. Table (1) shows the surface area of Razzah Lake and the quantity of water stored on the whole Lake water level. It is noted the lowest point in the lake is 17 m at sea level and the highest level is 40m

**Table 1:-** shows storage capacity and surface area of Razzah Lake based water based on water level

1	elevation	area(km)	capacity-مليار متر مكعب
2	17	0	0
3	18	180	0.125
4	19	260	0.3
5	20	350	0.55
6	21	460	0.9
7	22	580	1.4
8	23	700	2.1
9	24	830	2.8
10	25	940	3.8
11	26	1050	4.85
12	27	1140	5.9
13	28	1230	7.05
14	29	1320	8.2
15	30	1430	9.4
16	31	1465	10.75
17	32	1510	12
18	33	1550	13.5
19	34	1585	15.25
20	35	1620	16.87
21	36	1660	18.5
22	37	1700	20.25
23	38	1740	22.12
24	39	1770	23.75
25	40	1810	25.75

Razzah Lake was characterized by the large number of tourist facilities (homes, tourist restaurants and complexes. tourist recreation centers)n but because water was available in large quantity. But the drop in water level led to the deterioration of these facilities

#### **Research aim:-**

The research aims to achieve the following:

- Building a model of Razzah Lake for the recent years
- Specifying the areas that suffered water recession during the three periods

### Research problem

The research problem is represented by the continuous drop in Razzah Lake water level because it is no longer receiving water from Euphrates Research procedure, The researcher relied on aerial photos for the years 2007, 2010, 2013 Of the study area, Razzah Lake as well as ARC MAP, ARC CATALOG to build area definition model.

### Research Methodology:-

The researcher adopted two methods. The first one is theoretical in which main data on GIS are given as well as giving conclusions and recommendations

#### The first Part:involves the importance of the data in GIS:-

Data are considered the backbone of GPS .A researcher described it as the blood of GIS and it represents the huge demount of data and information, Its resources are numerous and demand on it increases, there has been an increase in data entry to databases. The data lose their importance when they are old or inaccurate because they then have a negative impact on analysis results therefore GIS data and information should be given equal attention to that given to equipment and programs

Aerial photographic instruments are considered one of the main factors in the development and spread of GPS because with them we can get accurate digital images of various areas .The drawing of features can be done in two ways

#### Vector model:-

Data are represented in this model by structures of basic components called simple special components , they are (point, line and area ). They are defined digitally and the relations between them are called special or topological relations . Figure (3) illustrates patterns of these features .

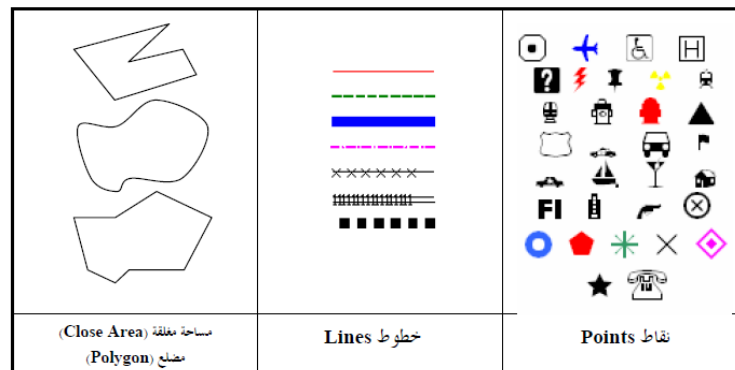
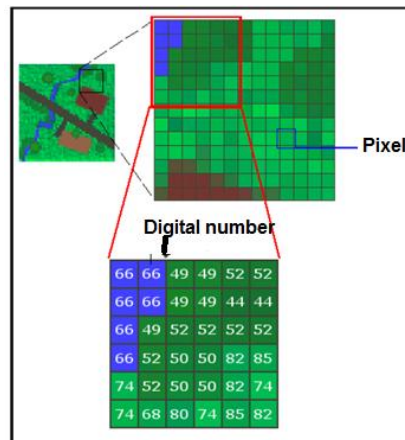


Figure 3:- Pattern of features. (point, line and area)

#### Rastor model:-

Data are represented in this model in the form of net or two dimensional matrix consisting of small cells called pixel .Each pixel has a value reflecting feature type and nature of the clarity because the pixel is the average of lighting or absorption measured electronically .The less the digital value of the pixel , the clearer the image. For example, an image with (0.5) m pixel value (the researcher has adopted this type) is which the pixel value is greater than an image in which the pixel value is 3 or 4 . Figure (4) illustrates this



**Figure 4:-** illustrates the pixel

Programs on GPS are numerous, they cover Surface, GlobalMapper, Arc. Gis which deal with spatial digital data in terms of collection, storage, analysis and exposition depending on geographical location. The researcher has adopted Arc and Gis in this research

The data sources used by GPS are of two types

1. Spatial data which cover radar data aerial images (which the researcher has adopted) as well as maps
2. Non spatial data which cover descriptive data such as tables and statistical

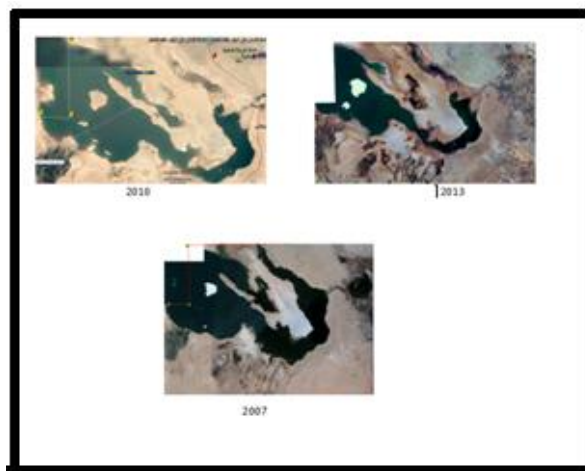
#### **The second part:- Building Razzah Lake model**

The researcher has used the southern part of the lake which lies within the administrative boundaries of Karbala province because aerial2020r photos are available for the years (3007.2010, 2013)

#### **Steps in building a model of study area:-**

There are several methods for building the model. Below are the steps of building the model according to one method

- 1-The photos of Razzah Lake part in Karbala province for the three years were retrieved from Arc Map, they are shown in Figure (5)



**Figure 5:-** Aerial views of Razzah Lake for years (3007. 2010, 2013)

**Sources:** The researcher

- 2- Drawing the boundaries if the water surface for each year using Arc Map as well as drawing the islands.

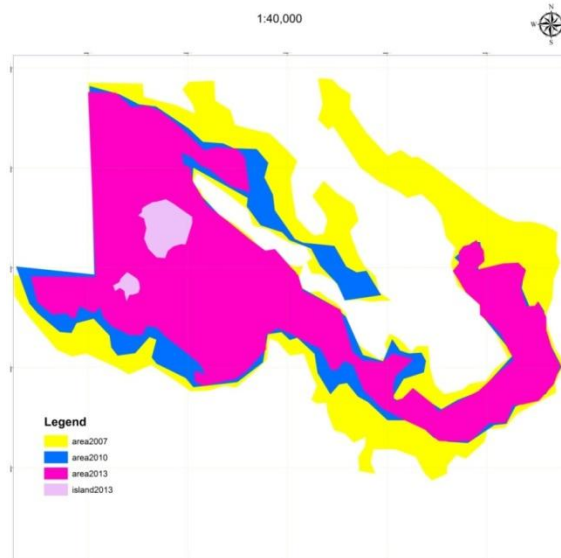
In the lake in the form of polygon. Figure (6) illustrates this where each color represents the area of water surface for each year adopted in the research



**Figure 6:-** illustrates Razzah Lake surface area for the three years

**Source :** The researcher

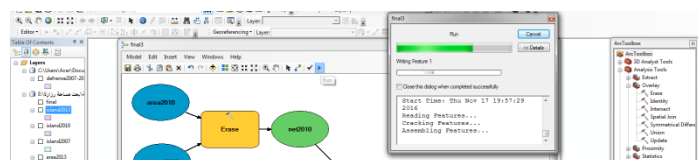
3-When these layers are assembled, they appear as in Figure (7) which shows the structure of these areas and the areas from which water has ebbed



**Figure 7:-** shows the structure of these areas

**Source :** The researcher

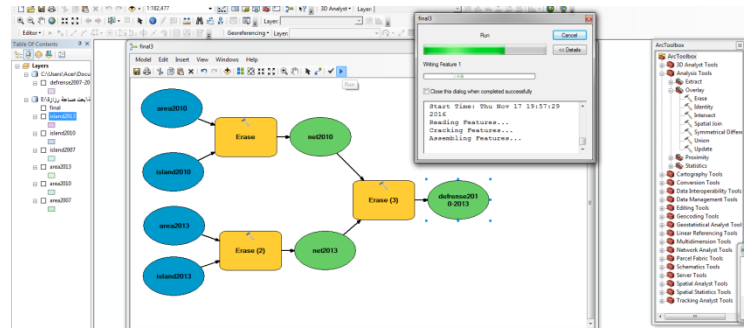
4-Stages for building water surface model .Arc toolbox was opened and a model was built for each year .This model contains the water surface and te islands in it as shown in Figure (8).The goal of this process is defining the pure area of the lake after deducting the island area from the lake total area



**Figure 8:-** shows how Razzah Lake model works

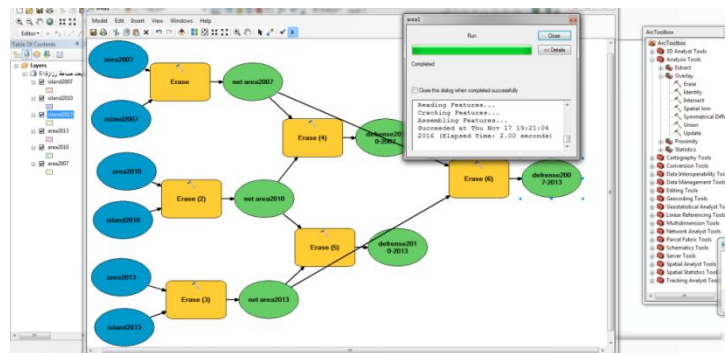
**Source :** The researcher

5-Another model was made which connects the pure areas for the years (2007, 2010, 2013) to find out the areas which suffered from water ebb as shown in Figure (9)

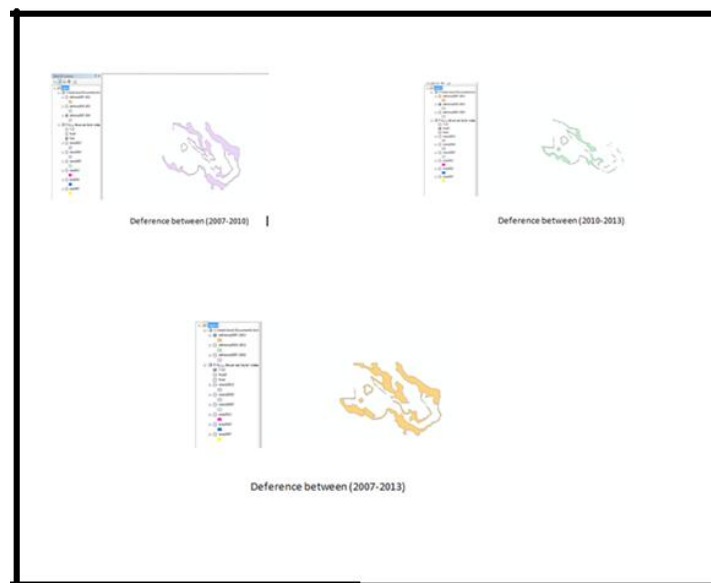


**Figure 9:-** shows how Razzah Lake model works to define the areas which suffered from water ebb  
Source : The researcher

6-After the model was run, the areas which suffered water ebb between 2007 and 2013 were calculated as shown in Figure (10) while Figure (11) shows the pure areas between each two periods



**Figure 10:-** shows how the model works between the years (2007, 2013)



**Figure 11:-** shows the pure areas from which water receded between each two periods  
Source : The researcher

7-From the data base built for model , the lake area lying within the administrative boundaries of Karbala was found for, the three years as well as the areas from which water receded as shown in Table c.

**Table 2:-** The areas from which water recede during the three years and their circumference

Area(km <sup>2</sup> )	Deference between years	Area(km <sup>2</sup> )	year
171.839	2007-2010	500.944	2007
53.137	2010-2013	329.105	2010
224.976	2007-2013	275.968	2013

Boundary(km)	year
235.866	2007
183.586	2010
156.924	2013

**Source :** The researcher

### **Third part:** Conclusions and recommendations

#### **Conclusions:-**

1. The lake surface area dropped by 35% during 2010 compared with 2007 that is 171,839 sq km
2. lake The surface area dropped by about 17% during 2013 from that of 2010. That is 53.137 sq km
3. lake The surface area dropped by about 45% during 2013 from that of 2007. That is 224,976sq km
4. The lake surface area diameter in 2007 was 235,866 km
5. The lake surface area diameter in 2010 was 183,586 km that is a drop of 23% from 2007
6. surface area The lake diameter in 2013 was 156,924,km 2010 that is a drop of 15% from 2010 that is a drop of 34% from 2007
7. After 2013, the lake surface area dropped less than in the previous years because the water quantity was low
8. Most areas which suffered water recession lie in the northern east and southern west which that these two areas have higher topography than other areas of the lake
9. Most sandstorms over Karbala are because it lie west part s in southern east of the lake
10. Recreation facilities stopped

#### **Recommendations:-**

1. It is necessary to feed the lake with water from Euphrates through Warar Barrage to improve Karbala climate and fish life and thus improve tourism
2. It is necessary that the related government bodies should provide aerial photos and specialized spatial data

#### **References:-**

1. Al-Jawahriy, Zuhair Abdul Wahab, Ass.Prof, Building a Digital Elevation Model for Razaza Lake by Using GIS, International Journal of Engineering and Advanced Technology (IJEAT), ISSN: 2249 – 8958, Volume-3, Issue 1, October 2013, p294
2. Omari, D. Mohammed bin Awad, spatial techniques converted data and information, into digital form, Department of Geography, Faculty of Arts, King Abdul Aziz University, p. 5
3. . The General Administration for curriculum design and development, the General Organization for Technical Education and Development Terminator, Saudi Arabia, Rapporteur of the GIS, Survey Section, p. 34
4. General Administration to design and develop curricula, op. Cit., P. 37
5. Christopher, J, 1999, "Geographical Information Systems and Computer Cartography", Addison Wesley Longman Limited, pp.19-38s.



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### RESEARCH ARTICLE

#### Evaluation Of Parents Knowledge About The Dangerous Effect Of Excessive Use Of Antibiotics On Children With URTIs In Jeddah City.

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#### Manuscript Info

##### Manuscript History

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#### Abstract

**Background:-** Upper respiratory tract infections (URTIs) occur most commonly among children and most of these infections are self-limiting with a very low risk of complications and its management consist of self-care and symptomatic treatment.

**Objectives:-** To examine assess parental knowledge about the antibiotic use in the treatment of childhood upper respiratory tract infections (URTIs), Saudi Arabia.

**Methods:-** A Pre-formed Self-administered questionnaire was conducted among the parents of children with URTIs of Jeddah City.

**Results:-** A total of 385 parents from Jeddah City were included, of them 325 were females. Overall, 69 members of all interviewed parents had satisfactory knowledge on antibiotic use but 316 parents which represents the majority of subjects had poor knowledge. Univariate analysis showed that female was found to be the only variable that associated with satisfactory knowledge.

**Conclusion:-** The knowledge of Parents in this study showed a poor knowledge on antibiotic use, which is significantly dependent on female gender.

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#### Background:-

Antibiotics have been used for the last 70 years to treat patients who have infectious diseases<sup>(1)</sup>. Antibiotics are targeted to kill or inhibit the growth of bacteria and have no effect on viral agents. Antibiotics are among the most commonly prescribed drugs used in human medicine and can be lifesaving drugs. 50% of the antibiotics prescribed is not even necessary and it is not needed<sup>(2)</sup>.

Unfortunately, they are often inappropriately used to treat viral infections such as upper respiratory tract infections (URTIs). URTIs are usually self-limiting and resolve in the same amount of time regardless of antibiotic consumption<sup>(3)</sup>. Thus, using antibiotics to treat these viral infections is considered a misuse of antibiotics. URTIs prevalence is high between children so they are usually the group which use antibiotics the most. It is currently considered to be one of the major worldwide public health issues<sup>(4)</sup>.

The bacterial drug resistance seems to be the main problem antibiotics misuse has caused. Antimicrobial resistance is the ability of microbes to resist the effects of drugs – that is, the germs are not killed, and their growth is not stopped. The threat is real and needs serious actions from the communities and governments<sup>(1)</sup>. This misuse may be due to reasons related to: patients, parents or guardians, or the medical practitioner. Several studies have discussed



the reasons associated with antibiotics overuse. These include: attitudes, beliefs, knowledge of antibiotic use<sup>(5, 6)</sup>, behaviors (e.g. over-the-counter medication and self-medication)<sup>(7)</sup>. Patients' perceptions regarding patient-doctor interaction, patient satisfaction, and patients' experience with antibiotics<sup>(7)</sup>. It is important to assess the situation in order to solve the problem. In this paper our goal is to assess the parent's role in antibiotics misuse in children with URTIs in Jeddah city which is a big city in the WEST of Saudi Arabia. Measuring the parent's knowledge, attitudes, behaviors, and beliefs about antibiotics will help in the assessment of the situation burdens are attributable.

The overall aim of the present work was to study the parents' knowledge about the dangerous effect of excessive use of antibiotics on children with URTIs in Jeddah City.

### **Rational:-**

The intervention of antibiotics has marked an important milestone in the history of medicine. The role of antibiotics in reducing the mortality and morbidity of diseases caused by bacteria is beyond any doubt. The challenge to the medical community is to maintain the effectiveness of antibiotics. When used inappropriately, antibiotics may lose its healing power as bacteria develop resistance.

### **Objectives:-**

#### **General objectives:**

- 1- To decrease the overuse of antibiotics in Jeddah city
- 2- To decrease the incidence of super-infections in Jeddah city
- 3- To decrease the incidence of hospital Acquired infections in Jeddah city

#### **Specific objective:**

- 1- To assess the parent's knowledge, attitudes, behaviors, and beliefs about antibiotics in Jeddah.

### **Methods:-**

#### **Study design:-**

It is community based, descriptive study.

#### **Setting and data collection:-**

This survey analysis among community population was conducted in Jeddah city. A pre-formed self-administered questionnaire was distributed to Parents of children with UTRIs.

#### **Sample size:-**

Subjects were chosen according to geographical and sex distribution. Sample size was calculated based on web-site calculator, taking the total size of Jeddah population (3,976,000), confidence level (95%) and margin error (5%) to be 385<sup>(8)</sup>.

#### **Study population:-**

Parents in Jeddah city and their children had URTIs were included.

#### **Study tools:-**

The tool used was Pre-formed Self-administered questionnaire that requires information about.

- 1- Demographics including age, gender, education level.
- 2- Self-administrated questionnaire:

To assess the knowledge of parents regarding antibiotic use, including the basic concepts of antibiotics and indications for their use, methods of administration, and side effects.

**In the questionnaire patients' knowledge of anti-biotic abuse was assessed using 12 questions relating to the prescriber, course, and need of use. Then scored by assigning one point for each correct response. The anti-biotic abuse knowledge score was calculated as a continuous variable by summing the participant's number with a maximum obtainable correct score of 12 for each respondent.**

#### **Limitation of the study:-**

- This study was carried out on only 385 parents, and limitations to generalizability are inevitable.
- Samples readiness in participating.

#### **Ethical considerations:-**

Informed consent was obtained from all the participating parents in the study. Participants were made aware that they could withdraw at any time.

#### **Statistical analysis:-**

Data were entered into the Statistical Package for Social Sciences (SPSS, version 24, SPSS, Chicago, IL, U.S.A.) and descriptive analysis conducted. The results were reported as percentage (95% confidence interval). The internal consistency was assessed using Cronbach's  $\alpha$  test.

Association of respondents' characteristics with about anti-biotic abuse anti-biotic abuse hazard, was evaluated using univariate logistic regression. Results were reported showing odds ratio (OR) and 95% confidence interval. Statistical significance was accepted at  $p < 0.05$ . The dependent variables: knowledge of anti-biotic abuse risk (1 = Poor knowledge and 0 = good knowledge). The following independent variables were included: (1) age:  $\leq 30$  years, [31–30 years] and [31 $\geq$ 41 years] (2) gender: males and females; (3) level of education: Collage, High School and Middle and Elementary School.

#### **Results:-**

##### **Demographics of the studied subjects:-**

The socio-demographic characteristics were shown in Table. 1.

**Table 1. Socio-Demographic Characteristics of Respondents**

	No.	Percentage (%)
<b><math>\leq 20.00</math></b>	24	6.4
<b>21.00 - 30.00</b>	181	48.1
<b>31.00 - 40.00</b>	113	30.1
<b>41.00 - 50.00</b>	46	12.2
<b>51.00+</b>	12	3.2
<b>Mean<math>\pm</math>SD (Min.-Max.)</b>	31 $\pm$ 9 (12-60)	
<b>Female</b>	325	85.5%
<b>Male</b>	55	14.5%
<b>Collage</b>	287	75.5%
<b>High School</b>	73	19.2%
<b>Middle School</b>	14	3.7%
<b>Elementary School</b>	6	1.6%

This study included total of 385 subjects who approved to answer the questionnaire. The range of age was from 12 to 60 years with a mean 31 years old. About 6.4% of subjects were less than 20 years old, 48.1% of participants were from 21-30 years old, 30.1% were from 31-40% years old, 12.2% ranged from 41-50 years old and 3.2% were more than 51 years old.

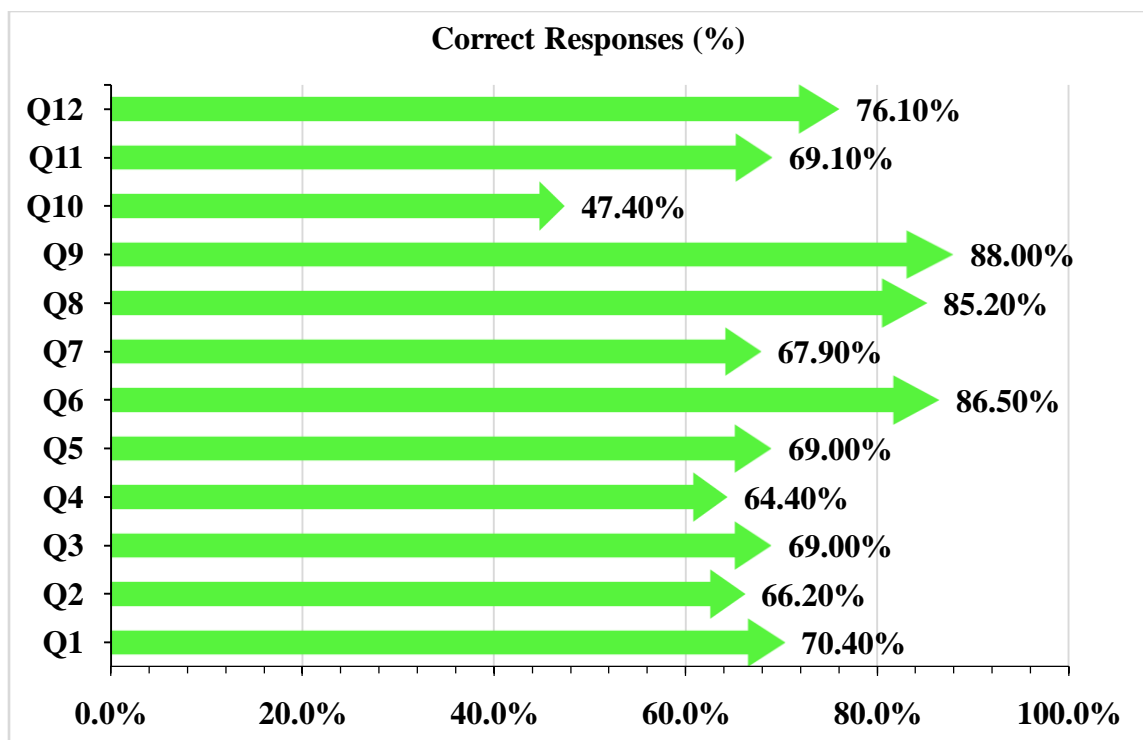
This study included 85.5% females and only 14.5% were males.

The study population represents a highly educated group of people, with 75.5% have completed college, 19.2% completed high school, 3.7% completed middle school and 1.6% have been to elementary school.

#### **Responses to questions of knowledge assessment questionnaire (Table. 2& Figure. 1):**

**Table 2:-** Responses to questions on assessment level of awareness toward excessive use of Antibiotics:

	No	Yes
<b>Q1:</b> Do you use antibiotic for your children without the advice of a doctor?	266 (70.4%)	112 (29.6%)
<b>Q2:</b> Is fever a strong motivation for the use of the antibiotic?	249 (66.2%)	127 (33.8%)
<b>Q3:</b> Do you usually complete the course (period specified for use by a physician) of antibiotic?	117 (31.0%)	260 (69.0%)
<b>Q4:</b> Have you ever heard of antibiotic resistance of bacteria?	134 (35.6%)	242 (64.4%)
<b>Q5:</b> Do you think that the bacterial resistant to antibiotics appear in the case of non-completion of the antibiotic course?	116 (31.0%)	258 (69.0%)
<b>Q6:</b> Taking the antibiotic often described by?	<b>Pharmacist</b>	58 (15.4%)
	<b>Doctor</b>	268 (71.1%)
	<b>Person Who used it before</b>	14 (3.7%)
	<b>Self</b>	37 (9.8%)
<b>Q7:</b> What are the symptoms that makes you give your children antibiotics?	<b>Fever</b>	105 (28.3%)
	<b>Diarrhea</b>	14 (3.8%)
	<b>Tonsillitis</b>	235 (63.3%)
	<b>Rhinitis</b>	17 (4.6%)
<b>Q8:</b> what do you depend on while choosing to buy a certain antibiotic?	<b>Price</b>	8 (2.1%)
	<b>Pharmacist</b>	49 (13.0%)
	<b>Doctor</b>	273 (72.2%)
	<b>Person Who used it before</b>	20 (5.3%)
	<b>Commonly Used</b>	28 (7.4%)
<b>Q9:</b> Do you see a doctor in case of treatment failure?	36 (12.0%)	265 (88.0%)
<b>Q10:</b> What is the period in which they define treatment failure?	<b>1-3 Day</b>	68 (22.4%)
	<b>4-6 Day</b>	92 (30.3%)
	<b>1 Week</b>	144 (47.4%)
<b>Q11:</b> Do you know what are the risks and complications of using antibiotics?	93 (30.9%)	208 (69.1%)
<b>Q12:</b> Do you know that antibiotics may interfere with some used drugs?	72 (23.9%)	229 (76.1%)



**Figure 1:-** Responses to questions which corresponds to (%) of patients answered correctly.

Table. 2 indicated the response of participants to the knowledge questionnaire about the use of antibiotics. Overall, 70.4% of the parents in the study didn't give their children antibiotic without advice from doctors as well as 66.2% didn't rate fever or high temperature as a motivation for using antibiotics.

Of the 385 parents responding, 69.0% of them usually complete the antibiotic course and 64.4% of parents believed that they had good knowledge on antibiotic resistance of bacteria, and 69.0% of them thought that non completion of the antibiotic course may lead to antibiotic resistance of bacteria. The main source for parents to obtain information on antibiotic use was from physicians (71.1%), and followed by pharmacy staff (15.4%), 9.8% was self-described and 3.7% take antibiotics according to person who used it before.

In addition, when parents were asked specifically about the most serious symptoms that would have to be present in order for them to buy a certain antibiotic in the case of URIs, 63.3 and 28.3 % of symptoms were tonsillitis and fever, respectively, often accompanied by other symptoms.

The majority of subjects depend on the doctor's advice (72.2%) to buy antibiotic followed by 13.0% depend on pharmacist. Price, the persons who used antibiotic before and commonly used antibiotics were the least percentages of dependence when buying antibiotics.

If treatment failed, 88.0% of participants go to seek doctor's advice. Also most of parents define the failure period to be 1 week (47.4%), followed by 30.3% of them thought that the treatment failure period was 4-6 days and 22.4% was from 1-3 days.

Only 30.9% of parents thought that antibiotics did not cause any harmful side effects, while 69.1% were certain that antibiotics might cause many harmful adverse effects and also the majority (76.1%) know about the interference of antibiotics with other drugs.

#### **Assessment of knowledge of participants regarding to the risks of excessive use of antibiotics:**

The mean knowledge score was 7.8 out of 12 for all subjects and it was considered as poor knowledge (Table. 3). Also, 316 parents which represents the majority of subjects had poor knowledge however, only 69 had good knowledge (Figure.2).

**Table 3:-** Knowledge of participants regarding to the risks of excessive use of antibiotics

	Knowledge Score
Mean $\pm$ SD	7.80 $\pm$ 2.83
Min.- Max.	0-12
Good Knowledge ( $\geq 85\%$ )	69 (17.9%)
Poor knowledge ( $\leq 84\%$ )	316 (82.1%)

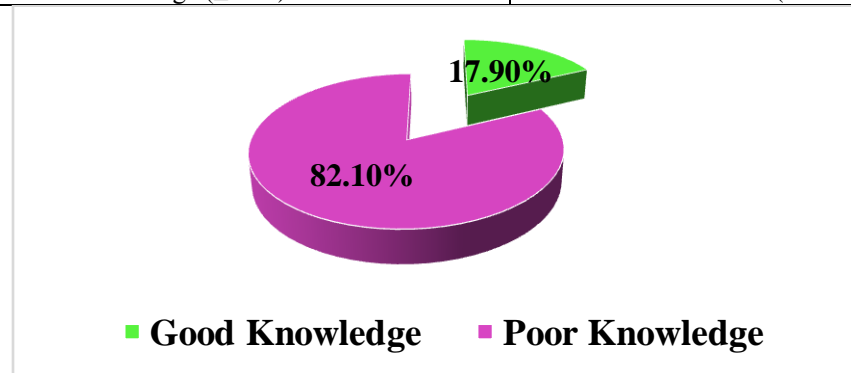
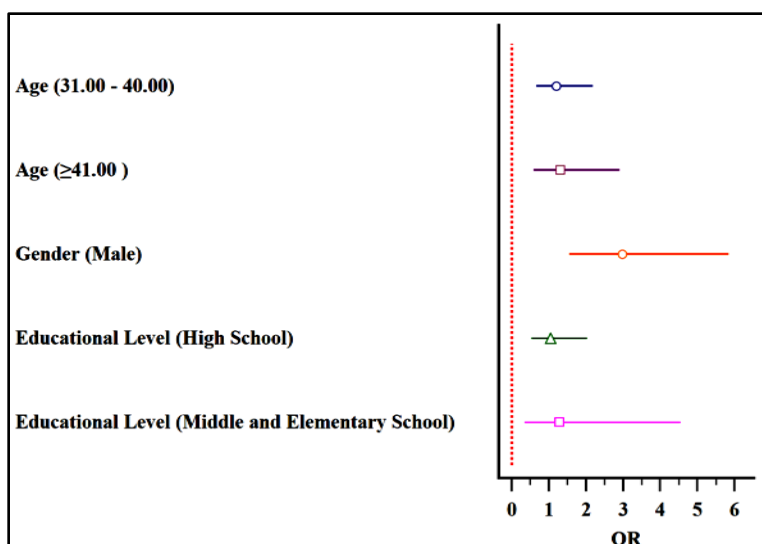
**Figure 2:-** Respondent's Knowledge about Anti-biotic Abuse risk**Association between knowledge and demographics of included participants:-**

Table. 4 showed the association between knowledge and subject's demographics. This study showed that there was no significant association between neither age nor educational level with demographic variables of the participants ( $P > 0.05$ ). On the other hand, the female gender was associated with higher levels of knowledge than males and achieved statistical significance ( $p < 0.0001$ ) association. Remarkably, females had higher levels of knowledge due to their higher interaction with their children (Figure. 3).

**Table. 4:-** Univariate logistic regression model for association between antibiotic use knowledge and socio-demographic variables:

	Good(n=69)		Poor(n=316)		OR	95%CI	P-value
<b><math>\leq 30.00</math></b>	40	19.5%	165	80.5%	1	Reference	0.718
<b>31.00 - 40.00</b>	19	16.8%	94	83.2%	1.20	0.66-2.19	0.554
<b><math>\geq 41.00</math></b>	9	15.5%	49	84.5%	1.32	0.60-2.91	0.491
Female	156	48.0%	169	52.0%	1	Reference	0.0007
Male	13	23.6%	42	76.4%	2.98	1.55-5.84	
<b>Collage</b>	53	18.5%	234	81.5%	1	Reference	0.924
<b>High School</b>	13	17.8%	60	82.2%	1.05	0.54-2.04	0.897
<b>Middle and Elementary School</b>	3	15.0%	17	85.0%	1.28	0.36-4.54	0.699



OR; Odds Ratio, 95% CI: Confidence Interval

**Figure 3:-** Forest plot illustrating the odd ratios with 95% confidence intervals of the different socio-demographic predictors for Respondent's Knowledge about antibiotic use.

### Discussion and Conclusion:-

The study assessed the parents knowledge that influence the use of antibiotics in children. Knowledge and beliefs of parents were assessed using a questionnaire to study the behaviors, antibiotics adherence, seeking information, and awareness about antibiotics resistance. All of these aspects were tested in this study against a set of demographic and child health-related aspects.

Antibiotics are helpful in treating bacterial infections, but have been widely used inappropriately to treat viral infections such as most Upper Respiratory Tract Infections (URTIs) otherwise known as the common cold infection, the most common infections around the world<sup>(9-12)</sup>.

This study showed that the majority of population had poor knowledge however prevalence of higher levels of education. This study was in agreement with a recent study that was conducted at Taif City, Saudi Arabia where they found that had poor parents knowledge on antibiotic use however it was significantly dependent on parents' level of education<sup>(13)</sup>.

Comparatively, other researchers reported high level of knowledge among 60% of caregivers interviewed to assess their KAP on the same topic<sup>(14)</sup>. Also, in contrast study in Saudi Arabia showed that most parents in the study show good-to-moderate awareness about antibiotic resistance<sup>(15)</sup>; similar results have been documented in other studies<sup>(16, 17)</sup>.

The parents here in this study trusted both the physician and the pharmacist as top sources of information about antibiotic use and the least were the common use and self-administered antibiotics. In consistence with these results, this was a positive finding that parents seek physician and pharmacist advice and this can be utilized for the distribution of health education in the future<sup>(13)</sup>.

Respondents in this research ranked tonsillitis and fever as the most common symptoms that enhance them to use antibiotics. In agreement with this result, the fever was the most common symptom (80.5%) that the child suffers and make them to visit the doctors<sup>(13)</sup>. Also, other researchers reported that the main symptoms considered important and would drive parents to visit the doctor were earache (84%) and fever (81%)<sup>(18)</sup>. These findings may be highly attributed to the parents' fear of the complication associated with fever beside their lack of knowledge about fever. Parents in Taif were interviewed about their knowledge about fever, which was found to be suboptimal and nearly 38% correctly determined the threshold for defining fever<sup>(19)</sup>.

There was a significant association between good knowledge and female gender also fathers in the current study appear to have lower knowledge and beliefs about the appropriate use of antibiotics in children. This result is consistent with other studies which found that males provided more incorrect information regarding the appropriate use of antibiotics than females<sup>(20, 21)</sup>. Belongia *et al.* (2002) also found that females have better knowledge and beliefs about the appropriate use of antibiotics in children<sup>(22)</sup>.

The univariate analysis showed no association between the age and knowledge score of the participants. In contrast with our findings, Belongia (2002) found that older parents have better knowledge and beliefs about antibiotics use. Which could be associated with older parents having more years of experience with antibiotics compared to younger parents, and experience leads to better knowledge and beliefs<sup>(22)</sup>.

During this study the knowledge about antibiotic resistance and complications associated with overuse of antibiotics were good despite low knowledge score achieved by the included parents. In agreement, the antibiotics resistance is currently one of the most important growing public health issues worldwide, mainly caused by antibiotics overuse<sup>(23)</sup>. Antibiotic resistance places both the community and the individual at risk<sup>(24)</sup>. Teng *et al.* (2004) assert that the inappropriate use or the overuse of antibiotics to treat viral URTIs is one of the main reasons for the development of antibiotic resistance<sup>(9)</sup>.

### In conclusion:-

providing patients and parents with this information will help doctors to give better medical treatment without prescribing unnecessarily antibiotic treatment for URTI. Further research should focus on evaluation of parents' expectations and effective ways to educate the parent about appropriate use of antibiotics in treatment for URTI.

### Budget

Item	Price
Transportations	700 SR
Paper work	800 SR
Data collection and analysis	3500 SR
Books	1000SR
Stationaries	1000SR

### Work plan

Tasks in the work plan	Time period
Literature review	<b>2 Months</b>
Preparation for data collection	<b>1 Months</b>
Data collection	<b>3 Months</b>
Statistical analysis	<b>1 Months</b>
Discussion of results	<b>2 months</b>
Writing an abstract	<b>1 months</b>

### References:-

1. CDC.retrieved from <http://www.cdc.gov/drugresistance/about.html>. 2016.
2. WHO.retrieved from <http://www.who.int/mediacentre/factsheets/fs194/en/>. 2016.
3. Wutzke SE, Artist MA, Kehoe LA, Fletcher M, Mackson JM, Weekes LM.Evaluation of a national programme to reduce inappropriate use of antibiotics for upper respiratory tract infections: effects on consumer awareness, beliefs, attitudes and behaviour in Australia. *Health Promot Int.* 2007;22(1):53-64.
4. Kisuule F, Wright S, Barreto J, Zenilman J.Improving antibiotic utilization among hospitalists: a pilot academic detailing project with a public health approach. *Journal of hospital medicine.* 2008;3(1):64-70.
5. Chan GC, Tang SF.Parental knowledge, attitudes and antibiotic use for acute upper respiratory tract infection in children attending a primary healthcare clinic in Malaysia. *Singapore medical journal.* 2006;47(4):266-70.
6. Mitsi G, Jelastopulu E, Basiaris H, Skoutelis A, Gogos C.Patterns of antibiotic use among adults and parents in the community: a questionnaire-based survey in a Greek urban population. *International journal of antimicrobial agents.* 2005;25(5):439-43.
7. Sarahroodi S, Arzi A, Sawalha A, Ashtarinezhad A.Antibiotics self-medication among southern iranian university students. *IJP-International Journal of Pharmacology.* 2010;6(1):48-52.

8. <http://www.calculator.net/sample-size-calculator.html?type=1&cl=95&ci=5&ps=3%2C976%2C000&x=37&y=6>.
9. Teng CL, Leong KC, Aljunid SM, Cheah M. Antibiotic prescription in upper respiratory tract infections. *Asia Pac Fam Med*. 2004;3(1-2):38-45.
10. He Y, Lin GY, Wang Q, Cai XY, Zhang YH, Lin CX, et al. A 3-year prospective study of the epidemiology of acute respiratory viral infections in hospitalized children in Shenzhen, China. *Influenza Other Respir Viruses*. 2014;8(4):443-51.
11. Lu ZW, Deng JK, Zheng YJ, He YX, Yang WG, Wei JR, et al. [Characteristics of severely and critically ill children with 2009 influenza A (H1N1) virus infection]. *Zhonghua er ke za zhi = Chinese journal of pediatrics*. 2010;48(8):571-4.
12. Wang H, Zheng Y, Deng J, Wang W, Liu P, Yang F, et al. Prevalence of respiratory viruses among children hospitalized from respiratory infections in Shenzhen, China. *Virology*. 2016;13:39.
13. Elbur A, Albarraq A, Abdallah M. Saudi Parents' knowledge, Attitudes and Practices on Antibiotic Use for Upper Respiratory Tract Infections in Children: A population-based Survey; Taif, Kingdom of Saudi Arabia. *JMR*. 2016;2(4):99-103.
14. Parimi N, Pinto Pereira LM, Prabhakar P. Caregivers' practices, knowledge and beliefs of antibiotics in paediatric upper respiratory tract infections in Trinidad and Tobago: a cross-sectional study. *BMC family practice*. 2004;5:28.
15. Alumran A, Hou X-Y, Sun J, Yousef AA, Hurst C. Assessing the construct validity and reliability of the parental perception on antibiotics (PAPA) scales. *BMC public health*. 2014;14(1):1.
16. Larson EL, Dilone J, Garcia M, Smolowitz J. Factors which influence Latino community members to self-prescribe antibiotics. *Nursing research*. 2006;55(2):94-102.
17. Corbett KK, Gonzales R, Leeman-Castillo BA, Flores E, Maselli J, Kafadar K. Appropriate antibiotic use: variation in knowledge and awareness by Hispanic ethnicity and language. *Preventive medicine*. 2005;40(2):162-9.
18. Rousounidis A, Papaevangelou V, Hadjipanayis A, Panagakou S, Theodoridou M, Syrogiannopoulos G, et al. Descriptive study on parents' knowledge, attitudes and practices on antibiotic use and misuse in children with upper respiratory tract infections in Cyprus. *Int J Environ Res Public Health*. 2011;8(8):3246-62.
19. Elbur A. Childhood fever and its management: differences in knowledge and practices between mothers and fathers in Taif; Saudi Arabia. *World Journal of Pharmaceutical Research*. 2014;3(3):4536-48.
20. McNulty CA, Boyle P, Nichols T, Clappison P, Davey P. Don't wear me out--the public's knowledge of and attitudes to antibiotic use. *The Journal of antimicrobial chemotherapy*. 2007;59(4):727-38.
21. Alumran A, Hurst C, Hou X-Y. Antibiotics overuse in children with upper respiratory tract infections in Saudi Arabia: risk factors and potential interventions. *Clinical Medicine and Diagnostics*. 2011;1(1):8-16.
22. Belongia EA, Naimi TS, Gale CM, Besser RE. Antibiotic use and upper respiratory infections: a survey of knowledge, attitudes, and experience in Wisconsin and Minnesota. *Preventive medicine*. 2002;34(3):346-52.
23. CDC. Centers for Disease Control and Prevention. Antibiotic resistance questions & answers. Retrieved September 2013, from [www.cdc.gov/getsmart/antibioticuse/antibiotic-resistance-faqs.html#q](http://www.cdc.gov/getsmart/antibioticuse/antibiotic-resistance-faqs.html#q). 2009.
24. Simasek M, Blandino DA. Treatment of the common cold. *American family physician*. 2007;75(4):515-20.





### RESEARCH ARTICLE

## EFFECT OF PLANT GROWTH REGULATORS ON IMMOBILIZED CELL CULTURE OF ADHATODA VASICA NEES.

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*A. vasica*, Immobilized cell, calcium alginate, cell growth, vasicine.

### Abstract

Immobilization have been suggested as a strategy to improve the overall productivity in plant tissue culture. Two auxin and one cytokine used to manipulate the media and the effect was studies in terms of cell growth. Secondary metabolite production was analyzed by HPLC.

The calcium alginate concentration was optimized on the basis of cell viability and cell number increase was observed in immobilized condition.

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### Introduction:-

Immobilized system facilitates cell viability over an extended time for secondary metabolite production. Immobilization enables reutilization of entrapped biomass, and this technique is especially suitable for slow growing plant cells. Immobilized plant cells have been employed to perform biotransformation and reported to have higher production from suspension culture cells. Enclosure in a support material exerts certain stress on plant cells leading to restricted growth, the condition normally considered as prerequisite for higher secondary metabolite production (Brodelius, 1979).

Immobilization separates cells from medium and the desired product is extracellular, simplifying down-stream processing. Manipulation of the auxin to cytokinin ratio in the medium can lead to the development of shoots, roots, or somatic embryos from which whole plants can subsequently be produced (Haigh, 1989).

Immobilized plant cells have been employed to perform biotransformations and reported to have higher production rates than freely suspended cells. For example, immobilized Capsicum cultures treated with precursors accumulated more quantities of biotransformed compounds than freely suspended cultures (Johnson et al., 1996; Rao and Ravishankar, 2000). Immobilization techniques were initially developed to immobilize enzymes for applications in the industrial production of sugars, amino acids and pharmaceutical products (Vasilev, 2014). In an immobilized system growth and production phases can be decoupled and controlled by chemical and physical stress conditions. This allows cells to be retained in the bioreactor for extended periods, with alternating rejuvenation /growth and secondary metabolite production cycles (Williams and Mavituna, 1992).

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*Adhatodavasica* Nees (Vasaka) is used in various chest infections and has reputation as an expectorant in the indigenous system of medicine. The leaves, roots and flowers are extensively used for various respiratory disorders like cough, asthma, bronchitis etc. *Adhatodavasica* has been used for centuries in India as an insecticide. Its leaves have been shown to control insect pests in oil seeds, in both laboratory and warehouse conditions (Srivastava, 1965). It provides relieves in muscular spasms, cramps or convulsions. Vasicine (peganine) is a quinazoline alkaloid (Atal, 1980). It is the active compound of A. Vasica.

## Material and method:-

### Immobilization in calcium alginate-

1 ml. of cell suspension, corresponding to 1 gm of fresh weight was added to 10 ml. of 2% sodium alginate (HI-media) and mix well to achieve the uniform distribution of cells throughout the sodium alginate solution and left for sometime to remove bubbles. This mixture was then added drop wise into 3mM calcium chloride solution through sterilized syringe under aseptic condition in Laminar airflow bench. This leads to form circular beads having diameter of 2.5-3.0 mm. Formed beads are then left in  $\text{CaCl}_2$  solution for 30 minits for stabilization. The beads were then washed with sterilized water to remove the traces of  $\text{CaCl}_2$ . Washed beads were then dispersed in 50 ml. production media in Erlenmeyer flasks in shaker cum incubator.

### Optimization of calcium alginate concentration by cell viability study:-

Immobilized cells are subjected to check the viability in calcium alginate entrapped condition. For cell viability study 5 beads are placed in 5 ml. of potassium phosphate buffer (pH 6.5) to release the cells from calcium alginate. After complete dissolution of beads the obtained suspension was centrifuge at 2000 rpm for 2 min and 1 ml. of 23.9 mM TTC (Tri phenyl tertazolumchloride) was added in separated cells in micro centrifuge tubes.

### Cell Number increase study in calcium alginate immobilized cells:-

Cell number was estimated by dissolving the randomly selected 10 beads in 10 ml. of potassium phosphate buffer (pH 6.5). After ensuring the complete dissolution of beads, the cells were counted under the microscope with cytometer.

### HPLC Quantitative estimation of Vasicine:-

The Quantitative estimation of Vasicine was analyzed qualitatively was done by High Performance Liquid Chromatography (HPLC) method (Indian Herbal Pharmacopoeia, 1998). The different dilutions of known concentration of vasicine (Provided by Laila Impex, Vijaywada) was prepared by dissolving them in methanol to get the concentration range between 10-60  $\mu\text{g/ml}$ .

### Sample preparation:-

For quantitative estimation of vasicine in immobilized cell culture, 25 ml production media was taken out from four flasks and pooled together to make it 100 ml. Which is then subjected for acid-alkali method<sup>7</sup> to extract alkaloidal fraction. At the end of process a semi solid mass was remains, was further dissolved in methanol and use for HPLC estimation.

### HPLC Standard curve for Vasicine:-

Instrument: Shimadzu, Mobile phase: Methanol: water (2:3), Flow rate: 0.7 ml/min.  
Column: Resolve C18 Spherical 5 $\mu$  (3.9 mm X 15 cm), Detector: SPD-M10 Avp.  
Wavelength: 298 nm, Retention time: 3.8 min.

## Results and discussion:-

From the above results it was observed that the immobilization of A. vasica cells in calcium alginate gel is showing promising results. 2% calcium alginate was found optimum for immobilization as it maintains higher degree of cell viability. Immobilization restricted cell number increment, which stimulates secondary metabolite productions. MS media was found suitable for more vasicine production, maybe due to higher concentration of ions and nutrient supplements, which provide necessary material for de-novo synthesis of vasicine. The above study showed that MS media supplemented with 2,4-D (2 ppm), Kinetin (0.5 ppm) and + IAA(0.5 ppm) is suitable for more vasicine production.

**Table 1. Percentage cell viability in different alginate gel concentration.**

Time in Days	% viability in different alginate gel concentration		
	1%	2%	3%
0	73	76	71
7	69	71	64
14	Beads Dissolved	68	61
21	Beads Dissolved	65	55

**Table 2. Cell number study in MS and B<sub>5</sub> media immobilized in 2% calcium alginate.**

Days	Cell number X 10 <sup>5</sup> /mm <sup>3</sup> in MS Media Supplemented with			Cell number X 10 <sup>5</sup> /mm <sup>3</sup> in B <sub>5</sub> Media supplemented with (cell number X 10 <sup>5</sup> )		
	2,4-D (2.0 ppm) + Kinetin (1.0 ppm) + IAA (0.5 ppm)	2,4-D (2 ppm) + Kinetin (0.5 ppm) + IAA (0.5 ppm)	2,4-D (1.5 ppm) + Kinetin (1.0 ppm) + IAA (1.0 ppm)	2,4-D (2 ppm) + Kinetin (1.0 ppm) + IAA (0.5 ppm)	2,4-D (2 ppm) Kinetin (0.5 ppm) + IAA (0.5 ppm)	2,4-D (1.5 ppm) + Kinetin (1.0 ppm) + IAA (1.0 ppm)
0	3.6	3.62	3.54	3.3	3.61	3.42
7	3.67	3.75	3.6	3.41	3.75	3.42
14	3.84	4.14	3.74	3.48	3.76	3.46
21	3.86	4.16	3.77	3.52	3.80	3.50

Value represent the mean  $\pm$  SE (n=3)

**Table 3. Vasicine content in immobilized cell culture.**

Time in days	Vasicine content ( $\mu\text{g/ml}$ / gm fresh weight) of <i>A.vasica</i> cells immobilized in calcium alginate					
	MS medium supplemented with			B <sub>5</sub> medium supplemented with		
	2,4-D (2.0 ppm) + Kinetin (1.0 ppm) + IAA (0.5 ppm)	2,4-D (2 ppm) + Kinetin (0.5 ppm) + IAA (0.5 ppm)	2,4-D (1.5 ppm) + Kinetin (1.0 ppm) + IAA (1.0 ppm)	2,4-D (2 ppm) + Kinetin (1.0 ppm) + IAA (0.5 ppm)	2,4-D (2 ppm) Kinetin (0.5 ppm) + IAA (0.5 ppm)	2,4-D (1.5 ppm) + Kinetin (1.0 ppm) + IAA (1.0 ppm)
01	0.17 $\pm$ 0.03	0.30 $\pm$ 0.05	0.20 $\pm$ 0.05	0.29 $\pm$ 0.05	0.31 $\pm$ 0.09	0.19 $\pm$ 0.04
07	0.48 $\pm$ 0.03	0.92 $\pm$ 0.07	0.61 $\pm$ 0.07	0.49 $\pm$ 0.07	0.90 $\pm$ 0.07	0.58 $\pm$ 0.07
14	1.59 $\pm$ 0.14	2.51 $\pm$ 0.21	2.1 $\pm$ 0.07	1.98 $\pm$ 0.04	1.87 $\pm$ 0.17	1.75 $\pm$ 0.04
21	1.73 $\pm$ 0.09	2.55 $\pm$ 0.14	2.20 $\pm$ 0.09	2.26 $\pm$ 0.12	2.50 $\pm$ 0.12	2.49 $\pm$ 0.17

Value represent the mean  $\pm$  SE (n=3)

## References:-

1. Brodelius, P., Deus, B., Mosbach, K., and Zenk, M. H. (1979): Immobilized plant cells for the production and transformation of natural products. FEBS Letters, 103: 93 – 97
2. Haigh, J.R., Linden, J.C. (1989): Phenolics production by encapsulated *Nicotiana glauca* cells. Plant Cell Reports, 8: 475 - 478.
3. Indian Herbal Pharmacopoeia, Joint publication of CSIR and Regional Research Laboratory, Jammu (India), 1992; 1-13.
4. Johnson, T. S., Ravishankar, G. A. and Venkataraman, L. V. (1996), Biotransformation of ferulic acid and vanillylamine to capsaicin and vanillin in immobilized cell cultures of *Capsicum frutescens*, Plant Cell, Tissue and Organ Culture, 44: 117 - 121.
5. Atal, C.K. (1980): Chemistry and Pharmacology of vasicine: A new oxytocin and abortifacient. Indian Drugs, 15: 15-18.
6. Rao, S. R. and Ravishankar, G. A., (2000): Biotransformation of protocatechuic aldehyde and caffeic acid to vanillin and capsaicin in freely suspended and immobilized cell cultures of *Capsicum frutescens*. Journal of Biotechnology, 76: 137 - 146.
7. Vasilev, N., Schmitz, C., Grömping, U., Fischer, R., Schillberg, S (2014): Assessment of Cultivation Factors that Affect Biomass and Geraniol Production in Transgenic Tobacco Cell Suspension Cultures. PLOS One, 9 (8): 1-7.
8. Williams, P. D. and Mavituna, F., (1992). Immobilized Plant Cells, in Plant Biotechnology: Comprehensive Biotechnology, Second Supplement, Fowler, M. W., Warren, G. S. and Moo-Young, M., Pergamon Press, Oxford.
9. Srivastava AS, Saxena HP, Singh DR. Adhatodavasicin, a promising insecticide against pests of storage. Lab Dev 1965; 3(2):138

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### RESEARCH ARTICLE

#### TURMERIC: THE GOLDEN AND PRECIOUS GIFT OF NATURE

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#### Abstract

In India from ancient time plants are consumed as source of food and also for prevention and treatment of various diseases. *Curcuma longa* is commonly known as turmeric cultivated in Asia and some tropical countries. Its medicinal usage has been reported in the traditional systems of medicine such as Ayurveda and Homeopathy. Its constituents are curcumin volatile oil and curcuminoids etc. *Curcuma longa* is known for its colour and its health-giving properties. It possesses various medicinal properties as anti-microbial, anti-oxidant, anti-inflammatory, anti-carcinogenic etc.

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#### Introduction:-

*Curcuma longa* is belonging to Zingiberaceae (ginger) family and it is a perennial herb. It is cultivated in Asia including India, China and other tropical countries. It grows to 3-5 ft long having pointed and oblong leaves, funnel-shaped yellow flowers.<sup>[3]</sup> Its root system has many rhizomes which is used as a spice known as turmeric and its medicinal extract curcumin. Rhizome is used as medicine which was introduced in Homeopathy and proved by Augustine, Arya and Balachandra. In India *Curcumin longa* has different names in different languages as Halda, Haldi, Hardee, Halad, Halede, Halada, Haldar, Aneshta, Bahula, Halud, Indian saffron, Turmeric, Lidar, Mannal, Halja, Manjal, Mancal.<sup>[4]</sup> In past it is used as aromatic stimulant and carminative while currently it is used for cough, rheumatism, sinusitis diabetic wounds, biliary disorders, anorexia and hepatic disorders.<sup>[3]</sup>

#### Geographical Distribution:-

Turmeric (*Curcuma longa* Linn. Syn. *C. domestica* Valet.) is one of the important spice crops. India is a leading producer and exporter of turmeric in the world. Andhra Pradesh, Tamil Nadu, Orissa, Karnataka, West Bengal, Gujarat, Meghalaya, Maharashtra, Assam are some of the important states cultivate turmeric, of which, turmeric can be grown in diverse tropical conditions from sea level to 1500m ASL, at a temperature range of 20-35°C with an annual rainfall of 1500mm or more, under rain fed or irrigated conditions. Though it can be grown on different types of soils, it thrives best in well drained sandy or clay loam soils with a pH range of 4.5-7.5 with good organic status<sup>[1], [12]</sup>

#### Classification of *Curcuma longa*:-

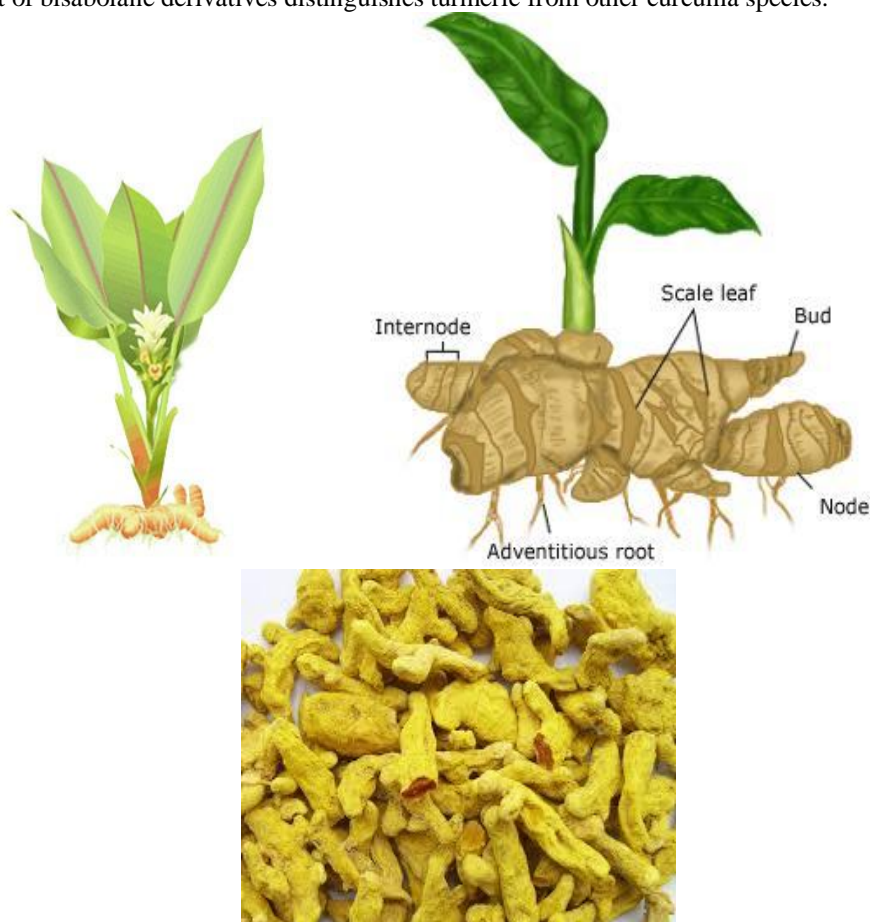
Class Liliopsida	Subclass Commelinids
Order Zingiberales	Family Zingiberaceae
Genus <i>Curcuma</i>	Species <i>Curcuma longa</i>

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### Chemical Composition Of Turmeric:-

Turmeric contains protein (6.3%), fat (5.1%), minerals (3.5%), carbohydrates (69.4%) and moisture (13.1%). The essential oil (5.8%) obtained by steam distillation of rhizomes has *a*-phellandrene (1%), sabinene (0.6%), cineol (1%), borneol (0.5%), zingiberene (25%) and Sesquiterpenes (53%)<sup>5</sup>. Curcumin (diferuloylmethane) (3–4%) is responsible for the yellow colour, and comprises curcumin I (94%), curcumin II (6%) and curcumin III (0.3%)<sup>6</sup>. Demethoxy and bisdemethoxy derivatives of curcumin have also been isolated<sup>7</sup>. Curcumin was first isolated<sup>8</sup> in 1815 and its chemical structure was determined by Roughley and Whiting<sup>9</sup> in 1973. It has a melting point at 176–177°C; forms a reddish brown salt with alkali and is soluble in ethanol, alkali, ketone, acetic acid and chloroform,<sup>[3]</sup> the high content of bisabolane derivatives distinguishes turmeric from other curcuma species.<sup>[4]</sup>



### Uses:-

1. Turmeric (*Curcuma longa* and *Curcuma aromatica* Salisb.) has been described in Ayurveda active principle called Curcumin or diferuloylmethane, a yellow pigment present in turmeric (curry powder) has been shown to exhibit numerous activities.<sup>[9]</sup>
2. It has therapeutic as well as Chemo-preventive activity, hence it is useful in different types of cancers like duodenal tumors<sup>[25]</sup>, tongue carcinoma, colon cancer, human breast cancer cells.<sup>[15]</sup> The anti-carcinogenic effects of turmeric and curcumin helping in prevention of nitrosamine formation and hepatic detoxification of mutagens.
3. The rhizome from *C. longa* L. has long been used to reduce menstrual disorders, rheumatism and traumatic diseases, and also act as antimicrobial, insecticidal repellent and anti-feeding against some stored-product insects.<sup>[7]</sup>
4. It is also used in confectionary and food industry and pharmacy, as well as in paints and varnishes as colouring agent.<sup>[2]</sup>
5. Turmeric has potential to give luster and glow to the skin as well as vigour and vitality to the entire body.<sup>[8]</sup>
6. In *Atharvaveda* (a collection of Vedas and mantras) Haridra (turmeric) was reported as a remedial drug for graying of hair, for skin disease and for curing jaundice.

7. Turmeric powder is employed in leech therapy to detach leech from the biting site.
8. In *Rasa sastra* (Alchemy) turmeric is added in group of yellow substances (*Peethavarga*) which is used in the processing of mercury.<sup>[9]</sup>
9. It has a strong antioxidant property, hence helps in protection of free radical damage.<sup>[13]</sup>
10. It acts as anti-inflammatory agent because it lowers histamine levels.<sup>[14]</sup>
11. It protects the liver from various toxic substances such as carbon tetrachloride (CCl<sub>4</sub>), galactosamine, acetaminophen (paracetamol), and *Aspergillus aflatoxin*..<sup>[15] [18]</sup>
12. It has ability to improve circulation by preventing platelets from clumping together, which may help protect against Atherosclerosis.<sup>[16]</sup>
13. Turmeric is anti-mutagenic because it inhibits new cancers caused by chemotherapy or radiation used to treat existing cancers. It is effective against metastasis (uncontrolled spread) of melanoma (skin cancer) cells and may be helpful to inactivate the carcinogens in cigarette smoke and chewing tobacco. Curcumin inhibits HIV in test tubes, though human trials but still needed to confirm its effectiveness for treating humans with this condition.<sup>[22][23]</sup>
14. Curcumin is useful for reducing pain and stiffness in the joints. Turmeric in the diet may defend against pain from bursitis, arthritis, and tendonitis.<sup>[24]</sup>
15. Turmeric increases the production of enzymes which helps in digestion of fats and sugars and also stops cholesterol from forming gallstones.<sup>[10]</sup>
16. Turmeric is effective in the treatment of some urinary disorders such as diabetes mellitus and also useful in diabetic nephropathy.<sup>[11]</sup>
17. Turmeric stimulates the secretion of bile, acts as an anti-bacterial, eases stomach pain. Turmeric extract's effect on cholesterol levels may be due to decreased cholesterol uptake in the intestines and increase conversion of cholesterol to bile acids in the liver.<sup>[5][17]</sup>
18. Paste or fresh juice of rhizome commonly used as local application as well as internally in the treatment of snake bites, leprosy, and vomiting associated with pregnancy.<sup>[19]</sup> and smallpox and chickenpox.<sup>[20], [21]</sup>
19. 1:20 proportion of Turmeric powder with alum powders are mixed and are blown into an ear that has chronic discharge or otorrhea.<sup>[10]</sup>
20. Turmeric powder can give relief from dental problems by massaging the aching teeth which eliminates pain and swelling.<sup>[5]</sup>



### Conclusion:-

Turmeric is very powerful natural medicine. It is considered as store house of tremendous medicinal potential. It is very common in our daily life. *Curcuma longa* has ability to prevent and cure various ailments like anorexia, dyspepsia, abdominal colic, constipation, laryngitis, dry cough, dysmenorrhoea, lumbago, headache, vertigo,



conjunctivitis, toothache and anxiety neurosis, atherosclerosis etc. curcuma longa is not only use in medicinal preparation but also used in cosmetics and food industry.

## References

1. Sahdeo Prasad and Bharat B. Aggarwal. \_Turmeric, the Golden Spice Herbal Medicine: Biomolecular and Clinical Aspects. 2nd edition. 2011
2. V. Gomathy<sup>1</sup>, M. Anbazhagan<sup>2\*</sup> and K. Arumugam<sup>2</sup> *In vitro* propagation of *Curcuma longa* (Turmeric) International Journal of Research in Plant Science 2014; 4(1): 30-33
3. Anil Kumar<sup>1</sup> \*, Jyotsna Dora<sup>2</sup> and Anup Singh<sup>2</sup> A REVIEW ON SPICE OF LIFE CURCUMA LONGA (TURMERIC) *International Journal of Applied Biology and Pharmaceutical Technology* 2011, 2(4) 271-279
4. P.S. Chakraborty et al Curcuma longa - A multicentric clinical verification study Indian Journal of Research in Homoeopathy 2011 5(1), 19-27.
5. Monika Nagpal<sup>1</sup>, Shaveta Sood Role of curcumin in systemic and oral health: An overview J Nat Sc Biol Med 2013;4:3-7
6. Annapurna A et al. Journal of Pharmacy Research 2011,4(4),1274-1276
7. Wongkaew, P. and Sinsiri, W.) Effectiveness of Ringworm Cassia and Turmeric Plant Extracts
8. on Growth Inhibition against Some Important Plant Pathogenic Fungi. *American Journal of Plant Sciences*, 2014 ,5, 615-626.
9. Pavitra Rastogi, Vishal Anand, Minkle Gulati, Nand Lal, Jaya Dixit, Rameshwari Singhal. A review of Curcumin in reference to its use in oral diseases Annals of Ayurvedic Medicine India 2012 1(4): 140-143
10. Handral et al. TURMERIC: NATURE'S PRECIOUS MEDICINE *Asian J Pharm Clin Res*, Vol 6, Issue 3, 2013, 10-16
11. TP Chaturvedi Uses of turmeric in dentistry: An update Indian J Dent Res, 20(1), 2009 107-109
12. Jennie Wickenberg Lindstedt Sandra Ingemansson and Joanna Hlebowicz Effects of *Curcuma longa* (turmeric) on postprandial plasma glucose and insulin in healthy subjects Nutrition Journal 2010
13. Shirgurkar, M.V., C.K. John and R.S. Nadgauda. 2001. Factors affecting *in vitro* microrhizome production in turmeric. *Plant Cell, Tissue and Organ Culture*.64: 5-11.
14. Ramirez-Boscá A, Soler A, Gutierrez MA. Antioxidant curcuma extracts decrease the blood lipid peroxide levels of human subjects. *Age* 1995;18:167-9.
15. Ammon HP, Safayhi H, Mack T, Sabieraj J. Mechanism of anti-inflammatory actions of curcumin and boswellic acids. *J Ethnopharmacol* 1993;38:113-9.
16. Kiso Y, Suzuki Y, Watanbe N, Oshima Y, Hikino H. Antihepatotoxic principles of *Curcuma longa* rhizomes. *Planta Med* 1983;49:185-7.
17. Srivastava R, Puri V, Srimal RC, Dhawan BN. Effect of curcumin on platelet aggregation and vascular prostacyclin synthesis. *Arzneimittelforschung* 1986;36:715-7.
18. Ramprasad C, Sirsi M. Curcuma longa and bile secretion. Quantitative changes in the bile constituents induced by sodium curcumin. *J Sci Ind Res* 1957;16:108-10.
19. Donatus IA, Sardjoko, Vermeulen NP. Cytotoxic and cytoprotective activities of curcumin. Effects on paracetamol-induced cytotoxicity, lipid peroxidation and glutathione depletion in rat hepatocytes. *Biochem Pharmacol* 1990;39:1869-75.
20. Snow JM. *Curcuma longa* L. (Zingiberaceae). *Protocol J Botan Med* 1995;1:43-6.
21. Arora RB, Kapoor V, Basu N, Jain AP. Anti-inflammatory studies on *Curcuma longa* (turmeric). *Indian J Med Res* 1971;59:1289-95.
22. Srivastava R, Dikshit M, Srimal RC, Dhawan BN. Anti-thrombotic effect of curcumin. *Thromb Res* 1985;40:413-7.
23. Mazumder A, Raghavan K, Weinstein J, Kohn KW, Pommier Y. Inhibition of human immuno-deficiency virus type-I integrase by curcumin. *Biochem Pharmacol* 1995;49:1165-70.
24. Barthelemy S, Vergnes L, Moynier M, Guyot D, Labidalle S, Bahraoui E. Curcumin and curcumin derivatives inhibit Tat-mediated transactivation of type 1 human immunodeficiency virus long terminal repeat. *Res Virol* 1998;149:43-52.
25. Deodhar SD, Sethi R, Srimal RC. Preliminary studies on antirheumatic activity of curcumin (diferuloyl methane). *Indian J Med Res* 1980;71:632-4.



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### RESEARCH ARTICLE

#### DIABETIC PATIENTS KNOWLEDGE, ATTITUDE AND PRACTICE TOWARD PERIODONTAL HEALTH.

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#### Abstract

This paper provides the results of analysis of total, sectoral-specific, and spatial-specific multipliers and flow-on effects in Sumatera Island economy. The model employed was Inter-Regional Input-Output Model (IRIOM) developed using new hybrid procedures with special attention on Island economy. Data used for model were updated Indonesian data for the year of 2015. The results show that firstly, the important sectors of Java Island economy could be based on total multipliers and flow-on effects of output, income and employment. Secondly, important economic sectors could be based on sector-specific multipliers effects; multipliers that occurred in own sector and other sectors. Thirdly, important economic sectors could be based on spatial-specific multipliers; multipliers that occurred both in own region and other regions. Fourthly, important economic sectors could be based on spatial distribution of flow-on; flow-on effects that occurred in own region as well as in other regions.

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#### Introduction:-

Diabetes Mellitus (DM), the commonest endocrine disorder. Oral diseases are common in diabetics as compared to non-diabetic's individuals. Despite the global acknowledgment of the risk of Diabetes Mellitus, diabetic patients' knowledge and attitude toward their increased risk for oral health has not been fully deal with. Oral hygiene behaviour and seeking oral health care depends on a number of factors. Lack of knowledge about dental health and conforming to better oral hygiene is among the causes for non-adherence to oral hygiene practices, economical limitations, lack of services and lack of proper counselling.

Diabetes Mellitus refers to a group of common metabolic disorders that share the phenotype of sustained hyperglycaemia affecting almost all tissues in the body including those in the oral cavity. It is associated with

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aberrations in carbohydrate, fat, and protein metabolism, and results of numerous chronic complications, comprising of microvascular, macrovascular, and neuropathic disorders (4).

### Aims and objectives:-

The aim of this study is to gather baseline information on knowledge, attitude, and practices of diabetic patients regarding their oral health with the view of enhancing dental health education for them, which will help in updating their knowledge about the disease and the various oral complications and to assess their attitudes and practices toward sustaining good oral health through proper oral hygiene and regular dental check-ups.

### Material and Method:-

This study was a cross-sectional Analytic of 416 diabetic patients visiting the Prince Abdulaziz Bin Majed Diabetic Centre (PABMDC). Eligible participants will be confirmed diabetes mellitus patients who can read and write.

A questionnaire will be designed to assess the knowledge, attitude, and practices of diabetic patients along with corresponding demographic variables.

Questionnaire questions were carefully selected from relevant published reports in international journals. The questionnaire questions will be related to participants' nationality, age and gender, Type and duration of diabetes, and their awareness for systemic and oral diseases as complications associated with diabetes

The questionnaire will be piloted in 416 patients to determine its validity.

### Result:-

The majority of the subjects were Saudis 99.6%, 99.8% and diagnosed with diabetes more than 6 months ago, 62.9% male and 37.1% female with mean age of 44.91 (Table 8). 31.4% of the subjects visited the dentist in the past 12 months for fillings, 2.9% for C&B, 23.1% for restorations, 48.8% for checkup, 18.5% for RCT, 18.7% for periodontal therapy, 11.6% for dental extractions and 9% for other reasons (Table 1). And the majority of them said that Tooth brushing & toothpaste is their oral hygiene method (Table 3). 7.9% of the subjects never brush their teeth (Table 4) and 46.6% said that tooth brushing is their Health promotion priority (Table 6), 18.2% of the subjects said that the reason for not visiting the dentist more often is the difficulty in scheduling an appointment, 38% said because of high cost, 24.4% said because they forgot, 23.1% because they don't like their dentist, 28.8 because of anxiety 26.4% because of transport problems and 12.1% because they can't leave work (Table 2).

Vast majority of the subjects have gingival bleeding 99.6% (Table 5). 50.8% think diabetic more prone to oral diseases (Table 7). 50.5% of the subjects have been told by their physician about the oral problems related to diabetes (Table 9), moreover 49.2% of them think that their oral problems are because of diabetes (Table 10).

**Table 1: visited a dentist visit at least once in the previous 12 months**

Have you visited a dentist visit at least once in the previous 12 months																
	Fillings		C&B		Restoration		Checkup		RCT		Dental extraction		Periodontal therapy		Other	
	Freq uency	%	Freq uency	%	Freq uency	%	Freq uency	%	Freq uency	%	Freq uency	%	Freq uency	%	Freq uency	%
Y es	143	31.4	95	22.9	105	25.3	222	48.8	84	18.5	53	11.6	85	18.7	41	9.0
N o	312	68.6	360	77.1	350	74.7	233	51.2	371	81.5	402	88.4	370	81.3	414	91.0

**Table 2:-** reason(s) for NOT visiting the dentist

What is/are the reason(s) for NOT visiting the dentist more often																
	Difficulty in scheduling appointment		costs		Forgot		Don't like my dentist		Fear or anxiety		Transportation problems		I can't leave work		Other	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Yes	83	18.2	173	38.0	111	24.4	105	23.1	131	28.8	120	26.4	55	12.1	30	6.6
No	372	81.8	282	62.0	344	75.6	350	76.9	324	71.2	335	73.6	400	87.9	425	93.4

**Table 3:-** oral hygiene method

What is your oral hygiene method											
	Tooth brushing & toothpaste		Use of dental floss at least once a week		Use of dental floss at least once a day		Miswak		Use of sticks		
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%	
Yes	313	68.8	87	19.1	93	20.4	114	25.1	42	9.2	
No	142	31.2	368	80.9	362	79.6	341	74.9	413	90.8	

**Table 4:-** Frequency of tooth brushing

How many time do you brush your teeth		
	Frequency	%
Never	36	7.9
Once a day	131	28.8
Twice a day	161	35.4
Three times a day	68	14.9
four times a day	26	5.7
More than four times a day	33	7.3

**Table 5:-** Gingival bleeding

Does your gingivae bleed		
	Frequency	%
yes	453	99.6
no	2	.4

**Table 6:-** Health promotion priorities

What are your health promotion priorities which have been done in the past year								
	Healthy diet		Brush teeth regularly		Visit a dentist regularly		Visit a doctor regularly	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Yes	128	28.1	212	46.6	122	26.8	55	12.1
No	327	71.9	243	53.4	333	73.2	400	87.9

**Table 7:-** Health promotion priorities

Is a diabetic more prone to oral diseases		
	Frequency	%
yes	231	50.8
no	178	39.1
Don't know	46	10.1

**Table 8:- Age**

Age	12	16	17	18	19	20	21	22	23	24	25	29	30	31	32	33	34	39	41	42	43	44	45	46	47	50	51	52	53	54	55	56	57	60	62	63	64	65	67	73	74	75	76	78	85
Frequency	5	1	2	4	3	4	6	14	4	2	6	2	9	4	7	10	65	5	1	5	17	6	36	3	2	5	1	9	16	22	8	13	8	5	3	14	19	29	19	1	3	1	10	5	4
%	1.1	0.2	0.4	0.9	0.7	0.9	1.3	3.1	0.9	0.4	1.3	0.4	2.0	0.9	1.5	2.2	14.3	1.1	0.2	1.3	3.7	1.7	7.9	0.7	0.4	1.1	0.2	3.5	4.8	1.8	2.9	1.1	0.3	3.4	4.6	4.2	0.2	0.7	0.2	2.2	1.1	0.9			

**Table 9:- Told by physician about the oral problems related to diabetes**

Did your physician tell you about the oral problems related to diabetes		
	Frequency	%
yes	230	50.5
no	183	40.2
Don't know	42	9.2

**Table 10:- Do you think that your dental/oral problems are because of diabetes**

Do you think that your dental/oral problems are because of diabetes		
	Frequency	%
yes	224	49.2
no	157	34.5
Don't know	74	16.3

**Discussion:-**

This cross sectional analytic study of 456 diabetic patients visiting Prince Abdulaziz Bin Majed Diabetic Center (PMBADC) located in Al Madinah, Saudi Arabia. Dent Hyg said that 78.7% of the subject visited a dentist for check-up in the past 12 months and 22.2% brush their teeth twice a day and 73.6% never use dental floss, 80% visited a physician in the past year and 12.6% visited a dentist (1). While Diabetes Res ClinPract. Said 42.7% of participants reported visiting a dentist for a regular check-up, and 58.6% went to see a dentist last year. Of the participants, 95.3% brushed teeth at least once a day and 61.2% brushed at least twice a day; 34.9% flossed their teeth at least once a day and 35.3% never flossed (2).

In present study 48.8% of the subject visited a dentist for check-up in the past 12 months and 35.4% brush their teeth twice a day and 79.6% never use dental floss, 12.1% visited a physician in the past year and 26.8% visited a dentist and 28.8% brushed teeth at least once a day and 20.4% flossed their teeth at least once a day.

**Limitations:-**

We acknowledge that the sample in this study is a convenience sample which may or may not represent the diabetes population. Nevertheless, it should be noted that oral health behaviors in the present study are similar to those reported in the literature (3). There are some potential limitations in this study that should be considered when interpreting the results. First, since the study was an analytical cross-sectional study, therefore, no direct relationship between variables and outcomes can be proved. A second limitation is the potential reporting bias associated with the self-administered questionnaire with the possibility that subjects tend to over-report compliance. Also, to get some participants respond was difficult especially diabetics who are not registered in (PMBADC). Another potential limitation is the use of a lot of close-ended questions (i.e. yes/no/don't know) in the oral health knowledge test may allow participants to guess the correct answer.

**Conclusion:-**

The subjects are well aware about their diabetic Bot/ADC

Conditions and the oral effects of diabetes, on the other hand, they have near to the ground attitude and practice (behavior) toward systemic and oral health.

**Recommendations:-**

Health professionals have the opportunity to educate patients with diabetes about oral manifestations (e.g., dry mouth) and complications (e.g., periodontitis and oral candidiasis) of diabetes and to promote proper oral health behaviors. They should provide appropriate special oral care information and advice concerns related to dental hygiene. In addition to the routine education of patients with diabetes about the importance of proper oral hygiene and receiving regular professional dental care, health professionals should educate patients more about oral complications related to diabetes and measures that can be taken to prevent these oral complications such as avoiding tobacco use.

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**References:-**

1. J Dent Hyg. Diabetes-Related Knowledge and Sources of Information among Periodontal Patients: Is There a Role for Dental Hygienists?.2013 Apr; 87(2): 82–89.
2. Diabetes Res ClinPract. Oral Health Knowledge and Behavior among Adults with Diabetes.2009 Dec; 86(3): 239–246.
3. Macek MD, Taylor GW, Tomar SL. Dental care visits among dentate adults with diabetes, United States, 2003. J Public Health Dent. 2008;68:102–110.

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### RESEARCH ARTICLE

## EVALUATION OF KNOWLEDGE, ATTITUDE AND PRACTICE OF HIV/AIDS IN THE STUDENTS AT TAIBAH UNIVERSITY

Omar Aljohani, Abdel Rahman Ramadan and Abdulrahman Almadani.

### Manuscript Info

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### Abstract

**Introduction:** Acquired immunodeficiency syndrome (AIDS) caused by the human immunodeficiency virus (HIV) is a major health problem in many parts of the world, and is considered as a pandemic disease [1, 2].

**Aim:** To find out the knowledge, attitudes and Practice among Taibah university students toward HIV/AIDS.

**Material and Method:** A cross sectional analytic study using an online anonymous self-administered structured questionnaire was used to collect information, there were 484 respondents to the questionnaire from students of both genders from the various colleges

**Results:** From the total of 484 respondents there were 139 (28.7%) males and 345 (71.3 %) females, The majority of the respondents 442 (97.4%) have heard About HIV/AIDS, the respondents shows an average level of KAP regarding HIV/AIDS, Positive attitudes towards HIV/AIDS were observed among 53.3% of respondents, However 82.9% said they heard condoms.

**Conclusion:** It is recommended to start HIV/AIDS Prevention Programs at Taibah University giving attention to changing attitudes and practices among students...

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### Introduction:-

Acquired immunodeficiency syndrome (AIDS) caused by the human immunodeficiency virus (HIV) is a major health problem in many parts of the world, and is considered as a pandemic disease [1, 2]

HIV/AIDS is one of the fastest-spreading epidemics in the world. There are 42 million people living with HIV/AIDS worldwide, and more than half of them are adolescents. [3]

Sexual contact remains the main mode of transmission of the disease worldwide followed by intravenous drug use and perinatal transmission [4]

HIV/AIDS, Its mode of transmission is known and is easily preventable, but because of the lack of knowledge and practices about HIV/AIDS in general population causes its rapid spread. So, this study was conducted to assess and compare the knowledge, attitude and practices about HIV/AIDS among the students at Taibah University [5]

**Study objectives:-**

- To find out the knowledge, attitudes and Practice among Taibah university students toward HIV/AIDS.
- WE will share the results and try to contact with the responsible members in Taibah University to explain to them the results so they can take measures to increase the student awareness toward HIV/AIDS.

**Study Design:-**

A cross sectional analytic study using an online anonymous self-administered structured questionnaire was used to collect information using google form sent to the emails and cell phones of the students at Taibah University in El-Madinah El-Munawarah through the Deanship of Student affairs.

The sample size is using the Roasoft<sup>1</sup> sample size calculator, based on the estimate that 50% of students may have enough knowledge on HIV/AIDS. Margin of error was set at 5%, 95% confidence, and an estimated 10% drop out, our expected sample size is 415 students.

Data entry and analyses of results will be done using the Statistical Package for Social Sciences (SPSS) ver 21 for Windows software<sup>2</sup>. Descriptive statistics such as mean and standard deviation (SD) for continuous variables, and frequency and percentage for categorical variables will be determined. Inferential statistics will then be followed using parametric and non-parametric test for univariate analysis followed by multivariate analysis using logistic regression. The level of significance is set at  $p < 0.05$ .

**Sample size:-**

- 70 students of each gender from the scientific colleges at Taibah University.
- 70 students of each gender from the humanities colleges at Taibah University.
- 70 students of each gender from the different health colleges at Taibah University

**Inclusion criteria:-**

The students of the different colleges (Scientific, humanities and health) at Taibah university in El-Madinah El-Munawarah

**Exclusion criteria:-**

1. Non Taibah University Students.
2. Students of Taibah University branches (outside El-Madinah El-Munawarah)

**Ethical clearance form:-**

1. Ethical clearance will be sought before the start of the study from the Taibah University College of Dentistry Research Ethics Committee (TUCD REC)
2. Data will be collected coded and locked in a password-protected computer at the principal investigator office to ensure confidentiality and privacy of patient data.

**Statistical Analysis:-**

For the statistical analysis, the data will be used for descriptive parameters in the form of frequency, percentage means and standard deviations. Chi-square and one-way ANOVA will be used to determine the significant differences in the frequency of subjects with other variables. Pearson Correlation will be used to correlate the variables using SPSS version 21<sup>3</sup> to analyse the data. The level of significance was set at  $p < 0.05$  or  $p < 0.001$ .

**Results:-**

There were 484 respondents to the questionnaire from students of both genders from the various colleges at Taibah University

From the total of 484 respondents there were 139 (28.7%) males and 345 (71.3 %) females (Table 1)

<sup>1</sup><http://www.raosoft.com/samplesize.html>

<sup>2</sup>. [www.ibm.com/software/analytics/spss/](http://www.ibm.com/software/analytics/spss/)

<sup>3</sup>IBM SPSS Statistics IBM North America, 590 Madison Avenue, New York, NY 10022. United States, E-mail: [www.ibm.com](http://www.ibm.com)

The age of the respondents ranged between 16-39 years of age. The respondents were grouped into 5 age groups. The 16-20 years formed (27.5%) and the 21-25 years of the respondents formed the largest age group comprising of 57.9%, the 26-30 years age group formed (10.8%), the 31-35 years formed the smallest age groups consisting of (1.4%). The 36-40 years age group formed (2.5%). (Table 1)

The respondents came from three types of colleges, the Health and medical colleges, the Literary & humanitarian colleges and the scientific colleges. From the Health and medical colleges there were 123 (25.5%) respondents, while from the Literary & humanitarian colleges were 205 (42.5%) respondents and from the Scientific colleges there were 154 (31.9%) respondents (Table 1)

The respondents represented the various academic years, from the 1<sup>st</sup> of college to the 6<sup>th</sup> year of college. The first academic year students comprised of 46(10.6%) of respondents were in, the 2<sup>nd</sup> academic year were 91(20.9%), 63(14.4%) were in the 3<sup>rd</sup> year, 79(18.1%) were in 4<sup>th</sup> year, 43(9.9%) were in the 5<sup>th</sup> year, and 114(26.1%) were in the 6<sup>th</sup> year (Table 1)

The respondents who have traveled outside Saudi Arabia comprised of 200(43.9%), while the majority of the respondents 256(56.1%) respondents have not traveled outside Saudi Arabia (Table 2).

The majority of the respondents 245(53.6%) rated their health as excellent, 166(36.3%) rated their health as very good, 39(8.5%) rated their health as good, 4(0.9%) rated their health as acceptable, 2(0.4%) rated their health as poor, and 1(0.2%) rated their health as very poor (Table 2)

The majority of the respondents were not smokers, comprising of 381(83.2%) while only 77(16.8%) were smokers (Table 2)

The majority of the respondents 442(97.4%) have heard About HIV/AIDS, (Figure 1).

The majority of the respondents heard of HIV/AIDS from the TV 291(60%), this is followed by 278(57.4%) respondents who heard of HIV/AIDS from Internet, 67(13.8%) heard about HIV/AIDS from Public health officials, , 212(43.8%) have heard about HIV/AIDS from their studying, while 137(28.3%) heard about HIV/AIDS from Magazines & Newspapers , 63(13%) have heard about HIV/AIDS from the radio and 4(0.8) have heard about HIV/AIDS from Friends. Table (3)

When asked about the symptoms of HIV/AIDS, the majority of the respondents 189(39%) think that persistent fever is a of the symptoms of HIV, 173(35.7%) think loss of weight and appetite is one of the symptoms of HIV, 99(20.5%) think acute diarrhea is one of the symptoms of HIV and 199(41.1%) of them don't Know. Table (4)

When asked about the organisms that causes HIV/AIDS, the majority of the respondents 279(57.6%) think it's a virus is the causative organism of HIV , 11(2.3%) think it's bacteria, 9(1.9%) think it's a fungi , 4(0.8%) think it's a parasite and 181(37.4%) don't know. (Table 5)

When asked have heard of a condom, most of the respondents 401 (82.9%) claimed to have heard of Condoms (Table 5) When asked that a Condom is a way to prevent the spread of AIDS 87(18%) of the respondents totally agree 109(22.5%) only agree with that, 83(17.1%) neither agree nor disagree, 28(5.8%) disagreed and 177(36.6%) don't know. (Table 6)

When the respondents were asked if their knowledge of AIDS is far better when they entered the college or university" 62(12.8%) totally agree 132(27.3%) agree, 206(42.6%) disagree and 84(17.4%) said that they totally disagree (Table 7).

When asked to what extent you wish to obtain additional information and education about the basic information about AIDS, 47(9.7%) of the respondents think that there is no need for them to get more knowledge, 214 (44.2%) think that there is some need, 126(26%) think that there is only a slight need and 97(20%) think that there is a great need. (Table 7)

When asked if they think their knowledge is sufficient 23(4.8%) of the respondents believe strongly that their knowledge about HIV is sufficient, 89(18.4%) thinks it's enough, 192(39.7%) don't think it's enough, 77(15.9%) don't think strongly it's enough and 103(21.3%) answer with I don't know. (Table8)

In answer to the question "does the term HIV means the term AIDS,the vast majority 308 (63.6%) don't know, 126(26%) of the respondents think that it does, and 50(10.3%) don't think so. (Table 9).

When asked if there is a cure for AIDS the majority 272(56.2%) think there is no cure for AIDS, 43(8.9%) of the respondents think there is and 169(34.9%) said they don't know. (Table 9)

In response a question whether coughing and/or sneezing transmit HIV/AIDS, the majority 215(44.4%) answered I don't know, 200(41.3%) of the respondents said no, while 69(14.3%) said yes, (Table 9).

In response a question that pregnant women with AIDS give birth to infected child, the majority 230(47.5%) don't know, 191(39.5%) said yes while only 63(13%) said no. (Table 9)

When asked if with AIDS / HIV (AIDS) look and feel healthy, the bulk of the respondents 248(51.2%) did not think so, 189(39%) did not know and 47(9.7%) of the respondents said yes (Table9)

In response to a question can infected with HIV could show no signs or symptoms for a period of five years or more, the majority 228(47.1%) of respondents don't agree, 225(46.5%) don't know while 31(6.4%) of the respondents think that the person who is infected with HIV could show no signs or symptoms for a period of five years or more, with that and. (Table 9)

Is there a vaccine to immunize adults from AIDS, the majority 291(60.1%) don't know, 152(31.4%) think there is no vaccine and 41(8.5%) of the respondents think that there is a vaccine against HIV (Table 10)

In response to a question do you think that people with AIDS can live with their families without the spread of AIDS? 182(37.6%) don't know, 169(34.9%) of the respondents believe that the people with AIDS can live with their families without spreading AIDS, and 133(27.5%) think they can't live with their families without spreading AIDS (Table 10)

In response to a question do you think that people with AIDS can continue their education and mingle with their colleagues in schools and universities? The majority 258(53.3%) of the respondents think that people with AIDS can continue their education and mingle with their colleagues while 226(46.7%) think they couldnot (Table10)

The was majority 410(84.7%) haven't been checked for HIV/AIDS while 74(15.3%) of the respondents have been checked for HIV (Table 10)

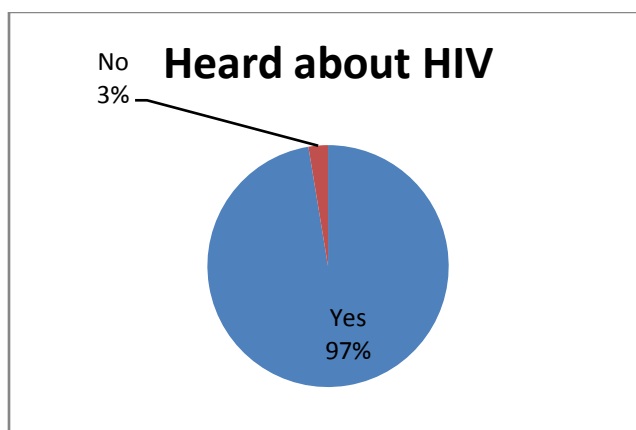


**Table 1:-** Personal information

<u>Gender</u>	Frequency	%
Female	345	71.3
Male	139	28.7
<u>Age group</u>		
16-20	122	27.5
21-25	257	57.9
26-30	48	10.8
31-35	6	1.4
36-40	11	2.5
<u>Type of College</u>		
Health and medical colleges	123	25.4
Literary & humanitarian colleges	205	42.4
Scientific colleges	154	31.8
<u>Academic Year</u>		
1	46	10.6
2	91	20.9
3	63	14.4
4	79	18.1
5	43	9.9
6	114	26.1

**Table 2:-** Health Related information

<u>Travelled outside KSA</u>	Frequency	%
Yes	200	43.9
No	256	56.1
<u>Rate your health</u>		
Excellent	245	53.6
Very good	166	36.3
Good	39	8.5
Acceptable	4	0.9
Poor	2	0.4
Very poor	1	0.2
<u>Do you smoke</u>		
Yes	77	16.8
No	381	83.2

**Figure 1:-** Heard about HIV

**Table 3:-** The way respondents heard about HIV

How did you hear about AIDS	Yes		No	
	N	%	N	%
Internet	278	57.4	206	42.6
Public health official	67	13.8	417	86.2
TV	291	60.1	193	39.9
Studying	212	43.8	272	56.2
Newspapers and magazines	137	28.3	347	71.7
Radio	63	13	421	87
Friends	4	0.8	480	99.2

**Table4:-** Symptoms of AIDS.

What are the symptoms of AIDS?	Yes		No	
	N	%	N	%
Persistent fever	189	39.0	295	61.0
loss of weight and apatite	173	35.7	311	64.3
Acute diarrhea	99	20.5	385	79.5
I don't know	199	41.3	275	57.1

**Table 5:-**Cause of AIDS

Cause of AIDS	Frequency	%
virus	279	57.6
bacteria	11	2.3
Fungi	9	1.9
parasites	4	0.8
I don't know	181	37.4

**Table 6:-** Condoms info.  
Heard about condom.

Yes	401	82.9
No	83	17.1
Condoms prevent AIDS		
Totally agree	87	18
Agree	109	22.5
Neither agree nor disagree	83	17.1
Disagree	28	5.8
I don't know	177	36.6

**Table 7:-** Need for more information about AIDS

Need for basic information about AIDS?	Frequency	%
No need	47	9.7
Some need	214	44.2
Slight need	126	26.0
Great need	97	20.0

**Table 8:-**Amount of respondent's information about AIDS.

Do you think that your knowledge about AIDS is sufficient?	Frequency	%
I believe strongly	23	4.8
I think it's enough	89	18.4
I don't know	103	21.3
I don't think it's enough	192	39.7
I strongly don't think it's enough	77	15.9

**Table 9:-**AIDS Knowledge.

Term HIV means the term AIDS?	Frequency	%	Is there a cure for AIDS?	Frequency	%
Yes	126	26	Yes	43	8.9
No	50	10.3	No	272	56.2
Idon't know	308	63.6	I don't know	169	34.9
<b>Transition of HIV could be through coughing?</b>			<b>Pregnant women with AIDS will have children with AIDS?</b>		
yes	69	14.3	yes	191	39.5
No	200	41.3	No	63	13
Idon't know	215	44.4	I don't know	230	47.5
<b>Are those infected with AIDS look and feel healthy?</b>	Frequency	%	<b>Can someone infect with AIDS show no signs for a period of 5 years or more?</b>	Frequency	%
Yes	47	9.7	yes	31	6.4
No	248	51.2	No	228	47.1
Idon't know	189	39	I don't know	225	46.5

**Table 10:-** AIDS Attitude

Is there a vaccine against AIDS?	Frequency	%	people with AIDS can live with their families without the spread of AIDS?	Frequency	%
Yes	41	8.5	Yes	169	34.9
No	152	31.4	No	133	27.5
I don't	291	60.1	I don't know	182	37.6

know					
people with AIDS can continue their education and mingle with their colleagues	Frequency	%	Checked for AIDS before	Frequency	%
Yes	258	53.3	yes	74	15.3
No	226	46.7	No	410	84.7

## Discussion

This is the first study on Knowledge, Attitude and Practice of HIV/AIDS in students at Taibah University in Medina, Saudi Arabia, This study reports an average level of knowledge relating to HIV/AIDS among students of Taibah University.

The majority of the respondents were female (71%), similar findings have also been reported in similar study done in South Africa. [6]

Almost All respondents had heard about HIV/AIDS (97%), similar findings have also been reported in study done in Lao People's Democratic Republic. [7]

Only 10% of the respondents differentiate between HIV and AIDS, This is lower than similar study 81.9% done in Ethiopia. [8]

Majority of respondents 272 (56.2%) knew there is no cure for AIDS and 169 (34.9%) said they don't know, While in a similar study done in Ethiopia 90.3% of respondents knew there is no cure for AIDS.[8]

Most of the students knew that the use of condoms during sexual intercourse could prevent HIV, Similar findings have also been reported in study done in Lao People's Democratic Republic. [8]

The majority of the respondents heard of HIV/AIDS from the TV 291(60%), this is followed by 278 (57.4%) respondents who heard of HIV/AIDS from Internet, 67(13.8%) heard about HIV/AIDS from Public health officials, , 212 (43.8%) have heard about HIV/AIDS from their studying, while 137 (28.3%) heard about HIV/AIDS from Magazines & Newspapers , 63(13%) have heard about HIV/AIDS from the radio and 4 (0.8) have heard about HIV/AIDS from Friends, While in a different study conducted in Lao People's Democratic Republic their findings were (61.3%) source of information was the television, followed by the radio (25.3%). Less than one-fifth of the respondents were aware about HIV/AIDS from friends (7.7%), brochures (3.7%), newspapers (1.3%) and magazines (0.7%). [8]

## Limitations:-

Because of the restricted cultures here in Saudi Arabia, it was difficult to ask the participants about their sex activates and related question to that. Also because of that most of the student will not respond to sex related questions. However, the anonymity of the questionnaires hopefully encouraged students to be honest in their responses.

## Conclusion:-

In conclusion, the surveyed university students had an average KAPs about HIV/AIDS. The students need more information about AIDS symptoms, transmittion and how to prevent its infection. It is recommended to start HIV/AIDS Prevention Programs at Taibah University giving attention to changing attitudes and practices among students. The study reveals that most of student get their information from the TV, so there should be more TV programs about AIDS.

**Recommendations:-**

It is recommended to start HIV/AIDS Prevention Programs at Taibah University giving attention to changing attitudes and practices among students.

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**References:-**

1. Addis Z, Yalew A, Shiferaw Y et al. Knowledge, attitude and practice towards voluntary counseling and testing among university students in Northwest Ethiopia: a cross sectional study. BMC Public Health. 2013; 13(714): 2-8.
2. Shiferaw Y, Alemu A, Girma A et al. Assessment of knowledge, attitude and risk behaviors towards HIV/AIDS and other sexual transmitted infections among preparatory students of Gondar town, northwest Ethiopia. BMC Research Notes. 2011; 4(505):2-8.
3. UNAIDS (2010)' UNAIDS report on the global AIDS epidemic.
4. Joint United Nations Programme on HIV/AIDS (UNAIDS) and World Health Organization (WHO) AIDS epidemic update: December 2002 WHO. 2002. pp. 1-40.
5. M Davhana-Maselesele, D(Phil), LL Lalendle, Ushotanefe Useh Knowledge, attitudes and practices related to HIV/AIDS/AIDS among learners in Vhembe district of Limpopo Province by 2007.
6. M.A. Pogrel. Removal of Third Molars. BAGHERI SC, Bell RB, KHAN HA, editors. Current Therapy in Oral and Maxillofacial Surgery, 1st Edition. Saunders: Elsevier Inc; 2011. P. 129-130.
7. Basini, Dixie Thomas. ASSESSMENT OF KNOWLEDGE, ATTITUDES AND PRACTICES (KAP) ON HIV/AIDS AMONG PEER EDUCATORS AND STUDENTS AT THE TSHWANE UNIVERSITY OF TECHNOLOGY: a cross sectional study. Thesis (MPhil)--Stellenbosch University. (2013-03)
8. Bounbouly Thanavanh, Md. Harun-Or-Rashid, Hideki Kasuya and Junichi Sakamoto. Knowledge, attitudes and practices regarding HIV/AIDS among male high school students in Lao People's Democratic Republic. : A cross sectional study. Journal of the International AIDS Society 2013, 16:17387
9. Wondemagegn Mulu , Bayeh Abera, Mulat Yimer. Knowledge, attitude and practices on HIV/AIDS among students of Bahir Dar University: a cross sectional study. Science Journal of Public Health. 2014; 2(2): 78-86

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## RESEARCH ARTICLE

### EVOLUTION OF WATER QUALITY OF A MOROCCAN DAM AFTER ITS SETUP.

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dam setup, water quality, cyanobacteria, microcystins, trophic status.

#### Abstract

This study was conducted to monitor, and to assess the water quality of the dam "Yaacoub Al Mansour" recently filled. The monitoring program concerned the evolution of physico-chemical parameters, bacteria indicating fecal contamination, trophic status and cyanobacteria biomass with their associated toxins. This reservoir is located at 65 km southeast of the city of Marrakech and was filled in May 2008. The main role of the dam is to supply Marrakech city with drinking water.

The early occurrence of *Microcystis aeruginosa* bloom and the high microcystin concentrations measured just only two years after the set up of the reservoir Yaacoub Al Mansour show the importance to consider the control of microcystins concentrations in the surveillance. So, the bacteriological control cannot be the only indicator of water quality of reservoirs which are intended for the supply of drinking water and it is necessary to consider others parameters. Indeed, management programs of drinking water should take into account the toxicity of cyanobacterial blooms from the setup of the reservoirs to protect effectively the health of humans and animals.

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#### Introduction:-

Water resources are becoming increasingly scarce due to the progression of incessant demands of the people.

In order to satisfy the increasing requirements for water, a strategy of establishing a large number of dams was adopted in Morocco.

However, after the construction of a dam, stream regimes are suddenly transformed into stagnant or lake aquatic systems. Species adapted to running water will disappear or readjust to lake conditions and will establish with the newly emerging species, a complex ecosystem in terms of relationships and interactions (Dauta, 1978; Landner and Wahlagreen, 1986). Moreover, after the filling of dams, several changes of physico-chemical, biological and microbiological water quality are induced. These changes require controls of several parameters to assess water quality and to establish a management system that will help to ensure water supply.

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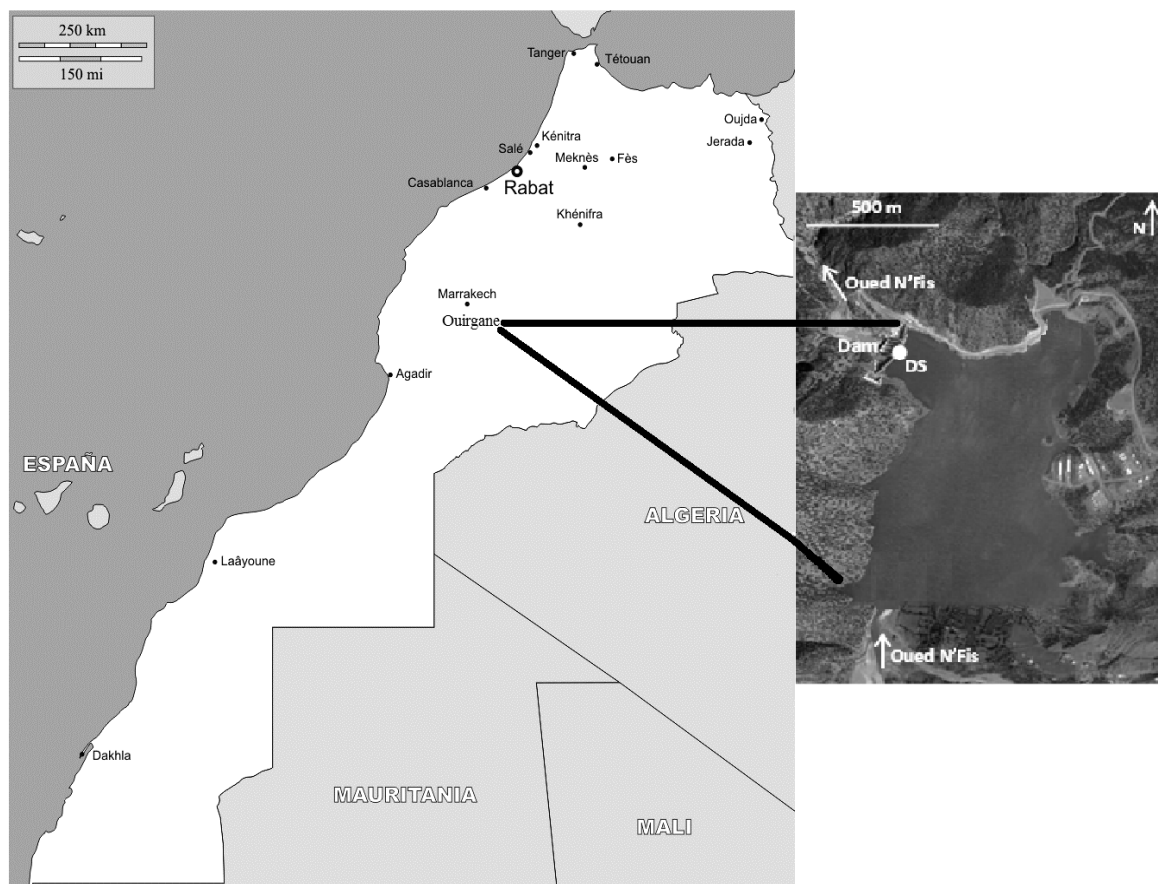
Therefore, we conducted a water quality study of the dam «Yaacoub Al Mansour» recently filled and which will be intended to supply drinking water for Marrakech city.

We performed a bimonthly sampling from February 2009 to December 2010, to study temporal variations of abiotic parameters, bacteriological parameters, cyanobacteria biomass and microcystins concentration since the filling of the dam.

## Materials and Methods:-

### Study site and sampling:-

Yaacoub Al Mansour lake ( $31^{\circ} 11'$  North  $8^{\circ} 05'$  West) is located at 65 km south-east of Marrakech city and 20 km upstream of the reservoir of Lalla Takerkoust (Fig. 1). The dam was built on Oued N'Fis (High Atlas stream) and filled in 2008. This reservoir is characterized by a total water volume of  $70 \text{ Mm}^3$  and a maximal depth of 70 m. The main role of the reservoir is to supply Marrakech city with drinking water.



**Figure 1:-** Geographical location of “Yaacoub Al Mansour” reservoir.

From February 2009 to December 2010, water samples were performed using a Van Dorn bottle (2 L), monthly in winter and spring and bimonthly in summer and autumn, at the surface of the deep station (DS) located near to the bridge.

### Analysis of Abiotic parameters:-

Water samples were collected in 1.5L bottles to measure abiotic parameters.

Temperature and conductivity were measured using the conductivity-type WTW LF 318. pH and dissolved oxygen were measured using pH meter type WTW PH 330i and oxygen probe HANNA HI 9142 successively. Transparency was measured by Secchi disk.

Total phosphorus, total nitrogen, ammonium and chlorides were analyzed using standard methods (AFNOR, 1994).

Nitrates, sulfates and oxidisability were analyzed according to standard methods of Rodier (1984). Chlorophyll a was determined using spectrophotometric method (ISO, 1992). Total Suspended Solids is obtained by filtration on Millipore filter (0,45µm).

#### **Fecal indicator bacteria:-**

From water samples (1 liter) stored in sterile glass bottles, enumeration of Total Coliform (TC), Fecal Coliform (FC), and Fecal Streptococcus (FS), was performed according to techniques described in AFNOR (1994).

#### **Cyanobacteria abundances:-**

Cyanobacteria cells count were estimated after the fixation of 250 mL of water with 10% of Lugol's solution.

The abundance of *Microcystis aeruginosa* cells was estimated after the fixation of 10mL of water with 10% of Lugol's solution. The samples were sonicated (50 KHz during 5 seconds) to disrupt *Microcystis aeruginosa* colonies and not alter the cellular integrity (Latour *et al.* 2004). Cells were counted in a Malassez cell with an optical microscope (objective x40). The results were expressed as number of cells per liter of water.

However, the counting of other cyanobacteria species was performed according to the classical method of Uthermohl (Uthermohl, 1958).

#### **Analyses of microcystins:-**

After filtration of 1 L of water on Whatman filter Grade GF/C, the microcystins (intracellular) were extracted twice by sonication (two sets of 5 baths during 15 min) of the filter in 2 ml of 75% methanol. The lysate was centrifuged at 14 000 rpm during 15 min to remove cellular debris then the supernatant was evaporated with a concentrator (Concentrator 5301, Eppendorf, Hamburg, Germany). The extract obtained was dissolved in 200 µl of methanol 20% and stored at -20°C until analysis.

The microcystin measurements were achieved by high-pressure liquid chromatography coupled with photodiode array detection (HPLC-DAD, Agilent Technologies Waghäusel-Wiesental, Germany). The sample was pushed by a mobile phase consisting of water (A) and acetonitrile (B) (each containing 0.1% formic acid). Separation was performed with a C18(2) column (250 of 4.6mm, 5Mm particle size; Phenomenex Luna) with the following gradient: 0-2 min, 98% A; 2-12 min, 98-2% A(linear); 12-13 min, 2-98% A. Quality control samples (MC-LR) and blank runs were interspersed between the samples under investigation.

### **Results and Discussions:-**

#### **Study of physicochemical and bacteriological quality:-**

For nitrogen compounds; total nitrogen, nitrates, and ammonium successively vary between 76 and 820,9 (µg/L), 35,9 and 568 (µg/L) and 15,2 and 351 (µg/L) (table 2).

During the two years of study, temperatures of reservoir waters of Yaacoub Al Mansour vary generally between 12 and 33,2 (°C) (table 2). The pH was alkaline throughout the study period and varies between 7,08 and 9 (Table 2). Concerning conductivity, values are between 165 and 420 (µg/cm). Concentrations of total phosphorus were included between 30,9 and 312,68 (g/L) (Table 2). For nitrogen compounds; total nitrogen, nitrates, and ammonium successively vary between 76 and 820,9 (µg/L), 35,9 and 568 (µg/L) and 15,2 and 351 (µg/L) (table 2).

Chlorides and sulfates are extremely low and successively vary between 14 and 77 (mg/L) and 0,1 and 2,8 (mg/L) (Table 2). However, values of suspended matter were relatively high (between 0,01 and 2,6 mg/L) (Table 2). The oxidisability varies between 0,1 and 3,8 (mg/L) (Table 2). Moreover, dissolved oxygen values were included between 2,15 and 11 (mg/L) showing then the oxygenation of reservoir waters (Table 2).



The comparison of values of the whole physico-chemical parameters measured with Moroccan standards for raw water intended to drinking water supply (Moroccan Standards, 2008), shows that the dam Yaacoub Al Mansour has a bad water quality and this water require an intensive physical and chemical treatment.

However, the number of bacteria colonies indicating water pollution (table 2) does not exceed Moroccan standards (Moroccan Standards, 2008). In this case, water requires just a simple physical treatment to be drinkable.

The bacteriological study has shown that the raw waters of the dam Yaacoub Al Mansour are good for production of drinking water and require only a simple treatment by disinfection. Nevertheless, physicochemical analysis has shown that water requires extensive treatment because some parameters exceed the Moroccan standard for raw water intended for drinking water. This treatment includes several stages: screening, sieving, desabling, settling and pre-oxidation.

**Table 2:-** Minimum and maximum value for each physico-chemical and bacteriological parameters studied.

Studied Parameters	Minimum and maximum value
Temperature	12-33,2 (°C)
pH	7,08-9
Conductivity	165-420 (µg/cm)
Total phosphorus	30,9-312,68 (µg/L)
Total nitrogen	76-820,9 (µg/L)
Nitrates	35,9-568 (µg/L)
Ammonium	15,2-351 (µg/L)
Chlorides	14-77 (mg/L)
Sulfates	0,1-2,8 (mg/L)
Oxidisability	0,1-3,8 (mg/L)
Dissolved oxygen	2,15-11 (mg/L)
Suspended matter	0,01-2,6 (mg/L)
Total Coliform	0 (UFC/100mL)
Fecal Coliform	0 (UFC/100mL)
Fecal Streptococcus	0-20 (UFC/100mL)

#### **Temporal evolution of cyanobacteria and microcystins:-**

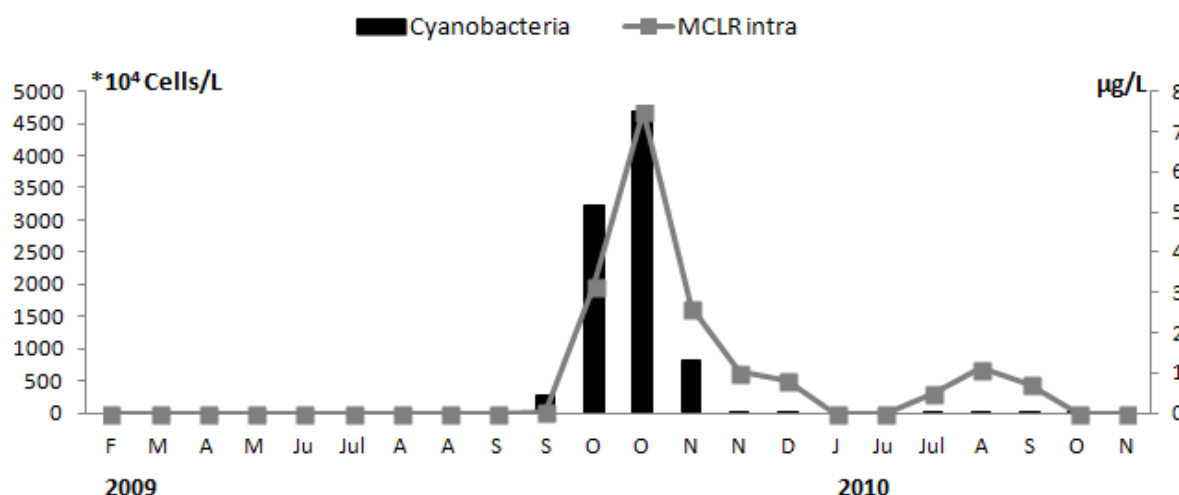
The autumn of the year 2009 was characterized by a significant development of cyanobacteria and a manifestation of *Microcystis aeruginosa* bloom (Maximum:  $46 \cdot 10^6$  cells/L) (Fig. 2).

This bloom appeared early just at the second year after the filling of the dam. However, the year 2010 has recorded a low development of cyanobacteria in summer (maximum:  $18 \cdot 10^4$  cells/L) (Fig. 2).

According to the World Health Organization, the presence of cyanobacteria blooms in water constitutes a high health risk and it should forbid any contact with these blooms (OMS, 2003).

Concerning concentrations of intracellular Microcystins LR (MCLR), they were very high in autumn of 2009 which corresponds to the bloom period (max:  $7,5 \mu\text{g/L}$ ). However, concentrations decreased in 2010 (max:  $1,12 \mu\text{g/L}$ ) (Fig. 2).

In all cases, maximum concentrations of MCLR for the two years exceed the standard ( $1 \mu\text{g/L}$ ) established by the World Health Organization for microcystin-LR in drinking water (OMS, 2004).



**Figure 2:-** Temporal evolution of cyanobacteria and microcystin LR at the surface of the reservoir

#### Evolution of trophic Status:-

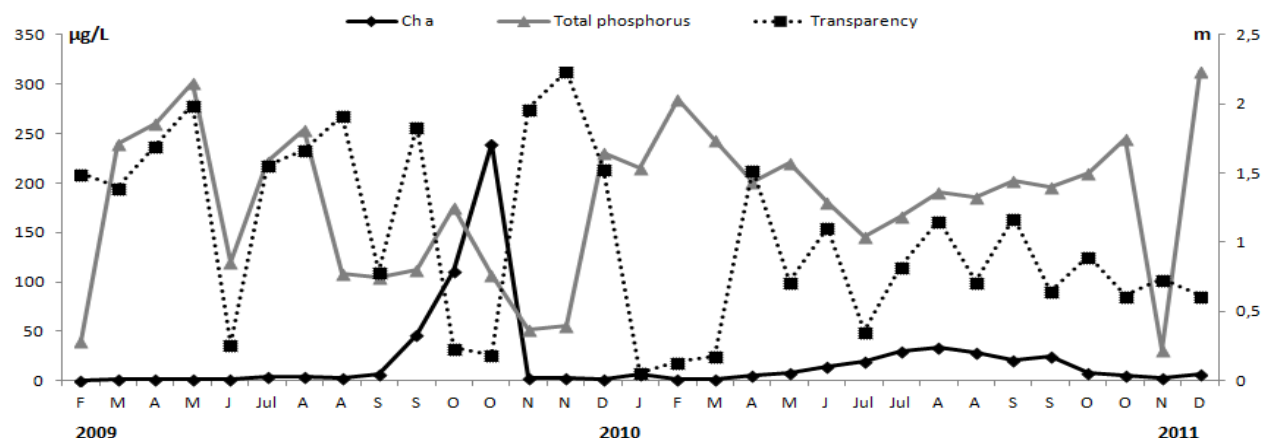
Several authors determine the trophic status of lakes based on qualitative and quantitative characteristics of the phytoplankton population. Others were based on phosphorus, nitrogen, chlorophyll a and transparency (Galvez-Cloutier and Michelle Sanchez, 2007; Vollenweider, 1968; OECD, 1982).

Based on the OECD classification (1982) and in particular on chlorophyll a, Yaacoub Al Mansour lake has been transformed from a hypereutrophic state in the first year of its filling in (2009) to a eutrophe state in 2010 (Fig. 3).

The high degree of trophy reached by this reservoir, two years after its filling, is a surprising event especially since there is no clearly visible source of pollution on the watershed. This state would probably represent a transitory state of trophic explosion, which is related to the young and unstable nature of this ecosystem.

This situation is similar to that observed in other lakes of Morocco (Loudiki, 1990; Fqih berrada, 2001). In fact, Loudiki (1990) found that the filling of dam of hassan I has promoted an early eutrophication which is due to the simple cleaning of vegetation.

Moreover, the degradation of organic matter and the geological substrate after the setup of a dam may lead to the nutrient enrichment. Like for the dam "Petit-Saut "in France, its setup resulted a mobilization and a permanent flow of dissolved elements (Richard, 1997). Other secondary contributions of nutrient can thereafter intervene by leaching waters after rainfall (Mama, 2011).



**Figure 3:-** Temporal evolution of chlorophyll a, total phosphorus and transparency at the surface of the reservoir .

### Conclusion:-

The bacteriological study shows that the reservoir Yaacoub Al Mansour has a good water quality which can be consumed just after a simple treatment. However, temporal evolution study of physico-chemical parameters, the biomass of cyanobacteria and microcystin concentrations showed that the reservoir Yaacoub Al Mansour has a bad water quality which can never be used for drinking water supply except after an intensive physical and chemical treatment.

Therefore, only the bacteriological control cannot determine the water quality of reservoirs which are intended for the supply of drinking water and it is strictly necessary to study physicochemical parameters, cyanobacteria biomass and microcystin concentrations.

Finally, the hypertrophic state and the early occurrence of *Microcystis aeruginosa* bloom in the reservoir Yaacoub Al Mansour show the importance to apply surveillance programs immediately after the setup of dam reservoirs to protect the health of humans and animals.

### Acknowledgments:-

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### References:-

1. AFNOR . (1994): In recueil des normes françaises des eaux, méthodes d'essais, 622p.
2. Daut, A. (1978): Evolution estivale du phytoplancton dans une retenue placée aux confluent de deux rivières, cahiers du laboratoire de Montereau, N°7.
3. Fqih Berrada, D. (2001): Comparative study of the water quality of two Moroccan dam reservoirs: El Kansera and Smir -Physico-chemistry, planktonic and bacteriological analyzes. Doctoral thesis, faculty of Science Ain Chock, Casablanca, 215p.
4. Galvez-Cloutier, R. Sanchez, M. (2007): Trophic Status Evaluation for 154 Lakes in Quebec, Canada: Monitoring and Recommendations. Water Qual. Res. J. Canada., 42: 252-268.
5. International Organization for Standardization (ISO). (1992): Water Quality-Measurement to biochemical parameters. Spectrometric determination of the chlorophyll-a concentration. ISO 10260, Geneva
6. Landner, A.L. and Wahlgreen, U. (1986): Eutrophication of Reservoirs lakes in warm climate, O.M.S./P.N.U.D:170 p.
7. Latour, D., Sabido, O., Salencon, M.J. and Giraudet, H. (2004): Dynamics and metabolic activity of the benthic cyanobacterium *Microcystis aeruginosa* in the Grangent reservoir (France). J. Plankton. Res., 26:1-8.
8. Loudiki, M. (1990): Limnological study of a hydrosystem recently filling in the Marrakech region (Morocco). Thesis in sciences. Faculty of Science and Technology of Saint Jerome, Marseille, 353p.

9. Mama, D., Deluchat, V., Bowen, J., Chouti, W., Yao, B., Gnon, B., Baudu, M. (2011): Characterization of a Lagoon System in Tropical Zone: Case of Lake Nokoué (Benin). *Eur. J. Sci. Res.*, 56: 516-528.
10. Moroccan Standards. (2008): Decree n°2-08-520 du 28 chaoual 1429, Official Bulletin of the Kingdom of Morocco. n°5684, 1597 p.
11. OMS. (2003): Guidelines for safe recreational-water environments, Coastal and fresh waters. World Health Organization, Genève, 1: 215 p.
12. OMS. (2004): Quality guidelines for drinking water. Recommendations, third edition Geneva. 1: 260 p.
13. OECD. (1982): Eutrophication of water: methods of monitoring, assessment and control, Paris: 165p.
14. Richard, S., Arnoux, A., Cerdan, P. (1997): Evolution of the physicochemical quality of the reservoir water and the downstream section since the beginning of the impoundment of the Petit Saut dam. *Hydroécol. Appl.*, 9: 57-83.
15. Rodier, J. (1984): Water analysis: Natural water, waste water, seawater. Dunod Paris Edition.
16. Uthermohl, H. (1958): Zur vollkommung der quantitative phytoplankton methodik. *Mitt. Internat. Ver. Limnol.*, 9: 1-88.
17. Vollenweider, R.A. (1968): The scientific basis of lake eutrophication, with par particular reference to phosphorus and nitrogen as eutrophication factors. Organisation for Economic Cooperation and Development, Paris, 159p.



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### RESEARCH ARTICLE

#### Gap Analysis- A comparative analysis of customer Gap between private and public sector banks in Jammu and Kashmir.

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#### Manuscript Info

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Gaps Model, Service Quality, SERVQUAL, customer perception, customer expectation, Jammu & Kashmir.

#### Abstract

One of the important prerequisite for the success of any service organization in general and banking sector in particular is the better Service quality. In view of this fact, service organizations require employees who give job performances that are perceived to be exceeding the expectations of the customers. With growing competition and advancement in technologies, the level of expectations of the customers increase considerably leaving no option for the service organizations but to improve and upgrade with those expectations. The efforts of the organizations would be to decrease the negative gap as much as possible between customer perception and their expectations of service quality. Existing research suggests that this gap between customer perception and their expectations of service quality was identified and presented in Gaps model by Parassuraman, et al. This gap was called as customer Gap or Expected Service-Perceived Service Gap. This Gap can be measured and estimated using SERVQUAL instrument also proposed by Parassuraman, et al. The study uses the SERVQUAL instrument to measure the Expected Service-Perceived Service Gap in private and public sector banks in Jammu and Kashmir. The data was collected from 1000 customers (500 each) of private and public sector banks located across Jammu and Kashmir. Reliability and validity tests were conducted followed by basic descriptive statistics. The gap score was calculated and their significance was tested using t-test. The gap score was used to test the proposed hypotheses. The results of the study reveal that the average customer gap score is more in public sector banks as compared to the private sector banks in Jammu and Kashmir

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#### Introduction:-

The banking sector in India has grown tremendously over a past decade. This growth has also been witnessed in the state of Jammu and Kashmir, as many private players have entered the state and are competing with the incumbents like Jammu and Kashmir bank and State Bank of India. After globalization, the operating environment for the banking sector has turned more dynamic and competitive. In order to search and maintain the competitive advantage, the banking industry is placing more focus on service quality as it has become an important competitive advantage in almost all industries (Albrecht and Zemke, 2001). It has been considered as the most researched

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concept in the service marketing because of its relationship with various outcomes. (Baron et al., 2009). According to Crosby (1979), the service quality has is supposed to have relationship with the costs. Bolton and Drew (1991) relate service quality with customer retention whereas Cronin and Taylor (1992) highlight the relationship of service quality with customer satisfaction. Rust and Zahorik (1993) relate it with the profitability and Stodnick and Rogers (2008) with positive word-of-mouth. In market place, as the banks compete generally with undifferentiated products, service quality becomes a key competitive weapon. Banks with high quality service can possess distinct marketing edge in terms of higher revenues, increased cross-sell ratios, higher customer retention (Bennett and Higgins, 1988). This ultimately leads to expanded market share (Brown and Hedges, 1993). As traditional and non-traditional financial institutions have adopted fierce marketing strategies, this has resulted in decline of customer loyalty. (Beckett et al., 2000, Wisner and Corney, 2001, Caruana, 2002, Corelli, 2002, Estell, 2002 and Humenick, 2002). Hence, attracting new customers has become equally important as retaining existing customers (Wisner and Corney, 2001; Jones et al., 2002). As a result, it is vital and important for banks to understand the various dimensions of customers' perception of banks' service quality. Furthermore the demand for more personalized products or services compels the banking industry to be more responsive in order to meet the expectations of the customers. In order to achieve this desired service quality, the performance of the employees in general and contact employees in particular need to be effective. The employees should be enough motivated to give desired performance. Thus organizations are consistently putting efforts to match the actual perceptions of the customers with their expectations of service quality and reduce the possible negative gap if any between them. It is in this context that the present study aims to explore the perceptions and expectations of customers regarding service quality in public and private sector banks and analyse the possible gaps between perception of service quality and expectations of the service quality in the state of Jammu and Kashmir.

### Literature Review:-

Literature on the service quality reveal that many researchers have termed service quality an 'elusive' and 'indistinct' construct that is difficult to define and measure (Parasuraman et al., 1988; Bolton and Drew, 1991; Carman, 1990; Cronin and Taylor, 1992). According to Baron et al. (2009), service quality is a highly abstract construct as compared to the goods quality, where technical aspects of quality are apparent. Furthermore, Clewes (2003) claim that finding an appropriate definition of service quality an unresolved issue in area of service marketing. Researchers have made attempts to define quality as one of the earliest definitions of quality was put forward by the Crosby (1979). He defines quality as: *"the conformation to specifications."* Crosby (1979) further states that quality is often mistaken for some imprecise adjectives like "goodness, or luxury or shininess or weight". These adjectives are illustrating the indefinable nature of the construct. However, Lewis and Booms (1983) were one of the first to define quality in terms of services. They define service quality as *"a measure of how well the service level delivered matches customer's expectations."* (Gronroos, 1984) defined service quality as follows *"the perceived quality of a given service will be the outcome of an evaluation process, where the consumer compares his expectations with the service he perceives he has received, i.e. he puts the perceived service against the expected service. The result of this process will be the perceived quality of the service."*

Parasuraman et al. (1988) developed this definition and argue that *"service quality stems from a comparison of a consumer's general expectations with their actual perceptions of a firm"* Consequently, service quality can be measured by how much the service provided to consumers exceeds their expectations (Lovelock and Wirtz, 2011). For the purpose of the study, the definition put forward by the Parasuraman et al. (1988) was used and service quality was defined as *"the ability of the organization to meet or exceed customer expectation in terms of what they feel a service provider should offer rather than would offer"*

### Models and Measures of Service Quality:-

Researchers over the period of time have recognized the need to develop valid measures of service quality. This has lead to the development of many measures service development in the past few decades. In service marketing literature, different models have been developed to find the different determinants of the service quality concept. Gronroos (1984) proposed technical and functional quality model that state that customers compare their expectations to their experience of service quality in forming their judgments. Parasuraman et al., (1985) proposed GAP model that define the service quality as a difference between expectation and performance. If expectations are more than performance, a gap is formed which in turn results from other four Gaps. This exploratory research was refined with their subsequent scale named SERVQUAL for measuring customers' perceptions of service quality (Parasuraman et al., 1988). Attribute service quality model given by Haywood-Farmer (1988) focuses on meeting the expectations of the customers regularly. According to this model a service organization has "high quality" if it

meets customer preferences and expectations consistently. Cronin and Taylor, (1992) gave performance only model that the service quality with consumer satisfaction and purchase intentions. The authors suggest that the perceptions are better predictor of service quality and the expectations are difficult to conceptualize. They authors thus developed performance only measurement of service quality called SERVPERF. They maintained that Performance instead of "Performance-Expectation" determines service quality and service quality is evaluated by perceptions only without expectations. Internal service quality model proposed by Frost and Kumar, (2000) uses Gaps model of Parasuraman et al. (1985) to develop an internal service quality. The model thus identifies three internal Gaps. Internet banking model (Broderick and Vachirapornpuk, 2002): The authors tests the service quality model of internet banking. The model suggests that five key elements in the context of the internet influence the perceived service quality. These key factors are: customer expectations of the service, the image and reputation of the service organization, aspects of the service setting, the actual service encounter, and customer participation.

These were few of the service quality models and measures which has considerable acceptance in the academic circles. However, one of the most popular measures of service quality widely accepted and used by academicians and researchers is SERVQUAL, originally developed by Parasuraman et al. (1985, 1988, 1990, 1991, 1994). According to Brown and Bond (1995), the GAPS model of the Parasuraman et al. is one of the best received valuable contributions to the service marketing literature. This pioneer study of Parasuraman et al. (1985) is regarded as major driving force in developing an increased understanding of service quality (Gerrard and Cunningham, 2001). The current study has used the SERVQUAL as a measure of service quality in banking sector and thus for evaluating the Customer Perception-Customer Expectation Gap.

#### **SERVQUAL Model:-**

Among the general instruments of service quality, the most popular instrument is SERVQUAL, which has been used to measure the service quality in variety of banks in original (Dedeke, 2003; A. 28 Hassan Al-Tamimi and Al-Amiri, 2003; Furrer et al, 2000; De Ruyter et al, 1999; Cowling and Newman, 1996; Kwan and Tan, 1994) as well as adapted versions (Adlaigan and Buttle, 2002; Othman and Owen, 2001, 2002; Bahia and Nantel, 2000; Kangis and Voukelatos, 1997; Teas, 1993). ). Many researchers consider a stream of research initiated by Parasuraman et al (1985) the most comprehensive investigation in the field of service quality. According to Parasuraman et al (1985), service quality is a function of three attributes i.e. pre-purchase customer expectations, perceived process quality, and perceived output quality. The researchers propose that consumers evaluate both the process and the outcome of the service received. SERVQUAL scale consists of 22-items spread over five dimensions, each item measuring two statements:

- (i) Customers expectations of service quality, and
- (ii) Customer's perceptions of the service they actually received.

According to Parasuraman et al., the content of the 22-items making up each dimensions of SERVQUAL was assessed and following labels and brief definitions for the five dimensions were suggested:

- i. **Tangibles:** Physical facilities, equipment, and appearance of personnel.
- ii. **Reliability:** Ability to perform the promised service dependably and accurately
- iii. **Responsiveness:** Willingness to help customers and provide prompt service
- iv. **Assurance:** Knowledge and courtesy of employees and their ability to inspire trust and confidence
- v. **Empathy:** Caring, individualised attention the firm provides to its customers

Parasuraman et al, (1985 &1988) suggested that the difference between customers' expectations of a service provider's performance and their evaluation of the services they have received will determine the service quality. According to Zeithaml et al, (1993), customers' expectations are beliefs about a service. Those beliefs act as standard against which service performance is judged. Parasuraman et al. (1988) state that customers' expectations are what customers think a service provider should offer rather than an actual offer. Thus,

$$\text{Service quality} = f(\text{Perceptions} - \text{Expectations})$$

On the basis of the above equation, Parasuraman et al, developed and proposed the SERVQUAL instrument as a reliable, valid, and generalizable way to measure the service quality construct. As service quality has been defined as difference between a customer's expectations and the perception, a gap is formed if the perception falls short of the expectations. This Gap results due to size and direction of four other Gaps associated with delivery of service quality on the marketer's side (Parasuraman et al, 1988). These five Gaps visualized by the authors are as under:

- Gap-1: Difference between consumers' expectation and management's perceptions of those expectations, i.e. not knowing what consumers expect.
- Gap-2: Difference between management's perceptions of consumer's expectations and service quality specifications, i.e. improper service-quality standards.
- Gap-3: Difference between service quality specifications and service actually delivered i.e. the service performance gap.
- Gap-4: Difference between service delivery and the communications to consumers about service delivery, i.e. whether promises match delivery
- Gap-5: Difference between consumer's expectation and perceived service.

The Gap-1 is referred as Consumer Expectations-management Gap. This Gap is discrepancy between what customers expect and what management perceived that they expected. The Gap-2 is referred as the Management Perception-Service Quality Specification Gap. This Gap is the result of the difference between manager's perceptions of customers' expectations and the actual standards they set for service delivery. The Gap-3 is referred as the Service Quality Specifications-Service Delivery Gap. This Gap is due to the difference between service specifications and the actual service delivery. The Gap-4 is referred as Service Delivery-External Communications Gap. The Gap is due to the difference between what a firm promises about a service and what it delivers. These four Gaps contribute to the Gap-5 which is referred Expected Service-Perceived Service Gap. This Gap is the result of the discrepancy between customers' expectations and perceptions of service quality. The fifth Gap is the basis of the SERVQUAL instrument which is used to measure the difference between consumers' expectation and consumers' perception of the service received. Parasuraman et al. (1988), state that the magnitude of the gap between expectations and perceptions decide the level of the perceived service quality. They believe that the smaller the gap, the higher the level of perceived service quality. When expected service exceeds perceived service, quality is less than satisfactory and the level of gap is negative. When expected service equals perceived service, perceived quality is satisfactory and the level of gap is zero. When perceived service exceeds expected service then service levels are more than satisfactory and the gap is positive. This positive gap depicts that the more than satisfactory service levels is tending towards customer delight.

#### **Empirical studies on Gap Analysis and Service Quality:-**

Numerous empirical studies have been carried out on the Gap analysis and service quality by various authors. Gautam, S and Singh, A (2014) in their study entitled as 'To Identify Service Quality Gaps in Banking Sector: A Comparative Study of Public Sector Banks and Foreign Banks' examined service quality gaps in public sector and foreign banks in India. The sample size for the study was 150 and the study was carried out in NCR. The results of the study revealed that the service quality gap in public sector banks is more than private sector banks. Jain, V, Gupta, S and Jain, S (2012) studied "Customer Perception on Service Quality in Banking Sector: With Special Reference to Indian Private Banks in Moradabad Region". The authors investigated the customer perception regarding service quality and explored different dimension of service quality in banks. The study was conducted in Moradabad and sample size taken was 100. SERVQUAL instrument was used and the analysis revealed that all the dimensions of the service quality are equally important in private sector banks. Singh, SP and Khurana, S (2011) examined gender wise customer's expectations and perceptions of service quality in their study entitled as "Analysis of Service Quality Gap and Customers' Satisfaction in Private Banks. The study was conducted in Hissar District and the sample size taken was 300. The study used the quota sampling technique and SERVQUAL as an instrument was used. The study identified the difference in expectation & perception of service quality of male & female customers. The results of the study reveals that the customer's perception of service quality was below their expectations in private sector banks in Hissar. Roy, R, Vijayanathi, P and Shreenivasan K (2011) in their study entitled as 'Service Quality Gap of Foreign Banks in India using PZB Service Quality Model – an Empirical Study' investigated various factors that contribute to the customer satisfaction in Foreign Banks in India. The study was conducted in Tamil Nadu and the sample size for the study was 275 customers. The dimensions of the SERVQUAL were used to analyse and measure the 5 Gaps proposed in the Gaps Model. The results of the study revealed that only first three gaps were prominent and foreign banks should focus on bridging those gaps in order to survive in Indian setting. A. Ananth, A, Ramesh, R and Prabakaran, B (2010) in their study entitled as "A Service Gap Analysis in Private Sector Banks- an Empirical Study of Customers' Expectations vs. Perceptions" investigated the service quality in various private sector banks. The study identified the gap between customer perception and expectations of service quality. The study used the dimensions SERVQUAL along with the one more dimension namely accessibility. The results of the study revealed that empathy variable of the SERVQUAL shows wider gap between customer perception and expectation. Furthermore, the multi-regression



analysis shows that Reliability, Assurance and Empathy positively influence the service quality in banking sector. Ravi K. Dhar and Silky Vigg Kushwah (2009) in their study on 'Service Quality Expectations and Perceptions of Public and Private Sector Banks in India: A Comparative Study' investigated the difference in perception and expectations of service quality among customers of private and public sector banks. The study also identifies the factors that influence those perceptions and expectations of the customers regarding service quality. The study was conducted in Madhya Pradesh and the sample size of the respondents was 400. The results of the study revealed that there exist a significant gap between perceptions and expectations of customers regarding service quality in both private and public sector banks. Mengi, P. (2009) conducted a study on 'Customer satisfaction with service quality: An empirical study of public and private sector banks'. The study was conducted in Jammu region of the state of Jammu and Kashmir. The service quality was measured using dimensions of SERVQUAL instrument. The results of the study revealed that the customers of public sector banks perceive better service quality as compared to the private sector banks in Jammu. Chawla, S., & Singh, F. (2008) investigated and measured service quality in life insurance companies in their work entitled as 'service quality perceptions of life insurance policyholders in northern India: Pre-privatization vs. post-privatization'. The aim of the study was to identify the service quality dimensions affecting satisfaction levels of the insurance policy holders. The study was conducted on 210 policyholders located in northern India. The results of the study revealed that accessibility dimension has a higher mean satisfaction compared with mean satisfaction of reliability and assurance dimensions. The results further highlighted the comparison of overall mean satisfaction of the customers and revealed that the policyholders who had purchased insurance policies before privatisation had a higher mean score compared with the policyholders who purchased insurance policies after privatisation. Brahmabhatt, M and Panelia, D (2008) examined and measured the service quality and customer satisfaction in their study "An Assessment of Service Quality in Banks". The study investigated the service quality in private, public and foreign banks. The study was carried out in Ahmedabad and Gandhinagar and the sample size taken was 246. The result of the study revealed that the foreign banks surpass the public and private sector banks in providing the better service quality. The customer gap is less in foreign banks as compared to private and public sector banks. Rohini, R. (2006) in her study 'Service quality in Bangalore hospitals - An empirical study' analysed the service quality perception in 5 hospitals. The study was conducted in Bangalore and the sample size of the study was 500 patients and 40 management personnel. SERVQUAL was used as a measuring instrument of Gap 1 and Gap 5. The results of the study revealed that there exists a service quality gap between patients' perception and patients' expectations. Furthermore the study also revealed that there also exist a gap between managements' perception about patients' expectations and patients' expectations of service quality. Hinson, R, Mohammed, A and Mensah, R (2006) conducted a comparative analysis of service quality across three banks in their study "Determinants of Ghanaian Bank Service Quality in a Universal Banking Dispensation". The aim of the study was to identify the most important dimensions that contribute most to the service quality. The study was carried in Ghana and sample size for the study was 250. The study used the SERVQUAL model and the results revealed that all the dimensions of the model significantly contribute in predicting service quality in Ghanaian bank in Ghana. Gudep and Elango (2006) in their study on 'the service quality and customer satisfaction amongst the private, public and foreign banks in India' analysed the difference in service quality between three banking sectors in India. The results of the study suggest that the private sector banks and foreign banks are well ahead in providing better service quality then public sector banks. In the light of the above reviewed studies, it is clear that very few studies have focused on comparative analysis of service quality perception and expectation of customers of private and public sector banks in India. Further extent of research in Jammu and Kashmir is very dismal and only one study of Mengi, P. (2009) is available in the subject that has been carried out in Jammu. It is against this backdrop, the present study has been conducted with a view to investigate the comparative analysis of customer Gap between private and public sector banks in Jammu and Kashmir.

### **Research Methodology:-**

The study was conducted using convenience sampling technique. Public and private sector banks in Jammu and Kashmir were selected for the purpose of the study. The questionnaire was administered on customers of those banks.

### **Sampling Frame and Method:-**

The sampling frame consisted of the customers of the private and public sector banks in Jammu and Kashmir. The private sector banks that were the units of the study were Jammu and Kashmir Bank and HDFC Bank. As for as the public sector banks were concerned, State Bank of India and Punjab National Bank were taken as the units of the study. Data was collected from customers through the questionnaire administered personally. A cover letter was accompanied with the questionnaire, which sought consent from the respondents for participating in the study. The

letter gave an introduction of the study and the researcher, ensured confidentiality and communicated that the data would be used for academic purposes only. The questionnaires were distributed to 500 customers of public sector banks and 500 customers of private sector banks. All the distributed questionnaires were received and were usable.

#### Instruments:-

The data collection method used to collect the primary data for this study consisted of SERVQUAL instrument. The service quality instrument consisted of 22 items covering 5 dimensions. The scales were properly reviewed to make them more readable and comprehensive.

#### Pre-testing:-

A pilot test was also conducted on customers of Private and Public sector banks. The SERVQUAL questionnaire was distributed among 100 customers of those banks (50 in each sector). After giving them brief introduction of the objective of the study, the respondents were asked to respond to the questionnaire and comment on any modifications needed.

#### Pre-Analysis data screening:-

Before submitting the dataset for final statistical analysis, each collected questionnaire was individually checked for preliminary analysis to evaluate missing data, incorrect data and outliers. The data was first checked for presence of outliers. The critical value at  $p < 0.001$  for chi squared with 5 independent variables for service quality is 20.52. Hence cases with Mahalanobis distance greater than 20.52 in case of service quality would be multivariate outliers. On inspecting the results it was found that there was no case with value greater than the critical value of 20.52 for  $df=5$  in case of Service Quality, signifying that no outliers existed amongst the data collected. All the collected cases were hence fit for further statistical testing. The extreme Mahalanobis values with case numbers are presented in Table 1.

**Table 1: Table of Extreme Values of service quality**

			Public Sector Banks		Private Sector Banks	
			Case Number	Value	Case Number	Value
Mahalanobis Distance	Highest	1	12	18.34553	11	19.67554
		2	125	18.12212	122	19.60012
		3	321	15.76261	211	17.77564
		4	342	14.99222	221	16.90109
		5	89	12.92882	412	16.65666
	Lowest	1	329	2.122112	82	3.670092
		2	223	2.312433	212	3.900122
		3	34	3.118291	312	4.610082
		4	23	3.421211	112	5.410078
		5	311	4.219872	301	5.610933

Shapiro-Wilk's test ( $p > .05$ ) (Shapiro & Wilk, 1964 ; Razali & Wah, 2011) as shown in Table 2 was conducted on the variables of the study to test for normality. The results of the test showed that the p value of all the variables were above the critical value of 0.05 indicating that all the variables of the study were approximately normally distributed.

**Table 2: Results of Shapiro-Wilk Test (Service Quality)**

	Shapiro-Wilk Public Sector Banks			Shapiro-Wilk Private Sector Banks		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Tangibility	.911	500	.305	.919	500	.576
Reliability	.932	500	.193	.925	500	.621
Responsiveness	.937	500	.442	.933	500	.451
Assurance	.952	500	.512	.941	500	.453
Empathy	.972	500	.508	.954	500	.565

The internal consistency of the instruments was also tested by Cronbach Alpha. The reliability coefficients of the constructs of the service quality were 0.908. Each construct exceeded the 0.70 benchmark recommended by Nunnally (1978). The Cronbach Alpha scores indicated that all the scales were internally consistent and the scale

items measured the constructs the way they are intended to be measured. The results of the Cronbach Alpha test is presented in Table 3

**Table 3: Cronbach Alpha Coefficients of Test Instrument**

Instrument	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
Service Quality	.908	.908	22

Furthermore item-to-total correlation test was also applied to check the consistency of the scale. Corrected item-to-total correlations were calculated for each item of service quality construct. It was observed from the results of the test that all the correlation coefficients of the items of service quality constructs were above the benchmark level of 0.30 (Cristobal et al., 2007) and hence were consistent. The results of the test are presented in Table 4

**Table 4: Results of Item-to-total Correlations for Service Quality**

	Public Sector Banks			Private sector Banks		
	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item deleted	Alpha
<b>Tangibles</b>			.912			.911
They should/will have modern equipment.	.526	.823		.635	.718	
Their physical installations /facilities should/will be visually attractive.	.718	.892		.522	.799	
Their employees should/will be well dressed and clean.	.701	.883		.726	.712	
The appearance of physical installations/facilities of these firms should/will be in keeping with type of service provided	.511	.899		.536	.737	
<b>Reliability</b>			.901			.810
When these firms promise to do something in a certain time, they should/will do so.	.599	.811		.482	.617	
When customers have problems, these firms should/will show sincere interest in solving them	.502	.733		.601	.721	
These firms should/will be trusted/dependable.	.610	.821		.663	.782	
They should/will provide the service in the time promised.	.590	.791		.534	.779	
They should/will keep their records correctly/accurately.	.799	.712		.611	.712	
<b>Responsiveness</b>			.823			.828
They should/will not be expected to tell customers exactly when services will be executed/performed	.801	.801		.701	.791	
Customers should/will not expect to receive immediate services from employees of these firms.	.621	.821		.491	.681	
Their employees should/will not	.677	.697		.621	.749	

always have to be willing/available to help customers						
It is okay if employees of these firms are too busy to respond to customer requests promptly.	.701	.747		.527	.719	
<b>Assurance</b>			.832			.811
Customer should/will be able to believe/trust employees of these firms	.619	.762		.519	.810	
Customers should/will feel secure in their transactions/negotiation with employees of these firms.	.710	.811		.599	.721	
Their employees should/will be polite.	.502	.723		.629	.771	
Their employees should/will get adequate support from these firms to perform their tasks correctly/ Their employees should/will have the knowledge to answer customer questions	.432	.771		.452	.673	
<b>Empathy</b>			.814			.801
These firms should/will not be expected to pay individual attention to customers.	.516	.722		.526	.723	
Employees of these firms cannot/will not be expected to give customers personal attention.	.710	.719		.620	.804	
Employees of these firms should/will not be expected to know customer needs.	.627	.801		.710	.819	
It is unrealistic to expect these firms to have their customer's best interest as its objective.	.810	.721		.617	.699	
They should/will not be expected to have convenient business hours for all clients.	.712	.771		.521	.711	

**Objectives of the study:-**

1. To examine the customer expectations and perceptions of service quality in private sector banks
2. To examine the customer expectations and perceptions of service quality in public sector banks
3. To study the gap between the customer perception and expectation of service quality in public sector banks.
4. To study the gap between the customer perception and expectation of service quality in private sector banks.
5. To compare the service quality gap between private and public sector banks

**Hypothesis:-**

- H<sub>0</sub>1: There is no significant difference in perception of customers of private and public sector banks
- H<sub>0</sub>2: There is no significant difference in expectations of customers of private and public sector banks
- H<sub>0</sub>3: There is no significant difference between customer perception and expectations of service quality in private sector banks
- H<sub>0</sub>4: There is no significant difference between customer perception and expectations of service quality in public sector banks
- H<sub>0</sub>5: There is no significant difference in Gap-1 between private and public sector banks.

**Data Analysis:-**

It begins with presenting the demographic profile of the respondents followed by the basic descriptive analysis. Finally the difference in customer perception and expectations of service quality in private and public sector banks was evaluated to test the proposed hypotheses.

**Demographic information of the sample:-**

The detailed demographic profile of the respondents of the study is presented in Table 5.

**Table 5: Demographic Characteristics of the Sample**

Demographic Characteristics	Private sector Banks (HDFC+JK BANK)		Public sector Banks (SBI+PNB)	
	Frequency	Percentage	Frequency	Percentage
<b>Gender</b>				
Male	355	71%	340	68%
Female	145	29%	160	32%
<b>Years of association with bank</b>				
3-5 years	110	22%	50	10%
5-8 years	230	46%	140	28%
8-10 years	100	20%	115	23%
>10 years	60	12%	195	39%

**Descriptive statistics:-**

The details of the descriptive statistics are presented in the Table 6

**Table 6: Descriptive Analysis of Service Quality Factors**

Items	N	Private sector banks				Public sector banks			
		Perceptions		Expectations		Perceptions		Expectations	
		Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
TANG0101	500	3.8665	.64817	4.5999	.32324	3.4298	.85621	4.3771	.51179
TANG0202	500	3.9751	.42964	4.4563	.54433	3.5137	.67765	4.5663	.50510
TANG0303	500	3.9887	.47773	4.7575	.76643	3.3638	.35467	4.4675	.49345
TANG0404	500	3.8665	.51077	4.6568	.43555	3.2875	.78656	4.3738	.56369
RELI0105	500	3.8012	.52876	4.6037	.98865	3.5538	.83454	4.6037	.58441
RELI0206	500	3.9143	.43256	4.6512	.86653	3.6175	.91734	4.7512	.66914
RELI0307	500	3.7156	.56778	4.5554	.55432	3.6712	.57632	4.8556	.75921
RELI0408	500	3.8467	.50834	4.1438	.76658	3.6725	.76832	4.6438	.74976
RELI0509	500	3.8965	.44288	4.6291	.66675	3.7459	.39065	4.7912	.75676
RESP0110	500	3.9001	.60286	4.4962	.66545	3.6789	.75943	4.8962	.52530
RESP0211	500	3.9124	.67025	4.3088	.76656	3.7125	.51438	4.7088	.60025
RESP0312	500	3.9652	.59768	4.7324	.56654	3.9262	.38872	4.8654	.75400
RESP0413	500	3.9554	.62045	4.7672	.39987	3.1875	.71043	4.2551	.66926
ASSU0114	500	3.9025	.45908	4.2302	.65532	3.5378	.68213	4.5025	.63569
ASSU0215	500	3.8971	.63972	4.3162	.88765	3.3845	.83421	4.3162	.62617
ASSU0316	500	3.9786	.56248	4.6975	.55432	3.7587	.44324	4.6975	.66562
ASSU0417	500	3.9712	.64120	3.9488	.21113	3.7956	.81123	4.7488	.60658
EMPA0118	500	3.9987	.54706	4.4151	.98223	3.9063	.83324	4.8121	.75377
EMPA0219	500	3.7128	.57296	4.2887	.51298	3.5862	.56643	4.5887	.77464
EMPA0320	500	3.8272	.54582	3.9913	.54391	3.6125	.98875	4.6213	.89909
EMPA0421	500	3.9712	.41037	4.1425	.96123	3.5288	.32234	4.5425	.68831
EMPA0522	500	3.8629	.57668	4.2812	.50987	3.6966	.99861	4.6812	.77180

It is seen from the Table 6 that the Mean score of the various items of the SERVQUAL variable Tangibility in private sector banks are close to the score of 4 whereas in case of public sector banks the value is close to 3

depicting that the perception of customers towards Tangibility is satisfactory in private sector banks as compared to the public sector banks. The mean score of the various items of the variable Reliability in private sector banks are again close to 4 as compared to public sector banks where the values are around 3.5, thus depicting the satisfactory perception of the customers regarding the Reliability of the private sector banks as compared to public sector banks. The mean score of the items of the variable Responsiveness in private sector banks are also close to 4 as compared to public sector banks where the values are either close to 3 or around 3.5. Finally, the mean score of items of Assurance and Empathy in private sector banks are also close to 4 as compared to the private sector banks where it round around 3 and 3.5. This can be further interpreted from the average mean score of all the 5 variables as presented in Table 7

**Table 7: Descriptive Statistics of SERVQUAL variables – Perception/Expectation questionnaire**

	N	Private sector banks				Public sector banks			
		Perceptions		Expectations		Perceptions		Expectations	
		Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Tangibility	500	3.9242	0.26102	4.6176	0.51738	3.3987	0.66877	4.4461	0.51850
Reliability	500	3.8348	0.32576	4.5166	0.76856	3.6521	0.69743	4.7291	0.70385
Responsiveness	500	3.9332	0.32934	4.5761	0.59960	3.6262	0.59324	4.6813	0.63720
Assurance	500	3.9373	0.32192	4.2981	0.57710	3.6191	0.69270	4.5662	0.63351
Empathy	500	3.8745	0.33364	4.2237	0.70204	3.6660	0.74187	4.6491	0.77752

As seen from the Table7 the average mean score of all the 5 variables in private and public sector banks reflect that the customers are less satisfactory about all the variables of the SERVQUAL in public sector banks as compared to the private sector banks meaning thereby that they feel public sector bank are less responsiveness and their physical facilities also need to be attractive and modern as compared to private sector banks where the customer perceive them more responsive to their needs and appearances of their contact employees are more appealing and their physical facilities are modern. Furthermore the customers of the public sector banks perceive those banks less dependable, less accurate, and less courteous, lacks the ability to pay individual attentions and care. Whereas the customers are somehow satisfied with the accuracy, courtesy and care in private sector banks. The perception mean score of various items of the all 5 variables in Table 6 and average Perception mean score of those variable represented in Table 7 reveal that customers have high expectations from those banks. The results of the basic descriptive analysis provide us the basic understanding of the customer perception and expectation towards various dimensions of the service quality in both types of banks. The results in no way makes us to conclude which type of bank is better in terms of the dimensions of the service quality, that can be actually inferred after evaluating the Gap between customer perception and expectation of service quality in both private and public sector banks. The lower value of perceptions mean score may not be so matter of concern if its expectations mean score is also not so high thus may not have much wider perception-expectation gap. Whereas higher value of perception mean score may be needed to get further better if the corresponding expectation score are far higher thus having much wider gap between customer perception and expectation of service quality. Thus it becomes important to evaluate the perception-expectation gap in order to conclude the performance of service quality.

#### **Hypotheses Testing using Gap analysis and T-test:-**

**Hypothesis 1:** *There is no significant difference in perception of customers of private and public sector banks*

The null hypothesis 1 that there is no significant difference in perception of customers of private and public sector banks is statistically tested. The statistical significance in difference is examined using T-statistics. If the calculated value of T-estimate is greater than 1.96 and less than 2.58, the difference in perception of customers in private and public sector banks is significant at 5% level. If the T- statistics value greater than 2.58, the difference is significant at 1%. If the T-value is significant, it means the null hypothesis is rejected and there exists a significant difference in perceptions of customers of private and public sector banks. The mean perception scores of customers of private and public sector banks along with T-values and significance level are presented in Table 8

**Table 8: Mean Perception scores, t-value and Significance level**

Dimensions	Statements	Perception Score (PS)		t-Value	Sig.
		(Private Sector Banks) JK BANK+HDFC	(Public Sector Banks) SBI+PNB		
TANGIBILITY	TANG01	3.8665	3.4298		
	TANG02	3.9751	3.5137		
	TANG03	3.9887	3.3638		
	TANG04	3.8665	3.2875		
<b>TANGIBILITY</b>		<b>3.9242</b>	<b>3.3987</b>	<b>4.321</b>	<b>.000</b>
RELIABILITY	RELI01	3.8012	3.5538		
	RELI02	3.9143	3.6175		
	RELI03	3.7156	3.6712		
	RELI04	3.8467	3.6725		
	RELI05	3.8965	3.7459		
<b>RELIABILITY</b>		<b>3.8348</b>	<b>3.6521</b>	<b>2.982</b>	<b>.003</b>
RESPONSIVENESS	RESP01	3.9001	3.6789		
	RESP02	3.9124	3.7125		
	RESP03	3.9652	3.9262		
	RESP04	3.9554	3.1875		
<b>RESPONSIVENESS</b>		<b>3.9332</b>	<b>3.6262</b>	<b>3.124</b>	<b>.002</b>
ASSURANCE	ASSU01	3.9025	3.5378		
	ASSU02	3.8971	3.3845		
	ASSU03	3.9786	3.7587		
	ASSU04	3.9712	3.7956		
<b>ASSURANCE</b>		<b>3.9373</b>	<b>3.6191</b>	<b>3.392</b>	<b>.000</b>
EMPATHY	EMP01	3.9987	3.9063		
	EMP02	3.7128	3.5862		
	EMP03	3.8272	3.6125		
	EMP04	3.9712	3.5288		
	EMP05	3.8629	3.6966		
<b>EMPATHY</b>		<b>3.8745</b>	<b>3.6660</b>	<b>2.749</b>	<b>.006</b>

It is seen from the Table 8 that the mean perception scores of customers of private sector banks with regard to all the variables of service quality exceed all the mean perception scores of customers of public sector banks. The difference is significant at 1% level of significance. This reveals that the customers of private sector banks perceive better service quality compared to customers of public sector banks. The overall mean perception score of customers of private and public sector banks is presented in Table 9

**Table 9: Mean Perception scores, S.D., t-value and Significance level**

PERCEPTION	Banks	Mean	Std. Deviation	t-value	Sig.
	PRIVATE SECTOR	3.89	0.27664	<b>3.321</b>	<b>.000</b>
	PUBLIC SECTOR	3.59	0.19886		

The t-value of 3.321 as seen from the Table 9 is more than the critical value of 2.58 at 1% level of significance. Thus the null hypothesis is not accepted. Hence we can conclude that there exists a significant difference in perception of customers of private and public sector banks.

**Hypothesis 2:** *There is no significant difference in expectations of customers of private and public sector banks*

The null hypothesis 2 that there is no significant difference in expectations of customers of private and public sector banks is statistically tested. The statistical significance in difference is examined using T-statistics. If the calculated value of T-estimate is greater than 1.96 and less than 2.58, the difference in perception of customers in private and public sector banks is significant at 5% level. If the T-statistics value is greater than 2.58, the difference is significant at 1%. If the T-value is significant, it means the null hypothesis is rejected and there exists a significant difference in expectations of customers of private and public sector banks. The mean expectations of customers of private and public sector banks along with T-values and significance level are presented in Table 10

**Table 10: Mean Expectation scores, t-value and Significance level**

Dimensions	Statements	Expectation Score (ES) (Private Sector Banks) JK BANK+HDFC	Expectation Score (ES) (Public Sector Banks) SBI+PNB	t-Value	Sig.
TANGIBILITY	TANG01	4.3771	4.5999	2.3987	.017
	TANG02	4.5663	4.4563		
	TANG03	4.4675	4.7575		
	TANG04	4.3738	4.6568		
	<b>TANGIBILITY</b>	<b>4.6176</b>	<b>4.4461</b>		
RELIABILITY	RELI01	4.6037	4.6037	2.6521	.009
	RELI02	4.7512	4.6512		
	RELI03	4.8556	4.5554		
	RELI04	4.6438	4.1438		
	RELI05	4.7912	4.6291		
	<b>RELIABILITY</b>	<b>4.5166</b>	<b>4.7291</b>		
RESPONSIVENESS	RESP01	4.8962	4.4962	2.0622	0.04
	RESP02	4.7088	4.3088		
	RESP03	4.8654	4.7324		
	RESP04	4.2551	4.7672		
	<b>RESPONSIVENESS</b>	<b>4.5761</b>	<b>4.6813</b>		
ASSURANCE	ASSU01	4.5025	4.2302	2.7191	.007
	ASSU02	4.3162	4.3162		
	ASSU03	4.6975	4.6975		
	ASSU04	4.7488	3.9488		
	<b>ASSURANCE</b>	<b>4.2981</b>	<b>4.5662</b>		
EMPATHY	EMP01	4.8121	4.4151	3.4660	.000
	EMP02	4.5887	4.2887		
	EMP03	4.6213	3.9913		
	EMP04	4.5425	4.1425		
	EMP05	4.6812	4.2812		
	<b>EMPATHY</b>	<b>4.2237</b>	<b>4.6491</b>		

It is seen from the Table 10 that the mean expectation scores of customers of Public sector banks with regard to all the variables of service quality except tangibility exceed all the mean expectations scores of customers of private sector banks. The difference is significant at 1% and 5% level. The overall mean expectations score of customers of private and public sector banks, standard deviations, T-value and significance level is presented in Table 11

**Table 11: Mean Expectations scores, S.D., t-value and Significance level**

EXPECTATION	Banks	Mean	Std. Deviation	t-value	significance
	PRIVATE	4.45	0.41314	4.513	0.000
	PUBLIC	4.61	0.29816		



The t-value of 4.513 as seen from the Table 11 is more than the critical value of 2.58 at 1% level of significance. Thus the null hypothesis is not accepted. Hence we can conclude that there exists a significant difference in expectations of customers of private and public sector banks.

**Hypothesis 3:** *There is no significant difference between perception and expectation of customers of private sector banks*

The null hypothesis 3 that there is no significant difference in perception and expectation of customers of private sector banks is statistically tested. The statistical significance in difference is examined using T-statistics. If the calculated value of T-estimate is greater than 1.96 and less than 2.58, the difference in perception of customers in private and public sector banks is significant at 5% level. If the T-statistics value greater than 2.58, the difference is significant at 1%. If the T-value is significant, it means the null hypothesis is rejected and there exists a significant difference in perceptions and expectations of customers of private sector banks. The mean perception and expectation scores of customers of private banks along with gap score, T-values and significance level are presented in Table 12

**Table 12: Perception and Expectation scores, t-value and Sig. level in Private sector banks**

Dimension	Private Sector Banks (JK BANK & HDFC BANK)					t-Value	Sig.
	Statements	Expectation Score (ES)	Perception Score (PS)	Gap Score (PS-ES)			
TANGIBILITY	TANG01	4.5999	3.8665	-0.7334			
	TANG02	4.4563	3.9751	-0.4812			
	TANG03	4.7575	3.9887	-0.7688			
	TANG04	4.6568	3.8665	-0.7903			
<b>TANGIBILITY</b>		<b>4.6176</b>	<b>3.9242</b>	<b>-0.6934</b>	<b>6.261</b>	<b>.0000</b>	
RELIABILITY	RELI01	4.6037	3.8012	-0.8025			
	RELI02	4.6512	3.9143	-0.7369			
	RELI03	4.5554	3.7156	-0.8398			
	RELI04	4.1438	3.8467	-0.2971			
	RELI05	4.6291	3.8965	-0.7326			
<b>RELIABILITY</b>		<b>4.5166</b>	<b>3.8348</b>	<b>-0.6818</b>	<b>5.812</b>	<b>.000</b>	
RESPONSIVENESS	RESP01	4.4962	3.9001	-0.5961			
	RESP02	4.3088	3.9124	-0.3964			
	RESP03	4.7324	3.9652	-0.7672			
	RESP04	4.7672	3.9554	-0.8118			
<b>RESPONSIVENESS</b>		<b>4.5761</b>	<b>3.9332</b>	<b>-0.6429</b>	<b>5.613</b>	<b>.000</b>	
ASSURANCE	ASSU01	4.2302	3.9025	-0.3277			
	ASSU02	4.3162	3.8971	-0.4191			
	ASSU03	4.6975	3.9786	-0.7189			
	ASSU04	3.9488	3.9712	0.0224			
<b>ASSURANCE</b>		<b>4.2981</b>	<b>3.9373</b>	<b>-0.3607</b>	<b>3.998</b>	<b>.000</b>	
EMPATHY	EMP01	4.4151	3.9987	-0.4164			
	EMP02	4.2887	3.7128	-0.5759			
	EMP03	3.9913	3.8272	-0.1641			
	EMP04	4.1425	3.9712	-0.1713			
	EMP05	4.2812	3.8629	-0.4183			
<b>EMPATHY</b>		<b>4.2237</b>	<b>3.8745</b>	<b>-0.3492</b>	<b>3.839</b>	<b>.000</b>	

It is seen from the Table 12 that the difference between customer perception and expectation of service quality in private sector banks is negative as seen from the gap scores. This difference is significant at 1% level of significance. This reveals that the customers of the private sector banks expect better service quality than what they receive from their banks. The overall mean perception and expectations score of customers of private sector banks, standard deviations, T-value and significance level is presented in Table 13

**Table 13: Mean Perception & Expectation, S.D., t-value, Sig. level in Pvt. Sector banks**

PRIVATE SECTOR BANKS		Mean	Std. Deviation	t-value	Sig.
	PERCEPTION	3.89	0.28123	4.012	0.000
	EXPECTATION	4.45	0.33213		

The t-value of 4.012 as seen from the Table 13 is more than the critical value of 2.58 at 1% level of significance. Thus the null hypothesis is not accepted. Hence we can conclude that there exists a significant difference between perceptions and expectations of customers of private sector banks.

**Hypothesis 4:** *There is no significant difference between perception and expectation of customers of Public sector banks*

The null hypothesis 4 that there is no significant difference in perception and expectation of customers of public sector banks is statistically tested. The statistical significance in difference is examined using T-statistics. If the calculated value of T-estimate is greater than 1.96 and less than 2.58, the difference in perception of customers in private and public sector banks is significant at 5% level. If the T-statistics value greater than 2.58, the difference is significant at 1%. If the T-value is significant, it means the null hypothesis is rejected and there exists a significant difference in perceptions and expectations of customers of public sector banks. The mean perception and expectation scores of customers of public sector banks along with gap score, T-values and significance level are presented in Table 14

**Table 14: Perception and Expectation scores, t-value and Sig. level in Public sector banks**

Public Sector Banks (SBI & PNB)						
Dimension	Statement	Expectation Score (ES)	Perception Score (PS)	Gap Score (PS-ES)	t-Value	Sig.
TANGIBILITY	TANG01	4.3771	3.4298	-0.9473		
	TANG02	4.5663	3.5137	-1.0526		
	TANG03	4.4675	3.3638	-1.1037		
	TANG04	4.3738	3.2875	-1.0863		
<b>TANGIBILITY</b>		<b>4.4461</b>	<b>3.3987</b>	<b>-1.0474</b>	<b>7.723</b>	<b>.000</b>
RELIABILITY	RELI01	4.6037	3.5538	-1.0499		
	RELI02	4.7512	3.6175	-1.1337		
	RELI03	4.8556	3.6712	-1.1844		
	RELI04	4.6438	3.6725	-0.9713		
	RELI05	4.7912	3.7459	-1.0453		
<b>RELIABILITY</b>		<b>4.7291</b>	<b>3.6521</b>	<b>-1.0760</b>	<b>8.012</b>	<b>.000</b>
RESPONSIVENESS	RESP01	4.8962	3.6789	-1.2173		
	RESP02	4.7088	3.7125	-0.9963		
	RESP03	4.8654	3.9262	-0.9392		
	RESP04	4.2551	3.1875	-1.0676		
<b>RESPONSIVENESS</b>		<b>4.6813</b>	<b>3.6262</b>	<b>-1.0552</b>	<b>7.1231</b>	<b>.000</b>
ASSURANCE	ASSU01	4.5025	3.5378	-0.9647		
	ASSU02	4.3162	3.3845	-0.9317		
	ASSU03	4.6975	3.7587	-0.9388		
	ASSU04	4.7488	3.7956	-0.9532		
<b>ASSURANCE</b>		<b>4.5662</b>	<b>3.6191</b>	<b>-0.9471</b>	<b>6.998</b>	<b>.000</b>
EMPATHY	EMP01	4.8121	3.9063	-0.9058		
	EMP02	4.5887	3.5862	-1.0025		
	EMP03	4.6213	3.6125	-1.0088		
	EMP04	4.5425	3.5288	-1.0137		
	EMP05	4.6812	3.6966	-0.9846		
<b>EMPATHY</b>		<b>4.6491</b>	<b>3.6660</b>	<b>-0.9831</b>	<b>7.031</b>	<b>.000</b>

It is seen from the Table 14 that the difference between customer perception and expectation of service quality in public sector banks is negative as seen from the various gap scores. This difference is significant at 1% level of

significance. This reveals that the customers of the public sector banks expect better service quality than what they receive from their banks. The overall mean perception and expectations score of customers of public sector banks, standard deviations, T-value and significance level is presented in Table 15

**Table 15: Mean Perception & Expectation, S.D., t-value, Sig. level in Public Sector banks**

PUBLIC SECTOR BANKS		Mean	Std. Deviation	t-value	Sig.
	PERCEPTION	3.59	0.19886	7.810	0.000
	EXPECTATION	4.61	0.29816		

The t-value of 7.810 as seen from the table 15 is more than the critical value of 2.58 at 1% level of significance. Thus the null hypothesis is not accepted. Hence we can conclude that there exists a significant difference between perceptions and expectations of customers of private and public sector banks.

**Hypothesis 5:** *There is no significant difference in Gap1 between private and public sector banks*

The null hypothesis 5 that there is no significant difference in Gap1 between private and public sector banks is statistically tested. The statistical significance in difference is examined using T-statistics. If the calculated value of T-estimate is greater than 1.96 and less than 2.58, the difference in perception of customers in private and public sector banks is significant at 5% level. If the T-statistics value greater than 2.58, the difference is significant at 1%. If the T-value is significant, it means the null hypothesis is rejected and there exists a significant difference in Gap1 between private and public sector banks. The average Gap1 score in all the dimensions of service quality in private and public sector banks along with T-values and significance level are presented in Table 16

**Table 16: Gap scores, t-value and Sig. level in private and public sector banks**

Dimensions	Gap Scores		t-value	Sig.
	Public Sector Banks SBI & PNB	Private sector Banks JKBANK & HDFC		
Tangibility	-1.047	-0.693	5.425	0.000
Reliability	-1.076	-0.681	6.011	0.000
Responsiveness	-1.055	-0.642	6.917	0.000
Assurance	-0.947	-0.360	7.018	0.000
Empathy	-0.983	-0.349	7.214	0.000

It is seen from the Table 16 that the average Gap 1 score in all dimensions of service quality in public sector banks exceeds the average Gap 1 score in private sector banks. This difference is significant at 1% level of significance. This reveals that the customers perception-expectation Gap in public sector banks are more as compared to private sector banks meaning thereby that that service quality of public sector banks far away from the expectations of the customers where as in private sector banks service quality is comparatively less away from the expectations of the customers. The overall mean perception and expectations Gap, standard deviations, T-value and significance level is presented in Table 17

**Table 17: Mean Gap score, S.D., t-value, Sig. level in Public Sector banks**

GAP SCORES		Mean	Std. Deviation	t-value	Sig.
	PUBLIC SECTOR	-0.545	0.49813	7.956	0.000
	PRIVATE SECTOR	-1.021	0.65123		

The t-value of 7.956 as seen from the table 17 is more than the critical value of 2.58 at 1% level of significance. Thus the null hypothesis is not accepted. Hence we can conclude that there exists a significant difference in Gap 1 between private and public sector banks.

### Conclusion:-

The current study measured and compared the service quality gap between private and public sector banks in Jammu and Kashmir. It is clear from the preceding discussion that the service quality parameters are seriously being evaluated by the customers of private and public sector banks. The findings of the study show that the customer expectation of service quality is more in public sector banks as compared to private sector banks whereas customers perceive better service quality in private sector banks as compared to public sector banks. This necessitates the need of improvement in all the dimensions of the service quality as highlighted in the preceding discussions in public sector banks. This in no way mean that the private sector banks provide optimal service quality as the gap between perception and expectation is also significant in these banks. The significant finding in the above discussions is the that the customers expect more reliability, responsiveness, assurance and empathy from public sector banks as compare to private sector banks. This means that the customers expect public sector banks to be more reliable, responsive, courteous and empathetic as compared to private sector banks. Thus private sector banks need to develop a sense of reliability, responsiveness, courtesy and empathy among their customers. The findings reveal that both the banks have to manage all the dimensions of the perceived service quality in order to match the expected service. To keep the gap between perceived service and the expected service as low as possible; all the marketing activities including word of mouth must not be unrealistic compared to the perceived service. Both the types of banks should continually evaluate how customers perceive their service quality and what are their expectations in order to check whether they match or not.

### References:-

1. Ahire, S. L., Golhar, D. Y., & Waller, M. A. (1996). Development and validation of TQM implementation constructs. *Decision Sciences*, 27(1), 23-56.
2. Aldlaigan, A. H., & Buttle, F. A. (2002). SYSTRA-SQ: A new measure of bank service quality. *International Journal of Service Industry Management*, 13(4), 362-81.
3. Anber Abraheem Shlash Mohammad and Shireen Yaseen Mohammad Alhamadani(2011). Service Quality Perspectives and Customer Satisfaction in Commercial Banks Working in Jordan. *Middle Eastern Finance and Economics*, 14(1):.60-72.
4. Arasli, H., Smadi, S. M. & Katircioglu, S. T. (2005). Customer service quality in the Greek Cypriot banking industry. *Managing Service Quality*, 15(1), 41-56.
5. Baker, D. A., and Crompton, J. L.,(2000). Quality Satisfaction and Behavioral Intentions. *Annals of Tourism Research*, 27 (3): 785-804.
6. Balachandler, K. G., Santha, V., Norhazlin, I. and Rajendra, P. (2001), Electronic banking in Malaysia: Evolution of services and consumer reaction. Brown, S.W. and Bond, E.U. III (1995), The internal/external framework and service quality: Toward theory in services marketing, *Journal of Marketing Management*. 25-39
7. Bahia, K., & Nantel, J. (2000). A Reliable and Valid Measurement Scale for the Perceived Service Quality of Banks. *International Journal of Bank Marketing*, 18(2), 84-91.
8. Berry, L., Parasuraman, A., & Zeithaml, V. A. (1989). Perceived service quality as a customer-based performance measure: An empirical examination of organizational barriers using an extended service quality model. *Human Resource Management*, 30(3): 335-364.
9. Berry, L., & Parasuraman, A. (1991). Marketing services: Competing through Quality. *Free Press/Macmillan*, London.
10. Bonaccorsi, A., & Fiorentinon, A. (1996). Customer service satisfaction in market and intra-company exchanges. in Kunst, P, Lemmink, J. (Eds), *Managing Service Quality*, Athanaum, Gateshead, 2,1-14.
11. Chawla, S., & Singh, F. (2008). Service quality perceptions of life insurance policyholders in northern India: Pre-privatization vs. post-privatization. *The ICFAI University Journal of Marketing Management*, 7(4), 24-53.
12. Cronbach, L. J. (1951), Coefficient alpha and the internal structure of tests, *Psychometrika*, 16: 297-334.
13. Crane, D. B., & Eccles, R. G. (1993). Customer relations in the 1990s. Hayes, S.L (Eds), *Financial Services: Perspectives and Challenges*, Harvard Business School Press, Boston, MA.
14. De Brentani, U., & Cooper, R. (1992). Developing successful new financial services for businesses. *Industrial Marketing Management*, 21, 231-41.

15. Ennew, C. T., & Binks, M. R. (1996). Good and bad customers: The benefits of participating in the banking relationship. *International Journal of Bank Marketing*, 14(2), 5-13.
16. Grönroos, C. (1990), *Service Management and Marketing*, Lexington Books, Lexington, MA.
17. Gudep, V. K., & Elango, R. (2006). A comparative study on the service quality and customer satisfaction among private, public and foreign banks. *The ICFAI Journal of Marketing Management*, 5(3), 6-17.
18. Jabnoun, N., & Al-Tamimi, H. A. H. (2003). Measuring perceived service quality at UAE commercial banks. *International Journal of Quality & Reliability Management*, 20(4), 458-72.
19. Liao, & Cheung (2005). Service Quality in Internet E-Banking: A User-Based Core Framework. *e-Technology, e-Commerce and e-Service*, 628-631, IEEE International Conference on e-Technology, e-Commerce and e-Service(EEE'05).
20. Lovelock, C., & Wirtz, J. (2007), *Services marketing: People, technology, strategy* (6th ed.). Prentice Hall. Book (ISBN: 0-13-187552-3):12-24.
21. Lovelock, C. H. & Wirtz J. (2007), *Services Marketing: People, technology and strategy*, Prentice Hall (ISBN-10: 0131875523 | ISBN-13: 9780131875524).
22. Mengi, P. (2009). Customer satisfaction with service quality: An empirical study of public and private sector banks. *The IUP Journal of Management Research*, 8(9), 7-17.
23. Nunnally, J. C. (1978), *Psychometric theory* (2nd ed.). New York: McGraw-Hill. Book (ISBN 0070474656) p. 678-685.
24. Oliver, R. L., & Swan, J. E (1989). Consumer perceptions of interpersonal equity and satisfaction transactions: a field survey approach. *Journal of Marketing*, 53, 21-35.
25. Parasuraman, A., Zeithmal, V. A., & Berry, L. L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. *Journal of Retailing*, 64, 12-40.
26. Rohini, R. (2006). Service quality in Bangalore hospitals - An empirical study. *Journal of Services Research*, 6(1).
27. Rosenblatt, J., Laroche, M., Hochstein, A., Mctavish, R., & Sheahan, M. (1988). Commercial banking in Canada: A study of the selection criteria and service expectations of treasury officers. *International Journal of Bank Marketing*, 6(4), 20-30.
28. Shekhar, V., & Gupta, N. (2008). Customers' Perspectives on Relationship Marketing in Financial Service Industry *The Icfaian Journal of Management Research*, 7(9), 68-79.
29. Thunman, C. G. (1992). Corporate Banking: Services and Relationships. *International Journal of Bank Marketing* 10(2), 10-16.
30. Turnbull, P. W., & Gibbs, M. J. (1987). Marketing bank services to corporate customers: the importance of relationships. *International Journal of Bank Marketing*, 5(1), 19-26.
31. Turnbull, P. W., & Moustakatos, T. (1996b). Marketing and investment banking 2: Relationships and competitive advantage. *International Journal of Bank Marketing*, 14(2), 38-49.
32. Turnbull, P. W. (1983). Corporate attitudes towards bank services. *International Journal of Bank Marketing*, 1(1), 53-68.
33. Turnbull, P. W., & Gibbs, M. J. (1989). The selections of banks and banking services among corporate customers in South Africa. *International Journal of Bank Marketing*, 7(5), 36-39.
34. Tyler, K. (1996). Exchange relationships in financial services: Marketing equities to institutions. *International Journal of Bank Marketing*, 14(2), 50-63.
35. Tyler, K. & Stanley, E. (1999). UK Bank-Corporate Relationships: Large Corporates' Expectations of Service. *International Journal of Bank Marketing*, 17(4), 158-172.
36. Yavas, U., Bilgin, Z., & Shemwell, D. J. (1997). Service quality in the Banking Sector in Emerging Economy: A Consumer Survey. *International Journal of Bank Marketing*, 15(6), 217-233.
37. Zeithaml, V.A. and Bitner, M.J. (2000), "Services Marketing", McGraw-Hill, New York, NY.



### RESEARCH ARTICLE

## KNOWLEDGE AND ATTITUDES TOWARDS HEPATITIS C VIRUS TRANSMISSION AMONG MEDICAL INTERNS OF KING ABDULAZIZ MEDICAL CITY , RIYADH.

Turky Al-Qahtani.

### Manuscript Info

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### Abstract

**Aim:** This study aims to investigate the knowledge and attitudes towards hepatitis C virus transmission among medical interns of King Abdulaziz Medical City in Riyadh city , kingdom of Saudi Arabia. **Methods:** A cross sectional descriptive study was conducted by administering a closed ended questionnaire on a sample of 100 medical interns. **Results :** Findings of this study showed that medical interns in King Abdulaziz Medical City in Riyadh city possess a good level of knowledge regarding HCV transmission , besides to the good level of knowledge regarding the prevention of HCV infection. Moreover , medical interns have a positive attitude towards patients infected by HCV. **Conclusion :** It could be concluded that there is an accepted level of knowledge among medical interns of King Abdulaziz Medical City regarding HCV transmission , and a positive attitude towards dealing with HCV patients.

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### Introduction:-

Hepatitis C is a significant global health issue due to the vast and increasing number of infections happening every year, besides to the increasing mortality rate among infected people.

Nowadays , it is estimated that there is around 170 million of infected people by HCV , as an estimated to be 3% of the world's population . high prevalence rate of hepatitis infection imposes high demand on health service providers and particularly on healthcare workers to be more close and in direct contact with HCV infected people.

Hepatitis C is a blood borne viral infection that is caused by the hepatitis C virus (HCV) (National and medical research council (NHMRC) , 1997).

Hepatitis C is still poorly understood , in part because has only recently been identified . the genome of HCV was isolated in 1988 and a serological test was developed in 1990 (Crofts et al.,1999) . The HCV has a tendency to mutate rapidly , which makes it genetically unstable. The rapid change in viral antigens makes it difficult for the immune system to clear the virus , consequently there is a high rate of chronicity.

Around 80% of HCV infected people go on to develop chronic hepatitis , up to 20% will develop cirrhosis of the liver and around 5% will develop hepatic cancer. The rapid mutation rate also means that there is no licensed , effective vaccine against HCV , and that gamma globulin is not an effective prophylactic therapy.

People with chronic Hepatitis C infection could be treated using interferon monotherapy , or with interferon and ribavirin combination therapy . Neither of both treatments is highly effective with only 15-20% of patients treated with interferon alone, and 35 – 50 % of patients treated with combination therapy showing a sustained response ( i.e. absence of viral RNA for at least six months after cessation of treatment).

Hepatitis C virus (HCV) is considered a major factor that increases the mortality rate in patients with end-stage-renal-disease (ESRD) that are treated with renal dialysis. Serological tests had indicated that there is a high prevalence rate of HCV infection among ESRD patients. Specific procedure represented by the early diagnosis and infection treatment, can help in reducing the mortality rate .Moreover,it's very important to perform blood screening to identify any available anti-HCV antibodies in the patients, or to detect Ribonucleic Acid molecules (RNA) of the HCV by hybridization screening methods. Little knowledge is known about the Saudi renal dialysis patients knowledge level about HCV infection, so that spot the light on the need for more survey and quantitative researches to explore their knowledge,attitudes, beliefs and other related aspects.

The greatest risk of transmission to healthcare workers is via a contaminated needlestick or sharp injuries . HCV is transmitted primarily by direct contact with human blood . transmission through blood transfusion that are not screened for HCV infection , through reuse of inadequately sterilized needles , syringes or other medical equipment , or through needle sharing among drug users , is well documented. Other modes of transmission through social , cultural , and behavioral practices using percutaneous procedures can occur if inadequately sterilized equipment are used. Sexual and parental transmission may also occur , although less frequently . HCV is not spread by sneezing , hugging , coughing , food or water , sharing eating utensils or casual contact , although there are household contacts with unexplained HCV infection .

Middle east countries , including Saudi Arabia , show an intermediate level of hepatitis C infection prevalence . although the disease can lead to huge burden especially in endemic areas , it is preventable. Prevention is the only safe strategy against high prevalence of viral hepatitis.

Having enough knowledge and proper attitudes towards these infections are cornerstone of preventing the spread of them . healthcare workers have the most important role in preventing the disease by improving the disease knowledge among them and the patients , because health services staff are in close with hepatitis infection patients. The present study aims mainly to determine the knowledge level and attitudes of medical interns towards the transmission and patients of HCV in Riyadh city , Saudi Arabia.

### Objectives of the study:-

Several studies had reported evidences regarding the prevention of HCV transmission to patients underlying hemodialysis. Medical interns in the hemodialysis units are supposed to possess enough knowledge regarding HCVprevention, and they have to hold enough experience and training to perform full prevention procedure. Current study aims to investigate and measure the level of knowledge among medical interns in hemodialysis units in King Abdulaziz Medical Cityin Riyadh city, KSA.

### Literature review:-

In a study conducted by Biancoet al (2013) , aimed to investigate and explore knowledge , attitudes and evidence based practices in hemodialysis units in Italy , Bianco and her colleagues had explored 37 hemodialysis units in Calabria region in Italy using a self-administered questionnaire.

Findings of the study had showed that there is a high level of knowledge regarding HCV pattern of transmission (73.7% to 99.3% ). Moreover , study results indicated that there is a positive attitude among the study participants , but it was the highest among the nurses category.

In another study performed by Kabiret al (2010) , aimed to evaluate knowledge , attitudes and behaviors of physicians concerning HBV and HCV. Researchers had distributed a semi-structured questionnaire composed of 29 items on 369 healthcare workers in Iranian hospitals.

Results showed that there is a low to moderate knowledge level among healthcare workers regarding routes of transmission of HBV and HCV and the prevalence rate, and seroconversion rates secondary to a needlestick injury.

Furthermore, results revealed that there was no significant correlation between the different specialties and: 1. Concern about HBV and HCV, 2. The understanding of needlestick injury; and 3. Correct knowledge of post-needlestick HCV infection.

Hu *et al* (2004) had investigated and compared Taiwanese dental students' knowledge of Hepatitis B virus (HBV) and Hepatitis C virus (HCV) and Human Immunodeficiency Virus (HIV), besides to explore their attitudes towards the infected patients and factors impacting their willingness to treat infected patients. They had distributed a self-administered questionnaire with closed ended questions on 1930 dental students in seven dental schools in Taiwan. Results showed that 80%, 75%, and 49% of the respondents were willing to treat HBV, HCV, and HIV patients, respectively. Moreover, it was found that students were less knowledgeable about HCV infection compared to HBV and HIV infections.

A study conducted by Ghanaei *et al* (2013) aimed to determine the knowledge level and attitudes of medical students in Guilan University towards hepatitis B and C viral infections. Study sample was composed of 424 medical students, and a standardized questionnaire was applied on the study sample. Results showed that there is a weak knowledge and attitude level of medical students, especially in the preventive methods, and in those groups of students who have less close contact with the patients. Moreover, study found that there is a positive correlation between students' knowledge and attitudes towards HBV and HCV infections.

One year later, Elkazeh *et al* (2014) had conducted a study to assess the knowledge level and attitudes towards patients with hepatitis C among nursing interns in Tanta university hospital. Descriptive correlation study was implemented on a convenient sample of 200 nursing interns. A pre-designed questionnaire was developed and applied on the study sample. Results showed that 11.5% of nursing interns had poor knowledge, 66.5% had a moderate knowledge and 28% had a good level of knowledge about patients with hepatitis C. Also, 50.5% of the nursing interns showed positive attitudes and 73.2% of them had good level of knowledge, while 49% of nursing interns had negative attitudes towards patients with hepatitis and only 26.8% of them were having a good level of knowledge.

Moreover, Shahbaz *et al* (2014) had performed a study entitled as "Hepatitis B and C: knowledge, attitudes and perception of medical students at Lahore medical and dental college, Lahore. As a descriptive cross sectional survey that involved the implementation of an evaluation questionnaire distributed over 280 medical students in different academic years. Results showed that about 80 – 90% showed a good knowledge level about transmission and prevention of these infections. Furthermore, results had indicated that medical students level of knowledge was associated with the academic grade, and the overall knowledge was found to be high, but vaccination status was low for this particular group.

Abdela *et al* (2016) had investigated and assessed the knowledge, attitudes, and practices toward prevention of hepatitis viral infection among students of medicine and health sciences in northwest Ethiopia. A cross sectional study was conducted on 246 students of healthcare professions. Results showed that majority of the study participants (more than 80%) had an adequate knowledge on risk factors of hepatitis viral infection, its mode of transmission, and preventions. About 83.3% of the respondents had positive attitudes towards following infection control guidelines, while 81.7% of the respondents believe that all healthcare workers should take hepatitis vaccinations.

#### **Justification of the study:-**

Several studies had reported that there is an increasing prevalence rate of Hepatitis C infection. Moreover, studies had showed that healthcare workers who are in direct contact with Hepatitis C patients are the most exposed category to HCV infection, which requires the healthcare workers to possess high level of knowledge and positive attitudes towards the transmission, prevention and patients of Hepatitis C viral infection.

Study setting representing the selected hospital, had reported verbally that there is an increasing rate of HCV infection among citizens and healthcare workers in the recent years. Which had motivated the researcher to perform this study.



Finally, one of the motivating factors to perform this study is the lack of the regional studies in Saudi Arabia, that examines and investigates the healthcare workers attitudes and knowledge level regarding HCV patients and transmission methods of the viral infection.

#### **Limitations of the study:-**

1. Current study has a narrow scope due to several limitations that could influence the results of the study, they are:
2. Restricted geographical spot of the study which limits the generalization of the study results to other areas.
3. Study sample is restricted to medical interns who are in direct contact with HCV patients, ignoring other healthcare workers categories, such as nurses and lab technicians.
4. Other aspects of HCV infection knowledge are not covered by this study, such as HCV treatment.
5. Limited size of the study sample could limit the validity of the results.

#### **Research design and methodology:-**

A cross sectional descriptive study, including 100 Saudi medical interns in hemodialysis units in King Abdulaziz Medical City in Riyadh city, Kingdom of Saudi Arabia.

Study population is represented by both male and female medical interns working, or previously worked in hemodialysis units in King Abdulaziz Medical City in Riyadh city, Kingdom of Saudi Arabia.

#### **Study setting:-**

The study will be conducted in the hemodialysis units in King Abdulaziz Medical City in Riyadh city, Kingdom of Saudi Arabia.

#### **Sample size, selection of sample and data collection:-**

Convenient sampling will be performed to get the study sample. Data will be collected using a semi structured questionnaire.

Socio-demographic data of the participants will be collected by another part of the study questionnaire.

Data regarding medical interns knowledge and attitudes towards Hepatitis C virus transmission will be collected using the study instrument that will be built in using available literature review.

Data analysis will be performed after coding study participants' responses using Statistical Package for Social Sciences (SPSS) software. Frequencies, percentages, means, and standard deviations will be utilized to extract the study results.

**Reliability:** Reliability of the study tool will be checked using Cronbach's Alpha coefficient.

**Validity:** The content validity of the research tool for its completeness and clarity had been maintained through literature review and consultation with concerned advisor.

#### **Ethical considerations and human subject issues**

- Formal approval will be obtained from the concerned authorities.
- Informed verbal consent will be obtained from study subjects before participating
- Confidentiality will be maintained throughout the study and will be maintained later.
- It is voluntary to participate in the study.

#### **Results and discussion:-**

This study aims to investigate and assess the knowledge of medical interns regarding hepatitis C virus transmission methods, besides to determining their attitudes towards hepatitis C virus patients.

In this chapter, we present a detailed preview of the study results based on the study participants responses to the study instrument (Appendix A)

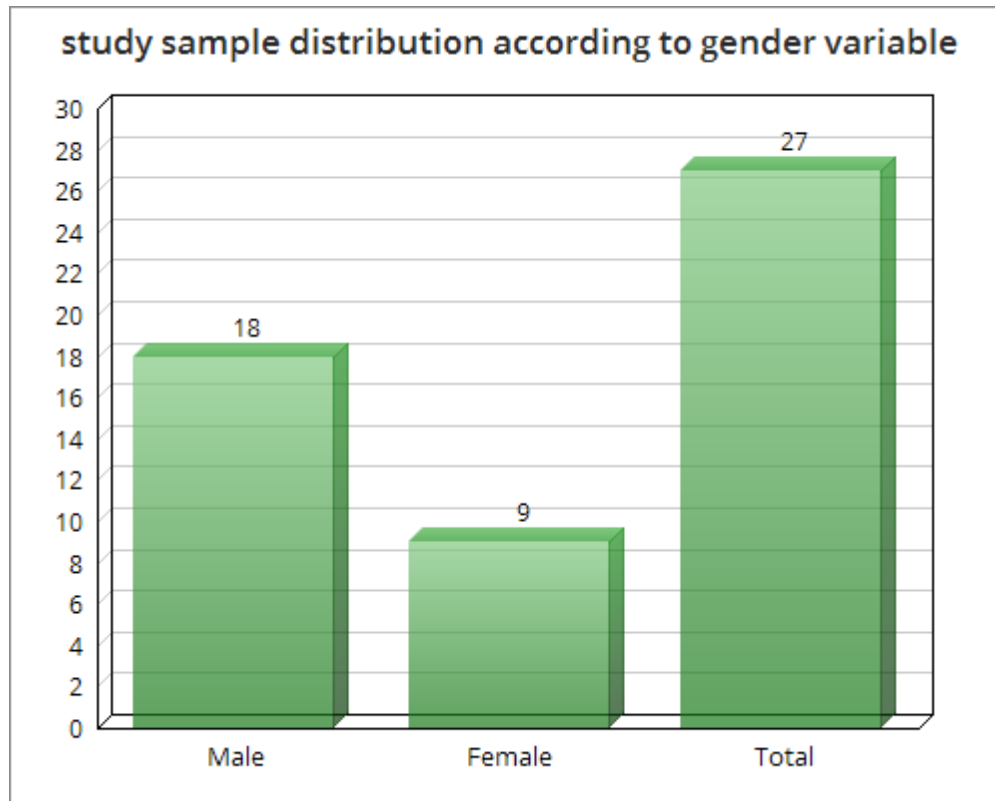
#### **Study sample distribution according to Age variable:-**

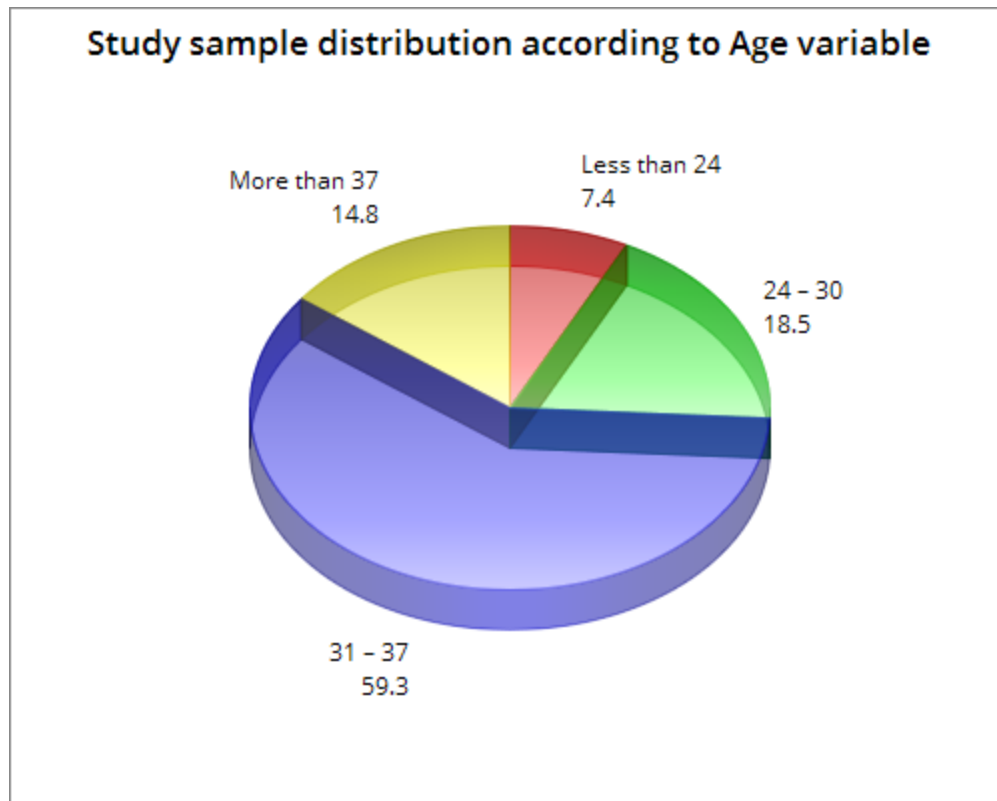
Results presented in table (1) show that participants ranging in age between 31 to 37 were representing the highest category among the study participants and constituted 59.3%, followed by the category of the participants ranging in age between 24 to 30 years (18.5%). The third rank, was for the medical interns who were more than 37 years

old (14.8%) , and finally came the category representing the participants who were less than 24 years old , and constituted 7.4% of the total study sample.

**Table 1:-** Study sample distribution according to Age variable

Category	Frequency	Percentage
Less than 24	2	7.4%
24 – 30	5	18.5%
31 – 37	16	59.3%
More than 37	4	14.8%
Total	27	100%





**Study sample distribution according to gender variable:-**

Results shown in table (2) indicate that about two thirds (66.7%) of the study sample were males , while one third (33.3%) was of females.

**Table 2:-** study sample distribution according to gender variable

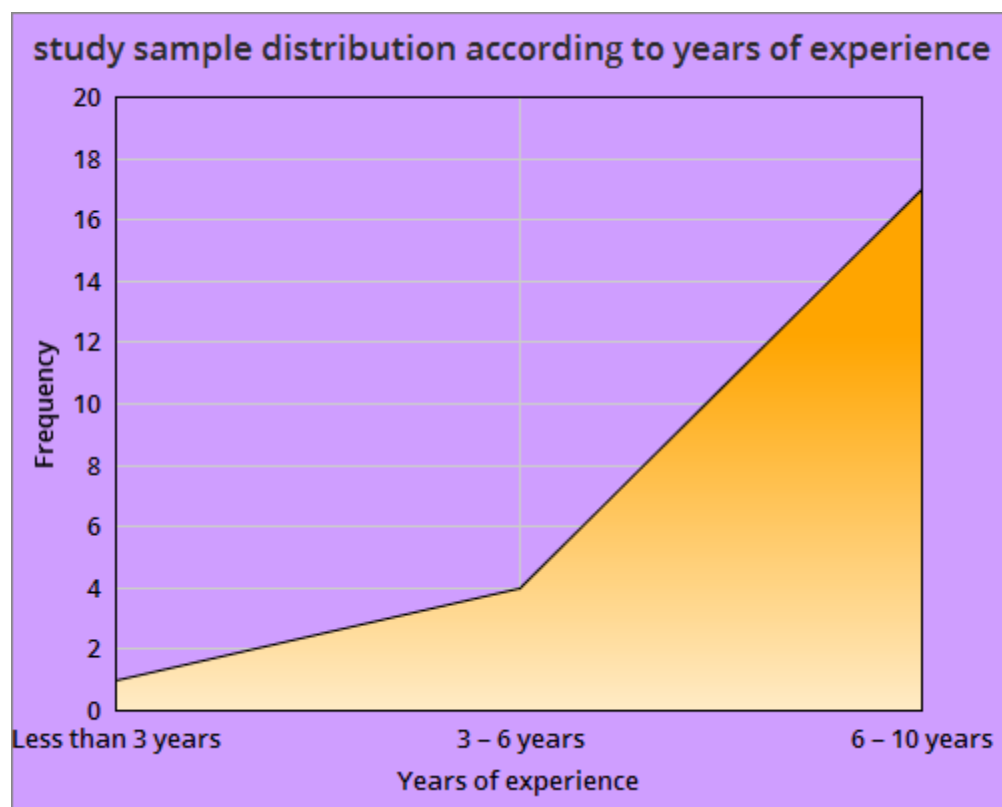
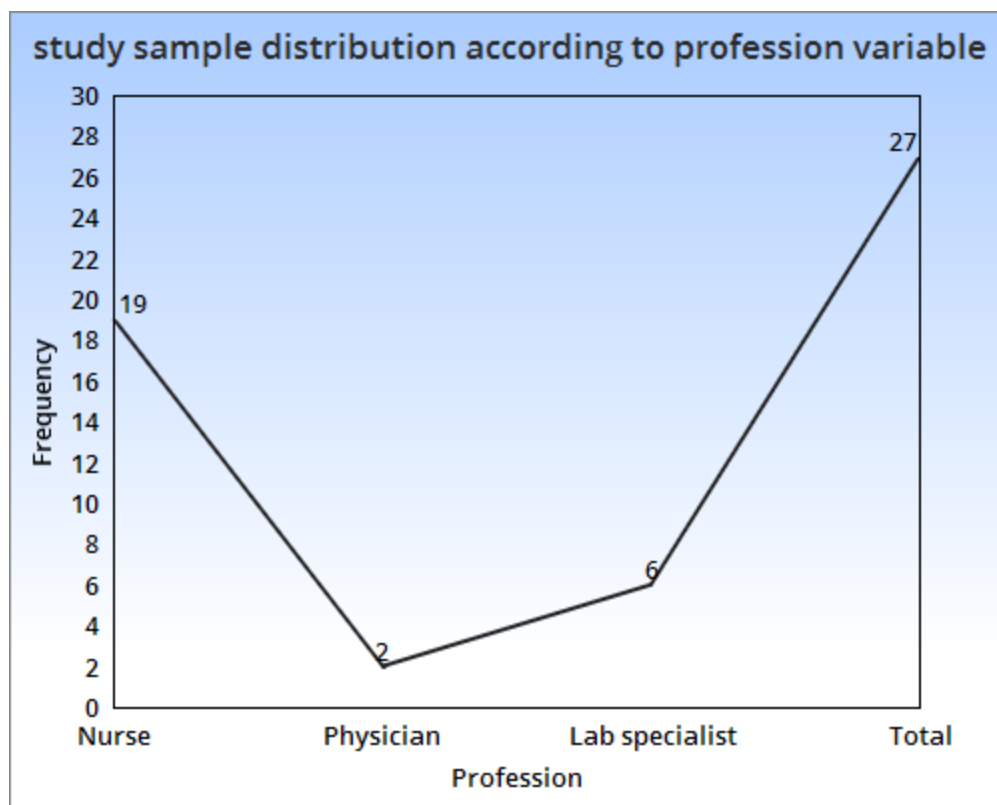
Gender	Frequency	Percentages
Male	18	66.7%
Female	9	33.3%
Total	27	100%

**Sample distribution according to profession variables:-**

Study sample distribution according to profession variable shows that the majority of the study sample is composed of nurses (70.4%) , followed by laboratory specialists category (22.2%) , and the least represented category were the physicians who constituted 7.4% of the total study sample .

**Table 3:-** study sample distribution according to profession variable

Profession	Frequency	Percentage
Nurse	19	70.4%
Physician	2	7.4%
Lab specialist	6	22.2%
Total	27	100%



### Study sample distribution according to participants years of experience

Results presented in table (4) show that the most represented category according to the number of experience years was for participants whose their experience was ranging between 6 to 10 years and constituted (63%) , while those who exceeded 10 years of experience came secondly by a percentage equals to 18.5% . moreover , participants possessing an experience period ranging between 3 to 6 years constituted 14.8% , while the least represented category was those whose their experience years were less than 3 years and constituted (3.7%) of the total study sample.

**Table 4:-** study sample distribution according to years of experience

Years of experience	Frequency	Percentage
Less than 3 years	1	3.7%
3 – 6 years	4	14.8%
6 – 10 years	17	63%
Total	27	100%

### Mean and standard deviation scores for the knowledge and attitudes scale items:-

Table (5) shows the mean and standard deviation scores of the knowledge and attitudes scale . it is clear from the previous results that there is a high level of knowledge regarding HCV transmission methods. Participants showed that they have a good knowledge level regarding HCV transmission through Saliva ( $2.89 \pm 0.75$ ) , and transmission through blood transfusion from an infected donor ( $2.74 \pm 1.03$ ) , and for the negative items , the low score means higher knowledge . for example , participants showed higher knowledge regarding that ingestion of HCV contaminated food ( $1.59 \pm 0.56$ ) is not a transmission method, as well as kissing an HCV positive individuals ( $1.93 \pm 0.39$ ) and transmission is possible via breast feeding (wrong statement) ( $1.36 \pm 0.73$ ).

Furthermore , participants had showed that they possess a good knowledge level for the positive statements stating that " sharing needles while injecting drugs is a transmission method " ( $2.86 \pm 0.71$ ) , and being born to an HCV positive mother ( $2.94 \pm 0.61$ )

Responses to questionnaire items measuring participants knowledge about HCV prevention , had showed that there is a high level of knowledge among medical interns . for example , participants showed a good level of knowledge in that using gloves is useful in preventing HCV infection ( $2.86 \pm 0.44$ ) , and avoiding renal transplantation can prevent HCV infection ( $2.54 \pm 0.64$ ).

Items designed to investigate attitudes of medical interns towards HCV patients had showed that there is a positive attitude among the study participants regarding willingness to treat people with HCV ( $2.21 \pm 0.33$ ) , and their feelings towards people who contacted HCV through a blood transfusion ( $2.76 \pm 1.01$ ) . finally , participants responded negatively to the negative items stating " I don't like treating people with HCV infection " ( $1.31 \pm 0.72$ ) which indicates to their positive attitudes towards HCV patients.

**Table 5:-** Mean and standard deviation scores for the study instrument items

Item	Mean	Standard deviation
Transmission is possible via saliva	2.89	0.75
Receiving a blood transfusion from an infected donor	2.74	1.03
Ingestion of HCV contaminated food	1.59	0.56
Sharing needles while injecting drugs	2.86	0.71
Kissing an HCV- positive individual	1.93	0.39
Being born to an HCV positive mother	2.94	0.61
Using gloves is useful in preventing HCV infection	2.86	0.44
Avoiding renal transplantation can prevent HCV infection	2.54	0.64
Transmission is possible via breast feeding	1.36	0.73
I am willing to treat people with HCV	2.21	0.33
I feel sorry for people who contracted HCV through a blood transfusion	2.76	1.01
I don't like treating people with HCV infection	1.31	0.72

**Summary:-**

Hepatitis C is a blood borne infection that is transmitted only by blood . statistics showed that there is an increasing number in HCV infections and increase in mortality rate due to its prevalence.

This study aimed to investigate the knowledge level and attitudes of medical interns in hemodialysis units regarding HCV transmission and HCV patients.

Results showed that medical interns possess a good level of knowledge regarding HCV transmission methods , besides to the good level of knowledge regarding the prevention of HCV infection.

Furthermore , results showed that medical interns have a positive attitudes towards patients infected by HCV , and dealing with them



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### RESEARCH ARTICLE

#### COMPLICATION AND OUTCOMES ASSOCIATED WITH SURGICAL MANAGEMENT OF RENAL CELL CARCINOMA: LITERATURE REVIEW.

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#### Abstract

Renal cell carcinoma (RCC) represent 90% to 95% of malignant neoplasms developing from the kidney. Current advances in surgical and systemic treatments have actually significantly altered the management of RCC. Therefore, This review aimed to discuss and evaluate the most common complications and outcomes Associated with Surgical Management of Renal Cell Carcinoma, through different trails from all around the world, which are based evidence ones.

We performed a comprehensive review of the literature based on free-text search in the National Library of Medicine Database MEDLINE using the following keywords: partial-nephrectomy, nephron-sparing surgery, cytoreductive-nephrectomy and metastatic renal cell carcinoma. Filtered for human trails, articles published in English to November 2016 were included in this article.

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#### Introduction:-

Renal cell carcinoma (RCC) represent 90% to 95% of malignant neoplasms developing from the kidney. Current advances in surgical and systemic treatments have actually significantly altered the management of RCC<sup>(1)</sup>. Regardless of the earlier detection of smaller sized kidney tumors, the rate of RCC-related mortality has actually increased<sup>(2,3)</sup>, recommending that recurrence and advanced disease are responsible for mortality. RCC consists of a heterogeneous group of growths with distinct genetic and metabolic defects, in addition to histopathologic and scientific functions (**Table1**)<sup>(4)</sup>. Medullary carcinomas are unusual however aggressive, and are specifically associated with sickle cell trait. Targeted treatments against the vascular endothelial development factor (VEGF) pathway have extended the lives of the patients with innovative disease significantly, with average total survival currently surpassing 2 years<sup>(1)</sup>.

With an estimated incidence of 61,560 cases and 13,040 deaths in 2015, renal cell cancer (RCC) stays a crucial and common reason for cancer death in the United States<sup>(5)</sup>. Around 25%-30% of patients have metastatic disease at the time of diagnosis<sup>(6,7,8,9,10)</sup>, which is connected with a mean survival of 1-2 years (11,12,13). Up until recently, immunotherapy, such as interleukin-2 and interferon-alpha, was the only readily available systemic treatment choices for metastatic RCC<sup>(14,15,16,17,18)</sup>; nevertheless, over the past years, treatment choices have actually increased significantly with the approval of numerous targeted treatment agents<sup>(18)</sup>. I Few studies exist examining the utility and efficiency of more aggressive surgical intervention for in your area advanced or metastatic RCC including the

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liver. Furthermore, concurrent surgical resection of the liver at the time of radical nephrectomy is connected with substantial morbidity, which might exceed the benefits of surgically debulking RCC<sup>(19,20,21,22)</sup>.

Even after surgical resection for clinically localized disease, 20 to 40% of patients will regression and have a poor prognosis with respect to long-lasting survival<sup>(23,24)</sup>. Even with the brand-new targeted systemic therapies being developed and authorized in the last years, rarely do they supply long-term or complete reactions. The only possibility of long-lasting treatment and survival of RCC involve surgical interventions consisting of radical nephrectomy, partial nephrectomy (PN), ablative techniques, and, in chosen cases, metastasectomy in mix with multimodal treatment techniques<sup>(25)</sup>.

Table 1. Classification of Renal Cell Carcinoma

Histology	Frequency	Cell of Origin
Clear cell	60%-70%	Proximal tubule
Papillary	5%-15%	Proximal tubule
Chromophobic	5%-10%	Cortical collecting duct
Oncocytic	5%-10%	Cortical collecting duct
Collecting duct	<1%	Medullary collecting duct

This Review aimed to discuss and evaluate the most common complications and outcomes Associated with Surgical Management of Renal Cell Carcinoma, through different trails from all around the world, which are based evidence ones.

### Methodology:-

We performed a comprehensive review of the literature based on free-text search in the National Library of Medicine Database MEDLINE using the following keywords: *partial-nephrectomy*, *nephron-sparing surgery*, *cytoreductive-nephrectomy* and *metastatic renal cell carcinoma*. Filtered for human trails, articles published in English to November 2016 were included in this article. Based on the relevance of the content, our review consisted of several articles. Of note, the reviewed literature had a low level of evidence, constituted by case reports, small case series and reviews.

### Results and Discussion:-

#### Less Prognosis of All RCC:-

Patients with Small RCC appear to have the worst diagnosis of all RCC. Couple of patients show extended survival; those who do generally present with early-stage disease (phase I and stage II)<sup>(26)</sup>. Most of series report an average survival time of just 4-9 months after medical diagnosis<sup>(27,28,29,30,31)</sup>. Compared to other patients with top-quality RCCs, those with sRCCs still have a worse diagnosis. Numerous series have validated the presence of sarcomatoid features to be an independent predictor of bad survival<sup>(27,32,33)</sup>. The existence of sarcomatoid components might be one of the most prominent prognostic variables for patient result<sup>(28)</sup>. Numerous studies have looked at the impact of the percentage of sarcomatoid transformation on prognosis and demonstrated that greater amounts were associated with a worse result<sup>(26,27,28)</sup>.

#### Roles of surgical management methods and their complications or RCC:-

For most RCC patients who provide at a sophisticated phase with a big, large tumor, surgical treatment can be really difficult, and generally radical nephrectomy is required. Regularly, these growths are connected with an intense desmoplastic reaction and resection of surrounding organs might be needed. In a series of patients undergoing cytoreductive nephrectomy, > 25% of them had T4 disease and 33% had favorable lymph nodes<sup>(28)</sup>. As such, significant morbidity may be inevitable in innovative cases.

Lymph node dissection in the lack of medical disease has actually been omitted due to the fact that of level I evidence<sup>(34)</sup>, Blute and associates at the Mayo Clinic advised extended lymph node dissection if sarcomatoid functions are identified at the time of surgery<sup>(35)</sup>.

A) **Cytoreductive nephrectomy (CN)** is utilized in patients with RCC who initially present in a metastatic RCC (mRCC) setting. 2 prospective randomized trials showed remarkable progression-free survival and OS in patients going through CN followed by immunotherapy compared with immunotherapy alone<sup>(36,37)</sup>. In a combined analysis, patients treated with CN and immunotherapy had a survival benefit of 13.6 versus 7.8 months in patients going through immunotherapy alone<sup>(40)</sup>. This is the factor that CN for patients with mRCC



has actually been extensively embraced, although only patients with excellent overall performance status were included and some poor prognostic metastatic sites (brain) were excluded, presenting a selection predisposition. CN is substantially more complex than basic RN, with in-hospital death rates of 5%, suggesting the need for cautious patient selection <sup>(41)</sup>. In the setting of metastatic RCC, level I evidence supports the benefits of cytoreductive nephrectomy prior to prepared immunotherapy <sup>(36,37)</sup>. Although the new era of targeted therapy has demonstrated responses in the primary tumor, cytoreductive nephrectomy typically remains an integral part of therapy <sup>(38,39)</sup>. Whereas cytoreductive surgery still has a major function in the treatment of metastatic RCC, for patients with sRCC, numerous question the survival benefit of cytoreductive surgical treatment <sup>(28,29)</sup>. The aggressive nature of this disease might lead to quick disease progression with postponed initiation of systemic therapy to enable postoperative convalescence <sup>(39)</sup>. Previous experience with these patients has indicated that ~ 60% cannot proceed to systemic therapy after surgery <sup>(28)</sup>.

- B) Radical Nephrectomy (RN);** radical nephrectomy has actually been the gold standard of dealing with deadly kidney masses with a curative intent for years <sup>(42)</sup>. In contrast to previously described pericapsular nephrectomy, radical nephrectomy consisted of the en bloc resection of the entire kidney in addition to the surrounding perinephric fat, the ipsilateral adrenal gland, and the local lymph nodes <sup>(42)</sup>. This improved overall survival (OS) significantly at that time to around 65% for localized RCC <sup>(42)</sup>. In the 1990s, minimally intrusive techniques to radical nephrectomy were established, and consequently laparoscopic radical nephrectomy (LRN) has actually ended up being an extensively adopted treatment <sup>(43)</sup>. LRN is carried out by transperitoneal, retroperitoneal, and hand-assisted methods. Due to equivalent oncologic control with lower morbidity, enhanced complication profile, and faster convalescence than ORN, LRN is now considered requirement in a patient population not amenable to NSS and with growth stages approximately T1-3, N0, M0 <sup>(44,45,46,47)</sup>. Numerous studies demonstrated improved perioperative and postoperative results such as decreased blood loss, reduced personnel time, shorter hospital stay, less need for analgesia, and faster healing to normal exercise <sup>(48,49)</sup>.
- C) Partial nephrectomy or nephron-sparing surgery (NSS);** is considered the treatment of option for localized small kidney masses with oncological outcome in cases of renal cell cancer (RCC) comparable to radical nephrectomy <sup>(50)</sup>. Using NSS has the advantage of preserving kidney function with lower cardiovascular death and morbidity <sup>(51,52,53,54)</sup>. NSS is considered the treatment of choice for localized little renal masses, <sup>(50)</sup> with oncological result comparable to Registered Nurse, and benefits of maintaining renal function and lowering cardiovascular death and morbidity <sup>(51,52,53,54)</sup>. Due to the fact that chronic kidney disease (CKD, glomerular filtering rate <60 mL/min/1.73 m<sup>2</sup>) is more widespread in a RCC patient, <sup>(52,54)</sup> the benefit of NSS can be appreciated in this study from Memorial-Sloan Kettering that found the incidence of new-onset CKD in patients with normal serum creatinine and two operating kidneys, who had actually gone through NSS and RN for little renal masses, to be 17% and 69%, respectively <sup>(53)</sup>. There is installing evidence in the literature that tumor characteristics instead of surgical method figured out CSS and OS (55,56). This evidence led to the expansion of the utility of NSS in tumors larger than 4 cm and in your area advanced RCC. In a research study by Margulis et al., the oncological efficacy of NSS versus Registered Nurse in patients with in your area advanced RCC was compared. In the comparison of 34 patients going through NSS and 567 patients undergoing RN, the CSS curves demonstrated comparable result <sup>(57)</sup>.

### Conclusion:-

Surgical resection represents the requirement of take care of handling patients with kidney masses. Radical nephrectomy is the gold requirement for bigger kidney masses, whereas nephron-sparing PN is the preferred treatment modality for T1a growths. NSS, when possible, might be a feasible option for surgical debulking in metastatic RCC. For patients with primary growths open to NSS, developed prognostic factors can be utilized for patient choice. Patients more than likely to take advantage of a nephron-sparing method are those for whom Registered Nurse is not feasible due to preexisting kidney impairment and patients with restricted metastatic disease anticipated to enjoy extended survival with a mix surgical intervention and systemic treatment. The very same benefit as resection of a systemic metastasis is suggested to be real for isolated local recurrence of RCC. Also, complete and aggressive surgical resection can supply long lasting local growth control, and a multimodal technique with th combination of systemic treatment should be considered in these patients

**References:-**

1. Motzer RJ, Hutson TE, Tomczak P, et al. Overall survival and updated results for sunitinib compared with interferon alfa in patients with metastatic renal cell carcinoma. *J Clin Oncol*. 2009;27(22):3584-3590.
2. Rini BI, Campbell SC, Escudier B. Renal cell carcinoma. *Lancet*. 2009;373(9669):1119-1132.
3. Hollingsworth JM, Miller DC, Daignault S, Hollenbeck BK. Rising incidence of small renal masses: a need to reassess treatment effect. *J Natl Cancer Inst*. 2006;98(18):1331-1334.
4. Linehan WM, Srinivasan R, Schmidt LS. The genetic basis of kidney cancer: a metabolic disease. *Nat Rev Urol*. 2010;7(5):277-285.
5. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2015. *CA Cancer J Clin*. 2015;65:5-29. 2.
6. Lam JS, Leppert JT, Belldegrun AS, Figlin RA. Novel approaches in the therapy of metastatic renal cell carcinoma. *World J Urol*. 2005;23:202-212. 3.
7. Motzer RJ, Bander NH, Nanus DM. Renal-cell carcinoma. *N Engl J Med*. 1996;335:865-875.
8. Hainsworth JD, Sosman JA, Spigel DR, Edwards DL, Baughman C, Greco A. Treatment of metastatic renal cell carcinoma with a combination of bevacizumab and erlotinib. *J Clin Oncol*. 2005;23:7889- 7896.
9. Mickisch GH. Multimodality treatment of metastatic renal cell carcinoma. *Expert Rev Anticancer Ther*. 2002;2:681-685.
10. Staehler M, Rohrmann K, Haseke N, Stief CG, Siebels M. Targeted agents for the treatment of advanced renal cell carcinoma. *Curr Drug Targets*. 2005;6:835-846.
11. Heng DY, Xie W, Regan MM, et al. External validation and comparison with other models of the International Metastatic RenalCell Carcinoma Database Consortium prognostic model: a populationbased study. *Lancet Oncol*. 2013;14:141-148.
12. Wahlgren T, Harmenberg U, Sandstrom P, et al. Treatment and overall survival in renal cell carcinoma: a Swedish population-based study (2000-2008). *Br J Cancer*. 2013;108:1541-1549.
13. Ko JJ, Xie W, Kroege N, et al. The International Metastatic Renal Cell Carcinoma Database Consortium model as a prognostic tool in patients with metastatic renal cell carcinoma previously treated with first-line targeted therapy: a population-based study. *Lancet Oncol*. 2015;16:293-300.
14. Motzer RJ, Russo P. Systemic therapy for renal cell carcinoma. *J Urol*. 2000;163:408-417. 11.
15. Eton DT, Cella D, Bacik J, Motzer RJ. A brief symptom index for advanced renal cell carcinoma. *Health Qual Life Outcomes*. 2006;4:68.
16. Bukowski RM. Natural history and therapy of metastatic renal cell carcinoma: the role of interleukin-2. *Cancer*. 1997;80:1198-1220.
17. Yang JC, Topalian SL, Parkinson D, et al. Randomized comparison of high-dose and low-dose intravenous interleukin-2 for the therapy of metastatic renal cell carcinoma: an interim report. *J Clin Oncol*. 1994;12:1572-1576.
18. Yang JC, Sherry RM, Steinberg SM, et al. Randomized study of highdose and low-dose interleukin-2 in patients with metastatic renal cancer. *J Clin Oncol*. 2003;21:3127-3132. 15.
19. Lombardi G, Zustovich F, Donach M, Dalla Palma M, Nicoletto O, Pastorelli D. An update on targeted therapy in metastatic renal cell carcinoma. *Urol Oncol*. 2012;30:240-246.
20. Yezhelyev M, Master V, Egnatashvili V, Kooby DA. Combined nephrectomy and major hepatectomy: indications, outcomes, and recommendations. *J Am Coll Surg*. 2009;208:410-418.
21. Staehler MD, Kruse J, Haseke N, et al. Liver resection for metastatic disease prolongs survival in renal cell carcinoma: 12-year results from a retrospective comparative analysis. *World J Urol*. 2010;28:543- 547.
22. Dabestani S, Marconi L, Hofmann F, et al. Local treatments for metastases of renal cell carcinoma: a systematic review. *Lancet Oncol*. 2014;15:e549-e561
23. Gupta K, Miller J D, Li J Z, Russell M W, Charbonneau C. Epidemiologic and socioeconomic burden of metastatic renal cell carcinoma (mRCC): a literature review. *Cancer Treat Rev*. 2008;34(3):193-205.
24. Lam J S, Shvarts O, Leppert J T, Figlin R A, Belldegrun A S. Renal cell carcinoma 2005: new frontiers in staging, prognostication and targeted molecular therapy. *J Urol*. 2005;173(6):1853-1862.
25. Escudier B. Emerging immunotherapies for renal cell carcinoma. *Ann Oncol*. 2012;23 08:viii35-40.
26. de Peralta-Venturina M, Moch H, Amin M, et al. Sarcomatoid differentiation in renal cell carcinoma: A study of 101 cases. *Am J Surg Pathol*. 2001;25:275-284.
27. Cheville JC, Lohse CM, Zincke H, et al. Sarcomatoid renal cell carcinoma: An examination of underlying histologic subtype and an analysis of associations with patient outcome. *Am J Surg Pathol*. 2004;28:435-441.
28. Shuch B, Said J, La Rochelle JC, et al. Cytoreductive nephrectomy for kidney cancer with sarcomatoid histology—is up-front resection indicated and, if not, is it avoidable? *J Urol*. 2009;182:2164-2171.

29. Mian BM, Bhadkamkar N, Slaton JW, et al. Prognostic factors and survival of patients with sarcomatoid renal cell carcinoma. *J Urol.* 2002;167:65–70.
30. Tomera KM, Farrow GM, Lieber MM. Sarcomatoid renal carcinoma. *J Urol.* 1983;130:657–659.
31. Sella A, Logothetis CJ, Ro JY, et al. Sarcomatoid renal cell carcinoma. A treatable entity. *Cancer.* 1987;60:1313–1318.
32. Shuch B, La Rochelle JC, Wu J, et al. Performance status and cytoreductive nephrectomy: Redefining management in patients with poor performance. *Cancer.* 2008;113:1324–1331.
33. Moch H, Gasser T, Amin MB, et al. Prognostic utility of the recently recommended histologic classification and revised TNM staging system of renal cell carcinoma: A Swiss experience with 588 tumors. *Cancer.* 2000;89:604–614.
34. Blom JH, van Poppel H, Marechal JM, et al. Radical nephrectomy with and without lymph node dissection: Preliminary results of the EORTC randomized phase III protocol 30881. EORTC Genitourinary Group. *Eur Urol.* 1999;36:570–575.
35. Blute ML, Leibovich BC, Cheville JC, et al. A protocol for performing extended lymph node dissection using primary tumor pathological features for patients treated with radical nephrectomy for clear cell renal cell carcinoma. *J Urol.* 2004;172:465–469.
36. Mickisch GH, Garin A, van Poppel H, et al. Radical nephrectomy plus interferon-alfa-based immunotherapy compared with interferon alfa alone in metastatic renal-cell carcinoma: A randomised trial. *Lancet.* 2001;358:966–970.
37. Flanigan RC, Salmon SE, Blumenstein BA, et al. Nephrectomy followed by interferon alfa-2b compared with interferon alfa-2b alone for metastatic renal-cell cancer. *N Engl J Med.* 2001;345:1655–1659.
38. Pantuck AJ, Belldegrun AS, Figlin RA. Cytoreductive nephrectomy for metastatic renal cell carcinoma: Is it still imperative in the era of targeted therapy? *Clin Cancer Res.* 2007;13:693s–696s.
39. Kutikov A, Uzzo RG, Caraway A, et al. Use of systemic therapy and factors affecting survival for patients undergoing cytoreductive nephrectomy. *BJU Int.* 2010;106:218–223.
40. Flanigan R C, Mickisch G, Sylvester R, Tangen C, Van Poppel H, Crawford E D. Cytoreductive nephrectomy in patients with metastatic renal cancer: a combined analysis. *J Urol.* 2004;171(3):1071–1076.
41. Trinh Q D, Bianchi M, Hansen J et al. In-hospital mortality and failure to rescue after cytoreductive nephrectomy. *Eur Urol* 2012(Sep):7
42. Robson C J, Churchill B M, Anderson W. The results of radical nephrectomy for renal cell carcinoma. *J Urol.* 1969;101(3):297–301.
43. Kerbl K, Clayman R V, McDougall E M, Kavoussi L R. Laparoscopic nephrectomy. *BMJ.* 1993;307(6917):1488–1489.
44. Gill I S, Meraney A M, Schweizer D K. et al. Laparoscopic radical nephrectomy in 100 patients: a single center experience from the United States. *Cancer.* 2001;92(7):1843–1855.
45. Chan D Y, Cadeddu J A, Jarrett T W, Marshall F, Kavoussi L R. Laparoscopic radical nephrectomy: cancer control for renal cell carcinoma. *J Urol* 2001;166:2095–2099. 2099, discussion 2099–2100
46. Wille A H, Roigas J, Deger S, Tüllmann M, Türk I, Loening S A. Laparoscopic radical nephrectomy: techniques, results and oncological outcome in 125 consecutive cases. *Eur Urol* 2004;45:4483–4488. 4488, discussion 4488–4489
47. Hemal A K, Kumar A, Gupta N P, Kumar R. Oncologic outcome of 132 cases of laparoscopic radical nephrectomy with intact specimen removal for T1-2N0M0 renal cell carcinoma. *World J Urol.* 2007;25(6):619–626.
48. Dunn M D, Portis A J, Shalhav A L. et al. Laparoscopic versus open radical nephrectomy: a 9-year experience. *J Urol.* 2000;164(4):1153–1159.
49. McDougall E, Clayman R V, Elashry O M. Laparoscopic radical nephrectomy for renal tumor: the Washington University experience. *J Urol.* 1996;155(4):1180–1185.
50. Van Poppel H, Da Pozzo L, Albrecht W, Matveev V, Bono A, Borkowski A, et al. A Prospective randomized EORTC Intergroup Phase 3 study comparing the complications of elective nephron sparing surgery and radical nephrectomy for low-stage renal cell carcinoma. *Eur Urol.* 2007;51:1606–15.
51. Lau WK, Blute ML, Weaver AL, Torres VE, Zincke H. Matched comparison of radical nephrectomy vs nephron-sparing surgery in patients with unilateral renal cell carcinoma and a normal contralateral kidney. *Mayo Clin Proc.* 2000;75:1236–42.
52. McKiernan J, Simmons R, Katz J, Russo P. Natural history of chronic renal insufficiency after partial and radical nephrectomy. *Urology.* 2002;59:816–20.
53. Huang WC, Elkin EB, Levey AS, Jang TL, Russo P. Partial nephrectomy versus radical nephrectomy in patients with small renal tumors-is there a difference in mortality and cardiovascular outcomes? *J Urol.*

- 2009;181:55–61.
54. Kates M, Badalato GM, Pitman M, McKiernan JM. Increased risk of overall and cardiovascular mortality after radical nephrectomy for renal cell carcinoma 2 cm or less. *J Urol*. 2011;186:1247–53.
  55. Patard JJ, Shvarts O, Lam JS, Pantuck AJ, Kim HL, Ficarra V, et al. Safety and efficacy of partial nephrectomy for all T1 tumors based on an international multicenter experience. *J Urol*. 2004;171:2181–5.
  56. Becker F, Siemer S, Hack M, Humke U, Ziegler M, Stockle M. Excellent longterm cancer control with elective nephron-sparing surgery for selected renal cell carcinomas measuring more than 4 cm. *Eur Urol*. 2006;49:1058–63.
  57. Margulis V, Tamboli P, Jacobsohn KM, Swanson DA, Wood CG. Oncological efficacy and safety of nephron-sparing surgery for selected patients with locally advanced renal cell carcinoma. *BJU Int*. 2007;100:1235–9.

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### RESEARCH ARTICLE

#### CONCENTRATION OF CERAMIDE KINASE (CER) AS ASSAY TO MEASURE CELLULAR LEVELS OF CERAMIDE IN SERUM AND TISSUE BY USING ELIZA TECHNIQUE IN BPH, PC, AND HEALTHY MEN IN IRAQ.

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#### Abstract

Ceramide is subsequently metabolized by ceramide kinase to generate C1P and by ceramidase to generate sphingosine, which is further phosphorylated to S1P by sphingosine kinase. Alternatively again, dephosphorylating of the metabolic derivate also occurs using specific phosphatases, such as C1P phosphatase and S1P phosphatase ceramide can also be produced from sphingosine by ceramide synthase the dynamic regulation for ceramide generation and metabolism is critical for cellular responses to extracellular stimuli, such as death receptor-mediated (TNF-and Fas), chemotherapeutic agent-mediated using in prostate cancer (zoladex , prostate car , and irradiation-mediated (UV and  $\gamma$ -irradiation) . For tumorigenesis, ceramide acts as a tumor-suppressor lipid, whereas S1P acts as a tumor-promoting lipid in BPH and PC cancer comparing with healthy men.

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#### Introduction:-

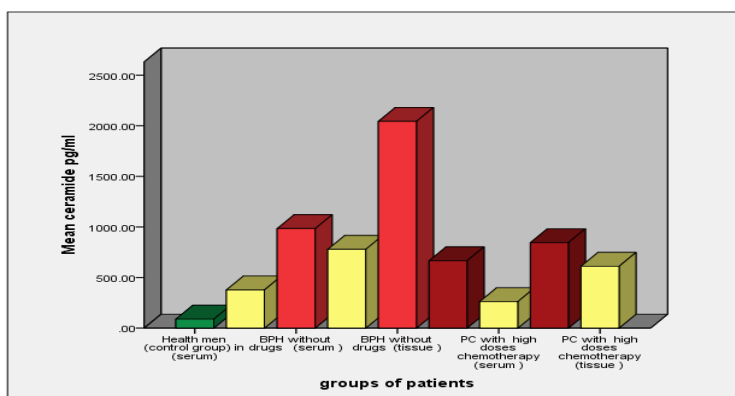
The experimental work was done at The Department of Chemistry and Biochemistry, College of Medicine AL-Nahrain University, and The Ministry of Science and Technology, during the period from (January to Jun) 2016. Sixty patients from men have malignant prostate cancer and Benign Prostatic Hyperplasia, were chosen to be subjected to this study and divided into two groups. The first group (B) consists of (30) patients of men with (BPH), This group was divided into four sub-groups: two groups were serum tested, and other two groups were tissue tested each group consist of (30) samples which were divided according to doses of drugs (high and low dose). The second group (C) consist of (30) patients of men with malignant prostatic cancer. At the same manner of this groups were divided into four sub-groups: two groups were serum tested, the other two groups were tissue tested. Each group consists of (30) samples which were divided according to chemotherapy doses (high and low doses of chemotherapy). The control group was marked (A) consists of (30) samples of healthy men who were free signs and symptoms of prostate cancer, age ranged from (50- 70) years, were nonsmokers, free from Diabetic mellitus, hypertension, renal function disease, and family history of prostatic cancer. All samples were collected from Al-Imameen Al-Kademen Medical City, AL-Jawad Oncology Centre, Medical City-Hospital Martyr Ghazi Al-Hariri for Specialized Surgery, AL-Yarmok Hospital, Educational Oncology Hospital, Special Nursing Hospital, and AL-Saadon Privet Hospital.

In this study it has been developed through examination to assess the Ceramide kinase as assay to measure concentration of ceramide in Serum and Tissue into three groups (control, BPH, and PC) of patients by using Elisa Kit and this Figure (1) shows standard curve of Ceramide in serum and tissue, and The (Mean  $\pm$  SD) of Cer in serum

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and tissue had shown an increase in the patient with BPH and malignant prostatic cancer in comparing to with control group as in Table (1). Membrane sphingolipid, regulators for cell growth, death, senescence, adhesion, migration, angiogenesis, inflammation, and intracellular trafficking, are bioactive metabolites including sphingosine, ceramide, sphingosine-1-phosphate (S1P), and ceramide-1-phosphate (C1P). Apoptosis or Type I programmed cell death, is essential for the maintenance of normal cellular homeostasis and is an important physiological response to many forms of cellular stress. One of the most studied roles of ceramide pertains to its function as a proapoptotic molecule. Ceramide accumulation has been found following treatment of cells with a number of apoptotic agents including ionizing radiation, UV light, TNF-alpha, and chemotherapeutic agents. (Saddoughi et al., 2008). This suggests a role for ceramide in the biological responses of all these agents. Because of its apoptosis-inducing effects in cancer cells, ceramide has been termed the tumor suppressor lipid. Several studies have attempted to define further the specific role of ceramide in the events of cell death and some evidence suggests ceramide functions upstream of the mitochondria in inducing apoptosis. It is owing to the conflicting and variable nature of studies into the role of ceramide in apoptosis, the mechanism by which this lipid regulates apoptosis remains elusive (Spiegel, S, et al, 2002).



**Figure 1:-** concentration of Ceramide (pg/ml) in serum and Tissue in BPH, PC, and matched with Healthy Men

**Table 1:-** Mean  $\pm$  SD of Cer levels in men Serum and Tissue with Prostatic Cancer, Benign Prostatic Hyperplasia and Healthy Men

Groups	Mean of peak area $\pm$ SD for serum groups	P value between serum groups	Mean of peak area $\pm$ SD for tissue groups	P value between tissue groups
Control	88.73 $\pm$ 43.16	P<0.001		P<0.001
BPH without drugs	377.50 $\pm$ 198.15		778.25 $\pm$ 106.55	
BPH with drugs	983.50 $\pm$ 174.67		2043.62 $\pm$ 38.50	
Prostatic cancer low doses chemotherapy	665.62 $\pm$ 222.17	P<0.001	844.87 $\pm$ 108.79	P<0.001
Prostatic cancer high doses chemotherapy	261.50 $\pm$ 90.37		610.87 $\pm$ 92.29	

Determination Concentration of Ceramide kinase (CERK) in Enzyme Linked Immunosorbent Assay (ELIZA) A double -antibody sandwich enzyme-linked immunosorbent one step process assay (ELISA) one stop process was used to measure Ceramide kinase (CERK) in serum and tissue samples.

#### Standard preparation:-

The Standard was diluted with Standard diluents in the method of Multiple proportion dilution and the concentrations were followed: (0, 75, 150, 300, 600, 1200 pg/ml).

#### Reagent Preparation:

20  $\times$  dilution of washing buffer: distilled water, diluted by 1:20, or 1 copy of the 20  $\times$  washing buffer plus 19 copies of the distilled water 5.

**Washing Method:-**

Manually washing method was emptied the plate by inverting it and shaking the content out, and then it was taped on the absorbent papers to dry. At least 0.35ml washing solution was added into each well, and the plate was soaked for 1~2 minutes. This process was repeated for 5 times.

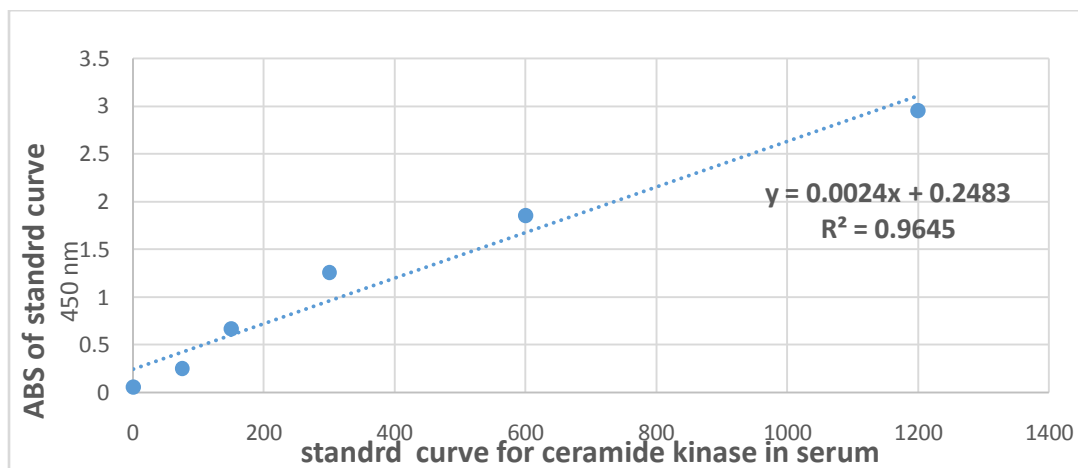
**Operation Steps:-**

Fifty  $\mu$ l of standard were added to standard wells. 40  $\mu$ l of sample diluent were added to sample wells and ten  $\mu$ l of sample were added. 50  $\mu$ l of horseradish peroxidase (HRP) were added into each well, except the blank well, the plate was shaken gently and was incubated 60 min at 37 °C.

Excess liquid was discarded, the wells then dried, washed with washing solution and dried again. Chromogen solution (A) followed by 50  $\mu$ l of Chromogen solution (B) were added to each well. The plate gently shaken and incubated for 10 minutes at 37°C in dark place. Fifty  $\mu$ l of stop solution were added into each well to stop the reaction (the blue changes into yellow immediately). Measurement and standard were the blank wells were set at zero and the optical density (OD) was measured at 450 nm within 15 min after adding the stop solution

**Standard curve:-**

According to standards concentration and the corresponding OD values, the standard curve linear regression equation was calculated and then the OD values of the sample was applied on the regression equation to calculate the corresponding Figure (2.2) shows the calibration in curve concentration of samples with a rang > 0- <150 ng/ml.



**Figure 2:-** standard curve of (CERK) concentration (pg/ml) in serum and tissue

**Discussion:-**

In Iraq, people with prostate cancer, according to statistics the Iraqi Ministry of Health is % 5.06 in 2011, a very large number for that was the need to discuss ways and analyzes new reduce the incidence of this disease and it has been the use of advanced technology at a cost of good for early detection of prostate hyperplasia and malignant cancer and result was significant and detection for prostate cancer. The concentration of S1P and Ceramide were different levels with control, and high levels in patients without any drugs or chemotherapy while levels of these markers still low with patients were taken drugs or chemotherapy and level of protein in tissue were raised. Results of biochemistry analysis still normal because we take patients without any D.M., renal failure, and hypertension. Approximately of the population in Western countries suffers from chronic pain syndrome there is a major need for renewed focus on novel targets that will be effective in both neuropathic and inflammatory pain. Compelling evidence implicates Ceramide-to-sphingosine 1-phosphate (S1P) pathways as contributors to pain of diverse etiologies. S1P and its receptors are emerging as important neuronal and immune cell regulators interacting at several sites in the pain pathway. Timely and important to critically evaluate the pharmacological basis for targeting the ceramide-to-S1P pathway as an approach to pain management (BraakM, et al, 2009). (P value) between control group and all groups were significant and (P value) between also two groups (BPH with and without drugs in serum and tissue) (PCa with high and low doses chemotherapy in serum and tissue) also founded significant.

**Conclusion:-**

A significant inverse correlation between total S1P and Ceramide levels with BPH and Prostatic cancer. The study concludes that increased incidence of Prostatic cancer with BMI and age.

Increase concentration of protein in tissue with BPH and PC and as well as being a marker that distinguishes indolent prostate cancer from those at risk of lethal progression.

**References:-**

1. Antoon, J.W.; White, M.D.; Burow, M.E.; Beckman, B.S. Dual inhibition of sphingosine kinase isoforms ablates TNF-induced drug resistance. *Oncol. Rep.* 2012; 27:1779–1786.
2. Abuhusain, H.J.; Matin, A.; Qiao, Q.; Shen, H.; Kain, N.; Day, B.W.; Stringer, B.W.; Daniels, B.; Laaksonen, M.A.; Teo, C.; et al. A metabolic shift favouring sphingosine 1-phosphate at the expense of ceramide controls glioblastoma angiogenesis. *J. Biol. Chem.* 2013; 288:37355–37364.
3. Anelli, V.; Gault, C.R.; Snider, A.J.; Obeid, L.M. Role of sphingosine kinase-1 in paracrine/transcellular angiogenesis and lymphangiogenesis in vitro. *FASEB J.* 2010; 24:2727–2738.
4. Antoon, J.W.; White, M.D.; Meacham, W.D.; Slaughter, E.M.; Muir, S.E.; Elliott, S.; Rhodes, L.V.; Ashe, H.B.; Wiese, T.E.; Smith, C.D.; et al. Antiestrogenic effects of the novel sphingosine kinase-2 inhibitor ABC294640. *Endocrinology* 2010; 151:5124–5135.
5. Arduengo, P.M. Sloppy technicians and the progress of science.wordpress.com/2010/03/15/sloppy-technicians Good, N.E. et al. (1966) Hydrogen ion buffers for biological research. *Biochemistry.* 2010 ; 5: 467–77.
6. Brizuela, L.; Ader, I.; Mazerolles, C.; Bocquet, M.; Malavaud, B.; Cuvillier, O. First evidence of sphingosine 1-phosphate lyase protein expression and activity downregulation in human neoplasm: Implication for resistance to therapeutics in prostate cancer. *Mol. Cancer Ther.* 2012; 11: 1841–1851.
7. Bektas, M.; Allende, M.L.; Lee, B.G.; Chen, W.; Amar, M.J.; Remaley, A.T.; Saba, J.D.; Proia, R.L. Sphingosine 1-phosphate lyase deficiency disrupts lipid homeostasis in liver. *J. Biol. Chem.* 2010; 285: 10880–10889.
8. Baran, Y.; Salas, A.; Senkal, C.E.; Gunduz, U.; Bielawski, J.; Obeid, L.M.; Ogretmen, B. Alterations of ceramide/sphingosine 1-phosphate rheostat involved in the regulation of resistance to imatinib-induced apoptosis in K562 human chronic myeloid leukemia cells. *J. Biol. Chem.* 2007; 282:10922–10934.
9. Brügger, B.; Sachsenheimer, T.; Wieland, F.; et al. A critical role for ceramide synthase 2 in liver homeostasis: I. alterations in lipid metabolic pathways. *J. Biol. Chem.* 2010; 285:10902–10910.



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### RESEARCH ARTICLE

#### IMPRINTS OF PLEISTOCENE SEDIMENTATION IN NARMADA RIFT VALLEY, CENTRAL INDIA.

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#### Abstract

The SONATA LINEAMENT ZONE embodies the two Quaternary basins of tectonic origin on the two margins of Satpura Crustal Block. The Satpura block traversed by enechelon system of faults and lineaments is characterized by thinner crust (33-38 km deep, basement depth >2.5 km) with series of ENE-WSW trending gravity high (viz. Sendwa, Khandwa, Chicholi, Tikaria etc.) with amplitudes of 10-35 mgal. The chain of gravity high indicates extensive magmatism and emplacement of derivatives at shallow crustal levels. The associated Narmada South (Satpura North) fault and Satpura South Fault marking the two hinges of the Satpura block are fundamental in nature and extend to Moho level. The Narmada Quaternary basin in the north and Tapti-Purna basin in the south are two Graben which formed prominent loci of sedimentation in lineament zone. The area of lineament zone studied tectonically encompasses two crustal provinces of Central India Shield, namely, the Northern Crustal Province (NCP) and the Southern Crustal Province (SCP). The two provinces are separated by a crustal level shear zone, referred as Central Indian Suture. The zone has been a major locus of episodic tectonism and Quaternary sedimentation with evidences of reactivation. The E-W to ENE-WSW trending Narmada and Tapti lineament from a prominent tectonic belt (SONATA) in midplate continental India.

The Narmada Rift valley formed a linear trench in the middle of Indian subcontinent was an ideal loci for accumulation of sediments. The rift trench is intruded by the dolerite and other mafic and siliceous dykes and sills along lineaments in different phases of tectonic deformation. The Quaternary sedimentation incepting from glacial activity, followed by fluvio-glacial, lacustrine and fluvial phase within the rifting and sinking environment, block faulting and linear displacement and dislocation, uplifting and isolated domal up- lift, Neogene rifting and Quaternary sedimentation. The rift-bound Pliocene-Pleistocene rifting and volcanic activities specifically during glacial and fluvio-glacial phase are major component of the Quaternary period and tectonic processes of the Narmada Rift System which form the base of quaternary deposits. The Narmada rift system basin platform provided a unique setting for dynamic ecosystems that were

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characterized by Rift-related subsidence and coeval sedimentation and has also created an ideal loci of Quaternary sedimentation and environment for the accumulation of sediments volcanic fabrics sediments, burial, diagenesis, and preservation of organic remains. The present disposition of Narmada blanket of Narmada, Tapti-Purna and Son in SONATA LINEAMENT ZONE revealed that the rift occurred after widespread Quaternary sedimentation and accumulation of sediments in the linear trench by glacial activity in late Pleistocene. The Fluvio-glacial phase is represented by boulder conglomerate which has formed the persistent horizon in the valley. The Narmada has in the area under study has sculptured the alluvial tract into stepped sequence forming four alluvial terraces along its course. These are designated as NT0 to NT3, NT0 being the youngest terrace and NT-3 the oldest terrace where the sub terraces are designated NT2-A is NT2-B, NT2 B, besides NT2-C, NT3-A & NT3-B in increasing order of antiquity. These are both erosional and depositional terraces and confined at an elevation of, between 280 to 310-380, are separated by the scarp both of curvilinear and linear in nature facing towards river side. These are abandoned flood plains represent the level of former valley floor in the area, and were formed by cumulative climato-tectonic changes in the watershed of Narmada in the Quaternary times.

The Indian Plate is currently moving northeast at 5 cm/yr (2 in/yr), while the Eurasian Plate is moving northeast at only 2 cm/yr (0.8 in/yr). This is causing the Eurasian Plate to deform, and the Indian Plate to compress leading to tectonic activity along major fault zones. In tectonically active areas sedimentary basins undergo phases of both crustal extension and contraction leading to basin inversion and hence display features typical of subsidence and uplift. Geomorphic attributes and deformation in late Quaternary sediments are the indicators of active tectonic activity in any sedimentary basin. The geomorphic evolution in such reactivated basins is primarily due to complex interaction between sedimentation processes and tectonics. The peninsular India has been undergoing high compressive stresses due to the sea-floor spreading in the Indian Ocean and locking up of the Indian plate with the Eurasian plate to the north. Much of this N-S directed stresses have been accommodated by the under thrusting of the Indian plate below the Eurasian plate. A part of these compressive stresses are accumulated along the Narmada-Son Fault (NSF), a major E-W trending crustal discontinuity in the central part of Indian plate. The Quaternary tectonic activity recorded in the Narmada valley possibly, has wider ramifications when viewed in the larger perspective of the Indian plate on Quaternary sedimentation. This suggests a renewed phase of extreme compression of the Indian plate, which led to tectonic insecurity and may cause tumors and earth quake in peninsular India. The Narmada Rift valley forms a ENE-WSW lineament where Quaternary deposits are confined in a trough like basin on unstable platform which forms a prominent lineament with profound geomorphologic and geological asymmetry between the northern and southern valley walls, giving it a tectonic significance. The alluvial deposits of the Narmada valley represent the thickest Quaternary deposits in peninsular India. These sediments were deposited in faulted and sinking platform under structural riparian rift trench remained silent and unrevealed. The quaternary blanket of Narmada consists of sediments of various domains which were deposited in different environment in vertical chronology in faulted trough in time and

space. The Quaternary blanket consists of sediments of three domains viz. glacial, fluvio- glacial and fluvial, which were deposited in distinct environments during Quaternary time. The Boulder Bed (20 to 260 m.) below ground level is of glacial origin, comprised of thick pile of sediments occupied at the base of rock basin and were deposited by glacial activities in dry and cold climatic condition during early Pleistocene time. The fossiliferous bed Boulder conglomerate (260 to 278 m. above m.s.l.) is of fluvio-glacial origin and top four formations in increasing antiquity are Sohagpur, Shahganj, Hoshangabad and Janwasa ( 278 to 350m. above m.s.l.) are of fluvial origin and represent the complete sequence of Quaternary sedimentation in Narmada valley & Central India Khan & Sonakia (1992). The boulder conglomerate is a marker horizon of Quaternary sedimentation in Narmada Valley and as well in Central India, its disposition and relation with other deposits in the valley, indicates a significant change in regional climate from cold dry to warm and humid, during which the sediment were re-worked from glacial front intermittently and deposited in the valley over a very long time. The skull cap of *Homo erectus* (Narmada Man) and other fauna recorded along with calc- nodules within the boulder conglomerate; suggest that warm climatic phase prevailed for very long time.

The skull cap of *Homo erectus* (Sonakia1984) and other fauna recorded along with calc- nodules near village Hathnora (22° 52' N; 77° 52' E) in fossiliferous boulder conglomerate; named as Hathnora formation Khan & Sonakia (1992) is found to be associated with volcanic Ash bed of Quaternary age in the area around Hathnora, and upstream Khan et.al. (1991). The two levels of horizons of Ash bed identified are designated as NAB-I and NAB-II in ascending antiquity in the valley. The Ash bed NAB-I is associated lower litho units of boulder conglomerate which is well preserved and persistent where as NAB-II is associated with younger deposits. The NAB-I contains three micro layer (L-1 to -L3) and NB-II two micro layers (L-4 to L-5) in increasing antiquity. The Ash bed is associated with Hathnora formation at the depth of 78 m in Quaternary column and occurrences skull cape of *Homo erectus* at the depth of 83 m in decreasing antiquity from the top assumed that Toba eruption have taken place later than existence of *Homo erectus* which appeared and resided in the valley for long time before the fall of Toba ash. The association of Ash is NAB-I NAB-II at the depth of 72 m with the younger deposit revealed the second cyclic fall of Toba ash which certainly have had influenced on hominines and had collective and cumulative impact on *Homo erectus* (Sonakia1984) *Homo sapiens* (Thobold 1860, 81 ), in Narmada valley and Indian sub-continent. The Toba eruption was a mega event of very great magnitude and intensity, far greater than any known historical eruption, suggesting it had very devastating impact and repercussions. It has change the global climate environment and ecology. It is significant to note that the occurrences and association of two marked horizons at different levels further reveal that the cyclic eruption and settling of volcanic matrix has taken place with pause in the valley during sedimentation

The study of grain morphology of glass matrix, their relation with other minerals shape, size, and texture of fragments and sediments of pyroclastic origin suggest that sediments were brought from distant source in the form of thick cloud containing dust matrix and volcanic ash which was highly explosive and siliceous in nature and remained in atmosphere for quite long time. The height of the eruption column

appears to be considerable. It is postulated that the tephra preserved as disconnected bodies within the river valley sediments represent rapidly settled ash falls from a volcanic ash cloud which formed a canopy over a large part of river basins for longer time of Peninsular India where sedimentation was on in different river basins including Narmada valley. The discontinuity of Ash bed in Narmada valley and Indian subcontinent is attributed to be associated with column of volcanic eruption, quantum of volcanic matrix, wind direction, moisture density of air and rate of fall of matrix on oscillating platforms of sedimentation in different basin. It is significant to note that the occurrences and association of two marked horizons at different levels further reveal that the cyclic eruption and settling of volcanic matrix was with pause in the valley which perhaps related with pause in volcanic eruption

The volcanic eruption and consequential ash fall has created severe dislocation in ecology and environment and adversely affected hominines in Narmada valley and Indian subcontinent. It is witnessed by association of Ash bed NAB-I with Hathnora formation at the depth of 78 m in Quaternary column and occurrences skull cap of *Homo erectus* at the depth of 83 m in decreasing antiquity from the top assumed that Toba eruption have taken place later than existence of *Homo erectus* which appeared and resided in the valley for long time before the fall of Toba ash. The association of Ash is NAB-II at the depth of 72 m with the younger deposit revealed the second cyclic fall of Toba ash which have had influenced collective and cumulative the *Homo erectus* (Sonakia1984) *Homo sapiens* (Thobold 1860, 81), in Narmada valley and Indian sub-continent.

The study of cyclic Toba ash fall and using phytogeographic data, Oppenheimer (2003) argues that *Homo. Sapiens* occupied India before ~74 ka and may have undergone "mass extinction" as a result of the Toba eruption. The argument of Oppenheimer (2003) is in strong conformity with the present observation of authors. As sediment & Ash bed sequence of Quaternary column of Narmada (325m) and occurrences of fossil of skull cap of *Homo erectus* (Sonakia1984) at 83 m & human cranium *Homo sapiens* (Thebold 1960,1981) (transported) have rarest occurrences of human fossils in Narmada valley and subcontinent which also confirm the intensive impact of volcanic ash fall on these hominines and their consequential mass extinction caused by mega dislocation in ecology and environment by volcanic eruption

The Narmada skull cap of *Homo erectus* which is recovered from the vom of basal unit of boulder conglomerate at the depth of 83 m. (278 m. above m.s.l.) is estimated to be of upper segment of lower Pleistocene age. It is older than the *Homo erectus* of Chenjiawo, Congwangling of China which were recovered from paleo-sole and loess deposit at the depth of 38 and 26 m. The Quaternary sequence of Narmada (325 m.) as compared to Louchuan (136 m.) sections of China on unified Quaternary platform is older and represents the complete and type sequence of Quaternary sedimentation in Narmada Rift System in Central India. The occurrence of skull cap of early man at the depth of 83 m. in basal unit of boulder conglomerate of fluvio-glacial origin in Narmada Valley is one of the earliest and oldest *Homo erectus* in Asia.

The statistical analysis of sediments from these different domain in vertical column has been conducted to ascertain the environment of sedimentation and trace the breaks in climate (Khan et.al. in press). An

attempt has been made for the first time Khan et.al (2013) to correlate the various stratigraphic columns of associated hominid fossils of Narmada valley ( 325 m) India and that of Luochuan sequence,( 90-120 m) Chenjiawoe (50m ) and Congwanling sequence ( 36 m ) of China on unified Quaternary platform tied up and developed at mean sea level. The study revealed that the depth of occurrence of Narmada skull cap on unified Quaternary platform is about (83 m) as compared to with that of Chenjiawo and Gongwangling of China which occur at very shallow depth of 38 and 26 m respectively. The estimated age of Narmada Man based on these parameters is about 1.38 m.y. (+), which is greater than *Homo erectus* of Chenjiawo 0.65 m.y. and Gongwangling 1.15 m.y. of China An Zhisheng and Ho Chuan Kun (1989).

In India Narmada basin considering the one of a main loci of Quaternary sedimentation, and assuming the uniform accumulation rate of sediment in the basin in the line of Ma. et. al. (1978) Yobin Sun & Zhisheng, An (2005) and comparing the Narmada sequence of Quaternary deposit (325 m.) with those of Luochuan standard sequence of Chenjiawo and Congwangling sequence of China. The skull cap of *Homo erectus* (Narmada Man) recovered from the boulder conglomerate of fluvio-glacial origin in middle part of Quaternary column from deep level of Narmada, at the depth of 83 m. above glacial deposits, in association of ash bed, as compared to Chenjiawo Hominid from inter bedded sequence of paleo sols loess and silty loess at the depth of 38 m. and Congwangling 26 m. from paleo sols which are younger than Narmada deposits.

The Narmada skull cap of *Homo erectus* which is recovered from the vom of basal unit of boulder conglomerate at the depth of 83 m. (278 m. above m.s.l.) is estimated to be of upper segment of lower Pleistocene age. It is older than the *Homo erectus* of Chenjiawo, Congwangling of China which were recovered from paleo-sole and loess deposit at the depth of 38 and 26 m. The Quaternary sequence of Narmada (325 m.) as compared to Louchuan (136 m.) sections of China on unified Quaternary platform is older and represents the complete and type sequence of Quaternary sedimentation in Narmada Rift System in Central India. The occurrence of skull cap of early man at the depth of 83 m. in basal unit of boulder conglomerate of fluvio-glacial origin in Narmada Valley is one of the earliest and oldest *Homo erectus* in Asia. (Table No HE\_1 to \_3 & Plate No HE\_1 to 9)

The Paleo- anthropological information from these localities is remained closely associated with Quaternary sedimentary deposits boulder conglomerate and boulder bed often related to the trench Quaternary sedimentation, formation and development of rift and linear basin caused by repeated uplift, and the development of rift basins that began in the middle to late Pliocene and Pleistocene period. The unfortunate part of these deposits is that due repeated tectonic dislocation and faulting they are displaced dislocated and distorted the presently they are only exposed in limited section of meandering loop of Narmada river in valley at the base of NT2 and mostly concealed under the thick pile of sediments of present and paleo domain of Narmada of late Pleistocene and Holocene time. The disposition of boulder conglomerate and hidden its nature does not provide an adequate opportunity to researcher to study the human remain as postulated, except in limited section where they are exposed. it is difficult to disclose mysteries of human evolution in Narmada due to concealed nature of these deposits in rift system, however the

complementary part of Tapti-Purna Quaternary blanket may be potential and possessive of human remain and should be studied to trace further the

Imprints of fossil man taking in to account of SONATA LINEAMAN ZONE as single ecosystem for evolution of man in Indian subcontinent. The rift system and platforms of sedimentation bear the imprints of and evidence of the effects of tectonics on fauna and flora are distinct, however the signatures of subsidence dislocation and concealing of fossiliferous horizons are uncontrolled and ill defined in the ecosystem in the valley during the Pliocene–Pleistocene periods. The boulder conglomerate which yielded the skull cap of *Homo erectus* in Narmada rift from Hathnora Sonakia (1984) remained only discovery of hominid fossil in last two and half decade due to concealed and hidden nature of Mio-Pliocene Pleistocene deposits in rift system and inconsistency in exposure of fossiliferous horizon of Narmada rift system which is the handicapp in search of further human remains in Narmada valley after Khan et.al (2016), Khan et.al (2016), Khan et.al (2016)

The Quaternary blanket has been studied complete in three dimension and about 907 sediment were collected to study of statistical parameters heavy mineral assemblage, quartz grain morphology, quartz grain morphology of paleosol, ash bed and other aspect across the depth of about 480 m. The study revealed that their binary relations distinctly display contrasting and relative heterogeneity in sediment characteristics throughout across the Quaternary blanket in Narmada valley. The study of sediments display diagnostic characteristics of glacial, fluvio-glacial and fluvial environment at different depth and levels 000.m to 150, 150 to 350, and 350 to 550 m from glacial, fluvio-glacial fluvial, and fluvial deposit (150 samples). The critical analysis of these parameters exhibits sediment textural linkage to long evolution in glacial, fluvio-glacial and fluvial environment in time and space in increasing antiquity in the valley. The characteristics inherited by the sediments from pre-existing domain of sediments are glacial & terrestrial & environment. The diagenetic and diagnostic features; varying degrees of heterogeneity, sediment angularity roundness, degree of sorting indicate evolution and sedimentation of quaternary sediments in a high-energy turmoil glacial environment on tectonically dislocated and unstable platform. The sediments confined up to 150 m below ground level represent paleo fluvial domain of Narmada and represent multi cycle sedimentation under varying energy condition on oscillating platform. The vertical variation in increasing antiquity in textural parameters and distinct breaks at specific level identified indicate changes of environments of sedimentation in vertical columns from glacial at the bottom of valley trough subsequently followed by fluvio-glacial and further overlain by fluvial deposits which is related with change of climate and tectonic in watershed of Narmada. The binary relation of these parameters effectively used in differentiating and fencing the sediments of these domains and their environment of sedimentation in time and space Khan et.al (2015). The study of statistical parameters across the entire thickness of Quaternary deposits revealed three breaks in sedimentation at 350 -290, 190-220, 100-150 which represent glacial, Fluvio-glacial and Fluvial environment of in increasing antiquity in from bed rock in Narmada valley.

The qualitative and quantitative studies of heavy minerals of Quaternary deposits of different domain revealed five prominent heavy mineral suites viz, opaque suite; amphibole-pyroxene suite, biotite-muscovite-chlorite suite, garnet, sillimanite, kyanite, staurolite suite

and zircon, rutile, tourmaline suite.. The mineral of stable group viz. rutile, zircon and tourmaline show uniform distribution in the entire domain of terraces in the area of study. The zircon rutile, tourmaline and sphene are highly stable minerals though their abundance is common in quaternary deposit, hence considered to be very significant. The grain morphology and imprints of sedimentation these mineral bear are of immense significance in understanding the source of sediment, its nature of transportation, mode of transport, kinetics of medium and sedimentation. The zircon rutile tourmaline and sphene minerals occur as accessories mineral, mostly released from rock fabrics comprising boulder bed and were subjected to different degree of wear and tear and physical condition of weathering transport and deposition, the micro imprints acquired by different condition of sedimentation revealed the intense grounding and bed traction of sediments from the source. The striations on these minerals indicate intense glacial activity in the initial stage of sedimentation. These are generally angular to highly angular in shape and show very poor indices of sphericity and roundness typical of glacial environments. Occasionally sub-hedral partly broken prismatic crystals of tourmaline are also in these deposits. The study revealed that sediments were primarily derived from metamorphic source comprising of kyanite-paragonite, muscovite schist, gneiss, garnet mica schist, and Para-amphibolite tourmaline garnet metasedimentaries and meta-volcanic. Apart these minerals are also reworked from older Quaternary deposits from Boulder bed glacial deposit, Boulder conglomerate of fluvio-glacial deposit and fluvial terrace and higher and other older terraces of fluvial domain. These heavies were basically transported from the sources area by glacial fluvio-glacial and fluvial agencies to the present site of their occurrence. The configuration of minerals, rock clastic, ground mass, imprints and impact of tectonics revealed the intense grounding and bed traction of sediments from the source to site of sedimentation.

The Narmada before debouching into Gulf of Cambay a conspicuous quaternary blanket is encountered. This segment is about 90 km in length and forms the southern margin of the N-S extending Gujarat alluvial plains. A significant feature of the lower Narmada valley is the deposition of a huge thickness of Tertiary and Quaternary sediments in a fault controlled rift trench. To the south of the ENE-WSW-trending Narmada-Son Fault (NSF), the Tertiary rocks and basaltic flows of Deccan Trap Formation occur on the surface while to the north they lie in the subsurface and are overlain by Quaternary sediments. However, the overlying Quaternary sediments having a maximum thickness of 800 m (Maurya et al., 1995).

The tectonic uplift of the lower Narmada valley during the Early and Late Holocene suggests inversion of an earlier subsiding basin. Such inversions of the basin have been common in the Tertiary times and are well recorded in the sediments of that age (Roy, 1990). A symmetric convergence of the NT-1, NT-2 terraces, diagonal disposition of paired equivalent of terraces across the channel, divergent and linear disposition of cliff of NT-3 terrace in conformity of NSF revealed constant subsidence of basin and in response to frequent movement of geotectonic activity along the NSF.

The strongest supporting evidence for the Early Holocene tectonic uplift of the area comes from the sea-level curves of the west coast of India which suggest a tectonic component of about 40 m at this time (Rao et al., 1996). In the Lower Narmada valley the Mid-Late Holocene Quaternary valley deposits is the product of a Holocene high

sea-level-induced deposition in a deeply incised valley trench trough highly influenced by NSF. The Mid–Late which resulted in both estuarine and fluvial sedimentation in the lower reaches. A significant slowing down of tectonic uplift facilitated the encroachment of the sea into the valley and the creation of a depositional wedge, which extended up to the deep in land foothills. The 5–10-m exposed thickness of the valley-fill sediments reveals tide dominated estuarine deposition in the lower reaches and fluvial deposition upstream of the tide reach.

The pre-existing quaternary platform of NT-3 of middle Pleistocene prior to induced sedimentation of tidal transgression was strongly induced by tectonic impulses of NSF. The relative disposition of terraces (NT-2 NT-3), cliff alluvial bluff and scarp, reveals that the present mouth of the Narmada river has retained roughly the originally funnel shape of the estuary formed during the Mid–Late Holocene. However, the size of the estuary is now considerably reduced in space and time with sedimentation and compressive tectonic environment. The stepped sequence of terraces NT0 to NT2A NT2B NT2C NT3A, NT3B) their disposition, their convergence & divergence, cyclic and non cyclic nature and mutual inter relation revealed at least three mega phases and four micro phases of up rise of sea level related with tectonics of the area in late to upper pleistocene time.

The incursion and transgression of tides, present estuarine reach contains several islands, which are coeval with the terrace surface above the present tidal range. Hence, they are the products of estuarine processes of the Mid–Late Holocene and not those of the present day. Funnel shaped morphology and increasing tidal energy landward are characteristics of tide-dominated estuaries (Wright et al., 1973). Existing data suggest that the Mid–Late Holocene sea level has remained at the same level up to the present with minor fluctuations (Chappel and Shackleton, 1986; Hashimi et al., 1995). The Mid–Late Holocene sediments show tilting of 10–20 which is more pronounced in the vicinity of the NSF suggesting that the incision and uplift of the valley-fill terraces well above the present day tidal limits is related to the continued differential uplift along NSF. Evidence of tectonic uplift has been reported from the coast also in the form of raised mudflats occurring 2–4 m above present sea level (Merh, 1993). Currently, the river occupies the northern margin of the Early Holocene channel belt and is clearly more sinuous. It exhibits a narrow channel with wide meanders inside wide belts of Mid–Late Holocene terraces ( NT-3) a typical pattern of under fit streams (Dury, 1970).

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### Introduction:-

The Narmada river originates from the Amarkantak plateau of Satpura Ranges in Rewa at an elevation of about 1057 m (22° 40' -81° 45') flows westerly course for about 1284 kms length across the middle of Indian subcontinent before entering Gulf of Cambay in the Arabian sea in Gujarat state.

The principal tributaries of Narmada are Hiran, Sher Shakkar, Dudhi, Tawa, Central sector where as Man, Madhumati, Heran and Orsang are in lower Narmada valley. These tributaries have developed transverse to the main axis of Narmada rifting and had deep cut across the quaternary blanket. The evolution of Narmada graben is differential and asymmetrical with rifting and sinking valley floor. These tributaries possess imprints of rifting and sinking events. These imprints are recorded in terms of manifestation and signature on landscape, drainage, land form elements, present and paleo- meandering segment, river terraces, cut of meanders, paleo channels, scars, rock cut terraces, selective channel entrenchment linear and curvilinear cliff & scarpment.

The Quaternary tract of Narmada basin covers an area of about 12950 sq. km starting from west of Jabalpur (23°07'79°53'00") to east of Harda (22° 29'; 76° 58') for a distance of about 320 km. It is found to be ideal locus of Quaternary sedimentation in Central India as witness by multi-cyclic sequence of Quaternary terraces in the valley. The general elevation of Narmada alluvial plain varies between 265.7 and 274.3 m above the sea level. The general gradient of this plain in this stretch is about 1m/Km towards West. (Plate No\_1 to 3)

### Sedimentation:-

The Quaternary blanket occurs in the central part of valley in Jabalpur –Harda section and in Gurudeshwar –Bharouche section in lower of valley; where as in the other part in Harda –Mandleshwar section thin and isolated caps and strips of quaternary sediments are noticed on rock cut terraces and rock benches of country rocks. In Mandleshwar-Barwani, Dhadgaon- Tilakwarda the quaternary deposits are shallow to moderate in thickness and thin out to wards east. The isolated loci of accumulation and sedimentation along the entire length of 1300 kms of Narmada area controlled by the tectonics and structural frame work and sinking and uplift of fault bounded blocks and lineaments. It is well illustrated by neoseismic signatures and imprints on quaternary deposits and landscapes in the valley. The critical analysis of landscape profile evolution of drainage, quaternary terraces, river morphology and analysis of bore hole data of basement configuration of rock and quaternary deposits revealed that Jabalpur-Harda section valley segment suffered mega dislocation and sink to level of about 1150 m as compared to the adjoining blocks and created and has formed open rock basin and platform of quaternary sedimentation. This section display complete record of quaternary deposits of glacial, fluvio- glacial and fluvial sediments in increasing antiquity from the base. The study of bore data of ETO, CGWB, and GSI indicates that average thickness of quaternary deposits of Narmada is about 435 m. The quaternary deposits bear well preserved imprints of neotectonism indicating that the Sonata lineament zone seismically is active and has direct bearing on quaternary landscape of rift valley. The Harda –Mandleshwar section predominantly portrays the sequence of cyclic and noncyclical rock cut terraces and rock cut platform and benches which are time equivalent to the quaternary terraces of central and lower Narmada valley Khan et.al (2014). In Mandleshwar-Barwani the quaternary sediment are of moderate to shallow in thickness which are incised along with the country rock by cyclic structural dislocation and tectonic activity along ENE WSW lineament fabrics and dynamic incision of stream. It is well documented in quaternary terraces and composite erosional terraces; rock cut terraces capped by quaternary sediments, river profile and channel morphology. The morphogenetic expression of the section revealed uplift of block. The Gurudeshwar-Bharouche embodies the thickest quaternary deposits which represents complete sequence from the base glacial fluvio-glacial fluvial, lacustrine and mud deposits.

The Narmada rift system basins provided a unique setting for dynamic ecosystems that were characterized by Rift-related subsidence and coeval sedimentation also created an ideal loci of Quaternary sedimentation and environment for the accumulation of sediments volcanic fabrics sediments, burial, diagenesis, and preservation of organic remains. Because rifts formed after widespread Quaternary sedimentation occurred and voluminous sediments in the rift basins were accumulated by glacial activity consequential upon the lowering of temperature and climatic changes in the region.

The Miocene -Pliocene–Pleistocene lake deposit of Katni on the eastern rift shoulder was created by faulting, topographic control, or isostatic depression similar to that of other Rift system. The Narmada flows along seismic tectonically active NSF which forms a fault controlled basin of a huge thickness of Tertiary and Quaternary

sediments. The thick blanket of Quaternary sediments occurs in the central part of valley in Jabalpur –Harda section and in Gurudeshwar – Bharouche section in lower of valley; where as in the other part in Harda –Mandleshwar section thin and isolated caps and strips of quaternary sediments are noticed on rock cut terraces and rock benches of country rocks. The Tilakwarda \_Bharouch section display complete record of quaternary deposits of glacial, fluvio- glacial and fluvial sediments in increasing antiquity from the base.

#### **Pleistocene Phase:-**

The Narmada Rift valley formed a linear trench in the middle of Indian subcontinent, was an ideal loci for accumulation of sediments. The rift trench is intruded by the dolerite and other mafic and siliceous dykes and sills along lineaments in different phases of tectonic deformation. The Quaternary sedimentation incepting from glacial activity, followed by fluvio-glacial, lacustrine and fluvial phase within the rinsing and sinking environment, block faulting and segmental and linear displacement and dislocation, uplifting and isolated domal up- lift, Neogene rifting and Quaternary sedimentation and rift-bound Pliocene–Pleistocene rifting and volcanic activity, specifically during glacial and fluvio-glacial phase are major component of the Quaternary period and tectonic processes of the Narmada Rift System which forms the base of quaternary deposits. The Quaternary sedimentation was triggered by tectonic activities / up lift and climatic changes. The provenance for these sediments is the weathering products of eroding pre- Cambrian, meta-sediments, sedimentary and volcanic rocks along the watershed upland, rift escarpments and shoulders; faulted and uplifted blocks, volcanic fissure zones, and plateaus within and outside the rift. The Narmada Rift System, bounded by adjacent plateaus rising 300–700 m above the rift floor, consists of number symmetrical and asymmetrical faulted blocks, escarpment, rock cut terraces, rock floors and segments of micro half grabben. Although rift-related basins started to form during the late Oligocene to early Miocene times, the Narmada Rifts were fully defined by middle to late Miocene time.

The Narmada rift system basin platform provided a unique setting for dynamic ecosystems that were characterized by Rift-related subsidence and coeval sedimentation also created linear depression for Quaternary sedimentation and environment for the accumulation of sediments volcanic fabrics sediments, burial, diagenesis, and preservation of organic remains. Because rifts formed after widespread Quaternary sedimentation occurred and voluminous sediments in the rift basins were accumulated by glacial activity consequential upon the lowering of temperature and climatic changes in the region.

The Miocene -Pliocene–Pleistocene lake deposit of Katni on the eastern rift shoulder was created by faulting, topographic control, or isostatic depression similar to that of other Rift system. The skull cap of *homo-erectus* Sonakia (1984), suggest that the Narmada Rift System created productive ecosystems during Pliocene–Pleistocene time. The volcanic rocks within the fossiliferous sediments provide temporal information for calibrating and sequencing hominid and other faunal evolution. The detailed geological sedimentological geochemical study of interbedded tephra, Quartz grain morphology of sediments of quaternary strata and paleo-sole of and geochronological studies of from the different localities for establishing accurate biostratigraphic and lithostratigraphic data, sedimentation rates, and paleoenvironmental and tectonic histories of different sediment columns in area along the rift system. Interbedded volcanic rocks allow determination of the time of rifting, the beginning of sedimentation, sedimentation rates, and the oscillation from glacial, fluvio-glacial lacustrine to fluvial environments. The cyclic environmental transitions recorded in the sedimentary sequences of the rift basins are caused by tectonic activities (uplift and subsidence), changes in relief, and climatic variations. The climatic changes in uplift, topographic and landscape features, coupled with block faulting, rinsing and sinking platform, created basins for the accumulations of thick lacustrine and fluvial sediments sequences with terrestrial and aquatic fossils. The sequential change in the sediment facies from finely bedded lacustrine deposits to fluvial sediments are commonly noted in the sedimentary sequences and reflect environmental and tectonic changes that can be temporally determined. Moreover, regional correlation based on the chemistry and geochronology of interbedded tephra has made it possible to establish accurate stratigraphic relations those are useful for pale- environment reconstruction and evolutionary studies of fossil remains in the Narmada rift valley Khan et.al. (2012). Regional tephra correlation is being used increasingly to link sites together, and has already established that similar tephra layers are known from other parts of rift valley, as well as from other basin and peninsular India Achariya, (1995), Khan (1992) Khan et.al. (2012) Tiwari (1996). There is a great potential for further correlation of tephra in the Rift System and marine sediments in the Arabian Sea. The Arabian Sea has a continuous record of deposition that extends to at least 7 million years. The Quaternary sediments interbedded with tephra within the age range of the ODP Ocean Drilling Program 721/722 stratigraphic sections of the Arabian Sea are also present within the rift floor and the western rift margin of the region. The chemical and chronological correlations of ash beds within the

rift sequences of have been made with ashes described in marine sections. Detailed correlations based on orbitally calibrated time scales of pale magnetic stratigraphy Rao (1996 ) within Quaternary sediments of rift deposits will provide ties to establish global climate changes based on the terrestrial and marine sediments of the rift system.

Moreover, because of tephra layers in sedimentary basins of different geologic periods, processes such as faulting, rifting, sedimentation and diagenesis, impact of climatic changes, age of fossils, nature and acquisition of archeological implements, and the origin, distribution, and functional significance of early hominid artifact assemblages can be deciphered. However, evidence of the effects of tectonics on fauna and flora are distinct and its signatures on dislocation and concealing of fossiliferous horizons are uncontrolled and ill defined in the ecosystem in the valley during the Pliocene–Pleistocene periods. The boulder conglomerate which yielded the skull cap of *Homo erectus* in Narmada rift from Hathnora Sonakia (1984) remained only discovery of hominid fossil in last two and half decade due inconsistency concealed nature of fossiliferous horizon due faulting, dislocation and subsidence of Quaternary blanket of Narmada rift system as such researcher and scientist failed to add any further knowledge to hominid discovery any further.

The Narmada Rift System consists of symmetrical basins that have been evolved in different stages of tectonism. The 100 -120 km-wide and 1300 km long rift bounded by Satpura in south and Vindhyan in north constitutes conspicuous ENE-WSW to E-W rift basin zone is filled with Pliocene–Pleistocene sediments, whereas some of them contain Miocene sedimentary deposits. Most of the sedimentary sequences contain faunal and floral remains including hominid species. Most of the basin-fill sediments were derived from topographically elevated rocks that are present within and outside the rift basins. Lava flows and tephra are interbedded with the fossiliferous sediments clastic sediments derived from .The provinces of sediment mostly from crystalline basement volcanic, sedimentary, meta basic and sedimentary rocks, aided in the cementation and preservation of organic remains by providing secondary minerals released during alteration in a burial environment. Quick burial minimized the effect of preburial taphonomic processes. Moreover, chemical constituents released by the alteration have provided critical temporal and spatial information without which the study of hominid evolution and paleoenvironmental reconstruction in the Rift System would have been impossible.

Moreover, because of tephra layers in sedimentary basins of different geologic periods, processes such as faulting, rifting, sedimentation and diagenesis, impact of climatic changes, age of fossils, nature and acquisition of archeological implements, and the origin, distribution, and functional significance of early hominid artifact assemblages can be deciphered. However, evidence of the effects of tectonics on fauna and flora are distinct and its signatures on dislocation and concealing of fossiliferous horizons are uncontrolled and ill defined and the ecosystem in the rift system during the Pliocene–Pleistocene periods is not clear. The boulder conglomerate which yielded the skull cap of *Homo erectus* in Narmada rift from Hathnora remained only discovery of hominid fossil in last two and half decade due inconsistency concealed nature of fossiliferous horizon in Narmada valley. Historical or modern analogs illustrate the potential of the regional and sometimes global effects of such major silicic eruptions in the geologic past of sedimentation, sedimentation rates, and the oscillation from lacustrine to fluvial environments. The cyclic environmental transitions recorded in the sedimentary sequences of the rift basins are caused by tectonic activities (uplift and subsidence), changes in relief, and climatic variations. Changes in topographic features, coupled with volcanic damming, created basins for the accumulations of thick glacial, fluvio-glacial lacustrine and fluvial sequences with terrestrial and aquatic fossils. Changes from finely bedded lacustrine deposits to fluvial sediments are commonly noted in the sedimentary sequences and reflect environmental and tectonic changes that can be temporally determined. Moreover, regional correlation based on the chemistry and geochronology of interbedded tephra has made it possible to establish accurate stratigraphic relations that are useful for pale environment reconstruction and evolutionary studies of fossil remains in the rift valleys across India sub continent Regional tephra correlation is being used increasingly to link sites together, and has already established that similar tephra layers from known area in Rift system.

The Boulder Bed and Boulder conglomerate which form the base of Quaternary sediments in Central sector of Narmada Rift Valley are not exposed in the lower Narmada valley. These deposits are concealed under the sediments of lacustrine and fluvial deposits in the valley. The presence of these deposits is confirmed by study of bore hole data and logs of State and Federal agencies drill in lower Narmada valley under various projects. The boulder bed is differentiated in Hominid locality by extensive and intensive statistical analysis of sediment collected from bore hole logs for grain size parameters heavy mineral study quartz grain morphology of sediments and palaeosol which have assisted in identifying the sedimentological breaks in increasing antiquity in vertical columns and their correlation in other sections of Narmada Rift valley.

**Early to Late Pleistocene phase:-**

In the Narmada valley the River terraces (NT-1 NT-2) which represents sediments of Bharuch and Tilakarda formation date back to the Late Pleistocene. The sedimentation commenced with the deposition of the marine basal clays during the last interglacial high sea level at 125 ka, which is presumed to be about + 7 m as revealed by the studies. Regression of this sea led to the initiation of fluvial sedimentation. The fluvial sediments were deposited in two phases of sedimentation with a sharp break marked by tectonic changes and related climatic changes. The fluvial flood plain deposit of Bharuch formation overlies the marine clays followed by the fluvial flood plain deposit of Tilakarda formation. The sequence of these two formations is exposed in the cliff section which represents different sediment facies typical of fluvial environments. The sequence of sediments displays imprints of compressive tectonic regimes of sedimentation. The southern margin of lower Narmada is marked by Narmada–Son Fault, the transformation of this geofracture in Tertiary to reverse fault in Quaternary is implicit in the seismic studies of the area (Roy, 1990). Additional evidence for prevalence of compressive stress regime in the lower Narmada basin is provided by numerous reverse faults (Fig. 2B) in the Neogene sediments exposed immediately to the south of Narmada–Son Fault (Agarwal, 1986). These evidences suggest that the sediments of both the formations were formed in a compressive tectonic environment. There are evidences of subsidence of basin which has been documented on landscape of basin which are authenticated by other studies exist from adjacent area of synsedimentary subsidence on alluvial plain sedimentation (Shuster and Steidtmann, 1987; Brown and Plint, 1994; Kraus and Middleton, 1987; Kraus, 1992; Jordan, 1981; Hagen et al., 1985).

Absence of soil profiles in the thick blanket of Quaternary sediments of the study area is indicative of synsedimentary subsidence of the basin. It is unlikely that a high sinuosity channel will produce stacked system of fluvial deposits showing these characteristics (Shuster and Steidtmann, 1987). Deformations in these sediments of the types described above are the direct manifestations of this subsidence. Strong similarity of the structural orientations of the deformation structures suggests subsidence in a thrusting environment along the NSF which is consistent with the subsurface studies. It is inferred a low sinuosity and relatively fixed river system in a slowly subsiding basin for the deposition of these sediments. Synsedimentary subsidence of the basin due to differential movement along the NSF is indicated by entrenched meander thick overbank sediments and the deformation structures. Folding and faults with reverse movement in the overbank sediments suggest a compressive stress regime along the NSF. A brief period of tectonic stability followed as suggested by the 4–5-m thick palaeosol (red soil), which is stratigraphically correlatable with the red soil exposed in the Mahi and Sabarmati river basins of Gujarat alluvial plains.

The alluvial fan in between of Tilakarda and Rajpipla within the loop of Narmada is mono illustration of morphogenetic process associated with neotectonic event. The disposition of Quaternary blanket, fan deposit and other quaternary land forms are controlled and restricted by SONATA LINEAMENT to wards north. The convergence of fan deposits and its apex is not in conformity of piedmont sedimentation, it is also devoid of torrential stream net work, which firmly rule out to be endogenetic fan deposits and appears to up lift cut & past mass of older quaternary deposits along SONATA LINEAMENT.

The physiographic set up and drainage configuration of the Narmada the area of study demonstrate strong influence of tectonic and structure on development and evolution of drainage. The Narmada enters in the area around Garudeshwar descends NW –SE direction cutting across NSA entering the quaternary tract. It further down stream of Tilakarda swing to wards west and suddenly become slow and sluggish and sinuous to meandering in channel pattern long the northern edge of upland and ultimately debouches in the Gulf of Cambay. The disposition and convergence of drainage net in conformity of disposition of quaternary landscape demonstrates is anomalous further imprints and neoseismic signatures on landscape profile revealed persistent instability of basin during sedimentation. The tectonic uplift of the lower Narmada valley during the Early and Late Holocene suggests inversion of an earlier subsiding basin. Such inversions of the basin have been common in the Tertiary times and are well recorded in the sediments of that age (Roy, 1990). A symmetric convergence of the NT-1, NT-2 terraces, diagonal disposition of paired equivalent of terraces across the channel, divergent and linear disposition of cliff of NT-3 terrace in conformity of NSF constant subsidence of basin and in response to frequent movement and geotectonic activity along the NSF. The displaced Late Pleistocene sediments across NSF in the Narmada and Orsang Heran and Madhumati & Karjan valleys, the NNW tilting of the NT-1, NT-2 sediments litho units consisting of the Late Pleistocene sequence, the anomalous topographic slope in the same direction and the incised cliffs up to 25–30 m in the streams that flow along this slope in the area between NSF and the Narmada River, indicate unsynchronized neoseismic movements along the NSF during the Early Holocene. The displacement of sediments of NT-1 surface across the NSF indicates differential movement of about 35 m along the NSF during Early Holocene. The block

between the Narmada and Karjan rivers bounded by the NSF and the two other cross-faults suffered subsidence leading to the formation of a series, linear and curvilinear cuts of on terraces and flood plains. The 5–8-m incised cliffs of the streams also suggest that this block escaped the uplift induced large scale incision going on simultaneously in other areas of the lower Narmada valley. The occurrence of ravines and association of deep gullies with the river terraces is morpho- tectonic manifestation caused by the sudden vertical movement and block adjustment due subsidence resulting to sudden collapse of water table and ground water regime in the area. The strongest supporting evidence for the Early Holocene tectonic uplift of the area comes from the sea-level curves of the west coast of India which suggest a tectonic component of about 40 m at this time (Rao et al., 1996).

#### **Middle Holocene - Recent phase:-**

In the Lower Narmada valley the Mid–Late Holocene Quaternary valley deposits is the product of a Holocene high sea-level-induced deposition in a deeply incised valley trench trough highly influenced by NSF. The Mid–Late Holocene which resulted in both estuarine and fluvial sedimentation in the lower reaches. A significant slowing down of tectonic uplift facilitated the encroachment of the sea into the valley and the creation of a depositional wedge, which extended up to the deep in land foothills. The 5–10-m exposed thickness of the valley-fill sediments reveals tide dominated estuarine deposition in the lower reaches and fluvial deposition upstream of the tide reach. The pre-existing quaternary platform of NT-3 of middle Pleistocene prior to induced sedimentation of tidal transgression was strongly induced by tectonic impulses of NSF. The relative disposition of terraces, (NT-2 NT-3 cliff alluvial bluff and scarp), reveals that the present mouth of the Narmada river has retained roughly the originally funnel shape of the estuary formed during the Mid–Late Holocene. However, the size of the estuary is now considerably reduced in space and time with sedimentation and compressive tectonic environment.

The incursion and transgression of tides, present estuarine reach contains several islands, which are coeval with the terrace surface above the present tidal range. Hence, they are the products of estuarine processes of the Mid–Late Holocene and not those of the present day. Funnel shaped morphology and increasing tidal energy landward are characteristics of tide-dominated estuaries (Wright et al., 1973). Existing data suggest that the Mid–Late Holocene sea level has remained at the same level up to the present with minor fluctuations (Chappel and Shackleton, 1986; Hashimi et al., 1995). The Mid–Late Holocene sediments show tilting of 10–20° which is more pronounced in the vicinity of the NSF suggesting that the incision and uplift of the valley-fill terraces well above the present day tidal limits is related to the continued differential uplift along NSF. Evidence of tectonic uplift has been reported from the coast also in the form of raised mudflats occurring 2–4 m above present sea level (Merh, 1993). Currently, the river occupies the northern margin of the Early Holocene channel belt and is clearly more sinuous. It exhibits a narrow channel with wide meanders inside wide belts of Mid–Late Holocene terraces (NT-3) a typical pattern of under fit streams (Dury, 1970).

In the Narmada valley the River terraces (NT-3) has occupied large area on the both bank of Narmada. It extends from Orsang river in the north east to Mahi river in the west from Baroda in the north to Bharuch –Aliabet in the southwest. In the southern bank of Narmada it is developed around Ankleshwar and Rajpipla and further south. The average elevation of this surface is about 75 m above m.s.l, separated by both linear and curvilinear scarp from NT-2. The average height of cliff is about 40 m. The sediments comprised of this terrace are exposed in the cliff section. The oldest deposit of the exposed sediment successions a highly pedogenised mottled clay horizon showing vertisolic characters like extensive fracturing giving rise to blocky aggregates, pseudo anticlines and hydro plastic slickenside along the fracture surfaces. The sediments of this terrace are associated with a rich assemblage of shallow marine foraminifers. The basal unit consisting of rock pebbles with clays is overlain by thick fluvial sediments, which comprise alluvial plain facies. The pebbly unit which contains rock fragments of quartzite, granite basalt, and limestone sandstone is about 5.5.m thick, it is a persistent horizon and exposed in the cliff section. It is marker horizon, represent distinct phase of sedimentation in the valley. In the Narmada valley the River terraces (NT-3) which represent sediments of Ankleshwar formation. The fluvial sediments indicate deposition in single phase of fluvial sedimentation with a sharp break marked by tectonic changes and related climatic changes. The sequence of this formation is exposed in the cliff section, is marked by the major break in sedimentation as witnessed by the occurrence of persist pebble horizon at the base. This formation represent different sediment facies typical of fluvial environments. The sequence of sediments display imprints of compressive tectonic regimes on sedimentation. In the lower Narmada Valley alluvial fan as identified between Tilakwarda and Rajpipla within the loop of Narmada is mono illustration of morphogenetic process and morpho tectonic manifestation associated with neotectonic event. The disposition of Quaternary blanket, fan deposit and other quaternary land forms are controlled and restricted by SONATA LINEAMENT. The convergence of fan deposits and its apex is indistinct

and not in conformity of piedmont sedimentation, further it is devoid of torrential stream net work and environment it firmly rule out to be endogenetic fan deposits. The present study of these deposits their disposition its composition indicate that these deposits are older deposits and brought to the present position by tectonic activity along SONATA LINEAMENT.

The boulder bed is diffrentiated in Hominid locality by extensive an intensive statistical analysis of sediment collected from bore hole logs for grain size parameters heavy mineral study quartz grain morphology of sediments and plaosole, which have assited in identifying the sedimentological breaks in increasing antiquity in vertical coloumns and their correlation in other sections of Narmada Rift valley.

The sediments of paleo-domain of Narmada conformably overlies the boulder conglomerate and represent the flood-plain fluvial facies of the Narmada. The sediments of the facies predominantly consist of clay silt and sand, discontinuous nodules and plates. The beds are horizontal, exhibit upward fining sequence typical of fluvial deposits. This domain may be divided into three formations based on lithology, sediment assemblage, shape and size of rock clastics, relative disposition and diagnostic sedimentary characteristics. These formations are, viz. (i) Shohagpur, (ii) Shahganj, and (iii) Hoshangabad Formations respectively. These formations represent the sediments the complete sequence of Narmada deposited in channel and flood plain environments during Upper Pleistocene time. (Plate No \_5 to \_8)

#### **Neotectonics Tectonics & sedimentation:-**

The Indian Plate is currently moving northeast at 5 cm/yr (2 in/yr), while the Eurasian Plate is moving northeast at only 2 cm/yr (0.8 in/yr). This is causing the Eurasian Plate to deform, and the Indian Plate to compress leading to tectonic activity along major fault zones. In tectonically active areas sedimentary basins undergo phases of both crustal extension and contraction leading to basin inversion and hence display features typical of subsidence and uplift. Geomorphic attributes and deformation in late Quaternary sediments are the indicators of active tectonic activity in any sedimentary basin. The geomorphic evolution in such reactivated basins is primarily due to complex interaction between sedimentation processes and tectonics. The peninsular India has been undergoing high compressive stresses due to the sea-floor spreading in the Indian Ocean and locking up of the Indian plate with the Eurasian plate to the north. Much of this N-S directed stresses have been accommodated by the under thrusting of the Indian plate below the Eurasian plate. A part of these compressive stresses are accumulated along the Narmada-Son Fault (NSF), a major E-W trending crustal discontinuity in the central part of Indian plate. The Quaternary tectonic activity recorded in the Narmada valley possibly, has wider ramifications when viewed in the larger perspective of the Indian plate. This suggests a renewed phase of extreme compression of the Indian plate, which led to tectonic insecurity and may causes tumores and earth quake in peninsular India. The manifestation of impact of compressional forces with the movement of Indian plates have resulted in reaped and frequent migration and changes in courses of Kosi, Sharda, Ghaggar, Ghagra and their tributaries in Ganga plain. The Himalayan river Ganga and Jamuna in intermontane region had unilateral chiselled fluvial terraces in western and eastern extremity of river banks which are unpaired and non cyclic in nature indicating up lift and up rising of block in between these two mighty accedental river. Besides area also possess imprints of neotectonism, hanging drainage, tilt in terraces, over stepping of alluvial fan and chopping of apex from main body of fan deposits along the fault and lineament hanging which further revealed that area is under stress and within the periphery zone of substratum and collision Of Indian and Eurasian plate. (Khan et al 2016)

In Narmada Rift system taking as single ecological unit for Quaternary sedimentation & tectonics and presence of the Katni Formation in central sector with angiosperm flora suggests that sedimentation continued during Mio-Pliocene in localized lakes. The relative disposition of such lakes and subsequent deformation and structural dislocation on oscillating valley platform clubbed with rifting and faulting during Quaternary period has shifted the site of the lakes towards the present alluvium-covered area between Harda -Jabalpur, Garudeshwar and Bharouch as presumed: where as the present study of various aspects of Quaternary blanket in SONATA LINEAMENT ZONE revealed that quaternary sedimentation was a sequential and continuous process in rift valley system from Mio-Pliocene Pleistocene time, has deposited complete sequence of glacial, fluvio-glacial lacustrine fluvial and tidal deposits with changing environments and climate in time & space. The present disposition of quaternary blankets in Son Narmada basin is due to post deposition Quaternary tectonics which is solely responsible for sedimentation, dislocation, faulting and shifting of different blocks and distorting ecology in rift system. The occurrence of Boulder bed and Boulder Conglomerate in Son Narmada Tapti and Purna with similar rock assemblages and suites of rock fabrics, heavy mineral assemblages, and quartz grain morphology in critical and

crucial sections across the SONATA LINEAMENT ZONE strongly support tearing and rifting of quaternary blanket during late Pleistocene time. The presence of thick boulder bed in Harda inliers area, such as at Chandgarh and north east of Barwaha, boulder bed in confluence are of Tapi and waghur around Khadgaon in Tapi valley Khan et.al (1984) supports this assumption.

The Narmada Rift valley formed a linear trench in the middle of Indian subcontinent was unique site for accumulation of sediments. The rift trench is intruded by the dolerite and other mafic and siliceous dykes and sills along lineaments in different phases of tectonic deformation. The Quaternary sedimentation incepting from glacial activity, followed by fluvio-glacial, lacustrine and fluvial phase within the rifting and sinking environment, block faulting and linear displacement and dislocation, uplifting and isolated domal up-lift, Neogene rifting and Quaternary sedimentation. The rift-bound Pliocene–Pleistocene rifting and volcanic activities specifically during glacial and fluvio-glacial phase are major component of the Quaternary period and tectonic processes of the Narmada Rift System which form the base of quaternary deposits. The Narmada rift system basin platform provided a unique setting for dynamic ecosystems that were characterized by Rift-related subsidence and coeval sedimentation and has also created an ideal loci of Quaternary sedimentation and environment for the accumulation of sediments volcanic fabrics sediments, burial, diagenesis, and preservation of organic remains. The present disposition of Narmada blanket of Narmada, Tapi-Purna and Son in SONATA LINEAMENT ZONE revealed that the rift occurred after widespread Quaternary sedimentation and accumulation of sediments in the linear trench by glacial activity in late Pleistocene. The Fluvio-glacial phase is represented by boulder conglomerate which has formed the persistent horizon in the valley. The Narmada has in the area under study has sculptured the alluvial tract into stepped sequence forming four alluvial terraces along its course. These are designated as NT0 to NT3, NT0 being the youngest terrace and NT-3 the oldest terrace where the sub terraces are designated NT2-A is NT2-B, NT2 B, besides NT2-C, NT3-A & NT3-B in increasing order of antiquity. These are both erosional and depositional terraces and confined at an elevation of, between 280 to 310-380, are separated by the scarp both of curvilinear and linear in nature facing towards river side. These are abandoned flood plains represent the level of former valley floor in the area, and were formed by cumulative climato-tectonic changes in the watershed of Narmada in the Quaternary times. (Khan et.al 2016).

The Quaternary landscape of Narmada comprises ( NT-1 to NT-3 ) and their correlation with rest of Narmada Rift Valley between Jabalpur-Harda and Harda - Bharuch suggest that it has evolved mainly due to tectonic activity along the SONATA LINEAMENT in a compressive stress regime. The sediments comprising these were deposited in a slowly subsiding basin during early Pleistocene middle Pleistocene and the Late Pleistocene. The Holocene period is marked by inversion, which had earlier suffered subsidence. The inversion of the basin is due to a significant increase in compressive stresses along the NSF during the Early Holocene, resulting in differential uplift of the lower Narmada valley. The continuation of the compressive stress regime due to ongoing northward movement of the Indian plate indicates that the NSF is a major candidate for future intraplate seismicity in the region. The alluvial fan in between f Tilakwarda and Rajpipla within the loop of Narmada is mono illustration of morphogenetic process associated with neotectonic event. The disposition of Quaternary blanket, fan deposit and other quaternary land forms are restricted by SONATA LINEAMENT to wards north. The convergence of fan deposits, geomorphic set up slope, impersistancy of apex and other converging points are not in ecology of piedmont sedimentation, hence it is firmly rule out to be endogenetic fan deposits; the assemblage of sediment matrix rock fabrics and rock pethology and occurrence and disposition of these deposits indicate that it is uplifted cut mass of older quaternary deposits which has moved by tectonic activity from deep level of strata and has been pasted along SONATA LINEAMENT. (Khan et.al 2016).

There are evidences of the effects of tectonics on fauna, flora and tephra layers associated with Quaternary deposits of Narmada Rift valley, have under gone faulting, rifting, and dislocation during sedimentation. The impact of structural disturbances and evidence of the effects of tectonics on fauna and flora are distinct and their signatures on dislocation and concealing of fossiliferous horizons are uncontrolled and ill defined in the ecosystem in the valley during the Pliocene–Pleistocene periods. The boulder conglomerate which yielded the skull cap of *Homo erectus* in Narmada rift from Hathnora Sonakia ( 1984 ) remained only discovery of hominid fossil in last two and half decade due inconsistency and concealed nature of fossiliferous horizon due faulting, dislocation and subsidence of Quaternary blanket of Narmada rift system as such researcher and scientist failed to add any further knowledge to hominid discovery in Narmada any further. The area is under tremendous stress due to movement of India plate to wards north east and vertical adjustment of different blocks in the Sonata lineament zone. There appear there is significant increase in compressive stresses accumulating on an intracrustal fault like the NSF can transform a

previously subsiding basin into an uplifting one. The NSF has been characterized by a compressive stress regime throughout the Quaternary and variations in the degree of compression relative to the rates of plate movement are responsible for the late Pleistocene subsidence and the Holocene tectonic inversion in the Narmada it is witnessed by manifestation on drainage net work imprints of neotectonism and shifting and tilt in terraces of Narmada and its tributaries. Khan et.al (2016).

The impact of structural disturbances and evidence of the effects of tectonics on fauna and flora are distinct and their signatures on dislocation and concealing of fossiliferous horizons are uncontrolled and ill defined in the ecosystem in the valley during the Pliocene–Pleistocene periods. The boulder conglomerate which yielded the skull cap of *Homo erectus* in Narmada rift from Hathnora Sonakia (1984) remained only discovery of hominid fossil in last two and half decade due inconsistency and concealed nature of fossiliferous horizon due faulting, dislocation and subsidence of Quaternary blanket of Narmada rift system as such researcher and scientist failed to add any further knowledge to hominid discovery in Narmada any further.

The Tapti-Purna graben is located south of Satpura which evolved as two separate basins of fluvio-lacustrine sedimentation, connected subsequently. The most conspicuous feature of the southern margin of the Satpura between longitude 74° and 78° is conspicuous ENE-WSW to E-W trend of Tapti which display local swing at places. These trends characterizing Tapti crustal block, conform to structural grain of the area reflecting the convergence of Tapti and Gavilgarh faults enechelon system traversing Satpura foot hills, with a southerly convexity. The Quaternary basin areas in Tapti Crustal block are characterized by relatively thinner crust with moho depth of 33-37 km, shallow basement (<1 km) with higher density (+0.239m) mantle derivatives emplaced at shallow level (4-5 km; Rao K.V., 1997). The present studies taking entire quaternary sedimentation of SONATA LINEAMENT ZONE as single ecological system besides the tectonics on the either side of Satpura, it revealed that the area of SONATA LINEAMENT ZONE formed a single loci of sedimentation and there was continuous and sequential deposition of sediments from Pleistocene to Upper Pleistocene time, it is witnessed by quaternary events morphogenetic expression disposition of river terraces their mutual relation, lithostratigraphic, correlation across Narmada, Tapti–Purna and Son valley Khan (in press). The Narmada and Son are two linear basins north of Satpura and Tapti-Purna in south, was a single elliptical trench which has provided a platform of Quaternary sedimentation in Central India. The present expression and configuration and fragmented disposition of quaternary blankets of Son Narmada, Tapti and Purna is due to tearing, faulting, dislocation subsidence, up rise of various blocks and reactivation of structural fabrics with in the SONATA LINEAMENT ZONE. (Khan 2016).

The Quaternary deposits of Tapti comprised of Boulder conglomerate, fluvial deposits of paleo- domain of Tapti and Fluvial deposits of present domain of Tapti. The Boulder deposits forms the base of Quaternary deposits overlying directly of basaltic rock embodied with older deposits in the basin. It revealed that inception of quaternary sedimentation occurred in the rock basin south of Satpura in Tapti which has outer rim of basin in the west and restricted by strong N-S structural trend and striking ranges in the west. It is contradictory to the opinion of earlier worker (Tiwari, 1996) and others. The quaternary deposits of Wardha upper Pleistocene-Holocene age (50 m) (Tiwari 1985) forms the eastern fringe of Tapti Basin; it is separated from Tapti-Purna basin by episodes activation of the eastern block during Quaternary period Khan (in press). The present studies within single ecology of geomorphology and in harmony of sedimentation in lineament zone in increasing antiquity revealed that Tapti-Purna was a single basin, formed a mega tectonic depression which was hospitable to sedimentation inception from Pleistocene and continued up to Upper Pleistocene–Holocene time. The present expression is due to neotectonism in the lineament zone. In Tapti basin the boulder conglomerate occurs as persistent horizon at the base of quaternary deposit which represents specific phase of sedimentation in the basin, it is time equivalent to the boulder conglomerate of Narmada and further add that the sedimentation on either edge of Satpura and in the SONATA LINEAMENT ZONE was contemporaneous and simultaneous, which further revealed quaternary deposits of Tapti are early to middle Pleistocene in age and related to the early reactivation of Tapti lineament. The association of rock cut terraces, rock cut benches, stream lines and rock cut scar in Tapti and Waghur rivers demonstrate mighty reactivation of Tapti lineament during the early stages of sedimentation. The cyclic reactivation has vertically incised and cut country rocks in to rock cut benches in stepped sequence; whereas in the Purna valley a gape was been created by reactivation of Tapti- Purna lineament it has resulted a converging point of accumulation of sediments. The sequential analysis of deposits and its relation with drainage and its evolution indicate it was a persistent locus which was hospitable to sedimentation. Khan (2016).



The Purna basin embraces hanging drainage and configuration of basin is closed which indicates that a deep gape was created by vertical and cyclic subsidence of fault bounded block south of Satpura after inception of sedimentation in Tapti in west which was hospitable to accumulate sediments. The thick pile of sediments comprised of five lithostratigraphic units viz. Ferruginised gravel and Sand, Red Silt Formation, Brown Silt Formation, Light Grey Silt Formation and Dark Grey Silt Formation where as Tapti Basin which has only three units viz. Boulder Conglomerate at the base on rock basin followed by quaternary deposits of paleodomain and present quaternary deposits of Tapti which are older deposits. The present studies within single tectonic and geomorphic ecology and in harmony of sedimentation in increasing antiquity revealed that Tapti-Purna was a single basin which formed a mega tectonic depression in the east was hospitable sedimentation from Pliocene to Upper Pleistocene –Holocene in increasing antiquity from west to east due to tectonic slope and topographic configuration south of Satpura. The quaternary deposits of Wardha upper Pleistocene-Holocene age (50 m) (Tiwari 1985) forms the eastern fringe of Tapti Basin, it is separated from Tapti-Purna basin by episodes activation of the eastern block during Quaternary period Khan (2016). (Plate No \_4).

#### **Volcanic Ash Bed & Sedimentation:-**

The Quaternary tract of Narmada basin covers an area of about 12950 sq.km starting from west of Jabalpur (23°07'790530) to east of Handia (22° 29'; 76° 58') for a distance of about 320 km. It is found to be ideal locus of Quaternary sedimentation in Central India, as witnessed by multi-cyclic sequence of Quaternary terraces in the valley. The total estimated thickness of Quaternary sediments in the central sector of Narmada is about 325 m. where the level of Ash bed occurrence has been identified at the depth between 75-83 m of Quaternary column of valley. The Quaternary blanket consists of sediments of three domains viz. glacial, fluvio- glacial and fluvial, which were deposited in distinct environments during Quaternary time. The Boulder Bed (20 to 260 m.) below ground level is of glacial origin, comprised of thick pile of sediments occupied at the base of rock basin and were deposited by glacial activities in dry and cold climatic condition during early Pleistocene time. The fossiliferous bed Boulder conglomerate (260 to 278 m. above m.s.l.) is of fluvio-glacial origin and top four formations in increasing antiquity are Sohagpur, Shahganj, Hoshangabad and Janwasa (278 to 350m. above m.s.l.) are of fluvial origin and represent the complete sequence of Quaternary sedimentation in Narmada valley & Central India Khan & Sonakia (1992).

The rock basin of Narmada is occupied by the Quaternary sediments of three domains viz. glacial, fluvio- glacial and fluvial which were deposited in distinct environments during Quaternary time. The glacial deposit comprised of thick pile of sediments occupied base of rock basin and was deposited by glacial activities in dry and cold climatic condition during early Pleistocene time. The study of these concealed sediments, their sedimentary environments and sedimentation and correlation both in vertical and horizontal columns indicates that the lower most units, Boulder bed (20 to 260 m. below ground level) is of glacial origin, where as the fossiliferous bed Boulder conglomerate (260 to 278m. above m.s.l.) is of fluvio-glacial and top four formations in increasing antiquity Sohagpur, Shahganj, Hoshangabad and Janwasa (278 to 350m. above m.s.l.) are of fluvial origin and represent the complete sequence of Quaternary sedimentation in Central India Khan & Sonakia (1992). ). The boulder conglomerate is a marker horizon of Quaternary sedimentation in Narmada Valley and as well in Central India, its disposition and relation with other deposits in the valley, indicates a significant change in regional climate from cold dry to warm and humid, during which the sediment were re-worked from glacial front intermittently and deposited in the valley over a very long time. The skull cap of *Homo erectus* (Narmada Man) and other fauna recorded along with calc- nodules within the boulder conglomerate; suggest that warm climatic phase prevailed for very long time. (Table No AB- 1-3 & Plate No AB-1).

The Boulder conglomerate is a persistent marker horizon in Narmada valley its disposition and relation with other deposits indicates a significant change in regional climate from cold dry to warm and humid, during which the sediment were re-worked from glacial front intermittently and deposited in the valley over a very long time.

The skull cap of *Homo erectus* (Sonakia 1984) and other fauna recorded along with calc- nodules near village Hathnora (22° 52' N; 77° 52' E) in fossiliferous boulder conglomerate; named as Hathnora formation Khan & Sonakia (1992). It is found to be associated with volcanic Ash bed of Quaternary age in the area around Hathnora, and upstream Khan et.al. (1991), the two levels of horizons of Ash bed are identified and designated as NAB-I and NAB-II in ascending antiquity in the valley. The Ash bed NAB-I is associated lower litho units of boulder conglomerate which is well preserved and persistent where as NAB-II is associated with younger deposits. The NAB-I contains three micro layer (L-1 to L-3) and NAB-II two micro layers (L-4 to L-5) in increasing antiquity.

In Narmada valley the association of Ash bed NAB-I with Hathnora formation at the depth of 78 m in Quaternary column and occurrences skull cap of *Homo erectus* at the depth of 83 m in decreasing antiquity from the top assumed that Toba eruption have taken place later than existence of *Homo erectus* which appeared and resided in the valley for long time before the fall of Toba ash. The association of Ash is NAB-II at the depth of 72 m with the younger deposit revealed the second cyclic fall of Toba ash which certainly have had influenced on hominines and had collective and cumulative impact on *Homo erectus* (Sonakia1984) *Homo sapiens* (Thobold 1860, 81 ), in Narmada valley and Indian sub-continent. Oppenheimer (2003) argues that *Homo. Sapiens* occupied India before ~74 ka and may have undergone “mass extinction” as a result of the Toba eruption. The argument of Oppenheimer (2003) is in strong conformity with the present observation of authors. As sediment & Ash bed sequence of Quaternary column of Narmada (325 m) and occurrences of fossil of skull cap of *Homo erectus* (Sonakia1984) at 83 m & human cranium *Homo sapiens* (Thebold 1960,1981) transported have existed prior to fall of Toba ash and they are among the few who inspite of mass extinction caused by mega dislocation in ecology and environment related with volcanic eruption survived in Narmada Valley. It is further documented by the rarest occurrences of these fossils in subcontinent which also confirm the intensive impact of volcanic ash fall on these hominines and their consequential mass extinction.

The study of assemblage of glass matrix of Ash bed, grain morphology of glass their- relation with other minerals shape, size, texture of litho fragments of pyroclastic origin suggest that sediments were brought from distant source by Aeolian agencies in the form of thick cloud containing volcanic dust, rock matrix and different gases which remained in atmosphere for very long time and settled down across the Indian sub continent during the different phases of river sedimentation. Further study of Ash bed material and silica revealed diagnostic morphological characters of glass shards which are typical of silica volcanism (Heiken, 1972, 1974) and show close similarity with those reported from the Quaternary tephra beds of the Narmada, Son, Purna and Kukdi basins (Basu et. al., 1987; Khan et.al. 1991 Basu and Biswas, 1991; Singaraju and Shivaji, (1991) Mukhopadhyay, (1992). It is significant to note that the occurrences and association of two marked horizons at different levels further reveal that the cyclic eruption and settling of volcanic matrix has taken place with pause in the valley.(Khan 2013& Khan 2015)

The Toba eruption of 74 ka was distinctly and clearly a mega event of very great magnitude and intensity, far greater than any known historical eruption, suggesting it had very devastating impact and repercussions. It has change the global climate environment and ecology. It is significant to note that the occurrences and association of two marked horizons at different levels further reveal that the cyclic eruption and settling of volcanic matrix has taken place with pause in the valley during sedimentation (Plate No\_1, 2 &\_9)

#### **Volcanic Ash Fall & Sedimentation:-**

The 74,000 year-old super eruption of the Toba volcano, located in northern Sumatra, is recognized as one of Earth's largest known eruptions and was certainly the largest of the Quaternary period (Smith and Bailey, 1968). It is presumed that it have led to both global climatic and environmental deterioration and had a impact on decimation of modern human populations (Rampino et al., 1988; Rampino and Self, 1992, 1993a) (Rampino and Self, 1993b; Ambrose, 1998, 2003a, 2003b; Rampino and Ambrose, 2000).

However, the severity of Toba's impact on climate and hominins has been contested and debated by scientist (Oppenheimer, 2002; Gathorne-Hardy and Harcourt-Smith, 2003). Geological, paleontological and archaeological evidence from the Indian subcontinent provides an excellent opportunity to address these issues. The intensity and scale of the Toba super eruption was multidimensional and its coloumn of eruption was so vast that it forma canopy of volcanic matrix led to the deposition of a blanket of volcanic ash across the continents and river valleys over India, Malaysia, the Indian Ocean, and the Arabian and South China Seas. Resulting persistent terrestrial tephra deposits have been documented in a number of river valleys throughout India. (Khan et.al 1991 Acharyya and Basu, 1993; Shane et al., 1995; Westgate et al., 1998). The occurrence of volcanic ash has been located in Narmada, Tapti, Purna Son valleys. These occurrences are associated and preserved with archaeological, paleontological sites in these valleys.

In Narmada valley and Indian sub continent the Environment and climate during late pleistocene has been significantly affected after Toba eruption, according to Rampino et al. (1988) the size of Toba at 74 ka could have induced a volcanic winter, similar to predicted nuclear winter scenarios, as modeled by Turco et al. (1983, 1990). The injection of vast amounts of gaseous aerosols and volcanic dust and matrix into the atmosphere, which follow large volcanic eruptions, is predicted to have detrimental and decisive consequences for changes of global climate. Past historical eruptions, such as Tambora in 1815 (Stothers, 1984) and Pinatubo in 1991 (McCormick et al., 1995),

have provided evidence of post-eruption climatic deterioration and climatic. With the eruption of Toba having been far larger than both of these historical eruptions, its consequences are therefore assumed to have been far more devastating.

The imprints of devastating impacts in the area of study and specific on human population are matter of scientific concern and yet to be investigated. The studies conducted of Ash bed associated with Quaternary deposits of Narmada Valley consist of sediments of two domains viz. deposits of interglacial domain (Boulder conglomerate-Hathnora formation) and fluvial deposit of paleo-domain of Narmada. The boulder conglomerate is fossiliferous horizon of Narmada and has yielded skull cap of *Homo erectus* Sonakia (1984) (Khan & Sonakia 1991). It is marker horizon and represents interglacial phase in the history of Quaternary sedimentation in Narmada Valley. The occurrence of ash bed reported from Quaternary sediments of Narmada are associated with two horizons of ash beds of middle and upper Pleistocene age (Khan et al. 1991). These ash beds are designated as NAB-I and NAB-II consisting of five layers designated as (L1 to L5) in ascending antiquity in the valley. The Ash bed NAB-I (L1- to L-3) is associated with upper gritty units of boulder conglomerate (Hathnora formation) and is identified at an elevation of about 290m. Above m.s.l. The Ash bed NAB-II (L-4 to L5) is associated with upper units of clay silt deposits of paleo-domain of Narmada (Shahganj formation) and is identified at an elevation of 310m. above msl. The study of grain morphology of glass matrix, their relation with other minerals shape, size, texture of lithic fragments and association of other ashy sediments of pyroclastic origin suggest that sediments were brought from distant source by Aeolian agencies, during the different phases of sedimentation in Narmada Valley. It is observed that in stratigraphic column two horizons of Ash bed occurred at the vertical distance of about 20 m. which indicate that there were two phases of settling volcanic ash in Narmada valley and Indian subcontinent as a whole with significant time break. The element of time break in terms of sedimentation perceptible appears to be related with global climatic changes induced by the super volcanic eruption. These ash beds are used as tool in correlation of different quaternary deposits and archeological sites in the valley. The occurrences of two horizons of Ash bed and their deposition by settling of volcanic dust with time gap suggest induced and defused atmospheric conditions in Narmada valley for a very long time after volcanic eruption.

The atmosphere contaminated by volcanic ash volcanic matrix and huge amount of gases and dust particles had definitely affected the atmosphere and climate had have led to temporarily darkened skies in the Narmada valley and Indian subcontinent for very long time.

The study of grain morphology of glass matrix, their relation with other minerals shape, size, texture of lithic fragments and association of other ashy sediments of pyroclastic origin suggest that sediments were brought from distant source by Aeolian agencies, during the different phases of sedimentation in Narmada Valley.

It is commonly argued that if Toba was truly devastating for *H. sapiens* then comparable bottlenecks should also be seen in many other species.

The critical three dimensional study of the area around Hathnora (22°52'77°52') between Vindhya and Satpura mountains vast industry sites of the same palaeo lithic implements have been located along the edge and pediment slope of the Vindhya and basaltic upland. These sites appear to have been inhabited by Narmada hominid and its contemporaries for generations together the left over stone industry sites and unfinished material haphazardly indicate sudden dissemination and migration of hominines in search of shelter and safe places after volcanic eruption. The reporting of remains of *H. sapiens*.

In the area of Bhambetaka about 20 Kms north of hominid locality of Hathnora and relicts of rocker shelter and ancient human signature documents the dispersal of hominines after the eruption of volcanic matrix and its fall Wakankar, V.S., 2002. The association of skull cap Sonakia, A (1984) and Sankhyan (2007) described two new hominine fossils from Netankheri up stream of Hathnora in the Central Narmada valley. They include a partial left humeral diaphysis and a distal shaft fragment of the left femur associated with Hathnora formation Khan & Sonakia 1992 and analysis of quartz grain morphology of sediment columns of Hathnora and quartz grain morphology of paleosol across the quaternary strata of bore hole sampling across 556 m of rock basin revealed that *Homo erectus* of Narmada partly sustain in the glacial and fluvio-glacial environment which is documented and witnessed by Hathnora formation which marks the end hostile climate and environment of sedimentation in Narmada valley Khan (2013). The study of quartz grain and their micro structures of paleo- soil identified in concealed blanket of quaternary deposits display relatively heterogeneity in Sediment characteristics throughout across the Quaternary column of Hathnora section in central Narmada valley. The quartz grain of paleo soil and sediments display

digonestic characters of glacial fluvio-glacial and fluvial concealed environment of sedimentation at different depth. The significant breaks in grain morphology of quartz grain, surface texture and associated elements and granular matrix in the sequence of quaternary strata is recorded at 150, 350 and 350 and beyond which linked to long evolution of glacial fluvio-glacial and fluvial environment of sedimentation in time and space in increasing antiquity in the valley from the base Khan (2013). In view of the recorded observation the concealed quaternary strata to the level of about 350 m below ground level further needs attention of geoscientist for the search of human remains in Narmada valley.

The skull cap of *Homo erectus* (Sonakia 1984) and other fauna recorded along with calc- nodules near village Hathnora (22° 52' N; 77° 52' E) in fossiliferous boulder conglomerate; named as Hathnora formation Khan & Sonakia (1992). It is found to be associated with volcanic Ash bed of Quaternary age in the area around Hathnora, and upstream Khan et al. (1991). The two levels of horizons of Ash bed identified are designated as NAB-I and NAB-II in ascending antiquity in the valley. The Ash bed NAB-I is associated lower litho units of boulder conglomerate which is well preserved and persistent where as NAB-II is associated with younger deposits. The NAB-I contains three micro layer (L-1 to L-3) and NAB-II two micro layers (L-4 to L-5) in increasing antiquity.

The study of assemblage of glass matrix of Ash bed, grain morphology of glass their- relation with other minerals shape, size, texture of litho fragments of pyroclastic origin suggest that sediments were brought from distant source by Aeolian agencies in the form of thick cloud containing volcanic dust, rock matrix and different gases which remained in atmosphere for very long time and settled down across the Indian sub continent during the different phases of active quaternary sedimentation. Further study of Ash bed material and silica revealed diagnostic morphological characters of glass shards which are typical of silica volcanism (Heiken, 1972, 1974) and show close similarity with those reported from the Quaternary tephra beds of the Narmada, Son, Purna and Kukdi basins (Basu et al., 1987; Khan et al. 1991 Basu and Biswas, 1991). It is significant to note that the occurrences and association of two marked horizons at different levels further reveal that the cyclic eruption and settling of volcanic matrix has taken place with break and pause in the valley related with eruption volcanic dust and storm. (Khan 2013 & Khan 2015).

The Toba eruption of 74 ka was distinctly and clearly a mega event of very great magnitude and intensity, far greater than any known historical eruption, suggesting it had very devastating impact and repercussions. It has changed the global climate environment and ecology.

The occurrences of these skull caps with short range of their occurrences in the stratigraphic column of Narmada with the Ash beds horizon NAB-I and NAB-II and specially with the Hathnora formation one at the top at an average elevation of about 268-273 m above the mean sea level and other with younger deposits had revealed the close association with volcanic activity with their existence. The Toba Ash fall is also in very close range with the sequence of sedimentation and occurrences with both the skull caps, which certainly has its impact on the middle and late Pleistocene Hominines in Narmada valley and Indian subcontinent.

The oldest fossil from India is represented by the Narmada hominine dated to not less than 236 ka (Cameron et al., 2004), or to some time in between 150 and 250 ka (Kennedy, 2001:167). Modern human remains have been discovered in an undated Late Paleolithic context at Bhimbetka rock shelter III-A-28 (Wakankar, 2002:5) which is situated about 70 km north of Hominid locality Hathnora and from three cave sites in Sri Lanka, dating from 27.7 ka (Kennedy 1999, 2001). Using phytogeographic data, Oppenheimer (2003) argues that *H. sapiens* occupied India before ~74 ka and may have undergone "mass extinction" as a result of the Toba eruption. The later argument is in conformity with the observation of authors as it is well illustrated by close association of Ash bed and *Homo erectus* in sediment sequence of Quaternary column of Narmada.

The volcanic eruption and consequential ash fall has created severe dislocation in ecology and environment and adversely affected hominines in Narmada valley and Indian subcontinent. It is witnessed by association of Ash bed NAB-I with Hathnora formation at the depth of 78 m in Quaternary column and occurrences skull cap of *Homo erectus* at the depth of 83 m in decreasing antiquity from the top assumed that Toba eruption have taken place later than existence of *Homo erectus* which appeared and resided in the valley for long time before the fall of Toba ash. The association of Ash is NAB-II at the depth of 72 m with the younger deposit revealed the second cyclic fall of Toba ash which have had influenced collective and cumulative the *Homo erectus* (Sonakia 1984) *Homo sapiens* (Thobold 1860, 81), in Narmada valley and Indian sub-continent.

The study of cyclic Toba ash fall and using phytogeographic data, Oppenheimer (2003) argues that *Homo. Sapiens* occupied India before ~74 ka and may have undergone “mass extinction” as a result of the Toba eruption. The argument of Oppenheimer (2003) is in strong conformity with the present observation of authors. As sediment & Ash bed sequence of Quaternary column of Narmada (325m) and occurrences of fossil of skull cap of *Homo erectus* (Sonakia 1984) at 83 m & human cranium *Homo sapiens* (Thebold 1960, 1981) (transported) have rarest occurrences of human fossils in Narmada valley and subcontinent which also confirm the intensive impact of volcanic ash fall on these hominines and their consequential mass extinction caused by mega dislocation in ecology and environment by volcanic eruption. (Plate No 1, 2 & 9).

#### **Indian *Homo erectus* China man & Sedimentation:-**

The Narmada basin contains fossiliferous Pliocene–Pleistocene volcanic fabrics sediments and volcanic rocks which were occupied by early hominid populations. The Main Narmada rift is both symmetrical and asymmetrical in different segments along its length of about 1300 km. Several paleoanthropological localities, archeological sites ranging in age from the Pliocene-Pleistocene times were discovered within these basins. The discovery of Human Skull *Homo erectus* from boulder conglomerate bed of Hathnora formation Khan (1992) by Sonakia (1984) De Lumley, and Sonakia, (1985): in Sehore district M.P. India was first fossil skull of man from Indian sub-continent. It is correlated with *Homo-erects* of China on Quaternary Platform is found to be the oldest homo-erectus in Asia Khan et.al (2013) & Khan et.al (2016).

The known Pliocene–Pleistocene paleoanthropological localities have given us information about ancestors who were habitants and sparsely concentrated in the Narmada rift valley. This is not a coincidence, because the volcanic and tectonic activities that were responsible for the formation of the rift basins and formed the loci of Quaternary sedimentation & created ideal environments for the proliferation of life and the preservation of faunal and floral remains. The Quaternary volcanic eruption, ash fall, repeated tectonic dislocation and were responsible for the quick burial and preservation of fossils during diagenesis. The assemblages of sediments and granulometric parameters, diagenetic processes involving silicification, calcification, feldspathization, clay formation, and pedogenesis all played vital roles in fossil preservation in the sediments. The various rock fabrics, ash bed, paleo- sole inter bedded with the fossiliferous sediments also provide temporal information about geologic processes, faunal evolution, pale -environment, and early hominid behavior and lithic technology.

The skull cap of Narmada Man *Homo erectus* was found in Narmada Valley near village Hathnora (22° 52' N; 77° 52' E) in fossiliferous boulder conglomerate, in district Sehore, M.P., India. The skull cap is completely fossilized undistorted, renal vault nearly complete except few left Supra-orbital and statures are nicely preserved. The various morphological features and robust form of skull and excessive thickness of the bones indicate that it belongs to adult male individual (Sonakia, 1984). The discovery of skull cap of *Homo erectus* in fossiliferous boulder conglomerate in association of other mammalian fossil is recorded in stratigraphic column of Quaternary deposits at the depth of 83 m, where estimated total thickness of deposits is about (325 m). This blanket consists of sediments of three domains viz. glacial, fluvio-glacial and fluvial, which were deposited in distinct environment during Pleistocene to Holocene time (Khan & Sonakia (1992), (Khan et.al. in press). The statistical analysis of sediments from these different domains in vertical column has been conducted to ascertain the environment of sedimentation and trace the breaks in climate (Khan et.al. in press). An attempt has been made for the first time Khan et.al (2013) to correlate the various stratigraphic columns of associated hominid fossils of Narmada valley (325 m) India and that of Luochuan sequence, (90-120 m) Chenjiawo (50m) and Congwanling sequence (36 m) of China on unified Quaternary platform tied up and developed at mean sea level. The study revealed that the depth of occurrence of Narmada skull cap on unified Quaternary platform is about (83 m) as compared to with that of Chenjiawo and Gongwangling of China which occur at very shallow depth of 38 and 26 m respectively. The estimated age of Narmada Man based on these parameters is about 1.38 m.y. (+), which is greater than *Homo erectus* of Chenjiawo 0.65 m.y. and Gongwangling 1.15 m.y. of China An Zhisheng and Ho Chuan Kun (1989). On the merits of correlation of stratigraphic columns of Quaternary of Narmada, accumulation of sediment, rate of sedimentation, palaeo- environments, lithostratigraphy and biostratigraphic position of boulder conglomerate in unified Quaternary Platform, author consider it as one of the earliest and oldest *Homo erectus* in Asia. Khan et.al (2013) Khan (2016). (Plate No 1 to 9).

#### **Paleosole & Sedimentation:-**

In addition to study of tephra the study of morphology of quartz grain of Quaternary sediment study of morphology quartz grain of paleo soil and present soil of Quaternary deposits of Narmada has been attempted for the first time to

supplement the data to decipher formation of paleo soil and present soil and over all environment of sedimentation of quaternary deposit in Narmada valley.

The statistical analysis of soil samples has been conducted from the representative and crucial section in the hominid locality of Hathnora in Narmada valley and Mean Size (MZ), Inclusive Graphic Standard Deviation, Inclusive Graphic Skewness (SKI) and Inclusive Graphic kurtosis have been computed. These parameters assist in the characterization of the samples by providing a concise summary of particle size distribution which provides a basis for an interpretation of the environments of source of derivation transport and deposition.

This study of quartz grain and their microstructures of fifteen paleosoil identified in the concealed blanket of Quaternary deposit display relative heterogeneity in sediment characteristics throughout across the Quaternary column of Central Narmada valley. The study quartz grain of soil and sediments display diagnostic characteristics of glacial, fluvio-glacial and fluvial environment at different depth and levels 000.m to 150, 150 to 350, and 350 to 550 m from fluvial, fluvio-glacial and, glacial deposit (72 samples +25). The majority of quartz grain population show characteristic surface textures linked to long evolution in fluvial, fluvio-glacial and glacial environment of sedimentation in time and space in increasing antiquity in the valley. There exist a direct relationship between grain-size characteristics and the shape and surface texture of grains. The variations in shape and size of grain assemblages and imprints of particular microstructures in specific population and distinct breaks at specific level identified indicate changes of environments of sedimentation in vertical columns from glacial at the bottom of valley trough subsequently followed by fluvio-glacial and further overlain by fluvial deposits distinctly related with change of climate and tectonic changes in increasing antiquity in Narmada valley.

The study revealed that dissolution and precipitation features on quartz grain surfaces including pits, silica precipitation, crystal growth and adhering forms were present in soils at all positions. Evidence of mechanical damage including conchoidal fracture, angular edges, rounded edges and cracks were also recorded on quartz grains in valley. The statistical analysis of soil indicates particle size distributions that changes in size sorting due to glacial alluvial and colluvial transportation in valley. It is noticed that in valley sand content increases and clay content decreases from valley flanks to the central part, this assemblage increases in vertical column of quaternary blanket in valley. There is a large increase in the clay content in the toe slope soil due transport of sediments from colluvium front by reworking, winning of sediments which increases towards central parts of valley. (Plate No\_5 to 8).

#### **Quartz grain morphology & Sedimentation:-**

The grain morphology of quaternary deposits in vertical column across the depth of 320 m from the exposed section of strata and bore log samples from ETO, CgWB, GSI and other state and federal agencies were studied. The surface texture of quartz sand grains in sediments of different domain is important elements which register and record the entire process of sedimentation tectonism of mega and micro events source of sediment, erosion transportation and deposition of materials (Xiao et al., 1995; Helland et al., 1997). The weathering intensity may be revealed by surface rounding, etching or overgrowth on quartz grains (Asumadu et al., 1987; Marcelino et al., 1999). Hence in addition to the study of morphology of quartz grain of paleo soil morphology quartz grain of Quaternary sediment in increasing antiquity from the base of rock basin has been attempted for the first time to supplement the data to decipher the environment of sedimentation of quaternary deposit in Narmada valley. The representative samples were collected across the in crucial exposed cliff sections in vertical column and from the bore hole logs to identify the spatial variation in quartz grain morphology of quartz sand grain morphology and particle size distribution using SEM techniques.

The study revealed that dissolution and precipitation features on quartz grain surfaces including pits, silica precipitation, crystal growth and adhering forms were present in sediment strata at all positions. Evidence of mechanical damage including conchoidal fracture, angular edges, rounded edges and cracks were also recorded on quartz grains in valley. The statistical analysis of sediments indicates particle size distributions that changes in size sorting due to glacial alluvial and colluvial transportation in valley. It is noticed that in valley sand content increases and clay content decreases from valley flanks to the central part, this assemblage increases in vertical column of quaternary blanket in valley. There is a large increase in the clay content in the toe slope soil due transport of sediments from colluvial front by reworking, winning of sediments which increases towards central parts of valley.

This study of quartz grain revealed fifteen microstructures of quartz grain in the concealed blanket of Quaternary columns of Hominid locality Hathnora sections I to IV, which display relative heterogeneity in sediment characteristics across the Quaternary column of Central Narmada valley. The study quartz grain of sediment and

soil display diagnostic characteristics of glacial, fluvio-glacial and fluvial environment at different depth and levels 000.m to 150, 150 to 350, and 350 to 550 m from fluvial, fluvio-glacial and, glacial deposit (72 samples +25). The majority of quartz grain population show characteristic surface textures linked to long evolution in fluvial, fluvio-glacial and glacial environment in time and space in increasing antiquity in the valley.

There exist a direct relationship between grain-size characteristics and the shape and surface texture of grains. The variations in shape and size of grain assemblages and imprints of particular microstructures in specific population and distinct breaks at specific level identified indicate changes of environments of sedimentation in vertical columns from glacial deposits at base of valley subsequently followed by fluvio-glacial and further overlain by fluvial deposits distinctly related with change of climate and tectonic changes in the region.

The study of quartz grain and fine siliceous matrix their analysis of shape size and surface textures from Quaternary columns of Harhnora section I to IV from deep bore sediment logs up to the depth of 550m indicate that occurrence of concealed blanket of Quaternary sediments deep in Narmada linear trench deposited in turmoil tectonic environment under dry and cold condition. Its configuration and its relation to the bed rock indicate that glacier was the dominant transport agent during lower and middle Pleistocene time and sediment were deposited on uneven platform in narrow and tight trench.. The depositional mechanisms were strongly influenced by tectonic and dry environment of sedimentation.

The grain morphology shapes and surface textures of sand-sized quartz grains from the sediments of various domains of Narmada Valley were studied to characterize and understand source of sediments, nature of weathering process, transport of sediments and overall environment of deposition and sedimentation. The study of sediment and fine matrix revealed that sediments were deposited in rinsing and sinking platform on tectonically adjusted blocks under different environments. The sediment assemblage is highly heterogeneous, assorted hybrid, and its distribution and its configuration is iritic and unpredictable. The source of sediments is multi provenance and there is strong mixing of sediment from multi sources of sediments including pre-existing Quaternary front of sedimentation. The configuration of sediments in the tectonic trench appears to be influenced by readjustment of various blocks in various phases the entire bulk of sediments were deposited a high-energy of glacial fluvio glacial and fluvial environment.

The initial stage of glacial sedimentation in deep Narmada rift trench is highly influenced by tectonics of SONATA lineament Zone. However, a fluctuation in energy condition in the sediment blanket has disclosed that detrital material dominantly derived from metamorphic meta- sedimentary and basaltic terrain by direct abrasion.

The 250- to 315-um-sized quartz fraction is characterized by a high percentage of sub angular grains (40%- 70%) at the depth of about 116 m b.g.l. The populations of the grain at upper Quaternary strata are surrounded and original morphic elements persist over quartz grain. The quartz grain indices between 166-255 m b.g.l depicts decrease in roundness and majority of population of grain show increasing percentage of angularity (40-60 %), further down quartz grains beyond 255 m b.g.l display high degree of angularity in isotropic pattern. The sub rounded grains have poor population and angular grains (10%-0%), which are dominant over rounded grains (0-5 %-), while well-rounded grains are minor (0%-2%). These grain-shape distributions indicate texturally immature sediments. The presence of both angular, sub angular to sub rounded grains suggests a mixing of grains with different degrees of wear and from several sediment sources. The variation of association associated constituents (mica, feldspar, carbonate, shale) also is indicative of multiple sediment sources. The grain-shape variations from sample to sample, particularly with the rock types in litho logic units are of different order and subjected. Amplitude However, these grain shapes do indicate consistency across the thickness of Quaternary blanket. It is observed that the shape and size mainly influenced by lithology and weathering processes which they are subjected, the indices of angularity indicates a general upward decrease of grains. However, the percentage of sub rounded grains does not increase significantly, and the well-rounded grains are present in the upper part of the blanket. This indicates a change of sediments homogeneous to wards heterogeneity and display inverse relation of size and shape and iritic dumping of sediments by glacial activity.

The concealed Quaternary sediments in lower segment (456m) is characterized by sediments that may contain a high percentage coarser-grained fraction and very low percentage of of fine sand. The percentage of rounded grains increases and the percentage of angular grains decreases when the fine sand content or the mean size increases. The percentage of well-rounded grains varies independently, but usually is lower when the fine sand content is higher.

The low proportion of sub rounded grains as well as well-rounded grains in the coarser-grained sediments are insignificant very rare and is inconformity with the modality of interpretation of these grains having been deposited under dynamic condition on platform of tectonic dislocation and instability during sedimentation by glacial agencies in the SONATA Lineament Zone the configuration of quaternary deposits with bed rock revealed that sedimentation is strongly influenced by repeated structural dislocation and anisotropic and asymmetric faulting.

The representative samples from stratigraphic sequence contain grains which show several different types of microstructures. Impact features Parallel striations grinding features Crescent-shaped features Solution of quartz Silica deposits Silica pellicle. Quartz crystal overgrowths Pressure-solution features. The study of sediments display diagnostic characteristics of glacial, fluvio-glacial and fluvial environment at different depth and levels 000.m to 150, 150 to 350, and 350 to 550 m from fluvial, fluvio-glacial and, glacial deposit (72 samples). The majority of quartz grain population show characteristic surface textures linked to long evolution in fluvial, fluvio-glacial and glacial environment in time and space. An indication of glacial evolution (parallel striations or grinding features) was observed in samples (10%-60% of grains) in 35 samples from different levels between 390 to 525 m the percentage of grains showing a glacial origin having parallel striations, fresh silica pellicles, and polished silica pellicles and fresh impact features. As such evidences of glacial, fluvio-glacial and fluvial evolution is marked in the lower stratigraphic columns of Narmada. In addition some of grains exhibit fresh quartz overgrowths, old aeolian features, and silica pellicles at some level of sedimentation. This indicates a mixing of grains from different provenances. The parallel striations and fresh impact features are diagnostics of glacial environment and demonstrate consistency in occurrence. This implies a change of environment of sedimentation from glacial to fluvio-glacial and fluvial. This variation is accompanied by a decrease in the percentage of rounded grains and in the fine-sand fraction. The parallel striations are polished, were observed. The composite illustration of fresh striations and polishing of grains support to glacial environment of sedimentation in Narmada valley during lower Pleistocene time. The density of grains possessing such diagnostic elements of glacial origin decreases up ward in vertical column and their consistency has inverse relation which indicates sequential change of environment from glacial, to fluvio-glacial and fluvial in chronological sequence up ward in the Narmada trough.

The sediments confined up to 150 m below ground level represent paleo fluvial domain of Narmada and represent multi cycle sedimentation under varying energy condition on oscillating platform. A direct relationship between grain-size characteristics and the shape and surface texture of grains is observed. The variations in shape and size of grain and assemblages and imprints of particular microstructures in specific population and distinct breaks at specific level identified indicate changes of environments of sedimentation in vertical columns from glacial at the bottom of valley trough subsequently followed by fluvio-glacial and further overlain by fluvial deposits distinctly related with change of climate and tectonic changes in the Region. This study revealed diversity in the sediment sources and in the transport agents before the last stage of sedimentation on tectonic platform of SON NARMADA LINEAMENT ZONE.

The study of quartz grain form surface and subsurface quaternary blanket enveloped in the tectonic trench display diagnostic characteristics of glacial, fluvio-glacial and fluvial environment at different depth and levels 000.m to 150, 150 to 350, and 350 to 550 m from fluvial, fluvio-glacial and, glacial deposit (72 samples + 25 ). The majority of quartz grain population show characteristic surface textures linked to long evolution in fluvial, fluvio-glacial and glacial environment in time and space. An indication of glacial evolution (parallel striations or grinding features) was observed in samples (10%-60% of grains) in 35 samples from different levels between 390 to 525 m the percentage of grains showing a glacial origin having parallel striations, fresh silica pellicles, and polished silica pellicles and fresh impact features. As such evidences of glacial, fluvio-glacial and fluvial evolution is marked in the lower stratigraphic columns of Narmada. In addition some of grains exhibit fresh quartz overgrowths, features, and silica pellicles at some level of sedimentation. This indicates a mixing of grains from different provenances. The parallel striations and fresh impact features are diagnostics of glacial environment and demonstrate consistency in occurrence. This implies a change of environment of sedimentation from glacial to fluvio-glacial and fluvial. This variation is accompanied by a decrease in the percentage of rounded grains and in the fine-sand fraction. The parallel striations are polished, were observed. The composite illustration of fresh striations and polishing of grains support to glacial environment of sedimentation in Narmada valley during lower Pleistocene time. The density of grains possessing such diagnostic elements of glacial origin decreases upward in vertical column and their consistency has inverse relation which indicates sequential change of environment from glacial, to fluvio-glacial and fluvial in chronological sequence up ward in the Narmada valley The study of statistical parameters across the entire thickness of Quaternary deposits revealed three breaks in sedimentation at 350 -290, 190-220, 100-150 in the valley where as an breaks in Hominid locality Hathnora I to IV section s is at 280m, at 210m and at 35m in



increasing antiquity from the base of rock basin which represent glacial, fluvioglacial and fluvial environment of sedimentation in the Narmada valley. The correlation of different sequential and sedimentological breaks indicate subsidence and up lift of different blocks and platform of sedimentation due to tectonic and neotectonic activity. (Plate No\_5 to \_8).

#### **Paleoanthropological Record & Sedimentation:-**

The area around Hominid locality of Hathnora area is occupied by thick Quaternary sediments which represent various domain of sedimentation. Based on sedimentological characters, depositional environments, and erosional processes and their correlation with depositional / erosional terraces revealed that quaternary blanket is consisting of three domains of sediments viz glacial, fluvio-glacial and fluvial. The lower most units (Boulder bed) is of glacial origin, the boulder conglomerate of glacio-fluvial (Khan *et. al* 1991) and fluvial terraces are of fluvial paleo- domain of Narmada. The top four formations Sohagpur, Shahganj, Hoshangabad and Janwasa are designated as (NT<sub>0</sub>-NT<sub>3</sub>). Boulder conglomerate is assigned an independent formational status based on distinct lithology and fossil assemblage. The sequence of Quaternary events and the history of sedimentation of Narmada indicate that the upper 70m to 90m of the Narmada alluvium was deposited in two distinct aggradations episode with a distinct and well defined break in sedimentation in rift system. The dissection of the quaternary blanket resulted two terraces (NT<sub>3</sub>-NT<sub>2</sub>), after break in sedimentation. The sediments of this aggradations episode constitute three lithostratigraphic units Sohagpur, Shahganj, Hoshangabad formation. The sediments of the alluvial phase are underlain by a boulder bed of glacio-fluvial origin. Thus, the fossiliferous boulder conglomerate, the basal unit of alluvium marks a disconformity between the lower glacial-boulder layer and upper fluvial sediments. The fossiliferous basal boulder conglomerate is being of middle Pleistocene age (Khan 1992).

In India Narmada basin considering the one of a main loci of Quaternary sedimentation, and assuming the uniform accumulation rate of sediment in the basin in the line of Ma. *et. al.* (1978) Yubin Sun & Zhisheng, An (2005) and comparing the Narmada sequence of Quaternary deposit (325 m.) with those of Luochuan standard sequence of Chenjiawo and Congwangling sequence of China. The skull cap of *Homo erectus* (Narmada Man) recovered from the boulder conglomerate of fluvio-glacial origin in middle part of Quaternary column from deep level of Narmada, at the depth of 83 m. above glacial deposits, in association of ash bed, as compared to Chenjiawo Hominid from inter bedded sequence of paleo soils loess and silty loess at the depth of 38 m. and Congwangling 26 m. from paleo soils which are younger than Narmada deposits.

The Narmada skull cap of *Homo erectus* which is recovered from the top of basal unit of boulder conglomerate at the depth of 83 m. (278 m. above m.s.l.) is estimated to be of upper segment of lower Pleistocene age. It is older than the *Homo erectus* of Chenjiawo, Congwangling of China which were recovered from paleo-soil and loess deposit at the depth of 38 and 26 m. The Quaternary sequence of Narmada (325 m.) as compared to Luochuan (136 m.) sections of China on unified Quaternary platform is older and represents the complete and type sequence of Quaternary sedimentation in Narmada Rift System in Central India. The occurrence of skull cap of early man at the depth of 83 m. in basal unit of boulder conglomerate of fluvio-glacial origin in Narmada Valley is one of the earliest and oldest *Homo erectus* in Asia.

The skull cap of Narmada Man *Homo erectus* was found in Narmada Valley near village Hathnora (22° 52' N; 77° 52' E) in fossiliferous boulder conglomerate, in district Sehore, M.P., India. The skull cap is completely fossilized undistorted, cranial vault nearly complete except few left supra-orbital and sutures are nicely preserved. The various morphological features and robust form of skull and excessive thickness of the bones indicate that it belongs to adult male individual (Sonakia, 1984). The discovery of skull cap of *Homo erectus* in fossiliferous boulder conglomerate in association of other mammalian fossil is recorded in stratigraphic column of Quaternary deposits at the depth of 83 m, where estimated total thickness of deposits is about (325 m). This blanket consists of sediments of three domain viz. glacial, fluvio-glacial and fluvial, which were deposited in distinct environment during Pleistocene to Holocene time (Khan & Sonakia (1992), (Khan *et.al.* in press). The statistical analysis of sediments from these different domain in vertical column has been conducted to ascertain the environment of sedimentation and trace the breaks in climate (Khan *et.al.* in press). An attempt has been made for the first time Khan *et.al.* (2013) to correlate the various stratigraphic columns of associated hominid fossils of Narmada valley (325 m) India and that of Luochuan sequence, (90-120 m) Chenjiawo (50m) and Congwangling sequence (36 m) of China on unified Quaternary platform tied up and developed at mean sea level. The study revealed that the depth of occurrence of Narmada skull cap on unified Quaternary platform is about (83 m) as compared with that of Chenjiawo and Gongwangling of China which occur at very shallow depth of 38 and 26 m respectively. The estimated age of

Narmada Man based on these parameters is about 1.38 m.y. (+), which is greater than *Homo erectus* of Chenjiawo 0.65 m.y. and Gongwangling 1.15 m.y. of China An Zhisheng and Ho Chuan Kun (1989). (Plate No 1 to \_9)

The Narmada Rift System provides a unique Quaternary landscape as sites of sedimentation setting which indicates human origins and evolution. Skeletal and cultural remains of hominids have been recovered from many locations within the basins. The most of localities occur on the rift floor in between Jabalpur\_Harda, in the east and Tilakwarda\_Bharouch in central in the west in the valley. The virgin and previously unknown areas of the rift basins were studied and inventory of paleoanthological and paleoanthropological resources were made. The survey indicated the potential of the Mio-Pliocene Pleistocene time and late and early Pleistocene Quaternary sediments of the Narmada Rift System for paleoanthological paleoanthropological research. The remarkable preservation of faunal and floral remains in the Pliocene–Pleistocene sedimentary rocks was possible because of quick burial by sediments. Moreover, these source rocks of rift system the Quaternary sediments and interbedded tuffs provided the necessary chemical components for the preservation of the fossils during diagenesis. There is a strong link between these dynamic processes, rapid sediment deposition, and fossil preservation. The most important primary and contextual data (fossils and artifacts) were embedded and preserved in sedimentary deposits until the recent exposure by tectonic driven erosional processes. The time-stratigraphic data obtained from tephra interbedded with fossiliferous Quaternary sedimentary deposits provided an important framework for the study of hominid origins, evolution, adaptations, and cultural changes. The paleoanthological Paleoanthropological information from these localities is remained closely associated with Quaternary sedimentary deposits boulder conglomerate and boulder bed often related to the trench Quaternary sedimentation, formation and development of rift and linear basin caused by repeated uplift, and the development of rift basins that began in the middle to late Pliocene and Pleistocene period. The unfortunate part of these deposits is that due repeated tectonic dislocation and faulting they are dislocated and distorted and at present are concealed under the thick pile of sediments of present and paleo domain of Narmada of late Pleistocene and Holocene time. These deposits do not provide adequate opportunity to scientist and researcher to study the human remain as postulated, except in limited section where they are exposed.

In Narmada valley the most of the hominid remains and associated artifacts in the would have been found associated with Miocene Pliocene–Pleistocene sediments of boulder bed and boulder conglomerate in increasing antiquity, unfortunately same are not exposed due rift system and tectonic setting. In the rift system the type development of Quaternary blanket is confined between Jabalpur\_Harda section, and Tilakwarda\_Bharouch which possess the complete sequence of all three domain in increasing antiquity in chronology in vertical column from the bottom of the rift trench viz Boulder bed (glacial), Boulder conglomerate (fluvio-glacial) sediments of paleo-domain of Narmada (fluvial). The intense tectonic activities within the basins of the Narmada Rift System during the Neogene and Quaternary periods have destroyed fossil record except the fossiliferous horizons exposed in river sections. The erosional-sedimentary cycle has persisted in the rift valley environment for millions of years as a result of the interplay between depositional and erosional forces driven by tectonic processes; there are numerous gaps in the fossil record, particularly in the important time period between Mio-Pliocene Pleistocene times. It is pertinent to the understand the origin of Hominid during the late Miocene, but it is difficult to disclose mysteries of human evolution in Narmada due to concealed nature of these deposits in rift system, however the complementary part of Tapti-Purna Quaternary blanket may be potential and possessive of human remain and should be studied to trace further the imprints of fossil man taking in to account of SONATA LINEAMAN ZONE as single ecosystem for evolution of man in Indian subcontinent.

The Narmada skull cap of Sonakia (1984), including other fossil assemblage suggest that the Narmada Rift System created productive ecosystems during Pliocene–Pleistocene time. The volcanic rocks within the fossiliferous sediments provide temporal information for calibrating and sequencing hominid and other faunal evolution. The detailed study geological, sedimentological, geochemical, aspects of interbedded tephra quartz grain morphology of sediments of quaternary strata paleo-sole and geochronological studies of different localities for establishing accurate biostratigraphic and lithostratigraphic data, sedimentation rates pale environmental and tectonic histories of different sediment columns in area along of the rift system, Interbedded volcanic rocks allow determination of the time of rifting, the beginning of sedimentation, sedimentation rates, and the oscillation of rift platform from glacial, fluvio-glacial lacustrine to fluvial environments. The cyclic environmental transitions recorded in the sedimentary sequences of the rift basins are caused by tectonic activities (uplift and subsidence), changes in relief, and climatic variations. The climatic changes in uplift, topographic and landscape features, coupled with block faulting, rising and sinking platform, created basins for the accumulations of thick lacustrine and fluvial sediments sequences with terrestrial and aquatic fossils. The sequential change in the sediment facies from finely bedded lacustrine deposits to fluvial sediments are commonly noted in the sedimentary sequences and reflect environmental

and tectonic changes that can be temporally determined. Moreover, regional correlation based on the chemistry and geochronology of interbedded tephra has made it possible to establish accurate stratigraphic relations that are useful for pale- environment reconstruction and evolutionary studies of fossil remains in the Narmada rift valley Khan et.al. ( 2013). Regional tephra correlation is being used increasingly to link sites together, and has already established that similar tephra layers are known from other parts of rift valley, as well as from other basin and peninsular India Basu, Biswas, and Acharyya, S.K. (1987): Achariya,( 1993), Khan, (1992) Khan et.al. (2013). There is a great potential for further correlation of tephra in the rift system and marine sediments in the Arabian Sea. The Arabian Sea has a continuous record of deposition that extends to at least 7 million years. The Quaternary sediments interbedded with tephra within the age range of the ODP Ocean Drilling Program 721/722 stratigraphic sections of the Arabian Sea are also present within the rift floor and the western rift margin of the region. The chemical and chronological correlations of ash beds within the rift sequences have been made with ashes described in marine sections. Detailed correlations based on orbitally calibrated time scales of pale magnetic stratigraphy Rao (1985) within Quaternary sediments of rift deposits will provide ties to establish global climate changes based on the terrestrial and marine sediments of the rift system.

The rift system and platforms of sedimentation bear the imprints of and evidence of the effects of tectonics on fauna and flora are distinct, however the signatures of subsidence dislocation and concealing of fossiliferous horizons are uncontrolled and ill defined in the ecosystem in the valley during the Pliocene–Pleistocene periods. The boulder conglomerate which yielded the skull cap of *Homo erectus* in Narmada rift from Hathnora Sonakia (1984) remained only discovery of hominid fossil in last two and half decade due to concealed and hidden nature of Mio-Pliocene Pleistocene deposits in rift system and inconsistency in exposure of fossiliferous horizon of Narmada rift system which is the handicapp in search of further human remains in Narmada valley after Sonakia (1984). (Plate No\_5 to 8).

#### **Sediment statistics & sedimentation:-**

The SONATA LINEAMENT ZONE embodies the two Quaternary basins of tectonic origin on the two margins of Satpura Crustal Block. The Satpura block traversed by enechelon system of faults and lineaments is characterized by thinner crust (33-38 km deep, basement depth >2.5 km) with series of ENE-WSW trending gravity high (viz. Sendwa, Khandwa, Chicholi, Tikaria etc.) with amplitudes of 10-35 mgal. The chain of gravity high indicates extensive magmatic and emplacement of derivatives at shallow crustal levels. The associated Narmada South (Satpura North) fault and Satpura South Fault marking the two hinges of the Satpura block are fundamental in nature and extend to Moho level. The Narmada Quaternary basin in the north and Tapi-Purna basin in the south are two Graben which formed prominent loci of sedimentation in lineament zone. The area of lineament zone studied tectonically encompasses two crustal provinces of Central India Shield, namely, the Northern Crustal Province (NCP) and the Southern Crustal Province (SCP). The two provinces are separated by a crustal level shear zone, referred as Central Indian Suture. The zone has been a major locus of episodic tectonism with evidences of reactivation.

The Narmada Rift valley forms ENE-WSW lineament where Quaternary deposits are confined in a trough like basin on unstable platform which forms a prominent lineament with profound geomorphologic and geological asymmetry between the northern and southern valley walls, giving it a tectonic significance. The alluvial deposits of the Narmada valley represent the thickest Quaternary deposits in peninsular India. These sediments were deposited in faulted and sinking platform under structural riparian rift trench remained silent and unrevealed. The quaternary blanket of Narmada consists of sediments of various domains which were deposited in different environment in vertical chronology in faulted trough in time and space.

The Quaternary sedimentation in Narmada Rift valley incepting from glacial activity, followed by fluvio-glacial, lacustrine and fluvial phase within the rifting and sinking environment, block faulting and linear displacement and dislocation, uplifting and isolated domal up- lift, Neogene rifting and Quaternary sedimentation. The rift-bound Pliocene–Pleistocene rifting and volcanic activities specifically during glacial and fluvio-glacial phase are major component of the Quaternary period and tectonic processes of the Rift System which form the base of quaternary deposits. The Narmada rift system basin platform provided a unique setting for dynamic ecosystems that were characterized by Rift-related subsidence and coeval sedimentation and environment for the accumulation of sediments volcanic fabrics sediments, burial, diagenesis, and preservation of organic remains.

The present disposition of Narmada blanket of Narmada, in SONATA LINEAMENT ZONE revealed that the rift occurred after widespread Quaternary sedimentation and accumulation of sediments in the linear trench by glacial activity in late Pleistocene. The Fluvio-glacial phase is represented by boulder conglomerate which has formed the persistent horizon in the valley. The Narmada has in the area under study has sculptured the alluvial tract into stepped sequence forming four alluvial terraces along its course. These are designated as NT0 to NT3, NT0 being the youngest terrace and NT-3 the oldest terrace where the sub terraces are designated NT2-A is NT2-B, NT2 B, besides NT2-C, NT3-A & NT3-B in increasing order of antiquity. These are both erosional and depositional terraces and confined at an elevation of, between 280 to 380 are separated by the scarp both of curvilinear and linear in nature facing towards river side. These are abandoned flood plains represent the level of former valley floor in the area, and were formed by cumulative climato-tectonic changes in the watershed of Narmada in the Quaternary times Khan et.al (2016).

The study of statistical parameters of MZ, STD, SKI, and KG of different domains of sediments in chronology and stratigraphic columns their relation in time space, their binary relation, trends of plots, their correlation with different columns in Jabalpur \_Bharuch section. The Quaternary deposits of Narmada valley represent the thickest sequence (320 m) which was deposited in faulted and sinking platform under structural riparian rift trench which remained silent and unrevealed. The work so far carried out is restricted to few exposed section of 18 m of river as such on work has been done on concealed strata of quaternary deposits. The synthesis of various parameters their binary relation, concentration of plots their pattern and trend revealed that the quaternary deposits consists of sediments of three mega lithostratigraphic units viz Boulder bed, boulder conglomerate and fluvial deposits. The fluvial deposits include sediments of paleo-domain of Narmada and present domain of Narmada which constitute fluvial terraces (NT1 to NT3) of Narmada. These three domains of sediments were deposited, from Pleistocene to Upper Pleistocene time in increasing antiquity in the valley.

The study of statistical parameters and their binary relation distinctly display contrasting and relative heterogeneity in sediment characteristics throughout across the Quaternary blanket in Narmada valley. The study of sediments display diagnostic characteristics of glacial, fluvio-glacial and fluvial environment at different depth and levels 000.m to 150, 150 to 350, and 350 to 550 m from glacial, fluvio-glacial fluvial, and fluvial deposit (150 samples). The critical analysis of these parameters exhibits sediment textural linkage to long evolution in glacial, fluvio-glacial and fluvial environment in time and space in increasing antiquity in the valley. The characteristics inherited by the sediments from pre-existing domain of sediments are glacial & terrestrial & environment. The diagenetic and diagnostic features; varying degrees of heterogeneity, sediment angularity roundness, degree of sorting indicate evolution and sedimentation of quaternary sediments in a high-energy turmoil glacial environment on tectonically dislocated and unstable platform. The sediments confined up to 150 m below ground level represent paleo fluvial domain of Narmada and represent multi cycle sedimentation under varying energy condition on oscillating platform. The vertical variation in increasing antiquity in textural parameters and distinct breaks at specific level identified indicate changes of environments of sedimentation in vertical columns from glacial at the bottom of valley trough subsequently followed by fluvio-glacial and further overlain by fluvial deposits which is related with change of climate and tectonic in watershed of Narmada. The binary relation of these parameters effectively used in differentiating and fencing the sediments of these domains and their environment of sedimentation in time and space Khan et.al (2015). The study of statistical parameters across the entire thickness of Quaternary deposits revealed three breaks in sedimentation at 350 -290, 190-220, 100-150 in the valley where as breaks in Hominid locality Hathnora I to IV sections is at 280m, at 210m and at 35m in increasing antiquity from the base of rock basin which represent glacial, fluvioglacial and fluvial environment of sedimentation in the Narmada valley. The correlation of different sequential and sedimentological breaks indicate subsidence and up lift of different blocks and platform of sedimentation due to tectonic and neotectonic activity.

The study of statistical parameters of Hathnora sections I, II, III, & IV and their binary relation distinctly display contrasting and relative heterogeneity in sediment characteristics throughout across the Quaternary blanket in Narmada valley. The study of sediments display diagnostic characteristics of glacial, fluvio-glacial and fluvial environment at different depth and levels 000.m to 150, 150 to 350, and 350 to 550 m from glacial, fluvio-glacial fluvial, and fluvial deposit (150 samples). The critical analysis of these parameters exhibits sediment textural linkage to long evolution in glacial, fluvio-glacial and fluvial environment in time and space in increasing antiquity in the valley. The characteristics inherited by the sediments from pre-existing domain of sediments are glacial & terrestrial & environment. The diagenetic and diagnostic features; varying degrees of heterogeneity, sediment angularity roundness, degree of sorting indicate evolution and sedimentation of quaternary sediments in a high-

energy turmoil glacial environment on tectonically dislocated and unstable platform. The sediments confined up to 150 m below ground level represent paleo fluvial domain of Narmada and represent multi cycle sedimentation under varying energy condition on oscillating platform. The vertical variation in increasing antiquity in textural parameters and distinct breaks at specific level identified indicate changes of environments of sedimentation in vertical columns from glacial at the bottom of valley trough subsequently followed by fluvio-glacial and further overlain by fluvial deposits which is related with change of climate and tectonic in watershed of Narmada.

The binary plots of co-efficient of sorting v/s kurtosis and coefficient of sorting v/s mean diameter have been used as effective tool in delineating an area of occupation of glacial and its activity. The plots of skewness v/s mean diameter and kurtosis v/s mean diameter have also been found effective to some extent in delineating areas glacial and fluvial activity. The fluvio glacial sediments in all the above plots show most erratic behavior and are not to be bounded by any pair of parameters. But however, the plot kurtosis v/s skewness is positive to some extent in demarcating a flexible boundary between glacial and fluvio-glacial sediments. As whol binary relation of these parameters effectively used in differentiating and fencing the sediments of these domains and their environment of sedimentation in time and space.

(Plate No \_5 to 8).

### Heavy Minerals & Sedimentation:-

The Narmada Rift valley formed a linear trench in the middle of Indian subcontinent was hospitable linear depression for accumulation of sediments. The rift trench is intruded by the dolerite and other mafic and siliceous dykes and sills along lineaments in different phases of tectonic deformation. The Quaternary sedimentation incepting from glacial, followed by fluvio-glacial, lacustrine and fluvial activity. The platform of sedimentation had rinsing and sinking environment, block faulting and linear displacement and dislocation, uplifting and isolated domal up- lift. The Neogene rifting and quaternary sedimentation, rift-bound Pliocene–Pleistocene rifting and volcanic activity specifically during glacial and fluvio-glacial phase are major component of the Quaternary period and tectonic processes of the Narmada Rift System which form the base of quaternary deposits.

The Narmada Valley in the Hathnora area is occupied by thick Quaternary sediments. These sediments are classified based on sedimentary depositional environments, sedimentological characters and correlation with depositional / erosional terraces. The lowermost units (Boulder conglomerate) is of glacio-fluvial origin (Khan *et al* 1991) whereas the rest of fluvial origin. The top four formations (Sohagpur, Shahganj, Hoshangabad and Janwasa) are classified based on morphostratigraphic state (NT<sub>0</sub>-NT<sub>3</sub>), degree of oxidation, calcification and compaction. Janwasa formation comprises of sediments of active channel deposition and is the older three (Sohagpur, Shahganj, Hoshangabad formation) are related to older flood plains deposits of paleo-domain of Narmada and are grouped under older alluvium. Boulder conglomerate of fluvio-glacial origin is assigned an independent formational status based on distinct lithology and fossil assemblage. The sequence of Quaternary events and the history of sedimentation of Narmada indicate that the upper 70m top 90m of the Narmada alluvium was deposited in a single aggradations episode with minor pauses when dissection of the alluvium produced two terraces (NT<sub>3</sub>-NT<sub>2</sub>). The sediments of this aggradations episode constitute three lithostratigraphy units viz. Boulder conglomerate, Sohagpur and Shahganj formation. The sediments of the alluvial phase are underlain by a boulder bed of glacio-fluvial origin. Thus, the fossiliferous boulder conglomerate, the basal unit of alluvium marks a disconformity between the lower glacial-boulder layer and upper fluvial sediments. The fossiliferous basal boulder conglomerate is being of middle Pleistocene age (Khan 1992). The Quaternary sediments in Narmada represent three distinct group of deposits viz. glacial, fluvio- glacial and fluvial; which was deposited in distinct environment in Quaternary times.

The Hathnora Sections \_I to IV (22° 52" N; 77° 58" E) are located around village Hathnora between Sardarpur\_Hoshangabad along Narmada from where the 203 sediment samples are collected for heavy mineral studies. In river section about 18 m scrap of sediments consisting of Boulder conglomerate and fluvial terraces deposit is exposed in increasing antiquity. The Boulder bed is hidden and concealed in the area under younger deposits as such samples have been taken from ongoing bore hole drilling log between the depths of 90 to 201 m below the surface for heavy mineral study. The qualitative and quantitative studies of heavy minerals of Quaternary deposits of different domain revealed five prominent heavy mineral suites viz, opaque suite; amphibole-pyroxene suite, biotite-muscovite-chlorite suite, garnet, sillimanite, kyanite, staurolite suite and zircon, rutile, tourmaline suite.

The Quaternary blanket has been studied in three dimension and about 907 sediment were collected to study of statistical parameters heavy mineral assemblage, quartz grain morphology, quartz grain morphology of paleosol, ash bed and other aspect across the depth of about 480 m. The study revealed that their binary relation distinctly displays contrasting and relative heterogeneity in sediment characteristics throughout across the Quaternary blanket in Narmada valley. The study of sediments display diagnostic characteristics of glacial, fluvio-glacial and fluvial environment at different depth and levels 000.m to 150, 150 to 350, and 350 to 550 m from glacial, fluvio-glacial fluvial, and fluvial deposit (150 samples). The vertical variation in increasing antiquity in textural parameters and distinct breaks at specific level identified indicate changes of environments of sedimentation in vertical columns from glacial at the bottom of valley trough subsequently followed by fluvio-glacial and further overlain by fluvial deposits which is related with change of climate and tectonic in watershed of Narmada. The qualitative and quantitative studies of heavy minerals of Quaternary deposits of different domain from the same samples revealed five prominent heavy mineral suites viz, opaque suite; amphibole-pyroxene suite, biotite-muscovite-chlorite suite, garnet, sillimanite, kyanite, staurolite suite and zircon, rutile, tourmaline suite.. The mineral of stable group viz. rutile, zircon and tourmaline show uniform distribution in the entire domain of terraces in the area of study. The zircon rutile, tourmaline and sphene are highly stable minerals though their abundance is common in quaternary deposit, hence considered to be very significant. The grain morphology and imprints of sedimentation these mineral bear are of immense significance in understanding the source of sediment, its nature of transportation, mode of transport, kinetics of medium and sedimentation. Their relative frequency in critical column bear significance as regard to tectonic set up of various rock units in the watershed. The contrasting grain morphology of these heavies in the various domains of quaternary deposits is useful in tracing the environments of their deposition. Minerals with low stability such as hornblende, hypersthene, Illuminat and biotite are more significant as regards to the correlation and chronological status of quaternary deposit. These minerals show variable degree of stability and morphological characteristics, hence these parameters have been taken into account is deciphering the mode of environment of sedimentation and correlation of quaternary deposits in Narmada Valley. The zircon rutile tourmaline and sphene minerals occur as accessories mineral, mostly released from rock fabrics comprising boulder bed and were subjected to different degree of wear and tear and physical condition of weathering transport and deposition, the micro imprints acquired by different condition of sedimentation revealed the intense grounding and bed traction of sediments from the source. The striations on these minerals indicate intense glacial activity in the initial stage of sedimentation. These are generally angular to highly angular in shape and show very poor indices of sphericity and roundness typical of glacial environments. Occasionally sub-hedral partly broken prismatic crystals of tourmaline are also in these deposits.

The study revealed that sediments were primarily derived from metamorphic source comprising of kyanite-paragonite, muscovite schist, gneiss, garnet mica schist, and Para-amphibolite tourmaline garnet metasedimentaries and meta-volcanic. Apart these minerals are also reworked from older Quaternary deposits from Boulder bed glacial deposit, Boulder conglomerate of fluvio-glacial deposit and fluvial terrace and higher and other older terraces of fluvial domain. These heavies were basically transported from the sources area by glacial fluvio-glacial and fluvial agencies to the present site of their occurrence. The mode of transportation, environment of deposition and energy system of transporting media has greatly affected the frequency of concentration of heavies, their grain morphology and stability in that particular domain of deposit. These minerals, mostly released from rock fragments and other fabrics comprising boulder bed, subjected to intensive wear and tear and physio-chemical environment of weathering transport and deposition, the micro imprints acquired by different condition of sedimentation revealed the intense grounding and bed traction of sediments from the source. The striations on these minerals indicate glacial activity in the initial stage of sedimentation. These suites of minerals are stable as compared to the other suite of minerals of these deposits although these mineral are associated with all domain of quaternary deposits but show different frequencies of their occurrence and physical characters, shape size sphericity and roundness and bear the micro imprints acquired by different condition of sedimentation revealed the intense grounding and bed traction of sediments from the source. The striations on these minerals indicate glacial activity in the initial stage of sedimentation. These are generally angular to highly angular in shape and show very poor indices of sphericity and roundness typical of glacial environments. The configuration of minerals, rock clastic, ground mass, imprints and impact tectonics revealed the intense grounding and bed traction of sediments from the source to site of sedimentation. The striations on these minerals indicate glacial activity in the initial stage of sedimentation. These are generally angular to highly angular in shape and show very poor indices of sphericity and roundness typical of glacial environments. The configuration of minerals, rock clastic, ground mass, imprints and impact tectonics revealed the intense grounding and bed traction of sediments from the source to site of sedimentation.

The study of heavy mineral suites of Quaternary deposits in the area is suggestive of Narmada Boulder Bed, which forms the base of quaternary deposits is of glacial origin Boulder Conglomerate of Fluvio-glacial origin and river terraces of Narmada are fluvial origin, the sediments comprising these domain measuring 325 m thickness has mixed sediments source comprising of Lower protozoic and middle protozoic rocks consisting of gneisses granite metabasic, amphibolites, meta-sedimentaries, high grade biotitic gneisses, muscovite gneisses, kyanite, paragonite, muscovite – schist, gneiss, garnet-mica schist, para amphibolite, tourmaline garnet, meta – sedimentaries and meta - volcanics and Gondwana rocks. (Khan et.al 2016) (Plate No\_5 to 8).

#### **Hominid Locality Hathnora & sedimentation:-**

The Narmada Rift valley in the vicinity of Hominid locality Hathnora was a tectonic depression associated with a linear trench in the middle of valley it was an ideal locus for accumulation of sediments. The rift trench is intruded by the dolerite and other mafic and siliceous dykes and sills along lineaments in different phases of tectonic deformation. The Quaternary sedimentation inception from glacial activity, followed by fluvio-glacial, lacustrine and fluvial phase within the rising and sinking environment, block, faulting, uplifting, Neogene rifting, Quaternary sedimentation, rift-bound Pliocene–Pleistocene rifting and volcanic activity specifically during glacial and fluvio-glacial phase are major component of the Quaternary period and tectonic processes of the Narmada Rift System which forms the base of quaternary deposits. The quaternary landscape in this segment is confined in trough like basin which embraces the stepped sequence of Narmada terraces (NT1 to NT3), where Boulder conglomerate exposed at the base of these deposits. The Boulder conglomerate is persistent horizon and represent distinct fluvial-glacial phase of sedimentation. It is underlain by Boulder bed which is concealed under younger sediments in the valley. The Quaternary landscape embodies imprints of tectonism which revealed that sedimentation had been controlled by mechanics of SONATA LINEAMENT ZONE.

The Quaternary deposits of Narmada valley represent the thickest deposits in faulted and sinking platform under structural riparian rift trench which is undisclosed and remained unrevealed. The work so far carried out is restricted to quaternary deposits of exposed section of 18 m of river section only, no work has been done on concealed strata of quaternary deposits below the Boulder conglomerate source of sediments, mode of transportation, deposition tectonic and environment of sedimentation to conceive the model of quaternary sediment. The inadequate data of concealed quaternary strata, environment of sedimentation, their disposition and correlation in vertical chronology in time and space restricted the systematic search of human remains with precise strata in synchronization of mechanics of tectonics and sedimentation in rift valley. The records of search of human skull and its remains revealed that the search was mostly random and confined around to hominid locality Hathnora from where skull of *Homo erectus* was reported by Sonakia (1984) except Sankhyan, A. R. (1997b) no further addition in tracing the human remains and its evolution is made. The present studies on various aspects of sedimentology of exposed section and bore hole logs across the vertical column of about 280 m in synchronization of tectonism and environment sedimentation in vertical chronology in faulted trough may provide clues in understanding the modal of quaternary deposits in rift valley and in search of human skull and its remains.

In Narmada Rift valley about 202 samples collected from hominid locality from exposed sections and bore hole logs across the vertical column 550 m for study to trace environments of sedimentation in Pleistocene to Holocene time. The statistical parameters viz MZ, STD, SKI, and KG of sediment samples were computed of Quaternary blanket of Narmada. The synchronized study of these parameters revealed that the quaternary deposits consists of sediments of three domain viz glacial, fluvio-glacial and fluvial representing Boulder bed, Boulder conglomerate and Fluvial deposits of paleo-domain of Narmada (NT1 to NT3). The study of various parameters their binary relation, their concentration of plots cluster and trends and patterns revealed three breaks in vertical column at 000.m to 150, 150 to 350, and 350 to 550 m in increasing antiquity in Narmada valley. The extensive and intensive analysis of statistical parameters heavy mineral quartz grain morphology, paleo sole analysis ash bed matrix depict contrasting diagnostic characters of sediments in chronology of quaternary sequence in vertical columns. The statistical parameters and binary clusters of plots of mean size and sorting, mean size and skewness, mean size and kurtosis are used in delineating and fencing boundary between the glacial and fluvio glacial and fluvial sediments. The concentration of these plots separates 87 % sediments fluvial domain fluvio-glacial 94% of the fluvial-glacial from glacial. The glacial sediments are un-oriented and un-organized, fluvio-glacial moderately organized whereas, the sediments of fluvial domain are well organized in synchronization to shape size sorting, and display a balance harmony and ecology in conformity of sedimentation. Khan et.al (2015) which is also authenticated by heavy mineral assemblage of sediments of quaternary column (2016).

The boulder bed which yielded Hominid fossil from boulder conglomerate reported to be of fluvio-glacial origin for first time (Khan & Sonakia 1992). Beside occurrences of associated ash beds with fossiliferous boulder conglomerate (Khan & Rahate 1991) Acharya 1993 indicates volcanic source. It appears that close to the completion of cycle of deposition of the boulder bed there was violent volcanic eruption in around Middle to upper Pleistocene time which was subsequently settled down across the globe and in the peninsular India during the Quaternary sedimentation. The occurrences of association of two marked horizons at different levels further revealed the cyclic eruption and settling of volcanic matrix was occurred with a pause during sedimentation. Khan et al. (1991). Khan and Sonakia (1992) reported for the first time glacial and interglacial deposit in the Narmada valley, Central India which is represented by arid and humid cycles. The lithostratigraphy of Narmada valley described by Khan (1984), Khan & Benarjee (1984), Khan & Rahate (1990-91), Khan & Sonakia (1992), Khan et al (1991), Rahate & Khan (1985), Khan (1991), Khan & Sonakia (1992), Yadav & Khan (1996).

The Quaternary lithostratigraphy and sedimentological aspects were studied and in the Narmada valley (Khan 1984, Khan & Benarjee 1984, Khan & Rahate 1990-91-90 Khan & Sonakia 1992, Khan & et al 1991, Rahate & Khan 1985, Khan et al. 1991, Khan 1991, Khan et al. 1992, Yadav & Khan 1996. The Narmada valley embodied complete sequence of Quaternary deposits from lower Pleistocene to Holocene (Khan & Sonakia (1992). Khan, et al (1912), Khan (2012) et al Khan (in press), Khan (in press), The results of sedimentological studies Khan (2015), quartz grain morphology, Khan (2014), quartz grain morphology, Palesole Quaternary column section in Hominid locality in central sector of Narmada revealed the presence of complete sequence of Quaternary sediments in Narmada rock basin viz Glacial, fluvio-glacial and fluvial domain whereas the boulder conglomerate which has yielded human skull is of fluvio-glacial origin from Khan & Sonakia (1991). The Quartz grain morphology of sediment column Khan (2014) Quartz grain morphology of different paleo- sole, Khan (2014), Ash bed Khan & Maria (2012) Khan & Maria (1912) Heavy mineral assemblage Khan (2016) tephra stratigraphy, Khan et al (1991) Acharya, S.K. and Basu, P.K. (1993) Khan et al (2014) Khan et al.(2015) Ash fall and its impacts (2015) Khan (2016) magnetostratigraphy, and bio-stratigraphy and correlation of sediment columns intra valley wise, inter valley wise and on unified Quaternary Platform Khan et al (2012) focusing on hominid localities of China have been studied on Quaternary platform which have given new insight on the age of the Narmada *Homo erectus*. The Quaternary deposits of the Narmada valley represent the thickest Quaternary deposits in peninsular India which were deposited in a tectonic trench of SONATA LINEAMENT ZONE., the sedimentation has been controlled and synchronised by mechanism of tectonism during entire span of sedimentation from Lower Pleistocene to Holocene time. The association of fossils and stone implements with Quaternary deposits of Narmada are well described, quarries on various aspects on geology geomorphology, sedimentology, provenance of sediments, stream kinetics, stratigraphy, chronology, tectonics, neotectonic, subsurface geometry, and overall model of Quaternary sedimentation of Narmada in faulted and oscillating rift trench remained silent and disclosed and unrevealed hidden miseries needed attention.

In the present studies revealed mega sedimentological three breaks in vertical column at 000.m to 150, 150 to 350, and 350 to 550 m in increasing antiquity in increasing antiquity from the base which represent boulder bed boulder conglomerate and sediments of paleo domain in chronology and sequence representing Pleistocene, middle Pleistocene and upper Pleistocene phase of sedimentation in Narmada Rift valley.

The binary clusters of plots of mean size and sorting, mean size and skewness, mean size and kurtosis are used in delineating and fencing boundary between the glacial and fluvio glacial and fluvial sediments. The concentration of these plots separates 87 % sediments fluvial domain fluvio-glacial 94% of the fluvial-glacial from glacial. The glacial sediments are un-oriented and un-organized, fluvio-glacial moderately organized whereas, the sediments of fluvial domain are well organized in synchronization to shape size sorting, and display a balance harmony and ecology in conformity of sedimentation. Khan et al (2015) Khan et al (2016) which is also authenticated by heavy mineral assemblage of sediments of Quaternary column Khan et al (2016), Khan et al (2016), Khan et al (2016), Khan et al (2016).

In Narmada rift valley the Quaternary sediments are accumulated in two section viz Jabalpur-Harda section and Guredhwar and Bharouch section where as in other area Harda to Gurudeshwar section of valley rock cut terraces, rock cut platform and benches are notices which at many places over lie by caps and strips Quaternary deposits representing the former level of valley floor of Narmada. The rock cut terraces and rock cut benches are time equivalent to NT1 to NT3 which have developed in Jabalpur-Harda and Gurudeshwar –Bharouche sections. Khan et al (2016). The Quaternary events of the Narmada portys three prominent terraces and two sub terraces in these



sections which are designated NT1 to NT3 and sub terraces NT2-A is NT2-B, NT2 B, besides NT2-C, NT3-A & NT3-B besides NT-0 in the valley. They have been designed NT<sub>0</sub> to NT<sub>3</sub>, ( 280 to 400 m ), NT<sub>0</sub> being the low level terrace above the present-day course of the river, NT<sub>1</sub>-the younger terrace both of cyclic and of cyclic nature. The NT<sub>3</sub> terrace occurs as elongated strip and isolated caps and lenses along the margin of valley flanks has divergent relative disposition. These land forms indicate vigorous and abrupt incision of valley floor due to relatively & repaid uplift of watershed area during Upper Pleistocene time. The NT<sub>1</sub> to NT<sub>2</sub> are the major depositional terrace and have both convergent & divergent mutual disposition with other terrace. These terraces further downstream have matched equivalents along the valley flanks, whereas in the up stream section the matched equivalents are rare. The conspicuous divergent relation of these terraces the valley reveals successive uplift of catchments area and consequential incision of valley floor and adjustment of base level of Narmada during Upper Pleistocene time.

The sequence of quaternary deposits in this segment of rift system was deposited on uneven platform of valley floor of turmoil nature in tight and narrow basin which depicts cyclic transitional environmental of the rift basins are caused by tectonic activities (uplift and subsidence), changes in relief, and climatic variations. The climatic changes in uplift, coupled with block faulting, rising and sinking platform, created basins unstable platform for the accumulations of thick lacustrine and fluvial sediments sequences with terrestrial and aquatic fossils. The evidence of the effects of tectonics on fauna and flora are distinct and its signatures on dislocation and concealing of fossiliferous horizons are uncontrolled and ill defined in the ecosystem in the valley during the Pliocene–Pleistocene periods. The boulder conglomerate which yielded the skull cap of *Homo erectus* in Narmada rift from Hathnora Sonakia (1984) remained only discovery of hominid fossil in last two and half decade due inconsistency and concealed nature of fossiliferous horizon due faulting, and subsidence of Quaternary blanket of Narmada rift system as such researcher and scientist failed to add any further knowledge to hominid discovery in Narmada valley. The study of statistical parameters across the entire thickness of Quaternary deposits revealed three breaks in sedimentation at 350 -290, 190-220, 100-150 in the valley where as an breaks in Hominid locality Hathnora I to IV sections is at 280m, at 210m and at 35m in increasing antiquity from the base of rock basin which represent glacial, fluvioglacial and fluvial environment of sedimentation in the Narmada valley. The correlation of different sequential and sedimentological breaks indicate subsidence and up lift of different blocks and platform of sedimentation due to tectonic and neotectonic activity.

(Plate No\_5 to 8).

#### Sea level fluctuation and sedimentation:-

The Narmada before debouching into Gulf of Cambay a conspicuous quaternary blanket is encountered. This segment is about 90 km in length and forms the southern margin of the N–S extending Gujarat alluvial plains. A significant feature of the lower Narmada valley is the deposition of a huge thickness of Tertiary and Quaternary sediments in a fault controlled rift trench. To the south of the ENE–WSW-trending Narmada–Son Fault (NSF), the Tertiary rocks and basaltic flows of Deccan Trap Formation occur on the surface while to the north they lie in the subsurface and are overlain by Quaternary sediments. However, the overlying Quaternary sediments having a maximum thickness of 800 m (Maurya et al., 1995) still remain unclassified. Drill data from some of the deepest wells in the basin have revealed occurrence of Deccan Trap at depths of 6000 m followed by an Archaean basement (Roy, 1990). The Tertiary sediments, outcropping to the south of the NSF, represent the full sequence from Eocene to Pliocene overlying the Deccan Trap and show extensive deformation in the form of several ENE–WSW-trending anticlinal highs and ENE–WSW and E–W-trending reverse faults (Fig. 2A). Neotectonic studies along the NSF have been singularly lacking. However, some studies dealing mainly with the channel form, fluvial processes and hydrological aspects have been restricted to the middle and upper reaches of the Narmada River (Kale et al., 1994; Rajaguru et al., 1995; Gupta et al., 1999).

The Narmada–Son Fault (NSF) divides the Indian plate into two halves and has a long tectonic history dating back to the Archaean times (Ravishankar, 1991). The NSF trends in ENE–WSW direction and is laterally traceable for more than 1000 km. It demarcates the Peninsular India into two geologically distinct provinces: the Vindhyan–Bundelkhand province to the north and the Deccan province to the south. Ravishankar (1991) regards the Narmada–Son Fault as a part of the composite tectonically controlled zone in the middle of the Indian plate and termed it as the SONATA zone (abbreviated form of Son–Narmada–Tapti Lineament zone). The Narmada and Tapti Rivers all throughout their course follow these tectonic trends. Other synonyms used in literature to describe this zone include Narmada–Son Lineament (Choubey, 1971), Central Indian Shear (CIS) (Jain et al., 1995) and Central Indian Tectonic Zone (CITZ) (Radhakrishna and Ramakrishnan, 1988; Acharyya and Roy, 2000). Geophysical studies in the central part of this zone reveal this to be a zone of intense deep-seated faulting (Reddy et al., 1995). The zone

witnessed large-scale tectonothermal events associated with large granitic intrusions around 2.5–2.2 and 1.5–0.9 Ga (Acharyya and Roy, 2000). It was again reactivated during the Deccan volcanic eruption during Late Cretaceous–Palaeocene (Agarwal et al., 1995). Profuse occurrences of E–W-trending dykes suggest that the zone formed the main centre of eruptive activity (Bhattacharji et al., 1996). The entire zone is presently characterized by high gravity anomalies, high-temperature gradient and heat flow and anomalous geothermal regime (Ravishankar, 1991) suggesting that the zone is thermo mechanically and seismically vulnerable in the framework of contemporary tectonism (Bhattacharji et al., 1996). The westward extension of this zone into the lower Narmada valley exhibits a less complex structural setting. Data on the NSF in this part is mainly the result of extensive geophysical surveys for commercial exploitation of petroleum reserves in the subsurface. In the lower Narmada basin, it is expressed as a single deep-seated fault (NSF) confirmed by the Deep Seismic Sounding studies (Kaila et al., 1981). Seismic reflection studies have firmly established that the NSF is a normal fault in the subsurface and becomes markedly reverse near the surface (Fig. 2B) (Roy, 1990). Reactivation of the fault in Late Cretaceous led to the formation of a depositional basin in which marine Bagh beds were deposited (Biswas, 1987). The NSF remained tectonically active since then with continuous subsidence of the northern block, designated as the Broach block, which accommodated 6–7-km thick Cenozoic sediments (Biswas, 1987). The total displacement along the NSF exceeds 1 km within the Cenozoic section (Roy, 1990). However, the movements along this fault have not been unidirectional throughout. The general tendency of the basin to subside has been punctuated by phases of structural and tectonic inversion (Roy, 1990). The N–S-directed compressive stresses during the Early Quaternary, folded the Tertiary sediments into a broad syncline, the Broach syncline, in the rapidly subsiding northern block (Roy, 1990). The Broach syncline extends from the NSF to the Mahi river in the north. The E–W trending axis of this syncline lies to the north of the Narmada river. Corresponding anticlinal structures are found in the Tertiary rocks exposed in the southern up thrown block (Fig. 2A and B). Historical and instrumental records indicate that the compressive stresses still continue to accumulate along the NSF due to continued northward movement of the Indian plate. This is evidenced by the fault solution studies of the earthquakes at Broach (23 March 1970) and Jabalpur (22 May 1997), which suggest a thrusting movement (Gupta et al., 1972, 1997; Chandra, 1977; Acharyya et al., 1998). However, the underlying cause of the seismicity in the NSF zone is not yet understood (Quittmeyer and Jacob, 1979).

The Narmada River in its lower reaches defends in sinuous to meandering pattern which is solely guided by ENE to WSW to E–W lineament and its sympathetic fractures. It has chiseled the landscape into terraces, valley flats which form the prominent landscape of quaternary terraces breaking the monotony of close topography. The Narmada downstream of Garudeshwar flows in a general WSW direction where it displays meanders with wavelengths of 5–8 km. The Orsang, Aswan, Men and Bhuki are the major rivers joining the Narmada from the north. The Karjan River, which drains a major part of the trappean uplands in the lower Narmada valley, meets the Narmada from the south. The other tributary, the Madhumati River drains the western fringe of the trappean upland. In between the Karjan and Madhumati rivers there are several north flowing small streams meeting the Narmada at various points. The network of drainage in the lower Narmada is structurally controlled and developed and works under the mechanism of neoseismic ecology of pulsation variance evident by river terraces, linear scarp. The presence of ravineous tracts with incised deep gullies of 20–25 m is manifestation of deep seated water table due to subsidence of block along the lineament zone. The disposition of river terraces, entrenched meanders and alluvial cliff 15–30 m are suggestive of neotectonic activity in the area. The display of active Narmada channel configuration of terraces, meander scrolls, entrenched meander revealed misfit nature of Narmada in the area. The present channel of Narmada is strongly influenced by NSF and displays persistent tendency to shift towards north due to geotectonic activity along the fault. It also authenticates that there is perceptible up rise in the southern block of fault and subsidence of northern block which resulted into gliding and shift of Narmada towards north.

The tectonic uplift of the lower Narmada valley during the Early and Late Holocene suggests inversion of an earlier subsiding basin. Such inversions of the basin have been common in the Tertiary times and are well recorded in the sediments of that age (Roy, 1990). A symmetric convergence of the NT-1, NT-2 terraces, diagonal disposition of paired equivalent of terraces across the channel, divergent and linear disposition of cliff of NT-3 terrace in conformity of NSF constant subsidence of basin and in response to frequent movement and geotectonic activity along the NSF. The displaced Late Pleistocene sediments across NSF in the Narmada and Orsang Heran and Madhumati & Karjan valleys, the NNW tilting of the NT-1, NT-2 sediments litho units consisting of the Late Pleistocene sequence, the anomalous topographic slope in the same direction and the incised cliffs up to 25–30 m in the streams that flow along this slope in the area between NSF and the Narmada River, indicate unsynchronized neoseismic movements along the NSF during the Early Holocene. The displacement of sediments of NT-1 surface across the NSF indicates differential movement of about 35 m along the NSF during Early Holocene. The block

between the Narmada and Karjan rivers bounded by the NSF and the two other cross-faults suffered subsidence leading to the formation of a series, linear and curvilinear cuts of on terraces and flood plains. The 5–8-m incised cliffs of the streams also suggest that this block escaped the uplift induced large scale incision going on simultaneously in other areas of the lower Narmada valley. The occurrence of ravines and association of deep gullies with the river terraces is morpho-tectonic manifestation caused by the sudden vertical movement and block adjustment due subsidence resulting to sudden collapse of water table and ground water regime in the area.

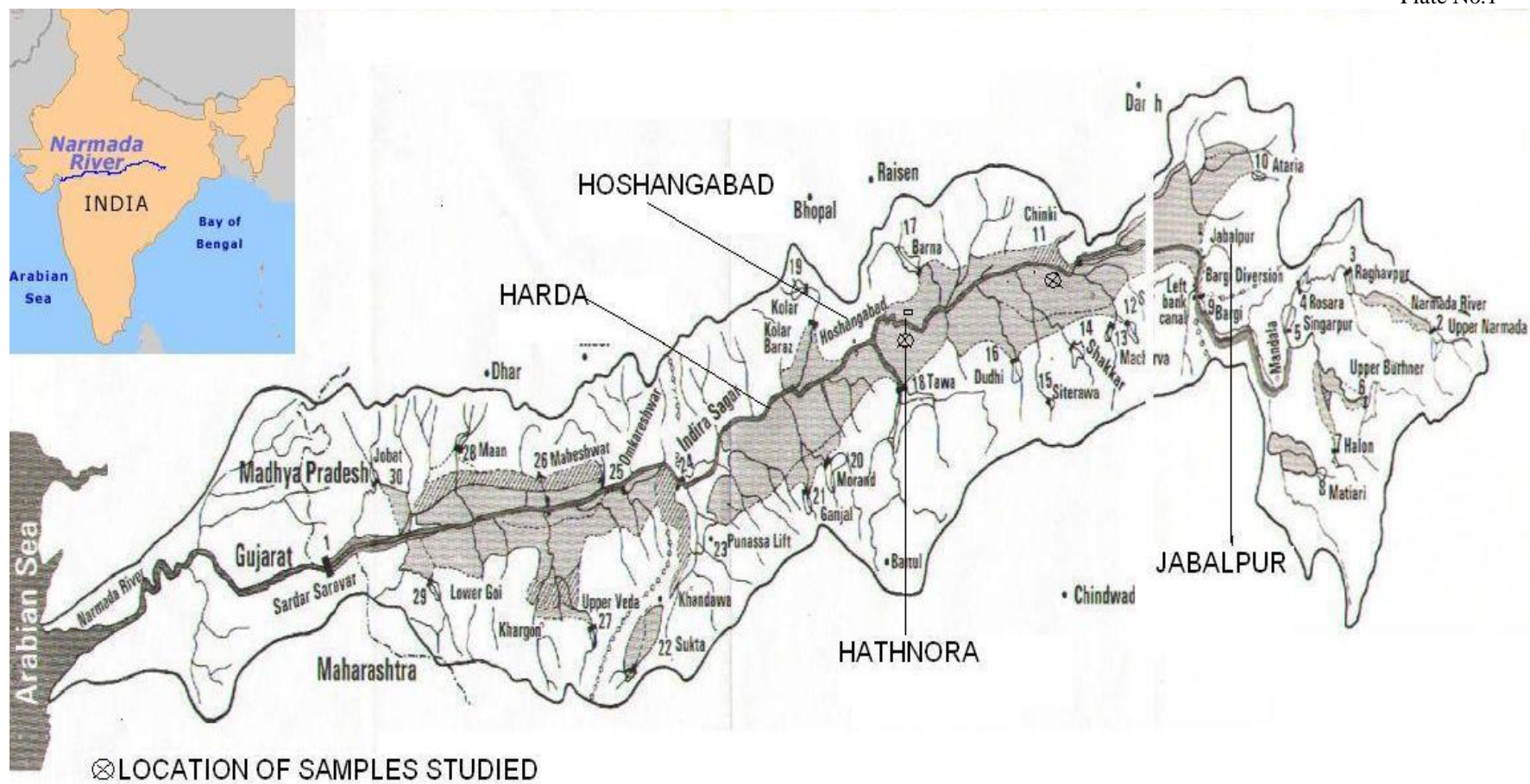
The strongest supporting evidence for the Early Holocene tectonic uplift of the area comes from the sea-level curves of the west coast of India which suggest a tectonic component of about 40 m at this time (Rao et al., 1996).

In the Narmada valley the River terraces (NT-3) has occupied large area on the both bank of. It extends from Orsang river in the north east to Mahi river in the west from Baroda in the north to Bharuch –Aliabet in the southwest. In the southern bank of Narmada it is developed around Ankleshwar and Rajpipla and further south. The average elevation of this surface is about 75 m above m.s.l, separated by both linear and curvilinear scarp from NT-2. The average height of cliff is about 40 m. The sediments comprised of this terrace are exposed in the cliff section. The oldest deposit of the exposed sediment successions a highly pedogenised mottled clay horizon showing vitriolic characters like extensive fracturing giving rise to blocky aggregates, pseudo anticlines and hydro plastic slickenside along the fracture surfaces. The sediments of this terrace are associated with a rich assemblage of shallow marine foraminifers. The basal unit consisting of rock pebbles with clays is overlain by thick fluvial sediments, which comprise alluvial plain facies. The pebbly unit which contains rock fragments of quartzite, granite basalt, and limestone sandstone is about 5.5.m thick, it is a persistent horizon and exposed in the cliff section. It is marker horizon, represent distinct phase of sedimentation in the valley.

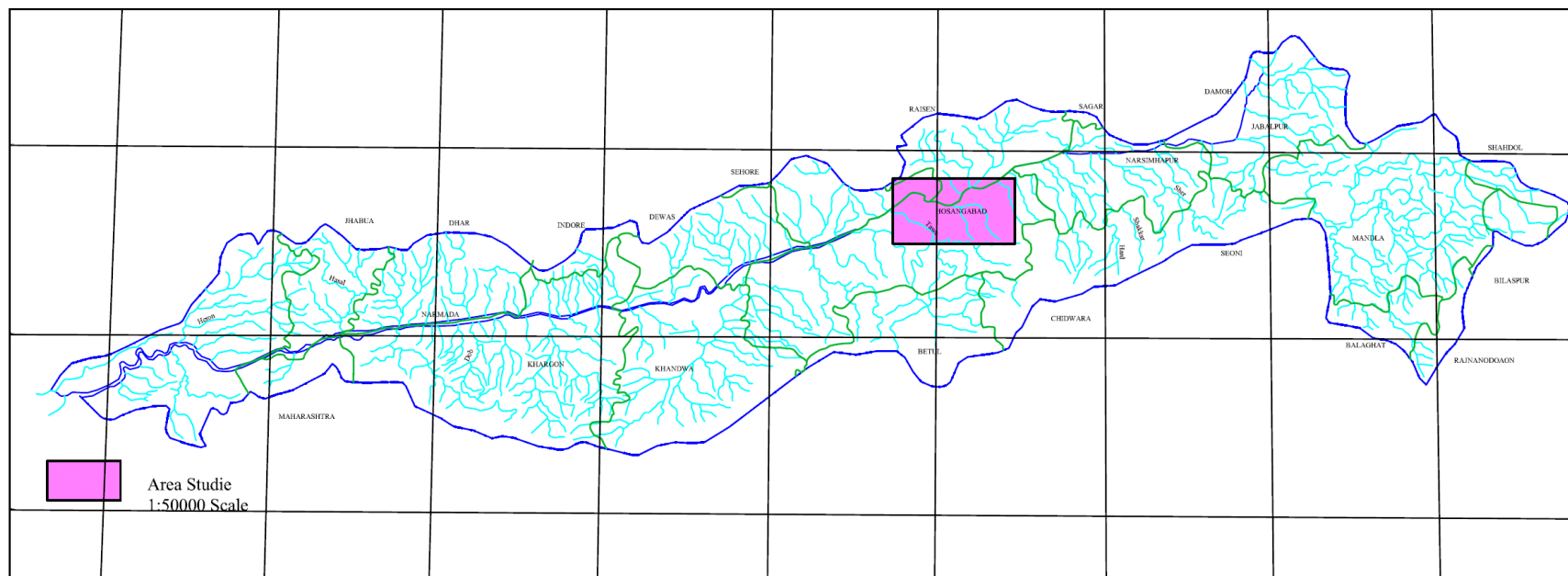
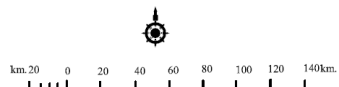
In the Lower Narmada valley the Mid–Late Holocene Quaternary valley deposits is the product of a Holocene high sea-level-induced deposition in a deeply incised valley trench trough highly influenced by NSF. The Mid–Late ey which resulted in both estuarine and fluvial sedimentation in the lower reaches. A significant slowing down of tectonic uplift facilitated the encroachment of the sea into the valley and the creation of a depositional wedge, which extended up to the deep in land foothills. The 5–10-m exposed thickness of the valley-fill sediments reveals tide dominated estuarine deposition in the lower reaches and fluvial deposition upstream of the tide reach.

The pre-existing quaternary platform of NT-3 of middle Pleistocene prior to induced sedimentation of tidal transgression was strongly induced by tectonic impulses of NSF. The relative disposition of terraces (NT-2 NT-3) cliff alluvial bluff ad scarp, reveals that the present mouth of the Narmada river has retained roughly the originally funnel shape of the estuary formed during the Mid–Late Holocene. However, the size of the estuary is now considerably reduced in space and time with sedimentation and t compressive tectonic environment. The stepped sequence of terraces NT0 to NT2A NT2B NT2C NT3A, NT3B) their disposition, their convergence & divergence, cyclic and non cyclic nature and mutual inter relation revealed at least three mega phases and four micro phases of up rise of sea level related with tectonics of the area in late to upper pleistocene time.

The incursion and transgression of tides, present estuarine reach contains several islands, which are coeval with the terrace surface above the present tidal range. Hence, they are the products of estuarine processes of the Mid–Late Holocene and not those of the present day. Funnel shaped morphology and increasing tidal energy landward are characteristics of tide-dominated estuaries (Wright et al., 1973). Existing data suggest that the Mid–Late Holocene sea level has remained at the same level up to the present with minor fluctuations (Chappel and Shackleton, 1986; Hashimi et al., 1995). The Mid–Late Holocene sediments show tilting of 10–20j which is more pronounced in the vicinity of the NSF suggesting that the incision and uplift of the valley-fill terraces well above the present day tidal limits is related to the continued differential uplift along NSF. Evidence of tectonic uplift has been reported from the coast also in the form of raised mudflats occurring 2–4 m above present sea level (Merh, 1993). Currently, the river occupies the northern margin of the Early Holocene channel belt and is clearly more sinuous. It exhibits a narrow channel with wide meanders inside wide belts of Mid–Late Holocene terraces ( NT-3) a typical pattern of under fit streams. (Khan2015) (Dury, 1970). (Plate No\_3, 4, 5 to 8)



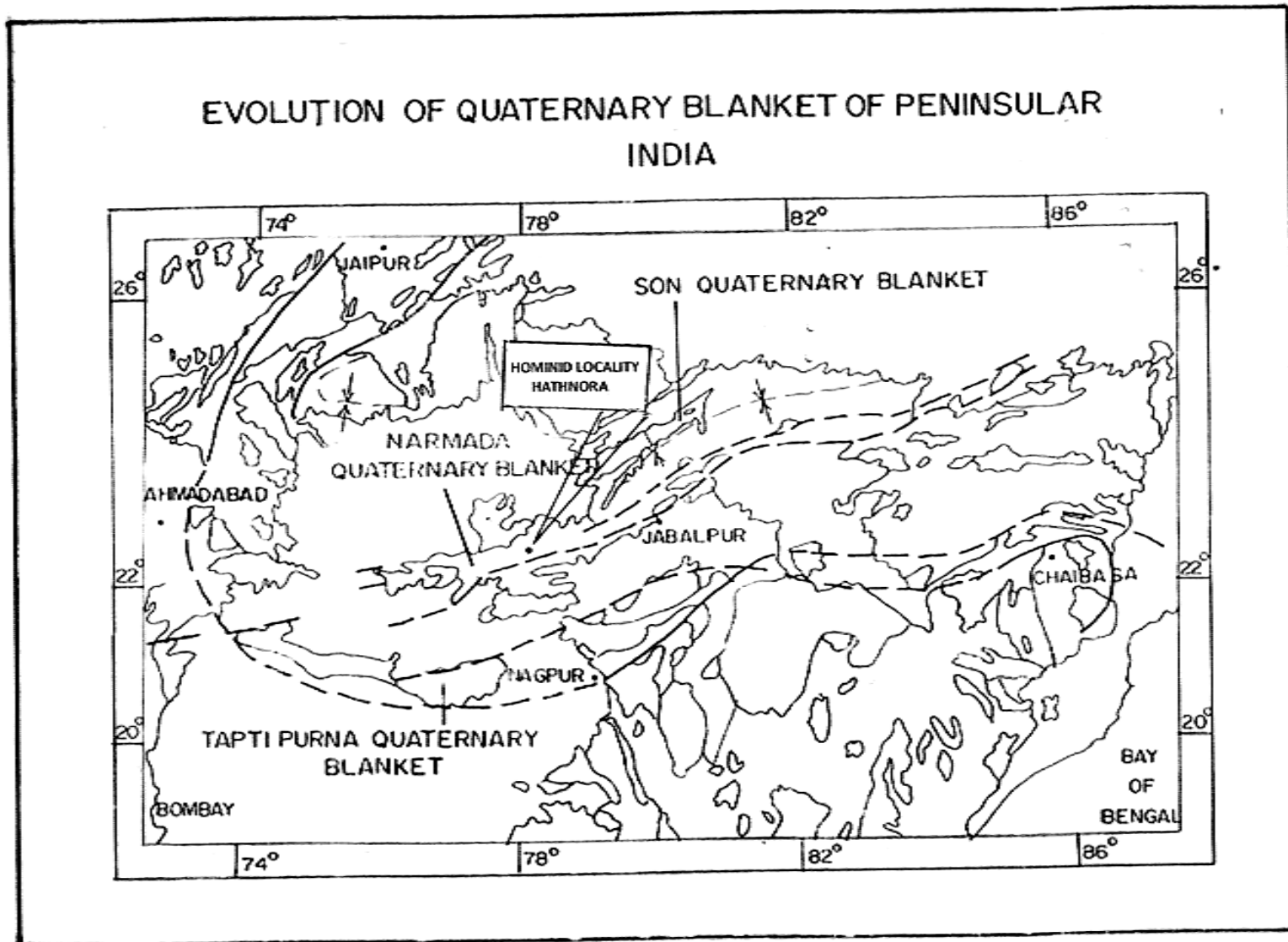
# AREA OF STUDY OF QUATERNARY GEOLOGY OF HATNORA, NARMADA VALLEY, M.P., INDIA



INDEX	
	Drainage



Plate No. 4

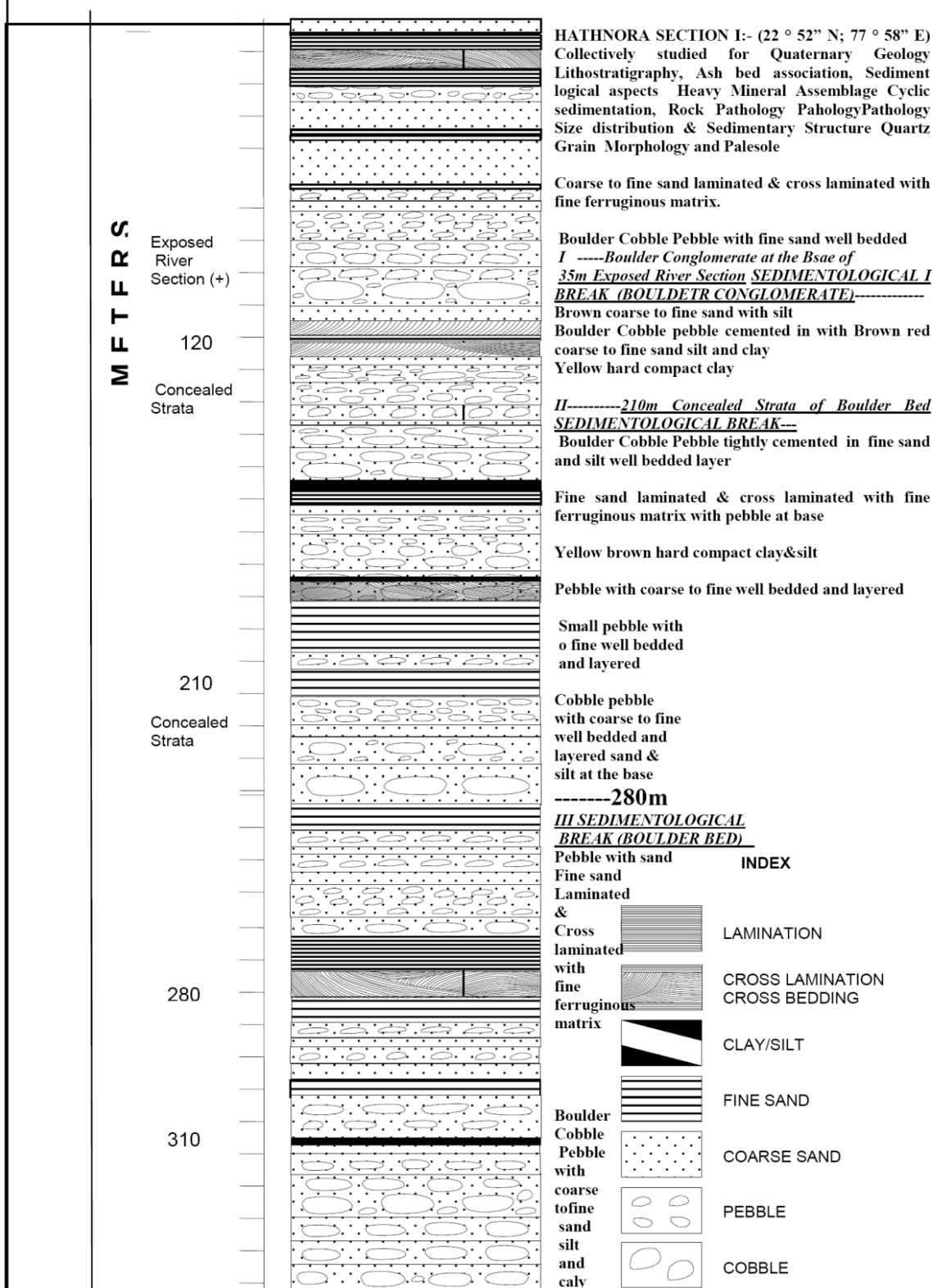




HATHNORA SECTION \_I:- (22 ° 52" N; 77 ° 58" E)

Plate No QG\_5

QUATERNARY GEOLOGY COMPOSITE LITHOSTRATIGRAPHIC SECTION OF QUATERNARY DEPOSITS OF PALEO DOMAIN OF NARMADA AND CONSEALLED STRATA BASED ON STUDY OF EXPOSED STRATA &amp; BORE HOLE LOGS.

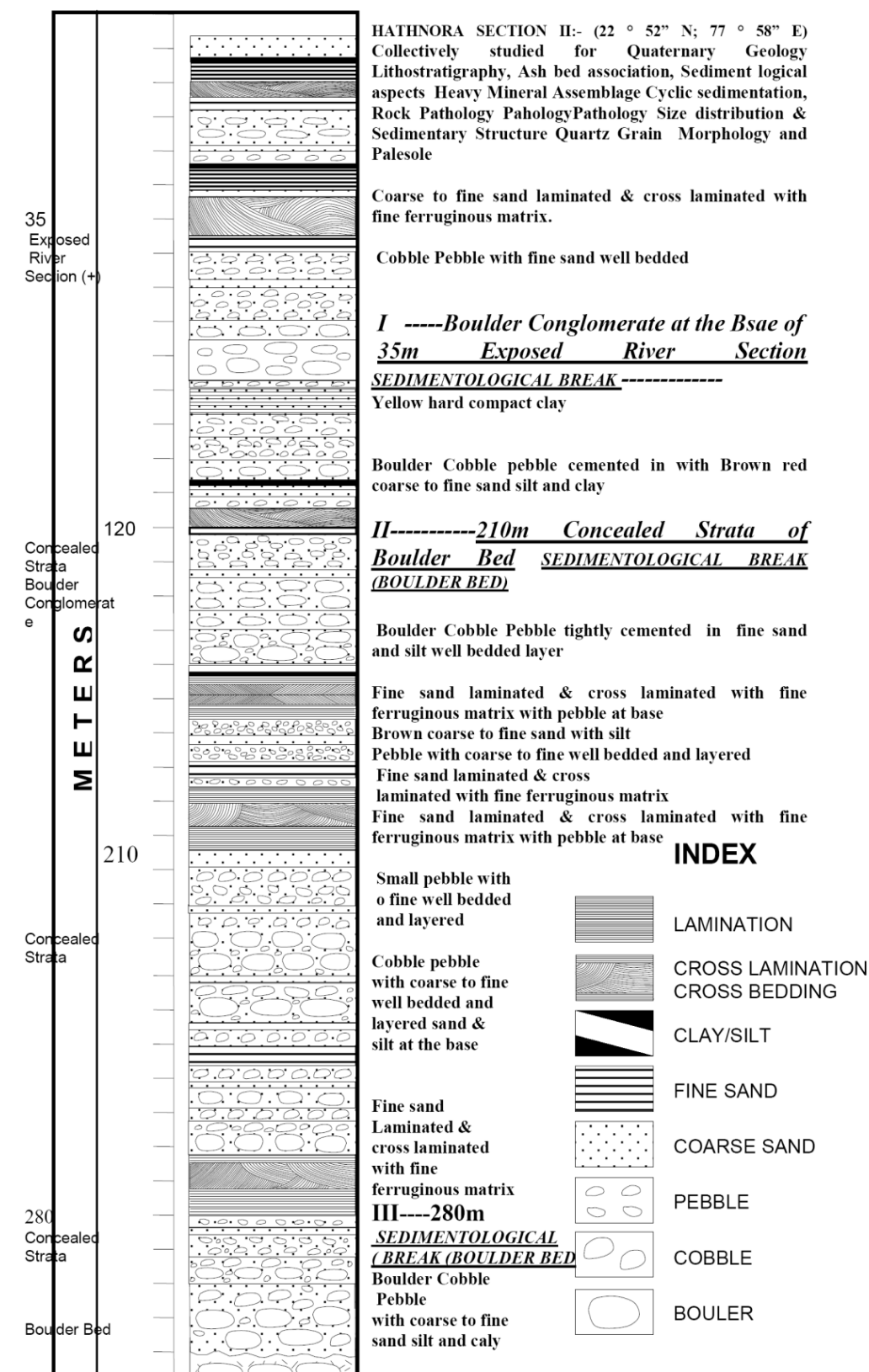


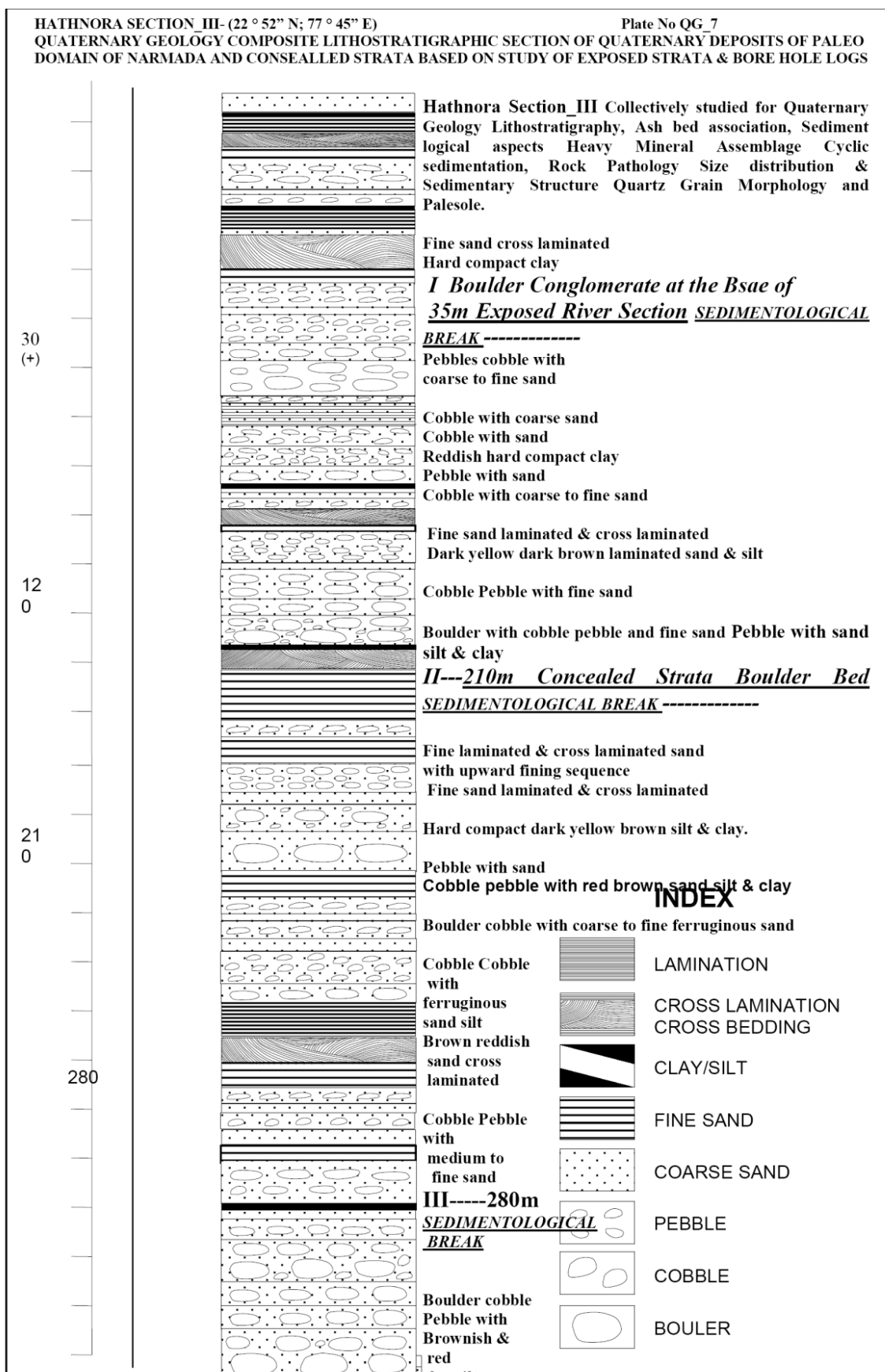


HATHNORA SECTION II:- (22 ° 52" N; 77 ° 58" E)

Plate No QG\_6

QUATERNARY GEOLOGY COMPOSITE LITHOSTRATIGRAPHIC SECTION OF QUATERNARY DEPOSITS OF PALEO DOMAIN OF NARMADA AND CONCEALED STRATA BASED ON STUDY OF EXPOSED STRATA &amp; BORE HOLE LOGS





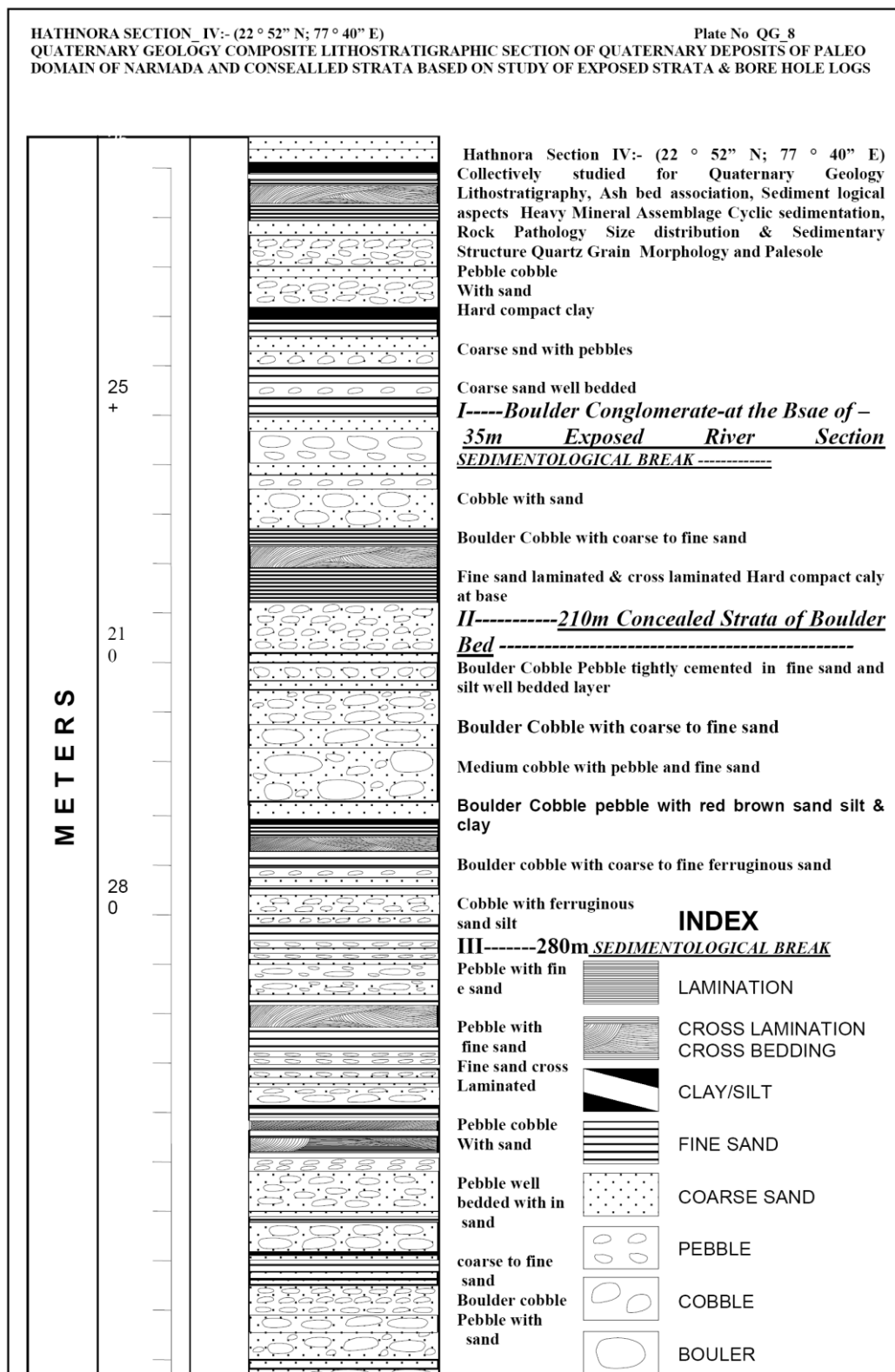
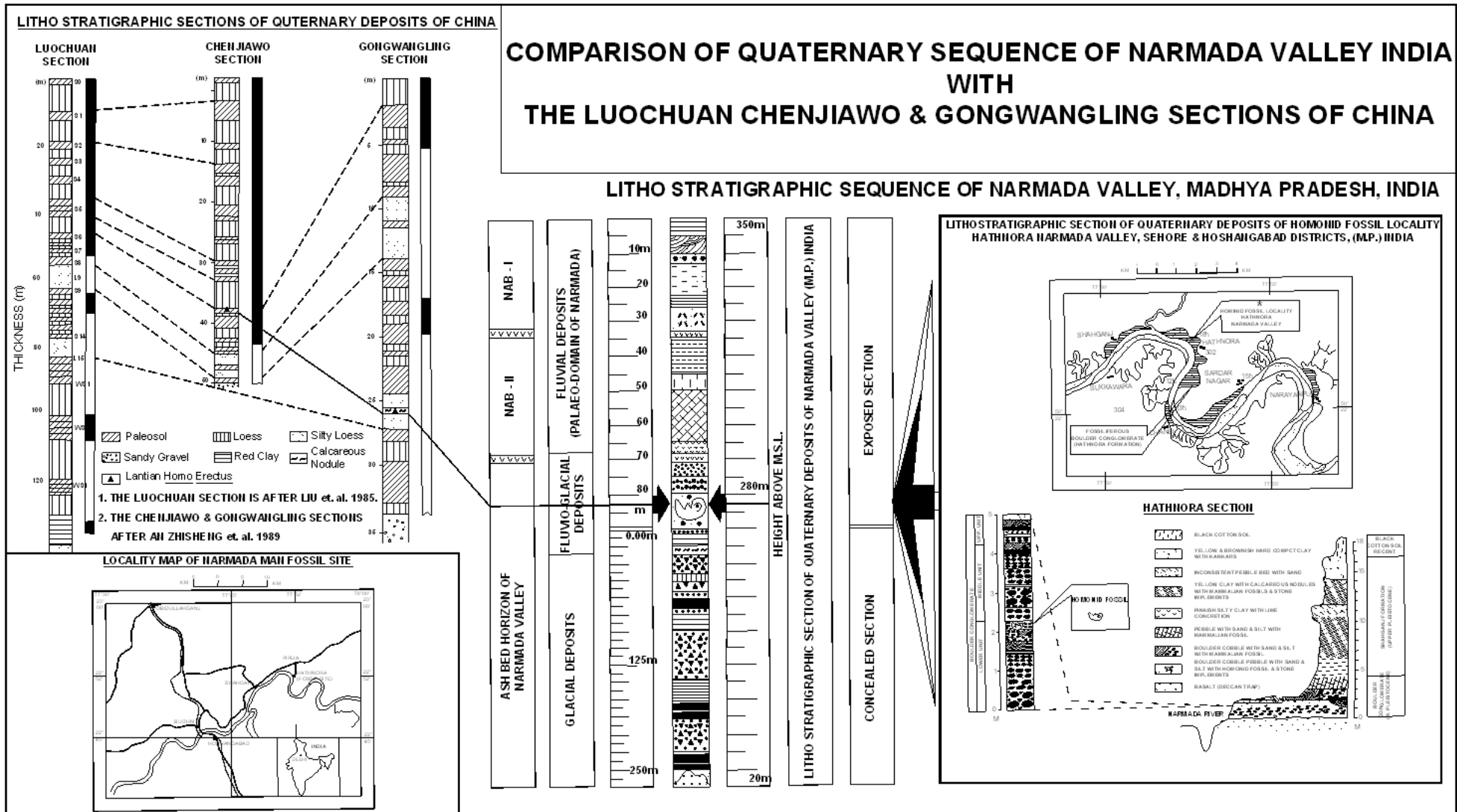


Plate No.9



### Conclusion and summary:-

The Indian Plate is currently moving northeast at 5 cm/yr (2 in/yr), while the Eurasian Plate is moving northeast at only 2 cm/yr (0.8 in/yr). This is causing the Eurasian Plate to deform, and the Indian Plate to compress leading to tectonic activity along major fault zones. In tectonically active areas sedimentary basins undergo phases of both crustal extension and contraction leading to basin inversion and hence display features typical of subsidence and uplift. Geomorphic attributes and deformation in late Quaternary sediments are the indicators of active tectonic activity in any sedimentary basin. The geomorphic evolution in such reactivated basins is primarily due to complex interaction between sedimentation processes and tectonics. The peninsular India has been undergoing high compressive stresses due to the sea-floor spreading in the Indian Ocean and locking up of the Indian plate with the Eurasian plate to the north. Much of this N-S directed stresses have been accommodated by the under thrusting of the Indian plate below the Eurasian plate. A part of these compressive stresses are accumulated along the Narmada-Son Fault (NSF), a major E-W trending crustal discontinuity in the central part of Indian plate. The Quaternary tectonic activity recorded in the Narmada valley possibly, has wider ramifications when viewed in the larger perspective of the Indian plate. This suggests a renewed phase of extreme compression of the Indian plate, which led to tectonic insecurity and may cause tumours and earthquakes in peninsular India.

In Narmada valley the association of Ash bed NAB-I with Hathnora formation at the depth of 78 m in Quaternary column and occurrences of skull cap of *Homo erectus* at the depth of 83 m in decreasing antiquity from the top assumed that Toba eruption have taken place later than existence of *Homo erectus* which appeared and resided in the valley for long time before the fall of Toba ash. The association of Ash is NAB-II at the depth of 72 m with the younger deposit revealed the second cyclic fall of Toba ash which certainly have had influence on hominines and had collective and cumulative impact on *Homo erectus* (Sonakia 1984) *Homo sapiens* (Thobold 1860, 81), in Narmada valley and Indian sub-continent. Oppenheimer (2003) argues that *Homo. Sapiens* occupied India before ~74 ka and may have undergone "mass extinction" as a result of the Toba eruption. The argument of Oppenheimer (2003) is in strong conformity with the present observation of authors. As sediment & Ash bed sequence of Quaternary column of Narmada (325 m) and occurrences of fossil of skull cap of *Homo erectus* (Sonakia 1984) at 83 m & human cranium *Homo sapiens* (Thebold 1960, 1981) transported have existed prior to fall of Toba ash and they are among the few who in spite of mass extinction caused by mega dislocation in ecology and environment related with volcanic eruption survived in Narmada Valley. It is further documented by the rarest occurrences of these fossils in subcontinent which also confirm the intensive impact of volcanic ash fall on these hominines and their consequential mass extinction. (Table No AB-1-3) & Plate No AB-2-8).

The study of assemblage of glass matrix of Ash bed, grain morphology of glass their relation with other minerals shape, size, texture of litho fragments of pyroclastic origin suggest that sediments were brought from distant source by Aeolian agencies in the form of thick cloud containing volcanic dust, rock matrix and different gases which remained in atmosphere for very long time and settled down across the Indian sub continent during the different phases of river sedimentation. Further study of Ash bed material and silica revealed diagnostic morphological characters of glass shards which are typical of silica volcanism (Heiken, 1972, 1974) and show close similarity with those reported from the Quaternary tephra beds of the Narmada, Son, Purna and Kukdi basins (Basu et. al., 1987; Khan et.al. 1991 Basu and Biswas, 1991; Singaraju and Shivaji, (1991) Mukhopadhyay, (1992). It is significant to note that the occurrences and association of two marked horizons at different levels further reveal that the cyclic eruption and settling of volcanic matrix has taken place with pause in the valley.

The occurrences of these skull caps with short range of their occurrences in the stratigraphic column of Narmada with the Ash beds horizon NAB-I and NAB-II and specially with the Hathnora formation one at the top at an average elevation of about 268-273 m above the mean sea level and other with younger deposits had revealed the close association with volcanic activity with their existence. The Toba Ash fall is also in very close range with the sequence of sedimentation and occurrences with both the skull caps, which certainly has its impact on the middle and late Pleistocene Hominines in Narmada valley and Indian subcontinent.

The skull cap of Narmada Man *Homo erectus* was found in Narmada Valley near village Hathnora (22° 52' N; 77° 52' E) in fossiliferous boulder conglomerate, in district Sehore, M.P., India. The skull cap is completely fossilized undistorted, renal vault nearly complete except few left Supra-orbital and sutures are nicely preserved. The various morphological features and robust form of skull and excessive thickness of the bones indicate that it belongs to adult male individual (Sonakia, 1984). The discovery of skull cap of *Homo erectus* in fossiliferous boulder conglomerate in association of other mammalian fossil is recorded in stratigraphic column of Quaternary deposits at the depth of 83

m, where estimated total thickness of deposits is about (325 m). This blanket consists of sediments of three domains viz. glacial, fluvio-glacial and fluvial, which were deposited in distinct environments during Pleistocene to Holocene time (Khan & Sonakia (1992), (Khan et.al. in press). The statistical analysis of sediments from these different domains in vertical column has been conducted to ascertain the environment of sedimentation and trace the breaks in climate (Khan et.al. in press). An attempt has been made for the first time Khan et.al (2013) to correlate the various stratigraphic columns of associated hominid fossils of Narmada valley (325 m) India and that of Luochuan sequence, (90-120 m) Chenjiawo (50m) and Congwangling sequence (36 m) of China on unified Quaternary platform tied up and developed at mean sea level. The study revealed that the depth of occurrence of Narmada skull cap on unified Quaternary platform is about (83 m) as compared to that of Chenjiawo and Gongwangling of China which occur at very shallow depth of 38 and 26 m respectively. The estimated age of Narmada Man based on these parameters is about 1.38 m.y. (+), which is greater than *Homo erectus* of Chenjiawo 0.65 m.y. and Gongwangling 1.15 m.y. of China An Zhisheng and Ho Chuan Kun (1989). On the merits of correlation of stratigraphic columns of Quaternary of Narmada, accumulation of sediment, rate of sedimentation, palaeo- environments, lithostratigraphy and biostratigraphic position of boulder conglomerate in unified Quaternary Platform, author considers it as one of the earliest and oldest *Homo erectus* in Asia. Khan et.al (2013).

This study of quartz grain and their microstructures of paleosols identified in the concealed blanket of Quaternary deposit display relative heterogeneity in sediment characteristics throughout across the Quaternary column of Central Narmada valley. The study quartz grain of soil and sediments display diagnostic characteristics of glacial, fluvio-glacial and fluvial environment at different depths and levels 000.m to 150, 150 to 350, and 350 to 550 m from fluvial, fluvio-glacial and, glacial deposit (72 samples +25). The majority of quartz grain population show characteristic surface textures linked to long evolution in fluvial, fluvio-glacial and glacial environment of sedimentation in time and space in increasing antiquity in the valley. There exists a direct relationship between grain-size characteristics and the shape and surface texture of grains. The variations in shape and size of grain assemblages and imprints of particular microstructures in specific population and distinct breaks at specific level identified indicate changes of environments of sedimentation in vertical columns from glacial at the bottom of valley trough subsequently followed by fluvio-glacial and further overlain by fluvial deposits distinctly related with change of climate and tectonic changes in increasing antiquity in Narmada valley.

The study of quartz grain from surface and subsurface quaternary blanket enveloped in the tectonic trench display diagnostic characteristics of glacial, fluvio-glacial and fluvial environment at different depths and levels 000.m to 150, 150 to 350, and 350 to 550 m from fluvial, fluvio-glacial and, glacial deposit (72 samples + 25). The majority of quartz grain population show characteristic surface textures linked to long evolution in fluvial, fluvio-glacial and glacial environment in time and space. An indication of glacial evolution (parallel striations or grinding features) was observed in samples (10%-60% of grains) in 35 samples from different levels between 390 to 525 m the percentage of grains showing a glacial origin having parallel striations, fresh silica pellicles, and polished silica pellicles and fresh impact features. As such evidences of glacial, fluvio-glacial and fluvial evolution is marked in the lower stratigraphic columns of Narmada. In addition some of grains exhibit fresh quartz overgrowths, features, and silica pellicles at some level of sedimentation. This indicates a mixing of grains from different provenances. The parallel striations and fresh impact features are diagnostics of glacial environment and demonstrate consistency in occurrence. This implies a change of environment of sedimentation from glacial to fluvio-glacial and fluvial. This variation is accompanied by a decrease in the percentage of rounded grains and in the fine-sand fraction. The parallel striations are polished, were observed. The composite illustration of fresh striations and polishing of grains support to glacial environment of sedimentation in Narmada valley during lower Pleistocene time. The density of grains possessing such diagnostic elements of glacial origin decreases upward in vertical column and their consistency has inverse relation which indicates sequential change of environment from glacial, to fluvio-glacial and fluvial in chronological sequence up ward in the Narmada valley.

In Narmada valley the most of the hominid remains and associated artifacts in the would have been found associated with Miocene Pliocene– Pleistocene sediments of boulder bed and boulder conglomerate in increasing antiquity, unfortunately same are not exposed due rift system and tectonic setting. In the rift system the type development of Quaternary blanket is confined between Jabalpur \_Harda section, and Tilakwarda \_Bharouch which possess the complete sequence of all three domains in increasing antiquity in chronology in vertical column from the bottom of the rift trench viz Boulder bed (glacial), Boulder conglomerate (fluvio-glacial) sediments of paleo-domain of Narmada (fluvial). The intense tectonic activities within the basins of the Narmada Rift System during the Neogene and Quaternary periods have destroyed fossil record except the fossiliferous horizons exposed in river sections. The

erosional-sedimentary cycle has persisted in the rift valley environment for millions of years as a result of the interplay between depositional and erosional forces driven by tectonic processes; there are numerous gaps in the fossil record, particularly in the important time period between **Mio-Pliocene Pleistocene times**. It is pertinent to understand the origin of Hominid during the late Miocene, but it is difficult to disclose mysteries of human evolution in Narmada due to concealed nature of these deposits in rift system, however the complementary part of Tapti-Purna Quaternary blanket may be potential and possessive of human remain and should be studied to trace further the imprints of fossil man taking in to account of SONATA LINEAMAN ZONE as single ecosystem for evolution of man in Indian subcontinent. The rift system and platforms of sedimentation bear the imprints of and evidence of the effects of tectonics on fauna and flora are distinct, however the signatures of subsidence dislocation and concealing of fossiliferous horizons are uncontrolled and ill defined in the ecosystem in the valley during the Pliocene–Pleistocene periods. The boulder conglomerate which yielded the skull cap of *Homo erectus* in Narmada rift from Hathnora Sonakia (1984) remained only discovery of hominid fossil in last two and half decade due to concealed and hidden nature of **Mio-Pliocene Pleistocene deposits in rift system and inconsistency in exposure of fossiliferous horizon of Narmada rift system** which is the handicap in search of further human remains in Narmada valley after Sonakia (1984).

The study of statistical parameters and their binary relation distinctly display contrasting and relative heterogeneity in sediment characteristics throughout across the Quaternary blanket in Narmada valley. The study of sediments display diagnostic characteristics of glacial, fluvio-glacial and fluvial environment at different depth and levels 000.m to 150, 150 to 350, and 350 to 550 m from glacial, fluvio-glacial fluvial, and fluvial deposit (150 samples). The critical analysis of these parameters exhibits sediment textural linkage to long evolution in glacial, fluvio-glacial and fluvial environment in time and space in increasing antiquity in the valley. The characteristics inherited by the sediments from pre-existing domain of sediments are glacial & terrestrial & environment. The diagenetic and diagnostic features; varying degrees of heterogeneity, sediment angularity roundness, degree of sorting indicate evolution and sedimentation of quaternary sediments in a high-energy turmoil glacial environment on tectonically dislocated and unstable platform. The sediments confined up to 150 m below ground level represent paleo fluvial domain of Narmada and represent multi cycle sedimentation under varying energy condition on oscillating platform. The vertical variation in increasing antiquity in textural parameters and distinct breaks at specific level identified indicate changes of environments of sedimentation in vertical columns from glacial at the bottom of valley trough subsequently followed by fluvio-glacial and further overlain by fluvial deposits which is related with change of climate and tectonic in watershed of Narmada. The binary relation of these parameters effectively used in differentiating and fencing the sediments of these domains and their environment of sedimentation in time and space Khan et.al (2015). The study of statistical parameters across the entire thickness of Quaternary deposits revealed three breaks in sedimentation at 350 -290, 190-220, 100-150 which represent glacial, Fluvio-glacial and Fluvial environment of increasing antiquity in from bed rock in Narmada valley.

The study revealed that sediments were primarily derived from metamorphic source comprising of kyanite-paragonite, muscovite schist, gneiss, garnet mica schist, and Para-amphibolite tourmaline garnet metasedimentaries and meta-volcanic. Apart these minerals are also reworked from older Quaternary deposits from Boulder bed glacial deposit, Boulder conglomerate of fluvio-glacial deposit and fluvial terrace and higher and other older terraces of fluvial domain. These heavies were basically transported from the sources area by glacial fluvio-glacial and fluvial agencies to the present site of their occurrence. The mode of transportation, environment of deposition and energy system of transporting media has greatly affected the frequency of concentration of heavies, their grain morphology and stability in that particular domain of deposit. These minerals, mostly released from rock fragments and other fabrics comprising boulder bed, subjected to intensive wear and tear and physio-chemical environment of weathering transport and deposition, the micro imprints acquired by different condition of sedimentation revealed the intense grinding and bed traction of sediments from the source. The striations on these minerals indicate glacial activity in the initial stage of sedimentation. These suites of minerals are stable as compared to the other suite of minerals of these deposits although these mineral are associated with all domain of quaternary deposits but show different frequencies of their occurrence and physical characters, shape size sphericity and roundness and bear the micro imprints acquired by different condition of sedimentation revealed the intense grinding and bed traction of sediments from the source. The striations on these minerals indicate glacial activity in the initial stage of sedimentation. These are generally angular to highly angular in shape and show very poor indices of sphericity and roundness typical of glacial environments. The configuration of minerals, rock clastic, ground mass, imprints and impact tectonics revealed the intense grinding and bed traction of sediments from the source to site of

sedimentation. The striations on these minerals indicate glacial activity in the initial stage of sedimentation. These are generally angular to highly angular in shape and show very poor indices of sphericity and roundness typical of glacial environments. The configuration of minerals, rock clastic, ground mass, imprints and impact tectonics revealed the intense grounding and bed traction of sediments from the source to site of sedimentation.

In Hominid locality of Hathnora about 202 samples collected from Section I to IV from the exposed sections and bore hole logs across the vertical column 550 m for study to trace environments of sedimentation in Pleistocene to Holocene time. The statistical parameters viz MZ, STD, SKI, and KG of sediment samples were computed of Quaternary blanket of Narmada. The synchronized study of these parameters revealed that the quaternary deposits consists of sediments of three domain viz glacial, fluvio-glacial and fluvial representing Boulder bed, Boulder conglomerate and Fluvial deposits of paleo-domain of Narmada (NT1 to NT3). The study of various parameters their binary relation, their concentration of plots cluster and trends and patterns revealed three breaks in vertical column at 000.m to 150, 150 to 350, and 350 to 550 m in increasing antiquity in Narmada valley

The study further revealed statistical parameters to gather with heavy mineral assemblage, quartz grain morphology, paleo sole analysis ash bed matrix depict contrasting diagnostic characters of sediments in chronology of quaternary sequence in vertical columns. The statistical parameters and binary clusters of plots of mean size and sorting, mean size and skewness, mean size and kurtosis are used in delineating and fencing boundary between the glacial and fluvio glacial and fluvial sediments. The concentration of these plots separates 87 % sediments fluvial domain fluvio-glacial 94% of the fluvial-glacial from glacial. The glacial sediments are un-oriented and un-organized, fluvio-glacial moderately organized whereas, the sediments of fluvial domain are well organized in synchronization to shape size sorting, and display a balance harmony and ecology in conformity of sedimentation. Khan et.al (2015) Khan (2016) Khan (2016)

The Narmada before debouching into Gulf of Cambay a conspicuous quaternary blanket is encountered. This segment is about 90 km in length and forms the southern margin of the N-S extending Gujarat alluvial plains. A significant feature of the lower Narmada valley is the deposition of a huge thickness of Tertiary and Quaternary sediments in a fault controlled rift trench. To the south of the ENE-WSW-trending Narmada-Son Fault (NSF), the Tertiary rocks and basaltic flows of Deccan Trap Formation occur on the surface while to the north they lie in the subsurface and are overlain by Quaternary sediments. However, the overlying Quaternary sediments having a maximum thickness of 800 m (Maurya et al., 1995).

The Narmada River in its lower reaches defends in sinuous to meandering pattern which is solely guided by ENE to WSW to E-W lineament and its sympathetic fractures. It has chiseled the land scape in to terraces, valley flats which form the prominent landscape of quaternary terraces breaking the monotony of close topography. The Narmada down stream of Garudeshwar flows in a general WSW direction where it display meanders with wavelengths of 5-8 km. The Orsang, Aswan, Men and Bhuki are the major rivers joining the Narmada from the north. The Karjan River, which drains a major part of the trappean uplands in the lower Narmada valley, meets the Narmada from the south. The other tributary, the Madhumati River drains the western fringe of the trappean upland. In between the Karjan and Madhumati rivers there are several north flowing small streams meeting the Narmada at various points. The net work of drainage in the lower Narmada is structurally controlled and developed and work under the mechanism of neotectonic ecology of pulsation variance evident by landscape manifestation.

The tectonic uplift of the lower Narmada valley during the Early and Late Holocene suggests inversion of an earlier subsiding basin. Such inversions of the basin have been common in the Tertiary times and are well recorded in the sediments of that age (Roy, 1990). A symmetric convergence of the NT-1, NT-2 terraces, diagonal disposition of paired equivalent of terraces across the channel, divergent and linear disposition of cliff of NT-3 terrace in conformity of NSF constant subsidence of basin and in response to frequent movement and geotectonic activity along the NSF.

The strongest supporting evidence for the Early Holocene tectonic uplift of the area comes from the sea-level curves of the west coast of India which suggest a tectonic component of about 40 m at this time (Rao et al., 1996).

In the Lower Narmada valley the Mid-Late Holocene Quaternary valley deposits is the product of a Holocene high sea-level-induced deposition in a deeply incised valley trench trough highly influenced by NSF. The Mid-Late which resulted in both estuarine and fluvial sedimentation in the lower reaches. A significant slowing down of



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### References:-

1. Aziz Maria & Khan, A.A. (2016) Homo erectus & Homo sapien in spectrum of volcanic ecology Narmada valley Madhya Pradesh India International Journal of scientific & Engineering Research Vol.7 issue 11, pp 692 – 703 November 2016
2. Aziz Maria & Khan, A.A. (2016) Review Article of Correlation of Vom of Indian Homo Erectus with China Man International Journal of scientific & Engineering Research Vol.7 issue 11, pp539-546 November 2016
3. Acharya, S.K. and Basu, P.K. (1993): Toba ash on the Indian subcontinent and its simplification for correlation of late Pleistocene alluvium. Quaternary Research, No.-14. Pp10-14.
4. Acharyya, S. K., & Basu, P. K. (1993). Toba ash on the Indian sub continent and its implications for the correlation of Late Pleistocene Al- Copyright © 20
5. Acharyya, S.K., Kayal, J.R. and Roy, A. 1998 “Jabalpur Earthquake of May 22, 1997: Constraint from after Shock Study”, Journal Geological Society of India, Vol. 51, pp. 295-304. Agarwai, B.N.P., Das, L.K., Chakraborty, K. and Sivaji, C.H. 1995 “Analysis of the Bouger anomaly over central India: A
6. Acharyya, S.K., Kayal, J.R. and Roy, A. 1998 “Jabalpur Earthquake of May 22, 1997: Constraint from L.K., Chakraborty, K. and Sivaji, C.H. 1995 “Analysis of the Bouger anomaly over central India: A
7. Acharyya, S.K., Kayal, J.R. and Roy, A. 2000, Tectono thermal history of the central India tectonic zone and reactivation of major faults, Jour.Geol.Soci. India 55,239-256.
8. Bhattaacharji,S; Chatterji,N; Wampler J.M. 1996 Zones of Narmada Tapti area activation and Deccan volcanism: geochronological and geochemical evidences.In Deshmukh,S.S; nair ; k.K.K. (Eds)Deccan Basalts. Gondwana geological society, Nagpur PP 329-340
9. Bhattaacharji,S.,Chatterjee,N.,Wampler,J.M.,(1996).ZonesofNarmada–Tapiriftre activation and Deccanvolcanism : geo-chronological and geochemical evidence. In: Deshmukh,S.S.,Nair,K.K.K.(Eds.),DeccanBasalts.GondwanaGeologicalSo-ciety,Nagpur,pp.329–340.
10. Biswas,S.K.,(1987).Regionaltectonicframework,structureandevolutionofwestern marginalbasinsofIndia.Tectonophysics135,307–327.
11. Chamyal,L.S.,Khadkikar,A.S.,Malik,J.N.,Maurya,D.M.,(1997)..SedimentologyoftheNarmadaAlluvialFan, WesternIndia.Sediment.Geol.109,263–279.
12. Chappel,J.,Shackleton,N.J.,1986. Oxygen isotopesand sea level. Nature324,137–140.
13. Dury,G.H.,(1970).Generaltheoryofmeanderingvalleysandunder-fitstreams.In:Dury,G.H.(Ed.),RiverandRiverTerraces.Macmillan,London,pp.264–275.

14. Khan A.A. & Balchandran,V (1974-75) Records Volume109 of Geological survey Of India partI,pp.59
15. Khan A.A. 1984 Geology of Geomorphological studies in parts of Narmada Basin, Sehore Dist. Of M.P. Geol.Surv. Of India Progress Report (Unpublished).
16. Khan, A.A. & Banerjee, S.N. (1984) Geology and Geomorphological studies in the parts of Narmada Basin, Sehore district of M.P. Un Pub. Report. Geol. Surv. India.
17. Khan, A.A. (1984) Geological and Geomorphological studies around Tapti-Vagher confluence district Jalgaon, Maharashtra. Geol, Surv. India Rec. V.113 pt 6 pp 99-109
18. Khan A.A. and Bajerjee, S.N. 1985: Geomorphological and geological studies of Quaternary sediments in collaboration with project Crumansonata in parts of the Narmada basin, Sehore, Dewas and Hoshangabad districts unpublished Geol. Surv. Ind. Progress Report.
19. Khan, A.A. (1990) Geomorphology of Narmada Valley Of Jabalpur\_ Handia Section Unpublished G.S.I Note.
20. Khan, A.A., and Rahate, D.N (1990-91 & 1991-92) Geological and Geomor -phological studies in parts of Narmada Basin) parts Hoshangabad and Narshingpur district, M.P. Geol. Surv. Of India Unpublished Progress Report.
21. Khan, A.A.( 1991).Geological studies of Harda – Barwaha basin in parts of Dewas, Sehore, Hoshangabad and Khandwa districts with the Aid of Satellite imagery and Remote Sensing Techniques, Geol. Surv. Ind, Rec. Vol; 126 pt-6
22. Khan, A.A, Rahate, D.N. (1991) Volcanic Ash from Quaternary deposits of Narmada Valley Central India. Proceed, of 78<sup>th</sup> session of Indian Sci. Cong. Association. (Abstract) pt. III pp 28-29
23. Khan, A. A, Rahate, D.N, Fahim, M & Banerjee, S.N.( 1991 ) Evaluation of Quaternary terrace of lower Narmada valley , Districts Sehore and Hoshangabad, Madhya Pradesh
24. Khan, A.A., Rahate, D.N; Shah; (1991) M.R. and Fahim; M. volcanic Ash from Quaternary deposits of Narmada valley central India. Indian science Congress 1991
25. Khan, A., &Sonakia, A. (1992). Quaternary deposits of Narmada with special reference to the hominid fossil. *Journal of the Geological Society of India*, 39, 147-154.
26. Khan, A.A, Rahate, D.N., FAHIM, M. and Banarjee,S.N ( 1992) Evaluation of Geology and Geomorphology in Central Narmada Valley ( Districts Sehore and Hoshangabad, Madhya Pradesh ) Scientific Publishers, Jodhpur.
27. Khan, A.A; Rahate D.N, Fahim, M. and Banarjee, S.N. (1992): Evaluation of Geology and Geomorphology in Central Narmada Valley (Districts Sehore and Hoshangabad, Madhya Pradesh) Scientific Publishers, Jodhpur
28. Khan A.A. 1994 Geological and Geomorphological studies around Tapti-Vagher confluence district JaloanMaharastra, Geol. Surv. Of India, Rev. Vol. 113 pt. 6 pp 99 – 109.
29. Khan A.A. & Maria Aziz (2012)“Homo erectus On Unified Quaternary Platform in India and China a Correlation & Sequential Analysis”. Status Published Research Scapes International Journal Vol I, Issue IV October -December 2012. (ISSN: 2277-7792)
30. Khan. A.A. & Aziz, Maria (2012) “Homo Erectus & Homo Sapiens In Spectrum Of Volcanic Ecology, Narmada Valley (M.P) India”Status Published Research Scapes International Multidisciplinary Journal Voll, Issue III July-September 2012
31. Khan, A.A. & Aziz; Maria (2013) Homo Erectus & Homo Sapien in Spectrum of Volcanic Ecology, Narmada valley (M.P.) India Research scapes vol. i issue -4 pp-161 -178
32. Khan A.A; & Joshi O.P. ( 2014) Geology Lithostratigraphy And Correlation of Basaltic Lava Flows of Parts of Western Madhay Pradesh With Special Reference To Megacryst Bearing Horizons And Geotechnical Aspects For Heavy Engineeing Structures
33. Khan, A.A & Aziz, Maria (2014-15) Tectonics Evolution, Quaternary Sedimentation, And The Paleoanthropological Record InThe Narmada Rift System (m.p.) Central India Khan\*, A.A. Aziz, Maria International Journal for Research and Technological Sciences Vol. 1, Issue 1 (2014) 91-93 ISSN -2349-0667.
34. Khan A.A. & Aziz, Maria (2015) Quaternary Tectonics & Sedimentation in Narmada Rift Valley, With Special Reference to Garudeshwar and Bharuch Section Gujarat State India, ISSN 2320-5407 International Journal of Advanced Research (2015), Volume 3, Issue 3, 430-457 430 Journal homepage: <http://www.journalijar.com>.
35. Khan, A.A. & Aziz; Maria (2014-2015). Quaternary volcanic Eruption Toba Ash fall its impact on Environment of late Pleistocene Hominines in Indian subcontinent with Special Reference to Narmada Valley. International journal of Research in Technological sciences vol.1, Issue 2 & Vol-2 issue-1 July -January 2014 January-June 2015 PP1-18 (ISSN-2349-0667)
36. Khan, A.A. Aziz; Maria (2015) A critical analysis of statistical parameters of quaternary deposit of Hominid locality, Hathnora, Narmada valley, distirtsehore (M.P), India Jour. Of Agriculture, Forestry and Environment al Science Vol.IIssue.I July –Aug 2015 .I pp 17-29 ISSN 2454-2792.

37. Khan A.A. & Aziz, Maria (2016) Heavy Minerals assemblage of quaternary column of hominid locality Hathnora, Narmada valley district Sehore M.P. India. ISSN 2320-5407 International Journal of Advanced Research (2016), Volume 4, Issue 7, 1748-1780 Journal homepage: <http://www.journalijar.com>.
38. Khan A.A. Maria Aziz. (2016) Quaternary tectonics & geomorphic evolution of Narmada valley, its impact on tracing the remains of Homo erectus and other quaternary fauna & flora. ISSN 2320-5407 International Journal of Advanced Research (2016),
39. Khan, A.A & Aziz, Maria (2014-15) Tectonics Evolution, Quaternary Sedimentation, And The Paleoanthropological Record In The Narmada Rift System (m.p.) Central India Khan\*, A.A. Aziz, Maria International Journal for Research and Technological Sciences Vol. 1, Issue 1 (2014) 91-93 ISSN -2349-0667.
40. Khan A.A. & Aziz, Maria (2015) Quaternary Tectonics & Sedimentation in Narmada Rift Valley, With Special Reference to Garudeshwar and Bharuch Section Gujarat State India, ISSN 2320-5407 International Journal of Advanced Research (2015), Volume 3, Issue 3, 430-457 430 Journal homepage: <http://www.journalijar.com>
41. Khan, A.A. & Aziz; Maria (2014-2015). Quaternary volcanic Eruption Toba Ash fall its impact on Environment of late Pleistocene Hominines in Indian subcontinent with Special Reference to Narmada Valley. International journal of Research in Technological sciences vol.1, Issue 2 & Vol-2 issue-1 July -January 2014 January-June 2015 PP1-18 (ISSN-2349-0667)
42. Khan, A.A. Aziz; Maria (2015) A critical analysis of statistical parameters of quaternary deposit of Hominid locality, Hathnora, Narmada valley, district sehore (M.P), India Jour. Of Agriculture, Forestry and Environmental Science Vol.I Issue.I July –Aug 2015 .I pp 17-29 ISSN 2454-2792
43. Khan, A.A & Aziz Maria &. (2016) Review Article Narmada Rift valley & Quaternary Sedimentation International Journal of scientific & Engineering Research Vol.7 issue 11, pp 526-538 November 2016
44. Merh, S.S., 1993. Neogene–Quaternary sequence in Gujarat: a review. J. Geol. Soc. India 21, 259–276
45. Merh, S.S., Chamyal, L.S., 1997. The Quaternary geology of Gujarat Alluvial Plains. Proc. Indian Natl. Sci. Acad. 63, 1–98.
46. Hashimi, N.H., Nigam, R., Nair, R.R., Rajagoplan, G., 1995. Holocene sea level fluctuations on western Indian continental margin: an update. J. Geol. Soc. India 46, 157–162.
47. Roy, A.K. 1971 Geology and Ground Water Resources of Narmada Valley Bull of Geol
48. Ravi Shankar, 1987 : History and status of geothermal exploration in the Central Region (M.P. & Maharashtra). Rao, Geol. Surv. Ind., 115, pt. 6, pp. 7-29.
49. Roy, A.K. 1971 Geology and Ground Water Resources of Narmada Valley Bull of Geol Surv. Of India Series B. Engineering Geology and Ground Water Geology.
50. Theobald, W. 1860. On the Tertiary and alluvial deposits of the Central portion of the Nerbudda valley. *Memoirs of Geol. Surv. India*, 2: 279, 298.
51. Sonakia A. 1984 The Skull Cap of Early man and associated mammalian fauna from Narmada Valley alluvium Hoshangabad area. Madhya Pradesh, India Rec. Geol Surv. India Vol. 113, Pt. 6 pp 159-172
52. Sankhyani, A. R. (1997b). A new human fossil find from the Central Narmada basin and its chronology. *Current Science*, 73, 1110-1111.
53. Williams, M.A.J., Clarke, M.F., 1984. Late Quaternary Environments in north-central India. *Nature* 308, 633–635.
54. Williams, M.A.J., Clarke, M.F., 1995. Quaternary geology and prehistoric environments in the Son and Belan valleys, north central India. In: Wadia, S., Korisettar, R., Kale, V.S. (Eds.), *Quaternary Environments and Geoarchaeology of India*. Geological Society of India, Bangalore, pp. 282–308.
55. Williams, M.A.J., Royce, K., 1982. Quaternary geology of the Middle Son Valley, north central
56. India: implications for prehistoric archaeology. *Palaeogeography, Palaeoclimatology, Palaeoecology* 38, 139–162.
57. Williams, M.A.J., Royce, K., 1983. Alluvial history of the Middle Son Valley, north central India. In: Sharma, G.R., Clark, J.D. (Eds.), *Palaeoenvironments and Prehistory in the Middle Son Valley*. Abinash Prakashan, Allahabad, pp. 9–21.
58. Williams & Clarke, M.F. 1995 Quaternary Geology and Prehistoric environment in Son and Belan valleys, North Central India, *Geol. Soc. Ind. Mem.* 32, pp 282-308.
59. Wright, L.D., Coleman, J.M., Thom, B.G., (1973). Processes of channel development in a high-tide-range environment: Cambridge Gulf-Ord River delta, Western Australia. *J. Geol.* 81, 15–41.

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### RESEARCH ARTICLE

## Effect of Balance Training on Postural Control and Risk of fall in Stroke Patients.

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Balance training, biodex balance system, visual feedback, stroke.

### Abstract

**Background:** Purpose of this study was to investigate of effect of visual feedback balance training on postural control and risk of fall in stroke patients.

**Methods:** Forty stroke patients were included in this study. Their age ranged from 40-60 years. They were evaluated using the Biodex Balance System pre and post treatment. They were divided into two equal groups (control group and study groups). Subjects in both groups participated in the conventional stroke rehabilitation program, one hour /day/ 5 days/week /3 successive months in addition, subjects in the study group received a 20 min of balance training once daily, five days a week for 3 months using the Biodex Balance System (BBS).

**Results:** Significant improvements in balance training measurements were found in the trained group at 3 months after completing the training program.

**Conclusion:** Patients in the visual feedback balance training group had significant improvements when compared with the control group in terms of improving of postural control and decreasing of risk of fall. The results showed that balance training was beneficial for patients after hemiplegic stroke.

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### Introduction:-

Stroke is a form of cardiovascular disease affecting the blood supply to the brain. Also referred to as cerebrovascular disease. In stroke, there has been a disturbance in brain function, often permanent, caused by either a blockage or a rupture in a vessel supplying blood to the brain [1]. Stroke is a common neurological disorder, the second commonest overall cause of death, and a major cause of disability in survivors. [2]. Stroke is the leading cause of serious long-term disability, with over 1 million adults reporting difficulties in function as a result of stroke. In addition to the primary deficits associated with stroke, there is a high rate of secondary complications, including falls [3].

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Balance problems in hemiplegic patients after stroke can be caused by different impairments in the physiological systems involved in postural control, including sensory afferents, movement strategies, biomechanical constraints, cognitive processing, and perception of verticality [4].

Clinical and laboratory evaluation in hemiparetic patients can show the asymmetrical distribution of weight in the lower limbs, with deviation of the center of mass to the uninvolved side, difficulty in actively transferring and keeping the center of mass in the hemiparetic side in the lateral and anterior directions and decreased frontal plane stability, impaired muscle selection with consequent increase in body oscillations during standing. Hemiparetic stroke patients may present difficulties in weight transfer from the affected to the unaffected side [4]. Postural sway for patients with hemiplegia can be twice that of their age-matched peers. hemiplegia can cause a reduction in patients' limits of stability, which is defined as the maximal distance that an individual can shift his or her weight in any direction without loss of balance [5].

To maintain balance in activities of daily living (ADL), posture control is essential, while motor, sensory and higher brain cognitive faculties all contribute to postural control [6-8]. Following a stroke, patients lose functions of the motor, sensory and higher brain cognitive faculties to various degrees which lead to diminished balance. [9-10]. The Biodex balance system (BBS) is an important valid and reliable balance assessment and therapeutic tool. It can be used for evaluating and training of patients with balance deficits as it includes many training and testing programs simultaneously. These assessment programs include Dynamic limits of stability (DLS), fall risk tests and others [11].

The Biodex Balance System has been used to evaluate postural balance in recent years. The BBS is a multi-axial device that objectively measures and records an individual's ability to stabilize the involved joint under dynamic stress. It uses a circular platform that is free to move in the anterior-posterior and medial-lateral axes simultaneously [12]. BBS allows up to 20° of foot platform tilt, which permits the ankle joint mechanoreceptors to be stimulated maximally. The BBS measures, in degrees, the tilt about each axis during dynamic conditions and calculates a medial-lateral stability index (MLSI), anterior-posterior stability index (APSI), and an overall stability index (OSI). These indexes represent fluctuations around a zero point established prior to testing when the platform is stable [13]. As far as we know, only a few studies have mentioned about the effects of visual feedback balance training for stroke patients using the Biodex balance system. Therefore, in this study, we evaluated the effects of this training program on postural control and risk of fall in stroke patients.

## Methods:-

### 2.1. Subjects:-

Forty stroke patients included in the study. Their age ranged from 40-60 years old. They were selected from al-Noor specialized hospital in Makkah. **Inclusive criteria:** Patients were required to meet the following criteria for inclusion in the study: (1) approximately 3 months or more after initial onset of an ischemic cerebrovascular accident (thrombotic and embolic stroke), (2) ability to understand and follow simple verbal instructions, (3) ambulatory before the stroke, (4) ability to stand with or without assistance and to take at least one or more steps with or without assistance, (5) no medical contraindication to walking. **Exclusive criteria:** Patients were excluded if they had a history of any other neurological pathology, conditions affecting balance, dementia, impaired vision or conscious levels or concomitant medical illness or musculoskeletal conditions affecting the lower limbs. All recruited patients were randomly assigned into two equal groups; control group and trained group. They were evaluated and treated in the laboratory of Physical Therapy Department, Faculty of Applied Medical Sciences, Umm Al-Qura University.

### 2.2. Intervention:-

#### 2.2.1. Measurement:-

Biodex Balance System SD: (BBS; Biodex Inc., Shirley, NY) was used as a valid and reliable equipment for performing Dynamic limits of stability and fall risk test. It consists of support handle, platform, display and printer. It has a static mode and 12 levels of dynamic platform tilt (static, 12 is more stable, 1 is less stable) as shown in **figure (1)**. This balance system was used for assessment of the changes in reactive postural balance control for the participated patients from standing position pre and immediately post training.

All participating were given several explanatory sessions before the evaluation process. During the evaluation, each patient was asked to stand bare feet in the center of platform while both arms at the side of the body and to look

straight and focus on visually feedback screen. They were tested on static level. Three trials were performed and the average of them was calculated.

The Support handles were adjusted and the evaluator stood close beside the patient to provide assistance in case of balance losses shown in **figure (2)**.

For postural stability testing, the overall stability index (OASI), mediolateral stability index (MLSI) and anteroposterior stability index (APSI) were obtained for the 40 patients by doing a test at static level for 20 seconds, with eyes open. The patients were asked for keeping the centre of pressure in the centre of a target displayed on the monitor. Patients not allowed to support themselves with their hands. Before the test, the patients did one training test. It was performed as a single test to reduce the potential effects of learning and fatigue as shown in **figure (3:A&B)**.

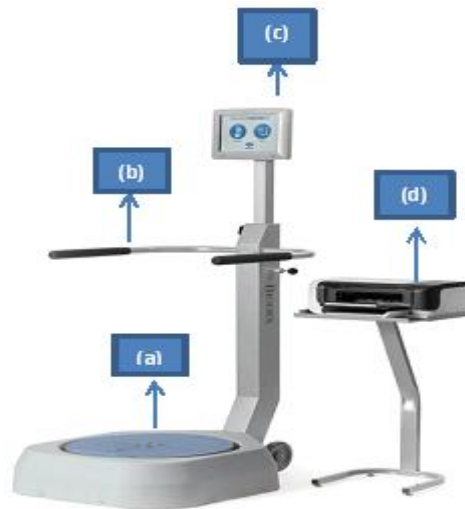
Test results were automatically compared to age dependent normative values stored in the higher risk of falling which is an indicator of poor balance. Lowering of this score post-training to be nearby normative values is a strong evidence for reactive balance control improvement.

### 2.2.2. Treatment:-

Subjects in both the experimental (A) (n=20) and the control group (B) (n=20) participated in our conventional stroke rehabilitation program, 5 days a week, one hour /day, for three successive months. The conventional program consisted of neurodevelopmental facilitation techniques, positioning, range of motion and progressive resistive exercises, together with training in endurance, walking and activities of daily living. Postural control exercises included maintenance of standing and shift of the weight loaded to the paretic side. Therapists combined elements of Brunnstrom's movement therapy, Bobath neurodevelopment treatment and proprioceptive neuromuscular facilitation techniques according to the patients' needs and performance. This personalized rehabilitative care was designed to help the patient to perform the daily activities of living independently in order to achieve the best possible quality of life. In addition to conventional program, the experimental group received 20 min. of balance training once daily, five days a week for three months using the Biodex Balance System (BBS). Subjects encouraged to maintain their posture steadily and symmetric weight bearing while adapting to different static sensory conditions through verbal or tactile cues. For dynamic function training, the patients were instructed to practice controlling their weight shifts by tracing the moving targets on the screen in every main direction [14].

The postural balance control training routine for group (A) was conducted in the form of postural stability training in every session through the usage of the Biodex balance system. The training program required the patient to perform training while standing bare feet in the same body position used during testing and followed the same instructions on the evaluation process for postural stability during every training session as shown in **figure (4B)**.

Weight shift training session consisted of three trials with five minutes rest between them. In each trial, the patient would complete the task requirements. Then each patient received 10 min rest before the application of the traditional training program for one hour as shown in **figure (4A)**.



**Figure 1:** Biodex stability system.

(a) A movable balance platform, (b) Support rails, (c) Display and (d) Printer



**Figure2:** Patient Preparation on biodex platform for evaluation and training



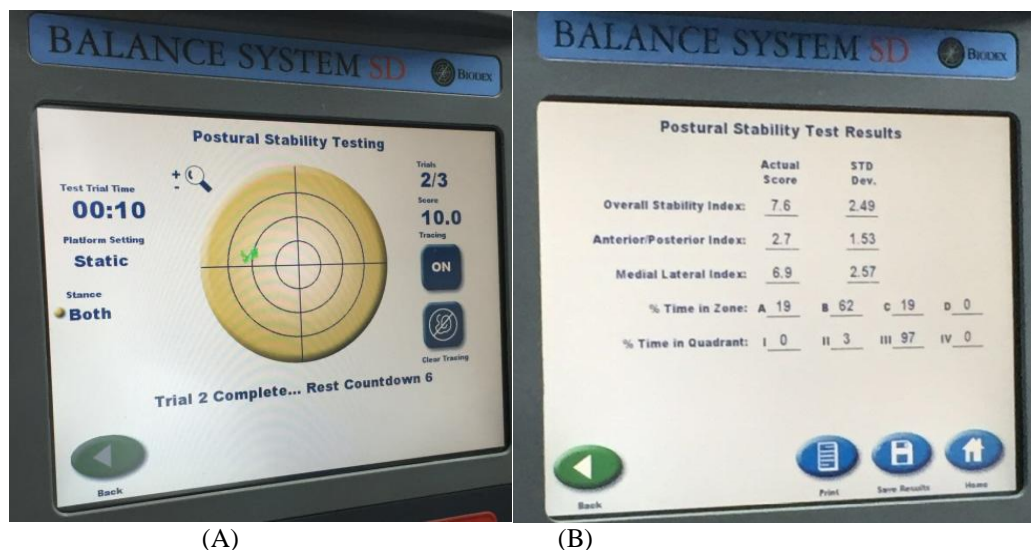


Figure 3: A) -Patient's postural stability test screen shot. B) - Patient's postural stability test results screen shot

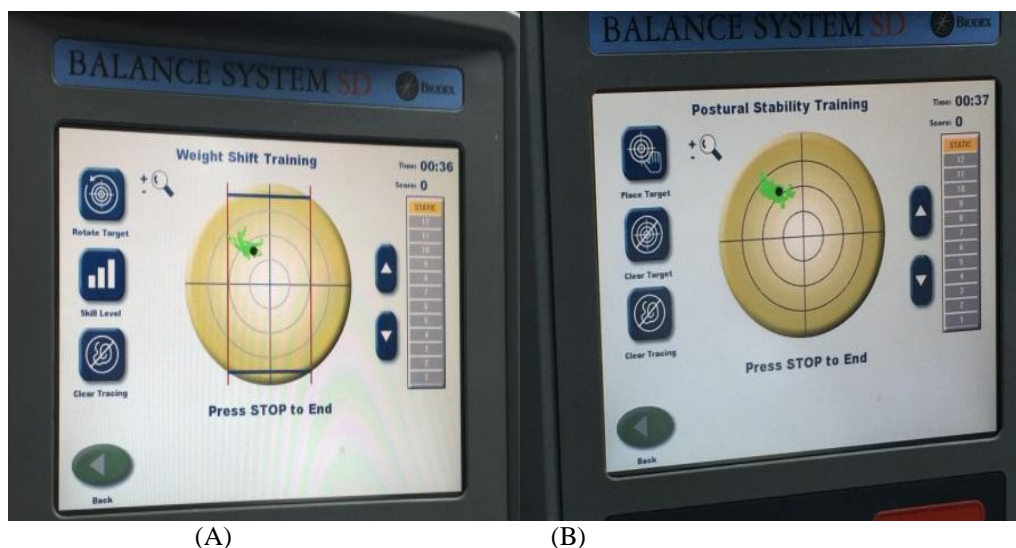


Figure 4:A)- Patient's weight shift training screen shot. B) - Patient's postural stability training screen shot

### 2.3. Data analysis and statistics:-

Data were pooled across subjects according to group (control group and trained group). Differences in the continuous data (age, body weight, and body height) between groups were compared using an Independent sample *t*-test. Comparison between pre- and immediately post-treatment in each group was performed using paired *t*-test. While the comparison between both groups pre and immediately post treatment was carried out by using an unpaired *t*-test. SPSS computer program version 16.00 (SPSS Inc., Chicago, IL) was used for data analysis. *p* Value less to 0.05 was considered significant.

### Results:-

Forty stroke patients randomly distributed into two equal groups were participating in this study. The demographic characteristics of the included patients were illustrated in Table 1. The mean age of study group was  $(52.9 \pm 6.08)$  while the mean age of control group was  $(51.25 \pm 6.71)$ , the mean of weight as well as the mean of height for study group were  $(74.9 \pm 7.75 \text{ kg})$  and  $(175 \pm 6.43 \text{ cm})$  respectively while the mean of weight as well as the mean of height for control group were  $(73.5 \pm 7.15 \text{ kg})$  and  $(172 \pm 6.0 \text{ cm})$  respectively and a mean time from stroke onset was  $(9.6 \pm 1.9)$  months for study group while it was  $(9.45 \pm 1.73)$  for control group, (see Table 1). And there were no significant difference between two groups regarding to patient's age, weight, height, and time of stroke onset as *p* value  $> (0.05)$ .



**Table 1.**Demographic and clinical characteristics of patients.

Variables	Study Group A (n20)	Control Group B (n20)	P value
Age (yearsSD)	52.9± 6.08	51.25± 6.71	0.42
Height (cm)	175±6.43	172±6.0	0.23
Weight (Kg)	74.9±7.75	73.5± 7.15	0.55
Time from stroke onset (month)	9.6±1.9	9.45±1.73	0.79

The results of this study regarding to the mean values of overall stability index of postural stability from pre- to post-treatment showed significant improvement in the ability to control balance and minimizing the risk of fall in study groups( $p<0.05$ ) as illustrated in table 2. Comparing these results between both groups pre-treatment indicated no significant differences. While their comparison post treatment mean improvement scores as elucidated in Tables 2 demonstrated significant differences in favor of the study group (A)( $p<0.05$ ).

More illustration, before treatment evaluation revealed that; the mean Overall stability index was ( $3.82\pm0.68$ ) for study group while it was ( $2.76\pm1.07$ ) for control group and there was no significant different between two group as  $p$  value = (0.1).

Post treatment evaluation revealed that; the mean Overall stability index was ( $2.4\pm0.6$ ) for study group while it was ( $2.52\pm0.80$ ) for control group and there was high significant different between post treatment improvement score means of two group as  $p$  value = (0.003) as illustrated in table 2 and figure 6.

Comparing mean values of OASI within study group revealed that there was high significant differences between before and after treatment mean values as  $p$  value =(0.002), while comparing mean values of OASI within control group revealed that there was no significant differences between before and after treatment mean values as  $p$  value =(0.32)as illustrated in table 2 and figure 5.

Table (2): Comparisons of means values of Overall stability index within each group and improvement Score means values between groups.

	Overall stability index		
	Study Group	Control Group	P value
Pre-treatment mean value	3.82±0.68	2.76±1.07	0.1
Post-treatment mean value	2.42±0.78	2.52±0.80	
P value	0.002	0.32	
Improvement Score mean	1.4±0.42	0.24±0.47	0.003

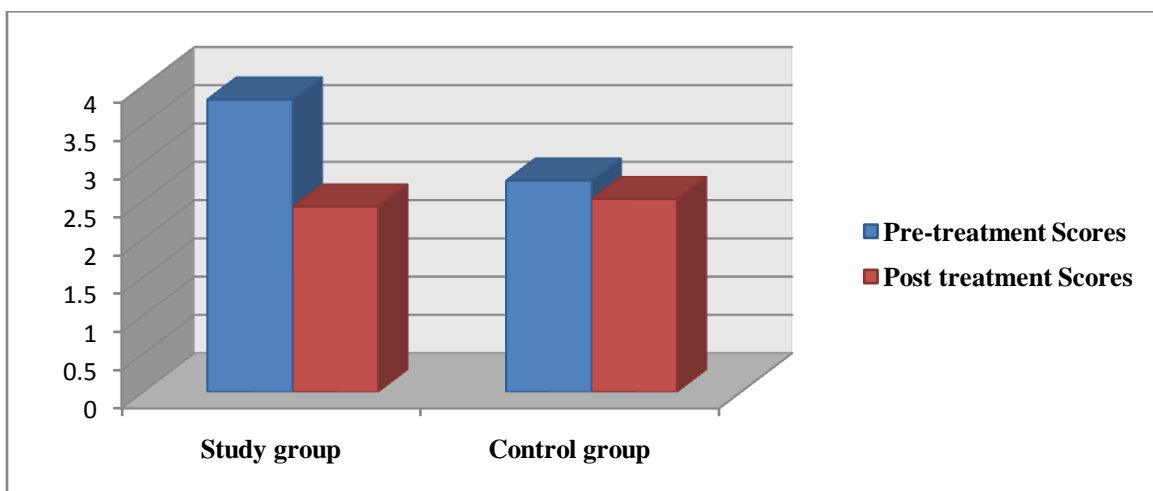


Figure5: Comparisons of mean values of Overall stability index within each group.

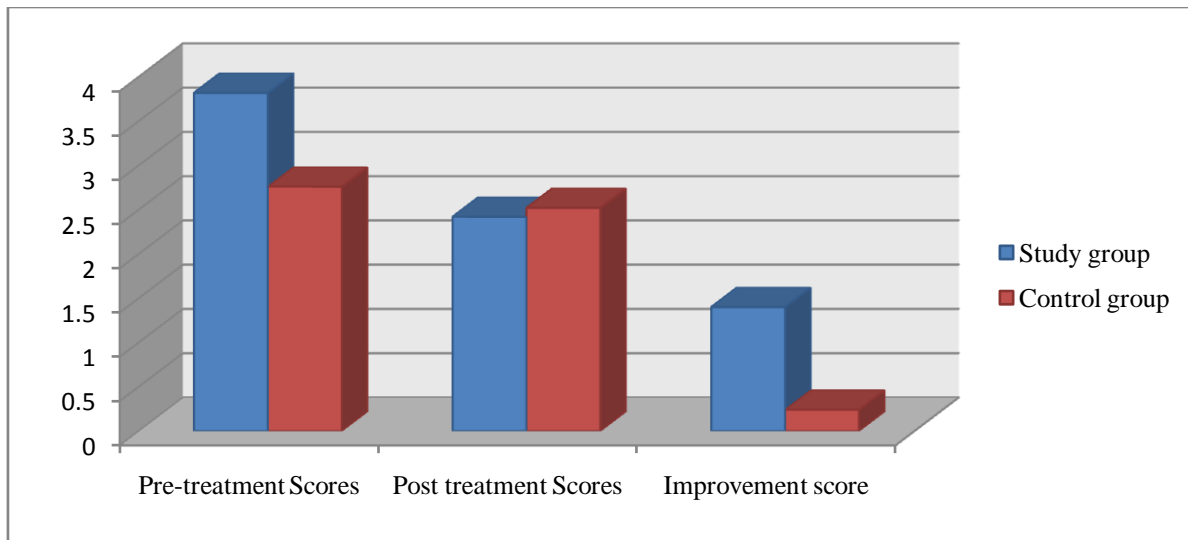


Figure 6: Comparisons of mean values of overall stability and improvement scores between groups.

### Discussion:-

Cerebrovascular disease is an important health problem [15]. After stroke, some patients are unable to stand, and others have higher postural sway, asymmetric weight distribution, impaired weight shifting ability and equilibrium reactions may be delayed or disrupted [16-20]. There is also an increased risk of falling, resulting in high economic costs and social problems [21-23]. Hemiplegia can cause reduction in patient's limits of stability, which are defined as the area where the individual can shift his center of mass without loss of balance and without changing the support base. This describes a theoretical cone extending around a person's feet [24]. Impaired balance greatly influences the activities of daily living (ADL), independence and gait. Therefore, it's essential to rapidly achieve postural control in order to improve independence, social participation and general health. The aim of balance rehabilitation is to ensure safe ambulation [25]. In spite of the multiple therapeutic approaches to promote recovery of postural control, no definitive conclusions can be drawn on which one is the best.

Balance is essential to all functional activities during sitting and standing [26]. Postural control is fundamental to maintain balance. The important resources for postural control are movement strategies, biomechanical constraints, cognitive processing, perception of the verticality (visual and postural), sensory modalities (somatosensory, visual and vestibular) and the sensory reintegration and reweighting in central nervous system (CNS) [27], which can be impaired after a stroke.

Biodex Balance system is designed to provide visual or auditory feedback to patients regarding the focus of their center-of-pressure (COP). In these systems, feedback is defined as augmented extrinsic information about task success provided to the performer. It's thought that, by giving patients additional information, they will become more aware of the body's displacements and orientation in space. It is believed that the relearning of postural control through external biofeedback is an effective therapy for improving balance control [28]. Hocherman et al. concluded that the hemiplegic patient's stability of stance on a moving platform could be improved by regular training [29].

Shumway-Cook et al. showed that postural sway biofeedback was more effective than conventional therapy in retraining postural stability in hemiplegic patients [30]. In a Cochrane's review of seven randomized controlled trials, Barclay-Goddard et al. concluded that force plate form feedback improved stance symmetry after stroke, without repercussion on postural sway or measures related to gait and independency in ADL [31].

Geiger et al. concluded that combining force platform visual feedback training with conventional physical therapy did not enhance the effects of conventional physical therapy on balance and functional mobility skills in stroke patients with hemiplegia [32]. The present study is designed to assess postural stability, risk of fall and the effect of balance training using biodex training system visual biofeedback among patients with postural disturbances following stroke. Following stroke, postural deficits are common [33]. In the hemiparetic gait there is reduced weight-bearing on the paretic limb [34-36] and excessive postural sway [37, 38].

The results of this study show that there is a statistically significant improvement in OASI within study group as well as there is a statistically significant increased OASI improvement scores in study group when compared to those in control group. Postural control is considered to be a prerequisite for restoration of independent living. Sacle et al. studied the effect of the visual feedback after stroke in a randomized controlled trial. They assessed sway and stance symmetry, motor and ADL function at 0, 4 and 12 weeks. They concluded that significant improvements were seen in the treatment group in measures of sway, stance symmetry, motor and ADL function, but differences between groups had disappeared at 3 months [39].

Chen et al. studied the effect of balance training on hemiplegic stroke patients, using 2 groups that received a conventional program. Only the treatment group received visual feedback balance training. They concluded that there were significant improvements of dynamic balance function and ADL function at 6 months of follow-up in the treatment group [40]. Yavuzer et al. studied the effects of balance training on quantitative gait characteristics in a randomized controlled trial. They concluded that balance training using platform biofeedback in addition to a conventional rehabilitation program is beneficial in improving postural control and weightbearing on the paretic side, 6 months after stroke [41]. Like the fore mentioned studies we also found a balance improvement and hence decreased risk of fall in stroke after using biodex balance training system.

### Conclusion:-

Balance training using Biodexbalance Systems may increase stability in hemiplegic patient and decrease risk of falling and this may be confirmed when completing the study by more patients involve.

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**Interest conflict:-**The author declares that; he has no interest competing.

### References:-

1. Yang, S., Hwang, W.H., Tsai, Y.C., Liu, F.K., Hsieh, L.F. &Chern, J.S. Improving balance skills in patients who had stroke through virtual reality treadmill training. *Am. J. Phys. Med. Rehabil.* 2011; 90, 969-978.
2. Kelley, R.E. &Borazanci, A.P. Stroke rehabilitation. *Neurol. Res.*2009; 31, 832-840.
3. Belgen B, Beninato M, Sullivan PE, Narielwalla K. The association of balance capacity and falls self-efficacy with history of falling in community-dwelling people with chronic stroke. *Arch Phys Med Rehabil* 2006; 87:554-61.
4. Graham, J.V., Eustace, C., Brock, K., Swain, E. & Irwin-Carruthers, S. The Bobath concept in contemporary clinical practice.*TopStroke.Rehabil.* 2009; 16, 57-68.
5. Geiger RA, Allen JB, O'Keefe J, Hicks RR. Balance and Mobility Following Stroke: Effects of Physical Therapy Interventions with and Without Biofeedback/Forceplate Training. *PhyTher* 2001; 81: 414-18.
6. Gil-Gomez, J.A., Llorens, R., Alcaniz, M. &Colomer, C. Effectiveness of a Wii balance board-based system (eBaViR)for balance rehabilitation: a pilot randomized clinical trial inpatients with acquired brain injury. *J. Neuroeng. Rehabil.*2011; 8, 30.
7. Flansbjer, U.B., Miller, M., Downham, D. &Lexell, J. Progressive resistance training after stroke: effects on muscle strength, muscle tone, gait performance and perceived participation. *J. Rehabil. Med.*2008; 40, 42-48.
8. De Oliveira C, De Medeiros I, Frota N, Greters M, Conforto A., Balance control in hemiparetic stroke patients: Main tools for evaluation. *Journal of Rehabilitation Research & Development.* 2008; 45 (8): 1215–1226.
9. Adegoke B, Olaniyi O, Akosile C. Weight Bearing Asymmetry and Functional Ambulation PerformanceIn Stroke Survivors. *Global Journal of Health Science*, March 2012; DOI: 10.5539/gjhs.v4n2p87.
10. Leroux, A., Pinet, H. & Nadeau, S. Task-oriented intervention in chronic stroke: changes in clinical and laboratory measures of balance and mobility. *Am. J. Phys. Med. Rehabil.*2006; 85, 820-830.
11. Karimi N, Ebrahimi I, Kharizi S, Torkaman G. Reliability of postural balance evaluation using the biodex balance system in subjects with and without low back pain. *J of Postgraduate Medical Institute.*2008;20:2:1013-16.

12. Aydog E, Bal A, Aydog ST, Cakei A. Evaluation of dynamic postural balance using the Biodex Stability System in rheumatoid arthritis patients. *Clin.Rheumatol.*2005; 10:1-6.
13. Wikstrom E, Tillman M, Smith A, and Borsa P.A New Force-Plate Technology Measure of Dynamic Postural Stability: The Dynamic Postural Stability Index.*JAthl Train.* 2005; 40(4): 305–309.
14. Chun C , Pao-Tsai C, Chia-Ling C, Shih-Ching C, Chia-Ying C, Tu-Hsueh Y. Effects of Balance Training on Hemiplegic Stroke Patients,*Chang Gung Med J* 2002; 25(9):583-589.
15. Glanz M, Klawansky S, Chalmers T. Biofeedback therapy in stroke rehabilitation: a review. *J R Soc Med* 1997;90(1):33-9.
16. Goldie PA, Matyas TA, Evans OM, Galea M, Bach TM. Maximum voluntary weight-bearing by the affected and unaffected legs in standing following stroke.*ClinBiomech.* 1996; 11(6):333-42.
17. Badke MB, Duncan PW. Patterns of Rapid Motor Responses During Postural Adjustments When Standing in Healthy Subjects and Hemiplegic Patients. *Phys Ther*1983;47:1020-8.
18. Horak FB, Esselman P, Anderson ME, Lynch MK. The effects of movement velocity, mass displaced, and task certainty on associated postural adjustments made by normal and hemiplegic individuals. *J NeurolNeurosurg Psychiatry* 1984;47:1020-8.
19. Dickstein R, Abuluflo N. Postural Sway of the Affected and Nonaffected Pelvis and Leg in Stance of Hemiparetic Patients. *Arch Phys Med Rehabil* 2000;81(3):364-7.
20. Lamb SE, Ferrucci L, Volapto S, Fried LP, Guralnik JM. Women's Health and Aging Study. Risk factors for falling in home dwelling older women with stroke: The Women's Health and Aging Study. *Stroke* 2003;34(2):494–501.
21. Harris JE, Eng JJ, Marigold DS, Tokuno CD, Louis CL. Relationship of balance and mobility to fall incidence in people with chronic stroke. *PhysTher.* 2005;85(2):150–8.
22. Belgen B, Beninato M, Sullivan PE, Narielwalla K. The association of balance capacity and falls self-efficacy with history of falling in community-dwelling people with chronic stroke. *Arch Phys Med Rehabil* 2006;87(4):554–61.
23. McCollum G, Leen TK. Form and exploration of mechanical stability limits in erect stance. *J Motor Behav* 1989;21:225-44.
24. Geurts AC, de Haart M, van Nes IJ, DuysensJ. A review of standing balance recovery from stroke. *Gait Posture* 2005;22:267-81.
25. Bonan IV, Yelnik AP, Colle FM, Michaud C, Normand E, Panigot B, Roth P,Guichard JP, Vicaud E. Reliance on visual information after stroke. Part II: Effectiveness of a balance rehabilitation program with visual cue deprivation after stroke: a randomized controlled trial. *Arch Phys Med Rehabil* 2004;85:274-8.
26. Eser F, Yavuzer G, Karakus D, Karaoglan B. The effect of balance training on motor recovery and ambulation after stroke: a randomized controlled trial. *Eur J PhysRehabil Med* 2008;44:19-25.
27. Oliveira CB, Medeiros IT, Frota NF, Greters ME, Conforto AB. Balance control in hemiparetic stroke patients: Main tools for evaluation. *J Rehabil Res Dev*2008;45(8):1215–26.
28. Walker C, Brouwer BJ, Culham EG. Use of Visual Feedback in Retraining Balance Following Acute Stroke.*PhysTher* 2000;80:886-95.
29. Hocherman S, Dickstein R. Platform training and postural stability in hemiplegia.*ArchPhys Med Rehabil* 1984;65:588-92.
30. Shumway-Cook A, Anson D, Haller S. Postural sway biofeedback: its effect on reestablishing stance stability in hemiplegic patients. *Arc Phys Med Reahabil* 1988;69:395-400.
31. Barclay-Goddard R, Stevenson T, Poluha W, Moffatt ME; Taback, SP. Force platform feedback for standing balance training after stroke. *Cochrane Database Syst Rev* 2004;18(4):CD004129.
32. Geiger RA, Allen JB, O'keefe J, Hicks RR. Balance and mobility following stroke: effects of physical therapy interventions with and without biofeedback/force plate training. *PhysTher* 2004;81:995-1005.
33. Dault M, de Haart M, Geurts AC, Arts IM, Nienhuis, B. Effects of visual center of pressure feedback on postural control in young and elderly healthy adults and in stroke patients. *Hum MovSci* 2003;22(3):221–36.
34. Yavuzer G, Ergin S. Effect of an arm sling on gait pattern in patientswithhemiplegia. *Arch Phys Med Rehabil* 2002;83:960-3.
35. Wong A, Lee MY, KuoJK , Tang, FT. The Development and Clinical Evaluation of a Standing Biofeedback Trainer. *J Rehabil Res Dev* 1997;34( 3):322-327.
36. Sacle C. The relationships between weight-bearing asymmetry after stroke, motor function and activities of daily living. *Physiotherapy Theory Pract* 1990;6:179-85.
37. deHaart M, Geurts AC, Huidekoper SC, Fasotti L, van Limbeek J. Recovery of standing balance in postacute stroke patients: a rehabilitation cohort study. *Arch Phys Med Rehabil* 2004;85:886-95.

38. Bonan IV, Colle FM, Guichard JP, Vicaut E, Eisenfisz M, Tran Ba Huy P, Yelnik AP. Reliance on visual information after stroke. Part I: Balance on dynamic posturography. Arch Phys Med Rehabil 2004;85:268-73.
39. Sacle CM, Lincoln NB. Single blind randomized controlled trial of visual feedback after stroke: effects on stance symmetry and function. Disabil Rehabil 1997;19(12):536-46.
40. Chen IC, Cheng PT, Chen CL, Chen SC, Chung CY, Yeh TH. Effects of Balance Training on Hemiplegic Stroke Patients. Chang Chung Med J 2002;25(9):583-90.
41. Yavuzer G, Eser F, Karakus D, Karaoglan B, Stam HJ. The effects of balance training on gait late after stroke: a randomized controlled trial Clin Rehabil. 2006;20(11):960-9.

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### RESEARCH ARTICLE

## GROWTH AND YIELD OF UPLAND RICE WITH THE ADDITION OF COMPOST FROM OIL PALM EMPTY FRUIT BUNCHES AND FUNGI MYCORRHIZAL.

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growth, mycorrhizal fungi, OPEFB  
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### Abstract

The study was conducted in Cengkeh Turi Binjai with a soil pH of 4.2. The source of mycorrhizal inoculation using mycofer from The Forest of Inter-University Center of Bogor Agricultural Institute, with mycorrhizal contents (*Gigaspora margarita*, *Glomus manihotis*, *Glomus etunicatum*, and *Acaulospora tuberculata*). Planting was conducted in January-May 2014. The upland rice variety used as the indicator plant was *Situ Bagendit*. This study used a factorial randomized block design (RBD) with two factors. The first factor is a mycorrhizal inoculation consisting of two levels, i.e. without giving mycofer and by giving 5 g of mycofer per planting hole. The second factor was giving oil palm empty fruit bunches (OPEFB) composts in 3 levels: 0, 3,375 g, 6,750 g/plot. The result of the research showed that (i) the dose of OPEFB composting of 3,375 g per planting hole can increase the number of productive tillers and panicles; and (ii) the addition of OPEFB compost (3,375 g/plot) and mycorrhizal inoculation (5 g mycofer/plot) can increase the number of filled grain of upland rice.

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### Introduction:-

The utilization of dry land is one of the resources with great potential both for food self-sufficiency stabilization and for future agricultural development. The need for rice has been met by rice paddy fields requiring land characteristics with relatively high fertility rates in their production. The characteristics of cultivation of such rice paddy fields, thus limit the opportunities for increased rice production through the expansion of paddy fields. This is due to the narrowness of reserve lands suitable for rice fields and the increasingly tight competition of water usage by industry, mining, and households (Abdurachman et al., 2008). National rice production has been relying on paddy fields; therefore, the national rice production has not been able to meet the needs for food (rice) sustainably.

Rice production in North Sumatra during the 2003-2013 period increased at an average of 0.92% per year. The average growth in rice paddy field production was 1.12% per year, while upland rice decreased at an average of 2.78% per year (Biro Pusat Statistik, 2015). According to the Central Bureau of Statistics of North Sumatra Province (BPS), the upland rice harvested areas reached 50,792 hectares with total production of 163,143 tons and average productivity of 3.2 tons/hectare. The productivity of upland rice is still relatively low compared to rice paddy field productivity, which has reached 5.1 tons/hectare. The low productivity of upland rice is caused partly by very varied climatic and soil conditions, drought stress, and lack of a dryland rice cultivation technology. Some of

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the obstacles leading to the low productivity of upland rice are thought to be caused by the land generally planted belongs to Ultisol soil with various problems, such as low of :soil fertility, organic matter content, and water holding capacity.

Developing upland rice cultivation on dry land is a strategic alternative in order to meet national food needs of its relatively large potential. Nevertheless, upland rice cultivation often encountered drought stress due to its full dependence on rainfall. Drought stress will affect crop growth, development and yield. Drought is one of the main constraints on crop productivity world wide and is expected to increase with climate change (IPCC, 2007 and the European Environmental Agency, 2011).

Such condition certainly requires efforts to improve upland rice production one of which is through improved cultivation system by adding compost from oil palm empty fruit bunches (OPEFB) and mycorrhizal fungi.

Compost from waste of oil palm mills in the form of empty fruit bunches (EFB) is one of potential raw material sources for composting because of its availability in large volumes. As an illustration, each ton of FFB (Fresh Fruit Bunches) processed would generate 20% or 200 kg of empty fruit bunches (Wijaya et al., 2001). OPEFB, which is 23% of the fresh fruit bunches, contains lingo cellulosic materials as much as 55-60% of dry weight (Rahmalia et al., 2006). OPEFB has several advantages such as enriching the nutrients in the soil, and improving physical, chemical and biological characteristics of the soil. In their research, Hanum Ch, et al. (2006) found that OPEFB compost contains such nutrients as N, P, K and Mg.

Loss of soil organic matter has caused agricultural losses of nearly 60 percent in sub-tropical areas and 70 percent in tropical areas. The loss of organic matter in the soil will cause loss of the energy source for soil microbes.

The allocation of soil organic carbon needed to associate with mycorrhizal fungi has been estimated to be around 5-20% of the total soil carbon (Hobbie and Hobbie, 2006).

Some of the research results revealed that there are nearly 80% of symbiotic associations between mycorrhizal fungi and vascular plants widespread in nature, and some ecophysiological studies indicate that symbiotic of mycorrhizal fungi is a key component in helping plants to overcome and improve resistance to abiotic stress (Auge, 2001; Ruiz-Lozano, 2003; Barea et al., 2011; Ruiz-Sanchez et al., 2010). Association of mycorrhiza in plants is one of the ways to overcome the growth inhibition due to drought stress. Mycorrhiza is symbiotic associations established between soil fungi and most vascular plants. The working principle of mycorrhiza is infecting root system of the host plant, producing intensively interwoven hyphae so that the plant containing such mycorrhiza will be able to increase its capacity in the absorption of nutrients and water.

Inoculation of plant roots with mycorrhizal fungi has been thought to be effective in increasing crop production in drought conditions. Root colonization by mycorrhizal fungi has been proven to increase crop productivity in drought stress (Al-Karaki and Clark, 1998). Increased productivity of plants inoculated by mycorrhiza is caused by nutrient absorption enhancements such as phosphorus, zinc and copper. In addition, other factors associated with mycorrhizal colonization can influence plant resistance to drought, including changes in leaf elasticity, improved leaf water and turgor potential, maintenance of stomatal opening and transpiration (Auge et al., 1987), increased root length and depth, and external hyphae development (Davies et al., 1992).

Mycorrhizal fungi can form a strong plant root structure, quick transplant establishment, healthy roots and quick closing of the plant canopy's green leaves. The root of seed plants that has been inoculated with vesicular arbuscular mycorrhizal is able to survive in marginal environmental conditions. Mycorrhizae can help the plant and protect the plant roots from extreme environmental disturbance so that it has the ability to survive.

The objective of these research was to study growth response and yield of upland rice by providing OPEFB compost and mycorrhizal inoculation.

### **Materials and Methods:-**

The study was conducted in Cengkeh Turi Binjai with soil pH of 4.9. The planting period was from January to May 2014, with the average rainfall within the five months was less than 100 mm (according to The Regional Agency for Meteorology, Climatological and Geophysics (RAMCG), Medan). The source of mycorrhizal inoculation used

mycofer from the Forest of Inter-University Center of Bogor Agricultural Institute with mycorrhizal contents (*Gigaspora margarita*, *Glomus manihotis*, *Glomus etunicatum*, and *Acaulospora tuberculata*). This study used a factorial randomized block design (RBD) with two factors. The first factor was mycorrhizal inoculation (M) consisting of two levels, without giving mycofer and by giving 5g of mycofer per planting hole. The second factor was giving OPEFB composts in 3 levels: 0, 3.375, 6.750g/planting hole. The examination on the percentage of endomycorrhizal infection was used a staining method.

The percentage of root infected by arbuscular mycorrhizal fungi (AMF) was calculated using the formula:

$$\% \text{ of infected roots} = \frac{\text{The number of infected roots}}{\text{The total number of observed roots}} \times 100\%$$

### Result and Discussion:-

Before been applied to the planting media, the analysis of chemical fertility of OPEFB compost as presented in Table 1 and chemical fertility of basic soil as presented in Table 2 had been carried out.

Based on the OPEFB fertility analysis, it was found that the nutrient content of organic materials generally have low criteria. The OPEFB compost was classified as alkaline, with moderate organic matter, content, different from the soil at the research location that had a low pH value (4.2) (See Table 2).

### Productive tiller per hill:-

The results of statistical analysis indicated that the treatment of OPEFB composts, significantly affected the number of productive tillers, whereas the provision of mycorrhizal fungi and the interaction between the two treatments do not affect significantly.

The increased OPEFB composting will increase the number of rice tillers (Table 1). There is a variety of assumptions concerning the high number of productive tillers in rice composted by OPEFB, i.e. an increase in pH and organic matter provision can increase the ability of soil to absorb water. The OPEFB composting analysis results (Table 1) indicate high organic matter content in the OPEFB. The higher of biomass and high seed production in wheat given mycorrhizal fungi than those which is not given is caused by the ability of plants to extract water from the soil solution (Al-Karaki et al., 2004).

The addition of OPEFB compost with this alkaline pH (pH: 8.63) will affect the balance of cations and anions in the soil. (Mc Cauley et al., 2009).

Soil organic matter contributes to biological, chemical, and physical properties of soil. The addition of organic matter to the soil will affect the amount and the rate of organic matter decomposition and nutrient mineralization. Organic matter helps the availability of nutrients by increasing the cation exchange capacity of the soil, providing chelates, and increasing the solubility of certain nutrients in the soil solution. Furthermore, the humus fraction of organic matter can improve soil structure by increasing soil, water storage capacity, infiltration and aeration. Plants need to maintain high internal water pressure or "turgor" to increase the formation of cellulose fiber cells. When the water supply to the plant is relatively low, one of the main consequences is the inhibition of the growth of shoots and leaves (Eastin and Sullivan, 1984).

This is assumed to be the factor leading to increase in the number of upland rice tillers added by OPEFB compost. The addition of organic matter can contribute to soil complex and a reduction of toxicity such as aluminum (Al) on acid soils (Tan and Binger, 1986), in addition to its ability to capture pollutants - herbicides or pesticides.

Mycorrhizal inoculation on upland rice has not been able to show an increase in the number of tillers. The results of observation on the mycorrhizal infection show that the highest average (70%) was obtained in the planting medium inoculated with mycorrhizal and without composting (Table 4).

The results of this study indicate that the better soil conditions the ones with the organic matter addition will cause a decrease in the degree of mycorrhizal infection. It is assumed that such condition is caused by mycorrhizal potential to be maximized on marginal soil conditions. Allen (2001) also found a decrease in the percentage of the degree of infection in adequate water soil.



Carrenho R et al.(2007) state that there is a close relationship between the percentage of the degree of infection and soil amendments (fertilization, organic matter and pH) in which changes in the soil will affect the inoculation effectiveness produced. The decreased degree of mycorrhizal infection at the chickpea roots by the addition of P on acid soils is also found by Alloush et al. (2000). Nevertheless, several research as related to the effect of organic matter adding to the percentage of infection degree are very varied such as the research done by Joner and Jakobsen (1995) who found an increased growth in the number of hypha with the addition of organic matter.

I Putu and Sukawidana's (2011) research shows that the increased use of organic matter that reached mycorrhizal dose of 30g/plant and organic fertilizer of 30 g/plant was able to increase the percentage of mycorrhizal infection on cashew. Increased provision of organic matter will stabilize pH: 7.6. Russell (1973) adds that a neutral soil pH, high organic matter content and low availability of nutrients (nitrogen and phosphor) can encourage the growth of mycorrhizae.

**Table 1:-** The nutrient content of OPEFB compost.

Parameter			Method	Criteria (The Department of Agriculture, 1983)
Organic materials	3.61	%	Walkley and Black Titration	Moderate
BO	31.88	%	Ashing	
N	0.28	%	Kjeldahl	Low
P	0.09	%	Spectrophotometry	Very low
K	0.80	%	Flame photometry	Very low
Ca	0.21	%	AAS	Very low
Mg	0.15	%	AAS	Very low
B	86.87	ppm	Spectrophotometry	
Fe	4200.00	ppm	AAS	
Cu	10.95	ppm	AAS	
pH	8.63		Electrometry	Mildly alkaline

**Table 2:-** The nutrient content in the soil used

Parameter		Criteria (The Department of Agriculture, 1983)
pH (H <sub>2</sub> O)	4.2	Acid
Soil Moisture (%)	3.25	
C-organic (%)	1.96	Very low
N-total (%)	0.14	Very low
P-available (ppm)	13.55	Very low
K-dd (me/100 g soil)	0.06	Very low
P-Bray	19.16	Very low
Ca	0.08	Very low
Mg	0.01	Very low

**Table 3:-** The number of productive tillers of rice being treated with OPEFB compost and mycorrhizal inoculation

Mycorrhizal Inoculation (g mycofer/hole)	OPEFB Compost (g/hole)			Average
	0	3,375	6,750	
	..... tiller .....			
0	7.95	10.65	11.15	9.92
5	7.05	11.85	12.25	10.83
Average	7.50b	11.25a	11.70a	10.15

Note : The number followed by different letters in the same column indicates significant difference at 5% level by Duncan's multiple range test (DMRT)

**Table 4:-** The percentage of the mycorrhizal infection

Treatment	% degree of mycorrhizal infection
M0K0	20%
M0K1	40%
M0K2	40%
M1K0	70%
M1K1	60%
M1K2	60%

**Table 5:-** The number of panicles per plant with OPEFB compost treatment and mycorrhizal inoculation

Mycorrhizal Inoculation (g mycofer/hole)	OPEFB Compost (g/planting hole)			Average
	0	3,375	6,750	
	.....panicle .....			
0	9.67	12.84	11.54	11.35
5	9.31	14.20	11.80	11.77
Average	9.49c	13.52a	11.67b	11.56

Note: The number followed by different letters in the same column indicates significant difference at 5% level by Duncan's multiple range test (DMRT)

**Table 6:-** Number of filling grain crops with OPEFB compost treatment and mycorrhizal inoculation

Mycorrhizal inoculation (g mycofer/hole)	OPEFB compost (g/planting hole)			Average
	0	3,375	6,750	
	..... grain.....			
0	1592.10d	2113.64b	1818.26c	1841.33
5	1534.53d	2338.20a	1945.73bc	1939.49
Average	1563.32	2225.92	1881.99	1890.41

Note : The number followed by different letters in the same column indicates significant difference at 5% level by Duncan's multiple range test (DMRT)

**Table 7:-** The number of empty grain per plant with OPEFB compost treatment and mycorrhizal inoculation

Mycorrhizalinoculation (g mycofer/hole)	OPEFB compost (g/planting hole)			Average
	0	3,375	6,750	
	..... grain.....			
0	1265.12d	1443.05c	1617.42ab	1441.86
5	1161.16d	1549.69bc	1829.22a	1513.36
Average	1213.14	1496.37	1723.32	1477.61

Noote : The number followed by different letters in the same column indicates significant difference at 5% level by Duncan's multiple range test (DMRT)

**Table 8:-** The production per plant with OPEFB compost treatment and mycorrhizal inoculation

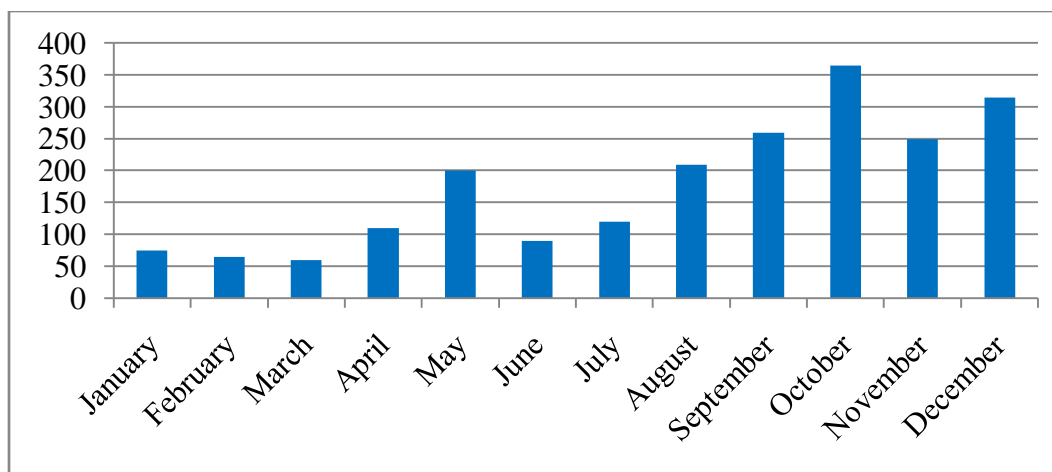
Mycorrhizal inoculation (g mycofer/hole)	OPEFB compost (g/hole)			Average
	0	3,375	6,750	
	..... g .....			
0	29.65	35.49	52.90	39.35
5	23.16	44.19	44.90	37.42
Average	26.41b	39.84ab	48.90a	38.38

Note: The number followed by different letters in the same column indicates significant difference at 5% level by Duncan's multiple range test (DMRT)

**Table 9:-** Production per plant with OPEFB compost treatment and mycorrhizal inoculation

Mycorrhizalinoculation (g Mycofer/hole)	OPEFB compost (g/ hole)			Average
	0	3,375	6,750	
	g			
0	11.07	11.66	12.96	11.90
5	12.36	13.09	15.69	13.71
Average	11.71	12.37	14.32	12.81

Note: The number followed by different letters in the same column indicates significant difference at 5% level by Duncan's multiple range test (DMRT)

**Figure 1:-** The average rainfall during the planting period (January to December 2014)**Number of panicles per plant:-**

The addition of OPEFB compost increases the number of panicles per plant, with the highest average dose of 3,375g/plant hole (Table 5). The OPEFB addition that reached 6,750 g/plot would decrease the number of panicles per plant.

The low number of panicles per plant on the rice given high dose of OPEFB (K3) is assumed to have been caused by the uneven distribution of assimilates. The soils with a high water content as a result of the addition of high doses of organic matter will stimulate the number of tiller formations. Assimilates are more directed to the vegetative growth rather than generative one. Although the number of potential tillers contributes to the results of rice yields (Wu et al., 1998), the great number of tillers indicates inconsistency in the mobilization of assimilates and nutrients among tillers. As a result, there will be a variation of the distribution of assimilates between tillers and panicles formation (Miller et al., 1991).

**Number of filling grain:-**

The results of statistical analysis show that there is a significant interaction between OPEFB compost treatment and mycorrhizal inoculation to the number of filling grain per plant (Table 6). The highest average number of filling grain per plant is obtained in the treatment of interaction between K1 and M1 (OPEFB compost of 3,375g/planting hole and inoculated mycorrhizae), while the lowest average is obtained in the plants without being given compost and mycorrhiza. The results of this research indicate the ability of mycorrhizal inoculation to give P in the plants for energy fulfillment in seed formation.

**The number of empty grain per plant:-**

For the parameter number of empty grain per plant, there is a significant interaction between OPEFB compost treatment and mycorrhizal treatment. The highest number of filling grain parameter is obtained in K1M1, while the highest number of empty grain is obtained in K2M1.

The results of the research presented in Table 7 show that the increase in the addition of compost to the mycorrhizal-inoculated soil will increase the amount of grain hollow. The increased number of empty grain in the increased

doses of OPEFB compost and mycorrhizal inoculation is assumed to be caused by friable soil and soil with sufficient water that will lead to an increased number of tillers. The increased number of these tillers will lead to the distribution of assimilates to tillers growth resulting in a lack of assimilates in grain filling.

The research conducted by Wangiyana et al. (2009) shows that the great number of tillers results in the great number of empty grains because the grains are not filled through the process of photosynthesis and the high rate of photosynthetic partition during the grain filling phase. According to Soemartono et al. (1984), the number of productive tillers is determined by the number of tillers growing before reaching the primordial phase. However, there may be a chance that the tillers forming the last panicles may not produce a panicle with fully filled grains, so there is a chance of producing grain hollow. Feng et al. (2007) also found the different number of grains within the tillers. The results of their study concluded that the first tiller is more potential to produce seeds rather than the last tiller. This condition is assumed to be the factor causing an increase in the number of tillers, resulting in an increased number of empty grain.

### **Production per plant:-**

From the results of the statistical analysis, it is found that the addition of OPEFB compost treatment gives significant effect to the crop production, while giving mycorrhiza and interaction between the two treatments does not.

OPEFB composting equivalent to 6,750g/plot produces the highest yield per plant. Such increased production per plant is assumed to be caused by fairly high potassium content in the planting media. Potassium is the macro nutrients that play a role in the metabolism of carbohydrates.

Although OPEFB compost treatment and mycorrhizal inoculation treatment statistically does not give significant effect, but there is an increase in the average weight of 1000 grains (Table 9).

The average weight of 1000 grains of *Situ Bagendit* variety treated by OPEFB compost and mycorrhizal is only about 11-14 g (Table 9). If this weight is compared to the value on the description (27-28 g), the result obtained will be half of its potential. This result indicates a decrease in grain weight of rice seeds during the dry season. Rainfall data at the research location obtained from RAMCG of Sampali, Medan, the planting was done in the dry season with rainfall of less than 100 mm (Figure 1).

Water deficit in rice planting response more seriously to generative phase rather than to vegetative phase (Kato et al., 2007). Therefore, upland rice cultivation should consider minimum water requirement to avoid a decrease in the yield (Matsumoto et al., 2014), whose amount depends on its varieties. Water plays an important role in rice cultivation; therefore, a sufficient amount of water supply is one of important factors in the production of rice. Rice crops will usually encounter stress if there is too little water (drought) or too much water (flooding). Limited availability of water causes discrepancy and variability of yield (Papademetriou, 2001).

Akinbile (2010) also found a significant difference between the observed variables in biomass and grain yield, LAI, plant height and maximum root depth among treatments with or without water supply. This result of research indicates that water is the main factor affecting grain yield.

### **Conclusions:-**

The dose of OPEFB composting of 3,375 g per planting hole can increase the number of productive tillers and panicles. The addition of OPEFB (3,375 g/planting hole) and mycorrhizal inoculation (5 g mycofer/planting hole) can increase the number of filling grains of upland rice. The provision of mycorrhiza in the soil by adding organic matter causes the ineffectiveness of this microbial function.

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**References:-**

1. Abdurachman, A, Dariah A, and Mulyani A. (2008): Strategi dan teknologi pengelolaan lahan kering mendukung pengadaan pangan nasional. *Jurnal Litbang Pert* 27(2): 43-49.
2. Akinbile, C. O. (2010): Behavioural pattern of upland rice agronomic parameters to variable water supply in Nigeria. *Journal of Plant Breeding and Crop Science* Vol. 2(4), pp. 073-080.
3. Al-Karaki, G.N., and Clark, R. B. (1998): Growth, mineral acquisition, and water use by mycorrhizal wheat grown under water stress. *J Plant Nutr* 21:263–276
4. Al-Karaki, Ghazi, B. McMichael and John Zak. (2004): Field response of wheat to arbuscular mycorrhizal fungi and drought stress. *Mycorrhiza* 14:263–269
5. Allen, F. M. (2001): Modeling arbuscular mycorrhizal infection: is % infection an appropriate variable?. *Mycorrhiza* 10:255–258
6. Alloush, G. A., S. K. Zeto, and R. B. Clark. (2000): Phosphorus source, organic matter, and arbuscular mycorrhiza effects on growth and mineral acquisition of chickpea grown in acidic soil. *Journal of Plant Nutrition*, Volume 23, Issue 9, pp. 1351-1369.
7. Augé, R. M. (2001): Water relations, drought and vesicular-arbuscular mycorrhizal symbiosis. *Mycorrhiza* 11:3–42.
8. Auge, R. M., Schekel, K.A., and Wample, R. L. (1987b): Leaf water and carbohydrate status of VA mycorrhizal rose exposed to drought stress. *Plant Soil* 99:291–302.
9. Barea, J. M., Palenzuela, J., Cornejo, P., Sánchez-Castro, I., Navarro-Fernández, C., López-García, A., Estrada, B., Azcón, R., Ferrol, N., Azcón-Aguilar, C. (2011): Ecological and functional roles of mycorrhizas in semi-arid ecosystems of Southeast Spain. *Journal of Arid Environments* 75:1292–1301
10. Biro Pusat Statistik. 2015: Provinsi Sumatera Utara dalam Angka 2014. Medan
11. Carrenho, R. Sandra F., Botelho Trufem, Vera Lúcia Ramos Bononi, and Eraldo Schunk Silva. (2007): The effect of different soil properties on arbuscular mycorrhizal colonization of peanuts, sorghum and maize. *Acta bot. bras.* 21(3): 723-730.
12. Davies, F. T. Jr, Potter, J. R., and Linderman R. G. (1992): Mycorrhiza and repeated drought exposure affect drought resistance and extraradical hyphae development on pepper plants independent of plant size and nutrient content. *J Plant Physiol* 139:289–294.
13. Eastin, J.D. and C.Y. Sullivan (1984): "Environmental stress influences on plant persistence, physiology and production." In *Physiological Basis of Crop Growth and Development*, M.B. Tesar (Ed.) American Society of Agronomy. Madison. Pp. 201–236.
14. European Environmental Agency (EEA) (2011): Global and European temperature (CSI 012/CLIM 001), Assessment May 2011. Copenhagen, <http://www.eea.europa.eu/data-and-maps/indicators/global-and-european-temperature/global-and-european-temperature-assessment-4> Accessed on 20 Aug 2012
15. Feng Wang, Cheng Fang-min, Zhang Guo-ping. (2007): Difference in Grain Yield and Quality among Tillers in Rice Genotypes Differing in Tillering Capacity. *Rice Science*, 14(2): 135-140
16. Hanum, Ch., Delvian and Tuban Wibisono. (2006): Laporan Penelitian Hibah Bersaing. Lembaga Penelitian USU.
17. Hobbie, J. E. and Hobbie, E.A. (2006): 15N in symbiotic fungi and plants estimates nitrogen and carbon flux rates in arctic tundra. *Ecology*, 87: 816-822
18. I Putu, W. and Sukawidana, I. M. (2011): Kondisi fisik, kimia dan biologi tanah pembibitan jambu mete akibat inokulasi mikoriza dan pupuk organik. Fakultas Pertanian Universitas Tabanan.
19. IPCC (2007) IPCC Climate change 2007: the physical science basis. In: Solomon S, Qin D, Manning M, Chen Z, Marquis M, Averyt K, Tignor MMB, Miller HL (eds) Working group 1 contribution to the fourth assessment report of the intergovernmental panel on climate change (IPCC). Chapters 3 (observations: surface and atmospheric climate change), 10 (global climate projections), 11 (regional climate projections). Cambridge University Press, Cambridge.
20. Joner, E. J and Jakobsen, I. (1995): Growth and extracellular phosphatase activity of arbuscular mycorrhizal hyphae as influenced by soil organic matter. *Soil Biology and Biochemistry* 27: 1153±1159.
21. Kato, Y, Kamoshita, A., Yamagishi, J., and Abe, J. (2007): Growth of Rice (*Oryza sativa* L.) Cultivars under Upland Conditions with Different Levels of Water Supply 3. Root System Development, Soil Moisture Change and Plant Water Status. *Plant Prod Sci* 10: 3-13.
22. Matsumoto, S., Tsuboi, T., Asea, G., Maruyama, A., Kikuchi, M. (2014): Water Response of Upland Rice Varieties Adopted in Sub-Saharan. Africa: A Water Application Experiment. *J Rice Res* 2: 121. doi: 10.4172/jrr.1000121.

23. McCauley, Ann, Clain Jones, and Jeff Jacobsen.(2009): Soil pH and Organic Matter. Montana State University-Bozeman, Bozeman, MT 59717; (406) 994-5132; E-mail - publications@montana.edu.
24. Miller, B. C., Hill, J. E., and Roberts, S. R. (1991): Plant population effects on growth and yield in water-seeded rice. *Agron J*, 83: 291-297.
25. Papademetriou, M. K. (2001): Issues and perspectives of rice production in Asia and the pacific Region: In Yield Gap and productivity Decline in Rice production consultation held in Rome 5-7: 39-67.
26. Rahmalia,W., Yulistira, F., Ningrum, J., Qurbaniah, M.,and Ismadi, M. (2006): Pemanfaatan potensi tandan kosong kelapa sawit (*Elais guineensis* Jacq) sebagai bahan dasar c-aktif untuk adsorpsi logam perak.
27. Ruiz-Lozano, J. M. (2003): Arbuscular mycorrhizal symbiosis and alleviation of osmotic stress. Newperspectives for molecular studies. *Mycorrhiza* 13:309–317.
28. Ruiz-Sánchez, M., Aroca, R., Muñoz, Y., Armada, E., Polón, R., Ruiz-Lozano, J. M. (2010): The arbuscular mycorrhizal symbiosis enhances the photosynthetic efficiency and the antioxidative response of rice plants subjected to drought stress. *J Plant Physiol* 167:862–869.
29. Russell, E. W. (1973): Soil Conditions and Plant Growth. Longman London
30. Soemartono, Bahrin, Hardjono, and Iskandar.(1984): Bercocok Tanam Padi. CV. Yasaguna. Jakarta.
31. Tan, K.H. and A. Binger. (1986): Effect of humic acid on aluminium toxicity in corn plant. *Soil.Sci.*, 14(1): 20-25.
32. Wangiyana, W., Zapril, L., and Sanisah.(2009): Pertumbuhan Dan Hasil Tanaman Padi Var. Ciherang Dengan Teknik Budidaya “SRI (System Of RiceIntensification)” Pada Berbagai Umur Dan Jumlah Bibit Per Lubang Tanam. Faculty of Agriculture, Universitas Mataram, Mataram.
33. Wijaya, T.,Rosyid,M.J.,and Boerhendhy, I. (2001): Teknologi pengelolaan nutrisi dan air pada perkebunan karet. Pusat Penelitian Karet
34. Wu, G. W., Wilson, L. T., Mc Clung, A. M. (1998): Contribution of rice tillers to dry matter accumulation and yield. *Agron J*, 90: 317-323.

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### RESEARCH ARTICLE

**Phytochemical screening and Antimicrobial activity of *Euphorbia linearifolia* var. *nallamalayana* J.L.Ellis from the Nucleus of Eastern Ghats.**

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#### Abstract

The current study was focused to investigate the phytochemical analysis, antibacterial and antifungal activity of plant extract of *Euphorbia nallamalayana* against different pathogens. Four solvent extracts were evaluated for antimicrobial activity using well diffusion method and MIC determination on different micro organisms. The shade dried plant material was subjected to different solvents for phytochemical screening. The antibacterial activity was done using well diffusion method against eight potentially pathogenic microorganisms *Aspergillus niger*, *Aspergillus flavus*, *Candida albicans*, *Saccharomyces cerevisiae*, *Escherichia coli*, *Staphylococcus aureus*, *Bacillus subtilis* and *Pseudomonas aeruginosa*. Phytochemical screening was done using standard qualitative methods which revealed the presence of Tannins, Saponins, Steroids, coumarins, Flavones, Flavanones, Phenols, Quinones and Carbohydrates. There was no antifungal activity with *Aspergillus flavus*, *Candida albicans* and *Saccharomyces cerevisiae*. The findings of this study indicate that the plant extract of *Euphorbia nallamalayana* showed significant antibacterial activity against both gram positive and gram negative organisms. We also found the antifungal activity against *Aspergillus niger*. However, further studies on isolation characterization of plant extract responsible for antibacterial activity is necessary to elucidate their mechanism of action and it would give comprehensive evidence of bioactive potential of medicinal plants at cellular and molecular levels. *Euphorbia nallamalayana* has a strong antimicrobial potential, which justifies its use in folk medicine for treatment of infectious diseases. Since this species is poorly investigated, further refined studies on its pure secondary metabolites are needed and very important, in the perspective to identify new antimicrobial molecules from this endemic plant.

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**Introduction:-**

Medicinal plants are important source of therapeutic remedies of various ailments. Scientific experiments on the antimicrobial properties of plant components were documented in the late 19<sup>th</sup> century [1]. The use of plants and plant product as medicines could be traced as far back as the beginning of human civilization. The earliest mention of medicinal use of plants in Hindu culture is found in 'Rigveda', which is said to have been written between 4500-1600 BC. and is supposed to be the oldest repository of human knowledge. It is Ayurveda, the foundation of medicinal science of Hindu culture, in its eight division deals with specific properties of drugs and various aspects of science of life and the art of healing [2]. Plant derivatives, such as infusions and decoctions, have since long been used in traditional medicine for prevention and treatment of several pathologies [3,4]. Including common infectious diseases, leading causes of morbidity and mortality [5], which are directly responsible for 26% of annual deaths worldwide [6], were also treated by those plants preparations since ancient times [7]. In modern medicine, the discovery of bioactive molecules from microbial origin and synthetic antimicrobial agents decreased the use of traditional plant preparations, especially in developed countries. But in last decade, and besides their toxicities and side-effects [8], it has become clear that current antimicrobial drugs are losing their effectiveness [9], due to the emergence of resistance in pathogens to those antibiotics, which causes therapeutic failures and death of individuals [10]. Therefore, there is a continuing need to search for new antibiotics [5,9]. Since plant-derived antibacterial are always a source of novel therapeutics [11], many researchers in field of ethno-pharmacology have concentrated in studies of those compounds in the past few decades [7] on a promising and wealthy source for safe and effective new antimicrobial agents. Natural antimicrobials have been often derived from plants, microorganisms or animal tissues [12]. India is known for its rich diversity of medicinal world [13]. Nearly 70% of world population is dependent on the traditional medicines for primary health care. The knowledge of medicinal plants has been accumulated during the course of many centuries based on different medicinal system such as Unani and Siddha [14]. Phytochemical from medicinal plants showing antimicrobial properties have the potential of filling this need, because their structure are different from those of more studied microbial sources, and therefore their mode of action may too very likely differ [15]. There is a growing interest in correlating the phytochemical constituents of a medicinal plant with its pharmacological activity [16]. An antimicrobial is a substance that kill microbes or prevent the growth of the plants with a new eye for their antimicrobial usefulness and as an alternative source to the existing drug. Plants with their wide variety of chemical constituents offer a promising source of new antimicrobial agents as well as specific activity [17]. Phyto-chemical from medicinal plants sharing antimicrobial properties have the potential of filling this need, because their structure are different from those of more studied microbial sources, and therefore their mode of action may to vary likely differ [18]. *Euphorbia linearifolia* var. *nallamalayana* J.L.Ellis a synonym of *Euphorbia deccanensis* var. *nallamalayana* (J.L.Ellis) [19] belongs to the genus Euphorbiaceae family. In medicine, some species of Euphorbiaceae have proved effective against genital herpes [20,21].

There are several reports on the presence of antimicrobial compounds of various plants [22-26] but there are no reports on antimicrobial potential of *Euphorbia nallamalyana* which belongs to the family of Euphorbiaceae.

**Materials and methods:-**

The plant parts of *Euphorbia nallamalayana* were collected in and around Nallamala forest (Eastern Ghats) Pavuralagutta nearest to Nallakaluva village, Atmakur mandal of Kurnool district in Andhra Pradesh. The specimen was identified with the help of the regional floras [25-28] and the voucher specimen was deposited at Botanical Survey of India, Hyderabad.

**Preparation of Plant Extract :-**

The leaves and whole plant of *Euphorbia nallamalayana* were collected, shade dried, powdered and extracted with hexane, chloroform, methanol using soxhlet apparatus for 6hrs. The extracts were filtered and the filtrate was concentrated under reduced pressure at 40°C using a rotaflash evaporator. The crude samples were subjected to antimicrobial screening against pathogenic organisms.

**Preparation of Standard culture inoculums of the test organism:-**

All the cultures were obtained from the Department of Microbiology, Andhra University, Visakhapatnam, A.P, India. From mother culture the inoculums was streaked and subcultured. Three or four isolated colonies were inoculated in 2ml nutrient broth and incubated for 24hrs. The 24hrs cultured broth was used to check the antimicrobial activity.

**Antibacterial Assay:-**



Antibacterial activity of extracts was determined by cup diffusion method on nutrient agar medium. Nutrient agar medium was prepared, sterilized and 0.2 ml of 24 hrs broth culture was mixed in the nutrient agar medium and poured in Petriplates. After solidifying wells are made in nutrient agar plates using cork borer [29].

Different concentrations of the working suspension of plant extracts and the same volume of the solvent for control were filled in the wells with micropipette. Plates were kept for some time until the extracts diffuse and incubated at 37°C for 24hrs. After the incubation was completed, the plates were observed for zone of inhibition. The Minimum Inhibitory Concentration (MIC) was determined by the broth micro dilutions [30-31] using 96 well micro titer plates.

#### **Antifungal assay:-**

The antifungal properties with organic solvent (methanol, hexane and chloroform) extracts from the whole plants were investigated against pathogen. Potato dextrose agar medium was prepared allowed to cool and streptomycin sulphate was added to prevent bacterial contamination, and then was allowed to solidify. The fungal isolate was kept in the middle on the surface of the medium and the plant extracts were placed using disc diffusion method. All the plates were incubated at 27°C for 48hrs. The zone of inhibition was measured along the control plates maintained by using available standard antifungal agents.

#### **Determination of Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC):-**

Determination of the minimum inhibitory concentration (MIC) was carried out using the Broth dilution method [32]. Briefly, 1.0 ml of the reconstituted *Euphorbia nallamalayana* extract solution at a concentration of 200 mg/ml was added to another test tube containing 1 ml of sterile broth so as to obtain a concentration of 100 mg/ml. 1 ml of this dilution was transferred to another test tube till the 7<sup>th</sup> test tube was reached. The 8<sup>th</sup> test tube did not contain any extract, but a solution of pure solvent and served as negative control. Then 1 ml of an 18 h old culture of each of the bacteria earlier adjusted at 10<sup>8</sup> cfu/ml was put into each tube and thoroughly mixed on a vortex mixer. The tubes were incubated aerobically at 37 °C for 18-24hrs. Two control tubes were maintained for each test batch. This is as follows: tube containing extracts and the growth medium without inoculums (antibiotic control) and the tube containing the growth medium, physiological saline and the inoculums (organism control). MIC was determined as the lowest concentration of the extracts permitting no visible growth (no turbidity) when compared with the control tubes. The MBC was determined by sub-culturing the test dilution on fresh solid medium and further incubated 37 °C at for 18-24hrs. The MBC values were determined by removing 0.10 ml of bacterial suspension from the MIC tubes that did not show any growth and subcultured into Muller Hinton agar plates and incubated at 37°C for 24 h. After incubation, the concentration at which no visible growth was seen was recorded as the MBC. The lowest concentration of MIC tubes with no visible bacterial growth on solid medium was regarded as MBC.

#### **Identification Tests for Photochemical Constituents:-**

The tests were performed to find out the presence of active chemical constituents such as alkaloids, terpenes, flavones, flavonoids, steroids, reducing sugars, proteins, amino acids, carbohydrates, tannins, anthraquinones, glycosides, cardiac glycosides by the following procedure. Phytochemical analysis was carried out for all the extracts using standard methods [33-34].

#### **Alkaloids:-**

Extracts were dissolved individually in diluted hydrochloric acid. The resulting acidic solution was tested for alkaloids by adding Mayer's reagent, Wagner's reagent, Dragendroff reagent and Hager's reagent.

The formation of a faint turbidity or precipitation on the addition of the above reagents indicates the presence of alkaloids.

#### **Flavanoids:-**

2-3ml of plant extract was dissolved in 50% of methanol separately on sand bath with a piece of magnesium ribbon and 1ml of concentrated Hcl was added. Red or yellow coloration of the solution indicates the presence of flavanoids.

#### **Steroids:-**

1ml of extract dissolved in 1ml of acetic anhydride, 1ml of chloroform and 1ml of conc. Hcl separately. Formation of green color indicates the presence of steroids.

**Triterpenoids:-**

To 1 ml of extract tin bit and thionyl chloride were added. Appearance pink color indicates the presence terpenoids.

**Coumarins:-**

To 1ml of plant extract, 1ml of 10%NaOH was added. The presence of yellow color indicates the presence of coumarins.

**Cardiac glycosides:-**

To the plant extract few ml of glacial acetic acid, ferric chloride and conc.H<sub>2</sub>SO<sub>4</sub> were added. Green color indicates the presence of cardiac glycosides.

**Terpenes:-**

To the plant extract few ml of chloroform was added, filtered. To the filtrate few drops of acetic anhydride and H<sub>2</sub>SO<sub>4</sub> were added. The color changing from blue to green indicates the presence of terpenes.

**Anthraquinones:-**

Benzene extract was taken to this 5ml of 10% ammonia was added .Pink, red or violet color indicates the presence of anthraquinones.

**Phlobtannins:-**

Plant extract was dissolved in distilled water. The filtrate was boiled with 2% HCl. Red precipitate indicates the presence of phlobtannins.

**Quinones:-**

To 1ml of extract 1ml of conc.H<sub>2</sub>SO<sub>4</sub> were added, formation of red color indicates the presence of quinones.

**Flavanones:-**

To few ml plant extract, 10% of few drops of NaOH was added yellow color indicates the presence of flavanones.

**Anthocyanins:-**

To the plant extract 10% NaOH was added, blue color indicates the presence of anthocyanins.

**Proteins:-****Biuret test:-**

To few ml of plant extract, 1ml of 40% NaOH solution and 2ml of 1%CuSO<sub>4</sub> were added. Violet color indicates the presence of proteins.

**Xanthoproteic test:-**

To few ml extract 1ml of conc.HNO<sub>3</sub> was added. White precipitate was observed boiled and cooled. Then 20% of NaOH or NH<sub>3</sub> was added. Presence of orange color indicates the presence of aromatic amino acid.

**Tannic acid:-**

To few ml of plant extract 10% of tannic acid was added. White precipitate indicates the presence of proteins.

**Carbohydrates:-****Molisch's test:-**

To few ml of plant extract 1ml of alpha-naphthol solution and conc.H<sub>2</sub>SO<sub>4</sub> was added along the walls of the test tube. Purple to reddish violet color at the junction of the two layers indicates the presence of carbohydrates.

**Fehling's test:-**

Equal volumes of fehling's - A & B were added. On heating the formation of brick red precipitate indicates the presence of carbohydrates.

**Benedict's test:-**

To 5 ml of Benedict's Reagent few ml of plant extract was added and boiled for 2min,cooled. The formation of red precipitate indicates the presence of carbohydrates.

**Aminoacids :-**

2 drops of Ninhydrin Reagent was added to the plant extract. Purple color indicates the presence of aminoacids.

**Glycosides :-**

The extract was mixed with a little amount of Anthrone on watchglass and 1 drop of conc.H<sub>2</sub>SO<sub>4</sub> was added and made to fine paste and boiled gently on waterbath. Presence of glycosides shows dark green coloration.

**Results:-**

Phytochemical screening of whole plant and leaves extract of *Euphorbia nallamalayana* showed the presence of various bioactive compounds like alkaloids, tannins, saponins, steroids, terpenes, triterpenoids, phenols and carbohydrates.

The results of the present antimicrobial assay of different solvent extracts like methanol extract, chloroform extract and hexane indicated that the plant exhibited antimicrobial activity against different test microorganisms at four different concentrations of 50,100,250,500ug/ml.

The activity of the plant extract was obtained against all the five microorganisms were tested and the zone of inhibition was recorded and presented below in the tabulation drawn.

**Table – 1 Phytochemical screening of different extracts of *Euphorbia nallamalayana***

S.no	Phytoconstituents	Methanol extract	Chloroform extract	Hexane extract	Aqueous extract
1	Tannins	+	+	-	-
2	Alkaloids	-	-	-	-
3	Saponins	+	-	-	+
4	Cardiac glycosides	-	-	-	-
5	Steroids	+	+	-	-
6	Terpenes	+	-	+	-
7	Flavanoids	-	-	-	-
8	Phlobtanins	-	-	-	-
9	Anthraquinones	-	-	-	-
10	Triterpenoid	-	-	-	-
11	Coumarins	+	-	+	-
12	Flavanones	+	+	+	+
13	Flavones	+	+	+	+
14	Anthocyanins	-	-	-	-
15	Anthraquinones	-	-	-	-
16	Phenols	+	+	-	-
17	Quinones	+	+	-	-
18	Glycosides	-	-	-	-
19	Carbohydrates	+	-	-	+
20	Amino acids	-	-	-	-
21	Proteins	-	-	-	-

(+) –Present, (-) – Not Present

**Table - 2 Antimicrobial activity of plant extract of *Euphorbia nallamalayana***

S. n o	Name of the organism	ZONE OF INHIBITION (mm)																	
		Methanol Extract mg/ml				Hexane Extract mg/ml				Chloroform Extract mg/ml				Aqueous Extract mg/ml				Standard Drugs	
		50	100	250	500	50	100	250	500	50	100	250	500	50	100	250	500	Antibacterial Agent Gentamycin	Antifungal Agent Gresiofungin

																		in	
1	<i>Staphylococcus aureus</i>	6	10	11	15	-	-	-	-	-	-	6	9	4	7	12	15	18	-
2	<i>Escherichia coli</i>	8	17	18	20	-	-	7	10	-	7	10	12	4	9	14	17	19	-
3	<i>Bacillus subtilis</i>	7	10	14	17	-	5	8	12	-	-	-	-	-	8	8	10	19	-
4	<i>Pseudomonas aeruginosa</i>	4	7	9	14	-	-	-	-	4	7	9	13	-	-	6	9	20	-
5	<i>Aspergillus niger</i>	6	6	10	12	-	-	8	10	-	-	6	8	-	4	7	7	-	14
6	<i>Aspergillus flavus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
7	<i>Candida albicans</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
8	<i>Saccharomyces cerevisiae</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18

**Table - 3 Minimum Inhibitory Concentration of plant extract of *Euphorbia nallamalayana***

S.no	NAME OF THE ORGANISM	Minimum Inhibitory Concentration mg/ml									
		Methanol Extract mg/ml		Hexane Extract mg/ml		Chloroform Extract mg/ml		Aqueous Extract mg/ml		Gentamycin	
		MIC	MB C	MIC	MB C	MIC	MB C	MIC	MB C	MIC	MB C
1	<i>Staphylococcus aureus</i>	0.032±0.000	0.025	ND	ND	0.063±0.000	0.100	1.000±0.000	0.0345	2.000±0.000	0.047-
2	<i>Escherichia coli</i>	0.020±0.000	0.500	4.000±0.000	0.125	1.000±0.000	-	0.040±0.000	≥1000	0.015±0.014	0.018-
3	<i>Bacillus subtilis</i>	0.125±0.000	0.0250	ND	ND	ND	ND	0.250±0.000	0.063	4.000±0.000	0.125
4	<i>Pseudomonas aeruginosa</i>	ND	≥1000	ND	ND	ND	ND	ND	ND	1.000±0.000	0.100

ND: not detected

**Discussion:-**

In the present investigation, the active phyto components of *Euphorbia nallamalayana* was studied and further the antimicrobial activity of the plant extract was also tested against eight potentially pathogenic microorganisms *Aspergillus niger*, *Aspergillus flavus*, *Candida albicans*, *Saccharomyces cerevisiae*, *Escherichia coli*, *Staphylococcus aureus*, *Bacillus subtilis* and *Pseudomonas aeruginosa* at different concentrations of the extract to understand the most effective activity.

Among the four solvent extracts methanol extract was more effective on test pathogens when compared to that of hexane, chloroform and Aqueous. Methanol extract showed significant inhibition zone ranging from 6-20mm against all the microorganisms. In the present study *Escherichia coli*, *Bacillus subtilis* were proved to be more susceptible at different concentrations of the plant extract. Among the fungal strains *Aspergillus niger* was susceptible to methanol extract and showed zone of inhibition ranging from 6-12mm at different concentrations. The

MBC was observed to be more when compared with that of MIC in *Staphylococcus aureus*, *Bacillus subtilis* and *Escherchia coli* in methanol extract.

In the present study, antibiotic potential of leaf extracts of *Euphorbia nallamalayana* plants has been determined against eight pathogens named *Aspergillus niger*, *Aspergillus flavus*, *Candida albicans*, *Saccharomyces cerevisiae*, *Escherchia coli*, *Staphylococcus aureus*, *Bacillus subtilis* and *Pseudomonas aeruginosa*. For the comparison positive and negative controls were used. Negative controls did not show inhibitory action on any of the test organisms, while positive controls significantly inhibited growth of all eight test organisms. The findings match with that of other findings [35-36]. It is often reported that Gram positive bacteria are more sensitive than Gram negative bacteria to plant based organic extracts [37-39]. But in our study, both gram positive and gram negative bacteria were found to be sensitive to plant extracts. In present study, *Staphylococcus aureus* was found to be most sensitive while *Aspergillus flavus*, *Candida albicans* and *Saccharomyces cerevisiae* were found to be least sensitive to plant organic extract than other organisms. The findings agree with that of other similar findings [40]. The antibacterial properties of medicinal plants may be due to presence of different chemical agents which were classified as bioactive antimicrobial compounds [41]. Phytochemical constituents such as alkaloids, glycosides, flavonoids, tannins, steroids, terpenoids and several other compounds are secondary metabolites of plants that serve as a defense mechanism against many microorganisms, insects and other herbivores. The present study also revealed the presence of medicinally active compounds like alkaloids, glycosides, flavonoids, steroid, terpenoid and tannins in most of the selected plants which could be responsible for the observed antibacterial property.

### Conclusion:-

The plant extract of *Euphorbia nallamalayana* showed significant antibacterial activity against both gram positive and gram negative organisms. However further studies on isolation characterization of chemical constituents of the plant extract responsible for antibacterial activity is necessary to elucidate their mechanism of action and it would give comprehensive evidence of bioactive potential of medicinal plants at cellular and molecular levels.

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### References:-

1. Zaika L.L. (1975): Species and herbs their antimicrobial activity 9:97-118.
2. Rastogi RP, Mehrotra BN (2002): Glossary of Indian medicinal plants. National Institute of Science Communication, New Delhi, India.
3. Gonçalves S, Gomes D, Costa P, Romano A. (2013): The phenolic content and antioxidant activity of infusions from Mediterranean medicinal plants. Ind Crops Prod; 43(1): 465-471.
4. Luo H, Li Q, Flower A, Lewith G, Liu J. (2012): Comparison of effectiveness and safety between granules and decoction of Chinese herbal medicine: A systematic review of randomized clinical trials. J Ethno pharmacol 140(3): 555-567.
5. Radulovic NS, Blagojevic PD, Stojanovic-Radic ZZ, Stojanovic NM. (2013): Antimicrobial plant metabolites: Structural diversity and mechanism of action. Curr Med Chem 20(7): 932-952.
6. Morens DM, Folkers GK, Fauci AS. (2008): Emerging infections: a perpetual challenge. Lancet Infect Dis 8(11): 710-719.
7. Ríos JL, Recio MC. (2005): Medicinal plants and antimicrobial activity. J Ethno pharmacol 100(1-2): 80-84.
8. Grill MF, Maganti RK. (2011): Neurotoxic effects associated with antibiotic use: management considerations. Br J Clin Pharmacol 72(3): 381-393.
9. Saleem M, Nazir M, Ali MS, Hussain H, Lee YS, Riaz N, (2010): Antimicrobial natural products: an update on future antibiotic drug candidates. Nat Prod Rep 27(2): 238-254.
10. Hooper DC, DeMaria A, Limbago BM, O'Brien TF, McCaughey B. (2012): Antibiotic resistance: how serious is the problem, and what can be done? Clin Chem 58(8): 1182-1186.
11. Hemaiswarya S, Kruthiventi AK, Doble M. (2008): Synergism between natural products and antibiotics against infectious diseases. Phytomedicine 15(8): 639-652.
12. Gordon M.C and David J.N. (2001): Natural product drug discovery in the next millennium. Pharm Biol. 139:8-17
13. Vedavathy S, Mrudula V and Sudhakar A Tribal in Chittoor District, Andhra Pradesh, India. Vedams e book P,Ltd 1977.

14. Pei,S.J.(2001): Ethanobotanical approaches of traditional medicine studies: Some experiences from Asia. *Pharmaceutical biology* 39:74-79.
15. Fabricant D.S and Fansworth N.R. (2001): The value of plant used in traditional medicine for drug discovery. *Environ. Health Perspect.* 109:69-79.
16. Al-Bayati F.A and Al-Mola H.F. (2008): Antibacterial and antifungal activity of different parts of *Tribulus terrestris* L growing in Iraq: *J. Zhejiang Univ. Sci. B.* 9:154-159.
17. Evans W.C. Trease and Evans (1996): *pharmacognosy* 14<sup>th</sup> Edition. WB Sacender Company Ltd., pp.290.
18. Fabricant D.S and Fansworth N.R. (2001): The value of plants used in traditional medicine for drug discovery. *Environ. Health Perspect.* 109:69-79.
19. <http://www.theplantlist.org/tpl1.1/record/kew-80596>.
20. Ahmed,Z.U.Begum,Z.N.T.,Hassan,M.a.Khonder,M.,Kabir,S.M.H.,Ahmad,M.,Ahmed,A.T.A.Rahman,A.K.A,Haque, E.U.(Eds). *Encyclopedia of Flora and Fauna of Bangladesh Dicotyledons*. Asiat. Soc. Bangladesh, Dhaka, 2007-2009,Vol 6-12,
21. Charles, C. D., Maribeth, L., Daniel, L. N., Kenneth, J. W., David, A. B. *Floral Gigantism in Rafflesiaceae Science Express ,USA.2007.*
22. Ravindra, B., Malabadi, Gangadhar, S., Mulgund and Nataraja, K. (2005):Screening an antibacterial activity in the extracts of *Clitorea ternatea* , *Jour medical and Aromatic Plant Sciences*, 27,26-29.
23. Prusti,A., Misra,S.R.,Sahoo,S. and Mishra,S.K., (2008):Antibacterial activity of some Indian medicinal plants, *Ethnobotanical leaflets*, 12,227-230.
24. Nair, R., Kalariya, T., Sumitra chanda., (2005): Antibacterial activity of some selected Indian medicinal flora. *Turk J Biol*, 29,41-47.
25. Ahmad, I., Mehmood, Z and Mehmood, I., (1998): Screening of some Indian medicinal plants for their antimicrobial properties. *J Ethnopharmacol*, 62,183-193.
26. Arjuna Patra , Jha,S., Murthy,P.N. Satpathy, S., Antibacterial activity of *Hygrophila Spinosa* T.Andres (2009): leaves. A comparative study. *Int J Pharm Tech Res*, 1(3), 837-839.
27. Pullaiah T & Ali. Moulali D. (1977): *Flora of Andhra Pradesh* ,1<sup>st</sup> ed ,Vol – II,Jodhpur ;Scientific Publishers.
28. Ellis J.L. (1987): *Flora of Nallamalais* ,Vol -II Botanical Survey of India.
29. Anonymous, (1996) *The Indian pharmacopoeia* Government of India, New Delhi. Ministry of Health and family welfare;.
30. National Committee for Clinical Laboratory Standards. *Performance Standards for Anti-Microbial Susceptibility Testing: Eleventh International Supplement*. NCCLS,2001, M100-S11.
31. Amarsingham P.P, Bisset, N.G, Millard P.H, Woods M.C, (1964): *Phytochemical Survey of Malaya part 3.Alkaloids and Saponins*. *Economic Taxonomic Botany* 18:270-278.
32. Sahm DF, Washington JA (1990). Antibacterial susceptibility tests: Dilution methods. In: *Manual of clinical Microbiology*. Lennette, EH (ed.), 5th edition. American Society of Microbiology, Washington, DC. pp. 1105-1118.
33. Harborne, J.B., *Phytochemical methods: A guide to modern techniques of plant analysis* Champman & Hall , London 973,279.
34. Raaman N. (2006) *Phytochemical Techniques* . New India Publishing Agency.New Delhi.
35. Rahman, A., Parvez, M.A.K., Parvin, T., Paul, D.K., Sattar, M.A., (2004): Antimicrobial activity of three bioactive compounds from the stream bark of *Piper chaba* hunter. *Bioscie. Res.*, 1: 16 20.
36. Bhattacharjee, I., Chatterjee, S.K., Chatterjee, S., Chandra, G. (2006): Antibacterial potentiality of *Argemone mexicana* solvent extracts against some pathogenic bacteria. *Memorias do Instituto Oswaldo Cruz.*, 101: 645 648.
37. Reynolds, J.E.F. Martindale (1996): *the extra harmacopoeia*, 31st edn, Royal Pharmaceutical Society of Great Britain, London.
38. Bezic, N.M., Dinkic, S.V., Radonic, (2003): A., Composition and antimicrobial activity of *Achillea clavennae* L. essential oil. *Phytother. Res.*, 17: 1037 1040.
39. Rahman, M.M., Alam, J., Sharmin, S.A., Rahman, A., Alam, M.F. (2009): In Vitro antibacterial activity of *Argemone mexicana* L. (Papaveraceae). *CMU J. Nat. Sci.*, 8: 77 84.
40. Joshi, B., Sah, G.P., Basnet, B.B., Bhatt, M., Sharma, D., Subedi, K., Pandey, J., Malla, R., (2011): Phytochemical extraction and antimicrobial properties of different medicinal plants: *Ocimum sanctum* (Tulsi), *Eugenia caryophyllata* (Clove), *Achyranthes bidentata* (Datiwan) and *Azadirachta indica* (Neem). *J. Microbiol. Antimicrob.*, 3(1): 17.
41. Arulmozhi, S., Mazumder, P.M., Ashok, P., Narayanan, L.S., (2007):Pharmacological activities of *Alstonia scholaris* Linn. (Apocynaceae)- A review. *Pharmaco. Rev.*, 1: 163 165.



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### RESEARCH ARTICLE

#### MAIN PREDICTORS ON THE USE OF BIOMATERIALS IN IMPLANT DENTISTRY: A REVIEW

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#### Abstract

Over the past 30 years, the number of dental implant procedures has been increasing worldwide, reaching about one million dental implants per year. In Brazil, in the last decades, there has been a very rapid evolution in implant dentistry with high success rates. The development of biomaterials for use in dental clinics in recent years has represented a powerful therapeutic tool in the correction of bone defects. This study aims to analyze and discuss the main types of biological membranes, positives, negatives, their indications and results. For the development of the present revision work, we used a database such as Medline, Embase, Pubmed, Ovid and Cochrane. The main descriptors (MeshTerms) used were "Implantology", "Regenerative Surgery", "Biomembranes", "Bioengineering Bone". Based on the literary findings, both non-absorbable and absorbable membranes are effective in the process of bone regeneration. Absorbents do not require a second surgical time. However, there are information gaps, and further research is needed to ensure the perfect knowledge of the properties of the physical barriers to achieve a perfect bone regeneration of the periodontal bone defects and around implants. Due to bone regeneration and biological barriers in the Grafting surgeries, there was a technological growth of these materials because they pointed out as potential tools for the treatment of bone loss.

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#### Introduction:-

In the last 30 years, the number of dental implant procedures has been increasing worldwide, reaching about one million dental implants per year [1,2]. In Brazil, in the last decades, there has been a very rapid evolution in the Implantodontia with high success rates [3]. The development of biomaterials for use in dental clinics in recent years has represented a powerful therapeutic tool in the correction of bone defects [3]. However, in spite of proven benefits, its use requires the professional to take clinical and ethical care in the analysis of the risks and benefits that each biomaterial can present.

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A study of 123 dental surgeons using biomaterials showed that professionals are not aware of the risks and benefits of biomaterials, nor of their biological principles, since 45% believe there is no risk to the patient and 56% do not consider Biomaterial as medicine. About 70% felt secure with respect to the origin [3]. Despite this, 96% of respondents said that there should be greater control of health authorities. More than half of the interviewees (51%) reported little or no patient participation in the process of therapeutic choice [3].

Many patients, elderly or not, sought implant-supported rehabilitation, but there is a need for some adjustments that lead to the consequent demand for regenerative procedures for maxillary reconstructions [5]. These patients can often present pathological changes, or make use of medications, which may alter bone healing [5]. Several materials can be used as a bone graft, each with different properties; For example: for neovascularization, materials such as hydroxyapatite and calcium phosphate showed the highest expression rates of vascular growth factors (VEGF) and microvascular density; While the polymer grafts showed the lowest rates [8].

The search for a solution for large bone defects has begun studies based on guided tissue regeneration therapy or guided bone regeneration. These studies promote the use of fillers and epithelial barriers that aid in treatment as an adjunct to bone grafting techniques. Thus, they favor greater predictability in alveolar and peri-implant reconstructions and present a good prognosis [4].

The main problem is with non-absorbable membranes, because they require a second surgical act, they provide infections if there is any type of exposure; Have a consistent consistency, which makes it difficult to adapt to the bone defect and thus impairs blood supply and can cause dehiscence and tissue necrosis [5-7].

Guided bone regeneration (GBR) favors the formation of new bone tissue and prevents the gingival tissue from invaginating into the space between the bone and the implant [5,6]. Covani et al [9] in a prospective 10-year study comparing patients who received the GBR technique with patients who did not receive indicated the possibility of gingival retraction in the group that did not receive the technique when compared to the group that received [4].

The filling materials can be: hydroxyapatite, lyophilized and milled demineralized bone marrow, autogenous bone, which is considered gold standard, among others. In conjunction with fillers, it is often necessary to use features to isolate the implant by using biological membranes, which are epithelial barriers that guide tissue regeneration, function as a mechanical barrier separating the periodontal tissues from the Bone surface or implant, thus promoting a new bone formation, a containment of the filling material and a stability of the graft [6,8].

This study aims to analyze and discuss the main types of biological membranes, positives, negatives, their indications and results.

### **Methods:-**

For the development of the present review, we used a database such as Medline, Embase, Pubmed, Ovid and Cochrane (figure 1). The main descriptors (MeshTerms) used were "Implantology", "Regenerative Surgery", "Biomembranes", "Bioengineering Bone" (Table 1).

### **Main Continuous Predictors:-**

The main continuous predictors were the inflammatory processes and the chemical quality of the biomembranes.

### **Main Predictor Answer:-**

The main predictor response was massive bone regeneration.

### **Literary Review:-**

#### **Epidemiology and Justification:-**

According to data from the Brazilian organ transplant association, the number of bone transplants per million population reaches 450 (18,200 transplants) in the State of São Paulo, 110 (4,100 transplants) in the State of Paraná and 30 (1,200 transplants) in the State of Rio de Janeiro, made available by the 5 Tissue Banks of the 3 States, during the 10<sup>th</sup> quarter of 2012 [13].



The lack of bone in the alveolar ridges has been a major problem in functional aesthetic recovery in patients who have suffered dento-alveolar trauma, traumatic dental extractions, congenital dental absence, pathologies involving maxilla and mandible, as well as infections due to the emotional and Possibility of deformity and also the economic impact they cause in the National Health System (NHS) [11,13]. Bone loss can also occur due to periodontal disease, traumatic surgeries, or even for physiological reasons due to lack of adequate bite function or prosthetic load [14]. The trauma in the face region can reach both the soft tissues (skin, muscles, nerves) and hard tissues (bones, teeth), so these lesions can affect the quality of life as well as the health of the victim [14].

The trauma maxillofacial injury can be considered one of the most devastating aggressions found in traumatology and oncology, due to the emotional consequences and the possibility of deformity and also the economic impact they cause in the National Health System (NHS) [15- 18]. The face, more than any other region of the body, is affected by aesthetic changes, since it is always visible, and damages are perceived immediately [19]. For this reason the trauma of the face deserves attention in the treatment of polytrauma due to its high incidence and severity.

#### **Tissue Engineering:-**

The microscopic bone structure consists of osteoprogenitor cells, support cells (osteoblasts and osteocytes), remodeling cells - osteoclasts - and a non-mineralized extracellular matrix called the osteoid, composed of type I collagen and non-collagen proteins such as osteonectin, osteocalcin, Morphonetic bone protein (BMP), glycosaminoglycans (GAG) and bone sialoproteins [29]. The osteoprogenitor cells are small spindle cells found on all non-resorbable bone surfaces, derived from primitive mesenchymal cells and form a population and precursor cells that can differentiate into more specialized cells such as osteoblasts and osteocytes [15].

Regeneration of composite tissues such as periodontal tissue has also been demonstrated, proving that adipose stem cell associated with platelet rich plasma can regenerate alveolar bone, cementum and periodontal ligament eight weeks after implantation [22,23]. Clinically, there is a combined study of bone graft with fibrin glue, a biodegradable biomaterial and adipose stem cell for the reconstruction of extensive bony defect in the skull cap of a 7-year-old victim of trauma [22].

Osteoblasts are derived from undifferentiated stem-cells and are responsible for the production of bone matrix, rich in collagen (mainly type I) and essential for subsequent mineralization, by adherence of calcium hydroxyapatite crystals, magnesium, potassium, sodium and Carbonate in collagen fibrils [10,20]. Osteoblasts are also rich in alkaline phosphatase, which has a high value in periods of bone formation. The process of formation of new bone mediated by osteoblasts is called osteogenesis [10]. It is known that osteoblasts bind directly to collagen through integrin-RDG (-Arg-Gly-Asp-) sites of interaction.

The osteoinduction process is influenced by several factors and consists in the induction of mesenchymal stem cells of adipose tissue in osteoprogenitor cells [15,25]. Osteogenic differentiation requires the presence of inducers, which include  $\beta$ -glycerolphosphate, ascorbic acid and dexamethasone [25]. In the presence of these substances the mesenchymal cells acquire the morphology and components of osteoblast membranes and begin to express alkaline phosphatase, to deposit extracellular matrix rich in calcium and certain proteins, such as osteopontin and osteocalcin [25].

Organic phosphates, such as  $\beta$ -glycerolphosphate, promote osteogeny by their function in mineralization and modulation of osteoblast activity [15]. Thus, free phosphates can induce mRNA and protein expression, exemplified by the osteopontin protein. If organic phosphate, for example  $\beta$ -glycerolphosphate is present, the formation of a mineral content occurs, hydroxyapatite that is formed between the collagen fibers [21]. Other compounds such as phosphoric ascorbic acid are also used in osteogenic induction, in the involvement of increased alkaline phosphatase activity and in the promotion of the production of osteocalcin and osteopontin [25,27].

Bone morphogenetic proteins (BMPs) function as growth factors with a specific role in the proliferation and differentiation of mesenchymal stem cells from adipose tissue [17,24]. BMP-4 is involved in the early stages of osteogenesis; in addition, it has been shown that the differentiation of human adipose mesenchymal stem cells into the osteogenic lineage requires the presence of BMP-4 in the first days of culture and that these cells, after 21 Days express specific proteins of the osteogenic lineage such as osteonectin, osteocalcin and osteopontin [24]. There are three fundamental parameters in bone tissue engineering that will determine the ability of osteoinduction are the

presence of soluble osteoinductive signals, the viability of the undifferentiated mesenchymal stem cells to respond, the ability to differentiate into bone-forming cells and the production of extracellular matrix Adequate [24].

Tissue engineering encompasses numerous advantages that meet the needs of injured tissue or organ for the regeneration process [12,17]. For this, it is necessary the understanding of chemical, physical and biological processes both biological material and the biological niche of the host [13]. The cross-referencing of compatible information between the microenvironments allows cellular recognition and signaling cascades for neovascularizations [14]. Another advantage is minimally invasive surgical intervention, that is, it allows the use of surgical techniques that are faster and cause less risk to the patient [19].

Thus, tissue engineering is a tool that makes possible through a suitable biological niche the construction and regeneration of any tissues and organs [18,27]. For this, xenografts, autografts and allografts are used, with and without the use of cells [13,14]. According to the Conference of the National Institute for the Development of Health Consensus in 1982, biomaterials are beneficial organic compounds, or a combination thereof, that can be used for a period of time, wholly or partially as part of a system that treats, Replace any tissue, organ or function of the human body [18,27,30].

The great challenge is to understand that the science of biomaterials is multidisciplinary and its application requires adjustments of its processing, sterilization and structural modifications to favor the interaction with the tissue of interest. Bioengineering and cell therapy work together for Regenerative Medicine, favoring and improving biological conditions to accelerate repair and tissue regeneration, and thus naturally maintaining tissue homeostasis [16]. This condition is maintained because the required cellular elements, cell proliferation and differentiation factors, and supramolecular structures are provided which guarantee the functional stereochemical organization of the tissues generated and their systemic integration [18,27,30].

### **Biomaterials:-**

It is used to direct, through the control of interactions with components of a living system, the course of a diagnostic or therapeutic procedure, whether in humans or animals. Checking the history of biomaterials in the medical-dental area, countless researches have been carried out in the search for natural or synthetic substances that can replace lost, hard or hard bodied tissues [31].

Thus, ancient records show us the use of substances, such as ivory. Dry bone, gold, gold wire, silver alloys, among other materials. From 1800, it is observed the use of synthetic compounds for bone replacement, when researchers advocated the use of calcium sulfate in bone defects [31].

Due to the great technological development of biomaterials, associated with the advancement of knowledge about the biology of bone tissues, it has become possible to selectively influence bone formation, controlling the quality and quantity of bone inside the buccal structures [31].

In this way, there is a wide variety of biomaterials, synthetic or biological, with variable particle sizes and mainly classified according to their mode of action: osteoconduction, osteoinduction or osteogenesis. In implantology, implant placement should be used as complementary therapy, and it is necessary to know the biological potential of each material to indicate it in the various clinical situations [31].

We can find in the market a varied range of biomaterials, such as demineralized lyophilized bone, anorganic bone and bioactive glass. These biomaterials should have precise indications and should not require unreal biological demands from them. It is known that bone neof ormation is a biological process that happens at the expense of osteoblastic activity and that the quality of the neoformed tissue, when in the presence of these biomaterials, is not the same for all, and depends on the material, its origin, clinical conditions The recipient site, the field of indications and the surgical technique [31].

### **Maintenance Of Alveolus Size After Exodontia:-**

The concern of the implantant after the extraction, is the bone loss in volume of the alveolus [31-33]. When it is not possible to install immediate implants, after exodontia, the alveolar process, depending on the thickness of the buccal bone board at the end of the bone remodeling process, may present depression on the vestibular surface, which would imply the need for block autogenous graft [33].

In a study carried out in 1967, it was observed that in the anterior maxilla there is loss of 25% of bone volume in the first year after exodontia. In the posterior region it is twice as large as in the anterior maxilla [34].

It is believed that if the bone defect is five walls (alveoli with intact walls) the alveolar bone repair will happen naturally. However, if the vestibular wall is less than 1.5 mm thick or absent, the practitioner should use intra-alveolar materials (autogenous bone, mineralized bone or alloplastic material), associated with membranes that improve the predictability of Restoration of the original bone contour in the alveolar process [35]. There is an indication of the technique called Bio-col for preservation of alveolar bone walls.

The author uses Bio-oss (inorganic material of bovine origin) as osteoconductive material that according to the author's understanding is slowly reabsorbed and replaced with vital bone [18]. If the bone defect is more than 2/3 of the vestibular wall, the reconstruction should be done with autogenous bone. Authors evaluated the action of two types of bioactive glass particles on mandibular alveoli after exodontia in dogs, and concluded that both Biogran and Biossilicate preserve the alveolar bone height and enable the implantation of implants [36].

Regarding the use of bone-guided regeneration, a study confirmed bone ridges after exodontia with and without the use of biological membranes. After six months, bone crest loss of 0.38 mm versus 1.50 mm and horizontal bead reabsorption of 1.31 mm versus 4.56 mm respectively were observed.

For a better predictability of the guided bone regeneration technique there is a requirement that the membrane be totally protected by the mucoperiosteal flap and that, in the presence of teeth, it is at least 1 mm away from the periodontal space [37]. It is also necessary that the biological space be maintained by membrane memory, or that the membrane be supported by the interdental septal bone structure, or by the remainder of the alveolar bone walls. If this condition does not exist, autogenous particulate bone, mineralized or synthetic biomaterial can be used [38].

In bone defects of four walls the indication of reconstruction falls on the autogenous bone or mineralized bone with membrane. Using the technique, which seals the alveolus with tissue composed of mucosa and trabecular bone obtained from the tuft of the maxilla with the aid of trephine drill of 6.0 to 10.0 mm in diameter [39].

On the other hand, bone defects with two or three walls require that the biomaterial to be used to reconstruct be the autogenous bone combined with the use of biological membranes [39]. On the other hand, the bone defect of a wall requires block grafting with fixation by means of screws. Based on the work of several authors, the implantation of implants in reconstructed areas with any biomaterial should be 4 to 6 months [39].

#### **Border Outline:-**

There are cases where the remaining bone tissue is sufficient to stabilize the implant, but there is deficiency of vestibular border contour that causes at the time of implant installation, partial dehiscence of the buccal bone board. Biomaterials are used to improve the contour of the collar, consequently the harmony of the prosthesis [31-33].

Biomaterials most suitable for improving the border contour are the inorganic ones, which maintain the volume and are not reabsorbed. When using these biomaterials, biological membranes should be used to protect the area and prevent biomaterial detachment [34-36].

The incorporation of the material into the receptor bed and stabilization of the material by fibrosis or adjacent soft tissue is observed. There can be no exposure of the biomaterial to the oral environment. This would cause its contamination and the failure of the surgical procedure [36,37].

It is also possible to use particulate autogenous bone, being biologically more favorable, the area should be well selected presenting thick and keratinized gingival tissue. At the moment of implant opening, part of the material is seen next to the gingival tissue and part forming a mass adhered to the bone [38].

#### **Peri-implant Bone Defect Filling:-**

Authors conducted a histological study in humans and concluded that the spontaneous repair of the peri-implant defect occurs when the space between the implant and the bone wall is up to 2.0 mm. 25% of sites with gaps greater than 2.0 mm were found to be repaired compared to 78% of gaps less than 2.0 mm [34].

Peri-implant bone defects in implants immediately after extraction, less than 2.0 mm, do not need to be filled, because spontaneous repair will occur. However, if the gap is greater than 2.0 mm, space filling should be performed in association with biological membranes [35]. In this case, the biomaterials in the form of particles are trapped by the bone walls, making use of either demineralized, mineralized materials, bioactive glass or particulate autogenous bone.

It is intended to fill the space by neoformed bone, and for this reason, the material used must have osteoconductive properties; To avoid the peri-implant bone defect, which is more worrying in the anterior maxilla region, due to aesthetics; Preserving the height of the alveolar process, including the interdental septa and raising the maxillary sinus membrane, or sinus graft [38].

#### **Increase In Height And / Or Thickness Of The Alveolar Process:-**

Autogenous block-shaped bone is indicated for the use of homogeneous, heterogeneous or alloplastic materials. The most used donor areas are: iliac crest, skull cap, chin, or oblique line. It is suggested that for total reconstructions, the most indicated would be: iliac crest and skull cap. When the reconstruction encompasses height and thickness, simultaneously, the iliac crest is the most indicated [31].

For reconstruction in thickness, the skull cap is more advantageous because there is little remodeling of the graft during the period of repair; Because bone quality is more adequate for implant installation; By the preoperative period have the minimum of symptomatology and for the shortest period of hospitalization.

For partial reconstructions, with individual losses or two dental elements, the oblique line can be indicated and, in loss of up to four elements, the ment would be more adequate indication [31].

#### **Elevation Of Maxillary Sinus:-**

The maxillary sinus survey, using bone grafts, became one of the most frequent procedures of implantology and also the most investigated by the use of platelet concentrates. Another reason is that it is a good model of evaluation of bone remodeling and is a closed and protected cavity where the interferences with the oral environment are minimal [29,30].

Many studies have reported that the addition of platelet rich plasma to a bone graft is associated with positive clinical results and is a good method of handling the bone graft during insertion in the maxillary sinuses and stimulates bone regeneration around implants placed in the graft. However, it is difficult to emphasize the conclusions of the studies carried out due to the large variables present in the in vivo models, however, in general the authors affirm that the quality of the bone formed and that the surgical technique used does not present advantages in the therapy [29,30].

#### **Guided Bone Regeneration And Guided Tissue Regeneration:-**

Guided bone regeneration is the technique that uses osteopromotion as a biological principle. It is indicated for bone regeneration in fresh alveoli, bone defects that have remaining bone walls, to promote bone neoformation around implants installed immediately after extraction, to correct bone loss (Peri-implant) that occurred after osseointegration [31].

It is used for correction of defects, when it is desired, increase of bone volume, for this it is necessary, that the tissue recomposes cells with characteristics of the region without interference of the connective tissue [32]. Guided tissue regeneration promotes selective cellular response without producing an inflammatory reaction. Its use presents a degree of specificity to the type of tissue where it will be performed [32].

#### **Important Features Of The Biological Membrane For Bone Neoform:-**

It should function as a physical support to the surrounding soft tissue, preventing the collapse of this space that will be filled by the blood clot, necessary for bone formation. It should also possess permeability that allows diffusion of plasma and nutrients, but which prevents the passage of non-osteogenic cells, in addition to having biocompatibility integration with the host tissue without creating inflammatory responses [32].

The first membranes to be successfully used in bone regeneration were expanded polytetrafluoroethylene, non-resorbable. The eventuality of exposure posed a risk of infection, requiring premature removal. Due to this inconvenience they developed resorbable membranes, collagen or polylactic acid polymers [32].

#### **Membrane Characteristics:-**

They must have good tissue integration, ensuring the growth of cells without crossing the material; Prevent the early migration of the epithelium on the outer surface of the material or encapsulation of the material; To provide stability to the suprajacent retail; Be available in easy configuration for better adaptation; Present selectivity (passage of nutrients, gases) and have occlusive property. The right choice of membrane to take advantage of its basic characteristics will depend on the operator's ability and his mastery with the material [32].

#### **General Characteristics Of Indications For Each Thickness:-**

Fine membranes are used when the need is only for insulation of the site. Medium membranes are used for insulation, and should have greater or lesser degree of strength and stiffness according to the imposed deformation. Thick membranes confer structural action, creating ample space and sustaining in adverse conditions.

#### **Non-Absorbable Membranes:-**

They are formed by overlapping layers of Teflon, of highly ordered structure, giving a controlled porosity that allows passage of liquids. They consist of two parts, a peripheral part of greater porosity and flexibility, which guarantees the adaptation to the margins of the bone defects and another part of less permeability with greater rigidity.

The disadvantages of non-absorbable membranes are the need for additional surgical intervention for their removal and possible complications associated with membrane exposure, leading to infections, requiring removal and disruption of the regenerative process [32].

Expanded polytetrafluoroethylene membranes do not trigger inflammatory reaction, foreign body, has autoclave resistance, insoluble to a range of enzymatic solvents, has elasticity similar to bone tissue. It is reinforced with titanium and indicated for situations in which the formation of bone with great defects is desired.

They are composed of double layer polytetrafluoroethylene expanded with titanium interposed. These barriers incorporate into their structure a skeleton, formed by a thin titanium blade. Titanium membranes are capable of promoting the formation of significant amount of new bone and maintaining sufficient space without the use of a support device [32].

#### **Reabsorbable Membranes:-**

Reabsorbable membranes eliminate the need for additional surgery. They are classified in: natural and synthetic. They are degraded by the body through enzymatic hydrolysis, triggered by the inflammatory infiltrate that forms around the material. Collagen-based membranes are widely used today. Its efficacy is demonstrated by studies, however there is disagreement as to its use. They have their origin: bovine, swine and derived from the dura mater of the human brain, collected and submitted to the lyophilization process to eliminate antigenic substances. Before its positioning, it must be hydrated by immersion of the membrane in saline.

The resorbable membranes, diverts the body's attention to a process, which is its own removal from the site. Alumina is an alloplastic membrane that presents characteristics of passivity in the scarring process, makes isolation, spacing and stabilization, and does not generate any mechanism capable of altering the process.

The autogenous graft is considered the best because it guarantees predictable results, due to the lower rejection rate. Due to this, when coated with membrane, the autogenous bone can reach 50% of the original bone volume in up to six months. Bovine bone, when associated with non-absorbable membranes, begins the resorption process from the seventh month, and has a significant effect on bone filling parameters after a period of nine months [32].

#### **Discussion:-**

Based on the literary findings, both non-absorbable and absorbable membranes are effective in the process of bone regeneration. Absorbents do not require a second surgical time [33,34]. However, there are information gaps, and

further research is needed to ensure a perfect knowledge of the physical barrier properties to achieve a perfect bone regeneration of the periodontal bone defects and around implants [34,35,36].

In this context, the use of biomaterials and membranes contribute to an optimized outcome in the rehabilitations with osseointegrable implants. Another prospective 3-year study in patients receiving platform switching implants indicated predictability of the technique associated with guided bone regeneration for aesthetic area reconstruction [34]. In a 10-year longitudinal prospective study, they indicated the possibility of gingival retraction in a group of patients who did not receive guided bone regeneration when compared to a group of patients who received the guided bone regeneration technique.

Regarding the use of the biomaterial, clinical studies have indicated predictability of the technique [34,35]. Another study showed in a randomized controlled clinical study that the guided bone regeneration technique using different biomaterials (Bone Ceramic / Bio-Oss) presented predictability and that both materials are suitable for preserving width and interproximal bone height of the collar Alveolar [18,28].

Another important aspect is the creation of a provisional implanted implant, since this prosthesis presents several functions such as adaptation of the patient, choice of color and shape, allowing gingival conditioning that besides obtaining aesthetics, such conduct represents less clinical time to the prosthetist During the final restoration phase [34-36].

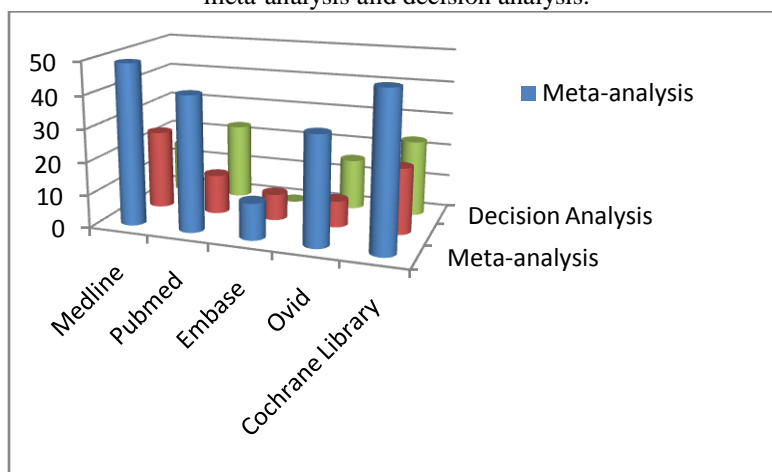
In addition, gingival conditioning allows the adjacent soft tissues to be directed during the osseointegration phase, thus avoiding gingival targeting maneuvers for esthetics [33]. The use of biomaterials in dentistry occurs on an increasingly wide scale. Several studies have demonstrated the synthesis of new biomaterials applied in all areas of dentistry with promising results [33-35].

Thus, the use of biomaterials at a clinical level should essentially be analyzed through the entire scientific evaluation process, ranging from in vitro laboratory tests to longitudinal clinical studies in vivo. Thus, the development of bioceramics and prostheses constituted by these materials must occur under the same interdisciplinary conditions that determine the development of any other dental material [19].

In addition, there is a need to know all the properties mentioned here by the Dentist, so that there is a critical discussion about the use of biomaterials, avoiding only commercial information that is often incomplete and superficial [19, 34]. The opportunity to discuss the use of biomaterials in dentistry, through the science of dental materials, expands the knowledge of this subject for professionals and researchers [19].

The diversity of applications of biomaterials, as well as their chemical, physical, biological and morphological differences, makes the research in this area of knowledge a work with eminently interdisciplinary characteristics. Within this context, professionals in the field of Materials Engineering can contribute significantly to the evolution of this area and to increase the range of its applicability, through the development of new and effective biomaterials and also in the elucidation of the mechanisms that govern the Bone regeneration [34-37].

**Figure1.**Quantification as a percentage of the recent papers published in the mentioned journals, broken down by meta-analysis and decision analysis.



**Table 1.** Main current references and outcomes on the use of biomembranes

AUTHOR	OUTCOMES
Caballé-Serrano et al. (2015)[33]	The protocols presented should encourage further revealing the paracrine effects of bone grafts during bone regeneration and pave the way for translational research in the broad field of reconstructive surgery.
Merli Met al. (2016) [34]	No substantial differences were obtained using different membranes and non-resorbable grafts, and the results were positive for the variables examined. A result of high heterogeneity has been observed in studies related to cross-linked membranes.
Moschouris Pet al. (2016) [35]	The recombinant protein Wnt3a in conjunction with GBR tissue can promote bone formation.
Caballé-Serrano (2016) [36]	These results demonstrated that collagen membranes can rapidly absorb the activity of TGF- $\beta$ released from bone splinters, a molecular process that may contribute to guided bone regeneration.
Saghiri MA et al. (2016) [37]	Angiogenesis is one of the key factors that plays a critical role in the success rate of the GBR technique and is seriously considered in the manufacture of bone and graft membrane barrier materials. However, there is still a lack of clinical and in vivo studies on the effect of angiogenesis on bone and graft treatments of barrier membrane materials.
Fujioka-Kobayashi M et al. (2016) [38]	The results indicate that the combination of collagen membranes with rhBMP9 significantly induced significantly higher mRNA expression and alizarin alizarin red staining when compared to rhBMP2. These findings suggest that rhBMP9 may be a suitable growth factor for future regenerative processes in bone biology.
Dai Z, Shu Y, Wan C, Wu C(2015) [39]	These microgels provided an extracellular matrix microenvironment that affect the biological behavior of mesenchymal stem cells, facilitating their potential applications in regenerative bone therapies.

### Conclusion:-

Because of bone regeneration and biological barriers in graft surgeries, there has been a technological growth of these materials because they are pointed as potential tools for the treatment of bone loss. Therefore, for its ethical and safe use, it is necessary for the professional to be careful in its use by assessing the advantages and disadvantages by means of prospective and randomized clinical studies of each material and with high casuistics.

**References:-**

1. Pye AD, Lockhart DEA, Dawson MP, Murray CA, Smith AJ. A review of dental implants and infection. *J HospInfect* ; 2009, 72:104–110.
2. Branemark PI, Hansson BO, Adell R, Breine U, Lindstrom J, Hallen O et al (1977) Osseointegrated implants in the treatment of edentulous jaw. Experience from a 10-year period. *ScandJPlastReconstrSurgSuppl* 16:1–192.
3. BugarinJúniorJG, GarrafaII V. Bioethics and biosafety: the use of biomaterials in dental practice. *Rev SaúdePública* 2007;41(2):223-8.
4. Mazaro JVQ, Godoy PAI, Junior JFS, Mello CC, Pellizzer EP, ZavanelliAC ; Regeneração óssea guiada em implantodontia: relato de caso ; RFO, Passo Fundo, v. 19, n. 1, p. 121-128, jan./abr. 2014.
5. BusetiJ ; Avaliação histológica e histomorfométrica da regeneração óssea guiada sob membranas biológicas não reabsorvíveis em ratos osteoporóticos com e sem tratamento com ácido zoledrônico ; Porto Alegre, 2015.
6. Fernandes TBG. Utilização de membranas absorvíveis e não absorvíveis em técnicas de regeneração óssea na implantodontia ; Uberlândia, 2015.
7. Costa JBZ, Silva F, Dultra CA, Souza LF, Santos MCNE ; Uso de membranas biológicas para regeneração óssea guiada em implantodontia – uma revisão de literatura - *Revista Bahiana de Odontologia*. 2016 Mar;7(1):14-21.
8. Saghir MA, Asatourian A, Garcia-Godoy F, Sheibani N. The role of angiogenesis in implant dentistry part II: The effect of bone-grafting and barrier membrane materials on angiogenesis. *Med Oral Patol Oral Cir Bucal*. (2016), doi:10.4317/medoral.21200.
9. Covani U, Chiappe G, Bosco M, Orlando B, Quaranta A, Barone A. A 10-year evaluation of implants placed in fresh extraction sockets: a prospective cohort study. *J Periodontol* 2012; 83(10):1226-34.
10. Calasans MD., Fernandes GVO.; Granjeiro, JM. Preservação alveolar com enxertos após exodontias e previamente à instalação de implantes. *RevistaImplantnews*, 2011, 6: 583-590.
11. Fontanari LA; Manne JM; Junior WT. Utilização de enxerto homogêneos para reconstrução em áreas atroficas pré-implante: banco de ossos. *RevistaImplantnews*, 2007, 5 (6) : 539-597.
12. Gimble JM.; Katz AJ.; Bunnell BA. Adipose-Derived Stem Cells for Regenerative Medicine. *Circ Res*; 2013, 100:1249-1260.
13. Hallman M, Cederlund A, Lindskog S, Lundgren S, Sennerby L. A clinical histologic study of bovine hydroxyapatite in combination with autogenous bone and fibrin glue for maxillary sinus floor augmentation. Results after 6 to 8 months of healing. *Clin Oral Implants Res* 2001 Apr;12(2):135-143.
14. Hing K. A. Bone repair in the twenty-first century: biology, chemistry or engineering? *Philos. Trans. R. Soc. Lond. B. Biol Sci.*, 2004, 362( 1825) : 2821-2850.
15. Langer R. ; Vacanti JP. Tissue Engineering. *Science* 1993; 260 : 920-926.
16. Lima, A F.; Martorelli. Enxertos ósseos: características de alguns materiais. *Revista ABO Nacional*, 2008, 16( 3).
17. Zago, MA.; Covas, DT. Células-tronco: Origens e Propriedades. In: *Células-tronco: A nova Fronteira da medicina*. Ed. M. Zago e D. T. Covas, pp. 3-20. Editora Atheneu São Paulo, 2006.
18. Maiorana C, Sommariva L, Brivio P, Sigurtà D, Santoro F. Maxillary sinus augmentation with anorganic bovine bone (Bio-Oss) and autologous platelet-rich plasma: preliminary clinical and histologic evaluations. *Int J Periodontics Restorative Dent* 2003 Jun;23 (3) : 227-235.
19. Mazzoneto, R. Reconstruções em Implantodontia – Protocolos clínicos para o sucesso e previsibilidade. Ed. Napoleão, 2009, 1ª Edição. Nova Odessa – SP, Brasil.
20. Aubin J. E.; Liu F. The osteoblast lineage. In: Bilizekian, J., Raisz, L., and Rodan, G., editors. *Principles of Bone Biology*. San Diego, CA: Academic Press: 1996, 39-50.
21. Liu, Y.; Clark, RAF.; Huang, L.; Rafailovich, MH. Hyaluronic acid-gelatin fibrous scaffold produced by electrospinning of their aqueous solution for tissue engineering applications. In *Advances in Material Design for Regenerative Medicine, Drug Delivery and Targeting/ Imaging* 2010; 1140 :131-136.
22. Nardi N.B.; Meirelles S.L. Mesenchymal stem cells: isolation, in vitro expansion and characterization. *HEP* 2006; 174 : 249-82.
23. Locke M, Windsor J, Dunbar PR. **Human adipose-derived stem cells: isolation, characterization and applications in surgery.** *ANZ J Surg*, 2009, **79**:235-244.
24. Vacanti, JP.; Langer, R. Tissue engineering: The design and fabrication of living replacement devices for surgical reconstruction and transplantation. *Lancet*, 1999; 354: 32–34.
25. Mesimäki K, Lindroos B, Törnwall J, Mauno J, Lindqvist C, Kontio R, Miettinen S, Suuronen R: **Novel maxillary reconstruction with ectopic bone formation by GMP adipose stem cells.** *Int J Oral Maxillofac Surg* 2009, **38** :201-209.



26. Chan, YL.; King, NM. Use of focused ion beam milling for investigating the mechanical properties of biological tissues: A study of human primary molars. *Journal of the Mechanical Behavior of Biomedical Materials* 2009, 2 (4) : 375-383.
27. Fardin A.C., et al. Enxerto Ósseo em Odontologia: Revisão de Literatura. *Innov Implant J, Biomater Esthet, São Paulo*, 2010, 5 (3): 48-52.
28. Zotarelli Filho IJ, Frascino LF, Greco OT, Araujo JDD, Bilaqui A, Kassis EN, Ardito RV and Bonilla-Rodriguez GO. Chitosan-collagen scaffolds can regulate the biological activities of adipose mesenchymal stem cells for tissue engineering. *J Regen Med Tissue Eng*. 2013; 2:12. <http://dx.doi.org/10.7243/2050-1218-2-12>.
29. Simonpieri, A., et al. (2012). Current Knowledge and Perspectives for the Use of Platelet-Rich Plasma (PRP) and Platelet-Rich Fibrin (PRF) in Oral and Maxillofacial Surgery Part 2: Bone Graft, Implant and Reconstructive Surgery *Current Pharmaceutical Biotechnology*, 13, pp. 1231-1256.
30. Tejero, R., Anitua, E. e Orive, G. (2014). Toward the biomimetic implant surface: Biopolymers on titanium-based implants for bone regeneration. *Journal of Progress in Polymer Science*, 39, pp. 1406-1447.
31. Carvalho PSP, Rosa AL, Bassi APF, Pereira LAVD. Biomateriais aplicados a implantodontia. *Revista Implantnews* 2010;7 (3a-PBA):56-65.
32. Pereira IKC, Fernandes JRS, Melo ITS. Uso de membranas como barreiras protetoras de enxertos ósseos utilizados na implantodontia. *Cadernos de Ciências Biológicas e da Saúde*. Boa Vista, n. 03, 2013.
33. Caballé-Serrano J, Sawada K, Schuldt Filho G, Bosshardt DD, Buser D, Gruber R. Bone Conditioned Medium: Preparation and Bioassay. *J Vis Exp*. 2015 Jul 8; (101):e52707.
34. Merli M, Merli I, Raffaelli E, Pagliaro U, Nistri L, Nieri M. Bone augmentation at implant dehiscences and fenestrations. A systematic review of randomised controlled trials. *Eur J Oral Implantol*. 2016 Spring;9(1):11-32.
35. Moschouris P, Retzepi M, Petrie A, Donos N. Effect of Wnt3a delivery on early healing events during guided bone regeneration. *Clin Oral Implants Res*. 2016 Mar 27.
36. Caballé-Serrano J, Sawada K, Miron RJ, Bosshardt DD, Buser D, Gruber R. Collagen barrier membranes adsorb growth factors liberated from autogenous bone chips. *Clin Oral Implants Res*. 2016 Jan 28.
37. Saghiri MA, Asatourian A, Garcia-Godoy F, Sheibani N. The role of angiogenesis in implant dentistry part II: The effect of bone-grafting and barrier membrane materials on angiogenesis. *Med Oral Patol Oral Cir Bucal*. 2016 Mar 31:0.
38. Fujioka-Kobayashi M, Sawada K, Kobayashi E, Schaller B, Zhang Y, Miron RJ. Recombinant Human Bone Morphogenetic Protein 9 (rhBMP9) Induced Osteoblastic Behaviour on a Collagen Membrane Compared With rhBMP2. *J Periodontol*. 2016 Jan 11:1-14.
39. Dai Z, Shu Y, Wan C, Wu C. Effects of pH and thermally sensitive hybrid gels on osteogenic differentiation of mesenchymal stem cells. *J Biomater Appl*. 2015;29:1272-83.

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### RESEARCH ARTICLE

**Developing Special Residential Zone (SRZ) near an economical magnet (SEZ) (a farmer responsive model for tardy process in land acquisition).**

**Ar.Trilok K Kubde.**

B. Arch, M. Arch. - Urban Design.

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#### Abstract

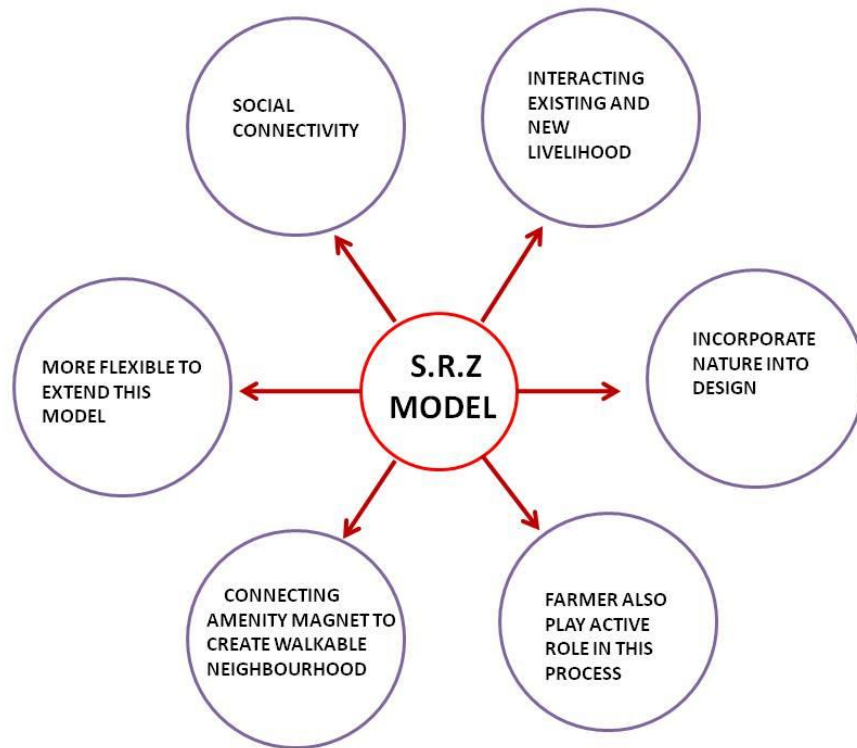
Special Residential Zone (SRZ) is an influence area of Special Economical Zone (SEZ). It is a dynamic area which changes with span of time. In India there are 173 new SEZ proposal has been in working condition. SEZ is a potential magnet which can disrupts the area where it emerges in terms of housing, land prices and quality of life. Some of these proposals emerge near the city or existing urban centre which directly affects the fringes of city, hence there is need to kind of sustainable development of SRZ to prevent the social turmoil, pressure on basic livelihood, impact on urban sprawl, declining natural vegetation and loss of wildlife and agriculture near the existing urban centre. This thesis has been focusing on the SRZ of Nagpur where the MIHAN (SEZ) as potential magnet which can disrupts the quality of life in SRZ.

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Intend of this project has been to create a model for special residential zone (SRZ) and module for farmers benefit in the tardy process of land acquisition. Focus is to create sustainable model which will suitable for newer development and approach to balance the convergence of the present and future in human settlements as well as a system for creatively coping with the growth of population, rapid change and the pressure of large scale high density housing. The goal is to give Urban Design strategies for SRZ. The focus of the project has been to collect the data and discuss issues and concern related to the new towns that come up in the SRZ area.

The quality of life (comprises of social infrastructure, recreational, community relationship with people and society and overall livability of an area) also plays very important role in urban areas, in city boundaries people living in comprehensive planning of cities and unplanned areas like the fringes which are newly developed. There are minimum standards of living for any given society. In absence of comprehensive planning the quality of life of SRZ are getting affected.

To understand Quality of life in city, the study intends to focus on industrial towns before 1970 and present scenario and analyze those towns in terms of land acquisition, number of people affected and displaced and livelihood of people. Identify why those towns were not been able to give proper remedy for surrounding area and give urban design proposal for it.

**Features of SRZ Model**

- 1) This model we can use everywhere in India where Special Economical Zones are suppose to come.
- 2) This model will prevent haphazard development, disconnected development, provide supportive infrastructure with respect to given population.
- 3) Reduce social turmoil of Farmers.
- 4) Making better livelihood for farmers.
- 5) Benefiting for both farmers and Government.
- 6) Enhance Quality of life in the Fringes.



### RESEARCH ARTICLE

#### IMPACT OF EMOTIONAL INTELLIGENCE ON THE ACADEMIC ACHIEVEMENT OF D.ELED STUDENTS.

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#### Abstract

The present study is conducted among the 739 students of teacher trainees for analyzing the impact of Non cognitive factor on the academic achievement. Self made tool is adopted for testing an emotional intelligence of the teacher trainees. And also the researcher has developed academic achievement tool in 2015 with the help of the Source book, tested at the 0.05 & 0.01 percent level of significance. The participants are considered male and female students in, which strength of female more than male students. The result of study reveals that there is positive and significant difference between Emotional Intelligence and Academic Achievement of teacher trainees.

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#### Introduction:-

Human life is full of events everyday and every event of a man's personal life is expressed in some emotional colouring. Behind every emotion there is a feeling. Feelings are described as emotions. Our emotions play quite a significant role in guiding and directing our behaviour. Many a time there are seen to dominate our behaviour in such a way that we have no solution other than behaving as per wish. On the other hand, if a person has no emotional current he then he becomes crippled in terms of living his life in a normal way. Hence, emotions play a key role in providing a particular direction to our behaviour and thus shaping our personality according to their development.

Emotional intelligence consists of two words Emotion and Intelligence. Emotion refers to intense feeling of human. Intelligence is basically based on mental ability of human to deal effectively with the environment. Emotional intelligence is the ability to sense and understand one's own emotions, to express and regulate them appropriately and to use them in the process of decision making. It includes the capacity to understand and feel for others, and so set up maintain quality relationships.

From Salovey and Mayer's theoretical model, EI is conceived as an authentic intelligence, based on the adaptive use of emotions such that the individual can solve problems effectively adjust to his or her surroundings. Mayer and Salovey's skill model considers that EI conceptualized through four basic skills. "the skill of accurate perception, appraisal and expression of emotions, the skill of taking on and/or generating feelings which facilitate thinking; the skill of understanding emotions and emotional knowledge and the skill or regulating emotions, thus promoting emotional and intellectual growth" (Mayer & Salovey, 1997).

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**Emotional Intelligence and Academic Performance:-**

The ability to pay attention to their emotions, experience feelings with clarity and be able to recover from negative states of mind will be a decisive influence on students' mental health, and this psychological balance in turn is related to and ultimately affects academic performance. Persons with limited emotional skills are more likely to experience stress and emotional difficulties during their studies, and consequently will benefit more from the use of adaptive emotional skills that allow them to cope with these difficulties. EI may act as a moderator of the effects of cognitive skills on academic performance (Brackett, 2011)

**Need and significance of the study:-**

The result of present study will provide a base which may help in strengthening or improving the achievement of the adolescents. The findings will also act as a linkage of emotional intelligence and creative thinking ability which in turn imparts a significant role in the development and achievements of adolescents. In the words of Smith (2009) in Teachers for the Real World keeping in mind the present day requirements remarks, If a student's is to be prepared for the evolving world, than an essential attribute of effective teacher is awareness of the realities of the world. Therefore, the primary school teachers have a great role in moulding future generation. In order to be better teachers, they need to be emotionally intelligent, creative and effective in their performance. The foundational seed to reach to this state is being sown in the initial stages of schooling. The potential seed is sown by the primary school teachers. Therefore, the investigator inclines to study the variables emotional Intelligence, creative thinking ability and academic achievement of D.EI.Ed students.

**Title of the study:-**

Statement of the problem is entitled as Impact of emotional Intelligence on the Academic Achievement of D.EI.Ed Students.

**Objectives of the study:-**

The following objectives have been formulated for the purpose of the study:

1. To find out the level of emotional intelligence of D.EI.Ed students.
2. To find out the level of Academic achievement of D.EI.Ed students.
3. To find out the difference, if any, in the Emotional intelligence of D.EI.Ed students in terms of demographic variables such as gender, nature of institution and marital status.
4. To find out the difference, if any, in the Academic Achievement of D.EI.Ed students in terms of demographic variables such as gender, nature of institution and marital status.

**Methodology:-**

The investigator adopted survey method. This method of investigation which attempts to describe and interpret what exists at present in the form of conditions practices, process, trends, effects, beliefs etc. The survey method gathers data from relatively large number of case at a particular time.

**Sample:-**

The investigator had used stratified random sampling technique for selecting the sample. The investigator randomly selected the Teacher trainees from three districts are Tirunelveli, Tuticorin and kanyakumari. The selection was done on the basic of the type of institution and location of the institution. From these institutions, 739 teacher trainees were randomly selected on the basis of the criteria.

**Research Tools:-**

Emotional Intelligence tool designed by Rasel. Academic Achievement tool developed by the researcher in the year 2015, with the help of source book.

**Procedures:-**

The above inventory was administered to subjects. Each item was scored with the help of scoring key. The data thus collected are tabulated to arrive at meaningful inference.

**Statistical Techniques:-**

The tabulation and analysis of data done by using appropriate statistical techniques such as Mean, Standard deviation and 't' test.

**Data Analysis:-**

To find out the meaningful interpretation of the raw scores the data were analyzed, the results of the study are presented in the following tables.

**Table – 1 Level of emotional intelligence and academic achievement of d.ei.ed students**

Category	Low		Moderate		High	
	No.	%	No	%	No	%
Emotional Intelligence	100	13.5	547	74.0	922	12.4
Academic Achievement	146	19.8	485	65.6	108	14.6

The table indicates that 13.5 of the D.EI.Ed students have low level, 74.0 percent have average level and 12.4 percent have high level of emotional intelligence. It is inferred from the table reveals that 19.8 percent of the D.EI.Ed students have low level, 65.6 percent have moderate level and 14.6 percent have high level of academic achievement. Further it is concluded that a good percentage of D.EI.Ed students have average level of emotional intelligence and academic achievement.

**Table – 2 significant difference among the emotional intelligence of d.ei.ed students in terms of demographic variables**

Emotional Intelligence		N	Mean	SD	DF	Calculated 't' value	$\rho$ -value
Gender	Male	40	230.18	24.810	737	0.234	0.815NS
	Female	699	229.32	22.326			
Nature of Institution	Girls	329	226.21	23.616	737	3.450	0.001**
	Co-Education	410	231.90	21.160			
Marital Status	Married	86	233.56	17.811	737	2.237	0.027*
	Unmarried	653	228.81	22.946			

S\*\* = Significant at 1% level. S\* = Significant at 5% level NS = Not significant

The calculated  $\rho$  value for the variable of Emotional intelligence as a more than 0.05 level of significance and so are not significant at 5% level. It means that there is no significant difference in the Emotional intelligence of D.EI.Ed student due to their gender. Hence the formulated null hypothesis, 'there is no significant difference in the emotional intelligence of D.EI.Ed students due to their gender to which they belong' is accepted.

The calculated  $\rho$  value for the variable of Emotional intelligence as less than 0.01 and so they are significant at 1 percent level. It means that there is significant difference in the nature of institution of D.EI.Ed students. While comparing the mean scores, girls institute (mean = 226.21) and co-education institute (mean = 231.90). Further it is observed that the co-education institute D.EI.Ed students are better than their girls institute counter parts in Emotional intelligence.

The calculated  $\rho$  value for the variable of Emotional intelligence as less than 0.05 and so they are significant at 5 percent level. It means that there is significant difference in the marital status of D.EI.Ed students. While comparing the mean scores of married (men = 233.56) and unmarried D.EI.Ed students (means = 228.81). Further it is observed that the married D.EI.Ed students are better than their unmarried D.EI.Ed students in their Emotional intelligence.

**Table – 3 Significant difference among the emotional intelligence on the academic achievement of d.ei.ed students in terms of demographic variables**

Academic Achievement		N	Mean	SD	DF	Calculated 't' value	$\rho$ -value
Gender	Male	40	32.5	9.541	737	1.975	0.049*
	Female	699	34.92	8.890			
Nature of Institution	Girls	329	36.64	9.085	737	5.220	0.000**
	Co-Education	410	33.25	8.543			
Marital Status	Married	86	38.31	8.028	737	4.306	0.000*
	Unmarried	653	34.29	8.958			

S\*\* = Significant at 1% level. S\* = Significant at 5% level.

It is known that the calculated  $\rho$  value for the academic achievement is less than 0.05 at 5 percent level of significance. Hence there is significant difference in the academic achievement between male and female D.El.Ed students. Further it is observed that the female D.El.Ed students are better than the male D.El.Ed students in their academic achievement. While comparing the mean scores, female students (mean = 34.92) achieve more than male students (mean = 32.5)

The study reveals that, the calculated  $\rho$  value for the academic achievement is less than 0.01 and so it is significant at 1 percent level. It means that there is significant difference in the academic achievement of D.El.Ed students due to the nature of institution. Further it is observed that the girls' institution D.El.Ed students are better than the co-education institute D.El.Ed students in their academic achievement. While comparing the mean scores, girls institute (mean = 36.64) achieve more than co-education institute D.El.Ed students (mean = 33.35)

It reveals that, the calculated  $\rho$  value for the academic achievement is less than 0.01 and so it is significant at 1% level. It means that there is significant difference in the academic achievement between married and unmarried D.El.Ed students. Further it is observed that the married D.El.Ed students are better than the unmarried D.El.Ed students in their academic achievement. While comparing the mean scores, married D.El.Ed students (mean = 36.64) achieve more than unmarried D.El.Ed students (mean = 33.35).

### **Findings:-**

Findings based on the objectives and followed by data analysis are given as follows: According to the table shows that; there is percent of the elementary teacher trainees have low level, 74 percent have average level and 12.4 percent D.El.Ed students have high level of emotional intelligence. It is inferred from that; there is 19.8 percent of the D.El.Ed students have low level, 65.6 percent have moderate level and 14.6 percent have high level of academic achievement. It reveals that; there is no significant difference among the emotional intelligence of D.El.Ed students in terms of their gender. It is reveals that there is significant difference among the emotional intelligence of D.El.Ed students in terms of their nature of institution. It reveals that; there is significant difference among the emotional intelligence of D.El.Ed students in terms of their marital status. It reveals that; there is a significant difference among the academic achievement of D.El.Ed students in terms of their gender. They showed that; there is significant difference among the academic achievement of D.El.Ed Students in terms of their nature of institution. They showed that; there is significant difference among the academic achievement of D.El.Ed students in terms of their marital status.

### **Educational Implications:-**

Students should be able to recognize their abilities and capacities instead of feeling low develop ability to work and study in adverse emotional condition of life. It can help future teacher to well equip with handling new aims, objectives of education, method of techniques and ready to take the responsibility which is a tactful task. In curriculum impetus should be given for the training of emotional intelligence to increase academic achievement of students.

### **Conclusion:-**

In the present study, it can be stated that the outcome of all hypothesis is accepted. It is true that there is positive and significant difference between Emotional Intelligence and Academic Achievement. There is a great need to explore the awareness about the Emotional Intelligence. Emotional Intelligent people are more likely to succeed in everything they undertake. Quality emotions and feeling help student gave their best potential in the classroom. The students who are aversive and think negatively cannot concentrate for a long time and have more difficulty in reaching their potential than others. The emotions, feelings and values are vital for a person well being and achievement in life.

**Reference:-**

1. Abi.Sarma N (2000) The relationship between Emotional Intelligence and Academic Achievement in eleventh graders. *Research in Education*. FED 661.
2. Aggarwal Y P (1990) *Statistical Methods*, New Delhi: Sterling publisher Pvt. Ltd.
3. Brackett M A (2011). Emotional Intelligence: Implications for Personal, Social, Academic and Workplace Success. *Soc Personal Psychol Compass*. 2011; 5: 88-103. doi:10.1111/j. 1751-9004.2010.00334.x.
4. Kothari C R (1990). *Research Methodology Methods and Techniques, Second edition*.
5. Lokesh koul (2007) *Methodology of Educational Research*, Vikas Publishing house Pvt. Ltd.
6. Salovey P & Mayer J D (1997) What is Emotional Intelligence? In Emotional development and emotional intelligence: Educational implications, NY: *Basic Books*, 3-34.
7. Sharma P Mangal S & Nagar P (2016) To Study the Impact of Emotional Intelligence on Academic Achievement of Teacher Trainees. *IRA International Journal of Education and Multidisciplinary Studies* (ISSN 2455-2526), 4(1). doi:http://dx.doi.org/10.21013/jems.v4.nl.p.6.
8. Smith T M (2009) Integrating multiple intelligences and anagogical principles into a pre-service teacher education programme. *Dissertation Abstracts International: Section A*, 69 (8), 3113.



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### RESEARCH ARTICLE

#### CHECKLIST OF FLOWERING PLANTS SURROUNDING THE WETLANDS IN VADODARA DISTRICT.

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#### Abstract

Wetland is the most productive ecosystems in the world. Aquatic plants are vital components for the proper management of wetland ecosystem for biological productivity and support various organisms. In the present study, diversity of flowering plants surrounding the wetlands in Vadodara District was carried out at selected 19 wetlands in 6 talukas.

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#### Introduction:-

Wetlands are “lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water.” Its features were (a) at least intermittently, the land supports chiefly hydrophytes (b) the substrate is chiefly undrained hydric soil (c) the substrate is non-soil and is saturated with water at some time throughout the growing season of the year.

Over the last era significant struggle which directed to the conservation and wise use of wetlands (Jonauskas, 1996; Finlayson, Hall and Bayliss 1998; Blackman, 1995). However, available knowledge or information for some wetlands are at the most basic level, as information on physical and ecological features, values and benefits, land tenure and uses, threats and disturbances, and monitoring and restoration of all wetlands is not available (Finlayson, Hall and Bayliss 1998). The wise use and conservation of wetlands will be partly needful on a greatly expanded information base. Data on the ecological character of wetlands, which is the amount of wetland loss and degradation, conservation measures and the success of monitoring strategies will be required. Moreover, this information base requires linkage and integration with executive processes (Finlayson, 1995). Classification and account of wetlands are processes designed to deliver a key point on wetlands and their resources (Finlayson, 1933). Aquatic biodiversity is dependent on hydrologic regime; geological conditions and efforts are being made to conserve the biodiversity found in wetlands, streams and rivers. The goal of this irreplaceable biodiversity is to minimize its loss through sustainable management and conservation practices. The first step in conservation of biodiversity is to assess the diversity of natural resources present and identify those, which are important and most irreplaceable (Groombridge & Jenkins 1998). The total numbers of aquatic plant species exceed 1200 and a partial list of animal for aquatic and wetland system is given by Gopal (1995). Wetlands are also important as resting sites for migratory birds. Avifauna species found in India have been listed by Gopal (1995).

Wetlands are one of the most valuable and important natural environments. They provide suitable habitats to innumerable organisms including birds. Wetlands in India cover an area of 58.2 million hectares (Prasad et al., 2002). Of 1340 bird species found in India (Ali and Ripley, 1987), 310 species are known to be wetland birds (Kumar et al., 2005). Mitsch and Gosselink (2000) stated that wetlands help in maintaining biodiversity of flora and

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fauna and it was further emphasized in the study that countless species of birds, mammals, reptiles, amphibians, fish and invertebrate species depend on water and wetland vegetation for their survival. Similar observations on wetlands were also made by Buckton (2007).

### Materials and Methods:-

**Study Area:** Vadodara is situated on the banks of the river Vishwamitri (whose name is derived from the great saint Rishi Vishwamitra). The city was once called Chandravati, after its ruler Raja Chandan, then Viravati, the abode of the brave, and then Vadpatra because of the abundance of banyan trees on the banks of the Vishwamitri. From Vadpatra it derived its present name Baroda or Vadodara. It is located at 22.30°N 73.19°E in western India at an elevation of 39 meters (123 feet) Occupying an area of 4138 sq. km.

In the present study 6 talukas are undertaken which are Vadodara, Karjan, Padra, Savli, Vaghodiya and Dabhoi.



Figure No 1: Map showing talukas of Vadodara District

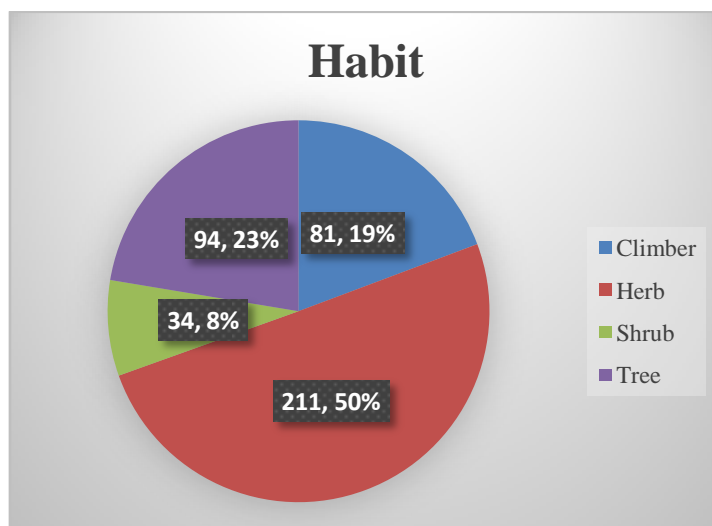
**Methodology:** The study has been conducted in wetlands of different talukas of Vadodara district during 2012-14.

**Flora:** During the field study, plants were documented and plant specimens were also collected along with their flowering and fruiting parts for preparing herbarium. These herbaria are useful for identifying the specimens from the flora. The herbarium sheets were labelled, numbered and deposited in the Herbarium of Gujarat University. The plant species were identified with the help of available literature in the library (Department of Botany, Gujarat University, Ahmedabad). Photographs of plants were captured with a SLR camera.

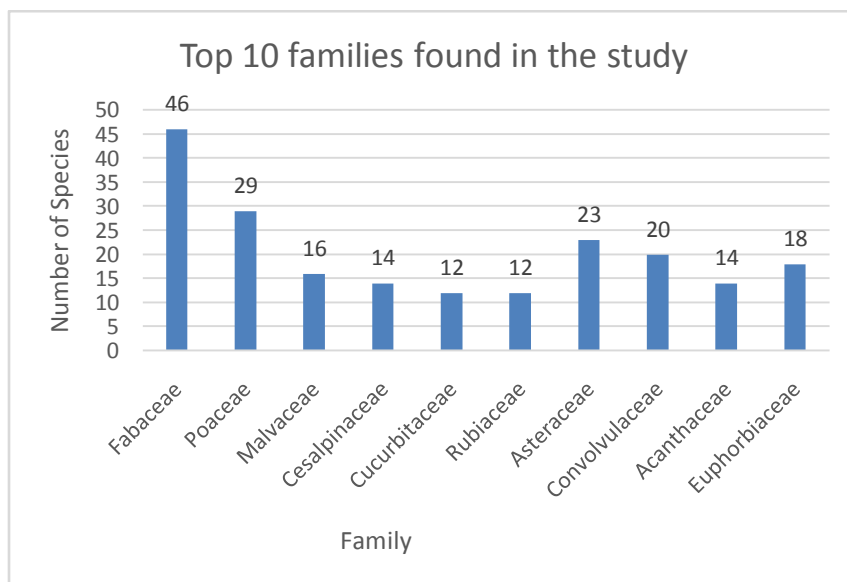
**Fauna:** Observations were made by conducting field visits at regular intervals. Fieldwork was conducted from 2012 - 2014. Field visits were made every month during the study period, to monitor three distinct seasons (i.e. winter, summer and monsoon). The observations were carried out with a pair of binoculars and the species were identified using recognized field guides like those of Ali & Ripley (1983), Grimmett et al. (1998), Rasmussen & Anderton (2005), etc.

### Result and Discussion:-

In the present study 420 species and 330 genera of vascular plants belonging to 91 families were reported. Out of 420 species, there are 211 herbs, 94 trees, 81 climbers and 34 shrubs reported (Graph No. 1). List of plants found in the present study were listed in Table No. 1 along with Botanical name, family and local name. In the present study Fabaceae is found largest family (46 species), followed by Poaceae (29 speceae), Asteraceae (23species), Convolvulaceae (20 species) and rest are below 20 species.



**Graph No. 1:** Graph showing the habit of flowering plants.



**Graph No. 2:** Graph showing the top 10 families found in the present study.

**Table No. 1:** List of flowering plants found nearby the wetlands in Vadodara district.

<b>List of vascular plants surrounding the Wetlands in Vadodara district.</b>			
<b>Sr. No.</b>	<b>Family</b>	<b>Botanical Name</b>	<b>Common name</b>
1	Menispermaceae	<u>Cocculushirsutus</u> (L.) Theob.	Vevdi
2		<u>Cocculuspendulus</u> (Forst.) Diels	Orad, Valur
3		<u>Tinosporaglabra</u> (Burm. f.) Merrill	Gulvel, Gadu, Gudaj vel
4		<u>Nymphaeanauchali</u> Burm. f.	Kamal, Poyana, Kamalful
5		<u>Nymphaeapubescens</u> Willd.	Kamal, Poyana, Kamalful
6	Nelumbonaceae	<u>Nelumbonucifera</u> Gaertn.	Vado kamalful, Suryakamal
7	Papaveraceae	<u>Argemonemexicana</u> L.	Darudi
8	Cleomaceae	<u>Cleome rutidosperma</u> DC.	
9		<u>Cleomeviscosa</u> L.	Pili -Tilvan
10	Cochlospermaceae	<u>Cochlospermumreligiosum</u> (L.) Alst.	
11		<u>Carseariagraveolens</u> Dalz.	Tandol
12	Flacourtiaceae	<u>Flacourtiaindica</u> (Burm. f.) Merr.	Kirambira Kirmira
13	Portulacaceae	<u>Portulacagrandiflora</u> Hk. f.	Chini-Gulab
14		<u>Portulacagranulato-stellulata</u> (Poelln.) Ricceri & Arrigoni	
15		<u>Portulacaoleracea</u> L.	Motiluni, Lakha luni
16		<u>Talinum portulacifolium</u> (Forssk.) Asch.ex Schweinf.	
17	Malvaceae	<u>Abelmoschusesculentus</u> (L.) Moench.	Bhinda, bhindi
18		<u>Abutilonglaucum</u> (Cav.) Sw.	
19		<u>Abutilonindicum</u> (L.) Sw.	Khapat, Dabaliar
20		<u>Gossypiumherbaceum</u> L. var. <u>acerifolium</u> (Guill. & Perr.) Chevalier	Kapas, Desi Kapas
21		<u>Hibiscuscannabinus</u> L.	Ambadi
22		<u>Hibiscuslobatus</u> (Murr.) O. Ktze.	Tali
23		<u>Hibiscusrosa-sinesis</u> L.	Jasund, Jasvanti
24		<u>Hibiscusabdariffa</u> L.	Khati Bhindi, Lal-Ambadi
25		<u>Hibiscuschizopetalous</u> (Masters) Hk. f.	
26		<u>Malachracapitata</u> (L.) L.	Pardeshi Bhindo
27		<u>Malvastrumcoromandelianum</u> (L.) Garcke	
28		<u>Pavoniaodorata</u> Willd.	Kalavala, Sugandh Bala
29		<u>Sidaacuta</u> Burm.f.	Bala
30		<u>Sidacordata</u> (Burm.f.) Boiss	Bhoyabala
31		<u>Sidacordifolia</u> L.	Bala, Baladana, Kharenti
32		<u>Urenalobata</u> L.	Vagadau Bhindo
33	Bombacaceae	<u>Salmaliarubra</u> (Buch.-Ham.) S. Dutta & P. Harvey	Savar, Shimlo
34		<u>Helicteresisora</u> L.	Maradsing, ati, Atai
35		<u>Melochiacorchorifolia</u> L.	Chuncha, Khapat
36		<u>Sterculiaurens</u> Roxb.	Kadai, Kadio, Kadya
37	Tiliaceae	<u>Corchorusaestuans</u> L.	Chunch, Chhadhari chunch
38		<u>Corchoruscapsularis</u> L.	Bor Chhunchi
39		<u>Corchorusolitorins</u> L.	

40		<u>Corchorustridens</u> L.	
41		<u>Grewiatiliaefolia</u> vahl.	Dhaman
42		<u>Microcospaniculata</u> L.	
43		<u>Triumfettapentandra</u> A. Rich.	
44		<u>Triunfettarhomboidea</u> Jacq.	
45	Malpighiaceae	<u>Hiptagebenghalensis</u> (L.) Kurz.	
46	Zygophyllaceae	<u>Tribulusterrestris</u> L.	Gokharu
47	Oxalidaceae	<u>Biophytumsensitivum</u> (L.) DC.	
48		<u>Oxaliscorniculata</u> L.	
49	Balsaminaceae	<u>Impatiens balsamina</u> L.	
50		<u>Impatiensminor</u> (D.C.) Bennet.	
51	Rutaceae	<u>Aeglemarmelos</u> (L.) Correa	Bil
52		<u>Citrus limon</u> (L.) Osbeck	Limbu
53	Balanitaceae	<u>Balanitesaegyptiaca</u> (L.) Del.	Ingoriyo
54	Burseraceae	<u>Boswelliaserrata</u> Roxb. ex Colebr.	Salai gugal
55		<u>Garugapinnata</u> Roxb.	Kakad
56	Meliaceae	<u>Azadirachta indica</u> Juss.	Limbado
57		<u>Meliaazedarach</u> L.	Bakam limdo
58	Celastraceae	<u>Cassineglauc</u> (Rottb.) O. Ktze.	Bhutad
59		<u>Celastruspaniculatus</u> Willd.	
60	Rhamnaceae	<u>Ventilagodenticulata</u> Willd.	
61		<u>Ziziphusmauritiana</u> Lamk.	Bor
62		<u>Zizyphusoenoplia</u> (L.) Mill.	
63		<u>Zizyphusrugosa</u> Lamk.	Ghatbor
64	Vitaceae	<u>Cayratia trifolia</u> (L.) Domin.	
65		<u>Cissusquadrangularis</u> L.	Had-sakal
66		<u>Cissusrepanda</u> Vahl	
67	Sapindaceae	<u>Cardiospermumhalicacabum</u> L.	
68		<u>Sapindusemarginatus</u> Vahl	Aritha
69		<u>Sapinduslaurifolius</u> Vahl.	Aritha
70	Anacardiaceae	<u>Anacardium occidentale</u> L.	Kaju
71	Asteraceae	<u>Lanneacoromandelic</u> (Houtt.) Merr.	Modal
72		<u>Mangifera indica</u> L.	Ambo
73		<u>Semecarpusanacardium</u> L.f.	
74		<u>Spondiaspinnata</u> (L.f.) Kurz.	Ambado
75	Moringaceae	<u>Moringaoleifera</u> Lamk.	Sargavo
76	Fabaceae	<u>Abrusprecatorius</u> L.	Chanothi
77		<u>Aeschynomene indica</u> L.	
78		<u>Aeschynomene Americana</u>	
79		<u>Alysicarpusheyneanus</u> Wt. & Arn.	
80		<u>Alysicarpuslongifolius</u> (Rott.ex Spr.) Wt. & Arn.	
81		<u>Alysicarpusvaginalis</u> (L.) DC.	
82		<u>Arachishypogea</u> L.	Magfali
83		<u>Cajanusscarabaoides</u> (L.) Thouars.	
84		<u>Cajanuscajan</u> (L.) Huth	Tuver
85		<u>Buteamonosperma</u> (Lamk.) Taub.	Kesudo
86		<u>Canavaliagladiata</u> (Jacq.) DC.	
87		<u>Canavaliacathartica</u> Thouars	
88		<u>Cicerarietinum</u> L.	Channa
89		<u>Clitoriaannua</u> Graham	
90		<u>Clitoriaternatea</u> L.	
91		<u>Crotalariaalbida</u> Heyne ex. Roth	
92		<u>Crotalariafilipes</u> Bth. var. <u>trichophora</u> (Bth. ex Baker) Cooke	

93		<u>Crotalariajuncea</u> L.	
94		<u>Crotalaria medicaginea</u> Lamk.	
95		<u>Crotalaria prostrata</u> Rottl.	
96		<u>Crotalaria triquetra</u> Dalz.	
97		<u>Dalbergialatifolia</u> Roxb.	Sisam
98		<u>Dalbergiasissoo</u> Roxb. ex DC.	Sisoo
99		<u>Dalbergiavolubilis</u> Roxb.	Patarali
100		<u>Derrisscandens</u> (Roxb.) Bth.	
101		<u>Desmodium gangeticum</u> (L.) DC.	
102		<u>Erythrina suberosa</u> Roxb.	Pangaro
103		<u>Erythrina variegata</u> L.	Pangaro
104		<u>Indigoferacordifolia</u> Heyne ex Roth	
105		<u>Indigoferaglandulosa</u> Roxb.	
106		<u>Indigoferatinctoria</u> L.	
107		<u>Paracalyxscariosus</u> (Roxb.) Ali	
108		<u>Pterocarpus marsupium</u> Roxb., var. <u>acuminata</u> Prain	Biyo
109		<u>Rhynchosia minima</u> (L.) DC.	
110		<u>Rhynchosia rothii</u> Benth. ex. Ait	
111		<u>Sesbaniabispinosa</u> (Jacq.) Wight	
112		<u>Sesbaniagrandiflora</u> (L.) Pers.	
113		<u>Sesbaniasesban</u> (L.) Merrill. subsp. <u>sesban</u> var. <u>bicolor</u> (W. & A.) F. W. Adreus	
114		<u>Smithiasensitiva</u> Ait. var. <u>flava</u> (Dalz.) Cooke	
115		<u>Tephrosia tinctoria</u> (L.) Pers.	
116		<u>Tephrosia villosa</u> (L.) Pers.	
117		<u>Teramnus labialis</u> (L.f.) Spreng.	
118		<u>Vignaradiata</u> (L.) Wilizeck.	
119		<u>Vignaradiata</u> (L.) Wilizeck. var. <u>sublobata</u> (Roxb.) Verdc.	
120		<u>Vignatrilobata</u> (L.) Verdc.	
121		<u>Vignavexillata</u> (L.) A. Rich.	
122	Caesalpinaceae	<u>Bauhinia purpurea</u> L.	Kanchnar
123		<u>Bauhinia racemosa</u> Lamk.	Ashitro
124		<u>Bauhinia tomentosa</u> L.	
125		<u>Caesalpinia pulcherrima</u> (L.) Sw.	Galtaro
126		<u>Cassia fistula</u> L.	Garmalo
127		<u>Cassia mimosoides</u> L.	
128		<u>Cassia occidentalis</u> L.	
129		<u>Delonix regia</u> (Boj. G. HKP) Raf.	Gulmohar
130		<u>Peltophorum</u> sp. (Vogel) Benth.	
131		<u>Peltophorum pterocarpum</u> (DC.) Baker ex Heyne	Tamrafali
132		<u>Sennasiamea</u> (Lamk.) Irwin & Barnby	Kasid
133		<u>Senna auriculata</u> Roxb.	Aval
134		<u>Sennatoria</u> (L.) Roxb.	Kuvadiyo
135		<u>Tamarindus indica</u> L.	Amli
136	Mimosaceae	<u>Leucaena leucocephala</u> (Lamk.) De Wit.	Subaval
137		<u>Mimosapudica</u> L.	Lajamani
138		<u>Pithecellobium dulce</u> (Roxb.) Benth.	Goras-aamli
139		<u>Prosopis juliflora</u> (Sw.) DC.	Gando-baval
140		<u>Vachellia farnesiana</u> (L.) Wight & Arn.	Aniyar
141		<u>Vachellia leucophloea</u> (Roxb.) Rashmi Sharma	
142		<u>Vachellia nilotica</u> (L.) P. J. H. Hurter & Mabb.	Baval
143		<u>Vachellia pennata</u> (L.) U.C. Bapat & Rashmi Sharma	Kher-vel
144	Vahliaceae	<u>Vahliadigyna</u> (Retz.) O. Ketz.	
145		<u>Anogeissus sericosa</u> Brandis	Adruk

146	Asclepiadaceae	<u>Calycopteris floribunda</u> Lamk.	
147	Combretaceae	<u>Terminalia catappa</u> L.	Badam
148	Myrtaceae	<u>Psidium guajava</u> L.	Jamfal
149		<u>Syzygium cumini</u> (L.) Skeels	Jambu
150	Lythraceae	<u>Ammannia baccifera</u> L.	
151		<u>Lagerstroemia speciosa</u> (L.) Pers.	
152		<u>Lagerstroemia lanceolata</u> Wall.	
153		<u>Rotala densiflora</u> (Roxb.) GRRS Koehne	
154		<u>Woodfordia fruticosa</u> (L.) Kurz.	
155	Onagraceae	<u>Ludwigia perennis</u> L.	
156	Caricaceae	<u>Carica papaya</u> L.	Papaya
157	Cucurbitaceae	<u>Citrullus colocynthis</u> (L.) Schrad.	
158		<u>Citrullus lanatus</u> (Thunb) Matsumara & Nakai	
159		<u>Coccinia grandis</u> (L.) Voigt	Tindola
160		<u>Cucumis melo</u> L.	
161		<u>Cucumis sativus</u> L.	Kakadi
162		<u>Cucurbita maxima</u> Duch. ex. Lamk.	Kolu
163		<u>Lagenaria siceraria</u> (Molina) Standl.	Dudhi
164		<u>Luffa cylindrica</u> (L.) M.J. Roem.	Turiya
165		<u>Momordica dioica</u> Roxb. ex. Willd.	
166		<u>Solenanthera phylla</u> Lour.	
167		<u>Trichosanthes cucurmerina</u> L.	Jangli parval
168		<u>Trichosanthes dioica</u> Roxb.	
169	Begoniaceae	<u>Begonia crenata</u> Dryand	
170	Molluginaceae	<u>Glinus lotoides</u> L.	
171		<u>Glinus oppositifolius</u> (L.) A. DC.	
172		<u>Mollugo pentaphylla</u> L.	
173		<u>Trianthema portulacastrum</u> L.	
174	Umbelliferae	<u>Cuminum cyminum</u> L.	Jira
175		<u>Daucus carota</u> L.	Gajar
176		<u>Foeniculum vulgare</u> Miller	Variyali
177	Alangiaceae	<u>Alangium salviifolium</u> (L.f.) Wangerin	Ankol
178	Rubiaceae	<u>Borreria articularis</u> (L.f.) F. N. Will.	
179		<u>Catunaregam spinosa</u> (Thunb.) Tirveng.	
180		<u>Gardenia resinifera</u> Roth.	
181		<u>Ixorabrachiata</u> Roxb.	Ixora
182		<u>Ixoracoccinea</u> L.	Ixora
183		<u>Meyna laxiflora</u> Robyns	
184		<u>Mitragyna parvifolia</u> (Roxb.) Korth.	Kalam
185		<u>Morinda citrifolia</u> L.	Aal
186		<u>Morinda tomentosa</u> Heyne ex Roth	Aal
187		<u>Oldenlandia corymbosa</u> L.	
188		<u>Oldenlandia herbacea</u> (L.) Roxb.	
189		<u>Xeromphis uliginosa</u> (Retz.) Maheshwari	
190	Asteraceae	<u>Acanthospermum hispidum</u> DC.	
191		<u>Ageratum conyzoides</u> L.	
192		<u>Bidens bipinnata</u> L.	
193		<u>Blumea eriandra</u> DC.	
194		<u>Blumea lacera</u> (Burm. f.) DC.	
195		<u>Caesulia axillaria</u> Roxb.	
196		<u>Conyza stricta</u> Willd.	
197		<u>Cyathocline purpurea</u> (D. Don.) O. Ktze.	
198		<u>Echinopsechinatus</u> Roxb.	Kanto-selio

199		<u>Ecliptaprostrata</u> (L.) L.	Bhrungraj
200		<u>Elephantopus scaber</u> L.	
201		<u>Emiliasonchifolia</u> (L.) DC.	
202		<u>Gnaphalium luteo-album</u> L.	
203		<u>Grangea maderaspatana</u> (L.) Poir.	
204		<u>Launea procumbens</u> (Roxb.) Ramayya & Rajgopal	
205		<u>Parthenium hysterophorus</u> L.	Congres grass
206		<u>Pluchea tomentosa</u> DC.	
207		<u>Sphaeranthus indicus</u> L.	Gorakh-mundi
208		<u>Spilanthes calva</u> DC.	Akalkarar
209		<u>Synedrella nodiflora</u> (L.) Gaertn.	
210		<u>Tricholepis amplexicaulis</u> Cl.	
211		<u>Tridax procumbens</u> (L.) L.	
212		<u>Vernonia cinerea</u> (L.) Less.	
213	Plumbaginaceae	<u>Plumbago zeylanica</u> L.	Chitrak
214	Sapotaceae	<u>Manilkara hexandra</u> (Roxb.) Dub.	Khirmi, Rayan
215		<u>Manilkara zapota</u> (L.) var. <u>royen</u>	Chiku
216		<u>Mimusops elengi</u> L.	Borsali
217		<u>Diospyros montana</u> Roxb.	Timbaru
218	Oleaceae	<u>Jasminum hirsutum</u> L.	
219		<u>Nyctanthes arbor-tristis</u> L.	Parijatak
220	Salvadoraceae	<u>Salvadora oleoides</u> Decne	Pilu
221		<u>Salvadora persica</u> L.	Pilodi
222	Apocynaceae	<u>Pergularia diamea</u> (Forssk.) Chiv.	Utarani, Kurmuda, Rankaral
223		<u>Cascabela thevetia</u> (L.) Lippold	Pili karen
224		<u>Tylophora dalzellii</u> Hook.f.	
225	Periplocaceae	<u>Cryptolepis dubia</u> (Burm.f.) Almeida	Kali-kauli, Krishna-sariva
226		<u>Hemidesmus indicus</u> (L.) Schult.	Kauli, Anantmul, Uparsal
227		<u>Hemidesmus indicus</u> (L.) Schult. var. <u>pubescens</u> (Wt. & Arn.) Hk.f.	Kaulicha-vel
228	Asclepiadaceae	<u>Calotropis gigantea</u> (L.) Dryand.	Akado
229	Amaranthaceae	<u>Dregea volubilis</u> (L. f.) Bth. ex. Hk. f.	
230	Asclepiadaceae	<u>Pergularia daemia</u> (Forsk).	Amar-dudheli
231		<u>Saricostemma acidum</u> (L.) Holm.	
232		<u>Telosma pallida</u> (Roxb.) Craib	
233	Gentianaceae	<u>Canscora diffusa</u> (Vahl) R.Br. ex Roem. & Schult.	
234		<u>Enicostema axillare</u> (Poir. ex Lam.) A.Raynal	
235		<u>Exacum pedunculatum</u> L.	
236	Menyanthaceae	<u>Nymphoides parvifolium</u> (Griseb.) O. Ktze.	
237	Hydrophyllaceae	<u>Hydrolea zeylanica</u> (L.) Vahl.	
238	Ehretiaceae	<u>Cordia dichotoma</u> Frost.	Gunda
239	Boraginaceae	<u>Cordia sinensis</u> Lam.	
240		<u>Ehretia aspera</u> Roxb.	
241		<u>Coldenia procumbens</u> L.	
242		<u>Heliotropium indicum</u> L.	Hathisundi
243		<u>Heliotropium paniculatum</u> R. Br.	
244		<u>Trichodesma indicum</u> (L.) R. Br.	
245	Convolvulaceae	<u>Argyreia sericea</u> Dalz.	
246		<u>Evolvulus alsinoides</u> (L.) L.	Sankhpushpi
247		<u>Evolvulus nummularius</u> (L.) L.	
248		<u>Ipomea aquatica</u> Forsk.	



249		<u>Ipomeabatatas</u> (L.) Lam.	Sakariya
250		<u>Ipomeacairica</u> (L.) Sw.	
251		<u>Ipomoeaeriocapa</u> R. Br.	
252		<u>Ipomoeafistulosa</u> Mart. ex Choisy	
253		<u>Ipomoeahederifolia</u> L.	
254		<u>Ipomoeaindica</u> (Burm.) Mem.	
255		<u>Ipomoeanil</u> (L.) Roth.	
256		<u>Ipomoeaobscura</u> (L.) Ker-Gawl.	
257		<u>Ipomeapes-tigridis</u> L.	
258		<u>Ipomoea marginata</u> (Desr.) Verdc.	
259		<u>Ipomoeatriloba</u> L.	
260		<u>Merremiahederacea</u> (Burm.f.) Hall. f.	
261		<u>Merremia tridentata</u> (L.) Hall. f.	
262		<u>Merremiavitifolia</u> (Burm. f.) Hall. f.	
263		<u>Operculina turpethum</u> (L.) Silva	
264		<u>Riveahypocrateriformis</u> . Choisy	
265	Cuscutaceae	<u>Cuscutachinensis</u> Lam.	Amarvel
266	Solanaceae	<u>Capsicumannuum</u> L.	Marcha
267		<u>Physalisminima</u> L.	
268		<u>Solanumnigrum</u> L.	
269		<u>Withaniasomnifera</u> (L.) Dunal	
270	Scrophulariaceae	<u>Bacopa monnieri</u> (L.) Wettst.	Bam, Jalnaveri
271		<u>Lindenbergiaindica</u> (L.) O. Ktze.	Pirsadedi, Zamarval, Patharchati
272		<u>Linderniaantipoda</u> (L.) Alst.	
273		<u>Linderniaciliata</u> (Colsm.) Pennell	
274		<u>Linderniaparviflora</u> (Roxb.) Haines	
275		<u>Scopariadulcis</u> L.	
276		<u>Sopubiadelphiniifolia</u> (L.) G. Don.	
277		<u>Verbascumchinese</u> (L.) Santapau	Kalhar, Kolhala
278		<u>Veronicaanagallis-aquatica</u> L.	
279	Orobanchaceae	<u>Strigaangustifolia</u> (D. Don) Saldhana	Dholo agio, Kunvario agio
280	Bignoniaceae	<u>Dolichandronespathacea</u> (L.f.) K. Schum.	Medsingi
281		<u>Millingtoniahortensis</u> L.	Deshi Buch
282		<u>Oroxylumindicum</u> (L.) Vent.	Tetu
283		<u>Tabebuiaapentaphylla</u> (L.) Hemsl.	
284		<u>Tecoma stans</u> (L.) Juss. ex Kunth	
285	Pedaliaceae	<u>Pedaliummurex</u> L.	Ubhu Gokhru
286		<u>Sesamumindicum</u> L.	Tal
287	Martyniaceae	<u>Martyniaannua</u> L.	Vinchhudo
288	Acanthaceae	<u>Adhatodavasica</u> (L.) Nees.	Ardusi
289		<u>Blepharis maderaspatensis</u> (L.) B. Heyne ex Roth.	Untigan, Utanjan chokd
290		<u>Elytrariaacaulis</u> (L.f.) Lindau	
291		<u>Hygrophilaauriculata</u> (Schum.) Heine	
292		<u>Justiciagendarussa</u> Burm. f.	
293		<u>Justicia japonica</u> Thunb.	
294		<u>Lepidagathiscristata</u> Willd.	
295		<u>Lepidagathistrinervia</u> Wall.	Harancharo, Paniru
296		<u>Neuracanthussphaerostachyus</u> (Nees.) Dalz.	Ganthera
297		<u>Ruelliatuberosa</u> L.	Fatkai
298		<u>Rungiapectinata</u> (L.) Nees	Khadsello

299		<u>Rungiarepens.</u> (L.) Nees	
300		<u>Thunbergia erecta</u> (Bth.) T. Anders.	
301		<u>Thunbergia grandiflora</u> (Roxb ex Rottl.) Roxb.	
302	Verbenaceae	<u>Clerodendrum inerme</u> (L.) Gaertn.	
303		<u>Clerodendrum serratum</u> (L.) Moon	Bharungi
304		<u>Gmelina arborea</u> Roxb.	Sivan
305		<u>Gmelina asiatica</u> L.	
306		<u>Gmelina philippensis</u> Cham.	
307		<u>Lantanacamera</u> L. var. <u>aculeata</u> (L.) Mold.	Lantana
308		<u>Vitex negundo</u> L.	Nagod, Nagud
309	Lamiaceae	<u>Hyptissuaveolens</u> (L.) Poit.	
310		<u>Leucas aspera</u> (Willd.) Link.	Kubi
311		<u>Leucas biflora</u> (Vahl) Sm.	
312		<u>Plectranthus mollis</u> (Ait.) Spreng.	
313		<u>Pogostemon parviflora</u> Bth.	
314	Nyctaginaceae	<u>Boerhavia diffusa</u> L.	Satodi
315		<u>Boerhavia chinensis</u> (L.) Rottb.	
316		<u>Mirabilis jalapa</u> L.	Gulbas
317		<u>Pisonia mitis</u> L.	Velati, Salet
318	Amaranthaceae	<u>Achyranthes aspera</u> L.	Anghedi
319		<u>Aerva lanata</u> (L.) Juss. ex Sch.	Kapuri madhuri
320		<u>Amaranthus spinosus</u> L.	
321		<u>Amaranthus viridis</u> L.	
322		<u>Gomphrenaceae</u> Mart.	
323		<u>Pupalia lappacea</u> (L.) Juss.	
324	Basellaceae	<u>Basella rubra</u> L.	Poi
325	Polygonaceae	<u>Antigonon leptopus</u> Hook. & Arn.	Ice cream creeper
326		<u>Persicaria glabra</u> (Willd.) Gomez.	
327	Loranthaceae	<u>Dendrophthoe falcata</u> (L. f.) Ettingsh.	Vando
328		<u>Viscum articulatum</u> Burm.f.	
329	Santalaceae	<u>Santalum album</u> L.	Chandan
330	Euphorbiaceae	<u>Acalypha ciliata</u> Forsk.	Dadari
331		<u>Acalypha indica</u> L.	Dadari
332		<u>Bridelia spinosa</u> Willd.	Asan
333		<u>Bridelia squamosa</u> (Lam.) Gehrm.	Asan
334		<u>Chamaesyce hirta</u> (L.) Millsp.	
335		<u>Chamaecyathium folia</u> (L.) Millsp.	
336		<u>Chrozophora rotleri</u> (Geis.) Juss.	Okharad
337		<u>Euphorbia antiquorum</u> L.	Thor
338		<u>Euphorbia nerii folia</u> L.	Thor
339		<u>Jatropha gossypifolia</u> L.	
340		<u>Kirganelia reticulata</u> (Poir) Bail.	Pichrun
341		<u>Mallotus philippensis</u> (Lamk.) Muell.-Arg.	Kapilo
342		<u>Pedilanthus tithymaloides</u> (L.) Poit.	Vilayati-kharsan
343		<u>Phyllanthus emblica</u> L.	Aavla
344		<u>Phyllanthus erecta</u> (Medic.) Almeida	Bhonya amla
345		<u>Phyllanthus maderaspatensis</u> L.	Bakarato
346		<u>Ricinus communis</u> L.	
347		<u>Securinega leucopyros</u> (Willd.) Muell.-Arg. in DC.	Chhini, Shenvi
348	Ulmaceae	<u>Holoptelea integrifolia</u> (Roxb.) Planch.	Kanjo, Papda
349		<u>Trema orientalis</u> (L.) Blume	Gol
350	Moraceae	<u>Artocarpus heterophyllus</u> Lamk.	Phanas, Jack-fruit
351		<u>Ficus benghalensis</u> L.	Vad

352		<u>Ficus carica</u> L.	Anjir
353		<u>Ficus hispida</u> L.f.	Dhedh Umbaro
354		<u>Ficus racemosa</u> L.	Umbaro
355		<u>Ficus religiosa</u> L.	Pipal
356		<u>Ficus virens</u> Dryand	Payar
357		<u>Morus alba</u> L.	Shetur
358		<u>Streblus asper</u> Lour.	Harero
359	Costaceae	<u>Costus speciosus</u> (Koen. ex Retz.) Smith	Pavuta
360	Amaryllidaceae	<u>Crinum asiaticum</u> L.	
361	Taccaceae	<u>Tacca leontopetaloides</u> (L.) Kuntze	
362	Liliaceae	<u>Gloriosa superba</u> L.	
363	Pontederiaceae	<u>Eichhornia crassipes</u> (Mart.) Solms.	Kanphutti
364	Commelinaceae	<u>Amischophacelus cucullata</u> (Roth) Rolla Rao & Kammathy	
365		<u>Commelinabenghalensis</u> L.	
366		<u>Commelinadiffusa</u> Burm.f.	
367		<u>Commelina erecta</u> L.	
368		<u>Cyanotis cristata</u> (L.) D. Don	
369		<u>Murdannia nudiflora</u> (L.) Brenan	
370	Arecaceae	<u>Arecacatechu</u> L.	Sopari
371		<u>Borassus flabelifer</u> L.	Tad
372	Typhaceae	<u>Typhadomingensis</u> Pers.	
373	Araceae	<u>Amorphophallus commutatus</u> Engler	
374	Lemnaceae	<u>Lemnagibba</u> L.	
375	Lemnaceae	<u>Wolffia arrhiza</u> (L.) Wimmer	
376	Potamogetonaceae	<u>Potamogeton crispus</u> L.	
377	Cyperaceae	<u>Cyperus alternifolius</u> L.	Umbrella plant
378		<u>Cyperus bulbosus</u> Vahl	
379		<u>Cyperus compressus</u> L.	
380		<u>Cyperus corymbosus</u> Rottb.	
381		<u>Cyperus difformis</u> L.	
382		<u>Cyperus esculentus</u> L.	
383		<u>Cyperus exaltatus</u> Retz.	
384		<u>Cyperus iria</u> L.	
385		<u>Cyperus rotundus</u> L.	Chido
386		<u>Eleocharis atropurpurea</u> (Retz.) Presl.	
387		<u>Fimbristylis bis-umbellata</u> (Forsk.) Bub.	
388		<u>Fimbristylis dichotoma</u> (L.) Vahl, Cooke	
389		<u>Fuirena ciliaris</u> (L.) Roxb.	
390		<u>Schoenoplectus articulatus</u> (L.) Palla	
391		<u>Apludamutica</u> L.	Harantodi, Godval
392	Poaceae	<u>Aristida adscensionis</u> L.	
393		<u>Bambusa arundinacea</u> (Retz.) Willd.	
394		<u>Brachiaria ramosa</u> (L.) Stapf	
395		<u>Chloris barbata</u> Sw.	Mindadiu
396		<u>Chrysopogon fulvus</u> (Spreng.) Chiov.	Draf, Kharalu
397		<u>Coix lachryma-jobi</u> L.	Kahudo, Kasai
398		<u>Cymbopogon citratus</u> (DC.) Stapf	Lili chaha
399		<u>Cynodon dactylon</u> (L.) Pers.	Darbha
400		<u>Dactyloctenium aegyptium</u> (L.) Willd.	
401		<u>Dendrocalamus strictus</u> (Roxb.) Nees	Narvans
402		<u>Desmostachya bipinnata</u> (L.) Stapf in Dyer	Manga, Darbha
403		<u>Dichanthium annulatum</u> (Forssk.) Stapf	
404		<u>Digitaria ciliaris</u> (Retz.) Koeler	

405	<u>Echinochloacolona</u> (L.) Link	Samo
406	<u>Eleusinecoracana</u> (L.) Gaertn.	Nagli
407	<u>Eleusineindica</u> (L.) Gaertn.	Ukdo
408	<u>Eragrostistenella</u> (L.) P. Beauv. ex Roem. & Schult.	
409	<u>Eragrostisuniloides</u> (Retz.) Nees ex Steud.	
410	<u>Eremopogonfoveolatus</u> (Delile) Stapf	
411	<u>Heteropogoncontortus</u> (L.) P. Beauv. ex Roem. & Schult.	
412	<u>Ischaemumrugosum</u> Salib.	
413	<u>Oplismenuscompositus</u> (L.) P. Beauv.	
414	<u>Oryzasativa</u> L.	Bhat, Chokha
415	<u>Paspalidiumflavidum</u> (Retz.) A. Camus	Jinko-samo
416	<u>Pennisetumglaucum</u> (L.) R.Br.	Bajra
417	<u>Saccharumofficinarum</u> L.	Sherdi
418	<u>Setariaglauca</u> (L.) Beauv.	
419	<u>Sorghumhalepense</u> (L.) Pers.	Baru
420	<u>Triticumaestivum</u> L.	Ghahun

### Conclusion:-

In the present study 420 species and 330 genera of flowering plants belonging to 91 families which provide basics for survival for others animal including birds, reptiles, amphibians and insects. Many wetlands are vital bird's habitats and bird's usage them as migratory resorts for breeding, nesting and rearing young once. Some water birds like Grebes have adapted to wetlands to such range to survive as an individual species depends on the accessibility of food and shelter in certain types of wetlands within their geographic ranges.

### References:-

1. Ali S and Ripley SD (1987) Compact Handbook of the Birds of India and Pakistan. Oxford University Press, Bombay.
2. Blackland JG, Gardiner SJ, Morgan MG (1995) Framework for biogeographic inventory, assessment, planning and management of wetland systems: The Queensland approach. Wetland research in the Wet-Dry tropics of Australia.
3. Brown M and Dinsmore JJ (1986) Implications of marsh size and isolation for marsh bird management. The Journal of Wildlife Management, 1:392-7.
4. Bryce SA, Hughes RM, Kaufmann PR. Development of a bird integrity index: using bird assemblages as indicators of riparian condition. Environmental management. 2002 Aug 1;30(2):294-310.
5. Cherry JA (2012) Ecology of wetland ecosystems: water, substrate, and life. *Nature Education Knowledge*, 3(10):16.
6. Cooke T (1967) The Flora of the Presidency of Bombay. Volume I, II and III. Botanical Survey of India, Calcutta.
7. Finlayson CM (1995) Wetland research in the wet-dry tropics of Australia. In Workshop, Jabiru NT, 22-24.
8. Finlayson CM (1999.) Information needs for wetland management. Max Finlayson and Abbie Speirs.
9. Finlayson CM, Hall R, Bayliss B (1998) Regional review of wetlands management issues: wet-dry tropics of northern Australia. Land and Water Resources Research and Development Corporation.
10. Gonzalves EA and Joshi DB (1985) The seasonal sucession of the algae in a tank of Bandra. Journal of Bombay Natural History Society. 46: 154-176.
11. Gopal B (2005) Biodiversity in Freshwater Ecosystems Including Wetlands, Biodiversity and Conservation in India, A Status Report.
12. Gosselink JG and Turner RE (1978) Role of hydrology in freshwater wetland ecosystems. Freshwater wetlands.
13. Groombridge B and Jenkins M (1998) Freshwater biodiversity: a preliminary global assessment. Mitsch WJ and Gosselink JG (2000) The value of wetlands: importance of scale and landscape setting. Ecological Economics, 35(200): 25-33.
14. Nirmal Kumar JI, Kumar RN, Bhatt I (2005) Study of Cultural Eutrophication in Relation to Plant Diversity of Wetland: Ratheshwar in Central Gujarat. Aquatic Biodiversity in India: *The Present Scenario*, 243.
15. Parikh P, Unadkat K and Nagar P (2015) Study of aquatic weeds in two ponds of Vadodara, Gujarat. *IJAPRR (International Peer Reviewed Refereed Journal)*, 2(1);1-7.

16. Prasad SN, Ramachandra TV, Ahalya N, Sengupta T, Kumar A, Tiwari AK, Vijayan VS and Vijayan L (2002) Conservation of wetlands of India-a review. *Tropical Ecology*, 43(1):173-86.
17. Shah GL (1978) The flora of Gujarat State. Vol-I and II. Sardar Patel University Press, Vallabh Vidhyanagar, Anand, India.
18. Singh DH (2003) Marine Protected Areas of India: Status of Coastal Wetland Conservation. *Gujarat Ecological Education and Research Foundation*, Gandhinagar.
19. Solanki HA (2001) Study on pollution of soils and water reservoirs near industrial areas of Baroda. *Ph.D Thesis submitted to Bhavnagar University, Bhavnagar*.
20. Soni HB, Dabhi M and Thomas S (2013) Surface water quality assessment and conservation measures of two pond ecosystems of Central Gujarat. *International Research Journal of Chemistry*, 3(3):69-81.
21. Verboom J, Foppen R, Chardon P, Opdam P and Luttikhuisen P (2001) Introducing the key patch approach for habitat networks with persistent populations: an example for marshland birds. *Biological conservation*, 100(1):89-101.

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### RESEARCH ARTICLE

#### Educational Philosophy of Thomas Gavan Duffy: with special reference to the Methods of Teaching in the Primary Schools and its significant impacts on Modern Education.

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Educational Philosophy, methods of teaching, impacts of the methods, Holistic formation and education of the masses.

#### Abstract

Educational Philosophy is the applied philosophy. Education and Philosophy are closely interrelated and complementary to each other. Every aspect of education has a philosophical base. The aims of education, curriculum, methods of teaching, the system of discipline, the role of teachers etc., are influenced and determined by Philosophy. Thomas Gavan Duffy was an eminent Educational Philosopher who founded, guided and developed hundreds of schools in the Presidency of Madras from 1911 to 1941. He was a son of Sir Charles Gavan Duffy, the 8<sup>th</sup> Premier of Australia. He landed Pondicherry in 1911 for the Christian Mission and committed himself for the cause of education of the underprivileged. He was one of the members in the educational council of the British Government. He was the champion of village schools and venerated by thousands of beneficiaries of his schools. His pioneering efforts in the reform of elementary educational system in the Presidency of Madras made his name legendary even in his life time among the educationists. He had evolved and explored an educational philosophy which aimed at the holistic development of the children. With the aim of giving relevant, purposeful and helpful education, he constructed the curriculum which was practical and useful, invented and introduced innovative methods of teaching, advocated school discipline which ensured self discipline, self esteem and self governance and well drafted the role and function of the teachers to achieve the objectives of education. The methods of teaching introduced by Duffy were innovative, relevant, attractive, inspiring and useful and were based on life experiences with practical aids. These methods were well directed towards the wholistic development of the children. These methods of Duffy still have great influence and significant impact on the modern education.

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#### Introduction:-

Thomas Gavan Duffy was “the Great Man” in every sphere of life. He was a great scholar, philosopher, educationist, social reformer and a man of God. He was born at Nice, France on 23<sup>rd</sup> December 1888 of an Irish father Sir Charles Gavan Duffy who fought for the freedom of his motherland and became the 8<sup>th</sup> Premier of

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Victoria. Duffy had landed to Pondicherry in 1911 for the Christian mission. Till 1941, for three decades he had been founding, guiding and developing hundreds of 'Little Schools' in the Presidency of Madras. Duffy, who had been educated in different nations, travelled far and wide and had experience of different peoples and cultures had successfully synthesized different philosophies and came with the educational philosophy for the ordinary masses. His educational philosophy is very much Naturalistic in its setting, Idealistic in its aims and objectives and Pragmatic in its method and plan of action. His educational philosophy was more ideal, practical, natural and useful and aimed at the holistic development of all irrespective of origin or religion. In the Pondicherry Mission, Duffy brought a uniformity of practice in the administration and control of village schools. He introduced the common syllabus, the same texts, the same method of teaching and standards of examination to all the little schools in the Pondicherry Mission which comprises the present civil districts of Cuddalore, Villupuram, Chengulpet, Kancheepuram, Tiruvannamalai, Vellore, Salem, Namakkal, Dharmapuri, Krishnagiri, Kumbakonam, Thanjavur, Tiruvarur of the State of Tamil Nadu and the Union Territory of Pondicherry in Indi. (Brady Gerard, Thomas Gavan Duffy, p.334). His innovative methods of teaching were very relevant and helpful to impart the quality and holistic education to the children. These methods are being used even today in the modern education.

### **Duffian Methods of Teaching in the Primary Schools:-**

Method has an important place in education. It is through method the teacher establishes and maintains the contact between the child and subject matter. Duffy was an enthusiast for the employment of novelty and imagination in the educative process. He said that talking is easy, teaching is hard; and influencing the will of the child whom God has made free is a grace given only to those who seek it very earnestly". (Brady Gerard, Thomas Gavan Duffy, p.472). Hence Duffy introduced different innovative and useful methods of teaching in the Pondicherry Mission schools in the Presidency of Madras.

### **The Correlation method:-**

'Correlation' means 'connect or to be connected'. Correlation in teaching indicates a technique which shows the reciprocal relationship between various subjects of the curriculum for making knowledge concrete and permanent. For Duffy the most objective of education was to prepare the children for future life. This objective would be achieved only if education was correlated with life. Therefore he correlated the various subjects with various aspects of life in order to make the subject relevant and practical to the day to day life of the children. For an example, Duffy introduced the theme 'cattle' for the kindergarten class. The classes started with the conversation between teacher and the children about cattle known to the children, connected with the life. The teacher also made efforts to correlate the given subject with the other subjects like Arithmetic, drawing, clay modeling, bead and stick laying, song and storytelling. (Duffy, Siruvarkalin Thozhan, Vol.6 (1931) sheet No. I A 1(1)).

By using this method of correlation, Duffy had two purposes namely to correlate the main subject with all other subjects taught on the day and to connect the subject with the day today life. It was moving from known to the unknown, simple to the complex and concrete to the abstract. It was very useful method to learn the lessons thoroughly and remember it for a long.

### **The Psychological Method:-**

Modern education is based and founded on Psychology. Rousseau once remarked, "The child is a book which the teacher has to learn from page to page". (Walia J. S., Principles and Methods of Education, p.76). Hence the whole concept of education and its implications are based upon psychological methods.

Duffy in his book, "A Think in Time" had given many guidelines to the educators to understand the child and to develop its all round personality by studying the child's interests, aptitudes, natural faculties and the limitations of the child. He reminded his collaborators often the words of Chesterton "In order to teach Latin to John....you must first know John as well as Latin....". The personal files kept about each student were a wonder of precision and care' (Arokiasamy G., (Ed.) Thozhan, 1988, p.105). Duffy followed this method in his Mission schools already in 1913, long before it was known in the educational world. (Arokiasamy, G., Thozhan, 1988, P.36).

### **Activity Based Learning (ABL) :-**

Activity Based Learning (ABL) means that learning is based on doing some hands-on experiments and activities. The idea of activity based learning is rooted in the common notion that children are active learners rather than passive recipients of information. In 1918 itself, Duffy had, with his great innovation and imagination, constructed the curriculum with a lot of activities in teaching the children. He very aptly mentioned that "Children need change.

Vary the routine, the time table, and the occupations as often as you can. Introduce some new thing. Make a fresh start. Too many of our institutions have a tendency to stagnation.’ (Duffy, A Think in Time, p.21)

Duffy admonished the educators to have a good and prior preparation for everyday class and instructed them to collect and prepare teaching aids from their village itself. Beads, pebbles, small nuts, sticks, clay models are to be used in teaching numbers, addition, multiplication and deduction. (Duffy, Siruvarkalin Thozhan, Vol.III, 1919, part 1, p.12). Thus, Activity Based Learning introduced by Duffy at the dawn of 20<sup>th</sup> Century, made a tremendous impact on the learning process of the children.

#### **Play way method:-**

Play is regarded as the language of the child. What he cannot express through language, he expresses that through his behavior and that behavior is play.

Duffy, as an innovative educational philosopher, had introduced the play way method in his curriculum. He said that “If you want the children to listen, you have to interest them. Modern pedagogy has plenty of tricks for that very purpose; use them. Begin with a story, a true story if possible, and one as close as may be to the children’s own life and interests.” (Duffy, A Think in Time, p. 49).

The underlying activities like singing songs, Music, storytelling, drawing, band, craft, bead and stick laying, play, games and drill, scouting were typical examples for the play way method of Duffy. Thus Duffy had very much insisted to use the play way method as an effective and purposeful medium of educating the children. He also periodically invented new techniques to enhance the play way system and greatly encouraged the teachers to make use of the natural materials and their own imaginative thinking to achieve this goal.

#### **Basic Education:-**

Basic is something relating to or forming/ serving as a base or basis; fundamental. Basic education “(in India) means education in which all teaching is correlated with the learning of a craft” (www. Collinsdictionary.com/dictionary/English/ Basic Education).

Duffy felt that traditional and colonial forms of education were irrelevant and un-supportive, costly, abstract and useless for the ordinary masses. In his first village school in 1913, Duffy introduced the subject cultivation which suited to the needs of the district and the capacity of the pupils. It was important that the children should be better fitted to earn their livelihood in the fields later on. The agricultural side of the school was an immediate success and soon aroused keen interests among the parents. The people from the neighborhood also flocked in great numbers to see the experiments in the school. The attraction of such manual training was a greater one for the villagers than the mere book learning of reading and writing. (Brady Gerard, Thomas Gavan Duffy, pp.230-232). This personal and practical experience and its impact on the day today life of the people was a driving force for Duffy to extend this system ‘Basic Education’ later on to all mission schools long before the name was known in India (Michael Bosco, D., Souvenir for the twenty fifth death anniversary of Thomas Gavan Duffy, 1966, p.8).

Besides Gardening and Manual labour, Duffy had also included in his Basic Education, carpentry, ironwork, bricklaying, weaving, basket making, mat weaving and other rural local crafts. Thus basic education for Duffy was a part of education aiming at development of the all round personality of the pupils and make them to be rooted to the soil with a glorious vision of the future.

#### **Self Governance method:-**

Self governance means the exercising control or rule over oneself or itself. It also means of having the right or power of self-government; autonomous. (www. the freedictionary.com/self governance).

Duffy invented and introduced the self-governance education method in the Mission schools in order to train and form the future leaders of the oppressed community.

At every school, Duffy established a ‘Students’ Panchayat’. The Panchayat was headed by a head monitor and a group of Panchayat members. They were chosen for this Panchayat for a period of a month. There were twenty five other officers who were appointed with tenure of office for a week so that all might enjoy frequent terms of office. The object of this educational method was to establish order and to develop a sense of communal responsibility. Each function had its books of rules and privileges.



In this way by the frequent rotation of these offices the pupils were trained in a variety of useful occupations and were trained to value local institutions, to feel the need of order and to exercise authority- in other words they received grounding in the elements of enlightened communal living. "It is amazing, Duffy wrote, "how soon the students began to feel and exercise their power in the community, how promptly they played up the role committed to them and how universally they came to prefer the school to the jungle and the book to the bullock." (Brady Gerard, Thomas Gavan Duffy, pp.229-230). By this method, Duffy aimed at forming the leaders for the village community as well as for the nation.

#### **Participatory Rural Appraisal (PRA) method:-**

Participatory Rural Appraisal (PRA) means involving the rural masses to find out of information about problems, needs, and potential in a village and to help them to plan, to make decisions, and to take actions towards improving their own situations.

Duffy introduced the excursion to the village resources in his curriculum. During the excursion, the teachers' work must be mainly passive and the pupils must be encouraged to see things for themselves.

The following were a few things of common interest in the ordinary village for the participatory appraisal for the children: 1. A visit to an oil mill, 2. A smithy, 3. A carpenter's shop, 4. A cycle shop, 5. A common well, 6. A village fair, 7. A mountain, stream or lake or river, 8. A crow's nest, an ant hill or wasp's nest, 9. Post office, Panchayat office, 10. Observation of a well digging operation, 11. Making a note of the effects of a heavy rain or severe storm, 12. Observation of rainbow, and 13. Observation of crops and animal husbandry. This method of education made the children to involve themselves to observe and to acquire a practical knowledge from their own local resources. It also motivated the children to think about their obligation and responsibility to the growth and development of their village in future. (Gavan Duffy, T., Siruvarkalin Thozhan, 1919, p.34)

#### **Duffian Methods of teaching and its significant impacts on Modern Education:-**

Duffy was a paramount educationist who has the credit of founding, guiding and developing hundreds of Educational institutions in South India for over three decades. He evolved and explored his own innovative methods of teaching in his schools. Duffian methods of teaching had really made a great impact on the people in the presidency of Madras and it has been continuing its influence even on today's schools.

- ❖ By Correlation method, Duffy made the lesson relevant to one's life and made it practical and useful. This method is being used in many disciplines in all levels of education and found useful for gaining the comprehensive knowledge of the subject.
- ❖ Basic Education which included compulsory Gardening, manual labour and rural crafts aimed at the holistic development of the children and made them to be rooted to the soil. It had a place in the educational policy of the Government in India.
- ❖ Self Governance Education is a system of Students' Panchayat which had given importance to the achievement of Self discipline, Self esteem, and Self reliant education.
- ❖ Psychology is an essential element in education. Studying the Psychological bases of the child like the child's interests, aptitudes, natural faculties and limitations is much needed and indispensable even today.
- ❖ 'Excursion on Rural School' is very important to learn the historical, geographical and social and Natural resources of the place.
- ❖ The Activity based learning, though it was introduced at the beginning of 20<sup>th</sup> Century by Duffy, has resulted in the tremendous impact on Modern education.
- ❖ The play way method created a joyful and attractive atmosphere to the children. It was an effective and purposeful medium of educating the children. In modern education, the play way method is being used to make teaching and learning as conducive and congenial.

#### **Conclusions:-**

Duffian methods of teaching were very innovative, inspiring, attractive, relevant and useful. Having gained thorough knowledge of the place and people, searching a solution for the ever ending school question for the poor and responding to the needs of the hour, Duffy advocated, adopted and implemented the concrete methods of teaching for the poor and the downtrodden who were deprived of their right to education and life for centuries. The Concrete method of teaching helped the people to remember their poetic verses, arithmetic, songs or story or the event till

their life time. Some methods greatly encouraged them to involve themselves to find means for their life. On the whole, Duffian methods were of new explorations for the remote rural uncivilized masses for their upliftment in all walks of life.

### References:-

1. Anand Amaladass, *Philosophy of Education*, Satya Nilayam Publications, Chennai, 2008.
2. Arokiasamy, G., (Ed.) "*Thozhan*" for Centenary Souvenir Father Thomas Gavan Duffy MEP, (1888-1988) TNBCLC, Tindivanam, 1988.
3. Brady, G., *Thomas Gavan Duffy, (1888-1941)* Dublin, Ireland, 1988.
4. Carof, A., *Catechists and Teachers in the Mission of Pondicherry (1675-1975)*, (Vol.I.: Book I- Catechists; Book II- Schools; Book III-Tindivanam and the DOS-1920-1930) Personal Notes, Pondicherry, 2003.(Unpublished).
5. Gavan Duffy, T., *A Think in Time*, St.Anthony Press, Madras, 1947.
6. Gavan Duffy, T., *Personal Diary (January 1913-July 1915)*, Translated from French to English by Carof, A., Pondicherry, 1984 (Unpublished)
7. Gavan Duffy, T., (Ed.) *Siruvarkalin Thozhan*, S.M. Press, Cuddalore, 1919.
8. Gavan Duffy, T., (Ed.) *Siruvarkalin Thozhan*, Mission Press, Pondy, 1920.
9. Gavan Duffy, T., (Ed.) *Siruvarkalin Thozhan*, R. C. Training School, Tindivanam, 1931.
10. Jacob, G., *Puduvai Mission Varalaru*, Mission Press, Pondicherry, 1976.
11. Michael Bosco, D.,(Ed.) *Souvenir for the twenty fifth death anniversary of Thomas Gavan Duffy*, Catholic Centre, Tindivanam, 1966.
12. Romesh, V., & Parjit, K, *Educational Philosophy*, Anmol Publications Pvt.,Ltd., New Delhi, 2009.
13. Sampathkumar, P.A., & Carof, A., *History of Pondicherry Mission: An outline*, University of Madras, Chennai, 1999.
14. Santhose, V., *Philosophy of Education*, APH Publishing Corporation, New Delhi, 2016.
15. Sharma, R.N., *Philosophy and Sociology of Education*, Surjeet Publications, 2003.
16. Walia, J.S., *Principles and Methods of Education*, Paul Publishers, Jalandhar, 2004.



## RESEARCH ARTICLE

### INFORMATION SECURITY THREATS: COMPUTER HACKING.

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#### Abstract

The purpose of this paper was to study information security threats, information threat, and security threats source with a threat agents. It focused on the meaning of hackers and perceptions of public against the word "hackers" with a special emphasis on different types of hackers within organizations and in the society. The empirical literatures provide the best way to prevent the problems of hacking in the society and shows that white hats, black hats and spy hackers motivation strategies are largely involved and effective to check organizations performance. It proposes quantitative approach with the design and descriptive for this study. The questionnaires will be used will be selected as a means to collect data with a simple random sample of the company's employees as observers / participants in the study.

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#### Introduction:-

##### background of the study:-

Information is esteem, and more corporations have understood that information security dangers can impact business prepare coherence and open picture, relations, can bring about monetary misfortune, impact relations with customers and accomplices and their fulfillment, and additionally make the issues with lawful dominant presences if there should be an occurrence of non-compliance (marchewka, 2014).

The world has turned into a worldwide town because of the broad utilization of the web where with a tick of a mouse, a solitary thought can achieve billions of individuals over the globe. The advantages of information for corporations are obviously incomprehensible. Information is as of now the main thrust of organizations and economies because of the globalization of products and markets. The internet has empowered information accessibility in this manner making it a most important information source and a method for information transmission. The obstruction achieved by area is starting to die down as virtual organizations are as of now running round the clock. Increased dependency on information by organizations has consequently led to an increase on the dependence of the CIA (confidentiality, integrity and availability) are the three main features of information security. The privacy guarantees that data is accessed only by those who have rights, information integrity serve as the state of being complete and uncorrupted and availability will enable users or other systems to access information (solms, & niekerk, 2013; shedden, smith, & ahmad, 2010; whitman & mattord, 2008). The paper presents a thorough details on information security threats, overviews of threats with the security threats source through the internal and external threats caused. This causes may likely to be the positive impacts to better identify threat's characteristics in order to

propose suitable measures to reduce risks. The succeeding of the paper is organized as follows. The next segment outlines information threats agents (accidental, contributory and deliberate). Section 3.1 discussed with word “hacker”, 3.2 stated various types of hackers and the 3.3 section consider how the problems of hackers can be prevented in the society. While the last section 3.4 provide the recommendation and conclusion at the ends of the paper.

#### **information security threats:-**

'Information security is the assurance of data and its basic components' (whitman&mattord, 2008). Ferrari and thuraisingham (2006) portrayed information security as shielding information and frameworks from dangers, for example, unapproved access, unlawful use, exposure, interruption, alteration or destruction. According to ponemon institute (2014), and walters (2014) uncovered that information or security ruptures happen when information is not adequately secured and unapproved people can get to it. an information break can prompt to genuine outcomes. For organizations, a break regularly includes genuine budgetary misfortunes, expensive claims, reputational harm and in outrageous cases loss of business. Wholesale fraud, money related misfortune and harm shockingly appraising are a portion of the results of information crack for people. Information crack regain takes numerous years and the money related harms are cruel (ponemon institute, 2014).

Information security (infosec) is sweeping and incorporates specialized, behavioral, administrative, philosophical, and hierarchical methodologies that discourse the insurance and moderation of dangers to information resources (zafar&clark, 2009). Despite the fact that a portion of the information systems inquire about in the infosec field has considered socio-philosophical concerns or socio-authoritative concerns, it has basically cantered around specialized issues concerning the outline and usage of security subsystems (choo, 2011). For example, advanced technical approaches to deal with forestall interruption into authoritative frameworks (hansen, lowry, meservy, &mcdonald, 2007), discovery of denial of service attacks (zhi-jun, hai-tao, ming-hua, &bao-tune, 2012), and more advanced solutions for firewall protection (ayuso, gasca, &lefevre, 2012).

Although these technical, externally focused efforts are important, one zone that is an overwhelming shortcoming in legitimately securing information resources is the individual client inside an organizations (posey, bennett, &roberts, 2011; warkentin&willison, 2009; stanton, stam, mastrangelo&jolton, 2005). This is an especially critical problem since investigators evaluate that about half of intrusions and security violations happen from inside an organization by authoritative insiders (richardson, 2011; baker, goudie, hutton, hylender, niemantsverdriet, &novak, 2010). Until recently, research exploring the operational aspect of information security has been lacking.

However, the improvement of information and communication technologies and expanding availability to the internet, organizations get to be defenseless against different types of threats. Indeed, their information gets to be presented to digital assaults and their subsequent harms. Dangers originate from various sources, similar to representatives' exercises or programmer's assaults. The financial losses related misfortunes brought about by security ruptures, for the most part cannot definitely be distinguished, on the grounds that a critical number of misfortunes originate from smaller scale security episodes, created an underestimation of information framework security chance (shiu, baldwin, beres, mont, &duggan, 2011; farahmand, navathe, sharp, &enslow, 2005). Hence, managers need to know dangers that impact their advantages and recognize their effect to figure out what they have to do to counteract assaults by selecting suitable countermeasures.

To find these threats, threats sources and specific areas of the system that may be affected should be known, so the information security assets can be protected in advance (alhabeeb, almuhaideb, le, &srinivasan, 2010).

#### **statement of the problems:-**

As the modernity of cyber hackers intensifies keeps on expanding, their techniques and targets have likewise advanced. Rather than building the expansive internet worms that have turned out to be so well known, these offenders are presently investing more energy focusing on riches gathering violations, including misrepresentation and information theft (damico, 2009). Cyber-media india online ltd (2006), recommends that since home cuestas regularly have the poorest efforts to establish safety set up, they have turned into the most broadly focused on gathering. Cyber media reports that 86% of all hacking attackers are gone for home users. As attacks on homebased clients' increment, new systems are surfacing, including the utilization of noxious code to attacks web programs and desktop applications.

Damico (2009) posits that by surveying that is efficient and effective in technique can limit the probability of been hacked. Although personal system users may not feel like they are associated with a system, any action on the internet can be considered "arranged action." therefore, security measures utilized by systems may likewise profit the home users. Switches and firewalls can regulate admission to a home computer, yet more particular strides might be used.

Top layer security (2008) considered the variance in network intrusion prevention and network detection systems. Its findings suggest that prevention systems "automatically detect and block malicious network and application traffic, while allowing legitimate traffic to continue through to its destination". It further stated that system that is detected may notice an unwarranted activity, but where is the protection from fast acting attacks? A system that is fully secured can stop and prevent malicious sites from entering or gaining access to a computer system. "the prevention system must operate with switch-like latency at all times". Due to advancement in technology old users of technology cannot be protected based on previous technology, they have to be up to date in order to beat malicious software.

a system that is prevented against virus and malicious software's must not block sites which are not dangerous to the system even if the system is at risk of an attack. It must have an extent to prevent malicious programs from damaging the system and must be up to date at regular intervals.

as a matter of facts, personal users of system must be known to various techniques which is been used in hacking and breaking in to a computer system. in hacking, the person can make use of various instrument to access information via the world wide web. We should bear in mind that system is not always stealing useful data but can also be used in saving content (such as pirated movie downloads) or a system could be recruited into an online 'bot army' (damico, 2009). In order to increase private owner's security against hackers, some steps can be taking such as making sure that his computer system anti-virus is updated. Computer users have always been attacked by malicious software due to negligence on their own part in updating the software which has been paid for by them. Virus data base needs to be constantly updated because of malicious threats always keep on transforming that is the reason why software updates are always available, in a situation where it is not updated then the user system might be infected with malicious software.

Hackingalert (2008) suggested a means through which users can get solutions by installing appropriate firewall. The firewall's acts as a shield in stopping unwarranted access to a computer system. However, a firewall does not erase data which is stored on the system. To be more secured an anti-virus subscription is needed in case it was able to bypass the firewall it will not be able to pass through an effective anti-virus. We have so many trojan and virus software in the market and running a different type will help in eliminating threats to a network or system.

## **Chapter two: literature review:-**

### **Threats:-**

A threat is the adversary's goal, or what an adversary might try to do to a system. It is also described as the capability of an adversary to attack a system (swiderski&snider, 2004).

### **security threat source:-**

A threat can be caused by internal, external or both external and internal entities.

- Internal threats is a situation when someone that has access to network with his details or credentials is negligent in his duties. A threat that is within the firm is usually because the worker failed to follow the due process or because he failed to report a specific threat (silowash, et al 2012).
- Jansen (2011) posits that threats outside the organization can be from outsiders not working for the organization. They have no access given to them by the firm in assessing their system or network. Organizations have to make sure that by pass by outsiders is cut off of natural disasters: hurricanes, fires, floods and earthquakes. External threats is done when network are intertwined together (wired and wireless), physical intrusion, or a partner network.

### **information threats agents:-**

The threat agent is the on-screen character that forces the risk to the system. There are currently wide range of sorts of threats to information security that may achieve loss of confidentiality, integrity or availability. this

study identified three categories of information threats such as accidental or unintentional, contributory or instrumental, and deliberate or intentional (greitzer, strozer, cohen, moore, mundie, & cowley, 2014; afyouni, 2006).

#### **accidental or unintentional threats:-**

Accidental or unintentional threats are those brought on by events outside the IT hardware (i.e. Those that are outside human ability to control) such as natural disasters, technological disasters and human threats (bompard, huang, wu, & cremenescu, 2013).

#### **natural disasters:-**

Natural disasters are one of the primary dangers to information. The term 'environmental threats' is also used by some authors to depict these sorts of threats. Natural threats are dangers brought on by non-human agent. It comes, in the first place, from environmental threats like fire, lightning, flood, tidal waves, wind or water and likewise, due to animals and wildlife which cause extreme harm to information structures like lightning, tidal waves (like tsunami), floods and fire. Without a doubt, this class incorporates different dangers, for example, terrorist attacks, riots and wars (jouini, rabai, & aissa, 2014).

#### **2.2.1.1.2 technological threats**

Innovative dangers are created by somatic and compound procedures on factual. Physical procedures incorporate the utilization of physical intends to pick up passage into confined ranges, for example, to build, compound room, or whatever other assigned territory like burglary or harm of equipment and programming. Be that as it may, synthetic procedures incorporate hardware and programming innovations. It, additionally, incorporates indirect system support equipment like power supplies (jouini, rabai, & aissa, 2014).

#### **human threats:-**

This class includes threats caused by human actions such as insiders or hackers which cause harm or risk in systems (abdulkadir, & dzarma, 2015; shaluf, 2007).

#### **Contributory or instrumental:-**

Contributory or instrumental intimidations are presented by the disaster or non-existence of adequate measures. Uncontrolled access to IT equipment would constitute a procedural threat (alhabeed et.al, 2010; poulsen, 2003). Hayes (2014) posits that technical disaster causes the main procedure to be hacked. For instance, someone who has no authority may have an access to a computer data if there are no necessary measures to check people. If there is no restricted access to key places then important information or data can be accessed to unauthorized individuals. An organization that has control over its data and updates it regularly and usually amends it at interval bridges the gap of a potential hack. All computer operators that have unqualified system operators are usually prone to hacks. For these reasons, administrators must make sure that only qualified people are employed and people who are trusted are in such seats or positions. Similarly, in case of leave or if an employee's services are no longer needed, all organization ID card or anything that can make him have access to the premises must be collected at the point of exit.

Contributory or instrumental threats are presented by the disappointment or non-presence of satisfactory methods. Uncontrolled access to IT hardware would constitute a procedural risk (alhabeed et.al, 2010; poulsen, 2003). Hayes (2014) procedural threats cause the correct procedures to be by-passed. For instance, an unapproved individual may acquire access to computers hardware or media if there are insufficient checking systems. In the event that inadequate intelligent gate to systems exist then information might be perused or overhauled by individuals with no power. Control over the advancement of new structures and the change of existing ones averts inaccurate projects being put into live utilize. All methods are at hazard through temperamental work force. Personnel routines ought to guarantee that exclusive respectable staff are utilized in places of trust. Exit systems ought to guarantee that staff leaving the organization do not hold their distinguishing proof or means of access.

#### **Deliberate or intentional:-**

Deliberate or intentional threats can be defined as the threats designed for either benign or malicious purposes to destroy or abuse targeted information. These include malware, hacks, intrusions, denial of service (dos) attacks, theft, fraud, espionage and arson (ateeq, 2012).

**Malware:-**

Malware is programming that is intended for a noxious reason. The software can contain viruses, trojan stallions and spyware (dezfouli, dehghantanha, mahmod, sani, shamsuddin, &daryabar, 2013). Solomon and chapple (2005) archived that viruses contain malevolent code intended to adjust documents to perform unapproved activities. Viruses are intentionally coursed to computer users with the expectation of spreading to different clients and harming or obliterating their information. The impact can be harmless (for instance, a screen message), or it can be a genuine defilement of either data or software (shim, qureshi, &siegel, 2013).

**laptop theft:-**

Laptop theft is a critical threats to users of laptop computers. Casualties of laptop theft can lose equipment, programming and key data that have not been moved down. Criminals may likewise access touchy information and individual data (brown, 2009).

**Fraud:-**

According to action fraud (2011), described fraud as any purposeful or consider act to deny another of property or cash by cleverness, fraud or other out of line means. It is one of the threats that can genuinely influence information. Misrepresentation or fraud is utilized as a part of numerous areas for various purposes, for example, internet misrepresentation and financial fraud. Internet fraud has gotten to be one of the most effortless courses for vandals to pick up cash or essential data utilizing strategies, for example, phishing tricks.

**Intrusions:-**

Vacca (2009) revealed that interruptions are assaults utilizing any strategy to increase unapproved access to a system. Denial of service (dos) attacks are intended to avoid honest to goodness access to systems and cause the inaccessibility of assets (desai, patel, somaiya, and vishwanathan, 2016). Hacking in to a computer software or data occurs when an individual is not giving the permission to handle such data. Hacking is a process of bypassing a network while to tab means to connect to a cable (easttom, 2006). Hacking is usually performed to prove the technical skill of the hacker but may destroy the confidentiality, integrity and availability of data.

Hacking and tapping happen when some person sets out, without power, to investigate pc held information. Hacking suggests breaking into a system while tapping infers truly partner into a connection (easttom, 2006). Hacking is commonly performed to show the particular mastery of the developer however may wreck the mystery, genuineness and openness of information.

Hackers can abuse information by inserting a piece of code into a program. This code operates at some future date to corrupt files or software.

**Hacker:-**

hackers are wise individuals who might not have a passion for their talent initially but they do it for the money involve. The main motive of hackers is to make information available for everyone and they think it is right to use programs produced by someone else in achieving their objective. Before we proceed it is imperative to understand what hacker is (loader &thomas, 2013).

In the first instance, a hacker cannot be regarded as a criminal because he does not break the law nor does he release virus to the system. Similarly, a hacker cannot be regarded as a kid who just sits down and eats and watches his environment (sanglakhi, 2013).

some one that hacks is usually not a computer guru because he cannot enter security codes of all websites nor software applications. Similarly, he is not someone who just sits around to do carpentering work like assembling and coupling of wood to make a chair or furniture (sanglakhi, 2013). Similar to the findings of sanglakhi (2013) sees an hacker as some features and his characterized as someone with interesting features, he uses his brain to think out of the box and usually tries to do what other people do not believe in or even thought of doing.sabahi (2011) posits that someone that explores and creates new things, new episodes and also does things in ways which no one as imagined or thought of as a hacker

In 2013 all these definitions are have turned to significantly more negative meanings. According to the merriam-webster dictionary (2013) described "hacker" as "a person who illegally gains access to and sometimes tampers with

information in a computer system.” This definition has led many people to fear computer hackers but not all hackers are bad people. Hackers can be put into different categories which are discussed below.

#### **types of hacker motivation:-**

According to online safety expert for intel security, robert (march 16, 2011), xu, hu, and zhang (2013), and bratus (2007), reported that computer hackers are typically grouped into various types, white hats, black hats, grey hats, script kiddie, hacktivist, cyber terrorists, spy hackers, phreaker, and the final hacker is motivated by government popularly known as state sponsored hackers.

White hats attempt to help prevent weak systems from being hacked and attempt to make the web a safer place for individuals. Black hats do the opposite; they cause problems and can sometimes harm individuals and companies by stealing identities, money and other things as well. A grey hat hacker is someone who is between white hat hacker and black hat hacker. Grey hat normally do the hacking without the permissions from the administrators of the network he is hacking. But he will expose the network vulnerabilities to the network admins and offer a fix for the vulnerability for money. script kiddies is a derogatory term for black hat hackers who use borrowed programs to attack networks and deface websites in an attempt to make names for themselves. A hacktivist is a hacker with political intentions. The hacktivist has the same skills as that of a hacker and uses the same tools as the hacker.

The main reason of hacking is to create attention. Cyber hackers usually have a motive which is either politically or religiously in tuned towards their belief and they try to create chaos and tension by destabilizing critical facilities. Hackers usually plan to rob secrets and have access to top security files. Hackers can act within the jurisdiction of the organization where they act like spy or they may act from outside. The main reason for hacking is to get the job for which they are paid done. Someone who hacks a prepaid card without paying is also a hacker. Hackers can be used by a nation or by the government to gain secrets of it enemies. They use the world wide web to gather information about a particular government all nine of these groups use various different hacking strategies that they use in order complete their tasks. Many hackers, both black hats and white hats are involved in organizations.

#### **Chapter three: research methodology:- research method:-**

The primary research method for this study is based on literature review and the methodology selected for this proposed study will be detailed here: the planned research design, methods of selection, data collection and analysis of results will be explained. It is hoped that the chosen methodology will provide useful information through the collection and analysis of data on the information security threat and the hackers.

#### **recommendation and conclusion:-**

The whole problem with cyber-security presently is that since the cyber-criminal is constantly upgrading his knowledge and methods, most intrusion prevention software applications only deal with the methods previously used. the home user may benefit by subscribing to any one of a variety of newsletters that stay abreast of the hacker world. one such free newsletter can be offered by [hackingalert.com](http://hackingalert.com).

Therefore, all users must take a large role in understanding the issues regarding cyber security and implementing their solutions. There are few recommendation that being suggested by scholars such as :

**Education and training;** teaching a student to hack is still an issue we face today. Some feels that hacking should be put into curriculum in university and that they will teach students how to improve intrusion. It is same like giving a tools for the students on how to hack is simply like giving a crowbar for a burglar to break into a house. Certain policies need to be applied at university as we never know whether the acquired skills will be used for the good or bad. Policies need to address issue for students who conduct malicious acts by applying security checks on individuals which universities do certain courses such as ethical hacking. For example, a criminal background check, the requirement of some sort of professional certification, and student interviews are a few measures that could potentially weed out several, if not all, all students with potential malevolent intentions.

**Trusting the potential enemy;** some of skilled professionals use their abilities to harm the society by finding vulnerabilities in the system and attacking them. This is when we need the ethical hacker that may do the job. Two totally different individual would need to be hired to run tests for companies so that no on individual can have total freedom with any one system.



**Risk management;** ethical hackers can minimize the risk of impact by exploring vulnerabilities beforehand to minimize the risk. Allow the company to undertake penetration test to find if they are vulnerable to attack. There should be some leeway and the hackers should be allowed to use certain tools to help them with their job without any question to identify security vulnerabilities in the company's system.

**Penetration testing;** penetration testing defined as a legal and authorized attempt to locate and successfully exploit computer systems for the purpose of making those systems more secure. Includes probing for vulnerabilities as well as providing proof of concept attacks to demonstrate the vulnerabilities are real. Proper penetration testing always ends with specific recommendations for addressing and fixing the issues that were discovered during the test. This process will help to secure computers and networks against future attacks by finding security issues.

## References:-

1. Abdulkadir, s. S., & dzarma, d. E. (2015). security threats analysis of ibrahimbabangida library, modibboadama university of technology, yola. *international journal of innovation and scientific research*, 13(2), 591-597.
2. Action fraud. (2011). Accessed 31 october 2016 <http://actionfraud.org.uk/what-is-fraud>
3. Afyouni, h. (2006). *Database security and auditing: protecting data integrity and accessibility*, thomson course, canada.
4. Alhabeeb, m., almuhaideb, a., le, p., & srinivasan, b. (2010, april). Information security threats classification pyramid. In *advanced information networking and applications workshops (waina), 2010 ieee 24th international conference on* (pp. 208-213). Ieee.
5. Ateeq, a. (2012). 'type of security threats and it's prevention', *international journal of computer technology and applications*, vol.3, no.2, pp.750-752.
6. Ayuso, p.n., gasca, r.m., lefevre, lft-fw.(2012). A cluster-based fault tolerant architecture for stateful firewalls. *computers & security*; 31(4):524e39.
7. Baker, w., goudie, m., hutton a., hylender, c., niemantsverdriet j, & novak, c, (2010). *verizon 2010 data breach investigations report*.
8. Bompard, e., huang, t., wu, y., & cremenescu, m. (2013). classification and trend analysis of threats origins to the security of power systems. *International journal of electrical power & energy systems*, 50, 50-64.
9. Bratus, s. (2007). What hackers learn that the rest of us don't. *Ieee security and privacy*.
10. Brown, b. (2009). *Help prevent computer theft*, palmerston north, new zealand.
11. Choo,. (2011). The cyber threat landscape: challenges and future research directions. *Computers & security*; 30(8):719e31.
12. Cyber-media (2006). Increase in cyber-attack against home users retrieved from <http://www.ciol.com/ciol-techportal/content/security/news/2006/2061010859.asp>
13. Damico, t. M. (2009). "cyber attack prevention for the home user: how to prevent a cyber attack." *inquiries journal/student pulse*, 1(11). Retrieved from <http://www.inquiriesjournal.com/a?id=47>
14. Dashora, k. (2011). Cyber crime in the society: problems and preventions. *Journal of alternative perspectives in the social sciences*, 3(1), 240-259.
15. Desai, m., patel, s., somaiya, p., & vishwanathan, v. (2016). Prevention of distributed denial of service attack using web referrals: a review.
16. Dezfouli, f. N., dehghantanha, a., mahmod, r., sani, n. F. B. M., shamsuddin, s. B., & daryabar, f. (2013). A survey on malware analysis and detection techniques. *international journal of advancements in computing technology*, 5(14), 42.
17. Easttom, c. (2006). *Computer security fundamental*, pearson prentice hall, united states of america.
18. Engbretonson, p. (2013). *The basics of hacking and penetration testing: ethical hacking and penetration testing made easy*. Elsevier.
19. Farahmand, f., navathe, s.b., sharp, g.p., & enslow, ph. (2005). A management perspective on risk of security threats to information systems, information technology and management archive; 202-225.
20. Ferrari, e., & thuraisingham, b. (2006). Guest editorial: special issue on privacy preserving data management. *The vldb journal*, 15(4), 291-292.
21. Greitzer, f. L., strozer, j. R., cohen, s., moore, a. P., mundie, d., & cowley, j. (2014, may). Analysis of unintentional insider threats deriving from social engineering exploits. In *security and privacy workshops (spw), 2014 ieee* (pp. 236-250). Ieee.
22. Hacker. merriam-webster.com. Merriam-webster.(2013). Web. 9th december 2013.

23. Hackingalert (2008).hacker tricks and prevention techniques.retrieved, from <http://www.hackingalert.com/hacking-articles/hacker-tricks.php>.
24. Hansen, j.v., lowry, p.b., meservy, r., &mcdonald, d. (2007).genetic programming for prevention of cyberterrorism through dynamic and evolving intrusion detection.*decision support systems*; 43(4):1362e74.
25. Hayes, r. (2014). *Retail security and loss prevention*.butterworth-heinemann.
26. Jamil, d., & khan, m. N. A. (2011). Is ethical hacking ethical?. *International journal of engineering science and technology (ijest)*, issn, 0975-5462.
27. Jansen, w. A. (2011, january). Cloud hooks: security and privacy issues in cloud computing. In system sciences (hicss), 2011 44th hawaii international conference on (pp. 1-10).ieee.
28. Jee, j. E., lee, s. J., lee, s. R., bae, b. C., & shin, y. T. (2012). A logical network partition scheme for cyber hacking and terror attacks. *Journal of kiise: information networking*, 39(1), 95-101.
29. Jouini, m., rabai, l. B. A., &aissa, a. B. (2014).classification of security threats in information systems. *Procedia computer science*, 32, 489-496.
30. Loader, b. D., &thomas, d. (eds.). (2013). *Cybercrime: security and surveillance in the information age*. Routledge.
31. Marchewka, j. T. (2014). *Information technology project management*.johnwiley& sons.
32. Padmanabhan, s. (2012).hacking for lulz: employing expert hackers to combat cyber terrorism. *Vand. J. Ent. & tech. L.*, 15, 191.
33. Ponemon institute. (2014).*cost of data breach*.ibm. Available:<http://www-935.ibm.com/services/us/en/it-services/security-services/cost-of-data-breach/> accessed 1<sup>st</sup>, november, 2016.
34. Posey, c., bennett,r.j, &roberts, t.l. (2011).understanding the mindset of the abusive insider: an examination of insiders' causal reasoning following internal security changes.*computers&security*.30(6e7):486e97.
35. Richardson, r. (2010/2011).csi computer crime and security survey, <http://www.gocsi.com>; 2011.
36. Robert, siciliano. (mar 6, 2011). <https://securingtomorrow.mcafee.com/consumer/family-safety/7-types-of-hacker-motivations/>
37. Sabahi, f. (2011, may). Cloud computing security threats and responses. In *communication software and networks (iccsn)*, 2011 *ieee 3rd international conference on* (pp. 245-249). Ieee.
38. Sanglakhi, a. (2013). Hackers and the internet.
39. Shaluf, i. (2007). 'an overview on disaster', disaster prevention and management, vol.16, no.5, pp.687-717.
40. Shedden, p., smith, w., &ahmad, a. (2010).*information security risk assessment: towards a business practice perspective*.
41. Shim, j., qureshi, a. A., &siegel, j. G. (2013). *The international handbook of computer security*.routledge.
42. Shiu, s., baldwin, a., beres, y., mont, m.c., &duggan, g. (2011).economic methods and decision making by security professionals.the tenth workshop on the economics of information security (weis).
43. Silowash, g. J., cappelli, d. M., moore, a. P., trzeciak, r. F., shimeall, t., &flynn, l. (2012).common sense guide to mitigating insider threats.
44. Solomon, m., &chapple, m. (2005).*information security illuminated*, jones and bartlett, united states of america.
45. Stanton, j.m, stam, k.r, mastrangelo, p, &jolton, j. (2005).analysis of end user security behaviors.*computers& security*. 24(2):124e33.
46. Swiderski, f., &snyder, w. (2004).threat modelling microsoft press.
47. Top layer security (2008). Securing tomorrow's networks today. Retrieved, 2008, from <http://www.toplayernetworks.com/content/resource/faq.jsp>.
48. Vacca, j. (2009). *Computer and information security handbook*, burlington, ma: morgankaufmann.
49. Von solms, r., & van niekerk, j. (2013).from information security to cyber security.*computers& security*, 38, 97-102.
50. Walters, r. (2014). Cyber-attacks on us companies in 2014. *Heritage foundation issue brief*, (4289).
51. Warkentin, m., &willison, r. (2009).*behavioral and policy issues in information systems security: the insider threat*. European journal of information systems. 18(2):101e5.
52. Whitman, m. E., &mattord, h. J. (2008).*management of information security*, course technology.
53. Xu, z., hu, q., &zhang, c. (2013). Why computer talents become computer hackers. *Communications of the acm*, 56(4), 64-74.
54. Zafar, h., &clark, j.g. (2009).current state of information security research in is.*communications of the association for information systems*; 24(34):557e96.
55. Zhi-jun, w., hai-tao z., ming-hua w., &bao-song, p. (2012). Msabms-based approach of detecting ldosattack.*computers& security* 31(4):402e17.



### RESEARCH ARTICLE

**The Self Nominated Doctors: Irrational the practice; Headache the professionals; Harming the public; National the problem - The industry of Quackery.**

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#### Abstract

Medical practice done by non-medical people in india and their propagation in medias, and also its implications are discussed in this article. Multidisciplinary approach is essential for eradicating the quackery industry.

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#### Introduction:-

Nothing is impossible in Indian law even if you endanger the life of the people; medical practice is not an exception. Every one of us might experience with quacks in medical practice either in good or bad situations. Quacks are untrained, often illiterates who have some experience with medical profession involved in medical practice for earning easy money. Even a medical person from other branch of medicine those are practicing allopathic medicine to earn easy money [1,2,22]. In my childhood I had got severe ear pain in the middle of the night due to accumulation of wax and I was treated by a quack with injections and by removing my ear wax with some instruments. He relieved my symptoms afterwards I never met a qualified doctor for that problem. In our village we are calling him as "Doctor", although he is a doctor to us, he neither studied at high school or nor trained at medical school.

#### What makes nonmedical person to practicing medicine?

Money is the first reason; you can earn money without hard work and education. How long it takes to learn basic practicing skills and basic illnesses? Hardly in few hours of practice, you can learn basic medicines and minor procedures like giving injections, in a few days of time suturing minor wounds and doing minor surgical procedures. Most of them were worked as an assistant for a medical practitioner for some time. When the medical practitioner is busy, they are in the position to teach them for how to dress a wound and how to give injections; it is the basic foundation for them in quackery [2,3,24].

Non allopathic practitioners are promoted most often by the corporate hospitals and private hospitals, which require duty doctors with less salary for long working hours. These paramedical professionals were trained in a need based

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manner for a particular specialty of the hospital. When they moved out they will engage in quackery. Some hospitals are giving hands to quacks to get referral cases and supporting them by managing complications results from quackery and providing referral charges to them for cases referred by them[3,4,5,24].

Most of the quacks are in big villages by doing mobile practice and some of them are having established clinics with few beds for intravenous fluid administration and most of them were charging more than General practitioners(GP) nearby. This is one of the reasons why private practitioners avoid practice in remote areas. Some places allopathic Medical Practitioners were threatened and defamed by these quacks by various means to avoid competing practice[6,7].

Laws which govern the people are not so stringent. Even though the law is not directly permitting the quackery, but it does in its own holes. Less captive punishment promotes the quacks to encounter this medical profession as a lovely profession. Some verdicts about these quackery permits anybody can practice modern medicine and government also not bothering them. Most of the time association of quacks obvious with well known local body members and politicians makes it difficult to handle. Indian Medical Association (IMA) voices against about this quackery are often unheard, sometimes with the effort of government quacks were stopped their practice temporarily but resumes once actions against them withheld[7,18].

Government run Health Sub-centers (HSC) are rooting the quackery in some places. Village health nurses are selling the drugs and collecting money for intravenous fluids and injections, which was supplied by government for free of cost. These village health nurses are less monitored by their medical officers.

Media also promoting quackery indirectly by promoting advertisements from the quacks and traders. Websites claiming magic cure for chronic non-curable diseases are not monitored by the government. Magic remedies and common cold, fever remedy advertisements results in selling of medicine in small shops without any knowledge of medicine. Websites claiming cure for HIV/AIDS is also possible in India and promoting alternate treatment for chronic diseases including cancers by avoiding surgery and adverse effect of chemotherapy too. Why not we nominate them for Nobel Prize? Like people disseminating wrong information about sex and infertility in state wide channels with local language in the name of native medicine, who is claiming a website also making the situation worse. Media which is also promoting quackery in many ways by advertising and interviewing quacks[8-10,25,26]. Medical shops owned in India are not run by pharmacists, but with license of a pharmacist anybody can own the medical shop. Most of the time medical shops are managed by uneducated person and they provide medicines for all your problems including medical termination of pregnancy. Some of these shops are providing injection facilities and Intravenous (IV) fluid administration too in their back doors. Their irrational prescription of combination medications results in mild allergic reactions to fatal anaphylactic reactions. Very few are buying drugs with prescription in medical shops, most are telling their symptoms and collecting over the counter medicines, even well educated people are doing the same. The worst scenario is over the counter medication moved from medical shops to "Petty shops", you can buy medicines in all the petty shops along with cigarette and gutka. Even though doctor's ratio increased considerably, people are lazy to care their health by professionals but often by quacks. People less often understood the difference between quacks and doctors; they are calling everyone as a doctor, who are all practicing medicine. Government officials were often bribed by quacks, medical shops are less monitored and some of them are attached to or run by quacks. Some medical shops are offering weekly visit of quacks in the name of "visiting doctor" but the public is not aware that they are not real doctors, but so called 'quacks'[11-14,27,28].

Even though some GP's were suffered by quacks, the real sufferers are public at present. In our practice, every day we encounter these quack treated patients and self medicated patients with adverse drug reactions. We should create awareness to the public regarding harms of these short of quacks and self medication[15-17,29].

A Non Governmental Organization's plan of training quacks in rural areas or Indian Governments plan of short medical courses will not provide the real and permanent solution rather than creating new medical colleges and good facilities for training medical students[19-21].

### **Conclusion:-**

Quacks are made by us for our convenience by forgetting the end result of condolences. It's the time to change ourselves from engaging and promoting quackery. Plan of training quacks and short medical courses to fulfill the gap of rural doctors is not the permanent solution. Any single approach is not going to change the situation; it should be a multidisciplinary approach by creating awareness to the public, enforcement of law and the involvement of government increasing quality medical colleges, verification in medical shops and private hospitals.

**References:-**

1. <https://en.oxforddictionaries.com/definition/quack> [Accessed on 23/12/2016].
2. <https://en.wikipedia.org/wiki/Quackery> [Accessed on 23/12/2016].
3. <https://mosaicscience.com/story/india-quacks> [Accessed on 23/12/2016].
4. <http://www.indiamedicaltimes.com/2012/05/07/legal-aspects-of-allopathic-hospitals-employing-ayush-practitioners/> [Accessed on 23/12/2016].
5. <http://www.dailyo.in/politics/the-ethical-doctor-medicine-corruption-cut-practice-referral-diagnosis-hospitals/story/1/13219.html> [Accessed on 23/12/2016].
6. <http://jeevankuruvilla.blogspot.in/2011/08/quacks-rmps-registered-medical.html> [Accessed on 23/12/2016].
7. <http://ahmedabadmedicalassociation.com/anti-quackery/> [Accessed on 23/12/2016].
8. <http://www.srisuhalaya.in/> [Accessed on 25/12/2016].
9. <http://www.hivcure.in/index.html> [Accessed on 25/12/2016].
10. <https://www.youtube.com/watch?v=sskH2qP4siA> [Accessed on 25/12/2016].
11. <http://timesofindia.indiatimes.com/city/bhubaneswar/Medicine-shop-run-by-quack-sealed/articleshow/52247984.cms> [Accessed on 25/12/2016].
12. <http://timesofindia.indiatimes.com/city/chennai/Medical-stores-in-Tiruvallur-face-action/articleshow/53936643.cms> [Accessed on 25/12/2016].
13. <http://www.thehindu.com/todays-paper/tp-national/tp-tamilnadu/Raid-in-medical-shop-quack-held/article16826568.ece> [Accessed on 25/12/2016].
14. <http://www.hindustantimes.com/punjab/life-and-law-going-cheap-abortion-pills-without-prescription/story-ktjqWhGiyqcMYPHRd9p3KM.html> [Accessed on 25/12/2016].
15. <http://www.thehindu.com/news/national/tamil-nadu/Quack-arrested-after-man%E2%80%99s-death/article16077597.ece> [Accessed on 25/12/2016].
16. [https://www.thestar.com/news/world/2014/03/25/indias\\_quack\\_doctors\\_leave\\_trail\\_of\\_medical\\_horror\\_stories.html](https://www.thestar.com/news/world/2014/03/25/indias_quack_doctors_leave_trail_of_medical_horror_stories.html) [Accessed on 25/12/2016].
17. Panda A, Pradhan S, Mohapatra G, Mohapatra J. Drug-related problems associated with self-medication and medication guided by prescription: A pharmacy-based survey. *Indian J Pharmacol.* 2016 Sep-Oct;48(5):515-521.
18. <http://www.newindianexpress.com/cities/chennai/2016/nov/01/fake-doctor-arrested-after-30-years-of-practice-1533715.html> [Accessed on 25/12/2016].
19. <http://www.liverfoundation.in/activities2.html> [Accessed on 25/12/2016].
20. Taneja D K. Rural doctors course: Need and challenges. *Indian J Public Health* 2010;54:1-2.
21. Priyanka Pulla. Are India's quacks the answer to its shortage of doctors?. *BMJ* 2016;352:i291doi: 10.1136/bmj.i291 (Published 21 January 2016).
22. Ecks S, Basu S. "We always live in fear": antidepressant prescriptions by unlicensed doctors in India. *Cult Med Psychiatry.* 2014 Jun;38(2):197-216. doi: 10.1007/s11013-014-9368-9.
23. Gupta PJ. The role of quacks in the practice of proctology. *Eur Rev Med Pharmacol Sci.* 2010 Sep;14(9):795-8.
24. Onuminya JE. Performance of a trained traditional bonesetter in primary fracture care. *S Afr Med J.* 2006 Apr;96(4):320-2.
25. Mohan A. Quack cashes in on AIDS scare. *Natl Med J India.* 2003 Jan-Feb;16(1):53.
26. Jerrold L, Karkhanavich H. Advertising, commercialism, and professionalism: a history of the ethics of advertising in dentistry. *J Am Coll Dent.* 2000 Winter;67(4):39-44.
27. Dada A, Giwa SO, Yinusa W, Ugbeye M, Gbadegesin S. Complications of treatment of musculoskeletal injuries by bone setters. *West Afr J Med.* 2009 Jan;28(1):43-7.
28. OlaOlorun DA, Oladiran IO, Adeniran A. Complications of fracture treatment by traditional bonesetters in southwest Nigeria. *FamPract.* 2001 Dec;18(6):635-7.
29. Kumar M, Singh J, Sharma P, Khera A, Singh P. Accidental intra-arterial injection of diclofenac -case report. *J Clin Diagn Res.* 2015 Jan;9(1):PD16-7. doi: 10.7860/JCDR/2015/11205.5430. Epub 2015 Jan 1.



## RESEARCH ARTICLE

### THE IDEA OF PRACTICAL REASONABLENESS.

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#### Abstract

The idea of practical reasonableness has been developed by John Finnis as one of the seven basic goods. The other basic goods are pursued with the help of this good. All these goods are objective goods which are self evident and they are not questionable. In order to know whether our decisions are practically reasonable or not Finnis has given nine requirements of practical reasonableness. These nine requirements are-coherent plan of life, non arbitrariness in the preference among values, non arbitrariness among persons, detachment, commitment, limited relevance of consequences, equal value to all the basic goods, following one's conscience. John Finnis is also against consequentialism or utilitarianism. This project therefore tries to study the idea of practical reasonableness as put forward by Finnis.

**Aim and Objective:** To study the idea of practical reasonableness put forwards by John Finnis.

##### Research Questions:-

- What is the idea of practical reasonableness?
- What are the requirements of practical reasonableness?
- How did Finnis criticized consequentialism?

**Scope and Limitation:** The scope of the project is limited to the idea of practical reasonableness of John Finnis.

**Review of Literature** John Finnis, *Natural Law & Natural Rights*( Paul Craig, 2<sup>nd</sup> Edition Oxford University Press 2011)

This book is the seminal work of John Finnis where he has discussed in detail his ideas of practical reasonableness. Practical reasonableness according to him is one through which we pursue the other basic goods. In his book he talks about the seven basic goods and practical reasonableness is one of them. He has listed down nine requirements of practical reasonableness. Through these requirements we can actually know if our decisions are practically reasonable or not. According to him consequentialists are not practically reasonable. They always talks about maximizing the net goodness but according to Finnis its not possible. Again what is good for one might be different for others.

Conor O' Mahony, ' The Failings of Practical Reasonableness: Another Look at John Finnis' ( *Cork Online Law Review* 2002)

<http://www.corkonlinelawreview.com/editions/2002/2002-5.pdf>  
accessed 10 October 2016

This article provides a critique to Finnis's idea of practical reasonableness. The author has criticized Finnis of giving more importance to practical reasonableness than other goods.

**Research Methodology:** The type of research is qualitative and doctrinal. Secondary sources are taken help of. Websites, blogs and books are taken help of to make the project.

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## Introduction:-

Practical reasonableness is an idea developed by John Finnis while he discussed about the seven basic goods of human life. John Finnis is an Australian legal scholar and currently he is a professor at the University of Oxford. In his work *Natural Law and Natural Rights* he talks about the seven basic goods of human life.<sup>1</sup> He classified the seven basic goods of human life into Life, Knowledge, Play, Aesthetic experience, Sociability (friendship), Practical reasonableness and Religion. According to Finnis these seven basic goods are independent of human thought and to flourish as human beings we need these goods. They are universal and apply to all humans at all times.<sup>2</sup> These basic goods or values are objective and we will be able to know them through introspection. These goods are self evident. We can participate in practical reasonableness by participation in the other basic goods by prioritizing one project over another or one commitment over another.<sup>3</sup> These basic goods are irreducible. Basic values are not the same as basic human urges. Individuals have urges or inclinations, but a value is something that a person thinks is worthwhile to pursue independent of any urge. I have an urge to gain knowledge, but I also think that the pursuit of knowledge is worthwhile.<sup>4</sup> Practical reasonableness is the type of reasoning that we use to make decisions about how to act and how to order our lives. Now some classical exponents of the theories of natural law might say that a person with experience, and a desire for reasonableness will only be able to decide which decisions are practically reasonable. Even Aquinas mentioned that there are certain self evident goods which can be understood only by those who have experience and in fact the moral principles like the Ten Commandments are inferred from the primary self evident goods. Therefore thinkers like Aristotle might think that what is morally good or practically reasonable can be understood only by those who have good habits, right minded but there is a problem that arises here regarding the people who really want to know if their decisions are practically reasonable or not. Therefore for this there are certain methods to practical reasonableness. These are certain requirements that tell a person what one must do to arrive at the basic good of practical reasonableness. Therefore one who follows all these requirements are Aristotle's *phronimas* and has Aquinas's *prudential*. Thus, speaking very summarily, we could say that the requirements to which we now turn express the 'natural law method' of working out the (moral) 'natural law' from the first (pre-moral) 'principles of natural law'.<sup>5</sup>

## Requirements of Practical Reasonableness:-

There are nine requirements of practical reasonableness. The first requirement of practical reasonableness is coherent plan of life. One should not live their life from moment to moment but they should see their life as a whole. Commitment to one specific project or another requires direction and control of impulses and with that it also requires the abandonment or adoption of projects according to circumstances, formation of new habits and the redirection of inclinations. This means the harmonizing of all of one's deep commitments. Since human life is in fact subject to all manner of unforeseeable contingencies, this effort to 'see' our life as one whole is a rational effort only if it remains on the level of general commitments, and the harmonizing of them. Since forever it has been said that one should always remember his/her last day while doing something. It basically is said to help people to choose their proper perspective of life at present. Finnis takes the help of a Christian parable from Luke 12:20 "But

<sup>1</sup> Hugh McCarthy, 'A Summary of John Finnis's Theory of Natural Law' (High McCartgy's ASC Blog) <https://hughmccarthylawscienceasc.wordpress.com/2015/01/03/a-summary-of-john-finnis-theory-of-natural-law/> accessed on 19 October 2016

<sup>2</sup> 'John Finnis- Natural Law- a quick summary <http://drmyrawilliamson.com/lectures/johnfinnis.pdf> accessed on 19 October 2016

<sup>3</sup> John Finnis, *Natural Law & Natural Rights* (Paul Craig, 2<sup>nd</sup> Edition Oxford University Press 2011)

<sup>4</sup> Suri Ratnapala, *Jurisprudence* (ISBN-13 978-0-511-59483-0 2009, Cambridge University Press)

<sup>5</sup> John Finnis, *Natural Law & Natural Rights* (Paul Craig, 2<sup>nd</sup> Edition Oxford University Press 2011)



God said to him, 'You fool! This very night your life will be demanded from you. Then who will get what you have prepared for yourself?' This means that the person who has all the riches but only with a view to drinking and eating them up, if his life is taken away by god on that day or that moment itself then who will use that wealth or how will his wealth be utilized, none of this will put meaning to his life.<sup>6</sup>

The second requirement is that there should be no arbitrary preferences among the values. For a coherent plan of life it is natural people may prioritise one basic human value over another. But this prioritization should not be arbitrary. The commitment will be rational only if it is on the basis of one's assessment of one's capacities, circumstances, and even of one's tastes. A person should not undervalue one good than another or overvalue one good than another. One may have no taste or capacity for friendship or life but they cannot say that they are not real forms of good. Finnis is against the thin theory of good propounded by John Rawls. According to Rawls liberty, opportunity, wealth and respect are the primary goods and one should not really accord much value to truth, art, friendship etc. Rawls also doesn't give any satisfactory reasons for such discrimination. According to Finnis it is unreasonable for one be it teachers, statesmen or parents to think that play, truth etc. have no value and never ask oneself whether in their plan of life they could make reasonable allowance to participate in such values or not, then one can be properly accused both of irrationality and of stunting or mutilating oneself and those in one's care.<sup>7</sup>

The third requirement is that there should be no arbitrary preference among persons. There should be fundamental impartiality among the human subjects who are or may be partakers of those goods. My own well being is my first interest or claim. And this self preference is because it's through my determined self realization and self participation that I will be able to do what reasonableness requires and realize the other forms of basic goods.<sup>8</sup> However this third requirement is against selfishness, double standards, hypocrisy or indifference to the good of others whom one could easily help. In fact so much so that many have sought to found ethics virtually entirely on this principle of impartiality between persons. One should not treat one the way in which he doesn't want the other person to treat him/her. One should always put oneself in the shoes of others and should prevent others from achieving something which he/she wants for themselves. Not following these requirements of reason means arbitrariness and reasonableness on our part.<sup>9</sup>

However reasonable self preference is there but there are some bounds. But what are these bounds? In Christian, Greek and Roman law they adopted the heuristic device of approaching this question by adopting a viewpoint of the standards of justice, the principles of justice of the one who has the interest of everyone at heart and mind, a person who is an ideal observer. Such a person will allow some form of self preference but not all. It also helps one to make impartial decision in terms of life preferences. However it does not suggest impartiality about the basic aspects of human good. It does not authorize one to set aside the second requirement of practical reason by indifference to death and disease, by preferring trash to art etc. In Rawls's theory of original position he talks about the veil of ignorance. In such a situation the individual without any knowledge of his identity or any knowledge whatsoever will always choose a principle of justice which is fair. Thus Rawls's heuristic device is of help for the third requirement. the fact that a principle chosen in the Original Position would be unbiased and fair as between individuals, that a principle which would not be chosen in the Original Position must be unfair or not a proper principle of justice in the real world. For in the real world, as Rawls himself admits, intelligence can discern intrinsic basic values and their contraries. Provided we make the distinctions between basic practical principles and mere matters of taste, inclination, ability, etc., we are able (and are required in reason) to favour the basic forms of good and to avoid and discourage their contraries. In doing so we are showing no improper favour to individuals as such, no unreasonable 'respect of persons', no egoistic or group bias, no partiality opposed to the Golden Rule or to any other aspect of this third requirement of practical reason.<sup>10</sup>

The fourth and the fifth requirement are somewhat related. The fourth requirement is detachment. One should not take up an attitude towards one particular objective so that when the specific project fails one would consider one's life drained. Such an attitude renders the basic human good of self determination in which a person participates simply because he wants to do something sensible, whether or not that particular project comes to bear any fruit. We

<sup>6</sup> John Finnis, *Natural Law & Natural Rights*( Paul Craig, 2<sup>nd</sup> Edition Oxford University Press 2011)

<sup>7</sup> John Finnis, *Natural Law & Natural Rights*( Paul Craig, 2<sup>nd</sup> Edition Oxford University Press 2011)

<sup>8</sup> John Finnis, *Natural Law & Natural Rights*( Paul Craig, 2<sup>nd</sup> Edition Oxford University Press 2011)

<sup>9</sup> John Finnis, *Natural Law & Natural Rights*( Paul Craig, 2<sup>nd</sup> Edition Oxford University Press 2011)

<sup>10</sup> John Finnis, *Natural Law & Natural Rights*( Paul Craig, 2<sup>nd</sup> Edition Oxford University Press 2011)



should be able to detach ourselves from one particular project. Unconditional significance to one particular project should be avoided. Succumbing to such temptations have also the evil consequences of fanaticism.<sup>11</sup>

The fifth requirement is after making a commitment one should not abandon that. And this requirement of fidelity has a positive aspect. One should be looking creatively for new and better ways of carrying out one's commitments, rather than restricting one's horizon and one's effort to the projects, methods, and routines with which one is familiar. Such creativity and development shows that a person, or a society, is really living on the level of practical principle, not merely on the level of conventional rules of conduct, rules of thumb, rules of method, etc.

The sixth requirement is that one should calculate and plan one's actions so that they are the most efficient (in a utilitarian sense) and do the most good.<sup>12</sup>

The seventh requirement is one should never commit an act that directly harms a basic good, even if it will indirectly benefit a different basic good. For example, one should not kill even if it will indirectly save more lives later.<sup>13</sup> To pick a demonstration which in itself essentially (or fundamentally) harms a fundamental great is in this way to draw in oneself pell mell (however straightforwardly) in a demonstration of resistance to an incommensurable esteem (an angle of human identity) which one regards as though it were a protest of quantifiable worth that could be exceeded by commensurable objects of more noteworthy (or aggregately more prominent) worth. To do this will regularly accord with our emotions, our liberality, our sensitivity, and with our responsibilities and activities in the structures in which we attempted them. In any case, it can never be defended in reason. We should pick reasonably (and this sane judgment can regularly advance a move in our point of view and therefore a realignment of beginning emotions and hence of our responsibilities and ventures).<sup>14</sup> Reason requires that each essential esteem be at any rate regarded in every last activity. In the event that one would ever properly pick a solitary demonstration which itself harms and itself does not advance some essential great, then one could properly pick entire projects and establishments and ventures that themselves harm and don't advance essential angles of human prosperity, for their 'net useful outcomes'. Presently we have as of now observed that results, even to the degree that they can be 'predicted as certain', can't be commensurably assessed, which implies that 'net advantageous outcomes' is a truly ludicrous general goal or model. It just stays to take note of that in the event that one imagines that one's discerning duty to be continually doing and seeking after great is fulfilled by a promise to act dependably for best results, one treats each part of human identity (and without a doubt, subsequently, regards oneself) as an utensil. One holds oneself prepared to do anything (and in this manner makes oneself a device for every one of those ready to undermine adequately terrible outcomes on the off chance that one does not participate with them).

The eighth requirement is that one should look after the common good of the community.

The ninth requirement is that one should always follow their conscience and practical reason. If one is generous, open minded towards the basic human goods by inclinations then one would be able to make their practical judgments without any abstract reasoning. The first theorist to formulate this ninth requirement in all its unconditional strictness seems to have been Thomas Aquinas, if one chooses to do what one judges to be in the last analysis unreasonable, or if one chooses not to do what one judges to be in the last analysis required by reason, then one's choice is unreasonable (wrongful), however erroneous one's judgments of conscience may happen to be. (A logically necessary feature of such a situation is, of course, that one is ignorant of one's mistake. Even is our conscience brings about wrong judgments it should be followed.<sup>15</sup>

### **Practical Reasonableness and Consequentialism:-**

The sixth requirement of practical reasonableness is the limited relevance of consequences. There is a wide range of contexts in which it is possible and only reasonable to calculate, measure, compare, weigh, and assess the consequences of alternative decisions. Where a choice must be made it is reasonable to prefer human good to the

<sup>11</sup> John Finnis, *Natural Law & Natural Rights* (Paul Craig, 2<sup>nd</sup> Edition Oxford University Press 2011)

<sup>12</sup> Hugh McCarthy, 'A Summary of John Finnis's Theory of Natural Law' (High McCarthy's ASC Blog) <https://hughmccarthylawscienceasc.wordpress.com/2015/01/03/a-summary-of-john-finnis-theory-of-natural-law/> accessed on 19 October 2016

<sup>13</sup> Hugh McCarthy, 'A Summary of John Finnis's Theory of Natural Law' (High McCarthy's ASC Blog) <https://hughmccarthylawscienceasc.wordpress.com/2015/01/03/a-summary-of-john-finnis-theory-of-natural-law/> accessed on 19 October 2016

<sup>14</sup> John Finnis, *Natural Law & Natural Rights* (Paul Craig, 2<sup>nd</sup> Edition Oxford University Press 2011)

<sup>15</sup> John Finnis, *Natural Law & Natural Rights* (Paul Craig, 2<sup>nd</sup> Edition Oxford University Press 2011)

good of animals. Where a choice must be made it is reasonable to prefer basic human goods (such as life) to merely instrumental goods (such as property). Where damage is inevitable, it is reasonable to prefer stunning to wounding, wounding to maiming, maiming to death: i.e. lesser rather than greater damage to one-and-the-same basic good in one-and-the-same instantiation. Where one way of participating in a human good includes both all the good aspects and effects of its alternative, and more, it is reasonable to prefer that way: a remedy that both relieves pain and heals is to be preferred to the one that merely relieves pain. However sixth requirement is only one requirement among all the requirements. We should also take into account the first, second, third requirements which clearly say that one cannot arbitrarily prefer one value to another or one person to another. Again the seventh and eight requirement excludes acts such as fraud, intentional killing etc. We cannot measure the utility of one basic good over another. Finnis is against the utilitarian or consequentialist approach. Consequentialism is irrational for him as it requires one to choose an act that maximizes the net good. But for him we cannot find out the 'best consequences'. If consequentialism has to work then (a) human beings have to have some single, well-defined goal or function (a 'dominant end'), or (b) the differing goals which men in fact pursue should have some common factor, such as 'satisfaction of desire'. However only a fanatic will think that human being has only one purpose. Consequentialism doesn't give any reason why we have to choose altruism over egoism. The consequentialist have not given any proper reason as to why they should criticize those who try to maximize their own happiness as unreasonable. Finnis considered the example where a hostage taker demands that a named individual be killed in exchange for the release of the hostages, who otherwise would themselves be killed. He seemed to assume that in this situation, the consequentialist would say that killing the individual is justified as it saves many lives. Finnis called this a senseless argument, and surely it is. He contended that the release of the hostages is one consequence among a multitude of incommensurable consequences of the act of killing. Finnis said that the calculus 'one life versus many' is naively arbitrary.<sup>16</sup> Again, consequentialist method enjoins us to make the choice that would produce greater net good than could be expected to be produced by any alternative choice. But the alternatives that are in fact 'open' or 'available' to one are innumerable. A genuine consequentialist assessment of alternative possibilities could never end, and could begin anywhere. So it should never begin at all, in reason.<sup>17</sup>

### Criticisms to Finnis's Idea of Practical Reasonableness:-

Practical reasonableness is the good through which people pursue the other forms of basic human goods. All these goods are said to be objective. Because if practical reasonableness is subjective then everyone will have their own interpretation of what is good or bad. But in the ninth requirement of practical reasonableness, Finnis talks about that everyone should follow their conscience. Now for example whatever Hitler did during his dictatorship for him it might be for practically reasonable or his conscience urged him to do so and if we go by Finnis's theory then Hitler has done no wrong as he simply followed his conscience. So it's better if practical reasonableness is treated as an objective concept rather than a subjective one.<sup>18</sup>

Again everyone has a different reason so whose idea of practical reasonableness Finnis is talking about is not clear. And this might give an additional advantage to the powerful class to exert their influence through their practical reason.

Again through practical reasonableness we can pursue the other goods. Therefore it seems that he gives more importance to this good, on the other hand he says that all the goods are equal. But he contradicts his own view when practical reasonableness becomes both the ends and the means. Furthermore, Finnis himself suggests as much by stating that despite being free to choose which of the Basic Goods we choose to pursue and which to ignore, we have no good reason to leave Practical Reasonableness out of account. Thus from this we can infer that all goods are equal but some are more equal than others.<sup>19</sup>

### Conclusion:-

Presently we can see why a few thinkers have found the substance of "ethical quality" in the diminishment of mischief, others in the expansion of prosperity, some in social agreement, some in universalizability of down to

<sup>16</sup> Suri Ratnapala, *Jurisprudence* (ISBN-13 978-0-511-59483-0 2009, Cambridge University Press)

<sup>17</sup> John Finnis, *Natural Law & Natural Rights* (Paul Craig, 2<sup>nd</sup> Edition Oxford University Press 2011)

<sup>18</sup> Conor O' Mahony, 'The Failings of Practical Reasonableness: Another Look at John Finnis' ( *Cork Online Law Review* 2002) <http://www.corkonlinelawreview.com/editions/2002/2002-5.pdf> accessed 10 October 2016

<sup>19</sup> Conor O' Mahony, 'The Failings of Practical Reasonableness: Another Look at John Finnis' ( *Cork Online Law Review* 2002) <http://www.corkonlinelawreview.com/editions/2002/2002-5.pdf> accessed 10 October 2016

earth judgment, some in the inside and out prospering of the person, others in the safeguarding of flexibility and individual credibility. Each of these has a place in sound selection of responsibilities, activities, and specific activities. Each, in addition, adds to the sense, hugeness, and compel of terms, for example, 'moral', '[morally] should', and 'right'; not each one of the nine necessities has an immediate part in each ethical judgment, yet some ethical judgments do total up the course of each and the greater part of the nine on the inquiries in hand, and each ethical judgment totals up the course of one or a greater amount of the prerequisites.<sup>20</sup>

## **Bibliography:-**

### **Books:-**

1. John Finnis, *Natural Law & Natural Rights*( Paul Craig, 2<sup>nd</sup> Edition Oxford University Press 2011)  
<https://disciplinas.stoa.usp.br/.../John%20Finnis%20Natural%20Law%20and%20Natural...> Accessed on 19 October 2016
2. Suri Ratnapala, *Jurisprudence* (ISBN-13 978-0-511-59483-0 2009, Cambridge University Press)
3. Websites and Blogs
4. Conor O' Mahony, ' The Failings of Practical Reasonableness: Another Look at John Finnis' ( *Cork Online Law Review* 2002) <http://www.corkonlinelawreview.com/editions/2002/2002-5.pdf> accessed 10 October 2016
5. ' John Finnis- Natural Law- a quick summary <http://drmyrawilliamson.com/lectures/johnfinnis.pdf> accessed on 19 October 2016

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<sup>20</sup> John Finnis, *Natural Law & Natural Rights*( Paul Craig, 2<sup>nd</sup> Edition Oxford University Press 2011)  
<https://disciplinas.stoa.usp.br/.../John%20Finnis%20Natural%20Law%20and%20Natural...> Accessed on 19 October 2016



## RESEARCH ARTICLE

### Some Aspects on the Taxonomy and Identification of Corals.

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#### Abstract

A brief analysis of the taxonomy and the identification methods of corals are provided. The attention is drawn to difficulties and mistakes, which have occurred in their systematics, in the selection of type-species and their holotypes. Modern methods for morphometric, biochemical, and genetic researches are considered using examples in solving taxonomic problems and identifying corals. It is concluded that the taxonomy of corals came into the historical stage in the twenty-first century, when the previous nomenclature uncertainty began to be removed due to the availability of all data connecting taxonomic, phylogenetic, biogeographical, ecological, paleontological, and bibliographical, as well as environmental data.

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#### Introduction:-

The known property of the human reasoning to look for similarities and differences in observed facts and phenomena, certainly to categorize and give names makes us to find or just to note features or characteristics, by which we get to know about familiar or similar subjects and to perceive unfamiliar ones. When perceiving a thing, a phenomenon, we find, what differences from other things and phenomena they have, what similarities to them they bear, and give them certain names. People have identified the term "species" as taxonomic category for convenience of sorting organisms. And we can only guess, what was at first – "snakes", "animals", and "plants" (the highest categories) or "adder", "wolf", and "wheat" (the lowest categories). At first, there were probably the last ones, and then they were combined into animals, birds, etc. even before the appearance of the first conscious systematist on the Earth. Then species concepts were developed and, consequently, the species problem is as result of the struggle of adherents of various concepts.

The taxonomy of corals as inherently subjective science has gone through three historical stages: (1) researches of collections performed during their discovery in the early expeditions; (2) researches performed directly on reefs using autonomous diving equipment; (3) molecular and biochemical researches. These stages, each of which is associated with a different methodology and perception, have little in common, but they have a common goal, which is a classification of corals according to the concept of their natural order.

In 2013, a great article by Ch. Veron dedicated to almost all questions and problems of the taxonomy of reef-building corals was published. Its main conclusion is that taxonomists can no longer rest on any one publication, method or concept. They should be based on the open access to updating websites connecting the whole information, such as taxonomic, phylogenetic, biogeographical, ecological, paleontological, as well as

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environmental and bibliographical one. Such information sources allow systematists of any belief to see results of their efforts in the broad context, rather than just within their own subdisciplines (Veron, 2013).

Despite the appearance of hard calcareous skeletons of Scleractinia, they are very soft organisms and have some significant variations (30-40-fold changes of values of their features) of all their skeletal elements (Latypov, 1984). K. Gravier (1911) summarizing results of the previous researches (Pace, 1901; Wood-Jones, 1907) wrote: "Nothing really remains stable in these animals: neither the overall appearance of the colony, the coenenchyme nor even the theca". Consequently, the question of unusual intraspecies variability and establishment of its boundaries for each specific taxon or population concerning the problem of corals' species was extremely urgent (Latypov, 1984; Latypov, 2016a). "Healthy species theory" for corals was represented by T. Vaughan (1907) at the beginning of the last century, and it had almost no differences from the biological species concept appeared two years earlier. At the same time, it was emphasized that it was not about using different species concepts, but about a single biological approach when researching any corals. Only now, after more than two centuries, the coral taxonomists withdrawing from "peculiarities" of researching their material based on the biological species concept are adopting a population analysis and detection of variability limits along with using modern genetic and biochemical researches (Latypov, 1982, 1984; Veron, 1995; Latypov, 2014, 2016b).

## Results:-

### General provisions:-

The coral taxonomy came into the historical stage in the past century, when the nomenclature uncertainty began to grow rapidly. The main reason was a mandatory compliance with the species identification in historical classical monographs, which did not have necessary information on species at all, especially for the typical specimens if they have existed at all, or are often represented as their fragments out of all recognition. The historical problems including incorrect following redescription or synonymy of species have created uncertainty for many established species and genera, too.

The historical collections of corals with some exceptions were built *as separate specimens* representing new or unusual ones, rather than as representatives of the population or the taxonomic group. They were gathered in shallow lagoons and on reef flats, where the branching and placoid colonies usually developed in unusual forms of colonies. These collections representing biased samples and those devoid of taxonomic researches have led to the expansion of "type-species", which did not clearly represent the species destined for the identification.

Thus, the corals were gathered in quantities in museums throughout Europe and the United States more than 200 years ago. The collections are considered as critical contribution to the natural history, especially when they are described and published in monographs. In the historical perspective, these scientific publications were like works of art. These are books with excellent illustrations well-known among paleontologists and biologists (Müller, 1775; Ellis & Solander, 1786; Stutchbury, 1830; de Blainville, 1834; Dana, 1846; Edwards & Haime, 1857; Haeckel, 1876; Agassiz, 1880), in which the authors tried to make the taxonomic characters of corals available to the broader scientific community. However, despite their high status among the best monographs of the time, they contain descriptions of the species, which cannot always be used, because they lack many details of morphology (especially variability and comparison with other species), a habit and even a location. For this reason, modern taxonomists should rely only on illustrations of the holotype, rather than on description to determine the described species.

The coral taxonomists of the one before last century did not have an opportunity to observe and gather corals on the reef under water. They did not understand how species (zooids, colonies) actually looked including their differences in form, color and abundance. If a received new specimen looked different, it was easily proclaimed a new species and given a new name. Inevitably, many of these specimens were lost, because they got a new mark and included in another collection, usually without specifying their original source (Veron, 2013). It is also probably that many typical specimens never existed, as they were no more than interesting specimens selected for illustration and description and then were returned to the general collection as soon as the description was completed.

### Typical specimens and type-species:-

Today many historical typical specimens have a correct status, some of them deserve special mention, while the position of other ones is precarious. For Example, J. Dana (Dana, 1846), the most insightful coral taxonomist of the 19<sup>th</sup> century, was especially precise in selecting and describing typical specimens as distinct from A. Verrill, who has prescribed barely recognizable fragments, which he had deposited in various museums, to typical specimens following in the footsteps of Dana (Verrill, 1864). Some of Verrill's species now found in the Museums of Comparative Zoology of the Harvard University and the Smithsonian Institution were apparently taken from

different colonies actually belonging to different species, for which the reference to Dana was not taken into account (Veron, 2013).

Many type-species, on which the genera are based, seem obvious. In practice, however, the use of type-species as basis for taxonomic solutions is not always effective, because they generally are a quintessence of historical problems described above among the first selections of type-species of genera. Coral taxonomists documentarily selecting an update of the typical species according to Vaughan and Wells (Vaughan & Wells, 1943; Wells, 1956) have found many surprises. For example, little is known about the type of the species of the *Leptoseris* genus – *Leptoseris fragilis* Milne Edwards & Haime, 1849. It was neither included nor redescribed in the edition of Denisen (Veron, (2000). The type-species called *Montastraea* is a fossil coral from the Miocene of France or Italy, *Astreaguetardi* de Blainville, 1830. It is considered to be extinct long ago and can not be identified. Such cases were ignored according to an old saying "Let sleeping dogs lie", but because of this the genus may be subject to integration (Veron, 2013). However, the stability of the generic names would be quite adequate without type-species and bundle, which is enclosed with them. Even the *Acropora* genus, the most famous one of all corals, was confirmed by the International Commission on Zoological Nomenclature (ICZN) only in 1963.

### Species in situ:-

The taxonomic researches using undersea observations began in the early 1970-ies and immediately created various conflicts with almost all aspects of the traditional taxonomy. So, *Pocilloporadamicornis* described in more than 50 taxonomic publications has had a double number of non-taxonomic works prior to 1970, which have most frequently used this species in experimental researches. It was not clear: what the corals of the *P. damicornis* species are actually; how it can be reliably distinguished from other *Pocillopora* species; what the expansion of this species is. The original description of C. Linnaeus (Linnaeus, 1758, 20 words of the Latin language) cannot be used – the holotype is lost, its location is very undefined («O. Africano&Indico»). More importantly, when *P. damicornis* was researched in situ, it turned out, how many environmental variants were correlated with this species (fig. 1). The researches of corals in their natural environment using the undersea observation have become a reliable instrument for coral taxonomists (Veron, Pichon, 1976; Veron, 2013; Latypov, 1990, 2014).

### Traditional and modern taxonomy:-

When working with corals having the extraordinary variability of almost all features and generally with polytypic species, the question is often if these differences between samples (populations) are great enough to consider them as different species. In most cases, we have isolated geographic or stratigraphical allopatric populations. Unfortunately, we cannot use a reproductive isolation criterion in pure form. And besides, to breed zooids of two or one prospective species on the experimental basis, first of all, we have to determine that these are zooids of one or two allied species, and this is our key problem. It remains to base on the probabilistic data on the fact that the reproductive isolation is correlated with a certain degree of a phenotypic, externally visible difference and is constant enough within a given taxonomic group. That is to act by contradiction: if groups with sufficiently clear morphological differences, with a distinct gap of values of qualitative or quantitative features are identified within this taxon, we may assume that these groups are good species.

So, three phenons of *Pocillopora* were revealed in the collection of Scleractinia from the South China Sea. They had differences in width of their branches, number of polyps per area unit, presence or absence of verruciform corallites on major branches, but almost all these variations were partially overlapped. A sample of other corals of *Pocillopora* had different colonies with wide (from 30 mm to 50 mm thick) and long (up to 50-80 mm) branches. They had different distances between their branches. A more representative sample of all corals has discovered both the continuous variability of modal sizes of branches, the distance between them, and obvious gaps of various holotypes of the *Pocillopora* species.

The construction of different scattering diagrams induced more surely to divide these phenons, but left doubt on the final decision on their assignment to one or two species (fig. 2). Receiving the data on features of the individual growth and the fatty acid content of these corals (table, fig. 3) allowed to reveal distinct gaps in ontogenetic and biochemical characteristics and to divide these phenons in two species: *P. damicornis* and *P. verrucosa*. The same methods allowed to unite all samples of these corals under one species named *P. eyudouxii* in another case, as continuous variability of features, difference in ratio of the fatty acid content were not detected. The analysis of the fatty acid content ratio among colonies of various growth forms has confirmed their modification nature identifying differences only in percentage shares.

Meanwhile, many features were partially overlapped in two samples of *Pocillopora* or had a very little gap except for one. The frequency of the shedding of the corals dissepiments of one sample was by more than 4-5 times in comparison with corals of the other one. The ratios of the content of some fatty acids of different samples of *Pocillopora* were different by 2-3 times, too. Two unfilled gaps (table, fig. 3) in morphometric, ontogenetic and biochemical features allowed to consider these *Pocillopora*'s samples as ones belonging to different species (Latypov, 1984, 2014). The cluster analysis has also confirmed the findings on the congeniality of ones and the isolability of other species (fig. 4).

#### Genetic systematic:-

Since the beginning of the current century, a considerable attention is given to the molecular and genetic researches of different groups of Scleractinia (Manchenko et al., 2000; Fukami, 2008; Huang et al., 2009; Arrigoni et al., 2012).

A wide range of taxonomic questions can be reliably answered by using the molecular and biochemical methods, and it is clear that the continuing dissemination of such researches will have a major impact on the most aspects of the taxonomy of corals. These methods produce especially demonstrable and convincing results in the cases, when it is necessary to classify objects, which are hard to distinguish. It should be noted that such cases can occur when working with sibling species or phenotypically similar species, as well as when working with groups, the taxonomic content of which is obscured as a result of the application of subjectively selected features. The genetic researches of zooids in natural populations require a labour-intensive work on breeding under controlled conditions. Such researches might be carried out in the laboratory with only a few organisms – those, which are easy to maintain and have a very short period of reproduction and development. The sympatric groups, or the morphs belonging to the similar species, are one and the same evolutionary unit. Therefore, they should have (taking into account the calculated error of the experiment) the same gene frequency for each gene locus. The zooids from different biotopes belonging to the same species must freely interbreed and differ only in their loci coding their morphological differences and, maybe, in some closest loci. Even if these morphs have been subjected to a rigorous selection, the gene frequencies for all other loci should remain the same ones through their recombination (Wright, 1978; Thorpe, Sole-Cava, 1994).

The actinias are a very diverse group of the marine invertebrates. Meanwhile, the features suitable for the taxonomy of these animals are very few, and the taxonomic problems in this group of the invertebrates often arise because of their relative structural simplicity. The analysis of genotypic differences between closely related species of the actinias is now actively used and often produces some interesting results. Generally, sympatric populations are subject to the analysis. In addition, sets of stinging cells of the actinias with an unclear taxonomic pattern are compared along with the electrophoresis of isozymes.

On the littoral of Skrebtsov Island (the South China Sea), settlements of the actinias of the *Anthopleura* species, which were presented by two color morphs, were examined. These actinias looked very alike. The variations in column coloration, mouth opening, tentacles have caused continuous series of the variability in this population. It was just observed that some actinias had a light grey-green oral disc, and the others had both a colorful and dark one. The actinias of the light morph raise higher above the sand surface. It turned out that the actinias differing in coloring of the oral disc are distinct both in the substrate nature, to which they are attached by the foot, and in the degree of their submergence in the sand. The combination of these features allowed to identify two morphs of the actinias in the population (Manchenko et al., 2000).

The analysis of genotypes of the sympatric morphs was performed by the electrophoresis of enzymes according to the standard method using original modifications (Manchenko, 1984). A 21 gene locus coding 19 enzymatic systems was examined. Eight of them have showed lack of common alleles in compared morphs. It clearly proves that the morphs gene pools are separate, and they do not exchange their genes between each other. Consequently, these morphs are separate species. They were morphologically identified as *Anthopleuraorientalis* (light morph) and *A. sp. 1* (dark morph), respectively. The genetic differentiation between the species is very significant, what follows from the assessment of the genetic distance between them ( $D = 1,284$ ). The average level of heterozygoty ( $H_e$ ) for *A. orientalis* and *A. sp. 1* amounts to  $0,351 \pm 0,054$  and  $0,250 \pm 0,061$ , respectively (Manchenko et al., 2000).

### Explanation and figures legend:-

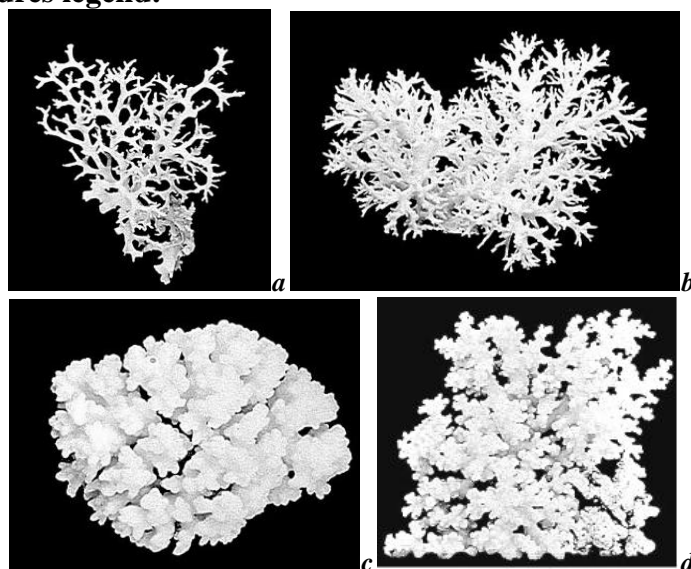


Figure 1. The dependence of *Pocilloporadamicornis* colonies from habitats. Shallow water mangrove (a), lagoon (b), reef flat (c), reef slope (d). (part by Veron, 2013)

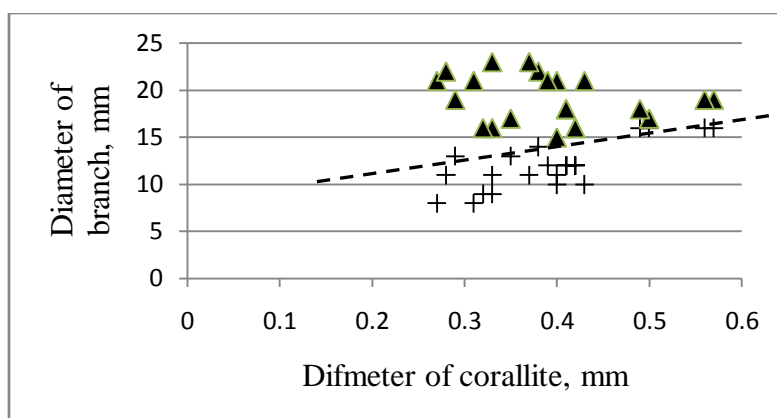


Figure 2. Separation of the two species *Pocillopora* depending on the diameter and number of corallites per unit area branch ▲ - *P. verrucosa*, + - *P. damicornis*. Dotted line the best separation.

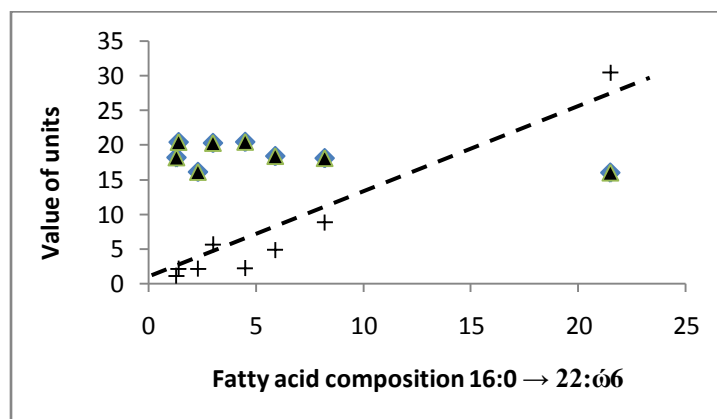


Figure 3. The separation of the two species *P. damicornis*-▲ *P. verrucosa*+ on the composition of the fatty acids (see table). Dotted line the best separation



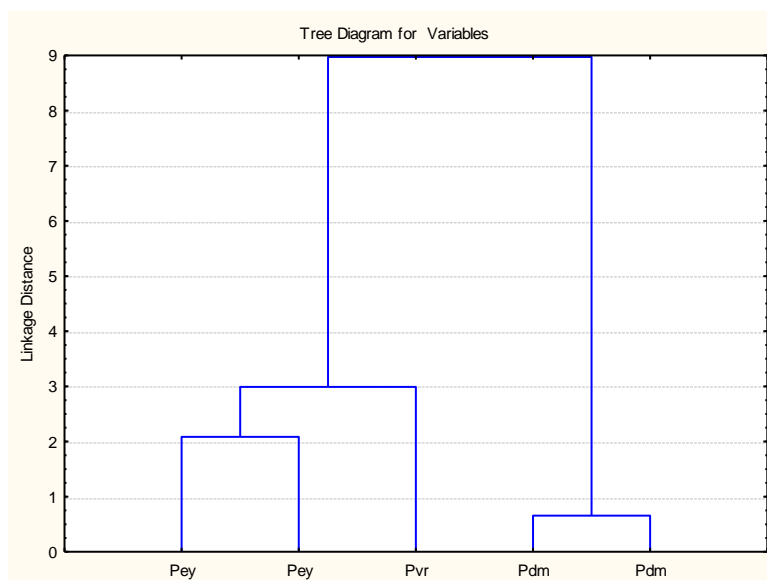


Figure 4. Clustered graph disunion and similarity different species *Pocillopora*. Pvr-*P. verrucosa*, Pdm-*P. damicornis*, Pey-*P. eydouxi*

Table. The ratio of fatty acid composition in various types of scleractinian

Fatty Acids	<i>Pocillopora damicornis</i>	<i>P. damicornis</i>	<i>P. verrucosa</i>	<i>P. eydouxi</i>	<i>P. eydouxi</i>
16:0	21,9	<b>21,5</b>	<b>30,4</b>	29,47	28,6
16:1	2,4	2,3	2,1	2,2	2,6
18:1	8,4	8,2	8,8	8,4	10,1
18:2 $\omega$ 6	1,1	1,3	1,1	0,7	0,5
18:4 $\omega$ 3	5,7	5,9	4,8	2,6	2,2
20:3 $\omega$ 6	3,1	<b>3,0</b>	<b>5,6</b>	5,7	6,1
20:4 $\omega$ 3	1,7	1,4	2,1	3,2	2,9
22:4 $\omega$ 6	4,3	<b>4,5</b>	<b>2,2</b>	0,9	1,2

Comment. Visible modifications the nature of qualitative and quantitative changes in the composition of the fatty acids from one species and significant discrete differences (in italics) up until the magnitude gap signs-different species

### Conclusion:-

Thus, the problems arising when determining intra- and interspecific differences identified by morpho-physiological, ecological, and ethological means can be solved by using biochemical, cytogenetic, electrophoretic researches. But in any case, the original conclusion on similarities or differences between taxa is made based on absence or presence of the unfilled gap in certain sequences of features, identification and comparison of the specific characteristics of each taxon. Then it turns out, which biological reasons cause these differences and similarities of the features. And based on the facts of discretization of phenotypes identified between two feature complexes, a reproductive isolation of each separate species can be stated (Mayr, 1969; Latypov, 1984, 2014, 2015; Latypov et al., 1998).

More than two hundred years of experience of the coral taxonomy promise that coral systematists can avoid pitfalls if: 1 - the established names will be saved in the absence of any compelling reasons to replace them; 2 - the nomenclative priority should not be a reason to change the established names; 3 - the fossil names are not used for modern species (except in cases when the holotype is definitive); 4 - the names of the established genera cannot be changed due to the taxonomic problems of the type-species.

The taxonomy of corals came into the historical stage in the twenty-first century, when the previous nomenclature uncertainty began to be removed due to the availability of all data connecting taxonomic, phylogenetic, biogeographical, ecological, paleontological and bibliographical, as well as environmental data.

### References:-

1. Agassiz, L. (1880): Report on the Florida reefs. Mem. Mus. Compar. Zool. Harvard College. 7: 1–61.
2. Arrigoni, R., Stefani, F., Pichon, M., Galli, P., Benzoni, F. (2012): Molecular phylogeny of the robust clade (Faviidae, Mussidae, Merulinidae, and Pectiniidae): an Indian Ocean perspective. Molec. Phylog. Evol. 65 (1):183-93.
3. Dana, J.D. (1846): Atlas of zoophytes. United States exploring expedition during the years 1838–1842. Philadelphia: Lea and Blanchard. 1–740 p. 61 pls.
4. deBlainville, H.M.D. (1834): Manuel d'actinologie, ou de zoophytologie. Planches. Paris: F.G. Levrault, 1–101 p.
5. Ellis, J., and Solander, D. (1786): The Natural History of many curious and uncommon Zoophytes collected from various parts of the globe. London. 1: 1–208. pl. 1–63.
6. Fukami, H. (2008): Short review: molecular phylogenetic analyses of reef corals *Galaxea*. Journal of Coral Reef Studies.10: 47-55.
7. **Gravier, Ch. (1911): Les recifs de coraux et les Madreporaires de la baie de Tadjourah (Golfed'Aden). Ann. Inst. oceanogr. 2(3): 1-99.**
8. Haime, J. and, Milne Edwards H. (1857): Histoire Naturelle des Coralliaires ou Polypes proprement dits. Vol. 2. In Milne Edwards H, Haime J. Paris: Roret, 1–633.
9. Haeckel, E. (1876): Arabische Korallen. Ein Ausflug nach der Korallenbänken des Rothen Meeres und ein Blick in das Leben der Korallenthiere. Berlin: Georg Reimer. 48.
10. Huang, D., Meier, R., Todd, P.A. and, Chou, L.M. (2009): More evidence for pervasive paraphyly in scleractinian corals: Systematic study of Southeast Asian Faviidae (Cnidaria; Scleractinia) based on molecular and morphological data. Molecular Phylogenetics and Evolution. 50 (1):102-116.
11. Latypov, Yu.Ya. (1984): Drevneishie odinochnye korally i principy ih systematiki. M.: Nauka. 92 p. (In Russian)
12. Latypov, Y.Y. (1990): Korally skleraktinii V'etnama. Tamnasteriidy, Astrotseniidy, Potsilloporidy, Dendrofilliidy [Scleractinian Corals of Vietnam. Thamnasteriidae, Astrocenidae, Pocilloporidae, Dendrophylliidae]. Nauka, Moscow, 80 p. (In Russian)
13. Latypov, Yuri.Ya. (2014): SCLERACTINIAN CORALS OF VIETNAM. Science Publishing Group, p. I-XXXIV, 1-481.
14. Latypov, Yu.Ya. (2015): Particular qualities of identification and taxonomy of some
15. Scleractinian. Species. 13(40): 29-41.
16. Latypov, Yu. Ya. (2016a): Particular Qualities of Identification and Taxonomy of Some Scleractinian Faviidae Gregory, 1900, (Scleractinia: Faviina). Intern. J. Mar. Scie. 6(11): 1-10.
17. Latypov, Yu.Ya. (2016b): Particular Qualities of Identification and Taxonomy of Some Scleractinian (Scleractinia: Astrocoeniina) Family Acroporidae Verrill, 1903. Intern. J. Mar.Sci. 6(16): 1-8.
18. Latypov, Yu., Ya., Dautova, T., N., and Moshenko, A., V., (1998): The principles and
19. Methods of the CNIDARIA classification. Vladivostok, Dalnauka, 244.
20. Linnaeus, C. (1758): Systema Naturae per regna trianaturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Tomus I. Regnum Animale. Holmiae. Editio Decima. Reformata. 824 p.
21. Manchenko, G.P. (1984): Handbook of detection of enzymes on electrophoretic gels. CRC Press. Boca Raton..
22. Manchenko, G., P., Dautova, T., N., and Latypov, Yu.Ya. (2000): High level of genetic divergence between sympatric color morphs of the littoral sea anemone *Anthopleura oriennalis* (Anthozoa: Actiniaria). Bioch. Syst. Ecol. 28: 737-750.
23. Mayr, E.W. (1969): Principles of Systematic Zoology. McGraw-Hill. 411 p.
24. Müller, P.L.S. (1775): Des Ritters Carl von Linné vollständiges Natursystem nach der zwölften lateinischen Ausgabe, und nach Anleitung des holländischen Houttuynischen Werks, miteiner ausführlichen Erklärung, ausgefertiget von Philipp Ludwig Statius. Nürnberg: Raspe. 6: 1–960. pl. 20–37.
25. Pace, S. (1830): On the corallum of *Turbinaria*. J. Linn. Soc. Lond. 28: 358-365.
26. Stutchbury, S. (1830): An account of the mode of growth of young corals of the genus *Fungia*. Trans. Linn. Soc. 16: 493–498.

27. Thorpe, J.,P., and Sole-Cava, A.,M. 1994. The use of allozyme electrophoresis in invertebrate systematic. Zool. Scr. 23: 3-18.
28. Vaughan, T.,W. (1907): Recent Madreporaria of the Hawaiian Islands and Laysan. U. S. Natl. Mus. Bull. 59: 1-427.
29. Verrill, A.E. (1864): List of the polyps and corals sent by the Museum of Comparative Zoology to other institutions in exchange, with annotations. Bull. Mus. Comp. Zool. 1: 29-60.
30. Vaughan, T.,W., and Wells, J.W. (1943): Revision of the sub-orders, families and genera of the Scleractinia. Geol. Soc. Amer. Spec. Pap. 44: 1-363.
31. Veron, J.E.N. (1995): Corals in space and time. New York: Cornell University Press. 321 p.
32. Veron, J.E.N. (2000): Corals of the World. Volumes 1–3. Townsville. Darwin. Perth: Austral. Inst. Mar. Sci. 382 p.
33. Veron ,J.E.N. (2013): Overview of the taxonomy of zooxanthellate Scleractinia. Zoological Journal of the Linnean Society. 24 p.
34. Veron, J.E.N., and Pichon, M. (1976): Scleractinia of Eastern Australia.I Families Thamnasteriidae, Astrocoeniidae, Pocilloporidae. Austr. Inst. Mar. Scie. Mon. Ser. 1:1–86.
35. Wells, J.W. (1956): The Scleractinia .Treatise on invertebrate paleontology. Pt I The Coelenterata. Lawrence: Univ. Kans. Press. P. 328-444.
36. Wood-Jones, F. (1907): On the growth form and supposed species in corals. Proc. Zool. Soc. Lond. P. 318-585.
37. Wright, S. (1978): Evolution and the genetics of populations. Vol. 4. Variability within and among natural population. Chicago. University of Chicago Press. 590 p.



## RESEARCH ARTICLE

### Comparative Study of E-marketing In India & China.

Soumya Pandey

#### Manuscript Info

#### Abstract

#### Manuscript History

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#### Research objectives:-

- To analyze about the importance of e-marketing in present scenario.
- To determine the difference of e-marketing between two countries: India & China.
- Current scenario of E-marketing in India and China and its impact on current markets.
- To know the online marketing methods of India and study Chinese consumer behavior.
- To forecast the future prospects of e-marketing in India & China.

#### Introduction:-

Any business process performed electronically is called e-business and today most of the business processes like recruitment, e-commerce, e-information, e-auction, e-marketing and so on, are being performed through e-business. E-marketing stands for 'electronic showcasing'. E-marketing is the idea that associate the reasonable and graphical parts of online instruments together, taking into account the reason, outline, exposure, brand improvement, advancement and deals.

#### Benefits of E-marketing:-

1. **Global reach:** A website can reach anywhere in the whole world who has the internet connection. We are just a search or a click of a button away from any internet source.
2. **Cost Effective:** It is very cheap and cost effective in terms of spending money on advertising on social media sites and other website as compared to broadcasting messages on radio and television in a particular timeslot period.
3. **24/7 online shopping:** The website enables communication with the customers at any point of time (24 hours\*7 days a week). They guide the customers about the product line in depth so that they can be fully educated.
4. **Website content has to be interactive and entertaining:** Unlike printed words or television, there is a possibility of opening up two-way communication with the customer.

This can occur as simply as an instant email response to customers and as complex as a regularly updated blog.

#### E-marketing tools:

- Search Engine Optimization
- Paid search
- Display Advertising

- Sponsorship
- Social Networking
- Blogging

When setting the e-marketing objectives, we need to make sure that they are:

- Specific: to specify what is to be achieved.
- Measurable: to express in measurable terms such as key performance indicators, outcomes, numbers, percentage, etc.
- Action-oriented: to state which actions need to be taken and who will take them.
- Time specific: to establish specified time frames.
- To increase online sales for all the products by 15% in the upcoming year trends.
- To grow email coverage to 50% of the current customers base by the end of the next year.
- Realistic: achievable with the resources available.

### **Research methodology:-**

**Research Methodology** is the way used to collect information and data for the purpose of making business decisions. The methodology may include publication research, interviews, surveys and other research practices, and could comprise both present and historic information.

There are basically two types of Research:

1. Descriptive
2. Exploratory

**Data Collection Method:** Data collection methods often used in program evaluations include literature search, file review, natural observations, surveys, expert opinions and case studies.

There are two types of data collection methods:

1. Primary Data: Data collected by an evaluation team specifically for the evaluation study.
2. Secondary Data: Data collected and recorded by another person or organization, usually for different purposes than the current evaluations.

Hereby, the current research is conducted through the information received from secondary sources such as:

1. Websites
2. Journals
3. Books.

### **Analysis of study:-**

Key drivers in Indian e-commerce are:

- Increasing the broadband internet connection and 3G penetrations across the country.
- Convenience of less availability of product ranges.
- Busy lifestyles, urban tie ups and the lack of our time for offline searching.
- Increasing usage of online classified sites, with a lot of consumers shopping for and merchandising second hand products.

E-commerce market in India was valued \$2.5 billion in 2010, and it went up to \$6.3 billion in 2011 and to \$14 billion in 2012. And basically 75% of that total value was related to airline tickets, railway tickets, building bookings and online mobile recharge etc. On March 7, 2014 E-retailer FLIPKART claimed its hit of \$1 billion sales, a deed it has managed to attain before its own target (2015).

Online retail in China generated \$121 billion sales last year, up 66% as compared to 2012. There are various factors for growth in China. Its impressively awesome that the online Chinese markets, ALIBABA and TAOBAO business is estimated that half of all the packets sent to the total account of China.

### **Examples of Indian internet companies with innovative business models:-**

- **Naukri.com:** It is the leader in Indian online job market. It offers free SMS-based job notifications, call centers with all the value added services.

- **Flipkart:** It's a pioneer in e-commerce in India. It has popularized the concept of online retail and has started its own logistics operations with 1500 employees. It even offers cash-on-delivery services in response to Indian consumer's low propensity to use cashless transactions
- **Redbus:** It was launched in 2006. Redbus.in is an online bus-ticketing portal with the current customer base of nearly 2millions. It primarily reaches customers through online platform. It has also introduced cash-on-delivery system due to customer's reluctance to use online payment methods.

#### **China's major market leading player companies:-**

The three big Internet market leading companies in China are ALIBABA, BAIDU, TENCENT, which dominate the three different categories of the market mainly: e-commerce, search and messaging, respectively. The vast majority of the online transactions happens in China which is around 85% as of 2009, that take place between consumers, ALIBABA-owned TAOBAO, is often described as the "eBay of China."

Like eBay, users on Taobao can usually purchase and sell new & used items at fixed or assigned prices, as well as through auction listings. Unlike eBay, most of the goods or items are new and there is no listing fees, the majority of the Taobao's income revenue comes from the advertising. Next year the company would bring in \$ 700 million pre-tax earnings and would be worth \$14 billion.

#### **China's Search Engine Marketing Planning and Execution:-**

1. Chinese SEO keyword research.
2. On-site SEO of Chinese web pages
3. Off-site SEO and online management/ online word of mouth marketing.

#### **China's retargeting banner and display stressing/promotion:**

1. Defining the Chinese targeted audience.
2. Defining the goals of the digital media.
3. Defining a China media way out.

#### **Methods of online marketing common in India:**

1. Social network
2. Online favorites and bookmarking
3. Blogging
4. E-mail marketing
5. Search engines
6. Pay-per-click advertising
7. Press release

#### **Learning outcomes:-**

##### **Comparative study of e-marketing in India and China:-**

- From the study related to the topic "Comparative study of e-marketing in India and China", it can be clearly stated that e-commerce scope is widely increasing at a fast pace. Total sales in Asia-Pacific region exceeds sales in North America and Europe combined.
- It's obvious that e-commerce in China and India is expected to grow quickly between in the years 2014 and 2018.
- At present, the Chinese e-commerce market is wholly dominated by Alibaba cluster, Taobao owner and sister Tmall web site. Together these 2 sites which are held by Alibaba cluster signify relatively ½ online purchases by Chinese customers.
- India, for the instant, it's estimated that the marketplace for e-commerce developed beneath 5% grow terribly quickly, at the rate of over 505 per projections by Forrester, the web retail can grow from U.S. \$2 billion in 2013 to over U.S. \$ 16 billion in 2018.
- If FDI are given the clearance to enter Indian markets, Indian e-commerce e-retailing websites would definitely face a severe drawback as many of the online buyers would definitely migrate to other FDI e-retailing companies. At instance, there would not be any issue regarding this but later in the upcoming online shopping trend it would be a gain to foreign companies.
- It has clearly shown that e-marketing influences upon businesses in a number of important ways. When used efficiently, e-marketing campaigns and strategies have the potential to reach customers in a speedy and low-cost manner and could definitely provide promotion for a wide range of products and services.

- The development of e-marketing and social media advertising has led to examples of businesses in recent years that appear to little more than categories and filter information relating to products and services on the internet, taking a small cut from any transaction that may occur as a result.
- The following five tips can surely help to alter a non-performing website into an efficient sales and marketing tool:
  1. Use control to get repeat visitors to the site, not showiness.
  2. Make sure that the potential customers can find the website on any search engines.
  3. Develop habitual e-newsletters & announcements to inform & keep up to date with current and potential customers (to only those who ask for them).
  4. Make sure that the website content is focused on customer's needs and interest, not company.

**References:-**

1. Simon, F.L. (1992). Marketing green products in the triad. Columbia Journal of World Business, 27(Fall–Winter), 269–285.
2. Simula, H., Lehtimark, T. & Salo, J. (2009). Journal of Systems and Information Technology, 11(4), 331–346.

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### RESEARCH ARTICLE

#### Sleep Quality among Type 2 Saudi Diabetics.

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#### Manuscript Info

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##### Key words:-

Diabetes, Diabetes Control, Pittsburgh Sleep Quality Index, Sleep quality, Risk factors, Saudi Arabia.

#### Abstract

**Objectives:** To explore the relationship between diabetes control among Saudi type 2 diabetics and their quality of sleep.

**Patients and Methods:** Following a cross-sectional study design, 400 Saudi type-2 diabetics (239 males and 161 females) registered at the Diabetes Center in Abha City, Saudi Arabia were included in this study. An interview questionnaire has been developed by the researchers. It comprised personal characteristics and diabetes-related variables and the Pittsburgh Sleep Quality Index Questionnaire (PSQI).

**Results:** More than three fourths of participants (77.3%) had uncontrolled diabetes (HbA1c >7%). Almost three fourths of diabetics (72%) had poor sleep quality. Poor quality of sleep was highest among illiterate diabetics (91.7%). Participants with longer duration of diabetes had significantly more prevalence of poor quality of sleep than those with shorter disease duration (75.9% and 66.3%, respectively,  $p=0.035$ ). Moreover, participants with uncontrolled diabetes had significantly higher prevalence of poor sleep quality than those with controlled diabetes (78.3% and 49.5%, respectively,  $p<0.001$ ). However, sleep quality among diabetics did not differ significantly according to their age, gender, or smoking status.

**Conclusions:** Type 2 diabetes is associated with high prevalence of poor quality of sleep. Risk factors for poor quality of sleep include less education, poorly diabetes control and long duration of disease. Detection and treatment of sleep disorders among diabetics is essential.

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#### Introduction:-

Sleep is an active biologic function that is essential for life and is critical for physical, mental and emotional well-being. Any defects in sleep quality and quantity may lead to several complications, including metabolic errors (1).

It is estimated that sleep disorders are among the most common health problems in the general. Nevertheless, sleep disorders are frequently overlooked. About one-third of people in the general population suffer from a chronic disorder of sleep and wakefulness. The critical role of sleep and sleep disturbances in daytime functioning is becoming increasingly apparent (2).

A relation has been recognized between respiratory disorders during sleep, e.g., snoring and sleep apnea, and the early manifestations of diabetes, since sleep apnea and snoring may increase cellular insulin resistance, leading to hyperglycemia and increased difficulty to control blood sugar (3).



Sleep appears to moderate the neurohormones that regulate blood glucose. Sleep deprivation and sleep disorders contribute to patho-physiological changes associated with the development of type 2 diabetes. In people who already have diabetes, sleep deprivation contributes to elevations of glycosylated hemoglobin (HbA<sub>1c</sub>). Symptoms that occur as a result of diabetes, such as nocturia and neuropathic pain, may in turn contribute to sleep disturbance and exacerbate sleep deprivation (4).

Evidence suggests that sleep disorders may contribute to the development of diabetes; and conversely, diabetes may contribute to sleep disorders (4). Sleep is an emotional issue and all diseases particularly chronic diseases, like diabetes, invite emotional reactions which can also affect sleep adversely (1).

Sleep debt leads to harmful effects on carbohydrate metabolism, resulting in impaired glucose tolerance (5). Acute sleep deprivation, whether total or partial, is associated with an alteration in hypothalamo-pituitary-adrenal function on the following day consisting of an elevation of evening cortisol concentration (6). Moreover, it has been well demonstrated that glucose tolerance is markedly better in the morning than in the evening (7).

Gisalason and Almqvist (8) reported that diabetes is associated with difficulty in initiating sleep (21.1%), difficulty in maintaining sleep (21.9%) and excessive day time sleepiness (12.2%). The sleep complaints are often related to the presence of underlying Sleep disordered breathing, nocturia, physical complications of diabetes and underlying depression. Lamond et al. (9) added that diabetics experience several types of sleep problems, e.g., more wakefulness, a high number of awakenings and fragmented sleep.

The “gold standard” for diagnosis of sleep disorders is laboratory polysomnography. However, sleep disorders are far more prevalent than can be handled by the limited number of available sleep laboratories. Therefore, a screening tool is usually applied to screen patients according to their clinical symptoms, their physical examinations, and their risk factors (10).

In clinical practice, detailed sleep history is often missed. Detection and treatment of sleep disorders among diabetics is essential since their treatment is highly rewarding. Moreover, the concurrence of sleep disorders and diabetes necessitates aggressive therapy to treat and control both conditions (11).

This study aimed to explore the relationship between diabetes control among Saudi type 2 diabetics and their quality of sleep.

### **Patients and Methods:-**

This study was conducted during the period from January till June 2014. It followed a cross-sectional analytical comparative design has been followed. This study has been conducted at the Diabetes Center of Abha City, Saudi Arabia.

Following a simple random sampling technique, the researchers interviewed 400 Saudi type 2 diabetics whose diabetes was diagnosed since at least one year. Patients known to have psychiatric disorders or other chronic comorbidities (i.e., malignancy, heart, renal, or liver diseases) in addition to those on psychoactive drugs were excluded. Diabetes control among participants was assessed according to patient's glycosylated hemoglobin (HbA<sub>1c</sub>) level. Controlled diabetes was considered at HbA<sub>1c</sub> ≤ 7%, while those with higher HbA<sub>1c</sub> levels were considered as having uncontrolled diabetes (12).

Data collection tools comprised 2 parts, i.e., the "personal characteristics and diabetes-related variables" and the "Pittsburgh Sleep Quality Index (PSQI) Questionnaire".

The personal characteristics questionnaire was constructed by the researchers. It included the following variables: age, gender, educational level, smoking status, duration of diabetes and HbA<sub>1c</sub> levels.

The PSQI is a validated measure of self-reported sleep quality. It comprises 19 items in 7 component scales that assess sleep quality over the past month. The component scores of these scales are summed to yield a “global PSQI score” with a range of 0-21, with higher scores indicating worse sleep quality. A global PSQI score >5 has a

diagnostic sensitivity of 98.3% and specificity of 90.2% in distinguishing normal subjects from patients with sleep quality problems (13).

Data entry and analysis were performed using the Statistical Package for Social Sciences (SPSS version 22.0). Descriptive statistics were calculated in the form of frequency and percentage. Chi-square test was applied to test significance of differences between groups. Differences were considered as statistically significant when  $p < 0.05$ .

### Results:-

Table (1) shows that 9.8% of participants aged less than 20 years, 66.3% aged 20-60 years and 24% aged more than 60 years. More than half of participants were males (59.8%). About one fifth of participants (21%) were illiterate, 51.3% had school education, while 27.8% were university graduates. Most participants (87%) were nonsmokers. The duration of diabetes among more than half of participants (57%) was 10 years or more. More than three fourths of participants (77.3%) had uncontrolled diabetes ( $HbA1c > 7\%$ )

Figure (1) shows that almost three fourths of diabetics (72%) had poor sleep quality.

Table (2) shows that poor quality of sleep was highest among illiterate diabetics (91.7%) followed by university graduates (68.5%) and school educated (65.4%). Differences in quality of sleep among diabetics according to their educational level were statistically significant ( $p < 0.001$ ). Participants with longer duration of diabetes had significantly more prevalence of poor quality of sleep than those with shorter disease duration (75.9% and 66.3%, respectively,  $p = 0.035$ ). Moreover, participants with uncontrolled diabetes (i.e.,  $HbA1c$  level  $> 7\%$ ) had significantly higher prevalence of poor sleep quality than those with controlled diabetes (78.3% and 49.5%, respectively,  $p < 0.001$ ). However, sleep quality among diabetics did not differ significantly according to their age, gender, or smoking status.

### Discussion:-

Diabetes mellitus is being increasingly recognized as a worldwide significant public health problem (14). Patients with diabetes mellitus, by virtue of its numerous clinical and associated implications, suffer a poor quality of life. It is not surprising that sleep quality among these patients are significantly impaired. Diabetic patients frequently experience challenges to their sleep and wakefulness due to physiological imbalance and co-morbid sleep pathologies (15).

This study aimed to assess the sleep quality of diabetic patients and to identify the impact of diabetes control on patients' quality of sleep.

According to  $HbA1c$  level among participants, the current study showed that only 22.7% had controlled diabetes, i.e., with  $HbA1c$  level more than 7%. This finding is in agreement with those of Ji et al. (16), who reported that the rate of glycemic control of type 2 diabetes was only 16.8% and Lou et al. (17), who found that the glycemic control rate among diabetic patients was only 17%. However, some studies in USA reported glycemic control levels of 35–59% (18-21).

Results of this study revealed a high prevalence of poor sleep quality among type 2 diabetics.

This finding is in agreement with several studies which emphasized the high prevalence of poor sleep quality among diabetics. Tsai et al. (22) stressed the significant association between poor sleep and worse glycemic control among diabetic patients. Using PSQI  $> 5$  as a cutoff, Song et al. (23) reported that the prevalence of poor sleep quality among diabetics was 49.3%. Lou et al. (17) reported that the prevalence of poor sleep among diabetics was 33.6%.

This study showed that prevalence of poor sleep quality differed significantly according to participants' educational level, being highest among illiterate diabetics. However, it did not differ significantly according to their age, gender, or smoking status. Lou et al. (17) reported that diabetics with poor quality of sleep tended to be older, female, and less educated, compared with good sleepers.

The present study also revealed that prevalence of poor sleep quality differed significantly according to disease duration and diabetes control. Diabetics with longer disease duration and/or uncontrolled diabetes (i.e.,  $HbA1c$  level

>7%) had significantly higher prevalence of poor sleep quality than those with shorter duration of sleep and/or controlled diabetes.

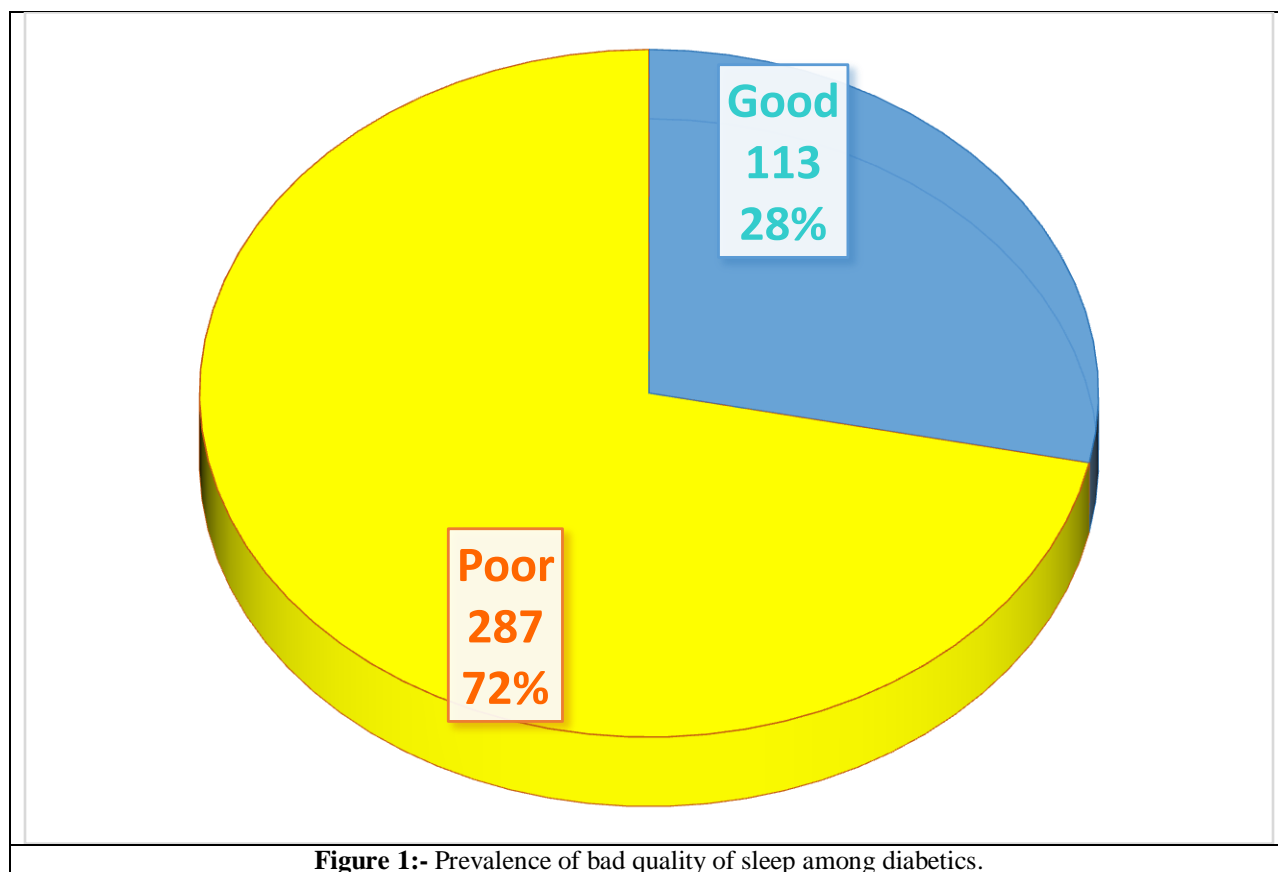
Keinanen-Kiukaanniemi et al. (24) argued that the duration of diabetes is a risk factor for poor quality of sleep. Jin et al. (25) explained this finding by that diabetics with long duration are more likely to suffer from a greater number of diabetes-related complications and poorer glycemic control, which are possibly associated with the poor quality of sleep, rather than the duration of diabetes itself.

Redekop (26) added that maintaining good glycemic control could reduce the risk of complications. Intensified glycemic control is expected as an important way to reduce risk of complications and improve quality of sleep. Sundaram et al. (27) stressed that better glycemic control, as assessed by HbA1c, is associated with lower emotional distress, better well-being, better health status, better quality of life and better sleep quality.

Sleep disturbance is an important health concern, especially among diabetics, as lack of adequate sound sleep interferes with all aspects of person's health and daily living activities (28).

**Table 1:-** Personal characteristics of study sample.

Personal characteristics	No.	%
Age groups		
• <20 years	39	9.8
• 20-60 years	265	66.3
• >60 years	96	24.0
Gender		
• Male	239	59.8
• Female	161	40.3
Educational level		
• Illiterate	84	21.0
• Primary/Intermediate/Secondary school	205	51.3
• University	111	27.8
Smoking status		
• Smoker	52	13.0
• Non-smoker	348	87.0
Duration of diabetes		
• <10 years	172	43.0
• 10+ years	228	57.0
Glycosylated hemoglobin level		
• <7%	91	22.8
• >7%	309	77.3

**Table 2:-** Participants' sleep quality according to their personal characteristics

Personal characteristics	Good Quality		Poor Quality		P value
	No.	%	No.	%	
Age groups					
• <20 years	16	41.0	23	59.0	
• 20-60 years	71	26.8	194	73.2	
• >60 years	26	27.1	70	72.9	0.175
Gender					
• Male	66	27.6	173	72.4	
• Female	47	29.2	114	70.8	0.731
Educational level					
• Illiterate	7	8.3	77	91.7	
• Primary/intermediate/secondary school	71	34.6	134	65.4	
• University	35	31.5	76	68.5	<0.001
Smoking status					
• Nonsmoker	18	34.6	34	65.4	
• Smoker	95	27.3	253	72.7	0.274
Duration of diabetes					
• <10 years	58	33.7	114	66.3	
• 10+ years	55	24.1	173	75.9	0.035
Glycosylated hemoglobin level					
• ≤7%	46	50.5	45	49.5	
• >7%	67	21.7	242	78.3	<0.001

### Conclusion:-

In conclusion, type 2 diabetes is associated with high prevalence of poor quality of sleep. Risk factors for poor quality of sleep include being illiterate, poorly diabetes control (i.e., HbA1c level > 7%) and long duration of disease. Primary health care physicians should monitor the quality of sleep among type 2 diabetics. Early detection and treatment of sleep disorders among diabetics is essential.

### References:-

1. Iyer SR. Sleep and Type 2 Diabetes Mellitus- Clinical Implications. JAPI 2012; 60: 42-47.
2. Yakoot M, Helmy S, Fawal K. Pilot Study of the Efficacy and Safety of Lettuce Seed Oil in Patients with Sleep Disorders. Pharco Corporation, 2011.
3. Bahammam AS. Sleep and blood sugar level (in Arabic). Website: <http://www.alnoum.com/index.php/ar/encrecord/getEncRecord/360/360>. Accessed on July 14th, 2015.
4. Taub LF1, Redeker NS. Sleep disorders, glucose regulation, and type 2 diabetes. Biol Res Nurs. 2008; 9(3):231-43.
5. Spiegel K, Leproult R, Van Cauter E. Impact of sleep debt on metabolic and endocrine function. Lancet 1999; 354:1435-1439.
6. Leproult R, Copinschi G, Buxton D, Van Cauter E. Sleep loss results in an elevation of cortisol levels in the next evening. Sleep 1997; 20:865-870.
7. Van Cauter E, Polonsky KS, ScheenAJ. Roles of circadian rhythmicity and sleep in human glucose regulation. Endocr Rev 1997; 18:716-38.
8. Gisalason T, Almqvist M. Somatic diseases and sleep complaints. Acta Med Scand 1987; 221:475-81.
9. Lamond N, Tiggemann M, Dawson D. Factors predicting sleep disruption in Type II diabetes. Sleep 2000; 23: 415-416.
10. Abrishami A, Khajehdehi A, Chung F. A systematic review of screening questionnaires for obstructive sleep apnea, Can J Anesth 2010; 57: 423-438.
11. Seibert PS, Valerio J, De Haas CA. Diabetes: Developing Telemedicine as a Viable Treatment Option. The Concomitant Relationship Shared by Sleep Disturbances and Type 2. Journal of Diabetes Science and Technology 2013; 7(6): 1607-1615.
12. Kassaian SE, Goodarzynejad H, Boroumand MA, Salarifar M, Masoudkabir F, Mohajeri-Tehrani MR, Pourhoseini H, Sadeghian S, Ramezanpour N, Alidoosti M, Hakki E, Saadat S, Nematipou E. Glycosylated hemoglobin (HbA1c) levels and clinical outcomes in diabetic patients following coronary artery stenting. Cardiovascular Diabetology 2012; 11:82.
13. Buysse DJ, Reynolds III CF, Monk TH, Berman SB, Kupfer DJ. The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. Psychiatry Res 1989; 28:193-213.
14. Surani S, Brito V, Surani A, Ghamande S. Effect of diabetes mellitus on sleep quality. World J Diabetes. 2015; 6(6): 868-873.
15. Kara B, Kılıç Ö. Predictors of poor sleep quality and excessive daytime sleepiness in Turkish adults with type 2 diabetes. J Clin Nurs. 2015; 24:1436-1439.
16. Ji LN, Lu JM, Guo XH, Yang WY, Weng JP, Jia WP, et al. Status of blood glucose control and treatment of type 2 diabetes in China. Chin J Diabetes Mellitus 2012; 4(7):397-401.
17. Lou P, Qin Y, Zhang P, Chen P, Zhang L, Chang G, Li T, Qiao C, Zhang N. Association of sleep quality and quality of life in type 2 diabetes mellitus: A cross-sectional study in type 2 diabetes mellitus: A cross-sectional study in China. Diabetes Research and Clinical Practice 2015; 107:69-76.
18. Koro CE, Bowlin SJ, Bourgeois N, Fedder DO. Glycemic control from 1988 to 2000 among U.S. adults diagnosed with type 2 diabetes: a preliminary report. Diabetes Care 2004; 27:17-20.
19. Zammitt NN, Frier BM. Hypoglycemia in type 2 diabetes: pathophysiology, frequency, and effects of different treatment modalities. Diabetes Care 2005; 28:2948-61.
20. Ong KL, Cheung BM, Wong LY, Wat NM, Tan KC, Lam KS. Prevalence, treatment, and control of diagnosed diabetes in the U.S. National Health and Nutrition Examination Survey 1999-2004. Ann Epidemiol 2008; 18:222-9.
21. Rombopoulos G, Hatzikou M, Latsou D, Yfantopoulos J. The prevalence of hypoglycemia and its impact on the quality of life (QoL) of type 2 diabetes mellitus patients (The HYPO Study). Hormones (Athens) 2013; 12(4):550-8.
22. Tsai YW, Kann NH, Tung TH, Chao YJ, Lin CJ, Chang KC, et al. Impact of subjective sleep quality on glycemic control in type 2 diabetes mellitus. Fam Pract 2012; 29(1):30-5.

23. Song Y, Ye X, Ye L, Li B, Wang L, Hua H. Disturbed subjective sleep in Chinese females with type 2 diabetes on insulin therapy. PLoS One 2013;8(1):e54951
24. Keinanen-Kiukaanniemi S, Ohinmaa A, Pajunpaa H, Koivukangas P. Health related quality of life in diabetic patients measured by the Nottingham Health Profile. Diabet Med 1996; 13:382–8.
25. Jin QH, Chen HH, Yu HL, Li TL. The relationship between sleep quality and glucose level, diabetic complications in elderly type 2 diabetes mellitus. Zhonghua Nei Ke Za Zhi 2012;51(5):357–61.
26. Redekop WK. Does improved glycaemic control lead to a better short-term quality of life in diabetes mellitus type 2? J Postgrad Med 2004; 5:194.
27. Sundaram M, Kavookjian J, Patrick JH, et al. Quality of life, health status, and clinical outcomes in type2 diabetes patients. Qual Life Res 2007; 16:165–77.
28. El-Kholy S, Hasanin A, Hosny H, Mostafa S, El Shazly N, El Gohary A, Samir S. Polysomnographic Aging in Normal Elderly Egyptians. Egypt J. Neurol Psychiat Neurosurg 2009; 46(2):421-429).

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### RESEARCH ARTICLE

#### The Role of MRI in the Early Detection of Multiple Sclerosis.

Thekra Al-harbi, Raghad Al-ruzaig and Maysa Al-Ghilan.

#### Manuscript Info

##### Manuscript History

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MS, MRI, active Multiple sclerosis,  
chronic Multiple Sclerosis .

#### Abstract

**Background:** Multiple sclerosis (MS) is the most common inflammatory demyelinating disease of the CNS and the most frequent cause of nontraumatic neurological disability in young and middle-aged adults (1). Women are twice as likely to be affected as men, and onset typically occurs between the ages of 20 and 40 years (2). The diagnosis Depend on a detailed history; careful neurological examination; and supportive paraclinical investigations. According to the new McDonald criteria, the diagnosis of MS requires objective evidence of lesions disseminated in space and time. MRI findings may contribute to the determination of dissemination in time or space (4).

**Aim of the study:** the aim is to evaluate the role of MRI and find the most common findings in the early stages of the disease, which could provide the knowledge to help finding a higher quality care or even a cure to the disease.

**Methodology:** This retrospective descriptive study was conducted at security forces hospital, Riyadh city, kingdom of Saudi Arabia. Data was collected by chart and radiological images review of all patients from any age or gender who were 1<sup>st</sup> diagnosed with multiple sclerosis by MRI. From 01-01-2013 till 01-01-2016 to evaluate the MRI role and to find what are the most common MRI findings of multiple sclerosis in early stages of the disease.

**Results:** We have found that the MRI is the first choice of imaging in detecting Multiple Sclerosis. From our 50 patients 15(30%) were diagnosed by active demyelinating MS and 35 patients (70%) were diagnosed by chronic demyelinating MS. The most used sequence in all the cases was T2 weighted, FLAIR was performed in 49 of the cases (98%), T1 after IV contrast was used in 7 cases (14%). The common findings in the chronic demyelinating MS were high signal intensity in T2 weighted and in Axial FLAIR, in active demyelinating MS was characterized by enhancement after IV contrast and restricted diffusion.

**Conclusion:** Most common technique for detecting MS in the early stages is Multiplanar Multisequential technique, we have found that the most common findings in Chronic multiple sclerosis are high signal intensity on T2 weighted images and flair and the active multiple sclerosis is represented by high enhancement after administration of IV contrast and in some cases, restricted diffusion is considered a sign of activity. MRI is in fact the most sensitive modality to detect MS at early stages.

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**Introduction:-**

Multiple sclerosis (MS) is the most common inflammatory demyelinating disease of the CNS and the most frequent cause of nontraumatic neurological disability in young and middle-aged adults (1). Women are twice as likely to be affected as men, and onset typically occurs between the ages of 20 and 40 years (2). The diagnosis depends on a detailed history; careful neurological examination; and supportive paraclinical investigations. According to the new McDonald criteria, the diagnosis of MS requires objective evidence of lesions disseminated in space and time. MRI findings may contribute to the determination of dissemination in time or space (4).

**General objectives:**

To evaluate the role of MRI in the early detection of Multiple Sclerosis (MS).

**Specific objectives:**

Find the best sequence for detecting MS in the early stages of the disease.  
Find the most common radiological findings in the early stages of MS.

**Hypothesis:**

Is there a best sequence for detecting MS in both active and chronic stages?

**Problem of study:**

Due to lack of full access of the patients recorded some information weren't able to reach.  
The short period due to the graduation semester didn't allow us to collect more data.

**Importance of the study:**

The disease is spreading among people. An early detection can help the patient to accept adapt and live with MS, because Managing MS is a process that begins with the very first symptom continuing throughout the disease.

**Ethical consideration:**

A signed consent was taken from princesses Nora university and from security forces hospital, Riyadh, Kingdom of Saudi Arabia. The data was managed confidential.

**Literature review:-****Definition:-**

Multiple sclerosis (MS) is considered one of the most common autoimmune diseases of the central nervous system (brain and spinal cord). (3)

MS is an inflammatory demyelinating condition; it is caused by damage to the myelin. Myelin allows the nerve to transmit its impulses rapidly. The loss of myelin (demyelination) is accompanied by a disruption in the ability of the nerves to conduct electrical impulses to and from the brain. This produces the various symptoms of MS. It is the speed and efficiency with which these impulses are conducted that permits smooth, rapid and coordinated movements to be performed with little conscious effort. (1)

In MS, the sites where myelin is lost (plaques or lesions) appear as hardened (scar) areas: in multiple sclerosis, these scars appear at different times and in different areas of the brain and spinal cord. (4)

**Incidence and prevalence:-**

MS is found in all parts of the world, its prevalence varies greatly, being highest in North America and Europe, and lowest in sub-Saharan Africa and East Asia. The number may be much higher as it is likely that many people with MS remain undiagnosed in certain parts of the world. There are about 2.3 million people in the world with MS. (1)  
It is almost unheard of in certain populations such as the Inuits, New Zealand Maoris and Australian Aborigines. (1)

**Risk factors associated with MS-**

The Risk factors affecting MS includes, Age, MS can occur at any age, but most commonly it affects people between the ages of 15 and 60. Sex, Women are about twice as likely as men are to develop MS, suggesting a role of



hormones in the disease's process. Family history, if one of the patient parents or siblings has had MS, they are at higher risk of developing the disease. (3)

There is a slightly higher risk of developing MS if the patient suffers from some types of disease for example, if the patient has thyroid disease, type 1 diabetes or inflammatory bowel disease. smokers usually have a higher risk of developing MS than nonsmokers especially if they experienced an initial event of symptoms that may signal MS. (7)

### **Signs and symptoms:-**

Multiple sclerosis signs and symptoms depends in the location of the damaged nerve fiber, they may differ greatly from one person to another and over the course of the diseases.

The Symptoms of MS may include; mental changes for example, decreased concentration, attention deficit and memory loss. Visual disturbances like, eye pain, loss of vision in one eye, blurred vision and color distortions. bladder and bowel dysfunction and some muscles disability like muscle spasms, fatigue, numbness and prickling pain. (3)

### **Stages of MS:-**

There are different forms of MS, depending on how it progresses. The disease can be: Primary progressive, this means that the symptoms are experienced by the patient regularly from the beginning. (4)

Secondary progressive, this means that the symptoms are not constantly experienced by the patient at first after that the attacks become more steady. This happens to many people who start out with relapsing-remitting disease. (7)

Relapsing-remitting, this means the symptoms of MS may come and go. Calling it an attack when the symptoms flare up. These attacks can last for days to weeks and usually refine slowly. Between attacks, people often feel ordinary While others may suffer from post attack effects. Relapsing-remitting is the most common type of MS. (6)

Progressive relapsing, this means that the worsening of the symptoms is steadily present from the beginning, and the attacks are also considered inconstantly occurring. (3)

### **Diagnosis of MS:-**

There are no specific tests for MS a diagnosis often relies on ruling out other conditions that might produce similar signs and symptoms, known as a differential diagnosis. (6)

Blood tests help to check for specific biomarkers associated with MS a, Lumbar puncture (spinal tap), in which a small sample of fluid is removed from the spinal canal for laboratory analysis. This sample can show abnormalities in antibodies that are associated with MS. (7)

MRI, is the diagnostic role that currently offers the most sensitive imaging of CNS. It can detect many more MS lesions than CT, and it can detect plaques in regions that are rarely abnormal on CT such as the brainstem, cerebellum, and spinal cord. Most lesions seen on MRI correlate with pathologic lesions. Patients with clinically definite MS have typical white matter lesions on MRI in nearly all cases. (2)

MRI evidence plays a supportive role in what is ultimately a clinical diagnosis of MS, in the appropriate clinical situation, and always at the exclusion of alternative diagnoses. (5)

A standardized MRI protocol for brain and spinal cord is crucial to differentiate between different diagnosis or between centers, this protocol called Multiplanar multi sequential technique. (6)

Gadolinium provides useful information about new lesion activity and is helpful in ruling out alternative diagnoses such as neoplasm, vascular malformations, and leptomeningeal disease. A single gadolinium-enhanced MRI can potentially provide evidence for dissemination in space and time. (7)

Spinal cord imaging is equally valuable to rule out spinal stenosis or tumor, and for detecting asymptomatic lesions when brain imaging is nondiagnostic in patients suspected of having MS. (3)

Evoked potential tests, which record the electrical signals produced by the nervous system in response to the stimuli. An evoked potential test may use visual stimuli or electrical stimuli, in which the patient watches a moving visual pattern, or short electrical impulses are applied to nerves in the legs or arms. Electrodes measure how rapid the information travels down the nerve pathways. (6)

The reason behind choosing this specific topic is how largely the disease is spreading among people. An early detection can help the patient to accept adapt and live with MS, because Managing MS is a process that begins with

the very first symptom continuing throughout the disease. Our study was held to evaluate the role of MRI in the early detection of MS, Since MRI is a powerful tool in detecting the disease it might provide an early detection even if the symptoms are not experienced by the patient yet and provide the knowledge to help finding a higher quality care or even a cure to the disease.

### Material and Methods:-

This retrospective descriptive study was conducted at security forces hospital, Riyadh city, kingdom of Saudi Arabia, to evaluate the MRI role and to find what are the most common MRI findings of multiple sclerosis in early stages of the disease. Data was collected by medical charts which include demographic data (age and gender) and the radiological images review of all the sequences performed for each patient who were diagnosed with multiple sclerosis by MRI from 1-1-2013 till 1-10-2016 and the data sample was 50 case.

#### Inclusion criteria:-

All cases that have been first diagnosed with Multiple Sclerosis By MRI.

#### Exclusion criteria:-

Relapsing stages of Multiple Sclerosis.

#### Date presentation:-

Data was presented by chart and tables

#### Data management:-

The data was analyzed by SPSS program.

### Results:-

This retrospective descriptive study was conducted at security forces hospital, includes 50 patients diagnosed with multiple sclerosis who have undergone MRI imaging of the brain and spine performed from 01/01/2013 to 01/10/2016, including 7 (14%) males and 43(86%) females. (table1).

Regarding age, the age range was between 17 to 58 years old and a median of 31 years old and a mean of 32 and a standard deviation of 10,34. our data were grouped into 3 categories, less than 26 years, includes 18 patients (36%), 26 to 40 years, includes 23 patients (46%), more than 40 years includes 9 patients (18%) (table1).

Multiple sclerosis affects women more commonly than men; we have found that 14% of the cases were males and the other 86% were females. The ratio of women to men having the disease is 43:7.

As showing in table 1 we have found two forms of the disease in the early stages: active demyelinating MS includes 15 patients (30%), while chronic demyelinating MS includes 35 patients (70%).

Table 1. Demographic data of 50 patients with Multiple Sclerosis

	Frequency	%
Age (years)		
Less than 26	18	36 %
26-40	23	46 %
40+	9	18 %
Gender		
Female	43	86 %
Male	7	14 %
Stages of MS		
Active demyelinating MS	15	30%
Chronic demyelinating MS	35	70%

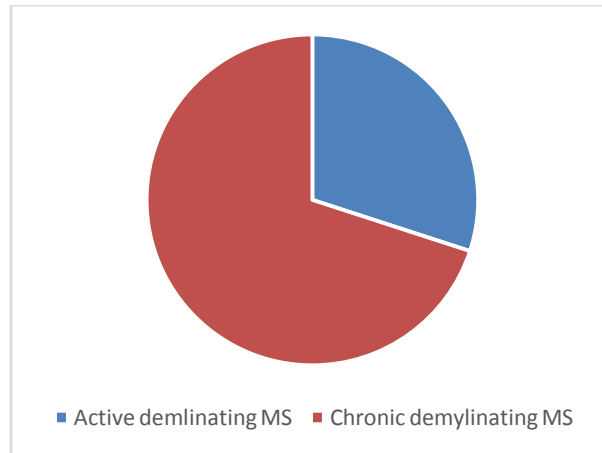


Figure 1. Stages of Multiple Sclerosis

We have found that some of the cases haven't applied the standardized technique for Multiple Sclerosis which is called multiplanar multi-sequential technique (table 3).

T2 weighted was the most common sequence which used in 49 of the cases (98%), Axial T1, Axial Flair and Axial Gradient Echo are used in 49 of the cases (98%), T1 after IV contrast was used in 7 cases (14%), T1 FAT SAT after IV contrast was used in 43 cases (86%). Diffusion was applied in 49 of the cases (98%) (table 2).

Table 2. the sequences performed in 50 patients of Multiple Sclerosis

Sequence	Frequency	%
Sagittal, Axial, Coronal T2	49	98%
Axial T1	49	98 %
Axial Flair	49	98 %
Axial Gradient Echo	49	98 %
T1 After IV Contrast	7	14%
T1 Fat Sat After IV Contrast	43	86 %
Diffusion	49	98 %

Table 3. The dominant standardized technique in the study population

	Frequency	%
Performed with multiplanar multi-sequential technique	41	82%
Performed without multiplanar multi-sequential technique	9	18%

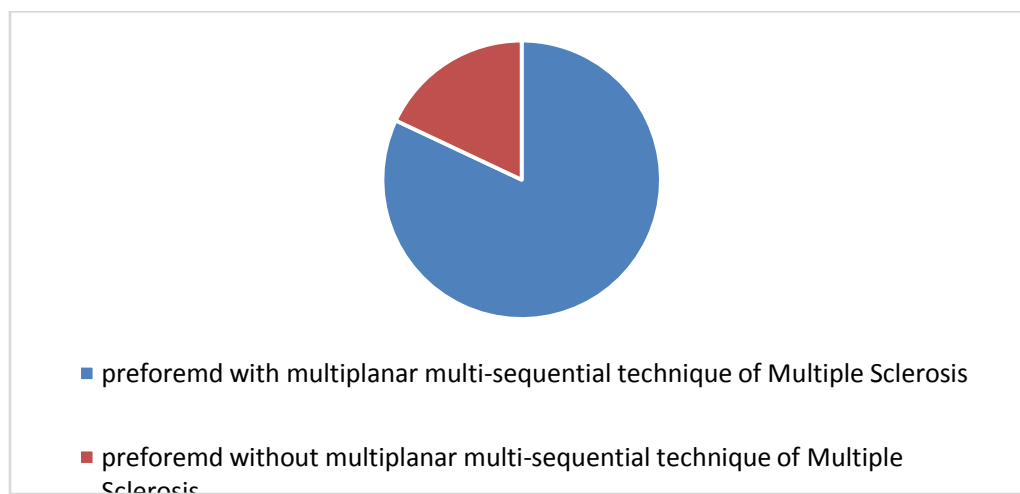


Figure2. multiplanar multi-sequential technique of Multiple Sclerosis.

Since comparable MRI abnormalities may be found in a variety of other diseases we have found that certain abnormalities are always present in the early stages of multiple sclerosis. We have found that Chronic multiple sclerosis shows high signal intensity on T2 weighted images and flair. The active multiple sclerosis is represented by high enhancement after administration of IV contrast and in some cases, restricted diffusion is considered a sign of activity.

All the cases (100%) shows high signal intensity on weighted T2. 45(90%) of the cases shows high signal intensity on flair. 2 (4%) of the cases shows small focal hemangioma. white matter changes appeared in 10 (19%) of the cases. 21 (42%) of the cases showed enhancement after IV contrast. Restricted diffusion appeared in 16 (32%) of the cases (table4).

Table 4. The MRI findings in the study population

Common MRI findings	Frequency	%
High signal intensity on t2 weighted	50	100%
High signal intensity on flair	45	90%
have a Few small focal hemangiomas	2	4%
White matter changes	10	19%
Enhancement after IV contrast	21	42%
Restricted diffusion	16	32%

### Discussion:-

The diagnosis of MS has traditionally relied upon accumulation of information, clinical and paraclinical, that leads to a positive diagnosis and can help to eliminate alternative diagnoses. The typical MRI findings in multiple sclerosis reflect the histopathology of the disease.

The result of Paty DW, Oger JJ, Kastrukoff LF, *et al.* (1988) research supports the hypothesis that consider MS a genetic disease which means that having a relative carrying the disease could increase the risk of developing it, however a valid evidence is not confirmed yet. We have noticed that some families have the disease more than others, but we couldn't determine if it is an actual factor or not, due to the lack of access to the patient's clinical history. (10)

We found in our 50 patients that Two stages of the disease are shown in the early diagnosis: active demyelinating MS and chronic demyelinating MS. We found a subtype of chronic MS the relapsing-remitting MS (RRMS) which is characterized by unpredictable relapses followed by a relative quiet period with no new signs of disease activity, we also found a subtype of active MS called Primary-progressive MS (PPMS) which is characterized by clearly defined relapses of increased disease activity and worsening symptoms, this matches the result of Barkhof F, Filippi M, Miller DH, *et al.* (1997) research. (11)

We have found that Some of our patients have a benign course of the disease. Which means that they only have mild symptoms and slow disease progression. Some studies show that some of these people experience some progression after 10 to 20 years.

We have found that Magnetic Resonance Imaging (MRI) offers the most sensitive imaging of the CNS, it can detect multiple sclerosis lesions better than CT and it can detect plaques in regions that are rarely abnormal on CT such as the brainstem, cerebellum, and the spinal cord. Therefore, we found that the first line of diagnosis in hospitals for MS is MRI.

As stated in Dalton CM, Brex, PA, Miszkiel KA, *et al.* (2002), research that There is a standardized MRI protocol for brain and spinal cord that is crucial for comparing between studies or to differentiate diseases that have similar symptoms as multiple sclerosis, such as seizure or stroke. our result matches this study, the protocol is known as the multiplanar multi-sequential technique which is a combination of all the sagittal, coronal and axial planes in addition to a before and after IV contrast images. (17)

We found that T2 weighted images always show high signal intensity in both active and chronic types which indicate the presence of a lesion, but it lacks the ability to distinguish between active and chronic lesions. The administration of gadolinium helps to determine the activity of the lesion and to roll out some other diseases.

A research by M Korostil and A Feinstein studied the relationship between alternative diagnoses and MS, it stated that there is a relationship between anxiety disorder and the onset of Multiple Sclerosis and patients with anxiety disorder should be scanned on a regular basis to look for Multiple Sclerosis. due to the social factors in Saudi Arabia there is less awareness about mental disorders, people here tend to ignore their mental health leading in a delay of the early diagnosis of MS in some cases. (3)

The findings of the study by Miller DH, Weinshenker BG, Filippi M, et al. (2008) assessed that a comparable MRI abnormalities may be found in a variety of other diseases, as shown in our result there are certain abnormalities that are always present in the early stages of multiple sclerosis. 20 percent of the cases showed changes in the white matter, some showed multiple periventricular/peri-callosal white matter changes and the other showed white matter edema. (22)

### Conclusion:-

The most common technique for detecting MS in the early stages was Multiplanar Multisequential technique, and the most common MRI findings in Chronic multiple sclerosis were high signal intensity on T2 weighted images and flair and the active multiple sclerosis is represented by high enhancement after administration of IV contrast and in some cases, restricted diffusion is considered a sign of activity. So, we conclude that the MRI is in fact the most sensitive modality to detect MS at early stages.

### Recommendation:-

Further studies should be done on the relation between the genetic factor and the onset of the disease. The benefit from these studies could assess an earlier detection of the disease if a relative carries it.

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We would like to show our gratitude for dr.Nermin Fahmy, who provided insight and expertise that greatly assisted the research and for sharing her pearls of wisdom with us during the course of this research and we are also immensely grateful for her comments on an earlier version of the manuscript and through the whole research.

### References:-

1. Polman, C., Reingold, S., Banwell, B., Clanet, M., Cohen, J., Filippi, M., Fujihara, K., Havrdova, E., Hutchinson, M., Kappos, L., Lublin, F., Montalban, X., O'Connor, P., Sandberg-Wollheim, M., Thompson, A., Waubant, E., Weinshenker, B. and Wolinsky, J. (2016). *Diagnostic criteria for multiple sclerosis: 2010 Revisions to the McDonald criteria.*
2. McDonald, W., Compston, A., Edan, G., Goodkin, D., Hartung, H., Lublin, F., McFarland, H., Paty, D., Polman, C., Reingold, S., Sandberg-Wollheim, M., Sibley, W., Thompson, A., Van Den Noort, S., Weinshenker, B. and Wolinsky, J. (2013). *Recommended diagnostic criteria for multiple sclerosis: Guidelines from the international panel on the diagnosis of multiple sclerosis.*
3. M Korostil A Feinstein (2006). *Anxiety disorders and their clinical correlates in multiple sclerosis patients - Jul 02, 2016.*
4. Nakahara, J., Maeda, M., Aiso, S. and Suzuki, N. (1999). *Current Concepts in Multiple Sclerosis: Autoimmunity Versus Oligodendrogliaopathy.*
5. Lublin, F. and Reingold, S. (1994). *Defining the clinical course of multiple sclerosis: Results of an international survey.*
6. DK, T. (2002). *The role of MRI in the diagnosis of multiple sclerosis.*
7. Franklin, G. and Nelson, L. (2016). *Environmental risk factors in multiple sclerosis: Causes, triggers, and patient autonomy.*
8. Schumacher FA, Beeve GW, Kibler RF, et al. (1965) *Problems of experimental trials of therapy in multiple sclerosis. Ann N Y Acad Sci*
9. Poser CM, Paty, DW, Scheinberg LC, et al (1983). *New diagnostic criteria for multiple sclerosis: guidelines for research protocols. Ann Neurol*
10. Paty DW, Oger JJ, Kastrukoff LF, et al. (1988) *MRI in the diagnosis of MS: a prospective study with comparison of clinical evaluation, evoked potentials, oligoclonal banding and CT. Neurology.*
11. Barkhof F, Filippi M, Miller DH, et al. (1997) *Comparison of MR imaging criteria at first presentation to predict conversion to clinically definite MS. Brain*
12. Fazekas F, Offenbacher H, Fuchs S, et al. (1988) *Criteria for an increased specificity of MRI interpretation in elderly subjects with suspected multiple sclerosis. Neurology.*

13. Tintoré M, Rovira A, Martínéz M, *et al.* (2000) *Isolated demyelinating syndromes: comparison of different MR imaging criteria to predict conversion to clinically definite multiple sclerosis.* *Am J Neuroradiol.*
14. Thompson AJ, Montalban X, Barkhof F, *et al* (2000). *Diagnostic criteria for primary progressive multiple sclerosis: a position paper.* *Ann Neurol.*
15. McDonald WI, Compston A, Edan G, *et al.*(2001) *Recommended diagnostic criteria for multiple sclerosis: guidelines from the International Panel on the diagnosis of multiple sclerosis.* *Ann Neurol.*
16. Polman CH, Reingold SC, Edan G, *et al.*( 2005) *Diagnostic criteria for multiple sclerosis: 2005 revisions to the "McDonald Criteria."* *Ann Neurol.*
17. Dalton CM, Brex, PA, Miszkil KA, *et al.* (2002) *Application of the new McDonald criteria to patients with clinically isolated syndromes suggestive of multiple sclerosis.* *Ann Neurol*
18. CHAMPS Study Group. (2002) *MRI predictors of early conversion to clinically definite MS in the CHAMPS placebo group.* *Neurology.*
19. Barkhof F, Rocca M, Francis G, *et al* (2003). *Validation of diagnostic magnetic resonance imaging criteria for multiple sclerosis and response to interferon beta-1a.* *Ann Neurol.*
20. Tintoré M, Rovira A, Rio J, *et al.*( 2003) *New diagnostic criteria for multiple sclerosis. Application in first demyelinating episode.* *Neurology*
21. Charil A, Yousry TA, Rovaris M, *et al.*( 2006) *MRI and the diagnosis of multiple sclerosis: expanding the concept of "no better explanation."* *Lancet Neurol*
22. Miller DH, Weinshenker BG, Filippi M, *et al.*( 2008) *Differential diagnosis of suspected multiple sclerosis: a consensus approach.* *MultScler*

## Appendices:-

### Images of different stages of Multiple Sclerosis



Case #1: 47-year-old female with chronic Multiple Sclerosis



Case #2: 36 years old female with active Multiple Sclerosis



Case#3: 52 years old female with chronic Multiple Sclerosis

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### RESEARCH ARTICLE

#### Using Interpreters: Can Black Feminist Thought and Anti-Oppressive Principles Be used to Improve Information Gathering and Social Service Efficacy in Populations That Are Culturally Diverse?

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#### Abstract

Globalization and other homogenizing developments, such as the free movement of citizens within the European Union, have brought people together from all corners of the earth, thereby increasing the need for skilled and culturally aware interpreters. In this paper, the authors reflect on their own experiences working with interpreters—both in research and in connection with the delivery of social services to marginalised women. When dealing with women of colour, the authors found, it is important to take into account principles defined by Black feminist writers and Anti-Oppressive Principles (AOP) designed to alleviate unequal, unfair, and otherwise oppressive conditions. Where women of colour are concerned, the authors further advocate using women from their cultures rather than men or women from outside their culture to interpret subjects' experiences. Using women interpreters from the same culture, the authors find, may increase the accuracy of research data and its interpretation and minimizes power inequalities associated with differences in gender, culture, and class. (160 words).

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#### Introduction

In international development as well as in the provision of social services, practitioners today are generally aware that steps must be taken to diminish female oppression, equalize opportunity, and otherwise promote gender equity (Equality Act/UK, 2010; Kanbur, 2002; UNDP, 2003b). The recent influx of refugees and asylum-seekers has meant that European nations now have an urgent need to improve the way they glean information and provide services to immigrant populations. Where developed countries host large numbers of refugees, where ethnic and economic tensions have led to large numbers of internally displaced people in developing countries, where war causes people to flee their homes—both incomers and locals will have to learn how to adapt to differences of language, religion, and culture. Global statistics show, moreover, that war and poverty disproportionately affect women and children, and that the feminization of poverty, especially for women of colour, is on the rise (International Labour Organisation 2011; Horn, 2010).

As societies become ever more heterogeneous, both culturally and linguistically, the need for interpreters also increases. Newcomers need to know the rules and to recognize their new countries' established institutions, and to understand what social and economic resources are open to them. Most of all, both hosts and newcomers need to understand how best to accommodate and adapt to each other's cultural norms.

Studies show that even in places where the law and policy supports the right to language, more often than not, speakers of non-official language are still disadvantaged, both financially and socially. Their lives, moreover, are marred by a great variety of misunderstandings and complexities, which proper interpretation could go far to alleviate (Norma and Garcia-Caro, 2016; Bhopal, 2010; Farooq and Fear 2003; Westmeyer, 1990). In addition, interpreters not only help with language barriers but also help bridge other kinds of differences to achieve common goals. Interpreters link service users with service providers and researchers with their informants. Without this vital link to bring about understanding, neither successful service provision nor research is possible.

The Australian study by Norma and Garcia-Caro (2016) highlights the importance of training interpreters dealing with certain types of situations in words and ideas specific to relevant fields. This study found, for instance, that community interpreters assisting migrant women experiencing high rates of domestic violence were not familiar with social science ideas about how best to deal with gender-related issues. The authors therefore recommend tailoring the education of interpreters in a research study of abused women to include information about these issues, so as to make them less obtrusive and more effective in gathering information from informants. When Australian migrant women had to relate experiences of violence through male interpreters, for example, they frequently found them insensitive. They also sensed that these interpreters were distorting their words, and became extremely distressed (Amnesty International Australia, 2008; Hunter, 2006).

Several authors have demonstrated that gender differences between subjects and interpreters can skew results and diminish the quality of information gathered. These studies showed clear benefits, when collecting research data about women, or using women to interview and interpret for women (Oakely, 1981; Harding, 1991; Finch, 1984; Cook and Fonow, 1990). Other studies raise questions about the advisability of using men from the same culture as interpreters for women reporting on gender-sensitive issues (Bhopal, 2010). Male interpreters with cultural taboos related to sex, for instance, are likely to shy away from sex-related topics and may even fail to translate sex-related incidents their subjects report (Hale, 2007; Pardy, 1995).

Psychiatrists have also noted the importance of research interpreters being familiar with the area of study, sensitive cultural issues, and words used in relevant fields (Farooq and Fear, 2003). Westmeyer (1990) reports a situation where an interpreter discouraged patients from divulging information seen as derogatory to their culture. Farooq and Fear (2003) found that interpreters unfamiliar with psychiatric-related words frequently introduced errors into the data gathered (see also Farooq et al. 1987).

Bhopal (2010), conducted research on how marginalised groups invariably deals with issues related to gender, identity, and personal experience. When properly handled, she observes, these three variables can create a “shared empathy and a shared understanding between the respondent and the researcher in which trust and rapport” encourage conversation. In her own research, Bhopal (2010) observed that her shared culture, experiences, and gender were instrumental in gaining access to Asian women and getting them to speak with her. She also discussed key issues for researchers and social service providers working with Gypsy communities, such as the separate spaces, both private and public, male and female Gypsies occupy. In this culture, women are prohibited from being in the company of men, including male interpreters, they are not related to (Bhopal, 2010). Bhopal’s research experience sheds light on the importance of gender as a key factor when recruiting interpreters and communicating with women from marginalised and non-indigenous cultures.

### **Black Feminist Thought and the “Anti-Oppressive” Principles**

Feminist theory overall is founded on the premise that women, although making valuable contributions to society globally, have been and still are culturally, economically, and educationally oppressed. This oppression has made it impossible for most women to achieve their full potential. Feminists therefore concentrate on ways to empower women, and to foster conditions likely to equalize access to education, power, and economic opportunity (Ropers-Huilman, 2002).

Emerging in the 1990’s and Informed by post-colonialist and post-modernist writings, Black Feminist Theory (BFT) is part of the third wave of the feminist movement as a whole. It goes beyond gender issues cited by earlier feminist writers and includes variables that specifically escalate female oppression (Hill 1991, Narayan 2004, Phoenix 2001). Black Feminist Theory contends, for instance, that the Black female experience goes beyond gender issues and must also include issues related to culture, class, and race. Hill (1991) and Phoenix (2001) contend that



the primary responsibility for defining a reality lies with the people who live it. Drawing on her own experience as a Black woman, Hill further confirms the Black feminist contention that race and class are essentials in the Black female life experience. Narayan (2004) additionally contends that lived experience confers a special expertise (an “epistemic advantage”) that allows a person to contextualize words and events with the understanding of a participant.

To understand the oppression of marginalised populations, Crenshaw (2007) emphasizes the importance of intersections where spheres of power overlap, and to compare them to marginalized peoples’ lived experiences. Social service professionals and academics may therefore find it useful, when working with marginalized women, to adopt the Black feminist practice of analysing human interactions and relationships in terms of race, culture, and class as well as gender equality (Burke and Harrison, 2002).

### **Understanding the Unknown Other:-**

Development specialists and researchers working in unfamiliar contexts obviously depend on interpreters to bridge the gap. They also draw on many different social work, sociological and anthropological theories about how best to analyse and understand information gleaned from other cultures—including Cultural Relativism (CR), Anti-Oppressive Principles (AOP), and Person-Centred Approaches (PCA).

Cultural Relativism denotes a person’s beliefs and activities must be understood in the context of that person’s own culture (Herskovits 1973, Lazer 1994). Anti-Oppressive Principles is the way we evaluate conditions and ways subjects’ powers (with regard to social status, race, gender, class, disability, sexual orientation, and age) can be used to shift power away from oppressive persons, organisations, structures, and communities. Clifton (1995) observes that our experiences, histories, geographical location, and place in society affect the way we understand and respond to the complex issues that lead to oppression. Helping to increase marginalised people (especially women)’s awareness of anti-oppressive principles helps them deal with issues arising from powerlessness. In Black Feminist Thought, black women are the best interpreters of the marginalised black woman’s experience. In Person-Centred Approach, Dominelli (2008) stresses the importance of using a Person-Centred Approach to reduce structural inequalities, because it helps to empower users and lessen the deleterious impact of social and economic inequality.

### **Interpreters: Reflections Working in Cross-Cultural Communities – Adelaide Lusambili**

In this section, I reflect on my own experience using male interpreters to speak with marginalized, non-English speaking women in both developed and developing countries. I then present my argument as to why I think black marginalised women’s accounts cannot be properly interpreted by men. It is my contention that, when recruiting interpreters, we need to apply Anti-Oppressive Principles and principles espoused in Black Feminist Thought and to minimise the damage done by chronic conditions of oppression and inequality in these women’s lives

The provision of services in the UK to minority ethnic groups from within the EU and from Commonwealth countries, many of whom come as refugees and asylum seekers and have limited proficiency in the English language, require help in interpreting their stories/views to professionals (Tipton, 2016). Scant research exists on the crucial role of interpreters in gathering information needed to provide culturally appropriate services. In the UK, trained and untrained interpreters work alongside each other. According to a National Health Service England (NHS) policy statement, patients should receive primary care services in a timely manner and should not be prevented from doing so because they do not speak English. and This means that the law requires they be provided with services designed to meet their language and communication needs.

Tipton’s (2016) research revealed some of the issues experienced by health professionals, interpreters, and service users. For example, her study revealed that interpreters are usually hired in a hurry and most of them have limited background in the subject matter. Despite this, interpreters are frequently called upon to provide opinions and give their views on material issues. Other issues raised were service users’ mistrust of interpreters and sometimes also of service providers, who are generally in a hurry to move on to the next appointment. Findings that there is a general feeling of mistrust and that frequent misunderstandings arise from poor quality interpretation, raise concerns about the quality of interpretation and also raise ethical concerns about the quality of treatment provided.

In 2016, I had the opportunity of working with marginalised non-English speaking women who needed interpreters to relay their messages to professionals so that they could be sign-posted to available community services where

they could obtain help. In one instance, a Gypsy male interpreter was called to interpret for a family whose child had undergone physical and sexual abuse. When the interview began, the female respondent whose child had undergone abuse began to explain what had happened in her language. The male interpreter looked on, and when his turn came to relay the message, all he said was, "She says people don't like her on this street...I think that is why her child was assaulted" and then kept quiet. The interpreter then went on to talk with her in their native language. The female interviewee then became emotional, went quiet and began to weep. We decided to cancel the session as we thought she was upset talking about her daughter's abuse. We decided that we would return another day. When we did so, we held the meeting in a community building, with a different male interpreter. This time, we completed the session; however, the male interpreter made it clear to us that he had not translated some words that may relate to sexual acts as the culture does not allow him to do that. He also intervened in the woman's account and told professionals that he knew the family the woman had mentioned that perpetrated the abuse and he did not think that they were capable of committing this act. He went further and spoke to the woman in their native language, which professionals learned later that she had put pressure on this woman not to implicate the family in this case.

This experience was not only with one family in this community but with many of the families with whom we worked. However, when Gypsy women were provided with interpreters from their culture who were women, conversations were detailed and professionals at the session were able to see and interpret the respondents' facial expressions for themselves. Women reported that they preferred their fellow women as interpreters and that male interpreters from the same community could not adequately report or talk about issues of physical or sexual abuse, especially when perpetrated by fellow men.

The experience of women feeling uncomfortable relaying their experiences of abuse in the presence of male interpreters and the issue of male interpreters not wanting to relay messages that they felt could stigmatise the women and their families were also experienced while working with some Black Africans and Asian women in the UK. For instance, while working with a Black African woman, she came to me after a male interpreter had left and revealed that, even though she had said she received welfare benefits, she did not personally receive and control the money, her husband did. She explained that she was afraid to share this information during the interpretation because the male interpreter, who hailed from the same community, might find a way of relaying the information to her husband. A similar instance was experienced when volunteering for an Asian Women organization in North of England who were working with ethnic minority families in fuel poverty. While interviewing an older lady, whose house was cold, the (male) community interpreter, who was familiar with the family, had deliberately omitted information that the bills had not been paid due to the son's financial abuse of his mother. The son had not paid the bills for many months, and the home was cold. When a female interpreter accompanied me, we learned that the son controlled the finances and was abusing the lady financially; however, the male interpreter had failed to tell us this information as he was familiar with the family, and it may be that he wanted to protect the son.

The experiences with interpreters working with black women living in developing countries are no different. Between 2005 -2008 and in 2009 and in the summer of 2016, I conducted research in the slums of Nairobi on differential impacts of environmental sanitation. One of the main findings of this study was women's physical and sexual abuse while accessing sanitation facilities in the night. Because women in these slums did not speak my native language, I employed a male research assistant to translate their stories from their native language into English. Women were uncomfortable sharing their experience of abuse with a male interviewer, while the male interviewer did not seem comfortable delving deeper into the topic.

Issues concerning physical and sexual abuse are very delicate. My experience demonstrates the role of gender identity in research. Research has shown that gender identity can create empathy between interpreters and service users. As such, trust and rapport can provide a conducive environment in which interpreters can open up and discuss their personal experiences (Bhopal, 2010). These experiences have also shown that tensions associated as a result of power relationships can impact the quality of information given by marginalised women. These experiences also highlight the need for professionals to be alert and able to use anti-oppressive principles to prevent ways in which poor interpretation could be detrimental to provision of services to marginalised groups. Adequate provision of services cannot be delivered if in the first instance the available information is not credible.

### **Interpreters, Gender, and Ethnic Conflict Research – Fr Kizito Muchanga**

In the following section, I reflect on my doctoral research conducted with women who had experienced rape and loss of property during the Post-Ethnic Violence (PEV) in Kenya. The purpose of this reflection is to share some

experiences from fieldwork and demonstrate how issues of power, gender and culture caused me to think that black women's – and in particular marginalised women's – stories of their experience of sexual abuse can be better researched or presented by other women. Secondly, based on my reflection, I want to add to the existing knowledge by arguing that women's stories must be understood holistically by locating them within social, cultural and political structures that are geographically and historically specific. Lastly, black feminist thought and anti-oppressive principles are crucial in understanding vulnerable people's experiences of abuse.

My study took place between 2012 and 2015 in Western Kenya. Before commencing this study, I was familiar with most of the women who had suffered physical and sexual abuse during Post-Ethnic Violence. This was through my work as a Catholic Priest in the area, who had provided shelter to these women during the violence. The objective of my study was to examine the effectiveness of the Catholic strategies in dealing with conflicts. As a clergyman and a researcher, I was also keen to understand the experience of these women and the ways in which the church could assist from a psycho-social point of view.

Many of the victims of Post-Election Violence came from a different ethnic group to mine, and spoke a language unfamiliar to me. As such, I had two interpreters helping with the research and alternating depending on their schedules. Because issues of physical and sexual abuse are sensitive culturally and can lead to long-time stigmatisation for individuals and their families in this culture, I decided to use a seminary nun and another clergyman familiar with their language to interpret these women's experiences. The interview process was slow, as potential interviewees who had been identified through the development project affiliated to the church either cancelled their interviews or recanted their testimonies of being raped. For a few of the interviews that we conducted, information received was scant and participants did not want to engage with me, the researcher, or the nun. One nun who worked with the majority of the women in the local health centre had noted that the women should be interviewed during their health sessions and that community health workers or nuns who spoke their language were better placed to interview them. This method was successful as women shared their experience comfortably with the nuns or community health workers. Even when it came to counselling, women preferred to talk to the nuns and they preferred to be counselled by the nuns.

My experience made me to reflect on ways in which development specialists working in Post-Conflict Violence can approach issues of physical and sexual abuse when working with women who have experienced male dominance. While women were willing to share other experiences with me, such as destruction of property they incurred during the violence, they were not comfortable divulging information on sexual abuse. Anti-Oppressive Approaches show how social differences and power can disempower some groups while empowering others. While I am not sure to what extent being male, a clergyman and from a different ethnic group may have caused the women to refrain from sharing their views, it was clear that they felt at ease with other women from their culture. This experience raises issues from Black Feminist Thought, in particular how to represent the subjects lived experience from an insider point of view while paying attention to the intersection between gender, class and culture.

### **Conclusions:-**

In this paper, the authors draw from Black Feminist Thought and Anti-Oppressive Principles' to reflect on the interpreters' role when working with marginalised women, especially women of colour, who are not native English speakers. The authors draw on their personal experience working with women from diverse cultures.

As developed countries are increasingly called upon to provide social services to people from many different cultures, the use of interpreters has also increased. Interpreters, in fact, provide the vital service of making service-users' accounts intelligible. These accounts ultimately guide which services are delivered, and how well interventions meet service users' needs. In questioning the efficacy of using male interpreters to communicate with marginalized female service users, this paper highlights a problem in social and medical service provision that is too often ignored.

Further research needs to examine ways in which social cultural and gender variables must be factored in the recruitment of interpreters. The reflections have also raised issues on the efficacy of male community interpreters in interpreting issues of sexual or physical abuse that are likely to be committed by men from the same culture. Even within countries that have internally displaced people, these reflections provide a platform upon which further research can be conducted that can inform how ethnicity and women speakers of local languages can be used to glean data from victims of sexual abuse in their own cultures.

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### References:-

1. Amnesty International Australia (2008). Setting the standard: International good practice to inform an Australian national plan of action to eliminate violence against women, Sydney, Australia. <https://static.amnesty.org.au/wp-content/uploads/2016/09/Setting-the-Standard-NPoA-Report-Stop-violence-against-women.pdf>. Retrieved on 25/November/2016
2. Bhopal, Kalwant (2010). Women's Studies International Forum, 33 (2010). PP 188-195.
3. Clifford, D.J. (1995). Methods in oral history and social work. Journal of the oral History Society. 23 (2).
4. Cook, Judith, & Fonow, Mary (1990). Knowledge and women's interests: Issues of epistemology and methodology in feminist sociological research. In Joyce Nielsen (Ed). Feminist Research Methods Boulder: West View.
5. Dominelli, Lena (2008). Anti-Racist Social Work Education. Palgrave. Third Edition. British Association of Social workers
6. Equality Act (2010). <http://www.legislation.gov.uk/ukpga/2010/15/contents>. Retrieved on 24/12/2016
7. Farooq, Saeed and Fear, Chris (2003). Working Through Interpreters. Advances in Psychiatry vol 9 (104-109).
8. Finch, Janet (1984). It is great to have someone to talk to'. The ethics and politics of interviewing women. In Colin Bell & Helen Roberts (Eds). *Social Researching: Politics, Problems, Practice* pp. 70-97. London: Routledge
9. Hale, S. (2007). Community Interpreting. Basingstoke, UK: Palgrave Macmillan.
10. Harding, Sandra (1991). Whose science? Whose knowledge? Milton Keynes: Open University Press.
11. Harrison, Philomena and Burke, Beverley (2002). Anti-Oppressive Practice, In Adams et al (2002) Anti-Oppressive Practice. Basingstoke: Palgrave Macmillan Ltd: 227-236.
12. Herskovits, Melville, J. (1973). Cultural Relativism: Perspectives in Cultural Pluralism. New York: Vintage Books.
13. Hill, Collins Patricia (1991). Black Feminist Thought: Knowledge Consciousness and the politics of empowerment. New York : Routledge.
14. Horn, Z. E. (2010) 'The Effects of the Global Economic Crisis on Women in the Informal Economy: Research Finding
15. Hunter, R. (2006). Narratives of domestic violence. Sydney Law Review, 28.
16. International Labour Organisation (ILO) (2011) Global Employment Trends 2011: The Challenge of a Jobs Recovery (Geneva: ILO).
17. Kanbur, Ravi (2002), Education, Empowerment and Gender Inequalities, Cornell University. [www.people.cornell.edu/pages/sk145](http://www.people.cornell.edu/pages/sk145).
18. Lazer, Mark (1994). Cultural Relativism. Texas: University of Texas-Pan American. Retrieved November 26<sup>th</sup>, 2016.
19. McCall, Leslie. (2005) "The complexity of intersectionality." *Signs* 30.3 (2005): 1771-1800.
20. Norma, Caroline and Garcia-Caro (2016). Gender Problems in the Practice of Professional Interpreters Assisting Migrant Women in Australia: A Theoretical Case for Feminist Education. Violence Against Women. Vol 22 (11). 1305-1325.
21. Oakely, Ann (1981). Interviewing women: A contradiction in terms. In Helen Roberts (Ed). Doing Feminist Research (pp. 30-161). London: Routledge.
22. Pardy, M. (1995). 'Speaking of Speaking': Experiences of women and interpreting. Interpreting for women project. Fitzroy, Australia: Clearing House on Migration Issues.
23. Phoenix, Ann (2001). Practising feminist research: The intersection of gender and 'race' in the research process. In Kum Kum Bhavnani (Ed). Feminism and race (pp. 203-219). Oxford: Oxford University Press.
24. Rampton, M. (2008). Three waves of feminism. The magazine of Pacific University. Retrieved on December 12, 2016 from <https://www.pacificu.edu/about-us/news-events/four-waves-feminism>
25. Rosalind, Edwards (1990). Connecting Method and epistemology: A White woman interviewing Black woman. Vol 3 (5), p 477-490
26. Tipton, Rebecca (2016). Perceptions of the "Occupational Other": Interpreters, Social Workers and Intercultures. British Journal of Social Work 46 (2) 463-479.
27. United Nations Development Program (2003b). Millennium Development Goals, Source: <http://www.undp.org/gender/docs/mdgs-genderlens.pdf> retrieved 25/12/2016
28. Westermeyer, J (1990). Working with an interpreter in psychiatric assessment and treatment. Journal of Nervous and Mental disorders. Vol 178 (745-749).

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## RESEARCH ARTICLE

### A KINETIC STUDY OF THE OXIDATION OF NITRITE ION BY PEROXODISULPHATE.

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#### Abstract

The oxidation of nitrite ion  $\text{NO}_2^-$  by Peroxodisulphate ion  $\text{S}_2\text{O}_8^{2-}$  was studied in high ionic strength and in phosphate and acetate media at around  $\text{pH}=7$  and  $60^\circ\text{C}$ . Under controlled conditions the reaction is of overall second order being first order with respect to reactants. Cations ( $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{+2}$ ,  $\text{Mg}^{+2}$  and  $\text{Cu}^{+2}$ ) catalyze the reaction and the extent of catalysis depends on the nature and concentration of the cations. The temperature effect on the redox reactions was studied and the activation energy is  $60.01 \text{ kJmol}^{-1}$ . The mechanism has been proposed. Based on experimental data and kinetic simulation, we have modified previous models for this reaction mechanism and show that the new model proposed here is consistent with experimental data. The stoichiometry was determined to be:-



And the experimental rate law is:

$$R_0 = k_1[\text{S}_2\text{O}_8^{2-}]_0 + k_2[\text{S}_2\text{O}_8^{2-}]_0[\text{NO}_2^-]_0 + \{\sum k_{\text{Mi}}^{n+}[\text{M}^{n+}]\}[\text{S}_2\text{O}_8^{2-}]_0[\text{NO}_2^-]_0 \quad (2)$$

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#### Introduction:-

Peroxodisulphate ion  $\text{S}_2\text{O}_8^{2-}$  is one of the strongest oxidizing agents known in aqueous solution<sup>(1)</sup>. Peroxodisulphuric acid and its salts were suggested to be among the most useful oxidizing agents in aqueous solution<sup>(2,3)</sup>. Many studies on the thermal decomposition of Peroxodisulphate ions were made by many workers such as Cotton, Kolthoff, Miller, Vasudeva, Taha and Wasif<sup>(4)</sup> and there is general agreement that it follows first order kinetics. Reactions involving peroxodisulphate ion are generally slow at ordinary temperatures<sup>(5)</sup> but become more rapid in the presence of some metal ions like  $\text{Ag(I)}$ ,  $\text{Fe(II)}$  and  $\text{Cu(II)}$ . Therefore in this work we used  $\text{Na}^+$  and  $\text{K}^+$  in the redox reaction between Peroxodisulphate ion and nitrite ion.

The kinetic study of the reaction of nitrite ion has been of increasing interest due to its biological and chemical implications<sup>(6,7)</sup>. Nitrite ion is a common contaminant in water, and because its complexing ligand (with  $\text{Fe(II)}$ ) its presence can be dangerous. The kinetics of the redox reaction of  $\text{S}_2\text{O}_8^{2-}$  and  $\text{NO}_2^-$  was studied by a number of workers. Elamin<sup>(8,9)</sup>, who found that the oxidation of nitrite ion by peroxodisulphate was second order, being first order with each reactant.

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**Materials:-**

All chemicals used are of high purity (98%). The redox reaction of peroxodisulphate with nitrite ion proceeds at measurable rate at about 60°C and it is for this reason, that the temperature range 60<sup>0</sup>- 75<sup>0</sup>C was chosen. For each run two solutions A and B were prepared. A was freshly prepared –K<sub>2</sub>S<sub>2</sub>O<sub>8</sub>- while B was a mixture of NaNO<sub>2</sub>, added salts (NaNO<sub>3</sub> and KNO<sub>3</sub>) which maintained the constant ionic strength and phosphate buffer (Na<sub>2</sub>HKPO<sub>4</sub> – KH<sub>2</sub>PO<sub>4</sub>). Also solutions A and B were prepared in the same manner and acetate (C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>Na – C<sub>2</sub>H<sub>4</sub>O<sub>2</sub>) buffer is used instead of phosphate buffer. Solutions A and B were made in such way that the concentration of each species was double the value required in the final reaction mixture. Water carefully redistilled from alkaline KMnO<sub>4</sub> was used.

**Preparation of Solutions:-**

**(i) Solution A:** Calculated amount of K<sub>2</sub>S<sub>2</sub>O<sub>8</sub> (A.R) was dissolved in double distilled water to make 500cm<sup>3</sup> of solution A.

**(ii) Solution B:** Calculated amount of NaNO<sub>2</sub>, NaNO<sub>3</sub>, KNO<sub>3</sub> and Phosphate buffer (Na<sub>2</sub>HPO<sub>4</sub> - KH<sub>2</sub>PO<sub>4</sub>) or acetate buffer (C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>Na – C<sub>2</sub>H<sub>4</sub>O<sub>2</sub>) are dissolved in double distilled water to make 500cm<sup>3</sup> of solution B. The additional components under study (i.e. allylacetate was added in each kinetic run to solution B.

**Reaction Conditions:-**

The redox reaction was carried out in the conditions: [S<sub>2</sub>O<sub>8</sub><sup>2-</sup>]<sub>0</sub>=[NO<sub>2</sub><sup>-</sup>]<sub>0</sub>, high ionic strength around one (I=0.80-1.34), Phosphate buffer [Na<sub>2</sub>HPO<sub>4</sub>]=[KH<sub>2</sub>PO<sub>4</sub>]=0.20 mol dm<sup>3</sup> or acetate buffer (Na<sub>2</sub>HPO<sub>4</sub> - KH<sub>2</sub>PO<sub>4</sub>).

**Kinetic measurements:-**

The progress of the reaction was followed by examining the concentration of peroxodisulphate ion at various time interval. The concentration of S<sub>2</sub>O<sub>8</sub><sup>2-</sup> was determined iodometrically during the kinetic run. Purified nitrogen gas was passed through the quenched iodine flask contain 10cm<sup>3</sup> sample so as to drive away any dissolved oxygen. Then 4gms of KI were added. It was then placed in the dark for about 10minutes till all the iodine was liberated. The liberated iodine was then titrated against standard sodium thiosulphate using starch as an indicator.

The concentration of nitrite ion was determined before the kinetic runs by two methods;

**(a) Titration method:** By using standard potassium permanganate solution.

**(b) Spectrophotometric method:** By reacting nitrite ion with a series of organic materials to form a purple dye, so that the measured absorption A was plotted vs. nitrite concentration. A straight line passing through the original point was obtained and thus providing that the solution obeys Beer's law.

**Results and Discussion:-****Kinetic order with respect to Peroxodisulphate ion**

The order of the reaction-in its initial stages-with respect to S<sub>2</sub>O<sub>8</sub><sup>2-</sup> was investigated under the constant conditions given in the captions of table (1) which shows the variation of the initial rate of disappearance of peroxodisulphate ion, R<sub>0</sub>, with its initial concentrations. A plot of R<sub>0</sub> vs. [S<sub>2</sub>O<sub>8</sub><sup>2-</sup>]<sub>0</sub> (fig.1) gives a straight line indicating that the reaction is first order with respect to S<sub>2</sub>O<sub>8</sub><sup>2-</sup>, thus:

$$R_0 = -d[S_2O_8^{2-}]_0/dt = k_{obs} [S_2O_8^{2-}]_0 \quad (1)$$

Where k<sub>obs</sub> is initial-pseudo first order rate constant. From fig(1) the slope = k<sub>obs</sub> = 3.7398X10<sup>-5</sup> s<sup>-1</sup>, at 60°C.

**Table (1) Variation of R<sub>0</sub> with [S<sub>2</sub>O<sub>8</sub><sup>2-</sup>]<sub>0</sub>**

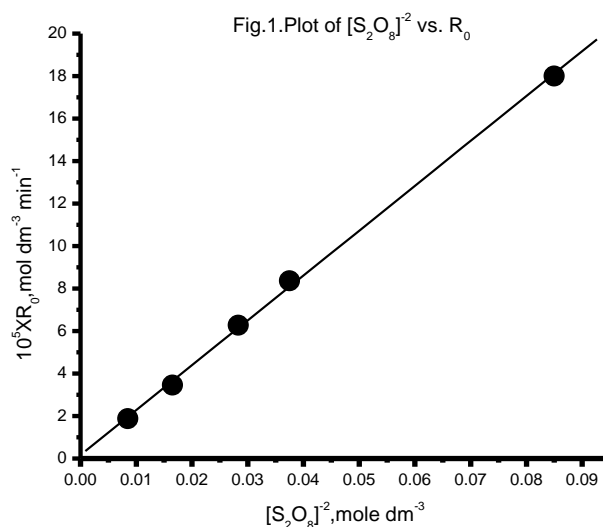
[NO<sub>2</sub><sup>-</sup>]<sub>0</sub>=0.0752 mol dm<sup>-3</sup> [Na<sup>+</sup>]=[K<sup>+</sup>]=0.500 mol dm<sup>-3</sup>

[HPO<sub>4</sub><sup>2-</sup>]=[H<sub>2</sub>PO<sub>4</sub><sup>-</sup>]=0.20 mol dm<sup>-3</sup> I=1.23-1.26

pH=6.47

Temp.=60°C

[S <sub>2</sub> O <sub>8</sub> <sup>2-</sup> ] <sub>0</sub> / mol dm <sup>-3</sup>	0.0085	0.0165	0.0283	0.0375	0.0850
10 <sup>3</sup> xR <sub>0</sub> /mol dm <sup>-3</sup> min <sup>-1</sup>	1.8771	3.4502	6.2727	8.3648	18.000



#### Kinetic order with respect to Nitrite ion:-

The effect of varying the initial concentration of nitrite ion –while- keeping  $[\text{S}_2\text{O}_8^{2-}]_0$  and other factors constant, was investigated by plotting of initial rate of the disappearance of peroxydisulphate against the respective  $[\text{NO}_2^-]_0$  values, (fig 2) and (Table 2), a straight line intercepting the y-axis was obtained suggesting a rate equation of the form:

$$R_0 = -d[\text{S}_2\text{O}_8^{2-}]/dt = R_1 + k[\text{NO}_2^-]_0 \quad (2)$$

$R_1$  represents the thermal decomposition of peroxydisulphate in the absence of nitrite ion while the second term represents the redox ( $\text{S}_2\text{O}_8^{2-}$ - $\text{NO}_2^-$ ) path. Since the reaction is first order in  $\text{S}_2\text{O}_8^{2-}$  equation (2) can be rewritten as:

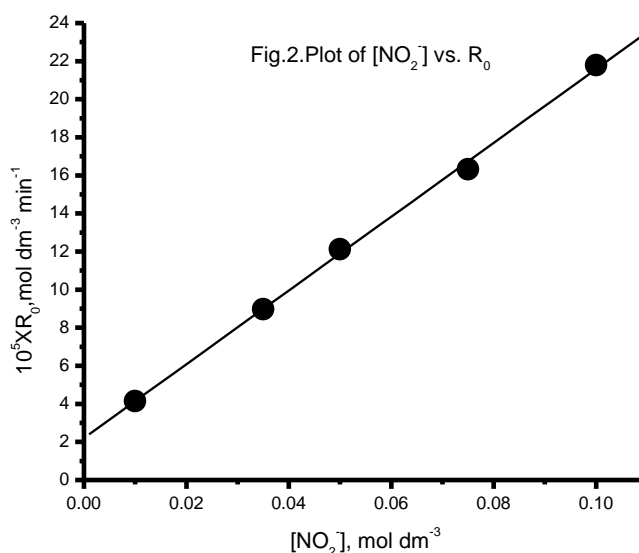
$$R_0 = k_1[\text{S}_2\text{O}_8^{2-}]_0 + k_2[\text{S}_2\text{O}_8^{2-}]_0 [\text{NO}_2^-]_0 \quad (3)$$

Where  $k_1$  is the thermal decomposition of peroxydisulphate and  $k_2$  is second order rate constant.

**Table (2) Variation of  $R_0$  with  $[\text{NO}_2^-]_0$**

$[\text{S}_2\text{O}_8^{2-}]_0 = 0.0751 \text{ mol dm}^{-3}$        $[\text{Na}^+] = [\text{K}^+] = 0.500 \text{ mol dm}^{-3}$   
 $[\text{HPO}_4^{2-}] = [\text{H}_2\text{PO}_4^-] = 0.20 \text{ mol dm}^{-3}$        $I = 1.23-1.27$   
 $\text{pH} = 6.47$        $\text{Temp.} = 60^\circ\text{C}$

$[\text{NO}_2^-]_0 / \text{mol dm}^{-3}$	0.0100	0.0350	0.0500	0.0750	0.1000
$10^5 \times R_0 / \text{mol dm}^{-3} \text{min}^{-1}$	4.1489	8.9667	12.1277	16.3176	21.7895



**Effect of hydrogen ion:-**

The pH of the redox reaction was changed in the range (4.65-8.41) by changing the ratio  $[\text{HPO}_4^{2-}]/[\text{H}_2\text{PO}_4^-]$  under otherwise constant experimental conditions table(3). The pH was measured directly using a pH-meter. From table (3.3) there is no clear effect on  $R_0$ . Therefore it is safe to conclude that the rate of the reaction is independent of pH.

**Table (3) Variation of  $R_0$  with pH:-**

$[\text{S}_2\text{O}_8^{2-}]_0 = 0.0750 \text{ mol dm}^{-3}$   $[\text{NO}_2^-]_0 = 0.0748 \text{ mol dm}^{-3}$   
 $[\text{Na}^+] = [\text{K}^+] = 0.500 \text{ mol dm}^{-3}$   $[\text{HPO}_4^{2-}] = [\text{H}_2\text{PO}_4^-] = 0.20 \text{ mol dm}^{-3}$   $I = 1.1-1.2$   
 Temp. =  $60^\circ\text{C}$

$10^7 \times [\text{H}^+], \text{mol dm}^{-3}$	pH	$10^4 \times R_0 / \text{mol dm}^{-3} \text{ min}^{-1}$
22.284	4.652	1.620
15.030	5.823	1.632
1.1939	6.923	1.650
0.1321	7.879	1.688
0.0389	8.409	1.711

**Effect of free radical scavengers:-**

The effect of adding allylacetate in multi concentrations was studied by carrying out the runs in experimental conditions given in the caption of table (4). From this table no clear effect is observed. This probably shows that free radicals are not involved in the rate-determining step although the result does not exclude the presence of free radicals in other fast steps.

**Table (4) Variation of  $R_0$  with Allyl acetate:-**

$[\text{S}_2\text{O}_8^{2-}]_0 = 0.0750 \text{ mol dm}^{-3}$   $[\text{NO}_2^-]_0 = 0.0750 \text{ mol dm}^{-3}$   
 $[\text{Na}^+] = [\text{K}^+] = 0.500 \text{ mol dm}^{-3}$   $[\text{HPO}_4^{2-}] = [\text{H}_2\text{PO}_4^-] = 0.20 \text{ mol dm}^{-3}$   $I = 1.24$   $\text{pH} = 6.47$   
 Temp. =  $60^\circ\text{C}$

$10^3 \times [\text{Allyl acetate}] / \text{mol dm}^{-3}$	Nil	6.1892	9.2193	11.2371
$10^5 \times R_0 / \text{mol dm}^{-3} \text{ min}^{-1}$	2.778	2.768	2.759	2.776

**Effect of added salts:-**

The effect of added the salts  $\text{NaNO}_3$ ,  $\text{KNO}_3$ ,  $\text{Mg}(\text{NO}_3)_2$ ,  $\text{Ca}(\text{NO}_3)_2$  and  $\text{Cu}(\text{NO}_3)_2$  on the redox reaction was shown in figs.( 3 and 4) by varying the concentration of the cation under otherwise constant experimental conditions given in tables (5 and 6). To investigate the effect of divalent cations ( $\text{Mg}^{+2}$ ,  $\text{Ca}^{+2}$  and  $\text{Cu}^{+2}$ ) the medium was changed from phosphate buffer to acetate buffer which does not form precipitates with the cations. Effect of  $\text{Na}^+$  and  $\text{K}^+$  were repeated in acetate medium. It is clear from figs.( 3 and 4) that the rate of the reaction is linearly to cations concentrations ( $[\text{M}^{+n}]$ ,  $n=1$  or  $2$ ), thus the rate of the reaction may be expressed by eq.4.

$$R_0 = C + k_{\text{obs}} [\text{M}^{+n}] \quad (4)$$

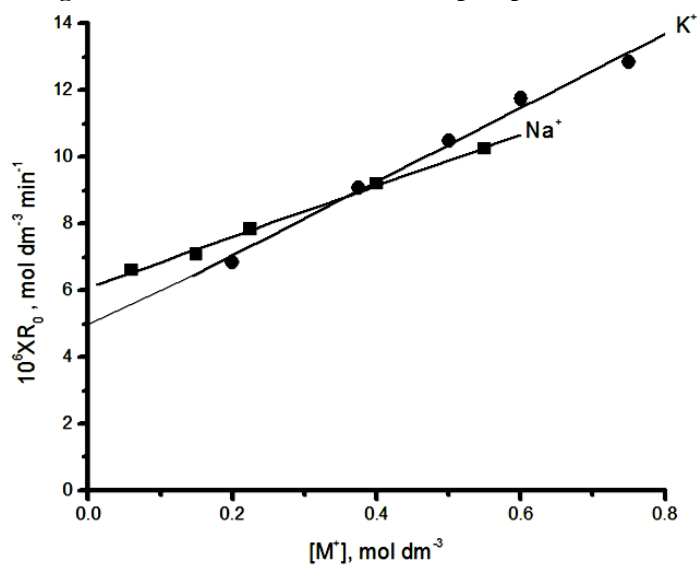
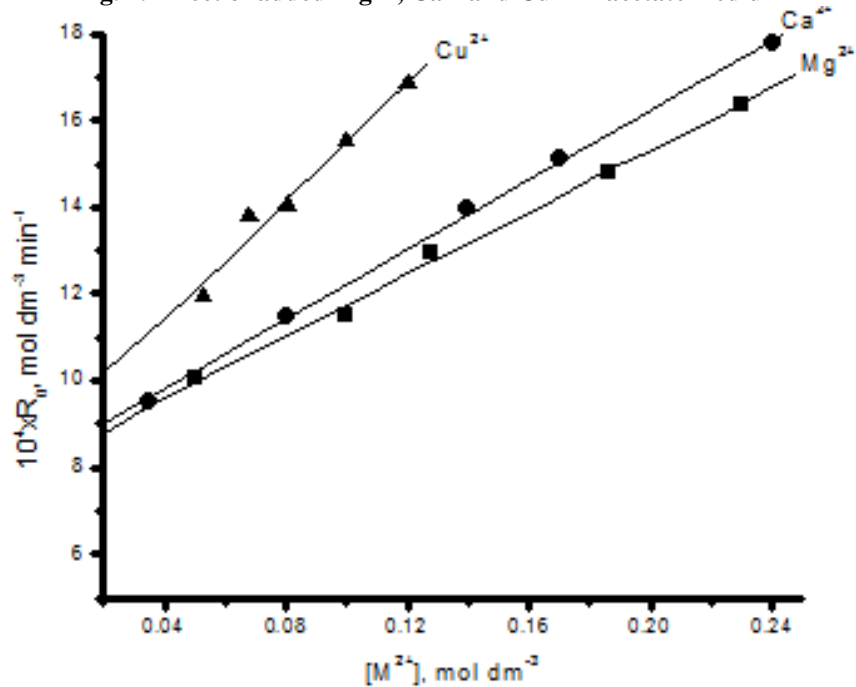
In which C is y-intercept at  $[\text{M}^{+n}] = 0$  and  $k_{\text{obs}}$  is slope of the straight lines, as defined by the equations (5) and (6) respectively:

$$C = k_1 [\text{S}_2\text{O}_8^{2-}]_0 + k_2^0 [\text{S}_2\text{O}_8^{2-}]_0 [\text{NO}_2^-]_0 + k_{\text{Mi}}^{+n} [\text{M}_i^{+n}] [\text{S}_2\text{O}_8^{2-}]_0 [\text{NO}_2^-]_0 \quad (5)$$

$$k_{\text{obs}} = k_{\text{M}}^{+n} [\text{S}_2\text{O}_8^{2-}] [\text{NO}_2^-] \quad (6)$$

where  $k_{\text{M}}^{+n}$  is the catalytic rate constant for the cation  $\text{M}^{+n}$  under study,  $k_{\text{Mi}}^{+n}$  is that of the residual cation  $\text{M}^{+n}$  and  $k_2^0$  is the second order rate constant at zero cation concentration. Substituting the relevant values of C and  $k_{\text{obs}}$  from each plot and the appropriate values of the other terms applicable to it leads to the results given in tables(5 and 6). Thus it is evident that the cations catalyze the redox reaction and that they do so in the ascending order  $\text{Na}^+ < \text{K}^+ < \text{Mg}^{2+} < \text{Ca}^{2+} < \text{Cu}^{2+}$ .



Fig. 3. Effect of added  $\text{Na}^+$  and  $\text{K}^+$  in phosphate mediumFig. 4. Effect of added  $\text{Mg}^{2+}$ ,  $\text{Ca}^{2+}$  and  $\text{Cu}^{2+}$  in acetate mediumTable (5) Effect of added  $\text{Na}^+$  and  $\text{K}^+$  cations in phosphate medium

$[\text{S}_2\text{O}_8^{2-}]_0 = 0.0750 \text{ mol dm}^{-3}$   $[\text{NO}_2^-]_0 = 0.0750 \text{ mol dm}^{-3}$   
 $[\text{HPO}_4^{2-}] = [\text{H}_2\text{PO}_4^-] = 0.20 \text{ mol dm}^{-3}$  pH=6.47 Temp.=60°C

Cation	$k_M^+ \times 10^4 \text{ mol}^{-2} \text{ dm}^6 \text{ s}^{-1}$
$\text{Na}^+$	$2.80 \pm 0.06$
$\text{K}^+$	$4.52 \pm 0.04$

**Table (6) Effect of added Na<sup>+</sup>, K<sup>+</sup>, Mg<sup>+2</sup>, Ca<sup>+2</sup> and Cu<sup>+2</sup> cations in acetate medium**

[S<sub>2</sub>O<sub>8</sub><sup>2-</sup>]<sub>0</sub>=0.0650 mol dm<sup>-3</sup> [NO<sub>2</sub><sup>-</sup>]<sub>0</sub>=0.0650 mol dm<sup>-3</sup> [C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>Na]=[C<sub>2</sub>H<sub>4</sub>O<sub>2</sub>]=0.20 mol dm<sup>-3</sup> pH=4.67 Temp.=60°C

Cation	Cx10 <sup>6</sup> (intercept) mol dm <sup>3</sup> s <sup>-1</sup>	k <sub>obs</sub> x10 <sup>6</sup> s <sup>-1</sup>	k <sub>M<sup>+</sup>nx10<sup>4</sup> mol<sup>-2</sup> dm<sup>6</sup> s<sup>-1</sup></sub>	K <sub>2</sub> <sup>0</sup> x10 <sup>5</sup> mol <sup>-1</sup> dm <sup>3</sup> s <sup>-1</sup>
Na <sup>+</sup>	1.03	1.25	2.91±0.04	4.31
K <sup>+</sup>	0.77	1.94	4.54±0.03	4.01
Mg <sup>+2</sup>	1.35	5.92	13.84±0.09	4.35
Ca <sup>+2</sup>	1.36	6.75	15.80±0.01	4.35
Cu <sup>+2</sup>	1.36	11.88	27.50±0.08	4.36

The rate law for the reaction is thus detailed as in equation (7).

$$R_0 = k_1[S_2O_8^{2-}]_0 + k_2[S_2O_8^{2-}]_0[NO_2^-]_0 + \{\sum k_{Mi}^{n+}[M^{n+}]\}[S_2O_8^{2-}]_0[NO_2^-]_0 \quad (7)$$

Where k<sub>Mi<sup>n+</sup></sub> is the catalytic rate constant for i<sup>th</sup> ion.

Where i = 1,2 represents the cations present in the system. When only one cation is present the term within the Σ sign reduces to k<sub>M<sup>n+</sup></sub>[M<sup>n+</sup>] and equation becomes:

$$R_0 = k_1[S_2O_8^{2-}]_0 + k_2[S_2O_8^{2-}]_0[NO_2^-]_0 + k_M^{n+}[M^{n+}][S_2O_8^{2-}]_0[NO_2^-]_0 \quad (8)$$

### Effect of temperature:-

The effect of temperature on the k<sub>2</sub> path was studied over the temperature range 60-75°C<sup>0</sup> at otherwise constant experimental conditions of:

[S<sub>2</sub>O<sub>8</sub><sup>2-</sup>]<sub>0</sub> = 0.0660 mol dm<sup>-3</sup>, [NO<sub>2</sub><sup>-</sup>]<sub>0</sub> = 0.0663 mol dm<sup>-3</sup>  
 [Na<sup>+</sup>]=[K<sup>+</sup>] = 0.50 mol dm<sup>-3</sup>, [HPO<sub>4</sub><sup>2-</sup>]=[H<sub>2</sub>PO<sub>4</sub><sup>-</sup>]=0.20 mol dm<sup>-3</sup>  
 I=1.24 pH=6.47

The values of the first order rate constant for the thermal decomposition of S<sub>2</sub>O<sub>8</sub><sup>2-</sup>, k<sub>1</sub>, calculated by Elamin, were used in calculating k<sub>2</sub> at each temperature from equation(5). Results are summarised in table(7).

The effect of temperature on k<sub>2</sub> components (i.e. k<sub>2</sub><sup>0</sup> and k<sub>M<sup>n+</sup></sub>) was also studied in the range 60-75°C. For each temperature k<sub>2</sub> was calculated from equation(3), and then k<sub>M<sup>n+</sup></sub> was calculated from y-intercept of figures resulting from plot of [M<sup>n+</sup>] vs. R<sub>0</sub> by using the equation

$$R_0 - k_1[S_2O_8^{2-}]_0 = k_2[S_2O_8^{2-}]_0[NO_2^-]_0 + k_M^{n+}[M^{n+}][S_2O_8^{2-}]_0[NO_2^-]_0 \quad (9)$$

From plot of log k<sub>M<sup>n+</sup></sub> against 1/T the relevant Arrhenius parameters are calculated in table (7) for each path.

**Table (7) Thermodynamics parameters of activation**

Path	ΔE <sup>#</sup> /kJmol <sup>-1</sup>	A	ΔS <sup>#</sup> /JK <sup>-1</sup>	ΔG <sup>#</sup> /kJmol <sup>-1</sup>
K <sub>2</sub>	60.01	7.64x10 <sup>5</sup>	132.97	14.54
K <sub>2</sub> <sup>0</sup>	98.74	1.26x10 <sup>11</sup>	33.23	87.68
k <sub>Na<sup>+</sup></sub>	74.70	1.56x10 <sup>8</sup>	88.73	45.15
k <sub>K<sup>+</sup></sub>	66.40	1.34x10 <sup>7</sup>	109.03	30.09

### Discussion:-

#### A proposed mechanism:-

The rate law equation(2) may be explained by the following mechanism:

**Path(I):** Thermal decomposition of peroxodisulphate independent of nitrite ion which has its rate-determining step in equation(6)

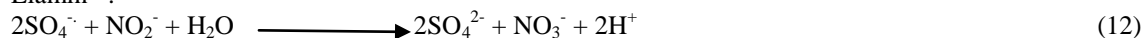


Therefore the rate equation of this path may represent by the equation(7)

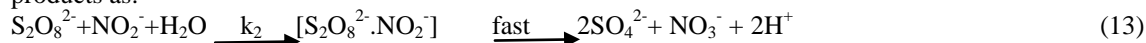
$$\text{Rate} = k_1 [S_2O_8^{2-}]_0 \quad (11)$$

Which corresponds to the right hand side (r.h.s.) of equation (2).

Some SO<sub>4</sub><sup>·-</sup> radicals seem to end up forming oxygen according to well established mechanism discussed by House<sup>(10)</sup>, while most SO<sub>4</sub><sup>·-</sup> radicals seem to oxidize NO<sub>2</sub><sup>-</sup> ion in some faster steps represented by the overall equ.(8) given by Elamin<sup>(7)</sup>.



**Path(II):** In this path the rate determining step involves both S<sub>2</sub>O<sub>8</sub><sup>2-</sup> and NO<sub>2</sub><sup>-</sup> which in presence of water leads to products as:

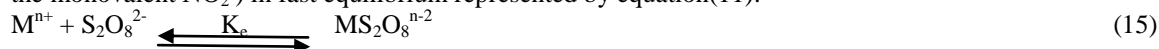


which the rate equation:

$$-d[S_2O_8^{2-}]_0/dt = k_2[S_2O_8^{2-}]_0 [NO_2^-]_0 \quad (14)$$

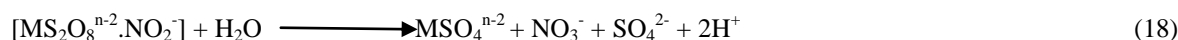
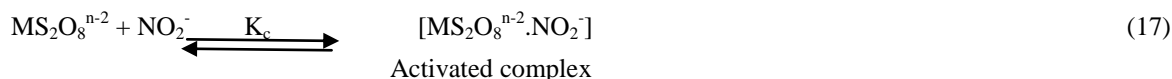
and this explains the second term on the r.h.s. of equation(2)

**Path(III):** Because of the divalent negative charge of  $S_2O_8^{2-}$  ion forms an ion-pair with the cation (in preference to the monovalent  $NO_2^-$ ) in fast equilibrium represented by equation(11):



$$\text{Which gives } K_e = [MS_2O_8^{n-2}] / [M^{n+}][S_2O_8^{2-}] \quad (16)$$

Nitrite ion is expected to react with the ion-pair faster than its reaction with the un-associated  $S_2O_8^{2-}$  ion<sup>(11,12)</sup> due to the decrease of coulombic barrier. The resulting activated complex formed by the interaction between  $NO_2^-$  and  $MS_2O_8^{n-2}$  decomposes to form reaction products in a series of steps represented by the equations:



Equation (13) is the rate determining step and therefore the rate equation is :

$$\text{Rate} = k_c[MS_2O_8^{n-2}][NO_2^-] \quad (19)$$

Substituting the value of  $[MS_2O_8^{n-2}]$  obtained from rearranging equation(12) in equ.14 gives:-

$$\text{Rate} = K_e k_c [M^{n+}][S_2O_8^{2-}][NO_2^-] \quad (20)$$

This equation explain the catalytic effect of the cations (i.e.  $Na^+$ ,  $K^+$ ,  $Mg^{+2}$ ,  $Ca^{+2}$  and  $Cu^{+2}$ ).

Which can be reduced to:-

$$\text{Rate} = k_M^{n+} [M^{n+}][S_2O_8^{2-}][NO_2^-] \quad (21)$$

This is equivalent to the third term of the r.h.s. of equation (2). When i is set equal to one and when:

$$k_M^{n+} = K_e k_c \quad (22)$$

Equation (2) can be rewritten as:

$$R_0 = k_1[S_2O_8^{2-}]_0 + k_2^0[S_2O_8^{2-}]_0 [NO_2^-]_0 + K_e k_c [M^{n+}][S_2O_8^{2-}]_0 [NO_2^-]_0 \quad (23)$$

#### Acknowledgement:-

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#### References:-

1. LATIMER, W.M., The Oxidation States of the Elements and their
2. Potential in Aqueous Solution, Prentice Hall, New York. P.78,1952.
- Prof. Ranjit K. Verma ., Inorganic Chemistry - Oxidation and reduction ,pp.(3-23),2006.
3. KOLTHOF, I.M. and MILLER, I.K, J.Amer.Chem.Soc.,pp.73-3055,1951.
4. BARTLET, P.and J. COTTMAN, J.Amer.Chem.Soc.Vol.71. p.1419, 1949.
5. MARSHALL,H., J.chem.soc.59.p.771,1981.J. Phys. Chem. B, Vol. 111, No. 27, 7779-7785, 2007.
6. CACHAZA,J.M.,CASADO,Can.J.Chem.Vol.54,p.3401,1976.
7. ELAMIN,S.M.,The Oxidation of Nitrite Ion by Peroxodisulphate,Gazz. Chim. Italiana.Vol.114,pp.77-84,1984.
8. BALL,E and O.EDWARDS, Inorganic chemical.Acta,99,1,pp.48-49,1985.
9. CHLEBEK,R.W. and M.W.LISTER,Can.J.Chem.Vol.49,p.2943,1976.
10. HOUSE,D.A.Chem.Rev.62,pp.185-200,1962.
11. MANUEL,B.,Gazz.Chem.Ital.pp.129-133,1980,via.Chem Abs.Vol.93,pp.10201-192876,1980.
12. Gennady E.Zaikov, Artur J. M. Valente, Alexei L. Iordanskii., Advances in Kinetics and mechanism of Chemical Reactions, apple academic press inc.pp.3-20, 2013.

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### RESEARCH ARTICLE

#### BONE CANCER- CURRENT PHARMACOTHERAPEUTIC APPROACH.

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Adjuvant  
therapy, Curettage, GCT, Phenol, Ulna

#### Abstract

Bone cancer is a malignant (cancerous) tumor of the bone that destroys normal bone tissue. Malignant tumors that begin in bone tissue are called primary bone cancer. Primary bone cancer is far less common than cancer that spreads to the bones. Types of Primary bone cancer are Osteosarcoma, Chondrosarcoma. Diagnostic tests may include the following:-X-rays, Bone scan, Computed tomography (CT or CAT) scan, Magnetic resonance imaging (MRI), Angiogram. Treatment options depend on the type, size, location, and stage of the cancer, as well as the person's age and general health. Treatment for bone cancer includes Surgery, Chemotherapy, Radiation therapy, and Cryosurgery. Surgery is one of the main treatments for primary bone cancers and is very specialized treatment. Chemotherapy works very well for some types of bone cancer, particularly Ewing's sarcoma. Radiotherapy called Intensity modulated radiotherapy (IMRT) to treat bone cancer. Cryosurgery is used to treat some types of low-grade cancerous and noncancerous tumors of the bone & is sometimes used instead of conventional surgery to destroy the tumor. Regular follow-up care ensures that changes in health are discussed and that problems are treated as soon as possible. Participation in clinical trials is an important treatment option for many people with bone cancer. NCI, a part of the National Institutes of Health, is sponsoring clinical trials in many hospitals and cancer centers around the country. Several cases of long bone giant cell tumor have been reported in the literature. We report the case of a patient with a giant cell tumor in the distal ulna. This is very unusual, with a reported incidence of 0.45 to 6%. A 17-year male presented with a painful swelling of the left wrist. After performing an instrumental examination, a diagnosis of distal ulna giant cell tumor was made. The tumor was treated with an intralesional curettage, phenol application and bone grafting. This tumor may have a good prognosis if it is diagnosed early and radically treated. It is important to be aware of atypical cancer localizations in order to perform a proper diagnosis.

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### Introduction:-

BONE CANCER-Is defined as the abnormal growth that are found in the bone which is affected. The growth may be malignant or may be benign<sup>1</sup>.

The bone tumor can be divided into two type's i.e.

- Primary bone tumor
- Secondary bone tumor

Primary bone tumor-this arises or originates from the bone.

Secondary bone tumor-this arises from other areas of body and then also starts spreading to the bone.

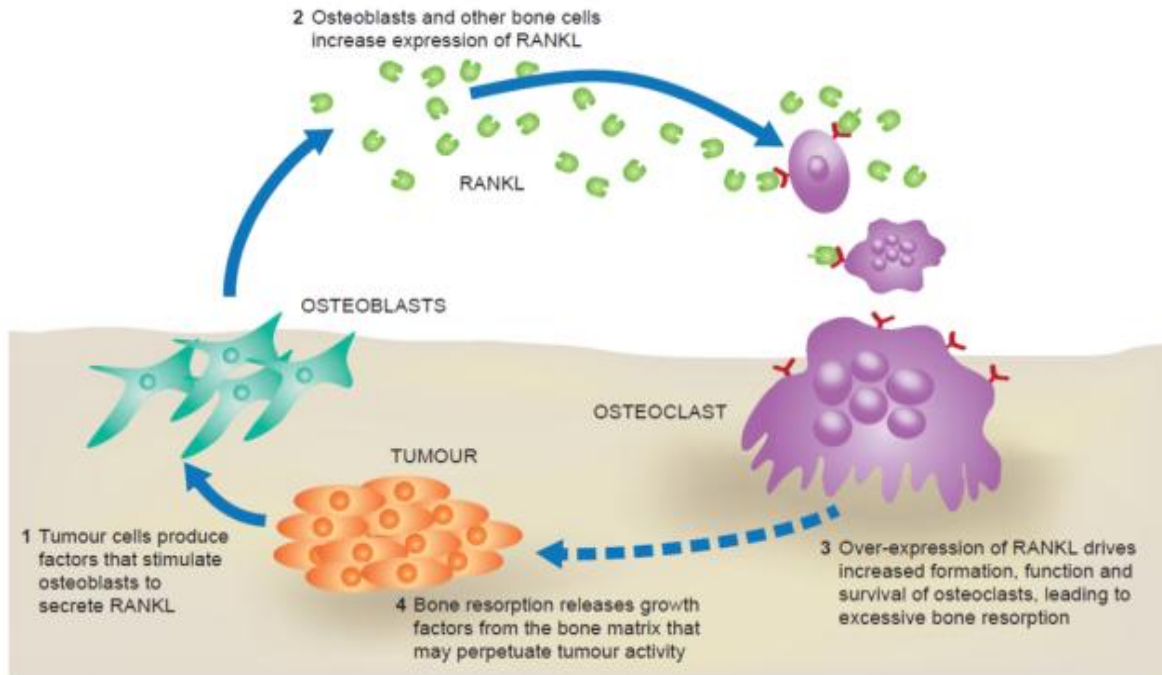


Figure 1:- Vicious cycle of bone destruction in metastatic bone.

### Epidemiology:-

he primary bone cancer involves less than 0.02 %of cancer. As per the analysis done by the Surveillance, Epidemiology and End Results Cancer Statistics Review of the National Cancer Institute<sup>2</sup>, they have an estimation of that 2,810 men and women will be diagnosed with and 1,490 will die of cancer of bones and joints in 2011. In UNITED STATES the malignancies diagnosed accounted for 0.2% of bone sarcomas.

Variable in Cox regression model	Deaths/PYs	HR	95% CI
Bone metastasis at or subsequent to diagnosis			
None	83,133 / 132,988	1.0 (referent)	-
Yes, without SREs	11,482 / 5,382	2.4	(2.4, 2.5)
Yes, with SREs	12,099 / 5,302	2.4	(2.4, 2.5)
Age at cancer diagnosis			
65-69	19,320 / 33,628	1.0 (referent)	-
70-74	26,334 / 41,783	1.1	(1.1, 1.1)
75-79	27,519 / 37,163	1.3	(1.2, 1.3)
80-84	20,084 / 21,275	1.5	(1.5, 1.6)
85+	13,457 / 9,824	2.0	(1.9, 2.0)
Race/ethnicity			
White	90,441 / 123,502	1.0 (referent)	-
African American	8,870 / 10,262	1.1	(1.1, 1.1)
Hispanic American	3,390 / 4,112	1.0	(1.0, 1.1)
Other	4,013 / 5,797	0.9	(0.8, 0.9)
Gender			
Men	58,406 / 70,875	1.0 (referent)	-
Women	48,308 / 72,798	0.9	(0.9, 0.9)
Stage at cancer diagnosis			
Distant	56,564 / 36,078	1.0 (referent)	-
Localized	14,144 / 53,818	0.3	(0.3, 0.3)
Regional	24,092 / 44,646	0.5	(0.5, 0.5)
Unstaged	11,914 / 9,131	1.0	(1.0, 1.0)
Charlson comorbidity score			
0	85,690 / 122,151	1.0 (referent)	-
1	2,274 / 3,030	1.1	(1.0, 1.1)
2	6,594 / 7,647	1.2	(1.2, 1.2)
3+	12,156 / 10,844	1.4	(1.4, 1.5)

\*HRs for each variable are adjusted for all other variables in the table

Table 1:- Epidemiology and End Results Cancer Statistics

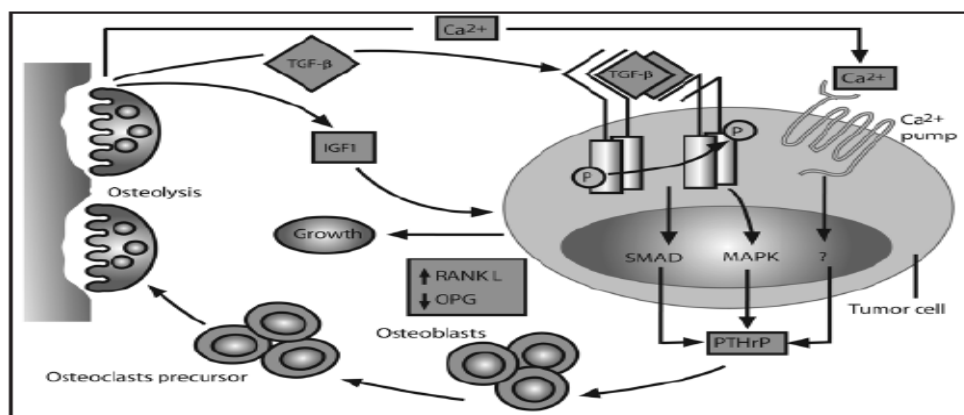
### Etiology(risk factors):-

The risk factors for the bone cancer includes as following-

- In general nobody knows the true cause of bone cancer.
- Patients with long term inflammatory diseases.
- Radiotherapy
- Paget's disease
- Hereditary renoblastoma
- Genetically heridited(close relatives)
- Li-fraumeni syndrome.

### Pathophysiology:-

Normal bone remodeling maintains an appropriate balance between the action of osteoclasts (bone-resorbing cells) and osteoblasts (bone-forming cells). Skeletal malignancies, including bone metastases, disrupt the OPG-RANKL-RANK signal transduction pathway and promote enhanced osteoclast formation<sup>3</sup>, thereby accelerating bone resorption and inducing bone loss. This osteolysis in turn leads to the release of bone-derived growth factors, contributing to a “vicious cycle” in which interactions between tumor cells and osteoclasts not only lead to increased osteoclastogenesis and osteolytic activity, but also aggressive growth and behavior of the tumor cells. The osteolytic complications associated with bone metastases are caused by tumor-induced alterations of the OPG-RANKL-RANK system, which are accompanied by enhanced bone resorption and disassociated from counterbalancing bone formation by osteoblasts<sup>4</sup>.



**Figure2: Physiology of osteolytic metastases.** Release of TGF- $\beta$  and IGF1 and increased concentrations of  $\text{Ca}^{2+}$  contribute to a “vicious cycle” in which interactions between tumor cells and osteoclasts not only lead to increased osteoclastogenesis and osteolytic activity, but also aggressive growth and behavior of the tumor cells.

### Consequences of bone metastases:-

#### Consequences of Bone Metastases



### Lab investigations:-

Tests that may be done include:- Alkaline phosphatase blood level, Serum phosphorus, Ionized calcium, Serum calcium, Bone biopsy, Bone scan, Chest x-ray, CT scan of the chest, MRI of the bone and surrounding tissue, X-ray of bone surrounding tissue. This disease may also affect the results of the following tests:- Alkaline phosphatase isoenzyme, Blood calcium level, Parathyroid hormone (PTH), Blood phosphorus level, ESR, Glucose tolerance test, CRP, PSA, PAP, Electrophoresis and Urinary Bence Jones protein<sup>5</sup>.

### Treatment of bone cancer:-

The treatment includes as follow-

Treatment options depend on the type, size, location and stage of the cancer, as well as the person's age and general health. The treatment options for the bone cancer includes as follows-

- Surgery
- Chemotherapy
- Radiation therapy
- Cryosurgery
- Genetics
- Analgesics
- Endocrine therapy
- Biologic therapy
- Radiopharmaceuticals
- Biphosphonates
- Supportive care

**Surgery:-**

This is the usual treatment for bone cancer<sup>6</sup>. Here the procedure is carried out by removing the entire tumor with negative margins. There are different types of surgeries done. They are as follows

- Surgery for cancer that does not affect the limbs.
- Surgery for removing the cancer while sparing the limb
- Surgery for removing a limb

Surgery for cancer that does not affect the limbs -is an surgical procedure performed for removing the bone and some nearby tissue if the bone cancer takes place in the bones apart from legs and arms<sup>7</sup>. The bone which is removed is then replaced with a part of bone from different place of the body or can be replaced by metal prosthesis<sup>8</sup>.

Surgery for removing the cancer while sparing the limb-here the surgical procedure is performed by sparing the limb if the bone cancer can be separated from other tissues and nerves. Then the lost bone can be replaced with other bone from the body or metal prosthesis<sup>9</sup>.

Surgery for removing the limb-this surgery is performed when the bone cancer is large by removing a part or all part of a limb. This is also done when it is located on very complicated point on the bone.

**Chemotherapy:-**

It is the use of anticancer drugs to kill cancer cell. It is the treatment which makes the use of chemicals for destroying cancer cells. These drugs or chemicals are given through a vein which travels in the entire body. Radiation therapy is often combined with the chemotherapy for shrinking the cancer to a manageable size so as to enable a surgeon to carry out a limb-sparing surgery. Currently chemotherapy is not being used to treat chondrosarcoma<sup>10</sup>.

The main chemotherapy drugs used in treatment of bone cancer are

DOXORUBICIN

CISPLATIN

CARBOPLATIN

ETOPOSIDE

IFOSFAMIDE

CYCLOPHOSPHAMIDE

METHOTREXATE

VINCRIStINE

Usually, several drugs (2 or 3) are given together. For example, common combination is cisplatin and doxorubicin.

**Side effects of chemotherapy:-**

Chemo kills cancer but it will also damage some normal cells. The side effects of chemo depend on the type of drugs, the amount taken, and the length of time they are taken.

Some common temporary side effects include -

- Nausea and vomiting
- Loss of appetite
- Hair loss
- Mouth sores

**Drugs used in chemotherapy and their side effects:-****Doxorubicin:-**

- Cardiomyopathy<sup>11</sup> leading to congestive heart failure
- Thyphlitis<sup>12</sup>
- Some may develop PPE characterized by skin eruptions on the palms of the hand or soles of the feet, swelling, pain and erythema.
- Dyspigmentation<sup>13</sup>

**Cisplatin:-**

- Nephrotoxicity
- Neurotoxicity (common neurological side effects include visual perception and hearing disorder)
- Nausea and vomiting
- Ototoxicity



- Electrolyte disturbance
- Haemolytic anemia

**Carboplatin:-**

- Relative to the cisplatin, the greatest benefit of carboplatin is that its reduced side effects, particularly the elimination of nephrotoxic effects.
- Nausea and vomiting are less severe and more easily controlled.
- Its main drawback is myelosuppressive<sup>14</sup> effect.(usually occurs 21-28 days after the first treatment, after which the blood cell and platelet levels in the blood begin to stabilize ,often coming close to its pre-carboplatin levels.

**Etoposide:-****Common side effects-**

- Low blood pressure
- Hair loss
- Pain and burning at the IV site
- Constipation and diarrhea
- Metallic food taste
- Bone marrow suppression leading to -
  - i. decreased white blood cells
  - ii. low red blood cell counts
  - iii. low platelet counts

**Less common side effects include-**

- Nausea and vomiting
- Rash
- Allergic type reactions
- Fever(occurring due to IV administration and not due to infection)
- Mouth sores
- Acute myeloid leukaemia
- When given with warfarin it may cause bleeding.

**Ifosfamide:-**

- Encephalopathy<sup>15</sup>
- Normal anion gap acidosis specifically renal tubular acidosis.

**Cyclophosphamide:-**

- Nausea and vomiting
- Bone marrow suppression
- Stomach ache
- Haemorrhagic cystitis
- Diarrhea
- Alopecia
- Lethargy
- Cyclophosphamide is itself carcinogenic and may increase the risk of developing lymphomas
- leukaemia
- skin cancer
- transitional cell carcinoma of bladder or other malignancies
- Cardiotoxicity is major problem with oncology patients treated with higher dose regimens.
- High dose IV can cause syndrome of inappropriate antidiuretic hormone secretion and a potentially fatal hyponatremia when compounded by IV fluids administered to prevent drug-induced cystitis<sup>16</sup>.

**Methotrexate:-**

- Common include-
- Black tarry stools
- Blood in urine or stools
- Bloody vomit
- Diarrhea
- Joint pain
- Reddening of the skin
- Sores in the mouth or lips
- Stomach pain
- Swelling of the feet or lower legs

**Vincristine:-**

- Blurred or double vision
- Constipation
- Difficulty in walking
- Drooping eyelids
- Headache
- Jaw pain
- Joint pain
- Lower back or side pain
- Numbness or tingling in fingers and toes
- Pain in fingers and toes
- Pain in testicles
- Stomach cramps
- Swelling of feet or lower legs
- Weakness

**Radiotherapy:-**

It is also known as radiation therapy which involves the use of high energy x-rays to kill cancer cells. This treatment may be used in combination with surgery. It is often used to treat chondrosarcoma<sup>17,18,19</sup>, which cannot be treated with chemotherapy, as well as EFTs. It is also considered in patients who refuse surgery. The high power beam of energy are targeted at precise points in the body. Radiation may also be used after surgery if cancer cells were present in the edges of removed tissue<sup>20</sup>.

**Types-**

- Intensity modulated radiation therapy<sup>21</sup>
- Proton beam radiation<sup>22</sup>

**Side effects of radiation therapy:-**

Common side effects include-

- Fatigue
- loss of appetite
- skin changes in the area being treated, ranging from redness and hair loss to blistering and peeling
- low blood counts
- nausea, vomiting and diarrhea (these are more common if radiation is given to the belly)

**Cryosurgery:-**

It is the use of liquid nitrogen to freeze and kill cancer cells. This technique is used sometimes in place of conventional surgery to destroy the tumor<sup>23</sup>.

### Genetics:-

In addition to clinical trials, researchers are making progress in learning about the causes of bone tumors. For example, changes to a certain part of chromosome 6 have been found in chordomas. Changes the *COL2A1* gene, which codes for a major form of collagen found in cartilage, have been found in many chondrosarcomas<sup>24</sup>. Further, more information about the DNA changes that cause bone cancers will eventually lead to treatments aimed at these gene defects<sup>25</sup>.

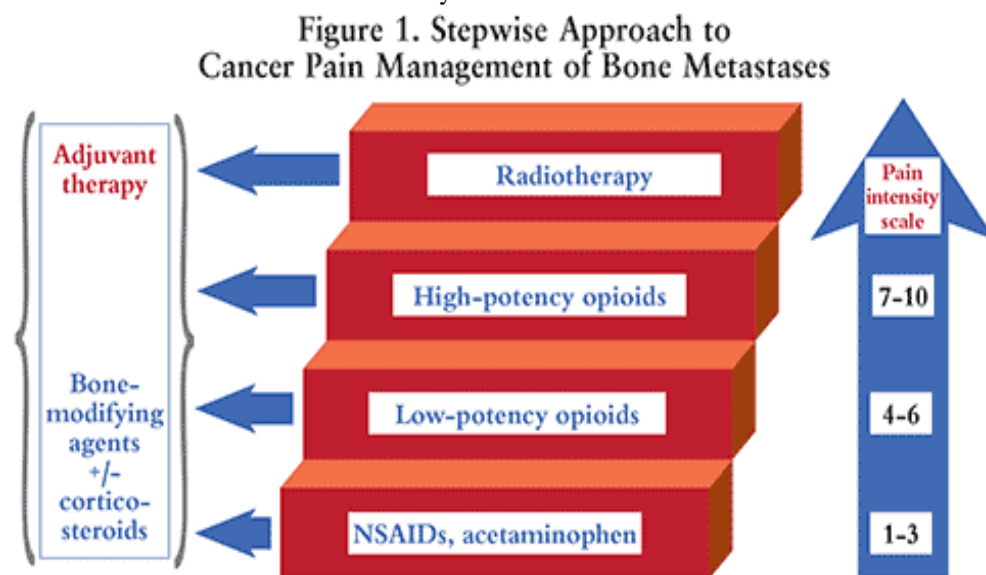
### ENDOCRINE THERAPY:-

Tamoxifen, aromatase inhibitors, ovarian suppression.

**Biologic therapies:-** Herceptin, Tykerb, Avastin

**Analgesics:-** Pain control medications

- Tylenol, NSAIDs (ibuprofen), narcotics, steroids
- Success can be limited by side effects.



NSAID: nonsteroidal anti-inflammatory drug. Pain intensity scale: 1-3 (mild); 4-6 (moderate); 7-10 (severe).  
Source: References 6, 7.

**Figure 1:- Stepwise approach to cancer pain management of Bone Metastases**

### Radiopharmaceuticals:-

Strontium-89 and samarium-153 are radioactive particles travel directly to tumor in bone, & Can reduce pain refractory to other measures, but they are infrequently used<sup>26</sup>.

### Biphosphonates:-

Bind to and inhibit osteoclast action

- Inhibit bone breakdown
- Prevent bone damage
- Improve bone density and strength

Recommended for almost everyone with breast cancer bone metastases

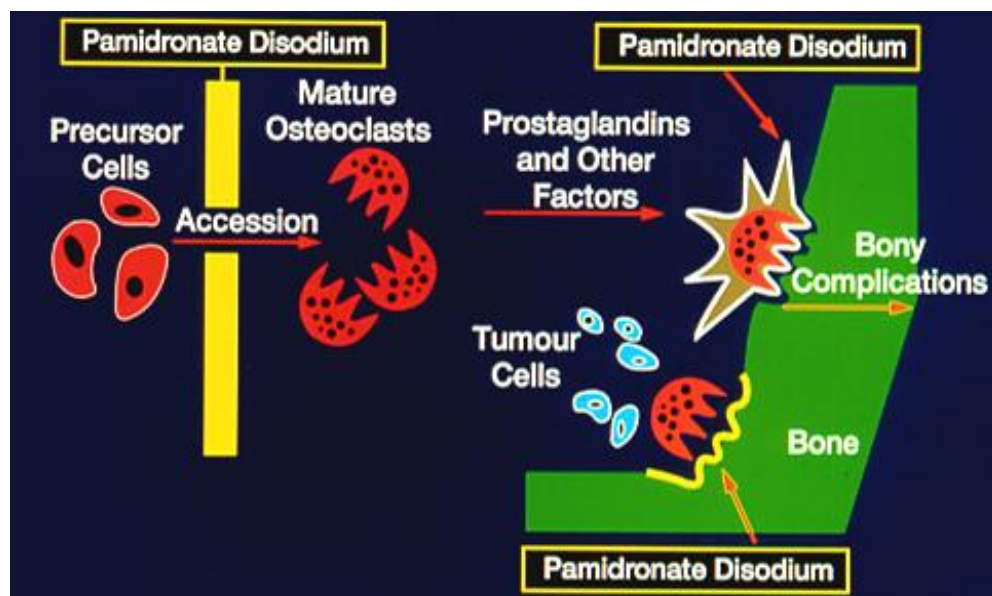


Figure 5:-Biphosphonate pharmacology: Mode of action

### Supportive care:-

Supportive care is critical. It includes managing the bone diseases, anaemia, infections, kidney failure, and pain associated with multiple myeloma<sup>27</sup>.

- ❖ Biphosphonates (medication) can prevent destructive bone lesions and spine fractures.
- ❖ Erythropoietin or occasional blood transfusions can manage anaemia.
- ❖ Antibody infusions and vaccination can help patients with recurrent infections.
- ❖ Corticosteroids and hydration can be used to treat high blood calcium concentrations (from bone loss) and dehydration<sup>28</sup>.
- ❖ Narcotics can decrease the pain associated with bone lesions.
- ❖ Operative intervention may be required to stabilize and control the pain associated with bone fractures<sup>29</sup>.

### What happens after treatment for bone cancer?

Bone cancer treatment may remove or destroy the cancer. Completing treatment can be both stressful and exciting. The patient may have fear of cancer recurrence after the treatment. This is a very common concern in people who have had cancer. Many cancer survivors have learned to live with this uncertainty and are leading full lives. For some people, the cancer may never go away completely. These people may get regular treatments with chemotherapy, radiation, or other therapies to try to help keep the cancer in check. Learning to live with cancer that does not go away can be difficult and very stressful. It has its own type of uncertainty<sup>30</sup>.

### Follow-up care:-

When treatment ends, the doctors will keep a watch on patient. It is very important to follow –up because doctors will look for signs of cancer recurrence and treatment side effects. Almost any cancer treatment can have side effects. Some may last for a few weeks to months, but others can last for rest of the life. Following extensive bone surgery, a program of rehabilitation and physical therapy will be an important part of helping patients regain as much of the mobility and independence as possible.

### Can I get another cancer after having bone cancer?

Survivors of bone and joint cancers can get any type of second cancer, but they have an increased risk of getting another bone or joint cancer (this is different than the first cancer coming back). Sometimes this is the same kind of cancer as the original tumor, but it can be a different type. For example, someone who had a chondrosarcoma<sup>32</sup> can get an osteosarcoma. Sarcoma of the soft tissues is also seen more often than expected after a cancer of the bone or joints. Survivors of bone and joint cancer also have an increased risk of:

- Lung cancer
- Esophagus cancer
- Stomach cancer
- Colorectal cancer
- Liver cancer
- Pancreas cancer
- Acute myeloid leukemia (AML)

The risk of leukemia is linked to treatment with chemotherapy.

### **Follow-up after treatment:-**

After completing treatment for bone cancer, the patient should visit the doctor regularly. The patient should undergo the tests to find out whether the cancer has recurred if they have any symptoms. Survivors of bone cancer should follow the guidelines as per American Cancer Society for the early detection of secondary cancer. The Children's Oncology Group has guidelines for the follow-up of patients treated for cancer as a child, teen, or young adult, including screening for second cancers. All patients should stay away from tobacco products. Smoking increases the risk of many cancers and might further increase the risk of some of the second cancers seen after bone cancer. To help maintain good health, survivors should also:

- Achieve and maintain a healthy weight
- Adopt a physically active lifestyle
- Consume a healthy diet, with an emphasis on plant foods
- Limit consumption of alcohol to no more than 1 drink per day for women or 2 per day for men These steps may also lower the risk of some cancers.

### **Lifestyle changes after treatment for bone cancer:-**

Doctors cannot change the fact that the patient have cancer but, can make their life better. Patient should make healthier choices by the following ways:

- Eating better
- Exercise can improve both the physical and emotional health.
- It improves your cardiovascular (heart and circulation) fitness. .
- It makes the muscles stronger.
- It reduces fatigue and helps in increasing the energy levels
- It can help lower anxiety and depression.
- It can make the patient feel happier.
- In long term, regular physical activity plays a role in helping to lower the risk of some cancers, as well as having other health benefits.

### **If treatment for bone cancer stops working:-**

If treatment is not successful, the disease may be called advanced or terminal cancer. If cancer keeps growing or comes back after one kind of treatment, it is possible that another treatment plan might still cure the cancer, or at least shrink it enough to help you live longer and feel better. If it does not respond to any treatment the cancer tends to become resistant. Then, the doctors will compare the advantages and disadvantages of the new treatments. When the doctor opt for new treatment, it is not likely to improve the health or change the outcome or survival of patients. The doctor can estimate how likely it is the cancer will respond to the treatment patients are considering. It is important to think about and understand the reasons for choosing the plan. The patient should receive treatment for symptoms such as nausea or pain. This type of treatment is called palliative care.

Palliative care helps relieve symptoms, but is not expected to cure the disease. It can be given along with cancer treatment, or can even be cancer treatment. The difference is its purpose - the main purpose of palliative care is to improve the quality of patient's life, or help them feel as good as possible. This may also requires use of drugs.

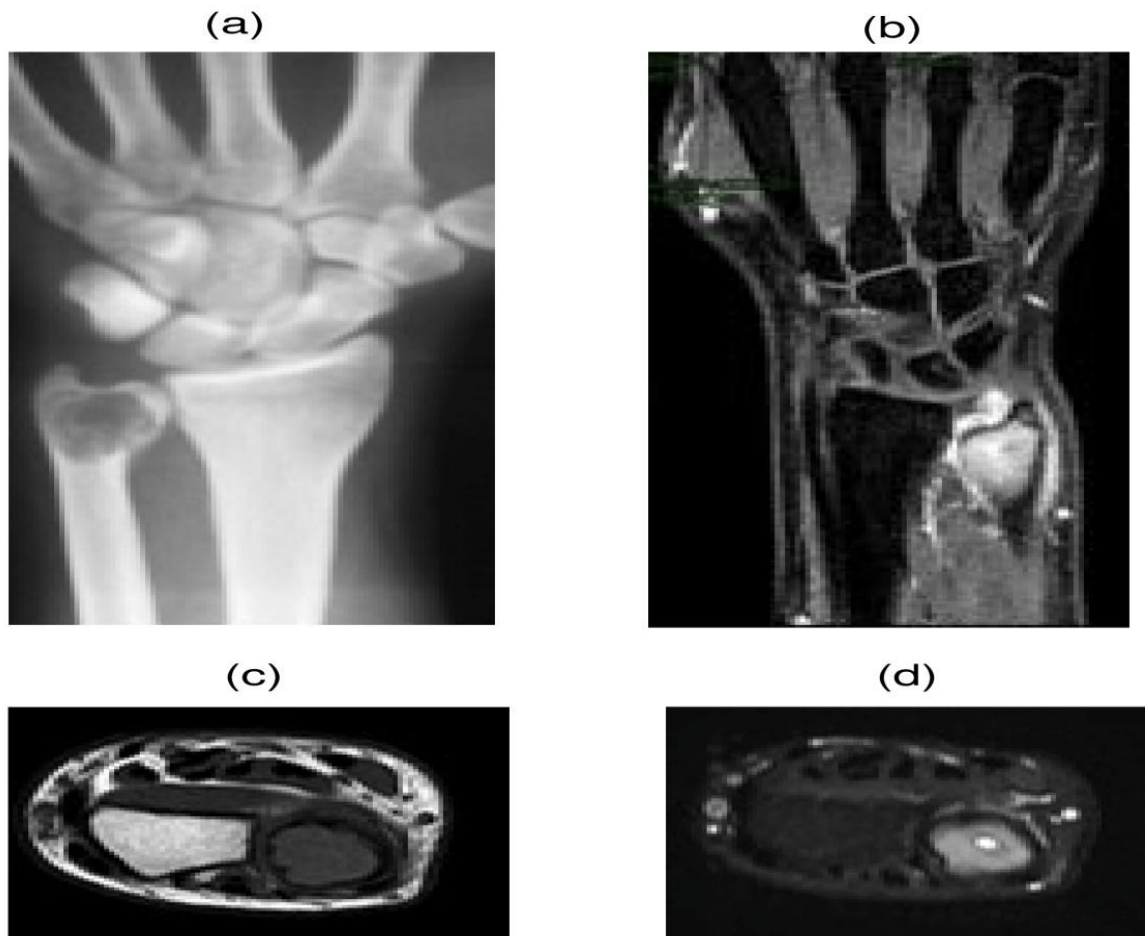
### **Case report on bone cancer:-**

#### **Introduction:**

A 17-year male presented with a painful swelling of the left wrist. After performing an instrumental examination, a diagnosis of distal ulna giant cell tumor(GCT) was made. The tumor was treated with an intralesional curettage, phenol application and bone grafting.

**Case presentation:-**

A radiographic examination of the left wrist was performed in a 17-year male as a result of a direct incidental trauma. No fracture was seen, but an osteolytic area was found in the ulnar meta-epiphysis. The initial diagnosis was 'juvenile bone cyst'. The patient presented with a painful swelling at the wrist dorsal ulnar side, about 2.5 cm, in the absence of any epidermal dyschromias. The skin was elastic and smooth. Wrist examination showed a range of motion (ROM) of 45° of extension, 70° of flexion, 15° of radial deviation and 10° of ulnar deviation; pronation, supination and circumduction were painful. Contralateral wrist ROM was normal. The diagnosis of 'juvenile bone cyst' did not seem right and a second radiographic examination was performed. At this time, a multilocular osteolytic area inducing an expansion of the distal ulna was seen. A cortical bone interruption was also visible. Although the patient had been the victim of a trauma, this was a poor prognostic sign. Therefore an Magnetic resonance imaging examination was performed. It showed a hypointense signal in the T1 sequences and a hyperintense signal in the short TI inversion recovery (STIR) sequences, characterized by enhancement after contrast administration, due to the presence of newly formed tissue.



**Figure 6:-**  
**X-rays and magnetic resonance imaging with and without contrast.**

**Discussion:-**

- It is a rare tumor, essentially benign, but it may behave unexpectedly, regardless of the results of radiological or histological examinations.
- It is usually located in the long bone meta-epiphysis and it frequently involves the subchondral bone without involvement of the articular surface; however, larger tumors may extend into the metaphysis and, more rarely, into the diaphysis. Proximal tibia, humerus, distal femur and radius are typical sites.
- GCT(Giant Cell Tumor) represents about 3% to 5% of all bone tumors and 21% of benign bone tumors<sup>34,35</sup>.

- In 70% of cases, it involves women in the third to fourth decade of life.
- The distal epiphysis of the ulna is an unusual place for a primary bone GCT; in fact, this occurs in only 0.45% to 3.2% of all primary bone GCT's<sup>36,37</sup>.
- In the past, these tumors were treated with amputation or large resections and ulnar reconstructions. Currently, surgical treatments are:
  - ❖ Intralesional curettage
  - ❖ Curettage and bone grafting
  - ❖ Cryotherapy of the cavity after curettage
  - ❖ Application of phenol after curettage
  - ❖ Radiation
  - ❖ Insertion of methyl methacrylate cement in the cavity after curettage
  - ❖ Resection followed by allograft
  - ❖ En-bloc resection with or without reconstruction or stabilization of the ulna and prosthetic reconstruction
  - ❖ Embolization of the feeding vessels
- The variables related to the tumor, such as size, location, biological activity, cortical bone destruction or pathologic fracture evidence, determine the treatment<sup>37</sup>.
- Although an en-bloc resection radically assaults the tumor, significantly reducing the risk of recurrence, functional outcome is very bad. A simple curettage provides an excellent functional outcome, but with a higher recurrence rate of approximately 40%<sup>34,35,36,37</sup> if compared with the patients who received adjuvant therapy (45% versus 18%).
- Therefore, various adjuvant therapies have been associated with the curettage: phenol, cryotherapy, cement<sup>39,40,41</sup> or polymethyl methacrylate (PMMA) used intraoperatively.
- The recurrence rate ranges from 5% to 8% when cement is used, and approximately 2.3% after cryosurgery<sup>39,40</sup>.
- However, it needs to be mentioned that a multicenter study of the Sarcoma Group<sup>43</sup> reported an overall recurrence rate of 17% and claimed that the filling material or the type of adjuvant would not have an absolute impact on recurrence.
- Furthermore, some studies show that the use of an adjuvant would not be necessary in some cases, such as intraosseous GCT<sup>44</sup>.
- According to Schajowicz<sup>44</sup>, curettage alone is an inadequate oncological procedure, but when it is combined with an adjuvant therapy, it globally provides a better result with respect to one-block excision, especially in terms of functionality.
- Therefore, the correct treatment must achieve a balance between oncological radicality and the restoration of skeletal segment functionality<sup>43,44,45,46</sup>.
- Curettage associated with bone grafting has been shown to be effective in many cases<sup>47</sup>. In this study it is used with phenol as an adjuvant, because it is capable of causing protein and DNA coagulation, inducing cell necrosis.
- In the present case intralesional curettage was possible because the tumor was a grade II and the reconstruction was carried out with synthetic cancellous bone, due to the young age of the patient<sup>48</sup>.

### Conclusion:-

Bone metastases are common in advanced breast cancer, and can cause significant symptoms. Multiple systemic and local therapies are available; standard therapy includes monthly zoledronic acid. Better understanding of toxicities can improve the safety of treatment. New agents take advantage of increased understanding of the biology of bone turnover. Women with advanced breast cancer may live with bone metastases for many years, therefore optimizing therapy is crucial. Neoformation bone diagnosis is difficult and requires a great deal of experience, especially in young patients. Osteolytic lesions incidentally found at a long bone epiphysis, can be misinterpreted. The tumor may have a good prognosis if treated early and radically. It is important to know atypical cancer locations in order to perform a proper diagnosis.

### References:-

1. Bone cancer detailed guide American Cancer Society. Cancer Facts and Figures, 2016. Atlanta, Ga: American Cancer Society; 2016.
2. Bjornsson J, McLeod RA, Unni KK, et al. Primary chondrosarcoma of long bones and limb girdles. Cancer. Vol:2008; Pgno:83-84

3. Bovee JV, Cleton-Jansen A, Taminiau AH, Hogendoorn PCW. Emerging pathways in the development of chondrosarcoma of bone and implications for targeted treatment. *Lancet Oncology*. Vol:2005; Pg no:599-607.
4. Casali PG, Stacchiotti S, Grosso F, et al. Adding cisplatin (CDDP) to imatinib (IM) reestablishes tumor response following secondary resistance to IM in advanced chordoma. Vol:7 Pg no:282-284.
5. Casali PG, Messina A, Stacchiotti S, et al. Imatinib mesylate in chordoma. *Cancer*. Vol:2004; Pg no:101-110
6. Chawla S, Henshaw R, Seeger L, et al. Safety and efficacy of denosumab for adults and skeletally mature adolescents with giant cell tumour of bone: interim analysis of an openlabel, parallel-group, phase 2 study, Vol:2013 Pg no:901-908.
7. Epub 2013 Jul 16. Damron TA, Ward WG, Stewart A. Osteosarcoma, chondrosarcoma, and Ewing's sarcoma: National Cancer Data Base Report. *Clin Orthop Relat Res*. Vol-2007; Pg no:40-47.
8. Engels EA, Fraumeni Jr JF. New Malignancies Following Cancer of the Bone and Soft Tissue, and Kaposi Sarcoma. In: Curtis RE, Freedman DM, Ron E, Ries LAG, Hacker DG, Edwards BK, Tucker MA, Fraumeni JF Jr. (eds). *New Malignancies Among Cancer Survivors: SEER Cancer Registries*, Vol:1973-2000.
9. National Cancer Institute. NIH Publ. No. 05- 5302. Bethesda, MD, 2006. Accessed on 4/18/2014 at [http://seer.cancer.gov/archive/publications/mpmono/MPMonograph\\_complete.pdf](http://seer.cancer.gov/archive/publications/mpmono/MPMonograph_complete.pdf).
10. Gebhardt MC, Springfield D, Neff JR. Sarcomas of bone. In: Abeloff MD, Armitage JO, Lichter AS, Niederhuber JE, Kastan MB, McKenna WG, eds. *Clinical Oncology*. 4th ed. Philadelphia, Pa.: Elsevier; Vol:2008; Pg no:2471-2572.
11. Gelderblom H, Hogendoorn PC, Dijkstra SD, et al. The clinical approach towards chondrosarcoma. *Oncologist*. Vol:2008; Pg no:320-329.
12. Giuffrida AY, Burgueno JE, Koniaris LG, et al. Chondrosarcoma in the United States (1973 to 2003): an analysis of 2890 cases from the SEER database. *J Bone Joint Surg Am*. Vol:2009; Pgno:1063-1072.
13. Hansen MF, Seton M, Merchant A. Osteosarcoma in Paget's disease of bone. *J Bone Miner Res*. Vol:2006; Pg no:P58-63.
14. Lewis DR, Ries LAG. Cancers of the bone and joint. In, Ries LAG, Young JL, Keel GE, Eisner MP, Lin YD, Horner M-J (editors). *SEER Survival Monograph: Cancer Survival Among Adults: U.S. SEER Program, 1988-2001, Patient and Tumor Characteristics*. National Cancer Institute, SEER Program, NIH Pub. No. 07; Pg no:6215-6216.
15. Bethesda, MD, 2007. Malawer MM, Helman LJ, O'Sullivan B. Sarcomas of bone. In: DeVita VT, Hellman S, Rosenberg SA, eds. *Cancer: Principles and Practice of Oncology*. 9th ed. Philadelphia, Pa.: Lippincott Williams & Wilkins; Vol:2011; Pg no: 1578-1609.
16. National Comprehensive Cancer Network (NCCN). *Practice Guidelines in Oncology: Bone Cancer*. Version 1.2014.
17. Accessed at [www.nccn.org](http://www.nccn.org) on January 6, 2014. Online Mendelian Inheritance in Man, OMIM (TM). McKusick-Nathans Institute of Genetic Medicine, Johns Hopkins University (Baltimore, MD) and National Center for Biotechnology Information, National Library of Medicine (Bethesda, MD).
18. Accessed at <http://omim.org/> on October 11, 2012. Springfield D, Rosen G. Bone tumors.
19. DW, Bast RC, Hait WN, Hong WK, Pollock RE, Weichselbaum RR, Holland JF, Frei E, eds. *Cancer Medicine*, 7th ed. Hamilton, Ontario: BC Decker; Vol: 2006;Pg no:1675-1693.
20. Stacchiotti S, Marrari A, Tamborini E, et al. Response to imatinib plus sirolimus in advanced chordoma. *Ann Oncol*. 2009;20(11): Pg no:1886-1894.
21. Stacchiotti S, Longhi A, Ferraresi V, et al. Phase II study of imatinib in advanced chordoma. *J Clin Oncol*. Vol: 2012;30(9):Pg no:914-920.
22. Epub 2012 Feb 13. Stacchiotti S, Tamborini E, Lo Vullo S, et al. Phase II study on lapatinib in advanced EGFRpositive chordoma. *Ann Oncol*. 2013;24(7): Pg no:1931-1936.
23. Epub 2013 Apr 4. Tarpey PS, Behjati S, Cooke SL, et al. Frequent mutation of the major cartilage collagen gene COL2A1 in chondrosarcoma. *Nat Genet*. 2013;45(8): Pg no:923-926.
24. Epub 2013 Jun 16. Thomas DM, Skubitz KM. Giant cell tumour of bone. *Curr Opin Oncol*. 2009;21(4): Pg no:338- 344.
25. Thomas D, Henshaw R, Skubitz K, et al. Denosumab in patients with giant-cell tumour of bone: an open-label, phase 2 study. *Lancet Oncol*. 2010;11(3): Pg no:275-280.
26. Walcott BP, Nahed BV, Mohyeldin A, et al. Chordoma: current concepts, management, and future directions. *Lancet Oncol*. 2012;13(2): Pg no:69-76.
27. American Joint Committee on Cancer. *Bone. AJCC Cancer Staging Manual*. 7th ed. New York.:Springer-Verlag; Vol:2010 Pg no:281-287.



28. Malawer MM, Helman LJ, O'Sullivan B. Sarcomas of bone. In: DeVita VT, Hellman S, Rosenberg SA, editors. *Cancer: Principles and Practice of Oncology*. Vol. 2. 7th ed. Philadelphia: Lippincott Williams and Wilkins, 2004.
29. Pizzo P, Poplack DG, editors. *Principles and Practice of Pediatric Oncology*. 4th ed. Philadelphia: Lippincott Williams and Wilkins, 2002.
30. Ries LAG, Smith MA, Gurney JG, et al., editors. *Cancer Incidence and Survival among Children and Adolescents: United States SEER Program 1975-1999*. Bethesda, MD: National Cancer Institute, 1999.
31. Miller RW, Boice JD, Curtis RE. Bone cancer. In: Schottenfeld D, Fraumeni JF, editors. *Cancer Epidemiology and Prevention*. 2nd ed. New York: Oxford University Press, 1996.
32. American Cancer Society (2008). *Cancer Facts and Figures 2008*. Atlanta, GA: American Cancer Society. Retrieved March 13, 2008.
33. Fischbach FT, Dunning MB. *A Manual of Laboratory and Diagnostic Tests*. 7th ed. Philadelphia: Lippincott Williams and Wilkins, 2004.
34. Beebe-Dimmer JL, Cetin K, Fryzek JP, Schuetz SM, Schwartz K: The epidemiology of malignant giant cell tumors of bone: an analysis of data from the Surveillance, Epidemiology and End Results Program (1975–2004). *Rare Tumors*. 2009, 1: e52-PubMedPubMed CentralGoogle Scholar
35. Campanacci M, Baldini N, Boriani S, Sudanese A: Giant-cell tumor of bone. *J Bone Joint Surg Am*. 1987, 69: 106-114.PubMedGoogle Scholar
36. Goldenberg RR, Campbell CJ, Bonfiglio M: Giant-cell tumor of bone. An analysis of two hundred and eighteen cases. *J Bone Joint Surg Am*. 1970, 52: 619-664.PubMedGoogle Scholar
37. Sung HW, Kuo DP, Shu WP, Chai YB, Liu CC, Li SM: Giant-cell tumor of bone: analysis of two hundred and eight cases in Chinese patients. *J Bone Joint Surg Am*. 1982, 64: 755-761.PubMedGoogle Scholar
38. Masui F, Ushigome S, Fujii K: Giant cell tumor of bone: a clinicopathologic study of prognostic factors. *Pathol Int*. 1998, 48: 723-729. 10.1111/j.1440-1827.1998.tb03973.x.View ArticlePubMedGoogle Scholar
39. Malawer MM, Bickels J, Meller I, Buch RG, Henshaw RM, Kollender Y: Cryosurgery in the treatment of giant cell tumor. A long-term followup study. *Clin Orthop Relat Res*. 1999, 359: 176-188.View ArticlePubMedGoogle Scholar
40. Malawer MM, Marks MR, McChesney D, Piasio M, Gunther SF, Schmookler BM: The effect of cryosurgery and polymethyl methacrylate in dogs with experimental bone defects comparable to tumor defects. *Clin Orthop Relat Res*. 1988, 226: 299-310.PubMedGoogle Scholar
41. Marcove RC, Weis LD, Vaghaiwalla MR, Pearson R, Huvos AG: Cryosurgery in the treatment of giant cell tumors of bone. A report of 52 consecutive cases. *Cancer*. 1978, 41: 957-969. 10.1002/1097-0142(197803)41:3<957::AID-CNCR2820410325>3.0.CO;2-Y.View ArticlePubMedGoogle Scholar
42. Turcotte RE, Wunder JS, Isler MH, Bell RS, Schachar N, Masri BA, Moreau G, Davis AM, Canadian Sarcoma Group: Giant cell tumor of long bone: a Canadian Sarcoma Group study. *Clin Orthop Relat Res*. 2002, 397: 248-258.View ArticlePubMedGoogle Scholar
43. Prosser GH, Baloch KG, Tillman RM, Carter SR, Grimer RJ: Does curettage without adjuvant therapy provide low recurrence rates in giant-cell tumors of bone?. *Clin Orthop Relat Res*. 2005, 435: 211-218.View ArticlePubMedGoogle Scholar
44. Schajowicz F: *Tumors and Tumor-like Lesions of Bone: Pathology, Radiology and Treatment*. 1994, Springer-Verlag. View ArticleGoogle Scholar
45. Gracia I, Proubasta IR, Trullols L, Peiró A, Moya E, Cortés S, Buezo O, Majó J: Distal radioulnar joint prosthesis for the treatment of giant cell tumor of the distal ulna: a case report and literature review. *Strategies Trauma Limb Reconstr*. 2011, 6: 103-106. 10.1007/s11751-011-0113-4.View ArticlePubMedPubMed CentralGoogle Scholar
46. Singh M, Sharma S, Peshin C, Wani IH, Tikoo A, Gupta SK, Singh D: Wide resection and stabilization of ulnar stump by extensor carpi ulnaris for giant cell tumor of distal ulna: two case reports. *Cases J*. 2009, 2: 8617-10.4076/1757-1626-2-8617.View ArticlePubMedPubMed CentralGoogle Scholar
47. Burke CS, Gupta A, Buecker P: Distal ulna giant cell tumor resection with reconstruction using distal ulna prosthesis and brachioradialis wrap soft tissue stabilization. *Hand (N Y)*. 2009, 4: 410-414.View ArticleGoogle Scholar
48. Ward WG, Li G: Customized treatment algorithm for giant cell tumor of bone: report of a series. *Clin Orthop Relat Res*. 2002, 397: 259-270.

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### RESEARCH ARTICLE

## FACTORS AFFECTING GROWTH OF THE FISHING INDUSTRY IN PUNTLAND: A CASE STUDY OF EYL DISTRICT.

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### Abstract

Fish harvesting in Somalia is very limited and unexploited natural resource due to existence of several factors that influence the growth of the fishing industry. This study focused on the factors influence growth of the fishing industry in Eyl district in Puntland State of Somalia. The general objective of this study was to examine the factors influence growth of the fishing industry in Puntland. The study examined how variables such as cultural practice and market accessibility influence growth of the fishing industry. The study was quantitative in nature; the study targeted population of 80 fishermen living in the two villages of Dawad and Badey. Due to the small number of the target population the study employed census technique method for the respondents who were only fishermen. Research instrument was primary data using Likert scale type of questions and close ended questionnaires. Pilot testing of the questionnaire was done to know whether the questions in the questionnaire were well worded and framed, the researcher identified that there are some errors in the questions and then replaced, one research assistant was trained. Lastly, data was analyzed by using Statistical Package for Social Scientists (SPSS version 20) with figures and tables. The findings from the study was that cultural practice have no influence on growth of the fishing industry in the study area. Another finding revealed by the study was poor market accessibility for the fishermen was the biggest challenge that influence on growth of the fishing industry. The recommendation is that there is need for the government to help the fishing communities to provide investment opportunities, loans, establish cooperative societies and banking systems, provide storage facilities and build cold rooms in every landing sites where fish is collected, improve roads leading to the fish collection centres so that the tracks and lorries transporting fresh fish to distant markets move within the stipulated time to avoid wastage.

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**Introduction:-**

With a coastline of over 3,898km long, Somalia has one of the largest maritime zones in the western Indian Ocean that embrace a very important large marine ecosystem (LME) known as the Somali Current Marine Ecosystem. A prominent feature of this ecosystem is a seasonal upwelling which gives rise to high levels of biological productivity which in turn sustains rich fishing grounds, most notably in the area between Ras Aseyr and Ras Mabber off the Puntland coastline. Because of its location of the convergence zone of three seas, Somalia is regarded as a major ecotone between the fauna and flora of the Indian Ocean, the Red Sea and the Arabian Sea. Obviously, the Somali coastal and marine environments are of national and regional significance both in terms of biodiversity and fisheries resources. Other distinctive features of the Somali coast include fringing reefs and patches of coral reefs along the Gulf of Aden coast as well as in the south coast between Adale and the Kenyan border. Conservative estimates have put the country's yearly sustainable marine finfish production in the range of 300,000 tons, with the major commercial fisheries being small and large pelagics, demersal fishes, sharks and rays, as well as shallow-water and deep-sea lobsters and shrimps (UNEP, 2010).

In an effort to tap the fisheries resources, successive Somali Governments had implemented, with technical and financial support from bilateral and multilateral donors, various fisheries projects along the coastline including fish processing plants, icemakers, boatyards and acquisition of modern fishing vessels. The Government also established and operated a modern fishing fleet under the Ministry of Fisheries in order to exploit the abundant offshore resources. In the early 1970s, fishermen were organized into district cooperatives and drought-affected nomads were as well resettled in the coastal villages and encouraged to take up fishing. The nascent cooperatives were provided with assistance from various international aid agencies in the form of training and various fishing inputs such as motorized fishing boats, fishing gear and other related shore facilities. However, the cooperatives never become economically viable and eventually collapsed due to mismanagement, corruption and fishermen's dissatisfaction with collectivization programme in the first place.

In spite of the huge resources and the Government's efforts, Somalia has failed to transform itself into a fishing nation owing to various factors and as a result its fish production has never exceeded more than 20,000 tons even when the catch of the licensed foreign fishing vessels is included. The sector provided only 2% of the country's GDP in the 1980s.

Livestock and agricultural sectors have always been the main stay of the economy. More than 60% of the population is still nomadic pastoralists who depend on raising camels, cattle and goats for their livelihoods. Eating fish is therefore unusual in the Somali tradition and even fishermen themselves prefer red meat to fish, resulting in the country to have one of the lowest per capita fish consumption in the world – a mere 1.6 kg/per person/per year (FAO, 2010) . For comparison, average global and African fish consumptions are respectively 15 and 7 Kg/person/year.

The fisheries sector has been hit hard by the civil war and the cost of its revival may require millions if not billions of dollars given the fact that the entire fisheries infrastructure and facilities put in place by the previous governments were either looted or destroyed beyond repair or left to degrade in the course of the civil strife. Other problems affecting the sector include Illegal, Unregulated and Unreported (IUU) fishing activity, irrational inshore resources exploitation and lack of markets as well as the absence of effective fisheries governance in the country. If developed and managed in a sustainable manner, however, the fisheries sector has without any doubt great potential to contribute significantly to national development and economy at large through food security, foreign exchange earnings and creation of employment opportunities.

The first serious investment in the sector was initiated in 1940s when Italian businessmen established two fish canneries in Kandla and Habo on the Gulf of Aden coast east of Bosaso. A similar but bigger factory was also implemented in Las Qorey in 1960s with Soviet assistance. The three canneries together employed several thousand Somalis during their heydays. These initiatives were followed by the implementation of NECFISH project in Bari Region in the 1980s that resulted in the construction of a cold storage in Bosaso and several fish collection points in Kandala and Alula districts. With the exception of the Bosaso cold storage, all the factories and facilities have been looted after the collapse of the Government. The Bosaso cold storage may not fair better though as it lies idle thanks to a tussle between the Puntland Government and a group of Businessmen over its ownership.

It was only after the collapse of the Government in 1991 that local Puntland businessmen had realized the potential of the sector and made modest investments in the form of reefer trucks, mobile cold stores, boats and other fishing inputs, mainly to exploit lobster resources. The venture paid off and the lobster fishery had at one time become the main stay of the economy replacing the livestock as the number one foreign exchange earner through the export of frozen lobster tails to UAE. The ban of the Somali livestock export to the Gulf countries also drew more investors to the fishery further intensifying the pressure on the lobster populations.

#### **Problem Statement:-**

According to the FAO, the only fish stocks in the world that are actually “underfished” are in deep water off Somalia’s coast. Large schools of, primarily, tuna migrate from north to south and back along the east coast of Africa and concentrate off Somalia, where the upwelling of oxygenated deep water brings nutrients to the surface and, ultimately, smaller fish on which the tuna feed. As Somalis prize meat from livestock and consider fish to be second-class food, the domestic market for fish is very small – a principal reason why the industry has not developed further.

The fact that it is cheaper in Somalia to buy canned tuna from Thailand than to get high quality tuna from a few miles up the coast illustrates the industry’s weaknesses. The situation has been complicated by piracy, mostly of Puntland, which peaked in 2009 and allegedly began to stop overfishing. With neither coast guard nor navy, Somalia is incapable of policing its own waters. Foreign navy vessels implementing the international anti-piracy effort check Somali fishing boats, which has made it difficult for legitimate Somali fishermen to go to sea because their boats are unregistered and crew members may not have clear identification.

However, various factors have significantly influenced to growth of the fishing industry in most of coastal areas, this have resulted many coastal communities in Somalia not to benefit the marine resources, most of these factors influencing fishing industry they experience include but not limited to cultural practice and market accessibility. According Ministry of Fisheries and Marine Resources with partnership of FAO (2014), found that despite Somalia have the largest coast in Africa it regarded as one of the lowest per capita fish consumption in the world; they further found that only 4% of the working force are engaged with the fishing industry, and hence this small percentage are faced by a number of problems including poor infrastructure, cultural practices and marketing accessibility. Moreover, there is need to study this problem by examining how such factors influence growth of the fishing industry as well as to propose better solutions that could enhance the fishing sector. There is no study done on factors influencing growth of fishing industry in Puntland.

The study investigated the factors influencing growth of the fishing industry in Eyl district. It provided strong arguments on how the variables such as cultural practice and market accessibility may directly or indirectly influence growth of the fishing industry in Puntland with especial case study of Eyl district in Nugal region.

#### **Objectives Of This Study:-**

The objectives of this study were:

1. To determine the influence of cultural practice on growth of the fishing industry in Puntland.
2. To establish the influence of market accessibility on growth of the fishing industry in Puntland.

#### **Theory:-**

Each of the selected two variables (cultural practices and market accessibility) of this study were guided by theories.

#### **Cultural variability theory model:-**

This theory was first introduced by Hofstede (1972), in this theory culture is measured in terms of individual and collective behavior, it emphasizes emphasize personal rights and responsibilities, privacy, voicing one’s own opinions, freedom, and self-expression. The “I” identity places emphasis on individuals with less concern for the group. Reciprocity is voluntary, self-initiated or self-motivated Members feel interconnected in a group orientation system which creates more group solidarity. Management can appeal to this group-level solidarity. Seventy-five percent of the world’s population subscribes to some kind of collective outlook and approach.

This theory believes that individual’s cultural material and non-materials plays significant role in development, it urges that some cultures are friendly to development, for example, Japanese cultures directly relates to their

development, the culture of confusion which made Japan more developed society, it also urges that some cultures are not friendly with development, the theory further urges that continuity of cultures that are friendly with the development, while giving examples to other society, likewise, the theory model urges that culturally unfriendly societies should integrate and modernize their culture and to be in line with the modern world perspectives.

Culture's freedom produces uncertainty, which leads to stress and anxiety. These cultures may seek to avoid uncertainty by increasing rules of behavior, this theory further suggests that many southern European countries, as well as Japan and Peru, tend towards uncertainty avoidance. Other countries (including many northern European countries) are, it is argued, better able to tolerate freedom and diversity without excess stress and anxiety, culture's rigidity and dogmatism are a function of the uncertainty avoiding dimension. This dimension also influences communication between individuals; particular direct or indirect forms of communication can be used to reduce uncertainty.

### **Market theory:-**

The theory of market participation has developed many different perspectives, including asset-based approaches and agricultural developmental theory approaches. Boughton et al (2007) viewed market participation as both a cause and a consequence of economic development. Markets offer households the opportunity to specialize according to comparative advantage and thereby enjoy welfare gains from trade. Recognition of the potential of markets as engines of economic development and structural transformation gave rise to a market-led paradigm of agricultural development during the 1980's (Reardon and Timmer, 2006) in which market liberalization policy agendas were widely promoted in Sub-Saharan Africa (SSA) and other low-income regions. Furthermore, as households' disposable income increases, so does demand for variety in goods and services, thereby increasing demand-side market participation, which further increased the demand for cash and thus supply-side market participation. The standard process of agrarian and rural transformation therefore involves households' transition from a model of subsistence, in which most inputs are provided for and most outputs consumed internally, to a market engagement mode, with inputs and products increasingly purchased and sold off the farm (Timmer, 1988; Staatz, 1994). The asset-based theory was summarized by Omiti et al (2009), who held that as the market share of agricultural output increases, input utilization decisions and output combinations are progressively guided by profit maximization objectives. This process leads to the systematic substitution of non-traded inputs with purchased inputs, the gradual decline of integrated farming systems, and the emergence of specialized high-value farm enterprises.

Several models have been proposed to explain why limited market participation may exist. In short, Allen and Gale (1994), Williamson (1994), Vissing-Jorgensen (1999), and Yaron and Zhang (2000) have focused on how entry costs and/or liquidity needs have created limited market participation.

### **Methodology:-**

The target population of the study was a fishermen living in Eyl district which was a total of 80 fishermen, since the target population was small, census technique was adapted so that all the target population were selected as respondents. The study used quantitative research with research instrument of close ended questionnaires using Likert Scale type as primary data collection tool, ranging from Strongly Agree (SA), Agree (A), Neither Agree nor Disagree (N), Disagree (D) and Strongly Disagree (SD). The rating corresponds to 1 (SA), 2 (A), 3 (N), 4 (D) and 5 (SD). Pilot testing of the questionnaire was done to know whether the questions in the questionnaire were well worded and framed, the researcher identified that there are some errors in the questions and then replaced, one research assistant was trained. Lastly, data was analyzed by using Statistical Package for Social Scientists (SPSS version 20) with figures and tables.

### **Results and discussions:-**

#### **Influence of cultural practice on the growth of fishing industry:-**

From the data analysis in Table 1 when enquired respondents' views on the statements of "People engaged with fishing activities are regarded as inferiors and henceforth they are socially discriminated and subordinated" Majority of the respondents with spectacular percentage of 50 (62.7%) disagreed the statement, while on the other hand, 20 (25.4%) agreed the statement, 4 (4.5%) of the respondents strongly agreed the statement, only 1 (1.5%) Neither agreed or disagreed the statement. Hence, the study found that people engaged with fishing industry are not socially discriminated and subordinated. Thus, the study contradicts with Ivan Kyangwa and Konstantine Odongkara, (2005) findings that fishing activities are always engaged by the inferiors and most discriminated part of the society.

Table 1: Social discrimination and subordination of people engaged in fishing industry

		Frequency	Percent (%)
	Strongly Agree	4	4.5
	Agree	20	25.4
	Neither Agree nor disagree	1	1.5
	Disagree	50	62.7
	Strongly disagree	5	6.0
	<b>Total</b>	<b>80</b>	<b>100.0</b>

From the data analysis in Table 2 when enquired respondents' views on the statements of "fish is regarded as men's job, and women involved in fishing industry are considered as immoral and considered as a bad example" majority of the respondents with 53 (65.7%) disagreed the statement, while on the other hand, 21 (26.9%) agreed the statement, also 5 (6%) of the respondents strongly disagreed the statement, only 1 (1.5%) of the respondents strongly agreed the statement. Therefore, the study found that fishing is not regarded as men's job and also women involved in fishing industry are not considered as immoral and bad example. Thus, the study contradicts with Adhiambo Eunice Okello et al, (2015) finding that fishing is a man's job is still very strong. Culturally, women are supposed to be housekeepers taking care of children. Naturally, women fear the lake and fishing is mostly done at night which is hard for women.

Table 2: Fishing are regarded as men's job and women involved are regarded as immoral

		Frequency	Percent (%)
	Strongly Agree	1	1.5
	Agree	21	26.9
	Disagree	53	65.7
	Strongly disagree	5	6.0
	<b>Total</b>	<b>80</b>	<b>100.0</b>

From the data analysis in Table 3, when enquired respondents' views on the statements of "Individuals who consumes the sea food including the fish are cultural regarded as 'Jaji' meaning somebody who have deep poverty and not able or even keen to rear camels, cows and goats. Majority of the respondents with 48 (59.7%) disagreed the statement, while also 4 (4.5%) strongly disagreed the statement, on the other hand, 27 (34.3%) of the respondents agreed the statement, while also 1 (1.5%) of the respondents strongly agreed the statement. Therefore, the study found that individual who consumes fish are not culturally regarded as 'Jaji' and there are not considered as people with deep poverty.

Table 3: Individual who consumes fish are regarded as "Jaji"

		Frequency	Percent (%)
	Strongly Agree	1	1.5
	Agree	27	34.3
	Disagree	48	59.7
	Strongly disagree	4	4.5
	<b>Total</b>	<b>80</b>	<b>100.0</b>

From the data analysis in Table 4, when enquired respondents' views on the statements of "There are concerns that staying landing sites and consuming fish would lead to deteriorating health issue including sight loss, mouth illness and change of person's way of talking" Majority of the respondents with overwhelming percentage of 61 (76.1%) of the respondents disagreed the statement, while 5 (6%) of the respondents strongly disagreed the statement, on the other hand, 11 (13.4%) of the respondents agreed the statement, while 1 (1.5%) of the respondents strongly agreed the statement, only 2 (3%) of the respondents neither agreed or disagreed the statement. Therefore, the study found that consuming fish does not lead to deteriorating health issue such as sight loss, mouth illness and change of person's way of talking, thus, the study contradicts with Adhiambo Eunice Okello et al, 2015, findings that most of his respondent's with 73% believed that fishing activities leads to deteriorate health by causing diseases including sight loss, mouth illness and change of peoples' way of talking.

Table 4: Consuming fish leads to deteriorating health condition

		Frequency	Percent (%)
	Strongly Agree	1	1.5
	Agree	11	13.4
	Neither Agree nor disagree	2	3.0
	Disagree	61	76.1
	Strongly disagree	5	6.0
	<b>Total</b>	<b>80</b>	<b>100.0</b>

#### 4.2 Influence of market accessibility on growth of the fishing industry

Fishers' perceptions were sought on domestic market demand. When asked whether the domestic market demand of fish is low, Table 5 shows that most of the respondents 53 (65.7%) were disagreed and mentioned that domestic market demand is high in the study area, the rest of the respondents 24 (29.9%) and 4 (4.5%) were agreed and strongly agreed that domestic market demand of fish is low respectively. The result is similar to Ssebisubi Maurice (2010) in a study in Uganda; who reported that 77% of the respondents stated that there is high demand of fish from their customers.

Table 5: Domestic market demand of fish

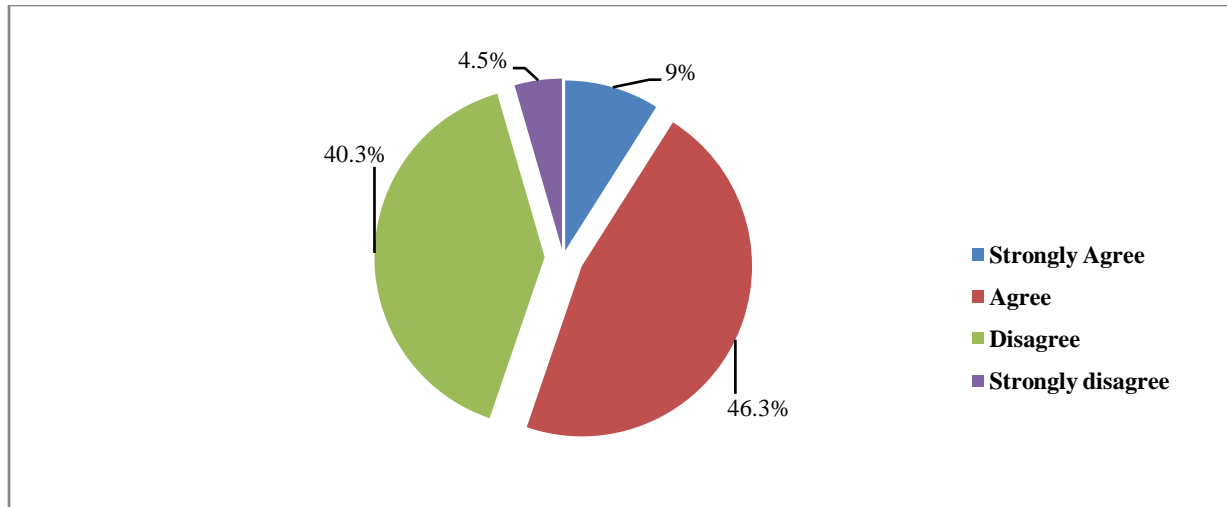
		Frequency	Percent (%)
	Strongly Agree	4	4.5
	Agree	24	29.9
	Disagree	53	65.7
	<b>Total</b>	<b>80</b>	<b>100.0</b>

As shown in Table 6 the analysis of the data revealed that majority of the respondents approved that there are no banks that would provide loans to invest the fishing sector. The Table 4.11 indicates that 59 (73.1%) and 18 (22.4%) were agreed and strongly agreed that no single bank would provide loans or investment grants to the fishermen, while 2 (3%) and 1 (1.5%) were strongly disagreed and disagree in the subject respectively. The result is in line with the findings of Adhiambo Eunice Okello et al. (2015) who reported that 54.8% of the respondents agreed that there is lack of banking facilities thus hindered them from saving money. Most banks were situated in the towns of Hoima county in Kenya.

Table 6: There are no bank services

		Frequency	Percent (%)
	Strongly Agree	18	22.4
	Agree	59	73.1
	Disagree	1	1.5
	Strongly disagree	2	3.0
	<b>Total</b>	<b>80</b>	<b>100.0</b>

The study intended to find out whether there are companies that monopolize fish export to international markets. The findings in Figure 1 revealed that most of the respondents 37 (46.3%) agreed that there are companies that monopolize the export of fish to international markets, 7 (9%) were also strongly agreed the existence of monopoly for fish export to international markets while 32 (40.3%) and 4 (4.5%) of the respondents were disagreed and strongly disagreed respectively the existence of monopoly in exporting fish to international markets.



**Figure 1: Monopolizing fish export to international markets**

The study also sought to examine whether there are limited companies that export fish from landing sites to international markets. The results of Table 7 indicated that 66 (82.1%) of the respondents agreed that there is limited fish export companies, 8 (10.4%) were also strongly agreed that there is limited fish export companies that operates in the study area while 5 (6%) and 1 (1.5%) of the respondents were disagreed and strongly disagreed respectively that there are limited fish export companies in the study area.

**Table 7: There are limited fish export companies**

		Frequency	Percent (%)
	Strongly Agree	8	10.4
	Agree	66	82.1
	Disagree	5	6.0
	Strongly disagree	1	1.5
	<b>Total</b>	<b>80</b>	<b>100.0</b>

The study set out to find out whether there is lack of access to market information by the fishermen that makes them not to be aware the existing opportunities in the markets. The Table 8 indicated majority of the respondents 50 (62.7%) were agreed that there is lack of access to market information by the fishermen, 4 (4.5%) were also strongly agreed that lack of information by the fishermen in the study area, while 25 (31.5%) of the respondents were disagreed that there is lack of access to market information by the fishermen and only 1 (1.5%) were also strongly disagreed the subject. The study findings oppose to the FSAU-FAO study (2011) that found majority of the population have access to information on fish (benefits, preparation and handling) from health workers, local media, fish mongers and other fish consumers.

**Table 8: There is lack of access to market information**

		Frequency	Percent (%)
	Strongly Agree	4	4.5
	Agree	50	62.7
	Disagree	25	31.3
	Strongly disagree	1	1.5
	<b>Total</b>	<b>80</b>	<b>100.0</b>

The study intended to find out whether there is no government subsidies for the fishermen to facilitate them to access to the markets. The analysis in Table 9 revealed that majority of the respondents 49 (61.2%) were agreed that there is no government subsidies to support for the fishermen, 10 (11.9%) were also strongly agreed that there is no government subsidies for the fishermen while only respondent 1 (1.5%) was neither agreed nor disagreed the query. On the other hand, 19 (23.9%) of the respondents were disagreed that there is no government subsidies for the fishermen. Similarly, only 1 (1.5%) of the respondents was strongly disagreed that there is no government subsidies



for the fishermen in the study area. This is in agreement with the findings of Harrison Kwame Golo and Lawrence Odumah (2015) who found that majority of the respondents (85%) cited high prices of inputs such as nets, premix fuel and outboard motors are the key major problems hampering their fishing activities in rural coastal fishing communities in the Volta region of Ghana.

Table 9: There is no government subsidies for the fishermen

		Frequency	Percent (%)
	Strongly Agree	10	11.9
	Agree	49	61.2
	Neither Agree nor disagree	1	1.5
	Disagree	19	23.9
	Strongly disagree	1	1.5
	<b>Total</b>	<b>80</b>	<b>100.0</b>

### Conclusion:-

In the past, cultural practice in study area have framed fishing as an inferior industry, and fish meat has been considered to be of a 'lower status' than others. Recently though, there has been a shift that has seen a greater acceptance of fish and fishermen. Much of this has to do with communities increasingly recognizing the health benefits of eating fish. The healthfulness of fish has been promoted by local doctors. The study concluded that cultural practice have no influence on growth of the fishing industry in the study area. The study dealt with domestic market demand, banking services. Other challenges included limited fish exporting companies, lack of access to market information and lack of government subsidy to support for fishermen.

### Recommendations:-

Based on the findings of this study and the conclusions drawn, the following recommendations were made:

1. The fishing communities need to be provided investment opportunities, loans, establish cooperative societies and banking systems.
2. The government should help the fishermen acquire storage facilities and cold rooms be built in landing sites where fish is collected.
3. Roads leading to the collection centres need to be improved so that the tracks and lorries transporting fresh fish to distant markets move within the specific time to avoid wastage.

### References:-

1. Adhiambo Eunice Okello et al, ( 2015) *Challenges Facing the Fishing Industry in Homalime and Kendu Bay Zone of Lake Victoria in Homabay County, Kenya*. Historical Research Letter ISSN 2224-3178 (Paper) Volume 19 2015
2. Allen, F. & Gale, D. (1994). *Limited Market Participation and Volatility of Asset Prices*, *American Economic Review* 84: 933-955.
3. Boughton, D., Mather, D., Barrett, C. B., Benfica, R., Abdula, B., Tschirley, D. & Cunguara, B. (2007). *Market Participation by Rural Households in a Low-Income Country: An Asset-Based Approach Applied to Mozambique*. Retrieved on 20th June, 2012 from [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1846745](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1846745)
4. Food and Agriculture Organization of the United Nations, *The State of World Fisheries and Aquaculture: Opportunities and Challenges* (Rome: FAO, 2014).
5. Harrison Kwame Golo, Lawrence Odumah. *Institutional Settings and Access to Assets in Rural Coastal Fishing Communities in the Volta Region of Ghana*. *American Journal of Social Sciences*. Vol. 3, No. 6, 2015, pp. 187-196.
6. Hofstede G (2004) *Culture's consequences: international differences in work-related values*. In: Gudykunst WB, Mody B (eds) *Handbook of international and intercultural communication*, 2nd edition (2002). SAGE
7. Ivan Kyangwa and Konstantine Odongkara (2005) *Sanitation, Fish Handling and Artisanal Fish Processing within Fishing Communities: Socio-cultural influences, Socio-economic Research Report 6 Lake Victoria Environmental Project*. Fisheries Resources Research Institute, National Agricultural Research Organization, Jinja, Uganda.
8. John Omiti et al, (2009) *Factors Influencing the Intensity of Market Participation by Small holder farmers: A Case Study of rural and peri-urban areas of Kenya*, Afjare Vol. 3 No 1.

9. Reardon, T., & Timmer, C. P. (2006). *Transformation of Markets for Agricultural Output in Developing Countries Since 1950: How Has Thinking Changed?* In R.E. Evenson, P. Pingali and T.P. Schultz (Eds). Handbook of Agricultural Economics 3. Agricultural Development: Farmers, Farm Production and Farm Markets. Amsterdam: Elsevier.
10. Somali Knowledge, Attitudes and Practices Study on Fish Consumption in Somalia (2011) *A Study Conducted by Food Security and Nutrition Analysis Unit (FSNAU) in collaboration with FAO Somalia-Fisheries Sector.*
11. Ssebisubi Maurice (2010), *The Value Chain of Framed African Catfish in Uganda*, Final Project AMC Ltd, Kampala, Uganda
12. Vissing-Jorgensen, A. (1999). *Limited Stock Market Participation and the Equity Premium Puzzle*, working paper, University of Chicago.
13. Williamson, S. (1994). *Liquidity and Market Participation*, *Journal of Economic Dynamics and Control* 18, 629-670.
14. Yaron, A. & Zhang, H. H. (2000). *Fixed Costs and Asset Market Participation*, *Revista De Analisis Economico* 15: 89-109.

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### RESEARCH ARTICLE

#### ELIMINATION CONTORTION OR MISS SHAPING EFFECT IN VERTICAL POLE (MAST) OF 50T LEVEL LUFFING CRANE.

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Luffing crane, dockyard, deformation, fixture, mast

#### Abstract

A level luffing crane is very useful crane in industry as well as at dockyard, ports etc. A level luffing crane consists of a vertical mast which is a very important and supporting structure of crane. Due to various loads of crane like dead load of a crane, load carried by crane etc. the cross section of mast is subjected to deformation. Also changes in diameter occur due to welding is called distortion. The objective of this work is to reduce deformation and distortion of vertical mast. A distortion can be reduced by developing fixture and deformation can be reduced by designing and analysing of mast on software.

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#### Introduction:-

The deformation occurs due to force applied on vertical mast of crane as it is constructed by 13 segments and a flange of 100mm height provided on mast.[1] It consists of mild steel(MS) E250J2 material of thickness 22mm. Outer diameter of vertical mast is 3520 mm and Inner diameter is 3476mm with a length of 14460 mm. As a dead load of 150 tone applied on mast it get deformed by maximum deformation occur on mast.

In material science, deformation refers to any changes in the shape or size of an object due to-

- an applied force
- a change in temperature

Depending of the type of material, size and geometry of the object and the force applied on various types of deformation may result. The different types of deformation occur are as follows.[2]

- Elastic deformation.
- Plastic deformation

#### Effects of deformation:-

Due to deformation the mast bend little downward and can damage the crane. As it is a main support on which crane rotates and carry load can cause damage in machinery and girder. It makes material uncap able to withstand[3].

#### Distortion:-

Distortion in weld results from the expansion and contraction of the weld metal and adjacent base metal during the heating and cooling cycle of welding process. There are various types of distortion and dimensional change including

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longitudinal, transverse, angular twisting, buckling and bowing. Two or more types of distortion may occur at the same time[4]. In a weld joint, expansion and contraction forces act on the weld metal and on base metal. As the weld metal solidifies and fuses with the base metal, it is in maximum expanded form. On cooling it attempts to contract to the volume it would normally occupy at a lower temperature but it is restrained from doing so. Because of this stress developed between the weld and adjacent base metal[5]. Major effect of distortion are strength of weld joint has been reduced and strength of vertical mast reduces.

In the present study,

### Methodology:-

Firstly, for reducing weld distortion, welding was observed and measured the diameter of segments by using mechanical measuring tape. Afterward more knowledge about distortion was taken. The original diameter of vertical mast is  $\phi 3520\text{mm}$  outside and inside diameter is  $\phi 3476\text{mm}$ . When distortion occurs in first two segments, the diameter was  $3526\text{mm}$  and by joining 3<sup>rd</sup> segment, it becomes  $3531\text{mm}$ . But as per company requirement it should be maximum  $\pm 5\%$ , which is acceptable.

### Heat treatment method:-

When heat treatment method is used, the result is achieved  $3533\text{mm}$  which is 13% more than original diameter. But heat treatment method is time consumable method and very costly [6].

### Re-rolling method:-

But this method is not possible because it require huge machine for rolling and this also increases the industry cost so, it is not possible to apply [7].

### By using fixture:-



Fig.1. Implementation of Fixture

It is also made by mild steel material with a diameter of  $3476\text{mm}$  which is internal diameter of vertical mast. The four plate used is of  $750\text{mm}$  length,  $10\text{mm}$  thickness and long rod is attached which is welded to four plate, It holds the whole fixture tightly[8].

For reducing deformation of vertical mast, collected necessary data of mast, design it on CRE-O software and analyze it on ANSYS software[9]. So first a mast thickness of  $22\text{mm}$  and making 13 segments of different height were taken and apply a load of 150 Tone applied and result was found as follows.

The deformation was found  $25.478\text{ mm}$  maximum on top of the mast which is high and as per company requirement it has to be reduced up to  $10\text{ mm}$  at least. After getting the above result it was decided to increase the thickness of mast but overall thickness of mast will increase the cost so, finally just increased the thickness of upper two segments and one bottom segment on which deformation was high.

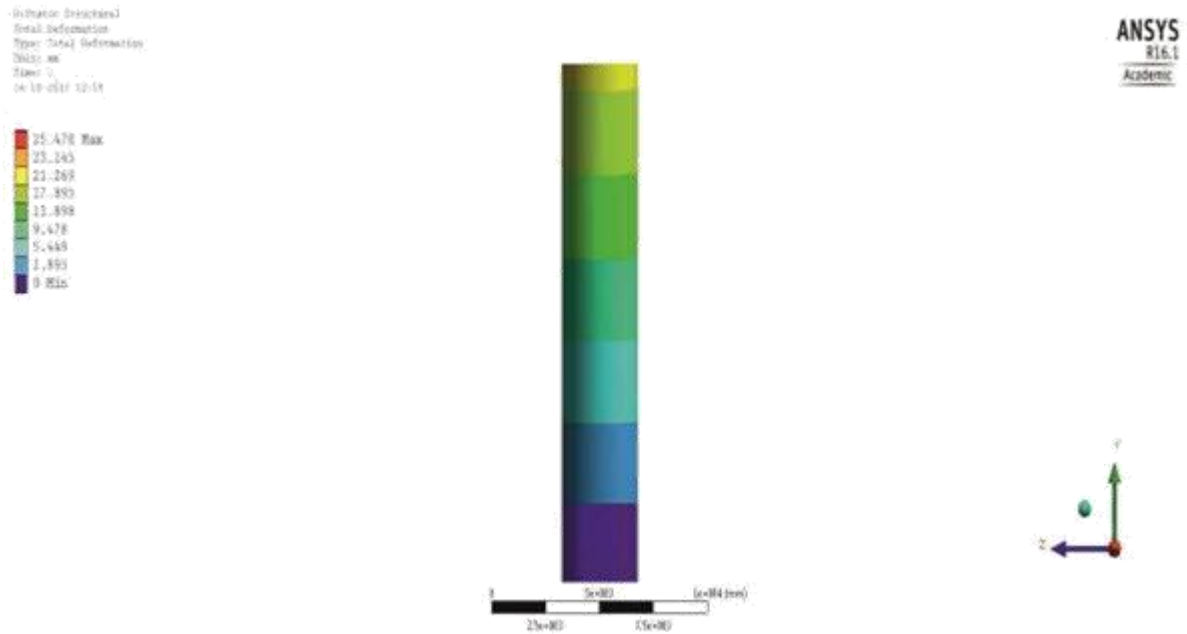


Fig: 2. Design and Analysis of vertical mast for Reduction of deformation

Increasing the thickness of upper two segments and bottom segment thickness from 22mm to 26mm as per standard given by ASME for material and again analysis is done, results are found as follows. Finally found the better achievement of problem as listed in table 1. Deformation of mast reduced up to 7.146mm max which is acceptable by company.

Table: 1

Load(Tonnes)	Segments	Thickness(mm)	Maximum Deformation(mm)
150	1 to 13	22	25.478
150	1st ,2nd and 13th	26	7.146

### Result and Discussion:-

When this fixture is welded and attached to one segment it reduced the segment distortion up to  $\pm 5\%$  which is acceptable in mast. So the distortion reduced and the diameter which was  $\phi 3534\text{mm}$  reduced up to  $\phi 3523$  which was just 3% more than its original diameter which is accepted. Same process was done in all 13 segments by applying 1 or 2 fixtures as per requirement and finally the distortion was reduced.

Table 2:

	Segments	Maximum Dia. of Mast(mm)	
		Before weld	After weld
Without Fixture	1 and 2	3520	3532
With Fixture	1 and 2	3520	3523

### Conclusion:-

With the new design for vertical mast by increasing thickness of top two segments and bottom segment, where maximum deformation occurs, for the same analysis was carried out. As a result of deformation, it was reduced to 7.146 mm maximum. With this the objective of the work was achieved. The problem of distortion is minimized with the use of fixture. After designing of fixture, fixture was implemented in two segments of vertical mast and check the maximum diameter after welding has been completed. The max diameter before weld and after weld was compared for two cases as mentioned in table no.2

**References:-**

1. D. Suverkrop, "Level luffing crane," Google Patents, 1975.
2. K. Hutter, *Theoretical glaciology: material science of ice and the mechanics of glaciers and ice sheets*: Springer, 1983.
3. F. Ju, Y. Choo, and F. Cui, "Dynamic response of tower crane induced by the pendulum motion of the payload," *International Journal of Solids and Structures*, vol. 43, no. 2, pp. 376-389, 2006.
4. Y. Pan, C. Liang, and L. Liu, "The Modeling of Main Hoist Mechanism of Quay Container Crane." pp. 377-381.
5. D. Juergens, "Crane control means employing load sensing devices," Google Patents, 1988.
6. S. Allin Sr George, "Lattice boom construction," Google Patents, 1967.
7. A. Nayfeh, Z. Masoud, and N. Nayfeh, "A smart sway controller for cranes from theory to laboratory to industry," *Vibration problems ICoVP*, pp. 14-29, 2011.
8. K. M. Gyomrey, "Endless chain drive for telescopic jib sections," Google Patents, 1982.
9. V. C. ARVINDKUMAR, "" design and analysis of beam for deformation of floor mounted jib crane," atmiya institute of technology and science, 2015.



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## RESEARCH ARTICLE

### Cancer cachexia - A review.

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#### Abstract

Cachexia is considered as a complex interplay of metabolic and behavioral parameters leading to deteriorated quality of life. In recent years many efforts by researchers and clinicians were made to improve our knowledge of cachexia. Cancer and many other chronic or end-stage diseases like AIDS, chronic obstructive pulmonary disease, rheumatoid arthritis, tuberculosis are associated with cachexia, a condition associated with weight loss and alteration in body composition. Cachexia in cancer is generally neglected and contributes to the poor prognosis. A more meticulous understanding of cachexia is needed that probably will lead to combination therapies being developed. Although its prevalence is less, it is a growing problem in Asia. This review is based on the computer-aided Pubmed database and general search for the term "cancer cachexia". Available free articles related to the pathophysiology, diagnosis and possible treatment modalities in cancer cachexia were downloaded for the review.

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#### Introduction:-

Cachexia is a complex interplay of metabolic and behavioral variables leading to continuous deterioration of health and compromised quality of life. The word "cachexia" is derived from the Greek "kakos" meaning "bad" and "hexis" meaning "condition". Cachexia is a debilitating state of involuntary weight loss complicating malignant, infectious, and inflammatory diseases and contributing significantly to mortality. Anorexia, also a frequent complication of these diseases, is a major contributor to the development of cachexia; although the pattern of weight loss in cachexia differs from that seen with pure nutrient deprivation.<sup>1</sup> The anorexia-cachexia syndrome continues to be a very difficult problem in the management of cancer patients. Despite the vast literature that exists on the subject, the etiology of this syndrome is not clearly established. Reduced food intake and abnormal host metabolism are thought to be major factors leading to cachexia. However, the extent to which either of these factors are present in any one group of patients is unknown as are the mechanisms whereby anorexia or abnormal host metabolism develop. The aim of future clinical research must be to build on the limited benefits of conventional nutritional support through a greater understanding of the mechanisms of wasting in the cancer host.<sup>2</sup>

Cachexia is infrequently identified or diagnosed and rarely treated and there is no universally agreed upon definition. It was essential to have a specific definition so that clinicians can recognize the problem and institute corrective measures to treat cachexia. On December 13th and 14th, 2006, scientists and clinicians met in

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Washington DC, to reach a consensus on the definition of the constellation of abnormalities that have been grouped under the name cachexia.<sup>3</sup>

#### **Search strategy:-**

The search for the review was based on the key word “cancer cachexia”. Pubmed search displayed total 3002 articles including 764 reviews and 586 free full text articles. In MeSH (Medical Subject Heading) search no items were found. Selected free articles were downloaded for the review. Other articles were selected from general web search. The decision to include the article was made by reading the title and the abstract. Articles related to animal studies and genetic studies were excluded while those related to pathophysiology, serum markers, treatment and nutrition were chosen for the review. The review discusses the pathophysiology, studies on diagnosis and treatment of cancer cachexia.

#### **Cancer cachexia:-**

About half of all cancer patients show a syndrome of cachexia, characterized by anorexia and loss of adipose tissue and skeletal muscle mass.<sup>[4]</sup> Although the etiology of cachexia is not well understood, several hypotheses like cytokines, circulating hormones, neuropeptides, neurotransmitters and tumor-derived factors are put forward. Decreased caloric intake and increased metabolic rate have been shown to be present in some cancer patients with pathological weight loss; however, the specific mechanisms by which these changes occur remain to be elucidated.<sup>[5]</sup> An emerging view is that the anorexia in cachexia is caused mainly by the cytokines produced by the cancer or released by the immune system in response to the presence of malignancy that induce profound lipolysis and protein degradation.<sup>1</sup>

Tumor products that have a direct catabolic effect on host tissues are lipid mobilizing factor (LMF), which acts on adipose tissue, and proteolysis-inducing factor (PIF), which acts on skeletal muscle.<sup>6</sup> Recent evidences suggest that an intricate interplay between multiple hypothalamic effector pathways and afferent hormonal signals of diverse systemic origin e.g. resistin, leptin and adiponectin from adipocytes, ghrelin and polypeptides from the gastrointestinal tract, and insulin from the pancreas are important in the regulation of energy intake and expenditure. Serum levels of these hormones play important role in cancer cachexia.<sup>7</sup>

Numerous cytokines, including Tumor Necrosis Factor- $\alpha$  (TNF- $\alpha$ ), Interleukin-1 (IL-1), Interleukin-6 (IL-6), Interferon- $\gamma$  (IFN- $\gamma$ ) and leukemia-inhibitory factor (LIF) have been postulated to play a role in the etiology of cancer anorexia-cachexia syndrome. Such cytokines may be produced by tumor or host tissue and are characterized by the induction of anorexia and a decrease in the clearing enzyme lipoprotein lipase. The ability to inhibit lipoprotein lipase varies among the cytokines. High serum levels of TNF- $\alpha$ , IL-1, IL-6 have been found in some, but not all, cancer patients, and the levels of these cytokines seem to correlate with the progression of some tumors. Chronic administration of these cytokines, either alone or in combination, is capable of reducing food intake and reproducing the different features of the cancer anorexia-cachexia syndrome.<sup>1,6</sup>

These cytokines exert a variety of behavioral and physiologic effects in addition to their immunologic and nutritional functions resulting in anorexia. The cytokine activity has both central and peripheral elements. The central effect is at the level of hypothalamic nuclei, which control feeding behavior.<sup>8</sup> The cytokines stimulate the expression of leptin and/or mimic the hypothalamic effect of negative feedback from leptin by disarranging the signaling pathway of neuropeptide Y (NPY), resulting in long-term inhibition of food intake. IL-1 antagonizes NPY-induced feeding and disrupts the orexigenic (feeding-stimulatory) pathway of NPY.<sup>9</sup>

As noted, muscle wasting is important in the pathophysiology of cachexia and a major cause of fatigue in patients. Accelerated or exaggerated loss of skeletal muscle mass distinguishes cachexia from the weight loss due solely to reduced energy intake. Several groups of investigators have suggested that actomyosin, actin and myosin are selectively targeted for degradation in clinical conditions associated with cachexia. Selective targeting of skeletal muscle is in part due to the systemic inflammation that frequently accompanies clinical conditions associated with cachexia. The common feature of cachexia, loss of muscle mass, suggests that therapies targeting muscle or inflammatory pathways may be effective in reducing the devastating effects of cachexia.<sup>2</sup>

Loss of skeletal muscle is characterized by a depression in protein synthesis and increased protein breakdown. There are also changes in the concentration of plasma amino acids, and most studies report a decrease in gluconeogenic amino acids, in contrast with severe malnutrition, where the concentration of branched-chain amino acids in plasma is normal or even increased. Protein degradation in muscle results in the release of amino acids, particularly alanine and glutamine. The former is channeled to the liver for gluconeogenesis and ATP synthesis, whereas glutamine is



taken up by the tumor to sustain the energy and nitrogen demands. Leucine oxidation to carbon dioxide is also increased in tumor-bearing animals.<sup>6</sup>

Cancer patients have a high turnover of both glycerol and free fatty acids and the elevated mobilization of lipids is often evident before weight loss becomes established. Loss of fat mass is a key feature of cancer cachexia and has been attributed to increased adipocyte lipolysis. Lipids have a high caloric value, and mobilization of lipids is required to meet the increased energy demands of the cachectic patient. As much as 85% of adipose tissue may be lost during the cachectic process, either through increased lipolysis or decreased lipogenesis. Increased production of lipolytic factors from adipose tissue such as IL-6 and TNF  $\alpha$  or by tumor-derived lipolytic factors such as zinc- $\alpha_2$  glycoprotein (ZAG) could explain increased lipolysis in cancer cachexia. Although some reports suggest reduced plasma levels of lipoprotein lipase (LPL) in cachectic patients, which is important in triglyceride synthesis, others have found no change in the total LPL enzyme activity. One of the characteristics of cytokines TNF-  $\alpha$ , IL-6, IL-1 $\alpha$ , INF- $\alpha$ , IFN- $\gamma$ , and LIF is that they inhibit LPL, thus inhibiting lipogenesis in adipose tissue.<sup>6, 10</sup>

### Diagnosis:-

The criteria for diagnosis of cachexia were put forward which include weight loss of at least 5% in 12 months or a body mass index (BMI) less than 20.0 kg/m<sup>2</sup> along with decreased muscle strength, fatigue, anorexia and low fat-free mass index. Abnormal biochemistry for increased inflammatory markers (c reactive protein and interleukin-6), anemia and low serum albumin should be evaluated. Diagnosis of cachexia in the presence of weight loss can be done if three of five conditions mentioned above are established.<sup>3</sup>

### Discussion:-

Many scientists and researchers have attempted to understand pathophysiology, role of tumor derived factors and cytokines, mechanism of weight loss through lipolysis, and loss of skeletal muscle in cachexia. Estimation of serum levels of various cytokines, tumor derived factors have been done to understand their role in cancer cachexia, anorexia and weight loss. Various treatment modalities in the form of drugs, nutritional supplementation, anti-tumor derivatives and hormones have also been tried for the alleviation of cancer cachexia.

Cachexia is a typical feature of infectious diseases where the invading pathogen may lead to stimulation of the immune system and cytokine production. However, the cachexia of cancer is not normally associated with the presence of infection and while the outward symptoms may look similar, it is unlikely that a single mediator could explain the heterogeneous pattern of changes seen in a wide spectrum of diseases. This raises the possibility that other factors in addition, or instead of the known cytokines, may mediate the changes seen in cancer cachexia. Further structural information of these factors is required for a full understanding of the condition.<sup>11</sup> It is suggested that despite a falling caloric intake, patients with cachexia frequently show elevated resting energy expenditure as a result of increases in Cori cycle (i.e., catalytic conversion of lactic acid to glucose) activity, glucose and triglyceride-fatty acid cycling, and gluconeogenesis. The presence of an acute phase response (APR) has been linked to accelerated weight loss and a shortened survival time. The APR is thought to be initiated by cytokines, the production of which is induced by a tumor factor, proteolysis inducing factor.<sup>4, 6</sup>

It was postulated that those tumors which are only slightly more active than the normal in their ability to concentrate amino-acids will grow slowly and produce only minor metabolic disturbances, while the more active ones will infiltrate faster, cause anorexia, and produce rapid cachexia and eventual death.<sup>12</sup> Anorexia is a common manifestation of cancer and the hypothalamus and probably other parts of the brain produce anorexigenic peptides. It is proposed that peptides, oligonucleotides, and other small metabolites produced by the cancer and by the tumor-bearing host are responsible for the genesis of the anorexia. They produce the anorexia through a peripheral effect on neuroendocrine cells and neuroreceptors and through a direct effect on hypothalamic and other central nervous system sensor and responder cells.<sup>13</sup> There are hypothalamic and extra-hypothalamic control components of feeding. Those control components mediated extra-hypothalamically get deteriorated during tumor growth. Eventually, the accumulated deletion of individual control components destroys the initial redundancy of the feeding control system and the system collapses, with overt cachexia.<sup>14</sup>

In an attempt to understand pathophysiology of cancer cachexia it was suggested that weight loss and failure to gain weight normally in cancer patients are attributable to negative energy balance and altered metabolism. Energy balance is negative because of decreased intake, increased expenditure, or both. Metabolic changes in lipids, proteins and carbohydrates result in muscle wasting in adult cancer patients and growth failure in pediatric cancer

patients.<sup>15</sup> The early appearance of circulating lipolytic activity may represent an early diagnostic marker of certain tumors, and since aberrations in lipid metabolism may be the initial step to generalized anergy (by a decline in all host metabolic pathways) and death, the characterization of the LPF would provide significant insight into the mechanisms of cancer cachexia and the eventual development of studies to reverse this phenomenon.<sup>16</sup> However the effect of recombinant human tumor necrosis factor on inhibition of LPL in adipose tissue was evaluated but the result was negative.<sup>17</sup>

It is proposed that yet unidentified factors among certain cancer patients increase the gene expression and thereby the protein production of hormone sensitive lipase (HSL) in fat cells. This enhances the stimulatory effect of lipolytic hormones and possibly of specific cachexia factors such as ZAG. Because the hormones are always present in the circulation, lipolysis is continuously activated because the action of the major antilipolytic hormone, insulin, is not altered. Therefore, HSL inhibitors may be useful in the treatment or prevention of cancer cachexia.<sup>10</sup>

It is suggested that decreased arginine availability is a specific feature of the presence of cancer and disturbances in arginine metabolism could contribute to the cascade of metabolic events leading to cancer cachexia.<sup>18</sup> Pathways specific to myostatin, nuclear factor  $\kappa$ B, and dystrophin glycoprotein complex have been identified and they maintain a link to the proteasome pathway. Further, proteasome remains a preferred choice for therapy and emerging upstream signaling molecules serve as additional promising therapeutic targets for the treatment of tumor-induced muscle wasting.<sup>19</sup> Serotonergic blockade for the treatment of the cancer anorexia-cachexia syndrome was undertaken that apparently improved the ability of patients to enjoy food but failed to prevent weight loss in patients with cancer cachexia or alter laboratory parameters of protein nutrition.<sup>20</sup> It is demonstrated that body fat was lost more rapidly than lean tissue in progressive cancer cachexia, a phenomenon that was related highly to alterations in the levels of circulating classic hormones and food intake, including both caloric amount and diet composition. The results showed importance in the planning of efficient palliative treatment for cancer patients.<sup>21</sup> While defining cancer cachexia, Fearon et al suggested a 3-factor profile i.e. weight loss, reduced food intake and systemic inflammation, which helps to identify the patient with adverse function and prognosis.<sup>22</sup>

The role of Parathyroid hormone-related protein (PTHrP) as a potential target of therapy for cancer-associated morbidity has been studied. It has been observed that PTHrP may cause not only hypercalcemia, but also elevation of the general production of proinflammatory cytokines. Further, PTHrP may be involved in the genesis of paraneoplastic syndrome, not only in terms of hypercalcemia, but also in deterioration of physical and mental activities (food and water intake, depression) and negative metabolic balance, which are frequently seen in patients with cancer, especially in near-terminal stages. He suggested that PTHrP is a promising molecular target for the development of a novel mode of treatment for patients with cancer-associated morbidity.<sup>23</sup>

The acute-phase response and elevated IL-6 are associated with cachexia and it is hypothesized that IL-6 may represent an important therapeutic target for head and neck squamous cell carcinoma patients with cancer cachexia.<sup>24</sup> It was also estimated that active ghrelin levels and the active to total ghrelin ratio were significantly increased in subjects with cancer-induced cachexia, compared with cancer and non-cancer controls.<sup>25</sup> Keram et al investigated the role of the adipocytokines, ghrelin and leptin in gastric cancer cachexia and found the elevated levels of ghrelin and leptin in cachectic patients.<sup>7</sup> The levels of various cytokines viz. serum leptin, IL-1 $\beta$ , IL-2, IL-6 and TNF- $\alpha$  in advanced head and neck cancer before and after the induction chemotherapy followed by concomitant chemoradiation therapy in advanced head and neck cancer were compared. It was found low serum levels of leptin and the high serum levels of proinflammatory cytokines. They also found correlation between lowering levels of leptin and increasing levels of proinflammatory cytokines, particularly IL-6, in patients who had a progressive disease during treatment, whereas the opposite occurred in patients responded to treatment.<sup>26</sup>

Various treatment modalities have been attempted for medical management of cancer cachexia (table I)<sup>27-32</sup>. Physical symptoms other than pain often contribute to suffering near the end of life. In addition to pain, the most common symptoms in the terminal stages of an illness such as cancer are fatigue, anorexia, cachexia, nausea, vomiting, constipation, delirium and dyspnea.<sup>33</sup> A number of drugs are available for the management of symptoms of cachexia, including corticosteroids and progestational drugs. Prokinetic drugs, either alone or in combination with other agents such as corticosteroids, are highly effective in the treatment of chronic nausea. For patients with asthenia, it should first be determined whether there are any reversible causes; if not, corticosteroids and psychostimulants may diminish the symptoms. Oxygen and opioids are effective in treating dyspnea, whereas there is limited evidence that benzodiazepines provide any relief of this symptom.<sup>34</sup>

The current medical treatment of cancer-related cachexia is been reviewed, in particular focusing on combination therapy and ongoing research. Among the treatments proposed for cancer-related cachexia, some proved to be ineffective, namely, cyproheptadine, hydrazine, metoclopramide, and pentoxifylline. Among effective treatments, progestagens are currently considered the best available treatment option for cancer-related cachexia. Drugs with a strong rationale that have failed or have not shown univocal results in clinical trials so far include eicosapentaenoic acid, cannabinoids, bortezomib, and anti-TNF-alpha MoAb. Several emerging drugs have shown promising results but are still under clinical investigation (thalidomide, selective cox-2 inhibitors, ghrelin mimetics, insulin, oxandrolone, and olanzapine).<sup>35</sup>

Forty years on from its worldwide withdrawal, thalidomide is currently undergoing a remarkable renaissance as a novel and powerful immunomodulatory agent. Over the last decade it has been found to be active in a wide variety of inflammatory and malignant disorders where conventional therapies have failed.<sup>36</sup> It has been demonstrated to suppress TNF-alpha production in monocytes in vitro and to normalize elevated TNF-alpha levels in vivo.<sup>37</sup> Thalidomide, an oral agent with antiangiogenic and immunomodulatory properties, is being investigated extensively in the management of advanced cancer. Multiple studies with large numbers of patients have confirmed that this drug has significant activity in multiple myeloma. The activity of thalidomide in solid tumors is less prominent. Studies in Kaposi's sarcoma, malignant melanoma, renal cell carcinoma and prostate cancer appear more promising especially when thalidomide is combined with biological agents or with chemotherapy.<sup>38</sup> Bruera et al suggest that thalidomide can be expected to be well tolerated and to have at least similar symptomatic effects as Megestrol Acetate.<sup>39</sup>

Eicosapentaenoic acid (an omega-3 fatty acid from fish oils) and the appetite stimulant, Megestrol Acetate have been tried for the management cachexia.<sup>40</sup> N-3 fatty acids in dose of at least 1.5 g/day for a prolonged time to advanced cancer patients with weight loss were associated with an improvement of clinical, biological and functional parameters and with amelioration of quality of life.<sup>41</sup> Gonçalves et al have tried conjugated linoleic acid supplements in patients with cachexia but their result was negative.<sup>42</sup>

It is demonstrated that the synthetic progestogen- medroxyprogesterone acetate has the potential to increase food intake and to concomitantly reverse fat wasting in weight-losing patients with cancer.<sup>43, 44</sup> But as an adverse effect, megestrol acetate may cause symptomatic suppression of the hypothalamic pituitary adrenal axis. In male patients with cancer, treatment with Megestrol Acetate may also suppress the gonadal axis, resulting in symptomatic androgen deficiency. In a study such three cases have highlighted the symptomatic burden of adrenal insufficiency and hypogonadism that warns clinicians about this complication.<sup>45</sup> Couluris et al found cyproheptadine hydrochloride and megestrol acetate very effective appetite stimulant in children with cancer/treatment related cachexia. Oral cyproheptadine hydrochloride was excellent in weight gain and they found elevated serum leptin levels. They recommend use of Megestrol Acetate as second-line therapy due to safety profile.<sup>46</sup>

Malnutrition is common in the cancer patient. The need for nutritional support should be considered in the light of the patient's condition and carefully planned along with specific antitumor therapy.<sup>47</sup> Appropriate clinical judgment is required in proper selection of the total parenteral nutrition candidate. Malnutrition is almost always a prerequisite, as is failure of the gastrointestinal tract. When the alimentary tract cannot be used effectively for feeding cancer patients, parenteral nutrition can be lifesaving. Moreover, patients who are poor candidates for any anti-neoplastic therapy because of their debility can be converted to reasonable candidates following a course of intravenous hyperalimentation.<sup>48, 49</sup> Consequently, in upcoming studies, it probably would be more rewarding to focus on improving the effectiveness of nutritional support using additional interventions, such as appetite stimulation and interactive hormonal therapy, perhaps in combination with palliative low dose chemotherapy.<sup>50</sup> In a study on total parenteral nutrition it is concluded that although it is unable to completely reverse some nutrition-related variables in cachectic patients with cancer, most patients were kept within a normal range and some improved. Therefore, further deterioration of the nutritional state, which is characteristic of this phase of disease, was at least prevented. Health care professionals should focus on physical health-related quality of- life indicators, such as nausea and emesis, dyspnea, and weakness, to gather prognostic clues in patients with terminal cancer.<sup>51, 52</sup> Patients and families as well as the medical community should use a comprehensive approach to improving the caloric and protein intake of patients who are still able to benefit from oral intake and further therapy.<sup>53</sup>

Palliative care is increasingly recognized as an essential component of a cancer patient's care both throughout the course of the disease and regardless of whether that patient's disease is potentially curable. Moreover, clinical application of the principles of palliative care need not and should not be limited to patients suffering from malignant disease. Optimal symptom control and care of the whole person are an integral part of the comprehensive care of any patient and deserve to be considered as such. Recent therapeutic advances in palliative care are exciting and some are controversial. They hold the potential to improve the quality of life of countless patients. To fulfill this role they require rigorous evaluation in properly conducted clinical trials.<sup>54</sup> Care of patients with cancer can be enhanced by continued involvement of the primary care physician. The physician's role may include informing the patient of the diagnosis, helping with decisions about treatment, providing psychological support, treating intercurrent disease, continuing patient-appropriate preventive care, and recognizing and managing or co-managing complications of cancer and cancer therapies.<sup>55</sup>

**Table 1: Various treatment modalities in cancer cachexia**

Researcher/ scientist (year)	Treatment modality
Daneryd P et al (1998) <sup>27</sup>	recombinant erythropoietin
Trikha M et al (2003) <sup>28</sup>	Targeted anti-interleukin-6 monoclonal antibody
Garcia JM et al (2007) <sup>29</sup>	RC-1291 – an oral ghrelin mimetic and growth hormone (GH) secretagogue
Lundholm K (2007) <sup>30</sup>	Insulin
Strasser F et al (2008) <sup>31</sup>	intravenous Ghrelin
Qi F et al (2010) <sup>32</sup>	Chinese herbal medicines

### Conclusion:-

The cancer cachexia is a clinical problem affecting many patients with cancer and other end-stage diseases. Correct identification of treatable, reversible causes must be aggressively sought and, when found, appropriately treated. New research into novel therapies directed at cancer cachexia is continuing, but there is a need of well-structured clinical trials. Professional participation and interventions from scientists and clinicians can have a profound influence on the diagnosis and treatment of patients with cachexia.

### References:-

1. Inui A. Cancer anorexia-cachexia syndrome: are neuropeptides the key? *Cancer research* 1999; 59, 4493–4501
2. Fearon KC, Carter DC. Cancer cachexia. *Annals of Surgery* 1988; 208; 1-5
3. Evans WJ, Morley JE, Argiles J, Bales C, Baracos V, Guttridge D, et al. Cachexia: a new definition. *Clinical Nutrition*. 2008; 27; 793-799
4. Tisdale MJ. Biology of cachexia. *J Natl Cancer Inst* 1997; 89; 1763–1773
5. Brown DR, Berkowitz DE, Breslow MJ. Weight loss is not associated with hyperleptinemia in humans with pancreatic cancer. *J Clin Endocrinol Metab*, 2001; 86: 162-166
6. Tisdale MJ. Pathogenesis of cancer cachexia. *J Support Oncol* 2003; 1:159–168
7. Kerem M, Ferahkose Z, Yilmaz UT, Pasaoglu H, Ofluoglu E, Bedirli A, et al. Adipokines and ghrelin in gastric cancer cachexia. *World J Gastroenterol*. 2008; 14: 3633-3641
8. Kotler DP. Cachexia. *Ann Int Med* 2001; 133: 622–34
9. Martignoni ME, Kunze P, Helmut, Friess H. Cancer cachexia. *Molecular Cancer* 2003, 2:36
10. Agustsson T, Ryden M, Hoffstedt J, van Harmelen V, Dicker A, Laurencikiene J, et al. Mechanism of increased lipolysis in cancer cachexia. *Cancer Res* 2007; 67:5531–5537
11. Tisdale MJ. Cancer cachexia. *Br. J. Cancer*. 1999; 63:337-342
12. Wiseman G, Ghadially FN. A biochemical concept of tumour growth, infiltration, and cachexia. *British medical journal*. 1958; 18-21
13. Theologides A. Anorexia-producing intermediary metabolites. *Am. J. Clin. Nutr.* 1976; 29: 552-558
14. Morrison SD. Origins of anorexia in neoplastic disease. *Am. J. Clin. Nutr.* 1978; 31: 104-110
15. DeWys WD. Pathophysiology of cancer cachexia: current understanding and areas for future research. *Cancer Research (Suppl.)* 1982; 42: 721S-726S
16. Taylor DD, Gercel-Taylor C, Jenis LG, Devereux DF. Identification of a human tumor-derived lipolysis-promoting factor. *Cancer Research*. 1992; 52: 829-834
17. Kern PA. Recombinant human tumor necrosis factor does not inhibit lipoprotein lipase in primary cultures of isolated human adipocytes. *J Lipid Res*. 1988; 29: 909-914

18. Vissers YLJ, Cornelis Dejong CHC, Luiking YC, Fearon KCH, von Meyenfeldt MF, Deutz NEP. Plasma arginine concentrations are reduced in cancer patients: evidence for arginine deficiency? *Am J Clin Nutr.* 2005; 81:1142–1146
19. Acharyya S, Guttridge DC. Cancer cachexia signaling pathways continue to emerge yet much still points to the proteasome. *Clin Cancer Res* 2007;13:1356-1361
20. Edelman MJ, Gandara DR, Meyers FJ, Ishii R, O'Mahony M, Uhrich M, et al. Serotonergic blockade in the treatment of the cancer anorexia-cachexia syndrome. *Cancer* 1999; 86:684–688
21. Fouladiun M, Korner U, Bosaeus I, Daneryd P, Hyltander A, Lundholm KG. Body composition and time course changes in regional distribution of fat and lean tissue in unselected cancer patients on palliative care—correlations with food intake, metabolism, exercise capacity, and hormones. *Cancer* 2005; 103:2189–2198
22. Fearon KC, Voss AC, Deborah S, Hustead DS. Definition of cancer cachexia: effect of weight loss, reduced food intake, and systemic inflammation on functional status and prognosis. *Am J Clin Nutr* 2006; 83:1345–1350
23. Ogata E. Parathyroid hormone-related protein as a potential target of therapy for cancer-associated morbidity. *Cancer.* 2000;88:2909–11
24. Richey LM, George JR, Couch ME, Kanapkey BK, Yin X, Cannon T, et al. Defining cancer cachexia in head and neck squamous cell carcinoma. *Clin Cancer Res.* 2007; 13: 6562-6567
25. Garcia JM, Garcia-Touza M, Hijazi RA, Taffet G, Epner D, Mann D, et al. Active ghrelin levels and active to total ghrelin ratio in cancer-induced cachexia. *J. Clin. Endocrinol. Metab.* 2005 90:2920-2926
26. Mantovani G, Proto E, Massa E, Mulas C, Madeddu C, Mura L, et al. Induction chemotherapy followed by concomitant chemoradiation in advanced head and neck cancer: a phase II study for organ-sparing purposes evaluating feasibility, effectiveness and toxicity. *Int J Oncol* 2002; 20: 419–427
27. Daneryd P, Svanberg E, Korner U, Lindholm E, Sandstrom R, Brevinge H, et al. Protection of metabolic and exercise capacity in unselected weight-losing cancer patients following treatment with recombinant erythropoietin: a randomized prospective study. *Cancer Research*, 1998; 58. 5374-5379
28. Trikha M, Corringham R, Klein B, Rossi J. Targeted anti-interleukin-6 monoclonal antibody therapy for cancer: a review of the rationale and clinical evidence. *Clin Cancer Res.* 2003; 9: 4653–4665
29. Garcia JM, Polvino WJ. Effect on Body Weight and Safety of RC-1291, a Novel, Orally Available Ghrelin Mimetic and Growth Hormone Secretagogue: Results of a Phase I, Randomized, Placebo-Controlled, Multiple-Dose Study in Healthy Volunteers. *The Oncologist* 2007;12: 594–600
30. Lundholm K, Korner U, Gunnebo L, Sixt-Ammilon P, Fouladiun M, Daneryd P, et al. Insulin Treatment in Cancer Cachexia: Effects on Survival, Metabolism, and Physical Functioning. *Clin Cancer Res* 2007; 13: 2699-2706
31. Strasser F, Lutz TA, Maeder MT, Thuerlimann B, Bueche D, Tscho M, et al. Safety, tolerability and pharmacokinetics of intravenous ghrelin for cancer-related anorexia/cachexia: a randomised, placebo-controlled, double-blind, double-crossover study. *British Journal of Cancer* (2008) 98, 300–308.
32. Qi F, Li A, Inagaki Y, Gao J, Jijun Li, Kokudo N, et al. Chinese herbal medicines as adjuvant treatment during chemo or radio-therapy for cancer. *BioScience Trends.* 2010; 4: 297-307
33. Ross DD, Alexander CS. Management of Common Symptoms in Terminally Ill Patients: Part I. Fatigue, Anorexia, Cachexia, Nausea and Vomiting. *Am Fam Physician* 2001; 64:807-14.
34. Bruera E, Neumann CM. Management of specific symptom complexes in patients receiving palliative care. *CMAJ* 1998; 158:1717-26
35. Tazi EM, H Errihani H. Treatment of Cachexia in Oncology. *Indian J Palliat Care.* 2010 Sep–Dec; 16(3): 129–137
36. Gordon JN, Goggin PM. Thalidomide and its derivatives: emerging from the wilderness. *Postgrad Med J* 2003; 79:127–132
37. Argilés JM, Olivan M, Busquets S, López-Soriano FJ. Optimal management of cancer anorexia–cachexia syndrome. *Cancer Management and Research* 2010;2; 27–38
38. Eleutherakis-Papaiakovou V, Bamias A, Dimopoulos MA. Thalidomide in cancer medicine. *Annals of Oncology.* 2004; 15: 1151–1160
39. Bruera E, Neumann CM, Pituskin E, Calder K, Ball G, Hanson J. Thalidomide in patients with cachexia due to terminal cancer: Preliminary report. *Annals of Oncology.* 1999; 10: 857-859
40. Dewey A, Baughan C, Dean TP, Higgins B, Johnson I. Eicosapentaenoic acid (EPA, an omega-3 fatty acid from fish oils) for the treatment of cancer cachexia. *Cochrane Database of Systematic Reviews.* 2007, Issue 1
41. Giacosa A, Rondanelli M. Fish oil and treatment of cancer cachexia. *Genes Nutr.* 2008;3: 25–28

42. Gonçalves DC, Lira FS, Carnevali (Jr) LC, Rosa JC, Pimentel GD, Seelaender M. Conjugated linoleic acid: good or bad nutrient. *Diabetology and Metabolic Syndrome*. 2010; 2: 62.
43. Simons JPFHA, Schols AMWJ, Janine MJ, Hoefnagels JMJ, Westerterp KR, ten Velde GPM, et al. Effects of medroxyprogesterone acetate on food intake, body composition, and resting energy expenditure in patients with advanced, nonhormone-sensitive cancer- a randomized, placebo-controlled trial. *Cancer* 1998; 82:553–560
44. Maltoni M, Nanni O, Scarpi E, Rossi D, Serra P, Amadori D. High-dose progestins for the treatment of cancer anorexia-cachexia syndrome: A systematic review of randomised clinical trials. *Annals of Oncology*. 2001; 12: 289-300
45. Dev R, Fabbro ED, Bruera E. Association between megestrol acetate treatment and symptomatic adrenal insufficiency with hypogonadism in male patients With Cancer. *Cancer* 2007; 110:1173–1177
46. Couluris M, Mayer JLR, Freye DR, Sandler E, Xu P, Krischer JP. The effect of cyproheptadine hydrochloride (Periactin®) and megestrol acetate (Megace®) on weight in children with cancer/treatment-related cachexia. *J Pediatr Hematol Oncol*. 2008 November; 30(11): 791–797
47. Dickerson JWT. Nutrition in the cancer patient: a review. *Journal of the Royal Society of Medicine*. 1984, 77:309-315
48. Souba WW, Edward M, Copeland III EM. Hyperalimentation in cancer. *CA Cancer J Clin* 1989; 39; 105-114
49. Dudrick SJ, MacFadyen, Jr. BV, Souchon EA, Englert DM, Copeland III EM. Parenteral nutrition techniques in cancer patients. *Cancer Research*, 1977; 37, 2440-2450
50. Lundholm K, Daneryd P, Ingvar Bosaeus I, Korner U, Lindholm E. Palliative nutritional intervention in addition to cyclooxygenase and erythropoietin treatment for patients with malignant disease: effects on survival, metabolism, and function a randomized prospective study. *Cancer* 2004; 100:1967–1977
51. Bozzetti F, Migliavacca S, Pupa A, Ammatuna M, Bonalumi MG, Terno G, et al. Total Parenteral Nutrition Prevents Further Nutritional Deterioration in Patients with Cancer Cachexia. *Ann. Surg.* 1987; 205(2): 138-143
52. Vigano A, Donaldson N, Higginson IJ, Bruera E, Mahmud S, Suarez-Almazor M. Quality of life and survival prediction in terminal cancer patients a multicenter study. *Cancer* 2004; 101:1090–1098
53. Drasin H, Rosenbaum EH, Stitt CA, Rosenbaum IR. The challenge of nutritional maintenance in cancer patients. *West J Med*. 1979; 130:145-152
54. Davis CL, Hardy JR. Palliative care. *BMJ* 1994; 308:1359-1362
55. Smith GF, Toonen TR. Primary Care of the Patient with Cancer. *Am Fam Physician*. 2007; 75: 1207-1214.



## RESEARCH ARTICLE

### EVALUATION OF BITE FORCE AMONG DIFFERENT AGE GROUPS IN VISAKHAPATNAM DISTRICT.

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#### Abstract

Bite force is an important aspect of masticatory system. Bite force assesses masticatory muscle function under clinical and experimental conditions. Measurement of maximum voluntary bite force (MVBF) in 100 individuals including males and females has been used for understanding masticatory mechanism, to evaluate the physiological characteristics of jaw muscles and study the effect of different physiological and morphological factors. The subject related factors includes- age, gender, periodontal support, height, weight, craniofacial morphology, malocclusion, temporomandibular disorder (TMD) pain. Therefore, bite force is used as a variable for evaluating masticatory function.

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#### Introduction:-

Face, being the most admired point in the human body and Mandible, despite being the largest and strongest facial bone, the muscular attachments and their influence and presence of developing or developed dentition play an important role in producing the inherent weakness.

Bite force is the force applied in dental occlusion, which is the important aspect of masticatory muscular system. It is used to understand the underlying masticatory mechanism, to study the effect of different physiological and morphological factors such as age, gender, periodontal support of the teeth, height and body weight, craniofacial morphology, presence of malocclusion, temporomandibular disorder (TMD) pain and also to evaluate the physiological characteristics of jaw muscles. Other variables reportedly affecting the bite force are the type of recording devices, technique employed to measure the bite force, position of sensor in the oral cavity, patient position, unilateral or bilateral measurements and magnitude of mouth opening during measurements<sup>1</sup>.

Masseter, the anti-gravity muscle, has a special consideration among all the masticatory muscles such as masseter, temporalis, medial pterygoid and lateral pterygoid in the quantitative assessment of the strength of the muscles. The relationship of maximum voluntary bite force and masticatory system is well documented in literature to indicate the health of stomatognathic system<sup>2</sup>. The main aim of this study was to evaluate the Maximum voluntary bite force among different age groups in both males and females in Visakhapatnam District.

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### Materials and methods:-

This study was conducted in 100 healthy individuals (51 males and 49 females) of Visakhapatnam District. The individuals were randomly selected for the study after the Ethical Committee approval. The total numbers of individuals are broadly categorized under six age groups i.e. 0-10, 11-20, 21-30, 31-40, 41-50, 51+ groups. Individuals with any kind of syndromes, degenerative diseases, mental deficiencies, malformation, changes of the temporomandibular articulation, open-bite and cross-bite, crowns and restorations, myofunctional changes of masticatory muscles and dental implants have been excluded from the present study.

The procedure involves a bite force meter which has a biting sensor. The individual is informed about the experimental procedure and the subject was seated comfortably in a chair in an upright position. A polythene sheet or a plastic wrapper was used to cover the biting sensor. The operator holds the holding instrument and it is used to load the bite force on the bite force sensor. It is placed on the incisal edge of the anterior teeth for measuring anterior bite force (ABF) and then placed on the occlusal surface of the first molar on the right side for measuring the right posterior bite force (RBF) and then placed on the occlusal surface of the first molar on the left side for measuring the left posterior bite force (LBF). The subjects were asked to bite hard on the sensor and the maximum bite force reading on the charge meter display was recorded. Three such readings were taken, alternated on each side, with an interval of 1 minute to avoid muscular fatigue. To reduce the error and bias in the study, a single operator has recorded the bite force in all the subjects. The highest among all these three consecutive records on either side was taken as the Maximum Voluntary Bite Force of that side. The mounting was repeated for each healthy subject on the anterior and bilateral posterior sides. The bite force transducers were disinfected before the experiments by immersing them in a disinfectant solution. The transducer was calibrated on each day of experimentation.

### Results:-

The statistical analysis was done by Mann Whitney Test to find of the statistical difference of bite force between males and females in different age groups. In both anterior and posterior region, the highest mean bite force is recorded in males in the age group of 41-50years (Fig 1, 2, 3). In the anterior and posterior region, the lowest mean bite force is recorded in females in the age group 0-10 (Fig 1, 2, 3). The mean bite force has increased as the age increases in the anterior and posterior region till the age group of 41-50 years. In the age group with above 51 years of age, there is a decrease in the mean bite force of all the males and females in both anterior and posterior region.

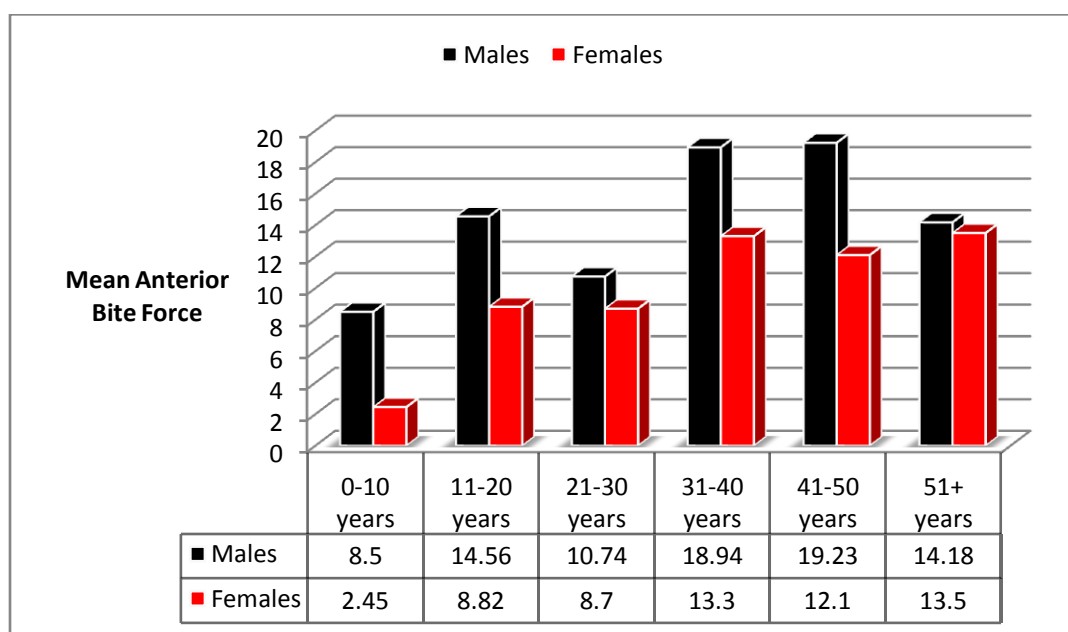


Fig 1. Mean of Anterior Bite Force



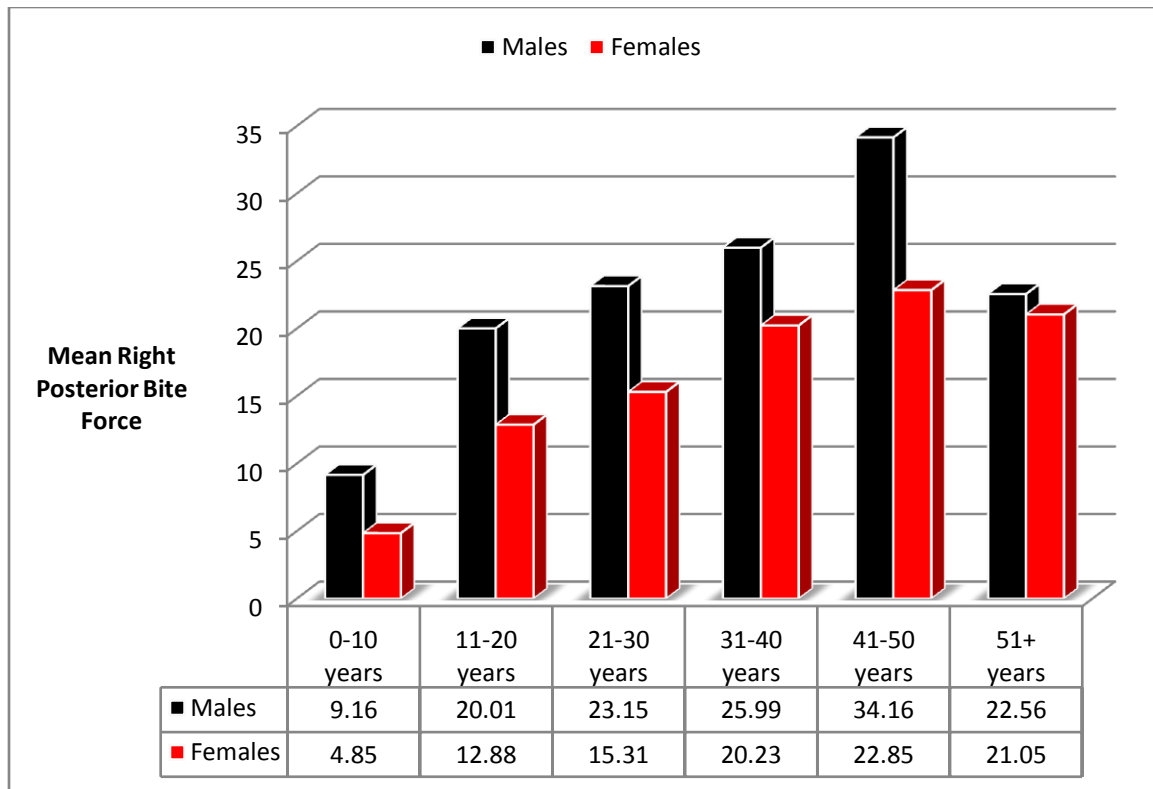


Fig 2. Mean of Right Posterior Bite Force

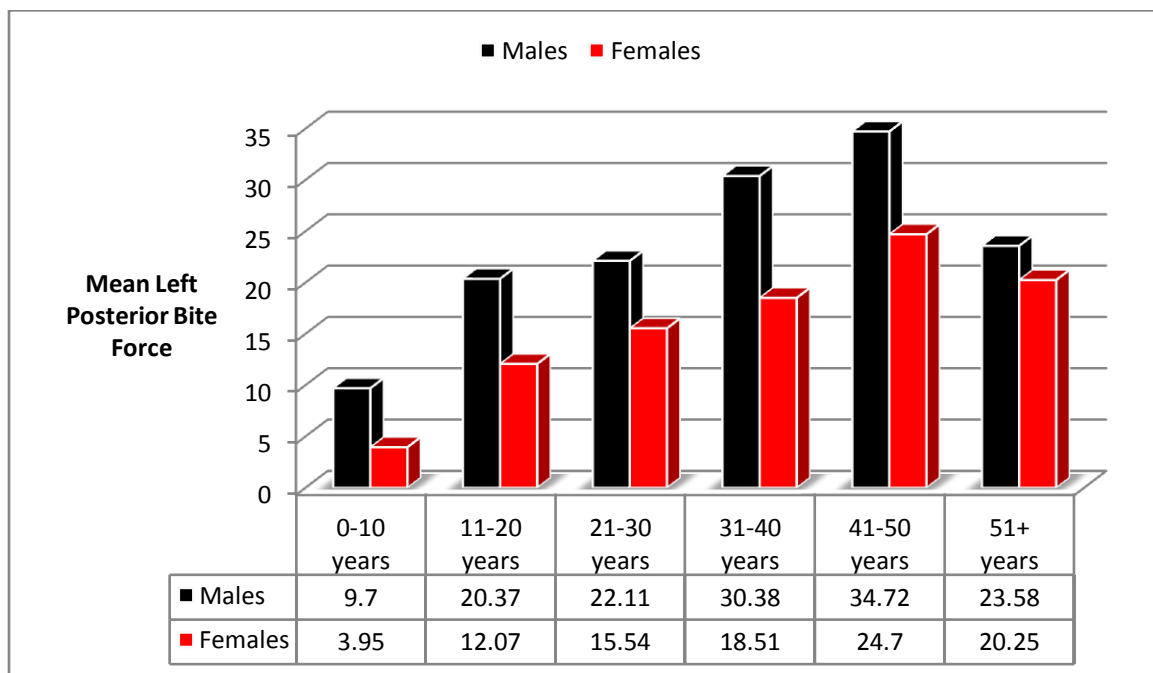


Fig 3. Mean of Left Posterior Bite Force

**Discussion:-**

Bite force is an important element of masticatory system. Masticatory performance is a cumulative contribution of various factors like bite force, severity of malocclusion, occlusal contact area, body loss of teeth, restorations, facial forms and other motor activities. Bite force has also shown to be affected by a number of variables such as

craniofacial morphology, age, gender, periodontal support of the teeth, height and body weight, temporomandibular disorders pain, and dental status and also other variables include the type of recording devices, technique employed to measure the bite force, position of the sensor in the oral cavity, patient position, unilateral or bilateral measurements and magnitude of mouth opening during measurements.

According to Suzana Varga et al<sup>3</sup>, bite force measurements were undertaken using a portable occlusal force gauge on both the left and the right sides of the jaw in the first molar region during maximal clenching. Two independent samples t-tests and multiple regressions were used for statistical analysis. MVBFs were age and gender related. Males showed a significant increase in bite force between 15 and 18 years of age, but gender differences were significant only in the 18-year-olds. In subjects with a neutral occlusion, MVBF could best be predicted using multiple regressions from age and gender. Morphological occlusion, jaw function, and BMI explained the remaining variance.

According to Virgilio F. Ferrario et al<sup>4</sup> conducted a study to assess the repeatability of maximal bite force estimates as obtained by sub-maximal electromyographic-force relationships performed simultaneously and symmetrically in both sides of the mouth. The protocol could be used in a clinical context to obtain indicative values for the occlusal loads to be resisted by the prosthetic reconstructions. Ten young healthy subjects performed; (1) a maximum voluntary clench (MVC) directly on their occlusal surfaces; (2) four simultaneous recording of sub-maximal bite forces on two transducers positioned on the left and right first mandibular molars) and surface EMG potentials of the masseter and temporalis anterior muscles. The actual force peak value was recorded. For each subject, a linear regression was run between the simultaneous bite force and EMG sub-maximal values recorded in the four tests. Using the EMG potentials obtained during the MVC tests, the best fitting line was used to estimate a maximum bite force. Two independent recordings were made by each subject (2 week interval) and analyzed by correlation analysis, paired Student's t-test, and Dahlberg statistic. Significant linear relationships were found between bite force and EMG potentials. The two series of indirect estimates of maximal bite force were correlated; without systematic differences. Simultaneously recorded sub-maximal bite forces and surface EMG potentials of mandibular elevator muscles had a linear relationship. The estimates of maximum bite force were repeatable on a short-term basis. The method limited the disadvantages of bite force recordings, and it could be used to obtain indicative values for the occlusal loads to be resisted by the prosthetic reconstructions.

According to Kazunori Ikebe et al<sup>5</sup>, investigated the effect of ageing, occlusal support and TMJ condition and general health status on bite force in older adults. The study sample consisted of 850 independently-living people over the age of 60 years. Bilateral maximal bite force in the intercuspal position was measured with pressure sensitive sheets. TMJ noise by palpation and limitation of mouth opening (less than 40 mm) were assessed. Subjects were grouped into three categories by occlusal support according to the Eichner Index. A multiple logistic regression analysis showed that whether participants had low bite force or not was significantly associated with gender, age, self-rated general health and occlusal support, but not TMJ noise or mouth opening limitation. Overall bite force showed a statistically significant but weak negative Spearman's correlation with age. However, there was no significant correlation between age and bite force in the Eichner C group for males or in any of the Eichner classification for females. Decline of occlusal support and general health might translate into reduction of bite force with ageing in older adults. Since tooth loss is not physiological ageing but pathological ageing, it cannot be shown that reduction of bite force is a natural effect of ageing.

According to C. M. Serra & A. E. Manns et al<sup>6</sup>, bite force has been measured by different methods and over a wide variety of designs. In several instruments, the fact that bite surface has been manufactured with stiff materials might interfere in obtaining reliable data, by a more prompt activation of inhibitory reflex mechanisms. The purpose of this study was to compare the maximum voluntary bite force measured by a digital occlusal force gauge (GM10 Nagano Keiki, Japan) between different opponent teeth, employing semi-hard or soft bite surfaces. A sample of 34 young adults with complete natural dentition was studied. The original semi-hard bite surface was exchanged by a soft one, made of leather and rubber. Maximum voluntary bite force recordings were made for each tooth group and for both bite surfaces. Statistical analyses (Student's t-test) revealed significant differences, with higher scores while using the soft surface across sexes and tooth groups. Differential activation of periodontal mechanoreceptors of a specific tooth group is mainly conditioned by the hardness of the bite surface; a soft surface induces greater activation of elevator musculature, while a hard one induces inhibition more promptly. Thus, soft bite surfaces are recommended for higher reliability in maximum voluntary bite force recordings.

Therefore, bite force is an important aspect of human masticatory system. Assessing the bite force provides the assessment of masticatory muscle function under clinical and experimental conditions. Maximum Voluntary Bite Force (MVBf) is an indicator of the functional condition of the masticatory system, resulting from the combined action of the jaw closing muscles and is modified by jaw biomechanics and reflexes. All the skeletal, muscular, and nervous systems will have an effect on bite force, and the condition of these systems will influence the biting ability of an individual.

### References:-

1. Jain V, Mathur VP, Pillai RS, Kalra S. A preliminary study to find out maximum occlusal bite force in Indian individuals. *Indian Journal of Dental Research*, 2014; 25(3): 325-30.
2. Bakke M. Mandibular elevator muscles: Physiology, action, and effect of dental occlusion. *Scand J Dent Res* 1993;101: 314-31.
3. Varga S, Spalj S, Varga ML, Milosevic SA, Mestrovic S and Slaj M. Maximum voluntary molar bite force in subjects with normal occlusion *European Journal of Orthodontics* 1 of 7, November 9, 2010.
4. Ferrario VF, Sforza C, Zanotti G, Tartaglia GM. Maximal bite forces in healthy young adults as predicted by surface electromyography *Journal of Dentistry* (2004) 32, 451–457.
5. Ikebe K, Nokubi T, Morii K, Kashiwagi J, Furuya M. Association of bite force with ageing and occlusal support in older adults *Journal of Dentistry* (2005) 33, 131–137.
6. C. M. Serra & A. E. Manns. Bite Force Measurements With Hard And Soft Bite Surfaces *Journal Of Oral Rehabilitation* 2013 40; 563—568.
7. Koc D, Dogan A, Bulent BGK. Bite Force and Influential Factors on Bite Force Measurements: A Literature Review. *European Journal of Dentistry*, April 2010, 4:223-232.
8. Koc D, Dogan A, Bulent BGK. Effect of gender, facial dimensions, body mass index and type of functional occlusion on bite force. *Journal of Applied Oral Sciences*, 2011, 19(3):274-279.
9. Takaki P, Vieira M, Bommarito S. Maximum Bite Force Analysis in Different Age Groups. *International Archives of Otolaryngology*, 2014, 18(3).
10. Eng CM, Lieberman DE, Zink KD, Peters MA. Bite Force and Occlusal Stress Production in Hominion Evolution. *American Journal of Physical Anthropology*, 2013, 151:544-557.
11. Muller F, Hernandez M, Grutter L, Kessler LA, Weingart D, Schimmel M. Masseter muscle thickness, chewing efficiency and bite force in edentulous patients with fixed and removable implant- supported prostheses: a cross sectional multicenter study. *Clinical Oral Implantology*, 2012, 23:144-150.
12. Sakaguchi K, Uehara S, Yagi T, Miyawaki S. Relationship between occlusal curvatures and bite force in humans. *Journal of Orthodontic Waves*, 2012, 71:79-84.
13. Santana-Mora U, Martinez-Insua A, Santana-Penin U, Palomar AP, Banzo JC, Mora MJ. Muscular activity during isometric incisal biting. *Journal of Biomechanics*, 2014, 47.
14. Park MK, Sung-Min, In Yun K, Park JU. Change in Bite Force and Electromyographic Activity of Masticatory Muscle in Accordance with Change of Occlusal Plane. *Journal of Oral and Maxillofacial Surgery*, 2012, 70:1960-1967.
15. Takahashi T, Hayakawa F, Kumagai M, Akiyama Y, Kohyama K. Relations among mechanical properties, human bite parameters and ease of chewing of solid foods with various textures. *Journal of food engineering*, 2009, 95:400-409.
16. Chen L, Prosche PA, Morne burg TR. Influence of bite force on jaw muscle activity ratios in subject-controlled unilateral isometric biting. *Journal of Electromyography and Kinesiology*, 2010, 20:961-966.
17. Jain V, Mathur VP, Abhishek K, Kothari M. Effects of occlusal splint therapy on maximum bite force in individuals with moderate to severe attrition. *Journal of Prosthodontic Research*, 2012, 56:287-292.
18. Lepley CR, Throckmorton GS, Ceen RF, Buschang PH. Relative contributions of occlusion, maximum bite force and chewing cycle kinematics to masticatory performance. *American Journal of Orthodontics and Dentofacial Orthopaedics*, May 2011, 139(5):606-613.
19. Abdullah MM, Saltaji H, Abou-Hamed H, Youssef M. The relationship between molar bite force and incisor inclination: A prospective cross-sectional study. *International Orthodontics*, 2014, 12:494-504.
20. Ibacache VT, Munoz VZ, Paul O'Higgins. The relationship between Skull morphology, Masticatory muscle force and cranial skeletal deformation during biting. *Annals of Anatomy*, 2016, 203:59-68.
21. Elham S, J. AbuAlhaja, Ibraheem A. AlZoubi, Mohammed E. Al. Rousan, Mohammad M. Hammad. Maximum occlusal bite forces in Jordanian individuals with different dentofacial vertical skeletal patterns. *European Journal of Orthodontics*, 2009, 1-7.

22. A. Shimada, L. Baad-Hansen, P. Svensson. Effect of experimental jaw muscle pain on dynamic bite force during mastication. Archives of Oral Biology, 2015, 60:256-266.
23. Abreu RAM, Pereira MD, Furtado F, Prado GPR, Wilson Mestriner Jr, Ferreira LM. Masticatory efficiency and bite force in individuals with normal occlusion. Archives of Oral Biology, 2014, 59:1065-1074.
24. Jain V, Mathur VP, Kumar A. A preliminary study to find a possible association between occlusal wear and maximum bite force in humans. Acta Odontologica Scandinavica, 2013, 71:93-101.
25. Hattori Y, Satoh C, Kunieda T, Endoh R, Hisamatsu H, Watanabe M. Bite forces and their resultants during forceful intercuspal clenching in humans. Journal of Biomechanics, 2009, 42:1533-1538.

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### RESEARCH ARTICLE

#### Pulsed Nd: YAG Laser versus Ultrasound in Treatment of Osteoporosis.

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Osteoporosis, Laser, Pulsed Ultrasound,  
Bone density.

#### Abstract

**Background:** Osteoporosis characterized by low bone mass and micro architectural deterioration of bone tissue, leading to enhanced bone fragility and a consequent increase in fracture risk. **Objective:** the aim of this study was to compare between pulsed high-intensity laser (HILT) and pulsed ultrasound (PUS) in treatment of osteoporosis in men. **Method:** Sixty male patients their age between 40- 65 years included in this study, the patients divided randomly into three equal groups. Laser group (LG,n=20), ultrasound group (USG,n=20), twenty patients and control group (CG,n=20). Patients in Laser and ultrasound groups received treatment for 12 weeks on the lumbar spine according to designed protocol ten minutes three times a week but the control group did not receive any treatment. Patients in the three groups evaluated at the beginning of the study and after completion using the DXA device for measuring the bone density and the results will be compared in the three groups. **Results:** The result of our study showed that there was significant improvement in bone density in LG and USG without significant difference between HILT and US. **Conclusion:** LASER and US was an effective physiotherapy modality in treatment of osteoporosis and improve bone mineral density.

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#### Introduction:-

Osteoporosis is a progressive skeletal disorder characterized by decrease bone mass and deterioration of bone micro architecture, predisposing it to increased risk of fracture. Osteoporosis affects approximately 200 million people worldwide **Lin and Lane 2004.**

These fractures exert a great impact on public health, as they are often associated to increased morbidity, mortality, loss of function and high economic costs which, only in the United States, may reach 15 billion dollars a year **NIH Consensus Development Panel on Osteoporosis Prevention Diagnosis and Therapy, 2001.**

Osteoporosis is associated with significant morbidity and mortality and its-related fractures are an important public health concern; increasing in physical and/or psychological problems as depression, chronic disabling pain, fear and anxiety as well as decrease in functional mobility and thereby reduction in quality of life (QOL) and difficulty of the

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activities of daily life **NIH Consensus Development Panel on Osteoporosis Prevention Diagnosis and Therapy 2001, Totosy de Zepetnek et al., 2009.**

Pharmacological interventions are widely used to treat and prevent osteoporosis and its related fracture clinically. However, such interventions can be accompanied with undesirable side effects as venous thromboembolism, osteonecrosis of the jaw, a syndrome of myalgias and arthralgias, induce osteoporosis in children and gastrointestinal intolerance **Lewiecki 2010, Whyte et al., 2008, Nelson et al., 2002, Noller 2002.**

The beneficial effect of ultrasound on bone healing is due to the piezo-electric phenomenon **Sheng et al., 2001.** Bone is piezo-electric, which means that electric potentials are produced in bone when it is subjected to mechanical stress **Hadjiargyrou 1998.**

Previous study found that ultrasound stimulate osteogenesis in bone, stimulate osteoblasts to increase collagen production **Rutten 2008**, inhibiting mature osteoclasts from resorbing bone and stimulating osteoblasts for bone formation **Doan 1999**, stimulate vascularization **Trelles 1987**, organization of collagen fibers and ATP levels **Garavello-Freitas 2003.**

Laser has the ability to stimulate the attachment and proliferation of the human osteoblasts like cells cultured on titanium implant material indicating that LLLT can modulate the activity of cells surrounding implant material **Khandra 2008.** Also; laser improve collagen fiber deposition at early stages of the healing; increased amount of well-organized bone trabeculae at the end of the experimental period on irradiated animals **Márquez 2008.**

Laser light affects the mitochondrial respiratory chain and consequently their selective permeability for sodium, potassium and calcium ions, or by increasing the activity of certain enzymes such as cytochrome oxidase and adenosine triphosphatase. It also increases DNA synthesis, collagen and pro-collagen production and may increase the cell proliferation or alter locomotory characteristics of cells **Loevschall 1994.** There was no study evaluate the comparison between laser and US. So our study was conducted to compare between pulsed high intensity laser and pulsed ultrasound in treatment of osteoporosis.

### **Material and methods:-**

This was a 12-week randomized study with two measurement points' baseline (pre) and 12 weeks (post). Sixty osteoporotic patients were enrolled in this study. **Inclusion Criteria:** Their age between 40 to 65 years (to avoid inclusion of older patients with multiple medical problems) with no history of cancer, renal disease, gastrectomy, metabolic bone disease or any condition (such as a neurogenic, myopathic or connective tissue disorder) that could cause secondary osteoporosis. The participants did not intake any medications associated with accelerated bone loss (steroids) or any medications affected bone metabolism (calcium, vitamin D), nonsmoker, and led sedentary life style without participation at any exercise training during this study. All participants were given a full explanation of the treatment protocol and a written informed consent form giving agreement to participation and publication of results was signed by the patients.

### **Randomization:-**

The participants in this study were randomly assigned into one of three groups (three randomized groups in a pretest-posttest design): Pulsed Nd: YAG laser group (LG, n=20), Low intensity ultrasound group (USG, n=20) and control group (CG, n=20). Subject characteristics (Mean  $\pm$  SD) of all groups were listed in the table (1).

### **Pulsed high intensity laser therapy:-**

Laser group received pulsed Nd: YAG laser on the lumbar region (L<sub>1-5</sub>), 3 times/weeks, 10 minutes for 12 weeks by Pulsed High Intensity Laser, High intensity laser machine by ASASrl company, Hilterapia, HIRO 3.0, Italy. High intensity laser (Nd:YAG), with pulsed emission (1064 nm), Very high peak powers (1-3 KW), Elevated energy content (150 - 350 mJ), High levels of fluence (energy density) ( 810-1780 mJ/cm<sup>2</sup> ), Brief duration (120-150  $\mu$ s), Low frequency (10-40 Hz), Duty Cycle of about 0.1%. The delivery technique for this group was automatic scanning with total energy of 4000 joule.

HILT was delivered in two different phases, Initial phase and terminal phase. **In initial phase**, three sub-phases of fast manual scan (every 10 cm scanned in about 1.5 second) was performed to lumbar region with increasing fluences (710-910-1530 mJ/cm<sup>2</sup>) and decreasing frequencies (30-20-15Hz) with total energy of 2000 joules reached

lumber region. In Final phase: 3 sub-phases of slow scanning (every 10 cm scanned in about three second) with increasing fluences (710-910-1530 mj/cm<sup>2</sup>) and decreasing frequencies (30-20-15Hz) with total energy of 2000 juels reached lumber region. Scans can be longitudinal or transversal to the anatomical structure to be treated, ideally following a straight lines path. The irradiation was performed contact with the back and done in three phases (initial, intermediate and final phase) according to designed protocol for laser application.

#### **Pulsed low intensity ultrasound:-**

Ultrasound group received low intensity ultrasound on the lumbar region (L<sub>1-5</sub>), 3 times/weeks, 10 minutes for 12 weeks. Low intensity ultrasound was composed of a pulse width of 200  $\mu$ s containing 1.5MHz sine waves, with a repeated frequency of 1.0 kHz with a spatial-averaged temporal-averaged intensity of 30 mW/cm<sup>2</sup> **Warden et al., 2001**. Before the application of LIUS, its output characteristics were measured by hydrophonic scanning. The treatment procedure was explained to all subjects. Skin was cleaned with alcohol. During the irradiation, the position of the subjects was the same for both groups (prone lying position with a pillow under her abdomen).

**Outcome measures** include BMD assessed by DEXA (Dual x-ray Absorptiometry (DXA) (Model QDR-1000W, Hologic, Inc., Waltham, MA) was used for the qualitative assessment of BMD in the vertebral bodies of the lumbar spine for both groups. DEXA performs an imaging test that measures bone density by passing x-rays with two different energy levels through the bone. It is used to diagnose osteoporosis (decrease in bone mass and density). It is also called bone mineral density scan (BMD scan).

#### **Statistical analysis:-**

All data were assessed using SPSS version 16.0. Data were tested by Shapiro-Wilk test and were normally distributed. Data were statistically analyzed using repeated measures ANOVA to test hypothesis and to assess both within and between variabilities. Results are reported as means and standard deviations. For all procedures, significance was accepted at the alpha level of 0.05.

#### **Results:-**

Sixty subject participated in this study. Their age ranged from 40 to 65 years with a mean (54.47 $\pm$  5.17). Their weight ranged from 58 to 85 kg with mean weight 76.7  $\pm$  7.4 and their height ranged from 162 to 178 cm with a mean 172.04  $\pm$  5.46 cm. Un paired t-test showed a non-significant difference between the subjects age, weight and height as p value was 0.57, 0.45 and 0.36 respectively, also; there was no significant difference between all groups at baseline values (p=0.2289), table 1.

Table 1: The mean values of T- score for all groups at baseline and after 12 weeks.

	LG (n=20)	USG (n=20)	CG (n=20)	P value (between LG and USG)
Baseline	-2.8 $\pm$ 0.35	-2.9 $\pm$ 0.36	-2.7 $\pm$ 0.38	0.2289**
12 weeks	0.80 $\pm$ 1.34	0.700 $\pm$ 1.84	-2.5 $\pm$ 0.70	0.8453**
P value (within group)	<0.0001*	<0.0001*	0.2630**	

\*\* Non-significant\* Significant LG, Laser group USG, Ultrasound group CG, Control group

There was a significant increase in T- score after 12-weeks in the laser and ultrasound groups as compared with baseline values. By comparing the two values after 12 weeks there no significant difference in T- score between laser and ultrasound groups (p=0.8453 and t=0.1965) as shown in table 1.

#### **Discussion:-**

The result of the this study showed that the HILT and PUS was effective in increasing the bone mineral density after 12 weeks of treatment and the effect of both modality nearly equal without significant difference in between. Many studies have examined possible treatments and prevent ivestrategies to deal with the bone loss in osteoporosis. Low intensity pulsed ultrasound (LIPUS) was proven to enhance fracture healing effectively; also pulsed ultrasound can be applied clinically to enhance both normal and osteoporotic fracture healing **Wing-Hoi et al., 2012**.

The beneficial effect of ultrasound on bone healing is due to the piezoelectric phenomenon **Sheng et al., 2001**. Bone is piezoelectric, which means that electric potentials are produced in bone when it is subjected to mechanical stress. Since Wolff's law basically states that bone remodels according to functional demands, it is assumed that the stress generated potentials in bone serve as a signal which controls bone remodeling **Hadjiargyrou 1998**.

Application of low-intensity ultrasound (LIUS) to osteoporotic bones preserved the bone microarchitecture. It effectively decrease the risk of osteoporotic bone fracture by increasing the mechanical characteristics of osteoporotic bone via improvements in both its effective structural and elastic modulus and LIUS would be very effective clinically in preventing osteoporotic bone fracture **Dae-Gon et al., 2010**.

Ultrasound (US) is a potential nonpharmacological intervention for many people with an increased bone fracture risk due to osteoporosis **Warden et al., 2001**. US, refers to a high-frequency nonaudible acoustic energy that travels in the form of a mechanical wave, can be directed at osteoporotic sites to exert a mechanical stimulus. Recently, several studies have shown that low-intensity ultrasound (LIUS) with a 200  $\mu$ s burst of 1.5 or 0.5 MHz sine waves, 1.0 kHz pulse repetition and 30 mW/cm<sup>2</sup> intensity are capable of augmenting bone strength, particularly its irregular geometry. **Siffert and Kaufman 2007**. Signals from electromagnetic fields and ultrasound have a clinically significant effect upon bone repair, since electrical fields can be directly induced by electromagnetic fields and indirectly induced via the piezoelectric effect by ultrasound **Pilla 2002**.

Previous studies found that osteogenesis is stimulated by ultrasound can be found in vitro studies. Osteoblasts can be stimulated to increase collagen production **Rutten 2000** and increase the production of prostaglandin E<sub>2</sub>, an important bone-healing mediator that exerts different effects on bone cells in the same microenvironments, such as inhibiting mature rat osteoclasts from resorbing bone and stimulating osteoblasts for bone formation **Doan 1999**.

The majority of studies conducted over the last thirty years in laser therapy have been carried out with medium and low intensity Laser devices (Low Level Laser Therapy: LLLT), with wavelengths in the infrared and near infrared 600 - 900 nm. Within this spectrum the Laser beam is partially absorbed by the natural chromophores, like melanin, which withhold part of the energy irradiated. This study on the other hand is based on the use of Nd: YAG Pulsed High Intensity Laser Therapy (HILT), which characterized by a wavelength 1046 nm that allows it to penetrate and spread more easily through the tissue due to not having an endogenous chromophore **Parra et al., 1992**. Nd:YAG lasers can produce new collagen formation in the papillary dermis **Chrys et al., 2004**.

Laser has the ability to stimulate the attachment and proliferation of the human osteoblasts like cells cultured on titanium implant material indicating that LLLT can modulate the activity of cells surrounding implant material **Khandra 2008**. The study conducted on the effect of laser photo biomodulation on the repair of surgical defects on the femur of rats filled with lyophilized bovine bone showed that there was histological evidence of improved collagen fiber deposition at early stages of the healing; increased amount of well-organized bone trabeculae at the end of the experimental period on irradiated animals **Márquez 2008** indicating laser enabling maximal photoactivation and stimulation of biological processes.

Many mechanisms of action have been proposed trying to explain the stimulatory effects of laser therapy on bone healing, as the effects of the laser on the inflammation process and angiogenesis **Lan et al., 2006**.

One promising treatment is the use of the low level laser therapy (LLLТ), which seems to induce osteogenesis and stimulate fracture healing **Gauthier et al., 2005**. Its action is based on the absorption of the light by tissues, which will generate modifications in the cell metabolism. When the LLLT is applied on tissue, the light is absorbed by photoreceptors located in the cells, called chromophores. Once absorbed, the light can modulate cell chemical reactions and stimulate the mitochondrial respiration, the production of molecular oxygen and ATP synthesis **Stein et al., 2005**. These effects can increase the synthesis of DNA, RNA and cell-cycle regulatory proteins, stimulating cell proliferation.

In vitro studies using osteoblastic cells showed that LLLT is capable of increasing mitochondrial activity **Pires-Oliveira et al., 2008** osteoblast, DNA and RNA synthesis, bone nodule formation, osteocalcin and osteopontin gene expression and alkaline phosphatase activity. Also, the LLLT has demonstrated to be able to accelerate the process of fracture repair in rabbits and rats, increasing the callus volume and bone mineral density (BMD) **Liu et al., 2007**, **Rennó et al., 2007**.



A study conducted by **Paulo Sérgio et al 2012** on the effect of low level laser therapy (LLLT) on osteoporotic rat using two fluence of laser doses and the authors conclude that LLLT improves bone repair in the osteoporotic rats as a result of stimulation of the newly formed bone, fibrovascularization and angiogenesis.

Laser light affects the mitochondrial respiratory chain by changing the electric potential of cell membranes and, consequently, their selective permeability for sodium, potassium and calcium ions, or by increasing the activity of certain enzymes such as cytochrome oxidase and adenosine triphosphatase. It also increases DNA synthesis, collagen and pro-collagen production, and may increase the cell proliferation or alter locomotory characteristics of cells **Noble 1992**.

Some authors affirm that low laser light treatment can accelerate bone formation by increasing osteoblastic activity, vascularization, organization of collagen fibers **Noble 1992**. Recent studies are suggesting the use of higher laser dosages to stimulate bone metabolism **Rennó et al., 2006**. In an in vitro study, our group comparing the effects of the 830 nm laser, at the dosages of 1, 5 and 10 J/cm<sup>2</sup>, showed that the higher dosage was more efficient to produce an increase of osteoblast proliferation and alkaline phosphatase activity. These findings further support the notion of cell/tissue, and dose/wavelength specificities. Also; the 830 nm laser irradiation, at 120 J/cm<sup>2</sup>, was able to increase the biomechanical properties and bone mineral density of osteopenic rats **Rennó et al., 2006**.

### Conclusion:-

Pulsed high intensity Nd: YAG laser photostimulation and pulsed ultrasound have a favorable beneficial effects on bone mineral density in treatment of osteoporosis

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### References:-

1. Chrys D. Schmults, MD; Robert Phelps, MD; David J. Goldberg, MD. Erythema Reduction and Histologic Evidence of New Collagen Formation Using a 300-Microsecond 1064-nm Nd:YAG Laser, 2004; 140:1373-1376
2. DaeGon Woo, Chang-Yong Ko, Han Sung Kim, Jong Bum Seo, and Doh Yung Lim. Evaluation of the Potential Clinical Application of Low-Intensity Ultrasound Stimulation for Preventing Osteoporotic Bone Fracture Annals of Biomedical Engineering 2010 ;38: 2438–2446.
3. Doan N, Reher P, Meghji S and Harris M. In vitro effects of therapeutic ultrasound on cell proliferation, protein synthesis, and cytokine production by human fibroblasts, osteoblasts, and monocytes", J Oral Maxillofac Surg 1999; 57:409-419.
4. Garavello-Freitas, I., Baranauskas, V., Joazeiro, P. Low-power laser irradiation improves histomorphometrical parameters and bone matrix organization during tibia wound healing in rats. J. Photochem. Photobiol 2003; 70, 81–89.
5. Gauthier O, Müller R, von Stechow D, Lamy B, Weiss P, Bouler JM, Aguado E, Daculsi, G. In vivo bone regeneration with injectable calcium phosphate biomaterial: a three-dimensional micro-computed tomographic, biomechanical and SEM study. Biomaterials 2005; 26; 5444–5453.
6. Hadjiargyrou M, McLeod K, Ryaby J. and Rubin C. Enhancement of fracture healing by low intensity U.S Clin Orthop 1998; 355:216-29.
7. Khandra M, Stale P, Lyngstadassa et al. Effect of laser therapy on attachment proliferation and differentiation of human osteoblast like-cells cultured on titanium implant material Biomaterials 2005. (26): 3504- 3509.
8. Lan CC, Wu CS, Chiou MH, Hsieh PC, Yu HS. Low energy helium–neon laser induces locomotion of the immature melanoblasts and promotes melanogenesis of the more differentiated melanoblasts: recapitulation of vitiligo repigmentation in vitro. J. Invest. Dermatol 2006; 126: 2119–2126.
9. Lewiecki EM. Intravenous zoledronic acid for the treatment of osteoporosis: The evidence of its therapeutic effect. Core Evid 2010; No. 4, pp. 13-23.
10. Lin JT, Lane JM. Osteoporosis: a review. Clin Orthop Relat Res 2004; 126-34.
11. Liu X, Lyon R, Meier HT, Thometz J, Haworth ST. Effect of lower-level laser therapy on rabbit tibial fracture. Photomed. Laser Surg 2007; 25: 487–494.

12. Loevschall H, Arenholt-Bindslev D. Effects of low level diode laser (GaAlAs) irradiation on fibroblast of human oral mucosa in vitro. *Lasers Surg Med* 1994; 14:347–354.
13. MárquezMartínez ME, Pinheiro AL, Ramalho LM. Effect of IR laser photobiomodulation on the repair of bone defects grafted with organic bovine bone. *Lasers Med Sci* 2008; 23 (3):313-7.
14. Nelson HD, HumphreyLL, Nygren P, et al. Postmenopausal hormone replacement therapy: scientific review. *JAMA* 2002; No. 288, pp. 872-881.
15. NIH Consensus Development Panel on Osteoporosis Prevention Diagnosis and Therapy. Osteoporosis prevention, diagnosis, and therapy. *JAMA* 2001; No. 285, pp. 785-795.
16. Noble PB, Shields ED, Blecher PD, Bentley KC. Locomotory characteristics of fibroblasts within a three dimensional collagen lattice: modulation by helium/neon soft laser. *Lasers Surg Med* 1992; 12:669–674
17. Noller, KL. Estrogen replacement therapy and risk of ovarian cancer. *JAMA* 2002, No. 288, pp. 368-369.
18. Parra PF, Ghinassi S, Ciuti F. The neodymium-YAG laser in defocused for its evolution increasingly effective treatment of the injured athlete. *Laser and Technology* 1992; 2(1):13-16.
19. Paulo SérgioBossini, Ana Claudia Muniz Rennó , Daniel Araki Ribeiro, Renan Fangel, Alessa Castro Ribeiro, Manoela de AssisLahoz , Nivaldo Antonio Parizotto. Low level laser therapy (830 nm) improves bone repair in osteoporotic rats: Similar outcomes at two different dosages *Experimental Gerontology* 2012; 47: 136–142.
20. Pilla AA. Low-intensity electromagnetic and mechanical modulation of bone growth and repair: are they equivalent? *J OrthopSci* 2002; 7, 420–428.
21. Pires-Oliveira DA, de Oliveira RF, Zangaro RA, Soares CP. Evaluation of low-level laser therapy of osteoblastic cells. *Photomed. Laser Surg* 2008; 26: 401–404.
22. Rennó ACM, de Moura FM, dos SantosNS, TiricoRP, Bossini PS, Parizotto NA. Effects of 830-nm laser, used in two doses, on biomechanical properties of osteopenic rat femora. *Photomed. Laser Surg* 2006; 24: 202–206.
23. Rennó ACM, McDoNeell PA, Parizotto NA, Laakso EL. The effects of laser irradiation on osteoblast and osteosarcoma cell proliferation and differentiation in vitro. *Photomed. Laser Surg* 2007; 25: 275–280.
24. Rutten S, Nolte P, Korstjens C and Klein J. Low intensity pulsed ultrasound increases bone volume, osteoid thickness and mineral apposition rate in the area of fracture healing in patients with a delayed union of the Osteotomized fibula", *Bone*. 2008; 43(2):348-54.
25. Sheng S, Hong C, Walter H and Chen L. In vitro effects of low intensity ultrasound stimulation on the bone cells", *Inc. J. Biomed Mater Res* 2001; 57:449-456.
26. Siffert RS and Kaufman JJ. Ultrasonic bone assessment: “the time has come”. *Bone* 2007; 40:5–8.
27. Stein A, BenayahuD, Maltz, L, Oron U. Low-level laser irradiation promotes proliferation and differentiation of human osteoblasts in vitro. *Photomed. Laser Surg* 2005; 23:161–166.
28. Totosy de Zepetnek JO, Giangregorio LM, Craven BC. Whole-body vibration as potential intervention for people with low bone mineral density and osteoporosis: a review. *J Rehabil Res Dev* 2009; No. 46, pp. 529-542.
29. TrellesMA and Mayayo E. Bone fracture consolidates faster with low-power laser. *Lasers Surg Med* 1987; 36-45.
30. Warden SJ, Bennell KL, Forwood MR, et al. Skeletal effects of low-intensity pulsed ultrasound on the ovariectomized rodent. *Ultrasound in Medicine and Biology* 2001; No. 27, pp. 989-998.
31. Warden SJ. Efficacy of low-intensity pulsed ultrasound in the prevention of osteoporosis following spinal cord injury. *Bone* 2001; No. 29, pp. 431-436.
32. Whyte MP, McAlister WH, Novack DV, et al. Bisphosphonate-induced osteoporosis: novel bone modeling defects, metaphyseal osteopenia, and osteosclerosis fractures after drug exposure ceases. *J Bone Miner Res*, 2008; No. 23, pp. 1698-1707.
33. Wing-Hoi Cheung, Wai-Ching Chin, Ling Qin, Kwok-Sui Leung. Low intensity pulsed ultrasound enhances fracture healing in both ovariectomy-induced osteoporotic and age-matched normal bones. *J Orthop Res* 2012; 30:129–136.

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### RESEARCH ARTICLE

#### Evaluation of PET/CT Role in Diagnosis and Management of Pediatric Malignancy

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PET/CT, Pediatric Malignancy.

#### Abstract

**Background:** Successful management of solid tumors in children requires imaging tests for accurate disease detection, characterization, and treatment monitoring. 18F-fluorodeoxyglucose positron emission tomography/computed tomography (18F-FDG PET/CT) is a highly sensitive and specific imaging modality for whole-body evaluation of pediatric malignancies. The study aimed to retrospectively evaluate the efficacy of FDG PET/CT imaging system in the management of some pediatric malignancy and to determine if it provided additional diagnostic information on disease status; during the last 4 years (y). **Methodology:** 180 pediatric patients (118 male and 62 female) were included in the study. Their ages ranged from 6 month to 19 y at their first PET/CT examination. 78.3% of the patients were below 10 years old. 100 patients had lymphoma (82 Hodgkin and 18 Non-Hodgkin), 26 had soft tissue sarcoma (STS), and 54 had neuroblastoma. The indication, purpose, and findings of each PET/CT examination were reviewed, in addition to other imaging findings as well as clinical information including follow-up results for >1 y from their last PET/CT examination. 720 scan was performed for whole body in all patients for initial diagnosis & staging and restaging of recurrent malignancy. It is also, performed to assess cancer response to therapy and after therapy as a routine follow-up procedure or for further evaluation of suspected recurrence or for secondary malignancy. 1080 suspicious sites were evaluated in the studied patients, and those whose reports indicated areas of increased FDG uptake were selected. PET/CT findings were compared with the results of other diagnostic procedures (including CT and ultrasound), biopsy findings and follow-up data. **Results:** The current study represents that the, 18F-FDG PET/CT may influence the treatment decision if distant metastases or second primary tumors are detected with regard to staging of the primary tumor. Post Chemo-radiotherapy (CRT) PET/CT does aid subsequent management decisions. The overall sensitivities, specificities & positive and negative predictive values of the imaging system for all the suspicious sites were 98.1%, 97.2%, 97.6% and 97.8% respectively. It was 94.60%, 97.50%, 92.10%, and 98.30% respectively for detecting the

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local recurrence at the end of treatment; and 96.20%, 98.30%, 92.60%, and 99.10% after 1y of treatment. The sensitivities and specificities of  $^{18}\text{F}$ -FDG PET/CT for initial staging of malignant lymphomas are 83.3%-100% and 93.75%-100% respectively. It ranged 66.70%-100% and 91.30%-100% respectively in sarcoma and 86.70%-100% and 95.80%-100% respectively in Neuroblastoma. **Conclusion:** The study concluded that the  $^{18}\text{F}$ -FDG PET/CT is the gold standard for noninvasive functional imaging in oncology. Technical developments in PET scanning in cancer management may increase the precision of radiotherapy planning and thus improve tumor control and reduce treatment-related morbidity. Recommendation regarding the use of PET/CT in the management of pediatric malignancy to facilitates the sparing of normal structures and the escalation of dose.

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## Introduction:-

The presence of distant metastases is one of the most important prognostic factors in most cancer patients. Most tumors are classified according to the TNM staging system, and treatment is modified when distant metastases are present. Disease localized to primary sites and to regional lymph nodes is generally treated with curative strategies, including surgery, chemotherapy, and radiotherapy. In contrast, palliative treatment of patients with metastatic disease consists of less aggressive strategies. Moreover, distant metastases usually occur late during the course of cancer, whereas second primary cancers may be found even in early-stage patients. Early detection of distant metastases and second primary cancers is a fundamental precondition for guiding precise staging and optimal management(Xu et al., 2012/2015).

Conventional imaging procedures (such as chest radiography, CT, abdominal ultrasonography, and bone scan) are commonly used to detect distant metastases and second primary cancers in patients with various cancers (Ng et al., 2009;Fuster et al., 2008). However, conventional imaging procedures often do not reliably characterize the extent of disease because it is difficult to identify small distant lesions on the basis of morphologic criteria and to distinguish potential metastatic lesions from benign findings.  $^{18}\text{F}$ -FDG PET is a functional imaging modality that is based on the increased glucose metabolism of malignant cells. However, anatomic information concerning distant lesions is limited on  $^{18}\text{F}$ -FDG PET images, and the resolution is insufficient to detect small lesions(Ng et al., 2009;Fuster et al., 2008;Antoch et al., 2005; Strobel et al., 2007;Veit-Haibach et al., 2009). Moreover, false-positive findings from inflammatory or granulomatous lesions in regions with a high prevalence of granulomatous disease are still problematic on  $^{18}\text{F}$ -FDG PET images. These issues may restrict its use for assessing distant malignancies in cancer patients. The introduction of PET/CT scanners combined the functional data of PET with the detailed anatomic information of CT into a single examination(Xu et al.,2012/2015).The poor spatial resolution of PET is substantially compensated for by integrated PET/CT, with co-registration of functional imaging with PET and anatomic imaging with CT. However, little is known about the validity of PET/CT relative to PET for detecting distant malignancies in cancer patients (Xu et al.,2012/2015). In several previous studies,  $^{18}\text{F}$ -FDG PET/CT was shown to be more sensitive and specific than conventional imaging procedures for the detection of distant malignancies in cancer patients at initial staging before treatment or restaging after treatment (Ng et al.,2009;Fuster et al., 2008;Antoch et al., 2005; Strobel et al., 2007;Veit-Haibach et al., 2009). For this reason, combined PET and CT systems (PET/CT) have emerged as promising imaging modalities and are being more routinely used in clinical situations (von Schulthess et al., 2006). Although many studies about whole-body PET/CT for various cancers were done, the results were still controversial and inconclusive. Despite growing numbers of reports on imaging adult malignancies with PET/CT, little data have been reported so far about the clinical relevance of this modality in pediatric patients(Xu et al.,2012/2015).

The study aimed to retrospectively reviewed our initial clinical experience with FDG PET/CT in pediatric malignancies to evaluate the efficacy of this new imaging system and to determine if PET/CT provided additional

diagnostic information on disease status; the study also, evaluate the efficacy of this imaging technique in the management of some pediatric malignancies.

### Materials and methods:-

One hundred and eighty pediatric patients (118(65.6%) male and 62(34.4%) female) with suspected or known malignancy, evaluated by  $^{18}\text{F}$ -FDG imaging using a combined PET/CT system, between January 2011 and January 2015, included in the study. The male to female ratio was 2.27:1. The patient's stage was from 6 month to 19 years (y) old with a median age of 12 y at their first PET/CT examination. 141 (78.3%) of the patients were below 10 years old. One hundred patients had lymphoma (82 Hodgkin and 18 Non-Hodgkin), 26 had sarcoma, and 54 had neuroblastoma. The indication, purpose, and findings of each PET/CT examination were reviewed, in addition to other imaging findings as well as clinical information including follow-up results for >1 y from their last PET/CT examination. PET/CT examination was performed for whole body in all patients (720 scan) for initial diagnosis & staging and for restaging of recurrent malignancy. It is also, performed to assess cancer response to therapy and after therapy as a routine follow-up procedure or for further evaluation of suspected recurrence or for secondary malignancy.

One thousand and eighty suspicious sites were evaluated in the 180 included patients. Patients were selected according to their reports which indicate areas of increased FDG uptake. PET findings were considered positive when uptake occurred at sites of previous disease, in asymmetrical lymph nodes or in nodes unlikely to be affected by inflammation (mediastinal, except for hilar, and abdominal). PET findings were adjudged negative for neoplastic localizations in the following instances: physiological uptake (urinary, muscular, thymic or gastrointestinal), symmetrical nodal uptake, very low uptake and non-focal uptake. PET findings were compared with the results of other diagnostic procedures (including CT and ultrasound), biopsy findings and follow-up data.

After at least 4 h of fasting, a total body PET scan was done one hour after IV injection of 300 MBq of  $^{18}\text{F}$ -FDG. 64 MSCT scan was performed using GE Discovery VCT simultaneously and used for attenuation correction, anatomical localization and diagnosis. Max. Variant of SUV; a semi-quantitative analysis would be done for selected ROI.s and the normal threshold is <2.5.

### Statistical Analysis:-

An important goal in diagnostic medicine research is to estimate and compare the accuracies of diagnostic tests which provide reliable information about a patient's condition and influence patient care. The purpose of a diagnostic test is to classify or predict the presence or absence of a condition or a disease. The clinical performance of a diagnostic test is based on its ability to correctly classify subjects into relevant subgroups (**Mandrekar and Mandrekar, 2005**). The diagnostic test consist the following events:  $D$ : Person has a disease,  $T+$ : Positive test result,  $\bar{D}$ : Person has no disease and  $T-$ : Negative test result (**Nyari, 2011**). The accuracy of any test is measured by comparing the results from a diagnostic test (positive or negative) to the true disease or condition (presence or absence) of the patient. The two basic measures of quantifying the diagnostic accuracy of a test are the sensitivity and specificity (**Mandrekar and Mandrekar, 2005**).

**-The sensitivity**  $P(T+/D)$  of a diagnostic test is the probability of a positive test result once the person has the disease:  $P(T+/D) = P(T+ \cap D)/P(D)$  = The number of ill persons with positive test results / The number of all persons who have the disease (**Nyari, 2011**).

**-The specificity**  $P(T-/\bar{D})$  of a diagnostic test is the probability of a negative test result once the person is healthy.  $P(T-/\bar{D}) = P(T- \cap \bar{D})/P(\bar{D})$  = The number of healthy persons with negative test results / The number of all healthy persons (**Nyari, 2011**).

Sensitivity and specificity are characteristics of the test but they do not help a clinician to interpret the results of an individual test (**Peacock and Peacock, 2011**). Therefore it is important to know how good the test is at predicting the true positives, i.e., the probability that the test will give the correct diagnosis. This is captured by the following predictive values (**Mandrekar and Mandrekar, 2005**):

**-Positive predictive value (PPV) (posterior probability)** is a probability that someone does have the disease once the test has given a positive result  $[P(D/T+)]$ .  $PPV = \frac{\text{the number of persons diagnosed as have that disease with positive test results}}{\text{the number of all positive test results}}$  (Nyari, 2011).

**- Negative predictive value (NPV)** is a probability that someone really does not have the disease once the test has given a negative result  $[P(\bar{D}/T-)]$ .  $NPV = \frac{\text{the number of healthy persons with negative test results}}{\text{the number of all negative test results}}$  (Nyari, 2011).

**-Prevalence (prior probability)** is defined as the prior probability of the disease before the test is carried out (Peacock and Peacock, 2011). It is a measure of disease that allows us to determine a person's likelihood of having a disease. Therefore, a prevalence rate is the total number of cases of a disease existing in a population divided by the total population (Health.ny.gov, 2015). PPV and NPV are dependent on the prevalence of the disease in the patient population being studied (Mandrekar and Mandrekar, 2005). Through Bayes Theorem of conditional probability, the prevalence, sensitivity and specificity lead to evaluation of the positive and negative predictive value (Walker et al., 1990).

$$PPV = \frac{\text{sensitivity} \cdot \text{prevalence}}{[\text{sensitivity} \cdot \text{prevalence}] + [(1 - \text{specificity}) \cdot (1 - \text{prevalence})]}$$

$$NPV = \frac{\text{specificity} \cdot (1 - \text{prevalence})}{[(1 - \text{sensitivity}) \cdot \text{prevalence}] + [\text{specificity} \cdot (1 - \text{prevalence})]}$$

## Results:-

The results of the present work are presented in tables (1-9).

Stage III was the most presenting stage in all malignant disease group (35%), followed by stage I (22.2%) then stages II (21.7%) and IV (21.1%) respectively. Tumor size was >5cm in 72.8% of patients. Chemotherapy (93.3%) and surgery (73.3%) was the most treatment modalities in all our patients but radiotherapy was used in 67.8% of them. However, 32.2% of patients didn't receive radiotherapy. On the other hands, 41.1% of patients presented with metastases, (table 1).

**Table (1): Patients Characteristics**

Items	Lymphoma (100 Patients)		Soft Tissue Sarcoma (26 patients)		Neuroblastoma (54 patients)		Total (180 patients)	
	No.	%	No.	%	No.	%	No.	%
Age								
<10years	77	77	15	57.7	49	90.7	141	78.3
>10 years	23	23	11	42.3	5	9.3	39	21.7
Sex								
Male	71	71	17	65.4	30	55.6	118	65.6
Female	29	29	9	34.6	24	44.4	62	34.4
Stage								
I	34	34	6	23.1	0	0.0	40	22.2
II	30	30	3	11.5	6	11.1	39	21.7
III	32	32	16	61.5	15	27.8	63	35
IV	4	4	1	3.9	33	61.1	38	21.1
Tumor size								
>5cm	65	65	18	69.2	48	88.9	131	72.8
<5cm	35	35	8	30.8	6	11.1	49	27.2
Treatment Modalities:								
Chemotherapy	97	97	18	69.3	53	98.2	168	93.3
Radiotherapy	74	74	19	73.1	29	53.7	122	67.8
-Radiotherapy alone	2	2.7	7	36.8	0	0.0		
-CRT	72	97.3	12	63.2	29	100		
-No radiotherapy	26	26	7	26.9	25	46.3	58	32.2
Surgery	93	93	11	42.3	28	51.9	132	73.3
Metastases:								
Present	24	24	2	7.7	48	88.9	74	41.1
Absent	76	76	24	92.3	6	11.1	106	58.9

The true positive and negative sites of the 1080 regions analyzed, was 562 and 493 respectively. The overall sensitivities, specificities & positive and negative predictive values of the imaging system for all the suspicious sites were 98.1%, 97.2%, 97.6% and 97.8% respectively (Tables 2-4).

**Table (2): Evaluating Pediatric Malignancy by of PET/CT Scan**

Items	Lymphoma (100 Patients)		Soft Tissue Sarcoma (26 patients)		Neuroblastoma (54 patients)		Total (180 patients)	
	Before PET/CT	After PET/CT	Before PET/CT	After PET/CT	Before PET/CT	After PET/CT	Before PET/CT	After PET/CT
<b>Staging:</b>								
I	36	34	4	6	1	0	41	40
II	25	30	5	3	8	6	38	39
III	29	32	14	16	13	15	56	63
IV	10	4	3	1	32	33	45	38
<b>Response to therapy:(at the end of treatment)</b>								
Complete remission(CR)	87	83	24	22	18	15	129	120
Progressive disease (PD)	8	12	1	3	19	22	28	37
Death	5	5	1	1	17	17	23	23
<b>Follow up after therapy:(after 1y)</b>								
Complete remission(CR)	85	88	19	17	16	13	120	118
Progressive disease (PD)	9	6	0	2	15	18	24	26
Death	6	6	7	7	23	23	36	36

**Table (3): The Detection of the Site of Lesion in Pediatric Malignancy by PET/CT Scan**

PET/CT Scan	True Positive	False Positive	True Negative	False Negative	Total No. of Scan
<b>Head &amp; Neck:</b>	99	4	93	2	198
<b>Chest:</b>	42	2	140	3	187
<b>Abdomen &amp; Pelvis:</b>	297	2	124	1	424
<b>Extremities:</b>	20	1	57	1	79
<b>bony skeleton:</b>	35	3	50	2	90
<b>Body LN Chains:</b>	69	2	29	2	102
<b>Total</b>	562	14	493	11	1080

**Table (4):Efficacy of PET/CT Scan in Detecting the Site of Lesion in Pediatric Malignancy**

PET/CT Scan	Prevalence	Sensitivity	Specificity	PPV	NPV
<b>Head &amp; Neck</b>	51.00%	98.00%	95.90%	96.10%	97.90%
<b>Chest</b>	24.10%	93.30%	98.60%	95.50%	97.90%
<b>Abdomen &amp; Pelvis</b>	70.30%	99.70%	98.40%	99.30%	99.20%
<b>Extremities</b>	26.60%	95.20%	98.30%	95.20%	98.30%
<b>bony skeleton</b>	41.10%	94.60%	94.30%	92.10%	96.20%
<b>Body LN Chains</b>	69.60%	97.20%	93.50%	97.20%	93.50%
<b>Total</b>	53.10%	98.10%	97.20%	97.60%	97.80%

PPV: Positive predictive value, NPV: Negative predictive value

The sensitivities and specificities of 18F-FDG PET/CT for initial staging of malignant lymphomas were ranged 83.3%-100% and 93.75%-100% respectively. They ranged 66.70%-100% and 91.30%-100% respectively in STS and 86.70%-100% and 95.80%-100% respectively in Neuroblastoma. The negative and positive predictive values in evaluating the stage of lymphoma were 93.30%-100% and 40.00%-100% respectively. They ranged from 83.30%-100% and 33.30%-100% in STS and 95.10%-100% and 0.00%-100% in neuroblastoma respectively (Table 5).

**Table (5): Efficiency of PET/CT Scan in Evaluating the Stage of Pediatric Malignancy**

PET/CT Scan	Prevalence	Sensitivity	Specificity	PPV	NPV
<b>Lymphoma</b>					
Stage I	34.00%	100.00%	97.00%	94.40%	100.00%
Stage II	30.00%	83.30%	100.00%	100.00%	93.30%
stage III	32.00%	90.60%	100.00%	100.00%	95.80%
stage IV	4.00%	100.00%	93.75%	40.00%	100.00%
<b>Soft Tissue Sarcoma</b>					
Stage I	23.10%	66.70%	100.00%	100.00%	91.00%
stage II	11.50%	100.00%	91.30%	60.00%	100.00%
stage III	61.50%	87.50%	100.00%	100.00%	83.30%
stage IV	3.90%	100.00%	92.00%	33.30%	100.00%
<b>Neuroblastoma</b>					
Stage I	0.00%	100.00%	98.10%	0.00%	100.00%
stage II	11.10%	100.00%	95.80%	75.00%	100.00%
stage III	27.80%	86.70%	100.00%	100.00%	95.10%
stage IV	61.10%	97.00%	100.00%	100.00%	95.50%

PPV: Positive predictive value, NPV: Negative predictive value

The sensitivities, specificities, PPV and NPV of PET/CT scan for patients reaching complete remission (CR) at the end of treatment of pediatric Malignancy were 100%, 76.50%, 95.40%, and 100% in lymphoma, it were 100%, 50.00%, 91.70%, and 100% in STS and 100%, 92.30%, 83.30%, and 100% in neuroblastoma. After one year of follow up, the percentage becomes 96.60%, 100%, 100% and 80.0% in lymphoma, 100%, 77.80%, 89.50% and 100% in STS, and 100%, 92.70%, 81.30% and 100% in neuroblastoma (Tables 6 & 7).

**Table (6): Efficiency of PET/CT Scan in Evaluating the Response to Therapy at the End of Treatment of Pediatric Malignancy**

PET/CT Scan	Prevalence	Sensitivity	Specificity	PPV	NPV
<b>Lymphoma</b>					
CR	83.00%	100.00%	76.50%	95.40%	100.00%
PD	12.00%	66.70%	100.00%	100.00%	95.70%
Death	5.00%	100.00%	100.00%	100.00%	100.00%
<b>Soft Tissue Sarcoma</b>					
CR	84.61%	100.00%	50.00%	91.70%	100.00%
PD	11.54%	33.30%	100.00%	100.00%	92.00%
Death	3.85%	100.00%	100.00%	100.00%	100.00%
<b>Neuroblastoma</b>					
CR	27.80%	100.00%	92.30%	83.30%	100.00%
PD	40.70%	86.40%	100.00%	100.00%	91.40%
Death	31.50%	100.00%	100.00%	100.00%	100.00%

**Table (7): Efficiency of PET/CT Scan in the Follow up of Patients after 1 Year of Therapy in Pediatric Malignancy**

PET/CT Scan	Prevalence	Sensitivity	Specificity	PPV	NPV
<b>Lymphoma</b>					
CR	88.00%	96.60%	100.00%	100.00%	80.00%
PD	6.00%	100.00%	96.80%	66.70%	100.00%
Death	6.00%	100.00%	100.00%	100.00%	100.00%
<b>Soft Tissue Sarcoma</b>					
CR	65.40%	100.00%	77.80%	89.50%	100.00%
PD	7.70%	0.00%	100.00%	0.00%	92.30%
Death	26.90%	100.00%	100.00%	100.00%	100.00%
<b>Neuroblastoma</b>					
CR	24.10%	100.00%	92.70%	81.30%	100.00%
PD	33.30%	83.30%	100.00%	100.00%	92.30%
Death	42.60%	100.00%	100.00%	100.00%	100.00%



The overall sensitivities, specificities & positive and negative predictive values of the imaging system was 94.60%, 97.50%, 92.10%, and 98.30% respectively for detecting the local recurrence at the end of treatment and were 96.20%, 98.30%, 92.60%, and 99.10% after 1y of treatment (Tables 8-9).

**Table (8): The Detection of Local Recurrence by PET/CT**

Uptake on PET/CT	Local Recurrence		No Local Recurrence		Total No. of Patients	
	At the end	After 1y	At the end	After 1y	At the end	After 1y
Positive	35	25	3	2	38	27
Negative	2	1	117	116	119	117
Total	37	26	120	118	157	144

**Table (9): The Efficacy of PET/CT in Detecting the Local Recurrence or Disease Relapse**

PET/CT Scan	Prevalence	Sensitivity	Specificity	PPV	NPV	Accuracy
At the end	23.60%	94.60%	97.50%	92.10%	98.30%	96.80%
After 1 year	18.10%	96.20%	98.30%	92.60%	99.10%	97.90%

PPV: Positive predictive value, NPV: Negative predictive value

### Discussion:-

Successful management of solid tumors in children requires imaging tests for accurate disease detection, characterization, and treatment monitoring. Technologic developments aim toward the creation of integrated imaging approaches that provide a comprehensive diagnosis with a single visit. These integrated diagnostic tests are not only convenient for young patients but also save direct and indirect health-care costs by streamlining procedures, minimizing hospitalizations, and minimizing school or work time lost for children and their parents (Uslu et al., 2015). Pediatric malignancies are regarded as distinct from adult malignancies in view of their low frequency, treatment strategy, and expected prognosis. Special attention should be required in interpreting images of pediatric patients, taking these conditions into consideration (Tatsumi et al., 2007). However, modern radiotherapy techniques heavily rely on high-quality medical imaging. PET provides biologic information about the tumor, complementary to anatomic imaging. Integrated PET/CT has found its way into the practice of radiation oncology, and  $^{18}\text{F}$ -FDG PET is being introduced for radiotherapy planning. The functional information possibly augments accurate delineation and treatment of the tumor and its extensions while reducing the dose to surrounding healthy tissues. In addition to  $^{18}\text{F}$ -FDG, other PET tracers are available for imaging specific biologic tumor characteristics determining radiation resistance (Troost et al., 2015).

PET is used for many cancers for diagnosis, initial staging, assessment of treatment response (Meta et al., 2001), restaging, detection of clinically suspected recurrence, and surveillance (la Fougère et al., 2006; Freudenberg et al., 2007; Cohade et al., 2003). Compared with conventional PET, PET/CT provides greater accuracy in localizing  $^{18}\text{F}$ -FDG uptake, with resultant improvement in observer performance (von Schulthess et al., 2006; Podoloff et al., 2009; Patel et al., 2013). In the current study, The overall sensitivities, specificities & positive and negative predictive values of the PET/CT imaging system for all the suspicious sites were 98.1%, 97.2%, 97.6% and 97.8% respectively. It was 94.60%, 97.50%, 92.10%, and 98.30% respectively for detecting the local recurrence at the end of treatment and were 96.20%, 98.30%, 92.60%, and 99.10% after 1y of treatment. Tatsumi et al., 2007 also demonstrated that PET/CT exhibited significantly high sensitivity, specificity, and accuracy than conventional imaging (CI) and showed accurate findings in 90% (72/80) of lesions with discordant findings between them. Additional information of PET/CT relative to CI was observed in more than one third of examinations compared. Accordingly, Xu et al., 2012/2015 documented in his meta-analysis that whole-body PET/CT has excellent diagnostic performance for the overall evaluation of distant metastases with or without second primary cancers in cancer patients. On the other hands, Patel et al., 2013/2015 founded a lack of evidence supporting using the PET/CT in post-treatment surveillance and is reflected in practice guidelines (Special Report, Podoloff et al., 2007). He evaluates patients with lymphoma, colorectal cancer, and head and neck cancer. Current National Comprehensive Cancer Network guidelines also, do not recommend surveillance. Nevertheless, PET/CT is commonly used for surveillance (Wagner-Johnston et al., 2011). Possible risks of using PET/CT for surveillance include overtreatment based on false-positives and unnecessary radiation exposure (Huang et al., 2009; Patel et al., 2013/2015). Therefore, a negative follow-up  $^{18}\text{F}$ -FDG PET scan is a strong indicator of absence of disease relapse, whereas a positive scan should be validated with other imaging modalities or biopsy (Rhodes et al., 2006). Several recent studies have demonstrated that routine follow-up by  $^{18}\text{F}$ -FDG PET/CT and other imaging techniques may be

overused for routine surveillance of patients with HL, contributing to increased cost and radiation exposure without a clear survival benefit (Nivelstein et al., 2012; Levine et al., 2006; Rathore et al., 2012). More data are needed to determine which patient group will benefit from which surveillance test for how long and at which frequency (Uslu et al., 2015).

Early detection of distant malignancies in cancer patients is crucial for guiding subsequent staging procedures and treatment (Xu et al., 2012/2015). Accordingly to the results of the study of Tatsumi et al., 2007, PET/CT is expected to serve as a powerful imaging modality, especially in staging or in evaluating suspected recurrence, in pediatric malignancies. The sensitivities and specificities of 18F-FDG PET/CT or 18F-FDG PET for initial staging of malignant lymphomas are 96%–99% and 95%–100%, respectively (Kabickova et al., 2006; Furth et al., 2006; Cheng et al., 2013; Miller et al., 2006; Paulino et al., 2012; Punwani et al., 2010; Uslu et al., 2015). In the present study, the sensitivities and specificities of 18F-FDG PET/CT for initial staging of malignant lymphomas were ranged 83.3%-100% and 93.75%-100% respectively. They ranged 66.70%-100% and 91.30%-100% respectively in STS and 86.70%-100% and 95.80%-100% respectively in Neuroblastoma. Nevertheless, Uslu et al., 2015 reported that, some investigators found that the use of 18F-FDG PET/CT has shown high negative predictive value, and therefore an early negative scan is a reliable indicator for therapy response (negative predictive value, 85.7%–100%; positive predictive value, 41.2%–85.7%) (Riad et al., 2010; Bakhshi et al., 2012; Ilivitzki et al., 2013). In the present study, negative and positive predictive values in evaluating the stage of pediatric lymphoma were 93.30%-100% and 40.00%-100% respectively. Furth et al., 2009, reported that a negative 18F-FDG PET/CT scan after 2 cycles of chemotherapy is a strong indicator of relapse-free survival, with a negative predictive value of 100% in HL patients. Therefore, an 18F-FDG PET/CT scan has been advocated by many investigators and has led to early intensification of chemotherapy in apparent non-responders (Furth et al., 2009; Levine et al., 2006; Meany et al., 2007; Uslu et al., 2015). Additionally, PET or PET/CT has clear advantage in evaluating soft-tissue masses and, thus, has been reported to be useful in patients with lymphoma or other malignancies after treatment (Rohren et al., 2004; Kostakoglu and Goldsmith, 2003; Weber, 2005). Schaefer et al., 2004 reported that PET/CT was particularly useful in demonstrating absence of residual active disease in adult lymphoma after treatment (Uslu et al., 2015). As absence of FDG uptake on the residual soft tissue is known to be a strong indicator for better prognosis in adults, accurate interpretation with confidence is valuable in managing patients in a post-treatment status. PET/CT has an advantage over CI or PET alone in this regard as well (Tatsumi et al., 2007). Furthermore, Choi et al., 2014, in a study of 30 neuroblastoma patients, found that 18F-FDG PET is more sensitive than CT in the evaluation of distant lymph node involvement and can help in detecting recurrent lymph node metastases. Therefore, 18F-FDG PET/CT might be particularly helpful in older patients who present with small, resectable primary tumors and chronic lymph node metastases (Uslu et al., 2015). However false-positives were noted because of thymic rebound, inflamed lymph nodes, physiologic cardiac uptake (Depas et al., 2005), infections or inflammation (Rhodes et al., 2006), and reconverted marrow. This is a typical false-positive paradox, that is, false-positive results are more probable than true-positive when the overall population has a low incidence of a condition (Uslu et al., 2015).

The ideal timing for a PET/CT after CRT has yet to be established, although, most commonly, within the literature, scans 3 months post CRT are used with the hope of minimizing post-treatment inflammation, maximizing potential tumor cell kill after CRT and without delaying the scan for too long to allow progression of residual disease (Sherriff et al., 2015). On the other hand, post-CRT PET/CT does aid subsequent management decisions. Patients with a negative PET/CT scan after radical CRT have a 91.8% chance of remaining free of local recurrence 19 months post treatment. A higher  $SUV_{max}$  on the post-CRT PET/CT may predict local recurrence and warrants further investigation (Sherriff et al., 2015). A substantial fraction ( $\leq 65\%$ ) of patients with positive PET results will still be cured, and patients with negative or positive results seem to do well if their PET results are negative at the completion of chemotherapy (typically 6 cycles) (Sher et al., 2009). Therefore, other investigators suggest performing follow-up 18F-FDG PET/CT scans at later time points (Longo, 2013). In NHL patients, Yang et al., 2009 reported that a persistent tumor 18F-FDG uptake on 18F-FDG PET/CT scans predicted worse overall survival and event-free survival. However, this principle may not hold for all types of NHL (Bakhshi et al., 2012; Depas et al., 2005). A recent study on non-lymphoblastic lymphoma patients showed that 18F-FDG PET/CT and CT scans could not predict survival (Bakhshi et al., 2012). Reported sensitivities and specificities of 18F-FDG PET/CT for therapy response assessment of HL and NHL at 2 wk to 3 mo after completion of therapy showed wide ranges of 75%–100% and 75%–90.9%, respectively (Riad et al., 2010; Bakhshi et al., 2012; Furth et al., 2009; Levine et al., 2006; Meany et al., 2007). In the present study, the sensitivities and specificities of PET/CT scan for patients reaching complete remission (CR) at the end of treatment of pediatric malignancy were 100% and 76.50% in

lymphoma. It was 100% and 50.00% in STS and 100% and 92.30% in neuroblastoma. After one year of follow up, it becomes 96.60% and 100% in lymphoma, 100% and 77.80% in STS, and 100% and 92.70% in neuroblastoma. More systematic data evaluations are needed to determine the best time point for interim scans for response assessment of pediatric lymphomas. Information about the value of 18F-FDG PET or 18F-FDG PET/CT follow-up studies of pediatric HL and NHL after therapy is based on few non-responders per evaluated study population (Miller et al., 2007; Amthauer et al., 2005; Depas et al., 2005; Furth et al., 2009; Levine et al., 2006; Hernandez-Pampaloni et al., 2006; Rhodes et al., 2006; Wickmann et al., 2003). 18F-FDG PET/CT has shown high sensitivity and specificity for the diagnosis of disease relapse in HL and NHL (95%–100% and 90%–100%, respectively) (Riad et al., 2010; Depas et al., 2005; Rhodes et al., 2006). In the current study, the overall sensitivities and specificities of the imaging system for detecting the local recurrence were 94.60% and 97.50% respectively at the end of treatment and were 96.20% and 98.30% after 1y of treatment. More evidence is needed on diagnostic algorithms for the detection of tumor recurrence (Uslu et al., 2015).

### Conclusion:-

PET with the glucose analog,  $^{18}\text{F}$ -FDG PET, is increasingly recognized as a powerful tool in evaluating patients with various malignant tumors (Rohren et al 2004). Recently, combined PET and CT systems (PET/CT) have emerged as promising imaging modalities and are being more routinely used in clinical situations (von Schulthess et al 2006). Despite growing numbers of reports on imaging adult malignancies with PET/CT, little data have been reported so far about the clinical relevance of this modality in pediatric patients. This study aimed to retrospectively evaluate the efficacy of FDG PET/CT imaging system in the management of some pediatric malignancy and to determine if it provided additional diagnostic information on disease status; during the last 4 years (y). The study concluded that the  $^{18}\text{F}$ -FDG PET/CT is the gold standard for noninvasive functional imaging in oncology. It is a useful technique for the staging and follow-up of pediatric malignancy. Technical developments in PET scanning in cancer management may increase the precision of radiotherapy planning and thus improve tumor control and reduce treatment-related morbidity. It has a very high but not absolute specificity for pediatric malignancy. Thus, combined PET/CT imaging had an impact on patient management affecting both the diagnostic and therapeutic approach. **Recommendation** regarding the use of PET/CT in the management of pediatric malignancy to facilitates the sparing of normal structures and the escalation of dose.

### Reference:-

1. Amthauer, H., Furth, C., Denecke, T., Hundsdoerfer, P., Voelker, T., Seeger, K., Stöver, B. and Henze, G. (2005): FDG-PET in 10 children with non-Hodgkin's lymphoma: initial experience in staging and follow-up. *Klin Padiatr.*, 217(6):327–333.
2. Antoch, G., Saoudi, N., Kuehl, H., Dahmen, G., Mueller, S.P., Beyer, T., Bockisch, A., Debatin, J.F. and Freudenberg, L.S. (2005): Accuracy of Whole-body dual-modality fluorine-18-2-fluoro-2-deoxy-d-glucose positron emission tomography and computed tomography (FDG-PET-CT) for tumor staging in solid tumor: comparison with CT and PET. *J Clin Oncol.*, 22:4357–4368.
3. Bakhshi, S., Radhakrishnan, V., Sharma, P., Kumar, R., Thulkar, S., Vishnubhatla, S., Dhawan, D. and Malhotra, A. (2012): Pediatric non-lymphoblastic non-Hodgkin lymphoma: baseline, interim, and posttreatment PET/CT versus contrast-enhanced CT for evaluation—a prospective study. *Radiology*, 262 (3): 956–968.
4. Cheng, G., Servaes, S. and Zhuang, H. (2013): Value of 18F-fluoro-2-deoxy-D-glucose positron emission tomography/computed tomography scan versus diagnostic contrast computed tomography in initial staging of pediatric patients with lymphoma. *Leuk Lymphoma.*, 54:737–742.
5. Choi, Y.J., Hwang, H.S., Kim, H.J., Jeong, Y.H., Cho, A., Lee, J.H., Yun, M., Lee, J.D. and Kang, W.J. (2014): 18F-FDG PET as a single imaging modality in pediatric neuroblastoma: comparison with abdomen CT and bone scintigraphy. *Ann Nucl Med.*, 28(4):301–313. Erratum in *Ann Nucl Med.* 2014;28(3):293.
6. Cohade, C., Osman, M., Leal, J. and Wahl, R.L. (2003): Direct comparison of  $^{18}\text{F}$ -FDG PET and PET/CT in patients with colorectal carcinoma. *J Nucl Med.*, 44:1797–1803.
7. Depas, G., De Barse, C., Jerusalem, G., Hoyoux, C., Dresse, M.F., Fassotte, M.F., Paquet, N., Foidart, J., Rigo, P. and Hustinx, R. (2005): 18F-FDG PET in children with lymphomas. *Eur J Nucl Med Moll Imaging*, 32(1):31–38.
8. Freudenberg, L.S., Rosenbaum, S.J., Beyer, T., Bockisch, A. and Antoch, G. (2007): PET versus PET/CT dual-modality imaging in evaluation of lung cancer. *Radiol Clin North Am.*, 45:639–644.

9. **Hernandez-Pampaloni, M., Takalkar, A., Yu, J.Q., Zhuang, H. and Alavi, A. (2006):** F-18 FDGPET imaging and correlation with CT in staging and follow-up of pediatric lymphomas. *PediatrRadiol.*, 36:524–531.
10. **Furth C., Denecke T., Steffen I., Ruf J., Voelker T., Misch D., Vondran F., Plotkin M., Stöver B., Henze G., Lemke A.J. and Amthauer H.(2006):**Correlative imaging strategies implementing CT, MRI, and PET for staging of childhood Hodgkin disease. *J PediatrHematolOncol.*, 28(8):501–512.
11. **Furth C., Steffen I.G., Amthauer H., Ruf J., Misch D., Schönberger S., Kobe C., Denecke T., Stöver B., Hautzel H., Henze G. andHundsdoerfer P.(2009):**Early and late therapy response assessment with [18F]fluorodeoxyglucose positron emission tomography in pediatric Hodgkin's lymphoma: analysis of a prospective multicenter trial. *J ClinOncol.*, 27(26):4385–4391.
12. **Fuster D., Duck J., Paredes P., Velasco M., Muñoz M., Santamaría G., FontanillasM. and Pons F.(2008):**Preoperative staging of large primary breast cancer with [<sup>18</sup>F] fluorodeoxyglucose positron emission tomography/computed tomography compared with conventional imaging procedures. *J ClinOncol.*, 26(29):4746–4751.
13. **Health.ny.gov.(2015):** 'Basic Statistics: About Incidence, Prevalence, Morbidity, and Mortality - Statistics Teaching Tools - New York State Department of Health'. N.p., 1999. Web. 7 Apr. **2015**.
14. **Huang, B., Law, M.W. andKhong, P.L.(2009):**Whole-body PET/CT scanning: estimation of radiation dose and cancer risk. *Radiology*, 251:166–174.
15. **Ilivitzki, A., Radan, L., Ben-Arush, M., Israel, O. and Ben-Barak,A.(2013):**Early interim FDG PET/CT prediction of treatment response and prognosis in pediatric Hodgkin disease: added value of low-dose CT. *PediatrRadiol.*, 43:86–92.
16. **Kabickova, E., Sumerauer, D., Cumlivska, E., Drahokoupilova, E., Nekolna, M., Chanova, M., Hladikova, M., Kodet, R. andBelohlavek, O.(2006):**Comparison of 18F-FDG-PET and standard procedures for the pretreatment staging of children and adolescents with Hodgkin's disease. *Eur J Nucl Med Mol Imaging*, 33(9):1025–1031.
17. **Kostakoglu. L. and Goldsmith. S.J.(2003):**18F-FDG PET evaluation of the response to therapy for lymphoma and for breast, lung, and colorectal carcinoma. *J Nucl Med.*, 44:224–239.
18. **la Fougère, C., Hundt, W., Brockel, N., Pfluger, T., Haug, A., Scher, B., Hacker, M., Hahn, K., Reiser, M. and Tiling, R.(2006):**Value of PET/CT versus PET and CT performed as separate investigations in patients with Hodgkin's disease and non-Hodgkin's lymphoma.*Eur J Nucl Med Mol Imaging*, 33(12):1417–1425.
19. **Levine. J.M., Weiner. M. and Kelly. K.M.(2006):** Routine use of PET scans after completion of therapy in pediatric Hodgkin disease results in a high false positive rate. *J PediatrHematolOncol.*, 28:711–714
20. **Longo D.L.(2013):**Treatment of advanced Hodgkin lymphoma: the more things change, the more they stay the same. *J ClinOncol.*, 31:660–662.
21. **Mandrekar, J.N. and Mandrekar, S.J.(2005):**Statistical Methods in Diagnostic Medicine using SAS® Software.SUGI 30. Statistics and Data Analysis. Proceedings of the Thirtieth Annual SAS® Users Group International Conference, **2005** by SAS Institute Inc., Cary, NC, USA. Paper 211-30; 1-8
22. **Meany, H.J., Gidvani, V.K. andMinniti, C.P. (2007):**Utility of PET scans to predict disease relapse in pediatric patients with Hodgkin lymphoma. *Pediatr Blood Cancer*, 48:399–402.
23. **Meta, J., Seltzer, M., Schiepers, C., Silverman, D.H., Ariannejad, M., Gambhir, S.S., Phelps, M.E., Valk, P. andCzernin, J.(2001):**Impact of <sup>18</sup>F-FDG PET on managing patients with colorectal cancer: the referring physician's perspective. *J Nucl Med.*, 42(4):586–590.
24. **Miller, E., Metser, U., Avrahami, G., Dvir, R., Valdman, D., Sira, L.B., Sayar, D., Burstein, Y., Toren, A., Yaniv, I. and Even-Sapir, E.(2006):**Role of 18F-FDG PET/CT in staging and follow-up of lymphoma in pediatric and young adult patients. *J Comput Assist Tomogr.*, 30(4):689–694.
25. **Ng, S.H., Chan, S.C., Yen, T.C, Chang, J.T., Liao, C.T., Ko, S.F., Liu, F.Y., Chin, S.C., Fan, K.H. and Hsu, C.L.(2009):**Staging of untreated nasopharyngeal carcinoma with PET/CT: comparison with conventional imaging work-up. *Eur J Nucl Med Mol Imaging*, 36(1):12–22. Erratum in: *Eur J Nucl Med Mol Imaging*, **2009**;36(3):538.
26. **Nievelstein, R.A., Quarles, van Ufford, H.M., Kwee, T.C., Bierings, M.B., Ludwig, I., Beek, F.J., de Klerk, J.M., Mali, W.P., de Bruin, P.W. and Geleijns, J.(2012):**Radiation exposure and mortality risk from CT and PET imaging of patients with malignant lymphoma. *EurRadiol.*, 22(9):1946–1954.
27. **Nyari, T.(2011):** Mathematical and Statistical Modelling in Medicine, Diagnostic Study: Conditional probability. [www.model.u-szeged.hu/data/.../Nyari\\_HU\\_SRB\\_03.pdf](http://www.model.u-szeged.hu/data/.../Nyari_HU_SRB_03.pdf)
28. **Patel. K., Hadar. N., Lee. J., Siegel. B.A., Bruce. E. Hillner. B.E. and Lau. J.(2013):**The Lack of Evidence for PET or PET/CT Surveillance of Patients with Treated Lymphoma, Colorectal Cancer, and Head and Neck

- Cancer: A Systematic Review. *J Nucl Med.*, 54 (9) 1518-1527 doi: 10.2967/jnumed.112.119362 Copyright © 2015 by AlphaMed Press
29. **Paulino, A.C., Margolin, J., Dreyer, Z., The, B.S. and Chiang, S.(2012):** Impact of PET-CT on involved field radiotherapy design for pediatric Hodgkin lymphoma. *Pediatr Blood Cancer*, 58:860–864.
  30. **Peacock, J. and Peacock, P.(2011):**Oxford Handbook of Medical Statistics.*Oxford Medical Handbooks*. Chapter 9, pp. 342 Oxford University Press.United Kingdom.
  31. **Podoloff, D.A., Advani, R.H., Allred, C., Benson, A.B. 3rd, Brown, E., Burstein, H.J., Carlson, R.W., Coleman, R.E., Czuczman, M.S., Delbeke, D., Edge, S.B., Ettinger, D.S., Grannis, F.W. Jr., Hillner, B.E., Hoffman, J.M., Kiel, K., Komaki, R., Larson, S.M., Mankoff, D.A., Rosenzweig, K.E., Skibber, J.M., Yahalom, J., Yu, J.M. and Zelenetz, A.D.(2007):**NCCN task force report: positron emission tomography (PET)/computed tomography (CT) scanning in cancer. *J Natl ComprCancNetw.*, 5(suppl 1):S1–S22.
  32. **Podoloff, D.A., Ball, D.W., Ben-Josef, E., Benson, A.B. 3<sup>rd</sup>, Cohen, S.J., Coleman, R.E., Delbeke, D., Ho, M., Ilson, D.H., Kalemkerian, G.P., Lee, R.J., Loeffler, J.S., Macapinlac, H.A., Morgan, R.J. Jr., Siegel, B.A., Singhal, S., Tyler, D.S. and Wong, R.J.(2009):**NCCN task force: clinical utility of PET in a variety of tumor types. *J Natl ComprCancNetw.*, 7(suppl 2):S1–S26.
  33. **Punwani, S., Taylor, S.A., Bainbridge, A., Prakash, V., Bandula, S., De Vita, E., Olsen, O.E., Hain, S.F., Stevens, N., Daw, S., Shankar, A., Bomanji, J.B. and Humphries, P.D.(2010):**Pediatric and adolescent lymphoma: comparison of whole-body STIR half-Fourier RARE MR imaging with an enhanced PET/CT reference for initial staging. *Radiology*, 255(1):182–190.
  34. **Rathore, N., Eissa, H.M., Margolin, J.F., Liu, H., Wu, M.F., Horton, T., Kamdar, K., Dreyer, Z., Steuber, P., Rabin, K.R., Redel, I. M., Allen, C.E., McClain, K.L., Guillerman, R.P. and Bollard, C.M.(2012):**Pediatric Hodgkin lymphoma: are we over-scanning our patients? *J PediatrHematolOncol.*, 29(5):415–423.
  35. **Rhodes, M.M., Delbeke, D., Whitlock, J.A., Martin, W., Kuttesch, J.F., Frangoul, H.A. and Shankar, S.(2006):**Utility of FDG-PET/CT in follow up of children treated for Hodgkin and non-Hodgkin lymphoma. *J PediatrHematolOncol.*, 28(5):300–306.
  36. **Riad, R., Omar, W., Kotb, M., Hafez, M., Sidhom, I., Zamzam, M., Zaky, I. and Abdel-Dayem, H.(2010):**Role of PET/CT in malignant pediatric lymphoma. *Eur J Nucl Med Mol Imaging*, 37(2):319–329.
  37. **Rohren, E.M., Turkington, T.G. and Coleman, R.E.(2004):** Clinical applications of PET in oncology. *Radiology*, 231:305–332.
  38. **Schaefer, N.G., Hany, T.F., Taverna, C., Seifert, B., Stumpe, K.D., von Schulthess, G.K. and Goerres, G.W.(2004):**Non-Hodgkin lymphoma and Hodgkin disease: coregistered FDG PET and CT at staging and restaging—Do we need contrast-enhanced CT? *Radiology*, 232(3):823–829.
  39. **Sher, D.J., Mauch, P.M., Van Den Abbeele, A., LaCasce, A.S., Czerminski, J. and Ng, A.K. (2009):**Prognostic significance of mid- and post-ABVD PET imaging in Hodgkin's lymphoma: the importance of involved-field radiotherapy. *Ann Oncol.*, 20:1848–1853.
  40. **Sheriff, J.M., Ogunremi, B., Colley, S., Sanghera, P., and Hartley, A.(2015):** The role of positron emission tomography/CT imaging in head and neck cancer patients after radical chemo-radiotherapy DOI: <http://dx.doi.org/10.1259/bjr/20976707>., Print ISSN: 0161-5505. Online ISSN: 2159-662X. Copyright © 2015 Society of Nuclear Medicine and Molecular Imaging.
  41. **Special report: positron emission tomography for the indication of post-treatment surveillance of cancer.** BlueCross BlueShield Association Web site. [http://www.bcbs.com/blueresources/tec/vols/25/25\\_03.pdf](http://www.bcbs.com/blueresources/tec/vols/25/25_03.pdf). Published November 2010. Accessed May 29, 2013.
  42. **Strobel, K., Skalsky, J., Kalff, V., Baumann, K., Seifert, B., Joller-Jemelka, H., Dummer, R. and Steinert, H.C.(2007):**Tumour assessment in advanced melanoma: value of FDG PET/CT in patients with elevated serum S-100B. *Eur J Nucl Med Mol Imaging*, 34(9):1366–1375.
  43. **Tatsumi, M., Miller, J.H. and Wahl, R.L.(2007):**18F-FDG PET/CT in evaluating non-CNS pediatric malignancies. *J Nucl Med.*, 48(12):1923-31.
  44. **Troost, E.G.C., Schinagel, D.A.X., Bussink, J., Boerman, O.C., van der Kogel, A.J., Oyen, W.J.G. and Kaanders, J.H.A.M.(2015):**Innovations in Radiotherapy Planning of Head and Neck Cancers: Role of PET. *Journal of Nuclear Medicine* Print ISSN: 1540-1405. Online ISSN: 1540-1413. Copyright © 2015 by Journal of the National Comprehensive Cancer Network
  45. **Uslu, L., Doing, J., Link, M., Rosenberg, J., Quon, A., and Daldrup-Link, H.E.(2015):** Value of 18F-FDG PET and PET/CT for Evaluation of Pediatric Malignancies. *J Nucl Med.*, 56:274–286. DOI: 10.2967/jnumed.114.146290.

46. **Veit-Haibach, P., Vogt, F.M., Jablonka, R., Kuehl, H., Bockisch, A., Beyer, T., Dahmen, G., Rosenbaum, S. and Antoch, G.(2009):**Diagnostic accuracy of contrast-enhanced FDG PET/CT in primary staging of cutaneous malignant melanoma.*Eur J Nucl Med Mol Imaging*, 36(6):910–918.
47. **von Schulthess, G.K., Steinert, H.C. and Hany, T.F.(2006):** Integrated PET/CT: current applications and future directions. *Radiology*, 238:405–422.
48. **Wagner-Johnston, N.D. and Bartlett, N.L.(2011):**Role of routine imaging in lymphoma. *J Natl Compr Canc Netw.*, 9:575–584.
49. **Walker, H.K., Hall, W.D. and Hurst, J.W.(1990):**Clinical Methods. The History, Physical, and Laboratory Examinations. 3rd edition. Chapter 6, Butter Worth publishers. Boston
50. **Weber, W.A.(2005):**Use of PET for monitoring cancer therapy and for predicting outcome. *J Nucl Med.*, 46:983–995.
51. **Wickmann, L., Luders, H. and Dorff, W.(2003):**18-FDG-PET-findings in children and adolescents with Hodgkin's disease: retrospective evaluation of the correlation to other imaging procedures in initial staging and to the predictive value of follow up examinations [in German]. *Klin Padiatr.*, 215:146–150.
52. **Xu, G., Zhao, L., and He, Z. (2012/2015):**Performance of Whole-Body PET/CT for the Detection of Distant Malignancies in Various Cancers: A Systematic Review and Meta-Analysis.*J Nucl Med.*, 53(12):1847-54. doi: 10.2967/jnumed.112.105049. Epub 2012 Oct 16. *Journal of Nuclear Medicine* Print ISSN: 0161-5505. Online ISSN: 2159-662X Copyright © 2015 Society of Nuclear Medicine and Molecular Imaging
53. **Yang, D.H., Min, J.J., Jeong, Y.Y., Ahn, J.S., Kim, Y.K., Cho, S.H., Chung, I.J., Bom, H.S., Kim, H.J. and Lee, J.J.(2009):**The combined evaluation of interim contrast enhanced computerized tomography (CT) and FDG-PET/CT predicts the clinical outcomes and may impact on the therapeutic plans in patients with aggressive non-Hodgkin's lymphoma. *Ann Hematol.*, 88(5):425–432.



### RESEARCH ARTICLE

## EVALUATION OF KNOWLEDGE ABOUT THE DANGEROUS EFFECT OF EXCESSIVE USE OF ANTIBIOTICS IN ASIR CITY.

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#### Manuscript History

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### Abstract

Antibiotics excessive and abusive use is associated with increased resistance and complications that have been well recognized worldwide in the literature.

**Objective:** The aim of this study was to assess knowledge, behavior and attitude toward antibiotics use among residents of 'Asir region.

**Method:** Our study was carried out among a sample of 409 residents in Asir region. To reach our goal and in order to collect the necessary informations, consenting residents responded to a questionnaire and the descriptive approach was employed in data and facts collection, classification and tabulation.

**Results:** The sample is consisted of 65,8% women and 34,2% men. The sample of individuals was distributed according to age, gender and educational level. Our study showed that (46.7%) of sample individuals are taking antibiotics without doctor's advice. Among the respondents, (38,4%) do not usually complete the course of antibiotics, however, (69,9%) of sample individuals do believe that the bacterial resistance to antibiotics appears in a case of an uncompleted antibiotic course. The majority of respondents (59.4 %) of sample individuals are often taking the antibiotics by doctor, yet, (10.5%) of sample individuals are taking the antibiotics often by themselves and (9.3 %) of sample individuals said that common cold drives them to buy and take antibiotics. The majority of sample individuals (35.5 %) believe that the period in which they define treatment failure in their opinion is ranging from one day to three days; also, (35.7%) of respondents do not know what are the risks and complications of antibiotics and (76.5 %) review their doctor in the case of treatment failure.

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Future interventional directions to improve knowledge about antibiotic use among residents of Asir are necessary. To achieve this, fundamental keystones for controlling antibiotics misuse and subsequent antibiotic resistance should be taken.

## Methodological procedures of the empirical study:-

### Introduction:-

The goal of the current research is to measure the extent of the awareness and knowledge of the community towards the use of antibiotics and its risks in 'Asir region; this chapter deals with the description of empirical research procedures carried out by the researcher to achieve the research objectives, including determining the research approach, the research community, research sample, and presentation of the study findings.

### Research Methodology:-

In order to achieve the objectives of the study; the researcher will use the descriptive analytical approach:" The descriptive approach is specified in data and facts collection, classification and tabulation. Besides, analyzing the results adequately and in-depth. It also includes some kind of explanation for these results. That is the reason behind using of measurement, classification, and interpretation methods. In order to extract significant exclusions then get generalizations about the phenomenon included in the study.

### Community and sample of research:-

The current community of research includes all the residents in Asir region, as the research sample included (409) individual of them.

#### Research tool:

Having reviewed the educational literature, and the previous studies concerning the research subject, the researcher built and developed a questionnaire to measure the extent of the awareness and knowledge of the community towards the use of antibiotics and its risks in the region of Asir, Saudi Arabia. In order to obtain the necessary information from the sample items to answer the research questions, the researcher relied on the questionnaire as an essential tool to collect the required data in support of the theoretical aspect of applied research to answer her questions and to achieve her goals.

The researcher has designed the questionnaire by searching the theoretical literature research and reviewing the previous studies, as well as access to some tools and measurements of other studies that are related to the current research subject. The questionnaire has included a series of questions that supports the subject of research through its direct relation to research objectives and its questions. The questionnaire has been prepared to achieve these goals. Also, it has been applied to the individuals in the research sample, and the results were as follows:

### Presentation and discussion of the results of the first question relating to age

The frequencies and percentages of the sample individuals were calculated according to age.

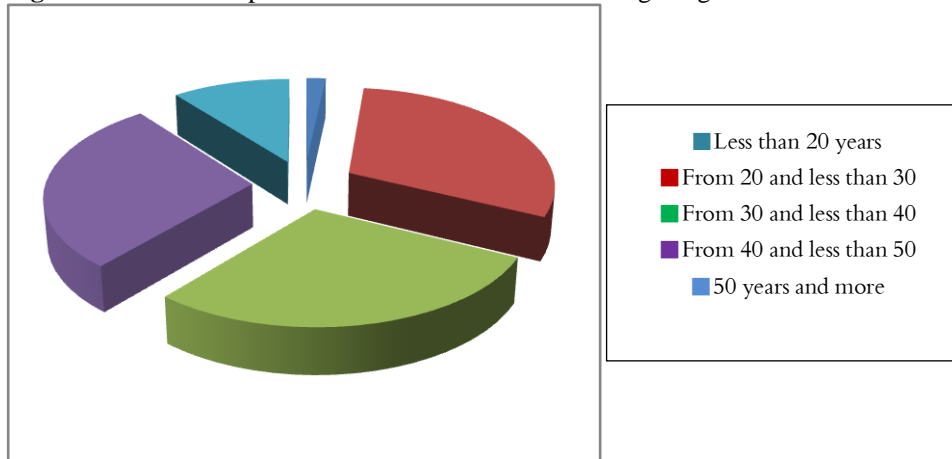
1. The distribution of sample individuals according to age:-

**Table 1:-** Sample individuals' distribution according to age

No.	Age	Frequency	Percent
1	Less than 20 years	7	1.7%
2	From 20 to less than 30 years old	125	30.6%
3	From 30 to less than 40 years old	118	28.9%
4	From 40 to less than 50 years old	116	28.4%
5	50 years and more	43	10.5%
Total		409	100.0%

As it is shown in (Table 1) that a percentage of (1.7%) of sample individuals are of age less than 20, while there are a percentage of (30.6%) of individuals aged between 20 to less than 30 years old, a percentage of (28.9%) of sample individuals aged between 30 and less than 40 years old, and the percentage of (28.4%) of individuals aged 40 and less than 50 years old. Also, a percentage of (10.5%) of sample individuals have aged more than 50 years and more. These results were attributed to the increase in the number of youth with ages between 20 years and less than 30 years in Asir region.



**Figure 1:-** Shows sample individuals' distribution according to age**Presentation and discussion of the results of the second question relating to sex**

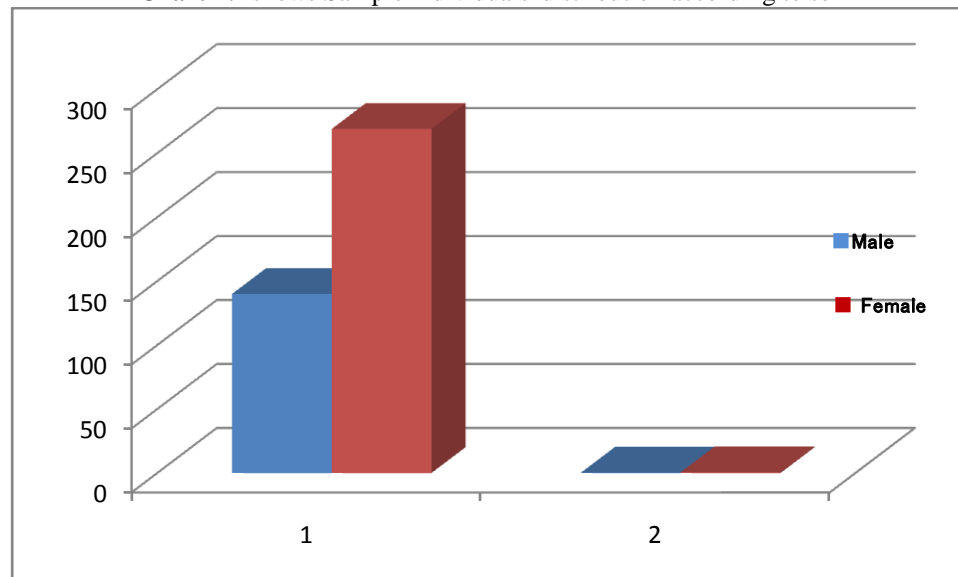
The frequencies and percentages of the sample individuals were calculated according to sex.

2. The distribution of sample individuals according to sex:

**Table 2:-** Sample individuals' distribution according to sex

No.	Sex	Frequency	Percent
1	Male	140	34.2%
2	Female	269	65.8%
Total		409	100.0%

As it is shown in (Table 2) that there is a percent of (34.2%) from the sample individuals are of males, and a percentage of (65.8%) from the sample individuals are of females. These results were attributed to the increase in the number of females more than males in Asir region.

**Chart 2:-** shows Sample individuals' distribution according to sex**Presentation and discussion of the results of the third question regarding the educational level**

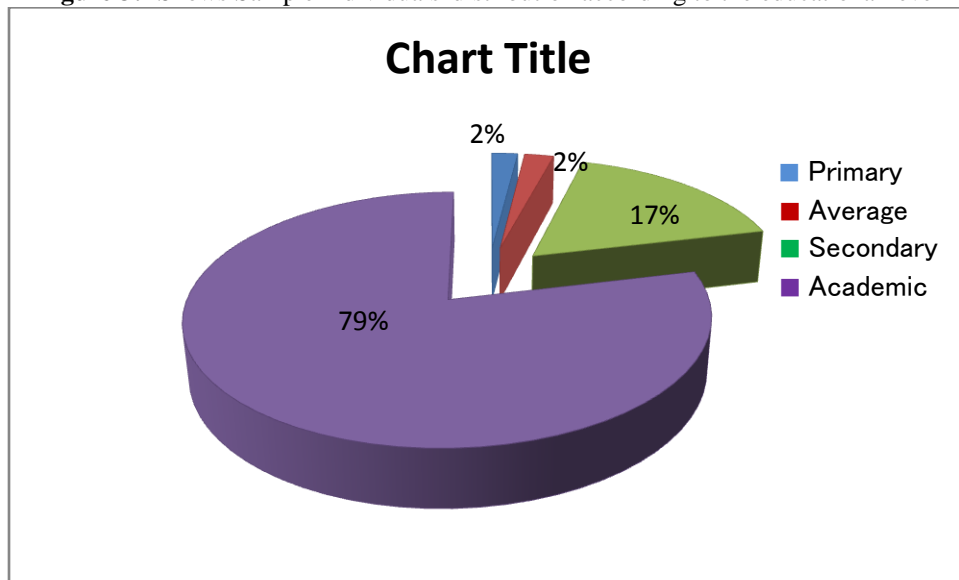
The frequencies and percentages of the sample individuals were calculated according to the educational level.

3. The distribution of sample individuals according to the educational level:

**Table 3:-** Sample individuals' distribution according to the educational level

No.	The educational Level	Frequency	Percent
1	Primary	8	2.0%
2	Average	9	2.2%
3	Secondary	70	17.1%
4	Academic	322	78.7%
	<b>Total</b>	409	100.0%

As it is shown in table No.3 that a percentage of (2.0%) of sample individuals hold a primary qualification, while there are a percentage of (2.2%) of individuals hold an average qualification, a percentage of (17.1%) of sample individuals has a secondary qualification, and the percentage of (78.7%) of individuals hold a university degree. These results were attributed to the people of Asir who care about the educational process and keen to pursue their academic career and keep acquiring the highest degrees of knowledge.

**Figure 3:-** Shows Sample individuals' distribution according to the educational level

#### **Presentation and discussion of the results of the fourth question "Are you taking Antibiotics without Doctor's advice?"**

The frequencies and percentages of the sample individuals were calculated according to the answer of "Are you taking Antibiotics without Doctor's advice?" question.

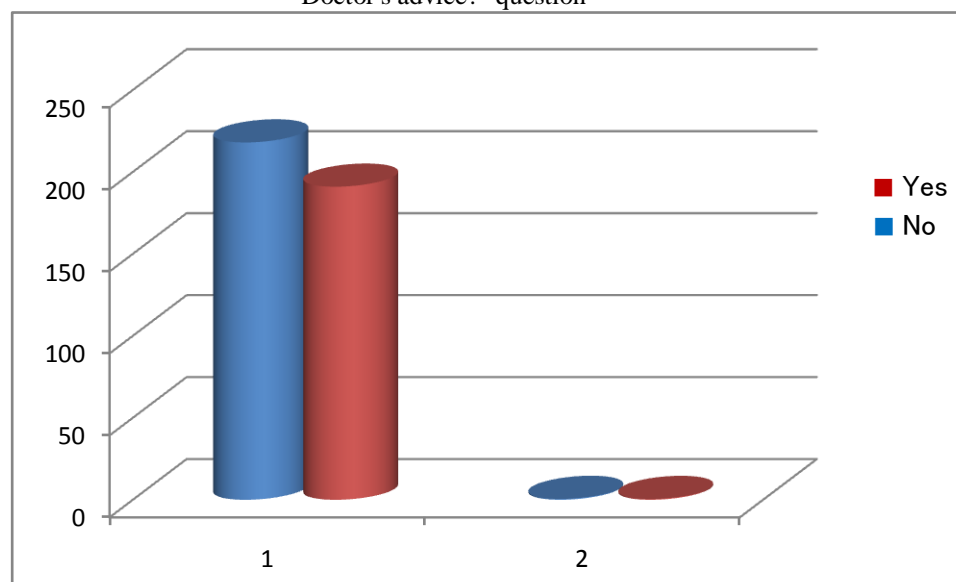
4. The distribution of sample individuals according to the answer of "Are you taking Antibiotics without Doctor's advice?" question:

**Table 4:-** Sample individuals' distribution according to the answer of "Are you taking Antibiotics without Doctor's advice?" question

No.	Are you taking Antibiotics without Doctor's advice?	Frequency	Percent
1	No	218	53.3%
2	Yes	191	46.7%
	<b>Total</b>	409	100.0%

As it is shown in table No.4 that a percentage of (53.3%) of sample individuals do not take antibiotics without doctor's advice, while there is a percentage of (46.7%) of sample individuals are taking antibiotics without doctor's advice. These results were attributed to the interest of the majority of individuals included in the sample to follow doctor's instructions, considering doctor as the worthier person to trust regarding taking drugs generally and antibiotics in particular.

**Chart 4:-** Shows Sample individuals' distribution according to the answer of "Are you taking Antibiotics without Doctor's advice?" question



**Presentation and discussion of the results of the fifth question on "Whether the high temperature or so called fever is a strong indication to use antibiotics"**

The frequencies and percentages of the sample individuals were calculated according to the answer of "Whether the high temperature or so called fever is a strong indication to use antibiotics" question.

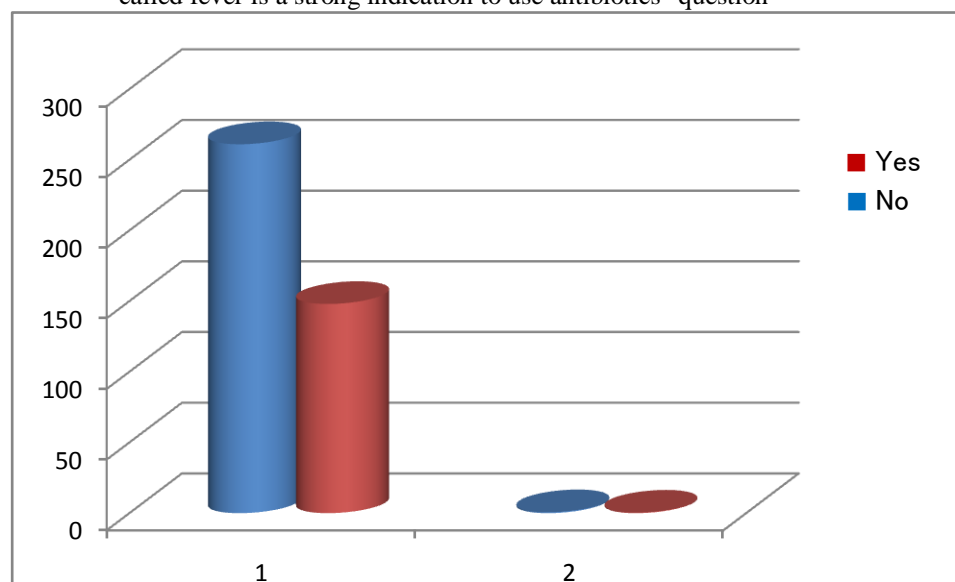
5. The distribution of sample individuals according to the answer of "Whether the high temperature or so called fever is a strong indication to use antibiotics" question:

**Table 5:-** Sample individuals' distribution according to the answer of "Whether the high temperature or so called fever is a strong indication to use antibiotics" question.

No.	Whether the high temperature or so called fever is a strong indication to use antibiotics	Frequency	Percent
1	No	261	63.8%
2	Yes	148	36.2%
	Total	409	100.0%

As it is shown in table No.5 that a percentage of (63.8%) of sample individuals do not consider having a high temperature or fever is not a strong indication to use antibiotics, while there are a percentage of (36.2%) of sample individuals consider having a high temperature or fever as a strong indication to use antibiotics. These results were attributed to the sample individuals' knowledge about the causes of high temperature which are numerous, variable, and don't require having antibiotics as a treatment. It may have another specific treatment. Also, they believe they need to take doctor's advice before using antibiotics.

**Chart 5:-** shows Sample individuals' distribution according to the answer of "Whether the high temperature or so called fever is a strong indication to use antibiotics" question



**Presentation and discussion of the results of the sixth question on "Do you usually complete the course (the period specified for use by a physician) of antibiotics?"**

The frequencies and percentages of the sample individuals were calculated according to the answer of "Do you usually complete the course (the period specified for use by a physician) of antibiotics?" question.

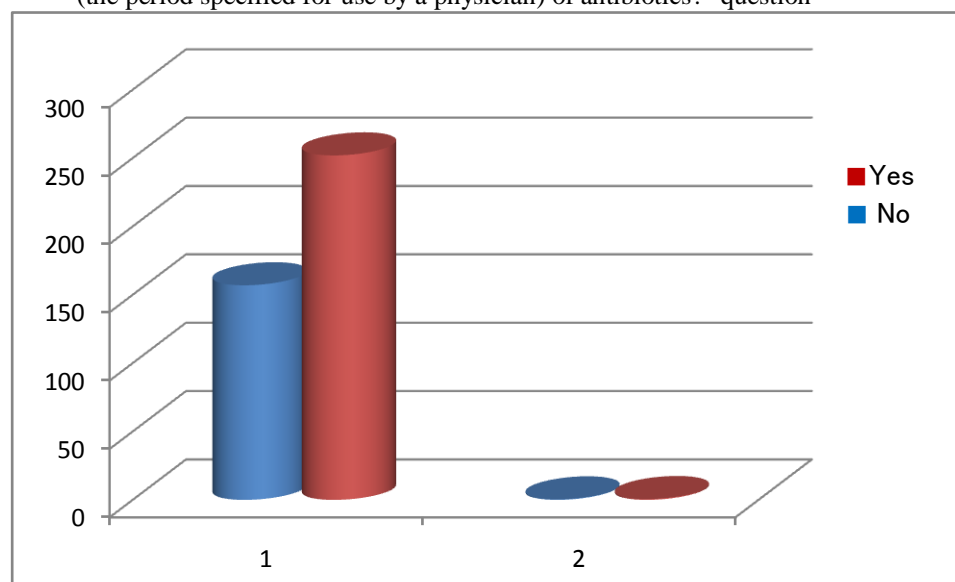
6. The distribution of sample individuals according to the answer of "Do you usually complete the course (the period specified for use by a physician) of antibiotics?" question:

**Table 6:-** Sample individuals' distribution according to the answer of "Do you usually complete the course (the period specified for use by a physician) of antibiotics?" question

No.	"Do you usually complete the course (the period specified for use by a physician) of antibiotics?"	Frequency	Percent
1	No	157	38.4%
2	Yes	252	61.6%
	Total	409	100.0%

As it is shown in table No.6 that a percentage of (38.4%) of sample individuals do not usually complete the course (the period specified for use by a physician) of antibiotics, while there are a percentage of (61.6%) of sample individuals usually complete the course (the period specified for use by a physician) of antibiotics. These results were attributed to the majority of sample individuals' conviction about the importance of doctor's opinion. As they work on the implementation of the doctor's directions properly in order to eliminate the disease.

**Chart 6:-** shows Sample individuals' distribution according to the answer of "Do you usually complete the course (the period specified for use by a physician) of antibiotics?" question



**Presentation and discussion of the results of the seventh question on "Do you heard before about the bacterial resistance to antibiotics?"**

The frequencies and percentages of the sample individuals were calculated according to the answer of "Do you ever heard about the bacterial resistance to antibiotics?" question.

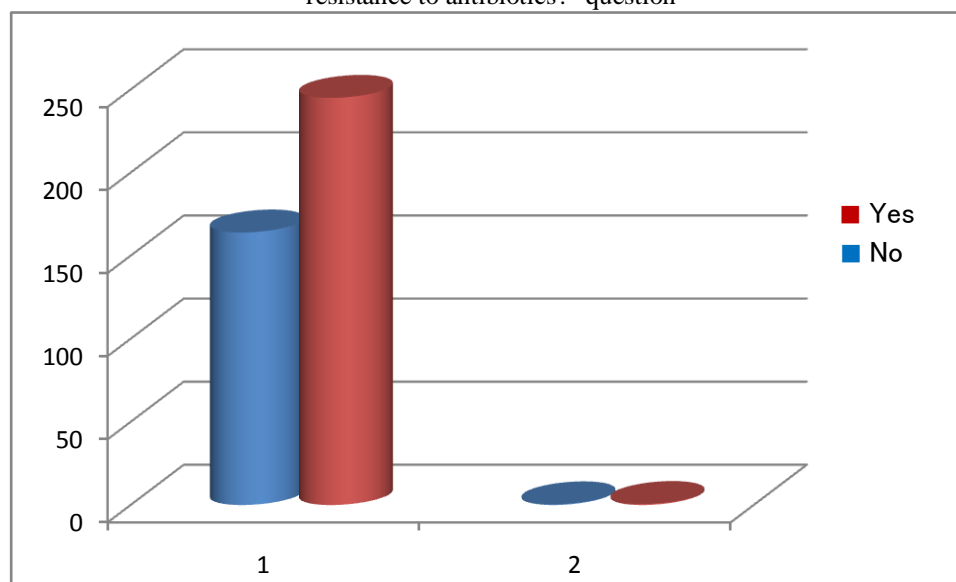
7. The distribution of sample individuals according to the answer of "Do you ever heard about the bacterial resistance to antibiotics?" question:

**Table 7:-** Sample individuals' distribution according to the answer of "Do you ever heard about the bacterial resistance to antibiotics?" question

No.	"Do you ever heard about the bacterial resistance to antibiotics"	Frequency	Percent
1	No	164	40.1%
2	Yes	245	59.9%
	Total	409	100.0%

As it is shown in table No.7 that a percentage of (40.1%) of sample individuals had not heard before about the bacterial resistance to antibiotics, while there is a percentage of (59.9%) of sample individuals had heard before about the bacterial resistance to antibiotics. These results were attributed to the increase in the medical counseling and awareness about the different types of bacteria socially or through the media which contributed to increase the sample individual's knowledge about the bacterial resistance to antibiotics.

**Chart 7:-** Shows sample individuals' distribution according to the answer of "Do you ever heard about the bacterial resistance to antibiotics?" question



**Presentation and discussion of the results of the eighth question "Do you think that the bacterial resistance to antibiotics develops in a case of an uncompleted antibiotics course?"**

The frequencies and percentages of the sample individuals were calculated according to the answer of "Do you think that the bacterial resistance to antibiotics develops in a case of an uncompleted antibiotics course?" question.

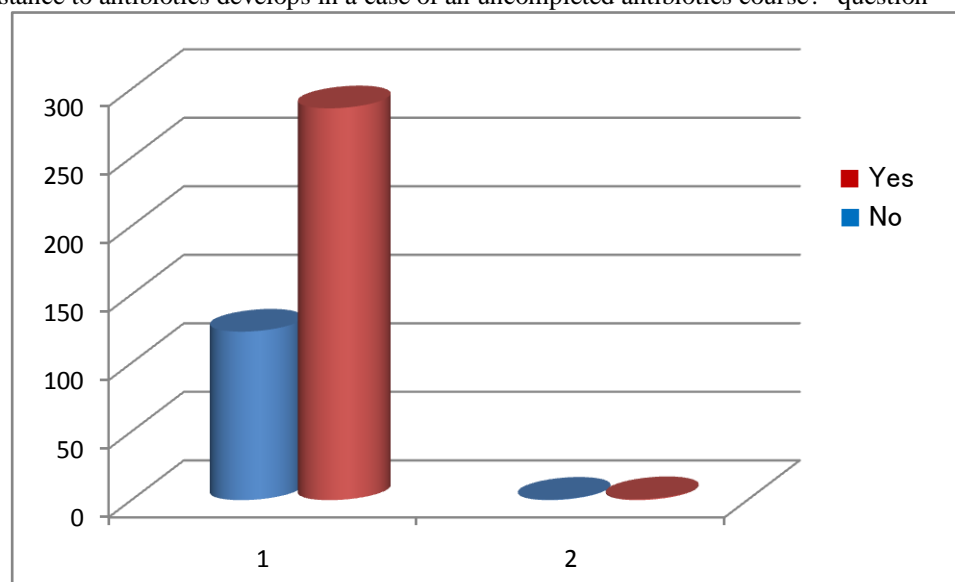
8. The distribution of sample individuals according to the answer of "Do you think that the bacterial resistance to antibiotics develops in a case of an uncompleted antibiotics course?" question:

**Table 8:-** Sample individuals' distribution according to the answer of "Do you think that the bacterial resistance to antibiotics develops in a case of an uncompleted antibiotics course?" question

No.	Do you think that the bacterial resistance to antibiotics develops in a case of an uncompleted antibiotics course?	Frequency	Percent
1	No	123	30.1%
2	Yes	286	69.9%
	Total	409	100.0%

As it is shown in table No.8 that a percentage of (30.1%) of sample individuals do not think that the bacterial resistance to antibiotics appears in a case of an uncompleted course of antibiotics, while there are a percentage of (69.9%) of sample individuals do believe that the bacterial resistance to antibiotics appears in a case of an uncompleted antibiotic course. These results were attributed to the majority of sample individuals' conviction about the importance of completing the medical course appropriately according to doctor's instructions. Perhaps, the reason behind this is due to the increase in medical awareness among the sample individuals, which enabled them to believe in the importance of completion of a specific course of treatment.

**Chart 8:-** Shows Sample individuals' distribution according to the answer of "Do you think that the bacterial resistance to antibiotics develops in a case of an uncompleted antibiotics course?" question



**Presentation and discussion of the results of the ninth question about "Taking the antibiotic often by whom?"**  
The frequencies and percentages of the sample individuals were calculated according to the answer of "Taking the antibiotic is often by whom?" question.

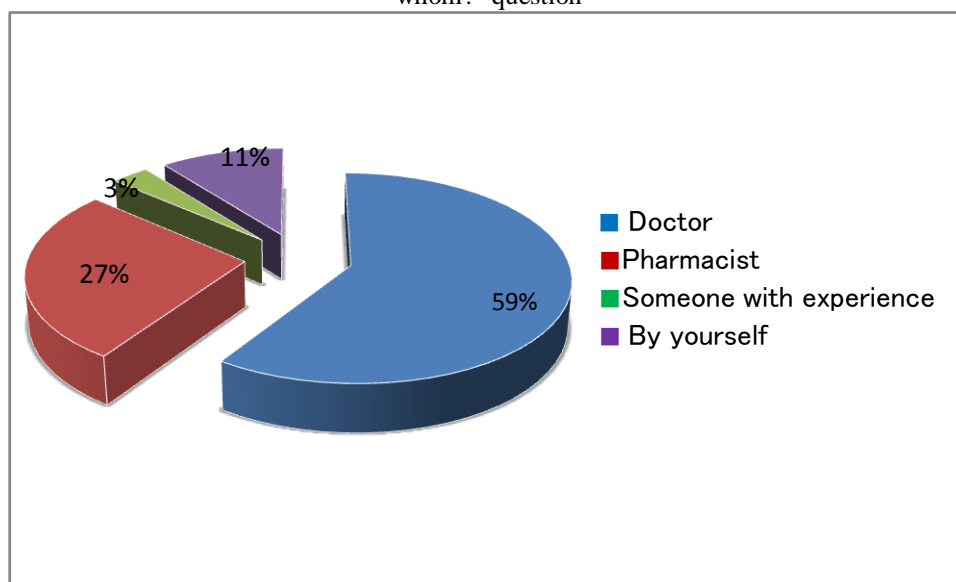
9. The distribution of sample individuals according to the answer of "Taking the antibiotic is often by whom?" question:

**Table 9:-** Sample individuals' distribution according to the answer of "Taking the antibiotic is often by whom?" question

No.	"Taking the antibiotic is often by whom?"	Frequency	Percent
1	Doctor	243	59.4%
2	Pharmacist	110	26.9%
3	Someone who take it before	13	3.2%
4	By yourself	43	10.5%
	Total	409	100.0%

As it is shown in table No.9 that a percentage of (59.4 %) of sample individuals are often taking the antibiotics by doctor, while there are a percentage of (26.9%) of sample individuals are taking antibiotics often by the pharmacist, a percentage of (3.2%) of sample individuals are taking the antibiotics often by someone who has tried it before, and the percentage of (10.5%) of sample individuals are taking the antibiotics often by themselves. These results were attributed to the conviction and belief of sample individuals in doctor's role which can't be replaced by anyone, even if they were people of confidence but are non-specialist. This makes them adhere to doctors' opinion before buying a particular antibiotic.

**Figure 9:-** showssample individuals' distribution according to the answer of "Taking the antibiotic is often by whom?" question



**Presentation and discussion of the results of the tenth question about "What are the symptoms that drive you to buy and take antibiotics?"**

The frequencies and percentages of the sample individuals were calculated according to the answer of "What are the symptoms that drive you to buy and take antibiotics?" question.

10. The distribution of sample individuals according to the answer of "What are the symptoms that drive you to buy and take antibiotics?" question:

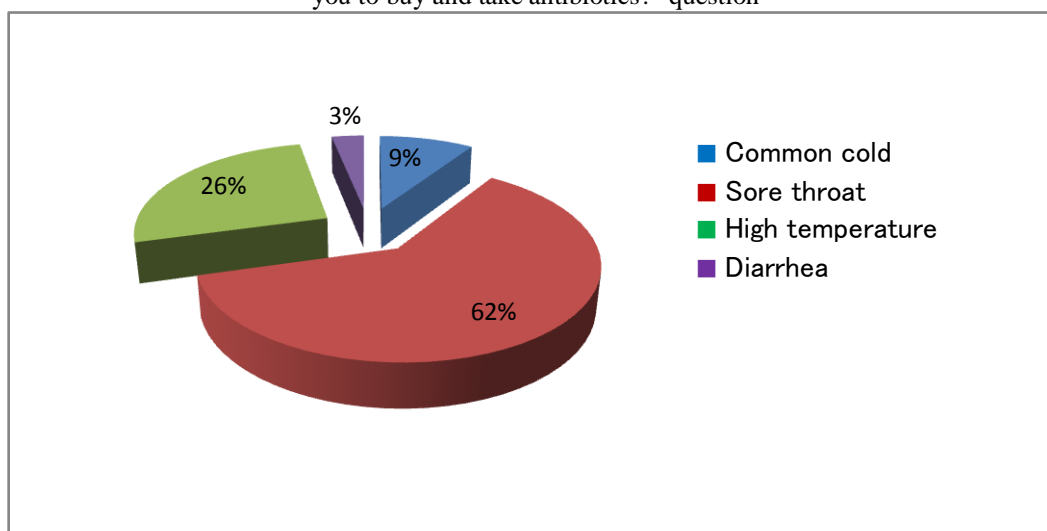
**Table 10:-** Sample individuals' distribution according to the answer of "What are the symptoms that drive you to buy and take antibiotics?" question

No.	What are the symptoms that drive you to buy and take antibiotics?	Frequency	Percent
1	Common cold	38	9.3%
2	Sore throat	251	61.4%
3	High temperature	107	26.2%
4	Diarrhea	13	3.2%
	Total	409	100.0%

As it is shown in table No.10 that a percentage of (9.3 %) of sample individuals said that common cold drives them to buy and take antibiotics, while there are a percentage of (61.4%) of sample individuals said that sore throat drives them to buy and take antibiotics, a percentage of (26.2%) of sample individuals said that high temperature drives them to buy and take antibiotics, and the percentage of (3.2%) of sample individuals are derived to buy and take antibiotics by diarrhea. These results were attributed to the fact that most of sore throat symptoms are caused by multiple types of colds and doctors often prescribe antibiotics for such a case, which is as a kind of experience of sample individuals due to the frequent exposure to common cold and their feeling of sore throat.



**Figure 10:-** Shows Sample individuals' distribution according to the answer of "What are the symptoms that drive you to buy and take antibiotics?" question



**Presentation and discussion of the results of the eleventh question about "Your choice to buy antibiotic depends on what?"**

The frequencies and percentages of the sample individuals were calculated according to the answer of "Your choice to buy antibiotic depends on what?" question.

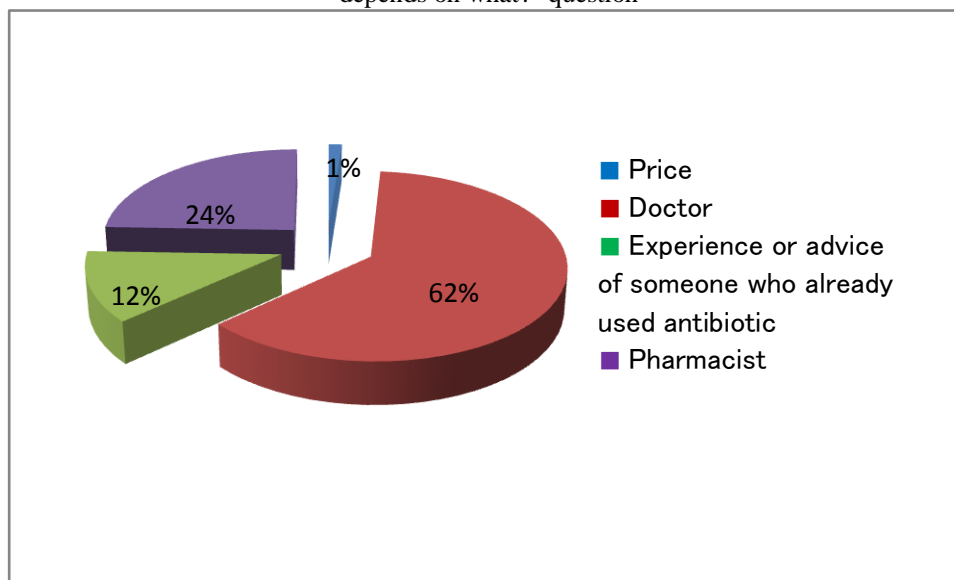
11. The distribution of sample individuals according to the answer of "Your choice to buy antibiotic depends on what?" question:

**Table 11:-** Sample individuals' distribution according to the answer of "Your choice to buy antibiotic depends on what?" question

No.	"Your choice to buy antibiotic depends on what?"	Frequency	Percent
1	Price	5	1.2%
2	Doctor	254	62.1 %
3	Experience or advice of someone who already used antibiotic	50	12.2%
4	Pharmacist	100	24.4%
	Total	409	100.0%

As it is shown in table No.11 that a percentage of (1.2 %) of sample individuals said that their choice to buy a specific antibiotic depends on the price, while there are a percentage of (62.1%) of sample individuals who said that their choice to buy a specific antibiotic depends on the doctor , a percentage of (12.2%) of sample individuals said that their choice to buy a specific antibiotic depends on a particular experience or advice from someone else already used the antibiotic, and the percentage of (24.4%) of sample individuals take their choice to buy a specific antibiotic depending on the pharmacist. These results were attributed to the fact that most of sore throat symptoms are caused by multiple types of colds and doctors often prescribe antibiotics for such a case, which is as a kind of experience of sample individuals due to the frequent exposure to common cold and their feeling of sore throat.

**Figure 11:-** shows Sample individuals' distribution according to the answer of "Your choice to buy antibiotic depends on what?" question



**Presentation and discussion of the results of the twelfth question about "Do you see the doctor if your treatment has failed?"**

The frequencies and percentages of the sample individuals were calculated according to the answer of "Do you see the doctor if your treatment has failed?" question.

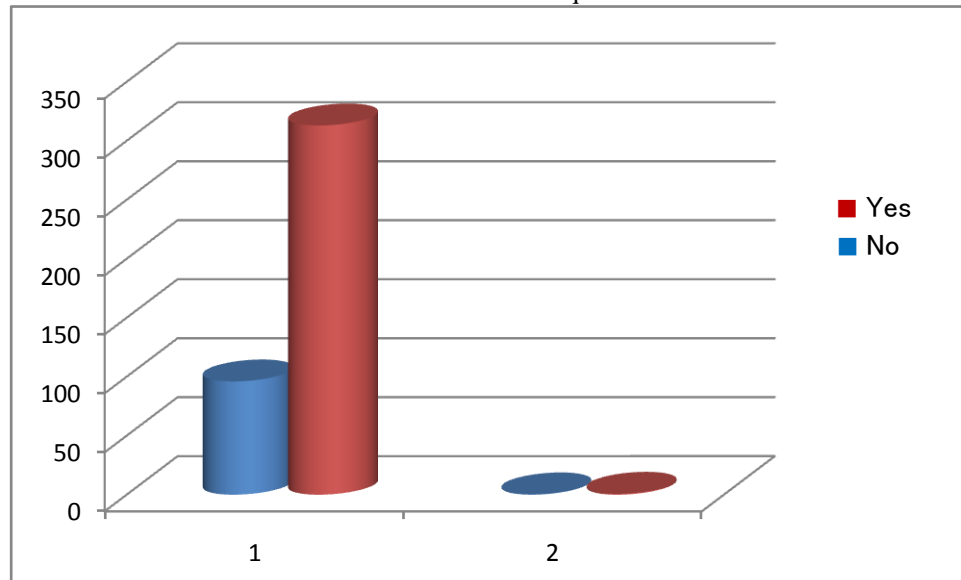
12. The distribution of sample individuals according to the answer of "Do you see the doctor if your treatment has failed?" question:

**Table 12:-** Sample individuals' distribution according to the answer of "Do you see the doctor if your treatment has failed?" question

No.	Do you see the doctor if your treatment has failed?	Frequency	Percent
1	No	96	23.5%
2	Yes	313	76.5%
	Total	409	100.0%

As it is shown in table No.12 that a percentage of (23.5 %) of sample individuals do not review their doctor in the case of treatment failure, while there are a percentage of (76.5 %) of sample individuals who review their doctor in the case of treatment failure. These results were attributed to the conviction of sample individuals in doctor as the worthier person who able to change the type of medication or determining another course for the treatment, which contributed to increase their review to doctor in the case of treatment failure.

**Chart 12:-** Shows Sample individuals' distribution according to the answer of "Do you see the doctor if your treatment has failed?" question



**Presentation and discussion of the results of the thirteenth question about "What is the period that determines treatment failure in your opinion?"**

The frequencies and percentages of the sample individuals were calculated according to the answer of "What is the period that determines treatment failure in your opinion?" question.

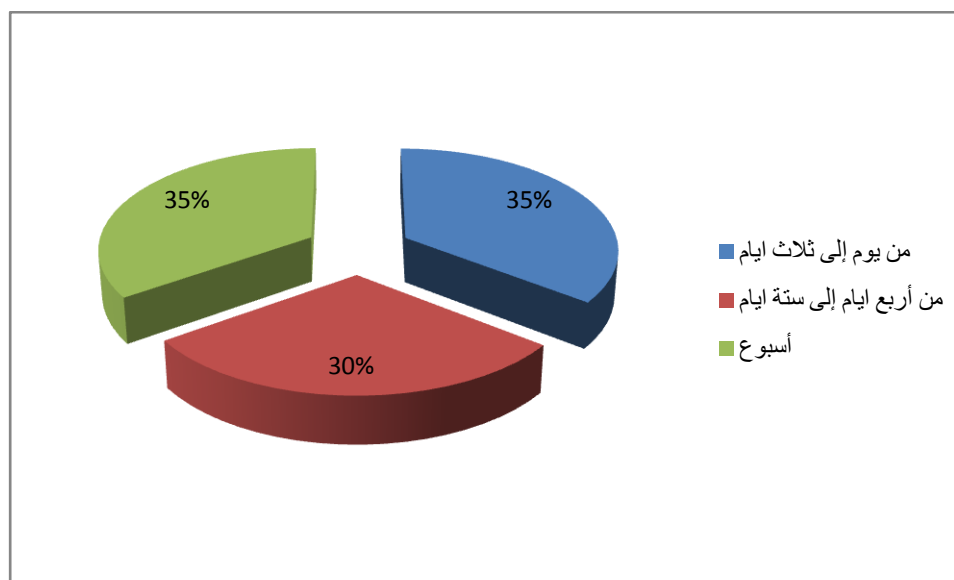
13. The distribution of sample individuals according to the answer of "What is the period that determines treatment failure in your opinion?" question:

**Table 13:-** Sample individuals' distribution according to the answer of "What is the period that determines treatment failure in your opinion?" question

No.	What is the period that determines treatment failure in your opinion?	Frequency	Percent
1	From one day to three days	145	35.5%
2	From four to six days	122	29.8%
3	One week	142	34.7%
	Total	409	100.0%

As it is shown in table No.13 that a percentage of (35.5 %) of sample individuals believe that the period in which they define treatment failure in their opinion is ranging from one day to three days, while there are a percentage of (29.8%) of sample individuals believe that the period in which they define treatment failure in their opinion is ranging from four to six days, and a percentage of (34.7%) of sample individuals believe that the period in which they define treatment failure in their opinion is a week. These results indicate that there is a convergence of cognitive levels among sample individuals concerning the period to be adhered to while taking the antibiotic but it varies from one person to another, making their responses nearest to choose the period of one day to three days as they were convinced that their symptoms doesn't worth more than that as a treatment period.

Figure (13)



Discussions around the 14<sup>th</sup> Question: Do you know the risks and complications of antibiotics?

The frequency and percentage of the surveyed sample have been accounted for regarding the knowledge of the risks and complications of antibiotics.

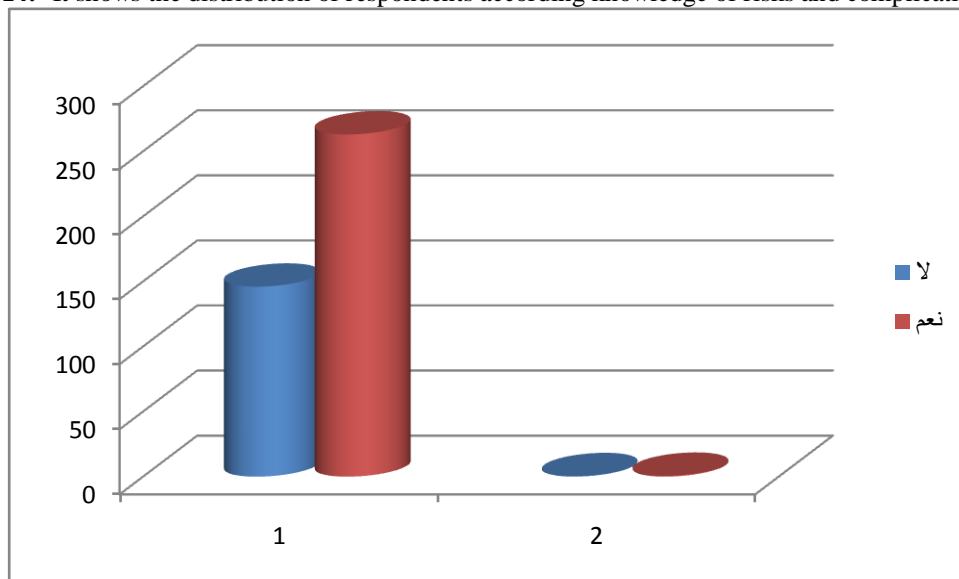
Distribution of the sample regarding their knowledge of the risks and complications of antibiotics.

Table (14)

The Distribution of the sample regarding the risks and complications of antibiotics.

	Risk and Complications of Antibiotics	Repetition	Percentage
1	No	146	35.7%
2	Yes	263	64.3%
	Total	409 – 100%	

It is shown in Table No. (14) that the percentage (35.7%) of respondents do not know what are the risks and complications of antibiotics, while the proportion (64.3%) of respondents know what are the risks and complications of antibiotics, and that outcome is attributed to awareness campaigns among members the sample result, that were exposed to this type of illness or awareness efforts by the Ministry of Health in the region of Asir.

**Figure 14:-** It shows the distribution of respondents according knowledge of risks and complications of antibiotics

Discussions around the 15<sup>th</sup> question: Whether or not do you know that antibiotics may interfere with other medications.

The frequency and percentage of the surveyed sample have been accounted for regarding the knowledge of interference of antibiotics with other drugs.

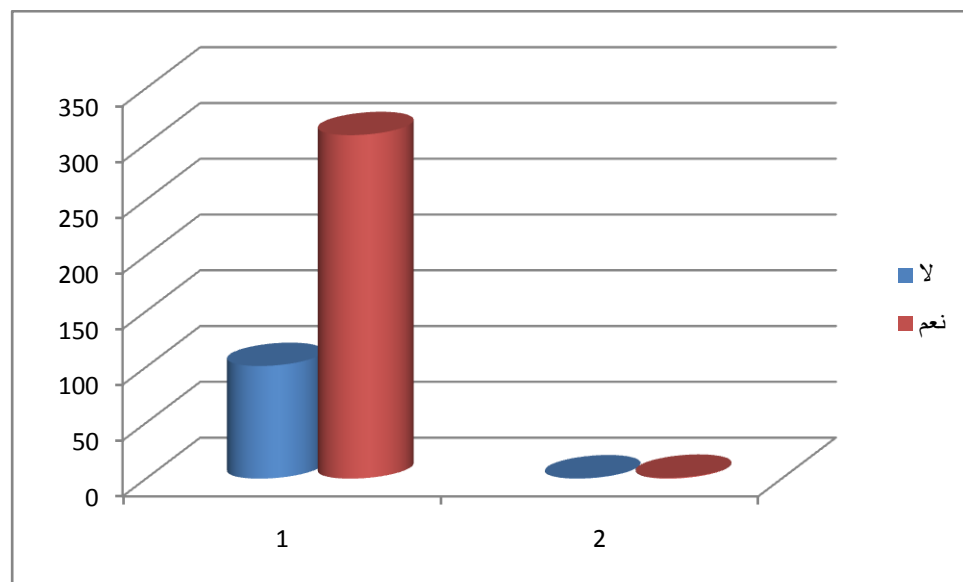
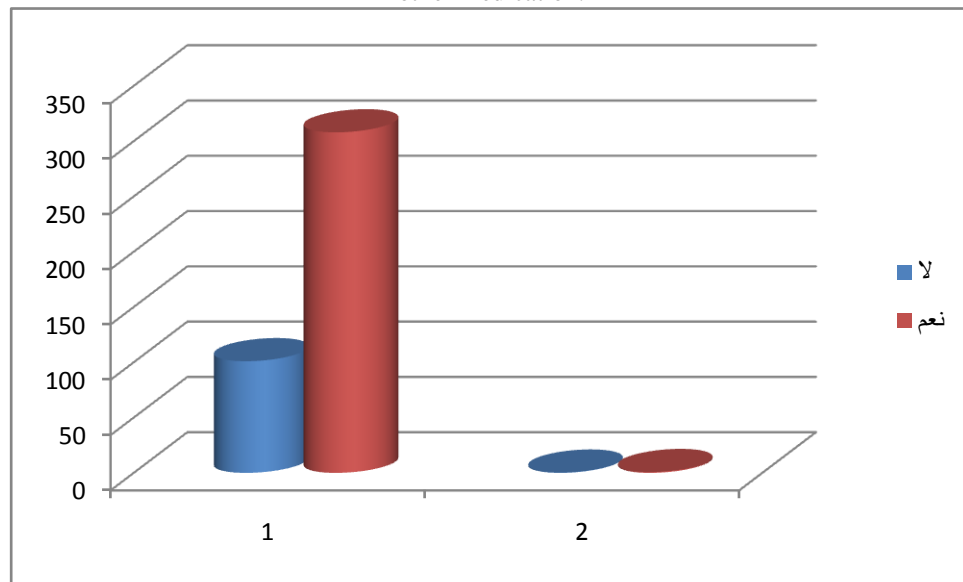
Distribution of the sample regarding their knowledge of interference of antibiotics with other drugs.

**Table 15:-** Distribution of the sample

	Do You know that Antibiotics may interfere with other drugs	Frequency	Percentage
1	No	101	24.7%
2	Yes	308	75.3%
Total	409		100%

As seen from the table (15) that the percentage (24.7%) of respondents do not know that antibiotics may contradict with their use with certain medications, while the proportion (75.3%) of respondents knowing that antibiotics may contradict their use with certain medications, Furthermore, aware respondents believed that each disease specific treatment and that some types of antibiotics, may interact with any type of chemical treatment/drug taken by the patient in the course of treatment of another disease and this is mainly the physician's role in raising awareness of patients.

**Figure 15:-** It shows the distribution of respondents according to knowledge of risk on antibiotic interference with other medication.



## Summary and Recommendations:-

### Introduction:

After the researcher presented the results of the search field results in the previous section. through the presentation of the research sample responses to questions from the research and statistically processed using descriptive statistics concepts and statistical methods, This chapter deals with the results of field research summary, and ends with providing a number of recommendations.

### First: Summary of Results

Presenting the most important findings of the research according to the asked questions as follows:

- That the percentage (30.6%) of respondents between the ages of 20 to less than 30 years.
- That the percentage (65.8%) of the sample are female members
- That the percentage (78.7%) of respondents hold a university degree
- That the percentage (53.3%) of respondents do not take antibiotics without a doctor advice

- That the percentage (63.8%) of respondents do not consider the high temperature (Fever) a strong motivation for the use of the antibiotic.
- That the percentage (61.6%) of the respondents usually complete the antibiotic course (the period specified for use by a physician) .
- That the percentage (59.9%) of the respondents had heard of before by bacteria resistant to antibiotics.
- That the percentage (69.9%) of the respondents believe that the bacteria resistant to antibiotics appear in the case of non-completion of the antibiotic course.
- That the percentage (59.4%) of respondents are taking the antibiotic often prescribed by a doctor.
- That the percentage (61.4%) of individuals driven by throat infections to buy antibiotics.
- That the percentage (62.1%) of respondents said that their choice to buy a particular antibiotic depends on the doctor.
- That the percentage (76.5%) of the respondents are head back to the doctor in the case of treatment failure.
- That the percentage (35.5%) of respondents believe that the period in which they define treatment failure, ranges from one day to three days.
- That the percentage (64.3%) of respondents know what are the risks and complications of antibiotics.
- That the percentage (75.3%) of respondents know that antibiotics may interfere with some other medicines

**Recommendations:-**

The researchers recommendations regarding the study:

- 1) Sticking to the antibiotic doses and timetable to ensure maximum efficiency
- 2) The need for the use of the antibiotic in adherence to medical guidelines, in other words, complete a full term, even if the patient feels better
- 3) The need to ask the doctor, if an antibiotic is taken on an empty stomach or not and what types of food to ingested if so.
- 4) You should not be grinding or cracking some antibiotic pills, either because of lack stability or that the drugs have a slow release that prolongs the effect f the drug
- 5) Some antibiotics expiry date vary after solved or added to water, the expiration date is often a period of two weeks after the drug is added to water, the solution may require keeping the medicine in the refrigerator.

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### RESEARCH ARTICLE

#### Assessment of Level of Knowledge and Beliefs Toward Psoriasis Among Community In Almadina Almonawara City, 2016.

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#### Abstract

**Objective:** To explore the patients' knowledge about psoriasis and the association of knowledge score with the socio-demographic variables among community population in Almadina Almonawara City.

**Method:** This study (2016) was carried out among a sample of 461 subjects. The mean age of citizens was 28,82. To assess citizens' demographic factors and beliefs about Psoriasis, consenting citizens completed an anonymous online questionnaire. The data was entered and analyzed using SPSS version 20.

**Results:** The sample is consisted of 65,8% women and 34,2% men. Among the respondents 7,7% reported suffering from psoriasis and 13,6% confirmed having a history of Psoriasis illness in their family. The results of the study showed that 153 (34,8%) subjects had weak knowledge related to the disease, 260 (59,1%) subjects had average level of knowledge while only 27 (6,1%) subjects had good knowledge regarding Psoriasis. There was a statistical significant association between gender, educational level and the level of awareness about Psoriasis.

**Conclusion:** Psoriasis is a chronic disease that is potentially controllable but that cannot be cured. Education still be important overall the treatment of the patients.

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#### Background:-

Psoriasis is a chronic, non-communicable, painful, disfiguring and disabling disease for which there is no cure and with great negative impact on patients quality of life. it can occur at any age, and is most common in the age group 50–69<sup>[1]</sup>. The reported prevalence of psoriasis in countries ranges between 0.09%<sup>[2]</sup> and 11.4%<sup>[3]</sup>, making psoriasis a serious global problem. The etiology of psoriasis remains unclear, although there is evidence for genetic predisposition<sup>[4]</sup>. The role of the immune system in psoriasis causation is also a major topic of research. Although there is a suggestion that psoriasis could be an autoimmune disease, no auto-antigen that could be responsible has been defined yet. Psoriasis can also be provoked by external and internal triggers, including mild trauma, sunburn, infections, systemic drugs and stress<sup>[5]</sup>. Psoriasis involves the skin and nails, and is associated with a number of co-morbidities. Skin lesions are localized or generalized, mostly symmetrical, sharply demarcated, red papules and plaques, and usually covered with white or silver scales. Lesions cause itching, stinging and pain. Between 1.3%<sup>[6]</sup> and 34.7%<sup>[7]</sup> of individuals with psoriasis develop chronic, inflammatory arthritis (psoriatic arthritis) that leads to

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joint deformations and disability. Between 4.2% and 69% of all patients suffering from psoriasis develop nail changes <sup>(8-10)</sup>. Individuals with psoriasis are reported to be at increased risk of developing other serious clinical conditions such as cardiovascular and other noncommunicable diseases <sup>[11,12]</sup>. Disfiguration, disability and marked loss of productivity are common challenges for people with psoriasis. There is also a significant cost to mental well-being, such as higher rates of depression, leading to negative impact for individuals and society <sup>[13,14]</sup>.

### **Our Study Was Designed To Examine Health Beliefs And Assessment Level Of Knowledge Toward Psoriasis Among Community In Almadina Almonawara City And Applies The Health Belief Model To Determine Barriers.**

#### **Rationale:**

There are very few studies on the psoriasis. psoriasis a serious global problem, it can occur at any age. Psoriasis has been associated other serious clinical conditions such as cardiovascular and other non communicable diseases and several other cardiovascular and metabolic disturbances. Psoriasis is not only a disease that causes painful, debilitating, highly visible physical symptoms. It is also associated with a multitude of psychological impairments. For many reasons, psoriasis can be psychologically devastating. Patients' lives become especially difficult when psoriasis is present in highly visible areas of the skin such as the face and hands.

#### **Objectives:**

##### **General objectives:-**

To assessment level of awareness toward Psoriasis Among Community In Almadina Almonawara City and to identify barriers of health beliefs.

##### **Specific objective:-**

The goal of this study was to examine community health beliefs regarding Psoriasis and their perceptions related to it, and evaluate the role of demographic factors in shaping beliefs about Psoriasis and assess possible associations between demographic characteristics with the preventive behavior of interest.

#### **Method:-**

##### **Setting and data collection:-**

We perform this survey analysis among community in Almadina Almonawara city. A pre-formed self-administered questionnaire will be distributed to Parents.

##### **Sample:-**

Subjects will be chosen according to geographical and sex distribution. Sample size was calculated based on web-site calculator <sup>[15]</sup>, taking the total size of Almadina Almonawara population (1180770)<sup>[16]</sup>, confidence level (95%) and margin error (5%) to be 385. Additional 20 % was added to cover the missing data. Number of refusals was 6. The total sample obtained was 461.

##### **Study population:-**

Subjects from Almadina Almonawara of both gender and who belonged to the age group of 8 to 71 years were included in the study.

#### **Study tool:**

Pre-formed Self-administered questionnaire that requires information about:

1. Socio-demographic data: age, nationality, gender, education level, income, marital status, and employment status.
2. Risk Factors Associated with psoriasis – clinical manifestation of prognosis - incidence and prognosis of psoriasis.
3. Beliefs about Psoriasis assessment including 8 questions. A score of 1 was given right answer and 0 otherwise. For each subject, a maximum score of 8 was calculated. A scoring system was applied to measure the respondents' beliefs about psoriasis. The awareness level was categorized into 3 levels indicated by weak (0–2), average (3-5) and good (6-8).
4. Knowledge about prevention behavior assessment including one question “Do you believe that psychological pressure is one of the psoriasis factors?”. A score of 1 was given to yes and 0 otherwise. For each subject, a maximum score of 1 was calculated. The knowledge level score was categorized into 2 levels indicated by poor knowledge (0) and good knowledge (1).

**Study limitations:-**

The following limitations are expected:

- Cooperation of sample
- Recall bias

**Ethical considerations:-**

All participants will give their informed consent before filling the questionnaire.

**Statistical analysis:-**

Data were entered into the Statistical Package for Social Sciences (SPSS, version 20) and descriptive analysis conducted.

Association of respondents' characteristics with beliefs about Psoriasis and knowledge about prevention behavior of interest was evaluated using:

1. Frequencies and percentages.
2. Chi-squared test.
3. Independent Samples Test (T-test).
4. ANOVA oneway test.

Statistical significance was accepted at  $p < 0.05$ .

**Results:-****I-Examine community health beliefs regarding Psoriasis and their perceptions related to it:-****1-Demographics of the studied subjects:-**

The socio-demographic characteristics are shown in table (1)

**Table 1:-** socio-demographic characteristics.

	Frequency	Percentage (%)
<b>Age (Years)</b>		
<b>Mean age: 28,82</b>		
<b>Gender</b>		
<b>Female</b>	<b>298</b>	<b>65,8</b>
<b>Male</b>	<b>155</b>	<b>34,2</b>
<b>Nationality</b>		
<b>Saudi</b>	<b>395</b>	<b>87,6</b>
<b>Non Saudi</b>	<b>56</b>	<b>12,4</b>
<b>Educational level</b>		
<b>Primary</b>	<b>6</b>	<b>1,3</b>
<b>Middle</b>	<b>15</b>	<b>3,3</b>
<b>Secondary</b>	<b>139</b>	<b>31,0</b>
<b>University</b>	<b>278</b>	<b>62,1</b>
<b>Master</b>	<b>6</b>	<b>1,3</b>
<b>PH.D.</b>	<b>4</b>	<b>0,9</b>
<b>Marital status</b>		
<b>Not married</b>	<b>233</b>	<b>51,5</b>
<b>Married</b>	<b>219</b>	<b>48,5</b>
<b>Income (RS)</b>		
<b>&lt;3000</b>	<b>183</b>	<b>42,5</b>
<b>3000-5000</b>	<b>52</b>	<b>12,1</b>
<b>5000-7000</b>	<b>38</b>	<b>8,8</b>
<b>7000-10000</b>	<b>65</b>	<b>15,1</b>
<b>&gt;10 000</b>	<b>93</b>	<b>21,6</b>
<b>Employment status</b>		
<b>Unemployed</b>	<b>277</b>	<b>61,7</b>
<b>Employed</b>	<b>172</b>	<b>38,3</b>

By looking at table (1), related to the distribution of respondents according to demographic factors:

- The mean age of population was: 28,82 years.
- With respect to gender, a majority of the subjects (298)( 65,8%) were Female.

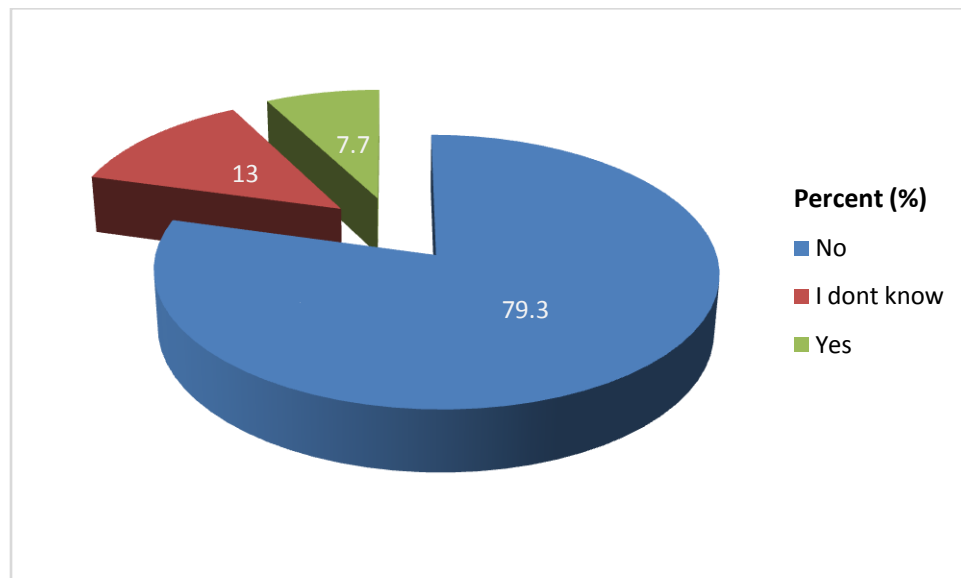
- 395 (87,6%) subjects had Saudi nationality.
- We see that (278) of the respondents have a university degree with a percentage of 62,1%.
- We see that (219) of the respondents are married with percentage of 48,5%.
- We see that (183) of the respondents have an income (<3000 RS) with percentage of 42,5%.
- We see that (277) of the respondents are unemployed with percentage of 61,7%.

#### Knowledge regarding the diagnosis of Psoriasis:-

**Table 2:-** Do you suffer from psoriasis?

Do you suffer from psoriasis?		Frequency	Percent (%)
	No	360	79,3
	I dont know	59	13,0
	Yes	35	7,7
	Total	454	100,0

Out of 454 subjects, 360 (79,3%) subjects reported not being affected with Psoriasis, 13% did not know if they are affected or not and 35 (7,7%) respondents reported that they suffer from Psoriasis, as it is shown in the figure below:



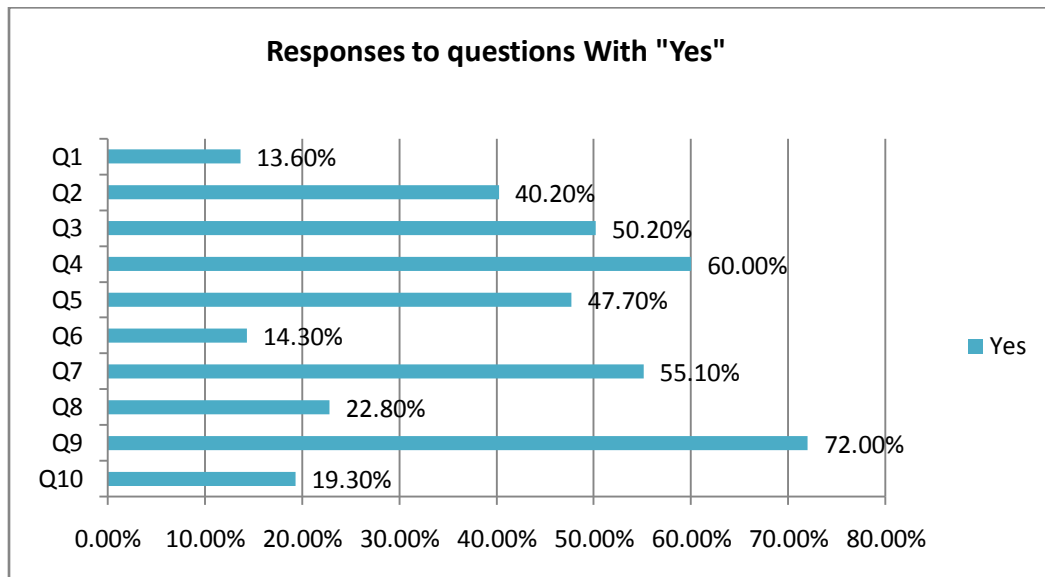
**Figure 1:-** Do you suffer from psoriasis?

#### Community health beliefs regarding Psoriasis and their perceptions related to it

**Table 3:-** Responses to questions on beliefs regarding Psoriasis (Green: correct answer)

	No	Yes	Don't Know
<b>Do you suffer from psoriasis?</b>	<b>360 (79,3%)</b>	<b>35 (7,7%)</b>	<b>59 (13,0%)</b>
<b>Q1: Is there a history of Psoriasis illness in your family?</b>	<b>291 (64,0%)</b>	<b>62 (13,6%)</b>	<b>102 (22,4%)</b>
<b>Q2: you have or ever had any of the skin diseases?</b>	<b>246 (54,1%)</b>	<b>183 (40,2%)</b>	<b>26 (5,7%)</b>
<b>Q3: Do you think that psoriasis could be prevented?</b>	<b>59 (13,0%)</b>	<b>228 (50,2%)</b>	<b>167 (36,8%)</b>
<b>Q4: Do you think that heredity play a role in having psoriasis?</b>	<b>55 (12,1%)</b>	<b>273 (60,0%)</b>	<b>127 (27,9%)</b>
<b>Q5: Do you think that psychological pressure is one of the psoriasis factors?</b>	<b>75 (16,5%)</b>	<b>217 (47,7%)</b>	<b>163 (35,8%)</b>
<b>Q6: Do you think that psoriasis increases the risk of heart disease?</b>	<b>123 (27,1%)</b>	<b>65 (14,3%)</b>	<b>266 (58,6%)</b>
<b>Q7: Psoriasis may affect humans at any age category?</b>	<b>32 (7,0%)</b>	<b>250 (55,1%)</b>	<b>172 (37,9%)</b>
<b>Q8: If you have psoriasis, do you feel socially ashamed by being affected?</b>	<b>161 (36,3%)</b>	<b>101 (22,8%)</b>	<b>181 (40,9%)</b>
<b>Q9: Do you think that psoriasis can be cured?</b>	<b>47 (10,4%)</b>	<b>327 (72,0%)</b>	<b>80 (17,6%)</b>
<b>Q10: Do you think that psoriasis is contagious?</b>	<b>227 (49,9%)</b>	<b>88 (19,3%)</b>	<b>140 (30,8%)</b>

- Most of the respondents 228 (50,2%) answered that psoriasis could be prevented.
- 273 (60%) of the patients were aware that psoriasis was a genetically determined disease and 217 (47,7%) thought that psychological pressure is one of psoriasis factors.
- Only 65 (14,3%) subjects knew that psoriasis increases the risk of heart disease.
- Most of the subjects 250 (55,1%) knew that psoriasis may begin at any age.
- The majority of respondents 181 (40,9%) did not know if they will be ashamed or not, if they have psoriasis.
- The majority of respondents 327 (72%) think that psoriasis can be cured and only 10,4% of the subjects knew the fact that the disease is not curable.
- The results of the study suggested that 227 (49,9%) subjects were aware of the fact that psoriasis is not contagious.



**Figure 2:- Responses to questions With "Yes"**

## II-Evaluation of the role of demographic factors in shaping beliefs about Psoriasis

### Level of awareness

**Table 4:-** Respondents' awareness evaluation for Psoriasis

Level of awareness	Frequency	Percent (%)
0-2 : Weak	153	34,8
3-5 : Average	260	59,1
6-8 : Good	27	6,1
Total	440	100,0

Table 4 shows that overall level of awareness on psoriasis among the study participants showed that out of 440 subjects, 153 (34,8%) subjects had weak knowledge about the disease, 260 (59,1%) subjects had average level of knowledge whereas only 27 (6,1%) subjects had a good knowledge regarding Psoriasis (Figure 3).

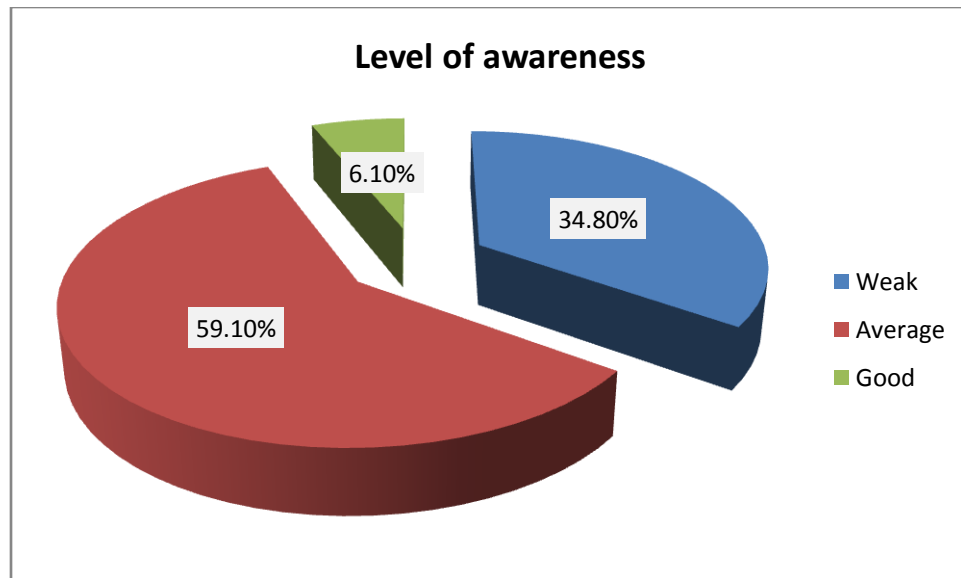


Figure 3:- Level of awareness

## Association of the subjects' knowledge with socio-demographic variables

## 1-Age

Descriptives								
Age								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
0-2 : Weak	128	28,23	10,243	,905	26,44	30,02	15	65
3-5 : Average	220	28,71	11,080	,747	27,24	30,18	8	71
6-8 : Good	24	28,67	11,239	2,294	23,92	33,41	15	60
Total	372	28,54	10,783	,559	27,44	29,64	8	71

ANOVA					
Age					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	19,250	2	9,625	,082	,921
Within Groups	43117,145	369	116,849		
Total	43136,395	371			

## Gender:-

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13,269 <sup>a</sup>	2	,001
Likelihood Ratio	13,066	2	,001
Linear-by-Linear Association	11,568	1	,001
N of Valid Cases	440		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 9,14.

## Nationality:-

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	,873 <sup>a</sup>	2	,646

Likelihood Ratio	,977	2	,614
Linear-by-Linear Association	,620	1	,431
N of Valid Cases	438		
a. 1 cells (16,7%) have expected count less than 5. The minimum expected count is 3,45.			

**Educational level:-**

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20,279 <sup>a</sup>	10	,027
Likelihood Ratio	24,811	10	,006
Linear-by-Linear Association	2,759	1	,097
N of Valid Cases	434		
a. 11 cells (61,1%) have expected count less than 5. The minimum expected count is ,24.			

**Marital status:-**

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1,161 <sup>a</sup>	2	,560
Likelihood Ratio	1,162	2	,559
Linear-by-Linear Association	,423	1	,516
N of Valid Cases	438		
a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 12,82.			

**Income:-**

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5,251 <sup>a</sup>	8	,730
Likelihood Ratio	5,752	8	,675
Linear-by-Linear Association	,355	1	,551
N of Valid Cases	419		
a. 3 cells (20,0%) have expected count less than 5. The minimum expected count is 2,45.			

**Employment status:-**

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	,853 <sup>a</sup>	2	,653
Likelihood Ratio	,881	2	,644
Linear-by-Linear Association	,198	1	,656
N of Valid Cases	435		
a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 10,24.			

There is a statistical significant association between gender, educational level and the level of awareness about Psoriasis, respectively ( $p=0,01 < 0,05$ ) and ( $p=0,027 < 0,05$ ).

**Assessment of possible associations between demographic characteristics with the preventive behavior of interest:-**

Psychological pressure is one of the psoriasis factors, which is reported in the fifth question; that is why it is important to avoid stress as prevention of the disease.

**Table 5:-** Do you think that psychological pressure is one of the psoriasis factors?

Level of knowledge	Frequency	Percent (%)
Poor knowledge	238	52,3
Good knowledge	217	47,7
Total	455	100,0

238 (52,3%) of the respondents have a poor knowledge about psychological pressure as a factor of psoriasis while 47,7% of the subjects have a good knowledge.

**Age:-**

Group Statistics					
	5-Do you think that psychological pressure is one of the psoriasis factors?	N	Mean	Std. Deviation	Std. Error Mean
Age	Poor knowledge	196	27,47	10,073	,719
	Good knowledge	187	30,13	11,679	,854

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Age	Equal variances assumed	2,327	,128	-2,389	381	,017	-2,659	1,113	-4,847	-,471
	Equal variances not assumed			-2,381	367,251	,018	-2,659	1,117	-4,855	-,463

**Gender:-**

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4,128 <sup>a</sup>	1	,042		
Continuity Correction <sup>b</sup>	3,735	1	,053		
Likelihood Ratio	4,145	1	,042		
Fisher's Exact Test				,048	,026
Linear-by-Linear Association	4,119	1	,042		
N of Valid Cases	453				
a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 74,25.					
b. Computed only for a 2x2 table					

**Nationality:-**

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5,466 <sup>a</sup>	1	,019		
Continuity Correction <sup>b</sup>	4,818	1	,028		
Likelihood Ratio	5,497	1	,019		
Fisher's Exact Test				,022	,014
Linear-by-Linear Association	5,454	1	,020		

N of Valid Cases	451			
a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 26,82.				
b. Computed only for a 2x2 table				

**Education level:-**

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5,397 <sup>a</sup>	5	,369
Likelihood Ratio	5,576	5	,350
Linear-by-Linear Association	,365	1	,546
N of Valid Cases	448		
a. 6 cells (50,0%) have expected count less than 5. The minimum expected count is 1,91.			

**Marital status:-**

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4,186 <sup>a</sup>	1	,041		
Continuity Correction <sup>b</sup>	3,809	1	,051		
Likelihood Ratio	4,192	1	,041		
Fisher's Exact Test				,048	,025
Linear-by-Linear Association	4,177	1	,041		
N of Valid Cases	452				
a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 105,14.					
b. Computed only for a 2x2 table					

**Income:-**

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5,331 <sup>a</sup>	4	,255
Likelihood Ratio	5,363	4	,252
Linear-by-Linear Association	2,409	1	,121
N of Valid Cases	431		
a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 18,34.			

**Employment status:-**

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	,075 <sup>a</sup>	1	,785		
Continuity Correction <sup>b</sup>	,031	1	,860		
Likelihood Ratio	,075	1	,785		
Fisher's Exact Test				,846	,430
Linear-by-Linear Association	,074	1	,785		
N of Valid Cases	449				
a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 81,59.					
b. Computed only for a 2x2 table					

There is a statistical significant association between age, gender, nationality, marital status and the level of knowledge about stress as factor of Psoriasis, respectively ( $p=0,17 < 0,05$ ), ( $p=0,42 < 0,05$ ), ( $p=0,19 < 0,05$ ) and ( $p=0,41 < 0,05$ ).



**Discussion:-**

Tham SN, Tay YK (17) and other studies (18) have reported in their work that many patients have a gap of knowledge about their disease and treatment aspects (17).

This study identified that:

- The majority of respondents have an average level of awareness toward Psoriasis.
- The majority of the studied subjects have a good knowledge about the fact that psychological stress is one of the factors of the pathology of Psoriasis.

Leovigildo et al. indicated that was an exacerbating factor of Psoriasis (19).

Our study showed that about half of respondents were not sure or were affirmative that psoriasis is contagious, respectively 30,8% and 19,3%.

Dika et al. have reported that physicians and dermatologists should be aware that their patients may have an inadequate understanding of their pathology (20).

**Recommendations:-**

- Therapeutic management is not limited to its molecular aspect by using drugs.
- Improving the health of a patient goes through many other aspects as essential as drugs: education, prevention, hygiene, listening, social solidarity... This change in vision has made it possible:
- To become aware of all the consequences of illness on the quality of life of the patient
- To identify the handicap and the resulting social exclusion
- To consider that psychological suffering is as important to take in charge as physical suffering, Indeed, the purpose of treatments is not only to eliminate the symptoms but, more generally, to improve the quality of life and, in the context of skin diseases, to return to the patient all his freedom in his relations with himself and with others (21).
- According to Jankowiak et al (22):
- Patients with psoriasis need to improve their knowledge of the disease and self-care methods to avoid exacerbation of disease.
- The disease requires systematic treatment and appropriate care.
- Health education is a main part of the management of psoriasis.

**Conclusion:-**

Our study showed that most of studied subjects had an inadequate level of knowledge about psoriasis. Efforts should be instaurated to improve the knowledge of people about psoriasis in order to ensure better well being and a better care of patients.

**Budget:-**

<i>Item</i>	<i>Price</i>
Transportations	700 SR
Paper work	800 SR
Software programs	2000 SR
Books	1000SR
Stationaries	1000SR

**Proposed workplan:-**

No.	Work	Proposed time
1	Literature review	2 Months
2	Preparation for data collection	1 Months
3	Data collection	3 Months
4	Statistical analysis	1 Months
5	Discussion of results	2 months
6	Writing an abstract	2.2. months

**References:-**

1. Institute for Health Metrics and Evaluation (IHME). Global Burden of Disease Study 2010: Results by Cause 1990–2010. Seattle: IHME; 2012.
2. Gibbs S. Skin disease and socioeconomic conditions in rural Africa: Tanzania. *Int J Dermatol.* 1996;35(9):633–9.
3. Danielsen K, Olsen AO, Wilsgaard T, Furberg AS. Is the prevalence of psoriasis increasing? A 30-year follow-up of a population-based cohort. *Br J Dermatol.* 2013;168:1303–10.
4. Harden JL, Krueger JG, Bowcock AM. The immunogenetics of psoriasis: a comprehensive review. *J Autoimmun.* 2015;64:66–73.
5. Boehncke W-H, Schon MP. Psoriasis. *Lancet.* 2015;386(9997):983–94.
6. Bedi TR. Clinical profile of psoriasis in North India. *Indian J Dermatol Venereol Leprol.* 1995;61(4):202–5.
7. Pariser D, Schenkel B, Carter C, Farahi K, Brown TM, Ellis CN, and Psoriasis Patient Interview Study Group. A multicenter, non-interventional study to evaluate patient-reported experiences of living with psoriasis. *J Dermatol Treat.* 2015;1–8.
9. Alshami MA. Clinical profile of psoriasis in Yemen, a 4-year retrospective study of 241 patients. *J Eur Acad Dermatol Venereol.* 2010;24(Suppl. 4):14.
10. Falodun OA. Characteristics of patients with psoriasis seen at the dermatology clinic of a tertiary hospital in Nigeria: a 4-year review 2008–2012. *J Eur Acad Dermatol Venereol.* 2013;27(Suppl. 4)
11. Reich K, Kruger K, Mossner R, Augustin M. Epidemiology and clinical pattern of psoriatic arthritis in Germany: a prospective interdisciplinary epidemiological study of 1511 patients with plaque-type psoriasis. *Br J Dermatol.* 2009;160(5):1040–7.
12. Augustin M, Radtke MA, Glaeske G, Reich K, Christophers E, Schaefer I et al. Epidemiology and Comorbidity in Children with Psoriasis and Atopic Eczema. *Dermatology.* 2015;231(1):35–40.
13. Vena GA, Altomare G, Ayala F, Berardesca E, Calzavara-Pinton P, Chimenti S et al. Incidence of psoriasis and association with comorbidities in Italy: a 5-year observational study from a national primary care database. *Eur J Dermatol.* 2010;20(5):593–8.
14. Sampogna F, Tabolli S, Abeni D, IDI Multipurpose Psoriasis Research on Vital Experiences (IMPROVE) investigators. Living with psoriasis: prevalence of shame, anger, worry, and problems in daily activities and social life. *Acta Derm Venereol.* 2012;92(3):299–303.
15. Mrowietz U, Steinz K, Gerdes S. Psoriasis: To treat or to manage? *Exp Dermatol.* 2014;23(10):705
16. <http://www.calculator.net/sample-size-calculator.html?type=1&cl=95&ci=5&ps=3%2C976%2C000&x=37&y=6>
17. Statistical Yearbook 50 (2014). Central Department Of Statistics & Information.
18. Tham SN, Tay YK. A questionnaire-based survey of patients' knowledge of psoriasis at the National Skin Centre. *Annals of the Academy of Medicine, Singapore.* 1995 May;24(3):415–20. PubMed PMID: 7574425. Epub 1995/05/01. eng.
19. Wahl AK, Moum T, Robinson HS, Langeland E, Larsen MH, Krogstad AL. Psoriasis Patients' Knowledge about the Disease and Treatments. *Dermatology Research and Practice.* 2013 06/24, 04/25/received 06/03/accepted;2013:921737. PubMed PMID: PMC3707276.
20. Leovigildo ÉS, David RAR, Mendes AS. Stress level of people with psoriasis at a public hospital. *Anais Brasileiros de Dermatologia.* 2016 Jul-Aug 07/18/received, 11/09/accepted;91(4):446–54. PubMed PMID: PMC4999102.
21. Dika E, Varotti C, Bardazzi F, Maibach HI. Drug-Induced Psoriasis: An Evidence-Based Overview and the Introduction of Psoriatic Drug Eruption Probability Score. *Cutaneous and Ocular Toxicology.* 2006 2006/01/01;25(1):1–11.
22. Dubertret L. Le psoriasis: évolution et révolution. *MEDECINE/SCIENCES.* 2006;22:164–71.
23. Jankowiak B, Krajewska-Kulak E, Van Damme-Ostapowicz K, Wronska I, Lukaszuk C, Niczyporuk W, et al. The need for health education among patients with psoriasis. *Dermatology nursing.* 2004 Oct;16(5):439–44. PubMed PMID: 15624709. Epub 2004/12/31. Eng.

**Appendix:-****A questionnaire:-**

<https://docs.google.com/forms/d/e/1FAIpQLScXr0W9htUXauahKDI3ZT5izpVr-aLx6I3AXHpYNnZCypIYNA/viewform>

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### RESEARCH ARTICLE

#### Software to Compute Pile Load Capacity in Case of Variable Soil Stratification.

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##### Key words:-

Pile Load Test, Soil Stratification

#### Abstract

High degree of uncertainty is associated with the geotechnical investigations as it is impossible to conduct the pile load test on each and every pile due to their expensiveness and tedious nature. As per the guidelines given by the IS 2911 (part1-section 2)-2014 considers only the granular or clayey (C or  $\Phi$  soils) throughout the depth of the pile. This is not actually possible in the actual field. So it is necessary to build the software which can calculate the pile load capacity for foundation soil having different soil strata, existing throughout the entire depth of pile. This software will eliminate excessive cost of investigations. **We have derived a new formula based on the existing formula given in the IS code 2911 and this formula is used for computation of result in the software.**

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#### Introduction:-

Geotechnical engineering is sub-branch of civil engineering discipline that deals with the engineering behaviour of earthen materials. Geotechnical engineering also has uses and application in mining, military, petroleum and different engineering discipline. It uses the basic principles soil mechanics to investigate surface and subsurface conditions and materials. It also deals with stability of slopes, soil deposits earthwork design and foundation design. One of major geological problem of the earth's subsurface topography lies in the fact that the soil below the ground does not have uniform soil stratification. For a given smallest area of land one cannot say that the soil type and properties of the soil in this small area are uniform. These soil properties may change laterally (horizontally) as well as vertically (in depth). Soil stratification may change in type of soil, properties of soil, shear strength parameters, soil structure, permeability and porosity etc. It is therefore necessary to determine accurate soil stratification by use of modern paraphernalia which gives accurate results. The soil beneath plays a major role in the design of foundation and also the design of subsequent structure.

Accurate soil tests, results in increased life of structures, eliminating need of maintenance, if any. Geotechnical investigation only cost 1-2% of the total cost of the project but proves to be crucial.

Soil stratification is helpful in knowing the Pile Load Capacity (PLC) in case of variable soil stratification. PLC is the maximum amount of load a pile foundation can carry before failure.

In this project attempts have been made to accurately examine PLC in case of variable soil stratification with the use of the software/excel sheet.

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**Literature review:-**

✚ Narayan V Nayak mentions in his book “Foundation Design manual” page number 1.81

“In a very stiff to hard clayey soils, particularly with N values of standard penetration test greater than 30, reliability of laboratory tests conducted on so called undisturbed samples is very low. In such cases dependence shall be on penetration test and/or pressuremeter tests.”

This software does not require N value or SPT value as inputs. In such a case we will not input “N” value and it will be evident from the software that the software will not show the same “N” value as derived from the test.

As the “N” value is not required as main input for the software, no computation of the software data will be based on the requirement of the “N” value and the results will be accurate.

✚ Further adding to the above contents Gopal Ranjan in his book “Basic and Applied Soil Mechanics” page number 589 wrote,

“Correlation of N value and soil parameters is available mainly for cohesionless soils. The use of N values for cohesive soils is limited, since the compressibility such soil is not reflected by N value”

Also P V Varghese mentioned that

“Even though are not considered as good measure of the strength of clays, it is used extensively as a measure of the consistency of clays. The consistency is then related to its approximate strength,” in his book Foundation Engineering page 16.

**Interpretation of pile load test result:-**

The interpretation of results PLT plays a crucial role in deciding the failure capacity of the given pile. Also the interpretation of the PLT load test results in finding out the maximum possible load a pile can take.

This computation is very complex problem requiring very careful consideration of factors like soil profile, pile installation method, sensitivity of the structure, possibility of negative drag etc.

Fellenius in the year 1975 described eight methods of pile failure and also with examples of full scale field test showed that the interpreted smallest and largest value differed by atleast 40%.

Chin Fung Kee in the year 1977 suggested a plot of settlement per unit load as abscissa against settlement as ordinate to determine the ultimate capacity of a test pile, assuming the load- settlement relationship is hyperbolic.

Some of the well-known fundamentals of the failure load are given below:-

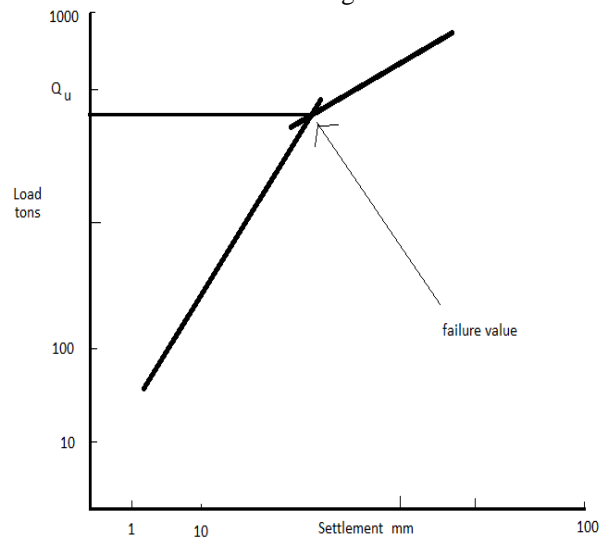


Fig 2.1 LOAD V/S SETTLEMENT GRAPH

1.) De Beer in the year 1968 plotted the load settlement values in a log-log scale, where the values can be shown to fall on two straight lines. The intersection of the lines corresponds to the failure value of that pile. In this the interpreted analysed values is conservative and the corresponding pile settlement is also small.

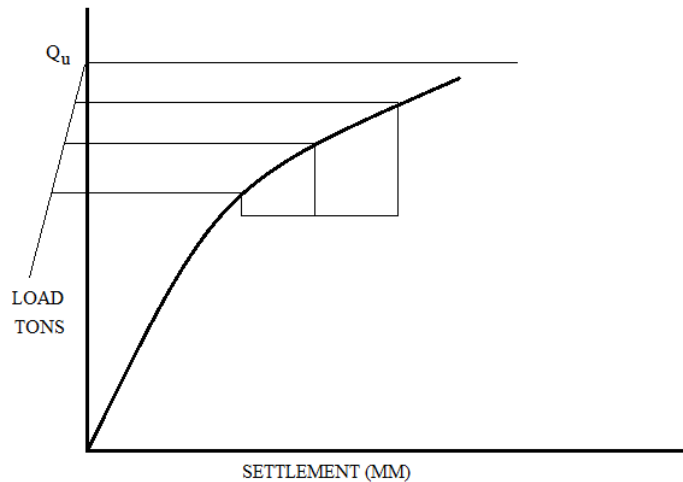


Fig 2.2 LOAD V/S SETTLEMENT GRAPH

2.) Mazirkiewicz in the year 1972 proposed a method that allows the failure load to be extended even if the maximum load is smaller than the failure load.

The figure shows equal settlement lines are drawn corresponding to the load. From the junction of each load line with the load axis a  $45^\circ$  line is drawn to intersect the next load line which intersects the next load line. It is based on the assumption that load-settlement curve is parabolic.

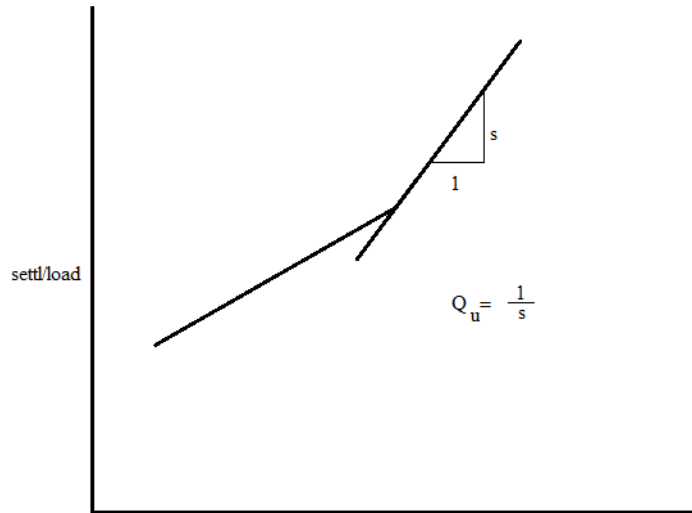


Fig 2.3 LOAD V/S SETTLEMENT GRAPH

3.)Chin Fung Kee in the year 1977 suggest a graph of the settlement is divided by load versus settlement. The graph consist of 2 straight lines. During the initial loads, the ratio of settlement to load is almost constant and as pile approaches failure, the graph shows the straight line with steeper slope. The inverse of the slope for the second straight line indicates failure corresponding to the load value of the curve.

### Problem deifinition:-

#### 1.1 Problem Justification:-

For construction of any type of building it is necessary to determine various soil parameters. These parameters includes shear strength parameters, soil stratification, SBC etc. To determine the SBC of soil it is necessary to carry out Pile Load Test (PLT). Pile load capacity test is very expensive and cannot be performed at a very large number of stations and one pile load test can take about a month to get results. As it cannot be performed at many places accurate results cannot be obtained. By the use of the software of the software we made we can accurately or near to accurate results can be obtained.

The software is open source and is user friendly which a normal person can use. It doesn't require any specialised training for operation. Any soil stratification can be computed with the use of this software on the basis of the different soils.

There are approximate 5% piles that are tested for the design of the foundation. That means there are 2-5 piles which are tested and approximately 95% are remained untested. This give high percentage of uncertainty in the design. So it is therefore necessary to test all the piles at failure to get accurate design parameters.

If you look at any international codes as well Indian standard code, engineering designs are not 100% correct because of the assumptions made in the results. So use of software decreases this uncertainty and gives the best design conditions.

### Aim of the project:-

The aim of the study is to develop a software that can directly compute the pile load capacity upon the input of the certain parameters.

### Objectives of the project:-

- ✚ To find pile load capacity in terms of variable soil stratification.
- ✚ To eliminate the need of performing too many pile load test on the sub surface.
- ✚ To further reduce the cost of geotechnical investigation.
- ✚ To provide free, user friendly and completely robust software to geotechnical engineers for the betterment of the infrastructure.

**About software:-**

Actually in the field, hardly pure cohesive soil or purely granular soil is available. Hence in this software an approach is made to derive the pile capacity for C- $\Phi$  soil. Many professional softwares are available to derive pile capacity for C- $\Phi$  soil. (like GEO 5, All-pile, L-pile etc)

But the professional software are having many limitations like

- 1) They are not user friendly
- 2) They are very costly (in terms of lacs of rupees)
- 3) They do not automatically accept changes of revised codal provisions.
- 4) They do not provide detail calculation as per our requirement

**About our software:-**

The software is totally

- 1) User friendly and
- 2) Maintenance free

**Design for use, reuse and sustainability:-**

(I) Design for use:-

The software designed is ready to use if required data are available like

- 1) Diameter of pile
- 2) Length of pile
- 3) Shear parameters of soil (cohesion and angle of internal friction)
- 4) Unit weight of soil etc.

These data can be obtained from the traditional soil tests.

(II) Design for reuse

The software can be reused for n number of times, for different diameter, different length and different soil parameters.

(III) Design for sustainability

The software is sustainable for n number of years provided that necessary updates are incorporated time to time.

(IV) Prototyping

It is not applicable for software. But a prototype modeling of a pile load test can be prepared to check the pile load capacity calculated from software.

(V) Test the prototype

The prototype is made showing following components

- 1) Soil strata
- 2) Pile
- 3) Loading arrangement

(VI) Measuring instruments

Visual observation can be made that - as the load on pile increases, the settlement of pile also increases.

(VII) Comparison of existing methods

In IS 2911, method for calculation of pile capacity is given for pure granular soil and pure cohesive soil only. But in actual field conditions, the soil is hardly pure granular or pure cohesive in nature. Hence this software is prepared in excel to determine the capacity of pile for actual field conditions having mix nature of soil (granular+cohesive)

Few readymade softwares are available to calculate pile capacity for mix soil conditions, but they are very costly and not user friendly. This software is user friendly, transparent and updatable.

**Derivation of the formula:-**

To derive the capacity of pile, Guidelines are given in IS 2911 (Part 1 section 2) -2014 . In this code equations are given to determine ultimate capacity of pile in soil in Clause B-1 and Clause B-2

The equations are given for

- 1) Piles in Granular soils ( $\Phi$  soil) and
- 2) Piles in Cohesive soils (C soil)

**Limitations of the IS code:-**

1 IS code 2911 assumes that same type of soil i.e pure cohesive or pure granular soil is found through-out the depth of excavation. But in real practice this case does not come into practicality.

2 IS code 2911 does not consider the change in soil stratification.

The formulas given in the IS code are:-

## B-1 PILES IN GRANULAR SOILS

The ultimate load capacity ( $Q_u$ ) of piles, in kN, in granular soils is given by the following formula:

$$Q_u = A_p (\frac{1}{2} D \gamma N_\gamma + P_D N_q) + \sum_{i=1}^n K_i P_{Di} \tan \delta_i A_{si} \dots (1)$$

The first term gives end-bearing resistance and the second term gives skin friction resistance.

where

$A_p$  = cross-sectional area of pile tip, in  $m^2$ ;

$D$  = diameter of pile shaft, in m;

$\gamma$  = effective unit weight of the soil at pile tip, in  $kN/m^3$ ;

$N_\gamma$  = bearing capacity factors depending upon  
and  $N_q$  the angle of internal friction,  $\phi$  at pile tip;

$P_D$  = effective overburden pressure at pile tip, in  $kN/m^2$  (see Note 5);

$\sum_{i=1}^n$  = summation for layers 1 to  $n$  in which pile is installed and which contribute to positive skin friction;

$K_i$  = coefficient of earth pressure applicable for the  $i$ th layer (see Note 3);



## B-2 PILES IN COHESIVE SOILS

The ultimate load capacity ( $Q_u$ ) of piles, in kN, in cohesive soils is given by the following formula:

$$Q_u = A_p N_c c_p + \sum_{i=1}^n \alpha_i c_i A_{si} \quad \dots(2)$$

The first term gives the end-bearing resistance and the second term gives the skin friction resistance.

where

- $A_p$  = cross-sectional area of pile tip, in  $m^2$ ;
- $N_c$  = bearing capacity factor, may be taken as 9;
- $c_p$  = average cohesion at pile tip, in  $kN/m^2$ ;
- $\sum_{i=1}^n$  = summation for layers 1 to  $n$  in which the pile is installed and which contribute to positive skin friction;
- $\alpha_i$  = adhesion factor for the  $i$ th layer depending on the consistency of soil, (see Note);
- $c_i$  = average cohesion for the  $i$ th layer, in  $kN/m^2$ ; and
- $A_{si}$  = surface area of pile shaft in the  $i$ th layer, in  $m^2$ .

The formulas that are given in the IS code are manipulated to get the formula that is used in the software. The friction components of both the formulas are merged and end bearing components of both the formula are combined. This gives rise to the new formula.

The total friction component of the pile is given by **new formula**.

<p><b>Ultimate frictional capacity (<math>Q_u</math>)<sub>f</sub> = <math>[\sum K \times P d_i \times \tan \delta \times A_s] + [a \times C \times A_s]</math></b>  <b>[Granular soil + Cohesive soil]</b></p>
--

The total end bearing component of the pile is given by new formula.

$\text{Ultimate end bearing capacity (Qu)}_b = [A_p(1/2 D \times g \times N_g + P_d \times N_q)] + [A_p \times N_c \times C_p]$ <p>[Granular soil + Cohesive soil]</p>
--

### Analysis and result:-

#### General:-

To analyze the data we will first conduct the PLT on the actual site to obtain the soil sample. This soil sample will be taken to laboratory for further testing of the of the soil sample. Shear strength parameters (cohesion and angle of internal friction) of the soil sample are found out.

#### Testing of soil:-

Having collected the soil sample, the specimen is taken to the laboratory for further testing of the soil sample. Soil sample is tested for the shear strength parameters. We have collected the data from 5 different sites, whose shear strength parameters are as follows:-

#### Location 1:-

##### Frictional capacity of pile

Layer 1			
		Location	Vasad
	D	Stem dia , cm	45
	L	Length of pile L1, cm	200
	K	Coefficient of earth pressure	1.0
	$\gamma$	Unit weight in kg/cm <sup>3</sup>	0.0019
	$\alpha$	Reduction factor	1.0
	C	Average cohesion ,kg/cm <sup>2</sup>	0.9
	$\phi \phi \phi \phi \phi$	Angle of wall friction between pile and soil, degree	21

Layer 2			
	D	Stem dia , cm	45
	L	Length of pile L2, cm	350
	K	Coefficient of earth pressure	1.0
	$\gamma$	Unit weight in kg/cm <sup>3</sup>	0.0019
	$\alpha$	Reduction factor	1.0
	C	Average cohesion ,kg/cm <sup>2</sup>	0.3
	$\phi \phi \phi \phi \phi$	Angle of wall friction between pile and soil, degree	19

Layer 3			
	D	Stem dia , cm	45
	L	Length of pile L3, cm	425
	K	Coefficient of earth pressure	1.0
	$\gamma$	Unit weight in kg/cm <sup>3</sup>	0.0019
	$\alpha$	Reduction factor	1.0
	C	Average cohesion ,kg/cm <sup>2</sup>	0.3
	$\phi \phi \phi \phi \phi$	Angle of wall friction between pile and soil, degree	23

##### End bearing capacity of pile

D	Pile Dia in cms	45
$\gamma$	Effective unit weight of soil at pile tip in kg/cm <sup>3</sup>	0.0021
$\phi$	Angle of internal friction around pile tip in degree	23
C <sub>p</sub>	Average cohesion at pile tip,kg/cm <sup>2</sup>	0.3

**Location 2****Frictional capacity of pile**

Layer 1			
		Location	Surat
	D	Stem dia , cm	60
	L	Length of pile L1, cm	100
	K	Coefficient of earth pressure	0
	$\gamma$	Unit weight in kg/cm <sup>3</sup>	0.0018
	$\alpha$	Reduction factor	1.0
	C	Average cohesion ,kg/cm <sup>2</sup>	0.4
	$\phi \phi \phi \phi \phi$	Angle of wall friction between pile and soil, degree	12
Layer 2			
	D	Stem dia , cm	60
	L	Length of pile L2, cm	400
	K	Coefficient of earth pressure	1.0
	$\gamma$	Unit weight in kg/cm <sup>3</sup>	0.00185
	$\alpha$	Reduction factor	1.0
	C	Average cohesion ,kg/cm <sup>2</sup>	0.32
	$\phi \phi \phi \phi \phi$	Angle of wall friction between pile and soil, degree	19
Layer 3			
	D	Stem dia , cm	60
	L	Length of pile L3, cm	350
	K	Coefficient of earth pressure	1.0
	$\gamma$	Unit weight in kg/cm <sup>3</sup>	0.0019
	$\alpha$	Reduction factor	1.0
	C	Average cohesion ,kg/cm <sup>2</sup>	0.36
	$\phi \phi \phi \phi \phi$	Angle of wall friction between pile and soil, degree	24

**End bearing capacity of pile**

D	Pile Dia in cms	60
$\gamma$	Effective unit weight of soil at pile tip in kg/cm <sup>3</sup>	0.0021
$\phi$	Angle of internal friction around pile tip in degree	24
C <sub>p</sub>	Average cohesion at pile tip,kg/cm <sup>2</sup>	0.36

**Location3****Frictional capacity of pile**

Layer 1			
		Location	Bharuch
	D	Stem dia , cm	75
	L	Length of pile L1, cm	250
	K	Coefficient of earth pressure	1.0
	$\gamma$	Unit weight in kg/cm <sup>3</sup>	0.0018
	$\alpha$	Reduction factor	1.0
	C	Average cohesion ,kg/cm <sup>2</sup>	0.36
	$\phi \phi \phi \phi \phi$	Angle of wall friction between pile and soil, degree	10
Layer 2			
	D	Stem dia , cm	75
	L	Length of pile L2, cm	400
	K	Coefficient of earth pressure	1.0
	$\gamma$	Unit weight in kg/cm <sup>3</sup>	0.00183
	$\alpha$	Reduction factor	1.0
	C	Average cohesion ,kg/cm <sup>2</sup>	0.33
	$\phi \phi \phi \phi \phi$	Angle of wall friction between pile and soil, degree	15

Layer 3			
	D	Stem dia , cm	75
	L	Length of pile L3, cm	350
	K	Coefficient of earth pressure	1.0
	$\gamma$	Unit weight in kg/cm <sup>3</sup>	0.0020
	$\alpha$	Reduction factor	1.0
	C	Average cohesion ,kg/cm <sup>2</sup>	0.35
	$\phi \phi \phi \phi$	Angle of wall friction between pile and soil, degree	20

**End bearing capacity of pile**

D	Pile Dia in cms	75
$\gamma$	Effective unit weight of soil at pile tip in kg/cm <sup>3</sup>	0.0022
$\phi$	Angle of internal friction around pile tip in degree	20
C <sub>p</sub>	Average cohesion at pile tip,kg/cm <sup>2</sup>	0.35

**Location 4****Frictional capacity of pile**

Layer 1			
		Location	Dahej
	D	Stem dia , cm	90
	L	Length of pile L1, cm	440
	K	Coefficient of earth pressure	1.0
	$\gamma$	Unit weight in kg/cm <sup>3</sup>	0.0018
	$\alpha$	Reduction factor	1.0
	C	Average cohesion ,kg/cm <sup>2</sup>	0.36
	$\phi \phi \phi \phi$	Angle of wall friction between pile and soil, degree	0
Layer 2			
	D	Stem dia , cm	90
	L	Length of pile L2, cm	360
	K	Coefficient of earth pressure	1.0
	$\gamma$	Unit weight in kg/cm <sup>3</sup>	0.00183
	$\alpha$	Reduction factor	0.6
	C	Average cohesion ,kg/cm <sup>2</sup>	0.81
	$\phi \phi \phi \phi$	Angle of wall friction between pile and soil, degree	0
Layer 3			
	D	Stem dia , cm	90
	L	Length of pile L3, cm	600
	K	Coefficient of earth pressure	1.0
	$\gamma$	Unit weight in kg/cm <sup>3</sup>	0.0020
	$\alpha$	Reduction factor	0.4
	C	Average cohesion ,kg/cm <sup>2</sup>	1.1
	$\phi \phi \phi \phi$	Angle of wall friction between pile and soil, degree	0

**End bearing capacity of pile**

D	Pile Dia in cms	90
$\gamma$	Effective unit weight of soil at pile tip in kg/cm <sup>3</sup>	0.0022
$\phi$	Angle of internal friction around pile tip in degree	0
C <sub>p</sub>	Average cohesion at pile tip,kg/cm <sup>2</sup>	1.1

**Location 5****Frictional capacity of pile**

Layer 1			
		Location	Rajasthan

	D	Stem dia , cm	75
	L	Length of pile L1, cm	250
	K	Coefficient of earth pressure	1.0
	$\square$	Unit weight in kg/cm <sup>3</sup>	0.0018
	$\alpha$	Reduction factor	1.0
	C	Average cohesion ,kg/cm <sup>2</sup>	0
	$\square \square \square \square$	Angle of wall friction between pile and soil, degree	21
Layer 2			
	D	Stem dia , cm	75
	L	Length of pile L2, cm	480
	K	Coefficient of earth pressure	1.0
	$\square$	Unit weight in kg/cm <sup>3</sup>	0.00183
	$\alpha$	Reduction factor	1.0
	C	Average cohesion ,kg/cm <sup>2</sup>	0
	$\square \square \square \square$	Angle of wall friction between pile and soil, degree	25
Layer 3			
	D	Stem dia , cm	75
	L	Length of pile L3, cm	500
	K	Coefficient of earth pressure	1.0
	$\square$	Unit weight in kg/cm <sup>3</sup>	0.0020
	$\alpha$	Reduction factor	1.0
	C	Average cohesion ,kg/cm <sup>2</sup>	0
	$\square \square \square \square$	Angle of wall friction between pile and soil, degree	32

**End bearing capacity of pile**

D	Pile Dia in cms	75
$\square$	Effective unit weight of soil at pile tip in kg/cm <sup>3</sup>	0.0022
$\emptyset$	Angle of internal friction around pile tip in degree	32
C <sub>p</sub>	Average cohesion at pile tip,kg/cm <sup>2</sup>	0

**SOFTWARE COMPUTED DATA**

The data and soil test results are input for the software to work. These data inputted will compute the pile capacity based on the formula we have derived. The software computed results are as shown below:-

**LOCATION 1**

<b>Layer 1</b>				
<b>Frictional capacity of pile</b>				
<b>Ultimate frictional capacity (Q<sub>u</sub>)<sub>f</sub> = [Σ K x Pdi x tan <math>\square</math> x As] + [<math>\square</math> x C x A<sub>s</sub>]</b>				<b>Location</b>
<b>[Granular soil + Cohesive soil]</b>				<b>Vasad</b>
1	D	Stem dia , cm	Given	45
2	L	Length of pile L1, cm	Given	200
3	A <sub>p</sub>	C/S area of base of pile , cm <sup>2</sup>	A <sub>p</sub> =(π/4) D <sup>2</sup>	1590
4	K	Coefficient of earth pressure	K is taken as 1.0	1.0
5	Pdi	Top overburden pressure (Pdi) <sub>top</sub> , kg/cm <sup>2</sup>	(Pdi) <sub>top</sub> is always zero	0
		Bottom overburden pressure (Pdi) <sub>bottom</sub> , kg/cm <sup>2</sup>	(Pdi) <sub>bottom</sub> = (Pdi) <sub>top</sub> + γ L	0.38
		Average overburden pressure , kg/cm <sup>2</sup>	Avg of (Pdi) <sub>top</sub> & (Pdi) <sub>bottom</sub>	0.19
6	$\square$	Unit weight in kg/cm <sup>3</sup>	Given	0.0019
7	A	Reduction factor	Refer Fig 1	1.0
8	C	Average cohesion ,kg/cm <sup>2</sup>	Given	0.9
9	$\square \square \square \square$	Angle of wall friction between pile and soil, degree	Given	21
1	A <sub>s</sub>	Surface area of pile shaft in cm <sup>2</sup>	A <sub>s</sub> = π D L	28274

0				
1 1	$(Q_u)_f$	Ultimate skin frictional resistance, MT	$(Q_u)_f = [k \times P_{di} \times \tan \delta \times A_s] + [\alpha \times C \times A_s]$	27.51
1 2	FOS	Factor of safety	Generally 2.5	2.5
1 3	$(Q_s)_f$	Safe skin frictional resistance in MT	$(Q_s)_f = (Q_u)_f / \text{FOS}$	11.0
<b>Layer 2</b>				
<b>Frictional capacity of pile</b>				
<b>Ultimate frictional capacity <math>(Q_u)_f = [\Sigma K \times P_{di} \times \tan \phi \times A_s] + [\phi \times C \times A_s]</math> [Granular soil + Cohesive soil]</b>				<b>Location</b> Vasad
1	D	Stem dia , cm	Given	45
2	L	Length of pile L2, cm	Given	350
3	$A_p$	C/S area of base of pile , $\text{cm}^2$	$A_p = (\pi/4) D^2$	1590
4	K	Coefficient of earth pressure	K is taken as 1.0	1.0
5	$P_{di}$	Top overburden pressure $(P_{di})_{top}$ , $\text{kg/cm}^2$	$(P_{di})_{top}$ is always zero	0.38
		Bottom overburden pressure $(P_{di})_{bottom}$ , $\text{kg/cm}^2$	$(P_{di})_{bottom} = (P_{di})_{top} + \gamma L$	1.05
		Average overburden pressure , $\text{kg/cm}^2$	Avg of $(P_{di})_{top}$ & $(P_{di})_{bottom}$	0.71
6	$\phi$	Unit weight in $\text{kg/cm}^3$	Given	0.0019
7	A	Reduction factor	Refer Fig 1	1.0
8	C	Average cohesion , $\text{kg/cm}^2$	Given	0.3
9	$\phi \phi \phi$ $\phi \phi$	Angle of wall friction between pile and soil, degree	Given	19
1 0	$A_s$	Surface area of pile shaft in $\text{cm}^2$	$A_s = \pi D L$	49480
1 1	$(Q_u)_f$	Ultimate skin frictional resistance, MT	$(Q_u)_f = [k \times P_{di} \times \tan \delta \times A_s] + [\alpha \times C \times A_s]$	26.98
1 2	FOS	Factor of safety	Generally 2.5	2.5
1 3	$(Q_s)_f$	Safe skin frictional resistance in MT	$(Q_s)_f = (Q_u)_f / \text{FOS}$	10.8
<b>Layer 3</b>				
<b>Frictional capacity of pile</b>				
<b>Ultimate frictional capacity <math>(Q_u)_f = [\Sigma K \times P_{di} \times \tan \phi \times A_s] + [\phi \times C \times A_s]</math> [Granular soil + Cohesive soil]</b>				<b>Location</b> Vasad
1	D	Stem dia , cm	Given	45
2	L	Length of pile L3, cm	Given	425
3	$A_p$	C/S area of base of pile , $\text{cm}^2$	$A_p = (\pi/4) D^2$	1590
4	K	Coefficient of earth pressure	K is taken as 1.0	1.0
5	$P_{di}$	Top overburden pressure $(P_{di})_{top}$ , $\text{kg/cm}^2$	$(P_{di})_{top}$ is always zero	1.05
		Bottom overburden pressure $(P_{di})_{bottom}$ , $\text{kg/cm}^2$	$(P_{di})_{bottom} = (P_{di})_{top} + \gamma L$	1.85
		Average overburden pressure , $\text{kg/cm}^2$	Avg of $(P_{di})_{top}$ & $(P_{di})_{bottom}$	1.45
6	$\phi$	Unit weight in $\text{kg/cm}^3$	Given	0.0019
7	A	Reduction factor	Refer Fig 1	1.0
8	C	Average cohesion , $\text{kg/cm}^2$	Given	0.3
9	$\phi \phi \phi \phi$ $\phi$	Angle of wall friction between pile and soil, degree	Given	23
1 0	$A_s$	Surface area of pile shaft in $\text{cm}^2$	$A_s = \pi D L$	60083
1 1	$(Q_u)_f$	Ultimate skin frictional resistance, MT	$(Q_u)_f = [k \times P_{di} \times \tan \delta \times A_s] + [\alpha \times C \times A_s]$	54.97
1 2	FOS	Factor of safety	Generally 2.5	2.5

1 3	$(Q_s)_f$	Safe skin frictional resistance in MT	$(Q_s)_f = (Q_u)_f / \text{FOS}$	22.0
<b>End bearing capacity of pile</b>				
<b><math>(Q_u)_b = [A_p(1/2 D \times \gamma \times N_\phi + P_d \times N_q)] + [A_p \times N_c \times C_p]</math> [Granular soil + Cohesive soil]</b>				
1	D	Pile Dia in cms	Given	45
2	$A_p$	Cross Section area of base of pile in $\text{cm}^2$	$A_p = (\pi/4) D^2$	1590
3	$\gamma$	Effective unit weight of soil at pile tip in $\text{kg/cm}^3$	Given	0.0021
4	$\phi$	Angle of internal friction around pile tip in degree	Given	23
5	$N_\phi$	Bearing capacity factor based on $\phi$ at pile tip	$N_\phi = 2 [e^{\pi \tan(\phi)} \times \tan^2(45 + \phi/2) + 1] \times \tan(\phi)$	8.20
6	$P_d$	Effective overburden pressure at pile tip $\text{kg/cm}^2$	$P_d = (P_{di})_{\text{bottom}}$	1.85
7	$N_q$	Bearing capacity factor based on $\phi$ at pile tip	Refer Fig 2	7.4
8	$N_c$	Bearing capacity factor usually taken as 9	$N_c$ is always 9.0 for deep foundation	9
9	$C_p$	Average cohesion at pile tip, $\text{kg/cm}^2$	Given	0.3
1 0	$(Q_u)_b$	Ultimate end bearing resistance, MT	$(Q_u)_b = [A_p \times (0.5 \times D \times \gamma \times N_\phi + P_d \times N_q) + [A_p \times N_c \times C_p]]$	26.72
1 1	FOS	Factor of safety	Generally 2.5	2.5
1 2	$(Q_s)_b$	Safe end bearing resistance in MT	$(Q_s)_b = (Q_u)_b / \text{FOS}$	10.7
<b><math>Q_s = \text{Safe capacity of pile in compression, MT}</math></b>			<b><math>Q_s = (Q_s)_f + (Q_s)_b</math></b>	<b>54.5</b>
<b>L = Total length of pile in M</b>			<b><math>L = L_1 + L_2 + L_3</math></b>	<b>9.8</b>

**LOCATION 2**

<b>Layer 1</b>				
<b>Frictional capacity of pile</b>				
<b>Ultimate frictional capacity <math>(Q_u)_f = [\sum K \times P_{di} \times \tan \alpha \times A_s] + [\gamma \times C \times A_s]</math> [Granular soil + Cohesive soil]</b>				<b>Location</b>
				Surat
1	D	Stem dia , cm	Given	60
2	L	Length of pile L1, cm	Given	100
3	$A_p$	C/S area of base of pile , $\text{cm}^2$	$A_p = (\pi/4) D^2$	2827
4	K	Coefficient of earth pressure	K is taken as 1.0	1.0
5	$P_{di}$	Top overburden pressure $(P_{di})_{\text{top}}$ , $\text{kg/cm}^2$	$(P_{di})_{\text{top}}$ is always zero	0
		Bottom overburden pressure $(P_{di})_{\text{bottom}}$ , $\text{kg/cm}^2$	$(P_{di})_{\text{bottom}} = (P_{di})_{\text{top}} + \gamma L$	0.18
		Average overburden pressure , $\text{kg/cm}^2$	Avg of $(P_{di})_{\text{top}}$ & $(P_{di})_{\text{bottom}}$	0.09
6	$\gamma$	Unit weight in $\text{kg/cm}^3$	Given	0.0018
7	$\alpha$	Reduction factor	Refer Fig 1	1.0
8	C	Average cohesion , $\text{kg/cm}^2$	Given	0.4
9	$\alpha \alpha \alpha \alpha$	Angle of wall friction between pile and soil, degree	Given	12
1 0	$A_s$	Surface area of pile shaft in $\text{cm}^2$	$A_s = \pi D L$	18850
1 1	$(Q_u)_f$	Ultimate skin frictional resistance, MT	$(Q_u)_f = [K \times P_{di} \times \tan \alpha \times A_s] + [\alpha \times C \times A_s]$	7.90
1 2	FOS	Factor of safety	Generally 2.5	2.5
1	$(Q_s)_f$	Safe skin frictional resistance in MT	$(Q_s)_f = (Q_u)_f / \text{FOS}$	3.2

3				
<b>Layer 2</b>				
<b>Frictional capacity of pile</b>				
<b>Ultimate frictional capacity <math>(Q_u)_f = [\Sigma K \times Pdi \times \tan \phi \times As] + [\phi \times C \times As]</math></b> <b>[Granular soil + Cohesive soil]</b>				<b>Location</b> Surat
1	D	Stem dia , cm	Given	60
2	L	Length of pile L2, cm	Given	400
3	Ap	C/S area of base of pile , cm <sup>2</sup>	$Ap = (\pi/4) D^2$	2827
4	K	Coefficient of earth pressure	K is taken as 1.0	1.0
5	Pdi	Top overburden pressure $(Pdi)_{top}$ , kg/cm <sup>2</sup>	$(Pdi)_{top}$ is always zero	0.18
		Bottom overburden pressure $(Pdi)_{bottom}$ , kg/cm <sup>2</sup>	$(Pdi)_{bottom} = (Pdi)_{top} + \gamma L$	0.92
		Average overburden pressure , kg/cm <sup>2</sup>	Avg of $(Pdi)_{top}$ & $(Pdi)_{bottom}$	0.55
6	$\gamma$	Unit weight in kg/cm <sup>3</sup>	Given	0.00185
7	$\alpha$	Reduction factor	Refer Fig 1	1.0
8	C	Average cohesion ,kg/cm <sup>2</sup>	Given	0.32
9	$\phi$	Angle of wall friction between pile and soil, degree	Given	19
10	As	Surface area of pile shaft in cm <sup>2</sup>	$As = \pi D L$	75398
11	$(Q_u)_f$	Ultimate skin frictional resistance, MT	$(Q_u)_f = [k \times Pdi \times \tan \delta \times As] + [\alpha \times C \times As]$	38.41
12	FOS	Factor of safety	Generally 2.5	2.5
13	$(Q_s)_f$	Safe skin frictional resistance in MT	$(Q_s)_f = (Q_u)_f / FOS$	15.4
<b>Layer 3</b>				
<b>Frictional capacity of pile</b>				
<b>Ultimate frictional capacity <math>(Q_u)_f = [\Sigma K \times Pdi \times \tan \phi \times As] + [\phi \times C \times As]</math></b> <b>[Granular soil + Cohesive soil]</b>				<b>Location</b> Surat
1	D	Stem dia , cm	Given	60
2	L	Length of pile L3, cm	Given	350
3	Ap	C/S area of base of pile , cm <sup>2</sup>	$Ap = (\pi/4) D^2$	2827
4	K	Coefficient of earth pressure	K is taken as 1.0	1.0
5	Pdi	Top overburden pressure $(Pdi)_{top}$ , kg/cm <sup>2</sup>	$(Pdi)_{top}$ is always zero	0.92
		Bottom overburden pressure $(Pdi)_{bottom}$ , kg/cm <sup>2</sup>	$(Pdi)_{bottom} = (Pdi)_{top} + \gamma L$	1.59
		Average overburden pressure , kg/cm <sup>2</sup>	Avg of $(Pdi)_{top}$ & $(Pdi)_{bottom}$	1.26
6	$\gamma$	Unit weight in kg/cm <sup>3</sup>	Given	0.0019
7	$\alpha$	Reduction factor	Refer Fig 1	1.0
8	C	Average cohesion ,kg/cm <sup>2</sup>	Given	0.36
9	$\phi$	Angle of wall friction between pile and soil, degree	Given	24
10	As	Surface area of pile shaft in cm <sup>2</sup>	$As = \pi D L$	65973
11	$(Q_u)_f$	Ultimate skin frictional resistance, MT	$(Q_u)_f = [k \times Pdi \times \tan \delta \times As] + [\alpha \times C \times As]$	60.64
12	FOS	Factor of safety	Generally 2.5	2.5
13	$(Q_s)_f$	Safe skin frictional resistance in MT	$(Q_s)_f = (Q_u)_f / FOS$	24.3
<b>End bearing capacity of pile</b>				



$(Q_u)_b = [A_p(1/2 D \times \gamma \times N_q + P_d \times N_q)] + [A_p \times N_c \times C_p]$ [Granular soil + Cohesive soil]				
1	D	Pile Dia in cms	Given	60
2	$A_p$	Cross Section area of base of pile in $\text{cm}^2$	$A_p = (\pi/4) D^2$	2827
3	$\gamma$	Effective unit weight of soil at pile tip in $\text{kg/cm}^3$	Given	0.0021
4	$\phi$	Angle of internal friction around pile tip in degree	Given	24
5	$N_q$	Bearing capacity factor based on $\phi$ at pile tip	$N_q = 2 [e^{\pi \tan(\phi)} \tan^2(45 + \phi/2) + 1] \times \tan(\phi)$	9.44
6	$P_d$	Effective overburden pressure at pile tip $\text{kg/cm}^2$	$P_d = (P_{di})_{\text{bottom}}$	1.59
7	$N_q$	Bearing capacity factor based on $\phi$ at pile tip	Refer Fig 2	8.5
8	$N_c$	Bearing capacity factor usually taken as 9	$N_c$ is always 9.0 for deep foundation	9
9	$C_p$	Average cohesion at pile tip, $\text{kg/cm}^2$	Given	0.36
10	$(Q_u)_b$	Ultimate end bearing resistance, MT	$(Q_u)_b = [A_p \times (0.5 \times D \times \gamma \times N_q + P_d \times N_q) + [A_p \times N_c \times C_p]]$	49.28
11	FOS	Factor of safety	Generally 2.5	2.5
12	$(Q_s)_b$	Safe end bearing resistance in MT	$(Q_s)_b = (Q_u)_b / \text{FOS}$	19.7
<b>Qs = Safe capacity of pile in compression, MT</b>			<b><math>Q_s = (Q_s)_f + (Q_s)_b</math></b>	<b>62.5</b>
<b>L = Total length of pile in M</b>			<b><math>L = L_1 + L_2 + L_3</math></b>	<b>8.5</b>

**LOCATION 3**

<b>Layer 1</b>				
<b>Frictional capacity of pile</b>				
<b>Ultimate frictional capacity <math>(Q_u)_f = [\sum K \times P_{di} \times \tan \alpha \times A_s] + [\gamma \times C \times A_s]</math></b> [Granular soil + Cohesive soil]				<b>Location</b> Bharuch
1	D	Stem dia, cm	Given	75
2	L	Length of pile L1, cm	Given	250
3	$A_p$	C/S area of base of pile, $\text{cm}^2$	$A_p = (\pi/4) D^2$	4418
4	K	Coefficient of earth pressure	K is taken as 1.0	1.0
5	Pdi	Top overburden pressure $(P_{di})_{\text{top}}$ , $\text{kg/cm}^2$	$(P_{di})_{\text{top}}$ is always zero	0
		Bottom overburden pressure $(P_{di})_{\text{bottom}}$ , $\text{kg/cm}^2$	$(P_{di})_{\text{bottom}} = (P_{di})_{\text{top}} + \gamma L$	0.45
		Average overburden pressure, $\text{kg/cm}^2$	Avg of $(P_{di})_{\text{top}}$ & $(P_{di})_{\text{bottom}}$	0.23
6	$\gamma$	Unit weight in $\text{kg/cm}^3$	Given	0.0018
7	$\alpha$	Reduction factor	Refer Fig 1	1.0
8	C	Average cohesion, $\text{kg/cm}^2$	Given	0.36
9	$\alpha$	Angle of wall friction between pile and soil, degree	Given	10
10	$A_s$	Surface area of pile shaft in $\text{cm}^2$	$A_s = \pi D L$	58905
11	$(Q_u)_f$	Ultimate skin frictional resistance, MT	$(Q_u)_f = [K \times P_{di} \times \tan \alpha \times A_s] + [\gamma \times C \times A_s]$	23.56
12	FOS	Factor of safety	Generally 2.5	2.5
13	$(Q_s)_f$	Safe skin frictional resistance in MT	$(Q_s)_f = (Q_u)_f / \text{FOS}$	9.4
<b>Layer 2</b>				

Frictional capacity of pile				
Ultimate frictional capacity $(Q_u)_f = [\Sigma K \times Pdi \times \tan \phi \times As] + [\phi \times C \times As]$ [Granular soil + Cohesive soil]				Location
				Bharuch
1	D	Stem dia , cm	Given	75
2	L	Length of pile L2, cm	Given	400
3	Ap	C/S area of base of pile , $cm^2$	$Ap = (\pi/4) D^2$	4418
4	K	Coefficient of earth pressure	K is taken as 1.0	1.0
5	Pdi	Top overburden pressure $(Pdi)_{top}$ , $kg/cm^2$	$(Pdi)_{top}$ is always zero	0.45
		Bottom overburden pressure $(Pdi)_{bottom}$ , $kg/cm^2$	$(Pdi)_{bottom} = (Pdi)_{top} + \gamma L$	1.18
		Average overburden pressure , $kg/cm^2$	Avg of $(Pdi)_{top}$ & $(Pdi)_{bottom}$	0.82
6	$\gamma$	Unit weight in $kg/cm^3$	Given	0.00183
7	$\alpha$	Reduction factor	Refer Fig 1	1.0
8	C	Average cohesion , $kg/cm^2$	Given	0.33
9	$\phi$	Angle of wall friction between pile and soil, degree	Given	15
10	As	Surface area of pile shaft in $cm^2$	$As = \pi D L$	94248
11	$(Q_u)_f$	Ultimate skin frictional resistance, MT	$(Q_u)_f = [k \times Pdi \times \tan \delta \times As] + [\alpha \times C \times As]$	51.77
12	FOS	Factor of safety	Generally 2.5	2.5
13	$(Q_s)_f$	Safe skin frictional resistance in MT	$(Q_s)_f = (Q_u)_f / FOS$	20.7
Layer 3				
Frictional capacity of pile				
Ultimate frictional capacity $(Q_u)_f = [\Sigma K \times Pdi \times \tan \phi \times As] + [\phi \times C \times As]$ [Granular soil + Cohesive soil]				Location
				Bharuch
1	D	Stem dia , cm	Given	75
2	L	Length of pile L3, cm	Given	350
3	Ap	C/S area of base of pile , $cm^2$	$Ap = (\pi/4) D^2$	4418
4	K	Coefficient of earth pressure	K is taken as 1.0	1.0
5	Pdi	Top overburden pressure $(Pdi)_{top}$ , $kg/cm^2$	$(Pdi)_{top}$ is always zero	1.18
		Bottom overburden pressure $(Pdi)_{bottom}$ , $kg/cm^2$	$(Pdi)_{bottom} = (Pdi)_{top} + \gamma L$	1.87
		Average overburden pressure , $kg/cm^2$	Avg of $(Pdi)_{top}$ & $(Pdi)_{bottom}$	1.53
6	$\gamma$	Unit weight in $kg/cm^3$	Given	0.0020
7	$\alpha$	Reduction factor	Refer Fig 1	1.0
8	C	Average cohesion , $kg/cm^2$	Given	0.35
9	$\phi$	Angle of wall friction between pile and soil, degree	Given	20
10	As	Surface area of pile shaft in $cm^2$	$As = \pi D L$	82467
11	$(Q_u)_f$	Ultimate skin frictional resistance, MT	$(Q_u)_f = [k \times Pdi \times \tan \delta \times As] + [\alpha \times C \times As]$	74.66
12	FOS	Factor of safety	Generally 2.5	2.5
13	$(Q_s)_f$	Safe skin frictional resistance in MT	$(Q_s)_f = (Q_u)_f / FOS$	29.9
End bearing capacity of pile				

$(Q_u)_b = [A_p(1/2 D \times \gamma \times N_\phi + P_d \times N_q)] + [A_p \times N_c \times C_p]$ [Granular soil + Cohesive soil]				
1	D	Pile Dia in cms	Given	75
2	$A_p$	Cross Section area of base of pile in $\text{cm}^2$	$A_p = (\pi/4) D^2$	4418
3	$\gamma$	Effective unit weight of soil at pile tip in $\text{kg/cm}^3$	Given	0.0022
4	$\phi$	Angle of internal friction around pile tip in degree	Given	20
5	$N_\phi$	Bearing capacity factor based on $\phi$ at pile tip	$N_\phi = 2 [e^{\pi \tan(\phi)} \times \tan^2(45 + \phi/2) + 1] \times \tan(\phi)$	5.39
6	$P_d$	Effective overburden pressure at pile tip $\text{kg/cm}^2$	$P_d = (P_{di})_{\text{bottom}}$	1.87
7	$N_q$	Bearing capacity factor based on $\phi$ at pile tip	Refer Fig 2	4.8
8	$N_c$	Bearing capacity factor usually taken as 9	$N_c$ is always 9.0 for deep foundation	9
9	$C_p$	Average cohesion at pile tip, $\text{kg/cm}^2$	Given	0.35
10	$(Q_u)_b$	Ultimate end bearing resistance, MT	$(Q_u)_b = [A_p \times (0.5 \times D \times \gamma \times N_\phi + P_d \times N_q) + [A_p \times N_c \times C_p]]$	55.63
11	FOS	Factor of safety	Generally 2.5	2.5
12	$(Q_s)_b$	Safe end bearing resistance in MT	$(Q_s)_b = (Q_u)_b / \text{FOS}$	22.3
<b><math>Q_s</math> = Safe capacity of pile in compression, MT</b>			<b><math>Q_s = (Q_s)_f + (Q_s)_b</math></b>	<b>82.2</b>
<b>L = Total length of pile in M</b>			<b><math>L = L_1 + L_2 + L_3</math></b>	<b>10.0</b>

**LOCATION 4**

<b>Layer 1</b>				
<b>Frictional capacity of pile</b>				
<b>Ultimate frictional capacity <math>(Q_u)_f = [\sum K \times P_{di} \times \tan \phi \times A_s] + [\alpha \times C \times A_s]</math></b> [Granular soil + Cohesive soil]				<b>Location</b> Dahej
1	D	Stem dia, cm	Given	90
2	L	Length of pile L1, cm	Given	440
3	$A_p$	C/S area of base of pile, $\text{cm}^2$	$A_p = (\pi/4) D^2$	6362
4	K	Coefficient of earth pressure	K is taken as 1.0	1.0
5	$P_{di}$	Top overburden pressure $(P_{di})_{\text{top}}$ , $\text{kg/cm}^2$	$(P_{di})_{\text{top}}$ is always zero	0
		Bottom overburden pressure $(P_{di})_{\text{bottom}}$ , $\text{kg/cm}^2$	$(P_{di})_{\text{bottom}} = (P_{di})_{\text{top}} + \gamma L$	0.80
		Average overburden pressure, $\text{kg/cm}^2$	Avg of $(P_{di})_{\text{top}}$ & $(P_{di})_{\text{bottom}}$	0.40
6	$\gamma$	Unit weight in $\text{kg/cm}^3$	Given	0.0018
7	$\alpha$	Reduction factor	Refer Fig 1	1.0
8	C	Average cohesion, $\text{kg/cm}^2$	Given	0.36
9	$\phi$	Angle of wall friction between pile and soil, degree	Given	0
10	$A_s$	Surface area of pile shaft in $\text{cm}^2$	$A_s = \pi D L$	124407
11	$(Q_u)_f$	Ultimate skin frictional resistance, MT	$(Q_u)_f = [K \times P_{di} \times \tan \phi \times A_s] + [\alpha \times C \times A_s]$	44.79
12	FOS	Factor of safety	Generally 2.5	2.5
13	$(Q_s)_f$	Safe skin frictional resistance in MT	$(Q_s)_f = (Q_u)_f / \text{FOS}$	17.9
<b>Layer 2</b>				
<b>Frictional capacity of pile</b>				
<b>Ultimate frictional capacity <math>(Q_u)_f = [\sum K \times P_{di} \times \tan \phi \times A_s] + [\alpha \times C \times A_s]</math></b>				<b>Location</b>

[Granular soil + Cohesive soil]				Dahej
1	D	Stem dia , cm	Given	90
2	L	Length of pile L2, cm	Given	360
3	Ap	C/S area of base of pile , cm <sup>2</sup>	$A_p = (\pi/4) D^2$	6362
4	K	Coefficient of earth pressure	K is taken as 1.0	1.0
5	Pdi	Top overburden pressure (Pdi) <sub>top</sub> , kg/cm <sup>2</sup>	(Pdi) <sub>top</sub> is always zero	0.80
		Bottom overburden pressure (Pdi) <sub>bottom</sub> , kg/cm <sup>2</sup>	(Pdi) <sub>bottom</sub> = (Pdi) <sub>top</sub> + $\gamma L$	1.46
		Average overburden pressure , kg/cm <sup>2</sup>	Avg of (Pdi) <sub>top</sub> & (Pdi) <sub>bottom</sub>	1.13
6	$\gamma$	Unit weight in kg/cm <sup>3</sup>	Given	0.00183
7	$\alpha$	Reduction factor	Refer Fig 1	0.6
8	C	Average cohesion ,kg/cm <sup>2</sup>	Given	0.81
9	$\delta$	Angle of wall friction between pile and soil, degree	Given	0
10	As	Surface area of pile shaft in cm <sup>2</sup>	$A_s = \pi D L$	101788
11	(Qu) <sub>f</sub>	Ultimate skin frictional resistance, MT	$(Q_u)_f = [k \times Pdi \times \tan \delta \times A_s] + [\alpha \times C \times A_s]$	49.47
12	FOS	Factor of safety	Generally 2.5	2.5
13	(Qs) <sub>f</sub>	Safe skin frictional resistance in MT	$(Q_s)_f = (Q_u)_f / FOS$	19.8
<b>Layer 3</b>				
<b>Frictional capacity of pile</b>				
<b>Ultimate frictional capacity (Qu)<sub>f</sub> = <math>[\sum K \times Pdi \times \tan \delta \times A_s] + [\alpha \times C \times A_s]</math></b>				<b>Location</b>
<b>[Granular soil + Cohesive soil]</b>				<b>Dahej</b>
1	D	Stem dia , cm	Given	90
2	L	Length of pile L3, cm	Given	600
3	Ap	C/S area of base of pile , cm <sup>2</sup>	$A_p = (\pi/4) D^2$	6362
4	K	Coefficient of earth pressure	K is taken as 1.0	1.0
5	Pdi	Top overburden pressure (Pdi) <sub>top</sub> , kg/cm <sup>2</sup>	(Pdi) <sub>top</sub> is always zero	1.46
		Bottom overburden pressure (Pdi) <sub>bottom</sub> , kg/cm <sup>2</sup>	(Pdi) <sub>bottom</sub> = (Pdi) <sub>top</sub> + $\gamma L$	2.63
		Average overburden pressure , kg/cm <sup>2</sup>	Avg of (Pdi) <sub>top</sub> & (Pdi) <sub>bottom</sub>	2.04
6	$\gamma$	Unit weight in kg/cm <sup>3</sup>	Given	0.0020
7	$\alpha$	Reduction factor	Refer Fig 1	0.4
8	C	Average cohesion ,kg/cm <sup>2</sup>	Given	1.1
9	$\delta$	Angle of wall friction between pile and soil, degree	Given	0
10	As	Surface area of pile shaft in cm <sup>2</sup>	$A_s = \pi D L$	169646
11	(Qu) <sub>f</sub>	Ultimate skin frictional resistance, MT	$(Q_u)_f = [k \times Pdi \times \tan \delta \times A_s] + [\alpha \times C \times A_s]$	74.64
12	FOS	Factor of safety	Generally 2.5	2.5
13	(Qs) <sub>f</sub>	Safe skin frictional resistance in MT	$(Q_s)_f = (Q_u)_f / FOS$	29.9
<b>End bearing capacity of pile</b>				
<b>(Qu)<sub>b</sub> = <math>[A_p(1/2 D \times \gamma \times N_q + P_d \times N_q)] + [A_p \times N_c \times C_p]</math></b>				
<b>[Granular soil + Cohesive soil]</b>				
1	D	Pile Dia in cms	Given	90
2	Ap	Cross Section area of base of pile in cm <sup>2</sup>	$A_p = (\pi/4) D^2$	6362
3	$\gamma$	Effective unit weight of soil at pile tip in kg/cm <sup>3</sup>	Given	0.0022

4	$\phi$	Angle of internal friction around pile tip in degree	Given	0
5	$N_{\phi}$	Bearing capacity factor based on $\phi$ at pile tip	$N_{\phi} = 2 [ e^{\pi \tan(\phi)} * \tan^2(45+\phi/2) + 1 ] * \tan(\phi)$	0.00
6	$P_d$	Effective overburden pressure at pile tip $\text{kg/cm}^2$	$P_d = (P_{di})_{\text{bottom}}$	2.63
7	$N_q$	Bearing capacity factor based on $\phi$ at pile tip	Refer Fig 2	0.3
8	$N_c$	Bearing capacity factor usually taken as 9	$N_c$ is always 9.0 for deep foundation	9
9	$C_p$	Average cohesion at pile tip, $\text{kg/cm}^2$	Given	1.1
10	$(Q_u)_b$	Ultimate end bearing resistance, MT	$(Q_u)_b = [A_p \times (0.5 \times D \times \gamma \times N_{\gamma} + P_d \times N_q) + [A_p \times N_c \times C_p]]$	67.59
11	FOS	Factor of safety	Generally 2.5	2.5
12	$(Q_s)_b$	Safe end bearing resistance in MT	$(Q_s)_b = (Q_u)_b / \text{FOS}$	27.0
<b>Qs = Safe capacity of pile in compression, MT</b>			<b><math>Q_s = (Q_s)_f + (Q_s)_b</math></b>	<b>94.6</b>
<b>L = Total length of pile in M</b>			<b><math>L = L1 + L2 + L3</math></b>	<b>14.0</b>

**LOCATION 5**

<b>Layer 1</b>			
<b>Frictional capacity of pile</b>			
<b>Ultimate frictional capacity <math>(Q_u)_f = [\sum K \times P_{di} \times \tan \phi \times A_s] + [\gamma \times C \times A_s]</math></b> <b>[Granular soil + Cohesive soil]</b>			<b>Location</b> Rajasthan
1	D	Stem dia, cm	Given
2	L	Length of pile L1, cm	Given
3	$A_p$	C/S area of base of pile, $\text{cm}^2$	$A_p = (\pi/4) D^2$
4	K	Coefficient of earth pressure	K is taken as 1.0
5	$P_{di}$	Top overburden pressure $(P_{di})_{\text{top}}$ , $\text{kg/cm}^2$	$(P_{di})_{\text{top}}$ is always zero
		Bottom overburden pressure $(P_{di})_{\text{bottom}}$ , $\text{kg/cm}^2$	$(P_{di})_{\text{bottom}} = (P_{di})_{\text{top}} + \gamma L$
		Average overburden pressure, $\text{kg/cm}^2$	Avg of $(P_{di})_{\text{top}}$ & $(P_{di})_{\text{bottom}}$
6	$\gamma$	Unit weight in $\text{kg/cm}^3$	Given
7	$\alpha$	Reduction factor	Refer Fig 1
8	C	Average cohesion, $\text{kg/cm}^2$	Given
9	$\phi$	Angle of wall friction between pile and soil, degree	Given
10	$A_s$	Surface area of pile shaft in $\text{cm}^2$	$A_s = \pi D L$
11	$(Q_u)_f$	Ultimate skin frictional resistance, MT	$(Q_u)_f = [k \times P_{di} \times \tan \delta \times A_s] + [\alpha \times C \times A_s]$
12	FOS	Factor of safety	Generally 2.5
13	$(Q_s)_f$	Safe skin frictional resistance in MT	$(Q_s)_f = (Q_u)_f / \text{FOS}$
<b>Layer 2</b>			
<b>Frictional capacity of pile</b>			
<b>Ultimate frictional capacity <math>(Q_u)_f = [\sum K \times P_{di} \times \tan \phi \times A_s] + [\gamma \times C \times A_s]</math></b> <b>[Granular soil + Cohesive soil]</b>			<b>Location</b> Rajasthan
1	D	Stem dia, cm	Given
2	L	Length of pile L2, cm	Given
3	$A_p$	C/S area of base of pile, $\text{cm}^2$	$A_p = (\pi/4) D^2$

4	K	Coefficient of earth pressure	K is taken as 1.0	1.0
5	Pdi	Top overburden pressure (Pdi) <sub>top</sub> , kg/cm <sup>2</sup>	(Pdi) <sub>top</sub> is always zero	0.45
		Bottom overburden pressure (Pdi) <sub>bottom</sub> , kg/cm <sup>2</sup>	(Pdi) <sub>bottom</sub> = (Pdi) <sub>top</sub> + $\gamma$ L	1.33
		Average overburden pressure, kg/cm <sup>2</sup>	Avg of (Pdi) <sub>top</sub> & (Pdi) <sub>bottom</sub>	0.89
6	$\square$	Unit weight in kg/cm <sup>3</sup>	Given	0.00183
7	$\alpha$	Reduction factor	Refer Fig 1	1.0
8	C	Average cohesion, kg/cm <sup>2</sup>	Given	0
9	$\square \square \square \square$ $\square$	Angle of wall friction between pile and soil, degree	Given	25
10	As	Surface area of pile shaft in cm <sup>2</sup>	As = $\pi$ D L	113097
11	(Q <sub>u</sub> ) <sub>f</sub>	Ultimate skin frictional resistance, MT	(Q <sub>u</sub> ) <sub>f</sub> = [k x Pdi x tan $\delta$ x As] + [ $\alpha$ x C x As]	47.03
12	FOS	Factor of safety	Generally 2.5	2.5
13	(Q <sub>s</sub> ) <sub>f</sub>	Safe skin frictional resistance in MT	(Q <sub>s</sub> ) <sub>f</sub> = (Q <sub>u</sub> ) <sub>f</sub> / FOS	18.8
<b>Layer 3</b>				
<b>Frictional capacity of pile</b>				
<b>Ultimate frictional capacity (Q<sub>u</sub>)<sub>f</sub> = [<math>\Sigma</math> K x Pdi x tan <math>\square</math> x As] + [<math>\square</math> x C x As]</b>				<b>Location</b>
<b>[Granular soil + Cohesive soil]</b>				Rajasthan
1	D	Stem dia, cm	Given	75
2	L	Length of pile L3, cm	Given	500
3	Ap	C/S area of base of pile, cm <sup>2</sup>	Ap = ( $\pi/4$ ) D <sup>2</sup>	4418
4	K	Coefficient of earth pressure	K is taken as 1.0	1.0
5	Pdi	Top overburden pressure (Pdi) <sub>top</sub> , kg/cm <sup>2</sup>	(Pdi) <sub>top</sub> is always zero	1.33
		Bottom overburden pressure (Pdi) <sub>bottom</sub> , kg/cm <sup>2</sup>	(Pdi) <sub>bottom</sub> = (Pdi) <sub>top</sub> + $\gamma$ L	2.31
		Average overburden pressure, kg/cm <sup>2</sup>	Avg of (Pdi) <sub>top</sub> & (Pdi) <sub>bottom</sub>	1.82
6	$\square$	Unit weight in kg/cm <sup>3</sup>	Given	0.0020
7	$\alpha$	Reduction factor	Refer Fig 1	1.0
8	C	Average cohesion, kg/cm <sup>2</sup>	Given	0
9	$\square \square \square \square$ $\square$	Angle of wall friction between pile and soil, degree	Given	32
10	As	Surface area of pile shaft in cm <sup>2</sup>	As = $\pi$ D L	117810
11	(Q <sub>u</sub> ) <sub>f</sub>	Ultimate skin frictional resistance, MT	(Q <sub>u</sub> ) <sub>f</sub> = [k x Pdi x tan $\delta$ x As] + [ $\alpha$ x C x As]	133.86
12	FOS	Factor of safety	Generally 2.5	2.5
13	(Q <sub>s</sub> ) <sub>f</sub>	Safe skin frictional resistance in MT	(Q <sub>s</sub> ) <sub>f</sub> = (Q <sub>u</sub> ) <sub>f</sub> / FOS	53.5
<b>End bearing capacity of pile</b>				
<b>(Q<sub>u</sub>)<sub>b</sub> = [Ap(1/2 D x <math>\square</math> x N<math>\square</math> + P<sub>d</sub> x N<sub>q</sub>)] + [A<sub>p</sub> x N<sub>c</sub> x C<sub>p</sub>]</b>				
<b>[Granular soil + Cohesive soil]</b>				
1	D	Pile Dia in cms	Given	75
2	Ap	Cross Section area of base of pile in cm <sup>2</sup>	Ap = ( $\pi/4$ ) D <sup>2</sup>	4418
3	$\square$	Effective unit weight of soil at pile tip in kg/cm <sup>3</sup>	Given	0.0022
4	$\emptyset$	Angle of internal friction around pile tip in degree	Given	32
5	N $\square$	Bearing capacity factor based on $\emptyset$ at pile tip	N $\gamma$ = 2 [ e <sup><math>\pi \tan(\phi)</math></sup> * tan <sup>2</sup> (45+ $\phi/2$ ) + 1 ] * tan( $\phi$ )	30.21

6	Pd	Effective overburden pressure at pile tip kg/cm <sup>2</sup>	$Pd = (Pdi)_{\text{bottom}}$	2.31
7	N <sub>q</sub>	Bearing capacity factor based on Ø at pile tip	Refer Fig 2	29.0
8	N <sub>c</sub>	Bearing capacity factor usually taken as 9	Nc is always 9.0 for deep foundation	9
9	C <sub>p</sub>	Average cohesion at pile tip, kg/cm <sup>2</sup>	Given	0
10	(Q <sub>u</sub> ) <sub>b</sub>	Ultimate end bearing resistance, MT	$(Q_u)_b = [A_p \times (0.5 \times D \times \gamma \times N_\gamma + Pd \times N_q + [A_p \times N_c \times C_p])]$	306.44
11	FOS	Factor of safety	Generally 2.5	2.5
12	(Q <sub>s</sub> ) <sub>b</sub>	Safe end bearing resistance in MT	$(Q_s)_b = (Q_u)_b / \text{FOS}$	122.6
<b>Qs = Safe capacity of pile in compression, MT</b>			<b>Qs = (Qs)<sub>f</sub> + (Qs)<sub>b</sub></b>	<b>197.0</b>
<b>L = Total length of pile in M</b>			<b>L = L1 + L2 + L3</b>	<b>12.3</b>

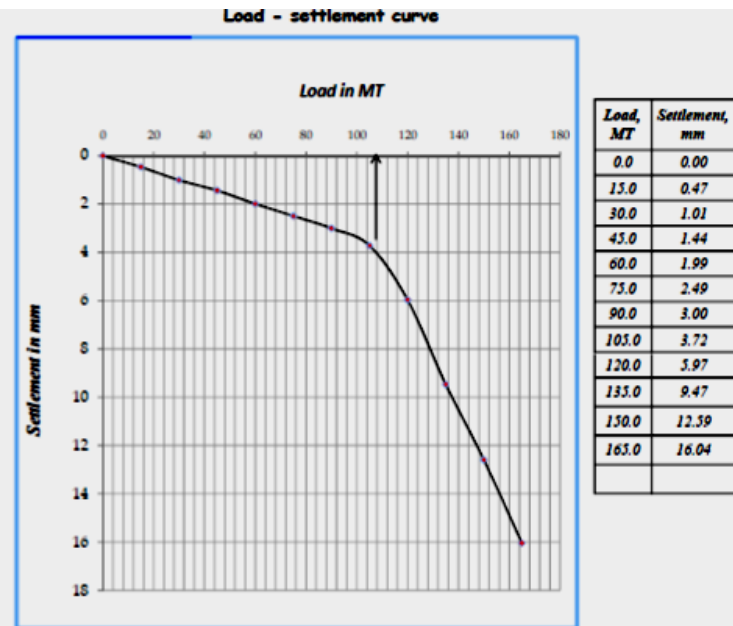
### PILE LOAD TEST DATA:-

First of all pile load test equipment is set up at the actual field, having attached 3-4 deformation dial gauges. Suitable load increments are given at a definite interval of the time. Also the settlement due to loads is also recorded. From this set of readings a graph of load v/s settlement is plotted.

Here pile load test data from actual site is given and is compared with our software.

### LOCATION 1

	Load in MT	Dial Gauge Readings (L.C - 0.01 mm)				Average Reading	Settlement in mm
		A	B	C	D		
1	0	2500	2500	2500	2500	2500.00	0.00
2	15	2450	2456	2455	2453	2453.50	0.47
3	30	2401	2399	2395	2403	2399.50	1.01
4	45	2356	2356	2359	2354	2356.25	1.44
5	60	2301	2303	2302	2299	2301.25	1.99
6	75	2255	2253	2246	2249	2250.75	2.49
7	90	2200	2196	2203	2201	2200.00	3.00
8	105	2134	2125	2127	2126	2128.00	3.72
9	120	1903	1905	1893	1910	1902.75	5.97
10	135	1560	1556	1548	1549	1553.25	9.47
11	150	1240	1243	1234	1246	1240.75	12.59
12	165	896	895	891	901	895.75	16.04



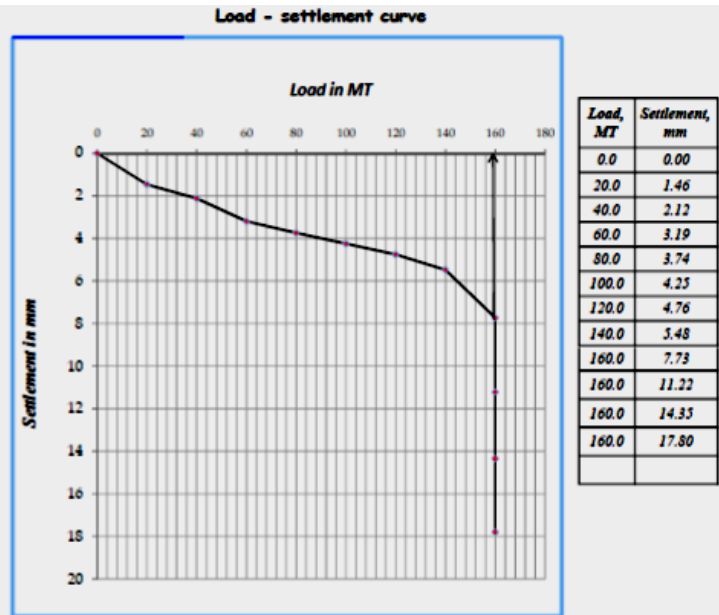
Safe pile capacity = Ultimate pile capacity / Factor of safety

$$= 114 / 2.5$$

$$= 56.4 \text{ MT}$$

## LOCATION 2

Sr. No.	Load in MT	Dial Gauge Readings (L.C - 0.01 mm)				Average Reading	Settlement in mm
		A	B	C	D		
1	0	3000	3000	3000	3000	3000.00	0.00
2	20	2900	2900	2930	2687	2854.25	1.46
3	40	2830	2800	2810	2713	2788.25	2.12
4	60	2856	2586	2693	2588	2680.75	3.19
5	80	2801	2533	2636	2533	2625.75	3.74
6	100	2755	2483	2580	2483	2575.25	4.25
7	120	2700	2426	2537	2435	2524.50	4.76
8	140	2634	2355	2461	2360	2452.50	5.48
9	160	2403	2135	2227	2144	2227.25	7.73
10	160	2060	1786	1882	1783	1877.75	11.22
11	160	1740	1473	1568	1480	1565.25	14.35
12	160	1396	1125	1225	1135	1220.25	17.80



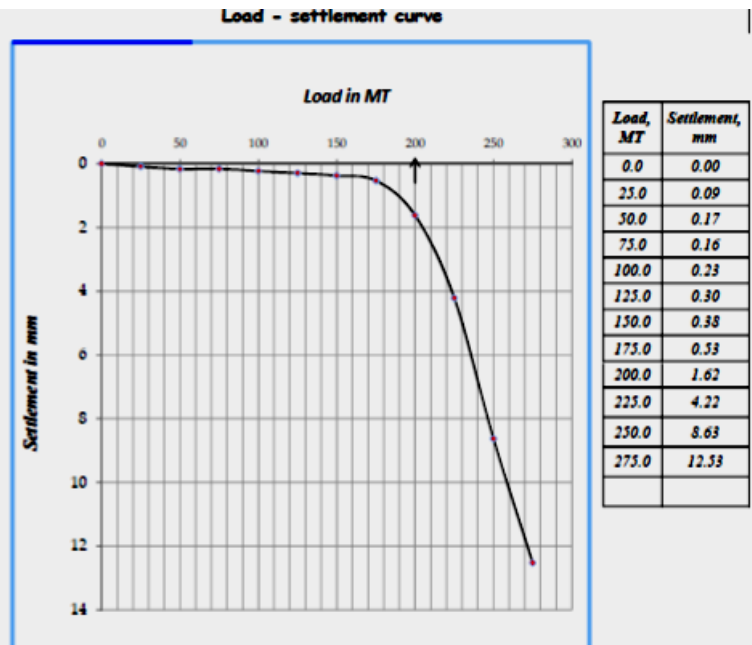
Safe pile capacity = Ultimate pile capacity / Factor of safety

$$= 160 / 2.5$$

$$= 64 \text{ MT}$$

## LOCATION 3

Sr. No.	Load in MT	Dial Gauge Readings (L.C - 0.01 mm)				Average Reading	Settlement in mm
		A	B	C	D		
1	0	3300	3300	3300	3300	3300	0.00
2	25	3290	3291	3295	3289	3291	0.09
3	50	3286	3285	3284	3279	3284	0.17
4	75	3281	3286	3285	3284	3284	0.16
5	100	3279	3280	3275	3274	3277	0.23
6	125	3270	3272	3276	3264	3271	0.30
7	150	3260	3270	3259	3261	3263	0.38
8	175	3247	3247	3247	3247	3247	0.53
9	200	3138	3137	3135	3141	3138	1.62
10	225	2877	2879	2884	2873	2878	4.22
11	250	2437	2430	2441	2439	2437	8.63
12	275	2047	2041	2054	2045	2047	12.53



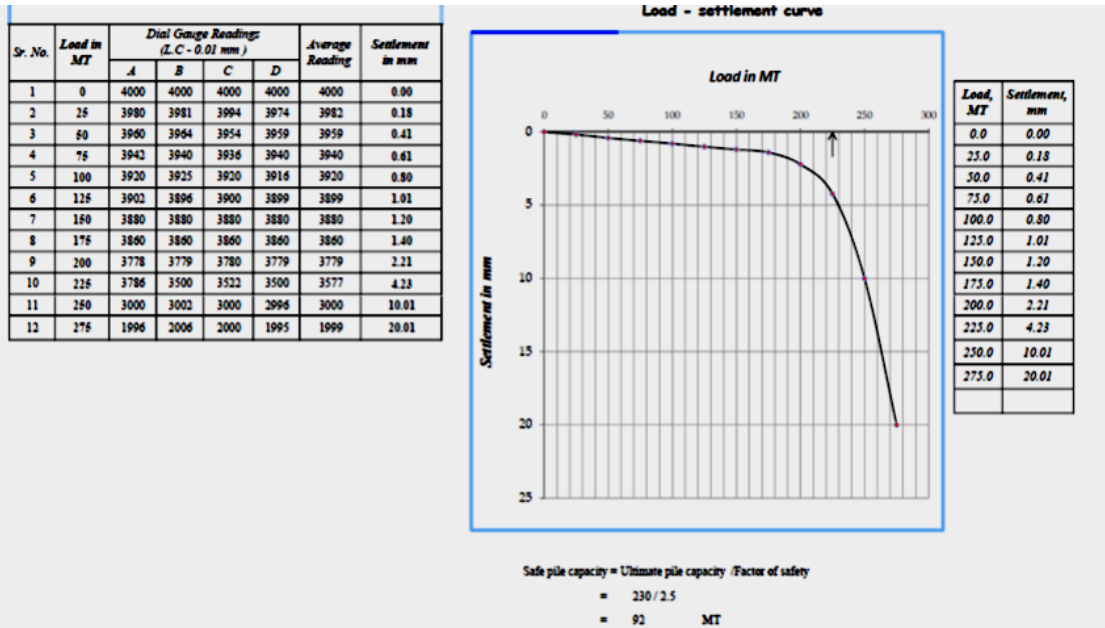
Safe pile capacity = Ultimate pile capacity / Factor of safety

$$= 200 / 2.5$$

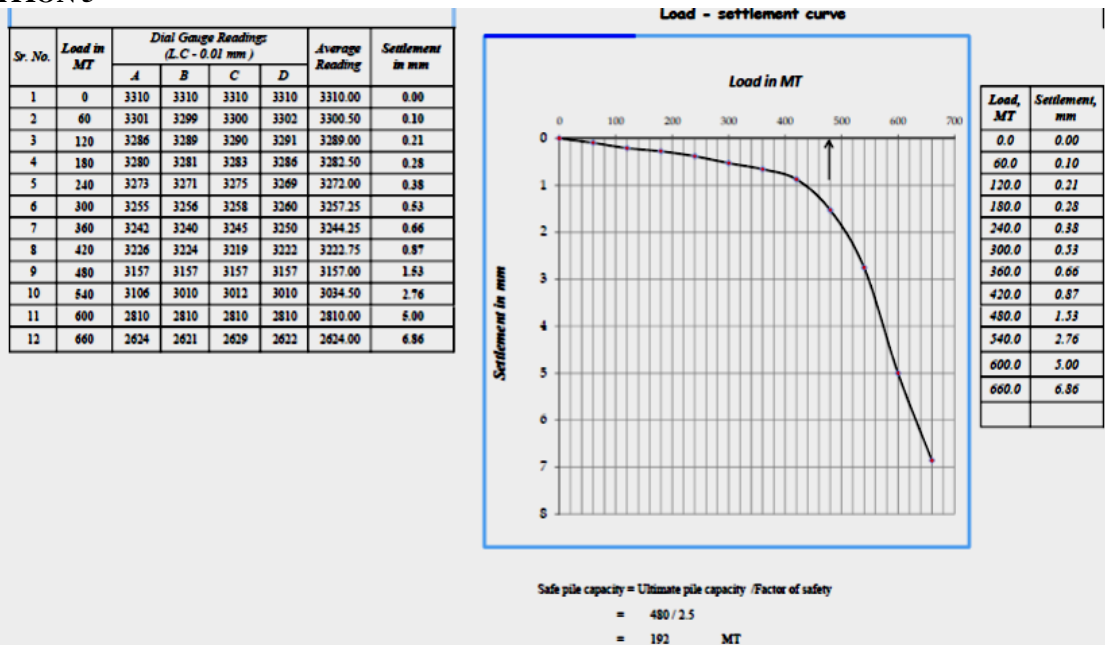
$$= 80 \text{ MT}$$



## LOCATION 4



## LOCATION 5



## COMPARISION OF RESULTS

We have collect the five numbers of pile load test data, which is sufficient to verify the accuracy of the software. By comparison of the actual field pile load test results are precisely same to the software results. Following table shows the comparison of the calculated results of the pile load test by the manually and by the software.

Sr no.	Field pile capacity(MT)	Calculated capacity in software(MT)
1	56.5	56.4
2	62.2	64
3	82.2	80
4	94.6	92
5	197	192

### Conclusions and future scope:-

On the basis of software we develop we conclude that pile capacity of soil calculated by software is precisely same as from pile load test. However necessary updates/modifications in the software should be incorporated time to time with any amendment in the IS code, new concepts and other modifications in the literature based on experimental results.

The software we are making can be used “n” number of times according to the changes in the IS codal provisions and any literature changes can be incorporated.

The software can be used for finding out the pile load capacity in case of different soil stratification and variable length of piles.

### FORMULA

The given formula is derived from the IS CODE 2911.

#### a) Frictional capacity of pile:

$$(Q_u)_f = [\Sigma K \times P_{di} \times \tan \delta \times A_s] + [a \times C \times A_s]$$

[Granular soil + Cohesive soil]

#### b) End bearing capacity of pile:

$$(Q_u)_b = [A_p(1/2 D \times g \times N_g + P_d \times N_q)] + [A_p \times N_c \times C_p]$$

[Granular soil + Cohesive soil]

### References

1. Broms, B. B. (1946a). “Lateral Resistance of piles in cohesion-less soils.” *ASCE Journal of the Soil Mechanics and Foundation Division Proceedings (JSMFD)*, 90 (SM3), pages 123-156.
2. Broms, B. B. (1946b). “Lateral Resistance of piles in cohesion soils.” *ASCE Journal of the Soil Mechanics and Foundation Division Proceedings (JSMFD)*, 90 (SM3), pages 123-156.
3. Dr.K.R.Arora (2003). “*Soil Mechanics and Foundation Engineering*”, Standard Publishers, India.
4. Dr.Kaniraj (1979) “*Design Aids in soil mechanics and Foundation Engineering*”, Tata McGraw-hill publication, India.
5. G. G. Meyerhof and Gopal Ranjan (1972). “The Bearing Capacity of rigid piles under Inclined Loads in Sand. I: Vertical Piles.” *Canadian Geotechnical Journal*, Vol 9, pages 430-446.
6. G.G. Meyerhof and Gopal Ranjan (1973) “The Bearing Capacity of Rigid Piles under Inclined Loads in Sand. III: Piles Groups.” *Canadian Geotechnical Journal*, Vol. 10, pages 428-438.
7. G.G.Meyerhof, A.Yalcin, S.Mathur (1983). “Ultimate pile capacity for eccentric inclined load.” *ASCE Journal of the Geotechnical Engineering Division*, 109(GT3), pages 408-423.
8. I.S. – 2911, Part – 4 (1985): “Code of Practice for Design and Construction of Pile Foundations”.
9. I.S. – 2911, Part – I (1997): “Code of Practice for Design and Construction of Pile Foundations-part-1 concrete piles section-1 driven cast in-situ concrete piles”.
10. I.S. – 2911, Part – I (1997): “Code of Practice for Design and Construction of Pile Foundations-part-1 concrete piles section-2 bored cast in-situ piles”.
11. I.S. – 2911, Part – I (1997): “Code of Practice for Design and Construction of Pile Foundations-part-1 concrete piles section-3 Driven Precast concrete piles”.
12. I.S. – 2911, Part – I (1997): “Code of Practice for Design and Construction of Pile Foundations-part-1 concrete piles section-4 Bored Precast concrete piles”.
13. Terzaghi K. (1955). “Evaluation of co-efficient of subgrade reaction.” *Geotechnique*, 5 (4), pages 297-326.

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### RESEARCH ARTICLE

#### Drug Compliance among Type 2 Diabetic patients in Jazan Region, Saudi Arabia.

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#### Abstract

**Background:** Although adherence to prescribed medications is a key dimension of healthcare quality, there is no information about the magnitude of compliance of the diabetic patients in Jazan region of Saudi Arabia. **Objectives:** The purpose of this study is to measure the rate of adherence and the factors contributing to compliance among the diabetic patients in Jazan region. **Methods:** A total of 273 Type 2 diabetic patients who fulfill the inclusion criteria were recruited in the study. Adherence to the treatment was evaluated during patients' attending to the usual appointment in the randomly selected Primary Health Care centers and Diabetic Centers in Jazan region. The medication adherence was assessed during a personal interview using the 8-item Morisky Medication Adherence Scale (MMAS-8). **Results:** Twenty Three Percent of patients reported good medication adherence, 38.8 % medium adherence and 37.6 % poor medication adherence. The factors significantly associated with adherence in univariate analysis were socio-demographic factors: residence (  $p = 0.02$  ) and distance from the health care center (  $p = 0.023$  ); disease and health care related factors: Regularly attending to the appointments ( $p = 0.038$ ) and HbA1c  $> 8$  (  $p = 0.06$  ). **Conclusion:** The findings indicate that there is a high rate of non-compliance among the diabetes patients in Jazan region of Saudi Arabia and there is a definite need for improvement in the healthcare system, health education, and training of diabetic patients.

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#### Introduction:-

Diabetes mellitus (DM) is a group of metabolic diseases characterized by hyperglycemia resulting from defects of insulin secretion and/or increased cellular resistance to insulin. Chronic hyperglycemia and other metabolic disturbances of DM lead to long-term tissue and organ damage as well as dysfunction involving the eyes, kidneys, and nervous and vascular systems. [1]

Diabetes is a serious condition with potentially devastating complications that affects all age groups worldwide. In 1985, an estimated 30 million people around the world were diagnose with diabetes; in 2000, that figure rose to over 150 million, and it is projected to rise further to 380 million by 2025. The International Diabetes Federation states

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that “everyten seconds, two people are diagnosed with diabetes somewhere in this world,” and given the current trend, more people will have diabetes in 2025 than the current populations of the United States, Canada and Australia combined. [2]

In the Eastern Mediterranean Region, there has been a rapid increase in the incidence of DM, consisting mainly of Type 2 (T2DM). Much of this increase occurs in developing countries and results from population ageing, unhealthy diet, obesity and a sedentary lifestyle. It is now the fourth leading cause of death in this region. [3]

A key dimension of healthcare quality is adherence to prescribed medications. According to the World Health Organization (WHO), adherence is the extent to which a person’s behavior – taking medication, following a diet, and/or executing lifestyle changes – corresponds with agreed recommendations from the health care provider. However, medication non-adherence is particularly common among patients with type 2 diabetes and inadequate adherence compromises safety and treatment effectiveness, leading to increased mortality and morbidity with considerable direct and indirect costs to the healthcare system. A recent WHO report states that, because the magnitude of non-adherence and the scope of its sequelae are so alarming, more health benefits worldwide would result from improving adherence to existing treatments than by developing new medical treatments [4]

Clinical experience confirms, however, that despite the availability of increasingly modern and effective methods of treatment at least half of the patients fail to achieve satisfactory therapy goals and that non-compliance is believed to be the most common cause of treatment failures. After several decades of research, it was concluded that medication non-adherence is due to many factors including lack of adequate knowledge about medication and treatment goals, beliefs about the medication, complex regimens that are difficult to manage, side effects, and costs associated with medications [5][6].

There are several types of non-adherence. Therapeutic or medication non-adherence which includes failure to have the prescription dispensed or renewed, omission of doses, errors of dosage, incorrect administration, errors in the time and frequency of administration, and premature discontinuation of the drug regimen. A second type of non-adherence is dietary/exercise non-adherence in which the patient fails to follow the diet and exercise recommendations. A third type is the appointment non-adherence in which the patient fails to show up at the clinics for the scheduled check up. The consequences of medication non-adherence may not only be dangerous for patient’s health, but also dramatically increase the financial costs of public health services [7][8]

There are several methods are used to measure therapeutic adherence. Indirect methods, like self reports and interviews with patient, are the simplest and most common methods for measuring medication adherence (Girerd et al) . Pill counts method is also used to assess compliance in medical drug trials, by measuring the difference between the number of doses initially dispensed and the number remaining in the container. The achievement of treatment goals might also be used to assess compliance, especially when the drug therapy is associated with a successful outcome like normal blood pressure, or blood glucose levels. Computerized compliance monitors are the most recent and reliable methods, like the Medication Event Monitoring System (MEMS). The system consists of microprocessor placed in the cap of the medication container, every time the patient removes the cap, the time and date are recorded. Direct methods like measuring drug concentration or biological markers in the patients’ biological fluids, could also be used to assess compliance. Of the various methods used to assess compliance, none is without disadvantages [9]

Few studies about patient adherence to OHAs in Arab Countries have been published. Most of these studies were carried out in Saudi Arabia. One study was performed at Al-Manhal primary health care center, aimed at identifying determinants of compliance among diabetic patients attending that clinic (Khattab et al., 1999). Other study has been conducted in Al Hasa region aiming to estimate the magnitude of the problem of non-compliance and explore the factors contributing to non-compliance of the diabetic patients [10]. A recent study was performed to gather data on current practices in the management of patients with T2DM in Saudi Arabia and to evaluate the degree of compliance with international guidelines (AIElq,2009 <http://www.ncbi.nlm.nih.gov/pubmed/19936419#> ).

To the best of our knowledge, there is little or no information on the magnitude of compliance of the diabetic patients in the Jazan region of Saudi Arabia. For this purpose we conducted this research study whose aim to investigate the variability in the rate of medication adherence among Type 2 diabetic patients. This may lead to a clear understanding about poor glycemic control among these patients as well as for a strict

and successful management of this chronic illness in the future.

#### **Study Objective:-**

To measure the rate of compliance and the factors contributing to compliance among the diabetic patients in Jazan region, Saudi Arabia.

#### **Specific Objectives:**

- 1- To measure the rate of compliance among the diabetic patients.
- 2- To determine the role of demographic and clinical features to patients Compliance.
- 3- To Identify the diseases and health-care characteristics that is contributing to Patients compliance.

#### **Patients and Methods:-**

This was a cross-sectional survey. Patients with diabetes were interviewed during their attending to the usual appointment in the PHCs and diabetes centers.

**Inclusion criteria** were registered diabetic patients who were attending the selected clinics and were getting medication on a regular basis. Subjects with age more than 18 years and at least a one-year history of diabetes, and who were on a fixed drug therapy for the last six months, were selected for this study [11].

**Sampling:-** Since the population proportion is not known so it considered as 50 % with 95% confidence intervals which is not more than  $\pm 5\%$  of true population proportion. The required sample size was 267 with 6% error. Two stages Cluster random sampling based on provinces and districts adopted to select the PHCs and Diabetic centers.

#### **Data Collection:-**

Patients who attended their regular appointments were interviewed using a structured questionnaire addressing the following aspects:

- (i) socio-demographic characteristics.
- (ii) health-care related factors,
- (iii) Disease and drugs related factors.
- (iv) assessment of patient adherence to medication using the 8-item Morisky Medication Adherence Scale (MMAS-8), translated into Arabic.

**The MMAS-8** contains eight questions with closed dichotomous (yes / no ) answers, designed to prevent the bias of positive response from patients questions asked by health professionals, by reversing the responses related to the interviewee's adherence behavior. Thus, each item measured a specific adherence behavior, with all questions must be answered negatively.

The degree of adherence was determined according to the score resulting from the sum of all the correct answers:

- High adherence (8 points)
- Average adherence (6 to < 8 points)
- Non-adherence (< 6 points)

In this study, patients was considered adherent when they had a score equal to eight in the MMAS-8 [12]

#### **Data Analysis:-**

The data obtained from the questionnaire were analyzed using **SPSS** for Windows, Version 17. Techniques involved **descriptive statistics** like frequency and percentage, and **inferential** statistics like Chi square test and logistic regression were used to analyze the significant associations between adherence rate and the and some selected factors. P-value < **0.05** was determined as significance.

**Results :**

Patients who satisfied the inclusion criteria were 237, 88.8% of the required sample. The **social-demographic** characteristics chosen in this study of the selected group of patients and their data, see Table 1.

**Table 1: Socio-demographic characteristics of 237**

Demographic Characteristic		Number	%
Gender	Male	156	65.8
	Female	81	34.2
Age	18-40	45	19.1
	41-60	110	46.6
	>60	81	34.3
Residence	City	99	41.8
	Village	138	58.2
Education	Uneducated	93	39.2
	Elementary	44	18.6
	Intermediate	23	9.7
	Secondary	18	7.6
	Higher Education	59	24.9
Marital Status	Single	12	5.1
	Married	202	85.2
	Divorced	5	2.1
	Widowed	18	7.6
Occupation	Student	5	2.1
	Employee	79	33.3
	Freelancer	13	5.5
	Retired	59	24.9
	Unemployed	81	34.2
Family income	Low	36	15.2
	Medium	166	70
	High	35	14.8

The majority of the participants were uneducated (39.2%, n = 93). Most were married (85.2%, n = 202).

There were 79% treated with OHA without insulin, most of them were taking medications for different diseases (45.6%, n = 108 ), for clinical characteristics chosen in this study of patients and their data, see Table 2

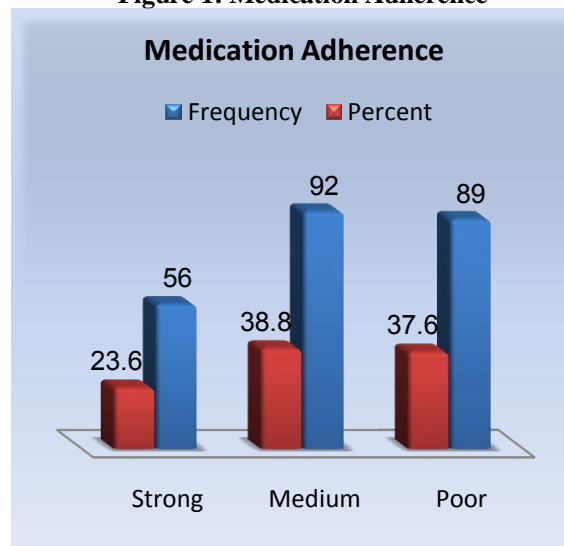
**Table 2: Clinical characteristics of 237 responders. N (%)**

Clinical characteristic		Total	Male	Female
Duration of the Disease	<2 years	24 (10.1)	15 (62.5)	9 (37.5)
	2-5 years	56 (23.6)	37 (66.1)	19 (33.9)
	>5 years	157 (66.3)	104 (66.2)	53 (33.8)
Treatment	OHA	135 (57)	100 (74.1)	35 (25.9)
	Insulin +/- OHA	102 (43)	56 (54.9)	46 (45.1)
Dosage	Once a day	26 (11)	19 (73.1)	7 (26.9)
	> once daily	210 (89)	137 (65.2)	73 (34.8)
Drugs	Monotherapy	48 (20.2)	34 (70.8)	14 (29.2)

	Combined therapy	81 (34.2)	61 (75.3)	20 (24.7)
	Drugs for deferent diseases	108 (45.6)	61 (56.5)	47 (43.5)
Hypertension	No	134 (56.8)	95 (70.9)	39 (29.1)
	Yes	102 (43.2)	60 (58.8)	42 (41.2)
CHD	No	216 (91.5)	142 (65.7)	74 (34.3)
	Yes	20 (8.5)	13 (65)	7 (35)

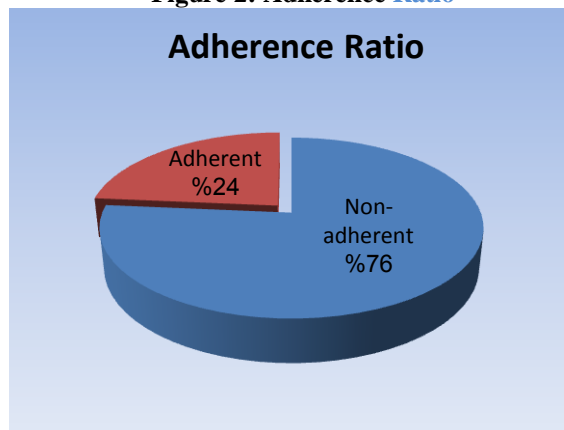
Twenty Three Percent of patients reported good medication adherence, 38.8% medium adherence and 37.6 % poor medication adherence. figure 1

**Figure 1: Medication Adherence**



So, as Adherent, Non-adherent prevalence, it was very high ratio as shown in figure 2 below.

**Figure 2: Adherence Ratio**



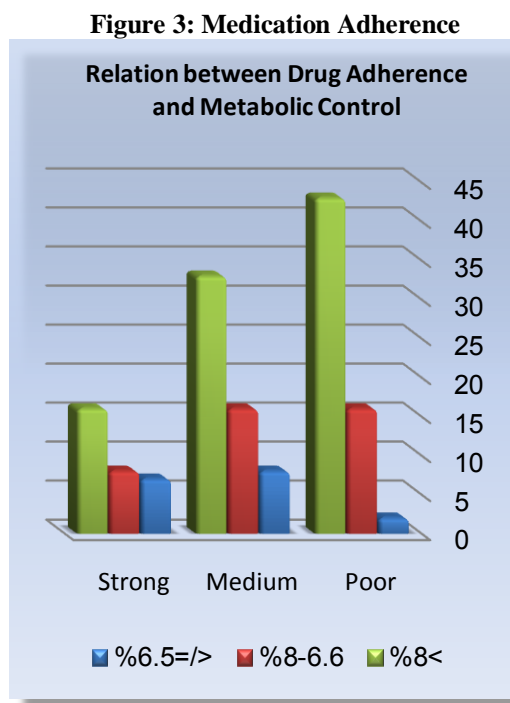
The non-adherence in the urban participants was significantly higher than in the rural participants (87.9 vs. 68.1%,  $P=0.02$ ).

People those were living near the centers showed high rate of non-adherence (80.3 vs 63.2%,  $P=0.023$ ) than those who live far. The non adherence was significantly higher in the patients they were not regularly attending their appointment than those who were regularly attending (88.1 vs. 72.2%  $P=0.038$ ) . see Table 3

Gender and duration since diagnosis did not affect medication adherence ( $P=0.74$ ,  $0.70$  respectively ). see Table 3

No significant association found between adherence and type of treatment ( $P=0.31$ ) or between poor-adherence and number of dosage taken by patients ( $P=0.6$ ). see Table 3

Seventy percent of poor adherence show low glycaemic control according to HbA1c test ( $>8\%$ ), see figure 3



**Table 3: Association** between **medication adherence** and some selected **demographic** and **clinical** characteristics, MMAS-8 (N = 237)



Variables			P-value	MMAS-8 Adherence						Total	
				Strong		Medium		Poor			
				N	%	N	%	N	%		
<u>Demographic Variables</u>											
Gender	Male		0.748	35	22.4	60	38.5	61	39.1	156	
	Female			21	25.9	32	39.5	28	34.6	81	
Age	18-40		0.109	11	24.4	10	22.2	24	53.3	45	
	41-59			25	22.7	47	42.7	38	34.5	110	
	>60			20	24.7	34	42	27	33.3	81	
Residence	City		0.02	12	12.1	46	46.5	41	41.4	99	
	Village			44	31.9	46	33.3	48	34.8	138	
Education	Uneducated		0.325	19	20.4	35	37.6	39	41.9	93	
	Elementary			14	31.8	18	40.9	12	27.3	44	
	Intermediate			5	21.7	11	47.8	7	30.4	23	
	Secondary			1	5.6	7	38.9	10	55.6	18	
	Higher Education			17	28.8	21	35.6	21	35.6	59	
Marital Status	Single		0.284	1	8.3	5	41.7	6	50	12	
	Married			46	22.8	78	38.6	78	38.6	202	
	Divorced			1	20	3	60	1	20	5	
	Widowed			8	44.4	6	33.3	4	22.2	18	
Occupation	Student		0.287	1	20	0	0	4	80	5	
	Employee			19	24.1	31	32.2	29	36.7	79	
	Freelancer			1	7.7	4	30.8	8	61.5	13	
	Retired			13	22	23	39	23	39	59	
	Unemployed			22	27.2	34	42	25	30.9	81	
Family income	Low		0.826	6	16.7	14	38.9	16	44.4	36	
	Medium			42	25.3	64	38.6	60	36.1	156	
	High			8	22.9	14	40	13	73.1	35	
Distance from HCC	Near		0.023	34	19.7	67	38.7	72	41.6	173	
	Far			21	36.8	20	35.1	16	28.1	57	
<u>Clinical Variables</u>											
Duration of the Disease	<2 years		0.703	8	33.3	8	33.3	8	33.3	24	
	2-5 years			12	21.4	20	35.7	24	42.9	56	
	>5 years			36	22.9	64	40.8	57	36.3	157	
Treatment	OHA		0.318	27	20	55	40.7	53	39.3	135	
	Insulin +/- OHA			29	28.4	37	36.3	36	35.3	102	
Dosage	Once a day		0.661	7	26.9	8	30.8	11	42.3	26	
	> once daily			49	23.3	84	40	77	36.7	210	
Drugs	Monotherapy		0.332	14	29.2	19	39.6	15	31.3	48	
	Combined therapy			14	17.3	30	37	37	45.7	81	
	Drugs for deferent diseases			28	25.9	43	39.8	37	34.3	108	
Hypertension	No		0.621	30	22.4	50	37.3	34	40.3	134	
	Yes	Before DM		8	19.5	15	36.6	18	43.9	41	102
		After DM		19	31.1	27	44.3	15	24.6	61	
CHD	NO		0.21	49	22.7	83	38.4	84	38.9	216	
	Yes			7	35	9	45	4	20	20	
Hb1c	Strong ≤ 6.5		0.068	7	41.2	8	47.1	2	11.8	17	
	Medium 6.6-8			8	20	16	40	16	40	40	
	Poor >8			16	17.4	33	35.9	43	46.7	92	
Committing to the Appointment	No		0.02	7	11.9	21	35.6	31	52.5	59	
	Yes			49	27.8	69	39.2	58	33	176	

### Discussion:-

The control of diabetes is crucially dependent on the diabetic patient's compliance to medical advice [13]. compliance of diabetic patients is a complex issue. This study explored therapeutic adherence and the factors contributing to the adherence of diabetic patients in Jazan region.

Non adherence with medication in this study was similar to the earlier finding in Egypt [7], Palestine [10], France [4], Poland [14] and Saudi Arabia [11]

In Palestine study, non-compliance was divided into two categories ( 51.4 % poor compliance and 6.5 % non-compliance ) [10]. In France the non-compliance was divided into two categories also (49% medium adherence and 12% poor adherence ) [4].

In the Saudi study, which conducted in Al Hasa region they found that the therapeutic non-compliance of the participants was 67.9% [11].

There was a significant rural–urban difference in the non-compliance rate among the diabetic patients in this study. The non-compliance in the urban population was significantly higher than the rural population (87.9 vs. 68.1%,  $P=.02$ ). The same finding has been documented in the Saudi and Palestine study where the non-compliance among urban diabetic patients was higher than among the rural patients (71.04 vs. 60.15%,  $P = .023$ ) for Saudi study and (8.2 vs. 6.2%,  $P = .003$ ) for the study conducted in Palestine, This difference may be due to various lifestyles. Urban residents tend to be more sedentary with relatively poor dietary habits as compared to the rural population [10][11]

In this study, no significant difference in adherence was found between males and females, The effect of gender on the rate of adherence to medication in other research studies is contradictory. Female patients were found by some researchers to have better adherence [15] while some studies suggested otherwise [16]. In addition, some studies could not find a relationship between gender and adherence to medication, this difference may be due to geographical variation in their education, and social factors [7].

This study showed a significant association between poor-adherence and attending to the appointments, patients they were not regularly attending their appointments have a high rate of poor-adherence than those attending their appointments regularly ( 88.1 vs. 72.2%  $P=0.038$ ).

The same result has found in the Saudi study, Patients who were regular on follow- up had a significantly higher compliance rate than those who were irregular (46.88% for those who never missed an appointment, 35.53% for those who had missed an appointment once or twice in a year, 26.40% for those who had missed the appointment more than twice in a year and 18.19% for those who never attended the clinic,  $P=.039$ ) [11].

In the researches that published earlier, they found that the most important causes of Poor adherence with clinic appointments were the non-availability of transport, followed by forgetfulness. Forgetfulness has been widely published as an important cause of irregularity of follow-up. Besides, owing to socio-cultural factors females cannot go out on their own to a health care center [11].

Patients with poor adherence showed low glycaemic control (  $HbA1c >8$  ) and this is similar to the results found in other researches [4].

We didn't find any significant association between poor-adherence and level of education. Some studies have found the same result. while other's studies have found an association between lower education level and poor adherence. A study conducted in UK shown that patients with a lower level of education have better compliance. It may be presumed that patients with a lower educational level may have more trust in the physician's advice. However, these results show that education may not be a good predictor of therapeutic Adherence [11].

Results showed no significant association between poor-adherence and type of treatment or number of dosages.

This results similar to that's conducted in French [4], in contrast to the Saudi study that's found non-adherence was least with the single drug regimen while it was highest among patients who were on combined oral and insulin treatment [11].

### **Conclusion:-**

Medication adherence is vital for effective diabetes management. The study results showed that the rate of non-adherence of diabetic patients in Jazan region was high.

Attending the appointments regularly played an important role in medication adherence, so we suggest that there is a need to establish some sort of system by which contact can be made with those patients who have difficulty in attending clinics and medication delivered to them on time.

Since patients showed more committing to their appointment in diabetic centers than in PHC, although they usually farther because they are more advanced facilities, more caring and have a better and specialized staff, they give them the relief, trust and more willing to follow the medical advice, so we suggest that the diabetic centers should be enhanced and take the major of the diabetic patients care system.

For the improvement with medication adherence Physician-patient relationship as well as patient's knowledge of diabetes should be improved through proper educational and training programs

Although this study is the first of its type in Jazanregion , it has some limitations

- Time : since we had to complete this study just in three weeks because of modules schedule of the college.
- Small sample size.
- The study used only one method to assess compliance.

**Our recommendations** for future works are to use validated adherence measures, e.g., Computerized compliance monitors like the Medication Event Monitoring System (MEMS) and to run other methods concurrently for assessment of therapeutic adherence, e.g pill counts for a comparison study. Moreover, it is very important to conduct a research on larger sample population and from different clinical settings and areas.

### References:-

1. Q. R. Guide, "Care of the Patient with Diabetes Mellitus," no. June, 2009.
2. C. P. Guidelines, "of Diabetes," vol. 32, no. September, 2008.
3. Diabetes Atlas, second ed. International Diabetes Federation, Brussels, 2003.
4. M. Tiv, J.-F. Viel, F. Mauny, E. Eschwège, A. Weill, C. Fournier, A. Fagot-Campagna, and A. Penfornis, "Medication adherence in type 2 diabetes: the ENTRED study 2007, a French Population-Based Study," *PLoS one*, vol. 7, no. 3, p. e32412, Jan. 2012.
5. L. Osterberg and T. Blaschke, "Adherence to medication.," *The New England journal of medicine*, vol. 353, no. 5, pp. 487–97, Aug. 2005.
6. a Al-Qasem, F. Smith, and S. Clifford, "Adherence to medication among chronic patients in Middle Eastern countries: review of studies.," *Eastern Mediterranean health journal = La revue de santé de la Méditerranée orientale = al-Majallah al-ṣiḥḥīyah li-sharq al-mutawassiṭ*, vol. 17, no. 4, pp. 356–63, Apr. 2011.
7. M. E. E. Shams and E. a. M. E. Barakat, "Measuring the rate of therapeutic adherence among outpatients with T2DM in Egypt," *Saudi Pharmaceutical Journal*, vol. 18, no. 4, pp. 225–232, Oct. 2010.
8. J. Jin, G. E. Sklar, V. Min, and S. Oh, "Factors affecting therapeutic compliance : A review from the patient ' s perspective," vol. 4, no. 1, pp. 269–286, 2008.
9. P. a Hedtke, "Can wireless technology enable new diabetes management tools?," *Journal of diabetes science and technology*, vol. 2, no. 1, pp. 127–30, Jan. 2008.
10. W. M. Sweileh, O. Aker, and S. Hamooz, "Rate of Compliance among Patients with Diabetes Mellitus and Hypertension Abstract : Introduction and Aims : Patient compliance or adherence is defined as the extent to which a," vol. 19, pp. 1–12, 2005.
11. A. R. Khan, Z. N. Al-Abdul Lateef, M. a Al Aithan, M. a Bu-Khamseen, I. Al Ibrahim, and S. a Khan, "Factors contributing to non-compliance among diabetics attending primary health centers in the Al Hasa district of Saudi Arabia.," *Journal of family & community medicine*, vol. 19, no. 1, pp. 26–32, Jan. 2012.
12. A. Manuscript, "NIH Public Access," vol. 90, no. 2, pp. 216–221, 2011.
13. Q. M. Division, "VA / DoD CLINICAL PRACTICE GUIDELINE FOR THE MANAGEMENT OF DIABETES MELLITUS."
14. J. Kasznicki, "Type 2 diabetic patients compliance with drug therapy and glycaemic control," pp. 17–19.
15. S. Lertmaharit, P. Kamol-Ratankul, H. Sawert, S. Jittimanee, and S. Wangmanee, "Factors associated with compliance among tuberculosis patients in Thailand.," *Journal of the Medical Association of Thailand = Chotmaihet thongphaet*, vol. 88 Suppl 4, no. 1, pp. S149–56, Sep. 2005.
16. J. N. Kalyango, E. Owino, and A. P. Nambuya, "Non-adherence to diabetes treatment at Mulago Hospital in Uganda: prevalence and associated factors.," *African health sciences*, vol. 8, no. 2, pp. 67–73, Jun. 2008.



### RESEARCH ARTICLE

Psycho-social problems of obesity among male students in Qassim university in Saudi Arabia.

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#### Abstract

**Introduction:** Studies have shown that overweight and obese persons face psycho-social problems. We conducted a cross-sectional study in Qassim university to explore the psycho-social problems faced by male obese students.

**Objectives:** To determine the types of psycho-social problems, and find their prevalence among Qassim University overweight and obese students.

**Research Methods:** A self-administered questionnaire was designed and pretested. The questionnaire consisted of questions regarding age, college, social background and social problems that they encounter. An open ended question was also included so that the study subject may identify some social problems that they encountered which the questionnaire may have failed to list. The participants of the study were selected by convenient sampling. The sample size was 65.

**Results:** In studied overweight and obese students sample, 58(89%) were unhappy about their weight and 52(80%) tried to follow weight reduction program. Fifty-six students (86.2%) considered overweight and obesity as a disease and 44(67.7%) had positive family history. Mood swing and social pressure were reported by 37(56.9%) and 30(46.2%); respectively. low self-esteem and effect on social life reported by 24(36.9%) and 13(20%); respectively. Reporting overeating due to anger, sadness and boredom was 9(13.8%), 11(16.9%) and 37(56.9%); respectively.

**Conclusion and recommendations:** Our study showed a substantial proportion of psycho-social problems among overweight and obese students. The finding of the study cannot be generalized to all Saudi adolescent, since the sample is small and not representative of all Saudi adolescent therefore we recommend that a larger study on the topic should be undertaken to estimate more accurately the magnitude of the problem.

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## Introduction:-

Obesity is now considered as an epidemic by WHO (world health organization)<sup>[1]</sup>.

The definition of overweight and obesity is:

**Overweight** : excessive increase in adipose tissue or in muscle and skeletal tissue .

**Obesity** : an increase in body weight beyond the limitation of skeletal and physical requirement, as the result of an excessive accumulation of fat in the body.

Overweight and obesity is best measured by calculating body mass index (BMI).

This definition lead us to what is the BMI ?

$$\frac{\text{weight (Kg)}}{\text{Height (m}^2\text{)}} = \text{BMI}$$

Regarding to BMI the meaning of overweight and obesity will be:

25.0 to 29.9 =overweight.

30 to 39.9 = obese.

The risk factors associated with obesity and overweight are:

- Diet (high fat and carbohydrate with excessive calories).<sup>[2]</sup>
- Sedentary lifestyle.<sup>[3]</sup>
- Genetics.<sup>[4]</sup>
- Illnesses (hypothyroidism, Cushing's syndrome, growth hormone deficiency).<sup>[5]</sup>
- Infectious agent.<sup>[6][7]</sup>
- Others causes of obesity like (insufficient sleep, decreased rates of smoking, increased use of medications that can cause weight gain, pregnancy at a later age).<sup>[8]</sup>

The Prevalence of Overweight& Obesity in all age groups in KSA<sup>[9]</sup>is:

14 % in men, and increasing level 30.7 %.

23.6 % in women, and increasing level 28.4 %.

In a study conducted by Wellman Friedberg in USA reports: "currently, the rates of both overweight and obesity in the US are 61% and 14% in adults and children, respectively. About 14% of children and adolescents are now seriously overweight."<sup>[10]</sup>

There're a lot of medical problems associated with obesity, including:

Mortality:

Obesity reduces life expectancy by six to seven years.<sup>[11]</sup>

Morbidity:

- diabetes mellitus type 2.
- hypertension.
- high blood cholesterol.
- high triglyceride levels.
- ischemic heart disease.<sup>[12]</sup>

## Beside Medical Problems, There're Also Psychological Problems Associated.

In astudy conducted by Wellman and Friedberg they report that:

"Emotional suffering may be among the most painful aspects of obesity. American society emphasizes physical appearance and often equates attractiveness with slimness, especially for women. Such messages may be devastating to overweight people. Many think that obese individuals are gluttonous, lazy, or both, even though this is not true. As a result, obese people often face prejudice or discrimination in the job market, at school, and in social situations. Feelings of rejection, shame, or depression are common."<sup>[10]</sup>

Low Self-Esteem<sup>[13]</sup>

Obese teens have significantly lower self-esteem than teens of normal weight. Low self-esteem often appears as loneliness, nervousness and sadness. Teens with low self-esteem may also engage in risky behavior such as

experimenting with drugs, alcohol or cigarettes. Obese teens who experience low self-esteem during childhood and adolescence often carry these feelings into adulthood.

#### Depression<sup>[13]</sup>

Depression is a common psychological effect of teen obesity. An obese teen who is heavier than her peers may experience feelings of sadness or hopelessness. Signs of depression include changes in sleep patterns, withdrawal from family or friends and loss of interest in activities she previously enjoyed. MayoClinic.com reports that some teens try to hide depression and appear emotionally flat rather than sad.

#### Anxiety<sup>[13]</sup>

Most children experience anxiety for various reasons throughout adolescence. Obese teens, however, may experience severe anxiety that often results in destructive behaviors or avoidance of friends and family. Overweight teens may also have social anxiety, the result of excessive bullying or teasing. Severe anxiety often interrupts the learning process and may lead to a decline in academic performance. Being an overweight teen can also affect an individual's anxiety level as an adult. Overweight teen girls may have a higher chance of developing anxiety disorders or depression in adulthood.

#### Poor Body Image<sup>[13]</sup>

Obese teens often experience poor body image as a result of being overweight. This may keep your teen from playing sports or engaging in physical activity, spending time with friends or wearing form-fitting clothing. Poor body image is connected to a number of psychological problems, including depression, anxiety and low self-esteem. Teens with poor body image are also at risk of developing an eating disorder.

#### Eating Disorder<sup>[13]</sup>

Obese adolescents are at risk of developing disorders such as bulimia, anorexia or compulsive overeating. An eating disorder is often the result of an overweight teen's effort to lose weight through risky and unhealthy behaviors.

A study from US has conclude the following "Obesity is associated with an approximately 25% increase in odds of mood and anxiety disorders and an approximately 25% decrease in odds of substance use disorders. Variation across demographic groups suggests that social or cultural factors may moderate or mediate the association between obesity and mood disorder."<sup>[14]</sup>

**The purpose of this study is to explore the psycho-social problems in obese student in four colleges of qassim university, by doing a Cross-Sectional study.**

### Research Objectives:-

#### Goal:

To get better understanding of the social and psychological problems that faced by Qassim university obese students.

#### Objectives:-

To determine the types of Psycho-social problems, and find the prevalence of it among Qassim University overweight and obese students.

#### Limitations of the study:

- 1-Since the selection of the study subjects was based on non-probability sampling technique, therefore it cannot be generalized to the entire obese population of students of Qassim university.
- 2-The study participants consent to participate in the study was voluntary, therefore there is a possibility of overestimation or underestimation of the result.
- 3-Only the male obese students were included in the study.

### Research Methodology:-

**Research setting:** The study was conducted in Qassim University, Colleges of Medicine, Dentistry, Pharmacy and Applied Health Sciences.

**Sampling and sample size:-**

All male obese students who agree to participate in the study were inducted in the study. Therefore, the sampling method was “convenient sampling”. The sample size was 65 male obese student.

**Data collection method:-**

For all obese students who agreed to participate in the study, BMI was calculated to confirm obesity. Those who do not fall in the category of obesity were excluded from the study. A self-administered questionnaire was designed and pretested. The questionnaire consisted of questions regarding age, weight, height, college, social background and the psych-social problems that they encounter. An open ended question was also given so that the study subject may identify other social problems that they encounter and were not listed in the questionnaire. The data were collected by the group members. Every 3-4 group members were assigned one college to collect the data.

**Data entry and analysis:-**

Before entering the data, the data were cleaned and edited. The data were entered and analyzed in SPSS program. Frequency tables were generated. Each variable frequency was analyzed and cross tabulation.

**Expected problems and their solutions:-**

The faculty members may not give the permission to conduct the study. This will be dealt by taking official permission from Deans’ of respective Colleges. The students may not cooperate for fear of their names being identified. This will be assured by having the questionnaire as anonymous.

**Results:-**

Question	No n (%)	Yes n (%)
1. Are you satisfied with your current weight?	58(89.2)	7(10.8)
2. Have you tried to follow a program to reduce your weight?	13(20)	52(80)
3. Do you believe the obesity is a disease?	9(13.8)	56(86.2)
4. Dose any of your family members have obesity?	21(32.3)	44(67.7)
5. Do you feel mood swing?	28(43.1)	37(56.9)
6. Do you feel social pressure due to your weight?	35(53.8)	30(46.2)
7. Does your overweight prevent you from going to public places?	58(89.2)	7(10.8)
8. Does your overweight prevent you from doing sport activity?	41(63.1)	24(36.9)
9. Did you try any dangerous method to reduce your weight?	45(69.2)	20(30.8)
10. Did obesity reduce your self-esteem?	41(63.1)	24(36.9)
11. Did you face difficulty in reduce your diet?	29(44.6)	36(55.4)
12. Did you thought that the obesity will affect you in the future?	9(13.8)	56(86.2)
13. Did you take any drug to reduce your weight previously?	47(72.3)	18(27.7)
14. Did your weight affect your study?	53(81.5)	12(18.5)
15. Did your weight affect your social life?	52(80)	13(20)
16. Did your overweight affect your activity?	30(46.2)	35(53.8)
17. Did you eat as a result of anger?	56(86.2)	9(13.8)
18. Did you eat as a result of sadness?	54(83.1)	11(16.9)
19. Did you eat as a result of boredom?	28(43.1)	37(56.9)
20. Did you eat as a result of frustration?	40(61.5)	25(38.5)
21. Your life style? Lazy, Active, Neutral	11(16.9) 8(12.3) 47(70.8)	

In studied overweight and obese studentssample, 58(89%) were unhappy about their weight and 52(80%) tried to follow weight reduction program. Fifty-six students (86.2%) considered overweight and obesity as a disease and 44(67.7%) had positive family history. Mood swing and social pressure were reported by 37(56.9%) and 30(46.2%); respectively. low self-esteem and effect on social life reported by 24(36.9%) and 13(20%); respectively. Reporting overeating due to anger, sadness and boredom was 9(13.8%), 11(16.9%) and 37(56.9%); respectively.

**Discussion:-**

In our study 36(56.9%) feels mood swing and 56(86.2%) thinks their obesity will affect them in the future while a study done in USA, shows that 25% obese adults have mood and anxiety disorder<sup>[14]</sup> Another study on psychosocial aspects of obesity suggest that in obese patients seeking treatment there is an increased prevalence (40-60%) of psychiatric morbidity, most commonly depression<sup>[15]</sup>, which is quite similar to the finding in our study.

**Conclusion and recommendation:-**

Our study showed a substantial proportion of psycho-social problems among overweight and obese students. The finding of the study cannot be generalized to all Saudi adolescent, since the sample is small and not representative of all Saudi adolescent therefore we recommend that a larger study on the topic should be undertaken to estimate more accurately the magnitude of the problem.

**References:-**

1. WHO. Body Mass Index (2012). Available from: [http://apps.who.int/bmi/index.jsp?introPage=intro\\_3.html](http://apps.who.int/bmi/index.jsp?introPage=intro_3.html)
2. "EarthTrends: Nutrition: Calorie supply per capita". World Resources Institute. Archived from the original on 2011-06-11. Retrieved Oct 18, 2009.
3. Effects of retirement on lifestyle in relation to changes in weight and waist circumference in Dutch men: a prospective study. Public Health Nutrition / Volume 8 / Issue 08 / December (2005).
4. Poirier P, Giles TD, Bray GA, Hong Y, Stern JS, Pi-Sunyer FX, Eckel RH. "Obesity and cardiovascular disease: pathophysiology, evaluation, and effect of weight loss" Arterioscler. Thromb. Vasc. Biol (Review) 26 (5): 968–76 (2006).
5. Rosén T, Bosaeus I, Tölle J, Lindstedt G, Bengtsson BA. "Increased body fat mass and decreased extracellular fluid volume in adults with growth hormone deficiency". Clin. Endocrinol. (Oxf) 38 (1): 63–71 (1993).
6. DiBaise JK, Zhang H, Crowell MD, Krajmalnik-Brown R, Decker GA, Rittmann BE. "Gut microbiota and its possible relationship with obesity". Mayo Clinic proceedings. Mayo Clinic (Review) 83 (4): 460–9 (April 2008)
7. Falagas ME, Kompoti M. "Obesity and infection". Lancet Infect Dis (Review) 6 (7): 438–46. (July 2006).
8. Putative contributors to the secular increase in obesity: exploring the roads less traveled. International Journal of Obesity 30, 1585–1594. (2006). doi:10.1038/sj.ijo.0803326; published online 27 June 2006
9. Obesity Research Center. Obesity in Saudi Arabia [Internet] (2007). Available from: <http://www.obesitycenter.edu.sa/Patients---Public/Obesity-in-Saudi-Arabia.aspx>
10. Wellman NS, Friedberg B. Causes and consequences of adult obesity: health, social and economic impacts in the United States, Asia Pacific J Clin Nutr (2002) 11(Suppl): S705–S709. Report.
11. Haslam DW, James WP. "Obesity". Lancet (Review) 366 (9492): 1197–209. (2005).
12. Grundy SM. "Obesity, metabolic syndrome, and cardiovascular disease". J. Clin. Endocrinol. Metab. 89 (6): 2595–600. (2004).
13. Adrienne Weeks. Psychological Effects of Teen Obesity [Internet]. (May 26, 2011). Available from: <http://www.livestrong.com/article/353259-psychological-effects-of-teen-obesity>
14. Simon GE, Von Korff M, Saunders K, Miglioretti DL, Crane PK, van Belle G, Kessler RC. Association between obesity and psychiatric disorders in the US adult population. Arch Gen Psychiatry. (2006);63: 824–30.
15. Vaidya V. Psychosocial aspects of obesity. PubMed (2006);27:73-85.



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### RESEARCH ARTICLE

#### COMPARISON OF LABORATORY METHODS FOR THE DIAGNOSTIC OF TRICHOMONASIS.

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##### Key words:-

*Trichomonas vaginalis*, trophozoite,  
PCR, method sensitivity

#### Abstract

In Mongolia, there is a variable number of *Trichomonas vaginalis* (*T.vaginalis*) infections reported and therefore we need a detection tool which is highly sensitive and specific. At the present study, we compared wet mount, gram stain, culture and PCR for detection of *T.vaginalis* from 109 samples collected in “UlaanTuuz” hospital in NCCID. As a result, 21.1%(23/109) were positive by wet mount, 18.3%(20/109) were positive by gram stain, 28.4%(31/109) were positive by culture and 36.6%(40/109) were positive by PCR respectively as compared to other methods. Further *T.vaginalis* trophozoite isolate was used to determine PCR sensitivity. Trophozoite isolate was counted by using haemocytometer and  $10.1 \times 10^4$  was counted in one mL diluted swab sample. From that sample, trophozoite isolate was diluted 3156, 1578, 100, 50, 12, 3, 1.5 (1-2) per mL sample. PCR was performed serially diluted samples and as a result, all the samples had 102bp *T.vaginalis* specific DNA band and confirmed PCR method was sensitive. Out of 109 samples 17 (15.5%) were positive by all detection methods. Since PCR had highest number of positivity, we have used it as a “golden standart” to calculate sensitivity and specificity of these methods. PCR had 100% specificity as compared to 98% wet mount, 98.5% gram stain and 100% culture. On the other hand culture had the highest sensitivity 77.5% as compared to PCR 100%, wet mount and gram stain 47.5-77.5%.

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#### Introduction:-

*Trichomonas vaginalis* commonly causes vaginitis and perhaps cervicitis in women, as well as urethritis in both sexes, 10-50% of those cases are clinically asymptomatic. Worldwide, more than 180 million people get the infection with this parasite annually. Statistics from NCCID reports every 4-6 (48-63.6% in 10000 population) people are infected with sexually transmitted diseases and *T.vaginalis* accounts 16.7-39.5% of those cases. Various methods have been used for the diagnosis of trichomoniasis such as wet mount, culture, Papanicolaou smear, and serologic test. Wet mount examination is an easy, simple, and rapid method but more than  $10^3$ /mL and live protozoa are required for detection. Culture demands a specialized medium and takes 2-5 days for the diagnosis. *T.vaginalis* is by indirect immunofluorescence test is the lack of sensitivity and specificity. In recent years, molecular biological

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techniques have a sexually transmitted infection disease. Therefore highly sensitive and specific clinical diagnostic methods needed for detection of *T.vaginalis*.

### Materials and methods:-

#### Patients and diagnostic test:-

Total 109 female patients swab and vaginal secretions were employed in this study. All the patients had informed consent at "Ulaan tuuz" voluntary clinic in NCCID hospital. All samples were tested the presence of *T.vaginalis* by wet smear, gram staining, culture by Feinberg-Whittington medium and PCR using TV-650 primer. Further *T.vaginalis* trophozoite isolate was used to determine PCR sensitivity. Trophozoite isolate was counted by using haemocytometer and  $10.1 \times 10^4$  was counted in one mL diluted swab sample. From that sample, trophozoite isolate was diluted 3156, 1578, 100, 50, 12, 3, 1.5 (1-2) per mL sample. PCR was performed serially diluted samples and as a result, all the samples had 102bp *T.vaginalis* specific DNA band and confirmed PCR method was sensitive. Sensitivity and specificity of clinical diagnostic method were determined by chi square test (SPSS-17).

#### Result:-

*T.vaginalis* was detected in culture, direct wet smear, Gram staining, and PCR techniques as follows, 28.4% (31/109), 21.1% (23/109), 18.3% (20/109) and 36.6% (40/109), respectively. Total 15.5% (17/109) samples were examined positive with *T.vaginalis*. PCR amplification method had highest sensitivity and specificity and therefore set as the "gold standard". In PCR TV-650 primer set used which produces single band with 330bp length. The specificity of the direct wet smear was 79%, gram staining was 76% and culture was 88% as compared to PCR amplification method. The sensitivity of the direct wet smear was 95%, gram stain was 95% and culture was 100% and as compared to PCR amplification method. *T.vaginalis* isolate was prepared from culture positive samples where sub-cultured in Trypticase-yeast extract-maltose, Meingassner and Heyworth medium. *T.vaginalis* trophozoite in culture was counted and diluted to make 3156, 1578, 100, 50, 12, 3, 1.5 cells per milliliter and DNA was extracted and subject to PCR amplification by TV-A5, TV-A6 primer sets (102 bp band). The highest dilution, 1.5 cells per milliliter Heyworth medium was positive by PCR. There was no correlation observed between clinical outcome and laboratory detection ( $r=0.001$ ).

#### Conclusions:-

1. We diagnosed *T.vaginalis* new cases by different clinical laboratory methods wet smear (21.1%), and gram stain (18.3%) and culture (28.4%) and PCR, respectively.
2. Sensitivity of the PCR assay is 100% for detection of *T.vaginalis* and culture is 100% specific, 77.5% sensitive and kappa coefficient is much more significant. Sensitivity of Gram stain and wet mount are 47.5-55.0% and specificity is 98-98.5% and kappa coefficient is also significant.

#### References:-

1. Gary E Garber "The laboratory diagnosis of *Trichomonas vaginalis*" Can J Infect diseases Med Microbiology 2005;16(1):35-38
2. Guillermo Madico at all "Diagnosis of *Trichomonas vaginalis* infection by PCR using vaginal swab samples" Journal of clinical Microbiology, Nov.1998, p.3205-3210
3. Evangelia-Theophano Piperaki at all "Prevalence *Trichomonas vaginalis* infection in women attending a major gynaecological hospital in Greece" J Clin Pathol 2010;63:249-253
4. Jae-Sook Rey at all "Diagnosis Of Trichomoniasis by Polymerase Chain Reaction Reaction" Yonsei Medical Journal Vol 40, No.1, pp 56-60, 1999.

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### RESEARCH ARTICLE

#### Mortality of watermelon aphids by neem natural oil and a chemical synthetic product.

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##### Key words:-

Malyphos, Mortality, Neem, Synthetic,  
Vegetable.

#### Abstract

To study the mortality of vegetable oil (Neem) on watermelon aphids, we carried out tests to compare it with the chemical synthetic Malyphos most used by farmers in our region. Because of this, we treated the aphid infested watermelon leaves with doses of vegetable oil (Neem) and Malyphos.

In summer, where there is a significant number of aphids on the leaves and after a controlled time, we determine the mortality rates of this parasite in order to obtain the mortality as a function of time and of the dose of the synthetic product and of this oil.

The comparison of the mortality of the aphids between the Malyphos and the vegetable oil made it possible to highlight the role of these natural extracts on the limitation of the losses of agriculture caused by these parasites. Then the possible use of Neem oil as a natural to replace this chemical product (Malyphos) without any side effect on human health and the environment.

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#### Introduction:-

Current methods of curative control use liquid insecticidal products whose active ingredients belong to the family of organophosphates, pyrethroids and synthetic carbamates. These preparations have proved to be both very effective but also harmful on many other species. Insecticides cause a significant accumulation of active matter in treated ecosystems; they are sensitive to human health and contribute to the development of resistant insects.

In early summer, the vast majority of watermelon fields contain a large amount of aphid that is present. They are found in the neck and then colonize the stems and leaves. In our area, all stages of aphids feed on the underside of leaves in watermelon fields. According to studies, the most important parasitic diseases leading to the development of leaf spot appear first on lower leaves. These affected leaves turn yellow and fall (Michel, 2002).

To cope with the harmful effects of these insects, the means of control are essentially oriented towards the use of synthetic chemical insecticides. However, while most of these products are effective under optimum conditions, their intensive and uncontrolled use has enormous disadvantages (Salim, 2011). These include resistant strains in insects, consumer poisoning, environmental pollution (Benayad, 2008; Camara, 2009; Gueye et al., 2011). Faced with these nuisances, the search for an alternative that is more respectful of human health and the environment is essential.

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We know that pesticides have contributed to increased crop yields, particularly pest control, but the side effects of using synthetic pesticides are numerous on the health of populations, fauna and flora. The increasing interest in the use of plant extract pesticides in the world is motivated by their effects comparable to those of chemical pesticides (Mouffok et al., 2007/2008).

Indeed, new preventive measures as well as new products are continuously sought to ensure on the one hand an effective protection of agricultural production and on the other hand to contribute to a sustainable management of the environment. From this point of view, the use of plant extracts with insecticidal effects offers certain potentialities. Already Volkonsky (1937) advocated the use of plant extracts for the control of migratory locusts. Among the most widely documented examples is the efficacy of extracts of *Melia azadirach* L. containing azadirachtin and from Neem on *Schistocerca gregaria* larvae (Wilps et al., 1992, Mordue, Blackwell, 1993, Linton and al., 1997).

This research aims to make a mortality comparison between the chemical insecticide Malathion and the vegetable oil of Neem on the aphids of watermelon fields. The aim is to reduce the damage caused by these pests by protecting the environment and by evaluating the natural insecticide used in this study.

### **Material and Methods:-**

#### **Synthetic insecticide (Malathion):-**

Plot: 35100.

Active ingredient: Malathion.

Field of action: flies, aphids, codling moth.

Dose of use: 200 ml / hl.

Product Company: Agri Chemistry (Morocco).

Nature of product: toxic insecticide and acaricide universal.

#### **Natural insecticide (Neem oil):-**

Reagents used in this work have been provided by Herb'Atlas, supplier of natural products, organic and conventional essential oils.

Neem vegetable oil: The botanical name of Neem, also known as Indian Lilac, is *Azadirachta indica*. Neem is an evergreen tree native to India, Burma, Java and the Lesser Sunda Islands (Mouffok et al., 2007/2008). Neem oil is obtained by cold pressing and sand filtration. The active molecule is azadirachtin (0.29 %). Its major constituents are oleic acid (46.8 %) and linoleic acid (12.8 %)

#### **Culture of watermelon:-**

The common name is watermelon. The latin name is *Citrullus Lanatus* (Thunberg) Matsumara & Nakai (also called *C. vulgaris*) and the Family name is Cucurbitaceae (David, 2008). The watermelon is a fruit with seeds or the arrangement of the plants is 2 m x 1 m between hills. Its varieties are the Sugar Belle and Royal Jubilee. Its duration of culture is from 70 to 95 days. The potential returns to high productivity of this fruit are of 5 to 12 kg. The watermelon prefers warmer temperatures and a long growing season.

#### **Description of the aphids:-**

The Common name is aphids and the latin name of aphids is *Adelgides*. There are the aphids of the cotton (aphid of melon), *Aphis gossypii* Glover on all cucurbits. It is an aphid-green blackish, about 1 to 2 mm long. The siphunculi and the cauda venenum' as the (the tail) are black in color. There is also the aphids green of the fish, *Myzus persicae* (Sulz). The adult aptere measure 1.5 to 2.6 mm long. It is a matte color olive green or light green, sometimes mixed with yellow. The antennae are as long as the body and the cornicles are green.

The adult wing has the head and thorax black in color. The length of its body is of 2.0 to 2.5 mm. It is a vector of cucumber mosaic and other viruses that can attack the cucurbits. To combat these aphids we used a spray of extracts of Neem, spraying of extracts of tobacco or use of ashes of wood (Bijlmakers and Verhoeck, 1995). The aphids were identified with a magnifying glass of 8x and they present the following characteristics: 0.25 mm – 2.5 mm long, dark and light green head, dark and light green chest, yellow-green and light green abdomen.

## Experimental conditions and method:-

### Conditions:-

The tests have been realized from the beginning of summer 2016 in watermelon fields. The geographical area chosen is near the Ziz Oasis Tafilalt in the Southeast Morocco. The area of the watermelon fields ranged from 0.1 to 0.5 hectare. In order to carry out these experiments, it was chosen randomly the plots of 1 m<sup>2</sup>.

### Experiments and procedures:-

Experiments were carried out to assess the mortality of aphids in the presence of dilute solutions using a methodology based on the World Health Organization protocol. Aphids parasitizing fields with a surface area of 1m<sup>2</sup> were collected after treatment in white plastic bags of 25 x 40 cm<sup>2</sup> for subsequent laboratory counting.

Stock solutions of each product sample were prepared in pure water and from these solutions the final dilutions of the assay were carried out at different concentration percentages (v / v) (0.5 % and 1 % of product in pure water). In order to verify the reproducibility of the results each test was repeated four times. A control sample of 100 ml of pure water and emulsifier enables to measure the natural mortality at the same experimental conditions. The count of dead aphids on the watermelon plants taken in a 1 m<sup>2</sup> surface area has been accomplished by means of a magnifying glass 8x, and this 3,5 and 7 hours after treatment.

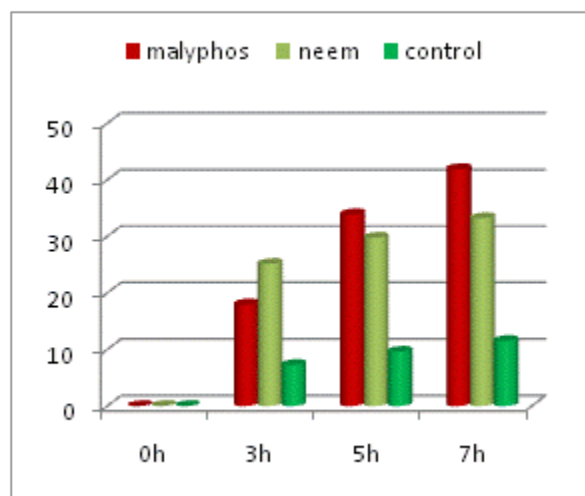
## Result and Discussion:-

### Results:-

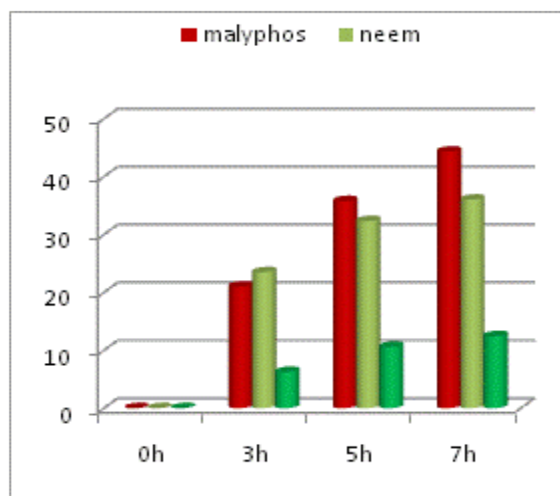
The action of different products on the aphids results in mortality after the time following treatment, as shown in table 1, figure 1 and figure 2. Each mortality percentage ( $m \pm \text{SEM}$  where  $m$  is the mortality and SEM is the Standard Error of Measurement) presented in table 1 is the average of sixteen tests which have the unavoidable uncertainty of the measurement.

**Table 1:** Aphid mortality percentage (%)

Time (h) Product	Concentration 0.5 % (v / v)			Concentration 1 % (v / v)		
	3	5	7	3	5	7
<b>Malyphos</b>	17.98±0.9	33.9±1.3	41.89±1.02	21.01±0.8	35.76±1.1	44.32±0.95
<b>Neem</b>	25.12 ±1.75	29.76 ±2	33.19 ±2.09	23.47 ±1.25	32.3 ±1.46	36.01 ±1.5
<b>Control</b>	5.25 ±1.08	07.6 ±0.99	12.5 ±1.05	6.8 ±0.41	8.89 ±0.85	12.06 ±1.01



**Figure 1:** Case of dose 0.5 %



**Figure 2:-** Case of dose 1 %

It is observed that at the 0.5 % dose the mortality is low at 3 hours for the Malyphos than for the Neem oil. But beyond 3 hours the product Malyphos becomes more deadly than the oil of Neem. At the 1 % dose, the same is observed for both products. The natural mortality of the control is too low at all times by contribution to the products used and does not exceed 12.5 %.

These mortality rates are clear at the end of each test and do not reach high mortality values over short periods, which proves that the effect of the products is long and similar. Also the Neem is active in the short term but the Malypfos becomes active in the long term. It is observed that mortality varies little, even at a high dose and over a long period.

To more accurately evaluate the insecticidal activity of these products against aphids, lethal times were calculated for mortality of 50 % ( $TL_{50}$ ) with 90 % ( $TL_{90}$ ) and lethal doses for mortality of 50 % ( $LC_{50}$ ) with 90 % ( $LC_{90}$ ) defined in table 2.

**Table 2:-**  $TL_{50}$ ,  $TL_{90}$ ,  $LC_{50}$  and  $LC_{90}$

	$TL_{50}$		$TL_{90}$		$LC_{50}$	$LC_{90}$
	0.5 %	1 %	0.5 %	1 %	After 7 hours	After 7 hours
<b>Malypfos</b>	8.2 h	7.6 h	14.6 h	13.8 h	1 %	1.9 %
<b>Neem</b>	9.8 h	9 h	18.2 h	16.6 h	1.25 %	2.35 %

### Discussion:-

In a watermelon field, aphids die slowly even at a high dose of 1 % and after 7 hours have a mortality value of 36.01 % for oil and 44.32 % for Malypfos. These values are close for both products and are very far from the natural mortality of the low and high dose control. It can be assumed that the mortality is mainly due to the different active compounds contained in these products, the dose used and the treatment time of the aphids. At high doses the oil and Malypfos become very active against the aphids with a superiority of the last product.

It is noted for the 0.5 % dose that the time to have 50 % mortality of the aphids for oil ( $TL_{50}$  = 9.8 hours) is close to Malypfos ( $TL_{50}$  = 8.2 hours). After 7 hours, the dose necessary to have 50 % mortality for oil ( $LC_{50}$  = 1.25 %) close to Malypfos ( $LC_{50}$  = 1 %). Viewing these results obtained in table 2, the insecticidal activity of Neem oil is closer to the synthetic product Malypfos often used by farmers in our country. These results are proved by Butler and Henneberry (Butler and Hennberry, 1990) who tested a 5 to 10 % solution of cotton seed oil on cabbage aphids.

In our study, we obtained results indicating that doses of 0.5 % and 1 % of the products applied to aphids have a close impact and sufficient insecticidal action. The high dose of 1 % showed that all samples had an unattractive activity on the aphids. Hour after hour, Neem extract in watermelon fields achieved a 90 % mortality rate for the high dose 1 % in less time than 16.6 hours close to that of Malypfos by 13.8 hours.

The natural insecticide will therefore have a great importance on human, animal and environmental health and will be better than the synthetic product. These results are consistent with Isman, the natural plant extracts have a real richness and can give many substances insecticides used in the fight against the parasites (Isman, 2001).

### Conclusion:-

The attack by the vegetable oil of Neem on the aphids of watermelon fields is also affected in the same way by the chemical Malypfos. This shows that vegetable oil with sufficient concentrations can cause death of the insect and replace the product Malypfos. These results show that natural plant extracts are a real wealth and can give many insecticide substances used in the control of parasites. It follows that the use of natural molecules of ecological and economic interest possessing insecticidal properties of lesser toxicity in humans proves to be an alternative approach to the use of synthetic insecticides.

### References:-

1. **Benayad, N. (2008).** Les huiles essentielles extraites des plantes médicinales marocaines : moyen efficace de lutte contre les ravageurs des denrées alimentaires stockées. Rapport d'étude. Faculté des sciences de Rabat, Maroc, 63p.
2. **Bijlmakers, H.W.L., & Verhoek, B.A.(1995).** Cultures vivrières et maraîchères, Guide de Défense des Cultures au Tchad. Rome, Page 69.
3. **Butler, G.D.Jr., & Henneberry, T.J.(1990).** Cottonseed oil and safer soap: effects on cotton and vegetable pests and phytotoxicity. The Southwestern Entomologist, 15(3):257-264.
4. **Camara, A. (2009).** Lutte contre *Sitophilus oryzae*. (Coleoptera: Curculionidae) et *Tribolium castaneum* Herbst (Coleoptera: Tenebrionidae) dans les stocks de riz par la technique d'étuvage traditionnelle pratiquée en Basse-

- guinée et l'utilisation des huiles essentielles végétales. Thèse de doctorat. Université du Québec, Montréal, Canada, 174p.
5. **David, R. (2008).** Watermelon – Notes. Vegetable Crops - HORT410. Department of Horticulture & Landscape Architecture.
  6. **Guèye, MT., Seck, D., Wathelet, JP., Lognay, G. (2011).** Lutte contre les ravageurs des stocks de céréales et de légumineuses au Sénégal et en Afrique occidentale : synthèse bibliographique. Biotechnol. Agron. Soc. Environ., 15(1) : 183-194.
  7. **Herb'Atlas** Supplier of products, organic and conventional essential oils. Address: 171, Rue de Crimée 13003 Marseille – France. [www.herbatlas.com](http://www.herbatlas.com) - [www.bioessentielle.com](http://www.bioessentielle.com)
  8. **Isman, M.B.(2001).** Pesticides based on plant essential oils for management of plant pests and diseases. In:International symposium on development of natural pesticides from forest resources. Korea Forest Research Institute, Seoul, Korea, p. 1-9.
  9. **Linton, Y., Nisbet, A., Mordue, A. (1997).** The effect of azadirachtin on the testes of the desert locust *Schistocerca gregaria* (Forsk.). J. Insect Physiol. 43, p. 1077–1084.
  10. **Michel, L. (2002).** maladies des céréales et de la luzerne, Laboratoire de diagnostic en phytoprotection, Direction de l'innovation scientifique et technologique, p 18.
  11. **Mordue, A., Blackwell, A. (1993).** Azadirachtin: an update. J. Insect Physiol. 39, p. 903–924.
  12. **Mouffok, B., Raffy, E., Urruty, N., & Zicola, J. (2007/2008).** Le neem, un insecticide biologique efficace. (Projet tutoré du S2) Université Paul Sabatier, Auch. 14p.
  13. **Salim, MM. (2011).** Evaluation de l'effet insecticide et de la persistance des huiles essentielles de *Callistemon viminalis* G Don, de *Xylopia aethiopica* Dunal et de *Lippia chevalieri* Moldenke sur *Callosobruchus maculatus* Fabricius et *Sitophilus zeamais* Motschulsky, principaux ravageurs des Stocks du niébé et du maïs. Mémoire de Master II, Biologie Animale/Entomologie. Université Cheikh Anta Diop, Dakar, Sénégal, 35p.
  14. **Volkonsky, M. (1937).** Sur l'action acridifuge des extraits de feuilles de *Melia azaderach*. Arch. Inst. Pasteur Algérie 15, p. 427–432.
  15. **Wilps, H., Kirkilionis, E., Muschenich, K. (1992).** The effects of neem oil and azadirachtin on mortality, flies activity, and energy metabolism of *S. gregaria* Forsk. A comparison between laboratory and field locusts. Comp. Biochem. Physiol. 102, p. 67–71.
  16. **World Health Organization (WHO).** Bioassay method for the titration of *Bacillus sphaericus*: consultation on the development of *Bacillus sphaericus* as a microbial larvicide. World Health Organ, 1985, 3: 85-95.



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### RESEARCH ARTICLE

#### Mothers knowledge about the otitis media risk factors among children: Multi-centric Saudi study.

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Otitis media, risk factors, caregivers, children

#### Abstract

**Background:** Identifying common risk factors of otitis media (OM) among children by caregivers, particularly mothers will help in controlling the disease and reducing its adverse outcome.

**Objectives:** To determine the knowledge of mothers on the risk factors associated with OM and its determinants.

**Subjects and methods:** A quantitative cross sectional study was carried out at King Fahd Medical city, Riyadh, Saudi Arabia among a representative sample of mothers attending Otolaryngology, pediatric and well-baby clinics at PSMC throughout the study period (December, 2016), irrespective of the child's complaint provided that they had a child aged below 6 years. Data were collected using a modified Ear Infection Survey questionnaire, which included questions regarding the possible risk factors for otitis media.

**Results:** The study included 218 mothers. Their age ranged between 17 and 55 (33.8±7.8) years. More than one third of them (39.4%) had more than three children. The most frequently known otitis media risk factors were male gender (94.5%), recurrent chronic rhinitis (84.4%), and absence of breast feeding (80.7%) whereas the lowest known risk factors were no existence of a vaccine (6.4%), Low socio-economic status (12.4%), day care attendance (16.1%) and malnutrition (19.7%). Overall, inadequate knowledge was reported among 71.6% of them. None of the studied risk factors was significantly associated with mothers' knowledge regarding otitis media risk factors.

**Conclusion:** Mothers' knowledge of otitis media risk factors among their children is suboptimal. Therefore, a public health education campaign targeted mothers of young children is necessary.

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#### Introduction:-

In both developed and developing countries, otitis media (OM) is a very common health problem and considered the main preventable reason (90%) for hearing loss among children.<sup>[1]</sup>

The prevalence of chronic OM differs in various countries, but the highest prevalence rates were reported in South East Asia, Africa and Western Pacific regions.<sup>[1]</sup>

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Epidemiological studies for middle ear inflammatory conditions in the Kingdom of Saudi Arabia are scarce as only few regional studies were conducted through local universities to investigate prevalence of Otitis media in different provinces of KSA. In Riyadh prevalence of OM was 13.8 %<sup>[2]</sup> and in Abha it was 2.3%.<sup>[3]</sup> In Qassim region, it was 7.5%.<sup>[4]</sup>

Risk factors (RFs) of OM include recurrent upper respiratory tract infections,<sup>[5, 6]</sup> household tobacco smoke,<sup>[7]</sup> short duration of breast feeding,<sup>[5]</sup> artificial bottle feeding,<sup>[8]</sup> day care attendance,<sup>[6]</sup> family history,<sup>[9]</sup> male gender and low socioeconomic status (SES).<sup>[10-13]</sup> Many of these risk factors could be modified by adopting proper lifestyle changes which helps in control of OM and its associated sequel<sup>[13]</sup>

Identifying common risk factors by caregivers, particularly mothers will help in controlling the disease and reducing its adverse outcome, therefore this study was conducted to determine the knowledge of mothers on the risk factors (RFs) associated with OM for possible controlling of some of these factors and reducing the burden of the disease.

### Subjects and Methods:-

A quantitative cross sectional study was carried out at King Fahd Medical city, Riyadh, Saudi Arabia. Riyadh is the capital of Saudi Arabia with an approximate population of 6.5 millions. Mothers attending Otolaryngology, pediatric and well-baby clinics at PSMC throughout the study period (December, 2016), irrespective of the child's complaint were eligible for study inclusion provided that they had a child aged below 6 years.

The sample size was calculated by using the single proportion equation in Raosoft software package. The required sample size is 219 mothers at 95% confidence level (estimated frequency 50%, margin of error accepted was 5%). Systematic random sampling technique was implemented to select the study sample. Data were collected using a modified Ear Infection Survey questionnaire,<sup>[13]</sup> which included questions regarding the possible risk factors for otitis media (low socio-economic status, recurrent of chronic rhinitis, Exposure to household smokers, past history of otitis media in the last 12 months, otitis media of siblings, malnutrition, male gender, parents with history of otitis media, day care attendance, bottle feeding, and non-existence of vaccines. The questionnaire also included demographic characteristics of mothers (age, educational level, current marital status, number of children, job, husband's age, job, education, and family income). For illiterate mothers, Arabic-speaking nurses will help in data collection.

Knowledge score was computed in the way that mothers who answered correctly to each risk factor were assigned a score of "1" whereas those answered wrongly or didn't know were assigned a score of "0". Total knowledge score and its percentage were computed. Mothers who got 50% or more of total knowledge score were considered as having "adequate knowledge" whereas those who got less than 50% were considered as having "inadequate knowledge".

The data were coded before computerized data entry. The statistical Package for Social Sciences (SPSS) software version 22.0 was used for data entry and analysis. Descriptive statistics in the form of frequency and percentage were computed and analytic statistics, using chi-square test were applied. P-values <0.05 was considered as statistically significant.

### Results:-

The study included 218 mothers. Their age ranged between 17 and 55 (33.8±7.8) years. More than one third of them (39.4%) had more than three children. Most of them (73.9%) were university graduated or above. Slightly less than half of the respondents (48.6%) were working. Their husband's age ranged between 23 and 84 (39.5±9.3) years. Most of their husbands (70.6%) were at least university graduated. Almost two-thirds (61%) of their husbands were professionals whereas 17% were militaries. The family income of almost half of them (50.9%) exceeded 10000 SR/month.

Regarding mothers' knowledge of otitis media risk factors, the most frequently known were male gender (94.5%), recurrent chronic rhinitis (84.4%), and absence of breast feeding (80.7%) whereas the lowest known risk factors were no existence of a vaccine (6.4%), Low socio-economic status (12.4%), day care attendance (16.1%) and malnutrition (19.7%). Overall, inadequate knowledge was reported among 71.6% of them as illustrated in figure 1.

None of the studied risk factors (age, number of children, educational level, job, husband's age, education, job and family income) was significantly associated with mothers' knowledge regarding otitis media risk factors.

### **Discussion:-**

The identified risk factors for OM among children in many studies were acute suppurative otitis media, recurrent upper respiratory tract infections, exposure to passive smoking, bottle feeding, malnutrition, immuno suppression, infection, low socioeconomic status, overcrowding in homes, schools and day care centers.<sup>[14]</sup>

Identifying common risk factors by caregivers, particularly mothers will help in controlling the disease and reducing its adverse outcome. Therefore this study was carried out to assess their awareness of the common risk factors of OM among their children. We recruited mothers since in our culture, they are more likely to present with sick children to the hospital.

Male predominance of the disease was reported in many studies.<sup>[9, 15-17]</sup> However, some other studies did not observe a gender difference regarding prevalence of OM among children.<sup>[18-20]</sup> In the current study, majority of mothers recognized male gender of children as a risk factor for OM.

Low socio-economic status (SES) was proven to be the single largest risk factor of OM.<sup>[21-23]</sup> Also, in South-western (Nigeria), Lasisi et al., (2007) reported a strong association between low socioeconomic status and OM.<sup>[12]</sup> Low SES itself is a risk factor, and at the same time it is closely associated with others risk factors such as overcrowding. In addition, low socioeconomic status may explain the recurrence of otitis media seen in parents and siblings. Other risk factors may be responsible for greater incidence of OM in the low socio-economic status including exposure to household passive smokers, lack of access to proper healthcare and medication as well as malnutrition, which is common in the low SES as a result of impaired immunity.<sup>[24-25]</sup> In the present study, low socio-economic status itself was recognized by only 12.4% of mothers as a risk factor for OM. However, other related risk factors were recognized by higher percentages such as OM in siblings (26.1%), parents (40.4%), recurrent OM (56.9%) and malnutrition (19.7%).

Overcrowding in poor ventilated day care centres predisposes children to viral infection of the upper respiratory tract which can lead to congestion of the Nasopharynx, Eustachian tube dysfunction and subsequent otitis media.<sup>[16]</sup> In the current survey, only 16.1% of mothers could recognize that daycare center is a risk factor for OM among children.

Breast feeding has been proven to enforce children immunity, but this protection decreases as they grow; hence vulnerability to infection increases from the age of one year because breast milk could no longer meet their nutritional need.<sup>[15]</sup> In the current study, absence of breast feeding as a risk factor for children OM was recognized by 80.7% of mothers.

The poor knowledge of most risk factors of OM demonstrated in this study suggests that a public health education campaign targeted mothers of young children is necessary.

Among limitations of the study is the inclusion of mothers from one institution which could affect the generalizability of results. However, mothers from all socio-economic statuses attending this hospital.

In conclusion, Knowledge of modifiable risk factors of OM among mothers is generally inadequate. Therefore, healthcare educational programs should be directed to them. Additionally, training and encouragement of health care professionals is needed to disseminate information to mothers and other caregivers on risk factors of OM.

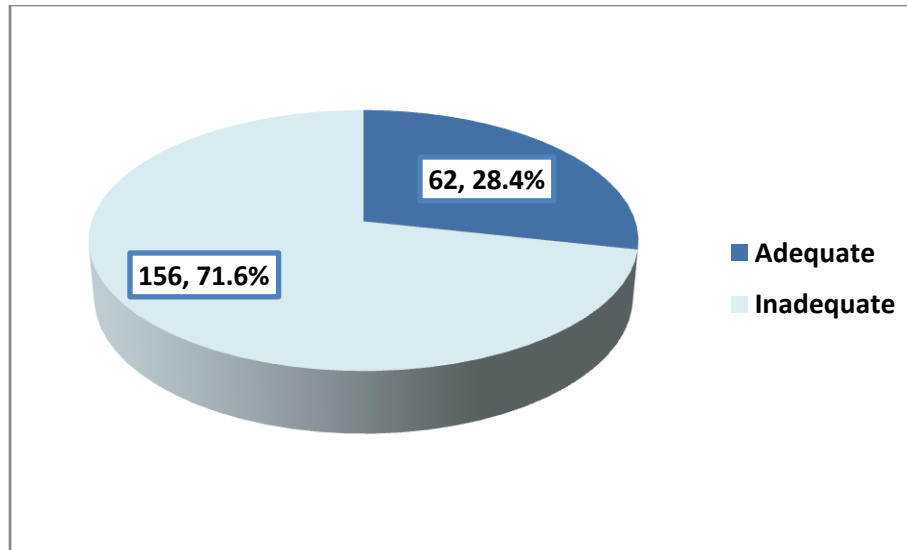


Figure 1: Mothers` level of knowledge regarding risk factors of otitis media

Table 1: Demographic characteristics of the participants (n=218)

	Number	Percentage
<b>Age (years)</b>		
≤25	37	17.0
26-35	101	46.3
36-45	64	29.4
>45	16	7.3
<b>Number of children</b>		
≤3	132	60.6
>3	86	39.4
<b>Educational level</b>		
Below secondary school	16	7.3
Secondary school	41	18.8
University/above	161	73.9
<b>Job</b>		
Working	106	48.6
House wife	112	51.4
<b>Husband`s age</b>		
≤35	80	36.6
36-45	81	37.2
46-55	47	21.6
>55	10	4.6
<b>Husband`s education:</b>		
Below secondary school	18	8.3
Secondary school	46	21.1
University/above	154	70.6
<b>Husband`s job</b>		
Professional	133	61.0
Military	37	17.0
Business/trading	20	9.2
Retired	14	6.4
Others	14	6.4
<b>Household income (SR/month)</b>		
<5000	17	7.8
5000-10000	90	41.3
>10000	11	50.9

**Table 2: Mothers` knowledge of otitis media risk factors.**

Risk factors	Correct answer	
	No.	%
Low socio-economic status	27	12.4
Exposure to household smokers	56	25.7
Recurrent chronic rhinitis	184	84.4
Past history of Otitis media in the last 12 months	124	56.9
Otitis media of siblings	57	26.1
Malnutrition	43	19.7
Male gender	206	94.5
Parents with history of otitis media	88	40.4
Day care attendance	35	16.1
No breast feeding	176	80.7
No existence of a vaccine	14	6.4

**Table 3: Association between demographic characteristics of mothers and their knowledge of otitis media risk factors**

	Knowledge of OM risk factors		Chi-square
	Inadequate N=156 N (%)	Adequate N=62 N (%)	
<b>Age (years)</b>			
≤25 (n=37)	24 (64.9)	13 (35.1)	<b>0.329</b>
26-35 (n=101)	70 (69.3)	31 (30.7)	
36-45 (n=64)	48 (75.0)	16 (25.0)	
>45 (n=16)	14 (87.5)	2 (12.5)	
<b>Number of children</b>			
≤3 (n=132)	92 (69.7)	40 (30.3)	<b>0.450</b>
>3 (n=86)	64 (74.4)	22 (25.6)	
<b>Educational level</b>			
Below secondary school (n=16)	10 (62.5)	6 (37.5)	<b>0.463</b>
Secondary school (n=41)	32 (78.0)	9 (22.0)	
University/above (n=161)	114 (70.8)	47 (29.2)	
<b>Job</b>			
Working (n=106)	78 (73.6)	28 (26.4)	<b>0.519</b>
House wife (n=112)	78 (69.6)	34 (30.4)	
<b>Husband`s age</b>			
≤35 (n=80)	53 (66.3)	27 (33.8)	<b>0.547</b>
36-45 (n=81)	62 (76.5)	19 (23.5)	
46-55 (n=47)	34 (72.3)	13 (27.7)	
>55 (n=10)	7 (70.0)	3 (30.0)	
<b>Husband`s education:</b>			
Below secondary school (n=18)	12 (66.7)	6 (33.3)	<b>0.081</b>
Secondary school (n=48)	39 (84.8)	7 (15.2)	
University/above (n=154)	105 (68.2)	49 (31.8)	
<b>Husband`s job</b>			
Professional (n=133)	91 (68.4)	42 (31.6)	<b>0.459</b>
Military (n=37)	29 (78.4)	8 (21.6)	
Business/trading (n=20)	13 (65.0)	7 (35.0)	
Retired (n=14)	12 (85.7)	2 (14.3)	
Others (n=14)	11 (78.6)	3 (21.4)	
<b>Household income (SR/month)</b>			
<5000 (n=17)	11 (64.7)	6 (35.3)	<b>0.507</b>
5000-10000 (n=90)	68 (75.6)	22 (24.4)	
>10000 (n=111)	77 (69.4)	34 (30.6)	

**References:-**

1. World Health Organization-Child and Adolescent Health and Development PoBaD. Chronic suppurative otitis media Burden of Illness and Management Options. Geneva, Switzerland: World Health Organization; 2004.
2. el-Sayed Y, Zakzouk S. Point prevalence of type B tympanogram in Riyadh. *Int J*
3. *Pediatr Otorhinolaryngol.* 1995; 31:53-61
4. Abolfotouh MA, Ghieth MM, Badawi IA. Hearing loss and other ear problems among schoolboys in Abha, Saudi Arabia. *Ann Saudi Med.* 1995; 15:323-6
5. Humaid AI, Ashraf AS, Masood KA, Nuha AS, Saleh AA, Awadh AM. Prevalence and risk factors of Otitis Media with effusion in school children in Qassim Region of Saudi Arabia *International Journal of Health Sciences, Qassim University* 2014 Oct-Dec; 8(4):325-334
6. Aniansson G, Alm B, Andersson B, Håkansson A, Larsson P, Nylén O, *et al.* A prospective cohort study on breast-feeding and otitis media in Swedish infants. *Pediatr Infect Dis J* 1994;13:183-8.
7. Daly KA, Brown JE, Lindgren BR, Meland MH, Le CT, Giebink GS. Epidemiology of otitis media onset by six months of age. *Pediatrics* 1999; 103:1158-66.
8. Adair-Bischoff CE, Sauve RS. Environmental tobacco smoke in middle ear disease in preschool age children. *Arch Pediatr Adolesc Med* 1998;152:127-33.
9. Wintermeyer SM, Nahata M. Chronic suppurative otitis media. *Ann Pharmacother* 1994;28:1089-99.
10. Teele DW, Klein JO, Rosner B. Epidemiology of otitis media during the first seven years of life in children in greater Boston: A prospective cohort study. *J Infect Dis* 1989;160:83-94.
11. Jahn AF. Chronic otitis media: Diagnosis and treatment. *Med Clin North Am* 1991;75:1277-91.
12. Fliss DM, Shoham I, Leiberman A, Dagan R. Chronic suppurative otitis media without cholesteatoma in children in Southern Israel: Incidence and risk factors. *Pediatr Infect Dis J* 1991;10:895-9.
13. Lasisi AO, Olaniyan FA, Muibi SA, Azeez IA, Abdulwasiiu KG, Lasisi TJ, *et al.* Clinical and demographic risk factors associated with chronic suppurative otitis media. *Int J Pediatr Otorhinolaryngol* 2007;71:1549-54.
14. Kerschner JE, Lindstrom DR, Pomeranz A, Rohloff R. Comparison of caregiver otitis media risk factor knowledge in suburban and urban primary care environments. *Int J Pediatr Otorhinolaryngol* 2005;69:49-56.
15. Hamilton J. Chronic otitis media in childhood. In Michael G (Ed), *Scott's Brown Otorhinolaryngology, Head and Neck Surgery.* 7th ed., 2008;1:956-964. London: Hodder Arnold.
16. Amusa YB, Ijaduola IK, Onayade OO. Epidemiology of otitis media in a local tropical African Population. *WJMS* 2005; 24: 227-230.
17. Amutta SB, Abdullahi M, Aliyu D, Iseh KR, Inoh MI. Risk factors for chronic suppurative Otitis Media among children under the age of fifteen years in Sokoto Metropolis, North-Western Nigeria. *IJIRD* 2016;5(10):400-404
18. Schilder AG, Zielhuis GA, Van Den Broek P. The otological profile of a cohort of Dutch 7.5-8-year-olds. *Clin Otolaryngol Allied Sci.* 1993;18:48-54
19. Al-Humaid IH, Abou-halawa SA, Khan AM, Al-Hamamah SN, Al Duways AS, Alanazi MA. Prevalence and risk factors of Otitis Media with effusion in school children in Qassim Region of Saudi Arabia. *International Journal of Health Sciences, Qassim University* 2014; 8(4):325-334
20. Kiris M, Muderris T, Kara T, Bercin S, Cankaya H, Sevil E. Prevalence and risk factors of otitis media with effusion in school children in Eastern Anatolia. *Int J Pediatr Otorhinolaryngol.* 2012; 76:1030-5
21. Engel J, Anteunis L, Volovics A, Hendriks J, Marres E. Risk factors of otitis media with effusion during infancy. *Int J Pediatr Otorhinolaryngol.* 1999; 48:239-49
22. Adeyemo AA. Knowledge of caregivers on the risk factors of otitis media. *Indian Journal of Otology* 2012 Oct; 18 (4):184-188
23. Paradise JL, Rockette HL, Colborn DK, Bernard BS, Smith CG, Kurs-Lasky M, *et al.* Otitis media in 2253 Pittsburgh-area infants: Prevalence and risk factors during the first two years of life. *Pediatrics* 1997;99:318-33.
24. Ah-Tye C, Paradise JL, Colborn DK. Otorrhea in young children after tympanostomy-tube placement for persistent middle-ear effusion: Prevalence, incidence and duration. *Pediatrics* 2001;107:1251-8.
25. Chandra RK. Nutrition and the immune system from birth to old age. *Eur J Clin Nutr* 2002;56:S73-6.
26. Casselbrant ML, Mandel EM. Genetic susceptibility to otitis media. *Curr Opin Allergy Clin Immunol* 2005;5:1-4.



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### RESEARCH ARTICLE

#### EFFECT OF SERUM COPPER LEVELS IN TYPE 2 DIABETES MELLITUS WITH NEPHROPATHY: A CASE CONTROL STUDY IN NORTH INDIAN POPULATION.

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#### Abstract

associated with various complications such as diabetic nephropathy. It is most common cause of End Stage Renal Disease (ESRD) in diabetic individual. In various studies, altered levels of serum copper levels are associated with diabetic complications such as diabetic nephropathy. We studied serum copper levels in type 2 diabetic individual with and without nephropathy.

**Materials and Methods-** The study population consisted of 100 type 2 diabetic individual which was further divided into two groups, first group consisted of 50 diabetic individual with nephropathy and second group consisted of 50 diabetic individual without nephropathy. Diabetic nephropathy status was assessed by spot urinary albumin creatinine ratio and GFR. Serum copper levels were measured by colorimetric method.

**Result-** Mean serum copper levels were significantly higher in diabetic patient with nephropathy ( $111.8 \pm 13.9$  mg/dl) as compare to diabetic patient without nephropathy ( $102.3 \pm 16.2$  mg/dl), ( $p = 0.002$ ). Serum copper was also positively correlated with weight of subject ( $r = 0.263$ ,  $p = 0.009$ ), and negatively correlate with serum zinc ( $r = -0.263$ ,  $p = 0.009$ ).

**Conclusion-** Diabetic nephropathy is the leading cause of death in diabetic individual. Our study points toward the increased serum copper levels are associated with diabetic nephropathy. Thus we could use copper chelator in an attempt to decrease serum copper, so that

**Introduction-** Diabetes mellitus is chronic metabolic disease,

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overall management of diabetic individual.

diabetic nephropathy could be prevented and thus improve

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### **Introduction:-**

Diabetes mellitus is the chronic, lifelong metabolic disease, which is characterised by hyperglycemia and it produce the organ damage by various mechanism such as free radical injury, formation of advanced glycation end products and various toxic metabolite which accumulate during the metabolism of excess of glucose such as polyol intermediate, sorbitol, hexose-amine etc.[1] These abnormalities in the presence of chronic hyperglycemia ultimately lead to various chronic micro and macro vascular complication such as diabetic nephropathy, diabetic retinopathy, diabetic neuropathy and include cardiovascular, cerebrovascular and various peripheral vascular diseases respectively.[2]

The prevalence of diabetes mellitus and associated complication is increasing globally at a faster rate. At present there are approximately 220 millions of diabetic patient present globally as per World Health Organisation (WHO) and if the current growth is not checked, then number of diabetes patient would exceeds 435 million in 2030, according to International Diabetes Federation (IDF).[3,4] WHO has already declared India as world capital of Diabetes.

Diabetic Nephropathy (DN) is the leading cause of chronic kidney failure all over the world.[5] Clinical hallmark of diabetic nephropathy include elevated blood pressure, elevated urinary proteins and abnormal renal function test.

It is one of the most significant long term complications in terms of morbidity and mortality for diabetic patient which usually present in 40-50% of diabetic patients out of which 20 % patient progress to End Stage Renal Disease (ESRD). Thus it points toward the certain population of diabetic patient who are susceptible for the development of diabetic nephropathy. The potential modifiable risk factors for the its development and progression are hyperglycemia, hypertension, and other minor risk factors including diabetic factor.[6]

It has been shown in various studies that alterations in levels of various elements lead to development of diabetes mellitus and its associated complications such as diabetic nephropathy. It has been suggested that perturbations in mineral metabolism are more pronounced when metabolic control is poor or if vascular complications are present. It has also been shown that excess of Cu lead to increase predisposition of vascular disease in diabetic patient.[7]

So we framed the hypothesis that alter levels of copper is the culprit for the development of diabetic nephropathy as the complication of diabetes. There also lack of studies regarding alter levels of copper in North Indian diabetic patient with and without Nephropathy.

### **Materials And Methods:-**

#### **Study design:-**

This hospital based observational case control study was done for the period of 3 years from 2013 to 2015 in the Department of Medicine with the collaboration of Department of Biochemistry, Lady Hardinge Medical College (LHMC) and Associated Hospitals, New Delhi. Institutional Ethical Committee approved our study design.

#### **Study Population:-**

Our study included 100 diabetic patients who had visited diabetic OPDs and routine OPDs of Department of Medicine, LHMC, New Delhi. Study population was divided into two groups. First group consisted of 50 diabetic patients with nephropathy and second group consisted of 50 diabetic patients without nephropathy.

#### **Inclusion criteria:-**

Known cases of type 2 diabetes mellitus for minimum period of 5 years of duration.

#### **Exclusion criteria:-**

Patient not willing to participate in the study, acute and chronic illness excluding diabetes mellitus, patient having hormonal abnormalities, drug intake history which have nephrotoxic effect and deleterious effect on glucose profile of diabetic patient were excluded from the study.

Bilingual and informed consent was taken from the patient and his relatives. Thorough clinical history and medical examination was done especially related to diabetes and diabetic nephropathy.

#### Sample collection:-

Five ml of venous sample was taken from the subject under sterile condition into plain vials without anticoagulant for routine and special investigations, anticoagulant containing purple cap vials for hemogram and NaF with anticoagulant containing grey cap vials for blood glucose profile. The plain vials were kept for half an hour for clotting. After clotting, the plain vials were centrifuged at the speed of 2000 RPM for 5 minutes. The serum was separated and aliquot into serum tubes. For routine biochemical investigations serum was sent immediately for analysis. For special investigation the serum was kept at -20°C for batch analysis of serum copper.

For assessing the status of diabetic nephropathy in the study population, we measured spot urine albumin creatinine ratio (U-A/C) and GFR. U-A/C values included Normoalbuminuria: <30 mg/g of creatinine, Microalbuminuria: 30-300 mg/g of creatinine and Macroalbuminuria: >300mg/g of creatinine. Cockcroft – Gault equation was used to assess GFR.[8]

Batch analysis was done to measure serum magnesium in the preserved samples by using fully AUTOMATED ANALYSER SYNCHRON BECKMAN CX-9 using standard reagent and kits. All kits were of centronic GmbH, Germany. Serum copper measurement was based on direct colorimetric method without deproteinisation in serum. In a pH 4.7 buffer system, copper is released from its carrier protein, the ceruloplasmin, and forms complexant 3,5-DiBr-PAESA[4-(3,5-dibromo-2-pyridylazo)-N-ethyl-N-(3-sulfopropyl)aniline] a stable complex. The colour intensity of this complex is proportional to the amount of copper in the sample. Lyophilised control serum was used. The colour so formed was red which was measured spectrophotometrically at wavelength of 582 nm. Reagent kit name-Copper REF 17106. Lot number -20299.

The normal values for serum copper was considered as 70 – 140 µg/dl for male and 80 – 155 µg/dl for female.[9]

#### Statistical Analysis:-

All data are expressed as mean  $\pm$  SD. (standard deviation) and statistical analysis was conducted using SPSS statistical package, version 20.0 (SPSS Inc., Chicago, IL, USA). A  $p$  value <0.05 was considered as significant. The Student's  $t$ -test was used to compare the mean between two groups for normally distributed data. Pearson's correlation was used to find out the correlation among the various parameters.

#### Results:-

Table 1 showing the renal function of study population which shows that group 1 had diabetic nephropathy as compare to group 2.

Table 2 showing that in group 1, mean serum copper level had significantly higher value than that of group 2.

On Pearson's correlation, serum copper was positively correlated with weight of subject ( $r = 0.263$ ,  $p = 0.009$ ), and negatively correlate with serum zinc ( $r = -0.263$ ,  $p = 0.009$ ).

**Table 1:- Renal profile of study population**

Parameters	Diabetic patient with nephropathy (n = 50)		Diabetic patient without nephropathy (n=50)		p value
	Mean	SD	Mean	SD	
U-A/C (mg/g)	130.7	46.72	18.37	4.99	<0.001*
GFR (ml/min)	62.16	24.74	108.44	7.96	<0.001*

\* $p$  value  $\leq 0.05$  is considered statistically significant.

**Table 2:- Serum Copper status of study population**

Parameters	Diabetic patient with nephropathy (n = 50)		Diabetic patient without nephropathy (n=50)		p value
	Mean	SD	Mean	SD	
Serum copper (mg/dl)	111.8	13.9	102.3	16.2	0.002*

\* $p$  value  $\leq 0.05$  is considered statistically significant. SD= Standard Deviation

#### Discussion:-



Diabetes mellitus is a chronic metabolic disorder which affects carbohydrate, lipid and protein metabolism. It has already taken pandemic in terms of number of diabetic patient. It lead to various complications, one of them is diabetic nephropathy which is responsible for chronic kidney failure in diabetic patients. This complication is responsible for high mortality and morbidity of the person suffering from type 2 diabetes mellitus.

There is need of finding the risk factor for development of diabetic nephropathy and its proper management, so that we can prevent the death from renal failure in diabetic individual.

In various studies, it has been seen that there is a strong relation between some specific oligoelements and diabetes mellitus.[10] It has been seen that altered serum copper (Cu) levels are associated with diabetes and associated complications.[11]

Diabetes complications associated with the increased free radical production leading to oxidative damage, and many of the pathological effects of copper overload are consistent with an oxidative damage to membranes or various macromolecules. Cu is involved in oxidation-reduction reactions and has a dominant role in diverse proteins such as cytochrome oxidase at the terminal end of the mitochondria electron transport chain. This divalent cation is also involved in super oxide dismutase activity. Copper has the capacity to form covalent bounds and it takes part in many redox processes. Copper ions are involved in generation of reactive oxygen species through Fenton reaction, having a pro-oxidant action.[12]

Copper ion is well known for cytotoxic effect due to its redox chemistry. Excess of copper aggravate the hyperglycemia which causes glycation of various protein and also displaces copper from copper binding site of protein and thus further aggravates the hypercuperemia, which lead to more oxidative damage to various tissue and organs.[13]

There are lots of studies done in serum copper levels in diabetic individual with and without complications, but still there is no uniformity in the results levels of copper in these patients. Our study result is in agreement with the study done by Rusu et al [14] and Noto et al [15] in which serum copper levels are increased in diabetic individual with complications such as diabetic nephropathy, but Prabodh et al found no difference of serum copper level in diabetic patient as compare to healthy control.[16] Moreover Hazzim et al showed in his study that serum copper levels are significantly decrease in diabetic patient with complications as compare to diabetic patient without complications.[17]

So our study hints toward the increase serum copper levels in diabetic patients with associated complications. Moreover we can treat the diabetic patient with copper specific chelator, so that various complications of diabetes mellitus including diabetic nephropathy could be prevented as it has been proven beneficial in various animal models.[18,19,20,21,22] Our study could give new insight for understanding the risk factor for development of diabetic nephropathy and also therapeutic modality could be develop to remove excess of copper ions from the diabetic patient, so that overall management of diabetic patient improves by decreasing various complication associated with copper induce oxidative stress.

Strength of our study is well characterised study population and standardized techniques to measures various parameters of the study.

**Limitations:-**

Our study had small sample size and study populations were selected from local area. Even it was hospital based case control study, so it would be difficult to predict cause and effect relationship.

**Suggestions:-**

Large prospective, interventional studies need to be undertaken to confirm the cause and effect relationship and to assess the protective role of supplementing copper chelator in human for preventing the development and progression of nephropathy.

**Conflict of Interest:-**

No conflict of interest to declare.

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### References:-

1. Ceriello A, Motz E. Is oxidative stress the pathogenic mechanism underlying insulin resistance, diabetes, and cardiovascular disease? The common soil hypothesis revisited. *Arterioscler Thromb Vasc Biol.* 2004;24(5):816-23.
2. King GL, Brownlee M. The cellular and molecular mechanisms of diabetic complications. *Endocrinol Metab Clin North Am.* 1996;25(2):255-7.
3. Wild S, Roglic G, Green, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care.* 2004; 27(5):1047-53.
4. World Health Organisation. Prevalence of diabetes. In: *Diabetes Action now*, editor. WHO; 2004.
5. Elina EL, Jerums G, Skene A, Grammer P, Power D, Cheong KY, Panagiotopoulos S, McNeil K, Baker ST, Fioretto P et al. Renal structure in normalbuminuric and albuminuric patient with type 2 diabetes and impaired renal function. *Diabetes Care.* 2013;Nov;36(II):3620-6.
6. Murea M, Ma L, Freedman BI. Genetic and environmental factors associated with type 2 diabetes and diabetic vascular complications. *The Review of Diabetic Studies : RDS.* 2012;9 (1):6-22.
7. Zargar AH, Shah NA, Massodi SR, Laway BA, Dar FA, Khan AR, Sofi FA, Wani AI. Copper, zinc and magnesium levels in non-insulin-dependent diabetes mellitus. *Postgrad Med J.* 1998(Nov); 74(877): 665-8.
8. Michels WM, Grootendorst DC, Verduijn M, Elliott EG, Dekker FW, Krediet RT. Performance of the Cockcroft-Gault, MDRD, and New CKD-EPI Formulas in Relation to GFR, Age, and Body Size. *Clinical Journal of the American Society of Nephrology : CJASN.* 2010;5(6):1003-1009
9. Burtis C A, Ashwood E R, Bruns E D. *Tietz Textbook of Clinical Chemistry And molecular diagnostic.* 1Vth ed: Saunders. Philadelphia. 2008.
10. Mohanty SS, Pinnelli VB, Murgod R, Raghavendra DS. Evaluation of serum copper, magnesium and glycated haemoglobin in type 2 diabetes mellitus. *Asian J Pharm Clin Res.* 2013;6(2):188-190.
11. Viktorinova A, Toserova E, Krizko M, Durackova Z. Altered metabolism of copper, zinc, and magnesium is associated with increased levels of glycated hemoglobin in patients with diabetes mellitus. *Metabolism* 2009; 58:1477-1482.
12. Bremner I. Manifestation of copper excess. *Am J Clin Nutr.* 1998; 67(5):1069S-1073S.
13. Quilliot D, Dousset B., Guerci B, Dubois F, Drouin P, Ziegler O. Evidence that diabetes mellitus favors impaired metabolism of zinc, copper, and selenium in chronic pancreatitis. *Pancreas* 2001; 22: 299-306.
14. Rusu ML, Marunoiu C, Rusu LD, Olivia FMN, Cristina HN, Laura P. Testing of Magnesium, Zinc and Copper Blood Levels in Diabetes Mellitus Patients. *Acta Universitatis Cibiniensis.Seria F Chemia.* 2005; 8:61-63.
15. Noto R, Alicata R, Sfogliano L, Neri S, Bifarella M. A study of cupremia in a group of elderly diabetics. *Acta Diabetol Lat.* 1984; 21(1):79-85.
16. Prabodh S, Prakash DS, Sudhakar G, Chowdary NV, Desai V, Shekhar R. Status of copper and magnesium levels in diabetic nephropathy cases: a case-control study from South India. *Biological trace element research.* 2011;142(1): 29-35.
17. Hazzim H Edan. Serum copper level in non insulin diabetes mellitus, Al-Mustansyriah University .*Mustansiriya Med J.* 2006; 6(1):36-41.
18. Cooper GC. Selective divalent copper chelation for the treatment of diabetes mellitus. *Current Medicinal Chemistry.* 2012;19(17):2828–2860.
19. Cooper GJ, Chan YK, Dissanayake AM, Leahy FE, Keogh GF, Frampton CM, Gamble GD, Brunton DH, Baker JR, Poppitt SD. Demonstration of a hyperglycemia-driven pathogenic abnormality of copper homeostasis in diabetes and its reversibility by selective chelation: quantitative comparisons between the biology of copper and eight other nutritionally essential elements in normal and diabetic individuals. *Diabetes.* 2005;54(5):1468–1476.
20. Lu J, Gong D, Choong SY, Xu H, Chan YK, Chen X, Fitzpatrick S, Glyn-Jones S, Zhang S, Nakamura T et al. Copper(II)-selective chelation improves function and antioxidant defences in cardiovascular tissues of rats as a model of diabetes: comparisons between triethylenetetramine and three less copper-selective transition-metal-targeted treatments. *Diabetologia.* 2010;53(6):1217–1226.
21. Bakker SJL, Navis G, Gans ROB. Copper chelation as a potential treatment for left-ventricular hypertrophy in type 2 diabetes. *Diabetologia.* 2009;52(10):2244.
22. Cooper GJ, Phillips AR, Choong SY, Leonard BL, Crossman DJ, Brunton DH, Saafi 'L, Dissanayake AM, Cowan BR, Young AA et al. Regeneration of the heart in diabetes by selective copper chelation. *Diabetes* 2004;53(9) 2501–2508.



### RESEARCH ARTICLE

#### SKIN RASH AND DEVELOPMENTAL DELAY IN A NEWBORN WITH PSEUDOHYPOALDESTRONISM.

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#### Abstract

Aldosterone is an essential hormone plays an important role in the regulation of plasma electrolytes in the body. In case of Pseudohypoaldosteronism, resistance to the action of aldosterone will cause certain electrolytes abnormalities in the form of hyponatremia and hyperkalemia associated with dehydration and metabolic acidosis. Skin and ophthalmological manifestations were reported in rare cases to be part of the type one primary inherited Pseudohypoaldosteronism and might consider a possible early approach to differentiate this condition from congenital adrenal hyperplasia in the neonatal period. We report a case of Pseudohypoaldosteronism in a newborn with a characteristic dermatological rash accompanied the acute attack with an association of a global developmental delay.

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#### Background:-

Pseudohypoaldosteronism (PHA) is a heterogeneous group of disorders that is characterized by electrolyte abnormalities due to renal tubular unresponsiveness or resistance to the action of aldosterone (1). Aldosterone is the major mineralocorticoid secreted by the adrenal gland (2). Nearly 90 percent of the mineralocorticoid activity is carried out by the aldosterone (2). It works on the renal tubules – mainly the principal cells of the collecting tubules and to a lesser extent on the distal tubule and collecting duct resulting in an increase of reabsorption of sodium and excretion of potassium (2). PHA type one is a rare inherited disease which can be either autosomal recessive or dominant. (3). Clinically, these patients present with renal salt wasting, hypovolemia, hyperchloremic acidosis and hyperkalemia despite the elevated level of aldosterone in plasma and urine (3). The autosomal dominant form is milder than the autosomal recessive (3). In the dominant type, there is aldosterone receptor resistance limited to the kidneys mainly (4).

The autosomal recessive type is considered a systemic disease (4). It involves the sweat glands, lungs and reproductive organs in addition to the kidney (4). PHA type 2 also known as Gordon Syndrome is characterized by hyperkalemic acidosis, hypertension and suppression of renin and aldosterone (3).

PHA symptoms are well known worldwide but the special feature in our case is that we found a generalized maculopapular rash in the skin that presents most commonly on the face and on the trunk. Four cases with a similar presentation to our patient have been reported and the cases were as follow. The first case was reported in 2007 in France, the child presented in the first days of life with a rash (5). The second case was in 2014 in Al-Kuwait, the child started to develop Miliaria rubra-like eruption on the 4<sup>th</sup> day of life (6). The same mother of the Kuwaiti child, 13

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months later, delivered a female baby who developed similar manifestations to her brother including the same characteristic rash over the face and trunk on day 2 of life(6). The third case was in 2015 in Turkey of a female baby, on the 7th day of life, she presented with a skin rash noted on her face, her arms and her chest(4). All these cases came with rash in addition to the other symptoms of PHA.

#### Case History:-

Our patient is an 11-month-old Syrian boy delivered as a spontaneous vaginal delivery, full term, with uneventful antenatal period. Parents are second-degree cousins. His weight at birth was 3200g, height 54cm and head circumference 36cm. He was stable, and after the initial screening tests, he was discharged with his mother with no specific complaint. Just 4 days later, he was admitted to the neonatal intensive care unit (NICU) with complaints of poor oral intake, excessive crying and multiple episodes of diarrhea. The patient was severely dehydrated, lethargic, cyanosed and afebrile. There was an obvious maculopapular skin rash covering all the body. He was then intubated and connected to a mechanical ventilator for 6 days and kept NPO for 8 days. He was on intravenous fluid and on total parenteral nutrition (TPN). Full septic workup was ordered and antibiotics started. Results of blood chemistry showed hyponatremia  $Na = 119.9 \text{ mEq/L}$  (135-145), hyperkalemia  $K = 9.44 \text{ mEq/L}$  (3.5-5) and hypercalcemia  $Ca = 12.6 \text{ mg/dL}$  (8.5-10.5). Patient received insulin with 10% dextrose, Ventolin, Ca gluconate and Na resonium for Hyperkalemia. These laboratory results raised the suspicion of congenital adrenal hyperplasia. Hydrocortisone and fludrocortisone were started. 17-hydroxy progesterone, plasma renin and aldosterone levels were sent. Vancomycin was added because gram positive cocci were found on the blood culture. Moreover, candida was also discovered and Amphotericin B was added. He became stable and he showed improvement in his blood chemistry results.



Figure 1:- maculopapular skin rash at crises

On day 11 after admission he again developed hyponatremia  $Na = 128 \text{ mEq/L}$  along with hyperkalemia  $K = 9.22 \text{ mEq/L}$ . Although 17-hydroxy progesterone hormone assay was elevated  $= 16.49 \text{ ng/ml}$  (1.70-4.00 ng/ml), however both plasma renin  $= 500 \text{ uIU/ml}$  (4.4-46) and aldosterone  $100 \text{ ng/dL}$  (2.2-35.3) levels were elevated. Abdominal Ultrasound show normal kidneys. These results raised the suspicion of diagnosis of PHA especially when our patient did not improve with both hydrocortisone and fludrocortisone.  $NaCl$  3% was given orally in addition to  $Na$  polystyrene. He stayed in the NICU for approximately 3 months then discharged. Since that time, he has been admitted to our hospital several times with similar symptoms of repeated vomiting, poor oral intake, fever, severe dehydration, hyponatremia and hyperkalemia along with generalized maculopapular skin rash that resolves after each attack. In addition, despite our patient is an 11 month-old, he has obvious developmental delay. He cannot sit without support. Also he uses mama and dada indiscriminately and the primitive reflexes are still present. There is a family history of death of two siblings (boy and girl) at 5 and 9 days of life with similar symptoms but no diagnosis.

was made at that time. He has other 4 living siblings with a good health status and without similar disease. This patient was noted to have frequent admissions (twice per week), but now when he has become a one year old, the admissions rate become less frequent once per month hoping that it will be more spaced in future.



**Figure 2:-** maculopapular skin rash after resolving

### Discussion:-

Usually in infants who come in their early days of life with symptoms of shock and dehydration associated with electrolyte disturbances of hyperkalemia and hyponatremia, congenital adrenal hyperplasia (CAH) must be ruled out. In our case, the diagnosis of CAH was suspected, therefore treatment with hydrocortisone and fludrocortisone were restarted. Although our patient showed some improvement especially with the correction of hyponatremia and hyperkalemia, however he presented again with similar symptoms a few days later. As a result, further investigations for the cause of these symptoms were indicated and hormonal analysis was sent. Renin and aldosterone levels were elevated and the diagnosis of PHA was suspected despite high level of 17-hydroxy progesterone hormone. Renal ultrasound was done to exclude secondary causes. NACL 3% and NA polystyrene were started with I.V fluid to correct electrolyte abnormalities and the patient started to improve dramatically.

Maculopapular rash which involves mainly the face and trunk is a characteristic feature that accompanied the acute attacks of the disease (sometimes upper and lower limbs were also involved). This rash is similar to that found in the literature and is a hallmark of the systemic type of PHA. It is not itchy, always disappears with management of acute attack and never leaves any pigmentation or scars. The rash does not respond to local steroid or lotion creams. It may be attributed to the increase concentration of sodium in the sweat which in turn leads to blockage and inflammation of exocrine sweat glands (4-6). We thought that there may be an underlying immune process that may be explained by the presence of the rash with each acute attack, high white blood cells count and rapid disappearance of rash after use of antibiotics and electrolytes correction. Fever is not always present.

No evidence of eye manifestations were noticed during the assessment of the child (no conjunctivitis, sclerositis, or eye discharge). However, the developmental review revealed a delay in the gross motor function (cannot sit without support), speech (say Dada, Mama indiscriminately) and the presence of primitive reflexes that are not consistent with his age. This might be due to a cerebral injury earlier in life and an underlying immune-compromised state.

The family history showed two previous deaths of two siblings of a different gender at 5 and 9 days of life who presented with similar symptoms but unfortunately resuscitation failed and no diagnosis was made at that time. The presence of four other living siblings with a good health support the diagnosis of the autosomal recessive systemic PHA.

**Conclusion:-**

Biochemical feature of congenital adrenal hyperplasia and Pseudohypoaldosteronism may be indistinguishable initially, especially with a delay in obtaining hormonal assay results. The skin manifestation may give an important diagnostic guideline in which this will influence the management and prevention of recurrence electrolytes disturbance. PHA type one can lead to salt losing crisis and life-threatening hyperkalemia. High dose of sodium supplementation and potassium binding resins are the standard treatment in such case.

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We thank parents who agreed to publish this case for educational purposes.

**References:-**

1. Pseudohypoaldosteronism: Background, Pathophysiology, Etiology [Internet]. Emedicine.medscape.com. 2016 [cited 17 September 2016]. Available from: <http://emedicine.medscape.com/article/924100-overview>
2. Guyton AHall J. Textbook of medical physiology. Philadelphia: Elsevier Saunders; 2006.
3. Elzouki A. Textbook of clinical pediatrics. [Berlin]: Springer; 2012.
4. Korkut S, Gokalp E, Ozdemir A, Kurtoglu S, Demirtas S, Gul U, et al. Dermal and Ophthalmic Findings in Pseudohypoaldosteronism. Journal of clinical research in pediatric endocrinology. 2015 Jun;7(2):155-8. PubMed PMID: 26316441. Pubmed Central PMCID: 4563190.
5. Argoubi H, Fitchner C, Richard O, Lavocat MP, Cambazard F, Stephan JL. [Pustular miliaria rubra and systemic type 1b pseudohypoaldosteronism in a newborn]. Annales de dermatologie et de venerologie. 2007 Mar;134(3 Pt 1):253-6. PubMed PMID: 17389851. Miliare rouge et pseudo hypoaldosteronemisme de type 1b de revelation neonatale.
6. Eliwa MS, El-Emmawie AH, Saeed MA. Ocular and skin manifestations in systemic pseudohypoaldosteronism. BMJ case reports. 2014;2014. PubMed PMID: 24654255. Pubmed Central PMCID: 3962973.





### RESEARCH ARTICLE

#### A DYNAMIC PANEL DATA MODEL FOR ANALYZING THE RELATIONSHIP BETWEEN MILITARY EXPENDITURE AND ECONOMIC GROWTH AND POPULATION IN 54 LESS DEVELOPED COUNTRIES.

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Military expenditure; Economic growth;  
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#### Abstract

Several alarming and largely ignored trends in the structure and size and of military spending of less developed countries (LDCs) have appeared during the past five decades. This study analyses the defense-growth relationship for 54 developing economies by using cross-section data such as random effect, fixed effect and system GMM model. The empirical results, bearing in mind the possible inaccuracies of the data set and given the chosen model, suggest that defence spending has a positive relationship with both the rate of economic growth and population in the sample countries.

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#### Introduction:-

Since Benoit's (1973) seminal work, the relationship between military spending and economic growth in developing countries has been the subject of widespread empirical study. Theoretically, however, there is no clear-cut prediction of the relationship between defense spending and economic growth. On the one hand, military expenditure may retard economic growth through what is generally referred to as an investment "crowding-out" effect, or a displacement of an equal amount of civilian resource use. Otherwise, military expenditure may also stimulate economic growth through Keynesian-type aggregate demand impacts. An increase in demand generated by higher military expenditure leads to increased utilization of capital stock, higher employment and profits, and, therefore, higher investment, which further generates short-run multiplier effects. In addition, economic growth stimulates spin-off impacts such as the creation of socioeconomic structures conducive to growth (Deger, 1986).

Even though defense spending would affect economic growth through these mechanisms, Joerding (1986) mentioned that economic growth maybe causally prior to military spending. For instance, a country with high economic growth rates wishes to strengthen it against foreign or domestic threats by increased military spending. In contrast, it is equally plausible that countries with high economic growth divert economic resources from defense into other productive sectors such as education and health sectors (Kollias, 1997). It is also possible that military spending increase less than proportionally at low levels of GDP, then greater than economic growth at middle levels of per capita income, and, finally, less than proportionally again at very high levels of growth. This would yield a nonlinear response to economic growth and even an appearance of a negative relationship between the two variables for certain countries over various time periods.

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With the end of the Cold War, global military spending has been reducing and it is predicted that this reduction in military spending will lead to peace dividends for less developed nations. But many less developed countries still spend a large amount of scarce resources on defence sector. For instance, 12.18% of central government expenditures are spent on military sector in lower and middle income nations in 2008 (World Development Indicator, 2011). A lacking of investment and expenditures in health, education and other social-economic activities, many LDCs' economic growth will be impacted by high military spending. For these reasons, the relationship between military spending and economic growth in less developed countries needs to be explored and analyzed carefully.

The purpose of this paper aims to investigate the military–growth nexus for 54 less developed countries in Africa, Latin America and South Asia over the period of 2005–2010. And, different panel data techniques including System GMM is used to estimate the results.

This article is organized as follows: Section 2 provides a brief literature review of the defence–growth nexus studies. Sections 3 and 4 give data and empirical results. Section 5 presents some conclusions.

### Literature Review:-

The literature on military spending and economic growth dated back to the seminal work by Benoit (1973) in which a positive relationship was found. Benoit's work inaugurated a vast array of studies in the hope of identifying a definitive pattern between the two variables (e.g. Fredericksen and Weede, 1986; Stewart, 1991; Ward et al., 1991; Mueller and Atesoglu, 1993; Murdoch et al., 1997; Yildirim et al., 2005) generally appeal to Keynesian economic theory to clarify their results. Included amongst the possible economic benefits of increased military spending are enhanced infrastructure, increased aggregate demand, heightened production, lower unemployment and a more skilled workforce (Chletsos and Kollias, 1995; MacNair et al., 1995).

Conversely, other studies conclude that heightened military spending exerts a negative relationship with economic growth due to a tendency to crowd out investment and the wider impacts of tax increases that are often necessary to finance the new expenditure (Smith, 1980; Cappelen et al., 1984; Dunne et al., 2001). Furthermore, other studies found that the relationship between military expenditure and economic growth might be mixed, such as (Chowdhury, 1991; Madden and Haslehurst, 1995; Lai et al., 2002; Wilkins, 2004) or non-existent relationship such as (Grobar and Porter, 1989; Alexander, 1990; Huang and Mintz, 1990; Adams et al., 1991; Ram, 1995).

Moreover, even where defense expenditure exerts a positive relationship with economic growth, it may nonetheless prove to a sub-optimal means of economic stimulation due to the greater effect exerted by non-military expenditure (Batchelor et al., 2000; Shieh et al., 2002). Both negative and positive relationship maybe mediated by a range of region and country specific factors that not only significantly complicate investigation into the relationship between military spending and economic growth, but also render any broad conclusions elusive. For instance, where increases in military spending occur during a time of war, additional variables such as the length and severity of the conflict and the degree to which economic agents are able to predict these factors and alter their behavior accordingly will also affect these relationship (Schneider and Troger 2003).

### Methodology And Data:-

#### The Data:-

In order to examine the military-growth relationship in the 54 developing countries over the period 2005-2010 and a balanced panel of time series data was constructed. The data set is balanced and the same time periods are available for all cross section units. The data are taken from the SIPRI Yearbooks for military expenditure (Stockholm International Peace Research Institute, various years) and the data on GDP and population are drawn from the World Development Indicator (WDI).

**Table I:-** variables descriptions: Annual data: (2005-2010; N=54)

Variable	Description	Source
ME	Military expenditure	SIPRI (2010)
RGDPC	Real Gross domestic product per Capita	WDI (2010)
POP	Population	WDI (2010)
Algeria, Benin, Bolivia, Botswana, Burkina Faso, Cambodia, Cameroon, Central African, Chad, Chile, China, Colombia, Congo, Cuba, Dominican, Ecuador, El Salvador, Fiji, Gabon, Gambia, Guatemala, India, Indonesia, Iran,		



Jordan, Madagascar, Malawi, Malaysia, Mali, Malta, Morocco, Mozambique, Nepal, Niger, Nigeria, Pakistan, Panama, Papua Guinea, Paraguay, Peru, Rwanda, Saudi Arabia, Senegal, Sierra Leone, South Africa, Sri Lanka, Sudan, Syria, Thailand, Togo, Tunisia, Uganda, Uruguay, Zambia.

### Econometric Methodology:-

The empirical specification of this study is aimed at explaining the military- growth correlation in the less developed nations. Thus, the empirical model employed in the analysis is as follows:

$$ME_{it} = \alpha_1 + \alpha_2 ME_{it-1} + \alpha_3 RGDPC_{it-1} + \alpha_4 POP_{it-1} + \lambda_i + \varepsilon_{it}, \quad i = 1, \dots, N; t = 1, \dots, T \quad (1)$$

Equivalently, Eq. (1) may be written as follows:

$$ME_{it-1} = \alpha_1 + \alpha_2 ME_{it-2} + \alpha_3 RGDPC_{it-1} + \alpha_4 POP_{it-1} + \lambda_i + \varepsilon_{it-1}, \quad i = 1, \dots, N; t = 1, \dots, T \quad (2)$$

Where  $ME$  is military expenditure,  $RGDPC$  is real gross domestic product (GDP) per capita,  $POP$  is population, and the subscripts  $i$  and  $t$  index countries and time, respectively. In addition, the specification also contains an unobservable country-specific effect  $\mu$  and error-term  $\varepsilon$ .

Moreover, in this paper we employ Generalized Method of Moments (GMM) which is a semi-parametrically efficient estimation model and since Hansen (1982) has established its large sample properties, GMM has gained abundant deal of attention in the field of economics. The GMM methodology begins from a set of over-identified population of moment conditions and seeks to find an estimator that minimizes a quadratic norm of the sample moment vector.

The resulting estimation has been shown to be consistent and asymptotically normal under many circumstances. However, the GMM first difference estimator suffers from a significant weakness. Blundell and Bond (1998) found that when the independent variable is persistent over time, lagged levels of these variables are weak instruments for the regression equation expressed in first differences. Blundell and Bond (1998) also found that the instrument variable used with the first-difference GMM method (i.e. the endogenous variables lagged two or more periods) become less informative in models where the variance of the fixed effects is mainly relative to the variance of the transitory shocks. This is likely to lead to biased coefficients, and the issue is generally intensified in small samples size. To avoid this bias, Blundell and Bond (1998) suggested a system GMM (SGMM) estimator.

This method essentially combines in a system the first-differenced with the same equation expressed in levels. The instruments for the regression in differences are the same as those labeled above, while the instruments for the equation in levels are lagged differences of the corresponding variables. The main advantage of the SGMM method comprises in the fact that unlike (between or within - first differences) approaches, it does use the estimation in levels for estimation and this exploits not only the variation in data but also between the countries as well. It therefore allows preserving more information to identify the parameters of interest. Arellano and Bond (1991) display on the basis of Monte-Carlo simulation that this additional information results in a considerable gain in the precision of the estimates.

### The Empirical Result:-

Our sample countries include 54 less developed nations for which data are available for over period 2005–2010. We report first estimates of Eq. (3) for the whole sample period with the standard panel data estimates, cross section estimates, random effects models REM, between and within the fixed effects models. Moreover, we shall use the systems GMM approach (SGMM) of Blundell and Bond (1998) in which the specifications in the first-step GMM, second-step GMM with robust SE of the variables are estimated simultaneously. Estimates with these alternative methods are illustrated in Table II. Two sets of subsample estimates with REM and SGMM are reported in Table III and Table IV.

In order to specify whether a fixed and random effects model are appropriate for our study we performed the Hausman test which is distributed as  $\chi^2$ , where the degrees of freedom are equal to the number of regressors. The results illustrate that the fixed effects model is rejected, and this finding is consistent with Murdoch et al. (1997)

since random effect models are considered more appropriate than fixed effect models. Thus, the fixed effects model is not necessary in our case. Parameter estimates from the random effect and fixed effect are presented in Table II and Table III for the 54 less developed countries. The results obtained, similar to Smith and Dunne (2001); who positive and significant correlation economic growth and military.

Furthermore, we have employed System GMM analysis based on balanced data-set, to examine the military-growth relationship in the context of different political and welfare less developed nations. We have used an AR (1) and an AR (2) model to capture the persistence in our sample data. Moreover, AR (1) and AR (2) models are desirable based on the Arellano and Bond (1991) test for AR (2).

The system GMM estimation results of this study, presented in Table IV, and it indicates that there is a positive relationship between military expenditure, economic growth and population for the rest of the sample countries, and it's statistically significant, it means that, when economic growth, it encourages military sector to spend more on it, and also population is directly related to economic growth, meaning that when population increase, it rises military expenditure in the developing countries. All diagnostics for the models in each table is satisfactory. Generally, GDP and population are positively related with military spending in this study, and all variables are statistically significant at different level such as the 1%, 5% and 10% level. The results illustrate that as economic growth (GDP) and population are increase military expenditures as a percentage of government expenditures are increased as well. Furthermore, this finding suggests that military spending plays a significant role in the less developed nations despite of many problems such as civil war, conflicts and border tensions, and this result supported by earlier works done by Benoit (1973&1978) for 44 developing nations. Moreover, our findings are also confirmed and supported by Ali's (2007) findings in the developing countries. Moreover, these net positive relationships support the belief that military spending and economic growth are related through an expansion of aggregate demand in less developed countries. Moreover, investment in infrastructure and human capital development in LDC economies operating below full employment thus, it has positive Benoit-type spillover impacts from military expenditures. There is less evidence to suggest that military spending in developing nations negatively related to economic growth. The positive impacts that arise when relationship runs from economic growth to military spending imply that many LDCs are still at a stage where military expenditures are constrained by low income and will grow along with the economy. They are not yet in a position to have defense expenditures grow less than proportionally with economic growth.

**Table II:- Random Effects Results: Dependent variable is ME.**

Variable	Coefficient	T ratio
Constant	-14.85266	0.000*
Ln RGDP	.8828427	0.000*
Ln POP	1.283371	0.000*
Hausman test	0.1139	-
N	324	
Countries	54	
Min obs	6	
Max obs	6	
Av obs	6.0	
Rsq within	0.6318	
Rsq between	0.8126	
Rsq overall	0.8097	
*, **, *** denote significance at 10%, 5% and 1%, respectively. Values in parentheses are heteroscedasticity consistent t-statistics and values in brackets are p-values.		

**Table III:- Fixed Effects Results Dependent variable is ME.**

Variable	Coefficient	T ratio
Constant	-14.85266	0.000*
Ln RGDP	.8828427	0.000*
Ln POP	1.283371	0.000*
Hausman test	0.1139	

N	324	-
Countries	54	-
Min obs	6	
Max obs	6	
Av obs	6.0	
Rsq within	0.6318	
Rsq between	0.8126	
Rsq overall	0.8097	
*, **, *** denote significance at 10%, 5% and 1%, respectively. Values in parentheses are heteroscedasticity consistent <i>t</i> -statistics and values in brackets are <i>p</i> -values.		

**Table IV:-** Results of system GMM estimations: Dependent variable is ME. (Sample period: 2005-2010)

Variable	One-Step System GMM	Two-Step System GMM	Two-Step System GMM with Robust SE
CONSTANT	.6478708* (0.000)	-1.480849 (0.401)	-1.480849 (0.736)
LnMIXit-1	.783148** (0.04)	.6413527* (0.000)	.6413527* (0.002)
Ln RGDPCit-1	.1112433*** (0.070)	.2016423* (0.000)	.2016423 (0.326)
Ln POP1t	.3607867* (0.005)	.2861577** (0.021)	.2861577 (0.373)
Sargant Test	84.66462 (0.0000)	22.37417 (0.0498)	-
AR(1)	-	-1.8481 (0.0646)	-1.5967 (0.1103)
AR(2)	-	.56618 (0.5713)	.56044 (0.5752)
N	54		
T	6		

Notes: All models are estimated using the Arellano and Bond dynamic panel GMM estimations (Stataxtabond command). The variables are defined as follows: ME = Military expenditure; RGDPC = real GDP per capita (in US dollars; POP = Population. Figures in the parentheses are *t*-statistics. (\*), (\*\*), (\*\*\*) indicate significance at 1%, 5%, 10% respectively. Time dummies were jointly significant and are not reported here to save space.

### Conclusion:-

The defense–growth relationship has been an issue of keen concern in defense economics and there is a huge amount of the literature investigating the military-growth relationship in less developed nations. However, the existing literature is inconclusive as to the military-growth relationship due to applying different theoretical models, different empirical techniques and different samples. This paper examines the relationship between defense expenditure and economic growth in 54 developing countries. Our panel regressions present reasonable and robust results by applying more recent econometric techniques such as the dynamic panel System GMM estimators. The empirical panel results show that defense spending has a significant and positive relationship with economic growth in 54 sample developing countries.

Thus, the empirical estimations support the positive relationship between defense spending and economic growth, and they are consensus of Kollias (1997) and Ali (2012). Furthermore, proper regression model and more advanced econometric methodologies do improve empirical results in this article which could make contributions to the defense economics literature.

### References:-

1. Adams, F.G., Behrman, J.R. and Boldin, M. (1991) Government expenditures, defense and economic growth in LDCs: a revised perspective. *Conflict Management and Peace Science* 11(2) 19–35.

2. Alexander, W.R.J. (1990) The impact of defence spending on economic growth: a multi-sectoral approach to defense spending and economic growth with evidence from developed economies. *Defense Economics* 2(1) 39–55.
3. Ali, H. E. (2007). "Military expenditures and inequality: empirical evidence from global data." *Defence and Peace Economics* 18(6): 519-535.
4. Ali, H. E. (2012). "Military expenditures and inequality in the middle east and north africa: A panel analysis." *Defence and Peace Economics* 23(6): 575-589.
5. Arellano, M. and S. Bond (1991). "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations." *The review of economic studies* 58(2): 277-297.
6. Batchelor, P., Dunne, P. and Saal, D. (2000) Military spending and economic growth in South Africa. *Defence and Peace Economics* 11(6) 553–571.
7. Benoit, E. (1973). "Defense and economic growth in developing countries."
8. Benoit, E. (1978). "Growth and defense in developing countries." *Economic Development and Cultural Change*: 271-280.
9. Blundell, R. and S. Bond (1998). "Initial conditions and moment restrictions in dynamic panel data models." *Journal of econometrics* 87(1): 115-143.
10. Cappelen, A., Gleditsch, N.P. and Bjerkholt, O. (1984) Military spending and economic growth in the OECD countries. *Journal of Peace Research* 21(4) 361–373.
11. Chletsos, M. and Kollias, C. (1995) The demand for Turkish military expenditure 1960–1992. *Cyprus Journal of Economics* 8(1) 64–74.
12. Chowdhury, A.R. (1991) A causal analysis of defense spending and economic growth. *The Journal of Conflict Resolution* 35(1) 80–97.
13. Deger, S. (1986). Economic development and defense expenditure. *Economic Development and Cultural Change*, 35 (1), 179– 196.
14. Dunne, P., Nikolaidoua, E. and Vougas, D. (2001) Defence spending and economic growth: a causal analysis for Greece and Turkey. *Defence and Peace Economics* 12(1) 5–26.
15. Joerding, W. (1986). Economic growth and defense spending. *Journal of Development Economics*, 21, 35– 40.
16. Huang, C. and Mintz, A. (1990) Ridge regression analysis of the defense-growth tradeoff in the United States. *Defense Economics* 2(1) 19–37.
17. Hansen, L. P. (1982). "Large sample properties of generalized method of moments estimators." *Econometrica: Journal of the Econometric Society*: 1029-1054.
18. Grobar, L.M. and Porter, R.C. (1989) Defense spending and economic growth in LDCs. *Journal of Conflict Resolution* 33(2) 318–345.
19. Kollias, C., et al. (1997). "Defence expenditure and economic growth in the European Union: a causality analysis." *Journal of Policy Modeling* 26(5): 553-569.
20. Lai, C.C., Shieh, J.Y. and Chang, W.Y. (2002) Endogenous growth and defense expenditures: a new explanation of the Benoit hypothesis. *Defence and Peace Economics* 13(3) 179–186.
21. MacNair, E., Murdoch, C. and Sandler, T. (1995) Growth and defense: pooled estimates for the NATO alliance, 1951–1988. *Southern Economic Journal* 61 846–860.
22. Madden, G. and Haslehurst, P. (1995) Causal analysis of Australian economic growth and military expenditure: a note. *Defence and Peace Economics* 6(2) 115–121.
23. Mueller, M.J. and Atesoglu, H.S. (1993) Defense spending, technological change and economic growth in the United States. *Defense Economics* 4(3) 259–269.
24. Murdoch, J.C., Pi, C.-R. and Sandler, T. (1997) The impact of defense and nondefense public spending on growth in Asia and Latin America. *Defence and Peace Economics* 8(2) 205–224.
25. Ram, R. (1995). Defense expenditure and economic growth. In *Handbook of Defense Economics, Vol 1*, edited by K. Hartley and T. Sandler. London: Elsevier, 251–273.
26. Shieh, J., Lai, C. and Chang, W. (2002) The impact of military burden on longrun growth and welfare. *Journal of Development Economics* 68 443–455.
27. Schneider, G. and Troger, V.E. (2003). *War and the World Economy: Stock Market Reactions to International Conflicts, 1990–2000*. Paper presented at the ISA Annual Meeting. <http://www.uni-konstanz.de/FuF/Verwiss/GSchneider/downloads/papers/Schneider-Tr%F6ger.pdf> (Accessed 14 February 2009)
28. Smith, R. (1980) Military expenditure and investment in OECD 1954–1973. *Journal of Comparative Economics* 4(1) 19–32.

29. Smith, R. and P. Dunne (2001). "Military expenditure growth and investment." Birbeck College and Middlesex University Business School, April.
30. Stewart, D.B. (1991) Economic growth and the defence burden in Africa and Latin America: simulations from a dynamic model. *Economic Development and Cultural Change* 40(1) 189–207.
31. Stockholm International Peace Research Institute (SIPRI 2010), <http://www.sipri.org/>. World Armaments and Disarmaments. Oxford: Oxford University Press.
32. Ward, M.D., Davis, D., Penubarti, M., Rajmaira, S. and Cochran, M. (1991) Military spending in India: Country Survey 1. *Defence Economics* 3(1) 41–63.
33. Weede, E. (1986) Rent seeking, military participation and economic performance in LDCs. *Journal of Conflict Resolution* 30(2) 77–91.
34. Wilkins, N. (2004). Defence expenditure and economic growth: evidence from a panel of 85 countries. <http://cama.anu.edu.au/macroworkshop/Nigel%20Wilkins.pdf> (accessed 14 August 2008).
35. World Development Indicator- World Bank. (2010).<http://data.worldbank.org/topic>
36. Yildirim, J., Sezgin, S. and Öcal, N. (2005) Military expenditure and economic growth in Middle Eastern countries: a dynamic panel data analysis. *Defence and Peace Economics* 16(4) 283–295.



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### RESEARCH ARTICLE

#### EVALUATION OF A CASE OF RECURRENT RESPIRATORY TRACT INFECTIONS.

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#### Manuscript Info

#### Abstract

#### Manuscript History

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#### Introduction:-

##### A rare case report

#### Introduction:-

A 40 year old Hindu female, housewife, with 2 children, of thin body build presented with chief complaints of shortness of breath for one year, which was progressive in nature and of MMRC grade II severity. She also complained of on off cough with scanty expectoration.

#### History of past illness:-

Her history of past illness revealed that she was on and off symptomatic since long with recurrent respiratory tract infections which got relieved with medications from local physicians.

She was not a known case of Pulmonary Tuberculosis / Diabetes Mellitus / Hypertension / Chronic Kidney Disease / Sickle Cell Disease.

She had no addictions.

#### General examination:-

On general examination, she was found to be febrile (temperature – 101.2 degree Fahrenheit). She had mild pallor and clubbing (grade II). Her pulse rate was 110 / minute, oxygen saturation was 86% at room temperature and her blood pressure was 100 / 60 mm Hg. Her respiratory rate was 32 / minute.

#### Examination of the respiratory system:-

Her respiratory system examination revealed that there was shifting of trachea to the left side. There was crowding of ribs on the left side. Diminished vesicular breath sounds were heard over left infrascapular and infra-axillary areas. Coarse crepitations were heard in the same areas.

#### Investigations:-

On investigations, her complete haemogram revealed a total leucocyte count of 12,600 / cumm. A differential count of neutrophils – 80 %, lymphocytes – 17 %, eosinophils – 3 %. Her haemoglobin was 8.2 gram %, her fasting blood sugar was 90 milligram / deciliter. Her blood urea was 27 milligram / deciliter and serum creatinine was 0.9 milligram / deciliter. Her ELISA test for HIV was negative.

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Two of her sputum samples for AFB( acid fast bacilli) tested negative. Sputum for gram stain revealed gram positive cocci in chains. Sputum for culture / sensitivity revealed Streptococcus pneumonia sensitive to Amoxycillin, Piperacillin, Ofloxacin, Ceftazidime, Ceftriaxone and Cefaperazone.

**Provisional diagnosis:-**

With the patient's chief complains, present and past history, general and Systemic examinations, and investigations, our provisional diagnosis was " Bronchiectasis of the Left lung ( lower lobe )".

We then proceeded further with the imaging studies such as chest X – Ray ( postero anterior view), Contrast enhanced computerized tomography of the lungs followed by Bronchoscopy.

**Imaging studies:-**

CHEST X-RAY POSTERO ANTERIOR VIEW – revealed features of loss of lung volume of left lung and shifting of mediastinum to left side with cystic lesions in the left lower lobe.

**Ultrasound of thorax, abdomen and pelvis:-**

revealed there was no pleural effusion. No abnormality was detected in abdomen and pelvis.

**Contrast enhanced computerised tomography of chest:-**

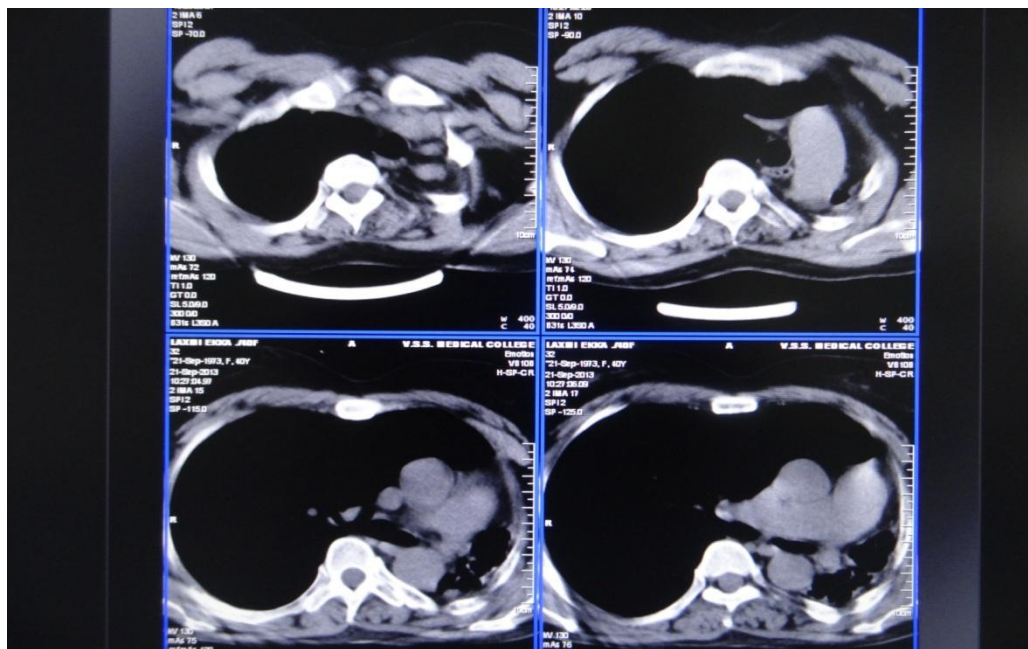
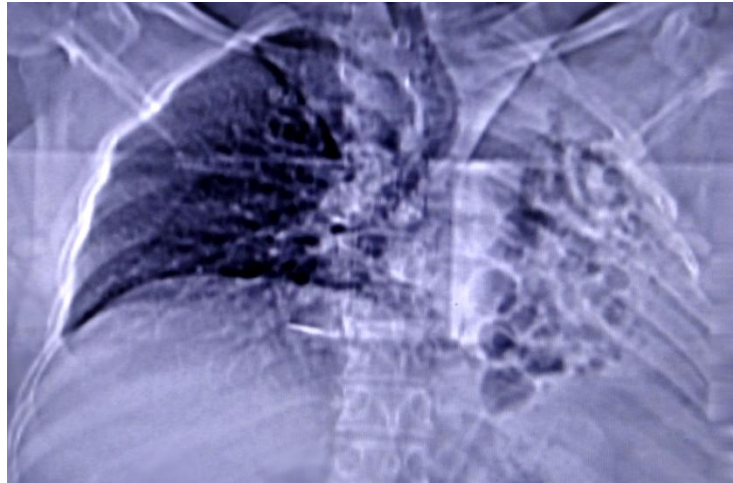
revealed decreased volume of left lung with multiple cystic lesions and shifting of trachea to the left. There was compensatory hyperinflation of the right lung with herniation to the left.

**Chest x-ray pa view:-**

Features of loss of lung volume on the left side Shifting of trachea to left side Cystic lesions changes in the left lower lobe Hyperinflation and herniation of the right lung.

**Cect Of Chest:-**

Decrease volume of left lung with multiple cystic lesions Shifting of trachea to left Approximation of ribs on left side.



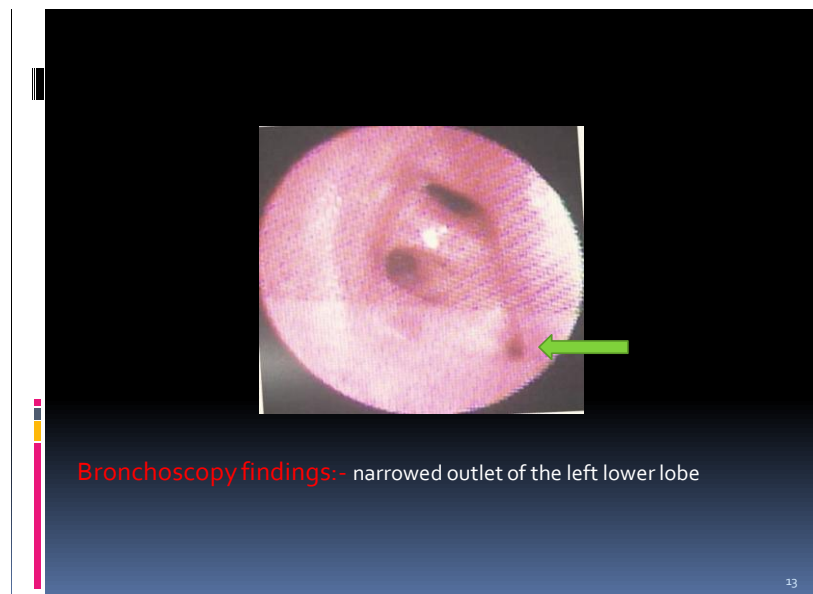
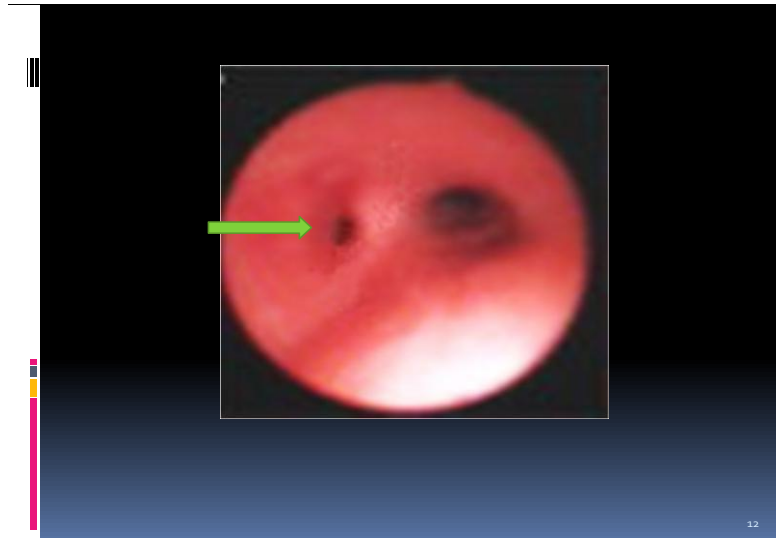
#### Non contrast ct study shows

Decrease vol. of left hemithorax Shifting of trachea & mediastinum to left Trachea normally divided to left and right bronchus.

#### Diagnosis:-

Unilateral left pulmonary hypoplasia with bronchiectatic changes. The diagnosis was confirmed with bronchoscopy which revealed the underdevelopment of left bronchial tree.





### Discussion:-

Hypoplasia of lung is a rare congenital anomaly in which gross morphology of lung is unremarkable ,but in which there is decrease in number or size of airways,vessels & alveoli.

Bronchiectatic changes have also been reported in the hypoplastic lung.

Development of the bronchial tree takes place at about 26<sup>th</sup> to 31<sup>st</sup> day of intrauterine life.

Monaldi divided the maldevelopment of lung in four groups.

Group I: No bifurcation of trachea

Group II: Only rudimentary main bronchus

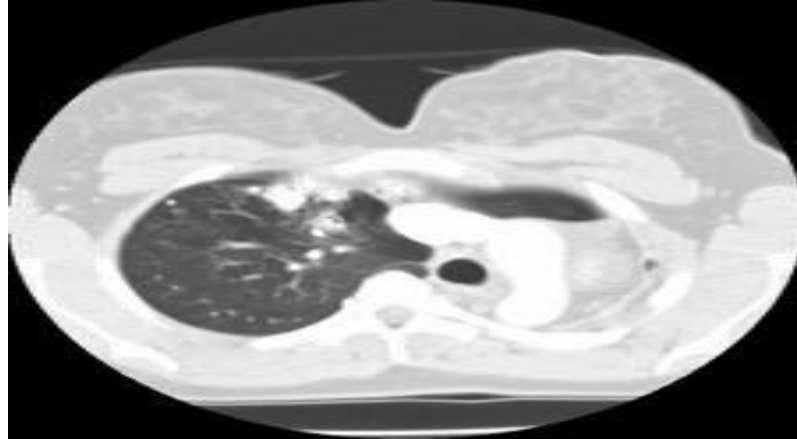
Group III: Incomplete development after division of main bronchus.

Group IV: Incomplete development of subsegmental bronchi & small segments of the corresponding lobe.

**According to Boyden there are three degrees of maldevelopment**

### Agenesis:-

Complete absence of one or both lungs with no trace of bronchial or vascular supply or of parenchymal tissue

**Aplasia:-**

Suppression of all vascular supply & parenchymal tissue but a rudimentary bronchus that ends in a blind pouch

**Hypoplasia:-**

It refers to deficient or incomplete development of parts of the lung, resulting in an abnormally low number or size of bronchopulmonary segments or alveoli.

**Epidemiology:-**

The true prevalence is not well known (1.4% of all births according to Knox), but in cases of premature rupture of membranes at 15 - 28 weeks gestation, the reported prevalence of pulmonary hypoplasia ranges from 9 to 28%.

**Aetiology:-**

Causes can be primary or secondary. Secondary causes are more common. Secondary causes can be intra or extrathoracic

**Intra-thoracic causes:-**

congenital diaphragmatic hernia - most common intrathoracic cause extralobar sequestration agenesis of the diaphragm mediastinal mass(es) / tumour(s) mediastinal teratoma decreased pulmonary vascular (arterial) perfusion from a congenital cardiovascular anomaly - e.g tetralogy of Fallot unilateral absence of the pulmonary artery.

**Extra-thoracic causes:-**

oligohydramnios

Potter sequence

preterm premature rupture of membranes (PPROM)

skeletal dysplasias - especially those causing a narrow fetal thorax thanatophoric dysplasia

achondrogenesis

osteogenesis imperfecta

short rib polydactyly syndrome

Main differential diagnosis of hypoplastic lung is SWYER-JAMES SYNDROME which refers to hyperlucent lobe or lung and functionally by air trapping during expiration initiated by viral bronchiolitis.

#### **Pathological Diagnosis Of Pulmonary Hypoplasia:-**

is done by taking fresh lung weight, fixed lung volume, radial alveolar count and estimates of tissue maturity. Precise characterization of the morphological changes is best performed by morphometric measurement after inflation of the lungs to a known transpulmonary pressure.

In the autopsy specimens, hypoplastic lungs are smaller, weigh less than normally expected for their age. There is decrease in number of size of alveoli. Abnormalities of **pulmonary arterial system** have also been identified in the pathology specimens consisting of decrease elastic tissue in the larger arteries. There is Increased muscle in normally muscular arteries and extension of muscle into non-muscular arteries.

#### **Radiographic Findings:-**

There is partial or total absence of aerated lung in one or both hemithorax and approximation of ribs. There is also elevation of ipsilateral diaphragm and shifting of the mediastinum. In most cases the contralateral lung is over inflated & displaced along anterior mediastinum into the involved hemithorax.

Although both conditions are associated with decreased lung volume on one side, Swyer-james syndrome demonstrate air trapping on radiographs or HRCT scans performed at the end of maximal expiration.

#### **Clinical Findings:-**

depend on degree of pulmonary abnormality and presence of other congenital malformations. Usually, however the patient is symptomatic & may present during childhood or adult life. Diagnosis may be established with chest x-ray, computerized tomography of thorax, fiber optic bronchoscopy, and if possible pulmonary angiography.

The diagnosis may sometime be done antenatally by USG, DOPPLER or MRI.

#### **Antenatal Ultrasound:-**

It may show the presence of oligohydramnios and / or also show any of the causative anomalies. Several sonographic parameters may give indirect clues as to the presence and extent of pulmonary hypoplasia.

Fetal lung head ratio - reduced (ratios less than 1 usually indicate a poor prognosis) Fetal chest circumference (or thoracic circumference - TC) below 5<sup>th</sup> percentile - is reduced in the case of intra-thoracic causes, however both these parameters can be normal.

#### **Magnetic Resonance Imaging:-**

It is being increasingly used to predict the presence of pulmonary hypoplasia.

#### **Factors used for prediction are -**

Fetal lung volume

The relative lung volume

The ratio of lung volume to body weight

#### **Computerised Tomography Scan:-**

Is being used to assess the degree of underdevelopment and to differentiate hypoplasia from other conditions that may closely mimic it radiographically such as atelectasis from other causes and severe bronchiectasis with collapse and advanced fibrothorax.

#### **Treatment:-**

Treatment of hypoplasia is in form of medical as well as surgical care both before & after delivery.

Before delivery it is usually directed towards correcting maternal conditions.

After delivery respiratory support is given ranging from oxygen to mechanical ventilation including ECMO (Extracorporeal membrane oxygenation). Surfactant administration at 4ml/kg - has been reported to increase

survival rate In adults treatment consists of control of infections & other symptomatic treatment in the form of expectorants & bronchodilators.

Management of other complications are done accordingly.

**Conclusion:-**

Whenever a patient presents with progressive dyspnea ,recurrent respiratory tract infections and unilateral small hemithorax ,PULMONARY HYPOPLASIA should be kept in mind as an important diagnosis, although it is a very rare condition.

It is important to spread this vital message amongst the medical fraternity .

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### RESEARCH ARTICLE

#### SCD147: EMMPRIN(EXTRACELLULAR MATRIX METALLOPROTEINASE INDUCER) AS TUMOUR MARKER FOR BLADDER CARCINOMA.

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#### Manuscript Info

#### Abstract

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#### Introduction:-

Bladder cancer is the second most common cancer of the genitourinary tract. It accounts for 7% of new cancer cases in men and 2% of new cancer cases in women. The incidence is higher in whites than in African Americans, and there is a positive social class gradient for bladder cancer in both sexes. The average age at diagnosis is 65 years, with approximately 75% of bladder cancers are localized to the bladder, 25% have spread to regional lymph nodes or distant sites. *A detailed study of bladder cancer cases registered from 2005 to 2010 in our tertiary care hospital revealed that bladder cancer ranks as the 7<sup>th</sup> leading cancer and 5.9% of all prevalent cancers in the Kashmiri population(1).*

#### TNM Staging System:-

The TNM staging system is the most commonly used system. Table 13 (a and b)

#### Clinical features:-

Hematuria (painless) is the presenting symptom in 85–90% of patients with bladder cancer. It may be gross or microscopic, intermittent rather than constant. In a smaller percentage of patients, it is accompanied by symptoms of vesical irritability: frequency, urgency, and dysuria. Irritative voiding symptoms seem to be more common in patients with diffuse CIS. Symptoms of advanced disease include bone pain from bone metastases or flank pain from retroperitoneal metastases or ureteral obstruction. Patients with large-volume or invasive tumors may be found to have bladder wall thickening or a palpable mass—findings that may be detected on a careful bimanual examination under anesthesia. Hepatomegaly and supraclavicular lymphadenopathy are signs of metastatic disease. Lymphedema from occlusive pelvic lymphadenopathy may be seen occasionally. The most common laboratory abnormality is hematuria. It may be accompanied by pyuria, which on occasion may result from concomitant urinary tract infection. Currently, urine cytology is the standard non-invasive marker. In a recent literature reviews, specificity of cytology ranged from 83% to 99.7% with a mean  $\pm$  standard deviation (SD) of 99% and sensitivity ranged from 20% to 53% with a mean  $\pm$  SD of 34%(02).

#### Other tumor markers.

- ImmunoCyt/uCyt+ test .
- BTA TRAK Assay .
- BTA Stat Test .

- iv. NMP22 assay .
- v. NMP22 BladderChekTest .
- vi. UroVysion Test .
- vii. sCD147: A new marker sCD147 also known as (EMMPRIN extracellular matrix metalloproteinase inducer), tumor collagenase stimulatory factor (TCSF), Hab 18 G, OX-47, Neurothelin, Basigin(03) is a cell surface protein which is broadly expressed on human peripheral blood cells, endothelial cells, cultured cells of hemopoetic and non hemopoietic origin. Thymocytes strongly express sCD147 (04), significant expression of sCD147 has also been reported in neoplasms of urinary bladder, liver and lung (05).

Various imaging modalities can detect bladder tumors but their presence is confirmed by cystoscopy and biopsy. Superficial (Ta, Tis) bladder cancers are staged with a properly performed TUR. However, higher stage lesions are often understaged, and the addition of imaging by CT and magnetic resonance imaging (MRI) or both have been used to characterize the extent of bladder wall invasion and detect enlarged pelvic lymph nodes, with overall staging accuracy ranging from 40% to 85% for CT and from 50% to 90% for MRI (06,07). The diagnosis and initial staging of bladder cancer is made by cystoscopy and transurethral resection (TUR). Superficial, low-grade tumors usually appear as single or multiple papillary lesions. Higher grade lesions are larger and sessile. CIS may appear as flat areas of erythema and mucosal irregularity. Use of fluorescent cystoscopy with blue light can enhance the ability to detect lesions by as much as 20% (08). Assessment of molecular markers of disease, with immunohistochemical methods, in biopsy specimens, or in cystectomy specimens can yield useful prognostic information.

#### **Treatment [table 14]**

##### **CD147 (EMMPRIN):**

CD147 is a member of the immunoglobulin family of receptors. Members of this family play a role in intercellular communication involved in many immunorelated functions, differentiation and development. CD147 plays a role in spermatogenesis, lymphocyte activation, expression of monocarboxylate transporters (MCT) and has been identified as a regulatory subunit of the  $\gamma$ -secretase complex in Alzheimer's disease amyloid  $\beta$ -peptide production (09, 10-13). CD147 is involved in the transport of the MCT-1 and MCT-3 to the plasma membrane since reduced accumulation of these transporters has been observed in the retina of *cd147* knockout mice. CD147 has been implicated in many pathological processes, such as rheumatoid arthritis, experimental lung injury, atherosclerosis, chronic liver disease induced by hepatitis C virus, ischemic myocardial injury and heart failure (12). Treatment of transplant patients with a CD147 antibody was effective due to inhibition of T-cell activation (14).

The *emmprin* gene consists of seven exons and six introns spanning 7.5 kb. The 5' upstream sequence of the *emmprin* gene contains no TATA or CAAT box but has a CpG-rich island. A 470-bp fragment upstream of the coding region of *emmprin* has been shown to promote its transcription. A 30-bp element of this sequence (-142 to -112 bp) which contains a binding site for Sp1, was also demonstrated to be important for *emmprin* transcription. CD147, a transmembrane protein of the immunoglobulin (Ig) superfamily and has many designations such as M6, Neurothelin, 5A11, HT7, OX-47, CE9, EMMPRIN, Basigin, and gp42. The transmembrane region harbors a leucine zipper and a charged residue (glutamic acid). The corresponding gene is located on chromosome 19p13.3 and encodes a 29 kDa backbone protein. Three *N* glycosylation sites have been identified and migration on sodium dodecyl-sulfate polyacrylamide gel electrophoresis (SDS-PAGE) occurs between 39 and 65 kDa depending on the degree of glycosylation. Weak expression has been noted on resting T lymphocytes, whereas expression is increased on activated T lymphocytes and monocytes (15-20).

##### **Expression of CD147 in Cancer:-**

High incidence of expression of CD147 in different cancer entities making use of tissue microarrays and monoclonal antibodies (mAb) MEM-M6/1. A lot of 2348 and 608 tissue samples covering 129 distinct tumor types and 76 different normal tissues, respectively, were investigated for their CD147 status with these antibodies. CD147 expression was found in 112 out of 129 tumor entities with the following incidences: squamous cell carcinomas (60-100%), pancreatic (87%), chromophobe kidney (83%), hepatocellular (83%), medullary breast (83%) and glioblastoma multiforme (79%). Homogeneous expression of CD147 was found in tumor types such as squamous cell carcinoma of different types of organs and mesotheliomas. Interestingly, CD147 isoforms differing in presence or absence of Lewis X glycan structures were found on breast cancer cells. A lot of 28 tissue microarrays and 1117 pathological sections of breast tissue samples were analyzed. The incidence of CD147 expression was: cancer of the liver 80% (n=20), lung 62% (n=90), stomach 66% (n=44), colon 58% (n=19), rectum 59% (n=17), breast 64% (n=1055), cancer 80% (n=10), brain 90% (n=52), oesophagus 87% (n=16), ovary 75% (n=40), urinary bladder 85%

(n=41), skin (squamous cell carcinoma) 58% (n=41), larynx 85% (n=63) and kidney 73% (n=33), and 30% of sarcomas such as osteo, chondro- and fibrosarcoma (n=102).

It has been shown that CD147-positive tumor cells and their supernatants induce expression of MMPs such as MMP-1, MMP-2, MMP-3, MMP-9 and MMP-11, in cultured fibroblasts (21,22,23). Therefore, CD147 is also designated as extracellular MMP inducer (EMMPRIN). It was shown that MMP induction can also be mediated by soluble CD147. Soluble CD147 also has been detected in microvesicles (exosomes)(24). CD147 can also be induced in tumor cells by epidermal growth factor receptor (EGFR)-mediated signaling (autocrine mechanism). Controlled degradation of the extracellular matrix is a prerequisite for tumor invasion and metastasis. Transfection of breast cancer cells with *CD147* resulted in increased tumor growth and metastasis after implantation into the mammary gland and correlated with high levels of MMP-2 and MMP-9. The molecular mechanisms of these phenomena have been poorly resolved. Glycosylated CD147 was shown to be a prerequisite for MMP induction at the transcriptional level(25). Induction of MMPs by CD147 was prevented with a monoclonal antibody directed against CD147(25).

#### **Role in MMP dependent and independent Angiogenesis:-**

It was found that CD147 expression was significantly upregulated in activated human umbilical venule endothelial cells (HUVEC's). Inhibition of CD147 expression by RNAi led to significantly decreased angiogenesis *in vitro*. CD147 may regulate angiogenesis by several mechanisms including proliferation, survival, MMP secretion and phosphoinositide 3 kinase/protein kinase B (PI3K/Akt) activation. Modulation of remodeling of the extracellular matrix by MMPs and its impact on angiogenesis is a wellknown phenomenon. CD147 is involved in the induction of vascular endothelial growth factor (VEGF). CD147 stimulates VEGF production in tumor and stromal compartments and VEGF induction involves the PI3K/Akt pathway.

#### **Role of CD147 as an Anti apoptotic Protein and Mediator of Chemoresistance:-**

In several cancer cell lines, CD147 has been identified as a mediator of anti-apoptotic function and chemoresistance. In HO-8910 ovarian carcinoma cells, *CD147* RNAi reduces tumor cell invasion, tumorigenicity and chemosensitivity to paclitaxel. Up-regulation of CD147 has been observed in several multidrug-resistant cancer cell lines. Independently, involvement of CD147 in resistance of cancer cells to a variety of chemotherapeutic agents was reported. In addition, CD147 was identified as a receptor which promotes androgen-independent growth of tumor cells in hyaluronan-dependent manner. In human oral squamous carcinoma cells (SCC), CD147-directed RNAi reduced X-chromosome linked inhibitor of apoptosis protein (XIAP) expression and increased chemosensitivity to 5 fluorouracil. In breast cancer cell lines, it was shown that CD147 confers resistance to anoikis as demonstrated by activation of caspase 3, increased DNA fragmentation and lower cellular viability. Silencing of CD147 resulted in elevation of Bim protein levels. Treatment of cells with a MAP/ERK kinase (MEK) inhibitor (UO126) or a proteasome inhibitor (epoximycin) also induced Bim-1 accumulation and rendered cells sensitive to anoikis. These results suggest that CD147 protects cancer cells from anoikis and that this effect is mediated at least in part by a MAP kinase-dependent reduction of Bim. It has been shown that expression of CD147 leads to activation of ERK which phosphorylates proapoptotic Bim, resulting in degradation of Bim by the proteasome. Down-regulation of Bim suppresses anoikis and promotes survival of tumor cells detached from matrices as a prerequisite for cancer cell invasion and metastasis. CD147 was shown to stimulate hyaluronan production. Hyaluronan-tumor cell interaction is implicated in multidrug resistance due to activation of the PI3K/Akt pathway. Furthermore, it was demonstrated that CD147 is a mediator of multidrug resistance through hyaluronan-mediated upregulation of ErbB2 signaling and cell survival pathways.

#### **CD147 Association with Cyclophilins (Cyps):-**

Cyps are a family of proteins that share peptidyl-prolylcis-trans isomerase activity which is involved in their chaperone function. However, there is also evidence that Cyps are involved in intracellular communication. Cyps are located intracellularly as well as extracellularly. A role of CypA in cancer is supported by the finding that CypA and macrophage inhibitory factor (MIF) are the most dominantly expressed proteins in non-small cell lung carcinoma and a novel cyclophilin similar to CypA has been associated with metastasis and shown to be overexpressed in bladder cancer, hepatocellular carcinoma, sarcoma and breast carcinoma.

#### **CD147 as a Target for Treatment of Cancer:-**

The molecular interactions of CD147 with associated proteins are poorly defined, interference with small molecules is presently in the focus of drug development. The most obvious mode of intervention is to block CD147 function with mAbs. RNAi-mediated intervention would need more progress regarding the targeted delivery to cancer cells.

A critical issue is the broad expression of CD147, requiring toxicity studies for mAbs in a cross-reactive species. The function of CD147 as a mediator across the blood brain barrier would call for appropriate experiments for a therapeutic mAb. On the other hand, dependence of tumor cells on energy supply by anaerobic glycolysis (Warburg effect) and inhibition of the latter by CD147 mAbs which disrupt interaction with MCT and amino acid transporters makes tumor cells vulnerable to modulation of CD147 function. However, CD147 clearly impacts on invasion, proliferation, angiogenesis, tumor cell metabolism such as glycolysis, and mediates prosurvival signals, multi-drug resistance and PI3K/Akt signaling, which are all hallmarks of oncogenesis.

Studies conducted by Han ZD *et al* in 2010(26) and R. Nawrothin 2010(27) concluded that emmprin can be promising target in the treatment of bladder cancer.

Material and methods:

In this study total of 32 patients were included. These patients were first evaluated for bladder cancer. The first sample was taken pre operatively at the time of admission and these patients were subjected to trans urethral resection of bladder tumor (TURBT). These patients were followed up for 3-5 months and second sample was taken. Same numbers of BHP cases were taken as control group.

#### Collection of samples:-

Peripheral blood (4ml) was collected from patients by venipuncture, following universal precautions and all aseptic conditions, in sterile serum collection tubes and allowed to clot. The tubes were subjected to centrifugation at 2500rpm for 5 minutes to separate the serum. The clear serum so obtained was aspirated using disposable plastic droppers and poured in 1.5ml microfuge tubes after proper labeling and stored at -20°C till assayed for sCD147 levels.

#### Test procedure:-

- (I). The standards and controls were prepared as described in the assay protocol and 0.1 ml of each standard and controls were dispensed in the respective wells.
- (II) 0.1ml of patients sample was dispensed in each designated well in the ELISA microplate.
- (III). The ELISA microplate was covered and incubated at 37°C for 90 mins.
- (IV). The contents of the plate were discarded and plate was blotted on to the absorbent paper.
- (V). 0.1ml of biotinylated anti-human Emmpirin antibody working solution was added to each well and plate was incubated at 37°C at 60 mins.
- (VI). The microplate wells were washed three times by wash buffer using an automated washer.
- (VII). The microplate wells were blotted on an absorbent paper and 0.1ml of Avidin-Biotin-Peroxidase-Complex working solution was added to each well and plate was incubated at 37°C for 30 mins.
- (VIII). Washing cycle was repeated five times as described above.
- (IX). 90µl of prepared Tetra Methyl Benzoate substrate solution was added to each well and plate was incubated at 37°C for 25-30 mins in dark.
- (X). The reaction was stopped by adding 0.1ml of stop solution to each well.
- (XII). The absorbance of the respective wells of the was recorded immediately at 450nm using an automated ELISA reader, which recorded the absorbance and calculated the corresponding concentration of sCD147 in the respective wells.

#### Observation:-

A total number 32 patients were subjected to evaluation for sCD147. The clinocopathological features of this study were:

##### Based on gender. Table 1

Bladder cancer was more common in males (24/32=75%) as compared to females (8/32=25%)

##### Based on age. Table 2

Out of 32 cases 20 were >50 yrs of age and 12 were ≤50 yrs of age.

##### Based on smoking. Table 3

Based on smoking status, out of 32 cases, 18(56.3%) cases were smokers and 14(43.7%) were non smokers respectively.

##### Presenting symptom. Table 4

On the basis of presenting symptoms 30(93.75%) presented with hematuria, 25(78.1%) presented with pain, 3(9.3%) presented with retention of urine 5(15.6%) had other symptoms respectively.



**Histopathological stage. Table 5**

Based on histopathological stage out of 32 cases, breakup is as, stage I 4(12.5%) cases, stage II 16(50%) cases, stage III 11(34.4%) cases and stage IV 1(3.12%) cases respectively.

**Lymph node involvement. Table 6**

Out of 32 cases only 1 case had lymph node involvement.

**Metastasis.**

Out of 32 cases only 1 had metastasis.

**Evaluation of sCD147.**

32 patients of bladder tumor showed mean preoperative plasma concentration of 1.0751 and controls had a mean of 1.07343. [Table 7]

**Preopvs postop: Table 8**

Mean preoperative and post-operative sCD147 levels were compared and showed significant results ( $p < 0.001$ ).

**Stage I Preopvs postop. Table 9**

Mean stage I preoperative and post-operative sCD147 levels were compared and results were not statistically significant.

**Stage II Preopvs postop. Table 10**

Mean Stage II preoperative and post-operative sCD147 levels were compared and showed statistically significant results ( $p = 0.017$ ).

**Stage III Preopvs postop. Table 11**

Mean Stage III preoperative and post-operative sCD147 levels were compared and showed statistically significant results ( $p < 0.001$ ).

**Preop intra stage-wise comparison. Table 12**

Stage wise comparison of mean sCD147 levels showed statistically significant results between stage I vs stage III and stage II vs stage III ( $p < 0.05$ ).

The suitable statistical tests like Students independent 't' test and paired 't' test have been used to analyse the data. Moreover Analysis of Variance (ANOVA) have been employed to measure the significant difference of the means in the three groups. All the results have been discussed statistically at 5% level of significance i.e, p value  $< 0.05$  considered significant. The variables have been represented with mean  $\pm$  SD and appropriate statistical charts.

**Discussion:-**

Bladder cancer is one of the common cancers worldwide. It was estimated that in 2005, 63,210 new cases of bladder cancer were diagnosed in the United States (Jemal et al, 2005)<sup>(28)</sup>. In our study bladder cancer was found more common in males (75%) as compared to females (25%). This is consistent with the study by Jemal et al, 2005<sup>(28)</sup>. Bladder cancer was found nearly three times more common in men than in women. Bladder cancer is a multifactorial diseases process. Incidence of disease increases with age and is more common in elderly  $> 60$  yrs of age. We also found that bladder cancer was more common in elderly age group. In our study bladder cancer was more common in smokers (56%) which is inconsistent with the study by Morrison et al, 1984<sup>(29)</sup>. Bladder cancer patients present with varied symptoms, commonest being painless hematuria. Painless hematuria was found in (93.75%) patients in our study group. Varkarakis et al, 1974<sup>(30)</sup>, found painless hematuria in about 85% of their patients. Histopathological examination of resected tissues showed Transitional cell carcinoma in all patients in our study.

In our study no significant association was found between mean sCD147 levels in bladder cancer patients as compared to the control group. However sCD147 levels were found to be significantly higher in preoperative bladder cancer patients as compared to postoperative bladder cancer patients ( $p < 0.001$ ). In our study, stage II and Stage III bladder cancer patients showed significant high expression of sCD147 as those bladder cancer patients who presented with stage I and stage IV bladder cancer ( $P < 0.05$ ). In our studied group we found sCD147 is over expressed in the serum of bladder cancer patients as has been already observed by various studies which showed its high expression in tumor tissues of bladder cancer patients. A study conducted in 2010 studied the expression and clinical significance of CD147 in genitourinary carcinomas (31). They found that CD147/EMMPRIN was expressed in neoplastic tissues, but not in normal tissues. Positive expression was shown in 41 of 58 (70.69%) of the patients with bladder carcinoma. Positive CD147/EMMPRIN staining was significantly associated with TNM stages and histological subtypes of patients with various urinary carcinomas ( $P < 0.05$ ). They concluded that this may assist in defining the suitability of CD147/EMMPRIN as a therapeutic target and as a method for predicting a poor outcome in patients with various urinary bladder carcinoma. Another study also supports our observation, which studied EMMPRIN (CD147) as a potential therapeutic and prognostic marker in bladder cancer and suggested that

EMMPRIN is a promising biomarker that has the potential for a better prognosis. EMMPRIN is also confirmed as an interesting target for new therapies in bladder cancer(120). A recent study conducted on Chinese patients in 2011 worked on CD147 overexpression is a prognostic factor and a potential therapeutic target in bladder cancer. In this study CD147 expression was detected in 108 bladder cancers CD147 protein expression was associated with poor prognosis ( $P < 0.001$ ), lymph node status ( $P < 0.001$ ), tumor stage ( $P = 0.003$ ), histological grade ( $P = 0.011$ ). Multivariate analysis showed that CD147 over expression was an independent prognostic factor ( $P = 0.019$ ). Their findings suggested that CD147 over expression plays an important role in progression of bladder cancer, and CD147 could be a potential target of bladder cancer therapy. Thus our results provide a new field of study for researchers, where serum sCD147 can be used as one of the prognostic marker for bladder cancer patients.

#### Tables:-

**Table 1:- Based on gender.**

Variable	Parameter	Cases N=32, n
Sex	Male	24, (75%)
	Female	08, (25%)

**Table 2:- Based on age.**

Variable	Parameter	Cases N=32, n
Age in years	>50	20, (62.5%)
	≤50	12, (37.5%)

**Table 3:- Based on smoking.**

Variable	Parameter	Cases N=32, n
Smoking	Smokers	18, (56.3%)
	Non smokers	14, (43.7%)

**Table 4:- Presenting symptom.**

Variable	Parameter	Cases N=32, n
Symptom	Hematuria	30, (93.75%)
	Pain	25, (78.1%)
	Retention	03, (9.3%)
	Others	05, (15.6%)

**Table 5:- Histopathological stage.**

Variable	Parameter	Cases. N=32, n
Stage	Stage I	04, (12.5%)
	Stage II	16, (50%)
	Stage III	11, (34.3%)
	Stage IV	01, (3.12%)

**Table 6:- Lymph node involvement.**

Variable	Parameter	Cases. N=32
Lymph node	Negative	31
	Positive	1

**Table 7:- Evaluation of sCD147. Preopvs controls.**

Variable(sCD147)	Group.	Mean Conc. Levels	S.D.	P- value.
	Pre-op	1.0751	0.349	0.984
	Control	1.07343	0.289	

**Table 8:- Preopvs postop**

sCD147 level	Mean	N	S.D	p-value
Preop	1.0994	29	0.355	<0.001
Postop	0.777734	29	0.262	

**Table 9:- Stage I Preopvs postop.**

sCD147 level	Mean	N	Std. Deviation	p-value
Stage I preop	0.87035	04	0.091	0.197
Postop	0.777734	29	0.262	

**Table 10:- Stage II Preopvs postop.**

sCD147 level	Mean	N	Std. Deviation	p-value
Stage II preop	1.003028	16	0.339	0.017
Postop	0.777734	29	0.262	

**Table 11:- Stage III Preopvs postop.**

sCD147 level	Mean	N	Std. Deviation	p-value
Stage III preop	1.2807	11	0.35116	<0.001
Postop	0.777734	29	0.262	

**Table 12 (a and b):- Preop intra stage-wise comparison.**

Stage	N	Mean	Std. Deviation	P value
I	4	0.8704	0.09385	
II	16	1.0030	0.33927	0.050
III	11	1.2807	0.35116	
Total	31	1.0844	0.35115	

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig. (p value)	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	-.13268	.18256	0.473	-.5066	.2413
	3	-.41038*	.19067	<b>0.040</b>	-.8010	-.0198
2	1	.13268	.18256	0.473	-.2413	.5066
	3	-.27770*	.12791	<b>0.039</b>	-.5397	-.0157
3	1	.41038*	.19067	<b>0.040</b>	.0198	.8010
	2	.27770*	.12791	<b>0.039</b>	.0157	.5397

**Table 13 (a and b)**

<i>Primary tumor (T)</i>	
TX	Primary tumor cannot be assessed
T0	No evidence of primary tumor
Ta	Papillary noninvasive carcinoma
Tis	Carcinoma in situ
T1	Tumor invades subepithelial connective tissue
T2	Tumor invades the muscularis
T3	Tumor invades periureteral fat [for renal pelvis only] Tumor invades beyond muscularis into perinephric fat or the renal parenchyma
T4	Tumor invades adjacent organ, or through the kidney into the perinephric fat
<i>Lymph nodes (N)</i>	
NX	Regional lymph nodes cannot be assessed

N0	No regional lymph node metastases
N1	Metastasis to a single lymph node, 2 cm or less in greatest dimension
N2	Metastasis in a single lymph node, more than 2 cm but not more than 5 cm in greatest dimension; or multiple lymph nodes, none more than 5 cm in greatest dimension
N3	Metastasis in a lymph node, more than 5 cm in greatest dimension
<i>Distant metastasis (M)</i>	
MX	Distant metastasis cannot be assessed
M0	No distant metastasis
M1	Distant metastasis

The American Joint Committee on Cancer (AJCC) staging system and the TNM system compare as follows:

<b>AJCC</b>	<b>TNM</b>
Stage 0	T0
Stage I	Ta, Tis, T1, N0, M0
Stage II	T2, N0, M0
Stage III	T3, N0, M0
Stage IV	T4 or any T, N+, M+

**Table 14:- Cancer Stage wise Initial Treatment Options**

<b>Cancer Stage</b>	<b>Initial Treatment</b>
Tis.	Complete TUR followed by intravesical BCG.
Ta (single, low-to-moderate grade, not recurrent).	Complete TUR.
Ta (large, multiple, highgrade, or recurrent).	Complete TUR followed by intravesical chemo or immunotherapy.
T1	Complete TUR followed by intravesical chemo or immunotherapy.
T2-4	i.Radical cystectomy. ii.Neoadjuvant chemotherapy followed by radical cystectomy. iii.Radical cystectomy followed by adjuvant chemotherapy. iv.Neoadjuvant chemotherapy followed by concomitant chemotherapy and irradiation.
Any T, M+,N+	Systemic chemotherapy followed by selective surgery or irradiation

#### **BIB:**

1. Arshad A Pandith, Zaffar A Shah, Nighat P Khan, Mohammad S Wani, AdfarYousuf, RoohiRasool, DilAfroze, Mushtaq A Siddiqi; *FGFR3 germ line mutations identified in skeletal dysplasia significantly cause low grade and low stage bladder cancer by somatic mutations*. UrotodayInt journal 2010; 3(6).
2. Lotan Y, Roehrborn C G, "Cost-effectiveness of a modified care protocol substituting bladder tumor markers for cystoscopy for the followup of patients with transitional cell carcinoma of the bladder: a decision analytical approach", J. Urol. 2002; 167: pp. 75–79.
3. Iacono KT, Brown AL, Greene MI, et al: *CD147 immunoglobulin superfamily receptor function and role in pathology*. ExpMolPathol 2007 83 (3) :283-295.
4. Fisher MR, Hricak H, Tanagho EA: *Urinary bladder MR imaging*. Neoplasm. Radiology 1985;157:471.
5. Wood DP et al: *The role of magnetic resonance imaging in the staging of bladder carcinoma*. J Urol 1988;140:741.
6. Kirsch, A.H., Diaz, L.A.J., Bonish, B., Antony, P.A. and Fox, D.A: *The pattern of expression ofCD147/neurothelin during human T-cell ontogeny as defined by the monoclonal antibody 8D6*. TissueAntigens 1997 50: 147-152.
7. Muraoka, K., Nabeshima, K., Murayama, T., Biswas, C. and Kono, M: *Enhanced expression of a tumor-cell-derived collagenase-stimulatory factor in urothelial carcinoma: its usefulness as a tumor marker for bladder cancers*. Int. J. Cancer 1993 55: 19-26.
8. Fisher MR, Hricak H, Tanagho EA: *Urinary bladder MR imaging*. Neoplasm. Radiology 1985;157:471.
9. Wood DP et al: *The role of magnetic resonance imaging in the staging of bladder carcinoma*. J Urol 1988;140:741.

10. Jocham D et al: *Improved detection and treatment of bladder cancer using hexaminolevulinate imaging: A prospective, phase III multicenter study.* J Urol 2005;174:862.
11. Iacono KT, Brown AL, Greene MI, et al: *CD147 immunoglobulin superfamily receptor function and role in pathology.* ExpMolPathol 2007 83 (3) :283-295.
12. Huet E, Gabison EE and Mourah S: *Role of emmprin/CD147 in tissue remodeling.* Connect Tissue Res 49: 175-179, 2008.
13. Nabeshima K, Iwasaki H, Koga K, Hojo H, Suzumiya J and Kikuchi M: *Emmprin (basigin/CD147): matrix metalloproteinase modulator and multifunctional cell recognition molecule that plays a critical role in cancer progression.* PatholInt56: 359-367, 2006.
14. Gabison EE, Hoang-Xuan T, Mauviel A and Menashi S: *EMMPRIN/CD147, an MMP modulator in cancer, development and tissue repair.* Biochimie87: 361-368, 2005.
15. Muramatsu T and Miyauchi T: *Basigin (CD147): A multifunctional transmembrane protein involved in reproduction, neural function, inflammation and tumor invasion.* HistolHistopathol18: 981-987, 2003.
16. Deeg HJ, Blazar BR, Bolwell BJ, Long GD, Schuening F, Cunningham J, Rifkin RM, Abhyankar S, Briggs AD, Burt R, Lipani J, Roskos LK, White JM,
17. Kasinrerk W, Fiebiger E, Stefanova I, Baumruker T, Knapp W and Stockinger H: *Human leukocyte activation antigen M6, a member of the Ig superfamily, is the species homologue of rat OX-47, mouse basigin, and chicken HT7 molecule.* J Immunol149: 847-854, 1992.
18. Altruda F, Cervella P, Gaeta ML, Daniele A, Giancotti F, Tarone G, Stefanuto G and Silengo L: *Cloning of cDNA for a novel mouse membrane glycoprotein (gp42): shared identity to histocompatibility antigens, immunoglobulins and neural-cell adhesion molecules.* Gene 85: 445-451, 1989.
19. Miyauchi T, Kanekura T, Yamaoka A, Ozawa M, Miyazawa S and Muramatsu T: *Basigin, a new, broadly distributed member of the immunoglobulin superfamily, has strong homology with both the immunoglobulin V domain and the beta-chain of major histocompatibility complex class II antigen.* J Biochem107: 316- 323, 1990.
20. Seulberger H, Lottspeich F and Risau W: *The inducible blood brain barrier specific molecule HT7 is a novel immunoglobulin like cell surface glycoprotein.* EMBO J 9: 2151-2158, 1990.
21. Fossum S, Mallett S and Barclay AN: *The MRC OX-47 antigen is a member of the immunoglobulin superfamily with an unusual transmembrane sequence.* Eur J Immunol21: 671-679, 1991.
22. Ochrietor JD, Moroz TP, van Ekeris L, Clamp MF, Jefferson SC, deCarvalho AC, Fadool JM, Wistow G, Muramatsu T and Linser PJ: *Retina-specific expression of 5A11/Basigin-2, a member of the immunoglobulin gene superfamily.* Invest Ophthalmol Vis Sci44: 4086-4096, 2003.
23. Kataoka H, DeCastro R, Zucker S and Biswas C: *Tumor cell derived collagenase-stimulatory factor increases expression of interstitial collagenase, stromelysin, and 72-kDa gelatinase.* Cancer Res 53: 3154-3158, 1993.
24. Biswas C, Zhang Y, DeCastro R, Guo H, Nakamura T, Kataoka H and Nabeshima K: *The human tumor cell-derived collagenase stimulatory factor (renamed EMMPRIN) is a member of the immunoglobulin superfamily.* Cancer Res 55: 434-439, 1995.
25. Guo H, Zucker S, Gordon MK, Toole BP and Biswas C: *Stimulation of matrix metalloproteinase production by recombinant extracellular matrix metalloproteinase inducer from transfected Chinese hamster ovary cells.* J BiolChem272: 24-27, 1997.
26. Simpson RJ, Jensen SS and Lim JW: *Proteomic profiling of exosomes: current perspectives.* Proteomics 8: 4083-4099, 2008.
27. Menashi S, Serova M, Ma L, Vignot S, Mourah S and Calvo F: *Regulation of extracellular matrix metalloproteinase inducer and matrix metalloproteinase expression by amphiregulin in transformed human breast epithelial cells.* Cancer Res 63: 7575-7580, 2003.
28. Han ZD et al: *Expression and clinical significance of CD147 in genitourinary carcinomas.* JSurg Res.2010 may 15;160(2)260-7).
29. R.Nawroth et al: *CD147(EMMPRIN):A potential therapeutic and prognostic markers in bladder cancer.* Patholge.2010 oct;31suppl 2;251-4).
30. Jemal A, Murray T, Ward E, et al. *Cancer statistics, 2005.* CA Cancer J Clin 2005; 55:10-30.
31. Morrison AS: *Advances in the etiology of urothelial cancer.* UrolClin North Am 1984; 11:557.
32. Varkarakis MJ, Gaeta J, Moore RH, et al. *Superficial bladder tumor: Aspects of clinical progression.* Urology 1974; 4:41  
Han ZD et al: *Expression and clinical significance of CD147 in genitourinary carcinomas.* JSurg Res.2010 may 15;160(2)260-7).



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### RESEARCH ARTICLE

## PREVALENCE OF ORAL CANCER IN PERSONS WITH ALCOHOL ABUSE AND ITS CORRELATION WITH SERUM AMINOTRANSFERASE LEVELS – A CASE CONTROL STUDY.

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Alcoholism, Mouth Neoplasms,  
Transaminases.

### Abstract

**Background:** Alcohol abuse is a major risk factor for various types of cancer, but strongest associations have been found for oral and pharyngeal cancers. Although the influence of alcohol on liver function has been extensively studied, studies correlating the liver function tests with prevalence of oral cancer are limited.

**Aims and Objectives:** The aim of our study was to assess the effect of alcohol in clinicopathogenesis of oral cancer, to test its synergism with tobacco use and to correlate this with serum aminotransferase levels.

**Materials and Methods:** A total of fifty patients with tobacco habit were equally divided into two groups: alcoholics with tobacco habit as cases (Group I) and non – alcoholics with tobacco habit as controls (Group II). A thorough intraoral examination was performed and histopathological grading for confirmation of oral cancer was done. Serum aminotransferases levels were assessed for all patients and the obtained results were analyzed statistically.

**Results:** Oral cancer was present in 84% of cases and 80% of controls and the result was not found to be statistically significant. Also, the relationship between levels of serum aminotransferases and occurrence of oral cancer in alcoholic patients was found to be statistically insignificant.

**Conclusion:** The combined deleterious habit of tobacco and alcohol increases the risk of oral cancer. The difference in prevalence of oral cancer in patients with and without alcohol habit was not found to be statistically significant. However, no correlation has been found between serum aminotransferase levels and prevalence of oral cancer in persons with alcohol abuse.

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### Introduction:-

Oral cancer is a common cancer of global concern. It is known to be a devastating disease of tremendous consequence to the individual, to family and to society. Known risk factors include alcohol consumption and tobacco, together responsible for about 75% of oral cancers in developed countries.<sup>1</sup> It has been difficult to

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distinguish the separate effects of these agents, however, since drinkers of alcoholic beverages tend to be smokers, and vice versa.<sup>2</sup> Oral cancer is related to these aetiological factors from qualitative as well as quantitative point of view. The consumption of alcohol is linked to the development of cancer due to combination of local toxic effects on the mucosa and systemic effects from the associated dietary deficiency, hepatic damage and possible alteration in patient's immunity.<sup>3</sup> Studies have shown that ethanol can increase the permeability of oral mucosa, resulting in epithelial tissue atrophy. Besides, alcohol is able to decompose the lipid composition of the outer epithelial membrane of mucosal tissue, which augments the susceptibility of oral mucosa to other carcinogens.<sup>4</sup> Liver function tests including estimation of serum aminotransferases (serum glutamic oxaloacetic transaminase and serum glutamic pyruvic transaminase) give objective information about alcohol consumption, changes in drinking habits and in decision making about the role of alcohol as an aetiological factor of disease.

Hence, a study has been planned to evaluate the effect of alcohol in the clinicopathogenesis of oral cancer and correlate these with the serum aminotransferase levels.

#### **Aims and objectives:**

- 1) To study the prevalence of oral cancer in persons with alcohol abuse.
- 2) To test the synergism of alcohol with tobacco use in oral cancer causation.
- 3) To correlate the prevalence of oral cancer in persons with alcohol abuse with serum aminotransferase levels.

#### **Materials and methods:-**

##### **1) Source of data:**

This case control study comprised of 50 patients visiting the Department of Psychiatry, BMCRI, Bangalore and Deaddiction Centre, Victoria Hospital, Bangalore.

The patients were selected on the basis of set inclusion and exclusion criteria and were further divided into two groups-

Group I- alcoholic patients with tobacco habit as cases- 25 patients

Group II- non-alcoholic patients with tobacco habit as controls- 25 patients

An ethical clearance from the institution and a written informed consent from the patients was taken prior to conductance of the study.

##### **2) Inclusion criteria:**

- a) Subjects with age group 21-79 years.
- b) Subjects with habit of tobacco use for more than one year.
- c) Histopathologically proven oral cancer patients.

##### **3) Exclusion criteria:**

- a) Subjects with habit history of less than one year of duration.
- b) Subjects who have undergone treatment for oral cancer.
- c) Subjects diagnosed with hepatitis, HIV and other systemic conditions affecting serum aminotransferase levels.

##### **4) Materials:**

- Sterilized Kidney tray
- Mouth mask
- Gloves
- Sterilized Mouth mirror
- Sterilized Straight probe
- Sterilized Metallic ruler
- Beckman Coulter AU analyzers

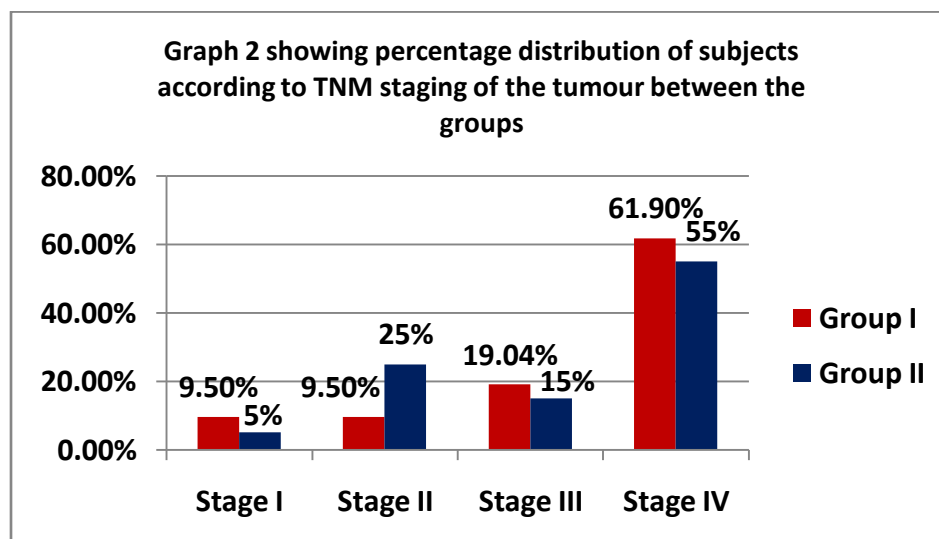
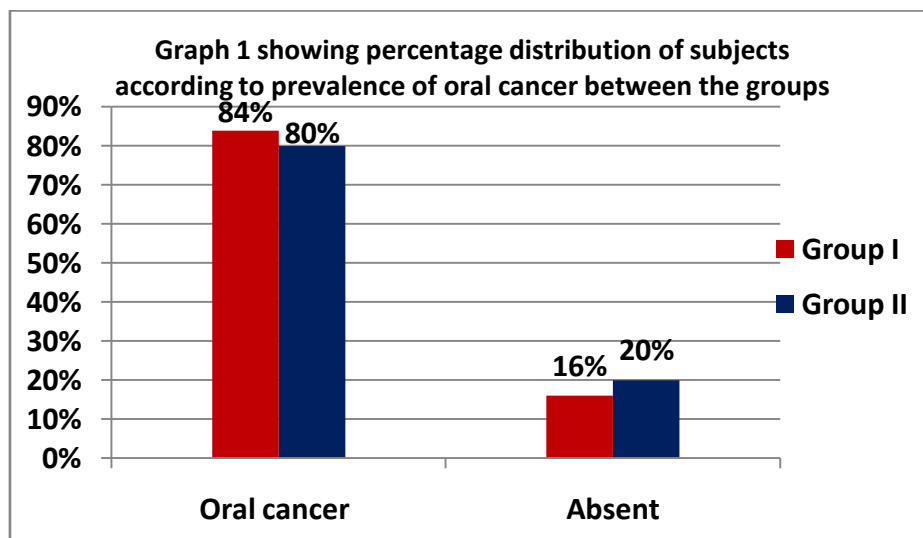
#### **Methodology:-**

All the participants were informed about the objectives and purpose of the study and their willingness was sought before conductance of the study. History was recorded on a specially prepared case history proforma. Questionnaire data collected through in person interviews was used to assess consumption of alcohol, use of tobacco, usual adult diet, medical and dental history and demographic characteristics. Under a well illuminated light source, a thorough

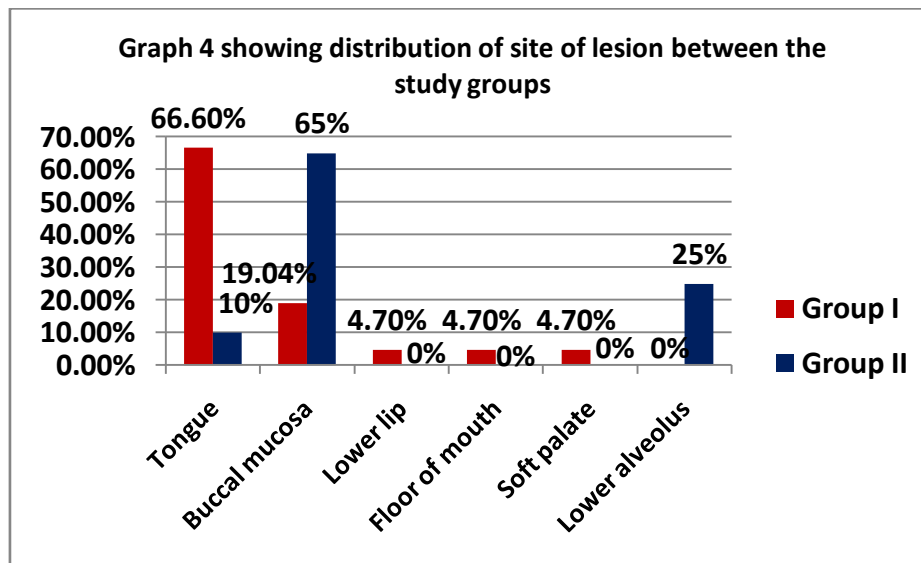
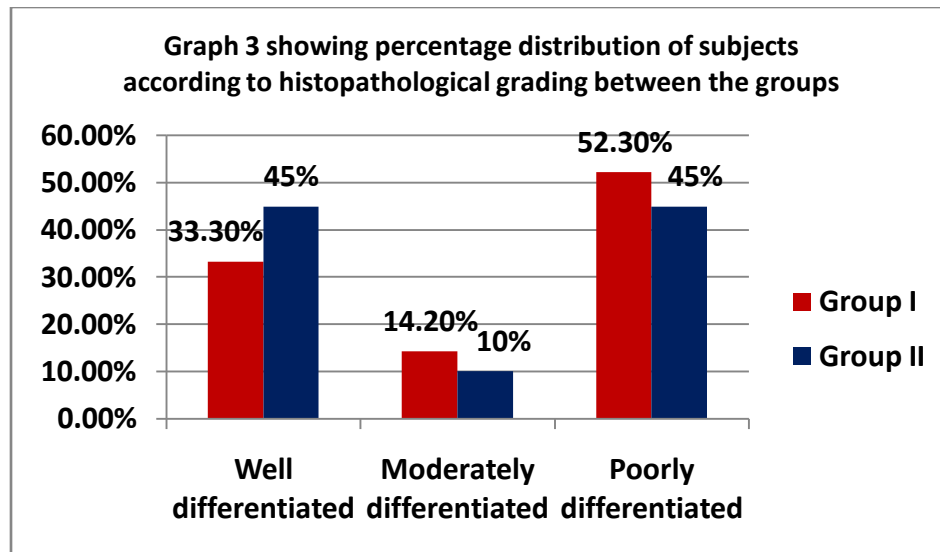
intraoral examination was performed with special emphasis on site, size, shape, margins and texture of the lesions. Histopathological grading for confirmation of oral cancer was done. The patients were further subjected to estimation of serum aminotransferase levels using Beckman Coulter AU analyzers. All measurements were performed by a single examiner to eliminate interexaminer variability. The collected data was subjected to statistical analysis.

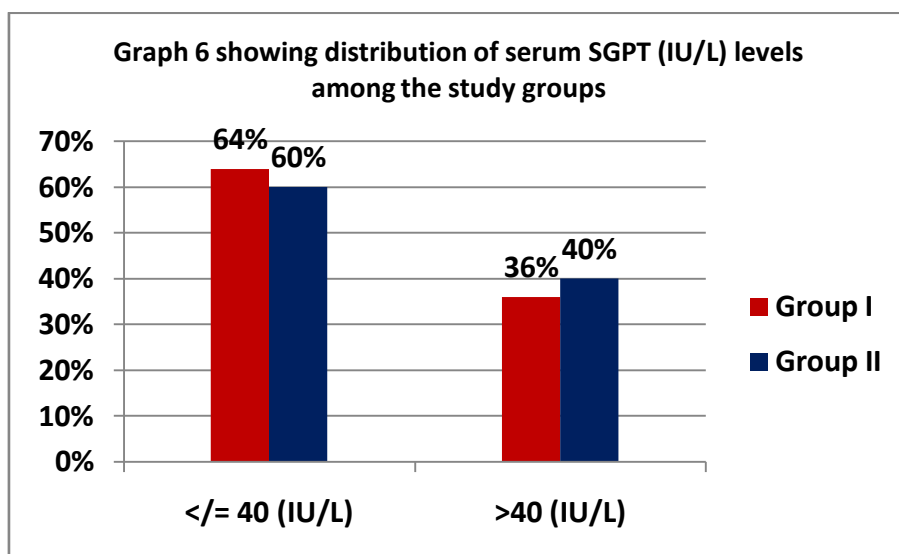
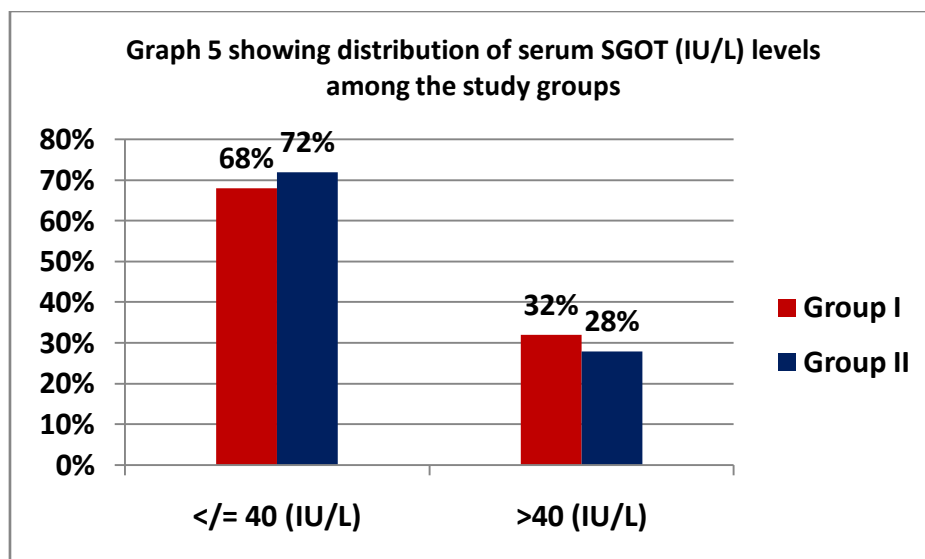
### Results:-

In our study, maximum numbers of cases were found in 50-69 years age group (72%). The majority of patients in Group I were males (96%) whereas 60% of the patients in Group II were females. Oral cancer was present in 84% of patients in Group I and 80% of patients in Group II and the result was not found to be statistically significant [Graph1]. Majority of the patients in Group I had stage IV tumours i.e. 61.9% [Graph 2] and 52.3% had poorly differentiated tumours [Graph 3]. Tongue was the most common site of involvement in Group I patients (66.6%), whereas buccal mucosa was the most frequent site of involvement in Group II. Ventral surface of tongue was involved in 19.04% of patients in Group I [Graph 4]. In Group I, 32% patients had elevated SGOT levels as compared to 28% in Group II [Graph 5]. When comparing SGPT levels, 36% patients in Group I had elevated levels as compared to 40% in Group II and the result was not found to be statistically significant [Graph 6].









### Discussion:-

In this population based case control study, we have found the occurrence of oral cancer in patients with alcohol and tobacco use to be more in males in group I. The predominance of oral cancer in males (96%) may be related to the high prevalence of use of alcohol and tobacco, a major oral cancer risk factor.

Our results revealed that combined exposure to tobacco and alcohol is strongly related to development of oral cancer. i.e. 84% of cases had oral cancer. These results are similar to studies of P.K. Varshney et al. This suggests the synergistic effect of alcohol and tobacco in carcinogenesis. It is proposed that tobacco is an initiator while alcohol is a promoter, presumably by either increasing the permeability of mucosa lining cells to tobacco carcinogens or by cellular lesions induced directly by alcohol metabolism.<sup>5</sup> Also, after alcohol intake, acetaldehyde (the first metabolite of ethanol) is locally formed in the oral cavity by oral mucosal alcohol dehydrogenases and by the oral microflora, both of which are able to oxidize ethanol to acetaldehyde. Also tobacco smoke contains high levels of acetaldehyde. There is convincing evidence for acetaldehyde being the ultimate local and topical carcinogenic compound behind alcohol intake in humans.<sup>6</sup> Also, tobacco was found to be an important risk factor for oral cancer as 80% of cases in group II had oral cancer.

In our study, carcinoma of tongue was seen in 66.6% cases with ventral surface of tongue being the most common site (19.04%). These findings were not in accordance with those reported by P.K. Varshney et al. in 2003, in which

carcinoma of tongue was reported in only 24% of cases. Our findings can be explained based on the assumption that the ventral surface of tongue is lined by thin non-keratinized epithelium and most of the carcinogens readily penetrate this thin epithelium to reach the progenitor cell compartment. Also, tobacco products and alcohol in solution constantly accumulate in the floor of the mouth and bathe the tissues of the floor of the mouth and the ventrum of tongue.<sup>7</sup>

In our study, the prevalence of T<sub>3</sub> and T<sub>4</sub> tumours was extremely high, i.e. 57.14%, which is in accordance with the result of the study by GS Dias et al. in 2007 and the involvement of regional lymph nodes was observed in 76.2% of cases. A probable factor related to the occurrence of T<sub>4</sub> tumours could be that in alcoholics with tobacco habit, the carcinogenesis may occur at a faster rate. Therefore, in a short duration of time, tumour will reach T<sub>4</sub> size as seen in our study.

In our study, 52.3% of the cases were histologically diagnosed as poorly differentiated tumours while well differentiated tumours were seen in 33.3% of the cases. These results are similar to a study by Effiom et al (2008). It was also shown that histological grade could be possibly associated with the site of the tumours as oral carcinoma affecting the buccal mucosa, gingivobuccal sulcus and lower lip were predominantly well differentiated, while tumours affecting the floor of mouth, borders and ventral surface of the tongue were predominantly poorly differentiated.<sup>8</sup>

Although, some studies have reported that smoking and alcohol abuse affect the individual components of liver function tests (including serum aminotransferases) in different ways, our results were not found to be statistically significant as 68% cases and 72% controls had normal SGOT levels and 64% cases and 63% controls had normal SGPT levels.<sup>9</sup> This suggests that oral cancer occurs much earlier than changes in liver function are evident.

### Conclusion:-

The combined deleterious habit of alcohol and tobacco increases the risk of oral cancer. Also tobacco is a significant risk in causation of oral cancer. The difference in prevalence of oral cancer in patients with and without alcohol habit was not found to be statistically significant. However, a no correlation has been found between the serum aminotransferase levels and prevalence of oral cancer in persons with alcohol abuse.

### References:-

1. Clinical Practice Guidelines. Guideline for the Early Detection of Oral Cancer in British Columbia 2008. p 1-8. 2008. British Columbia, Clinical Practice Guidelines.
2. Blot W J, McLaughlin J K, Winn D M, Austin D F, Greenberg R S, Martin S Petal. Smoking and Drinking in Relation to Oral and Pharyngeal Cancer. *Cancer Research* 1988;48:3282-3287.
3. Varshney P K, Agrawal N, Bariar L M. Tobacco and alcohol consumption in relation to oral cancer. *Indian Journal of Otolaryngology and Head and Neck Surgery* 2003;55(1):25-28.
4. Feng L, Wang L. Effects of alcohol on the morphological and structural changes in oral mucosa. *Pak J Med Sci* 2013;29(4):1046-1049.
5. Dias G S, Almeida A P. A histological and clinical study on oral cancer: Descriptive analyses of 365 cases. *Med Oral Patol Oral Cir Bucal* 2007;12(7):474-478.
6. Salaspuro V, Salaspuro M. Synergistic effect of alcohol drinking and smoking on in vivo acetaldehyde concentration in saliva. *Int. J. Cancer* 2004;111:480-483.
7. Feller L, Lemmer J. Oral Squamous Cell Carcinoma: Epidemiology, Clinical Presentation and Treatment. *Journal of Cancer Therapy* 2012;3:263-268.
8. Pires F R, Ramos A B, Oliveira J B C, Tavares A S, Luzi P S R, Santos T C R B. Oral squamous cell carcinoma: clinicopathological features from 346 cases from a single Oral Pathology service during an 8- year period. *J Appl Oral Sci* 2013;21(5):460-467.
9. Jang E S, Jeong S H, Hwang S H, Kim H Y, Ahn S Y, Lee J et al. Effects of coffee, smoking, and alcohol on liver function tests: a comprehensive cross – sectional study. *BMC Gastroenterology* 2012;12:145.

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### RESEARCH ARTICLE

## IMPACT OF MAHATMA GANDHI NATIONAL RURAL EMPLOYMENT GUARANTEE SCHEME IN HARYANA.

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Radiotherapy, Collagenase gene, cancer and Swiss mice.

### Abstract

Estimates of the total number of unemployed or underemployed people in India vary between 50 to 300 million. The Economic Survey of India has reported that the unemployment rate increased from 5.99 per cent in 1993-4 to 7.32 per cent in 1999-2000. To make matters worse, young people accounted for 53 per cent of the total unemployed in the country.

In absence of viable and reliable social or economic security of any kind, the majority of Indians have no option but to slave under appalling conditions for less than decent wages, often from childhood to old age. The case of brick kiln workers and also the efforts made by Swamy Agnivesh to get bonded labourers freed are telling. The brick kiln workers are not allowed to leave the work, even when some of them have no debt.

In 18 out of the 32 states and union territories where legislation on minimum wages applies, the minimum permissible daily wage is less than Rs 50; the range of minimum wages rises above Rs.100 only in four states. It goes without saying that even such low minimum wages are not always paid. To make matters worse, there are seasonal variations in availability of work and calamities of various kinds – from drought to social conflict – adversely affecting employment and livelihoods on a regular basis.

A number of programmes have been initiated in the country to provide gainful employment, enhancing rural peoples' skills, their income and thus to ensure their food security etc. but without the tangible and expected results from each of these programmes

Under the pressure of social groups, the congress party made NREGA a part of its election manifesto. Later on strong stand by the NAC and pressure of left parties on whose support the govt. was formed, it was made an essential aspect of National Common Minimum Programme of the UPA – I. The NREGA was passed in 2005 and brought into implementation in Feb. 2006, initially in 200 most backward districts spread over 27 states, another 130 districts in the following year (113 from 1<sup>st</sup> April and 17 districts of UP from 15<sup>th</sup> May). The entire country was covered in the third year of its implementation, i.e., from 1<sup>st</sup> April, 2008.

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The Act aims to provide on demand employment subject to 100 days minimum per household in a year to the rural poor through public works. It is expected to have the additional benefit of developing the infrastructure base in the countryside. Further, and importantly, an unemployment allowance has to be paid if work is not provided for any reason.

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### ..... **Introduction:-**

The Mahendergarh district of Haryana was one of those in the first phase. In its village Satnali, one Mr. Mahesh Kumar, 28 years of age, became the first person in the entire country to get himself registered on February 2<sup>nd</sup> to get 100 days employment @ Rs. 90/- a day. Now the wage rate under NREGA is Rs. 141 and minimum wage Rs. 151 in Haryana, which was revised on July 2009 from Rs 148 per day.

Along with Kumar, at around the same time, all 132 panchayats in the district held their special Gram Sabha meetings when work was a legal right. But in Haryana there had been labour shortage which was met by immigrant labour from states like Bihar on regular basis.

According to the information from the Department of Rural Development, Haryana fell short of the target in utilising funds as the number of applicants was insufficient.

The state could utilise only Rs 52.35 crore out of Rs 58.20 crore funds earmarked under NREGA in 2007-08.

Similarly, out of Rs 160.12 crore available, the amount spent under NREGA was Rs 110.00 crore in 2008-09. Thus only 70 per cent utilisation of the available funds could take place.

In the financial year 2007-08, 161,000 households were issued job cards which increased to 217,000 households in 2008-09.

The state has approved a labour budget of Rs 220 crore from the Union Ministry of Rural Development and this is for the first time that a labour budget has been sanctioned in advance, which is subject to revision, if required.

The Scope of NREGA has been enlarged which may help the state to fully absorb the funds which include land development, irrigation facilities and horticulture plantation which has been permitted to small and marginal farmers.

In Haryana, out of 1.5 million farmers, 998,000 (about 2/3<sup>rd</sup>) are small and marginal farmers. A number of reports have come out with unsatisfactory outcome of NREGA, particularly with regard to its implementation.

The present study based on Haryana experience attempts to look into the progress and achievements made in its implementation with the following specific objectives:

1. Identification of factors determining participation in NREGA
2. Impact of implementation of NREGA on employment generated, share of women in employment and change, if any, in their social status due to self earnings
3. Impact on wage differentials, across activities and also on non- NREGA works
4. Impact of NREGA on rural- urban migration.
5. Impact of NREGA on assets creation and their sustainability
6. Impact of NREGA on rural food security, and ,
7. Overall assessment and policy implications for further strengthening of the programme.
- 8.

For collection of data, five districts, Mewat, Ambala, Panipat, Sirsa and Rewari were selected. From each district two villages – one within a radius of 5 kms and the other beyond 20 kms were to be selected. From each village 25

respondents – 20 beneficiaries of NREGA and 5 non-beneficiaries were selected for detailed enquiry. Overall the study is based upon a sample size of 250 individual respondents and 10 villages represented by the respective sarpanches/ Panchayat secretaries/ village pardhans/ or village level workers of the state government.

#### **Functioning of NREGA:-**

We have used secondary data as available on the web site to analyse the functioning of NREGA in the state. The purpose was to have a broader picture of implementation of NREGA in the state. Data on the web site are given quite in detail covering households with socio-economic characteristics (scheduled castes, scheduled tribes and other backward castes as well as forward castes and women workers with regard to issuance of job cards, employment generation, work demanded and provided etc. We have used data for the latest three years, viz. 2008-09, 2009-10 and 2010-11.

The work on NREGA in the state was started with two districts, Sirsa and Mahendergarh in the beginning, followed by other two, Mewat and Ambala districts in 2007 and in the remaining 17 districts in the third year. District Palwal was created in 2009-10. The progress of issuing job cards is significant during the three years. The share of SC households in the issuance of job cards was more than 50% during the three years, though it decreased from 55% 2008-09 to nearly 50% in the latest year. The percentage growth of households issued job cards in the state as a whole was around 54%.

As far as generation of person days of work was concerned, there was almost 41% increase in women participation in 2010-11 over 2009-10 and 50% increase in 2010-11 over 2008-09. Overall the share of women in generation of work days was more than 30% in the three years.

Among the districts, Mewat and Jind created more than 41% work for women in the year 2010-11, while in Karnal about 44% work was created for women. The state and some districts have achieved magnificent growth in employment generation for scheduled castes.

So far as completion of works was concerned, share of Rural Connectivity projects within the districts as well as in the state was almost 1/3<sup>rd</sup> during the last three years and it was continuously increasing from 32% in 2008-09 to about 42% in 2010-11. It was followed by Water Conservation and Rain Water Harvesting measures with more than 20% share during the three years. Other

important projects getting about 15-16% share in the state as well as in the selected districts were Drought Proofing, Micro Irrigation etc. However, Rajiv Gandhi Gram Seva Kendra is also in focus. The utility of such Kendras is being questioned by the officials, village leaders and even by the conscientious NREGA workers.

About 25% of the total amount was spent in district Sirsa alone followed by Mewat among the selected districts in 2008-09. Among the activities about Rs.

5.5 crores were spent on renovation of traditional water bodies. In the following year the amount spent on ongoing/ suspended works increased by about 42%. However, in 2010-11, the amount spent increased by about 101% over 2008-09. Like 2008-09 district Sirsa topped the amount spent in the following two years as well, in 2009-10 by spending about 17% and in the year 2010-11 by spending about 19% of the total amount spent in the state. Rural Connectivity attracted maximum of the amount spent. It was more than 38% of the total amount spent in the state in the year 2009-10 and also in the year 2010-11. Water Conservation and Water Harvesting followed the Rural Connectivity, wherein about 16% of the total amount was spent.

In sum maximum amount has been spent on Land Development, Rural Connectivity and Water Harvesting related works and all of them will have long term economies for the communities associated with.

Social audit of the works, verification of muster rolls, and, gram panchayats' and gram sabhas' meetings are key to the functioning of NREGA.

Total number of muster rolls used in the year 2008-09 for the state as a whole was 25985 but 93.8% were verified during the year. Similarly in 2010-11 about 98% muster rolls in the state were verified. However, among the

districts selected for the sample, the muster rolls due and verified mostly match, except in Sirsa where only 67% muster rolls were verified.

The situation related with verification/ completion of Panchayats was no better than verification of muster rolls. In the state as whole, during the year 2010-11 about 40% verification of panchayats was not completed, whereas in the previous two years figure were about 29% and 40% less number than the total due.

In the state about 81 % and 78% works were inspected. During the first two years, whereas in the year 2010-11 almost all the works are shown as inspected, though at district level we find many lagging.

In many districts of the state meetings of the gram sabhas were not held, which as per the act was mandatory. It was in the year 2010-11 that in two districts, Ambala and Sirsa all the gram sabhas met. The assignment of social auditing is yet to mature.

We find number of individual and joint bank and post office accounts of NREGA workers increasing during the three years. But still a huge portion of wages is paid in cash. Secondly, money disbursed as wages through bank and post office accounts as percentage of total amount spent on completed and ongoing projects during the three years, 2008-09, 2009-10 and 2010-11 was merely 13.7%, 6.5% and 15.9. Keeping in mind the level of misappropriation of public funds, the disbursal of innocent workers' wages in cash is neither recommended and nor desired.

No unemployment allowance was paid even it had been reported as due for some considerable days during the year 2009-10 and for a few days in 2010-11. As far as work projection is concerned, about 7.8 million work days for unskilled workers were projected to be generated which would mean that 78, 000 workers getting 100 days work during the year. A similar act for the urban poor will lift the entire state out of hunger and poverty and many more evils.

#### **Demographic profile of the respondents:-**

The average size of the households of the beneficiaries was noted significantly large (5.59) than those non-beneficiaries (4.86) members per household. Also the earning members were more (2.68) in NREGA families than (2.36) in non- NREGA families. The ratio of male and female workers was about 55% and 45% under the NREGA category as compared to 56 and 44% under non- NREGA category. Also in the beneficiary households percentage of females was higher, 832 per 1000 males as compared to 783 in non-beneficiary households. In the working age groups of less than 60 more percentage of workers is found under beneficiary category as compared to non-beneficiaries. Whereas in the age group of more than 60 years, which is not considered suitable for physical labour a negative indicator, more people above 60 work under non-NREGA activities. Looking at the education level of both beneficiaries and non-beneficiaries, we find more percentage of people educated at primary level in the case of beneficiary households. But in the case of illiterate persons, the major difference of about 5% exists as more people are illiterate in the case of beneficiary households.

As far as card holding pattern is concerned, we did not find any worker holding AAY card holder availing benefits under NREGA. Workers below poverty line were more than 80% in aggregate and 80% in the case of beneficiaries.

As far as migration is concerned, a very small number of persons (only 2 out of 1356) migrated during the reference year 2009.

The percentage of total man days per household as main profession was highest under agricultural casual work for the beneficiaries and non- agricultural casual work for the non-beneficiary category. But non- agricultural casual work provides significant work for the beneficiary households also. Nonetheless for 25% beneficiary households work under NREGA was main profession. Moreover, the extra employment generated through NREGA would create extra income pushing up demand for other items like fruit and vegetables, resulting in more employment and income to the venders and growers with forward and backward linkages.

For the NREGA beneficiaries, about 25% per household income also was received from NREGA activities, about 37% from agricultural labour, 33% from working on other than agricultural operations, and about 4% income came from livestock. In the case of non-beneficiary sample households, the largest share of household income (60%)

came from non-agricultural wages, followed by (34%) wages received by doing casual agricultural work and about 5% income was generated by rearing livestock.

Across households the variation in income has been measured by Coefficient of variation. The CV in this case was the highest for beneficiaries, followed by income from agricultural wages. However, in the case of non-beneficiary households the highest variation was found in the case of income from agricultural wages then followed by non-agricultural wages.

As far as per capita monthly consumption of different edible items between beneficiaries and non-beneficiaries was concerned, no significant pattern emerged, except that overall food consumption was in favour of the beneficiaries. However, in terms of total monthly per capita consumption expenditure many important issues get highlighted. For example, monthly per capita consumption expenditure on food items works out to Rs, 487/- This small expenditure in both the cases of beneficiaries as well as non-beneficiaries may not be enough to save poor workers suffering from malnutrition, if not from hunger without NREGA. Even NREGA alone in the present form of providing 100 days' work at a fixed wage, will not address the issues of providing sufficient food, if the food was not provided at subsidized rates, mostly through the PDS. Because, per day per capita consumption expenditure of Rs. 13 per day in the case of beneficiaries and Rs. 12.4 in the case of non-beneficiaries, was not sufficient to provide two times food to satisfy one's hunger. Though NREGA seems to have benefited the poor directly by delivering some money and indirectly to non-beneficiaries by increasing overall wage rates, particularly during peak season, but to alleviate poverty and hunger some other steps need to be taken or improved. Wage rates need to be inflation neutral. Without effective PDS nothing will be effectively helpful to the poor to meet both ends. Many more items (food as well as non-food) need to be put under the PDS to increase their real income. Coming to the issues of beneficiaries vis-à-vis non-beneficiaries, overall persons benefiting from NREGA seem to be slightly better off, which further strengthens the arguments favouring NREGA.

In sum one can say that though progress of NREGA seems to be somewhat below targets to address the issues of gender equality with regard to employment generation and income, social equality by creating more opportunities for the deprived sections, it has helped in improvement of provision of food in the state, particularly in sections dependent mostly on wage labour.

#### **Work profile under NREGA:-**

As far as the work profile of the NREGA workers was concerned, the number of workers per household finding work under NREGA activities, varied from 1.35 to 1.98 in the selected districts. The average for the state as whole was 1.72 persons per household. Different social groups wise in the state as a whole, 1.75 members per household from the general category, 1.66 from scheduled Caste households, 2.33 from scheduled tribe households and 1.74 from the OBC households were getting work during the period. The number of females per household 0.62 working under NREGA activities was the lowest. Thus probably the targeted deprived sections like scheduled castes were the largest group of people to find per household work for number of family members under NREGA but the other deprived section the women, was the smallest.

The inter district variation observed in per household number of people finding work under NREGA was in the range of 1.98 in Mewat to 1.35 in Panipat. In other words, the most deserving region was able to generate more work for members per household. If the females could also be involved in a little more aggressive way, the objective of NREGA as far as involvement of different social and targeted groups and regional consideration was concerned, could have been largely met.

During the period under reference in aggregate 80 (exact 79.7) to 110 (109.5) days' work per household in the selected districts was provided, in two districts, Sirsa and Mewat, even exceeding the annual target of minimum 100 days work. In the state as a whole more than 94 days' work per household was provided during the period. Among different social groups ST households in districts Sirsa and Mewat were the largest beneficiaries getting more than 160 days' work per household during the period. In district Sirsa general category households got maximum work of 160 days. Overall in the state women got about 30 days' work per household in the state during the period.

However, per member work provided during the period varies drastically inter districts as well as inter social groups. In aggregate inter district variation is recorded from 44days (lowest) in district Rewari to 62 days in district



Ambala.

Similarly among the SC members lowest number of days was 29.34 in district Sirsa to highest being 112 days in district Mewat. The lowest variation among all the groups is found in OBC members, varying from 47.47 per member in district Ambala to 58 the highest variation in district Sirsa. Among the women, the variation was found between 37 days to about 52 days.

As far as wage rate was concerned, during the period the average wage rate was about Rs 150 per day, varying across sections marginally, among ST and women workers for example. The ST workers received lowest wages (Rs. 147) among all. Though the difference in minimum prescribed (Rs. 148) at that time and the lowest paid (Rs. 147) was marginal but considering the prevalent higher rate of wages in the state at that time, it was not that small too.

The average distance of work place from the residence in the state was about 2.23 Kms, varying from 1.28 kms. in district Ambala to 2.7 kms in district Rewari. In the state between January and December 2009 (reference period) about 6% households were employed to work on rural connectivity projects. In two districts, Ambala and Panipat, there was no work on this activity whereas in the remaining three, percentage of households employed varied between 12.5 (Mewat) the maximum to 5% the minimum in Rewari. Surprisingly In none of the selected districts work on water conservation was being undertaken.

As far as quality of these works was concerned, maximum respondents, 79%, reported it to be very good, and about 20% reported it to be of good quality. None of the respondents stated it of bad quality, and that is very significant response.

As providing employment allowance in lieu of work is state's responsibility, without any bearing on the central government, in the entire state efforts were made to see that not a single paisa is provided for allowance, and work to avoid stress on the state's resources is created as per demand. The introduction of more activities, such as developing horticulture, plantation, etc. will further reduce the pressure of finding and providing work to the needy in the village. If need be some categories of works presently covered under Khadi and village industries be considered for inclusion in NREGA. That will help provide work at door steps and open up more opportunities for the village panchayats to create jobs and productive assets.

The sample data show that there were negligible cases of immigration during the period.

#### **Household assets holdings:-**

The assets holding pattern of the respondents confirms that barring district Rewari, they were benefiting directly for the last two - three years in the state in the form of assured employment and extra income during the lean period. Barring utensils and other unspecified small items per household all major assets like land, house property, livestock, even a few ornaments of very little value were more valued in the case of beneficiary households vis-à-vis non-beneficiary households. The difference seems significant in the total value of assets. Aggregate value of all assets per household was Rs. 89 thousand and Rs.68 thousand respectively in the case of beneficiaries and non-beneficiaries. The major difference came from land and house property. Taking the value of beneficiary assets equal to one, we find that land in the case of non-beneficiary households is just 0.63, house property 0.88, live stock 0.91, ornaments 0.64 and some other assets 0.92. However, value of consumer assets was found slightly more than one, i.e. 1.18, and utensils 1.15 in the case of non-beneficiary households.

In fact, along with contribution in the creation of infrastructure like , water harvesting, land development, plantation, etc. contribution in enhancement of personal assets of the NREGA workers is important and NREGA seems to succeed in that area. Compared with Keynesian magical formula of digging the pits and then refilling them for the sake of creating jobs to lift the economy from depression, NREGA seems to be more effective way of doing many things simultaneously – removing poverty, ensuring food and nutrition for the most targeted sections, enhancing gender equality, productively utilizing the unused valuable human labour, creating infrastructure to be useful for future longer period, saving the society from turning chaotic or criminal, and most importantly, creating demand for the industry.

As far as financial position of the respondents was concerned, barring a solitary case of a loan of Rs. 50,000/- @

13% interest from the SBI for establishing a shop by one beneficiary household, not a single case was reported by any other household, neither by beneficiaries nor by non-beneficiaries households because for getting a loan one has to provide some assets as collateral, which for the households dependent on wage labour if not impossible would be difficult to provide. To begin with, there seems a very positive impact of NREGA that people have begun to create productive assets even by taking loan, which otherwise could not be envisaged.

But the households both beneficiaries as well as non-beneficiaries did borrow from the private money lenders. The amount and terms of loan might not have been revealed by the respondents. The other information gathered from the respondents does provide an indication of the strict terms of loan from private sources. For example, 22% respondents in aggregate (23% beneficiary households and 18% non-beneficiary households) did work for the lenders, they were indebted to.

Even though 18% reported that cooperative credit society was in existence in the village, 5% and 10% households respectively from beneficiary and non-beneficiary households were members of such a society, additionally, for the 12% respondents facility from formal credit society or Self Help Group was also available, about 7% family members were holding the membership of such a society or SHG. As much as 51% were also having live accounts in bank branch or post office, still no formal substantial credit line was opened to them.

Not only providing some material asset for collateral is essential to get loan from private sources, but also terms of repayment of loan in such cases are harsher ones, for example, high rate of interest, large repayment installments for fast recovery and some other conditions, like retention of some amount (may be one installment) even before making payment etc. That is what 23% beneficiary households and 18% non-beneficiary households reported doing wage labour for the lender.

As per the Act and rules the payment of wages to the NREGA workers has to be made either through the bank or through the post office. But only 53% beneficiaries and 44% non-beneficiaries reported having bank or post office accounts. Here also large percentage of bank accounts of beneficiaries is positive impact of NREGA. But only 78% respondents got the wages transferred to their bank accounts and 13% were paid by the sarpanch, In 21% cases of delayed payment and in 8% cases of less payment of wages complaints were lodged while 65% did not lodge any complaint.

Worksite facilities like child care, medical care or even first aid, except drinking water were not in existence.

A few things, need to be considered seriously: One, to ensure economic welfare of these groups, along with implementing the provisions of the act seriously, credit facility with convenient terms and easy availability has to be provided, two, to protect their health some strong medical/ health arrangement, through strengthening public health care system, medical insurance cover, etc. need to be put in place so that these groups if come above poverty line do not fall back due to any such reason. Recent arrangement made for bidi workers can be extended through the National Rural Health Mission to bpl card holders at least, NREGA workers and other targeted groups. To maintain quality of assets and to ensure that no genuine worker is left uncovered under NREGA, monitoring through regular meetings of the Gram Sabha and of the monitoring committee has to be made effective. In a good number of cases there was no monitoring at all. But still the assets created were rated very highly, either very good or in some cases of good quality and expected to last for 5 years.

Food expenses for the poor always remain main head of expenditure. In poor households, particularly AAY and BPL card holders many times meals for two times for the entire family is not secure. To mitigate such distressing situation it is expected that under NREGA, along with other income from non-NREGA work or from resources like live stock etc, if one has, one will secure at least two times meals for the family, and none would go to bed with empty stomach. Moreover, to ensure that, the minimum work days under NREGA can be increased to let us say to 200 per hh or 100 days per job seeker in the beginning. In Haryana, though people below poverty line as well as without any tangible resources do exist, but because state govt. has been providing social benefits, like old age pension, benefits to girl child for education, marriage etc. food for school children, some medical relief for the poor, the situation that people will go without food, is rare. But that does not mean that these measures will not be needed.

The NREGA has also successfully made the people more aware and conscious about the schemes, though they may not be very well versed with all the technical aspects of NREGA.

The NREGA through assets and infrastructure creation thus has generated great potential for the most deprived sections of the society, the poor, socially depressed classes and the women, who get employment and income during the lean period when it is most needed and thus helped them secure their food at least two times a day.

**Impact of NREGA on village economy:-**

The information gathered through village schedules shows that 90 % villages were connected with roads. In 50% villages there were double roads connecting the villages to different cities/ towns on different routes. It was only in one village that the nearest road was 2 kms away. No village was connected with railway station. The rail station on an average was 21 kms away. Telephone connectivity was 100%. In some villages even paid phone booths were noted. Post office facility was available only in 60% villages and the cooperative credit society in 40%. Despite the clear cut policy of the RBI that a bank branch with population of more than 2000 has to be opened, there was no bank branch, RRB, Cooperative Bank, or scheduled commercial one, neither public sector and nor private. In fact, the situation of rural banking is the poorest one.

Self help groups were working in 70% villages, primary school was working in all the villages, secondary school in 80% and senior secondary in 50%, PHC in 60%, dispensary and fair price shop in 40% each. The problem is related with distance also. On average the fair price shop was distanced at about 14 kms. The gram panchayat office was in all the villages.

The main concern of the nation now seems to be food security by providing nearly 70% people with subsidized food. In absence of fair price shops in 60% villages the task would be very difficult if not impossible. Therefore, urgent and effective steps would be needed.

Other infrastructure facilities like veterinary hospital/ dispensary, village purchase centre, mechanical workshop etc. did not exist in half of the sample villages. Village purchase centres have been a major successful story of the state, which helped not only the farmers to sell their produce at the nearest place, but many times at minimum support prices also. Additionally they have been a source of non-farm employment generation through linkages as well.

Historically with the development process, the people world over have been shifting away from agriculture. The percentage of cultivator households increased from 64.5% in 2001 to 65.2% in 2009. The percentage of agricultural labourers decreased from 33% to 30% in the respective years. Those involved in trade and commerce activities increased from 0.5% to 1.3%. The number of households doing other activities like working in household small industry, construction activities, transport and the like increased marginally from 2.1% in 2001 to 2.7% in 2009.

The number of cultivator households increased due to subdivision of households and holdings. The percentage of agricultural workers decreased due to availability of other less tiring and more rewarding works like small shops, trade etc. Overall, the development and nature of works do not suggest anything contradictory to the historical development process. Except that the rate of decrease of population dependent upon agriculture is much slower as compared to rate of decrease of share of agriculture in the GDP.

In Haryana higher wage rates have been the great attraction for immigrant workers from Bihar, eastern UP and Orissa.. Even the immigrant workers were not enough to reduce the prevailing wage rates. Introduction of NREGA has further increased the wage rates, probably due to, one - that number of immigrant labour has come down, though not eliminated completely, and two – because due to lean season earnings from NREGA local workers are not that much hard pressed to work under distress conditions. The increase in all type of wages both for male and female workers, during the period under reference has been noticed all around. In the wages of male workers almost 30% increase in agricultural wages, 40 % increase in non-agricultural wages, 36% rise in wages for construction work, more than 50% increase in mining, between 28% and 48% increase in the wages of semi skilled workers like electrician, plumber, pump set operators and mechanics has been noticed. Similarly in the case of female workers, almost 44% increase in wages for agricultural work, more than 49% for non-agricultural work, about 43% increase for construction work and 50% increase in the case of mining has been noticed. Along with effect of NREGA, general increase in price index and relatively more profits and more demand for work in construction and mining etc. due to overall increased growth rate of the economy and increase in value of

agricultural output due both to prices and production, can be the possible reasons.

Overall the average wage rate after NREGA has gone up handsomely.

It is pointed out by many studies/ reports. The latest being report by the Secretary Rural Development that NREGA has affected the wage rates positively by 2 to 2.5 times as compared to pre NREGA situation.

The labour charges per day for different agricultural operations have gone up two to three times in comparison to pre NREGA period. With so many changes all around, it is but essential that village economy, particularly cost of production, consumption pattern, migration and immigration etc, get affected. Shortage of agricultural wage labour at some point of time was reported by 70%. Even shortage of agricultural labour was expressed by 40%. Enhancement in cost of production by 20% to 50% was told by 10%.

Surprisingly and rightly too all the people agreed that there was no change after NREGA in the position of attached labourers, and probably it is the serious and negative aspect of NREGA. Because increase in wage affects them directly when they have to pay for the hired labourer by the land owner when they (attached workers) absent from work.

Finally on the question of improvement in NREGA two interesting suggestions were put forward – one more money, i.e., enhancement in wages and its immediate payment, and two, work for more than 100 days and not restricted to one member per household. Its scope needs to be enlarged to cover every one willing to work for as many days as one wants to work.

#### **Concluding Remarks:-**

From the above discussion and the relevant data, two issues come up clearly – one directly related with NREGA – its positive aspects and shortcomings in its implementation, and two, issues related with other aspects where NREGA and other schemes intermingle. It can be concluded that NREGA has helped improve the income level of the beneficiaries, through both, increase in wage rates and enhancement in their bargaining power, their food security, and that too with productively utilizing the scarce resources. The targeted groups, scheduled castes, scheduled tribes and women (to some extent) are the main beneficiaries of NREGA. The assets created are worth the money. The increase in percentage of school going children should be the major gain of NREGA combined with other measures like mid day meal, scholarship, free uniform, books etc. The position of attached workers who have not come out of the clutches of the rural rich is revealing.

However, many more things need to be done to improve the situation of rural India, for example, strict monitoring through Gram sabhas of the projects, list of beneficiaries, muster rolls, job cards, payment etc. In fact, the sarpanch centric system of panchayati raj needs to be made gram sabha centric through devolution of more democratic powers to the people. However, we would like to emphasize a few things for policy consideration:

1. Expansion of NREGA (200 days work per hh or 100 days work per job card) should be the minimum.
2. For improvement in the implementation, toll free application registration, complaint registration call centre scheme be made compulsory.
3. For accounts in banks, payments, job cards etc related issues administrative camps (like administration to the villages in Rajasthan, where all the officers camp in the village on specified day to settle all the issues) should be started.
4. Flow of Funds needs to be regular and not at the end of the year. For proper maintenance of records trained staff should be need based and recruited in a more liberal way instead of the present system of one project officer and one accounts assistant.
5. For monitoring of work, selection of work etc. involvement of workers' association along with some independent committee of village educated persons, may be teachers and retired government officials residing in the village, senior officers of the district, and academic staff of the local college etc. may be involved.
6. However, some other measures related with overall situation, other institutions also should be considered.
7. Credit facility through financial institutions needs to be improved to lift the poor above the poverty for longer periods.
8. For enhancement in real income through strengthening the PDS by inclusion of more edible as well as non-edible items at reasonable rates like CSD for the armed forces may be considered.

9. Immediate and effective steps for the welfare of the attached labour need to be taken.
10. More effective steps to strengthen the economy of the most backward sections of the society like artisans who have lost their traditional work under the new policies and development process like lohars, kumhars, carpenters, etc. need to be taken up on priority basis.
11. Health care of the rural poor needs to be taken care of either through the more effective way of public sector health services (NRHM) or through the insurance coverage.
12. For all these and many more welfare activities, the already going on schemes, like RKVY, Khadi and Village Industries, Sarve Shiksha Abhiyan.
13. Mother- Child care etc. need to be integrated and converged. Broad policy framework under the total monitoring of the Gram Sabha and grass root associations of the poor should be considered. The integration of schemes will help reduce the duplicity of works and projects.
14. Funds available under MPLAD, RKVY, RD and from other state and centre govt. departments should be pooled and used on the lines of RKVY and for that a greater coordination among centre and state governments, different ministries and departments need to be explored.

### References:-

1. Sinha, B.K Secretary (R.D), T. Vijay Kumar, JS(SGSY) and N.K. Sinha, JD(NREGA): Tour Report on the visit of Sirsa (Haryana)
  2. P. Sainath: Hindu (various write ups) Roy and N.Day: CATALYST Vol. VII. Issue 2, 19 Engel, Ernst [1857], 2nd ed. pp. 28-29
  3. SHAILLY KEDIA: Development Studies Association (DSA) Annual Conference, September 2009 Vidhya Das: NREGA – Orissa Experience, ceva
  4. Dr'eze and Sen 1991, Dev 1995 "Strategies of Entitlement Protection". In Hunger and Public Action, pp. 104 – 121
  5. India Centre for Research in Rural and Industrial Development, (CRRID): Appraisal of impact assessment of NREGS in selected districts of Himachal Pradesh, Punjab, Haryana. Districts Hoshiarpur, Sirsa and Sirmaur, July-August, 2009
  6. Prime Minister, Dr. Manmohan Singh: various speeches, address to the nation Drèze and Sen: Hunger and public action, oxford, 1989
  7. Reetika Khera Economic & Political Weekly, August 30, 2008 Jean Drèze and Christian Oldiges: How NREGA is doing?
  8. Sapna kedia: Sustainable Development through Inter-sectoral Convergence IFPRI discussion Paper 00963, 2010
  9. ET Bureau, 26.3.2010
  10. Aruna Roy and N Day: NREGA: Breaking new ground, The Hindu Komal Gera, Business Standard, New Delhi, Sep.22, 2009
  11. Sonu Jain: Indian Express, Feb 03, 2006 Economic Survey 2009-10
  12. Joseph. Is the media watching poverty enough, India Together, Times of India, Oct. 28, 2005
- Prof. CHH Hanumantha Rao and Dr. P. Rangaswamy: evaluation of IRDP, Planning Commission, Govt. of India.



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**RESEARCH ARTICLE**

**ASSESSMENT LEVEL OF AWARENESS TOWARD RADIATION EXPOSURE RISK AMONG  
 COMMUNITY IN MAKKAH CITY.**

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**Abstract**

**Background:** Radiological procedures are being used much more these days. Patients must be given sufficient information, in a way that they can understand, to be able to make the right decisions about their care.

**Objectives:** To examine health beliefs and assessment level of awareness toward radiation exposure risk among the general population of Makkah, Saudi Arabia.

**Methods:** A cross sectional analytical questionnaire based study among the general population of Makkah City.

**Results:** A total of 360 subjects answered the questionnaires. The mean age were 36 years, ranged from 16 to 70 and 45.2% females and 43.7% male respondents. Of these, 67% had attended college, 5% had postgraduate degree, 23.5% had completed high school, and 3.1% had basic school. The majority of participants had high level of monthly income (38%). The majority of subjects included in the research were (59.6%) married and (51.3%) were unemployed. Most subjects (338) had poor knowledge about hazards of exposure to radiation and there was no association between the knowledge and demographics of participants except for education as the higher the levels of education, the more significant association with good knowledge.

**Conclusion:** The knowledge of radiation exposure hazards was poor among the studied population. Also, education significantly impacts the knowledge of radiation risks thus there is a need for providing the patients with necessary information to improve their radiation awareness.

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**Introduction:-****Background:**

Ionizing radiation in medical imaging is one of the powerful diagnostic tools in medicine. Radiation which is applied in radiology departments has hazardous effects on biological systems<sup>(1)</sup>. Ionizing radiation is a broad, complicated, and often misunderstood topic. Exposure to ionizing radiation is associated with both acute and chronic disease states, especially as the radiation dose increases<sup>(2-4)</sup>.

Overexposure to ionizing radiation is a significant factor causing biological diseases such as various cancers, lens opacity, erythema, and genetic mutations<sup>(5)</sup>. Children are particularly susceptible to ionizing radiation and, because of their young age, may be more likely to experience delayed manifestations of ionizing radiation exposure. Nevertheless, individuals are constantly exposed to ionizing radiation from a variety of sources: naturally occurring, medical imaging, and other human-made. Studies indicate a difference in both risk perception and knowledge of actual sources of ionizing radiation between the general public and radiation experts<sup>(6-8)</sup>.

There is no threshold level of radiation exposure below which it could be said with certainty that cancer or genetic effects will not occur. Doubling the radiation dose doubles the probability that a cancer or genetic effect would occur. Epidemiological studies on populations exposed to radiation showed a significant increase of cancer risk at doses above 100 mSv/yr<sup>(8)</sup>. Studies have suggested that the general public is not concerned about exposure to ionizing radiation from medical procedures because of a widespread notion that healthcare professionals have received extensive training in principles of radiation and are competent in minimizing risk<sup>(9, 10)</sup>.

Our study was designed to examine health beliefs and assessment level of awareness toward radiation exposure risk among community in Makkah City and applies the Health Belief Model to determine barriers.

#### **Rationale:-**

Over the past two decades there was an increase in demand for radiologic imaging procedures in health care services to help in medical design making. Ionizing radiation can cause serious effects on the hematopoietic system, digestive system, skin, testicles, ovaries, central nervous system, and ultimately, the entire body. In Saudi Arabia, there are few studies that assessed awareness on radiation hazards among community.

#### **Literature Review:-**

Nowadays, radiological procedures are being used much more with technological advances. Those procedures assist in the diagnosis and management of many medical conditions. Requesting imaging modalities comprise risk factor to the patients (ionizing radiation cancer-causing biological effects). Every year there is increasing in the number of patients who are in need of diagnostic radiology<sup>(11, 12)</sup>, especially computed tomography (CT) scanning. During the last few years, the doses of radiation have increased up to 40% per scan<sup>(13)</sup>.

The repeated exposure to radiation increases the possibility of getting cancer. The lowest dosage of radiation for which there is a real proof of cancer-causing is around 10–50 mSv. The regular exposure dosage for one chest radiograph taken is around 0.02 mSv, and for an abdominal CT is around 9 mSv. The radiation from chest X-ray (CXR) is almost certainly less than background radiation established in a whole year (0.01 mSv daily). Around 0.015 mSv is received during a three-hour airline flight<sup>(14)</sup>.

It is essential that doctors who request imaging to be well trained in determining whether diagnostic imaging is required, but also they need to be aware of the associated risk. It has performed in many studies that the knowledge of medical professional on radiation hazards and dosage is limited<sup>(15, 16)</sup>.

A study published in 2006 by the Pediatric Radiology Journal showed that about 87% of pediatricians misjudged the radiation dosage from a chest radiograph and 94% underestimated the radiation dosage from a CT<sup>(1)</sup>.

Not only doctors had insufficient knowledge about radiation risks and dosage. In 2010, a study was performed to study the knowledge of doctors showed that half of the senior medical students and intern doctors underestimated the radiation doses from usually requested radiological procedures. Some of them incorrectly think that ultrasound (US) and magnetic resonance imaging (MRI) produce ionizing radiation<sup>(17)</sup>.

A study conducted by Karsli et al., (2009) indicated that a significant percentage of physicians advice that informed consent should be obtained from patients undergoing radiological exams and the information about cancer-related risks involved should be provided by the radiological department<sup>(18)</sup>.

Most contributors did not talk with patients about the associated hazards of radiation. A sufficient information should be given to patients, in a way that they can understand, to be capable of making the right decisions about their care<sup>(19)</sup>.

Few projects are focusing on the patient's knowledge about radiation risk in the literature. Two recent studies confirmed that the most of patients (74%) would consider that having their situation diagnosed with CT is more important than disturbing about radiation and patients had insufficient knowledge about radiation protection (15, 20).

Surprisingly, a number of articles have appeared in the literature that predict hundreds of cancers and cancer mortality per year in the U.S. and U.K. caused by ionizing radiation from medical imaging procedures. It was estimated 100-250 deaths occur per year from cancers directly related to exposure to medical radiation in U.K.<sup>(21)</sup>. In U.S., the estimated number of fatalities attributable to CT was 700-1800 during a year<sup>(22)</sup>.

Also, a recent pilot study was conducted among the general population of Makkah, Saudi Arabia, 2016 showed that education significantly affects the knowledge of radiation exposure hazards<sup>(23)</sup>.

### **Objectives:-**

#### **General objectives:-**

To assess the level of awareness toward radiation exposure risk among community in makkah city and to identify barriers.

#### **Specific objective:-**

The goal of this study was to examine community health beliefs regarding radiation exposure risk and their perceptions related to it and evaluate the role of demographic factors in shaping beliefs about radiation and assess possible associations between demographic characteristics with the preventive behavior of interest.

### **Methods:-**

**Study design:** cross sectional study.

#### **Setting and data collection:-**

This survey analysis was conducted among community population in Makkah city. A preformed self-administered questionnaire was distributed among the community population.

#### **Sample:-**

Subjects were chosen according to geographical and sex distribution. Sample size was calculated based on web-site calculator<sup>(24)</sup> taking the total size of Makkah population (1,249,000)<sup>(25)</sup>, confidence level (95%) and margin error (5%) to be 285. Additional 20 % was added to cover the missing data . The total sample obtained was 360.

#### **Study population:-**

The study population included were both male and female in Makkah City.

#### **Study tool:**

Preformed Self-administered questionnaire that requires information about:

- 1- Demographic characteristics: age, gender, education level, monthly income, marital status, and employment.
- 2- Knowledge assessment including 7 questions about risk factor of radiation and factors associated with long exposure to radiation. A score of 1 was given to yes and 0 otherwise. For each subject, a maximum score of 7 was calculated. A scoring system was applied to measure the respondents' knowledge towards radiation impacts. The radiation knowledge score was calculated as a continuous variable by summing the participant's number of yes answers to the questions. One point was awarded for each yes, and zero for each no or don't know, with a maximum obtainable correct score of 7 for each respondent. The knowledge score was categorized into two levels indicated by poor (0-4.5), and good (5-7).

#### **Ethical considerations:-**

An informed consent was obtained from the participants included in this research before filling the questionnaire.

#### **Statistical analysis:-**

Data were entered into the Statistical Package for Social Sciences (SPSS, version 24, SPSS, Chicago, IL, U.S.A.) and descriptive analysis conducted. The results were reported as percentage (95% confidence interval).



The internal consistency was assessed using Cronbach's  $\alpha$  test. The test results were for the 7 statements of knowledge about radiation exposure hazard was 0.422.

Association of respondents' characteristics with about radiation exposure hazard, was evaluated using univariate logistic regression. Results were reported showing odds ratio (OR) and 95% confidence interval. Statistical significance was accepted at  $p < 0.05$ . The dependent variables: knowledge of radiation exposure risk (1 = Poor knowledge and 0 = good knowledge). The following independent variables were included: (1) age:  $\leq 20$  years, [21–30 years], [31–40 years], [41–50 years],  $> 50$  years; (2) gender: males and females; (3) level of education: low, for those who completed secondary school or less, intermediate for those who finished college degree or have bachelor degree and high for those who had postgraduate degree; (4) monthly income: low [ $< 3000$  Saudi Riyal (SR)], middle [3000–10000 SR] and high [ $> 10000$  SR]; (5) marital status: single and married; (6) employment: unemployed and employed.

## Results:-

### Demographics of the studied subjects:

The socio-demographic characteristics were shown in Table. 1.

**Table 1:-** Socio-Demographic Characteristics of Respondents (n = 360)

	Frequency	Percentage (%)
<b>Age (Year)</b>		
<b><math>\leq 20.00</math></b>	36	8.60%
<b>21.00 - 30.00</b>	125	29.70%
<b>31.00 - 40.00</b>	56	13.30%
<b>41.00 - 50.00</b>	47	11.20%
<b>51.00+</b>	63	15.0%
<b>Missing</b>	94	22.30%
<b>Mean<math>\pm</math>SD (Min.-Max.)</b>	36 $\pm$ 14 (16 – 70)	
<b>Gender</b>		
<b>Female</b>	228	54.20%
<b>Male</b>	184	43.70%
<b>Missing</b>	9	2.10%
<b>Education level</b>		
<b>Basic school</b>	13	3.10%
<b>High School</b>	99	23.50%
<b>Collage degree</b>	282	67.00%
<b>Post-graduate</b>	21	5.00%
<b>Missing</b>	6	1.40%
<b>Monthly Income</b>		
<b><math>&lt; 3000</math></b>	90	21.40%
<b>3000-5000</b>	46	10.90%
<b>5000-7000</b>	34	8.10%
<b>7000-10000</b>	80	19.00%
<b><math>&gt; 10000</math></b>	160	38.00%
<b>Missing</b>	11	2.60%
<b>Marital Status</b>		
<b>Married</b>	251	59.60%
<b>Un Married</b>	169	40.10%
<b>Missing</b>	1	0.20%
<b>Employment</b>		
<b>Employed</b>	194	46.10%
<b>Un Employed</b>	216	51.30%
<b>Missing</b>	11	2.60%

A total of 360 subjects were included in the study and answered the questionnaire. The age ranged from 16 to 70 years. The mean was 36 and about 8.6% of subjects were less than 20 years old, 29.7% of participants were from 21-30 years old, 13.3% were from 31-40 years old, 11.2% ranged from 41-50 years old, 15% were more than 51 years old and 22.3% of participants had missing data about age.

The gender distribution showed that 54.2% of participants were females, 43.7% were males and 2.1% had missing data about gender.

The study population represents a highly educated group of people, with 67% having attended university or college, 23.5% having completed high school, 5% having post-graduate degree and 3.1% completed basic school and 1.4% had missing data about education level.

The majority of participants had high level of monthly income (38%) more than 10,000 SR, followed by 21.4% of patients had monthly income less than 3000 SR then 19% had income ranged from 7000-10,000 SR, 10.95% had an income that ranged from 3000-5000 SR and 8.1% had an income ranged from 5000-7000 SR.

The marital status showed that the majority of subjects included in the research were (59.6%) married and 40.1% were un-married.

The most of subjects were unemployed (51.3%), and 46.1% were employed, however only 2.6% had missing data.

**Responses to questions of knowledge assessment questionnaire (Table. 2):**

The response of participants to question 1 showed that 76.5% of patients answered that they had good knowledge about radiation hazards, 58.4% of subjects answered yes to question 2 as they have knowledge about the importance of radiological assessment demanded by doctors.

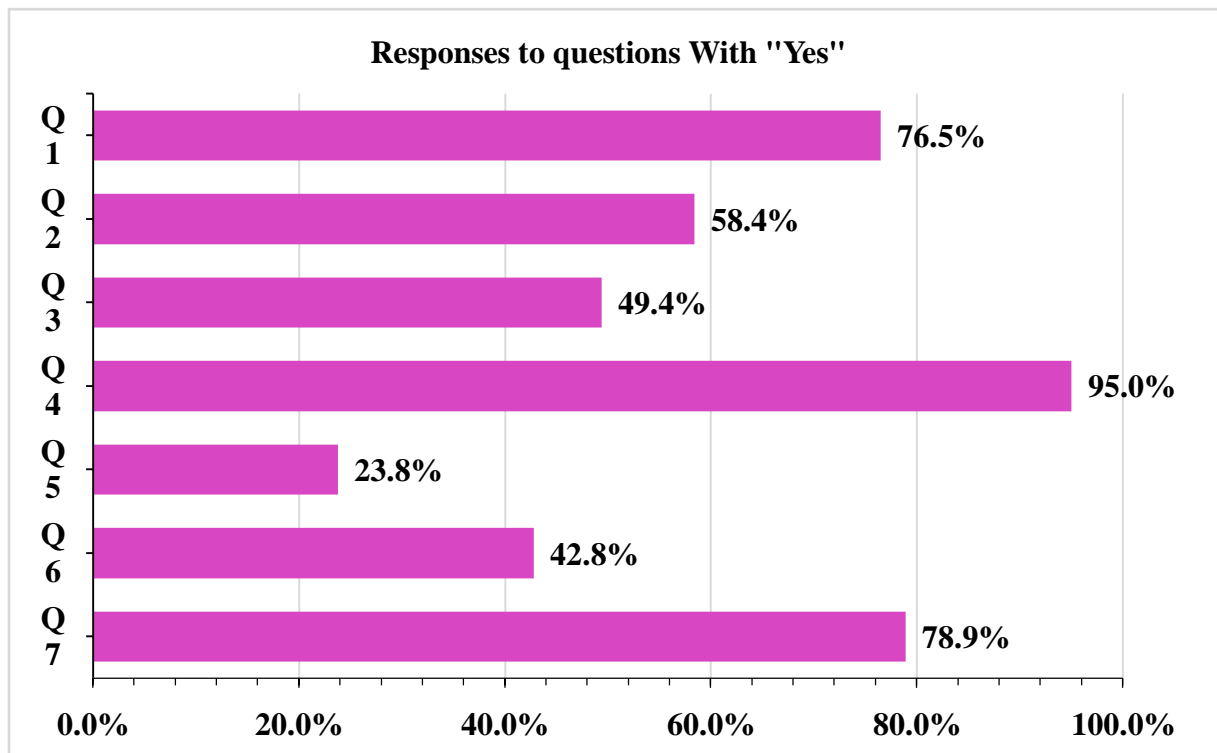
As for question 3, 50.6% of participants had no knowledge about the hazards of excessive and unnecessary use of radiation and 49.4% answered yes to this question.

Regarding to Q 4, 95% of subjects said yes to their knowledge about the impact of radiation on pregnant women. But 76.2% of participants said that the majority of doctors underestimate informing patients about the risks of radiation in Q 5.

57.2% of subjects said that doctors doesn't give them enough protection from radiation and 42.8% had been given protection from radiation in question 6. In question 7, 78.9% of patients had knowledge about the impacts of radiation on children (Figure. 1).

**Table 2:- Responses to questions on assessment level of awareness toward radiation exposure risk**

	No	Yes	Don't Know
<b>Q1:</b> Do you think that the diagnostic radiation has risks?	99(23.50%)	322(76.50%)	0(0.0%)
<b>Q2:</b> Do you think that all radiological scans tests conducted by doctors are important?	129(30.60%)	246(58.40%)	46(10.90%)
<b>Q3:</b> Do you have knowledge about the damage caused by unnecessary use of radiology?	213(50.60%)	208(49.40%)	0(0.0%)
<b>Q4:</b> Do you think that the radiation cause damage to pregnant woman?	21(5.00%)	400(95.00%)	0(0.0%)
<b>Q5:</b> Do doctors clarify the impacts of radiological imaging before scans?	321(76.20%)	100(23.80%)	0(0.0%)
<b>Q6:</b> Do doctors provide adequate protection for people to avoid excessive radiation exposure?	241(57.20%)	180(42.80%)	0(0.0%)
<b>Q7:</b> Do you think that the excessive exposure of children to radiation may cause complications in the long term?	89(21.10%)	332(78.90%)	0(0.0%)

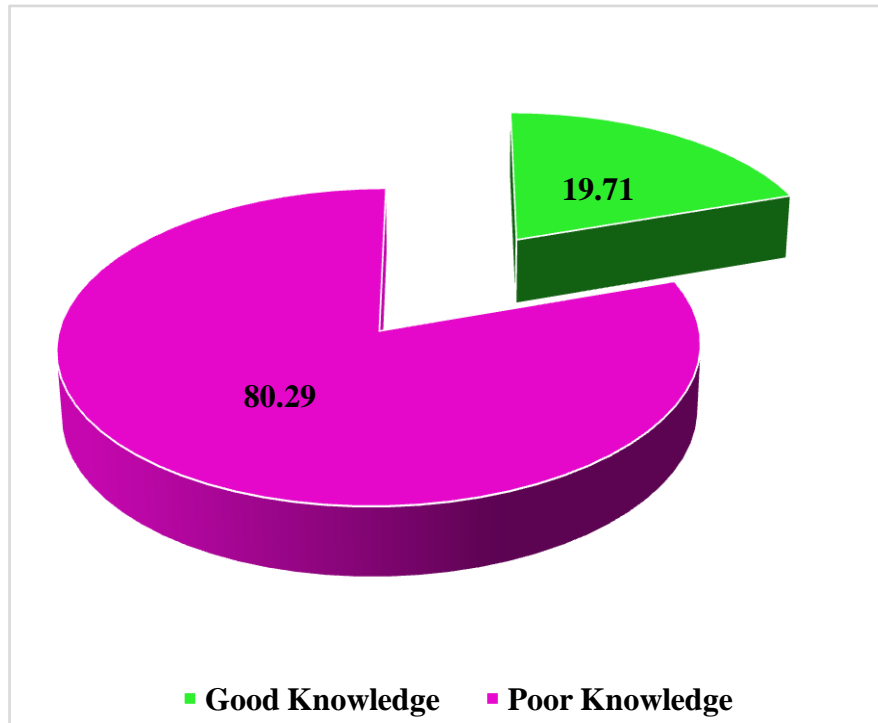


**Assessment of knowledge of participants regarding to the risks of exposure to radiation:-**

The mean knowledge score was 4.25 for all subjects (Table. 3). The overall mean knowledge score was 4.25 (1.44) (Table. 3). Based on Knowledge score respondents were Categorizing into: Respondents who had good knowledge about radiation exposure hazards corresponded to a score ( $\geq \text{Mean} + 1 \text{ SD} = 5.69$ ) which indicate about 81.2% knowledge % and those with bad knowledge corresponded to a score of ( $< \text{Mean} \pm 1 \text{ SD}$ ). So, it was found that the majority of (338) (80.29%) subjects had poor knowledge and only 83 subjects had good knowledge about radiation risks (Figure. 2).

**Table 3:- Knowledge of awareness toward radiation exposure risk**

	Knowledge Score
<b>Mean<math>\pm</math> SD</b>	4.25 $\pm$ 1.44
<b>Min.- Max.</b>	0-7
<b>Good Knowledge (<math>\geq 5.69</math>)</b>	83 (19.71%)
<b>Poor knowledge (<math>&lt; 5.69</math>)</b>	338 (80.29%)



**Figure 2:-** Respondent's Knowledge about radiation exposure risk

**Association between knowledge and demographics of included participants:-**

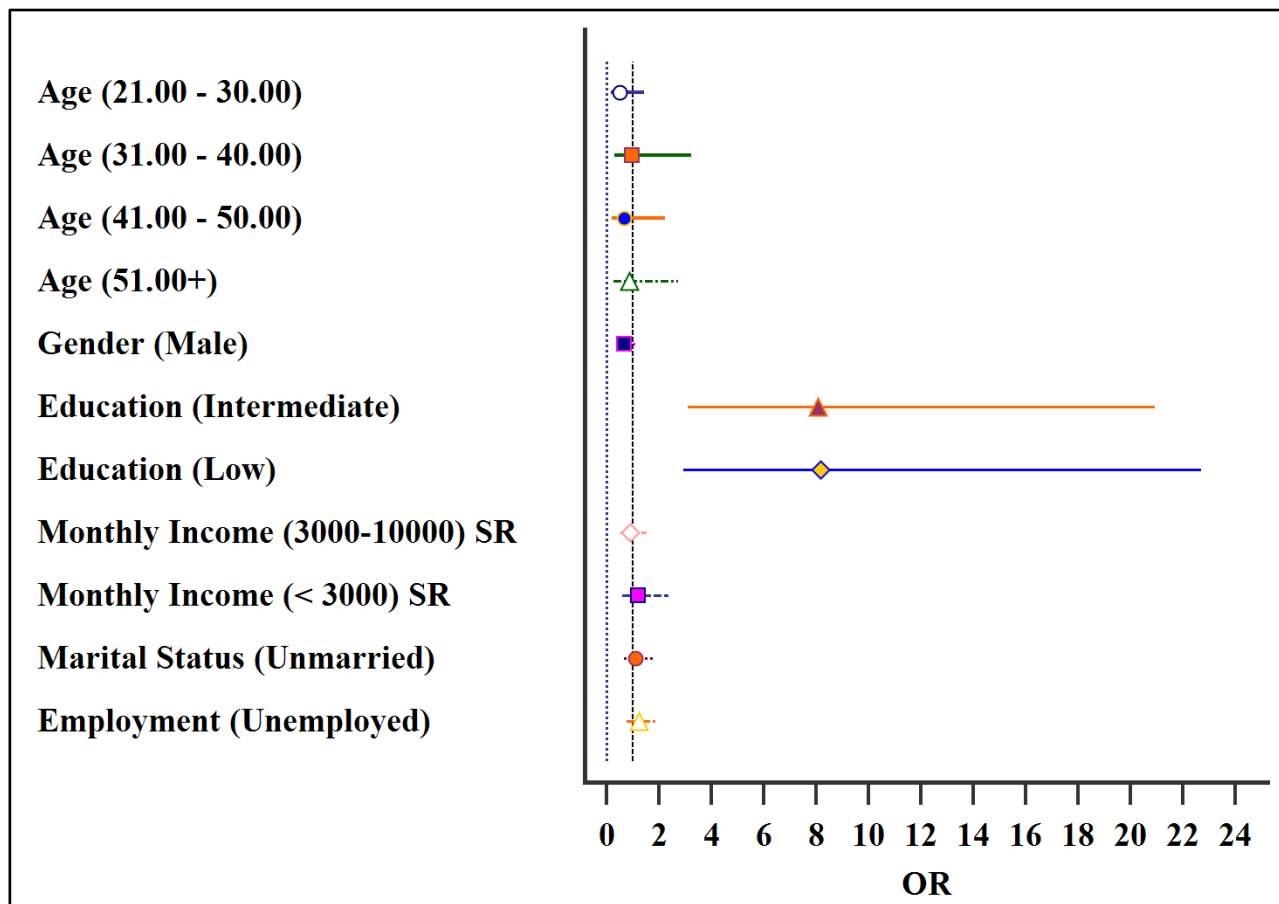
Univariate logistic regression to study the association between knowledge and participant's demographics showed that, neither age nor other demographic variables showed significant association with being aware of radiation exposure hazard ( $P > 0.05$ ). However, education level achieved statistical significance ( $p < 0.0001$ ) association with knowledge as higher education resulted in good levels of radiation exposure risks (Table. 4). Interestingly, it was found that respondents who have completed their college degree have had a higher likelihood to have poor knowledge about radiation exposure hazard with an OR (95% CI) of 8.07 (3.11 - 20.94) when compared with those who get higher post-graduate degree (Master of PhD). Nearly the same difference was found in respondents, who have completed either high school or lower, with % of poor knowledge about (80.4%) when compared with individuals with high post graduate degrees (Figure. 3).

**Table. 4:-** Univariate logistic regression model for association between radiation knowledge and socio-demographic variables:

	Good Knowledge (n=83)	Poor Knowledge (n=338)	OR (95% CI)	P-value
<b>Age</b>				
<= 20.00	5(13.9%)	31(86.1%)	1	0.434
21.00 - 30.00	30(24.0%)	95(76.0%)	0.51(0.18-1.43)	0.201
31.00 - 40.00	8(14.3%)	48(85.7%)	0.97 (0.29-3.23)	0.957
41.00 - 50.00	9(19.1%)	38(80.9%)	0.68 (0.21-2.24)	0.527
51.00+	10(15.9%)	53(84.1%)	0.86 (0.27-2.73)	0.791
<b>Gender</b>				
Female	39(17.1%)	189 (82.9%)	1	0.115
Male	43(23.4%)	141(76.6%)	0.68 (0.42-1.1)	

Education Level				
High	14 (66.7%)	7 (33.3%)	1	< 0.0001
Intermediate	56 (19.9%)	226 (80.1%)	8.07 (3.11 - 20.94)	< 0.0001
Low	22 (19.6%)	90 (80.4%)	8.18 (2.95 - 22.69)	< 0.0001
Monthly Income (SR)				
> 10,000 SR	31(19.4%)	129(80.6%)	1	0.68
3000-10000 SR	34(21.3%)	126(78.8%)	0.89 (0.52-1.54)	0.677
< 3000 SR	15(16.7%)	75(83.3%)	1.2 (0.61-2.37)	0.596
Marital Status				
Married	51(20.3%)	200(79.7%)	1	0.727
Un Married	32(18.9%)	137(81.1%)	1.09(0.67-1.79)	
Employment				
Employed	42(21.6%)	152(78.4%)	1	0.429
Un Employed	40(18.5%)	176(81.5%)	1.22(0.75-1.97)	

OR: Odds ratio, CI: Confidence Interval



#### Budget

Item	Price
Transportations	700 SR
Paper work	800 SR
Software programs	2000 SR
Books	1000SR
Stationaries	1000SR

**Work plan**

Tasks in the work plan	Time period
Literature review	2 Months
Preparation for data collection	1 Months
Data collection	3 Months
Statistical analysis	1 Months
Discussion of results	2 months
Writing an abstract	1 months

**References:-**

1. Thomas KE, Parnell-Parmley JE, Haidar S, Moineddin R, Charkot E, BenDavid G, et al. Assessment of radiation dose awareness among pediatricians. *Pediatric radiology*. 2006;36(8):823-32.
2. Christodouleas JP, Forrest RD, Ainsley CG, Tochner Z, Hahn SM, Glatstein E. Short-term and long-term health risks of nuclear-power-plant accidents. *The New England journal of medicine*. 2011;364(24):2334-41.
3. Linet MS, Slovis TL, Miller DL, Kleinerman R, Lee C, Rajaraman P, et al. Cancer risks associated with external radiation from diagnostic imaging procedures. *CA Cancer J Clin*. 2012;62(2):75-100.
4. Smith-Bindman R. Is computed tomography safe. *The New England journal of medicine*. 2010;363(1):1-4.
5. Borhani P, MOHAMMAD AS. EVALUATION OF RADIOLOGY PERSONNEL PRACTICE OF KERMAN UNIVERSITY OF MEDICAL SCIENCES HOSPITALS. *Med J Hormozgan Univ*. 2003;6(4):51-58.
6. Kanda R, Tsuji S, Yonehara H. Perceived risk of nuclear power and other risks during the last 25 years in Japan. *Health physics*. 2012;102(4):384-90.
7. Perko T. Radiation risk perception: a discrepancy between the experts and the general population. *Journal of environmental radioactivity*. 2014;133:86-91.
8. Poortinga W, Cox P, Pidgeon NF. The perceived health risks of indoor radon gas and overhead powerlines: a comparative multilevel approach. *Risk analysis : an official publication of the Society for Risk Analysis*. 2008;28(1):235-48.
9. Baerlocher MO, Detsky AS. Discussing radiation risks associated with CT scans with patients. *Jama*. 2010;304(19):2170-1.
10. Fazel R, Krumholz HM, Wang Y, Ross JS, Chen J, Ting HH, et al. Exposure to low-dose ionizing radiation from medical imaging procedures. *The New England journal of medicine*. 2009;361(9):849-57.
11. Brenner DJ, Hall EJ. Computed tomography--an increasing source of radiation exposure. *The New England journal of medicine*. 2007;357(22):2277-84.
12. Broder J, Fordham LA, Warshauer DM. Increasing utilization of computed tomography in the pediatric emergency department, 2000-2006. *Emergency radiology*. 2007;14(4):227-32.
13. Golding SJ, Shrimpton PC. Commentary. Radiation dose in CT: are we meeting the challenge? *Br J Radiol*. 2002;75(889):1-4.
14. Radiation UNSCotEoA. Sources and effects of ionizing radiation: sources: United Nations Publications; 2000.
15. Düzeyleri RKKB, Çalışması KBA. Knowledge About Ionizing Radiation and Radiation Protection Among Patients Awaiting Radiological Examinations: A cross-sectional survey. *The Medical Journal of Kocatepe*. 2009;10(3):25-32.
16. Fartum AR, Gjertsen JE, Larsen JL. [Patients' knowledge of the effects of X-rays]. *Tidsskrift for den Norske lægeforening : tidsskrift for praktisk medicin, ny række*. 2000;120(28):3427-8.
17. Zhou GZ, Wong DD, Nguyen LK, Mendelson RM. Student and intern awareness of ionising radiation exposure from common diagnostic imaging procedures. *Journal of medical imaging and radiation oncology*. 2010;54(1):17-23.
18. Karsli T, Kalra MK, Self JL, Rosenfeld JA, Butler S, Simoneaux S. What physicians think about the need for informed consent for communicating the risk of cancer from low-dose radiation. *Pediatric radiology*. 2009;39(9):917-25.
19. Roche A. [Radiation protection of patients in interventional radiology]. *Journal de radiologie*. 2010;91(11 Pt 2):1231-5.
20. Takakuwa KM, Estepa AT, Shofer FS. Knowledge and attitudes of emergency department patients regarding radiation risk of CT: Effects of age, sex, race, education, insurance, body mass index, pain, and seriousness of illness. *AJR American journal of roentgenology*. 2010;195(5):1151-8.

21. Quinn AD, Taylor CG, Sabharwal T, Sikdar T. Radiation protection awareness in non-radiologists. Br J Radiol. 1997;70:102-6.
22. Brenner D, Elliston C, Hall E, Berdon W. Estimated risks of radiation-induced fatal cancer from pediatric CT. AJR American journal of roentgenology. 2001;176(2):289-96.
23. Almaghrabi N. A Study of Knowledge & Awareness of Radiation Exposure Risk in Makkah, Saudi Arabia. Int J of Adv Res. 2016;4(7):1852-56.
24. <http://www.calculator.net/sample-size-calculator.html?type=1&cl=95&ci=5&ps=3%2C976%2C000&x=37&y=6>.
25. 50 SY. Central Department Of Statistics & Information. 2014.

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### RESEARCH ARTICLE

## LOCATION OF POSTERIOR OCCLUSAL PLANE WITH REFERENCE TO RETROMOLAR PAD IN KASHMIRI POPULATION.

Dr. Nazia Majeed Zargar and Dr. Falak Naz.

### Manuscript Info

#### Manuscript History

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### Abstract

**Introduction:** Relocation of posterior occlusal plane is of prime importance in prosthodontic practice. Various landmarks are used to determine the occlusal plane like lateral border of the tongue, retromolar pad, ala- tragus line, cephalometry. The purpose of this study was to determine which part of the retromolar pad correlates with the occlusal plane in kashmiri population.

**Material and methods:** The study was done on 50 males and 50 females. A stainless steel scale was used to record the level of retromolar pad coinciding with the occlusal plane intraorally.

**Results:** In majority of subjects occlusal plane coincided with middle part of retromolar pad in both males and females.

**Conclusion:** In kashmiri population middle third of retro molar pad can be taken as a reliable landmark for relocating occlusal plane in complete denture construction.

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### Introduction:-

Relocation of occlusal plane is of prime importance in prosthodontic practice. The position of occlusal plane of orientation forms the basis for ideal tooth arrangement. According to GPT 8 (Glossary of prosthodontic terms); Occlusal plane may be defined as “the average plane established by the incisal and occlusal surfaces of teeth.” Generally it is not a plane but represents the planar mean of curvature of these surfaces<sup>1</sup>. Lang & Swartz reported that occlusal plane in complete dentures shall be located in same position in which it existed in natural dentition<sup>2</sup>. Anteriorly occlusal plane mainly helps in achieving esthetics and phonetics while posteriorly, it forms a milling surface where tongue and buccinators muscle are able to position the food bolus onto it and hold it there during mastication<sup>3</sup>. If a clinician fails to place artificial teeth in alignment with the plane of occlusion, problems like food collection in sulcus and other extremes of cheek / tongue biting might occur.

Incorrect record of occlusal plane would hamper esthetics, phonetics and mastication resulting in instability of complete dentures and hence alveolar bone resorption<sup>3</sup>. A number of methods are employed for correct relocation of occlusal plane which include: Height of retro molar pad, Lateral Border of tongue, Parotid Papilla, HIP Plane, buccinator groove as intraoral landmarks and Ala tragus line, inter pupillary line, upper lip length as extraoral landmarks and cephalometry<sup>3</sup>.

Each of the above mentioned methods have their merits and limitations and they are subjected to inter population variation. So a need was felt to co- relate occlusal plane with the intraoral landmarks in kashmiri population to ensure quick and easy relocation. Considering retro molar pad height to be a prominent, stable and easily accessible



landmark, this study was conducted with a purpose of relating retro molar pad height with occlusal plane in kashmiri population, in order to eliminate inter population error. Effect of gender on various occlusal planes was also investigated. The purpose of this study was to check reliability of retro molar pad as an intraoral landmark in re establishing occlusal plane in kashmiri population.

### **Materials and methods:-**

The study was conducted on 100 dentate subjects (50 males and 50 females) selected from a group of approximately 200 dental students from Government Dental College Srinagar, Kashmir. Written consent of the subjects was taken and all of them participated in the study voluntarily. Clearance from Institutional Ethical Committee was obtained. Subjects within the age group of 17-21yrs, ideal arch form and alignment, no history of trauma, no spacing and crowding, no dental abrasion/attrition, no history of orthodontic treatment and no gingival/periodontal condition which would undermine a healthy tooth tissue relationship, were included in the study.

Impressions of mandibular arches were made with irreversible hydrocolloid material (alginate) and the casts were poured in dental stone. The casts were separated from the impression material 45min after pouring. The location of retro molar pad in relation to the plane of occlusion was determined by sliding a thin stainless steel scale posteriorly over the cusps of mandibular posterior teeth ensuring its contact with the tip of cuspid on one side of the mandibular arch extending to the disto-lingual cusp tip of second or third mandibular molar (Figure 1). Disto lingual cusp tip was used because it has more close anatomic relation with retro molar pad. The vertical height of the pad was divided into three parts (lower, middle and upper). The zone of contact between the scale and retro molar pad was recorded.

Initially this procedure was accomplished both intra orally and on the cast. Because of consistent correlation of these two determinants, the intraoral procedure was utilized. The procedure was carried out in both the right and left sides.

**Figure 1:-** Using stainless steel to obtain relation of retromolar pad with posterior occlusal plane**Table 1:-** Percentage distribution of different levels of retromolar pad in males and females

PART OF RETROMOLAR PAD	MALES No. Of subjects	FEMALES No. Of subjects	TOTAL %age
UPPER THIRD	0	0	0
MIDDLE THIRD	31	30	61
LOWER THIRD	19	20	39

**Results:-**

Our results suggested that in 61% of subjects, mandibular occlusal plane coincided with middle part of retro molar pad and in 39% it coincided with lower half. Upper half correlation was found in none of the patients. Hence forth these findings suggest that mandibular occlusal plane coincided with middle part in majority of patients. Inter gender variation seemed to be insignificant. (Table 1)

**Discussion:-**

Relocation of occlusal plane is of prime importance in complete denture therapy. It is advocated that establishing the plane of occlusion in full dentures as close as possible to the position which was previously occupied by the occlusal plane of natural teeth is must in order not to change the proprioceptive regulatory mechanisms which ensure normal function of cheek, tongue and masticatory muscles.<sup>4</sup>

Retro molar pad height is a prominent and stable anatomical landmark which is also easily accessible. A number of studies have been conducted in different populations comparing the relation of retro molar pad height with occlusal plane. Jack Piermatti(2006)<sup>5</sup> said the occlusal plane should terminate at upper level of retromolar pad while Arthur O. Rahn and Charles M. Heartwell (1986)<sup>6</sup> said posterior height should not exceed half of the height of retro molar pad. K. Shigli et al<sup>3</sup> concluded that mandibular occlusal plane was coincident with lower one third of retro molar

pad. Rubina et al<sup>7</sup> concluded that it coincided with the middle third of retromolar pad. Donald O.Lundquist and Colonel et al<sup>8</sup> concluded that occlusal plane coincided with the lower half of retromolar pad. Our study concluded that the middle third of retro molar pad coincided with the occlusal plane in both genders in kashmiri population. The results of our study coincided with study conducted by Rubina et al<sup>7</sup>.

### **Conclusion:-**

In kashmiri population middle third of retro molar pad can be taken as a reliable landmark for relocating occlusal plane in complete denture construction. This method is reliable, easily accessible, economical and less time consuming.

### **Reference:-**

1. Academy of Denture Prosthetics: Glossary of Prosthodontics terms 2008, GPT 8 page 57
2. Lang B. & Swartz W: Clinical dentistry, book 5. Clark J Series editor. Hagerstown, Md; 1979, Harper & Row publishers; Chap 12, P 9
3. K.Shigli, B.R.Chetal, J.Jabade. Validity of soft tissue landmarks in determining the occlusal plane. Journal of Indian prosthodontic society 2005; 5 (3): 139-144
4. A.Celebic, M.Valentic-Peruzovic. A Study of the occlusal plane orientation by intraoral method (retromolar pad). Journal Of Oral Rehabilitation 1995; 22: 233-236
5. Piermatti J. Tooth position in full mouth implant restorations-a case report. Gen Dent 2006; 54: 209-13
6. AO.Rahn and CM. Heartwell: Textbook of complete dentures. 5<sup>th</sup> ed. Wolters kluwer Co; 1986
7. Rubina Gupta, Himanshu Aeran, S.P.Singh. Relationship of anatomic landmarks with occlusal plane. JIPS 2009; 9 (3): 142-144
8. Donald O.Lundquist, Colonel, and Wallace W.Luther. Occlusal plane determination. J Prosthet Dent 1970; 23(5): 489-498

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### RESEARCH ARTICLE

#### A PROPOSED ARCHITECTURAL FRAME WORK FOR SECURE THE CLOUD DATA STORAGE TO PRODUCT MULTIMEDIA DATA.

**Sheik Saidhbi and Dr. Komati Thirupathi Rao.**

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##### Key words:-

Cloud, data, security, multimedia,  
architecture and Framework.

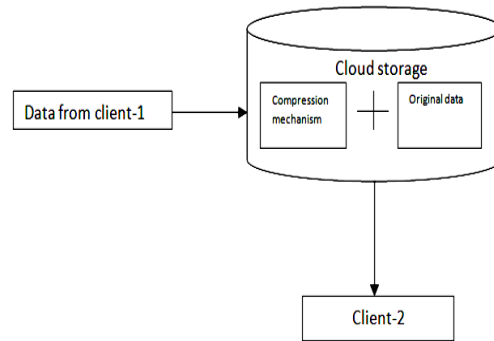
#### Abstract

In the modern communication era, the role of cloud computing is extensively utilized by most of the IT sector. In the characteristic of Data communication as well as data sharing among the consumers is conducting in different mode of communication mechsnaim. In the episode of data transmission and sharing is happen from the data storage for all the service providers. With irrespective of data access, each and every researchers focus on the safety measures of data transaction among different clients or between service providers and consumers. The data sharing by using clouds are generally carried out from the cloud data storage. In this research article deeply focusing a new architectural frame work for secure cloud data storage in the aspect of protect the multimedia data content by using the data compression mechanism. The entire work is divided into two sections, one of them is architectural framework and another one is implementation. The second one will carry as the continuation of this work.

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#### Introduction:-

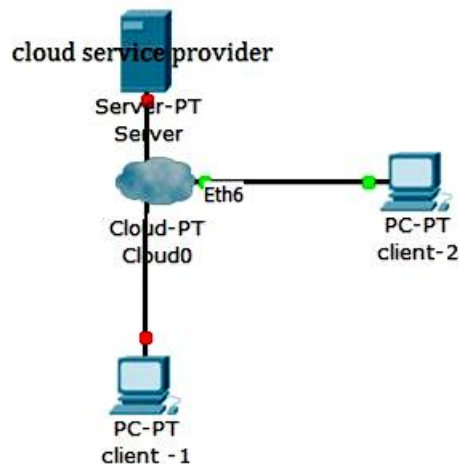
The way of modern approach comprising to muddle up the concepts of cloud computing with the data compression mechanism in order to protect the multimedia content resided in the cloud storage. In general the data access of the cloud service providers are taken place with the help of cloud storage. The data resides in cloud storage is in the form encrypted text or any other format. It will easily interact by the third-party unauthenticated users and put a question mark for security. In order to apply the any one of the data compression mechanism on the cloud data storage, we can easily avoid such kind of interruption and protect the unauthorized data consumption in the cloud data transactions. The paradigm of the proposed work is clearly depicted by the following block diagram (Figure 1),



**Figure 1:-** Data sharing paradigm

Crucial data and submission may require an agency to undertake a negotiated service agreement in order to use a public cloud. Points of negotiation can negatively affect the economies of scale that a non-negotiable service agreement brings to public cloud computing, however, making a negotiated alternative less cost effective. As an alternative, the organization may be able to employ compensating controls to work around identified shortcomings in the public cloud service. Other alternatives include cloud computing environments with a more suitable deployment model, such as a private cloud, which offers an organization greater oversight and control over security and privacy [1].

Cloud computing encompasses both a server and a client side. With emphasis typically placed on the former, the latter can be easily overlooked. Maintaining physical and logical security over clients can be troublesome, especially with embedded mobile devices such as smart phones. Their size and portability can result in the loss of physical control. Built security mechanisms often go unused or can be overcome or circumvented without difficulty by a knowledgeable party to gain control over the device. More than ever the compression technique is used for saving disk space, reducing the time needed for communication or the time needed for data transfer and more. Data to be handled as well as software has been growing, and the amount of information communicated between systems has also been constantly increasing. The general communication between the cloud providers (CSP) and the clients are depicted in the following Figure 2.



**Figure 2:-** Data communication between CSP and the clients

### Related Work:-

Cloud computing is seen as the last revolution in information technology, providing cheaper services and agility and productivity of organizations. But, despite all the advantages there is still much discussion around the term Cloud Computing: what feature displays? What limitations in terms of storage, compression and security?

Data management in cloud computing and data storage is widely used and is available from different suppliers and different solutions. Can be used as a data repository or as infrastructure to support and implement applications

with the help of cryptography [1][2][3].

Cloud computing presents interesting features for all users with advantages at the level of storage cost, scalability, elasticity face to the constant needs of availability and quick access in different computing devices.

There are different types of services for cloud computing: Infrastructure-as-a-service (IaaS) where the cloud offers services of its infrastructure such as CPU, memory, and storage. Platform-as-a-service (PaaS) where it is available an execution environment for the user and Software-as-a-Service (SaaS) where the cloud provides a specific application accessible via browser in the form of encryption [4][5].

The management and monitoring of data is an essential requirement for organizations, since it allows the reduction of the risk of internal breaches and ensures the responsibility of administrators. Each type of cloud service provides security requirements for the organization and access to data and systems. Organizations that use cloud technology monetize their services extracting the greatest benefits of this new technology base.

These companies have embraced the cloud as a strategy that provides everything you need to create, operate, manage and allocate in the cloud with efficiency, speed and reliability. The system of cloud computing provides a computational power available to the needs of the user thanks to a dynamic scalability and to utilize the service for encryption [4][5].

However even considering the characteristics and advantages presented to maintain safe and reliable data presents itself as very problematic for users. The purpose of this thesis aims to design, implement and evaluate a system that allows access to management, kept in cloud storage. The proposed application is intended to be used as intermediate system, aggregating a set of components and services between the user and various public clouds of data storage, made available by internet providers and cloud service providers.

The Cloud Computing still motivates much discussion. The essence of its functioning, its boundaries, the development of new applications, becoming increasingly agile and collaborative, inspiring subjects for research [6].

As we enter the new century, it appears that the ability of data centers is limited and runs out [7][8]. The economy in sequences the trend of technological development and the solution is the adoption of grid services and/or utility computing as well as the use of virtualization to maximize the available resources.

As services and applications become more distributed, paradigms like Service-Oriented Architecture emerge in response to integration and service orchestration, and the organization and technologies used in data centers evolve.

Today the data centers that support environments and platforms for Cloud Computing components are designed to utilize more economical, safe, quick and easy replacement. Given these factors, software developers have come, to design applications that can address the needs of users, in a safe, efficient and cost-effective way to implement and/or maintain an infrastructure of Cloud Computing [10].

### **Proposed Work:-**

Cloud storage services have grown and diversified significantly this development eventually promote the emergence of contract services and with the feature of allowing users to choose to acquire the one that is more suitable for him/her. Services are provided in a common environment by centralized cloud storage facilities.

As data volumes processed by large-scale distributed data intensive applications grow at high-speed, an increasing input/output pressure is put on the underlying storage service, which is responsible for data management. With the emergence of cloud computing, data intensive applications become attractive for a wide public that does not have the resources to maintain expensive large scale distributed infrastructures to run such applications.

The main objective of this dissertation is to propose and validate a solution to the problem of secure and efficient transmission and storage of multimedia content in public cloud environments using joint compression and encryption.

**Model Info**

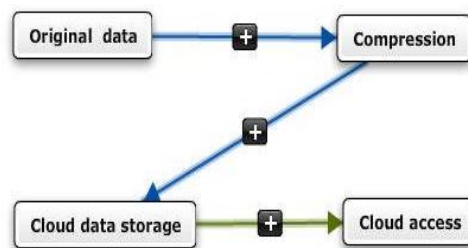
Author  
BHARATHIYAR UNIVERSITY RESEARCH SCHOLAR

Model Name  
ARCHITECTURE FRAMEWORK

Description  
This is the architectural components in the framework for a secure cloud data storage management as well as the comparison.

**Figure 3:- the Interface**

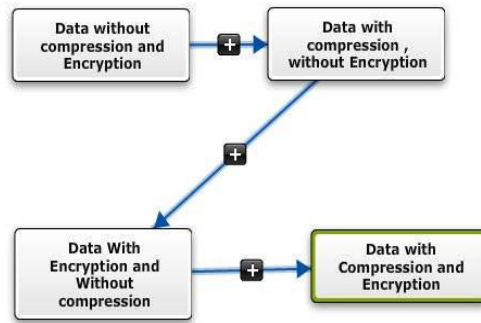
The architectural framework for the proposed work comprising the design specification in the aspect of Data transmission or communication in the first point of view is without compression and encryption, second one is with Compression and without Encryption, third one is with Encryption and without Compression, and the fourth one is With Encryption and Compression. The data analysis is performed with the help of the tool mental modeller 5.0. The interface is depicted in the above figure 3.

**Figure 4:- Architectural Framework**

From the figure 4, the components of the architectural frame work in order to prevent the unauthorized data access from the cloud storage management by the third party. The flow from the original data to the cloud services is clearly illustrated in this module. The module of compression is further classified in the following levels. It shown by the following figure 5.

Number of Concepts	4
Number of Connections	3
Density	0.1875
Number of Connections / Components	1.333333333
Driver Components	
	Data with Compression and Encryption 0.5
Receiver Components	
	Data without compression and Encryption 0.25
Number of Ordinary	2
Complexity Score	1
Highest Centrality Variables	
	Data With Encryption and Without compression 0.75
	Data with compression , without Encryption 0.5
	Data with Compression and Encryption 0.5
	Data without compression and Encryption 0.25

**Figure 5:- Components of Compression Cloud Storage**



**Figure 6:-** Components comparison in the Compression

#### **Iv. Conclusion And Future Work:-**

As per the above discussions provides the information about the proposed architectural frame work in the cloud computing data access mechanism. Especially it's designed the secure access of multimedia data content from the cloud data storage. The Original data storage is redesigned in the aspect of compression and it will further sub classified with the features of encryption. The detailed approach for the utilization of this architecture in the continuation of this research work.

#### **References:-**

1. AES page available via <http://www.nist.gov/CryptoToolkit>.
2. Computer Security Objects Register (CSOR): <http://csrc.nist.gov/csor/>.
3. J. Daemen and V. Rijmen, AES Proposal: Rijndael, AES Algorithm Submission, September 3, 1999, available at [1].
4. J. Daemen and V. Rijmen, The block cipher Rijndael, Smart Card research and Applications, LNCS 1820, Springer-Verlag, pp. 288-296.
5. B. Gladman's AES related home page [http://fp.gladman.plus.com/cryptography\\_technology/](http://fp.gladman.plus.com/cryptography_technology/).
6. AES page available via <http://www.nist.gov/CryptoToolkit>.
7. Computer Security Objects Register (CSOR): <http://csrc.nist.gov/csor/>.
8. J. Daemen and V. Rijmen, AES Proposal: Rijndael, AES Algorithm Submission, September 3, 1999, available at [1].
9. J. Daemen and V. Rijmen, The block cipher Rijndael, Smart Card research and Applications, LNCS 1820, Springer-Verlag, pp. 288-296.
10. B. Gladman's AES related home page [http://fp.gladman.plus.com/cryptography\\_technology/](http://fp.gladman.plus.com/cryptography_technology/).





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### RESEARCH ARTICLE

#### SYSTEMIC ANTIOXIDANTS IN MANAGEMENT OF ORAL SUBMUCOUS FIBROSIS: A SYSTEMATIC REVIEW OF RANDOMISED CONTROL TRIALS AND META-ANALYSIS.

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#### Manuscript Info

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##### Key words:-

Free radicals, medication therapy, management, Mouth opening.

#### Abstract

**Introduction:** Antioxidants relieve the signs and symptoms of oral submucous fibrosis by decreasing the load of free radicals.

**Aim:** The aim of this systematic review was to retrieve and analyse clinical studies investigating systemic antioxidants in the management of OSMF.

**Material and method:** Literature was searched in electronic search engines from 1995 to 2015. The identified titles / abstracts were independently screened according to set criteria for selection of abstracts. The full – text articles retrieved were assessed for eligibility and the eligible studies were assessed for qualitative and quantitative evidence. 9 full text articles were selected and assessed for eligibility. 6 full text articles were eligible for qualitative and quantitative analysis. Meta – analysis was done for mouth opening.

**Results:** The extracted data resulted in 207 subjects using systemic antioxidants. Meta – analysis of the combined data of the studies administering systemic antioxidants as a single entity or in combination with intralesional corticosteroids (n=121) as compared to other interventions (n=121) did not depict significant improvement in mouth opening (SMD = -1.446; 95% CI = -3.332 to -0.439) with significant test of heterogeneity (p = 0.0001 < 0.05). Meta – analysis of the combined data of all the interventional groups (n=207) and control groups (n=203) which depicted that systemic antioxidants as a single entity or in combination with intralesional steroids significantly improve mouth opening v/s controls (SMD = -1.235; 95% CI = -2.263 to -0.206) with a significant test of heterogeneity (and p = 0.0001 < 0.05).

**Conclusion:** Although the meta – analysis indicates that antioxidants appear to be effective in management of OSMF, the high degree of heterogeneity and limited amount of data in this systematic review and meta – analysis does not provide a credible evidence to support these observations.

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**Introduction:-**

Oral submucous fibrosis (OSMF) is a chronic, debilitating disease characterized by juxtaepithelial fibrosis of oral mucosa resulting in limitation of mouth opening and burning sensation.[1] Its etiopathogenesis is multifactorial with a high prevalence in areca nut chewers. OSMF is a potentially malignant disorder with a malignant transformation rate of 2.3 to 7.6%.[2][3] The most common debilitating symptoms of OSMF are burning sensation in the mucosa and inability to open mouth which also has psychological and social implications for patients.

Management of OSMF aims to reduce the symptoms and prevent the risk of malignant transformation. The current protocol for the management of OSMF can be divided into 3 broad groups: pharmacological, physical and surgical modalities.[4]

Pharmacological management includes usage of Vitamins and Antioxidants, anti – inflammatory drugs (principally corticosteroids), proteolytic agents (such as hyaluronidase) and anti - cytokines. Antioxidants act through their anti - inflammatory, anti – mutagenic and anti – carcinogenic properties. Moreover, Antioxidants stabilize and deactivate the free radicals which are induced by the ingredients of the betel nut. Various studies have shown that antioxidants are highly effective in controlling the signs and symptoms of OSMF and have been the mainstay of a conservative approach for management of OSMF.[4][5]

Several narrative and systematic reviews on management of OSMF have highlighted the beneficial role of various antioxidants like natural extracts, micronutrients, vitamins, nutritional supplements.[5][6][7] Nonetheless, no systematic review or meta – analysis has yet given evidence of efficacy of systemic Antioxidants in management of OSMF. Thus, this systematic review aimed to critically summarize and evaluate results of clinical studies investigating systemic antioxidants to improve signs and symptoms of OSMF.

**Aim:-**

To assess the effect of systemic antioxidants in the management of clinical signs and symptoms of OSMF by comparing them with each other and other treatment modalities through meta – analysis of retrieved data and to compare the effect of various systemic antioxidants used in the management of clinical signs and symptoms of OSMF.

**Material and methods:-****Review design:-**

The present systematic review was carried out by three investigators with an aim to systematically retrieve and analyse clinical studies investigating antioxidants in the management of clinical signs and symptoms of OSMF. The 3<sup>rd</sup> investigator performed an electronic search. Thus identified titles / abstracts through the search engines were independently screened by first and second investigators according to set inclusion and exclusion criteria for selection of abstracts. Full text articles of the selected abstracts were retrieved by the third investigator and further retrieval of titles / abstracts was done by cross – referencing of full – text articles. The full – text articles were assessed for eligibility by the first and second investigators and the selected studies are assessed for the quality of their reporting.

**Search strategy:-**

An electronic data base search was performed in PubMed and Science Direct for last 20 years from a time period of January 1995 to March 2015. The MESH keywords were ANTIOXIDANTS, MICRONUTRIENTS, VITAMINS, NUTRITIONAL SUPPLEMENTS combined with OSMF with Boolean term “AND”. A total of 1189 title / abstracts identified through the search engines and the 9 title / abstracts identified through manual search were independently screened according to set inclusion and exclusion criteria for selection of Titles / abstracts (Table.1). The investigators were not blinded to journal names or authors. Screening yielded total of 41 title / abstracts out of which 12 full text articles could be retrieved. 3 full text articles were excluded because of repetition. Finally 9 full text articles were selected and assessed for eligibility through PICO guidelines. Agreement concerning study inclusion or exclusion was achieved by thorough discussion among the investigators. Further 6 full – text articles were selected which fulfilled the PICO guidelines. These full – text articles are qualitatively analysed with consort

guidelines 2010 as modified by Friction et al. The extracted data was quantitatively assessed for the outcomes. (Flowchart - 1; showing the search strategy)

## 2.2 assessment of eligibility (With PICO guidelines)[8]-

The 9 full – text articles were evaluated with participants, interventions, comparators, outcomes (PICO) guidelines as follows-

### Participants-

Studies with human participants, who were diagnosed as having OSMF clinically or histologically or both.

### Type of interventions-

Systemic Antioxidants as a single entity or in combination, at any dosage and over any time period.

### Comparators (Control)-

Negative (placebo treatment), positive (other intervention; i.e other treatment modalities or antioxidant administered in any other mode).

### Outcomes-

The primary outcomes assessed were- maximal mouth opening, burning sensation, palpable fibrous bands, tongue movements. Secondary outcomes assessed were the adverse effects of the antioxidants used and Change or improvement of nutritional status by laboratory investigations and clinical evaluation.

### Data extraction and synthesis-

Data of the 9 full – text articles was extracted and recorded in a format designed for this purpose. The data extracted from all the studies were combined and the subjects who were administered systemic antioxidants alone or in combination with other treatment modalities were considered into interventional group. Subjects who were administered placebo, intralesional corticosteroids or topical antioxidants were considered in control group.

The data of the 9 full – text articles were assessed for eligibility according to PICO guidelines. However, only 6 studies could be included in the systematic review after assessment of eligibility (Table.2). [9] [10] [11] [12] [13] [14] [15] [16] [17].

The extracted data resulted in 207 subjects using systemic antioxidants these subjects were considered to be in interventional group in the systematic review and meta - analysis. 203 subjects were considered in the control / comparator group. Out of which, 82 were included in the placebo group, 121 controls were in the other treatment modalities group like intralesional corticosteroids or topical antioxidants.

### Quality assessment of selected studies-

The quality of reporting of RCTs was carried out by using the 2010 CONSORT criteria as modified by Friction, et al. 1<sup>st</sup> and 2<sup>nd</sup> investigators independently evaluated the method of randomization and blinding using points 8, 9, 10, 11, 15, 16 of CONSORT guidelines 2010 as they are the indicators of risk of systemic bias (Table 3 showing the details). In case of disagreement between the investigators, differences were discussed and a decision was made by consensus. The overall score of the studies gave an average of 6.83 which varied from a minimum of six to a maximum of 8 (scoring shown in Table 4).[18]

### Statistical analysis:-

The extracted data of the selected studies are tabulated. Meta – analysis could be achieved only for one primary outcome i.e mouth opening as the method of its assessment was uniform in all the included studies. Due to heterogeneity of data and methods of assessment the rest of the primary outcomes could not be taken for meta - analysis. The primary measures of effect between treatment and control groups for mouth opening were calculated as the standardized mean differences (SMDs) with a 95% confidence interval. A random and fixed effects model was used to calculate a pooled estimate effect. Cochrane's Q test, a statistic based on the chi – squared test was used to assess the existence of heterogeneity among the interventional and control groups for mouth opening.

### Results:-

#### Study characteristics:-

The electronic searches yielded a total of 1889 articles and manual search yielded total of 9 articles. Following a meticulous search strategy according to prisma guidelines (FIGURE.1), finally 9 full text articles were selected and assessed for eligibility through PICO guidelines. Further 6 full – text articles were selected which fulfilled the PICO

guidelines. These full – text articles were qualitatively analysed with CONSORT guidelines 2010 as modified by Friction et al. The extracted data was quantitatively assessed for the outcomes. The data analysis yielded complete information for only one of our primary outcomes i.e mouth opening. Meta – analysis could be achieved only for mouth opening as the methodology used for its assessment was same in all the included studies. All the other primary outcomes could not be taken for meta – analysis due to heterogeneous in complete data and different methodology used for their assessment.

### **Characteristics of outcomes:-**

#### **Mouth opening:-**

All the 6 included studies assessed change in mouth opening as one of their treatment outcomes. All the studies measured mouth opening using interincisal distance in dentulous patients and for edentulous patients, the opening between the upper and lower ridges was recorded (Table.2).

#### **Other primary outcomes:-**

Burning sensation was assessed by 5 of the included studies except from Patil et al 2014. This outcome was assessed by the 5 studies subjectively using different scales. Changes in palpable fibrous bands was assessed by Kumar et al.[9]. Karemore et al, Salvem et al, Patil et al 2014, Patil et al 2015 did not record changes in palpable fibrous bands. Changes in tongue movements was recorded by Kumar et al, Sudarshan et al and Patil et al 2014 however Karemore et al, Selvam et al and Patil et al 2015 did not record changes in tongue protrusion.(Table.2)

#### **Adverse reactions:-**

There were no side effects or intolerance to lycopene and other antioxidants reported by Kumar et al, Karemore et al, Selvam et al during the treatment period and follow – up. However, Karemore et al reported one case which showed ulceration and burning sensation of oral cavity for a period of one week during follow - up.

Patil et al 2014, reported mild abdominal discomfort due to Oxitard in 8 patients. Patil et al 2015 did not report any side effects of the antioxidants used.

#### **Meta analysis:-**

Metaanalysis was done for only one of our primary outcome i.e mouth opening. Forest plots were drawn for systemic antioxidants vs placebo, systemic antioxidants vs other controls (other treatment modalities) and systemic antioxidants vs controls (combining both placebo and other treatment modalities) using the standard mean deviations (SMDs) and pooled fixed and random overall effects were tabulated.

Patients administered 16 mg lycopene capsules (Kumar et al, Karemore et al) and 16 mg lycopene capsules with intralesional injection of betamethasone 8 mg daily (Kumar et al) v/s placebo depicted significantly improved mouth opening (SMD = -0.959; 95%CI = -1.284 to -0.635; for fixed effects and SMD = -0.941; 95%CI = -1.309 to -0.574; for random effects). Q test of heterogeneity was 2.4608, df = 2 and p value of 0.2922> 0.05 which was not significant.(Fig.2)

Patients administered oral lycopene (lycostar) 16 mg O.D with bi-weekly intralesional dexamethasone & hyaluronidase and oral antioxidant capsules (Multivitamin A – Z soft capsules) O.D with bi-weekly intralesional Dexamethasone & Hyaluronidase (interventional group) v/s bi-weekly intralesional Dexamethasone & Hyaluronidase (control group); (Salvem et al). Patients administered 2 oxitard capsules t.i.d (interventional group) v/s 5 mg aloe vera gel to be applied topically t.i.d. (control group); (Patil et al 2014). Patients administered 500 mg spirulina capsules b.i.d. (interventional group) v/s 5 mg aloe vera gel topically t.i.d. (control group); (Patil et al 2015). Patients administered aloe vera gel 5 mg on each side of buccal mucosa thrice daily for 3 months. (control group) v/s antioxidant capsules twice daily for 3 months (interventional group); (Sudarshan et al) did not significantly improve mouth opening considering the random effects model (SMD = -1.516; 95%CI = -1.853 to -1.179); for fixed effects and SMD = -1.446; 95% CI = -3.332 to -0.439; for random effects). Q test of heterogeneity was 122.9207, df = 4 with a significant p value of 0.0001. Hence, here emphasis should be placed on random effects model as test for heterogeneity is significant.(Fig.2)

A third forest plot was drawn combining all the interventional groups and control groups (placebo & other treatment modalities) which depicted that systemic antioxidants as a single entity or in combination with other treatment modalities i.e intralesional steroids significantly improve mouth opening v/s controls i.e topical antioxidants and intralesional steroids considering the random effects model. (SMD = -1.226; 95% CI = -1.459 to -0.993); for fixed

effects and SMD = -1.235; 95% CI = -2.263 to -0.206; for random effects). Q test of heterogeneity was 130.8958, df = 7 with a significant p value of 0.0001. Hence, here emphasis should be placed on random effects model as test for heterogeneity is significant. (Fig.2)

### Discussion:-

Antioxidants provide a non – invasive conservative approach for management of OSMF. Various studies have proved that antioxidants when used as a standard or adjunct are effective in controlling the signs and symptoms of OSMF. This systematic review aimed to assess the evidence of systemic antioxidants in management of signs and symptoms of OSMF and to compare the systemic antioxidants with other treatment modalities in improving the signs and symptoms of OSMF. This systematic review included only randomized controlled trials, as non randomized trials tend to show frequent “false - positive” results than randomized trials.

The primary outcomes assessed in this review were based on the signs and symptoms of OSMF. Mouth opening was measured in all the 6 studies as inter – incisal distance. Hence a Meta – analysis was carried out to assess the evidence of effectiveness systemic antioxidants in improving the mouth opening.

The systemic anti – oxidants reported in the RCTs of this systematic review are lycopene, spirulina, oxiard and antioxidant capsules.<sup>3</sup> Out of 6 RCTs administered lycopene in one of their interventional group. The Meta – analysis of lycopene as a single component or in combination with intralesional corticosteroids suggests an evidence that lycopene when given in a dosage of 16 mg twice daily for two months as a single entity or in combination with intralesional corticosteroids may be effective in improving the mouth opening in OSMF patients as compared with placebo (SMD = -0.959; 95% CI = -1.284 to -0.635).

Metaanalysis of the combined data of the studies administering systemic antioxidants as a single entity or in combination with intralesional corticosteroids (n = 121) as compared to other interventions (n = 121) i.e topical antioxidants and intralesional corticosteroids (Salvem et al, Patil et al 2014, Pati et al 2015, Sudarshan et al) does not depict significant improvement in mouth opening (SMD = -1.446; 95% CI = -3.332 to -0.439). This attributes to lack of credible evidence and high variability in between the studies as depicted significant test of heterogeneity ( $p = 0.0001 < 0.05$ ) to estimate the effect of intervention. However, it can be inferred that systemic antioxidants as a single entity or in combination with intralesional corticosteroids does not seem to be better than other treatment modalities i.e intralesional corticosteroids and topical antioxidants in improving mouth opening patients with OSMF.

Meta-analysis of the combined data of all the interventional groups (n = 207) and control groups (n = 203; placebo & other treatment modalities) which depicted that systemic antioxidants as a single entity or in combination with other treatment modalities i.e intralesional steroids significantly improve mouth opening v/s controls i.e topical antioxidants and intralesional steroids (SMD = -1.235; 95% CI = -2.263 to -0.206). However, this data also depicted high variability in between the studies as depicted by significant test of heterogeneity (and  $p = 0.0001 < 0.05$ ).

### Limitations:-

The meta-analysis and systematic review reported here combines data across studies in order to estimate treatment effects with more precision than is possible in a single study. The main limitation of this meta - analysis, as with any overview is that the antioxidant used and the outcome definitions are not the same across studies. Only one primary outcome could be assessed i.e mouth opening, rest of primary and secondary outcomes could not be assessed due to lack of consensus among researchers invalidation of other signs and symptoms of OSMF. Although, only two studies mention about the adverse effects of the systemic antioxidant used. This leads us to an observation that systemic antioxidants are relatively safe for the treatment of OSMF. Moreover, the lack of assessment of nutritional status by laboratory investigation or clinical evaluation further highlights the lack of clear markers in serum and saliva which can reliably estimate the overall status of the subjects suffering from OSMF.

At the study and review level our review did not include any grey literature and studies published in other languages were not considered in the review. Only 12 full – text article could be retrieved due to constrained resources available to the investigators. Although, randomization of the selected studies was adequate the quality of randomization varied and none of the studies could be given high scores according to CONSORT guidelines as modified by Friction et al.

**Conclusions:-****Implications for practice:-**

Although the investigators in all the trials concluded that the results indicated that antioxidants were safe, appeared to be effective in reducing symptoms and might prove beneficial in the therapeutic management of oral submucous fibrosis, the uncertain reliability of the limited amount of available data would not appear to support these contentions. Moreover, the meta-analysis carried out for mouth opening suggests that systemic antioxidants are not as effective when compared with other interventions but it does indicate a certain beneficial role of systemic antioxidants being used as an adjuvant with other medical intervention. Additionally other antioxidants like Oxitard and Spirulina have proved to be effective in alleviating the signs and symptoms of OSMF.

**Implications for research:-**

OSMF has proven to be a significant global burden, especially in the South Asian countries where prevalence of this debilitating disease is relatively more. But treatment of OSMF has been clearly inadequate owing to its multi-factorial pathogenesis and evaluation of the merits and disadvantages of individual drugs has been difficult because of empirical nature of the approach.

This systematic review opines that future research trials should be reported strictly adhering to the CONSORT guideline to ensure high quality research especially in terms of randomization and blinding of the subjects for better results. Further the effect of drug on progression of the OSMF can be assessed by using various classifications present in literature based on signs and symptoms of OSMF. However, this systematic review stresses the need of consensus among investigators for the various clinical criteria used to assess OSMF so that significant evidence of a particular treatment modality like antioxidant could be achieved in future review designs.

**Conflicts of interest - NONE****Table 1:-**Showing inclusion and exclusion criteria used for screening of title / abstracts

INCLUSION CRITERIA-	
1.	Randomised clinical trials which mention the use of antioxidants for management of OSMF on human subjects.
2.	Randomised clinical trials in the management of OSMF which include a group intervened with systemic antioxidants by random allocation.
3.	Randomised clinical trials in which effect of systemic antioxidants on signs and symptoms of OSMF could be clearly / separately identified.
EXCLUSION CRITERIA-	
1.	Publications written in languages other than English.
2.	Review articles on management of OSMF.
3.	Non-randomised studies on management of OSMF.

**Table 2:-** Showing assessment of 9 full text articles for eligibility according to PICO guidelines with the details of data extraction.

Author s & Year	Study type & participants	Interventions	Systemic antioxidant used	Interventional period / follow up	Outcomes	Assessment of eligibility	Reasons for exclusion
Kumar et al, 2007	Randomise control trial. GroupA=21 GroupB=19 GroupC=18	Gr A:Oral lycopene 16 mg b.i.d. Gr B: Oral lycopene 16 mg daily + intralesional injection betamethasone 8 mg twice weekly.	LYCOPENE	2 months/ weekly assessment.  Follow-up at 3 <sup>rd</sup> and 6 <sup>th</sup> month post treatment	Mouth opening, Tongue protrusion, Palpable fibrous bands in the buccal mucosa, Burning sensation.	Included for review	
Rao et al, 2010	Randomised Case control study Group 1 = 9 Group 2 = 9	Group 1: intralesional betamethasone 1 ml with hyaluronidase 1500 IU weekly once for 12 weeks + alpha lipoic acid administered orally OD for 3 months Group 2: intralesional betamethasone 1 ml with hyaluronidase 1500 IU weekly once for 12 weeks	ALPHA LIPOIC ACID	6 months/fortnightly	Mouth opening, Burning sensation, Post treatment biopsy.	Excluded	1. Case-control study. 2. Outcomes not mentioned clearly.
Karemore et al, 2012	Randomised control trial Lycopene group=46 Placebo group=46	Lycopene gr. = 8 mg oral Lycored capsules orally bid for 3 months Placebo gr. = placebo twice a day	LYCOPENE	2 months/fortnightly 2 months follow-up post-treatment.	Mouth opening Burning sensation Erythematous areas / ulcerations / erosions	Included for review	

		orally					
Sudarsan et al, 2012	Randomised control trial GroupA=10 GroupB=10	Gr A- topical aloe vera gel / tid for 3 months. Gr B- antioxidant capsules / bid for 3 months.	ANTIOXIDANT CAPSULES	3months	Mouth opening Burning sensation Cheek flexibility Tongue protrusion	Included for review	
Shetty et al, 2012	Interventional study GroupA=20 GroupB=20	Gr A- spirulina 500 mg bid for 3 months + betamethasone intralesional 4 mg / ml bi-weekly. Gr B- Placebo bid for 3 months + betamethasone intralesional 4 mg / ml bi-weekly	SPIRULINA	3months/twice a month.	Mouth opening Burning sensation	Excluded	1. Randomisation and blinding not mentioned clearly.
Salvem et al, 2013	Randomised control trial GroupA=15 Group B=15 Group C=15	Gr A: Oral lycopene (lycostar) 16 mg O.D + bi-weekly intralesional dexamethasone & hyaluronidase. Gr B: oral antioxidant capsules (Multivitamin A – Z soft capsules) O.D + bi-weekly intralesional Dexamethasone & Hyaluronid	LYCOPENE MULTIVITAMINS	6 week / weekly intervals	Mouth opening. Burning sensation.	Included for review	



		ase. Gr C (n=15): bi-weekly intralesional Dexamethasone & Hyaluronidase.					
Alam et al, 2013	Randomised control trial  Medicinal group=30 Surgical group=30	All patients- Lycostar capsules bid + Capsule Becosules – Z od during the treatment and upto 6 month post-treatment + physiotherapy for mouth opening 4-5 times / day Medicinal group:- submucosal injections twice/ week of hyaluronidase (1500 IU) for the first 3 weeks. Followed by submucosal injection twice/week of hyaluronidase (1500 IU) & 4 mg for the next 7 weeks. Surgical group- surgical excision of fibrotic bands. Each treatment category	LYCOPENE MULTIVITAMINS	NOT SAME FOR EACH GROUP	Mouth opening Burning sensation Elasticity of buccal mucosa	EXCLUDED	1. Multiple antioxidants used in both interventional and control group. 2. Effect of each antioxidant not mentioned clearly.

		(medicinal and surgical) was randomly divided into 2 groups, A and B, having an equal number of patients – application of aloe vera gel.					
Patil et al, 2014	Randomised control trial Group A=60 Group B=60	A: 2 oxitard capsules t.i.d. B: 5 mg aloe vera gel to be applied topically t.i.d.	Oxitard Aloe vera	3 months/monthly interval for 5 months.	Improvement in mouth opening (interincisal distance in mm). Tongue protrusion (in mm). Pain associated with the lesion (present, absent, reduced). Difficulty in swallowing (present, absent, reduced). Difficulty in speech (present, absent, reduced).		
Patil et al, 2015	Randomised control trial Group A=21 Group B=21	A: 500 mg spirulina b.i.d. B: 5mg aloe vera gel topically t.i.d.	Spirulina Aloe vera	3 months /monthly interval for 5 months.	Follow-up at monthly interval for 5 months. Improvement in mouth opening (interincisal distance in mm). Tongue protrusion (in mm). Ulcers/vesicles/ erosions (present, absent, reduced). Difficulty in swallowing (present:7-10, absent:0-1, reduced:1-6). Difficulty in speech (present:7-10, absent:0-1, reduced:1-6).		

**Table 3:-** Showing qualitative assessment of randomized control studies according to CONSORT guidelines.  
**RISK OF BIAS-**

CONSORT CRITERIAS ASSESSED	Kumar et al, 2007	Karemore et al, 2012	Sudarshan et al, 2012	Salvem et al, 2013	Patil et al, 2014	Patil et al, 2015
Randomisation sequence generation (point 8a consort guidelines)	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Type of randomisation; (point 8b consort guidelines)	Randomised; double blinded.	Randomised; single blind	Randomised; single blind.	Randomised; blinding not mentioned	Randomised; single blind.	Randomised; blinding not specified.
Randomisation / allocation (point 9 consort guidelines)	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Randomisation implementation (point 10 consort guidelines)	1 <sup>st</sup> Investigator categorised the pt. to different interventions. 2 <sup>nd</sup> investigator recorded variables.	Not specified	Not specified	Not specified	Not specified	Not specified
Blinding (point 11a consort guidelines)	Participants and investigators were blinded	Participants were blinded	Participants were blinded	Not specified	Not specified	Not specified
Blinding (point 11b consort guidelines) method of supply of intervening agent.	Placebo supplied was manufactured as bottled lycored capsules.	Not specified clearly	Placebo not used	Placebo not used	Placebo not used	Placebo not used
Baseline data (point 15 consort guidelines)	No. of subjects in different age group shown.	Tables for Age wise & sex distribution of subjects with baseline clinical characteristics shown	Table of changes of baseline data to follow-up visits shown.	Table showing age distribution of subjects shown.	Table for baseline demographic data NOT given.	Table for baseline demographic data NOT given.
Numbers of participants analysed. (point 16 consort guidelines)	Specified (n=58)	Specified (n=92)	Specified (n=20)	Specified (n=45)	Specified (n=120)	Specified (n=42)

**Table 4:-** Quality assessment using CONSORT criteria according to Fricton et al.

	AUTHOR	SCORE
1	Kumar et al, 2007	8
2	Karemore et al, 2012	8
3	Sudarshan et al, 2012	6
4	Salvem et al, 2013	6
5	Patil et al, 2014	7
6	Patil et al, 2015	7

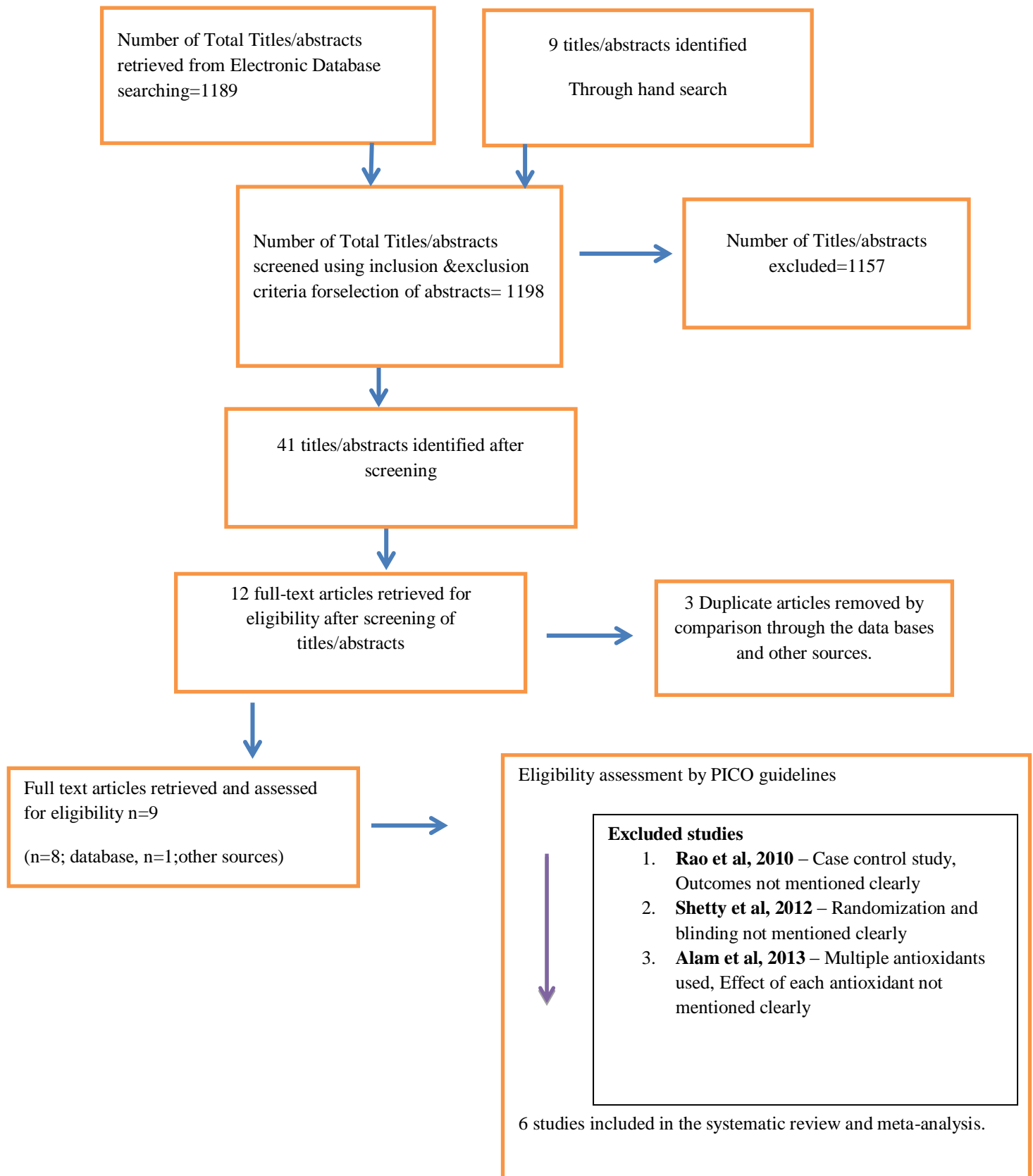
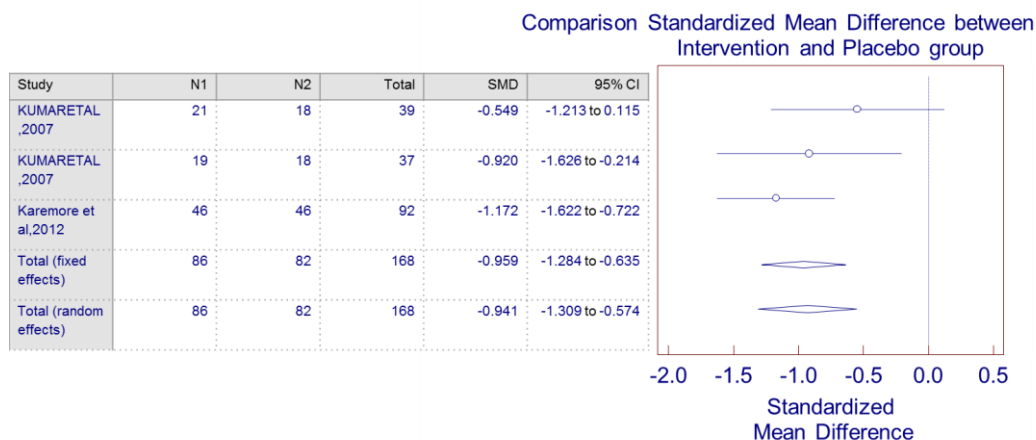
**Figure1:-** Flow chart showing search strategy for the systematic review-

Figure 2. Showing meta – analysis for mouth opening.

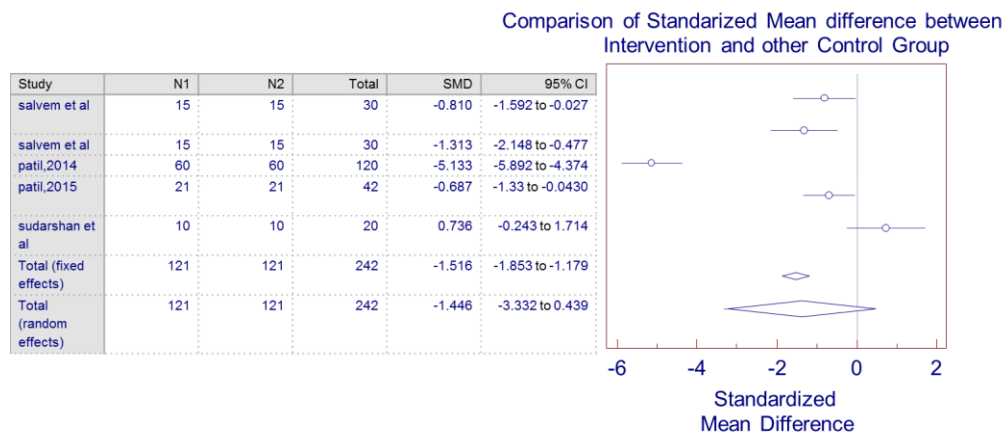


Test for heterogeneity

Q=2.4608

DF=2

Significance level, P = 0.2922

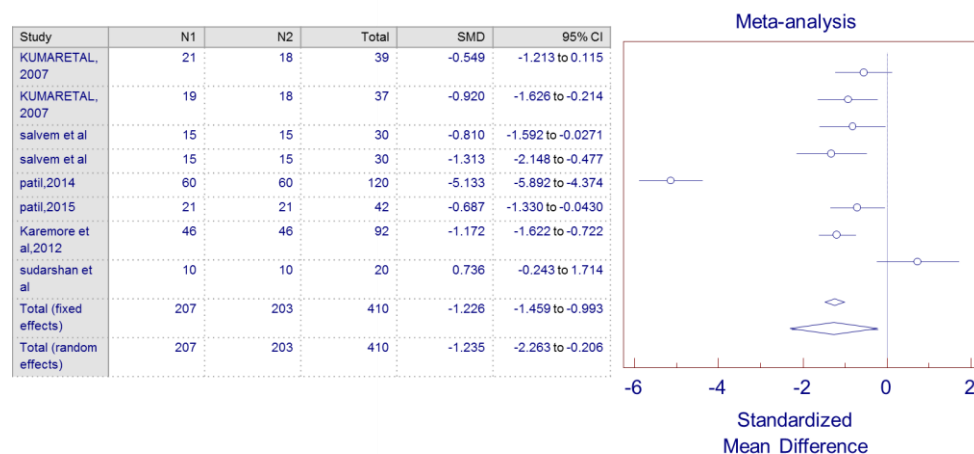


Test for heterogeneity

Q=122.9207

DF=4

Significance level, P &lt; 0.0001



Test for heterogeneity

Q=130.8958

DF=7

Significance level,  $P < 0.0001$

### References:-

1. Rajalalitha P, Vali S. Molecular pathogenesis of oral submucous fibrosis — a collagen metabolic disorder. *J Oral Pathol Med* 2005;**34**:321–8.
2. Pindborg J J, Murti P R, Bhonsle R B, Gupta P C et al. Oral submucous fibrosis as a precancerous condition. *Scand J Dent Res* 1984;**92**:224–9.
3. Mathew A L, Pai K M, Sholapurkar A A et al. The prevalence of oral mucosal lesions in patients visiting a dental school in Southern India. *Indian J Dent Res* 2008;**19**:99–03.
4. G. Arakeri, P.A. Brennan. Oral submucous fibrosis: an overview of the aetiology, pathogenesis, classification, and principles of management. *British Journal of Oral and Maxillofacial Surgery* 2013;**51**:587–93.
5. Kerr AR, Warnakulasuriya S, Mighell A J et al. A systematic review of medical interventions for oral submucous fibrosis and future research opportunities. *Oral Dis* 2011;**17**:42–57
6. Lai D R, Chen H R, Lin L M et al. Clinical evaluation of different treatment methods for oral submucous fibrosis. A 10 – year experience with 150 cases. *J Oral Pathol Med* 1995;**24**:402–6.
7. Borle R M, Borle S R et al. Management of oral submucous fibrosis: a conservative approach. *J Oral Maxillofac Surg* 1991;**49**:788–91.
8. Santos CMC, Pimenta CAM, Nobre MRC. The PICO strategy for the research question construction and evidence search. *Rev Latino – am Enfermagem* 2007 maio-junho;**15**(3):508-11.
9. Kumar A, Bagewadi A, Keluskar V et al. Efficacy of lycopene in the management of oral submucous fibrosis. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2007;**103**:207–13.
10. Rao PK et al. Efficacy of Alpha Lipoic Acid in the management of Oral Submucous Fibrosis. *J of cancer research and therapeutics* 2010;**4**:508-510.
11. Karemore TV, Motwani M et al. Evaluation of the effect of newer antioxidant Lycopene in the treatment of Oral submucous fibrosis. *Indian Journal of Dental research* 2012;**23**:524-28.
12. Sudarshan R, Annigeri RG, Sree Vijayabala G et al. Aloe vera in the treatment for oral submucous fibrosis- a preliminary study. *J Oral Pathol Med* 2012;**41**:755-61.
13. Shetty P, Shenai P, Chatra L et al. Efficacy of spirulina as an antioxidant adjuvant to corticosteroid injection in management of oral submucous fibrosis. *Indian J Dent Res* 2013;**24**:347-50.
14. Alam S, Ali I, Giri KY et al. Efficacy of aloe vera gel as an adjuvant treatment of oral submucous fibrosis. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2013;**116**:717-24.
15. Selvam NS, Dayanand AA et al. Lycopene In The Management Of Oral Submucous Fibrosis. *Asian J Pharm Clin Res* 2013;**6**:58-61.
16. Patil S, Halgatti V, Maheshwari S et al. Comparative efficacy of oxicort and aloe vera in OSMF. *J Clin Exp Dent* 2014;**6**:265-70.
17. Patil S, Al-Zarea BK, Maheshwari S et al. Comparative evaluation of natural antioxidants spirulina and aloe vera for the treatment of oral submucous fibrosis. *Journal of oral biology and craniofacial research* 2015;**11**:11-15.
18. Melis M, Giosia MD, Zawawi KH et al. Low Level Laser Therapy for the Treatment of Temporomandibular Disorders: A Systematic Review of the Literature. *The Journal Of Craniomandibular Practice* 2012;**30**:1-9.

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### RESEARCH ARTICLE

#### EXISTING AND FUTURE MSW GENERATION NEXUS POPULATION AND GDP GROWTH, THE CASE OF MEKELE CITY, ETHIOPIA

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#### **Abstract**

Municipal Solid Waste (MSW) generation is an unavoidable phenomenon in any Economic levels and population size. The fast expansion of urbanization, agricultural practices and industrial activities encouraged by quick population growth has produced an enormous amount of solid wastes that pollute the environment and destroy resources. The data was generated from secondary data sources of various institutions. The range and the composition of MSW generation are highly variable and heterogeneous with the contemporary way of life experience of both in low, middle and high income inhabitants. The result showed that the current scenario of MSW generation rate is small but it is tremendously increasing in an increasing fashion parallel with population and GDP growth of Mekele City. Thus, it is important and advisable to undertake well comprehensive kinds of research works in the City to identify and predict the prospect MSW generation trends together with its integrated management options.

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#### **Introduction:-**

Solid wastes are the materials which arise from various human and animal activities and discarded as useless or unwanted (Rana, 2007). Solid waste generation is an inevitable consequence of production and consumption activities in any economy (Eugenia et al., 2002). (UNEP, 2005) also reported that fast expansion of urban, agricultural and industrial activities spurred by rapid population growth has produced a huge amount of solid waste that pollutes the environment and destroys resources. Globally the per capita amounts of municipal solid waste generated on a daily basis vary significantly (WRI, 1996). Globalization can promote economic growth, a desirable outcome. However, this economic growth in addition to population increase and urbanization will seriously strain municipal resources to deal with booming amounts of wastes (Medina, 2002). Solid waste generation depends on the economy of the people and level of income of the family or individual. Previous studies have shown that for every Indian, an increase in income by Rs. 1000 results in an increase of solid waste generation by one kilogram per month. It is a common observation that with an increase of economic growth the waste generation grows in an equal manner. Economic growth and waste generation have not been decoupled in both developing and industrialized world (Visvanathan & Trankler, 2006). Medina (2002) also reported that a positive correlation tends to exist between a community's income and the amount of solid waste generated. Wealthier individuals consume more than lower-income ones, which result in a higher waste generation rate for the former. Income and household size are the most significant factors affecting the quantity of solid wastes from household consumption (Richardson & Havlicek,

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1974). Visvanathan & Trankler (2003) reported that in a family with rich socioeconomic condition, daily waste generation rates were generally higher than the lower socioeconomic families.

Increasing population levels, booming economy, rapid urbanization and the rise in community living standards have greatly accelerated the municipal solid waste generation rate in developing countries (Minghua et al., 2009). Municipalities, usually responsible for waste management in the cities, have the challenge to provide an effective and efficient system to the inhabitants. However, they often face problems beyond the ability of the municipal authority to tackle (Sujauddin et al., 2008) mainly due to lack of organization, financial resources, complexity and system multi dimensionality (Burntley, 2007).

#### Global MSW generation Scenario:-

Generally, in European countries and Organization for Economic Cooperation and Development (OECD) countries, MSW covers waste from households (82% of total MSW) including bulky waste, waste from commerce and trade, office buildings, institutions and small businesses, yard and garden waste, street sweepings, the contents of litter containers, and market cleansing waste (Eurostat, 2003). The definition of MSW excludes waste from municipal sewage networks and treatment, as well as municipal construction and demolition waste. However, national definitions of MSW may differ (OECD, 2007a).

The annual waste generation in East Asia and the Pacific (EAP) Region is approximately 270 million tons per year. This quantity is mainly influenced by waste generation in China, which makes up 70% of the regional total (UNEP, 2010; Wasswa & Schluep, 2008).

**Table1:- Waste Generation Per Capita by Region**

Region	Waste Generation per Capita(kg/capita/day)		
	Lower Boundary	Upper Boundary	Average
AFR	0.09	3.0	0.165
EAP	0.44	4.3	0.95
ECA	0.29	2.1	1.1
LAC	0.11	5.5	1.1
MENA	0.16	5.7	1.1
OECD	1.10	3.7	2.2
SAR	0.12	5.1	0.45

Source: Hoornweg et al., 2005)

In Eastern and Central Asia (ECA), the waste generated per year is at least 93 million tons. Eight countries in this region have no available data on waste generation in the literature. The per capita waste generation ranges from 0.29 to 2.1 kg/ person/day, with an average of 1.1 kg/capita/day. Latin America and the Caribbean (LAC) has the most comprehensive and consistent data (e.g. PAHO's Regional Evaluation of Solid Waste Management, 2005). The total amount of waste generated per year in this region is 160 million tons, with per capita values ranging from 0.1 to 14 kg/capita/ day, and an average of 1.1 kg/capita/day. Similar to the high per capita waste generation rates on islands in Africa, the largest per capita solid waste generation rates are found in the islands of the Caribbean. In the Middle East and North Africa (MENA), solid waste generation is 63 million tons per year. Per capita waste generation is 0.16 to 5.7 kg/person/day, and has an average of 1.1 kg/capita/day. The (OECD) countries generate 572 million tons of solid waste per year. The per capita values range from 1.1 to 3.7 kg per person per day with an average of 2.2 kg/capita/day. In South Asia Region (SAR), approximately 70 million tons of waste is generated per year, with per capita values ranging from 0.12 to 5.1 kg per person per day and an average of 0.45 kg/capita/day. Table 3 shows current waste generation per capita by region, indicating the lower boundary and upper boundary for each region, as well as average kg per capita per day of waste generated within each region.

**Table2:- Waste Generations Per Capita by Income Level**

Income Level	Waste generation per capita (kg/capita/day)		
	Lower Boundary	Upper Boundary	Average
High	0.70	14	2.1
Upper Middle	0.11	5.5	1.2
Lower Middle	0.16	5.3	0.79
Lower	0.09	4.3	0.60

Source: Hoornweg et al., 2005



Of the world's waste, while Africa and South Asia figure as the regions that produce the least waste. Table 4 below shows estimates of waste generation for the year 2025 as expected. According to Hoornweg et al., 2005, current trends in population growth in each region. In the coming 10 years the East Asia and Pacific regions are the most dominant solid waste producers.

**Table3:- Waste Generation Projections for 2025 by Region**

Region	Current Available Data			Projection for 2025			
	Total urban population (Millions)	Urban waste Generation		Projected Population		Projected Urban waste	
		Per capita (kg/capita/day)	Total (tons/day)	Total population (millions)	Urban population (millions)	Per capita (kg/capita/day)	Total (tons/day)
AFR	260	0.65	169,119	1,152	518	0.85	441,840
EAP	777	0.95	738,958	2,124	1,229	1.5	1,865,379
ECA	227	1.1	254,389	339	239	1.5	354,810
LCR	399	1.1	437,545	681	466	1.6	728,392
MENA	162	1.1	173,545	379	257	1.43	369,320
OECD	729	2.2	1,566,286	1,031	842	2.1	1,742,417
SAR	426	0.45	192,410	1,938	734	0.77	567,545
Total	2,980	1.2	3,532,252	7,644	4,285	1.4	6,069,703

Source: Hoornweg et al., 2005)

Waste generation varies as a function of affluence, however, regional and country variations can be significant, as can generation rates within the same city. Throughout the report, when Africa is mentioned as a region, we refer to Sub-Saharan Africa (AFR). Data are particularly lacking for Sub-Saharan Africa. Waste generation in sub-Saharan Africa is approximately 62 million tons per year. Per capita waste generation is generally low in this region, but spans a wide range, from 0.09 to 3.0 kg per person per day, with an average of 0.65 kg/capita/day. The countries with the highest per capita rates are islands, likely due to waste generated by the tourism industry, and a more complete accounting of all wastes generated, (Wasswa & Schluep, 2008). For example the composition of wastes in East African Cities are illustrates on table 4:

**Table4:- Composition of solid wastes generated in East African urban centers**

Waste composition (%)	Dare Salaam	Moshi*	Kampala	Jinja	Lira	Nairobi*
Bio-waste	71	65	77.2	78.6	68.7	65
Paper	9	9	8.3	8	5.5	6
Plastic	9	9	9.5	7.9	6.8	12
Glass	4	3	1.3	0.7	1.9	2
Metal	3	2	0.3	0.5	2.2	1
Others	4	12	3.4	4.3	14.9	14
Kg/cap/day	0.4	0.9	0.59	0.55	0.5	0.6
% collection	40	61	60	55	43	65
Population	3,070,060	183,520	1,700,850	91,153	107,809	4,000,000
Population paying for collection	ND	35	ND	ND	ND	45

ND= Not determined; Source: #NEMA, 2007;\*Scheinberg et al., 2010

#### **Current Waste Generation and in Emerging Cities of Ethiopia:-**

Waste management in Addis Ababa is fundamentally different from other emerging cities of Ethiopia. There has been no form of waste management in emerging cities until very recently. A few of these new municipalities, as seen in Figure 5, were designed to decrease human exposure to unsanitary conditions and environmentally degrading practices. Yet, as Table 3 illustrates, the collection and management of waste in most of the municipalities is still quite inefficient.

Two exceptions, Mekele and Dire Dawa, have recently experienced promising results for improved waste management and waste-to-energy conversion through biogas capture from landfills using both technical and

institutional strategies (Fikreyesus, 2011). International financing, such as the Clean Development Mechanisms, could support the transition to sustainable waste management in these emerging cities, similar to the Addis Ababa municipality.

**Table5:- Ethiopian municipalities and waste generation, in 2010**

City	Region	Population	MSWG	MSWC
Addis Ababa	Addis Ababa	2,979,100	1,132t/d	70% collected
Mekele	Tigray	261,200	78t/d	82% collected
Dire Dawa	Dire Dawa	256,800	77t/d	48% collected
Jima	Oromya	120,960	87t/d	30% collected
Adama	Oromya	260,600	59t/d	48% collected
Bahr Dar	Amhara	170,300	27t/d	58% collected
Hawassa	SNNPR	200,400	46t/d	44% collected
Harer	Harer	108,200	32t/d	45% collected

- t/d= tons/ day; Source: Central Statistical Agency of Ethiopia, 2010; Fikreyesus, 2011

Mekele is another Ethiopian city that has recently increased solid waste generation but lacks management to accommodate the growing rates of waste. The municipality currently offers poor disposal services throughout the city, with a total of 58 collection containers (Tadesse et al., 2008). Final collectors dispose of waste in two open dumping sites about 10km outside of the city (Tadesse et al., 2008).

## Materials and Method:-

### Area description:-

Mekele had a built up area coverage of 16 KM<sup>2</sup> in 1984 after ten years, in 1994 the size of built up area reached 23.04 KM<sup>2</sup> adopting a continuous increase with the rise of population size and the city administration has expanded its land holding to 100KM<sup>2</sup> in 2004 by engulfing the vast agricultural lands of neighboring villages and towns. The altitude of Mekele varies from 2150 m.a.s.l. - 2270 m.a.s.l. Mekele Experiences mild climatic condition with annual average maximum temperature of 24.1<sup>0</sup>C and annual average minimum temperature 11.11<sup>0</sup>C. June is the hottest month with a monthly mean maximum temperature of 27.1<sup>0</sup>C and monthly mean minimum temperature of 13.03<sup>0</sup>C. December is the coldest month with a mean monthly maximum temperature of 21.9<sup>0</sup>C and monthly mean minimum temperature of 8.51<sup>0</sup>C. There is one short rainy season, which starts on June and lasts on August. The rainy season is characterized by erratic, unreliable and uneven distribution. The city has annual average rainfall of 618.3mm/Year of which the substantial amount falls on July and August. The highest monthly rainfall occurs on August with a monthly rainfall of 229 mm (37% of the annual) and July is the second largest rainy month with a monthly rainfall of 207.7mm (33.5% of the annual).

### Data Collection Methods:-

The data was generated from the secondary data sources of Mekele City administration Municipality; Waste management and control stream. The projected population growth was estimated by the average growth rate of Mekele City; that is 4.4%, from Finance and Economic Development Office (October 2004), Mekele. The total current solid waste generated and projected waste generation was calculated based on the daily per capita generation of the City; the daily per capita waste generation of Mekele City is 0.268kg/c/d, (ECSA, 2010 and Feasibility study of ISWM for Mekele City, 2012). The GDP growth of Mekele City was also extrapolated from the Ethiopian GDP growth of the last 10 years by Statista, 2016 and [www.Trading Economics.com/](http://www.Trading Economics.com/) World Bank (2015). Its extrapolated by divided the yearly GDP growth to GDP per Capita and Multiplying by the total population of Mekele City for each year.

### The Existing Municipal solid waste generation Rate of Mekele:-

According to the Feasibility study in 2012 of Mekele City, the daily generation rate of every Kebele and City level is tracked with volume and weight per capita per day basis in table 6- below.

**Table 6:- Solid waste generation rate of inhabitants in Mekele Sub-City bases**

SN	Tabias	Per capita per day volume	Per capita per day weight	Per capita per day unit weight
		(cu m/c/d)	(Kg/c/d)	(Kg/cu.m)
1	Addis Alem	0.989	0.322	434.27
2	Industry	0.641	0.271	573.63
3	Sewhi Negus	0.713	0.171	272.98
4	Addishum Dhun	1.276	0.275	242.91
5	Kedamy Weyane	0.936	0.279	456.76
6	Aider	1.115	0.352	362.20
7	Hadnet	1.133	0.325	286.12
8	Hawltie	0.560	0.148	373.62
9	Adi Hakie	0.948	0.267	337.70
<b>Mekele City</b>		<b>0.924</b>	<b>0.268</b>	<b>371.13</b>

Source: Feasibility study ISWM for Mekele City 2012

**Table7:-Rates and quantities of solid waste generation Of Mekele City Bases**

Summary of Rate of Generation for MSW sources	Rates & Quantities of solid waste	
Years	2010	2015
Master plan population	285489.00	335583.00
Average annual quantity (cu.m/yr)	129540.33	156238.10
Average annual quantity (kg/yr)	1406307.50	1715342.27
Average monthly quantity (cu.m/m)	10795.03	13019.84
Average monthly quantity (kg/m)	117192.29	142945.19
Average weekly quantity (cu.m/wk)	2491.16	3004.58
Average weekly quantity (kg/wk)	27044.37	32987.35
Average daily quantity (cu.m/d)	355.88	429.23
Average daily quantity (kg/d)	3863.48	4712.48

Source: Feasibility study ISWM for Mekele City 2012

**Population Size, GDP growth and Solid waste generation forecast:-**

The total solid waste generated from Mekele City was calculated based on the projected population number and the per capita waste generation. The population growth also calculated by using the average annual growth rate of the City and the following formula was used to calculate the annual increment of population number.

$$P_i = P_o * (1 + r)^t$$

Where:  $P_i$  = Total population number for the target year

$P_o$  = Total population number in 2010

$r$  = Annual growth rate

$t$  = number of years from 2006 to the target year

**Table8:-Population growth rate Trends of Mekele City**

Year	Growth Rate
1965-1970	4.6%
1970-1978	5.1%
1978-1984	6.3%
1994-2004	4.4%
2004+	4.4

Source: Finance and Economic Development Office (October 2004)

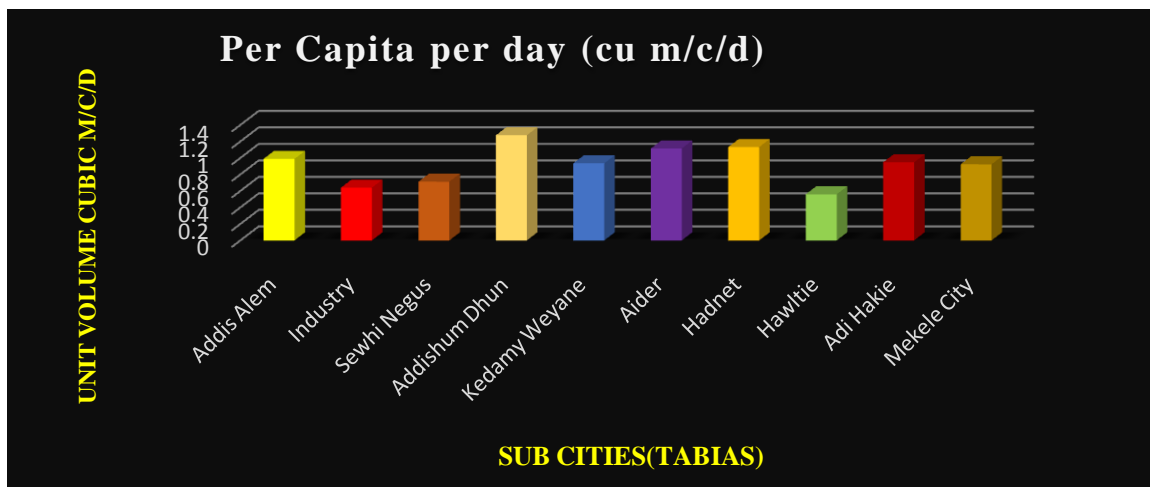
**Table9:-Projected Population and Waste generation of Mekele City**

Year	Population size in Thousands	GDP in Million (USD)	Waste Generation (Tons/c/day)
2010	261.200	89.2935708	25,550.73
2011	272.693	100.9940341	26,674.93
2012	284.691	111.6572337	27,848.41
2013	297.218	125.6792257	29,073.71
2014	310.295	141.113788	30,353.04
2015	323.948	157.525870	31,323.57
2016	338.202	174.9349845	33,082.87
2017	353.083	192.9598595	34,538.49
2018	368.619	212.0554521	36,058.35
2019	384.838	233.1156185	37,645.01
2020	401.771	255.707153	39,301.38
2021	419.449	278.3715233	41,030.38
2022	437.904	303.686424	42,835.67
2023	457.172	331.2439726	44,720.53
2024	477.288	359.7653758	46,688.25
2025	498.289	390.1852015	48,742.47

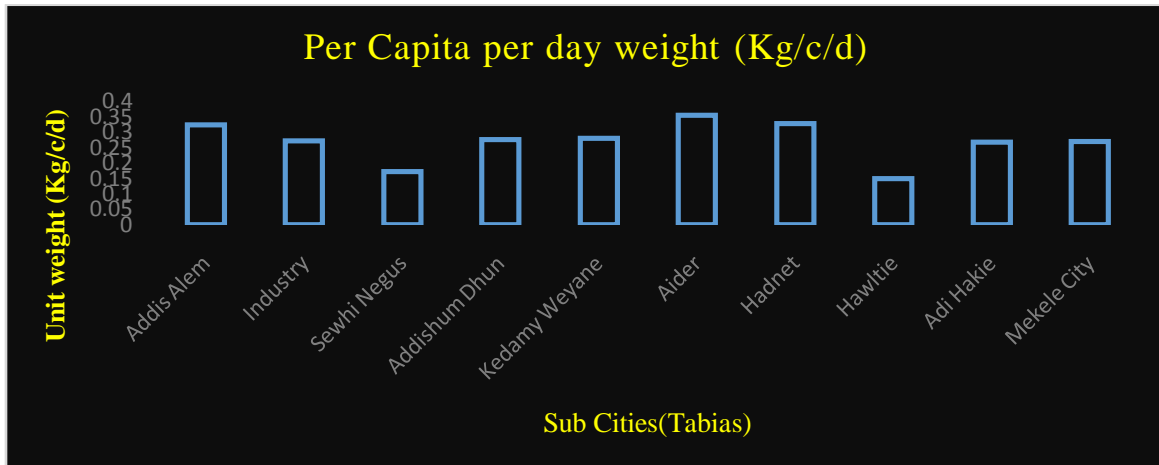
From 2016 onwards are forecasted numbers. Source: CSA, Reports of the 2007 and 2010 Census and 2012 Annual Statistical Abstract; Statista, 2016 and [www.Trading Economics.com/](http://www.Trading Economics.com/) World Bank (2015)

### Result and Discussion:-

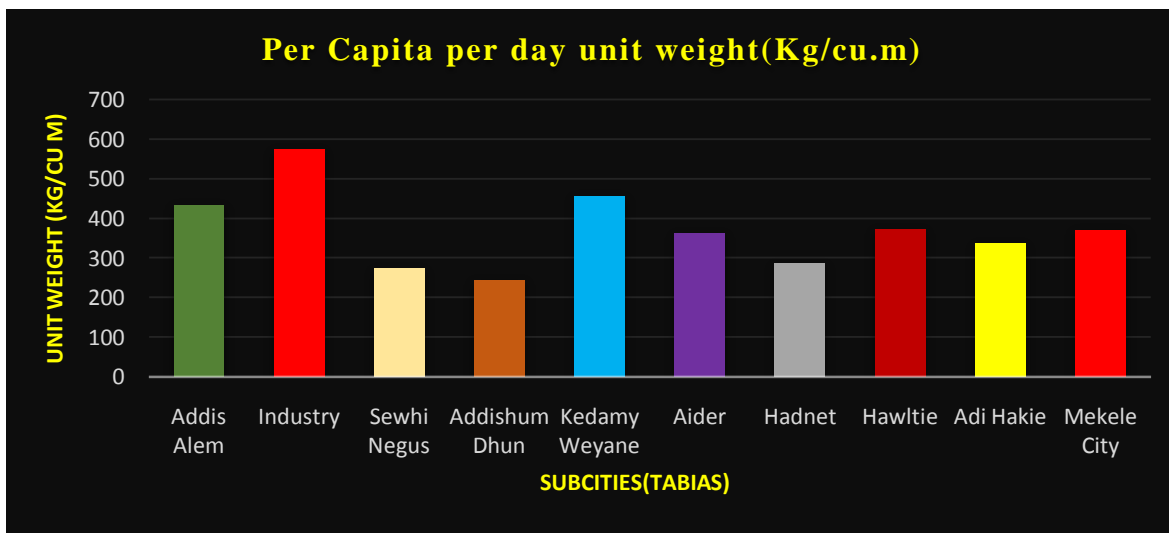
In the Solid waste generation rate of residential establishments of Sub-City bases; table 6, shows that the highest per capita per day volume, per capita per day weight and per capita per day unit weight of MSW is recorded in Hadnet, Addis Alem and Industry Sub-City respectively. There are also huge differences among the largest and the smallest waste generation Scenarios of the Sub-City; this is due to the economic level and the number of populations within the Sub-Cities. And generally in a City level the per capita per day volume, per capita per day weight and per capita per day unit weight are 0.924, 0.268, 371.13 respectively. Thus, Solid waste generation rate of inhabitants in Mekele Sub-City bases is elaborated below graphically (per capita per day (cu m/c/d) :



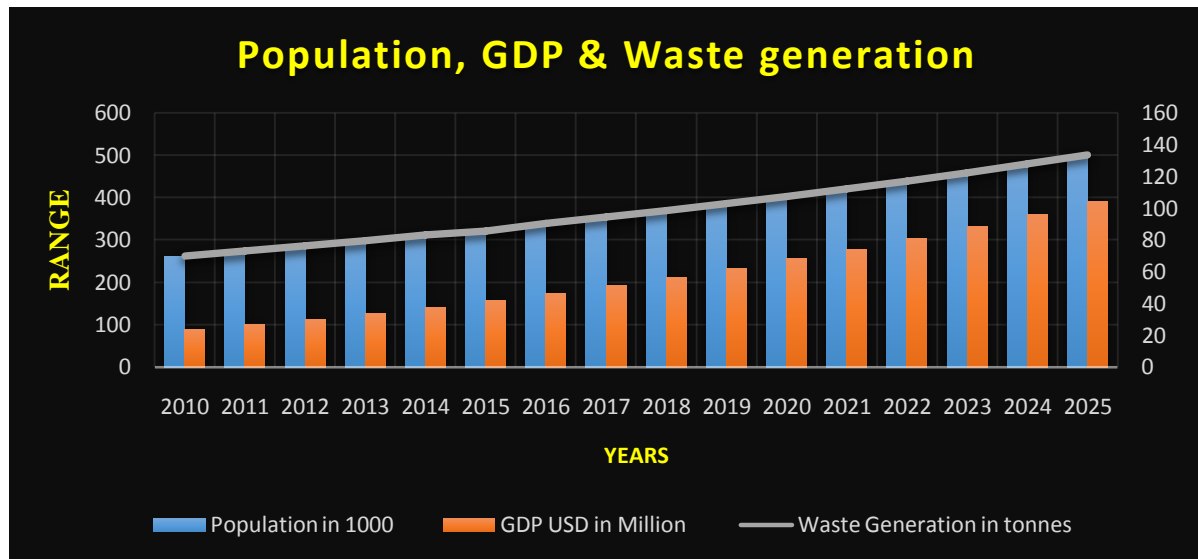
The rate of waste generation is known to be changed for every fiscal year. Among other factors economic status of residents is the main reason. However due to the difficulty of predicting the dynamics of economic changes and lack of previous recorded data to be used for trend analysis; so, the rate of generation is forecasted using probabilistic model. Thus, Solid waste generation rate of inhabitants in Mekele Sub-City bases is elaborated below graphically (Per capita per day weight (kg/c/d) :



From table six again the Solid waste generation rate of inhabitants in Mekele Sub-City bases is elaborated below graphically (Per capita per day unit weight (kg/cu m) :



According to table 9-results, the connection of population, GDP and waste generation is linear relationships. As the population and the economic growth increases the waste generation per capita also increase and the waste generation of the City per year is sharply increases. For the coming ten years of waste generation in Mekele City will also increasing tremendously by the influence of the population growth and the economic developments of the City as well. It was projected the future population growth by using the following population projection formula:  $P_t = P_0 * (1 + r)^t$



Mekele City solid waste generation in relative to the high income countries/ developed nations the recent rate of waste generation per capita is very small. The average waste generation of OECD countries (kg/capita/day) is 2.2, (Hoornweg et al., 2005). But the average waste generation of Mekele City (kg/capita/day) is 0.268; that is only 12% of the OECD countries is generated in Mekele City.

### Conclusion and The Way for wards:-

- ❖ Generally the Mekele City MSW generation is highly linked with the population size and the income level of the inhabitants. The MSW generation scenario of Mekele City in the Past six and the coming 10 years both the per capita and total annual generation rate for the City showed that ever increasing with linear relationships of the influencing Factors (Population and Income level of the Inhabitants).
- ❖ Even though the amount of waste generation is on the sharply increment Manner, it is very insignificant relatively to the high income level countries' generation rate.
- ❖ The population growth together with the economic development of the City has positive impacts in solid waste generation of the City; thus, the municipality should give serious concern on the controlling of the ever increasing MSW generation.
- ❖ The generated waste must be treated accordingly the nature, compositions and the characteristics of the MSWs.
- ❖ The Heterogeneity of MSW generation of the City should be managed by the participatory approaches of all stakeholders by involving in the waste Recycling, Reducing and Reuse (3R-Rules approach) responsibility roles.
- ❖ There should be a strong Policy and Laws to control and treat the generation and management processes of MSWs both in Sub-Cities and City levels.

**Reference:-**

1. Burntley, S.J. (2007). A review of municipal solid waste composition in the United Kingdom. *Waste Manage*, 27, 1274.
2. Central Statistics Agency of Ethiopia (CSAE) Census report, (2007, 2010 and 2012).
3. Eugenia, C. B., N. Georgina & L. Ramil. (2002). Solid Waste Segregation and Recycling in Metro Manila: Household Attitudes and Behavior. Resources, Environment and Economics Center for Studies, Philippines. pp. 45-67.
4. Fikreyesus, D. (2011). Ethiopia Solid Waste & Landfill.
5. Final feasibility and preliminary design report of Mekele City for ISWM, (2012).
6. Finance and Economic Development Office (FEDO), (October 2004).
7. Hoorweg, D.T.L., and Laura, T. (2005). What a waste: Solid management in Asia, Working Paper Series No. 1, Urban Development Sector Unit, East Asia and Pacific Region, World Bank, Washington, DC.
8. Medina, M. (2002). Globalization, Development, and Municipal Solid Waste Management in Third World Cities. El Colegio de la Frontera Norte [College of the northern border], Tijuana, Mexico. Unpublished paper.
9. Minghua, Z., Xiumin, F., Rovetta, A., Qichang, H., Vicentini, F., Bingkai, L., Giusti, A., and Yi, L. (2009). Municipal solid waste management in Pudong New Area, China. *Waste Manage*. 29, 1227.
10. NEMA-National Environment Management Authority. (2007). Clean Development mechanism (CDM) - Uganda solid waste composting project. Analysis Report. - (2006). State of Environment Report for Uganda 2006/7. NEMA, Kampala. 357pp.
11. Organization for Economic Cooperation and Development. (2007a). OECD environmental data, compendium 2006-2008. Paris, France: Organization for Economic Cooperation and Development.
12. Pan American Health Organization. (2005). Analysis sector ales de residuos sólidos [Analysis sector ales solid waste]. Area of Sustainable Development and Environmental Health, PAHO, Washington, DC.
13. Rana, S.V.S. (2007). Environmental Pollution. Narosa Publishing House, New Delhi. pp. 81-84.
14. Richardson, R.A. & J. Havlicek. (1974). an analysis of seasonal household waste generation. *Southern Journal of Agricultural Economics*. 06(02): 143-153.
15. Scheinberg, A., Wilson, D.C., Rodic, L., (2010). Solid waste management in the World's Cities. UN-Habitat's Third Global Report on the State of Water and Sanitation in the World's Cities. Earth Scan, Newcastle-upon-Tyne, UK.
16. Sujauddin, M., Huda, S.M.S., and Hoque, A.T.M.R. (2008). Household solid waste characteristics and management in Chittagong, Bangladesh. *Waste Manage*. 28(9), 1688
17. Tadesse, T., Ruijs, A., & Hagos, F. (2008). Household Waste Disposal in Mekele city, Northern Ethiopia. *Waste management* (New York, N.Y.), 28(10), 2003-12.
18. UNEP. (2010). Guidelines for E-Waste Management in Kenya. Ministry of Environment and Mineral Resources, Kenya.
19. United Nations Environment Programme. (2005). Selection, Design and Implementation of Economic Instruments in the Solid Waste Management Sector in Kenya. United Nations Environment Programme, Nairobi. pp. 157-163.
20. Visvanathan, C. & J. Trankler. (2003). Municipal Solid Waste Management in Asia: A Comparative Analysis. Proceedings of Workshop on Sustainable Landfill Management, 3-5 December, 2003, Chennai. pp. 3-15.
21. Visvanathan, C. (2006). Solid Waste Management in Asian Perspectives. Asian Institute of Technology, Bangkok pp. 1-7.
22. Wasswa, J., & Schluep, M., (2008). E-Waste Assessment in Uganda. A situational analysis of e-waste management and generation with special emphasis on personal computers. Uganda Cleaner Production Centre, Kampala Uganda and EMPA Switzerland, UNIDO, Microsoft.
23. World Resource Institute. (1996). the Urban Environment. Oxford University Press. Oxford. pp. 126-135.
24. www.Trading Economics.com/ World Bank (2015), and Statista (2016).





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### RESEARCH ARTICLE

#### RECYCLED POLYPROPYLENE/BOEHMITE ALUMINA NANOCOMPOSITES: ENHANCED STRUCTURE, THERMAL AND MECHANICAL PROPERTIES.

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Recycled polypropylene, Boehmite alumina, Nanocomposites, Morphology, X-ray diffraction, Thermal properties, Mechanical Properties.

#### Abstract

Boehmite alumina (BAL) powder was investigated in terms of its use as a filler in PP in order to improve the inherent properties of recycled polypropylene. Nanocomposites of recycled polypropylene with different loadings of BAL were prepared by melt compounding technique. The structural characterization and morphology of BAL nanopowder were characterized by X-ray diffraction (XRD) and Transmission electron microscope (TEM). The influence of BAL nanoparticle content on the thermal properties of recycled polypropylene (PP) was studied by means of differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA). The effect of the BAL content on the mechanical properties and morphological analyses (SEM) of recycled PP/BAL nanocomposites was also studied. It was found that BAL significantly affected the crystallization temperature and the degree of crystallization of recycled PP. The results showed that the BAL effectively improved the mechanical properties of recycled PP. In comparison with neat PP, the tensile strength of PP/BAL (3 wt%) nanocomposites increased by ~21% and the modulus increased by ~101%. Recycled polypropylene/boehmite alumina nanocomposites have such properties that advise their relevance for application in the packaging industries.

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#### Introduction:-

With the increasing usage of polymers, dwindling petroleum resources and high oil prices, there is the search for alternative virgin polymers. This search will also consider the financial viability of materials rather than produce them from raw materials. Recycling is a viable alternative to reduce the disposal of plastic products which contributes significantly to the negative environmental impact. Among all polymers, polypropylene (PP) is one of the most common plastic materials that is being used in various applications [1]. Therefore, annually, millions of tons

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of PP materials are discarded as wastes and they are required to be recycled in order to reduce plastic waste. However, during the recycling process, polypropylene undergoes various operations that bring out several modifications in the molecular structure. As a result, the mechanical, thermal and melt flow properties of the recycled products and their structural organization are quite different when compared to those composed of virgin material [2]. Several approaches have been made to improve the processability, mechanical and thermal properties of the recycled PP. These include: blending with the other polymers, addition of reinforcing agents, such as: nanofillers, natural fibers and other reinforcing fillers.

Recycled PP has been blended with virgin PP in order to improve its mechanical and thermal properties. Raj et al. reported that a 10% virgin PP was the best combination to improve the mechanical properties of the recycled PP [2]. Sawdust has been used to improve the impact strength of the recycled PP [3]. Recycled PP were also utilized to produce co-composites with kenaf fiber [4]. In addition, secondary fiber (from the paper industry) reinforced recycled polypropylene composites have been successfully processed by extrusion by using 2% maleic anhydride modified polypropylene that acts as an efficient compatibilizer and promotes interfacial adhesion between secondary fiber and recycled polypropylene [5]. Besides that, nano  $\text{CaCO}_3$  filler was also utilized to improve the mechanical and thermal properties of recycled PP [6]. However, for the first time, Boehmite alumina was used as a filler to improve the mechanical and thermal properties of recycled PP. Boehmite alumina (BAL) with chemical composition  $\text{AlO}(\text{OH})$  is an inexpensive nanofiller and it can also be produced synthetically, in particulates form, with different aspect ratios. Boehmite nanocomposites with recycled LDPE has already been reported in a previous study [7].

The main objective of this study is to use low cost boehmite nanofiller as a reinforcing agent in order to improve the properties of the recycled PP, using a melt compounding technique and to investigate the effect of the recycled PP and BAL loadings (ranging from 1 and 5 wt%) in order to get a better dispersion of BAL in the recycled PP matrix. Moreover, the influence of BAL on the structure, thermal and mechanical properties of the recycled PP was investigated in detail by using different techniques.

## **Experimental:-**

### **Materials:-**

The recycled polypropylene was obtained from R.K. Polymers, South Africa. The BAL powder containing 80%  $\text{Al}_2\text{O}_3$  used is a commercial product manufactured by SASOL, under the trade name Disperal 40. With several years of experience, SASOL developed this product that is not only high in dispersibility, but also with significantly low levels of common impurities, such as: iron, sodium and silica.

### **Processing of recycled PP/ Boehmite aluminan nanocomposites:-**

PP/BAL nanocomposites were prepared by using an extruder, equipped with co-rotating twin-screws. The processing temperature was  $165^\circ\text{C}$  and the screw rotation speed of the microextruder was fixed at 100 rpm. After the fixed processing time (2 min) in the micro-extruder, the molten mixture was transferred to a pre-heated micro-injection moulding machine. The injection mould temperature was maintained at  $40^\circ\text{C}$ . Finally, the specimen was conditioned according to ASTM standards, prior to testing. In order to investigate the performance of the nanocomposites, the loading of the BAL in the recycled PP matrix was varied from 1 to 5 wt.%.

### **Mechanical Properties:-**

Tensile testing of the composite specimens was carried out by using a UTM (Universal Testing Machine), Instron 3382 instrument, as per the ASTM D638. For this, rectangular specimens ( $2.54 \times 15$  cm) from each sample were stretched at a cross-head speed of 50 mm/min. Ten replicates were tested for each sample and the average values are presented.

### **Morphology Analysis:-**

The microstructure of the surface of the tensile fractured composites was observed using a Field Emission Scanning Electron Microscopy (FE-SEM) (S-4800, Hitachi Co., Ltd., Matsuda, Japan), operated at an accelerating voltage,  $V_{\text{acc}}$  of 10 kV and a current,  $I_e$  of 10  $\mu\text{A}$  with samples coated in vacuum with sputter of Os. The morphology of BAL was observed using a Transmission electron microscope (TEM) (JEM-2100F, JEOL, Japan).

**Differential Scanning Calorimetry (DSC):-**

The thermal properties of the samples were determined using a DSC 22 System, Seiko Instruments, Inc., Japan. The heating rate used was 10°C/min, in a temperature range of between 30-300°C under nitrogen atmosphere. The percentage crystallinity was determined using the following equation (1).

$$X_c(\% \text{Crystallinity}) = [(\Delta H_m - \Delta H_c) / \Delta H_{m0}] \cdot 100\% \quad \text{----- (1)}$$

where  $\Delta H_m$  is the enthalpy heat of fusion and  $\Delta H_c$  is the heat of cold crystallization (in J/g). The term  $\Delta H_{m0}$  is a reference value and represents the enthalpy heat of melting of an “ideally” 100% crystalline polymer.

**Thermo-gravimetric analysis (TGA):-**

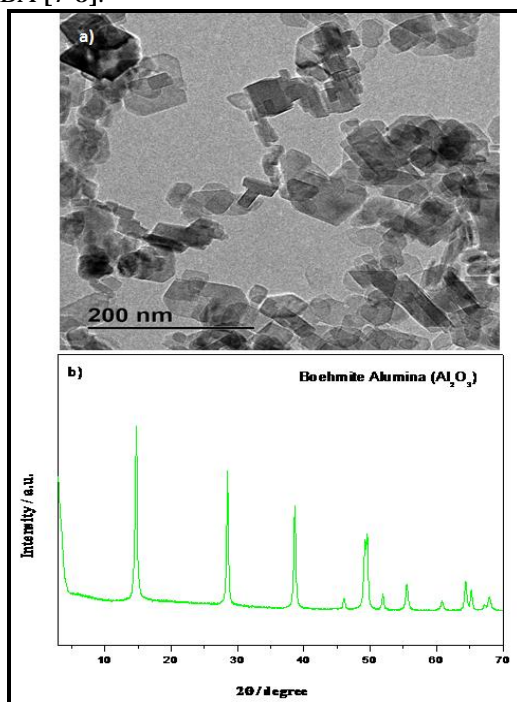
The thermal stability of the recycled PP and recycled PP/nanocomposite samples was determined with a thermogravimetric analyzer (TGA, Mettler Toledo, Schwarzenbach, Switzerland). About 5 mg of each sample was heated from room temperature to 600°C at a heating rate of 10°C/min under a nitrogen flow rate of 50 cm<sup>3</sup>/min.

**X-ray diffraction (XRD):-**

X-ray diffraction (XRD) pattern of the BAL was analyzed by using a PANalytical Xpert pro MRD diffractometer (Amsterdam, Netherlands). The XRD spectra were recorded using a Cu-K $\alpha$  radiation (wavelength of 0.1546 nm) with a nickel monochromator filtering wave at a voltage and current of 40 kV and 30 mA, respectively. The diffraction patterns were obtained at diffraction angles between 5° and 70° at a scanning rate of 0.4°/min at room temperature.

**Results and Discussion:-****TEM and X-ray diffraction analysis of BAL:-**

The morphology of BAL nanopowder are shown in **Fig. 1 (a)**. TEM images of the BAL exhibited some hexagonal, flake and rod-like shapes. It can also be observed that the BAL is slightly aggregated, with some particles clustered to each other. This slight aggregation of nanoparticles may be due to the drying process during the sample preparation. These self-aggregated nanoparticles are expected to be separated during the melt-mixing with the recycled PP. The crystalline structure of BAL nanopowder was observed by doing the XRD analysis. **Fig. 1(b)** shows the XRD pattern of BAL nanopowder. From the X-ray diffractogram of BAL nanopowder, intense peaks (*hkl* plane) at  $2\theta = 14.7^\circ$ ,  $28.5^\circ$ ,  $38.6^\circ$ ,  $49.5^\circ$  and  $55.5^\circ$  were recorded, which indicate the presence of typical orthorhombic crystalline form of BA [7-8].



**Fig. 1:-** (a) TEM micrograph and (b) XRD patterns of BAL nanopowder.

**Tensile properties:-**

The effect of BAL nanofiller content on the tensile properties of the recycled PP matrix is presented in **Table 1**. The mechanical properties of the recycled PP/BAL nanocomposites are significantly changed after blending with the BAL and the properties are influenced by the amount of the BAL nanopowder inclusion. The tensile strength increased from  $18.4 \pm 2.3$  MPa of the neat recycled PP to  $22.3 \pm 1.2$  MPa with 3wt% addition and then decreased with further addition of the BAL nanofiller. However, the strength of the recycled PP nanocomposites (with the highest amount of the BAL) is still higher than that of the neat recycled PP. The increased tensile strength of PP/BAL nanocomposites may be due to the better dispersion of BAL in to the PP matrix.

However, such reinforcing effect of the BAL nanopowder was reduced at high level of BAL additions (3 to 5 wt%). This is probably due to the formation of aggregation of the BAL at higher loading. Above 3 wt% of BAL loading, the interaction between the BAL nanopowder and polymer matrix is due to the non-uniform stress distribution in the composite, which consequently reduced the strength of the recycled PP nanocomposite. The tensile test result suggests that there is an optimum concentration of the BAL nanopowder in order to induce maximum increment of the strength of the recycled PP nanocomposite.

**Table 1:-** Tensile properties of PP and PP/BAL nanocomposites

Composites	TS (MPa)	TM (MPa)	EB (%)
PP	$18.4 \pm 2.3$	$91.8 \pm 40.6$	$522 \pm 121$
PP/BAL1%	$21.3 \pm 1.6$	$157 \pm 10$	$775 \pm 95.2$
PP/BAL2%	$21.1 \pm 1.5$	$161 \pm 18.6$	$748 \pm 72.2$
PP/BAL3%	$22.3 \pm 1.2$	$184 \pm 16.8$	$657 \pm 81.8$
PP/BAL 4%	$21.7 \pm 1.6$	$184.3 \pm 27$	$681 \pm 112$
PP/BAL5%	$20.5 \pm 0.9$	$166 \pm 13$	$719 \pm 59.5$

The tensile modulus (TM) of the recycled PP nanocomposites, which measures the extent or degree of stiffness of a plastic, also increased linearly with increasing concentration of BAL, up to 4 wt%. The stiffness of the recycled PP/BAL nanocomposites increased by 101% more than the neat recycled PP, when 3 and 4 wt% of the BAL were included. Streller et al. reported that the moduli of boehmite alumina reinforced recycled PP nanocomposites are due to the increased stiffness [9]. The elongation-at-break (EB), which measures the flexibility or ductility, of a material also varied, depending on the content of BAL. The pattern of change in the EB of recycled PP/BAL nanocomposites was similar to that of the tensile strength (TS), namely, it increased with increase in the content of BAL up to 5 wt%. The main advantage of the addition of BAL in the recycled PP is that there is no reduction in the EB, even at 5 weight % loading, which was reported by Svoboda et al. for similar nanocomposites [10]. Usually, the decrease in the flexibility of the composite, observed at high concentration of the filler is due to the restricted mobility of polymer strand, caused by the increased stiffness of the recycled PP nanocomposites.

**SEM analysis:-**

The tensile fractured surface of the neat recycled PP (i.e. without addition of nanofiller) and the recycled PP/BAL nanocomposites are presented in **Fig.2**. The fractured surface of the recycled PP shows brittle failure in layered planes. The presence of some cracks and slip lines are also observed. With the addition of BAL nanopowder, the fractured surface of the recycled PP nanocomposites fractured surface topography, changed (**Fig.2. (b), (c)**). **Fig.2 (b) and 2(c)** are the representative SEM micrographs of the tensile fractured surfaces of the recycled PP/BAL nanocomposite samples with 1 and 2 wt.% of nanofiller, respectively.

From **Fig.2 (b), (c)** the presence of rough surfaces and the occurrence of many short, rounded tear lines are highly discernable and the extent of which increases with 2wt% BAL concentration. The filler particles, due to the better polymer-filler interaction and adhesion, act as stress risers and hinder the smooth propagation of the stress paths. As a result, the elastic stored energy and tensile strength were found to be concomitantly improved with nanofiller addition [11].

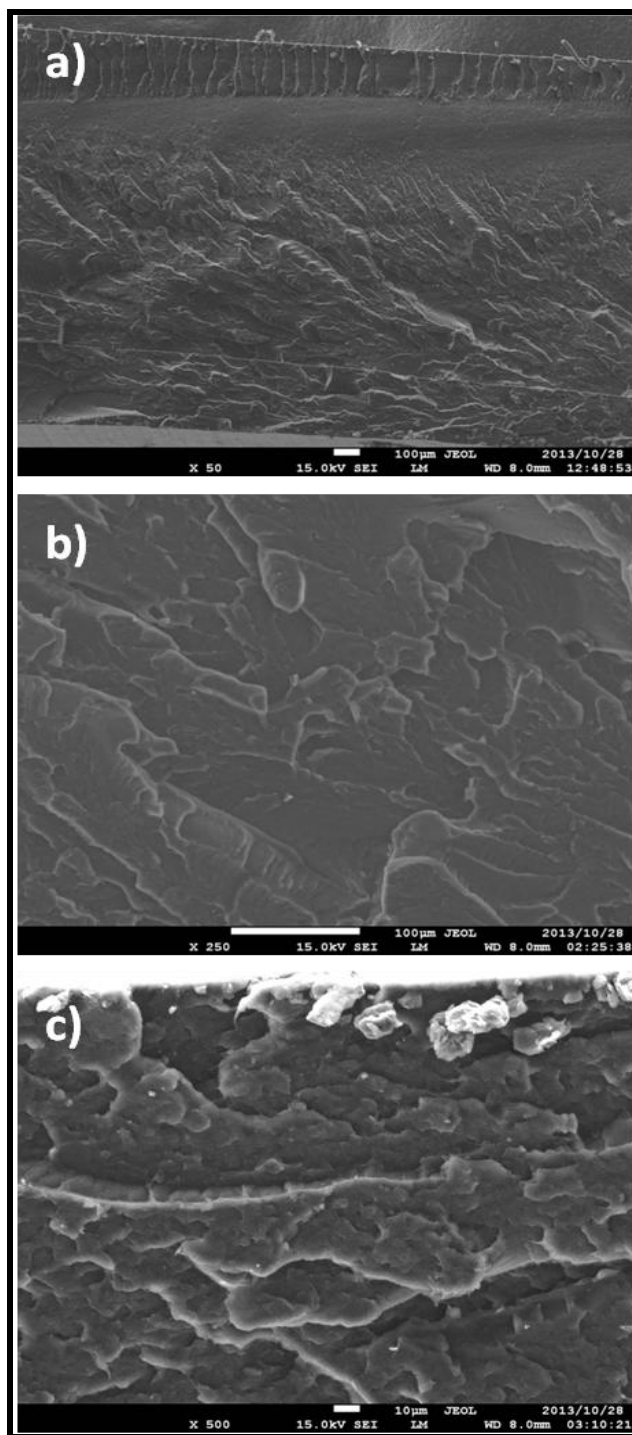


Fig. 2:-SEM micrographs of tensile fractured (a) PP, (b) PP/1% BAL and (c) PP/2% BAL

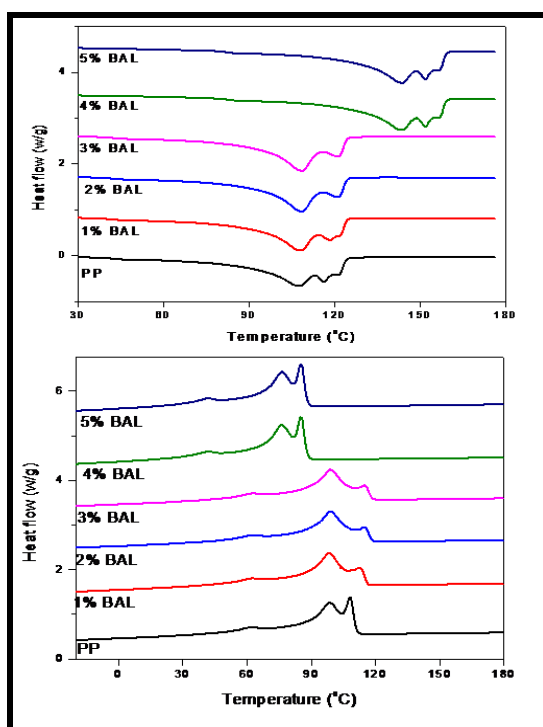
#### DSC Analysis:-

The degree of crystallinity and the change in crystallization temperature of PP and its nanocomposites were analyzed using the DSC. The results of the melting temperature and the percentage crystallinity are presented in Table2.

Composites	$T_m (^{\circ}\text{C})$	$T_c (^{\circ}\text{C})$	$\Delta H_m (\text{w/g})$	$X_c (\%)$
PP	107	98	78.3	41.7
PP/BAL1%	108	98.2	79.6	45.0
PP/BAL2%	108	98.7	84.1	47.8
PP/BAL3%	109	99.3	83.7	45.3
PP/BAL4%	133	76.3	81.1	42.7
PP/BAL5%	132	76.2	82.5	43.6

**Table 2:-**DSC analysis of PP and PP/BAL nanocomposites

The crystallization exotherms and endotherm peaks of PP and PP/BAL nanocomposites at various compositions are presented in **Fig. 3(a) and 3(b)**. From these curves, it can be observed that the melting temperature of PP shifted to higher temperature with increasing BAL contents. High melting exothermic peak was observed in nanocomposites with 4 and 5 with% BAL contents.

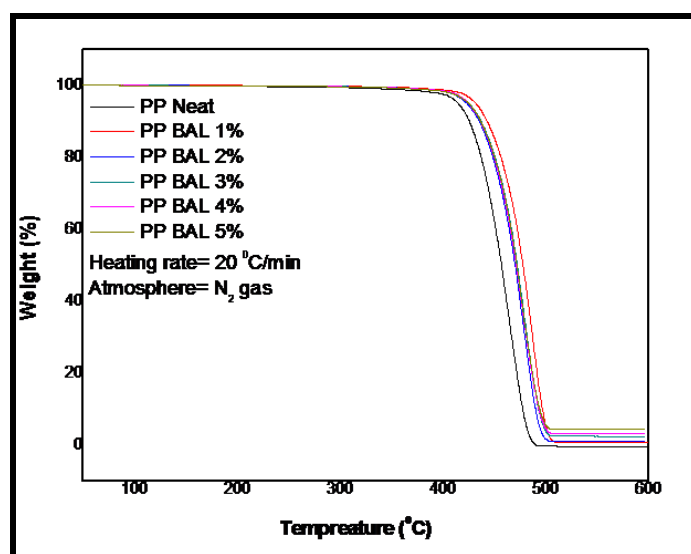


**Fig. 3:-**DSC analysis of PP/BAL nanocomposites

This increase in the melting temperature, clearly supports the crystallinity data. It is well known that highly crystalline samples possess better thermal stability [12]. In the cooling scan (**Fig. 3(b)**), the thermograms of neat recycled PP and recycled PP/BAL nanocomposites, show a peak of melt crystallization temperature ( $T_c$ ). The thermogram of the recycled PP/BAL nanocomposite shows similar trend as neat recycled PP, but the  $T_{cs}$  of the composites are higher than that of neat recycled PP. The degree of crystallinity of recycled PP/BAL nanocomposites is higher than the neat recycled PP. From the above results the exothermal or endothermal observations confirmed that the recycled PP nanocomposites possess high degree of crystallinity. This can be attributed to the nucleating effect of BAL nanopowder on the crystallization of recycled PP [13].

**TGA analysis:-**

Thermal stability of the recycled PP and recycled PP/BAL nanocomposites was analyzed using TGA and the results are shown in **Fig.4**. The thermal degradation parameters, obtained from the TGA thermograms, are also summarized in **Table 3**. As observed in the thermograms, the weights of the samples decreased with increasing temperature, indicating the thermal destruction of the recycled PP samples. The onset of major thermal degradation temperature of the recycled PP/1 wt% BAL nanocomposite (431°C) was higher than the neat PP (414°C), which indicates that the recycled PP nanocomposite is more thermally stable than that of neat recycled PP. This was observed for all the content of BAL nanopowder reinforced recycled PP composites. The increased thermal stability of the recycled PP nanocomposites can be attributed to the higher degree of crystallinity of BAL reinforced recycled PP nanocomposites [14]. Similar behavior was observed as the  $T_{max}$  of all recycled PP nanocomposites are significantly higher than the neat recycled PP, which indicates that the PP/BAL composites are thermally stable at higher temperature.



**Fig. 4:-** TGA analysis of PP/BAL nanocomposites

At the end of the degradation of the recycled PP, it had a 0.25% char content and the char residue increased with increasing BAL content. The highest amount of charred residue formed (ca. 4%) is due to the limited transformation to a thermally stable charred material of the reactive species, during decomposition.

**Table 3:-** Thermogravimetric analysis of PP/BAL nanocomposites

Composites	$T_{onset}$ , (°C)	$T_{max}$ , (°C)	Char at 0.0°C, (%)
PP	414	456	0.25
PP/BAL1%	431	477	0.82
PP/BAL2%	422	470	1.05
PP/BAL3%	424	471	2.5
PP/BAL 4%	423	471	3.25
PP/BAL5%	424	471	4.4

**Conclusion:-**

Recycled PP/BAL nanocomposites with different filler contents have been developed. The effect of BAL on the morphology, mechanical and thermal properties of the composites has been studied. The nano filler increased the stiffness of the recycled PP matrix, leading to the enhancement in the mechanical properties of the composites. The results of TGA and DSC experiments indicated that the addition of filler enhanced the thermal stability of the recycled PP nanocomposites. In addition, it was found that BAL significantly affected the crystallization temperature and the degree of crystallization of the recycled PP. The morphology, evaluated using the scanning electron microscopy (SEM), indicated that a uniform dispersion of BAL in the PP matrix was obtained.

**References:-**

1. **Hisham A. Maddah. (2016)**, “Polypropylene as a Promising Plastic: A Review”, American Journal of Polymer Science, vol. 6,1-11.
2. **G. Guerrica-Echevarria, J. I. Eguizaibal and J.Nazaibal (1996)**,” Effects of reprocessing conditionson the properties of unfilledandtalc-filled polypropylene” Polymer Degradation and Stability, vol.53, 1-8.
3. **LI, T. Q., C. N. Ng, R, and R. K. Y. LI. (2001)**, “Impact Behavior of Sawdust/Recycled-PP, Composites”, Journal of Applied Polymer Science, vol.81(6), 1420–1428.
4. **Srebrenkoska, V.,G. B. Gaceva, M Avella, E. E. Maria, and G. Gennaro. (2009)**, “Utilization of Recycled Polypropylene for Production of Eco-Composites” Polymer-Plastics Technology and Engineering, Vol. 48(11), 1113–1120.
5. **Dibyaranjan M, and P. Sanjay. (2012)**. “Secondary Fiber/Recycled Polypropylene Composites” Asian Journal of Research in Chemistry,vol. 5(5), 655-659.
6. **Fuad, M. Y. A., H. Hanim, R. Zarina, Z. A. M. Ishak, and A. Hassan.(2010)**, “Nanofillersimprove themechanical properties ofrecycled polypropylene. Polypropylene/calcium carbonate nanocomposites–effects of processing techniques and maleated polypropylenecompatibiliser”, eXPRESS Polymer Letters, vol.4(10), 611–620.
7. **Pedrazzoli, D., R. Ceccato, J. Karger-Kocsis, and A. Pegoretti. (2013)**, “Viscoelastic behaviour and fracture toughness oflinear-low-density polyethylene reinforced with syntheticboehmiten alumina nanoparticles” eXPRESS Polymer Letters, vol. 7(8), 652–666.
8. **Santos, P. S., A. C. V. Coelho, H. S. Santos, and P. K. Kiyohara. (2009)**, “Hydrothermal Synthesis of Well-CrystallisedBoehmite Crystals of Various Shapes”, Materials Research. 12(4), 437-445.
9. **Streller, R. C., R. Thomann, O. Torno, and R. Mülhaupt.(2008)**, “Isotactic poly(propylene) nanocomposites based upon boehmitenanofillers”, Macromolecular Materials and Engineering, vol. 293(3),218-227.
10. **Petr, S., K. Trivedi, D. Svobodova, P. Mokrejs, and K. Kolomaznik.(2012)**, “Effect of Initial Melting Temperature on Crystallization of Polypropylene/OrganoclayNanocomposites” Macromolecular Research, vol. 20(7), 659-666.
11. **Modesti,M., A. Lorenzetti, D. Bon, and S. Besco.(2005)**, “Effect of processing conditions on morphology and mechanical properties of compatibilized polypropylene nanocomposites”, Polymer, vol. 46(23), 10237-10245.
12. **Patnaik,K.S.K. R., K. S. Devi, and V. K. Kumar.(2010)**, “Non-isothermal Crystallization Kinetics of Polypropylene (PP) and Polypropylene (PP)/Talc Nanocomposite”, InternationalJournal of Chemical Engineering and Applications, vol.1(4), 346-353.
13. **Maiti, P., P. H. Nam, and M. Okamoto.(2002)**, “Influence of Crystallization on Intercalation, Morphology andMechanical Properties of Polypropylene/Clay Nanocomposites”, Macromolecules,vol. 35(6), 2042-2049.
14. **M. G. Salemane, and A. S. Luyt.(2006)**, “Thermal and Mechanical Properties ofPolypropylene-Wood Powder Composites”, Journal of Applied Polymer Science, vol. 100 (5), 4173-4180.



### RESEARCH ARTICLE

## THE INTERSTATE (ASSAM AND GUJARAT) DIFFERENCES IN THE ENVIRONMENTALLY ADJUSTED GSDP

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Environmental Accounting, degradation, Sustainable development, GSDP.

### Abstract

Environmental issues play a major role in the economic development of a country. It is an indispensable component for bringing about sustainable development. Environmental accounting refers to the compilation of data relating to the environment and natural resources into an accounting framework.

The objective of the study is to address the issues of environmental accounting for oil and gas resources in India and particularly for the states of Assam and Gujarat.

The present study is both analytical and empirical in its framework. It is based on select states of India, namely, Assam and Gujarat. According to literature on environmental accounting, the current national income measures did not provide adequate indicators of sustainable development of natural resources, as they exclude depletion and degradation of exhaustible resources.

As the conventional national accounts neglects depletion and degradation of natural resources, it is necessary to devise an analytical framework to assess the present situation in relation to the need for developing a practical approach which will establish a clear understanding of the relationship about Gross State Domestic Product (GSDP). The empirical analysis is based on the market valuation methods like Net Price Method and User Cost Method. These two methods are used to measure the economic value of natural capital depletion in the petroleum sector.

In this study the state level accounts are adjusted by compiling physical and monetary accounts for oil and gas resources and these accounts are then incorporated in GSDP.

The analysis presented in the study highlights the interstate (Assam and Gujarat) differences in the Environmentally Adjusted GSDP. The sensitivity of the estimated value to the choice of the methodology used (Net Price and User Cost) is also highlighted. The adoption of basic elements of green accounting will portray sustainability of resources in these states.

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### Introduction:-

Environmental aspects are gaining importance in the political and economic agenda of developing countries. Apart from this environmental degradation seriously threatens economic and social progress. Environmental accounts

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capture the interaction between environment and economy and also serve as a better measure for sustainable development of an economy.

Gross Domestic Product (GDP) is a national accounting term that accounts for the domestic output measured in value terms minus costs associated with input of goods and services. Thus GDP measures the value added of production, a value added that is available for payment of use of input factors like capital and labour. Environmental accounting takes care of the draw backs of conventional accounting. The correction helps to take into account the depletion of non-renewable resources, as well as various damages to the environment due to pollution to air, water and soil and also sometimes loss of eco system services due to pollution from economic activities.

Environmental accounting is an attempt to include measures of the depletion of important natural resources in the national income accounts to provide better measures of long sustainable development (Foy 1991)<sup>1</sup>. Thus environmental accounting, by working towards valuing depletion and degradation can help to prioritise the relative importance of environmental issues.

#### **Objective:-**

The main objective of this study is to analyse physical and monetary accounts for the mineral resources (Oil and Natural Gas) for Assam and Gujarat and to calculate Environmentally Adjusted GDP (GSDP).

#### **Methodology:-**

This study examines the natural capital depletion in India from 1991-2007. Market valuation method are used to measure the economic value of natural capital depletion in petroleum sector in Assam and Gujarat. Assam and Gujarat were specifically chosen because there is a higher probability of discovery of reserves of oil and gas in these states. The User Cost Method proposed by El Serafy (1989)<sup>2</sup> is followed in the estimation of natural asset depletion of oil and gas resources in India. The following formula is used to calculate the user-cost:

If R is the annual net revenues from the sales of the resource, assumed to be constant over its lifetime (of n years), a “true income” element X can be calculated such that

$R - X$  represents a “capital” element whose accumulated investment at an interest rate r during the n years would create a permanent income stream of income of X (per annum). X is calculated as  $X = R \left[ 1 - 1/(1+r)^{n+1} \right]$  and the user cost  $R - X = R/(1+r)^{n+1}$

i.e. the discounted (last) net revenue.

It is noticed that the user-cost method acts as a special case of defining depreciation as the change in the discounted value of a resource, e.g. over one year of exploitation, assuming that the yearly net returns are the same for the remaining life of the resource.

#### **Sources of Data:-**

Data used for reserves were collected from the compiled reports of the Ministry of Petroleum and Natural Gas (MoPNG)<sup>3</sup>. For Physical account, information about extraction of oil and Natural Gas is publicly available from Annual reports of the Ministry of Petroleum and Natural Gas. National Accounts Statistics<sup>4</sup>, an annual publication with time series data since 1988 -2008(CSO, 2008)

#### **Review of Literature:-**

Repetto et al. (1989)<sup>5</sup>, one of the best known natural resource accounting studies is the pioneering exercise by the World Resource Institute for Indonesia. They considered the changes in the stocks of natural resources (oil, forests and soil) in the capital and flow accounts. The valuation principle assumed for oil and forests (timber) is the net price method: rents are determined by the international resource commodity price less all factor costs incurred in extraction. This implies that domestic and international markets for these resources are assumed to be perfect, and optimal paths of extraction follow Hotelling Rule.

Vincent, et.al (1997)<sup>6</sup> examined the empirical significance of capital gains for petroleum depletion in Indonesia. The study covered the period 1971-1984 and included three resources, petroleum, timber and agricultural soils. For the calculation of economic depreciation of the resources, the study considered marginal cost. It assumed a discount rate of 12.5%. The results revealed that the capital gains associated with the rise in prices are much smaller than the

Hotelling rent estimates. It is understood that Indonesia has to invest more than the Hotelling rent due to the rise in price of oil.

European Commission (2000)<sup>7</sup> presented the framework for the subsoil asset accounts for several countries and was developed by the Euro Stat Task Force on Subsoil Assets, and has been tested in pilot studies in several countries. The numerical results and methodological findings of the pilot studies are documented. The subsoil accounts consist of balance sheets for oil and gas in physical and monetary terms, and parts of the production and capital accounts of the oil and gas extraction industry, as well as an estimate of the resource rent from extraction. They presented the physical balance sheets, which show stocks and changes in stocks of oil and gas in physical terms.

The main results of the study are as follows:

- U-15 proven subsoil reserves of oil can be estimated at 1 billion tones and the proven reserves of gas at 3.1 trillion standard cubic meters at the end of 1999. E
- With the inclusion of Norway has brought the proven reserves of oil in the European Economic Area (EEA) to 2.4 billion tones and the reserves of gas to 4.3 trillion Sm<sup>3</sup>. This is around 1.7% of the world's proven reserves of oil and 3.0% of the gas reserves. EU-15 has discovered reserves of oil, which include proven reserves as well as other discovered W
- Reserves with a lower probability of being produced can be estimated at 1.5 billion tones in 1999, i.e. around 50% higher than the proven reserves. EEA also discovered that oil reserves were about 4.1 billion tones. The reserves of gas are estimated at 7.7 trillion standard cubic meters in 1999, with 3.9 trillion standard cubic meters for the EU-15. R

Cairns (2008)<sup>8</sup> argued that income is flow of value to society; therefore, an economic modeler's choice of concept of value imposes a concept of income. The argument is used to distinguish three concepts of national income.

- In a discounted utilitarian model, which is usually the basis for theoretic discussion of net national income, the formulation of value imposes a concept of income that is not observable and hence does not provide income statistics. I
- In a perfectly competitive economy, national income is, in principle observable. Study of competitive model provides a theoretical foundation for national accounting, with extension to distorted economies. However, two unobservable components of ideal income, consumer surplus and capital gains are neglected. I

Cairns (2009)<sup>9</sup> provided an economic analysis of oil extraction. This paper summarises the findings of conventional macroeconomic modeling, the Hotelling analysis of the extraction of and green accounting for non renewable resources such as petroleum. The study reveals that the paths of shadow prices through time are determined by adjoint conditions. The adjoint condition for resources is known as Hotelling's rule, and hence per unit depreciation rises as the rate of interest changes. The study also shows that as the oil is depleted, the pressure and consequently quantity produced declines. Further, importance is given to increase in investment in oil industry.

Atkinson and H. Gundimeda (2006)<sup>10</sup> accounted for forest wealth in India. Changes in the timber and carbon wealth embodied in these forests are related to important green national accounting aggregates such as genuine saving and the change in wealth per capita. They found that, the annual losses due to release of carbon due to forest fires and loss in timber is 0.04% and 0.08% of GNP in India. Though the area subject to logging is less it translates into higher timber and carbon values. The contribution of forests due to harvesting timber contributes to 2.5% of GNP. However, the corresponding carbon loss due to usage of forests for timber and fuel wood is 0.53% of GNP.

Haripriya et al (2007)<sup>11</sup> estimated the value of educational capital formation in India by using a combination of the education stock based approach and the income and cost based approaches. The study focused only on the individuals in employment. The study found that, in all India level, the value of human capital formation is 5.1 times higher than the given fixed capital formation. The investment in education yields returns in the form of human capital, which is positive for all states.

**Empirical Estimation:-**

For empirical analysis was based on Physical Account, Monetary Account and Environmentally Adjusted GSDP. Physical Account is basically a summary of the reserves and changes of natural resources during a period of time, in physical units.

**Physical Account:-**

Physical Account shows an equation stating that opening stock plus growth and other additional reserves minus depletion equals closing stock.

**Monetary Account:-**

Monetary Account is derived by the application of monetary unit values, either market prices or estimated/ imputed values, to the Physical Accounts. This account can be obtained by multiplying each unit of commodity in the physical account by its economic rent. This is explained in Table No1 and 2.

**Table No:-1** Monetary Asset Accounts for Assam using Net Price Method.

Year	Opening stock Rs Cr	Addition Rs Cr	Depletion Rs Cr	Net change Rs Cr	Closing stock Rs Cr
	1	2	3	4	5
1997	14218.04	2883.34	3011.87	-128.53	14089.51
1998	14089.51	25.1	3640.37	-3615.27	10474.24
1999	10474.24	4433.92	4555.39	-121.47	10352.76
2000	10352.76	1192.81	6185.98	-4993.17	5359.59
2001	5359.59	121331.1	9483.29	111848	117207.4
2002	117207.4	92487.74	11045.82	81441.9	198649.3
2003	198649.3	23726.79	12836.89	10889.9	209539.2
2004	209539.2	2496.41	15076.77	-12580.4	196958.9
2005	196958.9	1207.87	17948.52	-16740.7	180218.2
2006	180218.2	9502.39	21872.37	-12370	167848.2
2007	167848.2	0	34415.71	-34415.7	133432.5

Source: The data for column1, 2&3 are obtained by multiplying the physical assets by the average of net price. Column 4 is obtained by subtracting column 3 from 2. Column 5 is calculated by [(1+2)-3].

The table1 indicates the Monetary Asset Account for Assam using net price method. It shows that the opening stock in 1997 was Rs.14218.04 Cr and it has increased to Rs. 1, 67,848.2 Cr in 2007, whereas the closing stock was Rs.14089.51 Cr in 1997 and increased to Rs.1,33, 432.5 Cr in 2007, but it was almost 20.5% less than that in 2006.

**Table No: 2:-** Monetary Asset Accounts for Gujarat using Net Price Method.

Year	Opening stock Rs Cr	Addition Rs Cr	Depletion Rs Cr	Net change Rs Cr	Closing stock Rs Cr
	1	2	3	4	5
1997	12081.48	407.01	3705.93	-3298.93	8782.45
1998	8782.46	0	4418.66	-4418.66	4363.79
1999	4363.79	1925.41	5266.04	-3340.63	1023.16
2000	1023.17	9718.19	8053.8	1664.39	2687.56
2001	2687.56	98986.58	11034.65	87951.92	90639.48
2002	90639.59	72863.18	12587.75	60275.43	150914.92
2003	150914.91	38263.17	15328.37	22934.84	173849.73
2004	173849.74	2634.01	18359.46	-15725.46	158124.36
2005	158124.39	1970.73	20194.74	-18224.53	139900.34
2006	139900.36	29238.13	27270.17	1967.95	141868.28
2007	141868.28	0	40357.05	-40357.24	101511.27

Source: The data for column1, 2&3 are obtained by multiplying the physical assets by the average of net price. Column 4 is obtained by subtracting column 3 from 2.

Column 5 is calculated by  $[(1+2)-3]$ .

Table 2 reveals the Monetary Asset Account of Gujarat for the period 1997-2007. It shows that the opening stock in 1997 was Rs. 12081.48 Cr and in 2007 it was Rs. 1, 41,868.28 Cr. In case of the closing stock, it was Rs8782.45. Cr in 1997 and increased to Rs.1, 01,511. 27 Cr in 2007, which was almost 28.4% less than that in 2006.

#### Calculation of Environmentally Adjusted GSDP:-

The current focus of research on integrating environment into national account is primarily concentrated on adjusting GDP. The United Nations has developed a framework for calculating an Environmentally Adjusted GDP (EGDP). Natural resource accounting provides a measure of environment degradation and resource depletion, which are used to adjust the conventional GDP. This study considers only User Cost approach to calculate oil and gas adjusted national accounts.

**Table No: 3:- Adjusted GSDP based on User Cost Method for Assam**

Year	GS DP Rs Cr	UC Rs Cr	Adjusted GSDP Rs Cr	UC as % GSDP	Growth Rate	
					GSDP %	Adj GSDP %
	1	2	3	4	5	6
1997	29353.74	644.83	28708.91	2.19	2.35	2.65
1998	30273.85	825.12	29448.74	2.72	3.13	2.57
1999	34205.13	1085.4	33119.75	3.17	12.98	12.46
2000	38277.02	1041.9	37235.08	2.72	11.9	12.42
2001	38034.68	2508.7	35525.94	6.59	-0.63	-4.59
2002	39957.93	1777.4	38180.56	4.44	5.05	7.47
2003	42428.03	1323.9	41104.1	3.12	6.18	7.65
2004	42833.65	1502.1	41331.53	3.5	0.95	0.55
2005	53397.72	2441.7	50956.05	4.57	24.66	23.28
2006	52886.55	2007.8	50878.73	3.79	-0.95	-0.15
2007	50164.15	3433.2	46730.92	6.84	-5.14	-8.15

Source: Data for column 1 are taken from National Accounts statistics (2008)<sup>4</sup>.

Data for Column 2 is calculated using the same procedure done for user cost calculation for India.

Column 3 is the difference between column 1 & 2.

Column 4 is derived by dividing column 2 by column 1.

Column 5 is derived by  $NNP \text{ of (current year minus previous year) divided by previous year} \times 100$ .

Column 6 is by applying Adj NNP of (current year minus previous year) divided by previous year  $\times 100$ .

**Table No :- 4 Adjusted GSDP based on User Cost Method for Gujarat**

Year	GSDP Rs Cr	UC Rs Cr	Adj GSDP Rs Cr	UC as % of GSDP	Growth Rate	
					GSDP %	Adj GSDP %
	1	2	3	4	4	6
1997	112918	1218.1	111700	1.079	11.14	11.41
1998	122893	1560.3	121333	1.27	8.83	8.624
1999	129198	1847.7	127351	1.43	5.13	4.96
2000	141910	2407.8	139502	1.697	9.83	9.542
2001	134602	4239	130363	3.149	-5.15	-6.551
2002	143759	3384.2	140375	2.354	6.8	7.68
2003	159695	3229.7	156465	2.022	11.08	11.46
2004	178872	3763.7	175108	2.104	12.01	11.92
2005	189118	4754.9	184363	2.514	5.72	5.286
2006	210517	5240.2	205277	2.489	11.32	11.34
2007	228714	7487.6	221227	3.274	8.64	7.77

Source: Data for column 1 are taken from National Accounts statistics (2008).

Data for Column 2 is calculated using the same procedure done for user cost calculation for India.

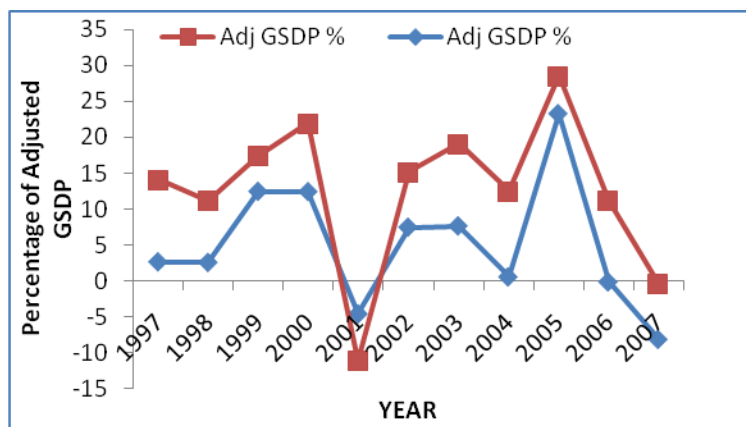
Column 3 is the difference between column 1 & 2.

Column 4 is derived by dividing column 2 by column 1.

Column 5 is derived by  $\text{NNP of (current year minus previous year) divided by previous year} \times 100$ .

Column 6 is by applying Adj NNP of (current year minus previous year) divided by previous year  $\times 100$ .

The Adjusted GSDP in Assam was 12.42% in 2000 and became negative i.e. -8.15 % in 2007 whereas in Gujarat it was 9.54% in 2000 and declined marginally to 7.77% in 2007



From the figure 1, it is clear that, the user cost approach yielded fluctuating values. When we compare the adjusted values of the two states, we find that though the Assam's Adjusted GSDP was less than that of Gujarat, the fluctuations in the growth rate of Adjusted GSDP was less erratic in Assam than in Gujarat.

### Findings:-

- Due to changes in the Exploration Policy of the Government in 1997 and public and private participation in the petroleum industry, the discovery of both oil and gas resources in various states had started increasing. As a result, the stock of the known reserves in India and the states of Assam and Gujarat also showed an increasing trend.
- The Monetary Asset Account for Assam using net price method. It shows that the opening stock in 1997 was Rs.14218.04 Cr and it has increased to Rs. 1, 67,848. 2 Cr in 2007, whereas the closing stock was Rs.14089.51 Cr in 1997 and increased to Rs.1,33,432.5 Cr in 2007, but it was almost 20.5% less than that in 2006.
- The Monetary Asset Account of Gujarat for the period 1997-2007. It shows that the opening stock in 1997 was Rs. 12081.48 Cr and in 2007 it was Rs. 1, 41,868.28 Cr. In case of the closing stock, it was Rs8782.45. Cr in 1997 and increased to Rs.1, 01,511. 27 Cr in 2007, which was almost 28.4% less than that in 2006.
- In the case of Assam the stock of reserves reached its peak level at 343.2 MMT in 2004. From 2004 onwards, the stock of the reserves started to decrease closing at a level of 316.68 MMT. In terms of extraction, the highest level was recorded in 2005 and the lowest in 2000. With respect to Gujarat, the opening stock of oil and natural gas was estimated at 279.80 MMT in 2004 and in 2007 it was declined to 263.90 MMT.
- At the end of the accounting period Gujarat's GSDP has increased more than that of Assam. In 2007 the Adjusted GSDP value of Assam is Rs. 46,730.92 Cr when compared to Rs. 2, 21, 226.50 Cr for Gujarat.
- The user cost approach yielded fluctuating values. When we compare the adjusted values of the two states, we find that though the Assam's Adjusted GSDP was less than that of Gujarat, the fluctuations in the growth rate of Adjusted GSDP was less erratic in Assam than in Gujarat.

### Summary and Conclusion:-

The aim of the present study is to explore the importance of oil and gas resources for the states of Assam and Gujarat by calculating environmentally adjusted output. In Gujarat, a large number of private sector firms have entered into exploration activities. This also increases the probability of discovery of reserves.

In the case of Assam the stock of reserves reached its peak level at 343.2 MMT in 2004. From 2004 onwards, the stock of the reserves started to decrease closing at a level of 316.68 MMT. In terms of extraction, the highest level was recorded in 2005 and the lowest in 2000.

Though there are difficulty in the measurement of natural resources on monetary basis, countries should introduce long term policies and plan to bring about sustainable development. Further, by adopting these methods of calculating natural resource depletion, it is felt that user cost method indicates a value for natural capital depletion twice that was found using the depreciation method. This result as claimed by many economists show that the depreciation Method places a high value on resource discoveries, allowing the anomalous situation where by the net output exceeds gross output.

### References:-

1. Foy E (1991), 'Accounting for Non-renewable Natural Resources in Louisiana's Gross State Product', *Ecological Economics* Vol.3, 25-41.
2. El Serafy S and E Lutz, (1989), 'Environmental and Resource Accounting: An overview', in: Y Ahmad, S. El Serafy and E. Lutz, (eds.) *Environmental Accounting for Sustainable Development* World Bank, Washington, DC.
3. Government of India (1988-2008), Annual Reports of Ministry of Petroleum and Natural Gas.
4. National Accounts Statistics , Central Statistical Organization (2006), National Account Statistics: CSO, Govt of India, New Delhi:
5. Repetto R. (1989), 'Balance-Sheet Erosion: How to Account for the Loss of Natural Resources', *International Environmental Affairs*, Vol.1, 103-137
6. Vincent J., T Panayotou, and J., Hartwick, J., (1997), 'Resource Depletion and Sustainability in Small Open Economies,' *Journal of Environmental Economics and Management* Vol.33, 274-86.
7. Hotelling H. (1931), 'The Economics of Exhaustible Resources' *Journal of Political Economy* Vol.39, 135-179.
8. European Commission (2000), 'Accounts for Subsoil Assets- Results of Pilot Studies in European Countries'. European Communities. Luxembourg.
9. Cairns (2008)<sup>9</sup>, 'Value and Income', *Ecological Economics* Vol.66, 417-424.
10. Cairns (2009)<sup>10</sup>, 'Green Accounting for Black Gold,' *The Energy Journal* Vol. 30(4), 113-139
11. Atkinson and H. Gundimeda (2006)<sup>11</sup>, 'Accounting for India's Forest Wealth' *Ecological Economics*. Vol. 59, 462 – 476.
12. Haripriya G. S., P. Sukhdev, R. K. Sinha and S. Sanyal (2007), 'Natural Resource Accounting for Indian States: Illustrating the Case of Forest Resources', *Ecological Economics* Vol. 61, 635-649.
13. Government of India, (2004). 'Draft National Environmental Policy', Ministry of Environment and Forests, New Delhi.



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### RESEARCH ARTICLE

## PSYCHOLOGICAL STRESS AMONG UNDERGRADUATE MEDICAL STUDENTS OF SAUDI ARABIA: A CROSS SECTIONAL SURVEY

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### Abstract

**Background:** Psychological stress can negatively affect learning and performance of medical students. Medical studies are considered intrinsically more stressful than many other disciplines. This study was conducted to investigate stress among undergraduate medical students of Saudi Arabia, and to compare stress between pre-clinical and clinical students, and to compare stress between male and female students.

**Methods:** This cross-sectional survey was conducted in December 2016 among medical students by using a self-administered questionnaire. The data were entered and analyzed using IBM-SPSS-20. The data were summarized and analyzed by frequencies, percentages, means, standard deviation and Chi-square test.

**Results:** A total of 119 participants (54.6% males, 45.4% females) with mean age of  $21.8 \pm 2.1$  years participated in this study. Severe and moderate stress was present among 78% and 20% of the participants, respectively. Prevalence of stress was high in all the medical students irrespective of whether they were in pre-clinical or clinical years of study; there was no statistically significant difference between them. Majority (77%) of the male students had severe stress as compared to 79.6% of the female students; there was no statistically significant difference between them.

**Conclusions:** Most of the medical students of Saudi Arabia perceive their studies and training as either moderately or severely stressful. The risk of stress was high among most of the participants irrespective of their gender, and pre-clinical or clinical years of study during MBBS. It is recommended that stress management courses should be included in the curriculum of undergraduate medical students.

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### Introduction:-

Stress can be defined as any challenge to homeostasis or to our body's ability to keep the internal environment constant (Bansal and Bhav, 2006). In psychology, stress can be defined as a feeling of strain and pressure. Stress is body's non-specific response to demands or to any disturbance in the environment. It is a process which enables us

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to perceive and cope with challenges or threats (Al-Dubai *et al.*, 2011). Stress can be good or bad. 'Good stress' is called as eustress. Eustress is a form of stress in which a person perceives a stressor as positive; it motivates and inspires the person to continue working. 'Bad stress' is called as distress and it is a negative form of stress which demotivates a person. Distress occurs when a person perceives that his capabilities or resources are less than the demands; stressors create tension and there is no fun in the challenge while a person is distressed (Le Fevre *et al.*, 2006).

Too much stress can affect physical and psychological health of individuals (Folkman, 1984). Perceived stress can create emotional instabilities leading to relationship problems, sleep disturbance, low self-esteem, anxiety, depression, drug addiction, and suicidal tendencies (Shapiro *et al.*, 2000; Moffat *et al.*, 2004; Stecker, 2004; Yousafzai *et al.*, 2009). Stress may also decrease the learning abilities and academic performance of students. Moreover, it can adversely affect the ability of doctors to provide high quality care (Firth-Cozens, 2003).

Tertiary medical education is regarded generally as being highly stressful. It has been observed that medical students and resident doctors experience more stress than students of other disciplines (Stewart *et al.*, 1999; Aktekin *et al.*, 2001; Dyrbye *et al.*, 2006). Medical students are prone to stress development due to vastness of their curriculum, length and depth of their courses, inadequate leisure time, lack of holidays, financial burden and career choices (Stecker, 2004; Yousafzai *et al.*, 2009; Waghachavare *et al.*, 2013; Oboko *et al.*, 2015). Some studies suggest that medical students are most prone to stress in their 1<sup>st</sup> year of study due to tremendous change in their lifestyle (Stewart *et al.*, 1999; Dyrbye *et al.*, 2006). Another study suggests that medical students are at risk of stress during transition from pre-clinical years to clinical training (Oboko *et al.*, 2015).

There seems to be limited information in Saudi Arabia relating to this important global issue, especially on comparison of stress between male and female students, and between pre-clinical and clinical students. Therefore, this study was conducted to: a) assess the degree of stress among undergraduate medical students of Saudi Arabia, b) compare stress between medical students of pre-clinical years and clinical years, and c) compare stress between male and female medical students.

### Methodology:-

This cross-sectional survey was conducted in December 2016 among medical students enrolled in various medical colleges of Saudi Arabia. The participants were male and female medical students aged  $\geq 18$  years studying in various years of MBBS from year 1 through year 6. A self-administered online questionnaire was created using Google Forms. The questionnaire had two sections; section 1 contained information on demographic characteristics of the participants while section 2 contained 25 standard questions to assess psychological stress. Section 2 of the questionnaire was taken from the website of International Stress Management Association-UK (ISMA, 2013).

Information on participants' age, gender and year of study were obtained. Medical students in years 1-3 and 4-6 of MBBS were considered doing their pre-clinical and clinical studies, respectively. Each participant was supposed to answer each of the 25 questions as 'Yes' or 'No'. 'Yes' carried 1 score and 'No' carried 0 score. Scores of all the 25 questions answered by a participant were added up. A participant with total score of 0-4 was supposed to have *least risk* of stress. A total score of 5-13 meant that the participant was *more likely* (moderate risk) to suffer from stress and stress-related illness. Stress score  $\geq 14$  meant that the participant is *most prone* (severe risk) to stress and stress-related illness.

All the participants were informed about the nature and scope of the study before their voluntary participation. To ensure anonymity, no questions about the name of the institution or the name of student were included in the questionnaire. We assured confidentiality of all the data. Moreover, we ensured to fulfill the ethical considerations in line with Helsinki Declaration.

The data were double entered and analyzed by using IBM Statistical Package for Social Sciences (SPSS) version 20. The data were cross checked to ensure accuracy. The data were summarized and analyzed by frequencies, percentages, means, standard deviation and Chi-square test. A *p*-value of  $\leq 0.05$  was considered statistically significant.



**Results:-**

A total of 119 participants (54.6% males, 45.4% females) with age of  $21.8 \pm 2.1$  (18-28) years participated in this study. More than half (61.3%) of the participants were students of pre-clinical (1-3) years and the rest (38.7%) were students of clinical (4-6) years (Table 1).

**Table 1:-**Demographic characteristics of the participants (n = 119)

Demographic characteristics	Frequency (%)
Age: Mean $\pm$ SD (Range)	21.8 $\pm$ 2.1 (18-28) years
Gender	
Male	65 (54.6)
Female	54 (45.4)
Year of study during MBBS	
1	23 (19.3)
2	24 (20.2)
3	26 (21.8)
4	12 (10.1)
5	9 (7.6)
6	25 (21.0)
Pre-clinical or clinical students	
Students of pre-clinical (1-3) years	73 (61.3)
Students of clinical (4-6) years	46 (38.7)

Cumulative responses of the participants to each question of the stress questionnaire are given in Table 2. Except questions 18, 20, 21 and 24, participants have predominantly reported a 'Yes' to all the questions of the stress questionnaire.

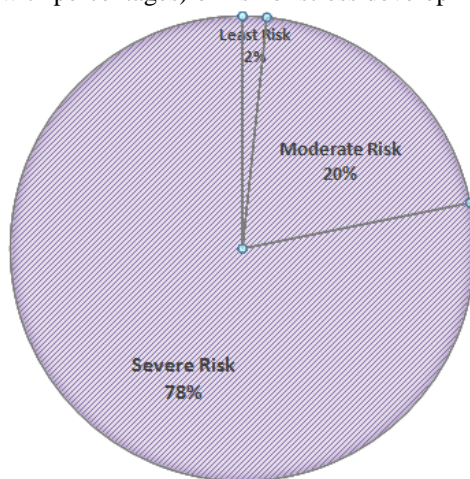
**Table 2:-**Participants' cumulative responses to each of the 25 questions of the stress questionnaire

Q.No.	Questions	Participants' Response		Total responses from the participants
		Yes n (%)	No n (%)	
1.	I frequently bring work home at night	93 (78.8)	25 (21.2)	118
2.	Not enough hours in the day to do all the things that I must do	89 (75.4)	29 (24.6)	118
3.	I deny or ignore problems in the hope that they will go away	65 (54.6)	54 (45.4)	119
4.	I do the jobs myself to ensure they are done properly	110 (92.4)	9 (7.6)	119
5.	I underestimate how long it takes to do things	80 (67.2)	39 (32.8)	119
6.	I feel that there are too many deadlines in my work / life that are difficult to meet	93 (80.9)	22 (19.1)	115
7.	My self-confidence / self-esteem is lower than I would like it to be	82 (69.5)	36 (30.5)	118
8.	I frequently have guilty feelings if I relax and do nothing	100 (84.7)	18 (15.3)	118
9.	I find myself thinking about problems even when I am supposed to be relaxing	103 (88)	14 (12)	117
10.	I feel fatigued or tired even when I wake after an adequate sleep	89 (76.7)	27 (23.3)	116
11.	I often nod or finish other people's sentences for them when they speak slowly	78 (67.2)	38 (32.8)	116
12.	I have a tendency to eat, talk, walk and drive quickly	81 (69.8)	35 (30.2)	116
13.	My appetite has changed, have either a desire to binge or have a loss of appetite / may skip meals	85 (73.3)	31 (26.7)	116
14.	I feel irritated or angry if the car or traffic in front seems to be going too slowly/I become very frustrated at having to wait in a queue	75 (64.7)	41 (35.3)	116
15.	If something or someone really annoys me I will bottle up my feelings	71 (61.2)	45 (38.8)	116
16.	When I play sport or games, I really try to win whoever I play	86 (74.1)	30 (25.9)	116

17.	I experience mood swings, difficulty making decisions, concentration and memory is impaired	90 (77.6)	26 (22.4)	116
18.	I find fault and criticize others rather than praising, even if it is deserved	49 (43)	65 (57)	114
19.	I seem to be listening even though I am preoccupied with my own thoughts	86 (74.1)	30 (25.9)	116
20.	My sex drive is lower, can experience changes to menstrual cycle	38 (34.9)	71 (65.1)	109
21.	I find myself grinding my teeth	45 (39.5)	69 (60.5)	114
22.	Increase in muscular aches and pains especially in the neck, head, lower back, shoulders	91 (78.4)	25 (21.6)	116
23.	I am unable to perform tasks as well as I used to, my judgment is clouded or not as good as it was	68 (59.1)	47 (40.9)	115
24.	I find I have a greater dependency on alcohol, caffeine, nicotine or drugs	52 (44.8)	64 (55.2)	116
25.	I find that I don't have time for many interests / hobbies outside of work	93 (80.2)	23 (19.8)	116

This study has shown that 78% of the total participants were most prone (severe risk) to stress and stress-related illness. A total of 20% of the participants were more likely (moderate risk) to develop stress, and just 2% of the participants had least risk (score 1-4) of stress (Figure).

**Figure:-**Three categories (with percentages) of risk of stress development among medical students



Majority (82.2%) of the pre-clinical (years 1-3) students were most prone (severe risk) to stress and stress-related illness as compared to 71.7% students of clinical years (years 4-6). Moreover, 16.4% of pre-clinical students and 26.1% of clinical students were more likely (moderate risk) to experience stress. Prevalence of stress was high in all the medical students irrespective of whether they were in pre-clinical years or clinical years of study, and there was no statistically significant difference ( $p=0.405$ ) of risk of stress between pre-clinical and clinical students (Table 3).

**Table 3:-**Comparison of the risk of stress development between medical students of pre-clinical years and clinical years

Year of study during MBBS	Frequency and percentage of the medical students showing risk of stress development. n (%)			Total Frequency (%)	p-value
	Least risk (Score 1-4)	Moderate risk (Score 5-13)	Severe risk (Score $\geq 14$ )		
Pre-clinical years (1-3)	1 (1.4%)	12 (16.4%)	60 (82.2%)	73 (100%)	0.405
Clinical years (4-6)	1 (2.2%)	12 (26.1%)	33 (71.7%)	46 (100%)	

Majority (77%) of the male students were most prone (severe risk) to develop stress and stress-related illness as compared to 79.6% of the female students. Furthermore, 20% of the male students and 20.4% of the female students were more likely (moderate risk) to experience stress. Prevalence of stress was high in all the participants irrespective of their gender, and there was no statistically significant difference ( $p=0.429$ ) of risk of stress development between male and female medical students (Table 4).

**Table 4:-**Comparison of the risk of stress development between male and female medical students

Gender	Frequency and percentage of the medical students showing risk of stress development. n (%)			Total Frequency (%)	p-value
	Least risk (Score 1-4)	Moderate risk (Score 5-13)	Severe risk (Score $\geq 14$ )		
Male students	2 (3%)	13 (20%)	50 (77%)	65 (100%)	0.429
Female students	0 (0%)	11 (20.4%)	43 (79.6%)	54 (100%)	

### Discussion:-

Findings from this study suggest that most of the Saudi medical students are stressed out during their studies. We also found that most of the study participants have high stress irrespective of whether they are in their pre-clinical or clinical years of study. Furthermore, we observed that the risk of stress is high in all the medical students irrespective of their gender.

High (78%) prevalence of severe stress in our study participants is similar to the findings of some other studies which have reported 75% to 90% risk of stress (Saipanish, 2003; Ofili *et al.*, 2009; Yousafzai *et al.*, 2009; Koochaki *et al.*, 2011). A study conducted by Oboko *et al.* (2015) to investigate the prevalence of stress, stressors and coping strategies among male medical students of Nigeria found that 70.3% and 22.1% of medical students perceived their studies and training as very stressful and moderately stressful respectively which is very similar to the findings of our study. However, some studies have reported a lower risk of stress among medical students than our findings. For example, Bhatti *et al.* (2016) have observed 13.3% risk of severe stress development among medical students of a Pakistani university; although they have used same ISMA stress questionnaire to assess the risk of stress development, the difference in the risk of stress development in their study may be due to differences in the educational curriculum and system, and social and cultural differences. Some other studies (Sherina *et al.*, 2004; El-Gilany *et al.*, 2008) have also reported a lower (41.9% and 43.7%, respectively) risk of severe stress than our findings (78%). These differences may be due to different tools used for assessment of stress in their studies.

We have observed a high (82.2%) prevalence of severe stress among our pre-clinical (years 1-3) students as compared to 71.7% prevalence among students of clinical years (years 4-6). The prevalence of severe stress was high among all participants irrespective of whether they were in pre-clinical years or clinical years of MBBS. Contrary to our findings, Oboko *et al.* (2015) observed a significantly higher (97.3%) prevalence among pre-clinical students than 88.5% prevalence among clinical students of a Nigerian medical college. This difference may be attributed to the use of different tools for assessing the risk of stress. Furthermore, it seems as if Nigerian study has combined the very stressful and moderately stressful categories, it is likely they might have over-reported prevalence of stress than our study.

We found that more than three-fourths of both male and female medical students were stressed during their studies and training, and there was no statistically significant difference between them. These findings are a bit lower than the findings of a Nigerian study (Oboko *et al.*, 2015) which has also described a high prevalence (above 90%) of stress in medical students irrespective of their gender. This difference may be attributed to the use of different tools for the assessment of stress; the Nigerian study has used DASS-21 guidelines to classify stress.

Very high prevalence of stress in our participants may be a serious concern as too much stress can affect physical and psychological health of individuals (Folkman, 1984). Perceived stress can create emotional instabilities leading to relationship problems, sleep disturbance, low self-esteem, anxiety, depression, drug addiction, and suicidal tendencies (Shapiro *et al.*, 2000; Moffat *et al.*, 2004; Stecker, 2004; Yousafzai *et al.*, 2009). Stress may also decrease learning ability and academic performance of students. Moreover, it can adversely affect the ability of doctors to provide high quality care (Firth-Cozens, 2003).

One of the strengths of this study is that we have studied three categories of stress among medical students by using a standardized questionnaire of International Stress Management Association, UK. Additionally, we have compared stress between male and female students, and also between pre-clinical and clinical students. A relatively small sample size as compared to other similar studies may be one of the limitations. Cross-sectional nature of this study may also limit the generalizability of the results of this study. Reporting bias cannot be entirely eliminated as we have used self-administered questionnaire; respondents' understanding of the questions or their wish to report their emotions in a certain way may have caused some degree of bias. Some possible confounding factors e.g. psychiatric problems and current emotional states of the participants, teaching styles and faculty characteristics were not considered for this study.

### Conclusions:-

This study has shown that most of the undergraduate medical students of Saudi Arabia perceive their studies and training as either moderately or severely stressful. The risk of stress development is high in most of the participants irrespective of their gender or year of study during MBBS. Since medical studies are intrinsically stressful and there are some stressors which are unavoidable, it is recommended that stress management courses should be included in the undergraduate medical curriculum. It is also important that we cooperatively discuss these results with students and offer them support in the form of counseling. Further studies are recommended to investigate stressors, consequences of stress, coping strategies, prevention and treatment of stress.

### References:-

1. Aktekin, M., Karaman, T., Senol, Y. Y., Erdem, S., Erengin, H. and Akaydin, M. (2001). Anxiety, depression and stressful life events among medical students: a prospective study in Antalya, Turkey. *Medical education*, 35(1): 12–7.
2. Al-Dubai, S. A. R., Al-Naggar, R. A., Alshagga, M. A. and Rampal, K. G. (2011). Stress and coping strategies of students in a medical faculty in Malaysia. *Malaysian Journal of Medical Sciences*, 18(3): 57–64.
3. Ayyaz Ahmed Bhatti, Mahvash Khan, Hamid Bashir, S. A. (2016). Risk of development of stress in university students. *Rawal Medical Journal*, 41(4): 483–486.
4. Bansal, C.P. and Bhave, S.Y. (2006). Stress in Adolescents and its Management. *Textbook of Adolescent Medicine*. New Delhi: Jaypee Brothers Medical Publishers. Pp.844–53.
5. Dyrbye, L. N., Thomas, M. R. and Shanafelt, T. D. (2006). Systematic Review of Depression, Anxiety, and other indicators of Psychological Distress among U.S. and Canadian Medical Students. *Academic Medicine*, 81(4): 354–373.
6. El-Gilany, A.H., Amr, M. and Hammad, S. (2008). Perceived stress among male medical students in Egypt and Saudi Arabia: effect of sociodemographic factors. *Annals of Saudi medicine*, 28(6): 442–8.
7. Firth-Cozens, J. (2003). Doctors, their wellbeing, and their stress. *BMJ (Clinical research ed.)*, 326(7391), pp. 670–671.
8. Folkman, R. S. L. and S. (1984) *Stress, Appraisal, and Coping*. New York: Springer Publishing Company.
9. Stress questionnaire. (2013). *International Stress Management Association UK*.
10. Koochaki, G. M., Charkazi, A., Hasanzadeh, A., Saedani, M., Qorbani, M. and Marjani, A. (2011). Prevalence of stress among Iranian medical students: a questionnaire survey. *Eastern Mediterranean Health Journal*, 17(7): 593–598.
11. Le Fevre, M., Kolt, G. S. and Matheny, J. (2006). Eustress, distress and their interpretation in primary and secondary occupational stress management interventions: which way first? *Journal of Managerial Psychology*. Emerald Group Publishing Limited, 21(6): 547–565.
12. Moffat, K. J., McConnachie, A., Ross, S. and Morrison, J. M. (2004). First year medical student stress and coping in a problem-based learning medical curriculum. *Medical Education*, 38(5): 482–491.
13. Oboko, O.A., Theodora, O.E., Oboko, O.O., and Monday, I.B. (2015). Prevalence of stress, stressors and coping strategies among medical students in a Nigerian medical school. *African Journal of Medical and Health Sciences*, 14(1): 29–34. doi: 10.4103/2384-5589.153384.
14. Ofili AN, Oriafio I, Okungbowa E, E. E. (2009). Stress and psychological health of medical students in a Nigerian university. *Niger J Clin Pract.*, 12(2): 128–33.
15. Saipanish, R. (2003). Stress among medical students in a Thai medical school. *Medical teacher*, 25(5): 502–506.
16. Shapiro, S. L., Shapiro, D. E. and Schwartz, G. E. (2000). Stress management in medical education: a review of the literature. *Academic medicine : journal of the Association of American Medical Colleges*, 75(7): 748–59.

17. Sherina, M. S., Rampal, L. and Kaneson, N. (2004). Psychological stress among undergraduate medical students. *The Medical journal of Malaysia*, 59(2): 207–211.
18. Stecker, T. (2004). Well-being in an academic environment. *Medical Education*, 38(5): 465–478.
19. Stewart, Lam, Betson and Wong (1999). A prospective analysis of stress and academic performance in the first two years of medical school. *Medical Education*, 33(4): 243–250. doi:10.1046/j.1365-2923.1999.00294.x
20. Waghachavare, V. B., Dhumale, G. B., Kadam, Y. R. and Gore, A. D. (2013). A study of stress among students of professional colleges from an urban area in India. *Sultan Qaboos University Medical Journal*, 13(3): 422–429.
21. Yousafzai, A. W., Ahmer, S., Syed, E., Bhutto, N., Iqbal, S., Siddiqi, M. N. and Zaman, M. (2009). Well-being of medical students and their awareness on substance misuse: a cross-sectional survey in Pakistan. *Annals of general psychiatry*, 8, p. 8.

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### RESEARCH ARTICLE

#### DETERMINATION OF PHYSICOCHEMICAL PARAMETERS AND DIVERSITY PATTERN OF THREE DIFFERENT PLACES OF KANYAKUMARI DISTRICT.

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#### Abstract

The current investigation suggests that the physicochemical parameters were analysed from three different places of Kanyakumari district. Population diversity of fungi also determined with reference to microfungi. The soil physicochemical parameters such as pH, electrical conductivity, organic matter, organic carbon, organic nitrogen, phosphorus, potassium, zinc, copper, iron, magnesium, calcium, manganese, nickel and potassium were analysed. Maximum amount of chemical parameters were recorded in the study site of Thengapattinam when compared to other places Erayumanthurai and Kollemcode site was 67, 44 and 36 total number of colonies recorded respectively. Minimum number of colonies was Kollemcode area represented due to the nutrient content of the study site. Maximum *Aspergillus* genera were presented. Some of the rare species of *Penicillium lanosum* also recorded from the all three different places of Kanyakumari District. The results were discussed in detail.

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#### Introduction:-

Soils are natural unconsolidated materials on the surface of the earth and are composed of solid, liquid and gas. They have organic and inorganic matter which are intimately mixed together by natural processes. That is aggregated into a porous body that accommodates air and water (Osman, 2013). Soil is an essential component of biosphere and it can be used sustainably or even enhanced, under careful management. Soil fungi play an important role as major decomposers in the soil ecosystem. They also provide mankind with very useful pharmaceutical product like antibiotics. The fungal derivatives like organic acids, enzymes, pigments and secondary metabolites are being used in the food industry and fermentation technology. In addition, some of the product from soil fungi and biological control agents for plant pathogens and insect pests. (Manoch, 1998). Fungi are not only beautiful but also play a significant role in the daily life of human beings besides their utilization in industry, agriculture, medicine, food, textiles, bioremediation, and many other ways.

Biological diversity encompasses the variety of living forms like animals, plants and microbes. According to Hawksworth (2002), fungi are a major component of biodiversity, essential for the survival of other organisms and are crucial in global ecological processes. Soil contains a vast array of microorganisms such as bacteria, viruses, fungi, actinomycetes, protozoa and algae (Alexander, 1977; Olowonihi, 2003) have been found that more number of fungi exist in soil than in any other environment (Nagmani, 2005). Contributing to the nutrient cycle and

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maintenance of ecosystem, fungi play an important role in soil formation, soil fertility, soil structure and soil improvement (Hao, 2008). The present study was planned to study the diversity and abundance of fungal species in the soil sample.

## Materials And Methods:-

### Soil physicochemical properties:-

Soil samples were collected from Thengapattinam, Erayumanthurai and Kollemcode Kanyakumari, District brought to the polythene bag and sieved through 2mm sieve at field moist conditions and determination of soil moisture content and pH also analysed. Air dried ground and sieved (0.25mm) samples were used for the estimation of organic carbon, total nitrogen. soil pH was measured in a 1:5 water suspension using a portable digital pH meter. Colorimetric method (Anderson and Ingram, 1993), Micro kjeldhal distillation and titration method (Jackson 1967) were applied to estimate organic carbon, total nitrogen, available phosphorus and exchangeable potassium respectively. The soil parameters were tabulated.

### Fungal population in the soil sample:-

For population of mycoflora by serial dilution plate method (Johnson and Curl 1972) was followed by Rose Bengal Agar Medium (Martin, 1950) was used. The inoculated petriplates were incubated at  $25\pm 1^\circ\text{C}$ . Colony Forming Units (CFU) were estimated by counting the number of colonies after five days. Fungi were identified according to their macroscopic and microscopic features. Identification at the species level was carried out according to the morphological characters found principally in publications by Gilman (1957), Barnett and Hunter (1972), Ellis (1993) pure cultures of fungi were maintained in test tubes slants containing Czapek Dox agar medium and preserved in deep freezer at  $-20^\circ\text{C}$  for future work.

## Results And Discussion:-

**Table 1:-** Analysis of physicochemical parameters of three different places of Kanyakumari District

S.No	Parameters	Thengapattinam	Erayumanthurai	Kollemcode
1	pH	8.3	8.5	8.2
2	Electrical conductivity ( $\text{dsm}^{-1}$ )	0.51	0.28	0.24
3	Organic matter (%)	0.52	0.46	0.48
5	Organic carbon (%)	0.26	0.23	0.24
6	Available Nitrogen (mg/kg)	126.2	102.2	104.5
7	Available Phosphorus (mg/kg)	4.62	4.52	4.16
8	Available potassium (mg/kg)	148	138	145
9	Available Zinc (ppm)	0.87	1.08	1.15
10	Available Copper (ppm)	0.59	0.95	0.86
11	Iron (ppm)	4.06	4.36	4.56
12	Available Mn (ppm)	2.06	2.24	2.21
13	Calcium ( $\text{C.mole}^+/\text{Proton}$ )	14.6	13.5	14.2
14	Magnesium ( $\text{C.mole}^+/\text{Proton}$ )	8.6	7.5	7.3
15	Sodium ( $\text{C.mole}^+/\text{Proton}$ )	1.48	1.36	1.46
16	Potassium ( $\text{C.mole}^+/\text{Proton}$ )	0.32	0.27	0.31

**Table 2:-** Biodiversity pattern of different places of Kanyakumari District

S.No	Name of the fungi	Thengapattinam	Erayumanthurai	Kollemcode	Total no. of colonies
1	<i>Alternaria alternata</i>	5	2	-	7
2	<i>A.awamori</i>	11	8	4	23
3	<i>A.flavus</i>	6	-	-	6
4	<i>A.fumigatus</i>	5	8	10	23
5	<i>A.niger</i>	8	6	7	21
6	<i>A.nidulans</i>	2	-	1	3
7	<i>A.oryzae</i>	-	2	-	2
8	<i>Cladosporium sp</i>	-	1	-	1
9	<i>Fusarium sp</i>	2	-	1	3
10	<i>Fusarium oxysporum</i>	3	1	-	4

11	<i>Penicillium citrinum</i>	5	3	4	12
12	<i>Penicillium sp</i>	9	7	6	22
13	<i>P. lanosum</i>	4	3	3	10
14	<i>Trichoderma harzianum</i>	4	2	-	6
15	<i>T.viride</i>	3	1	-	4
	Total no. of colonies	67	44	36	147

In the present investigation analysis of physicochemical parameters such as pH, electrical conductivity, organic carbon, organic nitrogen, phosphorous, potassium, zinc, copper, iron, manganese, calcium, Magnesium, sodium and Potassium was 8.3, 0.51dsm<sup>-1</sup>, 0.52 %, 0.26 %, 126.2 mg/kg, 4.62 mg/kg, 148 mg/kg, 0.87ppm, 0.59ppm, 4.06ppm, 2.06ppm, 14.6 C.mole<sup>+</sup>/Proton, 8.6 C.mole<sup>+</sup>/Proton, 1.48 C.mole<sup>+</sup>/Proton and 0.32 C.mole<sup>+</sup>/Proton from Thengapattinam area soil sample were recorded respectively. Where as in the case of minimum physico-chemicals of Kanyakumari district was observed. Similarly, the physico-chemical parameters recorded during the present study was not adversely affected the distribution of fungi. Salinity and temperature are the major factors affecting the diversity of marine fungi as well illustrated by Booth and Kenkel, 1986.

The organic layer at these sites could be attributed to the supply of raw materials and the different types of fauna presented. The evidence of soil fauna activity could be seen under a thick litter above the ground of the plantation site (Fisher, 1995). Macronutrient tends to be less available in soil with low pH, while the micronutrient tends to be less available with high pH. The pH of the soil samples was between 9.5 and 10.2; hence all soils were slightly alkaline in nature. According to Kadir *et al.*, (2001), the higher acidity in the surface soil was associated with hydrolysis of Aluminum which was released under strongly leaching conditions and which subsequently lower pH, causing toxicity.

In the present investigation diversity patterns from the Thengapattinam was 67 fungi, Erayumanthurai was 44 fungi and Kollemcode was 36 fungi recorded respectively. Totally 146 fungal colonies were represented and analysis of parameters vice versa. The rare species of *Penicillium lanosum* was 10 colonies recorded from the all three different sit of Kanyakumari district. So, the fungal diversity was more useful for the content of environmental conservation. The ocean of the world is varying greatly in intertidal amplitude and salinity of the waters, all features that can dramatically affect fungal biodiversity.

Afreen Arshi and Nasreen (2016) reported that the soil samples were analyzed with respect to different types of fungi. The most common fungi, *Aspergillus niger* and *Penicillium stoloniferum* are found in all three soil samples *Aspergillus niger*, *Penicillium stoloniferum*, *Penicillium sp.* and *Rhizopus sp.* are found in site A (Roadside soil). *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus terrrus*, *Penicillium stolonigerum*, *Pencillium sp.* *Fusrium oxysoprum*, *Alternaria solani*, *Trichoderma viride*, *Trichoderma sp* and *Rhizopus sp.* was observed in site B (garden soil). *Aspergillus niger*, *Pencillium stoloniferum*, *Alternair solani*, *Trichoderma sp.* and *Rhizopus sp.* was observed in site c (pot soil of rose plant).

## Reference:-

1. Alexander, M., (1977) Introduction to soil Microbiology, *John Wiley & Sons*, NewYork Olowonihi, E T. 2003. Studies on the distribution of Bacteria and Fungi in the five soil series of University of Ilorin Teaching and Research Farm. An M.Sc Thesis Dissertation submitted to the Department of Crop production, Faculty of Agriculture. University of Ilorin: 6-18 (2).
2. Anderson, J.M and Ingram, J.S.I., (1993). Tropical Soil Biology and Fertility. A Handbook of Methods. Second edition. CAB International, Wallingford, Oxon. UK. 221.
3. Arshi H.A. and Nasreen, S., 2016. Isolation And Identification of fungi from soil samples of different sites In Aurangabad City, India. *Inter. J. of Scientific Research*; 5 (3): 419.
4. Barnett H.L and Hunter, B.B., 1998. Illustrated Genera of Imperfect Fungi, IV edition. Published by APS Press St. Paul, Minnesota.
5. Booth, T. and N. Kenkel, 1986. Ecological studies of lignicolous marine fungi: a distribution model based on ordination and classification. In: *The Biology of Marine Fungi* (ed. S.T. Moss). Cambridge University Press, Cambridge: 297-310.



6. Ellis M.B. 1993. Dematiaceous Hypomycetes, CAB International. Published by Commonwealth Mycological Institute, Kew, Surrey, England.
7. Fisher, R.F., 1995. Amelioration of degraded rain forest soils by plantation of native trees. *Soil Sci. Soc. Am. J.*, 59: 544-549.
8. Hao quin Pan, Jin- Feng Yu, Yue- ming Wu, Tian- Yu Zhang and Hong- Feng Wang. 2008. Area: *J. Zhejiang Univ. Sci. B*; 9(10): 829-834.
9. Hawksworth D.L. 2002. Tropical Mycology Vol.2, Micromycetes CABI. 1 11.
10. Jackson, M.L., (1967). Soil chemical analysis. Prentice hall of India, Pvt Ltd., New Delhi: 498
11. Johnson, Leander F., and Elroy A. Curl. 1972. Methods for Research on the Ecology of Soil-Borne Plant Pathogens. 426 So. Sixth St., Minneapolis Burgess Publishing Company.
12. Kadir, S., I. Ishizuka, K. Sakurai, S. Tanaka, S. Kubota, M. Hirota and S.J. Priatna, 2001. Characterization of ultisols under different wildfire in South Sumatra, Indonesia, I. Physico-chemical properties. *Tropics*, 10: 565-580.
13. Manoch, L. (1998). Biodiversity of soil fungi in Thailand, pp. 126-140. In Proceedings of the Asia-Pacific Mycological Conference on Biodiversity and Biotechnology, Hua Hin.
14. Martin J.P. 1950. Use of acid, rose bengal, and streptomycin in the plate method for estimating soil fungi. *Soil Sci.*, 69:215- 232.
15. Nagmani A, Kunwar, I.K. and Manoharachary, C. 2005. Handbook of Soil Fungi. Published by I. K. International Pvt, Ltd. New Delhi.
16. Osman, K.T., 2013. Soils: principles, properties and management. Springer Science+ Business media Dordrecht, The Netherlands: 271
17. Raper K.B. and Fennell D.I. 1965. The Genus *Aspergillus*, The Williams and Willkins Company, Baltimore.
18. Subramanian C.V. 1974. Hyphomycetes, Published by ICAR, New Delhi
19. Warcup, J.H., 1955. On the origin of colonies of fungi developing on soil dilution plates. *Transactions of the British Mycological Society*, 38(3) : 298–301.



### RESEARCH ARTICLE

## CLINICAL CHARACTERISTICS OF GIST AND THE POSSIBLE ROLE OF SMOOTH MUSCLE ACTIN (SMA) AS A PROGNOSTIC FACTOR – INITIAL 5 YEAR EXPERIENCE IN A TERTIARY CARE CENTRE IN DAKSHINA KANNADA DISTRICT.

Dr. Dhanya R. Shaji and Dr. Saptarshi Paul.

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### Abstract

A study about Gist - the most common mesenchymal neoplasm of the git in the population in a small district in Karnataka (India)

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### Introduction:-

- Primary mesenchymal tumors of the gastrointestinal tract are a heterogeneous group of tumors with a wide clinical spectrum, of which gastrointestinal stromal tumors (GIST) typically occur in middle-aged to older individuals.
- Most common mesenchymal neoplasm of the gastrointestinal tract.
- Has been frequently studied in tertiary care centres around the world and in India, but no long term study has been conducted in South Kannada district of Karnataka till now.

### Objectives of the Study:-

- To observe
- Modes of presentation.
- Clinical course of gastrointestinal stromal tumours.
- To evaluate
- Possible role of the marker Smooth Muscle Actin as a prognostic factor.

### Gist In Brief:-

- Known presentations
- Management (surgical and chemo) (as short as possible)
- Defining feature of GIST is the expression of CD117, a marker of KIT activation, which is sensitive although not entirely specific
- Five percent of GISTs are known to be negative for CD117 (KIT protein), although they resemble KIT-positive GISTs by cytomorphology.

Why the trial with SMA as another prognostic factor?

- CD 117 stains many carcinomas and melanomas (lack of specificity)  
(<http://suropathcriteria.stanford.edu/gitumors/gist-gastrointestinal-stromal-tumor/differential-diagnosis.html> )
- Expressed in both benign and malignant GISTs
- Activating mutations in the exon 11 of some c-kit genes, classified as high risk
- Overall 5 year survival rate of patients with KIT-negative GISTs supposedly lower than that of patients with KIT-positive GISTs

- SMA tends to be positive in small bowel GISTs, and negative in rectal and esophageal GISTs (significance unknown)
- Long term studies regarding prognostic effects of SMA positivity not carried out

### **Subjects and Methods:-**

- Observational study conducted in YMC
- From January 2011 to December 2015
- Presenting features and clinical course were noted
- Clinically suspected to be GIST – 25
- Out of which 17 were histopathologically confirmed to be GIST
- These 17 cases were subjected to immunohistochemistry – CD 117 and SMA

### **Results:-**

- Clinical features:
  - Abdominal pain : 9
  - Abdominal mass : 6
  - Bleeding PR : 4
  - Dyspepsia and fullness of the abdomen : 3
  - Hematemesis : 2
  - Fever : 2
  - Vomiting : 2
  - Loose stools : 1
  - Weight loss : 1
  - k/c/o NHL : 1
- Location wise:
  - Small bowel: 7
  - Large bowel: 2
  - Stomach: 5
  - Omentum: 1
  - Pylorus extending on to duodenum: 1
  - Ileocecal junction: 1
- Histopathologically
  - Malignant: 8
  - Non malignant: 9
- Immunohistochemistry:
  - CD 117 positivity and SMA positivity: 9
  - CD 117 negativity and SMA positivity: 4
  - CD 117 positivity and SMA negativity: 3
  - CD 117 negativity and SMA negativity: 1
  - Total CD 117 positive cases: 12
  - Total SMA positive cases: 13
  - Total CD 117 negative cases: 5
  - Total SMA negative cases: 4

#### **Relation between Malignant GIST and CD 117**

- Malignant cases with CD 117 positivity: 5  
(total number of CD 117 positive cases: 12)
- Malignant cases with CD 117 negativity: 3  
(total number of CD 117 negative cases: 5)

Statistical significance

	<b>Malignant</b>	<b>Nonmalignant</b>	<b>Total</b>
SMA positivity	5	8	13
SMA negativity	3	1	4
Total	8	9	17

**Fisher's exact test:**

- The two-tailed P value equals 0.2941 The association between rows (groups) and columns (outcomes) is considered to be not statistically significant.

**Conclusion:-**

- Multiple possibilities in which patients can present.
- With the limited number of cases that we have encountered till now, the Fisher's exact test is not able to provide a correlation between SMA positivity and malignancy.
- With more number of cases being included and with the application of Chi square test, a correlation may be established in the future.

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### RESEARCH ARTICLE

#### GENDER DISCRIMINATION IN EDUCATION: A VIOLATION OF HUMAN RIGHT.

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Gender discrimination, Challenges,  
Violation.

#### **Abstract**

The right to education is a core human right. It should be free and compulsory for every child without any discrimination. The Universal Declaration on Human Rights adopted in 1948 proclaims that “everyone has the right to education” (Art.26). Since then, this right has been affirmed in numerous global agreements and duly incorporated into various regional treaties. In practice, however, there are numerous obstacles to the realization of the right to education. This paper first outlines the legal framework for the right of girls’ to education, and then identifies the main challenges limiting girls’ access to education. Finally, the paper proposes a few recommendations aimed at ensuring the right of girls to education to be realized and fulfilled. The most important objective of this paper is to contribute to a better understanding of the status of access to education for girls worldwide and to ensure that all girls are able to go to school, raise their voices and realize their dreams.

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#### **Introduction:-**

Education is essential for all and is fundamental to their holistic development. Education has continued to evolve, diversify and extend its reach and coverage since the dawn of human history. Education has been formally recognized as a human right since the adoption of the Universal Declaration of Human Rights in 1948. Since then, this right has been affirmed in numerous global human rights treaties. These treaties establish an entitlement to free, compulsory primary education for all children; an obligation to develop secondary education, supported by measures to render it accessible to all children, as well as equitable access to higher education. In practice, there are numerous obstacles to the realization of the right to education. Education continues to be denied to girls as a result of cultural and social norms and practices that perpetuate harmful stereotypes about appropriate roles for women and reinforce the idea that education is wasted on girls. Gender-related violence and other forms of discrimination within the schools also contribute to a high rate of school abandonment by girls. Besides the socio-cultural factors, there are other legal, political and economic obstacles that may limit the full implementation of the right to education for girls. The right to education must be effectively put into practice with clear implementation methods and strong monitoring systems.

#### **The Legal Framework of Girls’ Right to Education:-**

“The United Nations is committed to the principle of equality of men and women, meaning equality in their dignity and worth as human beings as well as equality in their rights, opportunities and responsibilities”. The principles of

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gender equality and non discrimination are at the core of all fundamental human rights treaties. There is a strong legal framework which protects and promotes the Girls' right to education.

#### **Human Rights Obligations and Global Political Commitments:**

International Human rights law prohibits discrimination against women in the area of education instead it guarantees the right to education as fundamental for all men and women. The Universal Declaration on Human Rights, adopted in 1948, proclaims that "everyone has the right to education" (Art.26). Since then, the right to education has been widely recognized and developed by a number of international instruments elaborated by the United Nations. The following are the important pronouncements of the global conventions on girls' right to education.

- i) The International Covenant on Economic, Social and Cultural Rights (1966) requires the States, "to ensure the equal right of men and women to the enjoyment of all economic, social and cultural rights" (Art.3) set forth in the treaty, including the right to education.
- ii) The Convention on the Rights of the Child (1989) in article 28, provides the States to recognize the right of the child to education, and in particular: (a) Make primary education compulsory and available free to all; (b) Encourage the development of different forms of secondary education, including general and vocational education; (c) Make higher education accessible to all on the basis of capacity by every appropriate means; (d) Take measures to encourage regular attendance at schools and the reduction of drop-out rates.
- iii) The Convention on the Elimination of All Forms of Discrimination against Women (1979) in Article 10, details a number of measures which should be taken to eliminate discrimination against women in order to ensure to them equal rights with men in the field of education.
- iv) The United Nations Educational, Scientific and Cultural Organization's Convention against Discrimination in Education also bans discrimination in education on the basis of sex, referring to all types and levels of education.
- v) The Beijing Platform for Action in 1995 recognized education as an essential tool for achieving more equal relations between women and men and urged the States to ensure a number of strategic objectives, including: equal access to education, the closing of the gender gap in primary and Secondary education, development of non-discriminatory education and training by developing and using curriculums, textbooks and teaching aids free of sex-stereotyping.
- vi) United Nations Millennium Declaration, (2000) in goal 2 calls for Universal Primary Education and goal 3 to "Promote Gender Equality and Empower women".

The above mentioned global pronouncements about the right to education has been incorporated into various States' treaties and enshrined as a right in the vast majority of national constitutions.

#### **The 4A Scheme:-A tool to achieve gender equality:**

The former UN Special Rapporteur on the right to education, Katarina Tomasevski developed the 4A framework, and it was adopted by the CESCR in 1999. Many elements in this scheme are focus points to guide States in overcoming the many hurdles for girls' right to education.

##### **i) Availability**

Availability means the establishment of schools and the availability of free primary and affordable education for all school age children. There should be an adequate infrastructure and trained teachers for the delivery of education.

##### **ii) Accessibility**

Educational institutions and programs have to be accessible to everyone without discrimination. The CESCR committee distinguishes the non-discrimination principle, the physical accessibility and the economic accessibility as the triple elements of education accessibility.

##### **iii) Acceptability**

Acceptability requires a guaranteed quality of education, minimum standards of health and safety, and professional requirements for teachers which are set in a standardized manner, monitored and enforced by the Government.

##### **iv) Adaptability**

Adaptability means that education should be adaptable to "the changing needs of the society and contribute to challenging inequalities, such as gender discrimination, and that it can be adapted locally to suit specific contexts".

The above 4A scheme can assist States Parties to fulfill their obligations under international human rights law to implement the right to education. Implementation of this scheme adequately accommodates the right to education for girls.

**States' Obligations to the right of girls to education:**

States have the primary responsibility for delivering and protecting the right to education. They should undertake all appropriate legislative and administrative measures for the implementation of the right to education for all children. In the context of the denial of education for girls States should take all appropriate measures to change discriminatory behaviors, such as strategic planning, legislation, and monitoring, awareness-raising, education resource allocation and information campaign. States should also include all stakeholders in their programmes to achieve gender equality within education.

**Responsibilities of the Stakeholders:**

In order to adequately implement the right to education for all children, the role of the stakeholders is very important. The role of the multilateral intergovernmental agencies, such as UNESCO, OHCHR, UNICEF, is of importance in providing technical and financial assistance. Civil society plays a crucial role in holding the State accountable for its obligations. Parents have the responsibility to direct and guide girls to exercise their right to education and have the obligation to contribute to the achievement of gender equality.

**Gender discrimination in education is a violation of human right:-****The Status of Gender Equality in Practice:-**

There is a strong international legal framework which affirms girls' rights to have access to education. This access to education for girls is promoted through many initiatives such as Millennium Development Goals and the Education for All movement led by UNESCO. But the world continues to face many obstacles to achieve the MDGs. Within primary education alone, gender equality remains a serious challenge, 68 countries still need to achieve this goal. Globally, there are still 57 million children out of primary school, of whom 32 million are girls. Again worldwide, 123 million youth of the aged between 15 to 24 lack basic reading and writing skills, of whom 61 percent are young women. Of the 774 million adults who cannot read and write in the world, about 70 percent are female. Despite the many international, regional and local regulations and programmes on gender equality, a lack of translation of these commitments into practice persists, limiting many girls' ability to achieve to their fullest potential.

**Rising violent attacks on girls who pursue the right to education:-**

According to United Nations' sources, attacks on schools in at least 70 different countries were documented during the period 2009-2014, with a number of these attacks being specifically directed at girls, parents and teachers advocating gender equality in education. Hundreds of schoolgirls have been abducted by Boko Haram Militants in Nigeria and more than 100 children, including girls died in a Taliban on their school in Peshawar, Pakistan. In Somalia, the girls were forced in 2010 from their schools to become "Wives of Al Shabaab rebels. In India girls were abducted and raped at a Christian School in 2013.

The removal of girls from education due to the fear of their safety may result in additional human right violations such as child and forced marriage, domestic violence, early pregnancy, female infanticide, trafficking, sexual and labor exploitation. Thus "Failure to respect and protect the rights of girls to education violates their rights as human beings".

**Challenges in Girls' Education:-**

In order to overcome gender inequality and ensure access to education for girls, the challenges such as cultural customs, religious practices, poverty, insecurity, low quality of education and political unrest need to be addressed by States and other Stakeholders.

**i) Cultural and Religious Customs:-**

Cultural and religious customs mean that in many parts of the world, the role of women in society is largely limited to the domestic sphere. As a result, many parents would prefer to send their sons to school, then sending their daughters to school. Parents may not be convinced of the benefits of girls' education, as boys will become responsible for the income and care of the family, whereas girls will likely go to another family through marriage. Such perceptions of the role of the women can present a serious obstacle for girls to have access to education.

**ii) Poverty:-**

Poverty is another important factor contributing to the denial of access to education for girls in many parts of the world. A state of poverty may lead the parents to make decisions which result in their daughters being involved in child labor and or being subjected to child marriage. Due to living in a state of poverty, children in many parts of the world are taking some menial jobs to provide for the primary needs of their families. In some cultures and regions of the world, girls may be subjected to child marriage due to financial reasons and cultural practices. Both child labor and child marriage blocks the access to education. Another factor which prevents access to education is the cost of education which forms an additional burden on poor families; therefore it is very important to make school affordable for all families.

**iii) Safety risks for girls:-**

The above mentioned brutal attacks and harassment on girls going to school clearly show the insecurity for the girls to education. Compared to boys, girls are more likely to be victims of discrimination, sexual abuse, punishment and social intolerance. The safety issue is even more challenging in rural areas where schools are established in geographical locations which are difficult to reach and appropriate transport is lacking. Many parents in such areas may choose to keep their girls at home rather than risking their safety.

**Recommendation for girls' right to education:-**

- a) There should be a national vision for girls' education and the Government must engage with the community, media, states, and other stakeholders to create an environment and mechanism to ensure implementation at every level for girls' education.
- b) Education must be child-centered, child friendly and empowering, and that education goes beyond formal schooling to embrace a broad range of life experiences through which positive development and learning occur.
- c) To ensure the safety of girls accessing to education and to protect girls' hygiene, there must be facilities like safe transport, separate female only sanitation, appointment of adequately trained teachers and establishment of separate girls only school.
- d) To discourage child labor, Governments can provide family grants on the condition that all girls in the family attend the school.
- e) Re-dedication of global community and the State Parties to the commitments that they have made to achieve the goals related to education and gender equality.

**Conclusion:-**

"If we invest in girls, we invest in our humanity" says Hauwa Ibrahim. It is clear that long term investment is essential to enable girls to go to school, raise their voices and realize their dreams. As outlined in this paper, many key international human right instruments affirm the importance of ensuring that girls have access to education. Failure to ensure this access cannot be justified on any ground, including gender, religious or cultural grounds. The 4A scheme can be used to detect the hurdles that each society encounters when implementing gender equal education. When the obstructions to access to education are attended to and lifted, parents often have no objection to sending their daughters to school. Educated girls are better informed and therefore better equipped to build an independent and strong future for them.

**References:-**

1. Tomasevski, Katarina, *Education denied; Costs and Remedies*, Zed Books: London& New York, 2003.
2. Mamta Rao, *Law Relating to Women and Children*, Eastern Book Company, Lucknow, 2012.
3. Martinez, Elin, *Attacks on Education: The impact of conflict and Grave Violations on Children's Future*, Save the Children, 2013.
4. Kids rights Report, *Access Denied: Girls' Equal Right to Education in a Global Context, with a focus on Pakistan*, Leiden University, 2013.
5. Patrick Maigua, *Right to Education still not a reality for many women and girls*, United Nations, Geneva, 7<sup>th</sup> July, 2014.
6. IDLO, *Accessing Justice: Models, Strategies and Best practices on women's Empowerment*, IDLO, Rome, 2013.
7. UNESCO, *Girls' and Women's Right to Education, Overview of measures supporting the right to education for girls and women* reported on by the member States, UNEDCO,(Paris), 2014.



8. CEDAW, '*CEDAW Statement: protection of Girls Right to Education*', adopted on 19<sup>th</sup> October 2012 during the 53<sup>rd</sup> Session.
9. CESCR, *General Comment No.20 on Non-Discrimination in Economic, Social, and Cultural Rights* (2009), E/C12/GC/20.
10. OHCHR, "*Education unlocks the doors to all other rights*", 5<sup>th</sup> August 2014, [www.ohchr.org](http://www.ohchr.org).
11. Amnesty international, "*Safe Schools, Every Girls' Right*" ACT 77/001/2008, 6th March 2008.
12. Global Campaign for Education, *Gender Discrimination in Education: the violation of rights of women and girls*, GEC, Feb.2012.
13. Navaneetham Pillay, *Women and Rights to Education*, UN Rights, Key note speech, Oct.2010.
14. Soumi das, *Understanding Education as Right*, Action Aid, 2013.
15. Ramachandran, V., *Girls' and women's Education: Policies and Implementation Mechanisms, (a case study in India)* Bangkok, UNESCO.



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### RESEARCH ARTICLE

## GENETIC DIVERSITY STUDIES IN SIX BIVOLTINE RACES OF *BOMBYX MORI* L., BASED ON PHENOTYPIC CHARACTERS.

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### Abstract

Comparative studies of phenotypic characters in some developmental stages of mulberry silkworm, *Bombyx mori*. L was carried out in order to access their genetic diversity. Three Jam and three Pam races evolved in J&K were selected for the study. The egg, larvae and cocoon stage were studied for the various phenotypic and economic parameters; these qualitative and quantitative characters were put into various statistical analysis like correlation studies of length and weight changes during V instar and clustering on the basis of UPGMA, Ward's method and Single linkage analysis. Results indicated highly significant differences for all the studied characters; high positive correlation between larval length and weight change during the V instar larval stage. Also, the races were divided into few clusters/groups on the basis of weight gain characteristics. The present study will help in selection of parents for various breeding programmes and evolving new locally acclimatized, high yielding superior quality silk producing races.

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### Introduction:-

The silkworm *B. mori* was domesticated over 5000 years ago (Nagaraju and Goldsmith, 2002) and is well known for its industrial importance in sericulture (Goldsmith *et al.*, 2005). It has a number of varieties viz; univoltine, bivoltine, and polyvoltine. *B.mori* has become a model organism for studying other lepidopteron insects that cause serious agricultural damage and is also an important model for scientific discovery in the areas of microbiology, physiology and genetics.

silkworm breeds play a vital role in the success of sericulture industry. Thus the breed development and improvement is a continuous process which aims at providing suitable genotypes with desired traits (Datta, 1984; Rao *et al.*, 2006). Enrichment of silkworm breeds / hybrids have always been one of the important factors contributing to increase the productivity in sericulture sector. Continuous development, evaluation, renewal and change of existing breeds/hybrids with new superior varieties and their commercialization is the prime factor to increase silk quality and quantity (Chandrashekharaiyah and Ramesh Babu, 2003).

The state of Jammu and Kashmir is known for producing bivoltine silk of international quality. Being one of the traditional agro-based industries of the state producing high quality bivoltine silk comparable to international quality helps in improving the economic conditions of landless farmers and weaker sections of the society and providing employment opportunities during pre- and post cocoon activities. Realizing the importance of sericulture, the

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genetic diversity of the silkworm should be maintained and analyzed for various traits so that it may help in evolving new locally acclimatized, high yielding superior quality silk producing breeds.

In the present study, six bivoltine races of *B.mori* were reared in sub-tropical conditions of Jammu, assuring the same micro-climate conditions, being fed with same variety of mulberry leaves. The egg, larval, and cocoon characters were analyzed for the differences and similarities. Agglomerative hierarchical clustering was done for the weight gain during the V instar development and dendrograms were prepared based on different indices that may help in selective breeding.

### Material And Methods:-

The study was conducted in Regional Sericulture Research Station, MiranSahib (RSRS, Miran Sahib) and Department of Zoology, University of Jammu simultaneously during Feb-Apr 2013. For the present study, two disease free layings (DFL's) each of six races (Jam 103, Jam 110, Jam 118, evolved in Jammu were obtained from RSRS, MiranSahib, Jammu and Pam 101, Pam 102, Pam 103 evolved in pampore were transported from CSRT&TI, pampore. Eggs were incubated for 9-12 days in a neat and clean, disinfected room at 80-85 % Humidity and 24-25°C Temperature with 18 hrs light till pin head stage, at this stage black -boxing was done to ensure maximum hatching on exposure to bright light. The hatched larvae were reared separately under uniform laboratory conditions as described by Yokoyama (1963) and Krishnaswami (1978).

During the entire period of research, same micro-climate and feeding conditions were ensured as per the larval stage (Table 1). The whole evolutive period was studied for Egg, Larval and Cocoon characters as follows:

**At egg stage:** egg shape, egg colour, hatching percentage and average fecundity per female moth were studied. **At larval stage:** larval colour, markings, mean length and mean weight of 10 larvae on each day of V instar were studied and analyzed. Correlation of larval length and weight was done and changes in length and weight of larvae of different races were compared. The statistical analysis was done with the help of software PRIMER. Length of larvae was measured with the help of vernier calipers and weight of larvae was measured with electronic balance.

Measurements performed for the determination of length and weight of 10 larvae, were done at each day of V instar larvae at 11:00 a.m. for five days before cocooning. The results obtained show high homogeneity in different races. The larval weight from day 1 to day 5 of V instar larvae was subjected to cluster analysis and similarity matrix was obtained. The races were clustered into different groups on the basis of Euclidean distances according to grouping from UPGMA method, ward's method and single linkage using PAST 3 and relationships were represented as Dendrograms. **At cocoon stage:** cocoon shape, cocoon colour and cocoon grain was noted.

### Results And Discussion:-

**Egg Stage:** Analyzing the biological parameters of eggs, colour of eggs was granite grey for all Jam races and Pam 101, while eggs of Pam 102 were nut brown and of Pam 103 were steel grey. Shape of eggs of different races being same, the highest average fecundity per moth was 515 in Pam 101 and lowest was 302 in Pam 102. The lowest hatching percent (89.31%) was obtained in Pam102 race and the highest (94.34%) was obtained in Jam 110 race, with a mean of 93.23% in all studied races. (Table 2).

**Larval stage:** The biological characters of larval stages were recorded as given (Table 3). Under ideal conditions it has been reported that the total larval duration is 25-30 days (Raina, 2000). The total larval duration in the studied races was 23-25 days with maximum in Jam 103 (24.38 days) and minimum in Pam 102 (23.11days). The V age larval duration was also maximum in Jam 103 and Jam 118 (6.05 days) and minimum in Pam 102 (5.54days). The V age 5 day larval colour was steel grey in Jam 110, Jam 118, Pam 103 and marble grey in Jam 103, Pam 101, Pam 102. All the larvae were plain with semi-plain in Pam 101 and marked in Pam 103. (Fig 1-fig 6). The length and weight of 10 larvae, is given in Table 4 and Table 5. The length of each race was correlated with the weight on each day. The results obtained show high homogeneity in different races with highest correlation coefficient in Jam 118 (0.9966) and lowest in Pam 102 (0.9799)(Table 6). The larval weight from day 1 to day 5 of V instar larvae was subjected to cluster analysis and similarity matrix was obtained (Table 7). The races were clustered into different groups on the basis of Euclidean distances according to grouping from UPGMA method, ward's method and single linkage using PAST 3 and relationships were represented as Dendrograms.(fig. 7, fig 8. and fig.9.)

**Cocoon stage:** Of these few phenotypic characters studied, all the races have oval shaped cocoons except Pam 101 having elongated constricted shape and Pam 102 with constricted shape, cocoon colour being white as of bivoltine races and cocoon grain medium in all except Jam 103 and Pam 103 with fine grain. (Table 8). (Fig 10-fig 15)

Varietal differences for studied traits in *B.mori* has been reported by Ahsan *et al.*, 2000, Li *et al.*, 2001; Furdui *et al.*, 2010. Similar studies on varietal diversity have also been sustained by the findings of Reza *et al.*, 1993, Mistri and Jayaswal, 1992; Ahsan *et al.*, 1999; Umashankara and Subramanya, 2002; Nezhad *et al.*, 2009; Nguku *et al.*, 2007; Nguku *et al.*, 2009; Zannata *et al.*, 2009; Pal and Moorthy 2011). The Cluster analysis (UPGMA) divided the 6 strains into 2 groups as shown in (fig.1, fig.2 and fig.3). All races were grouped together and 2 were far from other silkworm strains, indicating it might be suitable for future crossings, maintenance of germplasm so as to maximize heterosis and to avoid inbreeding depression. As studied by Peters *et al* 1989 UPGMA yields more accurate results for classification purposes than other hierarchical methods.

**Table 1:-** Temperature and Humidity conditions at various instars of Silkworm life cycle.

Instar	Temperature (°C)	Humidity (%)
I	26-28	85-90
II	26-28	85-90
III	24-26	80
IV	24-25	70-75
V	23-24	65-70

**Table 2:-** Biological characters of eggs of different races.

Race	Colour of hibernating eggs	Shape	Average fecundity per moth	Hatching percentage(%)
Jam 103	Granite grey	Ellipsoid	406	94.21
Jam 110	Granite grey	Ellipsoid	414	94.34
Jam 118	Granite grey	Ellipsoid	417	94.19
Pam 101	Granite grey	Ellipsoid	515	93.99
Pam 102	Nut brown	Ellipsoid	302	89.31
Pam 103	Steel grey	Ellipsoid	332	93.39

**Table 3:-** Biological characters of larvae of different races.

Race	Total larval duration(days)	V age larval duration(days)	Larval colour V age 5 day	Larval marking (V age)
Jam 103	24.38	6.05	Marble grey	Plain
Jam 110	24.08	6.00	Steel grey	Plain
Jam 118	23.52	6.05	Steel grey	Plain
Pam 101	24.08	5.83	Marble grey	Semi-Plain
Pam 102	23.11	5.54	Marble grey	Plain
Pam 103	23.30	6.00	Steel grey	Marked

**Table 4:-** Length of different races of V instar larvae from Day 1 to Day 5 in cm (Mean±S.D).

S.No.	Race	Day 1	Day 2	Day 3	Day 4	Day 5
.1	Jam 103	4.36±0.271	4.935±0.266	5.465±0.316	5.99±0.230	6.315±0.163
.2	Jam 110	4.525±0.241	4.885±0.310	5.465±0.286	5.965±0.240	6.245±0.195
.3	Jam 118	4.55±0.283	4.89±0.231	5.384±0.300	6.01±0.235	6.3±0.200
.4	Pam 101	4.665±0.184	5.0±0.154	5.47±0.277	6.275±0.145	6.49±0.182
.5	Pam 102	4.61±0.290	4.95±0.278	5.545±0.244	6.315±0.251	6.575±0.196
.6	Pam 103	4.35±0.176	4.835±0.193	5.24±0.234	5.84±0.260	6.195±0.187

**Table 5:-** Weight of different races of V instar larvae from Day 1 to Day 5 in g (Mean $\pm$ S.D).

S.No.	Race	Day 1	Day 2	Day 3	Day 4	Day 5
.1	Jam 103	1.136 $\pm$ 0.122	1.66 $\pm$ 0.211	2.269 $\pm$ 1.61	3.425 $\pm$ 0.616	3.787 $\pm$ 0.678
.2	Jam 110	1.057 $\pm$ 0.169	1.529 $\pm$ 0.343	2.225 $\pm$ 0.347	3.602 $\pm$ 0.343	3.952 $\pm$ 0.347
.3	Jam 118	0.894 $\pm$ 0.102	1.365 $\pm$ 0.137	2.01 $\pm$ 0.224	3.262 $\pm$ 0.372	3.615 $\pm$ 0.375
.4	Pam 101	1.693 $\pm$ 0.082	2.018 $\pm$ 0.097	2.875 $\pm$ 0.274	3.663 $\pm$ 0.196	3.825 $\pm$ 0.216
.5	Pam 102	1.449 $\pm$ 0.201	2.077 $\pm$ 0.253	3.095 $\pm$ 0.177	3.637 $\pm$ 0.297	3.861 $\pm$ 0.247
.6	Pam 103	1.309 $\pm$ 0.161	1.908 $\pm$ 0.223	2.585 $\pm$ 0.436	3.183 $\pm$ 0.271	3.296 $\pm$ 0.254

**Table 6:-** Correlation studies of increase in length and weight gain in day 1 to day 5 of V instar larvae of different races.

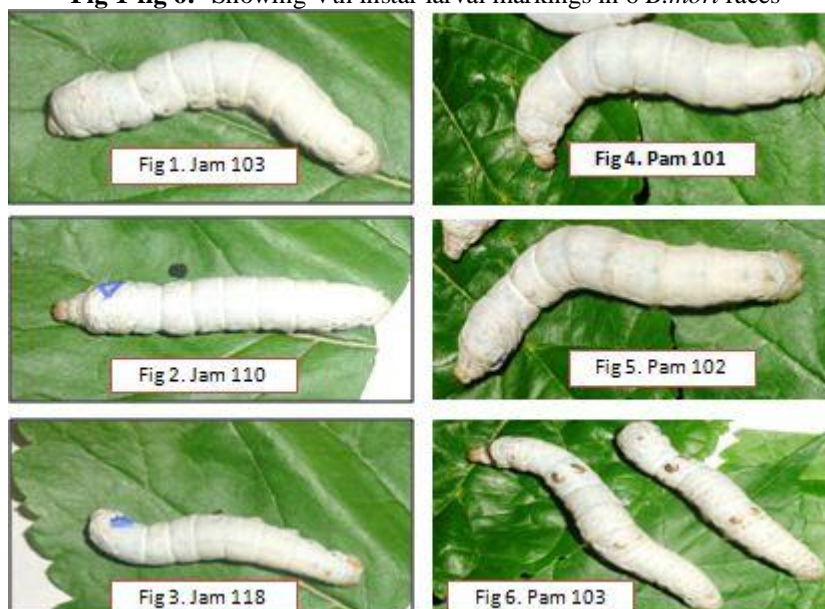
	Jam 103	Jam 110	Jam 118	Pam 101	Pam 102	Pam103
Correlation coefficient(r)	0.9864	0.9873	0.9966	0.9924	0.9799	0.9847

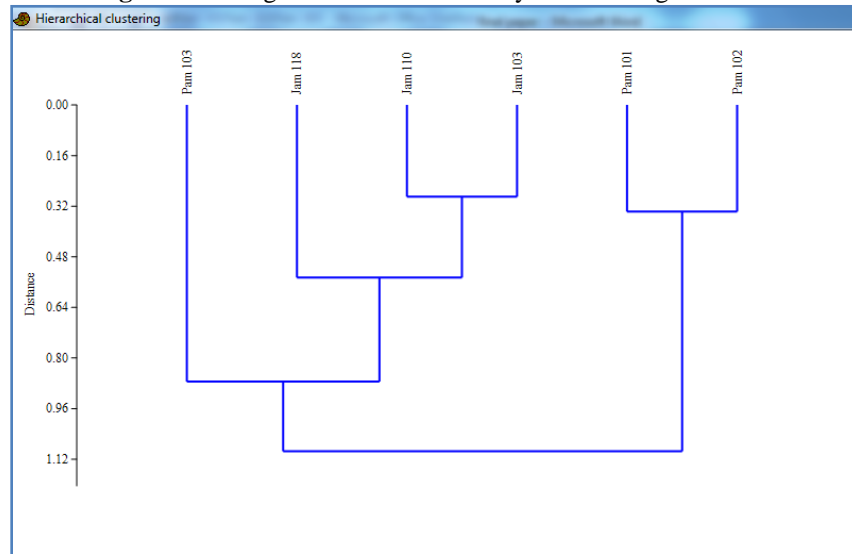
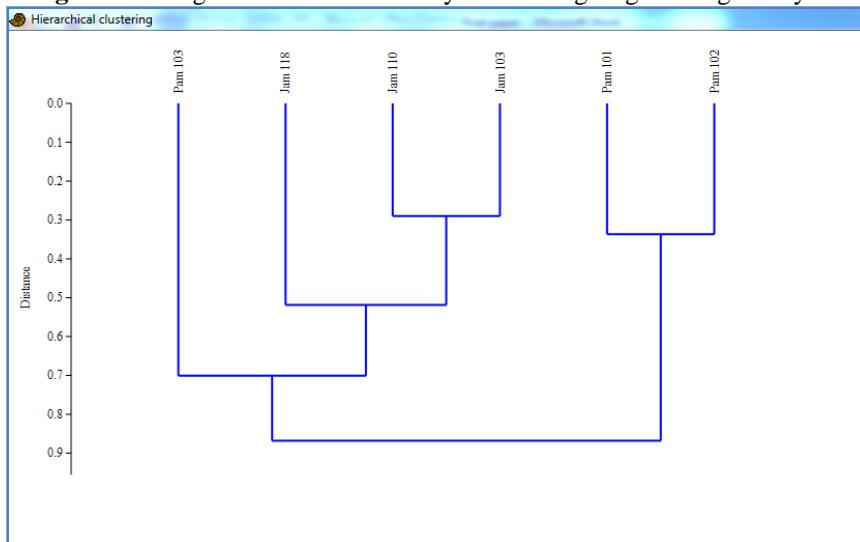
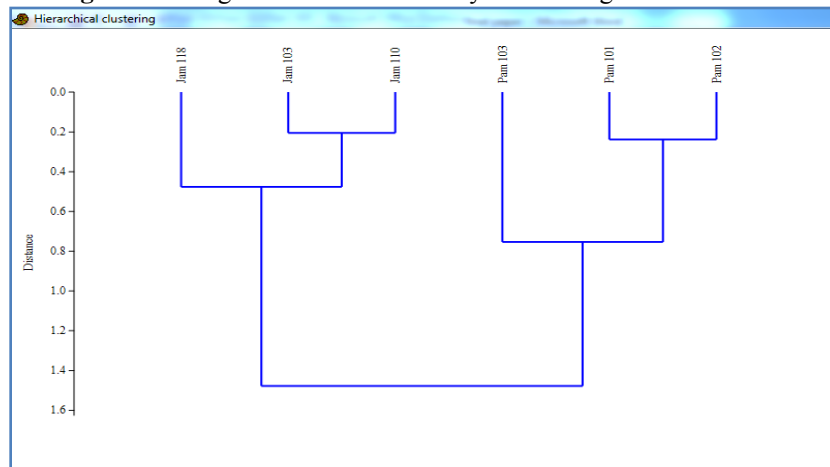
**Table 7:-** Similarity/distance index based on Euclidean distances.

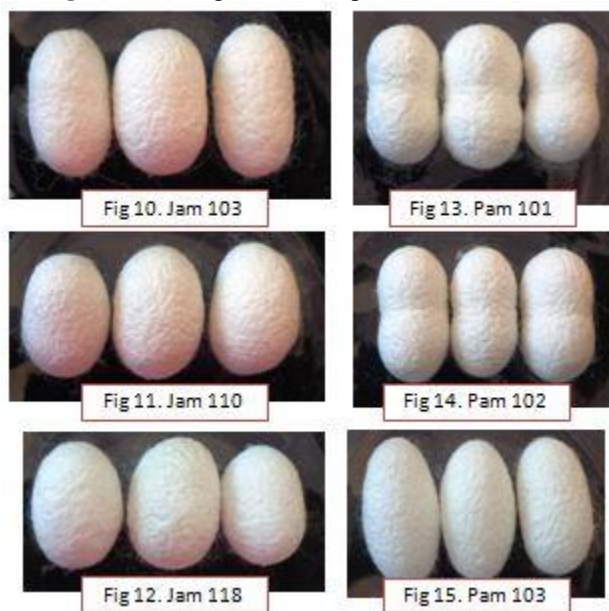
	Jam 103	Jam 110	Jam 118	Pam 101	Pam 102	Pam 103
<b>Jam 103</b>	0	0.289641	0.518481	0.929375	1.002274	0.700667
<b>Jam 110</b>	0.289641	0	0.573462	1.042097	1.104705	0.970898
<b>Jam 118</b>	0.518481	0.573462	0	1.420541	1.480991	0.951683
<b>Pam 101</b>	0.929375	1.042097	1.420541	0	0.336733	0.868272
<b>Pam 102</b>	1.002274	1.104705	1.480991	0.336733	0	0.913018
<b>Pam 103</b>	0.700667	0.970898	0.951683	0.868272	0.913018	0

**Table 8:-** Biological characters of cocoon of different races.

Race	Shape	Colour	Grain
Jam 103	Oval	White	Fine
Jam 110	Oval	White	Medium
Jam 118	Oval	White	Medium
Pam 101	Elongated Constricted	White	Medium
Pam 102	Constricted	White	Medium
Pam 103	Oval	White	Fine

**Fig 1-fig 6:-** Showing Vth instar larval markings in 6 *B.mori* races

**Fig. 7:-** Dendrogram based on similarity matrix using UPGMA.**Fig 8:-** Dendrogram based on similarity index using single linkage analysis.**Fig 9:-** Dendrogram based on similarity index using Ward's method.

**Fig 10- fig 15:-** showing cocoon shape in 6 *B.mori* races studied.**Conclusion:-**

The obtained data showed that there are highly significant differences among the races for all the studied characters. There is a high positive correlation between larval length and weight during V instar. The differences in obtained results are due to the variability and genotype characters for each individual of every race.

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**References:-**

1. Ahsan, M.K., Rahman, S.M. & Ali, I.A. (1999). Inheritance of some quantitative traits in fifteen indigenous varieties of silkworm, *Bombyx mori* L. Univ.J. Zool. Rajshahi Univ.18: 79-83.
2. Ahsan, M.K., Rahman, S.M. & Ali, I.A. (2000). Variability of some quantitative traits in the hybrids of silkworm, *Bombyx mori* L. Univ. J. Zool. Rajshahi Univ. 19: 20-24.
3. Datta, R.K. (1992). Guidelines for Bivoltine Rearing. Central Silk Board, Bangalore, India, p.18.
4. Furdui, E.M., Marghitas, L.A., Dezmirean, D., Mihai, C.M., Bobis, O and Pasca, I. (2010). Comparative study of biological characters of larvae, crude and dried cocoon in 7 races of Silkworm *Bombyx mori* L., raised in Transylvania area. Scientific Papers: Animal Science and Biotechnologies, 43(1): 490-493.
5. Goldsmith, M. R. (1995). Genetics of the silkworm: revisiting an ancient model system. In *Molecular Model Systems in the Lepidoptera*, ed. MR Goldsmith, AS Wilkins, pp. 21–76. New York: Cambridge Univ. Press
6. Goldsmith, M. R., Shimada, T and Abe, H. (2005). The genetics and genomics of the silkworm, *Bombyx mori*. Annu Rev Entomol, 50: 71-100.
7. Krishnaswami S. (1978). New technology of silkworm rearing in Bulletin No. 2, Central Sericultural research and Training Institute, Mysore, Central Silk Board, Govt. of India, 1-23.
8. Li, M., Qin, Y., Hou, C., Lin, C and Chen K. (2001). Studies on some special characters in the silkworm (*Bombyx mori* L.) germplasms in China. Sericologia41: 527–35
9. Mistri, P. K. & Jayaswal, K. P. (1992). Studies on phenotypic correlations between some economic traits of silkworm, *Bombyx mori* L. Bull. Seric. Res. 3: 26-29
10. Nagaraju, J., Goldsmith, M. R. (2002). Silkworm genomics – progress and prospects. Curr Sci 83: 415-425.

11. Nezhad, M.S., Mirhosseini, S.Z., Gharahveysi, S., Mavvajpour, M and Seidavi, A.R. (2009). Analysis of Genetic Divergence for classification of morphological and larval gain characteristics of peanut cocoon silkworm (*Bombyx mori* L.) Germplasm. American-Eurasian J. Agric. & Environ. Sci., 6(5): 600-608.
12. Nguku, E.K., Adolkar, V.V., Raina, S.K., Mburugu, K.G., Mugenda, O.M and Kimbu, D.M.(2009). Performance of six Bivoltine *Bombyx mori*. (Lepidoptera: Bombyxidae) silkworm strains in Kenya. The Open Entomology Journal, 3, 1-6.
13. Nguku, E.K., Muli, E.M and Raina S.K.(2007). Larvae, cocoon and post-cocoon Characteristics of *Bombyx mori* L.(Lepidoptera:bombyxidae) fed on mulberry leaves fortified with Kenyan royal jelly. J. Appl. Sci. Environ. Manage. 11(4) 85-89
14. Pal, N. B and Moorthy, S. M. (2011). Assessment of variability in larval and cocoon traits in some genotypes of bivoltine silkworm, *Bombyx mori* L. International Journal of Research in Biological Sciences, 1(4): 59-65.
15. Peters, J.P and Martinelli, J.A. (1989). Hierarchical cluster analysis as a tool to manage variation in germplasm collection. Theor. Appl. Genet., 78:42-48.
16. Rao, C.G., Seshagi, S.V., Ramesh, C., Ibrahim, B.K and Nagaraju, H., Chandrashekharaiiah. (2006). Evaluation of genetic potential of the polyvoltine silkworm (*Bombyx mori* L.) germplasm and identification of parents for breeding programme. J. Zhejiang Univ Sci B 7: 215-220.
17. Reza, A. M. S., Rahman, M. S. & Rahman, S. M. (1993). Studies on the variation of some larval traits in different breeds of silkworm, *Bombyx mori* L. Univ. J. Zool. Rajshahi Univ. 12: 21-24.
18. Umashankara, M. L. and Subramanya, G. (2002). Correlation between larval weight and cocoon characters in five breeds of silkworm, *Bombyx mori* L. Geobios, 29:154-157.
19. Yokoyama T. (1963). Sericulture. Ann. Rev. Entomol. 8:87-306.
20. Zanatta, D.B., Bravo, J.P., Barbosa, J.F., Munhoz, R.E.F and Fernandez, M.A. (2009). Evaluation of economically important traits from sixteen parental strains of the silkworm *Bombyx mori* L.(Lepidoptera: Bombyxidae). Neotropical Entomology 38(3): 327-331.





### RESEARCH ARTICLE

## CHROMOSOMAL ANALYSIS OF MULBERRY SILKWORM (*BOMBYX MORI*. L) FROM JAMMU REGION.

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### Abstract

In the present study, the chromosomal analysis of mulberry silkworm, *Bombyx mori* L. was carried out in order to study its chromosome behaviour and karyotype from larval gonadal tissue. The observed diploid number was  $2n=56$ . The mean total length, RL% and TCL% were measured at metaphase stage of gametogenesis. The chromosomal behaviour during meiotic stages viz., leptotene, zygotene, pachytene, diplotene, diakinesis and anaphase were also analyzed. Results indicate that the samples studied were males with a diploid chromosome number of  $2n=56$ .

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### Introduction:-

The order Lepidoptera includes moths and butterflies. It is a species rich order and among this order are some commercially important insects like silkmths and many serious agricultural pests too. The mulberry silkworm is a commercially important insect which is completely domesticated and one of the most genetically studied insect and well known as lepidopteran model insect (Nagaraju and Goldsmith, 2002) apart from its importance as a producer of silk-“the queen of textiles”.

As in most Lepidoptera, the chromosomes of *Bombyx mori* L. are holocentric (Murakami and Imai, 1974) i.e. they possess centromeres throughout the chromosome body. These chromosomes are highly condensed and appear dot-shaped at mitotic and meiotic metaphase stages. Their diffused centromeres and lack of special features make them difficult to identify individually. The chromosome number is known with  $n=28$  (Kawaguchi, 1928) and  $2n=56$  (Kawamura 1979, Yoshido *et al* 2005). In the present investigation, an attempt has been made to prepare a karyotype of *Bombyx mori* L. on the basis of decreasing chromosome length from meiotic metaphase complement. The chromosome behavior during the meiotic stages was also studied from the larval gonadal cells.

### Material and Methods:-

#### Rearing of silkworm larvae:-

The IIIrd instar larvae of mulberry silkworm, *B.mori* L. were collected from RSRS Miransahib, Jammu and transported to Cytogenetics Lab., Dept. of Zoology., University of Jammu. About 20 larvae were reared in rearing cage for further development (fig. 1). The temperature and relative humidity was maintained as  $26^{\circ}\text{C}$  and 80% RH for the IIIrd instar,  $24-25^{\circ}\text{C}$  and 75% RH for IV instar and  $23-24^{\circ}\text{C}$  temperature and around 70% RH for the V instar, the larvae were fed with mulberry leaves during larval period.

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**Cytological preparation of slides:-**

The gonads of IV and V instar larvae were used for cytological preparations (fig 2). The slides were prepared by using the technique of Murakami and Imai 1974 with slight modifications. Briefly, the larval gonads were dissected in colchicine-hypotonic solution (0.01 % colchicine in 0.45% sodium citrate solution) and then put in fresh hypotonic solution for 30-45 minutes at room temperature, the gonads were transferred to glass slide and torn into pieces in 60% acetic acid and fixed in Carnoy's fixative for 2-3 minutes. The material was squashed and stained with Aceto-orcein for 10 minutes. The prepared slides were scanned under Olympus camera aided microscope and photographed by CH20i B1MF microscope attached with Sony -SSC-DC378P camera under 1000x magnification. Histogram was prepared by taking chromosome pair number on X-axis and corresponding relative length percentage on Y-axis. The chromosomes were paired on the basis of size only as they lack any primary or secondary constriction.

**Results:-**

Spermatogonial metaphase (fig.3) showed the diploid chromosome number of  $2n=56$ , the chromosomes were numerous, darkly stained, highly condensed and dot-like without conspicuous centromere. The karyotype prepared on the basis of decreasing chromosome lengths showed 28 pairs of chromosomes with their homologous chromosomes. Sex chromosomes were not distinguished from others. The karyotype (fig.4) was prepared from well spread spermatogonial metaphase that revealed the presence of 56 elements and showed 28 pairs of chromosomes gradually decreasing in length. Histogram (fig. 5) was prepared on the basis of decreasing value of RL% from chromosome pair 1 to 28. The maximum TCL% i.e., 5.66% was found in first chromosome and the minimum 1.548% was found in the last chromosome pair. The RL% varied from 27.33% in the last chromosome pair to 100% in the first chromosome pair. The total complement length of the haploid set was  $132.35\mu\text{m}$  (Table 1). The other meiotic stages observed were leptotene, zygotene, pachytene, diplotene, diakinesis, anaphase and metaphase (side view)(Fig 6 to 13). The leptotene stage possessed chromosomes in the form of long and thin threads which crossed and inter-crossed each other forming a network. In zygotene stage, (fig. 7) all chromosomes are attached to the inner nuclear membrane. End to end synapsis of homologous chromosomes is also seen. The early pachytene stage showed cross-over between homologous chromosomes as in fig 8. The chromosomes are extended and lightly stained having recombination nodules. The late pachytene (fig 9) shows well spread chromosomes which are slightly more condensed. The points of chiasmata can be easily seen, the chromosomes are shortened and darkly stained (fig 10). These are not countable due to its small size and high number. In fig 11, the chromosomes are condensed and form ring like structures showing terminalisation of chiasmata. The chromosomes are dark, small and numerous at this stage marked with further condensation and not countable. This stage is the diakinesis stage of Prophase I. In metaphase stage, chromosomes lying at the equatorial plane are clearly seen in the side view as shown in fig. 12. Early anaphase with parallel alignment of chromosomes is seen in fig. 13 and the chromosomes are seen pulled to opposite poles. The point of attachment is not detectable due to holocentric nature of the chromosomes.

**Table 1:-** Karyo-morphometric data of *Bombyx mori* L. from its spermatogonial metaphase complement,  $2n=56$ .

Chromosome Pair Number	Mean Total Length ( $\mu$ )	Total Complement length percentage (TCL%)	Relative Length Percentage (RL%)
1	7.50	5.666	100
2	7.05	5.326	94.00
3	6.85	5.175	91.33
4	6.00	4.533	80.00
5	5.90	4.457	78.66
6	5.55	4.193	74.00
7	5.30	4.004	70.66
8	5.15	3.891	68.66
9	5.10	3.853	68.00
10	5.05	3.815	67.33
11	5.00	3.777	66.66
12	4.95	3.740	66.00
13	4.90	3.702	65.33
14	4.70	3.551	62.66
15	4.65	3.513	62.00
16	4.55	3.437	60.66
17	4.45	3.362	59.33

18	4.40	3.324	58.66
19	4.30	3.248	57.33
20	4.10	3.097	54.66
21	4.05	3.060	54.00
22	4.00	3.022	53.33
23	3.90	2.946	52.00
24	3.70	2.795	49.33
25	3.15	2.386	42.00
26	3.05	2.304	40.66
27	3.00	2.266	40.00
28	2.05	1.548	27.33

**Karvo-morphometric analysis of karyotype: -**

Actual mean length of the largest chromosome =  $7.5 \mu$

Actual mean length of the smallest chromosome =  $2.05 \mu$

Relative Length % of the largest chromosome = 100%

Relative Length % of the smallest chromosome = 27.33

Ratio of the largest to smallest chromosome = 3.658

Total complement length of haploid set =  $132.35 \mu$



**Fig 1:-** Rearing of silkworm larvae in rearing cage.



**Fig 2:-** V instar larvae taken for cytological preparations.

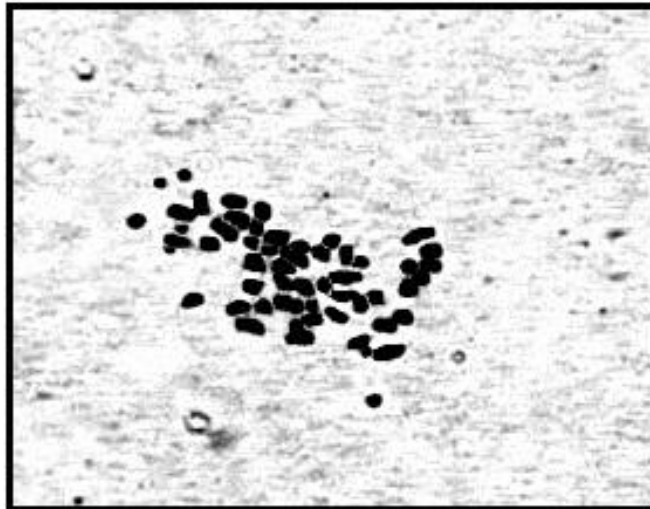


Fig.3

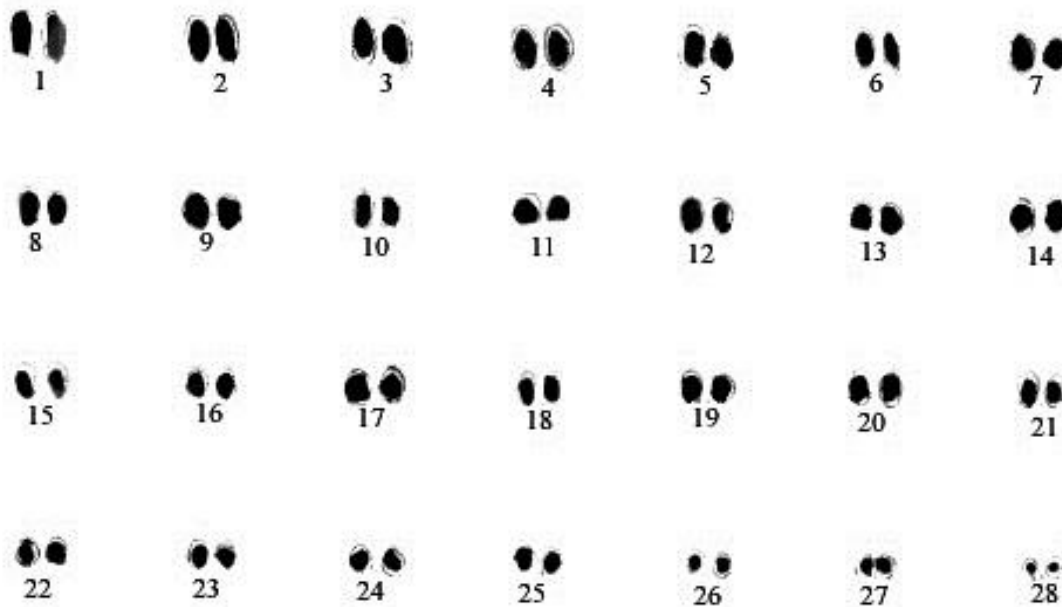


Fig.4

**Fig 3:-** Spermatogonial Metaphase of *Bombyx mori* L. with  $2n=56$ .

**Fig 4:-** Karyotype prepared from the meiotic metaphase complement.

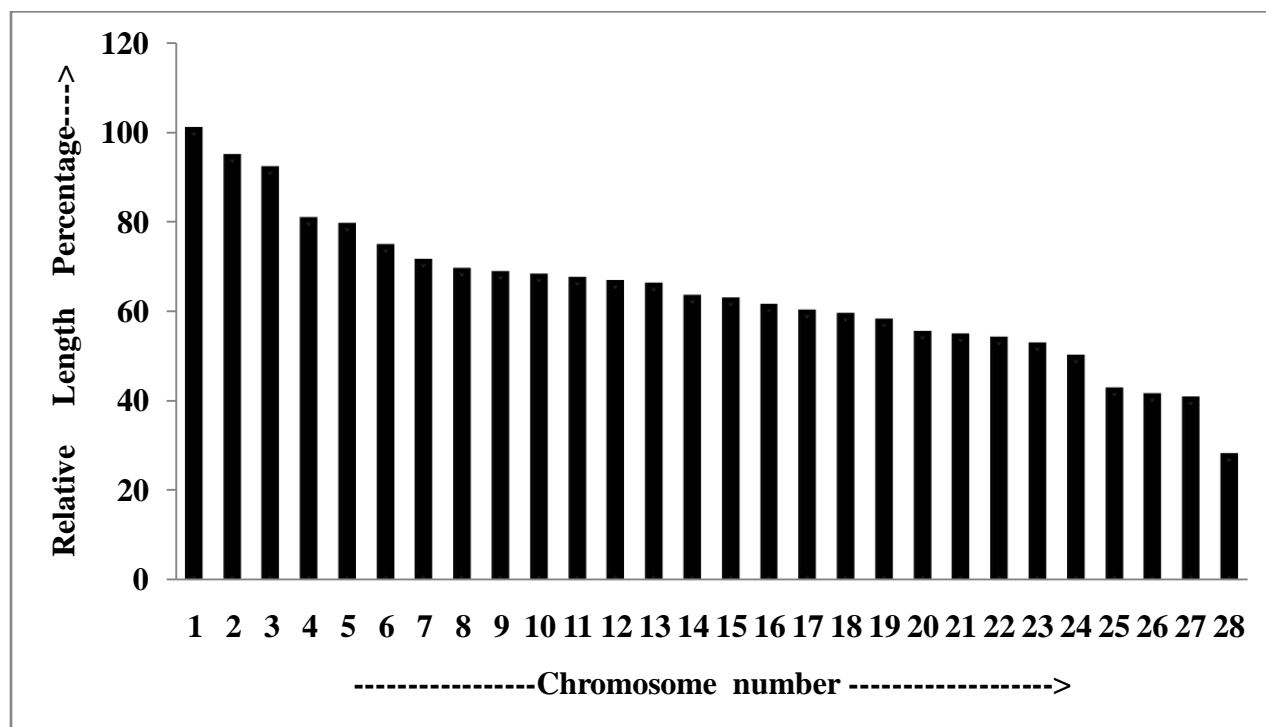


Fig 5:- Histogram prepared on the basis of relative length percentage.

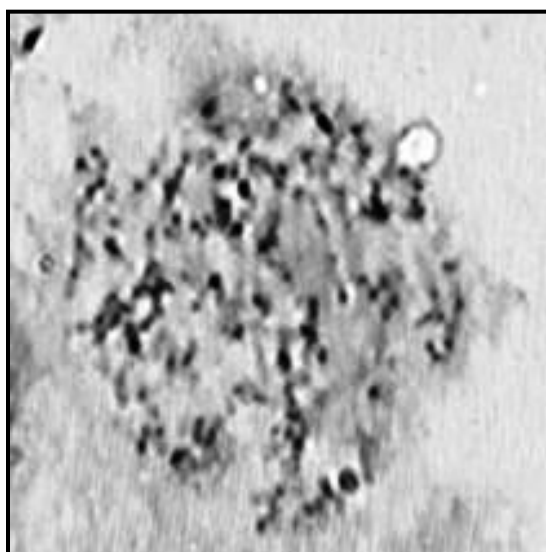


Fig 6:- Leptotene



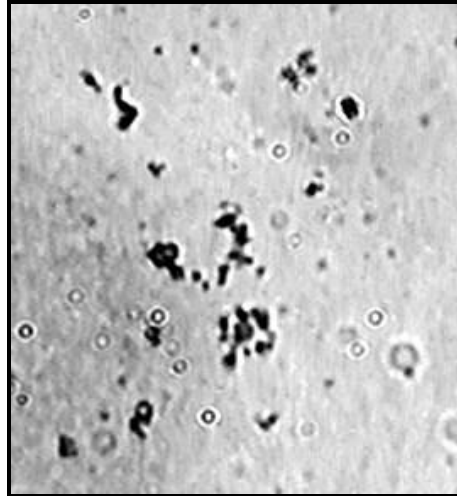
**Fig 7:-** Zygotene



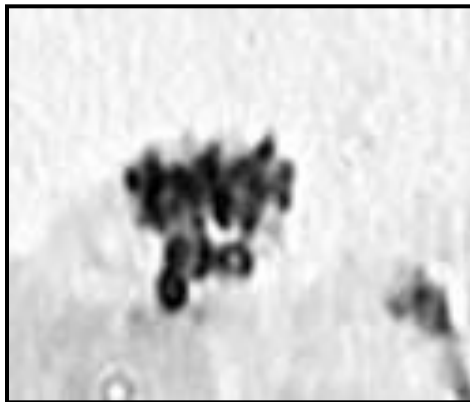
**Fig 8:-** Early pachytene



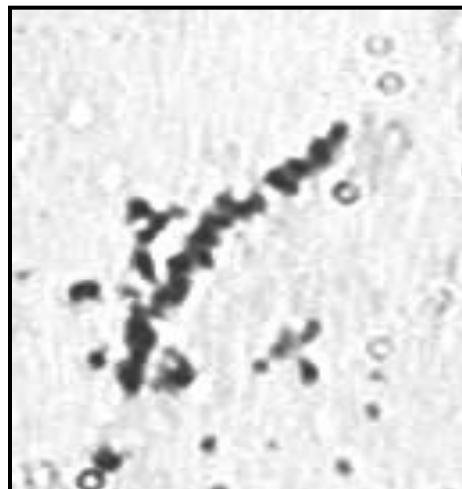
**Fig. 9:-** Late pachytene



**Fig. 10:-** Diplotene



**Fig 11:-** Diakinesis



**Fig 12:-** Metaphase (side view)



**Fig 13:-** Early Anaphase

### Discussion:-

The Lepidoptera have a great range in chromosome number than any other group of animals. ( $n=7$  to  $n=220$ ). In case of mulberry silkworm, *Bombyx mori* L. the diploid chromosome number has been reported for the first time by Toyama (1894) to be  $2n=28$ , which was later reported to be a haploid number and was a result of old microscopy techniques and large number and small size of the chromosomes. Kawaguchi (1928) reported the diploid chromosomal number to be  $2n=56$  and haploid set to be 28 chromosomes. Further, Yoshido *et al* (2005) prepared the *Bombyx mori* karyotype using genetically mapped *Bombyx mori* bacterial artificial chromosomes as probes and assigned already established genetic linkage groups and the correct orientation in the chromosomes. The present study done on *Bombyx mori* L. under the subtropical conditions of Jammu region further established the diploid chromosome number to be  $2n=56$  in mulberry silkworm as reported by Kawaguchi (1928), Kaur (1988) and Yoshido *et al* (2005).

The chromosomes in lepidopterans are holocentric with a presence of multiple and diffused kinetochores. In holocentric chromosomes, the attachment region of spindle is spread throughout the chromosome. Holokinetic chromosomal organization in Lepidoptera was deduced from the missing primary constrictions and a parallel separation in mitotic anaphase (Murakami and Imai, 1974), viability of chromosome fragments (Maeki 1981), high rate of viability of X-ray induced translocations (Bauer, 1967), high doses of X-ray necessary to induce sterility and chromosome fragmentation and fusion in evolution giving rise to highly different chromosome numbers in related species. (Suomalainen, 1953). Similar findings have been observed in the meiotic prophase stages like pachytene, metaphase-I, diplotene, diakinesis and anaphase stages. Murakami and Imai (1974) provided cytological evidence for holocentric chromosomes in *Bombyx mori* and *Bombyx mandarina*, Friedlander and Wahraman (1970) demonstrated some electron micrographs of silkworm chromosomes in which microtubules penetrate all along the polar faces of the chromosomes as in case of *Ostrinia nubilalis* and concluded that silkworm chromosome lacks a localized centromere.

Chromosome behavior in *B. mori* is essentially same in both the sexes from initial pairing at zygotene and formation of synaptonemal complex but the process of crossing over and chiasmata formation are limited to males only, and the females of *Bombyx mori* undergo achiasmatic meiosis and the pachytene chromosomes are synapsed side to side until metaphase-I, as studied by Sturtevant (1915), Tanaka (1913), Traut (1976) and Rasmussen *et al* (1977). In the present investigation, all the meiotic stages viz., recombination nodules at early pachytene, chiasmata at diplotene and diakinesis and similar 28 chromosome pair suggests that the samples studied were males thus the sex can be determined by using cytological techniques in *Bombyx mori*.

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**References:-**

1. Bauer, D.G. (1983). Die kinetische organization der lepidopteran chromosome. Chromosoma(Berl.), 22 : 101-125.
2. Friedlander, M. and Wahrman, J. (1970). The spindle as a basal body distributor: A study in the meiosis of the male silkworm moth, *Bombyx mori*. J. Cell Sci. 7: 65-89.
3. Kaur, T. (1988). Chromosome numbers of thirty-one species of Indian Lepidoptera. Genetica, 76 : 191-193.
4. Kawaguchi, E. (1928). Zytologische Untersuchungen am seidenspinner and seinen verwandten. I. Gametogenese von *Bombyx mori* L. and *Bombyx mandarina* M. und ihres Bastarde. Z. Zellf., 7: 519-552.
5. Kawamura, N. (1979). Cytological studies on the mosaic silkworms induced by low temperature treatment. Chromosoma, 74: 179-188.
6. Maeki, K. (1981). The kinetochore of the Lepidoptera. III. Morphology and behavior of fragment chromosomes and electron-microscopic illustration of microtubules (MTS) locating along chromosomes. Proc. Jap. Acad. Ser. B., 57 (3) : 71-76.
7. Murakami, A. and Imai, H.T. (1974). Cytological Evidence for holocentric chromosomes of the silkworms, *Bombyx mori* and *B. mandarina*, (Bombycidae, Lepidoptera). Chromosoma, 47: 167-178.
8. Nagaraju, J and Goldsmith, M. R. (2002). Silkworm genomics – progress and prospects. Curr Sci 83: 415-425.
9. Rasmussen, S.W., Raveh, D., Cowen, J. and Lewis, K.R. (1977). Meiosis in *Bombyx mori* Females (and Discussion). Philosophical Transactions of the royal Society of London. Series B, Biological Sciences, 277(955): 343-350.
10. Sturtevant, A. H. (1915). No crossing over in the female of the silkworm moth. Amer. Nat. 49 : 42-44.
11. Suomalainen, E. (1953). The kinetochore and the bivalent structure in Lepidoptera. Hereditas (Lund), 39: 88-96.
12. Tanaka, Y. (1913). A study of the Mendelian factors in the silkworm, *Bombyx mori*. The Journal of the College of Agriculture, Tohoku Imperial University, Sapporo, Japan. 5: 91-113.
13. Toyama, K. (1894). On the spermatogenesis of the silkworm. Bull. Coll. Agric. Tokyo. Univ., 2 : 125-157.
14. Traut, W. (1976). Pachytene mapping in the female silkworm, *Bombyx mori* L. (Lepidoptera). Chromosoma, 58: 275-284.
15. Yoshido, A., Bando, H., Yashukochi, Y. and Sahara, K. (2005). The *Bombyx mori* karyotype and the assignment of linkage groups. Genetics, 170(2): 675-685.



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## RESEARCH ARTICLE

### MENTAL STATES IN WOMEN: THE ROLE OF FAMILY

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family functioning; positive mental states; negative mental states.

#### Abstract

**Background:** Women disproportionately suffer from mental health disorders and are more frequently subject to social causes. Most findings implicate negative mental states are the offshoots of inadequate interaction with the environment and family environment is the chief cause. This study extends existing research in the field of mental health that focuses on the effects of family functioning on positive and negative mental states in females.

**Aims:** This study tested the hypothesized model that healthy family functioning leads to increased positive mental states and, subsequently, reduced negative mental states in females.

**Methods:** A sample of undergraduate and postgraduate ( $n = 201$ ) female students completed survey packets in order to test this sequence of relationships on the General Family Functioning Scale, Oxford Happiness Questionnaire, Herth Hope Index, Life Orientation Test and Depression Anxiety Stress Scale.

**Statistical analysis used:** A Structural Equation Model was then constructed and evaluated based on the tested measurement model of latent factors.

**Results:** The model yielded significant effect. The findings from the study indicated that healthy family functioning and positive mental states are positively related to each other, but negatively related to negative mental states. The findings provide compelling empirical evidence that healthy family functioning reduce the negative mental states by enhancing the positive mental resources. Thus negative mental states can be accurately modeled as an outcome of family functioning mediated by positive mental states.

**Conclusions:** This study suggests that combined interventions, targeting family functioning and increasing positive mental states may be particularly useful in addressing negative mental states in females. The research contributes recommendations for policy, practice and further studies.

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#### Introduction:-

Women's health within the policy domain is often defined as reproductive and identified with women's children's health. Although, this perspective is well-founded given that the health of women is well documented to have a positive impact on the general health of all members of a society (Marcia, 1997; Ware & Good, 1995). But, the

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question rises, what about programs designed to address women's needs as women? Such question challenges the traditional health policies and programs and calls for definitions of women's health which are broader than the reproductive and the maternal, incorporating mental health as well (Rosenfield & Maine, 1985). Women's well-being is not solely determined by biological factors and reproduction, but also by psychological factors. So the need is to mainstream mental health issues as well, because women disproportionately suffer from mental health disorders and are more frequently subject to social causes that lead to mental distress (Van der Kwaak, Vanden Engel, & Richters, 1991).

#### **Previous research on mental states:-**

Comparative analysis of empirical studies of mental disorders reveals a consistency across diverse societies and social contexts, revealing negative mental states more prevalent among women which can be related to the social circumstances of many women's lives (Ware & Good, 1995). Most findings implicate negative mental states are the offshoots of inadequate interaction with the environment and family environment is the chief cause (Chauhan, 2006; Chorpita & Barlow, 1998; Das, 1994; Joshi & Tomar, 2006; Parker, 1983; Sharma, Verma & Malhotra, 2008). Links between emotional deprivation or affectionless control, and psychological distress in women have also been documented in many studies, including work carried out in Brazil, Mexico and Pakistan (kaya, 1985; Malik, Bukhtari, & Good, 1992; Naeem, 1992; Nancy, 1995; Nations & Rebhun, 1988). Chorpita and Barlow (1998) articulated a model of the environmental influences on the development of negative mental states. Evidence from a variety of sources suggests that life experience with diminished control may foster a cognitive style characterized by an increased probability of interpreting or processing subsequent events as out of one's control, which may represent a psychological vulnerability for mental distress.

Psychologists have discovered that there is a set of human strengths that are the most likely buffer against mental illness: happiness, courage, optimism, interpersonal skill, hope, honesty and perseverance (Khordzanganeh, Heidarie, & Naderi, 2014; Seligman, 1998). A number of positive predictors of happiness have been identified, including satisfaction with relationships with people from whom support has been received (Lu & Argyle, 1992). This speaks to the importance of positive relationships with others for the well-being of an individual. Research suggests that hope and optimism are beneficial for physical and psychological well-being (Aspinwall & Taylor; 1992; Scheier, Carver, & Bridges, 1994). Carr (2004) contended that positive mental states are positively correlated with, and are predictive of, physical and mental health. Seligman and Csikszentihalyi (2000) called for counselors and psychologists working with families and other settings to develop climates that foster these strengths.

#### **Family Functioning:-**

From the work of Ackerman (1959), Jackson (1965), Minuchin (1974), and Bowen (1978) came family systems theory, developed on the basis of general systems theory (Bertalanffy, 1973). General systems theory includes basic ideas from Gestalt psychology, focusing on the whole, and Kert Lewin's field theory (1951) (Schwab, Stephenson, & Ice, 1993). A primary concept in the family systems theory is that the family includes interconnected members, and each member influences the other in predictable and recurring ways (Fingerman & Bermann, 2000; Van Velsor & Cox, 2000). Family functioning is more related to the transactional and systematic properties of the family system than to the intrapsychic characteristics of the individual (Westley & Epstein, 1969). Family functioning refers to set of basic attributes about the family system that characterize and explain how a family system operates (McCubbin & Thompson, 1991). Family therapists and theorists have identified different attributes of family functioning. McMaster's Model of Family Functioning (Epstein, Bishop, & Levin, 1978) conceptualizes family functioning as comprising of six dimensions: problem solving, communication, roles, affective responsiveness, affective involvement, and behavioural control. McMaster Model of Family Functioning (MMFF) (Epstein et al., 1978) is a clinically orientated conceptualization of families. It describes the structural and organizational properties of the family group and the patterns of transactions among family members which have been found to distinguish between healthy and unhealthy families. Many studies have examined family functioning of patients with psychiatric disorders, including depression, adjustment disorders, anxiety disorder, etc. (Friedmann, McDermut, Solomon, Ryan, Keitner, & Miller, 1997; Keitner, Miller, & Ryan, 1993; Miller, Keitner, Whisman, Ryan, Epstein, & Bishop, 1992).

#### **Contributions and Limitations of previous research:-**

Despite the importance of research investigating mental states in women, several key limitations of the research exist. These limitations are detailed below. In detailing these limitations, however, we also recognize the contribution of previous studies, and indicate how these contributions relate to the limitations identified.

Positive mental states have usually been shown to be related with negative mental states in research studies because positive mental states are assumed to be psychological beliefs which are known to be protective of mental health (Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000). The elements in the environment are also considered to support the development and maintenance of mental health (Seligman, 2002). Research studies have portrayed unhealthy family environment as a precursor of mental distress. Further it has been shown that healthy family functioning is supportive of development of positive beliefs, thoughts and behaviours.

Most of the research studies relating family functioning and mental problems have been conducted on adolescents. When studies have focused on mental states as a dependent variable, they have (like the present study) often focused on reducing negative mental states. However, in doing so, previous studies have adopted the general approach identifying antecedent social or psychological variables to mental states. However, these studies often investigate these variables in a general or theoretical sense, without direct psychological measurement or modeling, and/or using weaker methodologies. This study, in contrast, examines antecedent social and psychological variables of mental states by directly modeling negative mental states as the casual outcome of a network of these variables. In this way, this study follows the more rigorous approach.

#### **The present study:-**

For the reasons above, we sought to investigate mental states: (a) as a dependent variable, (b) using sophisticated latent variable modeling approaches, (c) with a focus on identifying a network of interrelated antecedent variables that may reduce negative mental states and (d) taking gender specific sample of women, (e) in a non-western context. More specifically, we propose to test a model hypothesizing that healthy family functioning leads to increased positive mental states and, subsequently, reduced negative mental states, i.e.,

Healthy Family Functioning  $\longrightarrow$  Increased Positive Mental States  
 $\longrightarrow$  Reduced Negative Mental States

The structural model tested in this research implies that healthy family functioning leads to increased resources of positive mental states. In turn, positive mental states have the strength to provide a cognitive and affective defense against negative mental states. Importantly, we hypothesize that the direct effects of family functioning on negative mental states will be less important than the indirect effects of family functioning acting on negative mental states through positive mental states. It is assumed that when healthy family environment leads to increased positive mental states then negative mental states are potentially reduced significantly because positive mental states implies resources of strength which are expected to counteract the negative mental states.

In this study the antecedent variable family functioning is defined as measured by General Family Functioning Scale, an overall measurement of family functioning, one of the subscales of Family Assessment Devise (FAD), developed on the basis of McMaster's Model of Family Functioning (Epstein, et al., 1978). The mediating variables in model is positive metal states defined as happiness, as measured by Oxford happiness Questionnaire; hope, as measured by Herth Hope Index; and optimism, as measured by Life Orientation Test – Revised. And the causal variable in the model i.e., negative mental states is defined as depression, anxiety, and stress, as measured by Depression anxiety Stress Scale.

#### **Purpose of the study:-**

The specific purpose of the study was to test the veracity of a model hypothesizing mental states to be the consequence of family. In order to achieve this purpose the measures in the study were first tested in a measurement model. Based on the measurement model, a Structural Equation Model (SEM) of Negative Mental States with family functioning and positive mental states as antecedent variables was then constructed and evaluated.

For the purposes of operationalizing our SEM model, we accepted the validity of certain relationships between constructs of interest already postulated in the literature, but noted that these relationships have not been tested within a causal modeling framework. In other words, for the purpose of constructing testable causal and measurement models, we assumed that the postulated relationships drawn from the literature, and operationalized in the models tested in this research, were at least plausible. At the same time, for the purpose of actually testing the models, we did not automatically assume that the postulated relationships operationalized in the models would hold in any particular sample/population. The study, then, both accepts the validity of the postulated relationships (for

model construction purposes), and does not (automatically) accept the validity of the postulated relationships (for model testing purposes).

### **Method:-**

#### **Participants:-**

The study was conducted in the Kashmir valley of India. Data were collected from 201 undergraduate and postgraduate female students, studying in University of Kashmir, Srinagar. They ranged in age from 18 to 30 years, with the average age of 23 years.

#### **Instruments:-**

The present study utilized self-reported instruments which are as follows.

- a. McMaster General Family Functioning Scale is a 12-item (6 phrased positively and other 6 negatively) sub-scale of McMaster Family Assessment Device (FAD) developed by Epstein, Baldwin, & Bishop (1983), on the basis of the McMaster Model of Family Functioning (MMFF; Epstein, et al., 1978; Westley & Epstein, 1969). General functioning scale assesses the overall health/pathology of the family. Scores range from 1 (*strongly agree*) to 4 (*strongly disagree*).
- b. Life Orientation Test – Revised (LOT-R; Scheier, Carver, & Bridges, 1994) consists of 10 items, 3 items measure optimism, 3 items measure pessimism, and 4 items serve as fillers. It has a 5-point scale ranging from 0 (*strongly disagree*) to 4 (*strongly agree*). Items 3, 7, and 9 are reverse scored. Items 2, 5, 6 and 8 are fillers and are not scored.
- c. Herth Hope Index (HHI; Herth, 1992), an abbreviated version of Herth Hope Scale, consists of 12 items that are based on three dimension, namely, temporality and future, positive readiness and expectancy, and interconnectedness. It is a 4 point scale, response ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). Items 3 and 6 are reverse scored.
- d. Oxford Happiness Questionnaire (OHQ; Argyle & Hills, 2002), has been derived from the Oxford Happiness Inventory (OHI). The OHQ short scale includes eight items of the OHI, (some are phrased positively and others negatively) which can be endorsed on a six-point Likert scale, ranging from “strongly agree (6)” to “strongly disagree (1)”. Items 1, 4, and 8 are reverse scored.
- e. Depression Anxiety Stress Scale (DASS-21) has been developed by Lovibond and Lovibond, 1995. It consists of 3 subscales of 7 items each: Depression (assesses dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest/involvement, anhedonia and inertia); Anxiety (assesses autonomic arousal, skeletal muscle effects, situation anxiety and subjective experience of anxious effect); and Stress (assesses levels of non-chronic arousal through difficulty relaxing, nervous arousal and being easily upset/agitated, irritable/over-reactive and impatient). The rating scale ranges from 0 (*never*) to 3 (*almost always*).

#### **Procedure:-**

Participants were asked to complete a survey package consisting of all the instruments described above with proper instructions. The questionnaires were distributed to the participants in the different departments and collected on the subsequent days

#### **Data analysis:-**

A measurement model of three latent variables (LVs) was created corresponding to family functioning, positive mental states, and negative mental states, and the strength of the relationships between the three LVs was the subject of investigation. Confirmatory factor analysis (CFA), using Analysis of Moment Structures (AMOS 20.0), evaluated the adequacy of the measurement model, prior to testing more complex SEM. The key interest of the present study was the relationships between family functioning, positive mental states and negative mental states. In this study, Hierarchical Structural Equation Modeling (HSEM – Byrne, 1998; Kaplan, 2000) was used to test these relationships.

Structural equation modeling (SEM), conducted with AMOS 20.0, was used to test the study hypotheses. SEM was used because it corrects for measurement error and can estimate both direct and indirect (mediated) effects simultaneously. Constructs were represented with item-parcels (i.e., sums of items) (Bandalos & Finney, 2001). The use of parcels is considered acceptable as long as the indicators represent a single dimension and are closely related to one another (Little, Cunningham, Shahar, & Widaman, 2002).

**Model fit:-**

Model fit in CFA and SEM Models may be assessed through a combination of parameter investigations (all parameters should be within acceptable values), the chi-square/ degrees of freedom ratio (which, ideally, should be close to, or less than, two), and various relative fit indices (which measure model fit relative to a “baseline” model hypothesizing a unidimensional factor structure) and information criteria, which provide a numerical estimate of the explanatory power of model based on certain assumptions about, and characteristics of, the model (see Hu & Bentler, 1999). In this study, we used standard indices and cut-off values to evaluate fit: the Root Means Square Error of Approximations (RMSEA < .08), and the Goodness-of-Fit Index (GFI > .90) and Comparative Fit Index (CFI > .90) (see Kline, 1998), as measures of model fit, with all parameters estimated using the maximum likelihood procedure.

**Results:-****Confirmatory factor analyses:-**

A correlation matrix was computed among the family functioning, positive mental states, and negative mental states variable domains (see Table 1). With three exceptions in the, all intra-domain correlations were found significant, demonstrating overall medium to high size relationship (Cohen, 1988).

CFA was conducted on the overall measurement model, including all three latent variables, and it produced satisfactory model fit,  $X^2(17, N = 201) = 53.58, p < .001$  (ratio = 3.15); CFI = .93; GFI = .94; RMSEA = .10, indicating that the observed variables were good indicators of the latent variables and the three latent variables represented separate constructs. Fig. 1 indicates that the indicators displayed high factor loadings. The average factor loading for all indicators was 0.71 (approx.).

Table 2 indicates that mental states (positive and negative) factors are negatively and statistically significantly related to each other. Family functioning factor is positively and statistically significantly related to positive mental states, but negatively related to negative mental states. This pattern of relationships is precisely as predicted theoretically.

**Structural Equation Modeling (SEM):-**

To test of the relationship between the predictor latent factor, that is, healthy family functioning and outcome latent factors of positive and negative mental states, a SEM was applied. Table 3 indicates that the model fit the data well. The chi-square/degrees of freedom ratio was close to two for the SEM model, GFI = .96, CFI = .96, and the RMSEA = .07, less than 0.08.

Fig. 1 indicates that all relationships between the latent variables were as predicted. Healthy family functioning is significantly and positively related to positive mental states, which is significantly and negatively related to negative mental. Thus, positive mental states act as mediating variable between healthy family functioning and negative mental states in women. The substantially good fit of all models allows for valid inferences to be drawn from the models. These inferences include that: (a) The survey scales represent substantially good measures of the factors they are intended to measure; (b) Negative mental states can be accurately modeled as an outcome of family functioning mediated by positive mental states.

**Table 1:**Correlations among Family Functioning, Positive and Negative Mental States Indicators

Variable	2	3	4	5	6	7	8
Family Functioning Domain							
Negative	-.54***	-.28***	-.36***	-.34***	.45***	.25***	.34***
Positive	-	.27***	.37***	.23**	-.24**	-.08	-.11
Positive Mental States Domain							
Happiness		-	.59***	.43***	-.44***	-.20**	-.17*
Hope			-	.53***	-.48***	-.14	-.25***
Optimism				-	-.44***	-.19**	-.18*
Negative Mental States Domain							
Depression					-	.49***	.51***
Anxiety						-	.52***
Stress							-

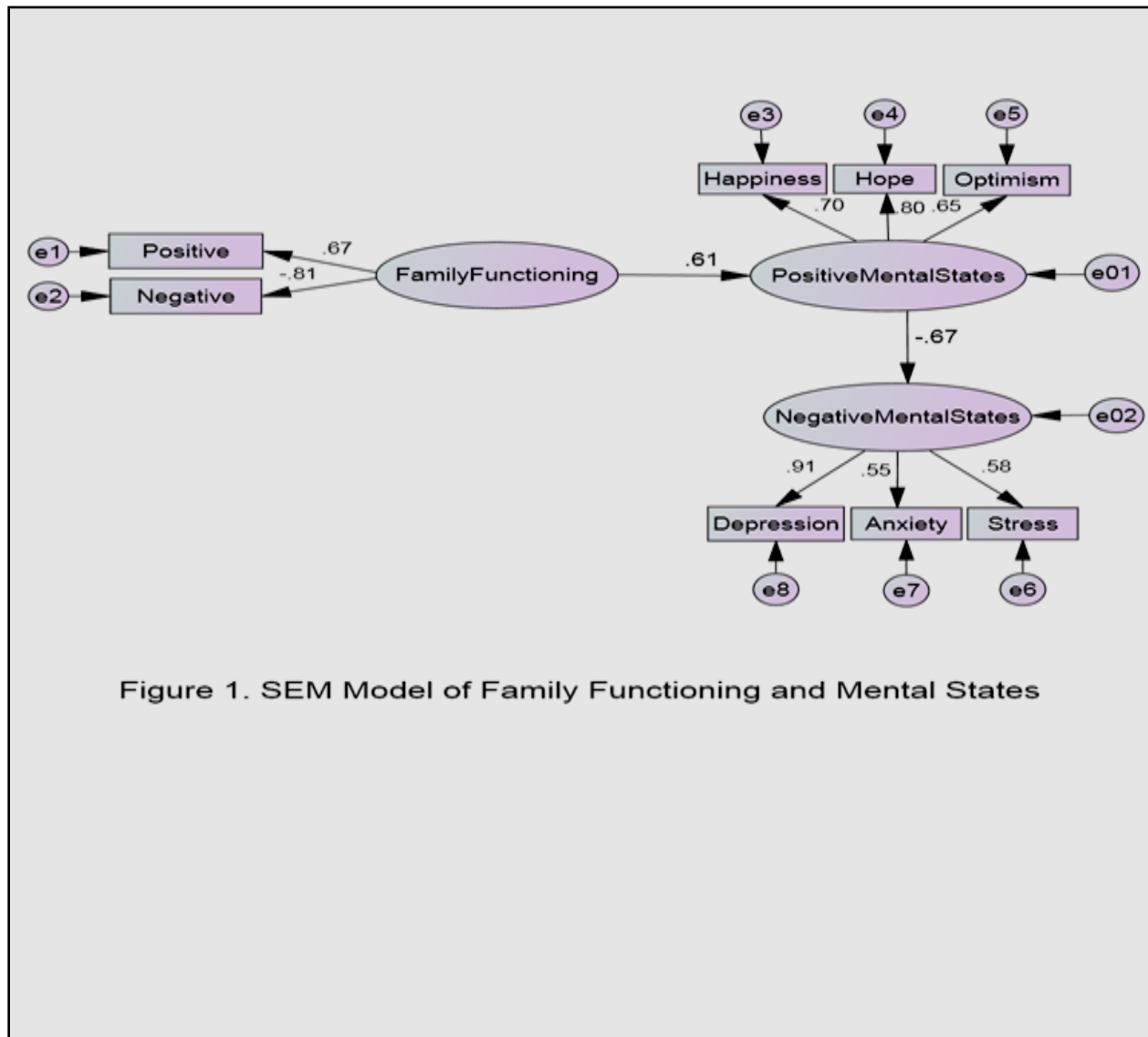
\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

**Table 2:-** Matrix outlining Factor Correlation

	Family Functioning	Positive Mental States	Negative Mental States
Family Functioning	-	.51*	-.55*
Positive Mental States		-	-.64*
Negative Mental States			-

\*  $p < 0.001$ .**Table 3:-** Model Fit Statistics

Model	Description	$\chi^2$	df	$\chi^2/df$	GFI	CFI	RMSEA
M1	First-order model: 8 indicators, 3 factors	53.58	17	3.15	.94	.93	.10
M2	SEM model for Mental states	35.75	17	2.10	.96	.96	.07



**Discussion:-**

The findings from the study indicate that healthy family functioning and positive mental states are positively and statistically significantly related to each other, but negatively related to negative mental states. This pattern of relationships is consistent with the findings of previous research studies conducted in both western and non-western contexts.

However, these variables have not been extensively modeled together as interacting variables influencing important outcomes. In this study we demonstrate that positive mental states mediates the relationship between family functioning and negative mental states – thus clarifying the way these two variables may work together to influence outcome, i.e., healthy family functioning leads to increased positive mental states and reduced negative mental states.

Theoretically, then, the observed relationships support our model which suggests that healthy family functioning ought to increase positive mental states, but with positive mental states having the larger direct impact on negative mental states. Put another way, our underlying hypothesis is that family environment is necessary for a reduction in negative mental states not because they directly impact on negative mental states, but because they directly enhance positive beliefs and thoughts, with the latter resulting in a direct reduction in negative mental states.

Earlier studies have typically explored the relationship of the variables with adolescents. In this study we examined this relationship in female students at the university level, and demonstrated that positive mental states is an important mediating variable in negatively influencing the negative mental states in women. This finding lends empirical weight to interventions designed to enhance both the environmental and individual strengths. However, because positive mental states was modeled (and identified) as a mediating variable in the present study, we suggest that successful interventions designed to enhance the family functioning may reasonably be expected to lead to both development of strengths, and subsequent reduced negative mental states in women. Thus, even though reduced mental distress is ultimately the desired outcome, the focus of interventions can remain on the enhancement of family functioning. One practical implication of this analysis is that we need not to attempt to directly target the negative mental states. In contrast, by remaining focused on developing the healthy family functioning, emphasizing strengths and capacities, we can expect development of positive mental states and subsequent reductions in negative mental states.

Although not explicitly tested in this study, the results of this study suggest that combined interventions targeting family functioning and increasing positive mental states may be particularly useful in addressing negative mental states in women.

**Limitations and recommendations:-**

The present study has several limitations. First, the sample was limited to female students enrolled in University of Kashmir. The study is also limited by fact that it did not use longitudinal data. Longitudinal data would enable an estimation of the causal effects of family functioning on mental states taking into account previous levels of each of these variables. Often when longitudinal modeling is undertaken, the size of the effects between variables is attenuated by effects within variables across time. Thus, although the structural paths in the present model were estimated in such a way as to reduce measurement error, it is nevertheless possible that the magnitude of these structural paths would be less in a longitudinal study.

Given the limitations noted above, we suggest that future studies could incorporate more diverse samples, providing longitudinal data, in order to verify the results of the study under more robust sampling and statistical conditions.

**Conclusion:-**

In this study we demonstrate that mental states in women can be accurately modeled as a function of family. This modeling suggests that both family functioning and positive mental states are key variables for negative mental states in women.



**References:-**

1. Ackerman, N. (1959): Theory of family dynamics. *Psychoanalysis and the Psychoanalytic Review*, 46 (4): 33–50.
2. Aspinwall, L.G., & Taylor, S.E. (1992): Modeling cognitive adaptation: A longitudinal investigation of the impact of individual differences and coping on college adjustment and performance. *Journal of Personality and Social Psychology*, 63: 989-1003.
3. Bandalos, D.L., & Finney, S.J. (2001): Item parceling issues in structural equation modeling. In Marcoulides GA, Schumacker, RE (eds) *New developments and techniques in structural equation modeling*: Mahawah, NJ: Lawrence Erlbaum Associates, pp. 269–296.
4. Bowen, M. (1978): *Family therapy in clinical practice*. New York: Jason Aronson.
5. Byrne, B. (1998): *Structural equation modeling with Lisrel, Prelis, and Simlis: Basic concepts, applications, and programming*. Philadelphia: Lawrence Erlbaum.
6. Byrne, B.M. (2001): *Structural equation modeling with AMOS: Basic concepts, applications, and programming*. Mahawah, NJ: Lawrence Erlbaum Associates.
7. Carr, A. (2004): *Positive psychology: The science of happiness and human strength*. New York, NY: Brunner-Routledge.
8. Chauhan, S. (2006): *The role of family environment in the development of neurotic tendencies and coping skills*. Unpublished Doctoral Thesis, Himachal Pradesh University, Shimla, India.
9. Chorpita, B.P. and Barlow, D.H. (1998): The development of anxiety: The role of control in the early environment. *Psychological Bulletin*, 124: 3-21.
10. Cohen, J. (1988): *Statistical power analysis for the behavioral sciences*. San Diego: Academic Press.
11. Das, V. (1994): *Moral Orientations to Suffering: Legitimation, Power and Healing*. In L. Chen, A. Kleinman and N. Ware (eds) *Health and Social Change in International Perspective* (pp 139-170). Boston: Harvard Series on Population and International Health.
12. Epstein, N.B., Baldwin, L.M., & Bishop, D.S. (1983): The McMaster Family Assessment Device. *Journal of Marital and Family Therapy*, 9(2): 171-180.
13. Epstein, N.B., Bishop, D.S., and Levin, S. (1978): The McMaster Model of Family Functioning. *Journal of Marital and Family Counseling*, 4: 19-31.
14. Fingerman, K., and Bermann, E. (2000): Applications of family systems theory to the study of adulthood. *International Journal of Aging and Human Development*, 51(1): 5–29.
15. Fornell, C.R., and Larcker, D.F. (1981). Two structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18: 39–50.
16. Friedmann, M.S., McDermut, W.H., Solomon, D.A., Ryan, C.E., Keitner, G.I., and Miller, I.W. (1997): Family functioning and mental illness: A comparison of psychiatric and nonclinical families. *Family Process*, 36: 357-367.
17. Herth, K.H. (1992): Abbreviated instrument to measure hope: Development and psychometric evaluation. *Journal of Advanced Nursing*, 17: 1251-1259.
18. Hills, P. and Argyle, M. (2002): The Oxford Happiness Questionnaire: a compact scale for the measurement of psychological well-being. *Personality and Individual Differences*, 33: 1073–1082.
19. Hu, L., and Bentler, P.M. (1999): Cutoff criteria for fit indices in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6(1): 1–55.
20. Jackson, D.D. (1965): Family rules: Marital quid pro quo. *Archives of General Psychiatry*, 12: 589–94.
21. Joshi, R. and Tomar, A.K. (2006): Effect of family environment on behavioural problems and family dynamics. *Journal of Research and Applications in Clinical Psychology*, 9: 51-56.
22. Kaplan, D. (2000): *Structural equation modeling: Foundations and extensions*. Newbury Park, CA: Sage.
23. Kaya, F. (1985): Symptomatic differences between the sexes in rural Mexico. *Culture, Medicine and Psychiatry*, 9: 27-57.
24. Keitner, G.I., Miller, I.W., and Ryan, C.E. (1993): The role of family in major depressive illness. *Psychiatric Annals*, 23(9): 500-507.
25. Khordzanganeh, F., Heidarie, A. R., and Naderi, F. (2014): The relationship between emotional intelligence, happiness and resiliency with mental health in male and female high school students of Ramhormoz city. *Indian Journal of Fundamental and Applied Life Sciences*, 4 (2): 633-641.
26. Kline, R.B. (1998): *Principles and practice of structural equation modeling*. New York: Guilford.
27. Little, T.D., Cunningham, W.A., Shahar, G., and Widaman, K.F. (2002): To parcel or not to parcel: Exploring the question, weighing the merits. *Structural Equation Modeling*, 9: 151–173.

28. Lovibond, S.H. and Lovibond, P.F. (1995): Manual for the Depression Anxiety Stress Scales (2<sup>nd</sup> ed.). Sydney: Psychology Foundation (Available from The Psychology Foundation, Room 1005 Mathews Building, University of New South Wales, NSW 2052, Australia) <http://www2.psy.unsw.edu.au/groups/dass/>
29. Lu, L., and Argyle, M. (1992): Receiving and giving support: Effects on relationships and well-being. *Counseling Psychology Quarterly*, 5: 123-133.
30. Malik, I. A., Bukhtari, N., and Good, M.J. D. (1992): Mothers' fear of child death: A Study in Urban and Rural Communities in Northern Punjab, Pakistan. *Social Science and Medicine*, 35: 1043-1053.
31. Marcia, A. (1997): The Ethics of Clinical Research in the Third World. *Journal of Medicine* 337(12): 847-849.
32. McCubbin, H.I., and Thompson, A.I. (eds) (1991): Family assessment inventories for research and practice. Madison: university of Wisconsin.
33. Miller, I.W., Keitner, G.I., Whisman, M.A., Ryan, C.E., Epstein, N.B., and Bishop, D.S. (1992): Depressed patients with dysfunctional families: Description and course of illness. *Journal of Abnormal Psychology*, 101(4): 637-646.
34. Minuchin, S. (1974): Families and family therapy. Cambridge, MA: Harvard University Press.
35. Naeem, S. (1992): Vulnerability factors for depression in Pakistani women. *Journal of the Pakistan Medical Association*, 6: 137-138.
36. Nancy, S.H. (1995). The primacy of the ethical: Propositions for a militant anthropology. *Current Anthropology*, 36(3): 409-421.
37. Nations, M. K. and Rebhun, L. (1988): Angels with wet wings won't fly: Maternal sentiment in Brazil and the image of neglect. *Culture, Medicine and Psychiatry*, 12:171-200.
38. Parker, G. (1983): Parental overprotection: A risk factor in psycho-social development. New York: Grune & Stratton.
39. Rosenfield, A., and Maine, D. (1985): Maternal mortality - A neglected tragedy. Where is the "M" in MCH? *The Lancet*, 2: 83-85.
40. Scheier, M.F., Carver, C.S., and Bridges, M.W. (1994): Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A reevaluation of the life orientation test. *Journal of Personality and Social Psychology*, 67: 1063-1078.
41. Schwab, J.J., Stephenson, J.J., and Ice, J.F. (1993): Evaluating family mental health: History, epidemiology, and treatment issues. New York: Plenum Press.
42. Seligman, M.E.P. (2002): Authentic happiness: Using the new positive psychology to realize your potential for learning and fulfillment. New York, NY: Free Press.
43. Seligman, M.E.P. (1998): Building human strength: Psychology's forgotten mission. Retrieved from <http://www.apa.org/monitor/han98/pres.html>.
44. Seligman, M.E.P., and Csikszentmihalyi, M. (2000): Positive psychology: An introduction. *American Psychologist*, 55: 68-78.
45. Sharma, A., Verma, R. and Malhotra, D.K. (2008): The role of pathogenic family patterns in the development of generalized anxiety in the urban and rural women. *Journal of Personality and Clinical Studies*, 24: 183-92.
46. Taylor, S.E., Kemeny, M.E., Reed, G.M., Bower, J.E., and Grunwald, T.L. (2000): Psychological resources, positive illusions, and health. *American Psychologist*, 55: 99-109.
47. Van Velsor, P., and Cox, D. (2000): Use of the collaborative drawing technique in school counseling practicum: An illustration of family systems. *Counselor Education and Supervision*, 40(2): 141-53.
48. Vander Kwaak, A., Vanden Engel, M., and Richters, A., (1991): Women and Health. *Vena Journal*, 3: 2-33.
49. Von Bertalanffy, L. (1973): General systems theory. New York: George Braziller.
50. Ware, N. and Good, M. (1995): Women. In R. Desjarlais, A. Kleinman, L. Eisenberg, B. Good (eds) *World Mental Health: Problems, Priorities, and Responses in Low-Income Countries* (pp 179-206). Oxford University Press.
51. Westley, W. A., and Epstein, N.B. (1969): The silent majority: Families of emotionally health college students. San Francisco: Jossey-Bass.
52. Whall, A.L. (1986): Family therapy theory for nursing. Connecticut: Prentice – Hall.



## RESEARCH PAPER

### AN APPROACH TO ELLIPTIC CURVES AND DISCRETE LOGARITHMIC PROBLEM.

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#### Abstract

This paper studies the mathematics of elliptic curves, starting with their derivation and the proof of how points upon them form an additive abelian group. I then worked on the mathematics necessary to use these groups for cryptographic purposes, specifically results for the group formed by an elliptic curve over a finite field,  $E(F_q)$ . I examine the mathematics behind the group of torsion points, to which every point in  $E(F_q)$  belongs, and prove Hasse's theorem along with a number of other useful results. I finish by describing how to define a discrete logarithmic problem using  $E(F_q)$  and showing how this can form public key cryptographic systems for use in both encryption and decryption key exchange.

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#### Introduction:-

An elliptic curve is usually defined to be the graph of an equation

$$y^2 = x^3 + Ax + B$$

where  $x, y, A$  and  $B$  belong to a specified field. These curves are of great use in a number of applications, largely because it is possible to take two points on such a curve and generate a third. In fact, we will show that by defining an addition operation and introducing an extra point,  $1$ , the points on an elliptic curve form an additive abelian group. Such a group can then be used to create an analogue of the discrete logarithm problem which is the basis for several public key cryptosystems. This project will introduce the mathematics behind elliptic curves and then demonstrate how to use them for cryptography.

#### Elliptic curves:-

Elliptic curves have, over the last three decades, become an increasingly important subject of research in number theory and related fields such as cryptography. They have also played a part in numerous other mathematical problems over hundreds of years. For example, the congruent number problem of finding which integers  $n$  can occur as the area of a right angled triangle with rational sides can be expressed using elliptic curves. In this chapter we set out the basic mathematics of elliptic curves, starting with their derivation and definition followed by the proof that points upon them form an additive abelian group.

1. A study on cryptography technologies, which is the basis for the four security services that are authentication, confidentiality, data integrity and non-repudiation.
2. A study on Elliptic Curve Cryptography applications and its standards.
3. A study on algorithms, architectures and implementations of ECC.
4. A study on Binary Galois field and the implementations of Galois Field arithmetic units.

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## 5. The implementation of Scalar Multiplication.

In the mid-1980s, Miller and Koblitz introduced elliptic curves into cryptograph, and Lenstra showed how to use elliptic curves to factor integers. Since that time, elliptic curves have played an increasingly important role in many cryptographic situations. One of their advantages is that they seem to offer a level of security comparable to classical cryptosystems that use much larger key sizes. For example, it is estimated in that certain conventional systems with a 4096-bit key size can be replaced by 313-bit elliptic curve systems. Using much shorter numbers can represent a considerable saving in hardware implementations.

**An elliptic curve E is the graph of an equation:-**

$E: y^2 = x^3 + ax + b$ , and denoted by  $E_p(a,b)$ .

Where a, b are in whatever is the appropriate set (rational numbers, complex numbers, integers mod n, etc.). We also include a “point at infinity,” denoted  $\infty$ , which is most easily regarded as sitting at the top of the y-axis. It can be treated rigorously in the context of projective geometry, but this intuitive notion suffices for what we need. The bottom of the y-axis is identified with the top, so  $\infty$  also sits at the bottom of the y-axis.

When we are working with real numbers, the graph E has one of two possible forms, depending on whether the cubic polynomial in x has one real root or three real roots. In the figure below are shown example of elliptic curves illustrated using Matlab files

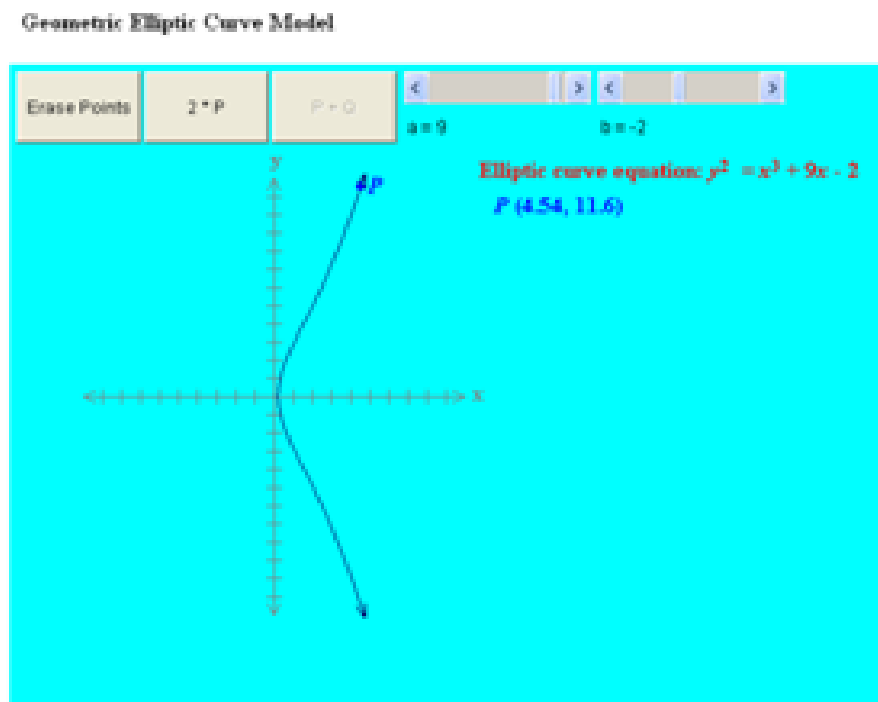


Figure 1

We assume that the cubic polynomial  $x^3 + ax + b$  has no multiple roots

### Technical point:-

Given two points  $P_1$  and  $P_2$  on  $E$ , we can obtain a third point  $P_3$  on  $E$  as follows: Draw the line  $L$  through  $P_1$  and  $P_2$  (if  $P_1 = P_2$ , take the tangent line to  $E$  at  $P_1$ ). In third point  $Q$ . Reflect  $Q$  through the x-axis (i.e., change  $y$  to  $-y$ ) to get  $P_3$ . Define a law of addition on  $E$  by

$$P_1 + P_2 = P_3$$

Note that this is not the same as adding points in the plane

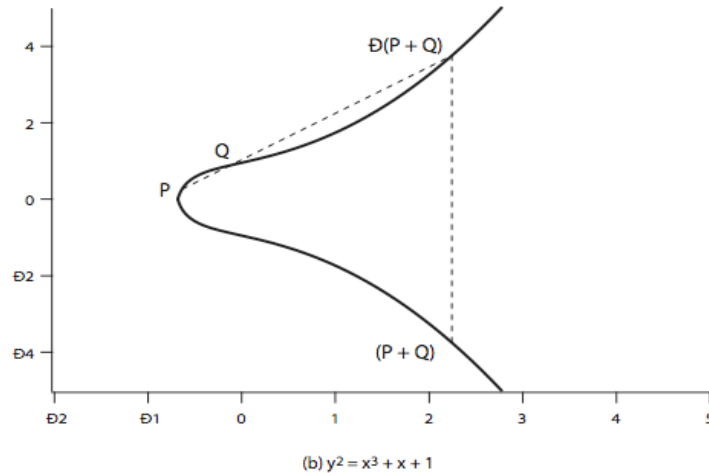


Figure 2:-

**Elliptic Curves Mod n:-**

If  $n$  is an integer, we can work with elliptic curves mod  $n$  using the aforementioned ideas. For example, consider  $E: y^2 \equiv x^3 + 2x + 3 \pmod{5}$ .

The points on  $E$  are the pairs  $(x, y) \pmod{5}$  that satisfy the equation, along with the point at infinity. These can be listed as follows. The possibilities for  $x \pmod{5}$  are 0, 1, 2, 3, 4 substitute each of these into the equation and find the values of  $y$  that solve the equation.

**Historical point:-** Elliptic curves are not ellipses. They received their name from their relation to elliptic integrals such as

$$\int_{z_1}^{z_2} \frac{dx}{x^3+ax+b} \text{ and } \int_{z_1}^{z_2} \frac{xdx}{x^3+ax+b}$$

**Point addition: Elliptic Curve Addition:- A Geometric Approach:**

- 1  $P + Q = R$  is the additive property defined geometrically.
- 2 Elliptic curve groups are additive groups; that is, their basic function is addition. The addition of two points in an elliptic curve is defined geometrically.
- 3 The negative of a point  $P = (X_1, Y_1)$  is its reflection in the  $x$ -axis: the point  $-P$  is  $(X_1, -Y_1)$ . Notice that for each point  $P$  on an elliptic curve, the point  $-P$  is also on the curve.

**Adding distinct points P and Q:-** The resulted point of adding two different points on the elliptic curve is computed as shown below in figure 2

When  $P = (X_1, Y_1)$  and  $Q = (X_2, Y_2)$  are not negative of each other,  $(X_1, Y_1) + (X_2, Y_2) = (X_3, Y_3)$ ; where  $X_1 \neq X_2$

$P + Q = R$  where

$$\lambda = (Y_2 - Y_1) / (X_2 - X_1)$$

$$X_3 = \lambda^2 - X_1 - X_2 \text{ and}$$

$$Y_3 = -Y_1 + \lambda (X_1 - X_3)$$

- 5 Note that  $\lambda$  is the slope of the line through  $P$  and  $Q$ .

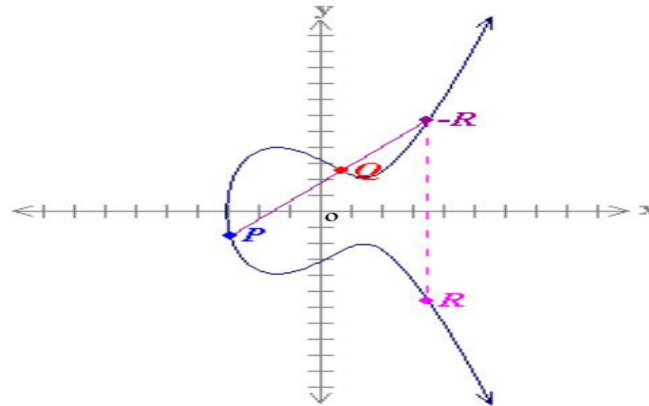


Figure 2:-

**Point Addition:-**

Suppose that P and Q are two distinct points on an elliptic curve, and the P is not -Q. To add the points P and Q, a line is drawn through the two points. This line will intersect the elliptic curve in exactly one more point, call -R. The point -R is reflected in the x-axis to the point R. The law for addition in an elliptic curve group is  $P + Q = R$ .

**Arithmetic in Elliptic Curve Group over  $F_p$** **Point addition:-**

Note that these rules are exactly the same as those for elliptic curve groups over real numbers, with the exception that computations are performed modulo p.

There are several major differences between elliptic curve groups over  $F_p$  and over real numbers. Elliptic curve groups over  $F_p$  have a finite number of points, which is a desirable property for cryptographic purposes. Since these curves consist of a few discrete points, it is not clear how to "connect the dots" to make their graph look like a curve. It is not clear how geometric relationships can be applied. As a result, the geometry used in elliptic curve groups over real numbers cannot be used for elliptic curve groups over  $F_p$ . However, the algebraic rules for the arithmetic can be adapted for elliptic curves over  $F_p$ . Unlike elliptic curves over real numbers, computations over the field of  $F_p$  involve no round off error - an essential property required for a cryptosystem.

**The rules for addition over  $E_p(a,b)$ :-** Correspond to the algebraic technique described for elliptic curve defined over real numbers. For all points  $P, Q \in E_p(a,b)$ ;  $P+O=P$ .

If  $P=(x_p, y_p)$ , then  $P+(x_p, -y_p)=O$ . The point  $(x_p, -y_p)$  is the negative of P, denoted as  $-P$ . For example, in  $E_{23}(1,1)$ , for  $P=(13,7)$ , we have  $-P=(13,-7)$ . But  $-7 \bmod 23=16$ . Therefore  $-P=(13,16)$ , which is also in  $E_{23}(1,1)$

if  $P=(x_p, y_p)$  and  $Q=(x_q, y_q) \neq -P$ , then  $R=P+Q=(x_R, y_R)$  is determined by the following rules:  $x_R=(\lambda^2 - x_p - x_q) \bmod p$ ,  $y_R=(\lambda(x_p - x_R) - y_p) \bmod p$

Where

$$\lambda = \begin{cases} \frac{y_q - y_p}{x_q - x_p} \bmod p & \text{if } P \neq Q \\ \frac{3x_p^2 + a}{2y_p} \bmod p & \text{if } P = Q \end{cases}$$

Multiplication is defined as repeated addition; for example,  $4P=P+P+P+P$ .

For example let  $P=(3,10)$  and  $Q=(9,7)$  in  $E_{23}(1,1)$ . Then

$$\lambda = \left( \frac{7-10}{9-3} \right) \bmod 23 = \left( \frac{-3}{6} \right) \bmod 23 = \left( \frac{-1}{2} \right) \bmod 23 = 11$$

$$x_R = (11^2 - 3 - 9) \bmod 23 = 109 \bmod 23 = 17$$

$$y_R = (11(3 - 17) - 10) \bmod 23 = -164 \bmod 23 = 20$$

so  $P+Q=(17,20)$ . To find  $2P$

$$\lambda = \left( \frac{3(3^2) + 1}{2 \times 10} \right) \bmod 23 = \left( \frac{5}{20} \right) \bmod 23 = \left( \frac{1}{4} \right) \bmod 23 = 6$$

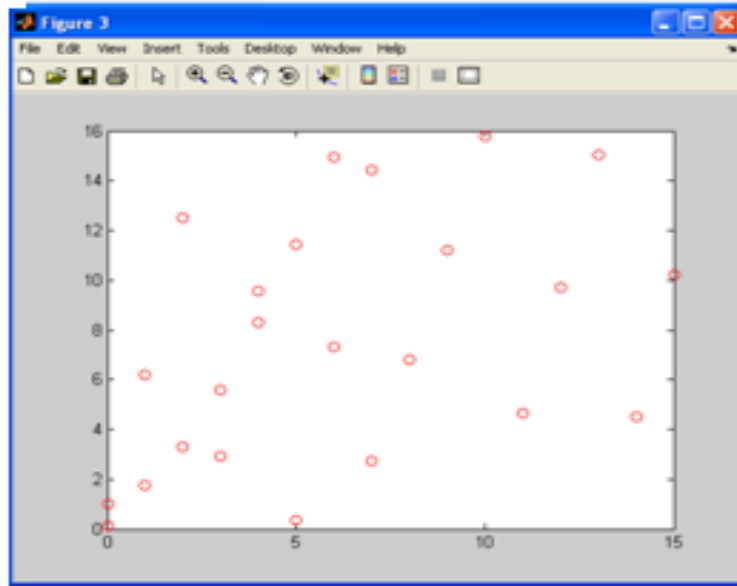


Figure 1.2:-

## 2 The Elliptic Curve Discrete Logarithm Problem:-

Discrete logarithms are fundamental to a number of public-key algorithms, including, Diffie-Hellman key exchange and the digital signature algorithm (DSA). This section provides a brief overview of discrete logarithms.

The power of an Integer, modulo  $n$

For  $a^{\phi(n)} \equiv 1 \pmod{n}$

Where  $\phi(n)$ , Euler's totient function, is the number of positive integers less than  $n$  and relatively prime to  $n$ . Now consider the general expression:-

$$a^m \equiv 1 \pmod{n} \quad (1)$$

If  $a$  and  $n$  are relatively prime then there is at least one integer  $m$  that satisfies the Equation (1), namely,  $m = \phi(n)$ . The least positive exponent  $m$  for which equation holds is referred to in several ways:

- The order of  $a \pmod{n}$
- The exponent which  $a$  belongs  $\pmod{n}$
- The length of the period generated by  $a$

To see the last point, consider the powers of 7, modulo 19:

$$\begin{aligned} 7^1 &\equiv 7 \pmod{19} \\ 7^2 &= 49 = 2 \times 19 + 11 \equiv 11 \pmod{19} \\ 7^3 &= 343 = 18 \times 19 + 1 \equiv 1 \pmod{19} \\ 7^4 &= 2401 = 126 \times 19 + 7 \equiv 7 \pmod{19} \\ 7^5 &= 16807 = 884 \times 19 + 11 \equiv 11 \pmod{19} \end{aligned}$$

There is no point in continuing because the sequence is repeating. This can be proven by noting that  $7^3 \equiv 1 \pmod{19}$  and therefore  $7^{3+j} \equiv 7^3 7^j \equiv 7^j \pmod{19}$ , and hence any two powers of 7 whose exponents differ by 3 (or multiply by 3) are congruent to each other  $\pmod{19}$ . In other words the sequence is periodic and the length of the period is the smallest positive exponent  $m$  such that  $7^m \equiv 1 \pmod{19}$ .

In the multiplicative group  $\mathbb{Z}_p^*$ , the discrete logarithm problem is: given elements  $r$  and  $q$  of the group, and a prime  $p$ , find a number  $k$  such that  $r = q^k \pmod{p}$ . If the elliptic curve groups is described using multiplicative notation, then the elliptic curve discrete logarithm problem is: given points  $P$  and  $Q$  in the group, find a number that  $P^k = Q$ ;  $k$  is called the discrete logarithm of  $Q$  to the base  $P$ . When the elliptic curve group is described using additive notation, the elliptic curve discrete logarithm problem is: given points  $P$  and  $Q$  in the group, find a number  $k$  such that  $Pk = Q$ .

**Example:-****In the elliptic curve group defined by:-**

$y^2 = x^3 + 9x + 17$  over  $F_{23}$ , the discrete logarithm  $k$  of  $Q = (4,5)$  to the base  $P = (16,5)$ ?

One (naïve) way to find  $k$  is to compute multiples of  $P$  until  $Q$  is found. The first few multiples of  $P$  are:  
 $P = (16,5)$   $2P = (20,20)$   $3P = (14,14)$   $4P = (19,20)$   $5P = (13,10)$   $6P = (7,3)$   $7P = (8,7)$

$8P = (12,17)$   $9P = (4,5)$

Since  $9P = (4,5) = Q$ , the discrete logarithm of  $Q$  to the base  $P$  is  $k = 9$ .

In a real application,  $k$  would be large enough such that it would be infeasible to determine  $k$  in this manner.  
 An Example of the Elliptic Curve Discrete Logarithm Problem

**Discrete logarithmic problem:-**

Consider the multiplicative group  $(Z_p^*, p^*)$ , where  $p$  is a prime. Let  $g$  be a generator of the group ,i.e, successive powers of  $g$  generate all elements of the group .So

$$g^1 \text{ mod } p, g^2 \text{ mod } p, \dots, g^{p-1} \text{ mod } p$$

Is a re-arrangement of the integers in  $Z_p^*$

Let  $x$  be an element in  $\{0, 1, 2, \dots, p-2\}$ . The function

$Y = g^x \text{ (mod } p)$  is referred to a modular exponentiation with base  $g$  and modulus  $p$ .

The inverse operation is expressed as  $x = \log_g^y \text{ (mod } p)$  And is referred to as the discrete logarithm. It involves computing  $x$  given the values of  $p, g$  and  $y \in Z_p^*$

**Example Discrete logarithm in  $(Z_p^*, 29^*)$  with  $g=2$** 

Y	$\log_2^y \text{ (mod } 29)$	22	26
1	28	23	20
2	1	24	8
3	5	25	16
4	2	26	19
5	22	27	15
6	6	28	14
7	12		
8	3		
9	10		
10	23		
11	25		
12	7		
13	18		
14	13		
15	27		
16	4		
17	21		
18	11		
19	9		
20	24		
21	17		

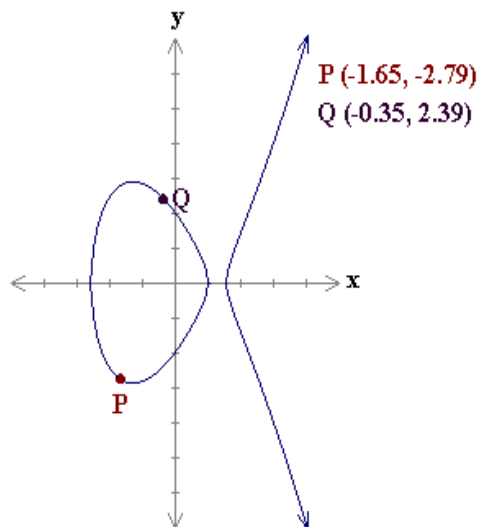


From the above problem it gives value of x given p&g means that  $2^7 \bmod 29 = 12$  i.e.  $\log_2^{12} = 7$  Similarly  $2^{21} \bmod 29 = 17$  i.e.  $\log_2^{17} = 21$  and so on Example let  $p=131, g=2$

Y	$\log_2^y(\bmod 131)$
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	125
9	119
10	107
11	83
12	35
13	70
14	9
15	18
16	36
17	72

The discrete logarithmic problem is  $2^{17}(\bmod 131)=72$ , i.e.  $\log_2^{72}(\bmod 131)=17, 2^{11}(\bmod 131)=83$  i.e.  $\log_2^{83}(\bmod 131)=11$

The discrete logarithm of  $Q(-0.35, 2.39)$  to the base  $P(-1.65, -2.79)$  in the elliptic curve group  $y^2 = x^3 - 5x + 4$  over real numbers is given by figure 3



Elliptic curve equation:  $y^2 = x^3 - 5x + 4$

Figure 3:-

**References:-**

1. Certicom, "standards for Efficient Cryptography, SEC 1: Elliptic curve", Cole, Eric, Jason Fossen, Stephen Northcutt, Hal Pomeranz. SANS Security Essentials with CISSP CBK, Version 2.1. USA: SANS Press, 2003.
2. J. Edge, an introduction to elliptic curve cryptography, <http://Iwn.net/Articles/174127/>, 2006.
3. N. Koblitz, A course in Number theory and cryptography, 2<sup>nd</sup> ed., brookes/Cole, 1997.
4. J. H. Silverman, The Arithmetic of Elliptic curves, Springer-Verlag, 1986.
5. RSA" Wikipedia. wikipedia, n.d. web. 09 feb 2011. Stalings, William. Cryptography and network security. fourth, pearson, 2009. print.
6. Alfred J. Menezes, Paul C. Van Oorschot and Scott A. Vanstone, guide to Elliptic curve Cryptography, 1996.
7. N. Koblitz. CM-curves with good cryptographic properties. In Advances in Cryptology: Crypto 91' volume 576 of in computer science, pages 279-287, springer-verlag, 1992. Notes
8. The Thesis of on 2-Spreads in PG(5,3) by K. Hanumanthu under the supervision of Prof. K. Satyanarayana.
9. Thesis of Dr. K. V. Durga Prasad : "Construction of Translation planes and Determination of their translation complements", Ph.D Thesis, Osmania University
10. Diffie, W., and M. E. Hellman. "New directions in cryptography." *IEEE Transactions on Information Theory*, 1976: 644- 654.
11. A Scalar Multiplication in Elliptic Curve Cryptography with Binary Polynomial Operations in Galois Field Hero Modares (thesis of master science).



### RESEARCH ARTICLE

## THE APPLICATION OF VACUUM-ASSISTED CLOSURE DEVICE IN THE MANAGEMENT OF EMPYEMATHORACIS

Zahra Abuzaid, Mohammed Aljehani and Yasser Aljehani.

### Manuscript Info

#### Manuscript History

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Empyema, Empyema thoracis, VAC device

### Abstract

The use of new technologies in thoracic surgery has become well established. Vacuum Assisted Closure (VAC) device is one of such technologies. Surgeons were spectacle about its use since it was thought to interfere with the negative intrapleural pressure. Few reports have been published in regards to its use in cases of empyema thoracis. We report a case of empyema thoracis that was managed surgically. Thoracotomy and decortication complicated later on by surgical site infection for which debridement and application of VAC device was used to drain the intrapleural collection as well as the subcutaneous collection. We concluded that the use of VAC device in empyema thoracis is feasible with very good outcome.

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### Introduction:-

Vacuum-assisted closure (VAC) therapy has been effectively used for a wide of range wounds and infections. These include infected surgical wounds, diabetic foot ulcers, pressure ulcers, traumatic wounds and venous stasis ulcers(1). In 2006, the VAC therapy was applied for the first time in the management of empyema thoracis(2). The use of VAC device was used later for various intrathoracic infections such as, postresection empyema, mediastinitis related to esophageal surgery, as well as necrotizing pleuropulmonary infections. In all these conditions, VAC therapy has been a useful tool that accelerates the healing process with an excellent safety profile(3). Moreover, its use is usually associated with a better outcome in terms of decreased morbidity, shorter hospital stay, greater patient acceptance and it can provide an outpatient based management (3,4).

### The Case:-

A 50-year-old male who is smoker and diabetic on insulin presented to our service with pleuritic chest pain, dyspnea and fever. On initial presentation he was tachypnic, temperature 37.3C° and oxygen saturation was 93% on 5 Liters of oxygen. Auscultation revealed reduced air entry with bronchial breathing over the right hemithorax. Complete Blood Count (CBC) showed marked leukocytosis and neutrophilia. His initial chest x-ray revealed right lower lobe consolidation with air bronchogram. Community acquired pneumonia was the provisional diagnosis and was started on ceftriaxone and azithromycin. Over the next few days the patient did not seem to improve and was still spiking despite the use of broad spectrum antibiotics. Computed Tomography (CT) showed multiloculated right-sided pleural effusion with lower lobe consolidation (Figure 1). A Sagittal reconstruction demonstrate the loculation more clearly (Figure 2). Pleural tap was done. It yielded an exudate and the culture and stain were negative for growth. The patient underwent Video Assisted Thoracoscopic Surgery (VATS) which revealed multiple, well-formed adhesions with multiloculated empyema space that was filled with frank pus. Conversion to thoracotomy, decortication and drainage of the pus with placement of drainage thoracostomy tubes was done. A pleural biopsy was sent for tissue culture and sensitivity, cytology and histopathology which came negative for an infection or

granulomas. On the 6<sup>th</sup> post-operative day, the wound demonstrated signs of surgical site infection (SSI). This was associated with new onset of pneumothorax evident radiologically. The patient was taken to the operating room and exploration of the wound was done with debridement of all unhealthy tissue. VAC device was placed into the communicating wound with the pleural space without thoracostomy drainage. The VAC device was changed twice on 3-day interval with vacuum pressures of around -120Hgmm. The VAC device was removed after complete healing of the wound. The patient was discharged with no subsequent complications. His last follow up at 6 months showed complete recovery. This has demonstrated that application of VAC with communication to pleural space without the usual thoracostomy drainage is feasible and did not interfere with the mechanics breathing.



Axial CT scan of the chest demonstrating the loculi which is consistent with empyema thoracis. The pockets of air can be seen within the collection..



Sagittal reconstruction demonstrate the multiloculated nature of this empyema thoracic.

### Discussion:-

Accumulation of pus within the plural space is referred as empyema thoracis (5). Though the commonest cause of this condition is poorly managed bacterial pneumonia, empyema may also complicate thoracic procedures or surgeries, thoracic trauma, lung abscess, spontaneous pneumothorax and esophageal perforation (6). The commonly isolated bacteria include *Streptococcus milleri* group species, *Streptococcus pneumoniae*, methicillin-sensitive *Staphylococcus aureus* (MSSA) and the *Enterobacteriaceae* group. However, *Mycobacterium tuberculosis* is not uncommon isolated (5). Parapneumonic effusion may progress through exudative, fibrinolytic, and organized stages. Although the clinical course varies among patients, about 5% of pneumonia patients and 20% of patients with parapneumonic effusion will progress into empyema regardless of appropriate management. The mortality rate of patients with empyema, especially patients with co-morbidities, accounts for 20% (7). The potential complications of empyema include broncho-plural fistula, empyema necessitans, osteomyelitis of the ribs, bronchoesophageal fistula, pericarditis and brain abscess which can develop either early or late during the clinical course. Managing the empyema properly depends on the stage of empyema, degree of lung function restriction and the patient tolerance and it requires control of the infection, evacuation of the purulent fluid and obliteration of the cavity. This can be achieved by an appropriate antibiotic therapy, closed chest tube drainage, intrapleural fibrinolytics, VATS and thoracotomy-decortication (6). Open window thoracotomy and decortication can be used in organized empyema; however decortication is associated with considerable morbidity and mortality rate. VAC therapy is a well-known modality in wound treatment. Intrapleural application of VAC shown to aid in local infection control, enhances chest expansion and shrinks the empyema cavity (8). The negative pressure applied by the VAC device accelerates wound healing as it enhances the blood flow in the treated area and promotes healthy granulation tissue growth. Moreover, it decreases edema and excessive fluid from the wound and limits bacterial colonization (9). Our case was bit different in terms of using the VAC as a solo arm in draining the SSI as well as the communicating empyema without thoracostomy tubes. The author has published the use of the same technique in an empyema necessitans case with excellent outcome (10).

### Conclusion:-

Application of negative pressure through the VAC system is valuable in the management of complicated intrathoracic infections such as empyema. This modality of treatment offers a faster recovery with less patient

discomfort, therefore it decrease the hospital stay and the overall treatment costs. We advocate this modality of treatment for further evaluation by larger studies and clinical trials.

### References:-

1. Venturi ML, Attinger CE, Mesbahi AN, Hess CL, Graw KS. Mechanisms and clinical applications of the vacuum-assisted closure (VAC) Device: a review. *Am J Clin Dermatol* [Internet]. 2005 Jan [cited 2015 Feb 7];6(3):185–94. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/15943495>
2. Varker K a., Ng T. Management of empyema cavity with the vacuum-assisted closure device. *Ann Thorac Surg*. 2006;81:723–5. Available from: <http://www.annalthoracicsurgery.org/article/S0003497504021423/fulltext>
3. Saadi A, Perentes JY, Gonzalez M, Tempia AC, Wang Y, Demartines N, et al. Vacuum-assisted closure device: a useful tool in the management of severe intrathoracic infections. *Ann Thorac Surg* [Internet]. Elsevier Inc.; 2011;91(5):1582–9. Available from: <http://dx.doi.org/10.1016/j.athoracsur.2011.01.018>
4. Haghshenasskashani A, Rahnavardi M, Yan TD, McCaughan BC. Intrathoracic application of a vacuum-assisted closure device in managing pleural space infection after lung resection: is it an option? *Interact Cardiovasc Thorac Surg*. 2011;13:168–74. Available from: <http://icvts.oxfordjournals.org/content/13/2/168.long>
5. Marks DJB, Fisk MD, Koo CY, Pavlou M, Peck L, Lee SF, et al. Thoracic empyema: A 12-year study from a UK tertiary cardiothoracic referral centre. *PLoS One*. 2012;7(1).
6. Vaziri M, Abed O. Management of thoracic empyema: Review of 112 cases. *Acta Medica Iranica*. 2012. p. 203–7.
7. Huang H-C, Chen H-C, Fang H-Y, Lin Y-C, Wu C-Y, Cheng C-Y. Lung abscess predicts the surgical outcome in patients with pleural empyema. *J Cardiothorac Surg*. 2010;5:88.
8. Sziklavari Z, Grosser C, Neu R, Schemm R, Szöke T, Ried M, et al. Minimally invasive vacuum-assisted closure therapy in the management of complex pleural empyema. *Interact Cardiovasc Thorac Surg*. 2013;17(1):49–53.
9. Hunter JE, Teot L, Horch R, Banwell PE. Evidence-based medicine: vacuum-assisted closure in wound care management. *Int Wound J* [Internet]. Blackwell Publishing Ltd; 2007;4(3):256–69. Available from: <http://dx.doi.org/10.1111/j.1742-481X.2007.00361.x>
10. Yasser Aljehani, Zahra Al-Matar, Samah Nawar ” The Application of Vacuum-Assisted Closure Device in the Management of Empyema Necessitans” *Case Reports in Surgery*, Volume 2016 (2016), Article ID 6805736, 3 pages, <http://dx.doi.org/10.1155/2016/6805736>.



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### RESEARCH ARTICLE

#### PROPERTIES AND APPLICATION OF MICROBIAL TRANSGLUTAMINASE PRODUCED FROM A NEWLY ISOLATED STRAIN OF *STREPTOMYCES* SP.

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Transglutaminase, *Streptomyces* sp, cross-linking, *Shamy* bread.

#### Abstract

The aim of the present work is to study some physical properties of microbial transglutaminase (MTGase) produced from a newly isolated strain of *Streptomyces* sp. Also, its application in producing *Shamy* bread from a mixture of wheat and corn flours was investigated. The results revealed that the enzyme exhibited optimum activity at 45°C; it retained about 80% of the initial activity after incubation for one hour at this temperature. The optimum activity was at pH 6.5 and was stable at this pH for one hour.

The cross-linking effect of the enzyme was tested through cross-linking of wheat dough prepared for *Shamy* bread. The results indicated that the enzyme have a cross- linking effects towards the free amino and thiol groups of wheat dough. The free amino groups of the wheat dough were 0.538 µM/ mg flour without adding the enzyme. It decreased to 0.378 µM/ mg flour when treated with the enzyme; the percent of reduction was 29.74. Mixing corn flour with wheat flour decreased the free amino groups of the resulted dough. It decreased to 0.248 µM/ mg flour in the sample treated with the enzyme and containing 30% corn flour with percentage of reduction 34.39.

In general, increasing the percentage of corn flour in the blends treated with MTGase decreases the free thiol groups. The free thiol groups of the wheat dough (without enzyme) were 11.222µM/ g flour, it decreased to 10.342 µM/ g flour when treated with the enzyme, with percentage of reduction 7.849 %. When the levels of corn flour increased to 30% the free thiol groups decreased and the percent of the reduction increased to 8.575. It was noted that the prepared *Shamy* bread from dough containing 70% wheat flour and 30% corn flour and treated with the enzyme have a higher volume with pronounced improvement in the general appearance and quality than that without the enzyme.

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## Introduction:

Transglutaminase (TGase) ( EC 2.3.2.13 ) is an enzyme that catalyses an acyl transfer reaction using peptide – bond glutamine residues as acyl donors and several primary amines as acyl acceptors (Yokoyama et al., 2004).

The enzyme is active over a wide range of temperatures and stable between pH 5 and 9 which is the range for most food processing ( Kuraishi et al., 2001). With respect to substrate specificity; most food proteins, legume globulins, wheat, egg yolk and milk caseins, as well as many other albumins could be cross linked by MTGase ( Nonaka et al., 1997).

MTGase is capable of gelling concentrated solutions of proteins such as soybean, milk, beef, chicken and fish proteins. Also, two or more different proteins can be covalently conjugated to produce new proteins with novel functionalities (Nielsen, 1995; Zhu et al., 1995).

The characteristics of MTGase obtained from various microorganisms vary even among strains. MTGase from *Streptomyces libani* showed slightly lower optimum reaction temperature and thermal stability than from *Streptomyces mobaraensis* (Umezawa et al., 2002).

The enzyme has many applications in the food industry because its effect of crosslinking which is useful in texturization, foaming and emulsifying properties as well as for improvement of nutritional properties.

Several studies reported that the use of TGase improves baking properties and products quality. The action of enzyme reinforces the protein network structure changing the viscoelastic properties of the dough (Larre et al., 2000). Gerrad et al. (2001) reported that addition of the enzyme to dough improved its stability and loaf volume, as well as, improved the lift of puff pastry. Many applications showed that TGase increased the crumb strength of baked loaves and improved the water absorption of the dough, which lowering processing costs for commercial baking (Dube et al., 2007). Ap et al. (2011) reported that the enzyme modified chemical and functional properties of glutenins fraction of proteins, improving dough strength and bread volume. The addition of 1.0% TGase increased both foam stability and emulsion activity of cake batter. Also, it had the maximum specific volume and the softest texture (Wang et al., 2013).

Corn flour is one of the most valuable cereal flours from a nutritional point of view. However, corn flour is unable to hold gas produced during fermentation for baked products. So, the aim of the present work is to study some physical properties of microbial transglutaminase produced from a newly isolated strain of *Streptomyces* sp. Also, its application in producing *Shamy* bread from blends of wheat and high levels from corn flour was investigated.

## Materials and Methods:-

### Microorganism:-

The actinomycetes strain used in the present study was isolated from soil samples collected from Alexandria Governorate, Egypt. The strain was identified as *Streptomyces diastaticus* as reported in the previous paper ( Eshra et al., 2015 )

### Chemicals and reagents:-

N-carboxybenzoyl-L-glutaminy-L-glycine (CBZ) was purchased from Sigma-Aldrich, Co., USA. All the other chemicals were of analytical grade.

### Preparation of tryptic casein hydrolyzate (TCH):-

Twenty grams of alkaline soluble casein were dissolved in 100 ml Tris-buffer pH 8.0, and then 0.2 g of trypsin (E-Merck) were added and incubated for 18 h at 37°C. The mixture was boiled for 5 min, cooled in ice bath and centrifuged at 3000 rpm for 20 min and preserved at - 4°C. The activity of equal volumes of pure enzyme solution (Ajinomoto Activa WM MTGase) was measured separately by both the prepared TCH and CBZ. A correction factor was calculated to convert the enzyme units measured by TCH to the more common units measured by the synthetic substrate CBZ. The correction factor was measured for each prepared batch of the tryptic casein hydrolyzate. The average of this factor was ranged between 1.42 to 1.55.

**MTGase Activity:-**

The enzyme activity was measured using the colorimetric hydroxamate procedure using TCH and CBZ as substrates. The absorbance was measured at 525 nm (Spectronic 20, Bausch & Lomb, USA). One unit of MTGase activity was defined as the amount of enzyme which causes the formation of one micromole of hydroxamic acid per min at 37°C. A calibration curve was prepared using  $\gamma$ -glutamic acid  $\gamma$ -monohydroxamate (Macedo *et al.*, 2007).

**Effect of Temperature:-**

The effect of temperature on the enzyme activity was tested at temperatures ranging from 25 to 60°C at pH 6. The relative activity was determined by maximal activity of the enzyme at a specific temperature as 100% (Cui *et al.*, 2007).

Thermal stability was determined by incubating the enzyme at 25 to 60°C for 1 hr. The percentage of stability was determined as follow:

$$\% \text{ stability} = \frac{\text{Residual units}}{\text{Initial units}} \times 100 \quad (\text{Cui et al., 2007}).$$

The effect of pH on the enzyme activity was determined using 50 mM citrate buffer (pH 4.0 – 6.5) and 50 mM Tris-HCL buffer pH (7.0-9.0) after 30 min at 35°C. To check the pH stability, the enzyme was incubated with the previous buffers at 37°C for 1 hr and the enzyme activity was determined (Cui *et al.*, 2007).

**Shamy bread making:-**

*Shamy* bread was prepared as described by Gujral and Rosell (2004) with some modifications. The following ingredients were used: 500 g wheat flour (72% extraction), 450 ml water, 15 g active dry yeast, 10 g salt and 40 g sugar (yeast was previously mixed with sugar and dissolved in 30 ml water). All ingredients were mixed in the Nouval dough mixer (Image, Egypt) for 5 min. MTGase was incorporated at level of 100 units/ 500 g wheat flour.

The resulted dough was left to ferment for about 20 min at 30°C, and then divided into pieces. The pieces were arranged on a wooden board and left to ferment for about 60 min at the same temperature. The fermented dough pieces were flattened. The flattened loaves were baked at 220°C for 5 min in muffle furnace (Vulcan<sup>TM</sup> A-550 Yucaipa, California, USA) 10-15 min. The loaves of bread were allowed to cool then packed in polyethylene bags.

The effect of using MTGase on *Shamy* bread containing different levels of corn flour was studied. Corn flour was added at levels of 10, 20, 30, 40 and 50% based on the weight of wheat flour. The same method was used for *Shamy* bread prepared from wheat flour only.

**Quantification of free amino groups:-**

Free amino groups in control and MTGase-treated dough samples were determined by the method described by Nielsen *et al.* (2001). The O-phthaldialdehyde (OPA) 40 mg was dissolved in 1 ml of ethanol. In a separate solution, 1.905 g of di-sodium tetraborate decahydrate and 50 mg of sodium dodecylsulfate were dissolved in 40 ml of distilled water. The two solutions were mixed and the volume brought to 50 ml with distilled water. The OPA reagent was stored in an opaque bottle in a refrigerator. One part of 2- mercaptoethanol was mixed with 21.27 parts of the OPA reagent just before use in the assay. Supernatant of each sample was obtained by mixing 100 mg dough with 90  $\mu$ l of distilled water, adding 1 ml 0.1 M HCl, mixing the suspension on a vortex mixer for 10 min and then centrifuging (Cell Refrigerated Centrifuges, Bunsen) at 16000  $\times$  g for 5 min. To 50  $\mu$ L of the dough supernatant, 250  $\mu$ l of the OPA reagent containing 2-mercaptoethanol was added. Absorbance at 340 nm was recorded for the mixtures after 2 min using a UV-spectrophotometer (Thermospectronic, UV- visible Spectrophotometers , Helios). The results were calculated against a serine standard curve (Gujral and Rosell, 2004).

**Quantification of free thiol groups:-**

Free thiol groups in control and dough samples –treated with MTGase were determined with a procedure using Ellman's reagent (Rao *et al.*, 2002). Tris-glycine (Tris-Gly) buffer (pH 8.0) was prepared by dissolving 10.4 g Tris, 6.9 g glycine and 1.2 g ethylenediamine tetraacetic acid (EDTA) in 1 l of distilled water. A solution (GuHCl/ Tris-Gly) containing 5 M guanidine hydrochloride (GuHCl) in Tris-Gly buffer was prepared. Ellman's reagent contained 4 mg of 5,5' dithiobis-2-nitrobenzoic acid in 1 ml of Tris-Gly buffer pH 8.0. To obtain supernatant, 200 mg of dough was added to 1 ml of (GuHCl/ Tris-Gly) solution, mixed on a vortex mixer for 10 min, and centrifuged (Cell



Refrigerated Centrifuges, Bunsen) at  $16000 \times g$  for 5 min. (GuHCl/ Tris-Gly) solution (150  $\mu$ l) and Ellman's reagent (50  $\mu$ l) were added to 100 $\mu$ l of the supernatant and the absorbance measured at 412 nm (Spectronic 20, Bausch & Lomb, USA). The results were calculated against a cysteine standard curve (Gujral and Rosell, 2004).

## Results and Discussion:-

### Effect of temperature:-

The results presented in Table (1) indicated that the enzyme exhibited optimum activity at 45°C. At 60°C, 52.0% of the maximum enzyme activity was detected. Decreasing the temperature to 25°C conserved only 48.0 % of the maximum activity. The enzyme retained about 80% of the initial activity after incubation for one hour at this temperature. The optimum activity was at pH 6.5 and was stable at this pH for one hour. Ho et al. (2000) reported that the optimal temperature of TGase enzyme purified from *Streptovorticillium ladakanum* was 40°C. It conserved more than 90% of its activity even after 30 min incubation at 35°C. Cui et al. (2007) mentioned that the optimum activity of MTGase from *Streptomyces hygroscopicus* was at 37-45°C. Also, they reported that the purified enzyme maintained full activity after incubation for 30 min at 20°C. When the temperature was above 50°C, the enzyme was rapidly inactivated and preserved only 7% of the initial activity when it was exposed to 60°C for 30 min.

**Table 1:-** Effect of temperature on MTGase activity produced from *Streptomyces diastaticus*.

Temperature (°C)	Relative Activity (%)	Stability (%)
25	48.00	97.15
30	54.00	98.06
35	65.33	100.00
40	82.67	96.15
45	100.00	80.77
50	70.67	67.31
55	54.00	48.08
60	52.00	40.38

### Effect of pH:-

The optimum activity was at pH 6.5. The activity decreased rapidly at alkaline pH, but it decreased gradually at acidic side being only 36.36% of its maximum activity at pH 4.0. MTGase was stable at pH 6.5 for one hour. At pH 5.0 the retained activity was about 50% of the initial activity. The activity decreased greatly below pH 5.0 and above 8.5 (Table 2).

**Table 2:** Effect of pH on MTGase activity produced from *Streptomyces diastaticus*.

pH	Relative activity (%)	Stability (%)
4.0	36.36	16.39
4.5	48.48	37.70
5.0	48.48	50.82
5.5	68.18	65.57
6.0	86.36	78.69
6.5	100.00	100.00
7.0	81.82	90.16
7.5	48.48	81.97
8.0	18.18	55.74
8.5	9.09	44.26
9.0	3.0	29.51

These results are in agreement with other authors (Cui et al., 2007) who reported that, the enzyme exhibited optimum activity in a range of pH 6.0- 7.0. Also, they declared that, the purified MTGase was stable within a wide range of pH 5.0- 8.0 at 10°C. The enzyme was stable at pH 5.0- 7.0 after 30 min of incubation at 37°C and about 50% activity was retained at pH 8.0. The activity decreases greatly outside this pH range.

**Attest the cross-linking effect of the prepared enzyme:-**

The attest of the occurrence of cross-linking and/ or its effect have to be proofed prior to its application in food. The cereal products mainly bread is one of the common applications of MTGase in food industry. So, the cross-linking effect will be tested through cross-linking of wheat dough prepared for *Shamy* bread making. The amount of the enzyme used was 100 enzyme units per 500 g of the flour used. The *Shamy* bread was prepared as described in the materials and methods section.

The free amino groups which representing the direct cross-linking by forming a new iso-peptide bonds and the free thiol groups which indicate the indirect effect refer to the oxidation of free sulfhydryl group and formation of disulphide bonds were investigated. The changes of the free amino and thiol groups content will be used as a tool for tracing the cross-linking occurred.

The results indicated that the enzyme have a cross-linking effects towards the free amino and thiol groups .These results are in agreement with those reported by all authors used MTGase (Gujral and Rosell, 2004 ; Ahn et al., 2005).

**Tracing the effect of MTGase in dough prepared from blends of wheat and corn Flours:-**

The following experiments were carried out to investigate the possibility of incorporating corn flour into wheat flour at higher levels for making *Shamy* bread with the aid of MTGase cross-linking. Corn flour was mixed with wheat flour at levels of 10, 20, 30, 40, and 50 % of the weight of wheat flour.

**Free amino groups:-**

The data in Table (3) revealed that the free amino groups of the dough. The results indicated that the enzyme have a cross- linking effects towards the free amino and thiol groups of wheat dough. The free amino groups of the wheat dough were 0.538  $\mu\text{M}/\text{mg}$  flour without adding the enzyme. It decreased to 0.378  $\mu\text{M}/\text{mg}$  flour when treated with the enzyme; the percent of reduction was 29.74. Mixing corn flour with wheat flour decreased the free amino groups of the resulted dough. It decreased to 0.356  $\mu\text{M}/\text{mg}$  flour, in dough containing 10 % corn flour and treated with the enzyme. Increasing the level of corn flour to 30% caused a decrease in the free amino group to 0.248  $\mu\text{M}/\text{mg}$  flour with reduction of 34.39%. The cross-linking effect was 0.142 and 0.130  $\mu\text{M}/\text{mg}$  flour in the blends containing of 10% and 30% corn flour, respectively. When the level of corn flour increased to 50%, a slight decrease in the cross-linking effect was observed. Generally increasing the corn wheat to 30% did not affect or have a slight positive effect on the enzyme activity.

**Table 3:-** Effect of prepared MTGase on the free amino groups in dough of wheat and corn flour blends

Flour blends	Control	Free amino groups ( $\mu\text{M}/\text{mg}$ flour)		
		After treatment "Residual"	Cross-linking effect	Reduction (%)
Wheat flour 100%	0.538	0.378	0.160	29.74
Wheat flour 90% + Corn flour 10%	0.498	0.356	0.142	28.51
Wheat flour 80% + Corn flour 20%	0.414	0.288	0.126	30.43
Wheat flour 70% + Corn flour 30%	0.378	0.248	0.130	34.39
Wheat flour 60 % + Corn flour 40%	0.288	0.208	0.080	27.78
Wheat flour 50% + Corn flour 50%	0.258	0.184	0.074	28.68

Gujral and Rosell (2004) reported that when rice flour was treated with different concentrations of MTGase, a progressive decrease in the amount of free amino groups was observed on addition of MTGase up to 1.0%. Beyond that concentration no significant differences in the amount of free amino groups were detected. This could be due to the disappearance of the lysine groups exposed to the enzyme effect. Ahn et al. (2005) indicated that, the amount of free amino groups in TGase-treated wheat, barley and soy flours and their blends were decreased with TGase treatment.

**Free thiol groups:-**

The data in Table (4) indicated that, the free thiol groups of the control samples (without enzyme) in the dough of wheat and corn flour blends decreased with increasing the percentage of corn flour.

**Table 4:-** Effect of prepared MTGase on the free thiol groups in dough of wheat and corn flour blends

Flour blends	Control	Free thiol groups ( $\mu\text{M}/\text{g}$ flour)		
		After treatment	Cross-linking effect	Reduction %
Wheat flour 100%	11.222	10.342	0.88	7.849
Wheat flour 90% + Corn flour 10%	10.861	10.008	0.853	7.854
Wheat flour 80% + Corn flour 20%	9.411	8.604	0.807	8.575
Wheat flour 70% + Corn flour 30%	9.103	8.626	0.477	5.240
Wheat flour 60 % + Corn flour 40%	8.612	8.211	0.401	4.656
Wheat flour 50% + Corn flour 50%	8.114	7.834	0.28	3.573

In general, increasing the percentage of corn flour in the blends treated with MTGase decreased the free thiol groups. The free thiol groups of the wheat dough (without enzyme) were  $11.222\mu\text{M}/\text{g}$  flour, it decreased to  $10.342\mu\text{M}/\text{g}$  flour when treated with the enzyme, with reduction of 7.849 %. The free thiol groups of the dough (without enzyme) contain 10% corn flour was  $10.861\mu\text{M}/\text{g}$  flour, it decreased to  $10.008\mu\text{M}/\text{g}$  flour when treated with the enzyme. When the levels of corn flour increased to 30% the free thiol groups decreased from  $9.103\mu\text{M}/\text{g}$  flour in the untreated sample (control) to  $8.626\mu\text{M}/\text{g}$  flour in the sample treated with the enzyme. Increasing the level of corn flour caused a gradually decrease in the free thiol groups. At a level of 50% corn flour the cross-linking was  $0.28\mu\text{M}/\text{g}$  flour with a reduction reached 3.573 % in the sample treated with the enzyme.

Gujral and Rosell (2004) declared that, there was a significant decrease in the free thiol groups content of rice flour treated with TGase. The decrease in thiol groups was more significant at a TGase concentration of 0.5% compared with 1 and 1.5%. The reduction in thiol groups concentration suggests the formation of disulphide bonds is most likely favored by the proximity of the cross-linked polypeptide chains.

Ahn et al. (2005) mentioned that, significant decrease in the number of free thiol groups of the blended samples (wheat, barley and soy flour) up on TGase treatment. Sulfur-containing amino acids may come close to each other during the TGase reactions leading to the formation of disulfide bonds via oxidation.

Ap et al. (2011) reported that the enzyme modified chemical and functional properties of glutenins fraction of proteins, improving dough strength and bread volume.

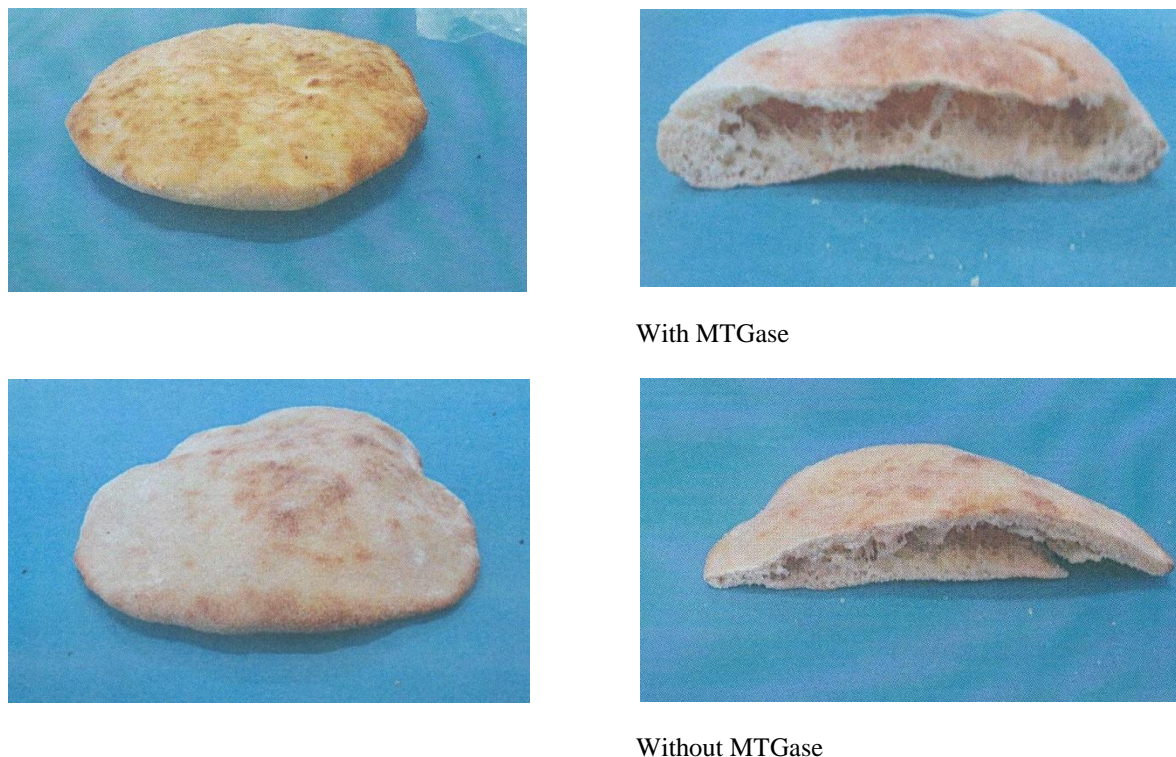
#### **Application of MTGase in Shamy bread using wheat and corn flour blends:-**

Wheat flour is the main flour used for production of bread and many other bakery products. Wheat flour contains proteins, mainly gluten which is the dominant proteins that characterize dough properties and play an important part in the quality of bread. Disulfide bridges between gluten proteins strengthen the gluten network, which is beneficial for the quality of the baked loaf (Kaufmann et al., 1986).

Corn flour is one of the most valuable cereal flours from a nutritional point of view. However, corn flour is unable to hold gas produced during fermentation for baked products. The properties of corn flour are very different from wheat flour this is because of the absence of gluten.

The previous results of tracing the cross-linking effect revealed from the free amino and thiol groups (Tables 3 and 4) indicated that the maximum effect was observed when using a flour blend contains 70% wheat and 30% corn flour. So this blend was used for making *Shamy* bread as indicated in the materials and methods section.

Figure (1) shows a complete and cross section of the prepared bread. The figure indicated that, the prepared loaf from the dough treated with the enzyme have a higher volume with pronounced improvement in the general appearance and quality than that when no enzyme was used.



**Figure 1:-** Baking performance of dough prepared from 70% wheat flour and 30% corn flour with and without the purified enzyme

De Jong and Koppelman (2002) stated that, articles describing the use of TGase in cross-linking of proteins are mostly focused on one single type of protein. The cross-linking reaction can however also be applied to the glutamines and lysine of two different types of proteins. By coupling two proteins with different structures, totally new functionalities can be created.

Basman et al. (2003) reported that, bread from TGase-treated samples prepared from different blends of wheat and barley flours had higher loaf volumes and better crumb and crust characteristics, and were apparently softer than those from untreated samples up 30% barely flour supplementation level. The increases in loaf volumes of TGase-treated samples might be the result of TGase transforming weak gluten into a strong one due to TG-catalyzed cross-linking reactions between and within wheat and barley proteins.

Gujral and Rosell (2004) reported that, the specific volume of rice bread which treated with MTGase increased by increasing the concentration of MTGase up to 1%, but negative effects was observed at higher concentrations. They attributed this behavior to the ability of the TGase to transform weak gluten into a strong one and suggest that at high TGase concentrations excessive cross-linking produced over-strong dough. Ap et al. (2011) reported that the enzyme modified chemical and functional properties of glutenins fraction of proteins, improving dough strength and bread volume.

### Conclusion:-

It can be concluded that the prepared enzyme have a cross-linking effects towards the free amino and thiol groups. Also, it is possible to produce *Shamy* bread with a good quality from a blend of wheat flour mixed with a high level of corn flour reached to 30% with the aid of the prepared enzyme. This is due to the cross-linking effect of the enzyme. The maximum level of corn flour which used previously was 20% only without using the enzyme.

### References:-

1. Ahn H.J., Kim J.H., and Ng P.K.W. (2005). Functional and thermal properties of wheat barley, and soy flours and their blends treated with a microbial transglutaminase. *Journal of Food Science* 70: 380- 386.

2. Ap E., Seravalli G., Lguti A.A., Ap I., and Filho F.F. (2011). Effects of application of transglutaminase in wheat proteins during the production of bread. *Procedia Food Science* 1: 935- 942.
3. Cui L., Du G., Zhang D., Liu H., and Chen J. (2007). Purification and characterization of transglutaminase from a newly isolated *Streptomyces hygroscopicus*. *Food Chemistry* 105: 612- 618.
4. Dube M., Schäfer C., Neidhart S., and Carle R. (2007). Texturisation and modification of vegetable proteins for food applications using microbial transglutaminase. *European Food Research and Technology* 225: 287- 299.
5. Eshra D.H., El-Iraki S.M., and Abo Bakr T.M. (2015). Isolation and identification of actinomycetes transglutaminase producing strain. *International Journal of Current Science* 18: E 76- 88
6. Gerrard J.A., Fayle S.E., Brown P.A., Sutton K.H., Simmons L., and Rasiah I. (2001). Effect of microbial transglutaminase on the wheat proteins of bread and croissant dough. *Journal of Food Science* 66: 781-786.
7. Gujral H.S., and Rosell C.M. (2004). Functionality of rice flour modified with microbial transglutaminase. *Journal of Cereal Science* 39: 225- 230.
8. Ho M.L., Leu S.Z., Hsieh J.F., and Jiang S.T. (2000). Technical approach to simplify the purification method and characterization of microbial transglutaminase produced from *Streptovorticillium ladakanum*. *Journal of Food Science* 65: 76-80.
9. Kuraishi C., Yamazaki K., and Susa Y. (2001). Transglutaminase: its utilization in the food industry. *Food Reviews International* 17: 221- 246.
10. Larré C., Denery Papini S., Popineau Y., Deshayes C., Desserme C., and Lefebvre J. (2000). Biochemical analysis and rheological properties of gluten modified by transglutaminase. *Cereal Chemistry* 77: 121- 127.
11. Macedo J.A., Sette L.D., and Sato H.H. (2007). Optimization of medium composition for transglutaminase production by a Brazilian soil *Streptomyces* sp. *Electronic Journal of Biotechnology* 10: 618-626.
12. Nielsen P.M. (1995). Reactions and potential industrial applications of transglutaminase. *Food Biotechnology* 9: 119- 156.
13. Nielsen P.M., Petersen D., and Dambrmann C. (2001). Improved method for determining food protein degree of hydrolysis. *Journal of Food Science* 66: 642-646.
14. Nonaka M., Matsuura Y., Nakano K., and Motoki M. (1997). Improvement of the pH-solubility profile of sodium caseinate by using  $\text{Ca}^{2+}$  independent microbial transglutaminase with gelatin. *Food Hydrocolloids* 11: 347- 349.
15. Rao U.J.S.P., Vatsala C.N., and Rao P.H. (2002). Changes in protein characteristics during the processing of wheat into flakes. *European Food Research and Technology* 215: 322-326.
16. Umezawa Y., Ohtsuka T., Yokoyama K., and Nio N. (2002). Comparison of enzymatic properties of microbial transglutaminase from *Streptomyces* sp. *Food Science and Technology Research* 8:113- 118.
17. Wang F., Huang W., Rayas-Duarte P., Wang H., and Zou Q. (2013). Baking characteristics of Chifon cake as influenced by microbial Transglutaminase. *Cereal Chemistry* 90: 463-468.
18. Yokoyama K., and Kikuchi N.N.Y. (2004). Properties and applications of microbial transglutaminase. *Applied Microbiology and Biotechnology* 64: 447- 454.
19. Zhu Y., Rinzema A., Tramper J., and Bol J. (1995). Microbial transglutaminase- a review of its production and application in food processing. *Applied Microbiology and Biotechnology* 44: 227-282.

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### RESEARCH ARTICLE

#### A Study on Phytodiversity in Fluoride contaminated site near Coromandel area in Visakhapatnam.

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#### Abstract

Increased population, industrialization and urbanization are responsible for environmental contamination. The discharge of industrial waste water, without any prior treatment in to the environment has always affected the health of human beings, plants and animals. These effluents contain toxic chemicals which are not degradable via chemical and microbial processes. However, they are very likely to accumulate in the soil, aquatic environment and in the plant organs. 2. In this genomic era development of science and technology facilitates the use of the potential of biological diversity for pollution removal which is termed as Bioremediation. 3. In any bioremediation study, site characterization is the preliminary step and is very important with respect to future application or augmentation of the organisms into the particular site involved. 4. In view of this the present study was undertaken to characterize the phytodiversity in fluoride contaminated site near Coromandel area in Visakhapatnam for their possible use in phytoremediation.

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#### Introduction:-

The problem of environmental pollution has existed since early time and is still growing rapidly as a result of industrialization in developing countries like India (Naheed et al, 1986). Industrial pollution is caused by discharge of various chemicals in the form of gases, liquids, and solids which affects the physical, chemical and biological conditions of the environment and is harmful to all living beings (Dueck and Endenjik, 1987). Various industrial pollutants affecting the plants have been reported which include many metalloids, heavy metals and other phenol's etc.

Metals in general are a class of chemical compounds that are good conductors of heat and electricity (Ghosh and Singh 2005). From past 10 to 15 years the disturbance caused by these metals to the nature has been of great concern. Among such metals, special attention is drawn with reference to fluoride which is a strong electronegative element wide spread in the environment (Jha et al.2009), Chemically active in nature and found mostly in combination with other metals like cadmium, zinc etc. Fluoride is a serious contaminant, even present at low levels as it can persist for a long time in the environment and exert negative effects at all levels of an ecosystem (Ares. J .O. Villa and Mandodari 1980).

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The exact mechanism by which fluoride causes damage to plants is little understood. Nevertheless, certain physiological processes are known to be markedly affected by fluoride. For example, a decrease in chlorophyll (McNulty & Newman, 1961), a diminished rate of photosynthesis (Thomas & Hendricks, 1956), decreased plant growth (Bonner & Thimann, 1950) and increased respiration in growing plants (McNulty & Newman, 1957) have been reported. An effect of fluoride on a physiological process may be a reflection that one or more enzyme systems are affected by fluoride.

The determination of fluoride contamination has received extensive attention because of its significant effects in plants and animals. The number of articles published on determination of fluoride has increased significantly in the recent years. Numerous methods have been developed to determine the amount of fluoride in various samples, which include, electrochemical methods (potentiometry, voltammetry) Chromatography, Sensors, Micro fluidic analysis, Titration and spectroscopy. Among them, Potentiometric determination by F-ISE (ion selective electrode) is the widely used method (Borjigin et al 2009, Krishna et al 2012).

#### **Need for remediation:-**

The use of biological diversity for the removal of chemicals in soil and water called bioremediation which is the emerging, efficient and innovative tool for management of a wide array of contaminants. This technology includes phytoremediation (use of plants), microbial remediation (use of microbes) and rhizo remediation (plant and microbe interaction) among which phyto remediation is the most evolved one, which is applicable for removal of contaminants in soil, surface water, ground water and sediments in air (Bindu Madhavi and Gaurav Reddy 2014.).

The present study was undertaken with the objectives of investigating the phyto diversity of area adjacent to the Coromandel Fertilizer limited that has high fluoride content and also to study the quantitative characters of the plant species so as to identify the abundantly growing plant species which may be the possible fluoride tolerant species that can be used to phytoremediate the fluoride contaminated sites.

#### **Study area:-**

Visakhapatnam is located on the east coast of India on 17°-43'N latitude 83°-17'S longitude and in between Calcutta and Madras. The surroundings of Visakhapatnam are rich in natural flora and approx. 550 species belonging to many Angiosperm families (Venkateswarulu J. Bhirava murthy and P. Narasimha Rao 1972). Vishakhapatnam is surrounded by many industries which discharge their effluents containing chemical pollutants in to the environment. Among them Coromandel Fertilizer Limited (fig 1,2) is the major one, which is spread over an area of about 480 acres of land at Sriharipuram lying to south of Visakhapatnam. A vast stretch of barren and vacant land remained adjacent to the industry where the effluents (raw material containing fluoride) released from the industry are flowing through a narrow stream into the surrounding area. The effluent affected area is occupied by herbaceous vegetation (fig3), with a limited number of species. Few of them are capable of accumulating high amounts of fluoride in their tissues (P.V. Arjun Rao, 1992)



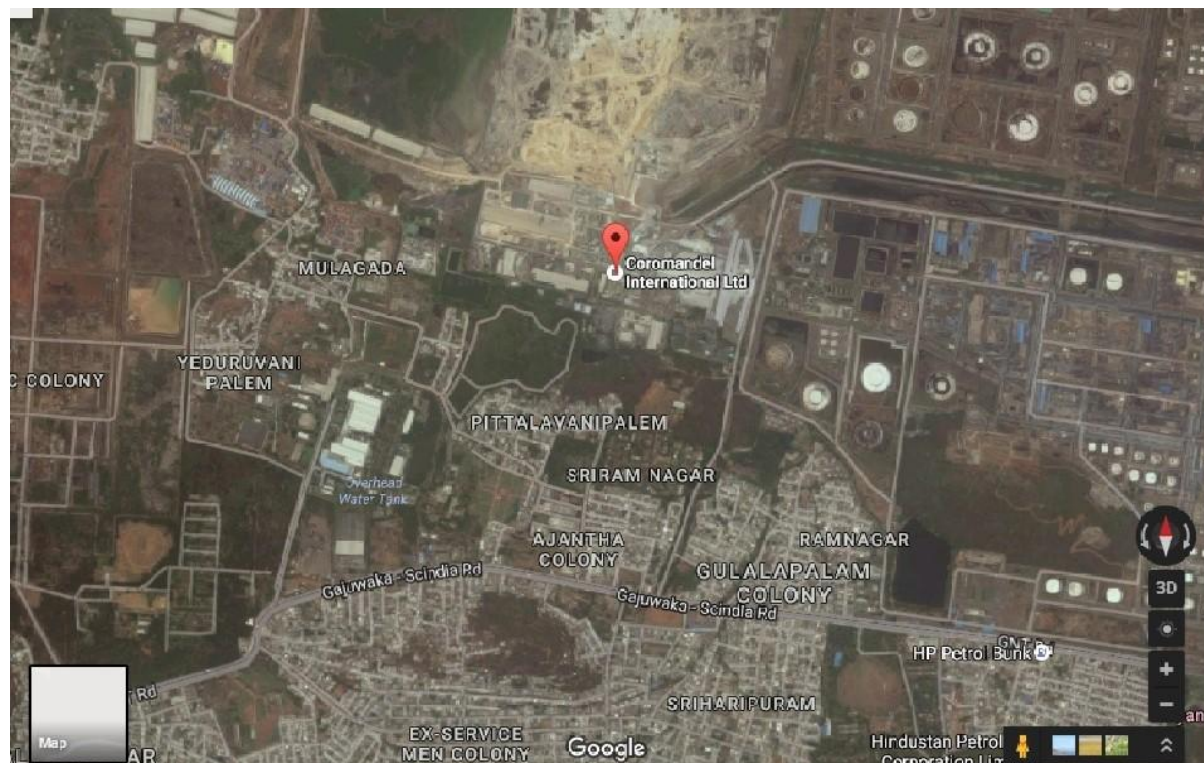


Fig:- 1, 2 Google maps showing the study area with location





Fig3: photograph showing the plants growing and canal flow adjacent to the Fertilizer industry

### Materials and Methods:-

The phyto diversity of an area adjacent to the Coromandel Fertilizer Limited that has high fluoride content was studied. The quadrats were laid 500 m apart (10 m x 10m) by using standard quadrat method (Trivedi and Geol 1986).

The species available inside the quadrats were collected and identified with the help of floras namely Flora of The Presidency of Madras by Gamble (1915-1938), the Flora of The Presidency of Bombay by Cooke (1967) and Mangroves in India - Identification Manual by Banerjee et al. (1989) and other taxonomic literature. Quantitative characters like Abundance, Density, Frequency and their relative values and Importance Value Index (IVI) were calculated for each species by applying the following principles of *Curtis and McIntosh (1950)*, *Misra (1968)* and *Muller-Dombois and Eilenberg (1974)*

$$\text{Frequency (\%)} = \frac{\text{Number of quadrats in which the species occurred} \times 100}{\text{Total number of quadrats studied}}$$

$$\text{Density} = \frac{\text{Total number of individuals of a species in all quadrats}}{\text{Total number of quadrats studied}}$$

$$\text{Abundance} = \frac{\text{Total number of individuals of a species in all quadrats}}{\text{Total number of quadrats in which the species occurred}}$$

$$\text{Relative density (RD)} = \frac{\text{density of individual species} \times 100}{\text{Total Density of all species}}$$

$$\text{Relative abundance (RA)} = \frac{\text{abundance of Individual species} \times 100}{\text{Total abundance of all species}}$$

$$\text{Relative frequency (RF)} = \frac{\text{frequency of individual species} \times 100}{\text{Frequency of all species}}$$

#### IMPORTAT VLUE INDEX =RA+RD+RF

To determine the amount of total fluoride present in the plants whole plant were collected and washed with tap water several times and thoroughly washed with double distilled water to remove the dust on the surface of the plants. Samples were shade dried for twenty days and ground in a grain mill to fine powder, passed through a 50mm mesh sieve. Samples were decomposed by alkaline carbonate fusion using  $\text{Na}_2\text{CO}_3$  in platinum crucible at  $450^\circ\text{C}$  for 12 hours. After extraction of the samples into  $\text{Na}_2\text{CO}_3$ . The extract were acidified with dilute HCl to pH 5.5 and mixed with total ionic strength adjustment buffer (TISAB) to maintain the pH at 7.5 and the fluoride content determined by using fluoride ion selective electrode (ORION 4 star) (k. prabhavati devi, ch.sita Bindu et.al 2016) the data is shown in table IV.

#### Results and Discussion:-

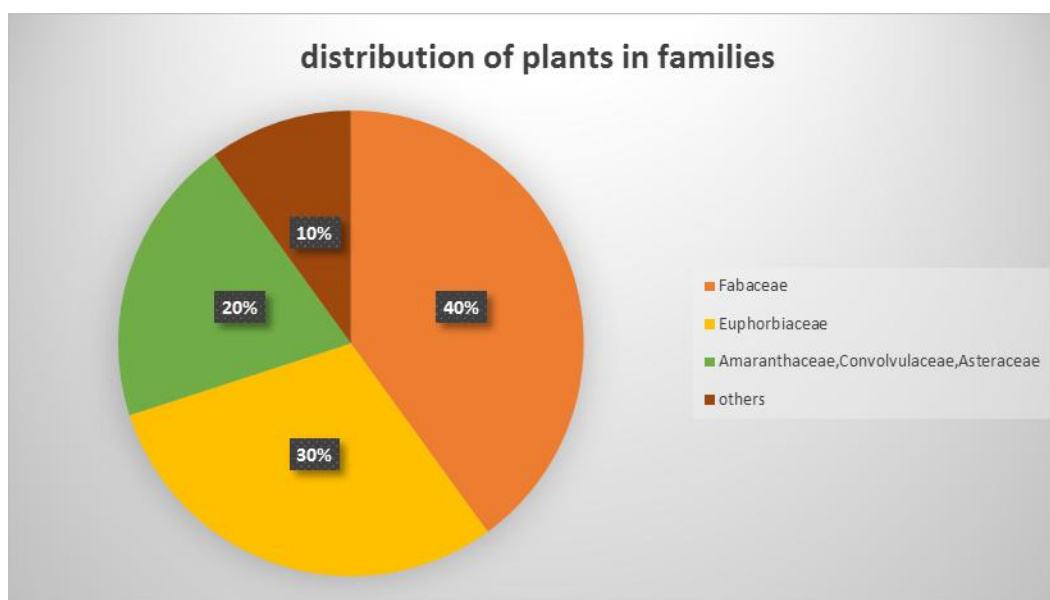
In the present investigation a total of 22 plant species were identified in the vast area of land present adjacent to Cormandal industry. Out of these 22 plant species 21 plants belonging to 12 families are dicots and 1 plant species of Poaceae is from monocots. The taxonomic position of plants and family wise percentage occurrence of species are shown in table I and II. The details of phytosociological attributes of the identified species is shown in table III the IVI values are plotted in graph I. the amount of fluoride determined is presented in table IV.

**Table I:-** The taxonomic categories of plant species encountered in the study area

Traditional plant group	Families	Genera	Species
dicotyledons			
Polypetalae	4	7	7
Gamopetalae	7	9	9
Monochlamydae	2	5	5
Monocotyledons	1	1	1
Total	14	22	22

**Table II:- Family wise percentage occurrence of plant species in the study area.**

S.No	Name of the family	No. of species	No. of genera	% Species to the total species recorded
1	Malvaceae	1	1	4.545
2	Fabaceae	4	4	18.18
3	Euphorbiaceae	3	3	13.63
4	Acanthaceae	1	1	4.545
5	Poaceae	1	1	4.545
6	Apocyanaceae	1	1	4.545
7	Solanaceae	1	1	4.545
8	Convolvulaceae	2	2	9.090
19	Cucurbitaceae	1	1	4.545
10	Asteraceae	2	2	9.090
11	Phyllanthaceae	1	1	4.545
12	Plantaginaceae	1	1	4.545
13	Cleomaceae	1	1	4.545
14	Chenopodiaceae	1	1	4.545
15	Amaranthaceae	1	1	4.545

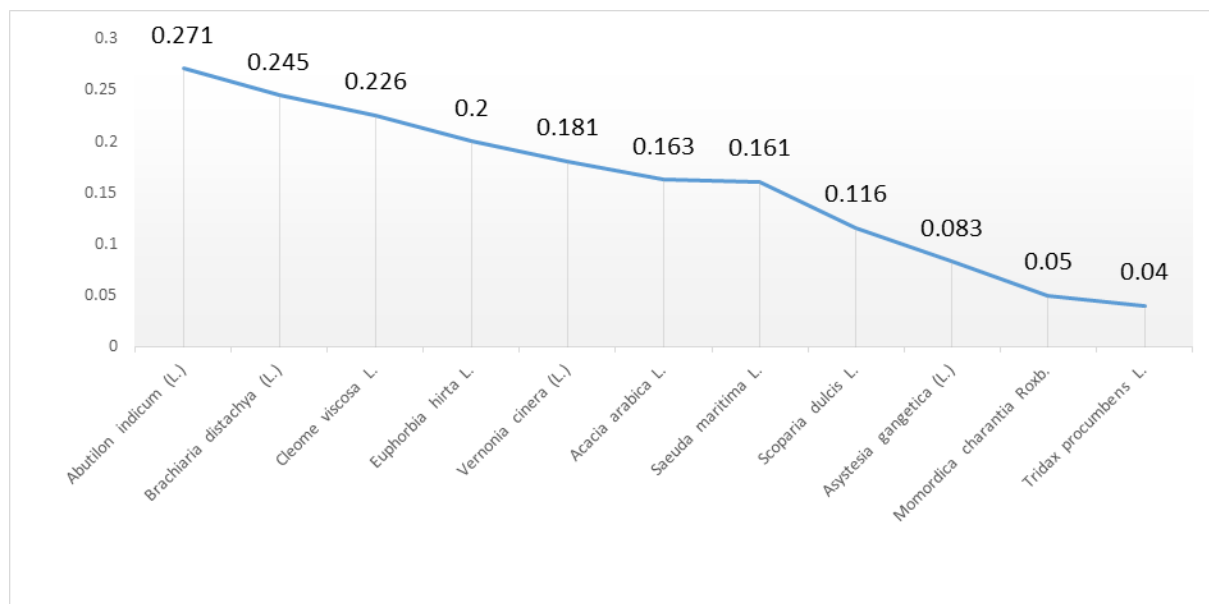
**Table III:- Phytosociological Attributes of flora present in the study area.**

S No	Name of the species	TOI	TNI	A	D	F	RA	RD	RF	IVI
1	<i>Abutilon indicum</i> (L.)	6	57	9.5	5.7	0.6	0.061	0.119	0.091	0.271
2	<i>Acacia Arabica</i> L.	2	25	12.5	2.5	0.2	0.081	0.052	0.03	0.163
3	<i>Acalypha indica</i> Linn.	6	41	6.83	4.1	0.6	0.044	0.085	0.091	0.22
4	<i>Amaranthus viridis</i> L.	2	21	5.25	2.1	0.4	0.034	0.043	0.061	0.138
5	<i>Asystesia gangetica</i> (L.)	1	8	8	0.8	0.1	0.052	0.016	0.015	0.083
6	<i>Brachiaria distachya</i> (L.)	3	47	15.6	4.7	0.3	0.101	0.098	0.046	0.245
7	<i>Cassia occidentalis</i> L.	3	14	4.6	1.4	0.3	0.029	0.029	0.046	0.104
8	<i>Calotropis gigantea</i> (L.) R.Br.	1	4	4	0.4	0.1	0.026	0.008	0.015	0.049
9	<i>Cleome viscosa</i> L.	6	43	7.1	4.3	0.6	0.046	0.089	0.091	0.226
10	<i>Clitoria ternate</i> L.	10	4	4	0.4	0.1	0.026	0.008	0.015	0.049

11	<i>Datura ionoxa L.</i>	2	8	4	0.8	0.2	0.026	0.017	0.03	0.073
12	<i>Euphorbia hirta L.</i>	7	31	4.42	3.1	0.7	0.029	0.065	0.106	0.2
13	<i>Ipomea biloba L.</i>	2	31	15.5	3.1	0.2	0.099	0.065	0.03	0.194
14	<i>Merremia tridentata L.</i>	1	3	3	0.3	0.1	0.019	0.006	0.015	0.04
15	<i>Momordica charantia Roxb.</i>	2	4	2	0.4	0.2	0.013	0.008	0.03	0.051
16	<i>Phyllanthus maderaspatensis L.</i>	2	7	8.5	1.7	0.2	0.055	0.036	0.03	0.121
17	<i>Prosopis juliflora (Sw.)</i>	2	12	6	1.2	0.2	0.039	0.025	0.03	0.094
18	<i>Ricinus communis L.</i>	4	30	7.5	3	0.4	0.048	0.063	0.061	0.172
19	<i>Suaeda maritima (L.)</i>	5	27	5.4	2.7	0.5	0.035	0.057	0.075	0.167
20	<i>Scoparia dulcis L.</i>	2	16	8	1.6	0.2	0.052	0.034	0.03	0.116
21	<i>Tridax procumbens L.</i>	1	3	3	0.3	0.1	0.019	0.006	0.015	0.04
22	<i>Vernonia Cinerea (L.)Less</i>	3	32	10.6	3.2	0.3	0.068	0.067	0.046	0.181

**TOI** : Total Occurrence of Individuals. **TNI**: Total Number of Individuals **A** = Abundance, **D** = Density, **F** = Frequency **RA** = Relative Abundance **RD**= Relative Density **RF** = Relative Frequency, **IVI** = Important Value

**Graph I:-** Showing the IVI variation of plants in the study area (Range of IVI variation (0.05 to 0.3))



**Table IV:-** The determination of Fluoride present the plants.

s.no	Name of the plants	total amount of fluoride (mg/kg)
1	<i>Abutilon indicum (L.)</i>	4.8
2.	<i>Acalypha indica Linn.</i>	2.1
3	<i>Acacia Arabica L.</i>	4.1
4.	<i>Amaranthus viridis L.</i>	3.1
5.	<i>Asystasia gigantea (L.)</i>	1.2
6.	<i>Brachiaria distachya (L.)</i>	27
7	<i>Cassia occidentalis L.</i>	2.1
8	<i>Cleome viscosa L.</i>	1.2

9	<i>Clitoria ternata L.</i>	2.3
10.	<i>Euphorbia hirta L.</i>	4.2
11	<i>Merremia tridentata Roxb.</i>	2.5
12	<i>Prosopis juliflora</i>	57
13.	<i>Suaeda maritima (L.)</i>	82
14	<i>Scoparia dulcis L.</i>	37

### Discussion:-

The present study on the Taxonomic distribution of plants in families (table I) shows that majority of them belong to Gamopetalae i.e...7 families which include 9 genera and Polypetalae with 4 families which include 7 genera and only one from monocotyledonae. The percentage occurrence of species is highest in Fabaceae i.e...18.18 followed by Euphorbiaceae with 13.63 and the lowest number is seen in few families namely Malvaceae, Acanthaceae, Apocyanaceae, Cucurbitaceae with 4.54 (table II). The IVI values is highest for *Abutilon indicum* (L.) with 0.271 and second highest is *Brachiaria distachya* with 0.245 and least value in *Tridax procumbens* with 0.04. The Plants were examined for fluoride content and the results show highest accumulation in *Suaeda maritima* (L.) with 82mg/kg and followed by *Prosopis juliflora*(Sw.) with 57mg/kg and, *Scoparia dulcis L.* with 37mg/kg .

From the results it observed that the plants like *Prosopis juliflora* (Sw.), *Scoparia dulcis L.*, *Suaeda maritima* (L.) are showing high amount of fluoride indicating their capacity to tolerate and grow which was supported by (Fatemeh et.al 2013). Further detailed study of plant, soil and microbe interactions is needed to affirm these plants as phytoremediants .

### Conclusion:-

From the results it's proved that few plant communities are dominating even in the high Fluoride polluted area. So obviously, further detailed studies are needed to decide whether these species can be regarded as indicator species of fluoride pollution and the form of the fluoride stored is whether in elemental or free form in the plant. It is worthwhile to carry this kind of test to evaluate the variety of plant species so that it can serve the purpose of providing a green cover for industrial area.

### References:-

1. Adams, d.f.1956. *The effect of air pollution in plant life* A.M.A. arch .Ind. health 14: 229-245.
2. Akbar KF, Ahmad Z, Shad MA, Ansari TM (2003). *An Ecological study of roadside vegetation and soils in Sahiwal district*. Online J. Biol.Sci. 3(7): 627-634
3. Al-Khashman OA (2007). *Determination of metal accumulation in deposited street dusts in Amman, Jordan*. Environ. Geochem. Health 29(1):1-10
4. Ares, J.O.Villa, G.Mandodari. *Air pollutant uptake by xerophytic vegetation: fluoride* Enviror.exp.bot. 20:259-269.
5. **Thesis:** Arjun Rao P.V, *Studies on the genotoxic effects of the effluent from cormandal fertilizers limited* 1992. M.Phil. thesis Visakhapatnam
6. Bonner, W. D., jun. & Thimann, K. V. (1950). Amer. J. Bot. 37, 66.
7. Bindu Madhavi G. S. Bharathi and K. Gaurav Reddy *Bioremediation and its applications*. Journal of chemical and pharmaceutical sciences 2014 .ISSN:0974-2115
8. Borjigin, S.; Ashimura, Y.; Yoshioka, T.; Mizuguchi, T.; *Determination of Fluoride Using Ion selective Electrodes in the Presence of Aluminium*. Anal.sci.2009, 25 (12), 1437-1443
9. **Book:** Curtis, J.T. & R.P. McIntosh. 1950. *The interrelationships of certain analytic and synthetic Phytosociological characters*. Ecology 31: 434-455
10. Dueck, T.A and G.J.Endenjik. 1987. *Soil pollution and changes in vegetation* .chemosphere, 16:1021-1030
11. J.G. Ray and Jojo George, *Phytosociology of road side communities to identify ecological potential of tolerant species*. Journal of ecology and natural environment Vol.1 (5), pp184-190 November, 2009.
12. Jha SK, Nayek AK, Sharma YK (2009) *Fluoride toxicity effects in onion (Allium cepa L.) grown in contaminated soils*. Chemosphere, 76:353-356
13. Kabir M., M .zafir Iqbal, Z.R. Farooqi and M.Shafiq. *Vegetation pattern and soil characteristics of the polluted industrial area of Karachi*.Pak.J.Bot42 (1):661-67
14. K.P Sharma R.K. Chaturvedi ,kamayani Sharma and S.M.Bhardwaj *dominance and diversity studies of vegetation of polluted habitats around sanganer ,Jaipur*. Tropical ecology 42(1):69-82, 2001.

15. K. prabhavati Devi, Ch. Sri Bindu, T.byragi reddy,K, K. Basavaiah, and P. Vani. *Accumulation of fluoride from soil by various plant species in the vicinity of fertilizer factory, Visakhapatnam* . world journal of pharmacy and pharmaceutical sciences, volume 5, issue 9, 2122-2128
16. Krishna, M. V. B.; Rao, S. V.; Murthy, V. S. N.; Karunasagar, D.; A simple UV-photolysis digestion method for the determination of fluoride in fluorine-containing drugs by ion selective electrode and spectrophotometry techniques. *Anal. Methods* 2012, 4 (6), 1565-1572.
17. 17.Kumar, R.T., B.T. Reddy & P.P. Murthy. 2013. *Weed distribution in Sugarcane fields of Srikakulam district, A.P., India*. *Research Journal of Pharmaceutical, Biological and Chemical Sciences* 4(1): 1380-1389.
18. Mc Nulty, I. B. & Newman, D. W. (1957). *Plant Physiology*. 32, 121
19. McNulty, I. B. & Newman, D. W. (1961). *Plant Physiol*. 36, 385.
20. 20.M. Gosh, SP. Singh (2005): *A review on phyto remediation of heavy metals and utilization of it's by product*. *Appl.ecol.Environ.Res.*3 (11-18)
21. 21.**Book** : Misra, R. 1968. *Ecology workbook*. Oxford and IBH publishing company Ltd., New Delhi.
22. **Book**: Muller – Dombois & H. Eilenberg. 1974. *Aims and Methods of Vegetation Ecology*. John Wiley and Sons, New York.
23. Naheed, S.N. Arizd and S. Baig. *Studies of particulate air pollutants in the vicinity of a cement factory and its health hazards*. *Pakistan journal of scientific and industrial research* 29(4):95-102.
24. Fatemeh Kazemeini , Behroz Eshghi Malayeri Abdolkarim Chehregani , Bahare Lorestani, Ramezan Kalvandi *Identification of the heavy metals accumulator plants in surrounding area of mine* . *International Journal of Agriculture and Crop Sciences*. IJACS/2013/6-10/565-574
25. 25.Pragada, P.M. and M. Venkaiah. 2012. *Phytosociological attributes of weed flora in major crops of north coastal Andhra Pradesh, India*. *Pakistan Journal of Weed Science* 18(1): 107-126.
26. Syeda Sadaf jehra, Muhammad Arshad, *Assement of heavy metal accumulation and their translocation in plant species*. *African journal of biotechnology* vol.8 (12), pp.2802-.2810.
27. **book** : Thomas, M. D. & Hendricks, R. H. (1956). *In Air Pollution Handbook*, sect. 9, p. 22. New York: McGraw-Hill Book Co.
28. **Book** : Trivedy RK, Goel PK (1986). *Chemical and biological methods for water pollution studies*. *Environmental Publications, India* .Karad pp. 415 -110





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### RESEARCH ARTICLE

#### GENETIC POLYMORPHISM OF PARAOXONASE 3 GENE ALA99ALA IN ADJA AND MAHI ETHNIC GROUPS IN BENIN.

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Single Nucleotide Polymorphism; gene; distribution; population

#### Abstract

**Introduction:** The paraoxonase has anti-atherogenic activity which may be altered by the coding gene polymorphisms. The purpose of this study was to assess the genotypic distribution and allelic frequencies in paraoxonase 3 gene Ala99Ala polymorphism in Beninese *Adja* and *Mahi* ethnic groups.

**Materials and methods:** The paraoxonase 3 gene Ala99Ala polymorphism of 144 subjects of Beninese *Adja* and *Mahi* ethnic groups was studied using Polymerase Chain Reaction-Restriction Fragment Length Polymorphism technique and compared with that in Beninese Abomey-Calavi population and others world populations.

**Results:** The alleles A and G frequencies were 67.0 percent and 33.0 percent respectively of *Adja* ethnic group; and 66.0 percent and 34.0 percent respectively of *Mahi* ethnic group. There were no significant ethnic differences for these allelic frequencies between these two ethnic groups.

**Conclusion:** The genotypic distribution and allelic frequencies of paraoxonase 3 gene Ala99Ala polymorphism in Beninese *Adja* and *Mahi* ethnic groups were significantly different from those in Beninese Abomey-Calavi population and in others world populations respectively.

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#### Introduction:-

The paraoxonases (PON) enzymes are associated with many inflammatory diseases, such as cardiovascular diseases, by protecting the cells against oxidative stress (Aviram and Rosenblat, 2004). They are associated with high-density lipoprotein (HDL), hydrolyzed lactones and inhibited the oxidation of low-density lipoprotein (LDL), a function that is believed to slow the initiation and progression of atherosclerosis (Seres et al, 2004 and Zhang et al, 2010). The paraoxonase gene has three isoforms, PON1, PON2 and PON3 (Draganov et al, 2005) located on chromosome 7q21.3–22.1 and covers approximately 136kb (Primo-Parmo et al, 1996). Various populations' studies have reported inter-ethnic differences in the allele frequencies for PON gene polymorphisms (Campo et al, 2004 and Wu et al, 2010). This variability suggests that ethnic differences, gene-gene interactions and susceptibility to environmental factors might modulate the relationship between PON polymorphisms and many inflammatory diseases (Wang et al,

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2003). Many studies have been conducted on the relation between PON polymorphisms and genetic susceptibility to coronary heart disease (Erlich et al, 2006 and Zhang et al, 2013). The paraoxonase 3 (PON3) have a similar role to PON1 (Sanghera et al, 2008). The expression of PON3 gene occurs mainly in the liver and bind to HDL in blood stream (Reddy et al, 2001). The PON3 gene has five commons Single Nucleotide Polymorphisms (SNPs) Ala99Ala, Asp107Asn, Glu146Lys, Ala179Asp and Tyr233Cys (Robertson et al, 2003; Li et al, 2004; Pasdar et al, 2006 and Sanghera et al, 2008). Despite the importance of the paraoxonase gene and its implications on the genetic susceptibility to coronary heart disease, no studies on African black populations have been reported. The purpose of this study was to assess the distribution of PON3 gene Ala99Ala polymorphism in Beninese ethnic groups, *Adja* and *Mahi* in order to investigate the genetic basis of PON3 gene related diseases in Beninese population.

## Materials and Methods:-

### Subjects:-

This study has been conducted on two Beninese ethnic groups *Adja* and *Mahi*. In June 2015, fifty (50) unrelated volunteers 13 men and 37 women, aged between 17 and 72 years old; were selected randomly from *Adja* ethnic group from Lokossa, a south-west city in Benin; and in November 2015, ninety-four (94) volunteers, 33 men and 61 women, aged between 6 and 70 years old; were selected randomly from *Mahi* ethnic group from Savalou, a central city in Benin.

### DNA extraction and genotyping:-

Venous blood samples were collected from each volunteer after written consent. Genomic DNA was extracted by phenol-chloroform method at Genetics and Biotechnologies Laboratory (GBL) at Abomey-Calavi University. The Polymerase Chain Reaction (PCR) primers sequences for the PON3 Ala99Ala SNP (rs1053275) were designed as previously described by Wu *et al* (2010) and synthesized by SANGON Biotech (Shanghai, China). The sequences were: forward 5'-TCCAGGCATGCCAACTTT-3' and reverse 5'-TTTCCCTCATTCCCCCTT-3' were used to amplify 197 bp fragment containing the polymorphism site Ala99Ala on PON3 gene. PCR was performed using thermocycler PTC 100™ (*Programmable Thermal Controller*; Perkin Elmer) in a final volume of 25 µL as follows: 3 µL (3 ng) DNA sample was added to a reaction mixture containing 2.5 µL of 10×PCR buffer, 1.5 µL of 25 mmol/L MgCl<sub>2</sub>, 1 µL of 200 µmol/L dNTPs, 1U Taq DNA polymerase (1 µL) (Fermentas) and 2 µL of 0.2 µmol/L of each primer, dimethyl sulfoxide (DMSO) was added to a final concentration of 5% and ultra-pure water (Merck) to a final volume of 25 µL. The fragment amplification was performed under the following conditions: 10 min pre-denaturation at 94 °C followed by 30 cycles of 45 sec denaturation at 94 °C, 45 sec hybridization at 50 °C and 45 sec extension at 72 °C; and finished by 7 min extension at 72 °C. Then 10 µL of PCR products was digested with 2 µL of 10×NEB buffer, 2 µL of HhaI endonuclease (Promega) and ultra-pure water to a final volume of 20 µL. Tubes were incubated at 37°C for 4h before separation on a 2% agarose gel and visualization by staining in ethidium bromide under UV trans-illumination. Digestion recognition sequences were GCGC, thus the G allele version would be digested by the enzyme HhaI. The expected results for this polymorphism were the electrophoretic profile with 112 bp, 63 bp and 22 bp bands corresponded to the homozygote genotype G/G; 175 bp and 22 bp bands to the homozygote genotype A/A; and 175 bp, 112 bp, 63 bp and 22 bp bands to the heterozygote genotype G/A. The 63 bp and 22 bp bands were not visible on the agarose gel.

### Statistical analysis:-

Alleles and genotypes frequencies were calculated by gene counting. The chi-square test on SPSS V 11 software was used both to estimate the Hardy-Weinberg equilibrium and to compare the allelic frequencies observed in Benin population with those reported in other world populations. Value of  $p < 0.05$  was considered statistically significant.

## Results:-

### PON3 gene Ala99Ala polymorphism identification:-

The PON 3 gene Ala99Ala polymorphism (rs1053275) is a G to A substitution resulting a synonymous change, Ala (GCG) to Ala (GCA). One-hundred-forty-four (144) samples from Beninese *Adja* and *Mahi* ethnic groups were used to amplify a 197 bp fragment, digested with HhaI. The figure 1 represents the electrophoretic profile of the different genotypes. The PCR products 197 bp fragment were represented on the gel by SG band. On the gel, the individuals A9, A12, M1 and M7 were genotyped G/A (with both fragment of 175 bp and 112 bp); the individuals A1, A3 and M2 were genotyped A/A (with only one fragment of 175 bp) and the individuals A19 and M22 were genotyped G/G (with only one fragment of 112 bp).



**PON3 gene Ala99Ala polymorphism genotypes distribution and alleles frequencies:-**

The genotypic and allelic frequencies of PON3 Ala99Ala polymorphism in Beninese *Adja* and *Mahi* ethnic groups was shown in Table 1. Two alleles and three genotypes were observed in Beninese *Adja* and *Mahi* ethnic groups. The homozygote individual G/G was found in these two ethnic groups. The observed and expected frequencies for the polymorphisms were at Hardy-Weinberg equilibrium ( $p > 0.05$ ).

The comparison of PON3 A99A allelic frequencies within Beninese different ethnic groups was shown in Table 2. There were no significant ethnic differences between *Adja* and *Mahi* for PON3 gene Ala99Ala polymorphism allelic frequencies ( $p > 0.05$ ). But significant differences were observed for PON3 gene Ala99Ala polymorphism allelic frequencies in these two ethnic groups compared to Beninese Abomey-Calavi population respectively ( $p < 0.05$ ).

The comparison of PON3 gene Ala99Ala allelic frequencies in Beninese *Adja* and *Mahi* ethnic groups with those in other world populations was shown on Table 3. There were significant differences in PON3 Ala99Ala polymorphism allelic frequencies in Beninese *Adja* and *Mahi* ethnic groups compared to Chinese *Li* minority and British *Caucasians*.

**Discussion:-**

The present study has determined the genotypes distribution and the allelic frequencies of PON3 gene Ala99Ala polymorphism in Beninese *Adja* and *Mahi* ethnic groups. Two alleles and three genotypes were observed. These genotypic and allelic frequencies of PON3 gene Ala99Ala polymorphism in the Beninese *Adja* and *Mahi* ethnic groups were compared with previously described frequencies in Beninese Abomey-Calavi population and others world populations (Chinese and British).

No significant ethnic differences in PON3 gene Ala99Ala polymorphism genotypes distribution between *Adja* and *Mahi* ethnic groups were observed. These two ethnic groups were referred as homogenous population in Benin, so may have the same characteristics in genetic information's transmission. However, there were significant differences in PON3 gene Ala99Ala polymorphism genotype distribution and alleles frequencies in Beninese *Adja* and *Mahi* ethnic groups compared to Beninese Abomey-Calavi population respectively (Segbo et al, 2014). In contrast with this previous study, the homozygote individual G/G was found in *Adja* and *Mahi* ethnic groups. Abomey-Calavi population, the major ethnic group is among the heterogeneous ethnic group; living in the south-central area (Abomey-Calavi city), the denser area in the country. While *Adja* and *Mahi* ethnic groups were considered as much homogenous populations within which the genetic traits transmission were much conservative. So the transmission of PON3 gene Ala99Ala polymorphism genotypes distribution in Beninese *Adja* and *Mahi* ethnic groups were much conservative and this polymorphism site may be used as an excellent genetic marker for DNA analysis in Benin.

There were significant differences in PON3 Ala99Ala polymorphism genotype distribution and allelic frequencies in Beninese *Adja* and *Mahi* ethnic groups compared to Chinese *Li* minority respectively (Wu et al, 2010). The G/G genotype frequency in *Adja* ethnic group (10.0 %) was similar to that observed in Chinese *Li* minority (8.0 %), but was significant different from that observed in *Adja* ethnic group (19.0 %). There were also significant differences in PON3 Ala99Ala polymorphism distribution in Beninese *Adja* and *Mahi* ethnic groups compared to British *Caucasians* ( $p < 0.05$ ) (Robertson, 2003; Pasdar, 2006).

Additional studies on large cohorts from different ethnic groups in Benin may be needed to determine the real genotypes distribution of PON3 Ala99Ala polymorphism in Beninese population

**Conclusion:-**

In this study, the genotypes distribution and allelic frequencies of the PON3 gene Ala99Ala polymorphism in Beninese *Adja* and *Mahi* ethnic groups were described and compared with other world populations. The PON3 gene Ala99Ala polymorphism distribution in Beninese *Adja* and *Mahi* ethnic groups were significant different from other populations. These ethnic variations in PON3 gene polymorphisms can be used as basis for further investigation on the association of this polymorphism with the risk of cardiovascular diseases and other inflammatory diseases.

**Table 1:-** Genotypic and allelic frequencies of PON3 gene Ala99Ala polymorphism in Beninese *Adja* and *Mahi* ethnic groups

Ethnic groups	n	Genotypes			Alleles	
		A/A	G/A	G/G	A	G
<i>Adja</i>	50	44.0	46.0	10.0	67.0	33.0
<i>Mahi</i>	94	51.0	30.0	19.0	66.0	34.0

**Table 2:-** Comparison of PON3 A99A allelic frequencies within Beninese different ethnic groups

	<i>Adja</i>	<i>Mahi</i>	<i>Fon</i>	<i>Adja</i> vs <i>Mahi</i>	<i>Fon</i> vs <i>Mahi</i>	<i>Fon</i> vs <i>Adja</i>
				<i>p</i> value	<i>p</i> value	<i>p</i> value
Alleles	33.0	34.0	2.0	<i>p</i> > 0.05	<i>p</i> < 0.05	<i>p</i> < 0.05

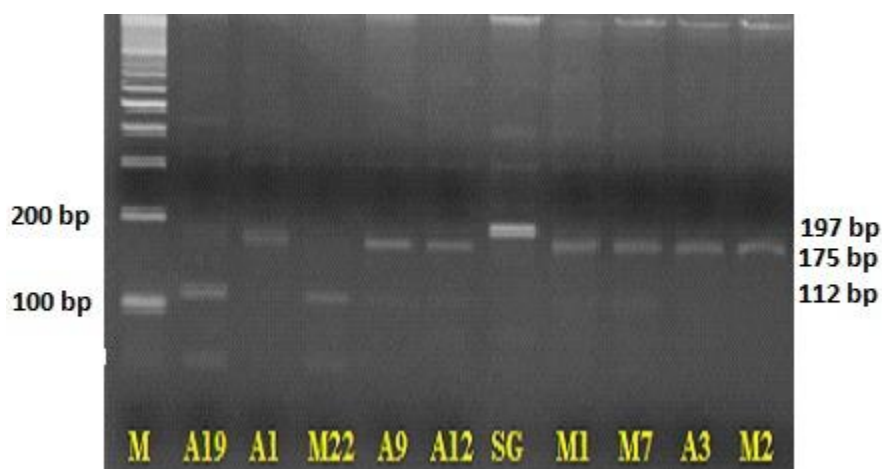
**Table 3:-** Comparison of PON3 A99A allelic frequencies in Beninese *Adja* and *Mahi* ethnic groups with those in other world populations.

Ethnic groups	n	Allelic frequencies (%)		<i>p</i> values
		A	G	
Beninese <i>Adja</i>	50	67.0	33.0	<i>p</i> > 0.05
Beninese <i>Mahi</i>	94	66.0	34.0	<i>p</i> > 0.05*
Chinese <i>Li</i> <sup>a</sup> minority	150	75.0	25.0	<i>p</i> < 0.05**
British <i>Caucasians</i> <sup>b</sup>	450	52.0	48.0	<i>p</i> < 0.05**

\*no significant ethnic difference was observed when compared to Beninese *Adja* ethnic group;

\*\* significant differences were observed when compared to *Adja* and *Mahi* ethnic groups;

<sup>a</sup> Wu et al. 2010 ; <sup>b</sup> Pasdar et al. 2006

**Figure 1:-** Electrophoretic profile of the different genotypes (Segbo, et al).

## References:-

1. Aviram, M. and Rosenblat, M., 2004. Paraoxonases 1, 2, and 3, oxidative stress and macrophage foam cell formation during atherosclerosis development. *Free Radical Biology & Medicine*, 37, 1304–1316;
2. Campo S., Sardo A. M., Campo G. M., Avenoso A., Castaldo M., D'Ascola A., Giunta E., Calatroni A., Saitta A., 2004. Identification of paraoxonase 3 gene (PON3) missense mutations in a population of southern Italy. *Mutat. Res.* 546, 75–80;
3. Draganov D. I., Teiber J. F., Speelman A., Osawa Y., Sunahara R., La Du B. N., 2005. Human paraoxonases (PON1, PON2, and PON3) are lactonases with overlapping and distinct substrate specificities. *J. Lipid Res.* 46, 1239–1247;
4. Erlich P. M., Lunetta K. L., Cupples L. A., Huyck M., Green R. C., Baldwin C. T., Farrer L. A., 2006. Polymorphisms in the PON gene cluster are associated with Alzheimer disease. *Hum. Mol. Genet.* 15, 77–85; Lawrence Whalley
5. Li H-l, Liu D-p, Liang C-c, 2004. Paraoxonase gene polymorphisms, oxidative stress and diseases. *J Mol Med* 81: 766-779;

6. Pasdar A., Ross-Adams H., Cumming A., Cheung J., Whalley L., St Clair D. and MacLeod M-J., 2006. Paraoxonase gene polymorphisms and haplotype analysis in a stroke population. BMC Med Genet.;7:28;
7. Primo-Parmo, S. L., Hsu, C., Law, D. J., La Du, B. N., 1996. Location and arrangement of three paraoxonase genes: PON1, PON2, and PON3, on human chromosome 7. (Abstract) Am. J. Hum. Genet. 59 (suppl.): A406.
8. Reddy, S. T., Wadleigh, D. J., Grijalva, V., Ng, C., Hama, S., Gangopadhyay, A., Shih, D. M., Lusi, A. J., Navab, M., Fogelman, A. M., 2001. Human paraoxonase-3 is an HDL-associated enzyme with biological activity similar to paraoxonase-1 protein but is not regulated by oxidized lipids. Arterioscler. Thromb. Vasc. Biol. 21: 542-547;
9. Robertson K. S., Hawe E., Miller G. J., Talmud P. J., Humphries S.E.; 2003. Human paraoxonase gene cluster polymorphism as predictor of coronary heart diseases risk in prospective Northwick Park Heart Study II, Biochimica et Biophysica Acta 1639: 203–212;
10. Sanghera D. K., Manzi S., Minster R. L., Shaw P., Kao A., Bontempo F., Kamboh M. I., 2008. Genetic variation in the paraoxonase-3 (PON3) gene is associated with serum PON1 activity. Ann. Hum. Genet. 72, 72–81;
11. Segbo J.A.G., Missihoun A. A., Tapara SDM, Sedah P, Ahanhanzo C., Agbangla C. 2014. Distribution du polymorphisme Ala99Ala du gène de la paraoxonase-3 dans la population béninoise : cas des communes d'Abomey-Calavi et de So-Ava. Abstract presented in *Journées Scientifiques Internationales de Lomé XVIème édition*, October 20 – 25.
12. Seres, I., Paragh, G., Deschene, E., Fulop, T., Khalil, A., 2004. Study of factors influencing the decreased HDL associated PON1 activity with aging, Exp. Gerontol, 39, 59-66;
13. Wang X-l., Fan Z-j., Huang J-f., Su S-y., Yu Q-j., Zhao J-g., Hui R-t., Yao Z-j., Shen Y., Qiang B-q., Gu D-f., 2003. Extensive association analysis between polymorphisms of PON gene cluster with coronary heart disease in Chinese Han population. Arterioscler. Thromb. Vasc. Biol. 23, 328–334;
14. Wu Q., Li L-j., Li D-m., Fu Q-y., Wu J., Fan Z-g., Pei H., Qian S-y., 2010. Polymorphism distribution of paraoxonase 3 gene Ala99Ala in Hainan Li nationality. Journal of Hainan Medical College, 16 (11) R596.1;
15. Zhang C., Peng W., Wang M., Zhu J., Zang Y., Shi W., Zhang J. and Qin J., 2010. Studies on protective effects of human paraoxonases 1 and 3 on atherosclerosis in apolipoprotein E knockout mice. Gene Ther., 17(5):626-633;
16. Zhang G-j., Li W-j., Li Z-q., Hong L., Ren Y-h., Ma R-m., Li X-h., Kang X-x., Shi Y-y. et Sun Y-m, 2013. Association between paraoxonase gene and stroke in the Han Chinese population. BMC Med Genet; 14.s: 16.



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### RESEARCH ARTICLE

#### MANNU BHANDARI KI KAHANIYO ME NARI : DASHA YAUM DISHA

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#### Abstract

हिन्दी साहित्य अंतर्गत लेखिकाओं द्वारा रचित साहित्य में मन्नू भण्डारी द्वारा रचित साहित्य अपनी एक अलग अमीट छाप छोड़ता है। इनके साहित्य का मुख्य केन्द्रबिन्दु नारी रही है। समाज में नारी के प्रति सामाजिक दृष्टिकोण को उजागर करना लेखिका का महत्वपूर्ण दृष्टिकोण रहा है। मन्नू भण्डारी एक सशक्त कहानीकार के रूप में उभरकर सामने आयी हैं। उनका समग्र साहित्य ही समाज में घटित महत्वपूर्ण तथ्यों को उजागर करता है। मन्नूजी द्वारा रचित कहानियाँ सामाजिक यथार्थ को प्रस्तुत करती हैं, तथा नारी के विभिन्न पक्षों को हमारे समक्ष उपस्थित करती हैं। जहाँ शोषण दिखाई देता है वहाँ मन्नू भण्डारी विरोध दर्शाती हैं। मानवीय गुणों की दृष्टि से यदि विचार करें तो हमारे ध्यान में आता है कि पुरुष की तुलना में नारी अधिक मानवीय है। मानव जाति की सभ्यता एवं संस्कृति का परिचायक या विकास का मूलधार नारी रही है। मन्नू भण्डारी कहानियाँ कहानी विधा की एक प्रमुख और विशेष रही हैं। उनकी कहानियों का मूलभूत आधार मौलिकता से परिपूर्ण दिखायी देता है।

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#### प्रस्तावना

भारतीय संस्कृति में पुरुष प्रधानता प्रमुखता रही है। जितना महत्व पुरुष को है, उतना महत्व स्त्री को नहीं मिल पाया। यही इस समाज का सबसे बड़ा दुर्भाग्य रहा है। यह एक निर्विवाद सत्य है। जिसे अनदेखा नहीं किया जा सकता। भारतीय नारी अपने अनुभवों का सच पूरी तरह बोलने की हिम्मत जुटा नहीं पायी है। पुरुष प्रधान समाज ने नारी को विभिन्न बंधनों में बँधकर रखा। वह नारियों को मात्र घरेलू श्रमशक्ति और भोगविलास की वस्तु बनाए रखने के लिए सदा प्रयत्नशील रहा है। नारी का दमन और शोषण इस दुनिया की पुरानी, गहरी और सबसे जटिल व्यवस्था है जिसकी जड़ें धर्म, संस्कृति और परम्पराओं में घँसी हुई हैं। इन जटिल विचारधारा को चिरकर महिलाएँ अपने विचारों को तथा अपने मन के भावों को तथा धीरे-धीरे अपनी बिखरी हुई और असंघटित हालात से निकलकर अपनी आवाज को सुनाने लगी हैं। इसीलिए हमें महिलाएँ घरेलू बंधनों से निकलकर सामाजिक, राजनीतिक, साहित्यिक और सांस्कृतिक कार्यों में अपनी अमीट छाप छोड़ती दिखाई देती हैं। नारी की पुरुष प्रधान समाज में अपने अस्तित्व की तलाश ही नारी का अपने अधिकार एवं अहसास को प्रदर्शित करता है।

#### मन्नू भण्डारी के कहानी में नारी

साहित्य की मुख्यधारा पुरुष-वर्चस्व से निर्मित है, ऐसे कृतिकारों ने नारी को जिन बिम्बों की रचना की, भोगलालसा, स्त्री-दमन आदि के पोषक हैं। मन्नू भण्डारी की रचनाशीलता का प्राणतत्व भी भारतीय नारी की मुक्ति है। सदियों से जो बंदी बनकर अपना जीवन मात्र जी रही है, ऐसी नारियों को जीवन का वास्तविक और सही रास्ता दर्शाने का प्रयास या फिर कहे कि उस ओर देखने का दृष्टिकोण दिखाने में जो अहम और महत्वपूर्ण भूमिका दर्शायी ऐसे नारियों में मन्नू भण्डारी की रचनाएँ अपना महत्वपूर्ण योगदान रखती हैं। मन्नू भण्डारी मध्यवर्ग में जीवन जी रही नारी को घुटन से मुक्त करना चाहती हैं।

बदलते परिवेश में नारियों को सजग और अपने अस्तित्व को लेकर तथा नारी जीवन में नई चुनौतियों और नई दिशाओं के प्रति, नई-नई समस्याओं को लेकर तथा सामाजिक बदलाव की सजगता की आवश्यकता है। मन्नू भण्डारी का जन्म किसी मेट्रो शहर में नहीं बल्कि एक साधारण और छोटे गाँव में हुआ। अपने जन्म को लेकर स्वयं मन्नू भण्डारी जी ने अपनी आत्मकथा 'एक कहानी यह भी' में बताया है—“जन्मी तो मध्य-प्रदेश के भानपुरा गाँव में थी, लेकिन मेरी यादों का सिलसिला शुरू होता है अजमेर के ब्रह्मपुरी मोहल्ले के उस दो मंजिले मकान से जिसकी ऊपरी मंजिल में पिता जी का साम्राज्य था, जहाँ वे निहायत अव्यवस्थित ढंग से फैली बिखरी पुस्तकों-पत्रिकाओं और अखबारों के बीच या तो कुछ पढ़ते रहते थे या फिर 'डिवटेशन' देते थे।” 1

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## दशा एवं दिशा

तात्पर्य यह है कि भारतीय समाज में प्रधानता पुरुष वर्ग की ही है, और रही है। इस सत्य को या इस वास्तविकता को नकारा नहीं जा सकता। मन्जूजी ने विपूल साहित्य की रचना कर इस साहित्य द्वारा समाज में एक नवचेतना जागृत करने का महान कार्य किया है। विशेषता: मानवीय जीवन से संबंधित सभी मूल्य उनकी रचनाओं में प्रमुखता से दिखायी देते हैं। 'मूल्य' समाज के जीवन में सामाजिक, धार्मिक, आर्थिक, नैतिक पृष्ठाभूमि के लिए एक महत्वपूर्ण वैचारिक इकाई है, उनका समग्र साहित्य विशेषता: नारी जीवन के सभी पक्षों को उजागर करता है। इनकी रचनाओं में जो नारी का स्वरूप चित्रित किया गया है वह हमें समाज में भी दिखाई देता है।

दर्शनशास्त्र में जगत, जीव एवं प्रकृति के साथ मानव एवं मानवीय मूल्यों पर भी विशेष बल दिया गया है। जैसे— " भारतीय दर्शन में चरम मूल्यों पर अधिक बल दिया जाता रहा है, जबकि 'पश्चिम में विघटन की स्थिति आने पर ही मूल्यों की चर्चा आरम्भ हुई।' " 2

अर्थात् मूल्य ही हमारी सबसे बड़ी धरोवर होती है, जिसके सहारे हमारा जीवन—यापन होता है। मन्जू भण्डारी की कहानियों में हमें मूल्य चेतना दिखायी देती है। जैसे मन्जू भण्डारी की 'चश्मे' कहानी है, जिसमें प्रेम पर आधारित एक आदर्शवादी मूल्यों की स्थापना करती है। तो दूसरी कथा प्रेम के आदर्शवादी मूल्यों का खण्डन करती दिखाई देती है। जैसे— " लीला चाहती है कि वह अपने कांतिकारी पति को हँसते हुए विदा दे, किन्तु अन्तिम घड़ियों में वह रो पड़ती है। फिर भी एक अलौकिक सन्तोष और तृप्ति की भावना उसके मन में है कि मरने से पहले वह अपने पति को अपना सब कुछ दे सकी। अपने आपको लुटाकर उसने उसे सुखी बनाया, धनी बनाया। " 3

उसीप्रकार उनकी 'तीन निगाहों की एक तस्वीर' कहानी यौन जीवन का चित्रण मनोविज्ञानिक ढंग से प्रस्तुत करती है। इस कहानी में शरीर को महत्वपूर्ण बताया गया। तथा शरीर की भूख 'काम' के आगे समाज के नैतिक मूल्यों को थोथा साबित किया गया है। हर स्त्री को ऐसा लगता है कि अपने पति से काम—वासना की तृप्ति हो। इस कहानी की नायिका 'दर्शना' भी यौन भावनाओं से त्रस्त है। उसका पति शादी के दिन से ही टी.बी. के कारण बीमार। वह हरीश के प्रति लगाव रखती है। जिससे वह घरवालों से दूर और अंत में दूनिया से चली जाती है। तीन निगाहों की तस्वीर' कहानी की दर्शना भी ऐसी स्त्री है, जो पति द्वारा घर से निष्कासित किए जाने के बावजूद नौकरी करके एकाकी जीवन—यापन करती है।

आज समाज में भी ऐसे कई उदाहरण मिलते हैं जो अपनी काम—पूर्ति हेतु कभी—कभी गलत रास्ता अपना लेते हैं, जिससे परिवार उथल—पुथल होते हुए दिखाई देते हैं। लोकजीवन के सघन कटू पारिवारिक, सामाजिक, सच्चाई को मन्जू भण्डारी ने अपनी कहानीयों के विषय बनाये। 'मैं हार गई' सन 1957 में प्रकाशित प्रथम कहानी संग्रह अर्तगत 'मैं हार गई' इस कहानी में राजनीति का वास्तविक चेहरा दिखाया। राजनीति पर तीखा व्यंग्य करने वाली श्रेष्ठ कहानी है। जिसमें लेखिका के मित्र ने राजनीति पर जो सवाल खड़े किए थे, उन सवालों पर करारा जवाब हेतु तथा उड़ायी गयी मजाक का कड़ा उत्तर देने हेतु लेखिका की असफलता। अंत: सहर्ष स्वीकार करना की मैं हार गई। डॉ. सुखवीरसिंह लिखते हैं,— " छोटे से कैनवास पर सामाजिक ढोंचे के बीच पनपने वाले कटु सत्य की अभिव्यक्ति जिस सांकेतिक रूप में इस कहानी में हुई है, उसमें निश्चित ही परंपरागत नैतिक अवधारणाओं के प्रति नकारात्मक रुख स्पष्ट हो जाता है। " 4

इस कहानी से यह स्पष्ट हो जाता है कि आज के इस आधुनिक, भूमण्डलीकरण, नीजिकरण, वैश्विकरण के युग में आदर्श नेता की कल्पना करना और उसमें भी सृजन करना मुश्किल है। इस कहानी के माध्यम से वर्तमान युग में राजनेताओं को लक्ष्य किया गया है। अपने व्यक्तिगत स्वार्थ से और सम्पन्न तथा विकासीनता से जकड़े हुए है।

पितृ प्रधान समाज में 'अकेली' कहानी की सीमा बुआ बेटे के आकस्मिक अवसान एवं पति के सन्यासी हो जाने के बाद नाना प्रकार के मानव सर्जित कटू अनुभवों से जूझती है। " मुझे क्या बावली ही समझ रहा है जो बिना बुलाए चली जाऊँगी? अरे वह पड़ोस वालों की नंदा अपनी आँखों से बुलावे की लिस्ट में नाम देखकर आई है। और बुलावेंगे क्यों नहीं? शहरवालों को बुलावेंगे और समधियों को नहीं बुलावेंगे क्या?—5

मन्जू भण्डारी पूर्ववर्ती एवं समकालीन नारी मनोविज्ञान का बराबर ध्यान अपनी कहानियों में रखती दिखायी देती है। लेखिका के अनुसार आज दास प्रथा, सामंती प्रथा एवं पूँजीवादी प्रथा से कहीं ज्यादा खतरनाक वैश्विकरण, निजीकरण, उदारीकरण एवं विश्वग्राम है। 'छोटे सिक्के' कहानी में खन्ना साहब मजदूरों से पूरा काम लेते हैं। दो प्राध्यापिकाओं के साथ बीस—बाइस छात्राएँ टकसाल देखने जाती हैं तो खन्ना साहब जिस भाव से लड़कियों से मिलते हैं वह भाव प्राध्यापिकाओं के साथ नहीं रहता है। " काम करने। अरे एक ही जगह खाली होती है तो पचासों टूट पड़ते हैं। आप जानती नहीं हमारे देश में इन्सान का जान बड़ी सस्ती है। " 6

मन्जू भण्डारी के अनुभव संसार की व्यापकता और वैविध्यता कबिल—ए—तारीफ है। उनकी यह व्यापकता हर कहानी में देखने को मिलती है। नारी मनोविज्ञान की अनछुई मन: स्थितियों को मन्जू भण्डारी भलीभाँति जानती पहचानती है। मन्जू भण्डारी की कहानी 'स्त्री सुबोधिनी' एक अविवाहित उन्मुक्त यौन सम्बन्ध रखने वाली नारी की कहानी है। कहानी की नायिका अपने बॉस शिंदे से यौन सम्बन्ध रखती है। उनके अनुसार प्रेम कतई कैरियर ओरिएंटेड नहीं है। मात्र शिंदे वैवाहिक व्यक्ति है, वह केवल शौकिया तौर पर उससे यौन सम्बन्ध रखता है, उससे महसूस होता है कि " प्रेम का बीज मन और शरीर का पवित्र भूमि से नहीं ठेठ घर परिवार की उपजाऊ भूमि में ही फलता—फूलता है। " 7

मन्जू भण्डारी की कहानी का दर्द समाज में भी मौजूद है। ऐसी कहानियाँ समाज में भी घटित होती दिखाई देती हैं। कहानी पारिवारिक मूल्यों की हिमायती है। सामाजिक मूल्य परिवर्तन में विशेष रूप से परिवार, प्रेमविषयक धारणाएँ आदि के परिणामस्वरूप मूल्य परिवर्तन की अटलता, शाश्वत मूल्यों को सुरक्षित रखने का प्रयास भी किया जाना आवश्यक है। आज हालात बिल्कुल विपरीत दिखाई देते हैं। वास्तव में यह समय मूल्यहीनता का है। सामाजिक, धार्मिक और सांस्कृतिक स्तर पर मनुष्य के व्यवहार में मूल्यहीनता आ गयी है। मूल्यहीनता की स्थिति परिवार के विघटन, दाम्पत्यों सम्बन्धों में बिखराव, उन्मुक्त—यौन संबंध आदि सब यह उसी के परिणाम हैं। स्वाधीनोत्तर हिन्दी कथा साहित्य को जिन लेखिकाओं ने समृद्ध किया है, उनमें मन्जू भण्डारी का अग्रणीय रहा है। मन्जू भण्डारी की रचनाओं में मानवीय संवेदनाओं के उफान के साथ नारी संघर्ष और शोषण के विरुद्ध स्वर तथा नारी मन की करुण व्यथा है। उनके पात्र नैतिकता और अनैतिकता के प्रश्नों से न उलझकर परिस्थितियों के अन्तर्द्वन्द्व को ही विशेष रूप से रेखांकित करते हैं।

मन्जू भण्डारी द्वारा लिखित कहानी 'रानी माँ का चबूतरा' में गुलाबों सामाजिक प्राणी होने के कारण कई कठिनाईयों से जूझती दिखाई देती है। स्वयं भूखी रहकर बेटी के लिए चूड़ियाँ खरीदती और बेटे को शिशु सुरक्षा केन्द्र में भर्ती कराती है। 'मजबूरी' कहानी में पात्र बूढ़ी अम्मा में मातृ वात्सल्य, त्याग और कर्तव्यनिष्ठा जैसे जीवन मूल्य दृष्टिगत होते हैं। "दो कलाकार" कहानी की नायिका अरुणा में त्याग, समर्पण और समाजसेवा के भाव लक्षित होते हैं। 'नकली हीरे' कहानी में इन्दु ऐसी नारी है, जो अपनी धनवान बहन द्वारा दिया गया हीरे का हार स्वीकार नहीं करती। 'नशा'

कहानी की आनन्दी में आत्म-सन्मान कूट-कूट कर भरा है। बंद दरवाजों के साथ कहानी में विवाह का बदला हुआ स्वरूप दिखाई देता है। कहानी की मंजरी को अपने पति के पूर्व जीवन के बारे में पता चलते ही वह उसे त्याग कर चली जाती है और दिलीप नामक अन्य युवक से शादी करके अपना नया जीवन आरम्भ करती है। 'यही सच कहानी की दीपा में स्थायी प्रेम लक्षित नहीं होता। वह कभी संजय की ओर आकर्षित होती है तो कभी निशीथ की ओर।

आज के समाज में व्यक्ति अपने संस्कारों भूलकर नारी पर अत्याचार, बलात्कार, उसका शोषण कर उसे अनुचित रूप से स्त्रियों को अपने मोह-जाल में फसाने की चेष्टा करता है। मन्नू भण्डारी की कहानियों में जो सच दिखायी देता है, वह आज समाज में घटित होता दिखाई देता है। अंधकार, बलात्कार, स्त्री के साथ अनुचित व्यवहार, उसपर अत्याचार कर उसके मौलिक अधिकारों पर हनन। 'वर्तमान समाज में स्त्रियाँ उपेक्षित और एक अर्थहीन जीवन को अभिशप्त हैं। चारित्रिक दृष्टि से रसखलित पुरुषों की वृत्ति तो दुषित है ही किन्तु स्त्रियों की आत्मबल क्षीणता भी निर्दोष नहीं, अन्यथा जैसी प्रताड़नापूर्ण घृणित घटनाएँ देखने, सुनने और पढ़ने में आती हैं, सम्भवतः न होती।' 8

ऊँचाई इस कहानी में लेखिका ने ऐसी नारी को रूपायित किया है। जो एक ही समय पत्नी और प्रेमिका दोनों भूमिकाओं का निर्वाह निर्वन्ध भाव से करती है। नारी के विवाहोत्तर-संबंध को सहज मानने का, विवाहिता नारी का नया नैतिक बोध इसमें दर्शाया गया है। नैतिक नियम पुरुष और स्त्री दोनों को समान होने चाहिए। पुरुष के लिए अलग और स्त्री के लिए भिन्न। ऐसा नहीं होना चाहिए। शिवानी की निर्भीकता और स्पष्टवादिता से पति निर्णय बदलता है। जिस समर्पण में वासना नहीं होती वह पाप नहीं होता ऐसे विचार शिवानी के होते हैं। इस संबंध में डॉ. कपूरिया का कथन विशेष उल्लेखनीय है—“एक प्यार की स्वीकृति के लिए दूसरे प्यार का झूठा सिद्ध करना आवश्यक नहीं है। कहीं ऐसी भी ऊँचाई है कि जहाँ शरीर का एक से अधिक व्यक्तियों के साथ संबंध बहुत नगण्य होकर दिखाई दे।” 9

शिवानी को विवाह बाह्य संबंध रखने में न कोई पाप बोध होता है न ही कोई तनाव, बल्कि एक साथ पत्नी और प्रेमिका का दायित्व निर्वाह करने का संतोष होता है। इस सन्दर्भ में वह कहती है—“नारी एक साथ एक से अधिक पुरुषों से प्रेम करती हुई उनसे शारीरिक संबंधों का निर्वाह करते हुए उस ऊँचाई पर रह सकती है, जिसे नैतिक ऊँचाई चाहे न भी कहा जाए, किन्तु वह उसके स्वतंत्र अस्तित्व एवं व्यक्तित्व की ऊँचाई अवश्य है।” 10

शिवानी सामान्य परिपाटी से अलग जीवन जीने में विश्वास रखती है, पवित्रता और नैतिकता का संबंध शरीर के साथ होता ही नहीं ऐसा विचार वह निर्भीकता से रखती है। वह सामान्य परिपाटी से निकलकर वह वैवाहिक जीवन के परंपरागत बंधनों को चुनौती देती है, तथा विद्रोह कर वह अति आधुनिक रूप सामने लाती है। परम्परा का घोर तिरस्कार आधुनिकता की देन है। भूमण्डलीकरण, निजीकरण, औद्योगीकरण और आधुनिकीकरण के फलस्वरूप परिवारों का स्वरूप टूटने लगा है। इस संदर्भ में डॉ. ब्रज मोहन शर्मा विशेष उल्लेखनीय कथन कहते हैं कि—“चिरकाल से पुरुष के हथकंडों की शिकार और अपने अधिकारों से वंचित नारी आज पूर्णतः जागरूक है।” 11

परम्परा को नकारनेवाली नारी की सूरत को मन्नू भण्डारी ने दीवार बच्चे और बरसात, यही सच है, ऊँचाई आदि कहानियों के द्वारा स्पष्ट दिखाया है। बरसात कहानी अंतर्गत बरसात के बहाव से दीवार का ढह जाना वास्तव में परम्परागत रुढ़ियों से नारी के मुक्त होने की सूचना ही देता है। एक एक पल की सार्थकता से जीवन की सम्पूर्णता को रूप देना क्षणबोध की विशेषता है।

### निष्कर्ष

मन्नू भण्डारी की कहानियाँ समाज के समक्ष एक वास्तविक सच उजागर करती हैं। उनके कहानी के विभिन्न पात्र समाज में चल रहे द्वन्द्व को अपने चरित्रों के जरिये उजागर करते हैं। मन्नू भण्डारी रचित कहानियों मध्यवर्गीय जीवन को संयुक्त परिवार का विघटन एवं जीवन्त चित्रण, अभिव्यक्त मध्यवर्गीय नारी पुरुष, परिवार समाज के निम्न लिखित रूप उभरकर सामने आए। संयुक्त परिवार का विघटन, अणु परिवार का उदय, दाम्पत्य विघटन, स्त्री-पुरुष सम्बन्धों में द्वन्द्व, पुरुष प्रधान समाज व्यवस्था, राजनीतिक आदर्शों की निरर्थकता, नैतिक मूल्यों का —हास, आर्थिक तनाव, तथा पूँजीपतियों की हृदयहीनता। मन्नू भण्डारी की रचनाओं में मानवीय संवेदनाओं के उफान के साथ नारी संघर्ष और शोषण के विरुद्ध स्वर तथा नारी मन की करुण व्यथा है।

### सन्दर्भ ग्रंथ—सूचि

- डॉ. धीना ईप्पन— मन्नू भण्डारी का रचनासंसार, जवाहर पुस्तकालय, हिन्दी पुस्तक प्रकाशक एवं वितरक, सदर बाजार, मथुरा, संस्करण—सन् 2009, पृ—19—20
- डॉ. ओम्प्रकाश नायर— मन्नू भण्डारी की कहानियों में मूल्य चेतना, विद्या प्रकाशन, सी—449, गुजैनी, कानपुर—22, संस्करण—प्रथम, 2010, पृ—11
- वही—पृ—55
- डॉ. किशोर सिंह राव, डॉ. मीरा ए. सक्सेना— मन्नू भण्डारी की कथा यात्रा, ज्ञान प्रकाशन, 128/90, जी, ब्लाक किदवई नगर, कानपुर, संस्करण—प्रथम, 2010, पृ—97
- वही— पृ—50
- वही— पृ—51
- डॉ. भारती शैलके— महिला रचनाकारों की कहानियों में जीवन मूल्य, विद्या प्रकाशन, सी—449, गुजैनी, कानपुर—22, संस्करण—2014, पृ—58
- डॉ. राजनारायण पाण्डेय— हिन्दी कथा साहित्य में नारी शोषण, उत्कर्ष पब्लिशर्स एण्ड डिस्ट्रीब्यूटर्स, ए—685, आवास विकास हंसपुर, कानपुर, संस्करण—प्रथम, 2013, पृ—119
- डॉ. सौ. मंगल कपीकेरे— साठोत्तरी हिन्दी लेखिकाओं की कहानियों में नारी, विकास प्रकाशन, 311 सी. विश्व बैंक, बर्रा, कानपुर, संस्करण—प्रथम, 2002, पृ—142
- वही—पृ—142
- डॉ. किशोर सिंह राव, डॉ. मीरा ए. सक्सेना— मन्नू भण्डारी की कथा यात्रा, ज्ञान प्रकाशन, 128/90, जी, ब्लाक किदवई नगर, कानपुर, संस्करण—प्रथम, 2010, पृ—97

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### RESEARCH ARTICLE

## HEALTH BELIEFS ABOUT OSTEOPOROSIS AND OSTEOPOROSIS RADIOLOGICAL SCREENING IN OLDER WOMEN AND MEN IN JEDDAH CITY 2016.

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#### Key words:-

Osteoporosis, Knowledge, Practice,  
Jeddah, Health Beliefs.

### Abstract

**Background:** Osteoporosis has been recognized as a major public health problem by healthcare providers in Saudi Arabia.

**Objective:** The present study was designed to examine health beliefs about osteoporosis and osteoporosis radiological screening in a large group of older women and men to determine barriers to screening.

**Methodology:** This is a self-administrated questionnaire conducted among a sample of 460 man and women in Jeddah, Saudi Arabia.

**Results:** The majority of the subjects had poor knowledge about osteoporosis and 50.4% of the subject had no practice to avoid the disease. The level of education showed a significant correlation with knowledge of osteoporosis. Also, the young age, higher level of education and females had significantly higher correlation with good practice.

**Conclusion:** This study indicated a lack of awareness and practice about osteoporosis. There was a significant association between knowledge and practice with level of education. Also, the female gender and age showed higher practice scores. All these results showed the significance of more health staff involvement regarding to awareness campaign about osteoporosis.

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### Introduction:-

Osteoporosis is systemic skeletal disease affecting bone density and its quality leading to bone strength weakening. It is now an established fact that low bone mineral density increases the frequency of bone fractures systemic skeletal disease affecting bone density and its quality leading to bone strength weakening<sup>(1)</sup>. Osteoporosis is a major public health problem in Saudi Arabia and the contributor of mortality and morbidity among elderly people<sup>(2, 3)</sup>. According to the International Osteoporosis Foundation (IOF) reports 1,461,401 Saudi persons aged 50 years or more, 8768 would suffer femoral fractures yearly at a cost of \$1.14 billion<sup>(4)</sup>. After 30 years there is a 1% - 2% decline in bone mass each year until menopause, in which 40% of their total bone mass decrease rapidly due to low estrogen levels<sup>(5)</sup>. Most individuals with osteoporosis are asymptomatic, undiagnosed, and untreated<sup>(6)</sup>. Men appear to be diagnosed and treated less often than women<sup>(7)</sup>. Previous studies suggest that health beliefs are important determinants of whether individuals participate in health screening<sup>(8, 9)</sup>. Lack of concern and knowledge can be attributed to lower perceptions of susceptibility<sup>(10, 11)</sup>.

The Health Belief Model is a widely used conceptual framework to explain and predict health-related behaviors. This model indicates that patient-level factors related to undertaking health-related action such as disease screening

include perceived susceptibility to a condition, perceived severity of the condition, perceived benefits to taking a health-related action, perceived barriers to taking action, cues to action (external events that prompt the desire to make a health change), and self-efficacy (belief in one's ability to improve health by taking action)<sup>(12, 13)</sup>. Despite the magnitude of this preventable health problem, osteoporosis preventive care has not been incorporated into standard primary care practice<sup>(14)</sup>. For example, a 2002 survey of 1,500 women ages 40–69 in a managed care health plan showed that only 49% had ever discussed osteoporosis with a health care provider, and only 12%–34% of high-risk women had bone density testing<sup>(15)</sup>. Although evidence-based guidelines support routine osteoporosis screening in women age 65 and older<sup>(16)</sup>. Low levels of risk factor assessment, bone density testing, counseling, and prescription of osteoporosis medications have been documented in primary care practices<sup>(6, 17, 18)</sup>.

Diagnostic imaging and interventional radiological techniques are increasingly used to diagnose a wide range of diseases, and to give life-saving treatment for many diseases. The use of radiation in medical practices has evolved since its beginning and 30% to 50% of medical decisions are based on radiological examinations<sup>(17, 18)</sup>.

Our study was designed to examine health beliefs about osteoporosis and osteoporosis radiological screening in a large group of older women and men to determine barriers to screening.

#### ***Rationale:-***

Osteoporosis has been recognized as a major public health problem by healthcare providers in Saudi Arabia, according to the International Osteoporosis Foundation (IOF) reports 1,461,401 Saudi persons aged 50 years or older adults demonstrate several beliefs that may be barriers to osteoporosis screening, including low belief in susceptibility to osteoporosis.

These beliefs should be targeted with patient education to improve radiological screening rates.

#### ***Objectives:-***

##### **General objectives:-**

To examine older adults' beliefs about osteoporosis and osteoporosis radiological screening to identify barriers to screening.

##### **Specific objective:-**

The goal of this study was to examine elderly health beliefs regarding osteoporosis and their perceptions related to radiological screening for the disease, and evaluate the role of demographic factors in shaping elderly beliefs about osteoporosis and assess possible associations between demographic characteristics with the preventive behavior of interest.

#### ***Methods:-***

##### ***Setting and data collection:***

This survey analysis was performed among elderly population in Jeddah city. A pre-formed self-administered questionnaire will be distributed to male and female.

##### ***Sample:***

Subjects were chosen according to geographical and sex distribution. Sample size was calculated based on web-site calculator<sup>(19)</sup>, taking the total size of Jeddah population (3,976,000)<sup>(20)</sup>, confidence level (95%) and margin error (5%) to be 385, additional 20 % was added to cover the missing data. The total sample obtained was **460**.

##### ***Study population:***

Both old age male and female in Jeddah city were included in this study.

##### ***Study tool:***

Pre-formed Self-administered questionnaire that requires information about: (osteoporosis and general health-related characteristics, and beliefs about osteoporosis severity, susceptibility, screening self-efficacy, and screening response efficacy).

##### ***Study limitations:***

The following limitations are expected:



- Cooperation of elderly
- Recall bias

#### ***Ethical considerations:***

An informed consent was maintained from all participants before filling the questionnaire.

#### ***Statistical analysis:***

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. Qualitative data were described using number and percent. Significance of the obtained results was judged at the 5% level.

#### **The used tests were**

##### **1 - Chi-square test**

For categorical variables, to compare between different groups

##### **2 - Fisher's Exact or Monte Carlo correction**

Correction for chi-square when more than 20% of the cells have expected count less than 5.

#### **Results:-**

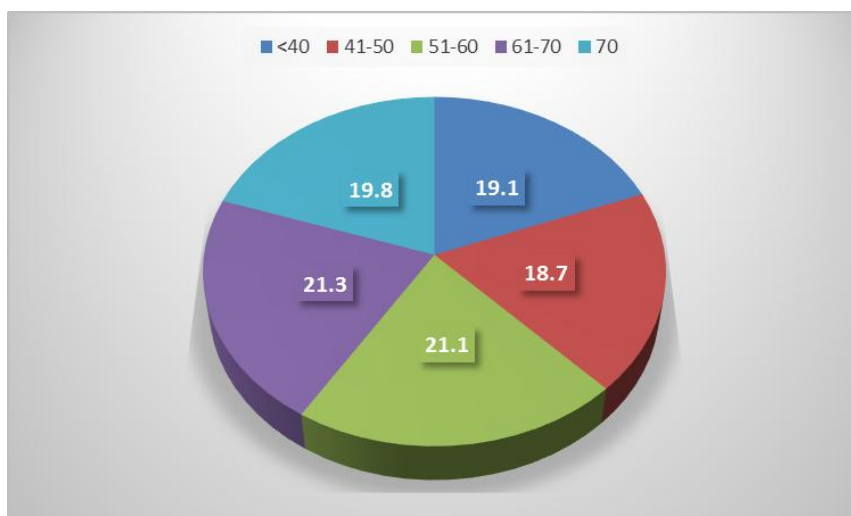
This study was carried out on 460 elderly both male and female in Jeddah city.

#### ***Demographic data:***

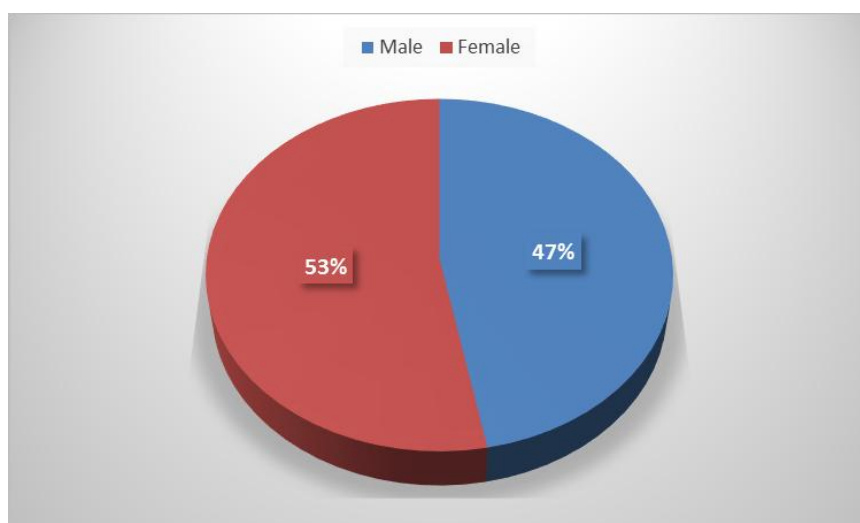
Table (1), show the demographic data of the studied subjects, the most frequent age group was 61-70 years, the females was slightly higher than male, the education of the majority of the population was university educated (Fig. 1-3).

**Table 1:-** Distribution of the studied patients regarding demographic data.

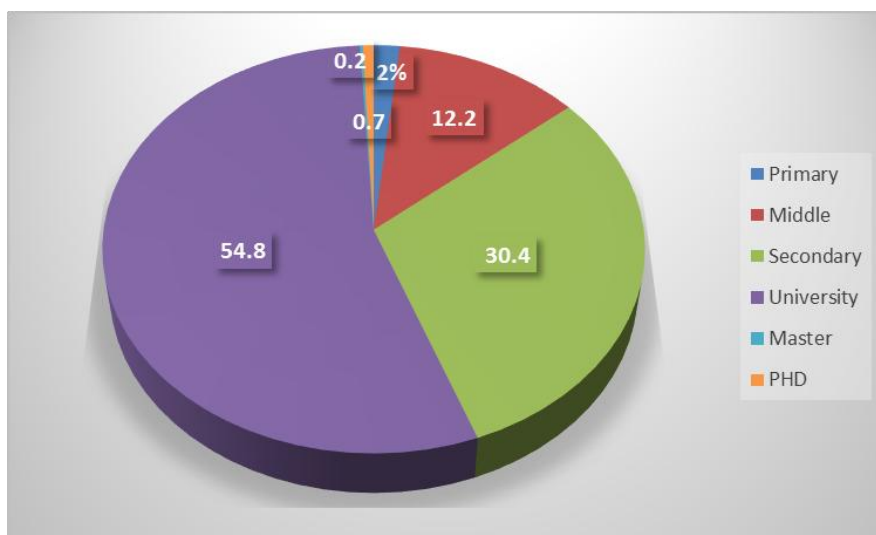
	Number	Percent
<b>Age</b>		
<40	88	19.1
41-50	86	18.7
51-60	97	21.1
61-70	98	21.3
+70	91	19.8
Total	460	100.0
<b>Gender</b>		
Male	216	47.0
Female	244	53.0
<b>Education</b>		
Primary	8	1.7
Middle	56	12.2
Secondary	140	30.4
University	252	54.8
Master	1	.2
PHD	3	.7



**Fig. 1:-** Distribution of the studied patients regarding age



**Fig. 2:-** Distribution of the studied patients regarding sex

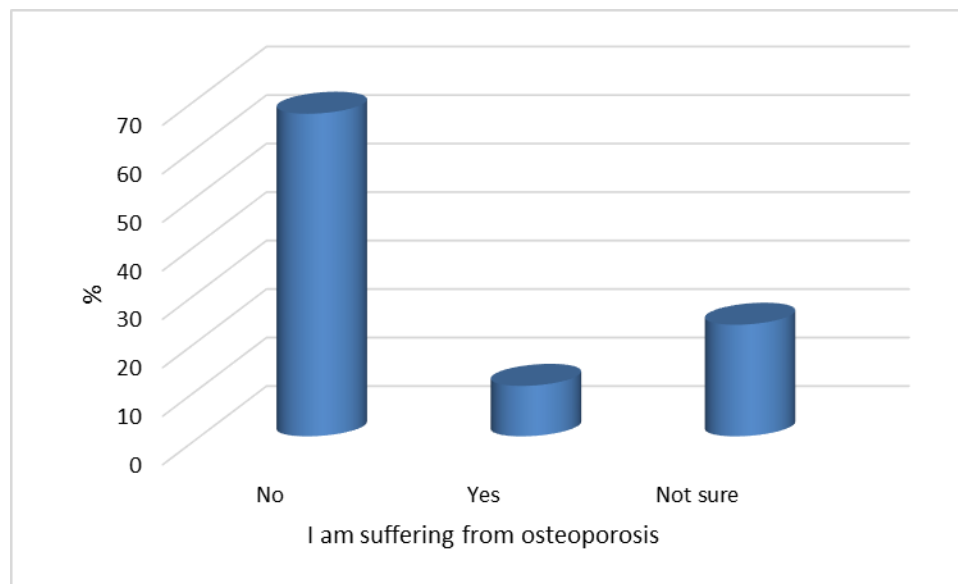
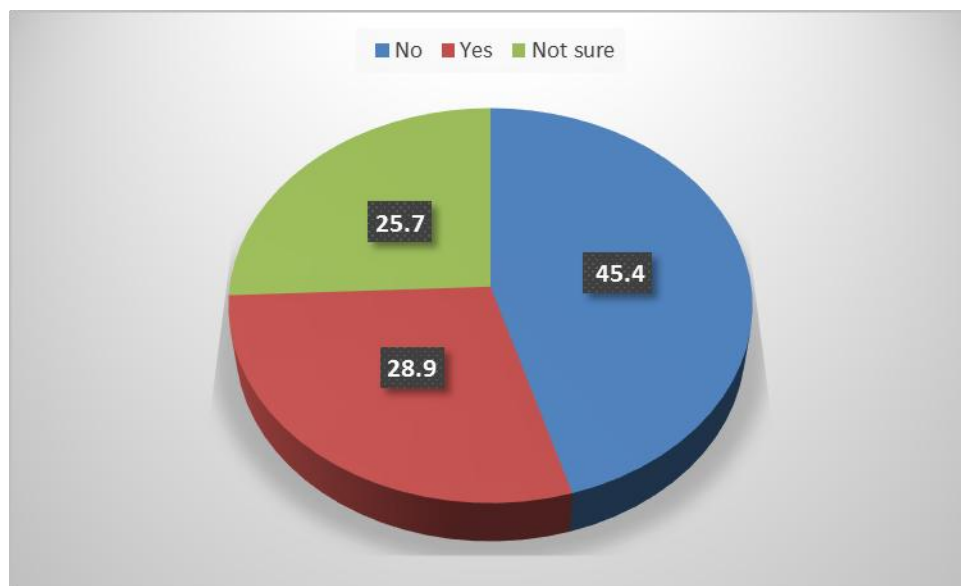


**Fig. 3:-** Distribution of the studied patients regarding education.

**Incidence of osteoporosis:****Table 2:-** Incidence of osteoporosis among the sample and their family history.

	Number	Percent
<b>I am suffering from osteoporosis</b>		
No	306	66.5
Yes	48	10.4
Not sure	106	23.0
<b>There are members of my family who is suffering from osteoporosis:</b>		
No	209	45.4
Yes	133	28.9
Not sure	118	25.7

Table (2), show the incidence of osteoporosis among the sample and their family history, from this table it was found that only 10.4% of the studied group suffering from osteoporosis. While 28.9% of them had at least one of his family suffering from osteoporosis (Fig. 4-5).

**Fig. 4:-** Incidence of osteoporosis among the sample.**Fig. 5:-** Incidence of osteoporosis among their family.

**Knowledge assessment:-****Table 3:-** Responses to questions on assessment level of knowledge toward osteoporosis.

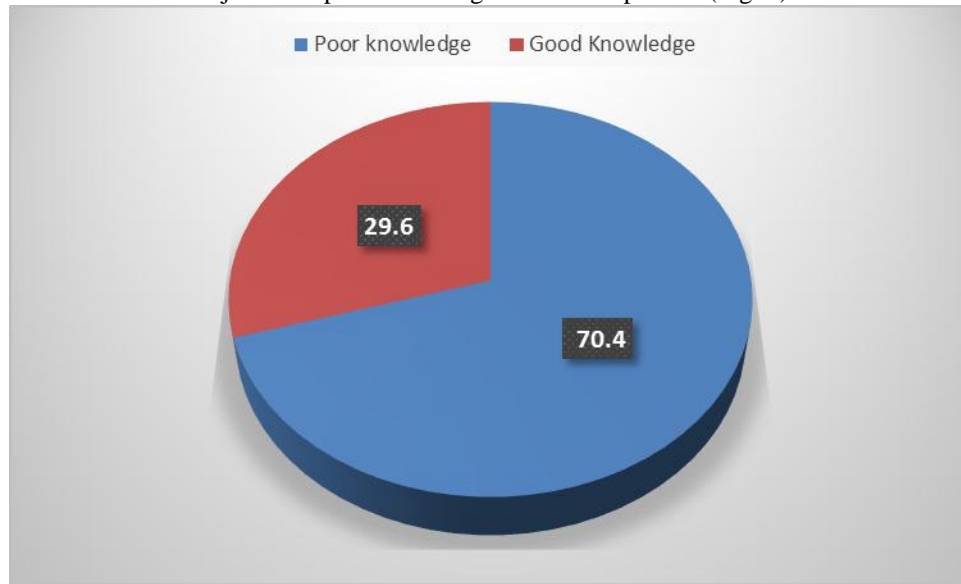
	Number	Percent
<b>I understand the concept of osteoporosis:</b>		
No	98	21.3
Yes	217	47.2
Not sure	145	31.5
<b>Know the symptoms of osteoporosis</b>		
No	129	28.0
Yes	247	53.7
Not sure	84	18.3
<b>I am familiar with the seriousness of osteoporosis:</b>		
No	111	24.1
Yes	275	59.8
Not sure	74	16.1
<b>I know that the females has a high risk to injury osteoporosis</b>		
No	70	15.2
Yes	316	68.7
Not sure	74	16.1
<b>I know that old age has a high risk to injury osteoporosis:</b>		
No	41	8.9
Yes	360	78.3
Not sure	59	12.8
<b>I know that a lack of exposure to the sun radioactive influential in a injury disease:</b>		
No	103	22.4
Yes	268	58.3
Not sure	89	19.3
<b>I know that steroids increase the risk of injury disease:</b>		
No	170	37.0
Yes	204	44.3
Not sure	86	18.7

Table. 3 showed that the knowledge about osteoporosis is low however higher percentage have good knowledge regarding to the higher risk of osteoporosis among females, old age and lack of exposure to the sun.

**Table 4:-** Distribution of the studied group regarding their Knowledge score

	Number	Percent
Poor knowledge	324	70.4
Good Knowledge	136	29.6
Total	460	100.0

**Table (4):-** show the distribution of the studied group regarding their Knowledge score, the majority of the subjects had poor knowledge about osteoporosis (Fig. 6).



**Fig. 6:-** Distribution of the studied group regarding their Knowledge score

#### Level of practice Assessment:-

**Table 5:-** Responses to questions on assessment level of practice toward osteoporosis.

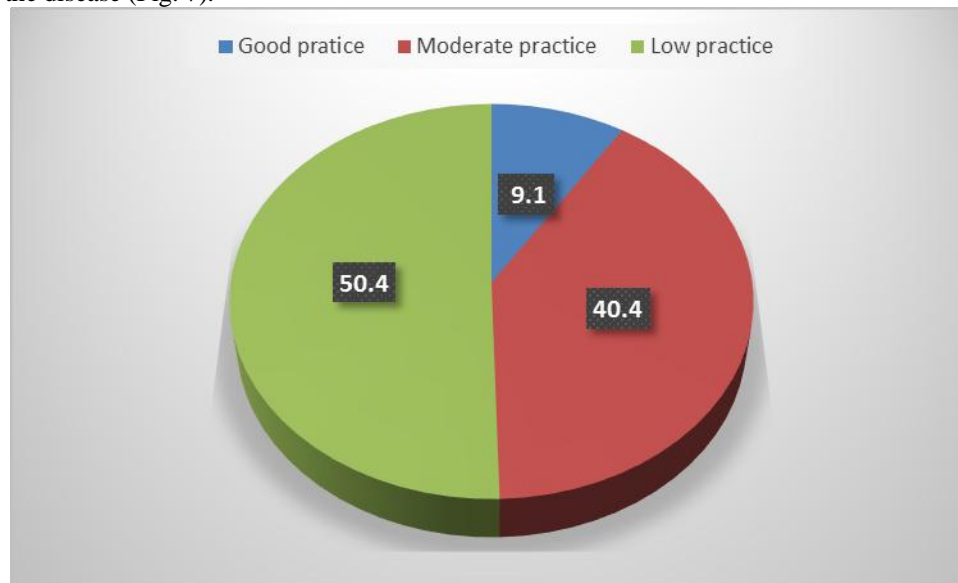
	Number	Percent
<b>Have you ever attended awareness about the programs injury osteoporosis</b>		
No	374	81.3
Yes	86	18.7
<b>Sports practice well:</b>		
No	306	66.5
Yes	154	33.5
<b>Exposed to sun well:</b>		
No	210	45.7
Yes	250	54.3
<b>Be sure to eat foods rich in vitamin D</b>		
No	256	55.7
Yes	204	44.3
<b>Be sure to visit the medical examinations</b>		
No	366	79.6
Yes	94	20.4
<b>Early screening and radiological examination decrease the risk of osteoporosis and complications.</b>		
No	96	20.9
Yes	364	79.1

Table 5 indicated the practice of participants toward osteoporosis. The majority of participants have never attended awareness programs, practicing sports, eating foods rich in vitamin D as well as visiting the medical examinations. On the other hand, 79.1% of participants know that early screening and radiological examination decrease the risk of osteoporosis and complications.

**Table 6:-** Distribution of the studied group regarding their Practice score.

		Number	Percent
	Good practice	42	9.1
	Moderate practice	186	40.4
	Low practice	232	50.4
	Total	460	100.0

Table (6), show the distribution of the studied group regarding their Practice score, only 9.1% of the sample had a good practice to avoid the disease, while 40.4% had moderate practice, while the other 50.4% of the subject had no practice to avoid the disease (Fig. 7).

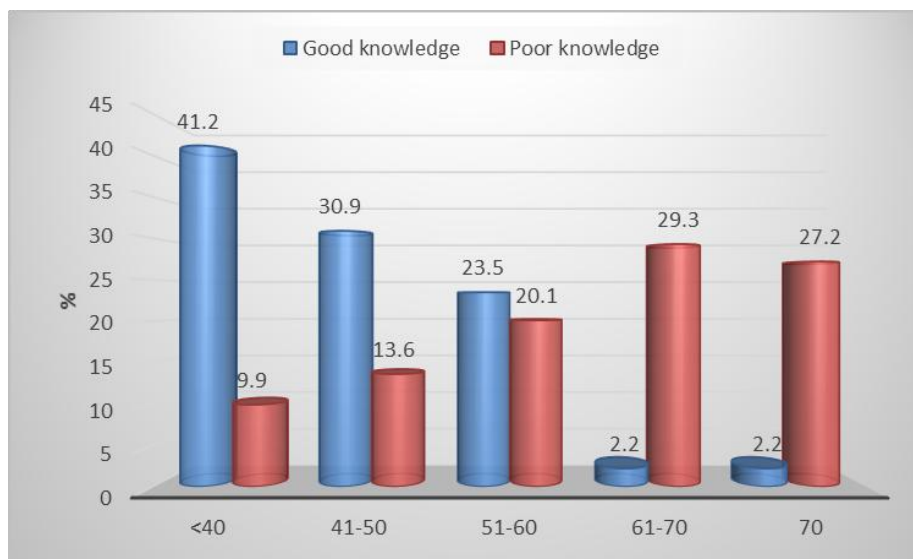
**Fig. 7:-** Distribution of the studied group regarding their Practice score

#### Correlation studies between demographic data and participants knowledge:

**Table 7:-** Relation between level of knowledge and age.

	Knowledge scale				Total	
	Good knowledge		Poor knowledge			
	No.	%	No.	%	No.	%
<40	56	41.2	32	9.9	88	19.1
41-50	42	30.9	44	13.6	86	18.7
51-60	32	23.5	65	20.1	97	21.1
61-70	3	2.2	95	29.3	98	21.3
+70	3	2.2	88	27.2	91	19.8
Total	136		324			
X <sup>2</sup>	28.15					
P	0.001*					

Table (7), show the relation between level of knowledge and age, it was found that the young age subjects had a good knowledge than the old age subjects ( $p < 0.05$ ) (Fig. 8).

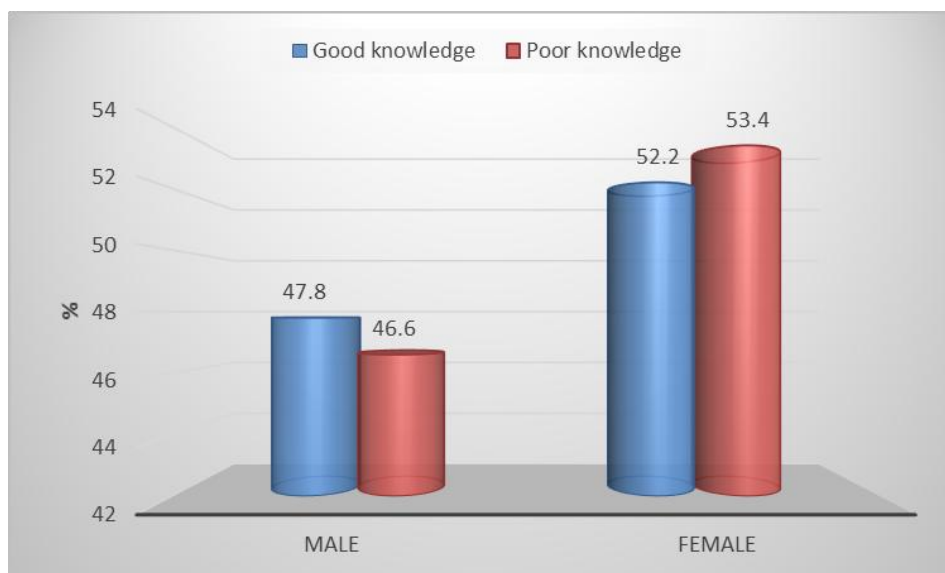


**Fig. 8:-** Relation between level of knowledge and age.

**Table 8:-** Relation between level of knowledge and gender.

	Knowledge scale				Total	
	Good knowledge		Poor knowledge			
	No.	%	No.	%	No.	%
Male	65	47.8	151	46.6	216	47.0
Female	71	52.2	173	53.4	244	53.0
Total	136		324			
X <sup>2</sup>	0.05					
P	0.815					

Table (8), show the relation between level of knowledge and gender, it was found that there was no significant effect of gender on the knowledge about osteoporosis ( $p > 0.05$ ) (Fig. 9).

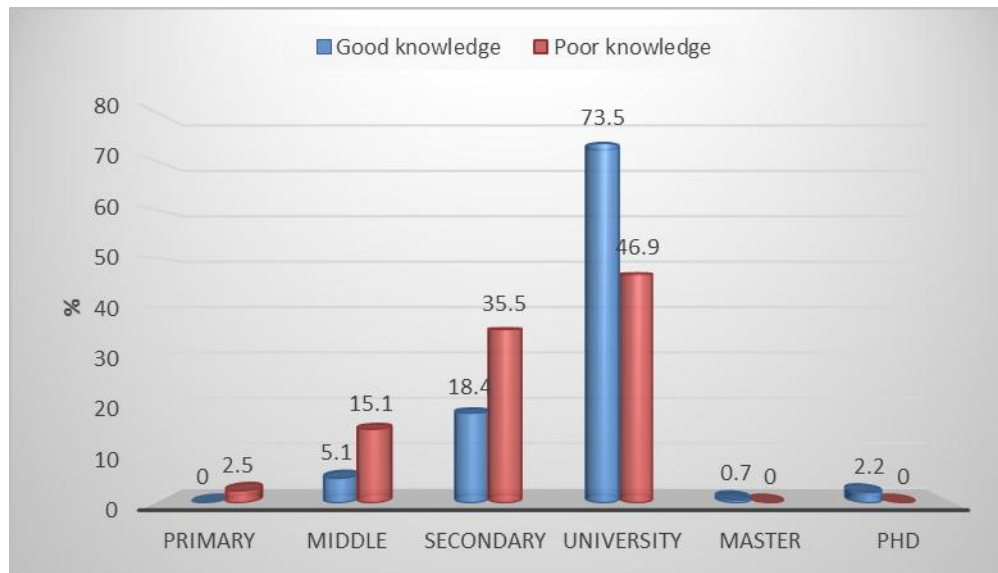


**Fig 8:-** Relation between level of knowledge and gender.

**Table 9:-** Relation between level of knowledge and education

	Knowledge scale				Total	
	Good knowledge		Poor knowledge			
	No.	%	No.	%	No.	%
Primary	0	0.0	8	2.5	8	1.7
Middle	7	5.1	49	15.1	56	12.2
Secondary	25	18.4	115	35.5	140	30.4
University	100	73.5	152	46.9	252	54.8
Master	1	0.7	0	0.0	1	.2
PHD	3	2.2	0	0.0	3	.7
Total	136		324			
X <sup>2</sup>	42.32					
P	0.0001*					

Table (9), show the relation between level of knowledge and education, it was found that there was a significant effect of level of education on the level of knowledge ( $p < 0.05$ ) (Fig. 10).

**Fig. 10:-** Relation between level of knowledge and education**Table 10:-** Relation between level of practice and age.

	Practice						Total	
	Good practice		Moderate practice		Low practice			
	No.	%	No.	%	No.	%	No.	%
<40	20	47.6	39	21.0	29	12.5	88	19.1
41-50	18	42.9	35	18.8	33	14.2	86	18.7
51-60	4	9.5	46	24.7	47	20.3	97	21.1
61-70	0	0.0	60	32.3	38	16.4	98	21.3
+70	0	0.0	6	3.2	85	36.6	91	19.8
Total	42		186		232			
X <sup>2</sup>	26.85							
P	0.001*							

Table (10), show the relation between level of knowledge and age, it was found that there was a significant positive effect of the age on good practice to avoid the disease. ( $p < 0.01$ ). The young age had good practice than the old age subjects (Fig. 11).



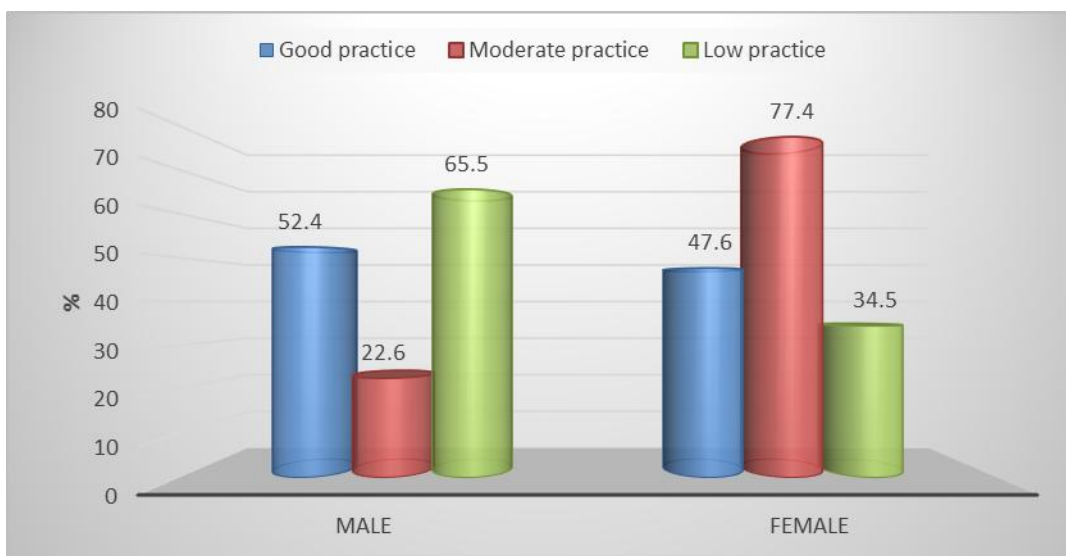


**Fig. 11:-** Relation between level of practice and age.

**Table 11:-** Relation between level of practice and gender.

	Practice						Total	
	Good practice		Moderate practice		Low practice			
	No.	%	No.	%	No.	%	No.	%
Male	22	52.4	42	22.6	152	65.5	216	47.0
Female	20	47.6	144	77.4	80	34.5	244	53.0
Total	42		186		232			
X <sup>2</sup>	26.5							
P	0.0001*							

Table (11), show the relation between level of knowledge and gender, it was found that there was a significant positive effect of gender on good practice to avoid the disease. ( $p < 0.01$ ). The male showed low practice than the females (Fig. 12).

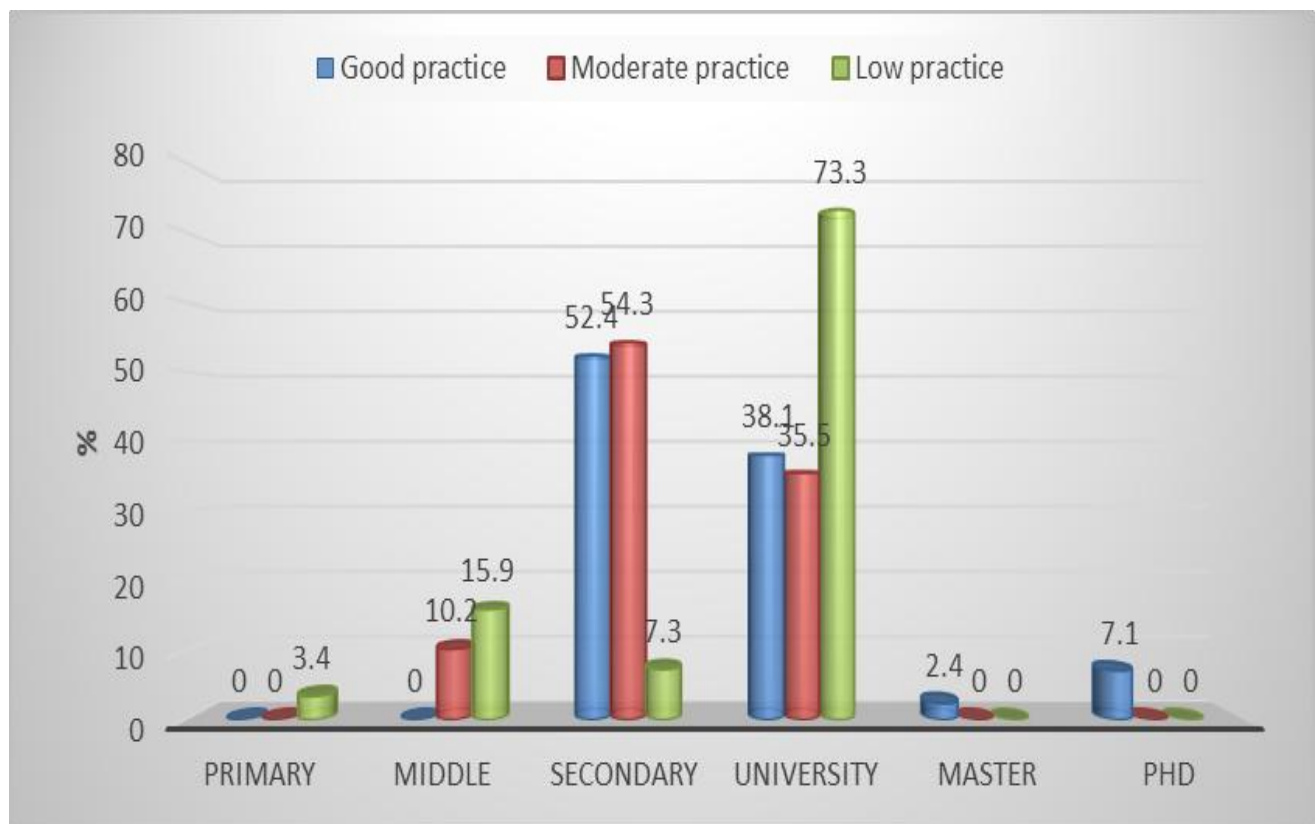


**Fig. 12:-** Relation between level of practice and gender.

**Table 12:-** Relation between level of practice and education

	Practice						Total	
	Good practice		Moderate practice		Low practice			
	No.	%	No.	%	No.	%	No.	%
Primary	0	0.0	0	0.0	8	3.4	8	1.7
Middle	0	0.0	19	10.2	37	15.9	56	12.2
Secondary	22	52.4	101	54.3	17	7.3	140	30.4
University	16	38.1	66	35.5	170	73.3	252	54.8
Master	1	2.4	0	0.0	0	0.0	1	0.2
PHD	3	7.1	0	0.0	0	0.0	3	0.7
Total	42		186		232			
X <sup>2</sup>	29.85							
P	0.0001*							

Table (12), show the relation between level of knowledge and education, it was found that there was a significant positive effect of level of education on good practice to avoid the disease. ( $p < 0.01$ ). I.e. The high educated had a good practice (Fig. 13).

**Fig. 13:-** Relation between level of practice and education

### Discussion:-

Osteoporosis has been recognized as a major public health problem by healthcare providers in Saudi Arabia. Sufficient information about knowledge, health beliefs, and some of the life habits are important to plan for the disease prevention. The present study examined the osteoporosis knowledge, and some of the life habits of Saudi participants in Jeddah to examine health beliefs about osteoporosis and osteoporosis radiological screening in a large group of older women and men to determine barriers to screening.

In this study, the majority of the subjects had poor knowledge about osteoporosis and 50.4% of the subject had no practice to avoid the disease. In partial accordance with these results, a recent study in Saudi Arabia showed that the majority of women in this study had a modest knowledge on osteoporosis. Regarding to practices towards preventing osteoporosis, it was inadequate in studied groups<sup>(21)</sup>.

However, another study among adults in Riyadh showed that participants' knowledge score was about 57 % of the total score and practice score was 51.7 %<sup>(22)</sup>. These scores are higher than our results and this could be attributed to different age and population size between the two studies.

The level of education showed a significant correlation with knowledge of osteoporosis. Also, the young age, higher level of education and females had significantly higher correlation with good practice. In agreement, there were significant associations between the level of awareness, practice and the sociodemographics of the participants including age, female gender and education<sup>(23)</sup>.

In conclusion, this study indicated a lack of awareness and practice about osteoporosis. There was a significant association between knowledge and practice with level of education. Also, the female gender and age showed higher practice scores. All these results showed the significance of more health staff involvement regarding to awareness campaign about osteoporosis.

### References:-

1. Drake MT, Clarke BL, Lewiecki EM. The Pathophysiology and Treatment of Osteoporosis. *Clinical therapeutics*. 2015;37(8):1837-50.
2. Sadat-Ali M, Al-Habdan IM, Al-Turki HA, Azam MQ. An epidemiological analysis of the incidence of osteoporosis and osteoporosis-related fractures among the Saudi Arabian population. *Ann Saudi Med*. 2012;32(6):637-41.
3. Alquaiz AM, Kazi A, Tayel S, Shaikh SA, Al-Sharif A, Othman S, et al. Prevalence and factors associated with low bone mineral density in Saudi women: a community based survey. *BMC musculoskeletal disorders*. 2014;15:5.
4. IOF. The International Osteoporosis Foundation (IOF). <http://www.iofbonehealth.org/facts-statistics#category-28>.
5. Al-Zu'bi A, Almuhtaseb N, Amayreh I. Osteoporosis awareness in a sample of teenage girls in Jordan. *Jordan Medical Journal*. 2010;44(4):420-26.
6. Gehlbach SH, Fournier M, Bigelow C. Recognition of osteoporosis by primary care physicians. *Am J Public Health*. 2002;92(2):271-3.
7. Morris CA, Cabral D, Cheng H, Katz JN, Finkelstein JS, Avorn J, et al. Patterns of bone mineral density testing: current guidelines, testing rates, and interventions. *J Gen Intern Med*. 2004;19(7):783-90.
8. Codori AM, Petersen GM, Miglioretti DL, Boyd P. Health beliefs and endoscopic screening for colorectal cancer: potential for cancer prevention. *Preventive medicine*. 2001;33(2 Pt 1):128-36.
9. Weinberg DS, Turner BJ, Wang H, Myers RE, Miller S. A survey of women regarding factors affecting colorectal cancer screening compliance. *Preventive medicine*. 2004;38(6):669-75.
10. Wallace LS. Osteoporosis prevention in college women: application of the expanded health belief model. *American journal of health behavior*. 2002;26(3):163-72.
11. Sedlak CA, Doheny MO, Jones SL. Osteoporosis education programs: changing knowledge and behaviors. *Public Health Nurs*. 2000;17(5):398-402.
12. Bandura A. Health promotion by social cognitive means. *Health education & behavior : the official publication of the Society for Public Health Education*. 2004;31(2):143-64.
13. Rosenstock IM, Strecher VJ, Becker MH. Social learning theory and the Health Belief Model. *Health education quarterly*. 1988;15(2):175-83.
14. Gourlay M, Richy F, Reginster JY. Strategies for the prevention of hip fracture. *The American journal of medicine*. 2003;115(4):309-17.
15. Gallagher TC, Geling O, Comite F. Missed opportunities for prevention of osteoporotic fracture. *Archives of internal medicine*. 2002;162(4):450-6.
16. Nelson HD, Helfand M, Woolf SH, Allan JD. Screening for postmenopausal osteoporosis: a review of the evidence for the US Preventive Services Task Force. *Annals of internal medicine*. 2002;137(6):529-41.

17. O'Sullivan J, O'Connor OJ, O'Regan K, Clarke B, Burgoyne LN, Ryan MF, et al. An assessment of medical students' awareness of radiation exposures associated with diagnostic imaging investigations. *Insights Imaging*. 2010;1(2):86-92.
18. Sani KG, Jafari M, Mohammadi M, Mojiri M, Rahimi A. Iranian physicians' knowledge about radiation dose, received by patients in diagnostic radiology. *Iranian Journal of Radiation Research*. 2009;6:207-12.
19. [Http://www.calculator.net/sample-size-calculator.html?Type=1&cl=95&ci=5&ps=3%2C976%2C000&x=37&y=6](http://www.calculator.net/sample-size-calculator.html?Type=1&cl=95&ci=5&ps=3%2C976%2C000&x=37&y=6).
20. 50 SY. Central Department Of Statistics & Information. 2014.
21. Al-Otaibi HH. Osteoporosis Health Beliefs, Knowledge and Life Habits among Women in Saudi Arabia. *Open Journal of Preventive Medicine*. 2015;5(06):236.
22. Barzanji AT, Alamri FA, Mohamed AG. Osteoporosis: a study of knowledge, attitude and practice among adults in Riyadh, Saudi Arabia. *Journal of community health*. 2013;38(6):1098-105.
23. Alamri FA, Saeedi MY, Mohamed A, Barzanii A, Aldayel M, Ibrahim AK. Knowledge, attitude, and practice of osteoporosis among Saudis: a community-based study. *J Egypt Public Health Assoc*. 2015;90(4):171-7.



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### RESEARCH ARTICLE

#### PROSPECTIVE STUDY OF RESPIRATORY TRACT INFECTION AMONG PILGRIMS VISITING ER AT ALMADINAHALMONAWARRH , 2016 .

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#### Abstract

**Objectives:** To compare the differences between the incidence of respiratory tract infections before and after performing Hajj and to identify the risk factors that may increase the prevalence of respiratory tract infections during Hajj. **Methods:** During the Hajj season of 1437H in Al Madinah, a prospective cohort study consisting of 566 pilgrim patients was admitted to ER in King Fahad Hospital (160 patients), Al Anssar (100), Bab Jebril Primary Health Clinic (70) and Al Safiah Primary Health Care (236). A face-to-face semi-structured questionnaire was given to each participant a week before and after the Hajj.

**Results:** During the two-week examination period, 92% of patients suffered from respiratory symptoms. It was the first visit to the doctor with the same symptoms for 82.3% of pilgrims. The age group of a vast majority of the patients who participate in the study was 46-65 years. Findings indicate that 89.2% of participants had been in crowded places during the pilgrimage period. Also, 15.9% of participants were smokers, and 81.3% of them had a good ventilation in their residential places. The residential areas of participants (63.4%) were very far from any sources of air pollution. Besides, 82.2% of them did not use their personal belongings during the pilgrimage period..

**Conclusion:** Most pilgrim patients suffered from and shown respiratory symptoms during Hajj. The study noted a reduction in most risk factors which increase respiratory tract infections except the problem of overcrowding during the Hajj season, a problem that cannot be avoided during the pilgrimage to Makkah Al Mukarramah and Al Madinah Al Munawarah, Saudi Arabia.

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#### Abbreviations Table:-

Abbreviation	Description
ER	emergency room
URTI	upper respiratory tract infections

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## Introduction:-

### Rationale and significance:-

The Islamic pilgrimage is unarguably the largest crowded event in the world. As at today, about two million pilgrims from more than 180 countries gather annually for Hajj to the holy cities of Makkah Al Mukarramah and Al Madinah Al Munawarah, Saudi Arabia. During this annual gathering, pilgrims are usually in close contact with one another, especially during Tawaf. As a result, this holy assembly usually exposes religious travellers to a high risk of infectious diseases, especially acute respiratory tract infections. (1) Evidence from the literature has also showed that pilgrims suffer from common infectious diseases such as common cold and other ailments such as influenza and pneumonia, both of which may lead to many complications and thus require urgent medical attentions. (2)

Furthermore, the congregation of such large number of pilgrims may present many public health risks and challenges. (3) In other words, the gathering in populous and limited places for a short time amplifies health risks and hazards. Physical exertion, overcrowding and any existing medical conditions such as diabetes mellitus and cardiovascular illness increase the chance of acquiring infectious diseases among pilgrims. (4)

The demographic characteristics of patients in the previous studies showed that cases of respiratory infections in males (43.5%) were higher than those of females (33.5%). According to the age demographic breakdown of participants, the elderly group (more than 50 years) were involved in more than 94 % of cases. Put simply, elderly people are more prone to infectious disease due to the disruption of diets and sleep and the impairment of the immune system. As for the nationality, most cases of infectious diseases were traced to Indonesian pilgrims (18%), Saudis (17%) and Pakistani (11%) pilgrims (4).

Many previous studies about respiratory tract infections found that cases of such infections increased during Hajj. Although an infection in the upper respiratory tract is very common, lower respiratory tract infection (pneumonia) can occur, and the latter is much more deadly than the former. The leading cause of these ailments includes influenza virus, other viruses and bacteria.

An increase in the incidence of respiratory tract infection during Hajj has a serious impact on the general health of the population as it could lead to an epidemic infection and have adverse effects on the economic by increasing healthcare costs and hospital bed demands as well as contributing to the loss of workdays. The purpose of this study is to compare the differences between the incidence of chest infection before and after performing Hajj and to proffer solutions and identify the risk factors that may increase the prevalence of such infection during Hajj.

### 1.2. Specific objectives:

- To compare the differences between the incidence of respiratory tract infections before and after performing Hajj.
- To identify the risk factors that may increase the prevalence of respiratory tract infection during Hajj.

## Methodology:-

During the Hajj season of 1437H in Al Madinah, a prospective cohort study had been conducted a week before and after the pilgrimage. Data were collected using face-to-face semi-structured questionnaire from patients in King Fahad Hospital (160 patients), Al Anssar (100), Bab Jebril Primary Health Clinic (70) and Al Safiah Primary Health Care (236).

The interviewed was developed based on the literature, sociodemographic data, common respiratory complaints that brought pilgrims to ER, related risk factor and medication. The inclusion criteria were nasal discharge and congestion, cough, sneezing, sore throat, pleuritic chest pain and fever. The data were consequently entered into a portable computer file of access program, and the statistical analysis was done using SPSS version 20.

## Population & Sample of the Study:-

The study population included all pilgrims of 1437H who were treated in one of the hospitals designated to receive them. As a result of the exposure to respiratory diseases before or after performing the pilgrimage, a random sample of 566 patients was selected. The participants were interviewed, and a questionnaire was given to each of them. Table 1 shows the characteristics of the participants according to their personal data.

**Table (1):- The participants personal data.**

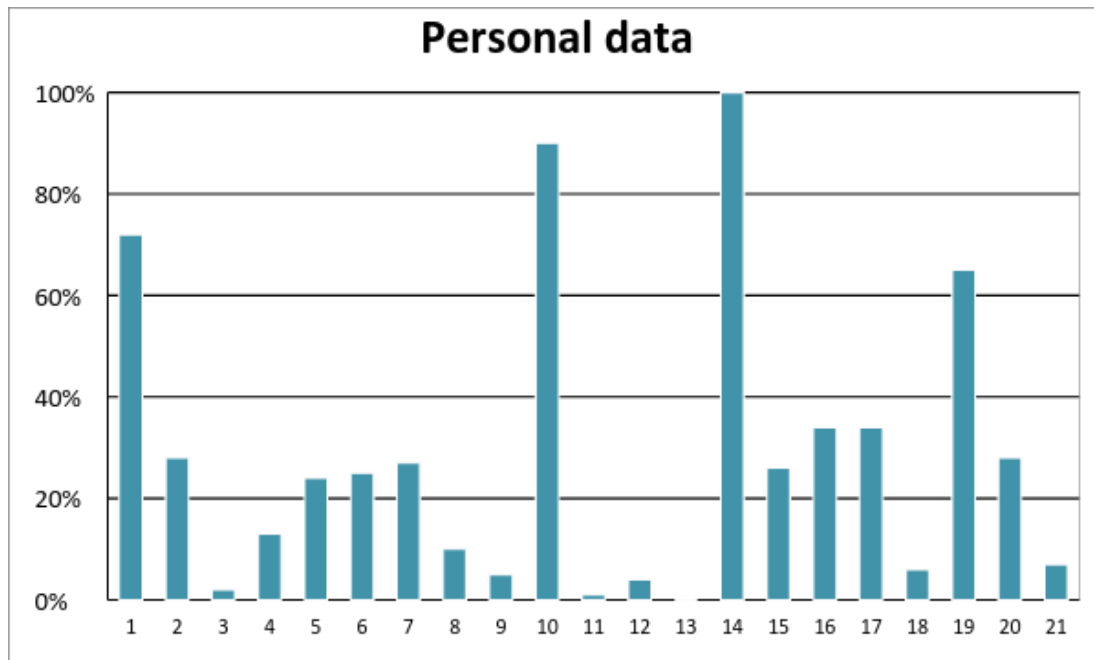
Personal Data		# (%)	P- value
Gender	Male	405 (71.6)	0.00**
	Female	161 (28.4)	
Age	25 or less	11 (1.9)	0.00**
	26-35	71 (12.5)	
	36-45	134 (23.7)	
	46-55	143 (25.3)	
	56-65	152 (26.9)	
	66 and more	55 (9.7)	
Marital status	Single	29 (5.1)	0.00**
	Married	508 (89.8)	
	Divorced	6 (1.1)	
	Widower	23 (4.1)	
Nationality	Saudi	0 (0.0)	--
	Non-Saudi	566 (100.0)	
Education level	Illiterate	147 (26.0)	0.00**
	secondary	194 (34.3)	
	Bachelor	193 (34.1)	
	Master / PhD	32 (5.7)	
Monthly income	less than 2500 sr	370 (65.4)	0.00**
	3000-5000 sr	156 (27.6)	
	More than 5000 sr	40 (7.1)	

\*\*Chi Square test - Significant at the 0.01 level.

As shown in Table 1, 71.6% of the participants were males, and 28.6% of them were females. Based on the distribution of their ages, some participants were 56-65 years old (26.9%), 46-55 years old (25.3%), 36-45 years old (23.7%), 26 -35 years old (12.5% ), more than 66 years old (9.7%), and less than 25 years old (1.9%).

As for the demographic of marital status, A number of sample members were married (89.8%), singles (5.1%), widows (4.1%), and divorced (1.1%).

The participants' distribution according to their educational level was as follows; 26% of them were illiterates, 34.3% had secondary school certificates, and 34.1% had bachelor degrees, and 5.7% were postgraduates. Lastly, their distribution according to their monthly income was as follows: 65.4% of the participants earned less than 2500 SAR, 27.6% received 3000-5000 SAR, and 7.1% were paid more than 50, 000 SAR. The personal diagram of participants is shown below (see Figure 1):



**Graph (1):-** The participants personal data.

### Results:-

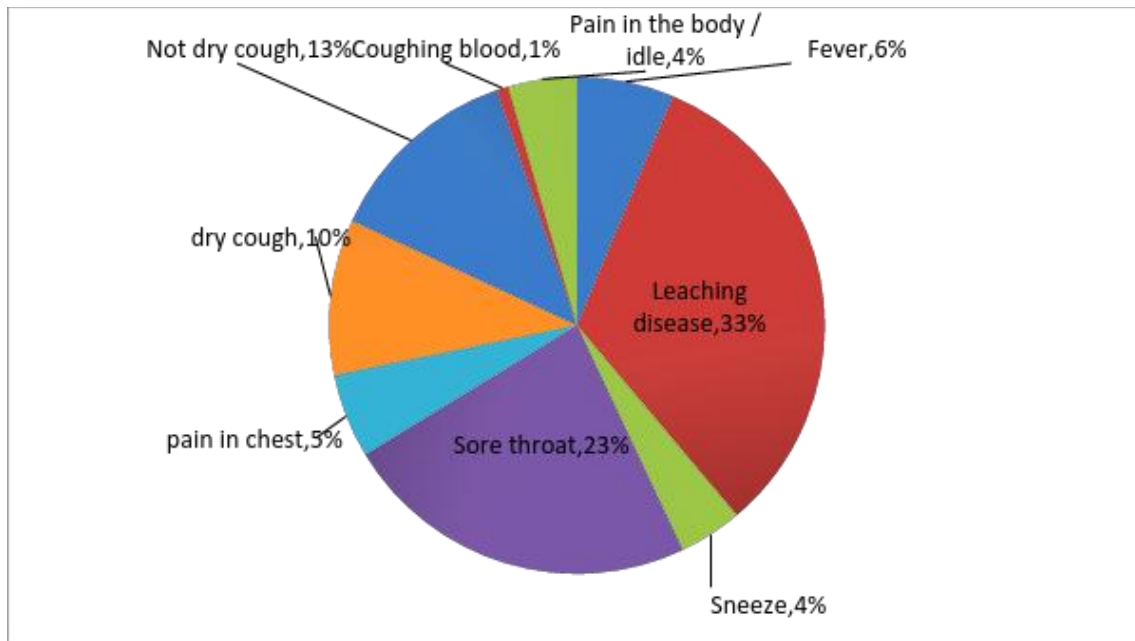
Table 2 shows the participants' distribution based on whether they were suffering from symptoms of the respiratory system; 92% of them suffered from the symptoms of the respiratory system, while 8% did not show any of sign of respiratory disorder.

**Table (2):-** Shows the participants' distribution according to whether they were suffering from symptoms of the respiratory system.

Answer	Frequency	Percent
Yes	521	92.0
No	45	8.0
Total	566	100.0

The following diagram highlights some of the disease symptoms experienced by the participants and the proportions of each of them. As indicated in Figure 2, 32% suffered from flu, 23% had a sore throat, 13% were vulnerable to dry cough, 10% were susceptible to dry cough, 6% had a high temperature, and 5% suffered from chest pain.





**Graph (2):** Shows some of the disease symptoms experienced by the participants in the study.

The next table indicates the participants' distribution according to whether they had been in crowded places during the pilgrimage period. As depicted in Table 3, unlike 89.2% of them, 10.8% were not crowded places during the pilgrimage period.

**Table (3):-** Shows the participants' distribution according to whether they had been in crowded places during the pilgrimage period.

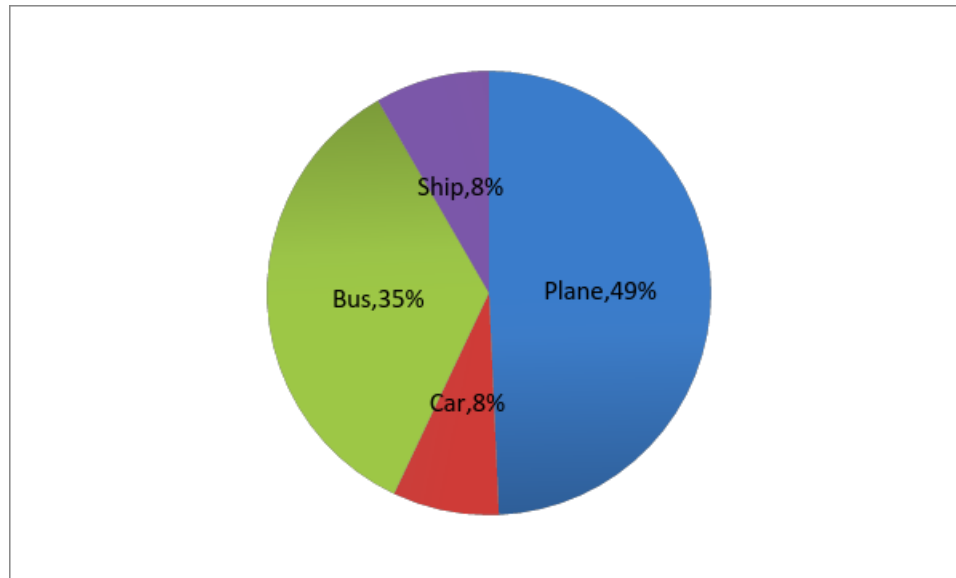
Answer	Frequency	Percent
Yes	505	89.2
No	61	10.8
Total	566	100.0

Table 4 shows the participants' distribution according to whether they utilised their personal belongings (towels, pillow, eating utensils, etc.) during the pilgrimage period; on one hand, 82.2% of them did not use their personal belongings during the pilgrimage period; on the other hand, 17.8% utilized their personal belongings during Hajj.

**Table (4):-** Shows the participants' distribution according to whether they participated their personal belongings during the pilgrimage period.

Answer	Frequency	Percent
Yes	101	17.8
No	465	82.2
Total	566	100.0

The following diagram shows the means of transportation used by the participants to navigate to Medina. As shown in Figure 3, some participants used planes (49%), buses (35%), cars (8%), and ships (8%).



**Graph (3):** Shows the means of transportation used by the participants during their journey to get to Medina.

The next table shows some of the diseases that were suffered by the participants and proportions of each; 35.7% suffered from diabetes, 36% of them suffered from hypertension, 13.8% of them suffered from asthma, 1.4% of them suffered from immune diseases, and other diseases by 13.1%.

**Table (5):**Diseases suffered by the participants..

Answer	Frequency	Percent
diabetes	106	35.69%
hypertension	107	36.03%
asthma	41	13.80%
immune diseases	4	1.35%
Others	39	13.13%

Based on whether they have had an organ transfer process before, 99.8% of them have never had a transfer process, whereas only 0.2% of them have done so (see Table 6).

**Table (6):**Participants distribution according to whether they have had an organ transfer process before.

Answer	Frequency	Percent
Yes	1	.2
No	565	99.8
Total	566	100.0

The next table shows some of the medicines used by the participants and the proportion of each medication. As illustrated in Table 7, a number of participants used analgesics (35.3%), 10.7% for steroids (10.7%), chemotherapy (4.3%), antidepressants (4.3%), antibiotics (2.7%), and other medicines (42.8%).

**Table (7):**Medications used by participants.

Answer	Frequency	Percent
steroids	20	10.7
antibiotics	5	2.7
chemotherapy	8	4.3
antidepressants	8	4.3
analgesics	66	35.3
Others	80	42.8

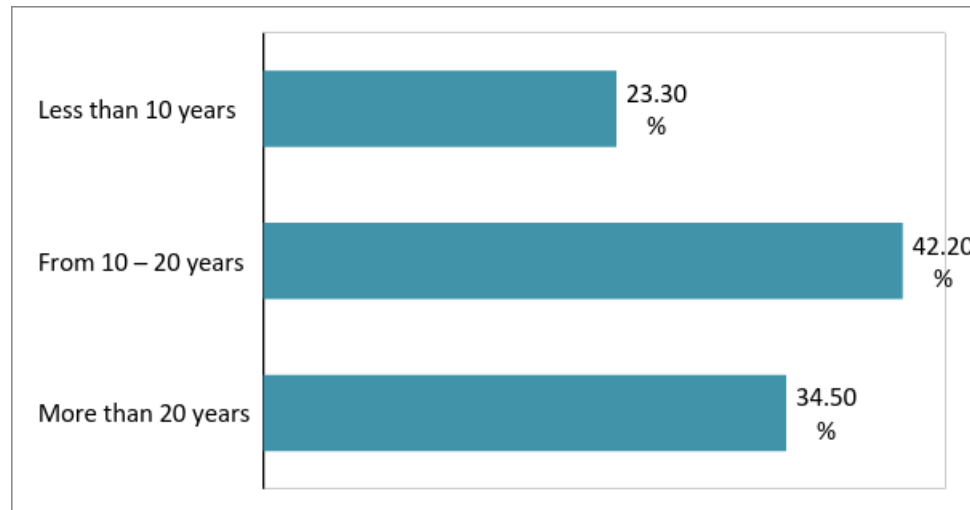
The next table shows the participants' distribution concerning smoking. As shown in Table 8, 84.1% of them were non-smokers and 15.9% were smokers.

**Table (8):** Participants' distribution concerning smoking.

Answer	Frequency	Percent
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Yes	90	15.9
No	476	84.1
Total	566	100.0

The following diagram shows the distribution sample of ers according to the period which they spent smoking. As indicated in Figure 4, some patients smoked for less than 10 years (23.3% ), 10-20 years (42.2%), and more than 20years (34.5%).



**Graph (4):** Shows the distribution of smokers according to the period of time they spent in smoking.

Table 9 explains the participants' distribution regarding whether the ventilation was good in their place of residence during the pilgrimage period; 81.3% of them had a good ventilation in their place of residence, while 18.7% did not have such semblance of atmosphere

**Table (9):-**Table 9: Participants' distribution regarding whether the ventilation was good in their place of residence during the pilgrimage period.

Answer	Frequency	Percent
Yes	460	81.3
No	106	18.7
Total	566	100.0

The next table also shows the participants' distribution in terms of whether their place of residence close to any air pollution such as traffic jam or torched places... etc., during the period of pilgrimage; 63.4% of them said that their residence places weren't close to any air pollution sources, while 36.6 % said that their residence places were close to the air pollution.

**Table (10):-** shows the participants' distribution in terms of whether their place of residence close to any air pollution during the period of pilgrimage

Answer	Frequency	Percent
Yes	207	36.6
No	359	63.4
Total	566	100.0

The next table shows the participants' distribution regarding whether this meeting was their first visits to the doctor with the same symptoms. As shown in Table 11, 82.3% of participants maintained that this meeting was their first visits to the doctor with the same symptoms. On the other hand, 17.7% of them pointed out that this meeting was not their first visit to the doctor with the same symptoms.

**Table (11):-**Participants' distribution regarding whether this meeting was their first visits to the doctor with the same symptoms.

Answer	Frequency	Percent
Yes	466	82.3
No	100	17.7
Total	566	100.0

Table 11 indicates the number of times the participants, who have had several visits to the doctor with the same symptoms, visited the doctor with the same symptoms; 45% of them visited a doctor once before this visit, 39% visited a doctor twice for the same symptoms prior to this meeting, 12% of them visited a doctor thrice for the same symptoms, and 4% had visited a doctor more than three times for the same symptoms.

**Table (12):-**The number of times the participants visited the doctor with the same symptoms prior to this visit.

Answer	Frequency	Percent
One	45	45.0
Two	39	39.0
Three	12	12.0
More than three	4	4.0
Total	100	100.0

The next table shows participants' distribution in terms of whether They been stayed in the hospital or not; 96.5% of them have not been stayed hospital, while only 3.5% were stayed hospital.

**Table (13):-**Participants' distribution in terms of whether they have stayed in the hospital..

Answer	Frequency	Percent
Yes	20	3.5
No	546	96.5
Total	566	100.0

## Discussion:-

The Hajj is the largest annual gathering in the world, bringing millions of people in a small and geographically confined area together. Evidence from the literature suggests that overcrowding increases the chances of trauma and the transmission of communicable diseases. Moreover, pilgrims are subjected to fatigue and bad weather conditions during this period. Hence, crowding, fatigue and extreme climatic conditions are important factors for transmitting air- and droplet-borne infections. In fact, respiratory tract infections are one of the leading types of infections observed during the Hajj season (7,8). Hence, this study aims to compare the difference between the incidence of respiratory tract infections before and after performing Hajj as well as identifying the risk factors that may increase the prevalence of respiratory tract infections during this pilgrimage.

This study includes 566 pilgrim patients of year 1437H. Most of them (92%) suffered from respiratory symptoms, and the results of this study conform with those of Bakhsh et al., who found that most patients were suffering from respiratory problems (9). In this study, the majority of participants (71.6%) were male. Another similarity of this study with other research is that in contrast to females, males are more prone to pneumonia infections (10). However, this finding is different from that obtained by Madani et al (11). It is somewhat illogical that most pilgrim patients are males as both genders are subjected to the same environment and physical activities during the Hajj journey.

Furthermore, we found that most patients attending the King Fahad Hospital, Al Meeqat Hospital, and Alanssar in Al Madinah belonged to the age bracket of 46-65 years old. Bakhsh et al. noted that most patients attending the Haram Medical Centre Facilities belonged to the age group of 41-60 years old (43.7%) (12). Generally, elderly pilgrims are susceptible to infections due to exertion, lack of sleep, disturbance in dietary schedules, etc.; they develop serious medical complications due to decreased immune functions (10,11,13,14).

As noted earlier, this high ratio of infection of the respiratory system is considered normal due to the extremely high crowding density to which people from many parts of the world are exposed when performing Hajj rituals. The seasonal flu vaccination, which is regarded as a preventive measure, has been recommended especially for high-risk individuals or people above 65 years old (15,16,17). Besides, the recommendations for the prevention of influenza

include wearing face masks (18). Although wearing mask may not provide complete protection from infections, it may reduce the exposure to droplet nuclei, which are considered among the main modes of transmitting most URTIs (18). We found that 32% of participants suffered from flu and 23% from a sore throat. It has been observed that the use of seasonal influenza vaccine prolongs the period of a sore throat (19). The prevalence of dry coughs (not dry coughs), high temperature, and pain in the chest was less nonetheless.

Most participants (89.2%) had been in crowded places during the pilgrimage period. This behaviour is considered normal because of the large number of pilgrims and the limited time and space. Also, about 82.2% of the participants did not use their personal belongings during the pilgrimage period. This attitude is also considered a good indication of the awareness of pilgrims.

In our study, participants suffered from diabetes (35.7%) and hypertension (36%), a result which was very similar to that of Khan et al. in which 31.9% suffered from diabetes mellitus, and 37.2% had hypertension (20). Like the result of Emamian et al. in which 9.47% of respondents were smokers, our finding shows that 15.9% of the participants in this study were smokers (21).

The majority of our participants (81.3%) had good ventilation in their place of residence. Such atmosphere is commendable because poor ventilation contributes to the rapid spread of infections. Besides, 63.4% of the participant's residential areas were not close to any sources of air pollution.

For the first time, approximately 82.3% of the participants visited the doctor for the same symptoms. This result means that they exhibited these respiratory symptoms during Hajj. Nonetheless, Al-Jasser et al. reported that a significant proportion (53%) of pilgrims from Riyadh experienced a URTI during or immediately after the Hajj (18).

As in many mass gatherings, it is important to understand how to prevent the occurrence of a heavy burden of symptoms of the respiratory system. Given the circumstances of the Hajj, it is almost impossible to control the spread of illnesses facilitated by crowding adequately. The use of personal protective measures such as vaccination, chemoprophylaxis, frequent hand washing/sanitising, and face mask can provide a level of sufficient protections (22).

### **Conclusion:-**

The recent study found that most of the patient pilgrims suffered from respiratory symptoms and that the majority of them showed these symptoms during Hajj. Regarding the risk factors which increase respiratory tract infection, most pilgrims did not use their personal belongings during the pilgrimage period. Moreover, non-smokers had a good ventilation in their place of residence, and residential places were not close to any sources of air pollution. All these factors are considered good indicators. Nevertheless, most pilgrims had been in crowded places during the pilgrimage period. Such gathering, which cannot be avoided due to a large number of people and the limited time and space, increases the chances of respiratory symptoms.

### **Recommendation:-**

- Further studies on the same subject should include larger groups of pilgrims in various health centres in the city of Medina and Mecca.
- There should be awareness campaigns for pilgrims about the need to take proactive actions and preventive measures such as vaccination, chemoprophylaxis, frequent hand washing/sanitizing, and using face mask to provide a level of sufficient protection.
- The WHO and other global stakeholders in the health sectors should cooperate with the Saudi authorities on how to mitigate infectious diseases during Hajj.

### **Study Strength:-**

- This study can help the world control the spread of both epidemic and pandemic diseases.
- The combination of using questionnaires and personal interviews helps increase the accuracy of the research results.

### **Study limitations:-**

- Difficult to communicate with participants due to the language barrier.
- Poor organisation by hospitals.
- Overcrowding.

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**References:-**

1. Ahmed QA, Arabi YM, Memish ZA. Health risks at the Hajj. *Lancet* (London, England) [Internet]. 2006 Mar 25 [cited 2016 Jun 16]; 367(9515):1008–15.
2. Voordouw BCG, van der Linden PD, Simonian S, van der Lei J, Sturkenboom MCJM, Stricker BHC, et al. Influenza Vaccination in Community-Dwelling Elderly. *Arch Intern Med* [Internet]. American Medical Association; 2003 May 12 [cited 2016 Jun 16]; 163(9):1089.
3. Gautret P, Soula G, Delmont J, Parola P, Brouqui P. Common health hazards in French pilgrims during the Hajj of 2007: a prospective cohort study. *J Travel Med* [Internet]. [cited 2016 Jun 28];16(6):377–81.
4. Asghar AH, Ashshi AM, Azhar EI, Bukhari SZ, Zafar TA, Momenah AM. Profile of bacterial pneumonia during Hajj. *Indian J Med Res* [Internet]. Medknow Publications; 2011 May [cited 2016 Jun 28]; 133(5):510–3.
5. Rashid H1, Abdul Muttalif AR, Mohamed Dahlan ZB, Djauzi S, Iqbal Z, Karim HM, Naeem SM, Tantawichien T, Zotomayor R, Patil S SH. The potential for pneumococcal vaccination in Hajj pilgrims: expert opinion. *Travel Med Infect Dis* [Internet]. 2013; 11(5) (288-94.):10.
6. Alzeer AH. Respiratory tract infection during Hajj. *Ann Thorac Med* [Internet]. Medknow Publications; 2009 Apr [cited 2016 Jun 28];4(2):50–3.
7. Madani, Tariq A., et al. "Causes of hospitalization of pilgrims during the Hajj period of the Islamic year 1423 (2003)." *Annals of Saudi medicine* 26.5 (2006): 346.
8. Al-Ghamdi, Saeed M., et al. "Pattern of admission to hospitals during muslim pilgrimage (Hajj)." *Saudi medical journal* 24.10 (2003): 1073-1076.
9. Bakhsh, Abdulrahman R., et al. "Diseases pattern among patients attending Holy Mosque (Haram) Medical Centers during Hajj 1434 (2013)." *Saudi medical journal* 36.8 (2015): 962.
10. Combes, Alain, et al. "Gender impact on the outcomes of critically ill patients with nosocomial infections." *Critical care medicine* 37.9 (2009): 2506-2511.
11. Madani, Tariq A., et al. "Causes of hospitalization of pilgrims during the Hajj period of the Islamic year 1423 (2003)." *Annals of Saudi medicine* 26.5 (2006): 346.
12. Bakhsh, Abdulrahman R., et al. "Diseases pattern among patients attending Holy Mosque (Haram) Medical Centers during Hajj 1434 (2013)." *Saudi medical journal* 36.8 (2015): 962.
13. Memish, Z. A. "The Hajj: communicable and non-communicable health hazards and current guidance for pilgrims." *Euro Surveill* 15.39 (2010): 19671.
14. Alzeer, A., et al. "Tuberculosis is the commonest cause of pneumonia requiring hospitalization during Hajj (pilgrimage to Makkah)." *Journal of infection* 36.3 (1998): 303-306.
15. Alzeer, Abdulaziz H. "Respiratory tract infection during Hajj." *Annals of thoracic medicine* 4.2 (2009): 50.
16. Memish, Z. A. "The Hajj: communicable and non-communicable health hazards and current guidance for pilgrims." *Euro Surveill* 15.39 (2010): 19671.
17. Al-Tawfiq, Jaffar A., Alimuddin Zumla, and Ziad A. Memish. "Respiratory tract infections during the annual Hajj: potential risks and mitigation strategies." *Current opinion in pulmonary medicine* 19.3 (2013): 192-197.
18. Al-Jasser, Fahad S., et al. "Patterns of diseases and preventive measures among domestic hajjis from Central, Saudi Arabia." *Saudi medical journal* 33.8 (2012): 879-886.
19. Deris, Zakuan Zainy, et al. "The prevalence of acute respiratory symptoms and role of protective measures among Malaysian hajj pilgrims." *Journal of travel medicine* 17.2 (2010): 82-88.
20. Khan, Nasim A., et al. "Pattern of medical diseases and determinants of prognosis of hospitalization during 2005 Muslim pilgrimage Hajj in a tertiary care hospital. A prospective cohort study." *Saudi medical journal* 27.9 (2006): 1373-1380.
21. Emamian, Mohammad Hassan, Ali Mohammad Hassani, and Mansooreh Fateh. "Respiratory tract infections and its preventive measures among Hajj pilgrims, 2010: a nested case control study." *International journal of preventive medicine* 4.9 (2013): 1030.
22. Choudhry, A. J., et al. "Hajj-associated acute respiratory infection among hajjis from Riyadh." (2006).

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### RESEARCH ARTICLE

#### A STUDY ON SCOPE OF EXTERNAL EQUITY FINANCE IN MSME UNITS IN INDIA.

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Finance and Economic Growth.

#### Abstract

The Micro, Small and Medium Enterprises are back bone of the India. They contribute the significant amount to the GDP. They are located equally in both urban and rural areas and it provides high employment. So the governments also taking many actions to the growth of the MSME sector. Even though, the MSMEs in India are still struggle to survive, most of the MSME run loss or very smaller profit. The key issue of the MSME sector is funding. They cannot be able to raise as much funds from public for meet out their requirements. The MSMEs are mainly depend on the debt from other sources rather than banks. Now the MSMEs have many alternative sources to raise the funds. In that sources the external equity is one of the important sources to raise the investment. They have own advantage while considering other sources of finance. It is one of the less used sources of finance by the MSMEs. It is most suitable finance source to the MSMEs. The equity finance will help to avoid some of the major drawbacks like repayment, fixed interest payment of the MSMEs for raising and using of funds.

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#### Introduction:-

The Micro, Small and Medium Enterprises (MSME) plays a vital role in the economic and social development of the country. They often act as a nursery of entrepreneurship. They also play an important role in the development of the economy with their flexible, effective, efficient and innovative entrepreneurial spirit. The Micro, Small and Medium Enterprises (MSME) sector has been a significant contributor to the country in the stream of generating the highest employment growth and it also accounts for the major share of industrial production and exports.

Micro, Small and Medium Enterprises (MSME) fuels the economic growth across the globe and they are the key instruments for promoting equitable development. The primary attribute of the sector is its employment potential at low capital cost. The labour intensity space of Micro, Small and Medium Enterprises (MSME) are much higher than that of large enterprises. Micro, Small and Medium Enterprises accounts for about 90 per cent of total enterprises in most of the economies. On the domestic front, MSMEs play an essential role in the overall industrial economy of the country. In recent years, the MSME sector has been consistent in registering a higher growth rate compared with the overall industrial sector. Further with qualities such as agility and dynamism, the sector has shown admirable innovativeness and adaptability to survive the recent economic downturn and recession.

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The Indian Micro, Small and Medium Enterprises (MSME) sector space is immensely heterogeneous with regards to the size of the enterprises, variety of products and services, and levels of technology. The sector not only plays a crucial role in providing employment opportunities at comparatively lower capital cost than large industries but also helps in industrialization of rural and backward areas, reducing regional imbalances and assuring more equitable distribution of national income and wealth.

The Micro, Small and Medium Enterprises (MSME) are now the backbone of India's industrial landscape. With about 40 million units employing around 100 million people, directly and indirectly, the sector is the largest job provider in the country. They contribute about 8 per cent to the GDP, has a share of 45 percent in the country's manufacturing output growth, and contributes 40 percent to the country's exports.

#### Definition:-

Definitions of MSME in accordance with the provision of Micro, Small & Medium Enterprises Development (MSMED) Act, 2006 they are classified in two Classes:

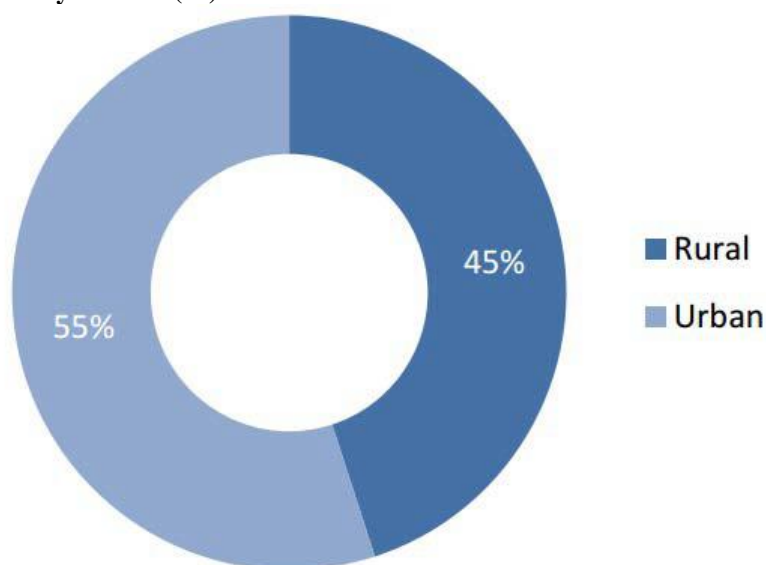
**Manufacturing Enterprises-** The enterprises are engaged in the manufacturing or production of goods pertaining to any industry specified in the first schedule to the industries (Development and Regulation Act, 1951) or employing plant and machinery in the process of value addition to the final product having a distinct name or character or use. The Manufacturing Enterprise are defined in terms of investment in Plant & Machinery.

<b>Manufacturing Sector</b>	
<b>Enterprises</b>	<b>Investment in plant &amp; machinery</b>
Micro Enterprises	Does not exceed twenty five lakh rupees
Small Enterprises	More than twenty five lakh rupees but does not exceed five crore rupees
Medium Enterprises	More than five crore rupees but does not exceed ten crore rupees

**Service Enterprises:-**The enterprises engaged in providing or rendering of services and are defined in terms of investment in equipment.

<b>Service Sector</b>	
<b>Enterprises</b>	<b>Investment in equipment</b>
Micro Enterprises	Does not exceed ten lakh rupees:
Small Enterprises	More than ten lakh rupees but does not exceed two crore rupees
Medium Enterprises	More than two crore rupees but does not exceed five crore rupees

#### Classification of MSMEs by location (%):-



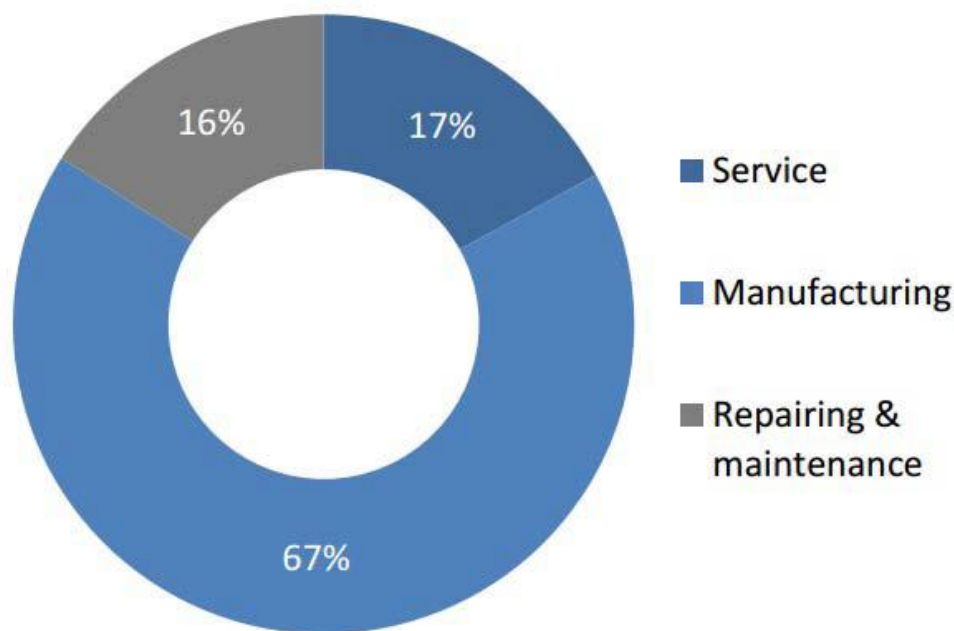


MSMEs have played an important role in the development of States in terms of the employment generation. More than 55 per cent of these enterprises are located in six major States of the country, namely, Uttar Pradesh, Maharashtra, Tamil Nadu, West Bengal, Andhra Pradesh and Karnataka.

The MSME sector has slowly come into the limelight, with increased focus from the government and other non-government institutions, corporate bodies and banks. The changes based on the policies, investments into the sector, globalization and India's growth story have giving several business opportunities for this sector.

According to this chart 55 per cent of MSMEs are located in urban areas of the country. But almost equal number 45% of about MSMEs are located in the rural areas. So the MSMEs in India playing a vital role in the development of rural areas and employment of rural peoples. Since India having more rural areas rather than the urban areas, the employment and development of rural peoples are more important to the development of the nation.

#### Classification of MSMEs by sector (%):-



Indian MSMEs are mostly on the Manufacturing sector. The graph shows 67% of the Indian MSMEs in the manufacturing sector. The small manufacturing units are more important than the big manufactures in India because the small manufacturing units are contributing more in the economy rather than the big ones. After the manufacturing the Indian MSMEs are concentrating on the service sector. The 17 per cent of the MSMEs are in the service sector. The total Indian economy is concentrated more on the service sector but MSMEs are different in this case. They are more on manufacturing sector and lesser on the other sector sectors. It's a good sign to the government. Because now the government try to concentrate on manufacturing sector (E.g.:- Make In India program). The government can boost the MSMEs since they are more on manufacturing sector. For that the Indian government made many initiatives.

#### MSME Funding – Challenges:-

##### Loan Finance:-

The most dominant factor that stands as a hurdle to the MSME sector has been access to loan finance, sufficiently and timely. This problem is persistent despite clear instructions from the Reserve Bank of India (RBI) and the Ministry of Finance to encourage flow of funds from the commercial banks to small enterprises. It is examined that, there are strong structural underpinnings to the inadequate flow: the organizational structure of banks, and processes within them, have taken them far from task orientation, and have created a specific bias against small loan portfolios. With the proper guidelines and direction from RBI and an absence of performance-based incentive

system for proactive bankers have all constricted easy flow of loan finance to small firms, it is much more difficult for tiny sectors.

It is observed that, transparency of the financial conditions of MSME is still lagging. This due to the lack of evaluation of the financial conditions by the owners themselves. This results in hesitation from banks to lend loan to small scale units. In fact, there is evidence to establish that a fairly significant proportion of loans given to small enterprises in the past have compounded the problem of non-performing assets (NPAs). Unless there is fairly detailed information on small firms, banks would hesitate to take risk. So to ensure transparency in decision on finance, loan finance is the alternate source.

#### **Issues in loan finance:-**

There are many issues and challenges that MSME's faces in getting loan from financial institutions.

#### **Lack of Information:-**

The adequacy of information about the MSME borrowers is the real problem for decision-making by banks in the lending process. Where information asymmetry exists, lenders may respond by increasing lending margins to levels in excess of that which the inherent risks would require. However, the low size of MSME lending makes it unviable for banks to invest in development of information systems about MSME borrowers. In such situations, banks may also reduce the extent of lending even when MSMEs are willing to pay a fair returns to them. The implication of raising interest rates and/or curtailing lending is that banks will not be able to finance as many projects as otherwise would have been the case.

#### **Granularity:-**

This is a situation where the risk grading system at banks does not have the requisite capability to discriminate between good and bad risks. This will lead to tightening of credit terms, or an increase in prices, or both. From the borrower's perspective, this leads to an outcome where the bank is over-pricing good risks and underpricing bad risks. The fact that most banks in India have not developed adequate expertise in MSME lending risk assessment exercises leads to the problem of granularity when it comes to MSME lending. Most banks in India are not having an effective risk assessment technique when it comes to MSME lending.

#### **Pecking order Theory:-**

This theory flows from the above mentioned issues that make MSME lending highly difficult for banks. Under this hypothesis, the sector which faces a cost of lending that is above the true risk-adjusted cost will have incentives to seek out alternative sources of funding. Evidence suggests that in such situations MSMEs prefer to utilize retained earnings instead of raising loans from banks.

#### **Moral Hazard:-**

Loans even though provided by banks to the MSME's the owners of the companies preference goes towards getting finance through other sources. One reason for this situation is that the owner of the firm benefits fully from any additional returns but does not suffer disproportionately if the firm is liquidated. This is referred to as the moral hazard problem, which can be viewed as creating a situation of over-investment. The moral hazard problem may thus lead to MSME lending turning bad in a short period of time, a situation that all banks would like to avoid.

#### **Switching Costs:-**

MSMEs may find it harder to switch banks, when countered with any issue. It is a known fact that the smaller the business, the more significant the switching costs are likely to be and, therefore, it is less likely that the benefits of switching outweigh the costs involved. This situation results in MSME lending becoming a seller's market, which may not be attractive to MSME borrowers.

#### **Alternative Financing:-**

##### **Securitization of Trade Credit:-**

The Trade credit is one of the source of financing for MSMEs, as they sell on credit to their large customers and then wait for long periods for payment. If these receivables (trade credit) could be packaged as a securitized asset, which would essentially be a commercial paper with the credit rating of the large firm, it could help MSMEs reduce their investment in working capital and their need for finance significantly. The credit worthiness of a typical MSME would also improve, qualifying it for greater bank funding. Though the securitization process which is similar to

factoring, could be more cost-effective than bank funding, factoring, and letters of credit. But the Securitization of credit also depending on the borrowings.

#### **Angel Funds / Venture Capital Funds:-**

Angel investors are investors who typically invest their own funds, who manage the pooled money of others in a professionally-managed fund are increasingly becoming another alternative source of funding for MSMEs in India.

Venture/ Risk capital is often a more appropriate financing instrument for high-growth potential and start-up MSMEs. However, the ability of MSMEs (especially those involving innovations and new technologies) to access alternative sources of capital like angel funds/risk capital needs to be enhanced considerably. Although the sector commonly uses traditional debt, this type of financing is often not accessible for fast growth and start-up firms. During their initial phase, firms need finance to study, assess and develop an initial concept (seed phase) or for product development and initial marketing (startup phase). At this stage, firms may be in the process of being set up or may exist, but have yet to sell their product or service commercially. High-growth firms usually develop an idea, concept or product that requires an incubation period before generating revenues and profits.

#### **Private Equity Funding:-**

Private Equity (PE) investment provides another source of raising capital for MSMEs. Private Equity funds have been invested in Indian firms since 1990s. These financial enterprises are typically focused on funding a company early, adding value to them and making an exit at a later stage. They are stable sources of capital and tend to have an investment horizon of 3-5 years looking at a multiple return on their investment. Private Equity investors not only bring capital but also expertise and experience from established businesses and from the global markets. Private Equity companies will expect the portfolio of companies in which they are going invest should be best in practice. They also work extensively with their portfolio companies and encourage management to undertake operational improvements in case of any strategic opportunities such as mergers, acquisitions and joint ventures. The Planning Commission recently released a preliminary approach paper regarding its 12th five-year plan (2012-2017). A key focus area in the plan is to promote equity investment in MSMEs by constituting a Working Group devoted to the concept.

But the inclusion of private equity leads to some problems. The private equity investors will demand larger share of the business. So the existing owner will lose their ownership power and also their control on the business.

#### **Mezzanine Financing:-**

Mezzanine refers to hybrid financial instruments that possess characteristics of both debt and equity. It lies somewhere in the midst of debt and equity on the risk-return spectrum. In the hierarchy of creditors, mezzanine debt is subordinate to senior debt but ranks higher than equity. Mezzanine financing, usually completed with little due diligence on the part of the lender and little or no collateral on the part of the borrower, it is treated like equity on a company's balance sheet. Mezzanine debt is also called subordinated debt or second mortgage. Commensurate with their subjugated position in the claim over the assets of a corporation which is tantamount to the assumption of relatively higher risks, mezzanine financiers typically demand a higher rate of return as compared to debt providers but lower than that required by equity investors.

Mezzanine financing requires the business owner to give up some measure of control over the firm. Business owners who agree to mezzanine financing may be forced to accept restrictions in how they spend their money in certain areas of the business. It is more expensive compare to the other traditional debt arrangements and arranging the Mezzanine finance is a lengthy process.

#### **Role of capital in MSME sector:-**

The challenges faced by Micro, Small and Medium Enterprises (MSME) sector arise from many areas. These enterprises are small in sizes have limited ability to withstand any economic problems. They are generally running with inadequate amount of capital. A large number of enterprises depend completely on the owner's capital and borrowing from individuals, without borrowing funds from financial institutions. It naturally inhibits their potential to grow their businesses. Many of the concerns of this sector like low technology level, lack of product variants, inability to increase manpower etc. cannot be addressed without adequate and timely availability of credit. It is only when these enterprises are adequately funded. Also, these enterprises often being the suppliers of larger enterprises suffer from the problem of the realization of payments for their products or services. These issues make pressure on

their working capital which impacts severely their operations. Therefore, in the one hand they have limited capital to invest in fixed assets to expand their operations; on the other hand, due to lack of adequate working capital they find it difficult to continue their existing operations. The concerns are not confined to issue of credit availability; it's also about cost of credit. If the cost of credit cannot be made attractive for the borrowers of this sector, loan disbursal cannot be improved. The MSME sector, therefore, urgently needs more capital at a reasonable cost. The availability of funding can help it to address some of its key concerns. It needs more seed capital to start new ventures. Long term capital is needed to help the enterprises to invest in infrastructure in terms of land, plant & machinery, technology sourcing etc. and to augment its operations. Working capital is required to ensure the running of day to day operations of the business. The flow of funds is critical for the survival and growth of MSMEs in the present competitive market. Not only these firms need debt financing, the growth cannot take place without equity financing. There is a possibility of growing firms taking only bank finance, getting over-leveraged. At that point further bank financing is hard to get. Therefore, the MSMEs can grow by having the access to both debt financing and equity financing options.

#### **Equity Finance:-**

Equity financing is the process of raising capital through the sale of shares in an enterprise. Equity financing essentially refers to the sale of an ownership interest to raise funds for business purposes. So the MSME have an option to raise the funds through Equity or issuing of shares.

Access to Equity Capital through SME Exchanges: Access to equity capital from the stock market is a genuine problem for MSMEs. Till some years ago, there was no great flow of equity capital into this sector. Absence of equity capital poses a serious challenge to the development of knowledge-based industries, particularly those promoted by the first-generation entrepreneurs with the requisite expertise and knowledge. Further, for efficient capital structure decisions, an optimal mix of equity and debt is very important. Keeping this in mind, the Report of the Task Force on MSME Chairman (Shri. T.K.A. Nair, 2010) had recommended the setting up of a dedicated Stock Exchange/Platform for MSMEs to access institutional and retail capital. This would also facilitate greater financial inclusion in the country. Following this, SEBI laid down the regulatory framework for the SME Exchanges with relaxed listing conditions and accorded approval to BSE and NSE to launch an SME Exchange in September 2011 and October 2011 respectively. Successful examples of SME Exchanges across the World include AIM (London), Canada (TSXV), Hong Kong (GEM), Japan (Mothers), Korea (KOSDAQ) and US (NASDAQ).

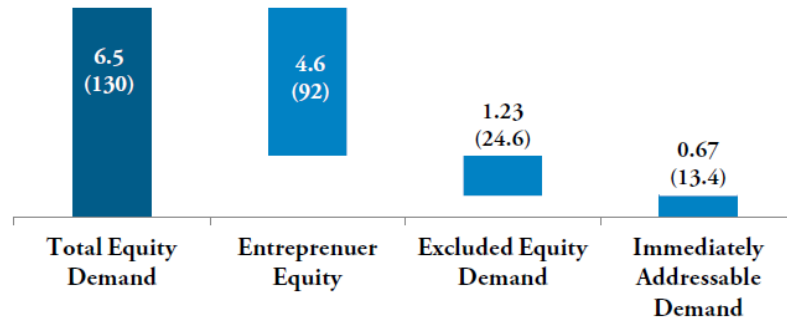
In March 2012, both BSE and NSE launched their SME exchange platforms to enable MSMEs to raise funds and get listed as public entities. BCB Finance Ltd. was the first Indian SME to get listed on the BSE SME Exchange. This was an event of immense significance for MSMEs as they have a huge listing potential but mostly had debt-financing options. The launch of SME exchanges will play an important role in growth of MSMEs and the need of the hour is to improve the awareness among MSMEs about equity capital, stock markets and funding options, other than banks. The capital markets can play a crucial role in helping MSMEs improve their visibility and raise capital for their growth and expansion, offering an effective way to improve financial inclusion. They can also offer investors opportunities to invest in growing businesses at an early stage. Since its launch in March 2012, 13 companies have listed with BSE SME exchange, and BSE is negotiating with other companies for listing. BSE's rival NSE has also followed suit and launched its own SME platform called 'Emerge' with the proposed listing of Chennai-based SME Thejo Engineering. A vibrant equity market for MSMEs would also provide an added incentive for private equity and venture capital investments by providing an exit option for them. Listing on exchanges will also offer MSMEs an opportunity to offer equity ownership to their employees, thereby, increasing their commitment to their company and working for its future success.

The MSME sector is an important factor for growth of the country's economy, and presents a significant business opportunity for both banks and alternative finance providers. The improvements of financial exclusion in MSMEs is high and in spite of the increase in credit outstanding in recent years, fetching the adequate and timely credit from a bank is still a critical problem faced by the Indian MSME sector. So the alternative sources of finance can step in and assist MSMEs in their growth and development. In recent years, the amount of alternative finance options have improved and have proven to be an important source of financing for Indian MSMEs. The alternative financing avenues discussed above truly have the potential to bridge the financing gap for MSMEs from banks. Access to finance is essential for improving MSMEs competitiveness, as MSMEs have to invest in new technologies, skills and innovation. On their part, the MSMEs should be responsible borrowers, should use the finance in a judicious manner and take advantage of the business opportunities both within and outside the country. They should improve

their governance and risk management practices, maintain proper books of accounts, submit correct information to banks and all authorities, and make their operations more efficient and productive to get easier access to finance from banks and other investors. This way the MSME sector would become more competitive and efficient and contribute further to the economic development of our country.

#### Equity Demand:-

**Figure 19: Viable and Addressable<sup>[55]</sup> Equity Demand in MSME Sector (in INR trillion)\***



\*Figure in brackets is in USD Billion

Source: MSME Census, SIDBI, Primary Research, IFC-Intellectcap Analysis

The picture shows the overall equity demanded by the MSMEs are 6.5 trillion rupees. In the total demand 71 per cent (4.6 trillion) contributed by the entrepreneur or the real one owner of the firm. The MSMEs are demanded the 1.23 trillion rupees excluded equity. The graph clearly shows that the Indian MSMEs are more depend on the Entrepreneur equity. The most of the MSMEs in India running with depending more on the individual owner's money and borrowed capital.

#### Small Size of Equity Investments in the MSME:-

Enterprise	Average Investment Size (in INR Million)
Micro	0.04-0.05 (800 – 1000)
Small	0.3 – 0.5 (6000 – 10,000)
Medium	7 – 10 (0.14 – 0.2 Million)

\* Figures in bracket in USD; Source: IFC – Intellectcap Analysis

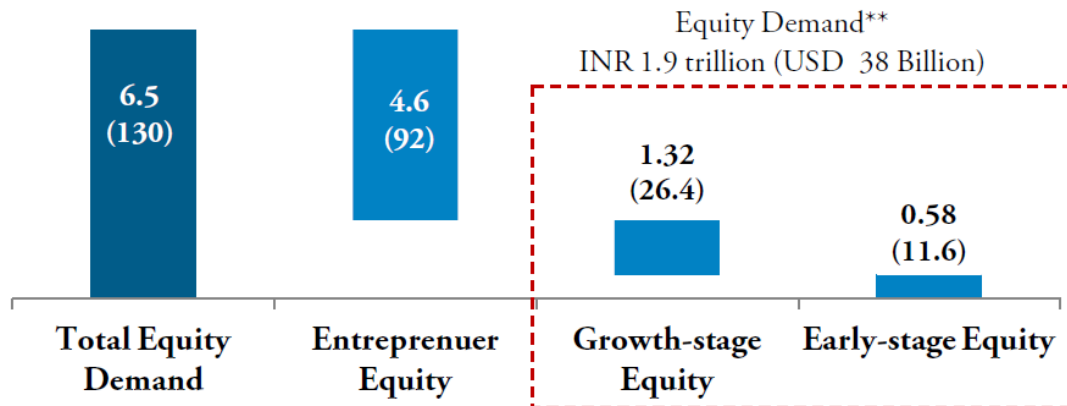
Micro and Small Enterprises have less access to external equity initially because only low number of players supplying early-stage equity capital. If the equity were made available, the absorption would remain low because of:-

- Legal structure of enterprises that prevent infusion of external equity;
- Low level of willingness and ability of entrepreneurs to manage formal sources of equity capital
- Entrepreneur's concern regarding control and management.

However, the equity demand from small enterprises that have legal structures other than proprietorship and partnership is considered as viable and addressable in the near term.

Medium-scale enterprises have a more balanced debt-equity ratio (2:1). It is maintained because of the high ability of the entrepreneur to invest in capital. The debt-equity ratio maintaining through the high levels of contribution of the individual owner of the firm.

#### Equity Demand in Early-Stage and Growth-Stage Enterprises:-



\*Figure in brackets is in USD Billion

\*\*Includes equity demand by micro enterprises

Source: MSME Census, SIDBI, Primary Research, IFC-Intellect Analysis

Early-stage enterprises are defined as those that have an operational history of one-year or less. Their equity demand is very less compare to the Growth stage enterprises. The total equity demanded is 1.9 trillion, in that 1.32 trillion demanded by Growth-stage equity enterprises. The balance will demand by the Early-stage equity enterprises.

#### Benefits for MSME Using External Equity:-

##### Permanent Source of Finance:-

One of the permanent solution for finance needs of an MSME is equity financing. No company's main focus or objective can be financial management only. If one organization raise the funds from borrowings. But they should repay the debt amount over a period of time. But the equity finance never be repay because it do not have any maturity period. Equity finance provides that leverage to the management to continuously focus on fulfilling their core objectives. It keeps management away from the hassles of raising funds again and again like other sources of financing. So the MSMEs do not worry about the maturity period of the raised funds and repayment of them.

##### Retained Earnings:-

If company having the external equity finance in their capital structure through that they can develop an internal source of finance. The earnings which a company generates using the capital can be retained with the company to finance the increased working capital and other fund requirements. The company can effectively achieve its objective of shareholder's wealth maximization by the way of using this funds in projects with higher returns compared to what is available to the equity shareholders. Through the retained earnings the MSMEs can rise more funds with less expenses.

##### Dividend Payments:-

Equity finance for a new company is like the blessings of an angel. The main limitation of a new company is the uncertainty of cash flows. No fixed obligation to pay dividends will help to avoid the problems arising from the uncertainty of cash flows. A company can choose to pay no dividend or smaller dividends as per the earnings of the company. It help to the MSMEs to avoid the burden of monthly payment of higher interest rates for other raised funds.

**Less burden:-**

Using equity finance, there is no loan to repay. This offers relief in several ways. First, the business doesn't have to make a monthly loan payment. This can be particularly important if the business doesn't initially generate a profit. This also frees you to channel more money into growing the business.

**Challenges for MSMEs in Equity Infusion:-**

The legal structure will influence the ability of an enterprise to accept external equity funds. The investors can invest in the firms through that the enterprise will be extent their liability is limited to their respective shareholding in case of Limited companies and limited liability partnerships. In the case of proprietorship and partnership transfer unlimited liability to the equity investor, hence discouraging equity infusion in such enterprises.

Approximately 96 percent of MSMEs in India are proprietorships or partnerships. Because of that the MSMEs can't able to attract external equity. While change in the legal form of an enterprise to limited company or limited liability partnership is an option, it entails taxation and compliance overheads for the enterprises, often rendering the business model financially unviable. Most of the entrepreneurs do not have much awareness of alternative sources of finance. So the benefits of changing their legal structures are not always obvious. Limited presence of external equity, entrepreneurs use informal sources (usually debt) to meet the needs of their enterprise.

Most of the mature small enterprises and medium enterprises which are able to keep their financials transparent, and tend to attract more equity investors. Also, the legal structure of mature small enterprises and medium enterprises allows for inclusion of external equity. It is because the external equity investors expects transparency in both financial record-keeping and governance.

**Conclusion and Suggestions:-**

The growth of MSMEs sector in India is far reaching. The government special programs to develop this sector are stronger.

The central government of India has a separate minister to take over the MSME sector. Which makes the sector more powerful. Because they can make separate programs for the development of the MSMEs in India.

The real drawbacks of Indian MSMEs are insufficient funds. MSMEs can't able to raise as much funds to invest and develop. Indian MSMEs are raising funds by way of debt. For this also they not getting much assistance from banks. So the MSME owners are focus on other debt sources apart from the banks. The banks also do not have enough information about the MSME organizations to provide the loans. Because the MSMEs are mostly failed to keep their records correctly.

Another important sources of funds are single owner investment. According to the capability of the owner can contribute the funds to the organization from his wealth (equity). So, mostly Indian MSMEs are depending on single owner funds and Debt.

The use of external equity is one of the finest solution to the Indian MSMEs for the issues of raising funds. But it is the one of the less used way of fund raising by the MSMEs especially micro enterprises. Using external equity in the capital structure will help to the MSMEs to avoid some key issues faced by them. The issues are like fixed monthly payment of the interest amount, Repayment of the raised amount and problems of paying return to the investors if the firm get losses in initial stages. The organization need not to pay the dividend if they get loss.

The MSMEs get another fund raising option called retained earnings. They choose less or no dividend payment option. This will give another pool of funds to further more growth of the organization. The investors also happy because the value of their share will go up through the growth of the organization.

The Indian MSMEs are have great opportunities to raise the funds through the external equity. For that the main Indian exchanges BSE and NSE are opened the particular platform. So the Indian MSME owners also should take some initiatives to grab this opportunity.

**Reference:-**

1. International Financial Corporation- “Micro, Small and Medium Enterprise Finance in India” A Research Study on Needs, Gaps and Way Forward (November, 2012)
2. Biswajit Bose – “Financing of Micro, medium and small scale enterprises in India Key Challenges” -Volume 1, Issue 1 (May. – Jun. 2013), PP 01-04
3. Report of Prime Minister’s task force on Micro, Small and Medium Enterprises, Govt. of India, January, 2010.
4. Vision 2020: Implications for MSMEs (2011), Grant Thornton, FICCI.
5. Chakrabarty K.C. (June, 2010). Bank Credit to MSMEs: Present status and way forward, RBI monthly Bulletin.
6. Annual Report, (2014-15). Ministry of Micro, Small and Medium Enterprise, Government of India.
7. Badulescu Daniel. SMEs Financing: The extent of Need and the Responses of Different Credit Structures.
8. Final Report (Edition: April, 2011) 4th All India Census of MSME, 2006-07: Registered Sector.
9. Risk Capital and MSMEs in India (A SIDBI Publication).
10. Resurgent India Limited - MSME Funding – Opportunities & Challenges.
11. Business line, (June 8, 2011), Challenge of financing SMEs.
12. Government of India Ministry of MSME - MSME Schemes
13. <https://efinancemanagement.com/working-capital-financing/disadvantages-of-trade-credit>
14. PricewaterhouseCoopers Private Limited - Financing for MSMEs the eastside story
15. Ayyagari, M., Beck, T., and Demirgüç-Kunt, A., 2007. Small and Medium Enterprises across the Globe. Small Business Economics 29, 415-434.
16. Balling M, Bernet B and Gnan E. Financing SMEs in Europe, SUERF-The European Money and Finance Forum, Vienna, 2009.
17. Financial Express, (February 27, 2015), Options in MSME financing.
18. Bebczuk RN. What determines the Access to Credit by SMEs in Argentina, Documento de Trabajo Nro, 2004, 16(1).
19. Dr. Ram Jass Yadav, Issues in SME Financing.
20. Beck, T. and Demirgüç-Kunt, A., 2006. Small and Medium-Size Enterprises: Access to Finance as a Growth Constraint. Journal of Banking and Finance 30, 2931–2943.



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### RESEARCH ARTICLE

## LE SURDOSAGE ET ACCIDENTS AUX AVK : ETUDE CAS TEMOIN : A PROPOS DE 400 PATIENTS

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#### Manuscript Info

##### Manuscript History

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##### Key words:-

AVK, hemorrhage, complication.

#### Abstract

**Introduction:** occurrence of bleeding is the most feared complication of warfarin and prevention remains a key concern in monitoring. The purpose of this study is to identify the characteristics of patients with severe accidents AVK and its management.

**Material and Methods:** We conducted a prospective study of 100 patients conducted in the cardiology department chu Mohamed VI in Marrakech from Mai 2014 to Mai 2016.

**Résultat:** The average age of our patients is 55 sex ratio of 1, 27. Atrial fibrillation was the main indication identified. Gastrointestinal bleeding origin was the most frequent in 60% of cases. The majority of patients experienced at least one bleeding risk factor: age in 30% of cases, the biological overdose of INR 80% of cases, drug interactions in 10% of cases of hypertension in 40 % of cases, cerebrovascular diseases in 13% of cases and the antecedent of bleeding in 10%. 60% of our patients did not have a good biological monitoring based INR default means. The emergency conduct was based on the cessation of AVK, the administration saw K, transfusion of packed red cells and fresh frozen plasma. The average hospital stay is 2 days

**Conclusion:** The prognosis The AVK is one of the most effective treatments. However, their handling is difficult and the risk of bleeding complications is present. The new oral anticoagulants offer another alternative.

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#### Introduction:-

L'intérêt clinique des antivitamines k (AVK) a été démontré dans de nombreuses situations pathologiques, leur prescription ne cesse d'augmenter. La survenue d'un saignement reste la complication la plus redoutée des AVK et la prévention demeure un souci essentiel dans le suivi.

Le but de cette étude est de préciser les caractéristiques des patients présentant des accidents graves aux AVK et sa prise en charge.

#### Matériels et méthodes:-

Nous avons réalisé une étude prospective portant sur 100 malades, réalisée au service de cardiologie chu Mohamed VI de Marrakech.

Du Mai 2014 au Mai 2016.

**Corresponding Author:- M. Ztati.**

Address:- Service de cardiologie CHU Mohammed VI Marrakech.

Pour chaque patient une fiche de recueil des données a été utilisée. Elle comprenait les données anthropométriques, les antécédents, l'indication et la dose de l'AVK, l'ancienneté de sa prescription et les traitements associés. Les paramètres biologiques recensés étaient principalement l'INR. Les résultats ont été analysés à l'aide du logiciel de biostatistique SPSS.

### Résultats:-

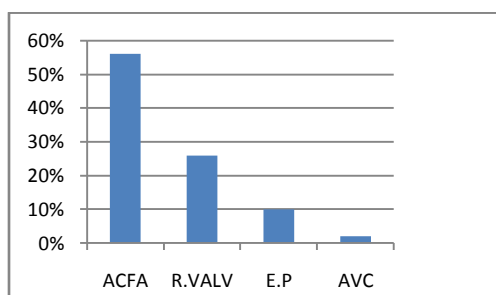
Sur 100 patients 44 hommes et 56 femmes soit un sexe ratio de 1,27 (femme/homme). La moyenne d'âge était de 55,6 ans, avec des âges extrêmes allant de 30 à 65 ans.

Leurs antécédents étaient variés:

**Tableau 1:-** Antécédents de nos patients

Antécédents	Pourcentage
Hypertension artérielle	46%
Insuffisance cardiaque	33%
Diabète	45,6%
Tabac	32%
Antécédents d'insuffisance rénale	4%

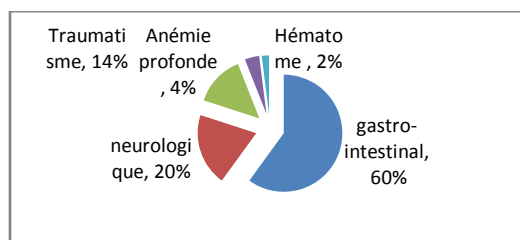
La fibrillation auriculaire était la principale indication recensée dans 56 %, Le remplacement valvulaire dans 26% des cas, l'embolie pulmonaire dans 10% des cas et l'AVC dans 8 % des cas.



**Figure 1:-** Les indications du traitement anticoagulant

70% des patients étaient poly médicamenteux au moment de l'accident. 20 % prenaient un ou deux médicaments et 10% n'en prenaient aucun.

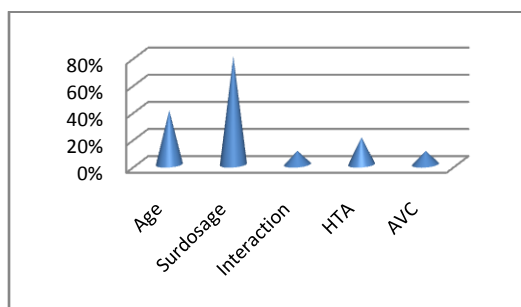
Le saignement par le tractus gastro-intestinal était le plus fréquent 60% mais d'autres motifs d'admission figuraient : Les signes neurologiques 20 %, le Traumatismes dans 14% ; l'anémie profonde 4 % et l'hématome de la paroi 2 %.



**Figure 2:-** Les étiologies du saignement

Dans 80 %, l'accident correspondait à une manifestation hémorragique, l'hémorragie était extériorisée dans 80 % des cas et interne dans 20 % restant. La dose moyenne de L'AVK était de 1/2 comprimé par jour, avec des extrêmes de 1/4 cp et 1cp 1/2. La durée moyenne du traitement était de 18 mois avec des extrêmes allant de 15 jours à 10 ans.

La majorité des patients ont présenté au moins un facteur de risque de saignement : l'âge dans 40 % des cas, le surdosage biologique de l'INR dont 80 % des cas, les interactions médicamenteuses dans 10% des cas, l'HTA dans 20% des cas, les pathologies cérébro-vasculaires dans 13% des cas et l'antécédent de saignement dans 15%.

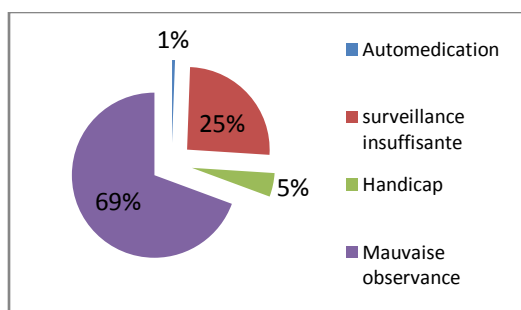


**Figure 3:-** facteur de risque de saignement chez nos patients

Évaluation du comportement du patient envers son traitement antivitamines K (AVK) :

Erreur par automédication chez 1 patient soit 1%, la non-respect d'un plan de prise fixe chez 30 de nos patients soit 20% des cas, Surveillance biologique insuffisante (moins d'une fois/mois) chez 44 de nos patients soit 24% des cas, Patients handicaps 8%.

60% de nos patients ne bénéficiaient pas d'une bonne surveillance biologique à base d'INR par défaut de moyen.



**Figure 4:-** comportement du patient envers son traitement

La conduite en urgence était basé sur l'arrêt des AVK, l'administration de vit K, la transfusion de culots globulaires et plasma frais congelé.

La durée d'hospitalisation moyenne est de 3 jours, avec des extrêmes de 2 à 10 jours.

50% des patients ont été transfusés par des culots globulaires, 40 % ont reçu des unités de plasma frais congelé et 80% ont reçu de la vitamine K.

**Tableau 2:-** Comparaison entre les cas qui ont présenté un accident hémorragiques et les patients du groupe témoin.

Caractéristiques des patients		Témoins (n=300)	Cas (n=100)	P value
Moyenne d'âge		55.9 ans	55.6ans	NS
Age>60 ans		21%	45%	0.033
Sexe		50%	44%	NS
• Homme :				
• Femme :		49%	56%	NS
FDRcx :		28,5%	45,6%	0.013
• Diabète				
• HTA		20%	46%	0,01
ATCD :				
• AVC		0%	13%	0.022
• Gastrite		4%	7%	NS

• IDM			1%		7%	NS
• IC			2%		5%	NS
• Embolie			1%		4%	NS
pulmonaire			4%		5%	NS
• Néphropathie						
<b>Indication des AVK :</b>			31%		26%	
• Valvulopathies						NS
• ACFA			60%		56%	NS
• Cardiopathie			5%		9%	NS
ischémique			4%		6%	NS
<b>Poly médication</b>			60%		57%	NS
<b>Bilan :</b>			80%		20%	<0.001
• INR Normal						
<b>SCORE</b>	<b>HASBLED-</b>		2		3	<0.001

### Discussion:-

Les accidents hémorragiques sous AVK sont des événements fréquents qui surviennent chez une population fragile.

L'incidence annuelle de ces complications varie selon les séries publiées entre 0,25 et 0,8% pour les complications mortelles, et entre 1,1 et 4,9% pour les accidents graves mais on a pu définir quelques facteurs de risque prédictifs de saignement durant notre étude, à prendre en compte au cours du suivi des patients sous traitement par les AVK(1).

Les facteurs de risque que les différentes études ont révélé et qui ont contribué à augmenter le risque de survenue des complications hémorragiques des AVK ne prennent pas en considération les pratiques professionnelles et le comportement du patient envers son traitement. Une évaluation de ces pratiques a été envisagée dans notre étude. Celle-ci s'appuie sur la validation des contre-indications, des doses, des interactions médicamenteuses, le suivi du patient de la part du médecin, l'intervention du pharmacien en cas d'erreur au niveau de l'ordonnance, ainsi que le comportement du patient envers son traitement(2,3).

Le sexe du patient n'intervient pas dans la survenue des accidents des AVK. La nette prédominance féminine concorde avec d'autres études; alors que les statistiques européennes sont tout à fait contraire: prédominance masculine pour Costecalde et coll.(4) L'âge avancé est un facteur sensibilisant à l'action des AVK.

Le risque d'accident hémorragique est trois fois plus fréquent dans la population de plus de 70 ans (5,6°

La prescription des AVK doit tenir compte des contre-indications absolues et relatives qui tiennent au terrain et à l'état digestif hépatique est rénal. Berrutti, dans son étude portant sur 151 accidents hémorragiques dus aux anticoagulants a mis en évidence; Une HTA dans 27 cas; Un diabète et un éthyisme chronique dans 7 cas respectivement(7,8).

L'éducation constitue alors une étape majeure pour l'amélioration de l'observance et des connaissances des patients : un patient connaissant son traitement sera plus enclin à respecter la prescription (9). Cette stratégie demeure sans doute pertinente du fait qu'elle réduit la probabilité de survenue des hémorragies (10) et, par suite, réduit le coût d'hospitalisation pour événements iatrogènes médicamenteux

Un score HAS- BLED  $\geq 3$  indique que le patient a un risque élevé d'hémorragie (11). Blas.-Châtelain C, et al rapportent que le risque d'hémorragie grave est 3,9 fois plus élevé lorsque le score HAS-BLED est supérieur ou égal à 3 (11). Les données retrouvées dans notre étude corrélaient ainsi les données de ces articles : La moyenne de HAS BLED est de 3 chez le groupe des cas contre 2 chez les témoins, avec une p value très hautement significative (<0.001). La mauvaise observance du traitement varie selon les études de 10 à 26% (12). Et selon plusieurs auteurs, elle serait associée à une augmentation du risque hémorragique. Dans notre étude, elle représentait la principale cause des saignements, retrouvée chez 69% des cas. L'hémorragie d'origine gastro-intestinale constitue la complication la plus fréquente de notre série avec 60%, ce qui rejoint les données de la littérature avec des

pourcentages plus importants. C. Blas. Châtelain et ses collaborateurs rapportent 50% de complications hémorragiques digestives (11). Dans une autre étude, hémorragiques digestives représentaient 60% de l'ensemble des complications hémorragiques (13).

### Conclusion:-

Les AVK sont utilisés depuis plus d'un demi-siècle dans la prévention des accidents thromboemboliques et sont l'une des thérapeutiques les plus efficaces. Cependant leur maniement est délicat et les risques de complications hémorragiques sont très présents. Les nouveaux anticoagulants oraux offrent une autre alternative.

### Reference:-

1. RA O' Reilly. Piccin. 2000. Pharmacologie fondamentale et clinique (7<sup>ème</sup> édition) pp. 570–4. Médicaments utilisés dans les troubles de la coagulation
2. Agence française de sécurité sanitaire des produits de santé (AFSSAPS); 2001. Janvier
3. Piccin. 2000. Pharmacologie fondamentale et clinique (7<sup>ème</sup> édition) pp. 570–4. Médicaments utilisés dans les troubles de la coagulation
4. Gitter MJ, Jaeger TM, Petterson TM, Gersh BJ, Silverstein MD. Bleeding and thromboembolism during anticoagulant therapy: A population-based study in Rochester Minnesota. Mayo Clin Proc 1995;70:725–33.
5. Launbjerg J, Egeblad H, Heaf J, et al. Bleeding complications to oral anticoagulation therapy: Multivariate analysis of 1010 treatment years in 551 outpatients. J Intern Med 1991;229:351–5.
6. The stroke prevention in atrial fibrillation investigators. Bleeding during anti-thrombotic therapy in patients with atrial fibrillation. Arch Intern Med 1996;156:409–16.
7. Penning-van Beest FJ, Van Meegen E, Rosendaal FR, et al. Characteristics of anticoagulant therapy and comorbidity related to over anticoagulation. Thromb Haemost 2001;86:569–74.
8. Levine MN, Raskob G, Landefeld S, Kearon C. Hemorrhagic complications of anticoagulant treatment. Chest 2001;119:108S–21S.
9. Fihn SD, Callanhan CM, Martin DC, McDonnell MB, Henikoff JG, White RH. The risk for and severity of bleeding complications in elderly patients treated with warfarin. The National consortium of anticoagulation clinics. Ann Intern Med 1996;124:970–9.
10. Siguret V, Esquirol C, Debray M, Gouin I, Andreux JP, Pautas E. Surdosage en antivitamine K dans une population de patients hospitalisés âgés de plus de 70 ans : enquête prospective sur un an. Presse Med 2003;32:972–7.
11. Tremey B, Tazarourte K, Ract C, Gabteni M, Lavagna L, Dépret-Vassal J, et al. Teaching improves adherence to clinical guidelines in the treatment of oral anticoagulation related severe bleeding in the Emergency Department. ESICM J 2009;35:1444-8. 12-Suzuki M, et al. Improvement of HAS-BLED bleeding scores predictive capability by changing the definition of renal dysfunction in Japanese atrial fibrillation patients on anticoagulation therapy. J Cardiol 2014;876:421-510.
12. Boston Area anticoagulation Trial for Atrial Fibrillation Investigators. The effect of low dose warfarin on the risk of stroke in patients with non-rheumatic atrial fibrillation. N Engl J Med 1990; 323:1505-11.

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## RESEARCH ARTICLE

### ACUTE INVERSION OF UTERUS.

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uterine inversion, AMTSL, Shock,  
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#### Abstract

Complete inversion of uterus after delivery of the baby is always the consequence of strong traction on umbilical cord attached to the placenta implanted in the fundus. With AMTSL the incidence is decreasing. In this article we discuss about a 21 yrs primi who was referred as uterine inversion to our tertiary care centre in a state of shock. The prompt resuscitative measures with hysterectomy done at appropriate time saved the patient's life.

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#### Case Report:-

A 21 yrs primipara delivered an alive term female baby of birth wt - 2.9kg by labour natural on 15.09.11 at 9.00pm at PHC. Referred from peripheral hospital as inversion of uterus at 9.50pm. Patient was received on 16.09.11 at 1.30am – 4 1/2hrs after delivery. Patient was in a state of shock. On examination patient was unconscious with peripheral pulses absent, BP not recordable, carotid felt, heart sounds muffled. P/A – Uterus was not palpable per abdomen. L/E – entire uterus with placenta lying outside the introitus, bluish black in color. Simultaneous resuscitation with Nasal O<sub>2</sub>, IV crystalloids, O+ve blood transfusion, Dopamine drip and Endotracheal intubation done in labour ward. Under GA in OT repositioning of uterus done after removing placenta. Endometrium blackish color. 20 units synto drip, iv methergine, im prostadin given. Uterus was atonic. Decision for Laparotomy was taken. Uterus was flabby intraoperatively. Conservative surgical management failed. Proceeded with hysterectomy. 3 units of whole blood and 2 units FFP transfused. Patient shifted to IRCU for ventilatory support. Post operatively one unit FFP given. Treated with Inj. Piperacillin + Tazobactam 4.5g iv tds. Suture removal done on 8<sup>th</sup> POD. Wound healthy. Discharged on 28/9/11. Investigations revealed normal LFTs, Blood sugar, urea and creatinine.



### Discussion:-

#### Govt. Rajaji Hospital, Madurai Statistics:-

YEAR	2001	2002	2003	2004	2005	2006	2007	2008	2009
INCIDENCE	5	1	4	6	5	2	3	1	4

Totally 32 cases reported – all were referral cases. There was an average of 12000 deliveries per year in this period of observation. Incidence of MMR depend on the time interval between delivery/inversion and resuscitation with repositioning. Between 2009-2010 - 3 cases of death occurred. 2 cases died due to neurogenic shock, 1 case cause of death was uremic encephalopathy. Patient died after 40 days. This case of acute inversion of uterus is presented as unique in the sense that after 4 hrs of delivery and inversion, patient survived.

**Contributing factors for uterine inversion** are uterine atony ,improperly applied pressure over fundus, traction of umbilical cord, placenta accreta , parenteral  $MgSO_4$  in women with PIH. Uterine inversion is most often associated with shock disproportionate to the blood loss. It is fatal without prompt treatment and delay in treatment increases mortality. The degrees of inversion are 1° – Dimpling of the fundus, 2° – Fundus passes through internal os, 3° – Uterus at introitus. Simultaneous resuscitation with two intravenous infusion system, iv fluids and cross matched blood and if placenta is attached, it can be removed and then repositioning of the uterus done. Portion of the cervical canal that is the last to come down is to be replaced first and the fundal portion the last. Simultaneous oxytocics to contract the uterus should be given. Conservative methods used are Huntington, Kellog and Haultain method. When conservative management fails hysterectomy is done as life saving procedure as in this case.

### Conclusion:-

AMTSL is preventive against acute inversion of the uterus. Training to VHN, Maternity assistants and Staff nurses should be given about proper care in the conduct of 3<sup>rd</sup> stage of labour and to avoid injudicious traction on the cord, applying pressure over fundus, forcible expression of non-separated placenta. Thus uterine inversion is an obstetric complication that, due to its gravity, requires a rapid diagnosis and immediate clinical action. Its low incidence leads to scarce experience in solving this kind of situation. Regardless of the treatment, vaginal or surgical approach, the best prognosis occurs in situations when the diagnosis and maneuvers for uterine reversal are made early.

**References:-**

1. Dwivedi S, Gupta N, Mishra A, Pande S, Lal P: Uterine inversion: a shocking aftermath of mismanaged third stage of labour. Int J Reprod Contracept Obstet Gynecol. 2013, 2 (3): 292-295. 10.5455/2320-1770.ijrcog20130907
2. Hostetler D, Bosworth M: Uterine inversion, a life-threatening obstetric emergency. J Am Board Fam Med. 2000, 13 (2): 120-123. 10.3122/15572625-13-2-120.
3. Adesiyun A: Septic postpartum uterine inversion. Singapore Med J. 2007, 48: 943
4. Uterine inversion - Better Health Channel; State of Victoria, Australia; accessed 2009-04-03
5. Hussain M, Jabeen T, Liaquat N, et al; Acute puerperal uterine inversion. J Coll Physicians Surg Pak. 2004 Apr;14(4):215-7





## RESEARCH ARTICLE

### A STUDY ON MSME PROFITABILITY IN CONNECTION WITH POOR MARKET LINKAGE

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#### Abstract

MSME is the most developed sector in India. It contributes the growth in GDP. This article is mainly concerned with micro, small and medium enterprises (MSMEs) and its market linkage based on their profitability. MSME plays a crucial role to India to generating employment and contributing to regional economic growth. It gives opportunity to rural people those who have minimum capital to invest in small business and make earnings on the daily or weekly basis. To start MSME, the people should utilize all the optimum resources available in their place. This paper presents the consequences the MSME faced by to get linkage with top companies. The level of profitability should lead linkage with other companies. This article gives brief idea about the MSME and importance of their market linkage.

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#### Introduction:-

In India MSME plays a vital role in the economic development of the nation by contributing 11.5% of GDP consistently every year. It is a stimulus for the socio economic transformation of the society not only by generating employment opportunities in both rural and urban areas of the country but also by promoting rapid industrialization in the country to the length and breadth of the country eliminating regional imbalances. The sector identification and the requirements of the area and utilization of the available resources locally to reduce the cost of production is the most important factor of this sector. It helps a lot to prevent poverty and rural migration to towns in search of employment.

The Sector consisting of 36 million units, as of today, provides employment to over 80 million persons. The Sector through more than 6,000 products contributes about 8% to GDP besides 45% to the total manufacturing output and 40% to the exports from the country. The MSME sector has the potential to spread industrial growth across the country and can be a major partner in the process of inclusive growth.

#### Objectives:-

1. To understand the impact of poor profitability of poor market linkage
2. To overall study of the relevance of MSME in Indian economy
3. To general study about MSME and helps to contribute our GDP
4. To review the challenges to be faced by MSMEs in India

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**Understanding msme:-****Understanding MSME:**

'The MSME Act 2006' modifies the definition of MSME in India. Under the said Act, the sector is broadly classified into two parts, manufacturing and service. The unit is identified based on investment made as shown in the following table.

	<b>MANUFACTURING UNIT</b>	<b>SERVICE UNIT</b>
A micro enterprise	Investment in plant and machinery does not exceed Rs.25 lakhs	Investment in equipment's does not exceed Rs.10 lakhs
A small enterprise	Investment in plant and machinery is more than Rs.25 lakhs but does not exceed Rs.5 crores	Investment in equipment is more than Rs.10 lakhs but does not exceed Rs.2 crores
A medium enterprise	Investment in plant and machinery is more than Rs.5crores but does not exceed Rs.10 crores	Investment in equipment is more than Rs.2 crores but does not exceed Rs.5 crores

**Micro Small Medium Enterprise Development (MSMED) act definition of MSME:-**

<b>Initial Investment in Plant and Machinery (in INR Million)*</b>			
<b>Category/ Enterprise Size</b>	<b>Micro</b>	<b>Small</b>	<b>Medium</b>
<b>Manufacturing</b>	<2.5 (<50,000)	2.5 – 50 (50,000 – 1 Million)	50– 100 (1 Million – 2 Million)
<b>Services</b>	<1 (<20,000)	1 – 20 (20,000 – 0.4 Million)	20– 50 (0.4 Million – 1 Million)

*\*Figures in brackets are in USD: Source: MSMED Act*

As per the private financial institutions in India, the internal definition of MSME can be explained with the help of the following table.

**Internal Definitions used by Private Financial Institutions (Indicative):-**

<b>INTERNAL DEFINITIONS USED BY BANKS FOR MSME</b>						
<b>ENTERPRISE SIZE</b>	<b>MICRO</b>		<b>SMALL</b>		<b>MEDIUM</b>	
<b>Institution Type</b>	<b>Turnover(INR Million)</b>	<b>Credit Size (INR Million)</b>	<b>Turnover(INR Million)</b>	<b>Credit Size (INR Million)</b>	<b>Turnover (INR Million)</b>	<b>Credit Size(INR Million)</b>
<b>Private Commercial Banks</b>	1.5-50 (30000-1 million)	0.2-1 (4000-20000)	50-200 (1 million-4 million)	5-150 (0.1 million - 3 million)	200-2000(4million-40 million)	50-200(1 million -4 million)
<b>Non-banking financial companies</b>	0.05-1 (1000-20000)	1-5 (20000-0.1 million)	5-25 (0.1 million- 0.5 million)	0.3-5 (6000-0.1 million)	10-1000 (0.2million-20 million)	2.5-50 (50000-1 million)

**Source:** Primary Research

However, all should use the official definition given by the MSMED Act for reporting purposes.

**Online Indian MSME's finance providers:-**

In India, only less number of players are there who provide money to MSME through online. The online startup have shown interest towards starting new business. The finance service providers collectively have disbursed loans worth INR ~ million in 2015. Some companies launched their operations in 2015. The online market for MSME finance in India has seen presence of players such as Faircent, Indifi technologies, Leading kart, ME Corner, Capital Float, Mandii.com and others.

**MSME's in India: challenges and opportunities:-**

The MSME is a highly unorganized sector even though it highly contribute in multiple ways towards the economy. Being a highly unorganized sector with fragmented nature of reach, the sector has always been a laggard in enjoying the full flow of Government policies and financing company's empathy and understanding. In order to understand the obstacles ; probable steps to be taken to exploit the opportunities offered by MSMEs, lets discuss the details of the working dynamics of MSMEs as under:

**Shortage of finance and credit instruments:-**

Finance is the major constraints of all the business especially it is very high in MSME. Most Indian MSMEs start out with minimal capital, which eventually stalls their growth after a certain point. The lack of easy credit tends to stagnate the growth of MSMEs, which in turn affecting generic growth in terms of GDP, import, export and employment. Unavailability of credit at the right time can also affect business growth at many seals leading to many small businesses shutting shop due to inadequate margins. Some major problems that approximately 80% MSME Entrepreneurs face on a day-to-day basis while trying to obtain credit assistance for their business operations are:

1. Need more collateral security to get loan
2. Import Export cost
3. To obtain of Private Equity Funding is difficult
4. Banks offer high rates for term loans
5. Private equity (PE) dilutes control in the company
6. Un-standardized project appraisal system for term loans

**Complicated Regulatory Policies for Starting a Business:-**

India is ranked at 130th position out of 189 countries who participated in the World Bank's Ease of Doing Business Ranking primarily due to unfavorable business climate for its enterprises, especially the MSMEs. India is full of regulatory policies like taxation, dealing with construction permits, registering property, enforcing contract, resolving insolvency, etc. Indian MSMEs are weighed down by inflexible and complicated regulatory policies like Owing to this prohibitive business climate, this leads to many innovative entrepreneurs and are not able to enter the markets or sustain a business. The following points show a breakdown of how inflexible regulatory policies affect the functioning of MSMEs :

1. Absence of a common regulatory body
2. Procedures of setting up business is complicated
3. Less special schemes for start-ups
4. Book keeping regulations is difficult

**Unavailability of modern, affordable technology:-**

In a present competitive business environment, the need to align people processes and technology is stronger than ever. Latest technology can help enterprises reduce cost and time taken to innovate and offer sophisticated products and services. To adopting new technology, helps to MSMEs differentiate from peers, optimize cost structures and most importantly compete on a global level. However, MSMEs in India face struggles because of accessing and using the latest technological advancements. While knowledge, access and funds continue to implementation of technology, absence of an ecosystem that enables technology transfer and interaction with experts is a critical reason of limited adoption. The absence of a common platform for interaction with technology providers continues to be the most critical challenge faced by MSMEs in this area. The below mentioned are the key reasons why MSMEs fail to adopt latest technology to innovate and transform their businesses.

1. MSME have less number of linkage so there is less interaction between tech providers and seekers
2. Ecosystem for technology transfer is absence
3. To Access modern technology is expensive

4. MSME have only minimum knowledge about upcoming technologies
5. Unavailability of e-Governance systems
6. Lack of effective information systems
7. Limited funds to support Innovation and R&D

**Lack of basic infrastructure facilities:-**

Adequate and modern infrastructure powers is the emerging growth of a nation's economy. The absence of proper infrastructure can cause serious problems to an enterprise's daily business operations of manufacturing, consumption, and distribution of goods and services. It affects businesses at every level and ends up being a warning to healthy growth. The following reasons are the major consequences of the infrastructure facilities.

1. Lack of electricity resources
2. Inadequate supply of water
3. Lack of facilities like customized warehouse
4. Insufficient methods of industrial waste management
5. Inadequate cluster infra reducing competitiveness
6. Lack of reliable electricity resources
7. No minimum price for power fixed for MSME
8. Volatility in prices of basic fuels

**Absence of exclusive marketing platforms and distribution networks:-**

The nature of marketing changes the habits of customer. With consumer, habits changing rapidly it leads to competition from both local and global brands, market dynamics and customer loyalties are in a state of flux. While offering best-in-class products and services, enterprises also need to enhance the quality of customer interaction at each opportunity. Enhancing customer engagement is not a matter of choice anymore and to succeed, Market intelligence, tools and well-trained workforces are required to respond these external pressures. The below mentioned are the key reasons why domestic MSMEs in India are unable to approach marketing and distribution effectively.

1. Lack of monetary support/schemes
2. Knowledge about digital marketing is less
3. Limited expertise in new-age marketing
4. Less aware of technology for marketing
5. Not enough trade fairs and buyer-seller meets
6. Due to lack of networks losing to large competitors

**Inflexible labour laws and availability of affordable skilled labour:-**

Indian MSMEs employ 40% of the country's workforce, making them the employment powerhouse of the country. However, India today faces the big challenge of outdated labour laws that are still in use. Bigger organizations like Maruti too have faced labour problems in the recent past. This leaves many MSMEs struggling with problems of culture and scale and not being able to meet their workforce demands. A labour law reform overhaul is required to regulate large influx of workforce, which will enter the working landscape. The following points highlight some of the key issues that enterprises face related to workforce:

1. Retaining talent due lack of ability to pay
2. Low productivity of labours
3. Common minimum wage policies
4. Lack of skilled workers

Nonetheless, the sentiments towards Micro, Small & Medium Enterprises is growing positive, putting them back in the spotlight. There is an expectation that their growth would be much faster over the next few years. However, the companies, which would emerge winners, would need to find a way around to leverage their strengths and remain ahead of intense competition. The use of technology to progress a competitive advantage would be key defining point to look out for having access to the right talent, adequate sources of funding will develop a 'value proposition', which embeds itself into the journeys of improving customers experience and benefit for the country as a whole. This has to be supported by a defined framework and deft handling of the challenges of MSMEs in India.

**Different types of ownership and Growth impacted by multiple constraints:-**

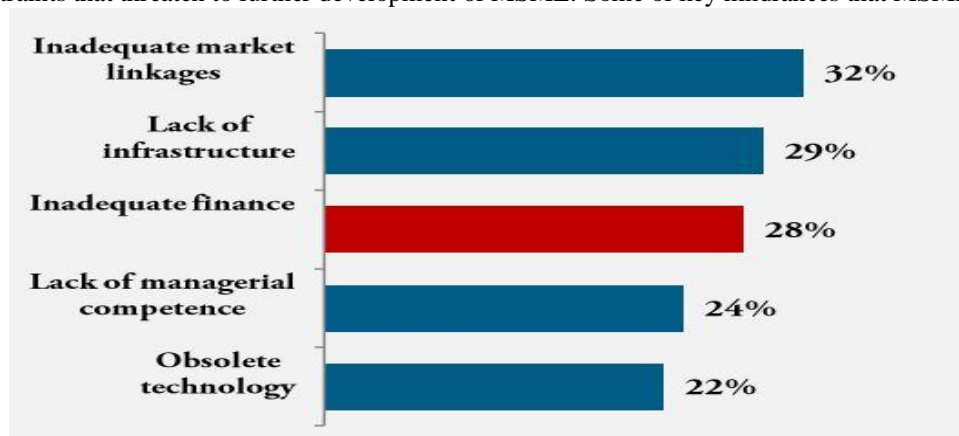
There are more than five types of ownerships in MSMEs in India. Among them proprietorship of business is common (94.5%) whereas the rest all-together only 5.5%.

**Ownership Structure of Enterprises in the MSME Sector:-**

Ownership Structure in the Sector	
Type of Structure	Share of MSME Enterprises
Proprietorship	94.5%
Partnership, Cooperatives	1.2%
Private Limited, Public Limited	0.8%
Others	3.5%

Source: MSME Census

Although the MSME sector has been growing at a faster rate than the overall industrial sector, MSMEs experience multiple constraints that threaten to further development of MSME. Some of key hindrances that MSMEs face



Source: Report of working group on rehabilitation of MSMEs RBI

**Lack of infrastructure:-**

Inadequacy of infrastructure such as power, water and roads upsurges operating costs for MSMEs and marks their businesses uncompetitive. Insufficient access to backing of infrastructure dejects these units from implementing newer technologies, where available.

**Inadequate finance:-**

MSMEs ponder encounters in accessing finance as one of the biggest constrictions in growth. Various researches on the MSME sector also proposes that the multiple growth constraints can be mostly related to insufficient access to finance.

**Lack of managerial competence:-**

Micro and small enterprises in particular largely comprise first-generation entrepreneurs, who have had a limited structured training on resource planning, capital management and labour management.

**Outdated technology:-**

While large industries like automotive, forging, software development sector want cutting-edge expertise in operations, the majority of the small and medium enterprises are lacking the same. A low technology base outcome in low productivity, which makes these initiatives not reasonable in nature.

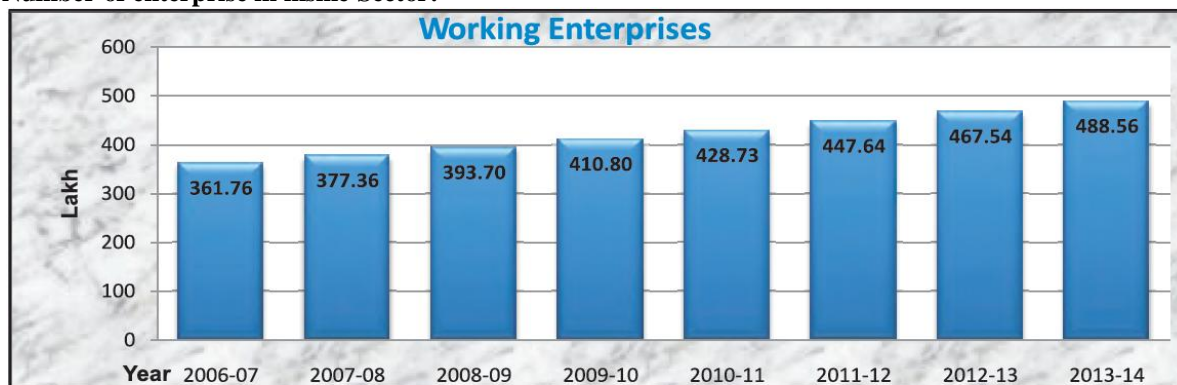
**Inadequate market linkages:-**

Other than cluster-linked and ancillary MSMEs that have natural linkages with large enterprises, MSMEs are having poor market access. The poor market linkage leads to poor profitability of MSME and hence, are unable to shape themselves to compete with the market in order to reduce purchase cost from large enterprises or reorganize the retail chain.

**Msme profitability:-****Performance of MSME, Employment and Investments:-**

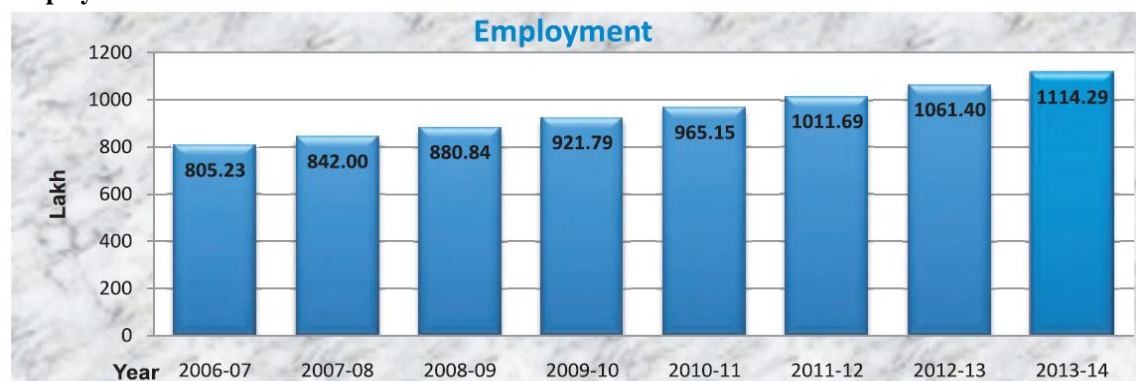
As per the results of Fourth All India Census of MSME, the sector contributes significantly to the number of enterprises, employment and output of the country. Based on the data sets of Fourth All India Census of MSME, augmented with data sets of EC, 2005 and growth rate observed during Fourth (1998) and Fifth (2005) Economic Census, the performance of MSME.

S.No	Year	Total Working Enterprises(in lakh)	Employment (in Lakh)	Market Value of Fixed Assets(Rs.in Crore)
I	II	II	III	IV
1	2006-07	361.76	805.23	868,543.79
2	2007-08	377.36	842.00	920,459.84
3	2008-09	393.70	880.84	977,114.72
4	2009-10	410.80	921.79	1,038,546.08
5	2010-11	428.73	965.15	1,105,934.09
6	2011-12	447.64	1,011.69	1,182,757.64
7	2012-13	447.54	1,061.40	1,268,763.67
8	2013-14	488.46	1,114.29	1,363,700.54

**Number of enterprise in msme Sector:-**

Projected data for the years 2007-08 to 2013-14



**Employment in MSME Sector:-**

Projected data for the years 2007-08 to 2013-14.

**Fixed investment in MSME Sector:-**

Projected data for the years 2007-08 to 2013-14.

**Interpretation:-**

As per the above given data it has been shown a gradual increase in context of performance of MSME, employment and investments from the dated year 2006-2014. In the year, 2006 the total working enterprises was Rs.361.76 and in 2014 was Rs. 488.46 so the difference seen was Rs.126.7. In Employment in the year 2006, it was Rs.805.23 and in 2014, it was Rs. 1,114.29 so the difference seen was Rs. 309.06. In Market Value of Fixed Assets in the year 2006, it was Rs. 868,543.79 and in 2014, it was Rs. 1,363,700.54 so the difference seen was Rs. 4,95,156.75.

**Contribution of manufacturing output of msme in GDP:-**

Year	Gross Value of Output of MSME Manufacturing Sector (in crore)	Share of MSME sector in total GDP (%)		Share of MSME Manufacturing output in total Manufacturing Output (%)	
		Manufacturing Sector MSME	Services Sector MSME	Total	
2006-07	1198818	7.73	27.40	35.13	42.02
2007-08	1322777	7.81	27.60	35.41	41.98
2008-09	1375589	7.52	28.60	36.12	40.79
2009-10	1488352	7.45	28.60	36.05	39.63
2010-11	1653622	7.39	29.30	36.69	38.50
2011-12	1788584	7.27	30.70	37.97	37.47
2012-13	1809976	7.04	30.50	37.54	37.33

**Interpretation:-**

The above given data shows the Contribution of Manufacturing output of msme in GDP from the dated year 2006-2013. In the year 2006 Gross value of output of msme manufacturing sector was Rs. 1198818 in 2013 Rs. 1809976 so the difference seen as Rs. 6,11,158. In Share of MSME sector in total GDP (%) in the year 2006 Manufacturing Sector MSME shows 7.73% but in the year 2013 it has reduced to 7.04% and Services Sector MSME in the year 2006, 27.40% and in the year 2013 30.50%. It shows a gradual increase in every year. So comparing both Manufacturing and Service Sector it was 35.13% in 2006 and in 2013 37.54% has been increased. Share of MSME Manufacturing output in total Manufacturing Output (percentage) was noticeable declining in the year 2013 compared to the year 2006

**Market linkage:-**

Market Linkage is a word give the real success essence to the MSME. It helps to connect the medium level business to top level where the medium enterprise can get various linkage. The objective of the market linkage is an attempt to combine the strengths of value chain analysis with the promotion of sustainable, market-based solutions that respond to the recurrent needs of micro, small, and medium scale enterprise (MSME). Market linkage is essential in understanding market potential, inter-firm relationships, and critical constraints that limit MSME growth and industry competitiveness, while market based, commercially viable solutions can result in solutions that are sustainable in the end and that do not distort local markets.

**Market linkage requires effective value chain to sustain:-**

**Step 1:** Value Chain Selection– Choose a value chain with the greatest potential for growth in MSME income and employment.

**Step 2:** Value chain Analysis – Gain a greater understanding of the operating context for MSMEs and intelligence on the market players, their roles, and interrelationships.

**Step 3:** Identification of obstacles and opportunities – Appropriately identify key issues hindering growth and competitiveness in the value chain.

**Step 4:** Identification of (Potential) Market linkage – Determine which sources can best address the obstacles identified in Step 3.

**Step 5:** Selection of suitable Market linkage Solutions – Target specific market-based solution(s) for more in-depth analysis.

**Step 6:** Assessment of Targeted Market-Based Solutions – Recognise limitations to the viable supply/demand of the battered solution.

**Step 7:** Identification of Enabling Activities – Appropriately identify various activities helps to address the constraints of the target market based solution.

**Step 8:** Selection of Easing Activities – Choose the most suitable facilitation activities to implement.

**Msme Financing & Strengthening Msme linkages:-**

1. India MSME units is 25% are presented in East and North - Eastern region. It was contributing GDP of 13% for our country. All are micro enterprises. The recent statistics say 4259 MSME clusters, 1086 industrial cluster and 2682 handicraft clusters in the Eastern and North Eastern region of India.
2. To develop MSME, the Indian government to conduct various programs like, Credit Guarantee Scheme, yet new MSME application registration has remained very low in the Eastern and North Eastern region compared to the Southern and Western side of the country. The rating coverage has not spread across this region properly.
3. Except west Bengal the regional imbalance, inadequate infrastructure, low income statistics dependence on agriculture are counted to be the major hindrance for the growth of MSME units in the region
4. The MSMEs faced problems like, non-availability of timely and adequate credit at reasonable interest rate is one of the barriers for growth of MSMEs, so the first generation entrepreneurs are not access to credit at reasonable interest rate. The high risk perception of the banks in lending to MSMEs and it is difficult for the micro and small entrepreneurs to set up new business or expand the existing one.
5. Tax submission of Micro and small enterprises has been very poor in India. Because of the high tax rates and complex filing procedures to lead crucial factor to MSME.
6. The Reduction of tax rate on the MSMEs to provide enough fund for expansion and better survival of MSMEs in viable market. The entrepreneurs need to engage to increase in tax exemptions and tax holidays. Therefore, those initiatives will also eventually attract investors who are potential taxpayers in future.



7. The upcoming entrepreneurs need more update in the modern technology in packaging to increase the product competitiveness not only in domestic market, but also in international market. The technology up gradation leads to good linkage in domestic as well as international market.
8. The MSME earning level is very low so they do not reveal their financial pattern. Therefore, it leads to limited transparency between bank and the entrepreneurs to establish direct linkage between banks the MSME entrepreneurs.
9. Technology and IT services play a vibrant role for the growth of MSMEs. Most of the investments are currently done in traditional technology, but they should follow the new trends to expand the technology. Investment should rise in R&D, particularly in areas of emerging technologies including mobility, data analytics and cloud computing to improve the core business.
10. Creation of social entrepreneurs is preferred to encourage e-commerce among rural consumers. There lies a possible market for e-commerce in rural areas, which can be explored by undertaking certain policy initiatives and using modern technological tools.
11. The high constraints of MSME units in the form of land acquisition, availability of power, transport, logistics, credit disbursal, skilled labor, adequate marketing initiatives and issues in taxation. The essential issues should be addressed by the government for the growth of MSMEs
12. Absence of innovative initiatives and interest among people are counted as the major reasons for this region to lag behind. They have to support awareness among youth about entrepreneurship and they need to be encouraged.

### Conclusion:-

Micro, Small and Medium Enterprises (MSMEs) contribute to economic development in various ways such as creating employment opportunities for rural and urban population, providing goods & services at affordable costs by offering innovative solutions and sustainable development to the economy as a whole. The MSMEs continue to struggle on proper market linkage. In present scenario government frame many policies that will give benefit to the MSME to earn minimum profit and the policies. However, it is not enough to getting linkage with blue chip companies. The companies initiate to give some orientation to MSME's and lead to successful linkage. While credit and finance issues challenge some, others are struggling to cope with stringent regulatory environments. The role and importance of MSME sector in the vital growth. The problems MSMEs face which also become the reason for slow-paced growth of this sector and these have been detailed in the paper. In a close, this paper has tried to offer some suggestions to overcome those challenges and offer a ray of hope for the MSME sector in India.

The need for enterprise to increase market coverage, improve operational efficiencies and enhance customer engagement is imperative. However, this requires readiness on two accounts-the company and government regulation and policies, including MSME special programs, initiatives and funds.

### Reference:-

1. Aliyu mukhtar shehu and Rosli mahmood, August (2014) The Relationship between Market Orientation and Business Performance of Nigerian SMEs: The Role of Organizational Culture, International journal of business and social science, School of business management, Malaysia.
2. World Bank (1994) Industrial Structures and the Development of Small and Medium Enterprise Linkages: Examples from East Asia, Meyanathan, EDI Series, World Bank
3. FICCI-CMSME(Aug 19,2014)MSME Definition in India: The Present State and the imperatives
4. Government of India MSME:MSME at a Glance 2016
5. Dr.Mukund Chandra Mehta,2<sup>nd</sup> International Conference on Management, Humanity and Economics(2013) kuala Lumpur (Malaysia), Challenges and Opportunities in Micro, Small and Medium Enterprises in India
6. IFC(International Finance Corporation) World Bank Group (Nov 2012) MSME A Research Study On Need, Gaps and Way Forward.
7. Prof. Mishu Tripathi.Mr.Saurabh Tripathi,Mr.RikinDedhia,International Journal Of Science Technology and Management (march 2016), Challenges Faced by Micro,Small and Medium Enterprises Sector in India.
8. Government of India, Ministry of MSME, Annual Report(2014-15)
9. Brij Raj. Challenges in SME financing. Developing alternative financing source. Skoch Development Foundation
10. Pankaj Trivedi, K.J.Somaiya Institute of Management Studies and Research, Mumbai, 12th AIMS International Conference on Management: Strategy for Profitable Growth through MSME Lending by Indian Banks.

11. Development Commissioner MSME, Ministry of Micro, Small & Medium Enterprises (2014-15) Entrepreneurs Memorandum (Part II) Data On MME Sector
12. Department of Agriculture, Forestry & Fisheries, (Oct 2012): Linking Procedures to market programme
13. Sylvia S. Temu & Esther K. Ishengoma, Indian Journal Of Economics & Business (June 2010): Financial Linkages and Performance of Rural Microfinance Cooperatives: Tanzanian case
14. Jayne Bisman & Neelam Goela, Indian Journal Of Economics & Business (December 2010): The Small Industries Development Bank of India: A Retrospective on SME Financing
15. Dossani, & Kenney, M. (2002), creating an environment for venture capital in India. World Development, 30(2), pp. 227-253



### RESEARCH ARTICLE

#### RISK OF OBSTRUCTIVE SLEEP APNEA IN PATIENTS WITH TYPE 2 DIABETES MELLITUS.

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##### Key words:-

Diabetes, obstructive sleep apnea.

#### Abstract

**Introduction:** Many studies provided a positive relationship between Obstructive sleep apnea and diabetes mellitus type2. It has been revealed that almost one third of middle aged Saudi papulation are at risk for OSA. The aim of this study is to compare the risk of OSA between diabetic patients and non-diabetic middle aged Saudi population.

**Materials and Methods:** This was a cross-sectional questionnaire-based study conducted in King Fahad hospital diabetes center in AL-Ahsaa, Saudi Arabia. Saudi patients aged 18 years and above with diabetes type 2 who visited the outpatient clinics in July and august 2015 where engaged in the study. Medical records were reviewed for demographic characteristics, weight, height, body mass index (BMI), blood pressure, glycated hemoglobin, and chronic medical conditions. Berlin questionnaire was used to assess the risk of OSA.

**Results:** Based on berlin questionnaire, 45 out of 147 of sample (30.6%) are at high risk for OSA. 43.4% who have hypertension in high risk of OSA. Also, 33% of patients with BMI above or equal 25 are in high risk for OSA. There is no significant relation between age, gender and HA1C. Contrariwise, there is significant relation between presence of HTN and BMI above or equal 25 with increased risk for OSA.

**Conclusion:** Hypertension, overweight and obesity contribute in high risk of OSA in diabetic patients. There is no difference between diabetic patients and middle aged Saudi population regarding the risk of OSA.

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#### Introduction:-

Obstructive sleep apnea (OSA) is defined as intermittent cessation of breathing during sleep due to episodic collapse pharyngeal air way. The severity of OSA is usually determined using apnea-hypopnea index (AHI) which measures the number of apneic and hypopneic events per hour of sleep. The prevalence of this disorder among middle-aged American population is 24% for men and 9% for women. Unfortunately, the available data about OSA prevalence in Saudi Arabia is not sufficient but it has been revealed that the prevalence of OSA risk and symptoms among middle aged Saudi men and women is 30% and 40% respectively. [1,2]

Obesity, male gender, aging, metabolic disorders such as hypothyroidism and structural abnormalities of the upper airway including (nasal polyps, enlarged tonsils, adenoids and others) are predisposing factors for OSA. Obesity is

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present in 70% of OSA patients which indicate that it's one of the most important risk factors. Age of 65 and older has 2-3 folds higher prevalence of OSA than middle age population. [1,3]

Obstructive sleep apnea has a negative impact on the quality of life and is also associated with cardiovascular disease, stroke, hypertension, motor vehicle accidents and the development of diabetes. [1,4]

Many studies provide a positive relationship between Obstructive sleep apnea and diabetes mellitus type2. 70% to 90% of patients with diabetes show apnea-hypopnea indices (AHIs) > 5/h, which is a higher prevalence of OSA than general population. Untreated OSA complicates glycemic control and encourages diabetes, which, consecutively, alters respiratory control. [5]

The under-recognition of OSA leads to 10 years delay between symptoms onset and referral to sleep centers in Saudi Arabia that was suggested by many studies caught our attention to this problem and the urgent need to do more researches in this field.[2]

The aim of this study is to compare the risk of OSA between diabetic patients and non-diabetic middle aged Saudi population.

### **Patients And Methods:-**

This was a cross-sectional questionnaire-based study conducted in King Fahad hospital diabetes center in AL-Ahsaa, Saudi Arabia. The consent was obtained from King Fahad Hospital Health Affairs prior conducting the study. The approval of each participant was taken.

Data was collected from Saudi patients who have visited the outpatient clinics during July and august 2015. They were screened for OSA by using an Arabic version of Berlin questionnaire. This questionnaire is a valid tool which is used to screen for OSA. It is classified into three categories. Category 1 includes five questions on apnea and snoring. The second category consists of three questions on wake time somnolence and drowsiness behind the steering wheel. The third category contains diagnosis of high blood pressure and body mass index (BMI). The questionnaire consider the first and second category positive if two or more questions were positive three times/week or more, whereas the third category 3 is positive if contributor have been diagnosed as hypertensive or his BMI was greater than 30 kg/ m<sup>2</sup>. Contributors that fulfilled the criteria in two or more categories were considered as high risk for OSA and others considered low risk for OSA.

Medical records were reviewed for demographic characteristics, weight, height, body mass index (BMI), blood pressure, glycated hemoglobin, and chronic medical conditions. Regarding polysomnography test results, medical records didn't contain enough information.

The patients who were included in the study are adult patients ( $\geq 18$  years old) with established diagnosis of type 2 diabetes and visited the diabetes center during the study period.

The analysis was done using SPSS software, version 20. Proportions and frequencies were used to present qualitative data whereas quantitative data were presented in mean, median, mode and standard deviation. Chi-squared test was used to assess the relation between OSA and the subsequent categories: age, gender, body mass index, duration of diabetes mellitus, medications and presence of hypertension and its duration.

### **Results:-**

Berlin questionnaires were distributed among 160 patients who visited diabetes center at King Fahad hospital, all of the included contributors are Saudi patients who are eighteen years and older, with confirmed diagnosis of type 2 diabetes mellitus. Thirteen questionnaires were excluded due to incomplete data.

Out of 160 questionnaires, 147 were analyzed. The mean age of participants is  $53 \pm 10.79$ . Seventy nine of the contributors are men (53.1%) and sixty eight are women (45.6%) (Table 1). Berlin questionnaire shows that forty five have high risk of OSA (30.6%) and one hundred and two have low risk (69.4%).

There is no significant relation between risk of OSA and age groups (P value = .463) (Table 2). Moreover, no significant relation between risk of OSA and gender (P value= .770).

**Table 1:-** number of men and women and relation to berlin questionnaire.

Berlin			Total	
positive		negative		
gender	Male	25	54	79
	Female	20	48	68
Total		45	102	147

**Table 2:-** Age classes and relation to berlin questionnaire.

		Age class				Total
		<=39	40-49	50-59	>=60	
Berlin	positive	3	9	21	12	45
	negative	13	24	35	30	102
Total		16	33	56	42	147

Most of the patients have hypertension 99 (67.3%). From those 99 patients, 76 (76.77%) have hypertension for less than 20 years, 23 (23.23%) have hypertension for 20 years or more.

There is significant relation between risk of OSA and presence of hypertension (P value= .000)(Table 3).

**Table 3:-** Presence of HTN and relation to berlin questionnaire.

		Berlin		Total
		positive	Negative	
HTN	yes	43	56	99
	no	2	46	48
Total		45	102	147

Body mass index was calculated and it was found that no patient underweight (BMI less than 18.5), 17 (11.6%) are normal weight (BMI= 18.5 to 24.9), 43 (29.3%) are overweight (BMI = 25 to 29.9), 40 (27.2%) are obese class I (BMI= 30 to 34.9), 20 (13.6%) are obese II (BMI= 35 to 39.9) and 27 (18.4%) with morbid obesity (BMI more than 40).

There is significant relation between risk of OSA and BMI above or equal 25 (P value= .023) (Table 4).

**Table 4:-** BMI value and relation to berlin questionnaire.

		berlin		Total
		positive	negative	
BMI	<18.5	0	0	0
	18.5-24.9	2	15	17
	25-29.9	9	34	43
	30-34.9	12	28	40
	35-39.9	8	12	20
	>=40	14	13	27
Total		45	102	147

Most of the patients with uncontrolled blood sugar, 110 (74.8%) have HA1C more than 7, 37 (25.2%) have controlled blood sugar (<=7).

There is no relation between risk of OSA and HA1C level (P value= .781) (Table 5).

**Table 5:-** HA1C level and relation to berlin questionnaire.

		HA1C		Total
		<=7	>7	
berlin	positive	12	33	45
	negative	25	77	102
Total		37	110	147

### Discussion:-

The research revealed that forty five (30.6%) of patients with type two diabetes are at high risk of OSA. In addition, having a body mass index of overweight or obese classes has a significant role in increasing this risk. There is no difference between age groups, males and females regarding the prevalence of OSA, Also having hemoglobin A1C result below seven which is the recommended value for DM type 2 patients according to World Health Organization (WHO) doesn't have a role in increasing the risk.

The gold standard method to diagnose OSA is overnight polysomnography. In this research, berlin questionnaire was used and it's a valid screening tool for OSA that has been used in many previous studies.

The research demonstrated that the prevalence of obstructive sleep apnea among diabetic patient is (30.6%). In other researches a close percentage was shown (48.6%, 27%) respectively [6,7].

In general, questionnaire often has lower sensitivity in assessment compared to sleep study analysis. So, the actual prevalence of sleep disorders and apnea may be higher than reported in this study. [8]

A lot of studies showed that presence of obesity (BMI  $\geq 30$ ) or prior diagnosis of hypertension increase the risk of OSA, and this study shows similar outcome [9,10,11,12].

A study revealed that a 96.8% of patients with high risk for OSA had a positive third category of berlin questionnaire (BMI greater than 30 and/or presence of hypertension). Other study shows that patients with comorbid obesity (BMI  $> 40$ ) were 12 times probabilities of having OSA compared with normal weight patients (18.5-24.9) [14, 19].

This study reports that 43.4% of hypertensive patients have high risk for OSA which indicate that it's a significant risk factor ,many previous studies had shown hypertension as a risk factor for OSA. [15,16,17]

Untreated OSA can contribute to the development or progression of other disorders. OSA has now been shown to be a cause for systemic hypertension, and there is some evidence suggesting that it can also cause pulmonary hypertension [20, 21, 22].

Other studies presented that male gender is a strong predictor for OSA, one of them revealed that men twice at higher risk than women for OSA. Meanwhile in this study there was no difference between males and females patients [13,18,19].

As mentioned above obesity is a significant risk factor for OSA, female patients had higher prevalence of obesity (67.65%) than male patients (51.9%). This might has a role in the lack of gender difference in risk shown in this study. This high proportion of obesity in female and the absence of gender difference was also seen in other study [14].

### Conclusion:-

Overweight, Obesity , hypertension play an important role in increasing the risk of OSA in diabetic patients , the risk of OSA among diabetic patients with the mean age of 53+- 10.79 is 30.6%. Comparing this result with the risk among middle aged Saudi men and women which is 30%, 40% respectively, this will indicate that there is no difference between diabetic patients and middle aged Saudi population regarding the risk of OSA.[1,2]

### References:-

1. Krayem, A. B., & Boudal, A. M. (2012). Obstructive sleep apnea syndrome: an overview. Saudi Journal of Internal Medicine, 1(1), 13-21.
2. BaHammam, Ahmed S. (n.d.). Sleep medicine in Saudi Arabia: Current problems and future challenges. Medknow Publications.
3. Young, T., Skatrud, J., & Peppard, P. E. (2004). Risk factors for obstructive sleep apnea in adults. Jama, 291(16), 2013-2016.
4. Al, L. N. M., Patel, S. R., & Ayas, N. T. (January 01, 2009). Epidemiology, risk factors, and consequences of obstructive sleep apnea and short sleep duration. Progress in Cardiovascular Diseases, 51, 4.).

5. Heffner, J. E., Rozenfeld, Y., Kai, M., Stephens, E. A., & Brown, L. K. (January 01, 2012). Prevalence of diagnosed sleep apnea among patients with type 2 diabetes in primary care. *Chest*, 141, 6, 1414-21.
6. Nasser, J., Habib, F., Malallah, F., Darwish, N., & Rabie, E. (2014). Risk for Obstructive Sleep Apnea among People with Diabetes. *Bahrain Medical Bulletin*, 36(3), 145-149.
7. Obaseki, D. O., Kolawole, B. A., Gomerep, S. S., Obaseki, J. E., Abidoye, I. A., Ikem, R. T., & Erhabor, G. E. (2014). Prevalence and predictors of obstructive sleep apnea syndrome in a sample of patients with type 2 Diabetes Mellitus in Nigeria. *Nigerian medical journal: journal of the Nigeria Medical Association*, 55(1), 24.
8. Schober, A. K., Neurath, M. F., & Harsch, I. A. (2011). Prevalence of sleep apnoea in diabetic patients. *The clinical respiratory journal*, 5(3), 165-172.
9. Einhorn, D., Stewart, D., Erman, M., Gordon, N., Philis-Tsimikas, A., & Casal, E. (2007). Prevalence of sleep apnea in a population of adults with type 2 diabetes mellitus. *Endocrine Practice*, 13(4), 355-362.
10. Foster, G. D., Sanders, M. H., Millman, R., Zammit, G., Borradaile, K. E., Newman, A. B., ... & Darcey, V. (2009). Obstructive sleep apnea among obese patients with type 2 diabetes. *Diabetes care*, 32(6), 1017-1019.
11. West, S. D., Nicoll, D. J., & Stradling, J. R. (2006). Prevalence of obstructive sleep apnoea in men with type 2 diabetes. *Thorax*, 61(11), 945-950.
12. Shim, U., Lee, H., Oh, J. Y., & Sung, Y. A. (2011). Sleep disorder and cardiovascular risk factors among patients with type 2 diabetes mellitus. *The Korean journal of internal medicine*, 26(3), 277-284.
13. Lee, W., Nagubadi, S., Kryger, M. H., & Mokhlesi, B. (2008). Epidemiology of obstructive sleep apnea: a population-based perspective. *Expert review of respiratory medicine*, 2(3), 349-364.
14. Cass, A. R., Alonso, W. J., Islam, J., & Weller, S. C. (2013). Risk of obstructive sleep apnea in patients with type 2 diabetes mellitus. *Fam Med*, 45(7), 492-500.
15. Pedrosa, R. P., Drager, L. F., Gonzaga, C. C., Sousa, M. G., de Paula, L. K., Amaro, A. C., ... & Lorenzi-Filho, G. (2011). Obstructive sleep apnea the most common secondary cause of hypertension associated with resistant hypertension. *Hypertension*, 58(5), 811-817.
16. Wolk, R., Shamsuzzaman, A. S., & Somers, V. K. (2003). Obesity, sleep apnea, and hypertension. *Hypertension*, 42(6), 1067-1074.
17. Dopp, J. M., Reichmuth, K. J., & Morgan, B. J. (2007). Obstructive sleep apnea and hypertension: mechanisms, evaluation, and management. *Current hypertension reports*, 9(6), 529-534.
18. Jennum, P., & Riha, R. L. (2009). Epidemiology of sleep apnoea/hypopnoea syndrome and sleep-disordered breathing. *European Respiratory Journal*, 33(4), 907-914.
19. Heffner, J. E., Rozenfeld, Y., Kai, M., Stephens, E. A., & Brown, L. K. (2012). Prevalence of diagnosed sleep apnea among patients with type 2 diabetes in primary care. *CHEST Journal*, 141(6), 1414-1421.
20. McNicholas, W. T., Bonsignore, M. R., & Management Committee of EU Cost Action B26. (2007). Sleep apnoea as an independent risk factor for cardiovascular disease: current evidence, basic mechanisms and research priorities. *European Respiratory Journal*, 29(1), 156-178.
21. Blankfield, R. P., Hudgel, D. W., Tapolyai, A. A., & Zyzanski, S. J. (2000). Bilateral leg edema, obesity, pulmonary hypertension, and obstructive sleep apnea. *Archives of internal medicine*, 160(15), 2357-2362.
22. SAIKOV, D., WANG, T., SAUNDERS, N. A., BUNE, A. J., & Douglas McEvoy, R. (2002). Continuous positive airway pressure treatment improves pulmonary hemodynamics in patients with obstructive sleep apnea. *American journal of respiratory and critical care medicine*, 165(2), 152-158.
23. C. Abbreviations and Acronyms DM: Diabetes mellitus, HTN: Hypertension, OSA: Obstructive sleep apnea, BMI: Body mass index, HA1C: Glycated hemoglobin, AHI: Apnea-hypopnea indices, WHO: World health organization.



### RESEARCH ARTICLE

#### TITLE OF THE PAPER – PRELIMINARY PHYTOCHEMICAL ANALYSIS OF DIFFERENT SOLVENT EXTRACTS OF *LAGENARIA SICERARIA* (MOLINA) STANDL. AND *LUFFA CYLINDRICA* (L.) M.ROEM VEGETABLE PEEL WASTE.

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Phytochemical, *Lagenaria siceraria* (Molina) standl., *Luffa cylindrica* (L.) M. Roem. peels.

#### Abstract

India is the second major producer of fruits and vegetables in the world. According to India Agricultural Research Data Book 2004, the total waste generated from fruits and vegetables comes to 50 million tons per annum. Peel waste is a serious problem to the processing industries and pollution monitoring agencies. Waste utilization in fruits and vegetable processing industries is the one of the important and challengeable job around the world. The effect of resources depletion and environmental concerns have triggered new regulations and growing awareness throughout the world, thus promoting the use of more and more fruit and vegetable waste to obtain by-products with health benefits. Thus, in the present study an attempt was made to bring the utilization of two vegetable peel waste by investigating the presence of various phytochemicals in the different extracts of *Lagenaria siceraria* (Molina) standl. and *Luffa cylindrica* (L.) M. Roem. peels. Ten different extracts of the selected vegetable peels were made using water and organic solvents. Various phytoconstituents were found to be present in different extracts of *Lagenaria siceraria* (Molina) standl. and *Luffa cylindrica* (L.) M. Roem. peels.

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#### Introduction:-

Plants are the essential and integral part in medicine because of their ability to form secondary metabolites like proteins, flavonoids, alkaloids, steroids and phenolic substances that are in turn used to restore health and heal many diseases [1]. Food of plant origin is capable of contributing appreciable quantities of nutrients, including proteins needed by both children and adults [2].

In various plants, fruits and vegetables form the rich source of bioactive molecules and are considered to be rich in antioxidants due to presence of compounds like polyphenols and vitamins, which play an important role in scavenging of free radicals [3].

Waste are generated in many forms and at various stages, ranging from domestic to industrial processing and its improper disposal has detrimental effects on the environment as well as human life. It has been observed that of the

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enormous supply of food for human consumption, about one-third gets wasted globally. India, with rich agricultural resources, accounts for 50 MT of vegetable waste which is about 30 % of its total production [4].

Waste generated from food industries is a source of an untapped energy which is mostly dumped inland fills whereby it releases greenhouse gases into an atmosphere. It is very difficult to treat and recycle food waste due to its composition. These wastes lead to increasing waste disposal problem and can pose severe pollution problems and represent a loss of valuable biomass and nutrients [5]. Thus, there is an increased attention in bringing useful products from waste material. Suitable methods have to be adopted to utilize them for the conversion into value-added products [6].

Thus, in the present study an attempt was made to bring the utilization of *Lagenaria siceraria* (Molina) Standl. and *Luffa cylindrica* (L.) M. Roem. vegetable peel waste by detecting the presence of various phytochemicals in the different extracts.

## Material and Methods:-

### Collection of Sample:-

The vegetables of *Lagenaria siceraria* (Molina) Standl. and *Luffa cylindrica* L. M. Roem. used in the present study were collected from the local market of Kalyan. These vegetables were identified from the Department of Botany, Agharkar Institute, Pune. The peels of these vegetables were washed properly under running tap water to remove dust particles. The peels were then shade dried for 5 days and once the moisture was reduced the peels were then completely dried in an oven at 50°C. The dried peels were then powdered using grinder and stored in air tight bottles.

### Preparation of peel extracts:-

#### Aqueous extract:-

5 gm of dry peels powder were suspended in 50 ml of distilled water. Extraction was done in orbital shaker at 100 rpm (25°C) for 60 mins, followed by filtering of the extracts using Whatman filter paper No.1. Extracts were then evaporated at 50°C. The dry and sticky extracts were refrigerated until further use.

#### Organic extract:-

5 gm of dry peel powder were added in different solvents. Extraction was allowed to stand in orbital shaker at 100 rpm (25°C) for 24 hours, after which they were filtered using Whatman filter paper No.1. Extracts were then evaporated at 50°C. The dry and sticky extracts were refrigerated until further use.

### Qualitative phytochemical screening:-

Petroleum ether, chloroform, ethyl acetate, methanol, ethanol, butanol, acetone, hydroxymethanol, hydroxyethanol and distilled water extracts of *Lagenaria siceraria* (Molina) Standl. and *Luffa cylindrica* (L.) M. Roem. peel powdered samples were tested for the presence or absence of various phytochemicals using standard methods.

### Test for Carbohydrates:-

To 1 ml of the extract, 0.5 ml of  $\alpha$ -naphthol solution was added. After 2-3 mins incubation, 2 ml of concentrated sulphuric acid was added through the sides of the test tube. Formation of reddish violet color at the junction of the two liquids revealed the presence of carbohydrates.

### Test for Amino Acids:-

Two drops of freshly prepared 0.2% ninhydrin reagent was added to the 2 ml of extract solution and boiled for 2 mins. Development of violet ring revealed the presence of amino acids.

### Test for Protein:-

To 1 ml of extracts add 1 ml of alkaline sodium carbonate solution and 2 drops of 1% copper sulphate solution. Formation of blue color indicated the presence of proteins.

### Test for Alkaloids:-

To 1 ml of extract, 1 ml of Dragendorff's reagent was added. An orange-red precipitate indicated the presence of alkaloid.

**Test for Cardiac glycosides:-**

To 1 ml of extracts, 1 ml of glacial acetic acid containing 2.5 ml of ferric chloride solution was added. Carefully 2 ml of concentrated sulphuric acid was added. A reddish brown layer forms at the junction of the two liquids and the upper layer slowly becomes bluish green, darkening with standing indicated presence of cardiac glycosides.

**Test for Terpenoid:-**

1ml of chloroform was added to 2ml of each extract followed by a few drops of concentrated sulphuric acid. A reddish brown precipitate produced immediately indicated the presence of terpenoids.

**Test for phenols:-**

An aliquot of the extract was mixed with 5 ml Folin-Ciocalteu reagent and 4 ml of sodium carbonate. The tubes were vortexed for 15 sec and allowed to stand for 30 min at 40°C for colour development. An appearance of blue colour showed the presence of phenols.

**Test for Flavonoids:-**

2ml of extracts was treated with few drops of 20% sodium hydroxide solution. Formation of intense yellow colour, which becomes colourless on addition of dilute hydrochloric acid, indicated the presence of flavonoids.

**Test for Saponins:-**

1 ml of extracts was shaken with 2 ml of distilled water vigorously 5 minutes. Formation of foam indicated the presence of saponins.

**Test for Tannins:-**

To 1 ml of the extracts, 1 ml of 5% ferric chloride solution was added. Formation of dark blue or bluish black color showed the presence of tannins.

**Test for Anthraquinone:-**

To 1 ml of extracts, 1 ml of 1% potassium hydroxide solution was added. Formation of orange to yellow colour indicates presence of anthraquinone.

**Test for Phlobatannins:-**

About 2 ml of extract was added to 2 ml of 1% HCl and the mixture was boiled. Deposition of a red precipitate was taken as an evidence for the presence of phlobatannins.

**Tests for Steroids:-**

Development of a greenish colour when 2 ml of the organic extract was dissolved in 2 ml of chloroform and treated with sulphuric and acetic acid showed the presence of steroids.

**Test for Phytosterols:-**

A little quantity of the extract was dissolved in 5 ml of chloroform separately. This chloroform solution was treated with a few drops of concentrated sulphuric acid. To this a few drops of dilute acetic acid and 3ml of acetic anhydride was added. A bluish green colour confirmed the presence of phytosterols.

**Result and Discussion:-**

Each extract was subjected to phytochemical screening and various phytoconstituents were found to be present in different extracts of *Lagenaria siceraria* (Molina) standl. and *Luffa cylindrica* (L.) M. Roem. peels (Table 1, 2, 3 and 4).

Carbohydrates were found to be present in all the extracts of *Lagenaria siceraria* (Molina) standl. and *Luffa cylindrica* (L.) M. Roem. peels. Amino acids and proteins were found to be present in aqueous, methanolic, ethanolic, hydroxyethanolic, hydroxymethanolic and acetone extract of *Lagenaria siceraria* Molina standl. and *Luffa cylindrica* (L.) M. Roem. peels and were absent in butanol, petroleum ether, ethylacetate and chloroform extracts.

Flavonoids were found to be present in all the extracts of *Lagenaria siceraria* (Molina) standl. peels whereas in case of *Luffa cylindrica* (L.) M. Roem. peels, flavonoids were present in all the extracts of *Luffa cylindrica* (L.) M. Roem. peels except in chloroform extract. Alkaloids were found to be present in aqueous, methanolic, ethanolic,

hydroxyethanolic, hydroxymethanolic extracts of *Lagenaria siceraria* Molina standl. and *Luffa cylindrica* (L.) M.Roem.peels.

Saponins were found to be present in aqueous extract of *Lagenaria siceraria* Molina standl. and *Luffa cylindrica* (L.) M.Roem.peels. Phenols were found to be present in all the extracts of *Lagenaria siceraria* Molina standl. and *Luffa cylindrica* (L.) M.Roem.peels except in petroleum ether and chloroform extracts.

Tannins were found to be present in aqueous, methanolic, ethanolic, hydroxyethanolic, hydroxymethanolic extracts of *Lagenaria siceraria* (Molina) standl. and *Luffa cylindrica* (L.) M.Roem.peels. Phlobatannins were absent in all the extracts of *Lagenaria siceraria* (Molina) standl. and *Luffa cylindrica* L. M.Roem.peels.

Cardiac glycosides were found to be present in all the extracts of *Lagenaria siceraria* Molina standl. and *Luffa cylindrica* L. M.Roem.peels except in petroleum ether extract. Phytosterols were present in methanolic and acetone extract of *Lagenaria siceraria* (Molina) standl. and only in the acetone extract of *Luffa cylindrica* (L.) M.Roem.peels.

Steroids and terpenoids were found to be present in all the extracts of *Lagenaria siceraria* (Molina) standl. and *Luffa cylindrica* (L.) M.Roem.peels except in petroleum ether extract.

Anthraquinone were found to be present in aqueous, methanolic, ethanolic, hydroxyethanolic, hydroxymethanolic and acetone extracts *Lagenaria siceraria* (Molina) standl. and *Luffa cylindrica* (L.) M.Roem.peels.

**Table 1:-** Preliminary phytochemical analysis of different extracts of *Lagenaria siceraria* (Molina) Standl. vegetable peel

Sr. No.	Phytochemical	<i>Lagenaria siceraria</i> (Molina) Standl. vegetable peel extracts				
		AE	ME	EE	HME	HEE
1.	<b>Carbohydrates</b>	+	+	+	+	+
2.	<b>Proteins</b>	+	+	+	+	+
3.	<b>Amino Acids</b>	+	+	+	+	+
4.	<b>Alkaloids</b>	+	+	+	+	+
5.	<b>Flavonoids</b>	+	+	+	+	+
6.	<b>Saponins</b>	+	-	-	-	-
7.	<b>Phenols</b>	+	+	+	+	+
8.	<b>Anthraquinones</b>	+	+	+	+	+
9.	<b>Tannins</b>	+	+	+	+	+
10.	<b>Cardiac Glycosides</b>	+	+	+	+	+
11.	<b>Phlobatannins</b>	-	-	-	-	-
12.	<b>Steroids</b>	+	+	+	+	+
13.	<b>Terpenoids</b>	+	+	+	+	+
14.	<b>Phytosterols</b>	-	+	-	-	-

**Keys:** +: Present and - : Absent

**Keyword:** AE: Aqueous extract; ME: Methanolic extract; E: Ethanolic extract; HME: Hydroxy Methanolic extract and HEE: Hydroxy Ethanolic extract

**Table 2:-** Preliminary phytochemical analysis of different extracts of *Lagenaria siceraria* (Molina) Standl. vegetable peel

Sr. No.	Phytochemical	<i>Lagenaria siceraria</i> (Molina) Standl. vegetable peel extracts				
		BE	PE	EAE	CE	ACE
1.	Carbohydrates	+	+	+	+	+
2.	Proteins	-	-	-	-	+
3.	Amino Acids	-	-	-	-	+
4.	Alkaloids	-	-	-	-	-
5.	Flavonoids	+	+	+	+	+
6.	Saponins	-	-	-	-	-
7.	Phenols	+	-	+	-	+
8.	Anthraquinones	-	-	-	-	+
9.	Tannins	-	-	-	-	-
10.	Cardiac Glycosides	+	-	+	+	+
11.	Phlobatannins	-	-	-	-	-
12.	Steroids	+	-	+	+	+
13.	Terpenoids	+	-	+	+	+
14.	Phytosterols	-	-	-	-	+

**Keys:** +: Present and -: Absent

**Keyword:** BE: Butanol extract; PE: Petroleum ether extract; EAE: Ethyl acetate extract; CE: Chloroform extract and ACE: Acetone extract

**Table 3:-** Preliminary phytochemical analysis of different extracts of *Luffa cylindrica* (L.) M.Roem. vegetable peel

Sr. No.	Phytochemical	<i>Luffa cylindrica</i> (L.) M.Roem. vegetable peel extracts				
		AE	ME	EE	HME	HEE
1.	Carbohydrates	+	+	+	+	+
2.	Proteins	+	+	+	+	+
3.	Amino Acids	+	+	+	+	+
4.	Alkaloids	+	+	+	+	+
5.	Flavonoids	+	+	+	+	+
6.	Saponins	+	-	-	-	-
7.	Phenols	+	+	+	+	+
8.	Anthraquinones	+	+	+	+	+
9.	Tannins	+	+	+	+	+
10.	Cardiac Glycosides	+	+	+	+	+
11.	Phlobatannins	-	-	-	-	-
12.	Steroids	+	+	+	+	+
13.	Terpenoids	+	+	+	+	+
14.	Physterols	-	+	-	-	-

**Keys:** +: Present and -: Absent

**Keyword:** AE: Aqueous extract; ME: Methanolic extract; E: Ethanolic extract; HME: Hydroxy Methanolic extract and HEE: Hydroxy Ethanolic extract

**Table 4:-** Preliminary phytochemical analysis of different extracts of *Luffa cylindrica* (L.) M.Roem. vegetable peel

Sr. No.	Phytochemical	<i>Luffa cylindrica</i> (L.) M.Roem. vegetable peel extracts				
		BE	PE	EAE	CE	ACE
1.	<b>Carbohydrates</b>	-	+	-	-	-
2.	<b>Proteins</b>	-	-	-	-	+
3.	<b>Amino Acids</b>	-	-	-	-	+
4.	<b>Alkaloids</b>	-	-	-	-	-
5.	<b>Flavonoids</b>	+	+	+	-	+
6.	<b>Saponins</b>	-	-	-	-	-
7.	<b>Phenols</b>	+	-	+	-	+
8.	<b>Anthraquinones</b>	-	-	-	-	+
9.	<b>Tannins</b>	-	-	-	-	-
10.	<b>Cardiac Glycosides</b>	+	-	+	+	+
11.	<b>Phlobatannins</b>	-	-	-	-	-
12.	<b>Steroids</b>	+	-	+	+	+
13.	<b>Terpenoids</b>	+	-	+	+	+
14.	<b>Phytosterols</b>	-	-	-	-	+

**Keys:** +: Present and -: Absent

**Keyword:** BE: Butanol extract; PE: Petroleum ether extract; EAE: Ethyl acetate extract; CE: Chloroform extract and ACE: Acetone extract

### Conclusion:-

Recycling of fruit and vegetable waste is one of the most important means of utilizing it in a number of innovative ways yielding new products. The secondary metabolites (phytochemicals) and other chemical constituents of medicinal plants account for their medicinal value. The phytochemical evaluation can be used for further assessment of secondary metabolites. The preliminary phytochemical tests are helpful in finding chemical constituents in the plant material that may lead to their quantitative estimation and also in locating the source of pharmacologically active chemical compound.

### References:-

1. CK Atal, ML Sharma and Khariya, *A J of Ethnopharmacology*, **1986**, **18**: 133-141.
2. JC Okaka, ENT Akobundu and ANC.Okaka, Human nutrition: An Integrated Approach. 2 ed. OCJANCO Academic Publishers, Enugu (2002)312-320.
3. S Okonogi, C Duangrat, S Anuchpreeda, S Tachakittirungrod and S Chowwanapoonpohn, *Food Chem.*, **2007**, **103**: 839-846.
4. V. Singh and A.N. Garg, *Food Chemistry*, **2006**, **94**(1): 81-89.
5. O Vasso, R Winfried, Springer, **2007**, 3.
6. K. Nand: Recent advances in the treatment of liquid and solid wastes of food processing industries for biogas production and pollution abatement. Proc. 4th International. Food Convention, Mysore,(1998)35.



### RESEARCH ARTICLE

## ROLE OF WEIGHT REDUCTION VERSUS PHYSICAL THERAPY IN MANAGEMENT OF OBESE PATIENTS WITH KNEE OSTEOARTHRITIS.

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### Abstract

**Objective:** the aim of our work was to study the effects of physical therapy versus weight reduction and their combined effects in obese patients with knee OA.

**Methods:** 156 obese patients (137 females and 19 males) with knee OA were recruited. their BMIs ranged from 30.2 to 50.8. Patients were randomized to three groups: Group I: underwent physical therapy only. Group II: underwent weight reduction only. Group III: underwent combined physical therapy and weight reduction. Changes in body weight and body composition were examined as independent predictors of changes in knee OA symptoms. Symptoms were monitored by the Western Ontario and McMaster Universities' (WOMAC) OA index.

**Results:** the mean changes of group II and III ( $-16.9 \pm 2.7$  and  $-15.7 \pm 2$ ) were highly significant respectively while mean change of group I ( $-0.6 \pm 0.4$ ) was non significant. Group II had the best improvement of BMI with mean change of ( $-6.6 \pm 0.8$ ) followed by group III ( $-4.9 \pm 0.7$ ) while group I had the worst ( $-0.3 \pm 0.2$ ). The total WOMAC index improved within each group after two and four months from baseline ( $p < 0.001$ ), The best mean change of WOMAC score was found in group III ( $-14.8 \pm 4.9$ ).

**Conclusion:** Combination of both weight reduction and physical therapy gives better results as regard improving knee pain and function in patients with OA, reduces disability and improves quality of life compared to each method alone

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### Introduction:-

OA is the most common cause of musculoskeletal disability in the elderly, and it places an enormous economic burden on society (1).

Osteoarthritis (OA) of the knee is a degenerative joint disease with progressive degradation of articular cartilage and subchondral bone. Clinical manifestations may include joint pain, tenderness, stiffness, locking and joint effusion depending on the stage of the disease (2).

Obesity is one of the most significant and potentially most preventable risk factor for the development of OA and numerous studies have shown a strong association between body mass index and OA of the knee (3).

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Obesity and knee OA are two of the most common chronic diseases and are often co-morbid. The risk of knee OA related to weight gain and obesity begins from an early age. Weight loss reduces the risk of incident knee OA and, in established disease, reduces symptoms, improves function and is likely to reduce disease progression (4).

The precise mechanism by which obesity leads to OA remains unknown, but is likely to be due to a combination of mechanical, humoral and genetic factors. Weight loss has clear medical benefits for the obese patient and seems to be a logical way of relieving joint pain associated with degenerative arthritis (5).

Exercise therapy reduces pain and activity limitations in OA of the knee. Classical exercise therapy is aimed at improving muscle strength, aerobic capacity, range of joint motion, and training of walking and activities of daily living (6).

Weight loss, preferably combined with exercise therapy, reduces pain and activity limitations in OA patients who are overweight (6).

#### **Aim of the work:-**

The aim of the work was to study the effects of physical therapy versus weight reduction and their combined effects in obese patients with knee osteoarthritis

#### **Patients and Methods:-**

This study was carried out at rheumatology and rehabilitation department at Zagazig university hospitals, Egypt on 156 obese patients (137 females and 19 males) aged between 38 and 57 years old with disease duration of 1 to 9 years of primary knee OA diagnosed according to The American College of Rheumatology (ACR) classification criteria of OA (7).

After taking a written consent from them for ethical consideration, patients were randomly divided into three groups: Group I: They underwent physical therapy only. Group II: They underwent weight reduction only. Group III: They underwent combined physical therapy and weight reduction. All patients in this study had radiographic severity grade I or II according to the Kellegren-Lawrence grading system (8).

Major exclusion criteria were: Other rheumatic diseases that might be responsible for 2ry OA, haematological disorders., CVS, renal or hepatic diseases, DM or other endocrinal disorders, patients having grade III and IV knee OA or history of knee trauma. Before inclusion in the study, fasting blood glucose was measured as well as hemoglobin and TSH. All patients meeting the previously mentioned inclusion criteria were initially assessed at 1st visit by full medical history, general and systemic examination, Local examination of both knees, assessment of pain severity using visual analogue scale (VAS). (9), measuring functional disability using WOMAC questionnaire (Western Ontario and McMaster Universities Arthritis Index) (10), determination of ambulation activity by measuring the walking speed (time needed (in seconds) to complete a distance of 100 meters on a treadmill as tolerably and quickly as possible) (11), measuring body mass index (BMI) for all patients included in the study using the following equation :  $BMI = (\text{Weight (in Kgs)} / \text{Height (in meters)})^2$  (12).

Calculating Estimated Nutrient Needs: Nutritional needs were calculated for patients in group II and III according to Harris Benedict Equation which calculates the resting energy expenditure (REE) (13) and recalculated every 2 weeks to change diet program.

#### **Physical therapy programs:-**

Physical therapy programs were done for patients in group I and III in the form of TENS, quadriceps exercise, ultrasonic, cold packs, infra-red or faradic stimulation. These modalities were chosen according to severity of symptoms and reevaluated every 2 weeks to change the program.

#### **Follow up sessions:-**

All patients in this study were reevaluated after 2 and 4 months by: Full medical history and physical examination, reassessment of VAS scale and WOMAC index, reassessment of ambulation activity by measuring walking speed and reassessment of BMI.

**Statistical analysis:-**

The statistical analysis of data was done by using SPSS program (statistical package for social science) version 20.0. The description of the data was done in form of mean and standard deviation for quantitative data, frequency and proportion for qualitative data. For quantitative data one way ANOVA test was used to compare the means of the three groups. Repeated measure ANOVA test was used for the comparison of the means of each group at the three readings during the follow up. For qualitative data (frequency and proportion), Chi-square test was used. The correlations between the quantitative variables was tested using the Pearson correlation test.

The mean change was calculated by calculating the difference between the mean of the variable after the intervention and the mean of the variable at the baseline. All data were tested for normality of distribution prior to any calculations. Statistical significant difference was considered at  $P < 0.05$ , and highly significant difference at  $P < 0.001$ .

**Results:-**

The study was a clinical trial conducted on 156 cases with disease duration of 1 to 9 years of primary knee OA who were divided into three groups, each of which included 52 cases. Seven cases were dropped during the study (4 refused to continue and 3 had depression). Finally, we had 149 patients divided into 3 groups; 50 patients in group I (44 females and 6 males) aged between 38-52 years who underwent physical therapy only, 50 patients in group II (45 females and 5 males) aged between 38-57 years who underwent weight reduction only using weight reduction program and 49 patients in group III (44 females and 5 males) aged between 38-55 years who underwent combined physical therapy and weight reduction (using same weight reduction program).

**Table 1:-** Characteristics of the studied groups at baseline.

	Group I (n=50)	Group II (n=50)	Group III (n=49)	One-way ANOVA test	
				F	P
Age (yrs)					
Range	38 – 52	38 – 57	38 – 55	0.348	0.707
Mean $\pm$ SD	43.5 $\pm$ 5.3	44.3 $\pm$ 5.9	43.6 $\pm$ 5.6		(NS)
Sex (n, %)					
Female	43 (86%)	45 (90%)	44 (89.8%)	0.12	0.942
Male	7 (14%)	5 (10%)	5 (10.2%)		(NS)
Disease duration (yrs)					
Range	1 – 9	1 – 9	1 – 9	1.900	0.153
Mean $\pm$ SD	4.5 $\pm$ 2.2	5 $\pm$ 2.4	4.1 $\pm$ 2.3		(NS)
Height (cm)					
Range	155 – 167	153 – 168	151 – 170	1.995	0.140
Mean $\pm$ SD	161.7 $\pm$ 3.8	160.1 $\pm$ 4.5	159.9 $\pm$ 6.2		(NS)
Body weight (kg)					
Range	82 – 121	84 – 128	81 – 130	0.990	0.374
Mean $\pm$ SD	98.9 $\pm$ 10.3	100.1 $\pm$ 12.1	102.1 $\pm$ 12		(NS)
BMI (kg/m <sup>2</sup> )					
Range	31.6 – 47.9	31.6 – 49.3	30.2 – 50.8	0.990	0.374
Mean $\pm$ SD	37.9 $\pm$ 4	39 $\pm$ 4.4	38.9 $\pm$ 5		(NS)

**Table 2:-** Pain and functional scores of the studied groups at baseline.

	Group I (n=50)	Group II (n=50)	Group III (n=49)	One-way ANOVA test	
				F	P
WOMAC					
Range	6 – 40	9 – 43	16 – 44	0.493	0.612
Mean $\pm$ SD	28.6 $\pm$ 7.8	28 $\pm$ 8.9	29.6 $\pm$ 7.9		(NS)
VAS scale					
Range	3 – 7	4 – 7	5 – 7	1.467	0.234
Mean $\pm$ SD	5.7 $\pm$ 0.9	6 $\pm$ 1	5.9 $\pm$ 0.8		(NS)
Walking speed					
Range	80.7 – 92.3	78.8 – 100.4	80.8 – 105.7	2.983	0.054
Mean $\pm$ SD	85.8 $\pm$ 3.1	85.4 $\pm$ 5	87.6 $\pm$ 6.1		(NS)



**Table 3:-** Correlation between change of body weight and WOMAC score, VAS-pain score and walking speed in the group I of patients.

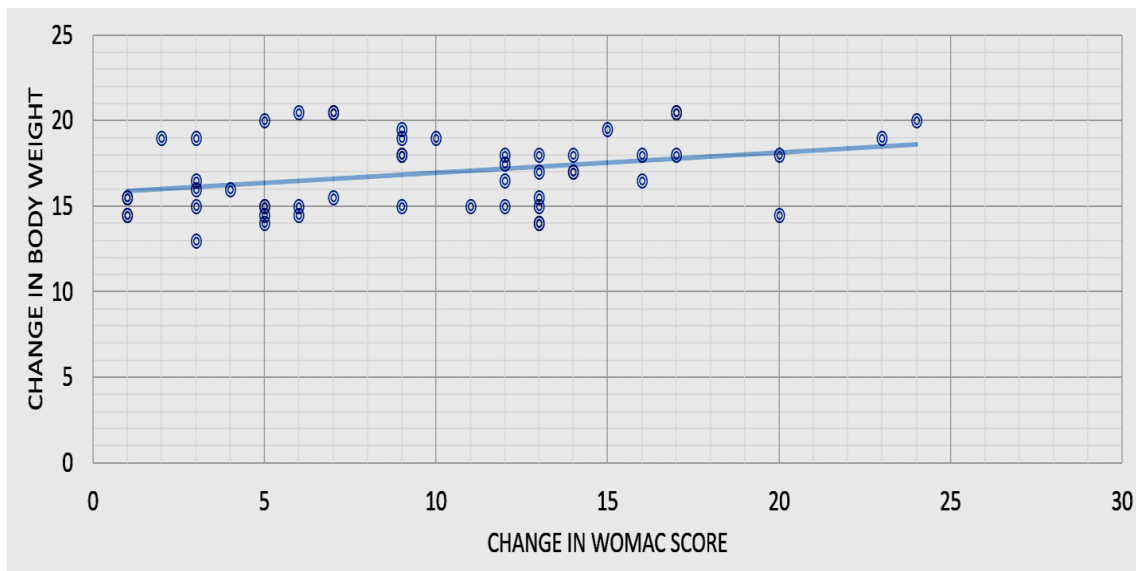
	Body weight	
	R	P
WOMAC score	0.136	0.337 (NS)
VAS scale	-0.086	0.545 (NS)
Walking speed	0.200	0.155 (NS)

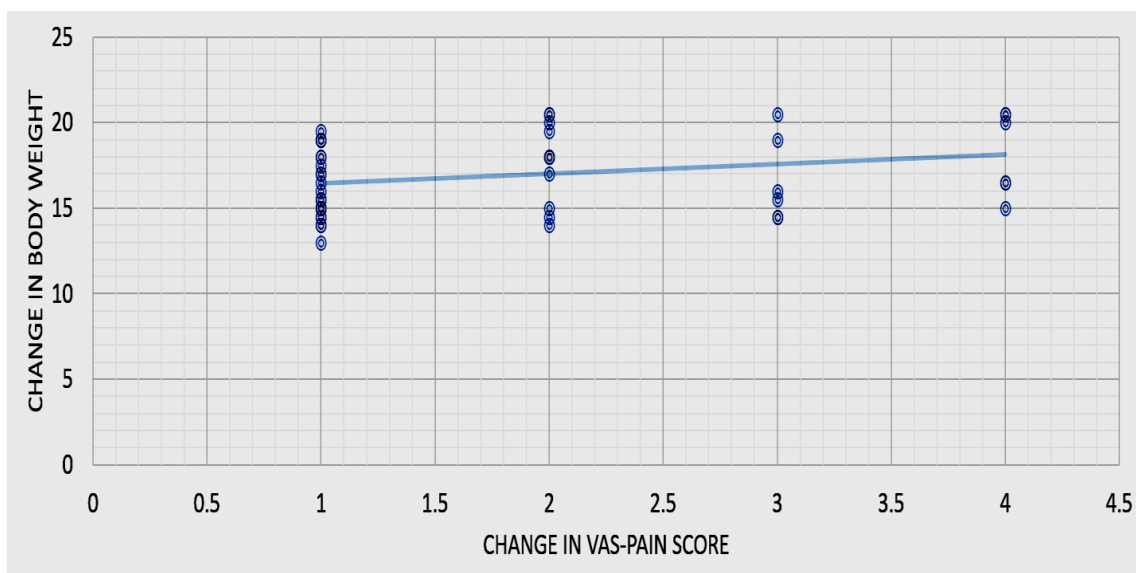
**Table 4:-** Correlation between change of the body weight and WOMAC score, VAS-pain score and walking speed in group II of patients.

	Body weight	
	R	P
WOMAC score	0.327	0.018*
VAS scale	0.275	0.048*
Walking speed	0.279	0.045*

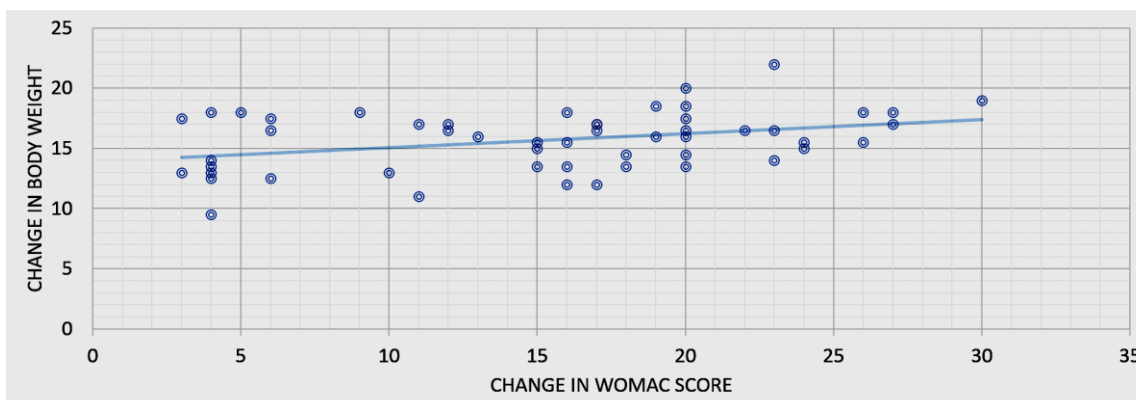
**Table 5:-** Correlation of the change of the body weight with WOMAC score, VAS scale and walking speed in group III of patients

	Body weight	
	R	P
WOMAC score	0.362	0.008*
VAS scale	0.328	0.018*
Walking speed	0.343	0.013*

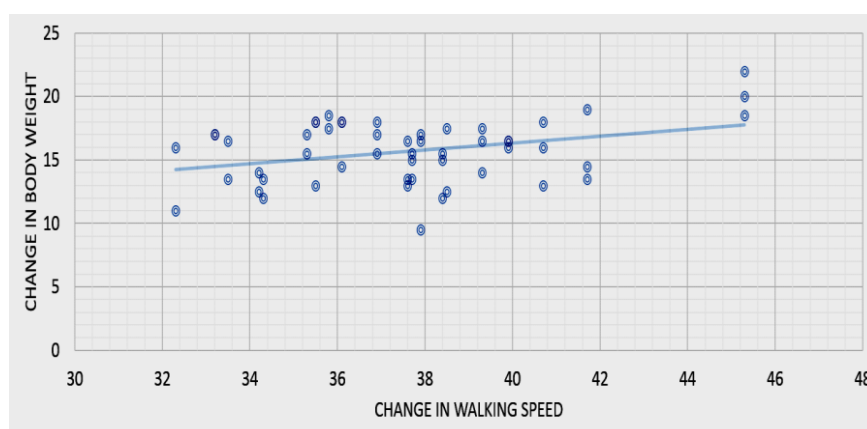
**Fig 1:-** Correlation between the change of body weight with the change of WOMAC score in group II of patients.



**Fig 2:-** Correlation between the change of body weight with the change of VAS-pain score in group II of patients.



**Fig 3:-** Correlation between the change of body weight with the change of WOMAC score in group III of patients



**Fig 24:-** Correlation between the change of the body weight with the change of walking speed in group III of patients.

### Discussion:-

This study compared the efficacy of physical therapy, weight reduction and their combined effects on 149 obese patients (132 females and 17 males) aged between 38-57 years complaining for 1 to 9 years of primary knee OA.

Patients were divided into 3 groups; group I underwent physical therapy only, group II underwent weight reduction only and group III underwent both physical therapy and weight reduction.

At the beginning of this study as shown in table 1 , body weights of the studied group ranged from 81 to 130 kg , their BMIs ranged from 30.2 to 50.8 while their heights ranged from 151 to 170 cm.

Among all patients, 64 patients had grade I knee OA while 85 patients had grade II. Also, 79 patients had quadriceps wasting. Most of patients (113 patients) had tender joint line while only 53 patients had deformity. Effusion was absent in 64 patients, mild in 55 patients and moderate in 30 patients only.

Regarding pain and functional scores of studied groups at the beginning of the study shown in table 2, WOMAC scores ranged from 6 to 44, VAS score ranged from 3 to 7 and walking speeds ranged from 78.8 to 105.7 seconds.

A special equation (Harris –Benedict equation), (13) was used to calculate nutritional needs for patients undergoing weight reduction in group II and III. Also, different modalities of physical therapy were used including TENS, quadriceps exercise, ultrasonic, cold packs, infrared and faradic stimulation which were chosen according to severity of symptoms for patients in group I and III.

In the present study, there was no significant difference between patients in all groups regarding their demographic data, pain and functional scores, clinical signs and radiographic grades of OA at baseline.

In this study, there was no significant difference between the three groups at baseline as regard body weight and BMI while highly significant difference was present between the three groups after 2 and 4 months. Highly significant difference was present regarding body weights and BMI of patients within group II and group III after 4 months while no significant difference was found in group I. Group II had the best improvement of body weight and BMI followed by group III while group I had the least as detected by comparing the mean change of the 3 groups after 4 months .

These results agreed with Huang et al., (11) who classified 126 obese osteoarthritic patients into 3 groups. Group (a) underwent weight reduction, group (b) underwent electrotherapy and weight reduction while group (c) underwent electrotherapy only. They reported significant change of body weight after 6 months in group (a) and (b). But, they used different protocol than this study as they used triple regimen for weight reduction including auricular acupuncture, diet control and aerobic exercises.

Also a study by Lee and Kean, (14) was in agreement with this study. They found significant difference of body weight among the studied groups in their meta analysis on a total number of 36 different studies on obese patients with knee OA. They all used diet control with exercise program to achieve weight reduction.

In the present study, highly significant difference was found regarding WOMAC, VAS and walking speed among the three groups at the end of the study from baseline. Improvement was better in group III followed by group II while group I had the least improvement as detected by comparing the mean change of WOMAC, VAS and walking speed of the three groups at the end of the study.

Results of the present study were in agreement with the results of Huang et al., (11). They used VAS and walking speed similar to us but they used different 112 functional index (lequesne index) to assess functional disability. They had significant difference of pain and functional indices at the end of their study in those groups who underwent combined weight reduction and physical therapy better than the other groups who underwent one method alone.

Results of the present study agreed also with the results of Christensen et al., (15). They also used Lequesne index to assess knee function while walking speed and VAS was used to assess knee pain. They found significant difference as regard knee pain and functional measures in patients who did both weight reduction and physical therapy better than patients that underwent one modality alone.

In the current study, change of body weight was significantly correlated with change of WOMAC score, VAS pain score and improvement of walking speed among patient in groups II and III as shown in tables 4 and 5 while no significant correlation was found in group I regarding all previously mentioned parameters as shown in table 3.

The study of Huang et al., (11) was in agreement with results of the current study as they found that weight reduction was a practical adjuvant treatment in the rehabilitation of patients with knee OA. They suggested that the amount of weight reduction must be greater than 15% of the initial body weight to provide effective treatment of joint pain. Furthermore, if the weight reduced were more than 12% of initial body weight, an acceptable functional status would be obtained.

Another study agreeing with our study was done by Christensen et al., (16) who showed that the efficacy of weight reduction on improvement of function in 80 patients with knee OA and showed that weight reduction of 10% improved knee function by 28%.

Messier et al., (17) concluded that the combination of modest weight loss plus moderate exercise provides better overall improvements in self-reported measures of function and pain and in performance measures of mobility in older overweight and obese adults with knee OA compared with either intervention alone.

A study by Miller et al., (18) suggested that intensive weight loss intervention incorporating energy deficit diet and exercise training improves physical function in older obese adults with knee OA. But they said that greater improvements in function were observed in those with the most weight loss.

Results of the present study were in agreement with meta analysis made by Christensen et al., (15) which indicated that physical disability of patients with knee OA and overweight diminished after a moderate weight reduction regimen. The analysis supported that a weight loss of >5% should be achieved within 20 weeks period.

Grundy et al., (19) found that combination of weight loss and exercise provide better improvements in physical function and pain in obese adults with knee OA compared with either intervention alone. Exercise used in association with weight loss provides better improvements in physical capacity and muscle strength

The study of Riddle and Stratford, (20) suggested a dose response relationship between changes in body weight and corresponding changes in pain and function. The threshold for this response gradient appears to be body weight shifts of  $\geq 10\%$ . Weight changes of  $\geq 10\%$  have the potential to lead to important changes in pain and function of the knee.

Jenkinson et al., (21) studied the effects of weight loss and quadriceps exercise on 389 men and women aged 45 and over with a body mass index (BMI)  $\geq 28$ . They disagreed with this study as they suggested that simple knee strengthening exercises can significantly reduce knee pain and improve knee function in 114 overweight and obese people with knee pain. A moderate sustained weight loss was achieved with dietary intervention but with no apparent influence on pain or function.

At the end of the present study, we found that physical therapy is an effective method of reducing pain and improving function in obese patients with grade I and II of primary knee OA. Weight reduction is also an effective treatment modality in improving pain and knee function in obese patients with grade I and II of primary knee OA. Combination of both physical therapy and weight reduction gives superior results to using either method alone in obese patients with knee OA regarding reduction of disability, improvement of knee pain, physical function, daily activities and quality of life.

## References:-

1. Lopez H.L.,: Nutritional interventions to prevent and treat osteoarthritis. Part I: focus on fatty acids and macronutrients. PMRJ.;2012, 4 (5): S145-154.
2. Diehl P., and Gerdesmeyer L.,: conservative therapy of osteoarthritis. Orthopade, 2013, 42 (2): 125-139.
3. Griffin T.M. and Guilak F., : Why is obesity associated with osteoarthritis? Insights from mouse models of obesity. Biorheology. 2008, 45(3-4): 387-398.
4. Wluka A.E., Lombard C.B., Cicuttini F.M.,: Tackling obesity in knee osteoarthritis. Nat Rev Rheumatol. 2013 ; 9 (4): 225-235.
5. Sridhar M. S., Jarrett C. D., Xerogeanes J. W., et al.,: Obesity and symptomatic osteoarthritis of the knee. J Bone Joint Surg (Br). 2012 ; 94 B (4): 433-40.
6. Dekker J., and Peter W.,: Exercise therapy in hip or knee osteoarthritis. Ned. Tijdschr. Geneesk. 2011;155 (30-31): A3462.

7. Altman R., Asch E., Bloch D., et al., : Development of criteria for the classification and reporting of osteoarthritis. Classification of osteoarthritis of the knee. Diagnostic and Therapeutic Criteria Committee of the American Rheumatism Association. *Arthritis Rheum.* 1986; 29 (8): 1039–1049.
8. Guermazi M., Hunter D.J., and Roemer F.W.,: Plain radiography and magnetic resonance imaging diagnostics in osteoarthritis: validated staging and scoring, *J Bone Joint Surg Am.* 2009; 91 (1): 54–62.
9. Williamson A. and Hoggart B.,: Pain: a review of three commonly used pain rating scales. *Journal of Clinical Nursing.* 2005; 14: 798–804.
10. Guermazi M, Poiraudau S, Yahia M, et al.,: Translation, adaptation and validation of the Western Ontario and McMaster Universities osteoarthritis index (WOMAC) for an Arab population: the Sfax modified WOMAC. *Osteoarthritis and Cartilage.* 2004; 12 (6): 459–468.
11. Huang M.H., Chen C.H., Chen T.W., et al., : The effects of weight reduction on the rehabilitation of patients with knee osteoarthritis and obesity. *Arthr. Care and Res.* 2000 ; 13 (6), 398-405.
12. Graeme T, Harding Y, Cheryl L, et al, : Body mass index affects knee joint mechanics during gait differently with and without moderate knee osteoarthritis. *Osteoarthritis and Cartilage.* 2012; 20: 1234-1242.
13. Fernández C.A, Casariego V.A, Pomar B.,: Comparative study of total energy expenditure estimated by Sense Wear Armband and Harris-Benedict equation in healthy ambulatory population; utility in clinical practice. *Nutr. Hosp.* 2012; 27 (4): 1244-1247.
14. Lee R. and Kean W.F.,: Obesity and knee osteoarthritis. *Inflammopharmacology.* 2012; 20 (2): 53-58.
15. Christensen R., Bartels E.M., Astrup A., et al.,: Effect of weight reduction in obese patients diagnosed with knee osteoarthritis: a systematic review and meta -analysis. *Ann Rheum Dis.* 2007; 66 (4): 433–439.
16. Christensen R., Astrup A., Bliddal D.H., et al.,: Sustained weight loss as a treatment of osteoarthritis in obese patients: long-term results from a randomized trial. *Ann. Rheum. Dis.* 2005; 64 (III): 66.
17. Messier S.P., Loeser R.F., Miller G.D., et al., : Exercise and dietary weight loss in overweight and obese older adults with knee osteoarthritis: the arthritis, diet and activity promotion trial. *Arthritis Rheum.* 2005; 50: 1501–1510.
18. Miller G.D., Nicklas B.J., Davis C., et al., : Intensive weight loss program improves physical function in older obese adults with knee osteoarthritis. *Obesity (Silver Spring).* 2006; 14 (7): 1219-1230.
19. Grundy S.M., Cleeman J.I. and Daniels S.R. : Diagnosis and management of the metabolic syndrome: An American Heart Association. National Heart, Lung, and Blood Institute scientific statement. *Curr. Opin. Cardiol.* 2006; 21: 1–6.
20. Riddle D.L., and Stratford P.W., : Body weight changes and corresponding changes in pain and function in persons with symptomatic knee osteoarthritis: a cohort study. *Arthritis Care Res (Hoboken).* 2013; 65 (1): 15-22.
21. Jenkinson C.M., Doherty M., Avery A.J., et al., : Effects of dietary intervention and quadriceps strengthening exercises on pain and function in overweight people with knee pain: randomised controlled trial. *BMJ.* 2009; 18 (339): 3170.



## RESEARCH ARTICLE

### ROLE OF SPIRITUAL AND RELIGIOUS PRACTICES IN MODERN MEDICAL THERAPY

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#### Abstract

Since ancient times spiritual and religious practices proved their worth in management of many disorders. In fact, religious and spiritual leaders were once strongly against the practice of modern medicine. As the time passed modern medicine laid firm foundation in human civilization and people slowly forgot about spiritual and religious practices. Few physicians and surgeons noticed great improvement in patients who were practicing spiritual and religious practices. Further studies aimed to find effect of religious and spiritual practices in diseased patients proved that, religious and spiritual practices in combination with modern medical therapy work synergistically and a high number of patients were cured in due time. This paper highlights the role of spiritual and religious practices in modern medical therapy.

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Spiritual and religious practices are important aspects of medical care. However physicians are not sure about, when and how to address about religious issues. Physicians who spent a lot of time in reading modern medicine have little or no knowledge about religious or spiritual healing. There is an ethical issue in practicing spiritual healing according to which, a physician should not try to impose his or her belief on their patients. Apart from ethical issues as the modern medicine is being more directed towards science and technology physicians find it difficult to concentrate themselves on religion or spiritual healing. There are innumerable example in history where spiritual and religious healing proved to be successful. However, the question remains unanswered that, how spiritual or religious healing works or what is the exact science behind the spiritual healing. According to ancient literature spiritual and religious practices helps to initiate and regulate biofeedback mechanism. Yoga and Meditation are claimed to regulate secretion from pineal and pituitary glands<sup>1</sup>. If we combine the role of meditation and other spiritual practices we can find that these can have important role in prevention and management of various diseases related to cardiovascular, nervous , immune and reproductive system. various studies<sup>2,3</sup> have found positive effect of yoga and meditation on nervous and cardiovascular system. As written in history books that, many saints possessed the power of healing as they eliminated illness in human using some supernatural power. Mother Teresa of Kolkata, India recently given the honor of being a saint as she has said to have healed an ailing patient through her prayers and supernatural power. The reality behind supernatural power is beyond the reach of science or beyond the imagination of human mind, as said by great saints and scholars of Hindu mythology.

Sometimes the physician or the patient is not religious and there is lack of understanding in between patient and physician. In this condition one must not try to impose his belief over another. Imposing the beliefs can have negative impact both upon the treatment and on the interpersonal relationship. Various researches which were focused on quality of life of patients having spiritual or religious beliefs have found that, overall quality of life of

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patients suffering from psychiatric and stress disorders is better than those not practicing spiritual or religious practices<sup>4,5</sup>. Similarly few other studies in patients having cardiovascular disorders found that, spiritual and religious practices have profound effect on maintaining optimal health of cardiovascular system<sup>6,7</sup>. It was found that meditation has very critical role in maintaining good blood pressure in hypertensive and stressed patients. These finding again point towards possible effect of meditation and spiritual practices on pituitary, pineal glands and on the cardiovascular system. Apart from these disorders there are numerous infective, metabolic, inflammatory and neoplastic disorders which cannot be treated by using spiritual and religious practices. However if knowledge of spiritual practices is applied accurately, this can be used as an aid to reinforce patient to take proper medicine at right interval and for longer duration. Simkin. P et al in 2004<sup>8</sup> published an update over non pharmacological method of labor pain control in which he focused on possible role of spiritual and religious practices to control labor pain. In fact spiritual practices are ancient method of labor pain control for generations till the analgesics and anesthesia were discovered. According to him, spiritual and religious belief help overcome maternal stress and other psychological problems related to premature delivery, abortion or infant death<sup>9</sup>.

In cancer patients receiving palliative therapy to extend life expectancy and in those cancer patients whose death is near spiritual practices again prove their worth. Most patients who were found have practicing the religious practices have fewer treatment related complaints or complications than those who were not practicing<sup>10</sup>. A study which was performed on female patients who were getting treatment for breast cancer, it was found that, those women practicing spiritual and religious practices had better immune response<sup>11</sup>.

### Conclusion:-

Spirituality and religious practices are very strong tool in modifying body hormonal response and functioning of central nervous system. Together with modern medicine many psychological, psychiatric and cardiovascular diseases can be managed efficiently.

### References:-

1. Yoga in relation to brain, pituitary - adrenocortical axis. In Interaction Within the Brain - Pituitary - Adrenocortical Systems, Udupa, K.N. & Singh R.H. (Ed. M.T.Jones, B.Gillham, M.F.Dallman, S.Chattopadhyaya). New York: Academic Press 1978
2. The effect of yogasanas on muscular tone and cardiovascular adjustment. Gopal Yoga Life, 1975. 6; 5:3-11
3. Muscle activity in some asans, a pilot study. P.V., Bhole, M.V. & Gharote, M.L yog mimansa. 1969; 1 :1-13
4. Religiousness affects mental health, pain and quality of life in older people in an outpatient rehabilitation setting. Lucchetti G, Lucchetti AG, Badan-Neto AM, Peres PT, Peres MF, Moreira-Almeida A, et al J Rehabil Med. 2011;43:316-22
5. Contribution of spirituality to quality of life in patients with residual schizophrenia. Shah R, Kulhara P, Grover S, Kumar S, Malhotra R, Tyagi S Psychiatry Res. 2011;190:200-5
6. Spirituality predicts health and cardiovascular responses to stress in young adult women. Edmondson, K. A., Lawler, K. A., Jobe, R. L., Younger, J. W., Piferi, R. L., & Jones, W. H. *Journal of Religion and Health*, 2005; 44(2): 161-171.
7. Review of the effect of spiritual and religious factors on mortality and morbidity with a focus on cardiovascular and pulmonary disease. Luskin, F. *Journal of Cardiopulmonary Rehabilitation and Prevention*, 2000 ;20(1) :8-15.
8. Update on nonpharmacologic approaches to relieve labor pain and prevent suffering. Simkin, P., & Bolding, A. *Journal of midwifery & women's health*, 2004; 49(6): 489-504.
9. Territories of the self and spiritual practices during childbirth. *Birth Territory and Midwifery Guardianship*: Parratt, J. *Theory for practice, education and research* Edinburgh: Butterworth Heinemann Elsevier, 2008: 39-54.
10. Effect of spiritual well-being on end-of-life despair in terminally-ill cancer patients. McClain, C. S., Rosenfeld, B., & Breitbart, W. *The lancet*, 2003; 361(9369) :1603-1607.
11. Spiritual expression and immune status in women with metastatic breast cancer: an exploratory study. Sephton, S. E., Koopman, C., Schaal, M., Thoresen, C., & Spiegel, D *The breast journal*, 2001; 7(5): 345-353.





### RESEARCH ARTICLE

## 10 YEARS PREVALENCE OF HEPATITIS B INFECTION AMONG WOMEN DELIVERING AT KAMC-JEDDAH AND THEIR INFANTS.

Taghreed Shams, Aishah Saeed Alasmari, Daniyah Hassan Saleh and Hawazin Abdul Rahman Fallatah.

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### Abstract

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### Introduction:-

Hepatitis B infection is a common infectious disease worldwide. There are nearly 2 billion people with hepatitis B infection throughout the world. About one million people die yearly from its complications(1). In Saudi Arabia, the ministry of health considers hepatitis B virus infection as second most common viral disease after chickenpox with almost 4700 new cases diagnosed annually(2).

Hepatitis B is an inflammation of the liver caused by specific type of virus called B virus, interaction of the virus and host immunity lead to liver injury which may be complicated by cirrhosis and hepatocellular carcinoma (HCC). HBV is transmitted through infected body fluid such as blood, semen and vaginal secretions. IV drug users, infected sexual contact, infant born to infected mothers are all at risk of development of the infection. Infected individual can be symptomatic or asymptomatic(3).

Mother-to-child transmission, is one of the most important cause of HBV carriers(4), that's why recommended to screen all pregnant ladies for HBsAg in the first antenatal visit specially in endemic areas (e.g. Saudi Arabia). Infection with hepatitis B in newborns of carrier mothers is the leading cause of development of chronicity state up to 80% of the disease, Interrupting of HBV transmission through administration a highly effective neonatal immune-prophylaxis by vaccination and intra-venous immunoglobulin (IVIG) in the first 24 hours of life has a major impact in reducing the prevalence of cases. Despite immune-prophylaxis there are still documented cases of vertical transmission of HBV(5). In study conducted in china (2014), Vertical transmission rate has been reported around (5.44%) of infants despite immune-prophylaxis. they recommended further studies should work on prevention of immune-prophylaxis failure. Several studies implied that Mothers with positive HBeAg, high maternal viral load and positive cord blood for HBV DNA are most important factors that contributed to immune-prophylaxis failure(6).

Other studies shows a correlation between risk factors such as mode of delivery, ante-partum complications, procedures, intra-partum intervention and HBV vertical transmission(7).

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The aim of study is to measure SCREENING RATES of mother and their infants for HBV and the failure rate immune-prophylaxis in preventing vertical transmission of HBV at King Abdul-Aziz Medical City, National Guard Hospital Affairs (KAMC, NGHHA).

#### **The Research Problem:-**

To screening rates for mother and their infants for HBV and to measure failure rate of immune-prophylaxis in preventing vertical transmission of HBV at King Abdul-Aziz Medical City, National Guard Hospital Affairs (KAMC, NGHHA).in the period between 2005-2014.

#### **Research objectives:-**

- To Identify screening rate of HbsAg of mothers and their infants.
- To Estimate the incidence of vertical transmission of HBV in infants of HBV carrier mothers.
- To count the incidence of HBV carrier state in pregnant women at KAMC in the period between 2005-2014.
- To correlate risk factors for failure of HBV immune-prophylaxis.

#### **Research Methodology:-**

This retrospective cross-sectional study was conducted at KAMC between Sep 2009 until Dec 2014. Medical records of all pregnant women with positive HBsAg and their infants were collected and reviewed. Maternal Demographic data, hepatitis serology, liver function test, antepartum procedures and duration of rupture of fetal membrane, mode of delivery, and perinatal tears were collected. Infant timing of initial HBV vaccination and administration of IVIG, subsequent HBV vaccination, and screening were collected.

The primary outcome was the screening rate of HbsAg in infant HBV among pregnant women delivering in KAMC-Jeddah.

The secondary outcomes were failure of infant immune-prophylaxis to achieve positive HBsAb at age of 6-12 months, and rate vertical transmission of HBV from carrier mothers to their infant's defined as HBsAg positive at age 6-12 months. All Data was managed by SPSS version 21.

#### **Results and Discussion:-**

This study is the first done in Saudi Arabia that addresses a health issue with a significant burden of disease. Hoping in results can help in primary prevention of HBV infection. Although Saudi Arabia is one of endemic areas of hepatitis B but still ante-natal screening for mothers is low for many reasons such as decrease awareness about HB infection among health care providers and society. Even after mothers being HBsAg positive after screening only about 38.18% of these infants was screened for HBV for many reasons such as maternal poor compliance, no booked appointment and emergent delivery cases. Which is despite recommendation against invasive intervention of mothers with infectious diseases (8).

Among 23,756 deliveries in the period between 2005-2014, 152 women with positive HBsAg were identified. Those women gave birth to 251 children during study period. Only 16.7 % (42/251) of infants were screened, none was found to have HBsAg.

7% of all children (18/251) were screened between age of 2-6 years. Only one child was found to have HbsAg positive at age of 5 years. Among screened children, 20% (14/60) were found to be susceptible at time of screening. 23.9 % (60/251) of children had antenatal invasive testing. 60 of them had done Fetal scalp electrode and with Chorionic villous sampling. 14 of them had HbeAg (9%) and 54% had abnormal liver function test. The mean age of screened mother was 31.17 years, with gestational age mean of delivery 38.99 weeks.

All 251 children that delivered were documented received first dose vaccine and 199 (79%) of them found to have IVIG within the first 24 hours after delivery.

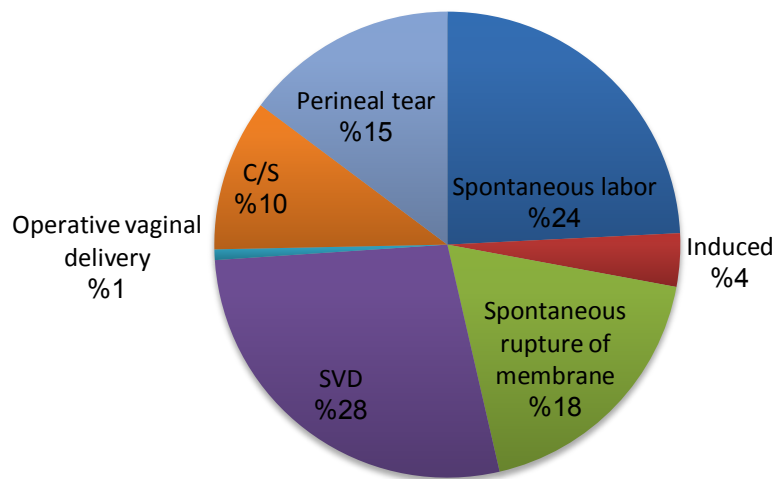
In previous studies suggested the role of caesarian deliveries to achieve a better outcome in decreasing rate of vertical transmission by minimize the direct contact between mother and fetus in compare with vaginal deliveries (7).

One of changes dealt through conducting the study HBV It is relatively rare disease. Retrospective nature that relies on documentation and limited access all medical records due to lack of computerized health information system before 2009. A lot of infant got immunized in other health care facilities other than KAMC.

**Table 1:-** The rate of HBV screening among infant of HBV infected mothers

Rate of screening			
screened	60	23.9% of all HBV mothers	
First year	44	70 %	
Second	8	3.18%	
Third	2	0.79%	
Forth	1	0.39%	
Fifth	2	0.79%	
Sixth	3	1.19%	

**Figuer: Intra-partum risk factors of total 251**



**Figure 1:-** Intra-partum risk factors of total 251 deliveries.

### Conclusion:-

Screening rates of HbsAg of 251 (38.18%)for infants and (23.9%) for of total 152 women whom found with positive HBsAg period between 2005-2014 whom delivered in KAMC, NGH. 70% of them during first year of infancy.

All 251 about 38.18% of these infants and children that delivered were documented received firstdose vaccine and 199 (79%) of them found to had IVIG within the first 24 hours after delivery.

There were an observed decreased numbers of maternal and infant screening rates for HBV. A Further studies are needed to determine the risk factors associated with failed immune-prophylaxis.

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**Perspectives:-**

Educating health care worker regarding the WHO recommendation for prevention of HBV vertical transmission. Institute a strong policy regarding screening and follow up for infant of HBV infected mother Educating the HBV infected mothers regarding the importance of infant screening. We will calculate the rate of HBV screening among pregnant women.

**References:-**

1. André F. Hepatitis B epidemiology in Asia, the middle East and Africa. Vaccine. 2000;18:S20-S2.
2. Abdo AA, Sanai FM, Al-Faleh FZ. Epidemiology of viral hepatitis in Saudi Arabia: Are we off the hook? Saudi journal of gastroenterology: official journal of the Saudi Gastroenterology Association. 2012;18(6):349.
3. Mast EE, Margolis HS, Fiore AE, Brink EW, Goldstein ST, Wang SA, et al. A comprehensive immunization strategy to eliminate transmission of hepatitis B virus infection in the United States. MMWR. 2005;54(16):1-32.
4. Wiseman E, Fraser MA, Holden S, Glass A, Kidson BL, Heron LG, et al. Perinatal transmission of hepatitis B virus: an Australian experience. Medical Journal of Australia. 2009;190(9):489.
5. Godbole G, Irish D, Basarab M, Mahungu T, Fox-Lewis A, Thorne C, et al. Management of hepatitis B in pregnant women and infants: a multicentre audit from four London hospitals. BMC pregnancy and childbirth. 2013;13(1):222.
6. Lin X, Guo Y, Zhou A, Zhang Y, Cao J, Yang M, et al. Immunoprophylaxis Failure Against Vertical Transmission of Hepatitis B Virus in the Chinese Population: A Hospital-based Study and a Meta-analysis. The Pediatric infectious disease journal. 2014;33(9):897-903.
7. Guo Z, Shi X, Feng Y, Wang B, Feng L, Wang S, et al. Risk factors of HBV intrauterine transmission among HBsAg-positive pregnant women. Journal of viral hepatitis. 2013;20(5):317-21.
8. Giles ML1, Grace R, Tai A, Michalak K, Walker SP. Prevention of mother-to-child transmission of hepatitis B virus (HBV) during pregnancy and the puerperium: current standards of care. 2013 Jun;53(3):231-5.

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### RESEARCH ARTICLE

#### A BRIEF OVERVIEW OF MYOFASCIAL TRIGGER POINTS.

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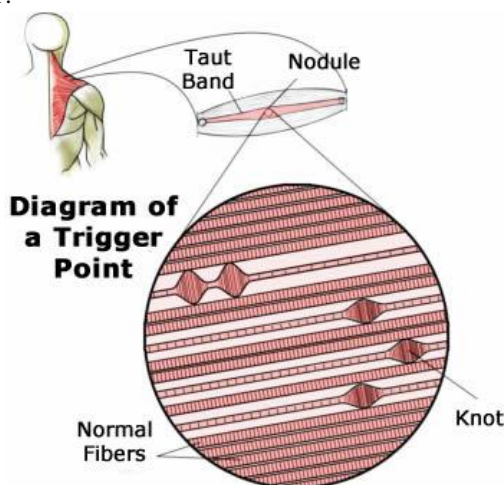
#### Abstract

Participating in school sports is an important means to increase physical activity among adolescents. While participation in schools can play an important role in increasing physical activity levels, school sports participation alone may not be sufficient to meet the current physical activity recommendations for adolescents. Therefore sports participation should not be seen as a replacement for physical education in schools but rather as a supplement to the solid foundation provided by physical education.

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#### Introduction:-

It has been usually believed that myofascial trigger points (MTrPs) are significant pathologies in the muscles and sometimes these points become painful and extremely irritating. The common definition of MTrP is described as the presence of local tenderness due to the existence of a contraction knot in a taut band of the muscle tissue (Figure 1). These points are painful and may produce referred pain, either spontaneously or due to direct pressure. MTrPs might be considered as one of the most frequent causes of pain and disability in the muscular and skeletal system (Cummings and Baldry, 2007). However, what are the existence theories and explanations regarding MTrP mechanism and its relation to pain?



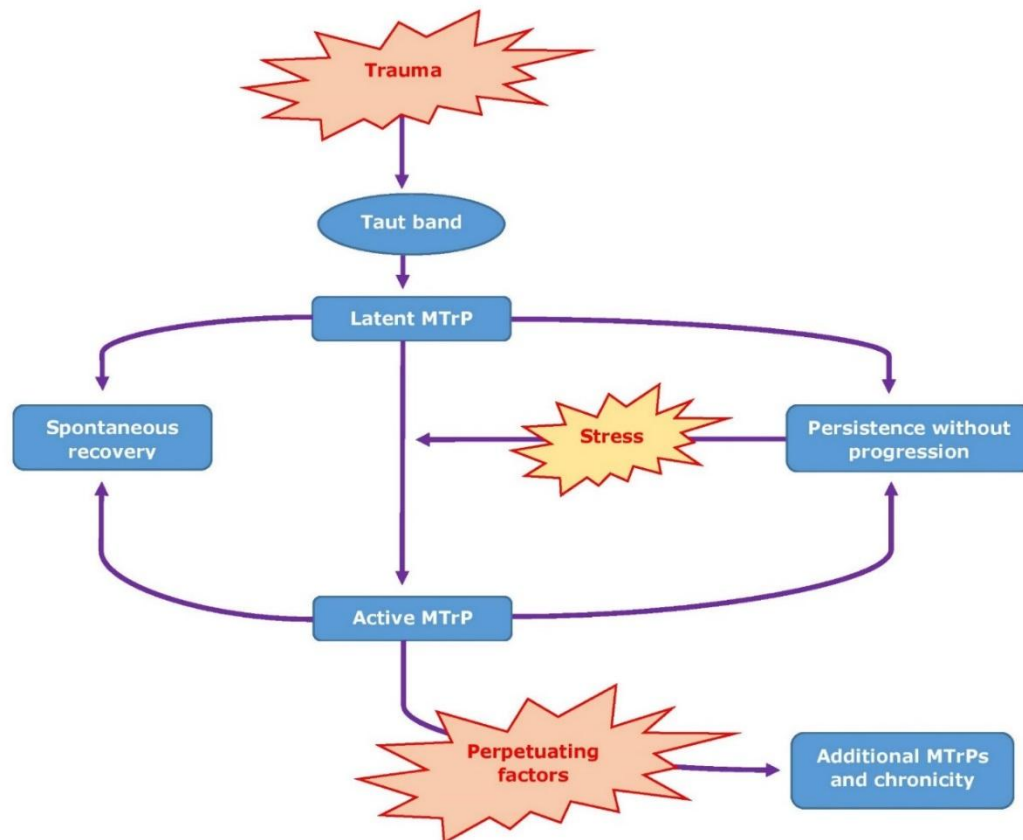
**Fig 1:-** Diagram of a Myofascial Trigger Point (taken from <http://www.healbodypain.com>)

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It seems possible that MTrPs are not a serious condition but it is important to clearly understand the concept of MTrPs pain mechanism. MTrPs can be divided into two main types. One of them is referred to as a latent trigger point, while the second is called an active trigger point. Latent trigger points are inactive points without spontaneous pain but which might be painful as a result of deep and direct compression. On the other hand, active trigger points are painful and spontaneous, and may be associated with referred pain. This might also present some other symptoms such as muscle weakness, a limited range of motion of the affected area and temperature alterations (Huguenin, 2004).

It is possible for a latent trigger point to become an active point. Many factors such as traumatic injuries, muscle overuse, poor posture, psychological stress and systemic pathology may contribute to the development of a local palpable latent MTrP. Therefore, latent MTrP could become active MTrP if subjected to mechanical stress or to other hurtful factors (Saxena et al., 2015). An active MTrP may spontaneously recover, return to the latent stage, or continue without progression. Moreover, an active MTrP could remain in a dynamic state, so it can change from being a latent MTrP to becoming an active MTrP, and back again in a vicious cycle, all of which is probably controlled by stressors (Figure 2). MTrPs can be also classified as primary and secondary MTrPs. A primary MTrP occurs from overloading or the overuse of specific muscle tissue, with the cause of their activation not being due to the action of another muscle. Secondary (satellite) MTrPs develop due to mechanical stress and/or neurogenic inflammation as a result of activity of a primary trigger point. The activity of nociceptive receptors in various structures (somatic or visceral) can develop secondary MTrPs (Simons et al., 1999).



**Fig 2:-** Myofascial trigger point vicious cycle (adapted from Saxena et al., 2015)

### Pathophysiology of MTrPs:-

There is a heated debate about the pathophysiology of MTrPs. There are a number of hypotheses about its mechanism. For example, an integrated hypothesis suggests that the cause of MTrP is due to overloading or overuse of a muscle that might cause micro-trauma which might lead to a release of acetylcholine (ACh). An increased in the amount of ACh contributes to a contraction knot, which is the area where there is a localized shortening in the

sarcomere. This contraction is sustained and leads to local ischaemia and hypoxia (Simons, 2004). Consequently, a loss of the energy supply (oxygen) leads to a release of sensitizing noxious substances, which may be the cause of the associated pain with MTrPs. This hypothesis is called the energy crisis theory and has been widely accepted by many healthcare professionals. There is another hypothesis, which is similar to the previous one, which is that blood vessel compression resulting from a continued contraction knot causes local hypoperfusion (Gerber, 2011). As a result, the ischemic tissue is usually associated with pain and tenderness.

In contrast, there are some theories that focus more on neurological models and are opposed to the previous theories. These theories propose that neuro tissue or process involvement is the major cause of myofascial pain, while the trigger point is just a minor phenomenon. One of their explanations is that the properties of myofascial pain based on myofascial trigger points are not discernible from neural pain. Therefore, they believe that the main cause is due to the nervous system such as neuritis (inflammation of the nerve), allodynia (pain sensation from non-painful stimulus) or hyperalgesia (exaggerated sensitivity to pain) (Quintner, 2014).

There are lots of studies which have discussed the factors that cause, lead, or maintain myofascial pain. Saxena et al. (2015) identified three categories of perpetuating factors that may have a negative effect on the body, and could lead to the development and increase in the number of MTrPs and which, with time, might also develop myofascial pain syndrome. These factors are divided into three main components: structural factors (such as scoliosis, functional leg length inequality and osteoarthritis of main joints), ergonomic factors (for example, poor posture and work related activities) and medical factors (such as hormonal imbalance, nutritional deficiencies and infectious diseases). However, these categories did not take into account the psychosocial factors that probably play an important role in developing MTrPs. It has been acknowledged that psychosocial factors such as anxiety and depression are frequently found in patients with chronic pain (Kuch, 2001). Therefore, muscle tension might cause fatigue, and with high loads in the muscle tissue, could lead to the development of MTrPs. Therefore, it is necessary to look deeply at all possible factors.

#### **MTrPs Diagnosis:-**

The MTrPs examination is not supported by high evidence. This because the fact that MTrPs assumed to be localized and are identified as a result of the clinical examination of the clinicians. However, the methods of clinician's examination do not follow gold standard criteria, and if any other therapists try to undertake such an examination they may identify different MTrPs or may identify nothing. Another issue is that these points can be palpated only if located in the superficial layer of the muscle tissue or if they are associated with areas of localized muscle shortening. Thus, there is always a question, how the therapists can differentiate between muscle stiffness, localized adhesions, allodynia, and tender points without a contraction knot from MTrPs. Therefore, a high level of manual skill is required to detect these points properly. There are four major clinical features of MTrPs (Cummings and Baldry, 2007):

- A tender point in the taut muscle tissue
- A possible pattern of pain distribution (Figures 6 and 7)
- Patient/client recognition of pain on continued pressure over MTrPs
- A local twitch response (LTR), which is a temporary and a quick contraction of the muscle fiber during pincer palpation of MTrPs. LTR could be visible or palpable, or may both.

MTrPs can be palpated and assessed in three ways. These are direct pressure, flat palpation and pincer palpation. The first two are used for superficial muscle tissue, while the third is used for deep muscle tissue (Simons et al., 1999). However, the force and the accuracy of performance that is applied during the assessment may influence the process and production of referred pain and, as a result may affect the judgment of the clinician about the diagnosis. Even complementary and instrumental testing such as ultrasound, electromyography, algometry and thermography are still controversial and their ability to diagnose MPS and detect MTrPs have not been confirmed due to the lack of sensitivity and specificity (Vázquez-Delgado et al., 2009). However, they are usually used simply to confirm the diagnosis of the clinician.

As a result, the relationship between MTrPs and myofascial pain syndrome (MPS) is a controversial one, for many reasons. There is no definite, validated and a significant diagnostic criteria to detect trigger points in the body as well as the overlapping symptoms of MPS with other musculoskeletal pain disorders may lead to confusion with regard to the diagnosis. Furthermore, most of the evidence, which support the idea of MPS based on trigger points, relates to low quality studies or ones conducted using in small groups, which may not allow us to generalize

the results. However, some recent studies look at other causes of MPS such as central sensitization (Giamberardino et al., 2011; Quintner, 2014).

### **Conclusion:-**

MTrPs are of two types: active or latent, which may be part of a vicious cycle that is usually controlled by stressors. There are many theories about the causes of MTrPs and how they produce pain but no theory has been significantly confirmed and stand out above the other theories. There are several perpetuating factors which may play a primary or secondary role in the development of MTrPs or which might activate the latent MTrPs. Clinicians should be considered these issues when using any interventions that based on the detection of MTrPs. Future studies need to investigate the relationship between pain and MTrPs involving patients with different musculoskeletal disorders in order to provide an adequate recommendation.

### **References:-**

1. Cummings, M. and Baldry, P. (2007): Regional myofascial pain: diagnosis and management. *Best Pract. Res. Clin. Rheumatol.*, 21(2): 367-387.
2. Gerber, N.L., Sikdar, S., Hammond, J. and Shah, J. (2011): A Brief Overview and Update of Myofascial Pain Syndrome and Myofascial Trigger Points. *Journal of Spinal Research Foundation*, 6(1): 55-64.
3. Giamberardino, M.A., Affaitati, G., Fabrizio, A. and Costantini, R. (2011): Myofascial pain syndromes and their evaluation. *Best Pract. Res. Clin. Rheumatol.*, 25(2): 185-198.
4. Huguenin, L.K. (2004): Myofascial trigger points: the current evidence. *Phys. Ther. Sport.*, 5(1): 2-12.
5. Kuch, K. (2001): Psychological factors and the development of chronic pain. *Clin. J. Pain.*, 17(4): 33-38.
6. Quintner, J. L., Bove, G. M., & Cohen, M. L. (2014). A critical evaluation of the trigger point phenomenon. *Rheumatology*, 54(3): 392-399.
7. Saxena, A., Chansoria, M., Tomar, G. and Kumar, A. (2015): Myofascial pain syndrome: an overview. *J. Pain. Palliat. Care. Pharmacother.*, 29(1): 16-21.
8. Simons, D.G. (2004): Review of enigmatic MTrPs as a common cause of enigmatic musculoskeletal pain and dysfunction. *J. Electromyogr. Kinesiol.*, 14, 95-107.
9. Simons, D.G., Travell, J.G. and Simons, L.S. (1999): Travell & Simons' myofascial pain and dysfunction the trigger point manual. Second edition, Williams & Wilkins, Baltimore, USA.
10. Vázquez-Delgado, E., Cascos-Romero, J. and Gay-Escoda, C. (2009): Myofascial pain syndrome associated with trigger points: a literature review. (I): Epidemiology, clinical treatment and etiopathogeny. *Medicina Oral, Patología Oral y Cirugía Bucal* 14(10): 494-498.

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### RESEARCH ARTICLE

## BASELINE RENAL DYSFUNCTION IN ACUTE ISCHEMIC STROKE PATIENTS: PREVALENCE AND IMPACT ON EARLY MORTALITY.

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#### Key words:-

Acute ischemic stroke; renal dysfunction; mortality

### Abstract

**Introduction:** Stroke is considered the second leading cause of death globally. Chronic kidney disease (CKD) has been identified as a risk factor for stroke. However, little is known about the impact of renal dysfunction on early mortality following acute ischemic stroke. The aim of the current study was to evaluate the prevalence of renal dysfunction among acute ischemic stroke patients and its role on the early overall mortality.

**Patients and methods:** This prospective cohort study included a total of 889 patients with first ever ischemic stroke who were hospitalized within 24 hours of symptoms onset. All patients were clinically evaluated to determine stroke risk factors. Stroke severity was assessed using National Institute of Health Stroke Scale (NIHSS) in the 1st day of admission. Baseline investigations were obtained within 24 hours of admission, including serum creatinine and estimated Glomerular Filtration Rate (eGFR) that was calculated from the equation of the Modification Diet for Renal Disease in ml/min/1.73m<sup>2</sup>. Patients were followed up for 30 days after admission or at least until death.

**Results:** Of the 800 stroke patients who completed follow up during the study period, 242 (30.2%) had renal dysfunction, and 128 (16%) died within 30-days of stroke onset, whereas mortality was higher (19.8%) in patients with eGFR <60 ml/min/1.73m<sup>2</sup> than in patients (14%) with eGFR ≥60 ml/min/1.73m<sup>2</sup>. In multivariate analysis, 30-days mortality risk of stroke was higher in patients with eGFR < 60ml/min/1.73 m<sup>2</sup> (HR= 1.7, 95% CI=1.4-2, P=0.002), stroke severity (HR= 1.5, 95% CI=1.3- 1.7, P=0.001), and presence of atrial fibrillation (HR= 1.4, 95% CI=1.1-1.7, P=0.007). Meanwhile, the odds of mortality risk increased by 1.7 for each 1 mg/dl increase in baseline serum creatinine.

**Conclusion:** The prevalence of renal dysfunction in our cohort of acute ischemic stroke patients was high. Presence of baseline renal dysfunction was recorded as an independent predictor of early mortality in the setting of acute ischemic stroke beside other well-known prognostic factors.

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## Introduction:-

Stroke represents a continuously evolving medical and social problem, being the second leading cause of death globally after ischemic heart disease. It was responsible for 1 in 10 deaths worldwide<sup>1</sup>. Predictors of early mortality identification are considered to be an important issue for clinicians, so that specific therapies and management strategies can be applied to patients at high risk of mortality. However, limited information is available for short-term mortality after acute ischemic stroke<sup>2</sup>.

Being a worldwide health problem as it was recorded in up to 15% of the adult population, chronic kidney disease (CKD) was considered a substantial risk for cardiovascular morbidity and mortality.<sup>3</sup> Stroke and CKD share a common cardiovascular risk factors including high blood pressure, smoking, high cholesterol and diabetes. Although CKD had been recognized as a risk factor for stroke with a glomerular filtration rate (GFR) of <60 mL/min/1.73 m<sup>2</sup>, little is known about the prevalence of renal dysfunction in the setting of ischemic stroke<sup>4</sup>.

Although CKD has been shown to be associated with poor early outcome after an acute myocardial infarction<sup>5</sup>, there are only few data about the impact of renal dysfunction on mortality in patients suffering from ischemic strokes<sup>6-8</sup>.

The aim of the present study was to assess the prevalence of renal dysfunction among acute ischemic stroke patients and its role on the early overall mortality.

## Patients and Methods:-

This study was a prospective cohort study conducted on 889 consecutive patients with first ever ischemic stroke who were admitted to Intensive Care Unit (ICU) and stroke unit of Neurology Department as well as ICU of Internal Medicine Department of Zagazig University Hospitals during the period from May 2013 to May 2015. Patients who were hospitalized within 24 hours after symptoms onset with a CT-confirmed diagnosis of stroke were included and followed up for 30 days after admission or at least until death.

The follow-up data were available for 800 (90%) of patients who were included in the present analysis. Informed consents from patients or their relatives about the study were obtained. We excluded patients with neurological deficits due to hemorrhagic brain insult transient ischemic attack (TIA), non-stroke causes (e.g. brain tumor), patients on dialysis, patients with missed data or missed follow-up.

All patients of this study were subjected to the following: detailed medical and neurological history taking from either patients or relatives with stressing on stroke risk factors (especially ischemic heart disease, hypertension, smoking, diabetes) complete general and neurological examination with special emphasis on National Institute of Health Stroke Scale<sup>9</sup> (NIHSS) which was done on admission. Electrocardiography was performed for all patients.

Laboratory investigations were done within 24 hours of admission, including complete blood count, random blood sugar, lipid profile (cholesterol, LDL, HDL, and Triglycerides), liver and kidney function tests, uric acid and electrolytes measurements. Calculation of glomerular filtration rate using The Modification of Diet in Renal Disease (MDRD) Study equation<sup>10</sup>:  $eGFR \text{ (ml/min/1.73 m}^2\text{)} = 175 \times (S.\text{creatinine})^{-1.154} \times (\text{Age})^{-0.203} \times (0.742 \text{ if female})$ . CKD was defined according to the National Kidney Foundation definition as kidney damage reflected by an estimated GFR of <60 mL/min/1.73 m<sup>2</sup> of body surface area and state that prediction equations have greater consistency and accuracy than serum creatinine in the assessment of GFR. In addition, prediction equations are equivalent or better than 24-h urine creatinine clearance.<sup>11</sup>

All patients were subjected to Computed Tomography (CT) scan of the brain to confirm diagnosis of ischemic stroke. Repeated CT scans were done 48 hours later if the initial scans were normal. All survivors were followed up in outpatient clinics. This study has been ethically approved by the local ethical committee of our faculty.

## Statistical Analysis:-

Collected Data were tabulated and analyzed using IBM, SPSS Version Statistics 20.0 software package<sup>12</sup>. Descriptions of data in the form mean  $\pm$  standard deviation (SD) for all quantitative variables, and frequency and percentage for all qualitative variables. The independent t-test or chi-square test was used to compare differences between the patient groups with and without renal dysfunction. Significance levels measured according to p value

(probability) where  $p < 0.05$  is significant and  $p < 0.001$  is highly significant. The associations between renal dysfunction and 30-day mortality were evaluated by multivariate Cox proportional hazards models. In the multivariate analysis, patients with  $eGFR < 60 \text{ mL/min/1.73 m}^2$  were further subdivided into two categories: those with  $60 > eGFR \geq 30$  and those  $< 30 \text{ mL/min/1.73 m}^2$ .

### Results:-

The mean age of the 800 ischemic stroke patients was  $62.25 \pm 9.7$  years (range, 37–86 years) with 424 were males (53%) and 376 were females (47%). According to the  $eGFR$  values, we found that 558 patients (69.8%) had normal renal function with  $eGFR \geq 60 \text{ mL/min/1.73 m}^2$  and 242 of patients (30.2%) had renal dysfunction ( $eGFR < 60 \text{ mL/min/1.73 m}^2$ ). 128 of the studied patients (16%) died within 30-days of stroke onset.

The demographics, clinical and laboratory characteristics of the studied patients were shown in **Table (1)**. There was a significant difference between ischemic stroke patients with low and those with normal  $eGFR$  regarding most of the studied variables. The stroke severity (NIHSS) was higher in those with impaired than those with normal renal function ( $13.4 \pm 1.42$ ,  $8.98 \pm 2.75$  respectively). Deceased patients were older than survivors and had a higher percentage of IHD, AF, high glucose levels and more renal impairment than survivors (**Table2**). In the multivariate Cox proportional hazard analysis model adjusted for age and sex (**Table 3**), risk of 30-days mortality was significantly increased in patients with high blood glucose on admission, presence of AF and IHD,  $GFR < 60 \text{ mL/min/1.73 m}^2$ , high NIHSS on admission, and high Uric acid. 30-days mortality risk was increased with  $30 \leq eGFR < 60 \text{ mL/min/1.73 m}^2$  ( $HR = 1.7$ , 95%  $CI = 1.4-2$ ,  $P = 0.002$ ),  $eGFR < 30$  ( $HR = 1.9$ , 95%  $CI = 1.6-2.2$ ), stroke severity ( $HR = 1.5$ , 95%  $CI = 1.3-1.7$ ,  $P = 0.001$ ), presence of atrial fibrillation ( $HR = 1.4$ , 95%  $CI = 1.1-1.7$ ,  $P = 0.007$ ) and IHD ( $HR = 2.1$ , 95%  $CI = 1.6-2.6$ ). **Table (4)** showed predictors of overall mortality after acute ischemic stroke. The risk of mortality was related to age (per 10-year increase), baseline creatinine (per  $1 \text{ mg/dL}$  increase), and NIHSS score (per 5-point increase).

**Table 1:-** Demographics, clinical and laboratory characteristics of the studied ischemic stroke patients (classified according to estimated Glomerular Filtration Rate,  $eGFR$ ).

	Patients with $eGFR < 60$ N=242	Patients with $eGFR \geq 60$ N=558	Test	P
Age	$65.4 \pm 10.9$	$54.8 \pm 9.41$	$t = 13.1$	<b>&lt;0.001</b>
Weight	$71.4 \pm 5.9$	$73.5 \pm 5.75$	$t = -4.7$	<b>&lt;0.001</b>
Smoking, n (%)	54 (22.3)	147 (26.3)	$\chi^2 = 1.25$	0.26
AF, n (%, )	90 (37.2)	112 (20)	$\chi^2 = 25.3$	<b>&lt;0.001</b>
IHD, n (%)	75 (30.9)	106 (18.9)	$\chi^2 = 13.2$	<b>&lt;0.001</b>
SBP	$160 \pm 25.64$	$150 \pm 27.6$	$t = 4.80$	<b>&lt;0.001</b>
DBP	$96.26 \pm 14.39$	$92.4 \pm 14.5$	$t = 3.47$	<b>&lt;0.001</b>
NIHSS	$13.4 \pm 1.42$	$8.98 \pm 2.75$	$t = 30.48$	<b>&lt;0.001</b>
HCT	$40.92 \pm 4.1$	$41.78 \pm 4$	$t = 2.75$	<b>&lt;0.05</b>
Creatinine	$2.32 \pm 1.3$	$1.03 \pm 0.21$	$t = 15.35$	<b>&lt;0.001</b>
Urea	$49.56 \pm 23.9$	$25.96 \pm 4.3$	$t = 15.25$	<b>&lt;0.001</b>
$eGFR$	$34.9 \pm 13.79$	$80.5 \pm 17.05$	$t = 33.348$	<b>&lt;0.001</b>
Uric acid	$8.5 \pm 1.4$	$5.9 \pm 1.3$	$t = 24.6$	<b>&lt;0.05</b>
Calcium	$8.17 \pm 0.62$	$9.19 \pm 0.58$	$t = 0.338$	NS
Phosphate	$3.1 \pm 0.61$	$3.23 \pm 0.54$	$t = 2.86$	<b>&lt;0.05</b>
Serum Albumin	$3.17 \pm 0.54$	$3.42 \pm 0.57$	$t = 4.874$	<b>&lt;0.001</b>
Glucose	$117.9 \pm 68.89$	$131.9 \pm 59.9$	$t = 2.74$	<b>&lt;0.05</b>
LDL-C	$114 \pm 17.51$	$113.74 \pm 14.0$	$t = 0.172$	NS
Triglyceride	$116.5 \pm 44.2$	$104.6 \pm 40.5$	$t = 3.58$	<b>&lt;0.001</b>
Cholesterol	$163.12 \pm 51.93$	$147.52 \pm 53.0$	$t = 3.87$	<b>&lt;0.001</b>
Male-female ratio	79/ 163	200/358	$\chi^2 = 0.63$	NS
30 -day mortality	48(19.8%)	80(14.3%)	$\chi^2 = 9.6$	<b>&lt;0.01</b>

**SBP:** systolic blood pressure; **DPB:** diastolic blood pressure; **LDLC:** low density lipoproteins cholesterol; **HCT:** Haematocrit value; **eGFR:** estimated glomerular filtration rate; **NIHSS:** National Institutes of Health Stroke Scale; **IHD:** ischemic heart disease; **AF:** atrial fibrillation.

**Table 2:-** Comparison between survivors and deceased acute ischemic stroke patients within 30 days of admission.

	Survivors N=672	Deceased N=128	Test	P
Age	57.5±11.8	64.95±9.8	t= 7.61	<0.05
Weight	72.1 ±5.8	72±6.5	t= 166	NS
SBP	156.35 ±26.7	160±26.19	t= 1.44	NS
DBP	94.7±14.5	96.31 ±14.46	t= 1.15	NS
Smoking, n (%)	131 (19.5)	21 (16.4)	$\chi^2=0.8$	NS
AF, n (%)	141 (20.98)	35(27.3)	$\chi^2=5.6$	0.01
IHD, n (%)	127 (18.89)	32 (25)	$\chi^2=4.9$	0.02
NIHSS	7.6±3.1	16.8±2.8	t= 19.718	<0.001
HCT	41.16 ±4.11	41.4 ±4.17	t= 0.513	NS
Creatinine	1.2 ± 0.3	1.7 ± 0.7	t= 7.943	<0.001
eGFR	50.9±26	43±23.8	t= 3.39	<0.001
Uric acid	5.7±2.05	8.79±1.65	t= 18.62	<0.05
Calcium	9.19 ±0.6	9.13 ±0.5	t= 0.813	NS
Phosphate	3.3±0.5	3.3±0.6	t= 0.023	NS
Albumin	3.2±0.5	3.2±0.5	t= 0.800	NS
Glucose	117 ± 56.9	149.95 ± 61.5	t= 5.62	<0.001
LDL-C	113.5±16.6	115.9±16.48	t= 1.158	NS
Triglyceride	111.67±43.6	118.35 ±41.5	t= 1.271	NS
Cholesterol	157.12 ±53.1	163.23 ±51.1	t= 1.23	NS

**SBP:** systolic blood pressure; **DBP:** diastolic blood pressure; **AF:** atrial fibrillation; **IHD:** ischemic heart disease; **NIHSS:** National Institutes of Health Stroke Scale; **HCT:** haematocrit value; **LDLC:** low density lipoproteins cholesterol.

**Table 3:-** Multivariate Cox proportional adjusted for age and sex hazard analysis determining the effect of different factors on 30 -day mortality of the studied patients .

	Sig.	HR	95% CI	
			Lower	Upper
AF	0.007*	1.4	1.1	1.7
IHD	0.0001**	2.1	1.6	2.6
Glucose	0.040*	1.2	1.0	1.4
60>eGFR≥30	0.002*	1.7	1.4	2
eGFR < 30	0.002*	1.9	1.6	2.2
Uric acid	0.009*	1.6	1.3	1.9
NIHSS	0.001*	1.5	1.3	1.7

**AF:** atrial fibrillation; **IHD:** ischemic heart disease; **NIHSS:** National Institutes of Health Stroke Scale ;**eGFR:** estimated Glomerular filtration rate.

**Table 4:-** Predictors of mortality after acute ischemic stroke.

Variable	OR	(95% CI)	P
Age (per 10-year increase)	1.8	(1.4-2.2)	<0.001**
Baseline creatinine (per 1 mg/dl increase)	1.7	(1.4-2.0)	<0.001**
NIHSS score(per 5-point increase)	1.6	(1.2- 2.0)	<0.001**

**NIHSS:** National Institutes of Health Stroke Scale; **CI:** confidence interval; **OR:** odds ratio.

## Discussion:-

Renal dysfunction is considered a valuable predictor of poor outcomes including mortality in patients with ischemic stroke<sup>13-15</sup> as well as in the general population.<sup>16-17</sup> Renal function can be roughly assessed by serum creatinine level but more accurately evaluated from estimated glomerular filtration rate (eGFR), which is usually automatically calculated in a clinical setting, based on serum creatinine and basic demographic findings.<sup>18</sup>

From this study, we observed that approximately one-third (30.2%) of the stroke patients had a low eGFR level ( $\text{eGFR} < 60 \text{ ml per minute per } 1.73 \text{ m}^2$ ). Also, this study showed that patients with renal dysfunction were older, had a higher prevalence of hypertension, a higher NIHSS score and a higher blood glucose level on admission. Similar results were found by Hoshino and colleagues<sup>19</sup> in their study among stroke patients with mild to moderate renal dysfunction. Tsagalis et al.,<sup>20</sup> observed a similar rates (28%) of renal dysfunction in acute stroke patients suggesting a significant prevalence of CKD in stroke sufferers.

Chronic kidney disease was defined as estimated glomerular filtration rate  $< 60 \text{ ml/min/ } 1.73 \text{ m}^2$  according to Yahalom and colleagues<sup>21</sup> who showed in their study that CKD was present in 36% of patients with acute stroke based on MDRD formula and in only 18% if based on Mayo Clinic formula.

It was postulate that the aetiology for the high prevalence of cerebrovascular disorders in patients with renal dysfunction is enhanced atherosclerosis<sup>22-23</sup>. In patients with CKD, advanced asymptomatic atherosclerosis in the carotid arteries compared with healthy control subjects was observed<sup>24</sup>. Moreover, Preston et al.,<sup>25</sup> reported that the increased intima media thickness was directly related with the level of renal dysfunction.

This study showed that early mortality after acute ischemic stroke was quite high and even increased in patients with associated renal dysfunction. This increased risk of mortality appeared to be associated with severity of baseline renal dysfunction.

In this study, the 30-day mortality of all ischemic stroke patients was 16%, whereas it was 14.3% in patients with baseline  $\text{eGFR} \geq 60 \text{ ml/min/ } 1.73 \text{ m}^2$ . Similar rates were reported from the European Registries of Stroke Collaboration in which 1-month mortality after stroke ranged from 13 to 27%<sup>26</sup>. While a lower rates of 13% were observed by Yahalom and colleagues.<sup>21</sup>

However a lower rate of 10% mortality at 30 -days were reported by De Jong et al.,<sup>27</sup> in 998 patients with first-ever cerebral infarction. In addition 5%<sup>28</sup>, 7.6%<sup>29</sup> and 8.2%<sup>30</sup> mortality at 30 days after stroke were reported in previous Studies.

The present study revealed that old age, presence of AF, IHD, baseline creatinine, and high uric acid level, low eGFR, higher NIHSS on admission were associated with early mortality. These results were in agreement with previous studies<sup>31-32</sup>

From this study, we observed a higher mortality rates (19.8%) in patients with baseline  $\text{eGFR} < 60 \text{ ml/min/ } 1.73 \text{ m}^2$  in comparison to those with normal eGFR (14.3%). Also, the severity of impaired kidney function was associated with increased risk of early mortality (odd ratio= 1.7, 95% CI =1.4- 2 , per 1mg/dl increase in serum creatinine). Similarly, Carter et al<sup>33</sup>. showed that serum creatinine level was a strong predictor of mortality in patients with ischemic stroke. Furthermore, other studies showed that low eGFR was associated with a higher in-hospital mortality rates.<sup>3,34</sup>

Data from Nationwide Inpatient Sample study showed that among 1 million of stroke hospitalizations during the study period, 6.1% had a co- morbid diagnosis of CKD, and 9% of those with CKD died in hospital. Presence of CKD was independently associated with higher odds of dying during stroke hospitalization regardless of stroke type<sup>8</sup>.

The association between kidney function and survival following an acute ischemic stroke could be due to shared risk factors underlying vascular diseases including age, diabetes mellitus, hypertension, AF, smoking, coronary artery disease and dyslipidemia.<sup>35</sup> In addition, Ovbiagele<sup>8</sup> stated that hospitalized stroke patients with CKD are less likely to receive evidence-based therapies compared to patients without CKD that contribute to poorer clinical outcomes in these patients. Other reasons for poor early outcomes in stroke patients with compromised kidney function include the association of CKD with conditions that hinder rapid recovery such as oxidative stress, elevated uremic toxins, including plasma dimethylarginine, electrolyte derangements, and procoagulation.<sup>36</sup>

Large sample size could be a point of strength in this study. However, some limitations should be mentioned. The diagnosis of CKD requires the presence of kidney damage for  $\geq 3$  months. GFR was only estimated once, meaning that some patients with acute kidney injury may have been misclassified as having CKD. Also, no

differentiation was possible between the different subtypes of ischemic stroke as the localization and extension of ischemic stroke may have prognostic significance. Moreover, our center is a tertiary care center with a large referral base, so patients included may have more severe strokes than patients treated at community hospitals, which may explain higher mortality compared to other studies.

In conclusion, impaired kidney function (assessed by eGFR) was prevalent in patients presented with acute ischemic stroke and associated with increased early mortality. This finding suggests that eGFR can be added to the other known prognostic factors of ischemic stroke and emphasizes the importance of monitoring and proper management of kidney disease in those patients.

## References:-

1. Lozano R ,Naghavi M, Foreman K, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012; 380: 2095–128
2. Heuschmann PU, Kolominsky-Rabas PL, Roether J, et al. Predictors of in-hospital mortality in patients with acute ischemic stroke treated with thrombolytic therapy. *JAMA*. 2004; 292(15):1831-8.
3. Hojs R and Fabjan T H. Renal Dysfunction and Ischemic Stroke. *ACTA FACULTATIS MEDICAE NAISSENSIS* 2013; 30(4): 185-191.
4. Masson P , Webster A C , Hong M et al. Chronic kidney disease and the risk of stroke: a systematic review and meta-analysis. *Nephrol Dial Transplant* 2015; 30: 1162–1169.
5. El-Menyar A, Zubaid M, Sulaiman K, et al. In-hospital major clinical outcomes in patients with chronic renal insufficiency presenting with acute coronary syndrome: data from a Registry of 8176 patients. *Mayo ClinProc* 2010; 85(4): 332–40.
6. Ovbiagele B, Sanossian N, Liebeskind DS, et al. Indices of kidney dysfunction and discharge outcomes in hospitalized stroke patients without known renal disease. *Cerebrovasc Dis* 2009; 28(6): 582–8
7. Agrawal V, Rai B, Fellows J, et al. In-hospital outcomes with thrombolytic therapy in patients with renal dysfunction presenting with acute ischemic stroke. *Nephrol Dial Transplant* 2010; 25(4):1150–7
8. Ovbiagele B. Chronic kidney disease and risk of death during hospitalization for stroke. *Journal of the Neurological Sciences* 2011; 301(1-2): 46–50.
9. Kasner SE: Clinical interpretation and use of stroke scales. *The Lancet Neurology* 2006; 5(7): 603-612.
10. Levey AS, Coresh J, Greene T, et al. Chronic Kidney Disease Epidemiology Collaboration. Using standardized serum creatinine values in the modification of diet in renal disease study equation for estimating glomerular filtration rate. *Ann Intern Med* 2006 ;15 : 145(4): 247-54.
11. Levey AS, Coresh J, Balk E, et al. National Kidney Foundation practice guidelines for chronic kidney disease: evaluation, classification, and stratification. *Ann Intern Med* 2003; 139(2):137–47.
12. IBM Corp. Released 2010. IBM SPSS Statistics for Windows, Version 20. Armonk, NY: IBM Corp; 2010
13. Lima HN, Cabral NL, Gonçalves AR, et al. Association between albuminuria, glomerular filtration rate and mortality or recurrence in stroke patients. *Nephron ClinPract*. 2011; 117:246–252.
14. Sander D, Weimar C, Bramlage P et al. Microalbuminuria indicates long-term vascular risk in patients after acute stroke undergoing in-patient rehabilitation. *BMC Neurol*. 2012;12:102.
15. Toyoda K. Cerebral small vessel disease and chronic kidney disease. *J Stroke* 2015; 17:31 37.
16. Matsushita K, Coresh J, Sang Y et al. Estimated glomerular filtration rate and albuminuria for prediction of cardiovascular outcomes: a collaborative meta-analysis of individual participant data. *Lancet Diabetes Endocrinol*. 2015; 3:514–525
17. Mahmoodi BK, Yatsuya H, Matsushita K et al. Association of kidney disease measures with ischemic versus hemorrhagic strokes: pooled analyses of 4 prospective community- based cohorts. *Stroke* 2014; 45:1925–1931.
18. Horio M, Imai E, Yasuda Y et al. Modification of the CKD epidemiology collaboration (CKD-EPI) equation for Japanese: accuracy and use for population estimates. *Am J Kidney Dis*. 2010; 56:32–38.
19. Hoshino H, Itoh Y, Yamada S, et al. Clinical features and neurologic severity in stroke patients with mild to moderate renal dysfunction. *J Stroke Cerebrovasc Dis* 2012; 21(5): 343-349.
20. Tsagalis G, Akrivos T, Alevizaki M, et al (2009). Renal dysfunction in acute stroke: an independent predictor of long-term all combined vascular events and overall mortality. *Nephrol Dial Transplant* 24(1): 194-200.
21. Yahalom G, Schwartz R, Schwammenthal Y, et al. Chronic kidney disease and clinical outcome in patients with acute stroke. *Stroke* 2009; 40:1296-303
22. Kawagishi T, Nishizawa Y, Konishi T et al. High-resolution B-mode ultrasonography in evaluation of atherosclerosis in uremia. *Kidney Int* 1995; 48: 820–6.

23. Hojs R. Carotid intima-media thickness and plaques in hemodialysis patients. *Artif Organs* 2000;9:691–5.
24. O'Rourke M F and Safar M E (). Relationship between aortic stiffening and microvascular disease in brain and kidney: cause and logic of therapy. *Hypertension* 2005; 46(1): 200-204.
25. Preston E, Ellis MR, Kulinskaya E, et al. Association between carotid artery intima-media thickness and cardiovascular risk factors in CKD. *Am J Kidney Dis* 2005; 46: 856–62.
26. Wolfe CD, Giroud M, Kolominsky-Rabas P, et al: Variations in stroke incidence and survival in 3 areas of Europe. European Registries of Stroke (EROS) Collaboration. *Stroke* 2000; 31: 2074–2079.
27. De Jong G, van Raak L, Kessels F et al. Stroke subtype and mortality.a follow-up study in 998 patients with a first cerebral infarct. *J ClinEpidemiol* 2003; 56 (3): 262-268.
28. Hartmann A, Rundek T, Mast H et al. Mortality and causes of death after first ischemic stroke: the Northern Manhattan Stroke Study. *Neurology* 2001; 57(11): 2000-2005.
29. CovicA , Schiller A , Mardare NG , et al. The impact of acute kidney injury on short-term survival in an Eastern European population with stroke, *Nephrol. Dial. Transplant.* 2008; 23 (7): 2228-2234.
30. Collins T C, Petersen N J, Menke T J, et al. Short-term, intermediate-term, and long-term mortality in patients hospitalized for stroke. *J ClinEpidemiol* 2003; 56 (1): 81-87.
31. Castillo J, Davalos A, Marrugat J et al. Timing for fever-related brain damage in acute ischemic stroke. *Stroke* 1998; 29(12): 2455-2460.
32. Nedeltchev K, Renz N, Karameshev A, et al . Predictors of early mortality after acute ischemic stroke. *Swiss Med Wkly* 2010; 140 (17-18): 254-259.
33. Carter A M, Catto A J, Mansfield M W, et al. Predictive variables for mortality after acute ischemic stroke. *Stroke* 2007; 38(6): 1873-1880.
34. Brzosko S, Szkolka T and MysliwiecM . Kidney disease is a negative predictor of 30-day survival after acute ischemic stroke. *Nephron ClinPract* 2009; 112 (2): 79-85.
35. Sarnak M J, Levey A S, Schoolwerth A C, et al . Kidney disease as a risk factor for development of cardiovascular disease: a statement from the American Heart Association Councils on Kidney in Cardiovascular Disease, High Blood Pressure Research, Clinical Cardiology, and Epidemiology and Prevention. *Circulation* 2003; 108 (17): 2154-2169.
36. Schiffrin EL, Lipman ML, Mann JF. Chronic kidney disease: effects on the cardiovascular system. *Circulation* 2007; 116: 85–97.

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### RESEARCH ARTICLE

#### BRICKS FROM WASTE PLASTIC.

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#### Abstract

This project reviews one of the sustainable and effective ways of managing plastic waste in urban and rural parts of India in order to minimize their adverse environmental impacts. The requirement for such a research is validated as it is desirable to change the unsustainable arrangement of consumption, production and disposal associated with these materials. After studying the whole scenario, I developed an effective way of utilizing the soft plastic waste and recycling it into plastic bricks which are very light in weight and can withstand high amount of pressure as compared to standard modular bricks. However due to some physical and chemical properties of plastic which can be disadvantageous to the brick created from it, some changes in its design and manufacturing processes can be made.

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#### Introduction:-

Environmental engineering is the branch of engineering bothered with the application of scientific and engineering principles for conservation of human populations from the effects of adverse environmental factors; preservation of environments, both local and global, from the potentially destructive effects of natural and human activities; and improvement of environmental quality. Relating to this, environmental engineers also work upon the different strategies and effective ways of managing the waste created naturally and artificially within the environment. Among the different types of wastes generated, plastic waste is one of the most hazardous wastes which need to be treated in a proper systematic way.

Plastic Waste management is all the activities and actions required to manage plastic waste from its inception to its final disposal. This includes amongst other things, collection, transport, treatment and disposal of plastic waste together with monitoring and regulation. It also encircles the legal and regulatory framework that relates to plastic waste management enclosing guidance on recycling etc.

As more cities become industrialized, the surplus problem of plastic waste management comes along with it. Technological and economic advancement has made the types and kinds of plastic wastes very diverse and their management much more complex. The complex nature of disease outbreaks; cases of cholera as well as other diarrheal diseases in recent times authenticate this fact. Furthermore, the changing economic trends and rapid urbanization disarrange plastic waste management (PWM) in developing countries. Consequently, plastic waste is not only increasing in composition but also changing in quantity from a few kilograms to tonnage proportions.

The plastic brick is compressed by the two iron rods. Firstly the plastic waste is being collected in bulk amount. Then a modular brick mould is being taken and plastic waste such as crisp bags and polythene bags are filled in it.

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Air tight amount of plastic waste has to be filled in the mould. After that the mould is closed with a metal plate on it and allowed to heat in a solar grill oven for 1 hour. Then the mould is taken out from the oven and cooled down immediately with a jet spray. After this with the help of mechanical means the plastic brick is being removed from the mould.

### **Literature Review:-**

The need of creating this plastic waste brick is as mentioned.

Municipal control board emphasizes the current scenario of plastic waste in india.

The leading factor for plastics is its functional convenience and cost effectiveness. By upright economies of scale, plastics have disintegrated the traditional industries in india and have slowly conserved the throwaway culture in the indian society.

The bottled water, junk foods and pepsi coke culture in the country distributes to the increasing plastic waste generation in india. The problem becomes very vast when there is no effective end of life management to take care of the litter, and this creates an environmental, social as well as economic problems.

The increasing use of plastics as a packaging material has resulted in the landscapes of india being littered with non-biodegradable plastic bags and PET bottles, with plastic bags commanding the litter.

High amount of plastic waste has a value, and is constantly taken care of by the informal recycling sector.

Market executives guide the informal sector, and they contribute to the waste system excessively by collecting waste material that has a value, thereby taking over a part of the responsibilities on the municipalities.

Inspite the attempts from the formal and the informal sector, massive quantities of the plastic waste remain uncollected. Waste management is also embarrassed by the lack of public awareness and low municipal finances in the country.

Most municipalities are malnourished of finances and this blemish the system of waste collection and disposal in many cities in india. Even when budgets are consequent for collection, safe disposal remains a primary problem.

Taking in consideration, improper waste management leads to so many environmental problems. The situation is more immense in countries like india where economic growth as well as urbanization is quite frequent.

A total of 36.5 million tonnes per year that is 36.5 kg per individual of municipal solid waste is generated in the country. Considering the fact that the plastic consumption in the country is 4 million tonnes and 52% of the plastics is used for packaging, and then we could estimate that the plastic waste generated is at least 2 million tonnes and not more than 4 million tonnes.

In view of the limited resources and availability of land for disposal, especially in the mega cities, there is a great need for an effective effort to develop cost-effective and feasible policy options for overcoming the waste management problems.

### **Problem Definition:-**

For effective plastic waste management, it is necessary to carry out the work in a systematic step by step manner. For this areas where waste management is required is studied out and then which techniques of waste collection and disposal will be the most suitable is being analyzed and carried out.

Plastic waste contains high amount of polythene bags and crisp bags which is further collected and used for manufacturing of newly designed plastic brick which proves to be cost effective and beneficial as it is used in a proper way rather than disposing or burning it in the atmosphere.

Also the waste disposing techniques of plastic waste such as pyrolysis, chemical decomposition of waste, land filling, incineration, composting are quiet time consuming techniques and does not offer to clear out large quantities



of waste in a short period of time. Hence this method of using soft plastic waste for a beneficial purpose of making out bricks which are very light in weight and gives high pressure handling capacity would prove to be very useful as it would minimize the plastic waste at a large extent.

**Aim of the Project:-**

The aim of the project is to study the plastic waste management strategies and provide an effective way to minimize it and use it for a beneficial purpose.

**Further adding to this, the main project work also relates the following:-**

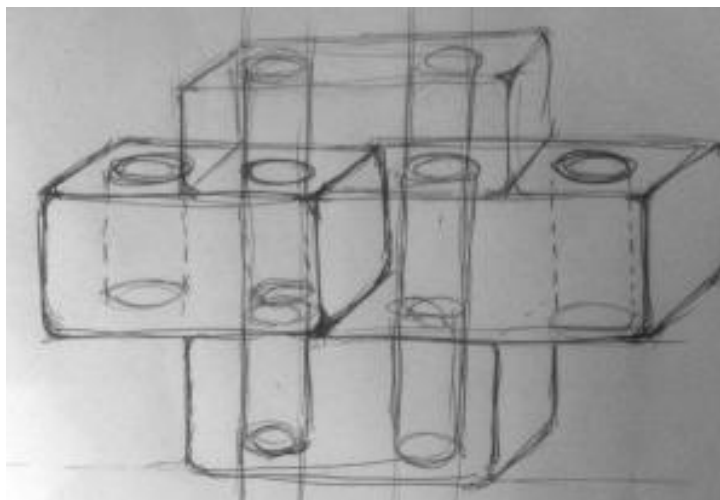
- Compilation of data on plastic waste from rural and urban areas.
- Analysis and study of plastic waste to understand its utilization or disposal.
- To measure the willingness of help and co-operation provided by people for plastic waste management.
- To review the methods for waste collection, transportation and disposal as available for municipal solid waste.
- To provide an effective way of using plastic waste into a very beneficial way and giving a plastic brick as a final product by using plastic waste.
- The need of developing such a brick was to minimize the plastic waste by using it in the best possible way and replacing these bricks with raw mud as a constructing material for houses so that the major issue of houses getting washed away during floods and damaging during earthquakes can be minimized.

**Design of brick:-****OVERVIEW:-**

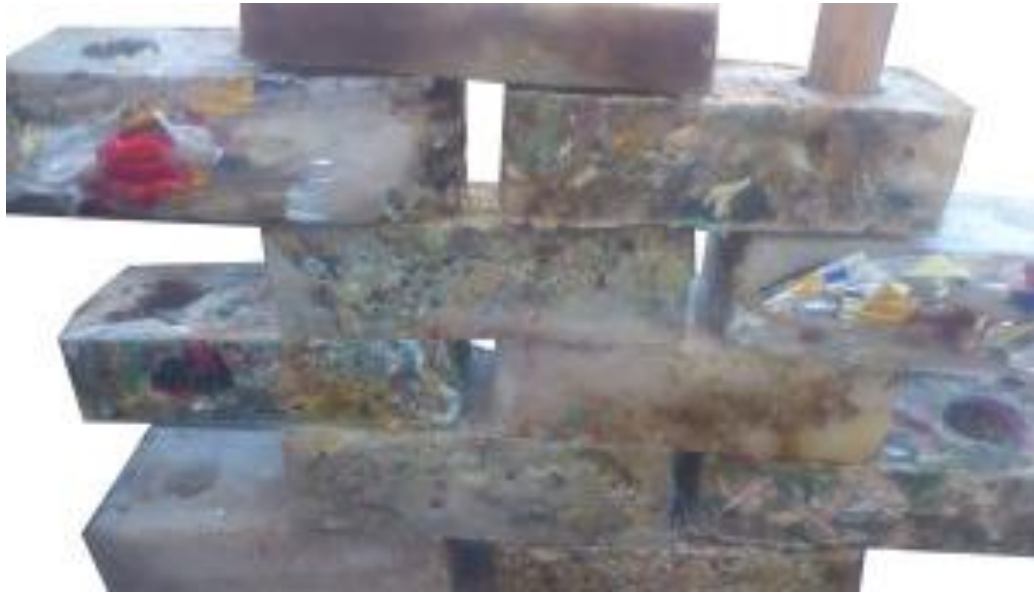
- ❖ In present times, in rural and coastal regions of India, there is no waste management system present to deal with the continuous increase of plastic waste that come into the villages everyday due to improper dumping by the localities.
- ❖ The villages due to lack of education and understanding about the importance of waste management, just burn away the waste in their stoves or in open places or may throw it in the nature, which creates problems such as foul smell around the region, blockage of drainage pipes, which are created to prevent flooding in the area, unhealthy environment for living and polluting the nearby river banks.

**The Prototype:-**

- A prototype of the block made from plastic waste has been made.
- This will give a basic idea of how the block can be used in real life.
- The block will be used as a kind of fundament for the houses, covered with clay, so they maintain the look as from today.
- After completion of the monsoon seasons, the house will still be existing with the roof on so there's no need to build up the house again from the scars as they need to do it today.



**Fig 4.1:-** Sketchmatic Diagram Of Brick



**Fig 4.2:- Plastic Brick Arrangement.**

#### **Required Materials:-**

- Plastic waste such as crisp bogs, polythene bags.
- Standard brick mould for preparing bricks of dimension 19\*9\*9 cms.
- A solar grill oven or an electric oven of heating capacity 100 to 500° C.
- A metal cover plate and a compressing/tamping rod.
- A water jet sprinkler.

#### **Preparation Methodology:-**

- At initial stage, waste soft plastic (polythene bags, crisp bags) of (approximate 4 to 5 kgs) is filled up in a brick mould of dimensions 19\*9\*9cms and then it is made air tight so as to prevent the leakage of viscous plastic.
- After filling the mould with plastic bags, it is compressed with a tamping rod until fully filled and then it is closed with a metal plate.
- The brick mould is now placed in a heating oven and heated at 175 to 200°C for one and a half to two hours.
- Further the mould is taken out from the oven with accurate precautive measures and for sudden cool down, a jet of water is sprayed on the mould.
- Finally with the help of mechanical means, the final product a plastic brick is obtained.

#### **Result and Analysis:-**

##### **General:-**

To analyze the compressive strength and the technical features of plastic brick, we will conduct the laboratory test and thus the brick sample will be taken to the laboratory.

##### **Standard and nominal brick sizes in India:-**

In India, according to recommendation of BIS, standard modular brick size is 190 mm x 90 mm x 90 mm.

With mortar thickness, the dimension of the brick becomes 200 mm x 100 mm x 100 mm which can be also called as the nominal size of the modular brick.

##### **Compressive /Crushing Strength of Bricks:-**

Compressive strength of bricks are very unsteady, and may vary from 30 kg/sq. cm to 150 kg/sq. cm for hand-made burnt bricks, while compressive strength of heavy duty bricks which are machine pressed may have compressive strength as high as 450 kg/sq. cm, and even 500 kg/sq. cm. The minimum compressive strengths of burnt bricks tested flat-wise described are:

1. Common building bricks—35 kg/sq. cm,
2. Second class bricks—70 kg/sq. cm,
3. First class bricks— 105 kg/sq. cm.
4. Compressive strength of bricks, not less than 140 kg/sq. cm are graded as AA class.

The strength of brick decreases by about 25 percent when drowned in water.

Strength of sun-dried bricks is from 15 to 25 kg/sq.cm

Water absorption of bricks after 24 hours is shown as follows:

1. First class brick-20%
2. Second class brick-22%
3. Third class brick-25%

Heavy duty machine made bricks should not absorb more than 5% of their weight.

### Testing of Plastic Brick:-

#### Determining the compressive strength of three different graded bricks:-

##### Theory:-

- Bricks are categorized into three different grades as per IS 1977-1976. The minimum compressive strength of the brick is at the class A that is equal to 350 kg/cm.sq.
- The minimum compressive strength of class 'c' bricks should not be less than 350 kg/cm.sq
- Also the compressive test of individual bricks would not fall below the maximum requirement by more than 20%.

#### Instruments and Materials Required:-

- 1) Compressive testing machine.
- 2) Plastic bricks sample.
- 3) Scale / Ruler.

#### Application:-

Compressive strength is one of the prime property of bricks as various types of bricks are used for different purpose of work. It is important to check out it's compressive strength for given grades of brick.

#### Diagram:-



Fig 5.1:- Compression testing machine

#### Procedure:

- Take a sample of plastic and measure its dimension.
- After measuring the dimension, calculate cross sectional area of bricks with help of it.
- Place the block between the mouth of compression testing machine.
- Apply the load continuously on the block until cracks are formed on the brick.
- When cracks are recognized on bricks, stop the machine and measure applied load and note down the readings.
- Repeat the above procedure for three different types of machines.

**Precautions:-**

- There should not be any kind of cracks on the brick before testing its compressive strength.
- Mechanism of crack on the brick should be noted delicately.
- Reading should be taken without any mistakes.

**Observation Table:**

Sr No.	Types of bricks	Size of bricks	Plastic used (in kgs)	Cross-sectional area of bricks	Load applied	Compressive strength
1)	A	22*10*5.5	5kg	55.06cm.sq	5000kg	90.86kg/cm.sq
2)	B	22*10*5.6	10kg	54.30cm.sq	7000kg	128.91kg/cm.sq
3)	C	22.5*9.5*5.8	15kg	50.39cm.sq	10000kg	198.45kg/cm.sq

**Calculation:-**

$$\text{Compressive strength} = \frac{\text{Maximum load at failure (N)}}{\text{Average area of bed face (mm}^2\text{)}}$$

- a) Compressive strength of bricks (A):  
 $P/A = 5000/55.06 = 90.86 \text{ kg/cm.sq}$   
 b) Compressive strength of brick (B):  
 $P/A = 7000/54.30 = 128.91 \text{ kg/cm.sq}$   
 c) Compressive strength of brick (C):  
 $P/A = 10000/50.39 = 198.45 \text{ kg/cm.sq}$

**Results:-**

Compressive strengths of plastic bricks are as follows:

- 1) For class 'A' bricks, compressive strength is 90.86kg/cm.sq
- 2) For class 'B' bricks, compressive strength is 128.91kg/cm.sq
- 3) For class 'C' bricks, compressive strength is 198.45kg/cm.sq

**Conclusion:-****Future Scope:-**

After preparing a brick out of plastic waste it can be concluded that this project will be proved very helpful for the rural and coastal region people and will have a great impact on environmental pollution created by plastic wastes. Local people of these areas will be free from the hazardous issues of waste around them and this brick will be used for redesigning their houses which used to get washed away in the monsoon season. This project is an innovative and new idea in itself because it deals with the problem at a very macro level but solves it in a very micro perspective view. This project can be further implemented in the other parts of the world after its success in india.

**Final Compressive Strength:-**

After testing the three samples of the plastic brick, the average compressive strength comes out to be as follows:

$$\text{Average compressive strength} = \frac{90.86 + 128.91 + 198.45}{3} = 139.40 \text{ kg/sq.cm}$$

The average compressive strength of the plastic brick is 139.40 kg/sq.cm

**References:-**

1. Aguado et al., 2007 J. Aguado, D.P. Serrano, G.S. Miguel, J.M. Escola, J.M. Rodriguez Catalytic activity of zeolitic and meso structured catalysts in the cracking of pure and waste polyolefins Journal of Analytical and Applied Pyrolysis, 78 (1) (2007), pp. 153–161
2. Ahrenfeldt, 2007 Ahrenfeldt, J., 2007. Characterization of biomass producer gas as fuel for stationary gas engines in combined heat and power production. Ph.D. Thesis, Department of Chemical Engineering, Technical University of Denmark, Lyngby, Denmark.
3. Al-Jayyousi, 2001 O. Al-Jayyousi A methodology for evaluating environmental impact of solid waste disposal sites: case study from Jordan Arabian Journal of Science and Engineering, 26 (2C) (2001), pp. 81–88
4. Al-Salem, 2009a S.M. Al-Salem Establishing an integrated databank for plastic manufacturers and converters in Kuwait Waste Management, 29 (1) (2009), pp. 479–484
5. The Indian Standard IS 5454:1976 'Method for sampling of clay building bricks (first revision)' is a necessary adjunct to this standard.
6. Dhaval m. vaviya "comparing clay bricks nomograms with fly ash bricks" PG-Construction Engineering & Management student, B.V.M. Engineering college, Gujarat Technological University, Vallabh Vidhayanagar.
7. Dr. Akshaya Kumar Sabat "A study of nalco fly ash on compressive strength for effective use in high volume mass concrete for a sustainable development" kiit university, bhubaneswar-751024, Orissa
8. Tabin Rushad "Experimental studies on lime-soil-fly ash bricks" ph d scholar, department of civil engineering, motilal Nehru national institute of technology, Allahabad.
9. Jayeshkumr Pitroda "Comparative Study on Rice Husk Shell in Fly Ash Bricks" Assistant Professor of Civil Engineering Department Birla Vishvakarma Mahavidyalaya Engineering
10. Oehlmann J. et al., A critical analysis of the biological impacts of plasticizers on wildlife, Phil. Trans. R. Soc. B 364, 2047–2062. (doi:10.1098/rstb.2008.0242) (2009) DEFRA 2007 Waste strategy factsheets.
11. APe (American Plastics Council) 1998. ([http://IVWW. Plastics\\_resource.com](http://IVWW.Plastics_resource.com)) Boettcher, Peter. 1992. "Environmental Compatibility of Polymers" Emerging Technologies in Plastics Recycling, M. Subramanian and G. D. Andrews.
12. Dinger, Peter W. 1998. "Recycling Perspective- As packaging recovery rates slow the new focus is durables recycling" Modern Plastics Encyclopedia A-34
13. Duranceau, C & Lindell.T. 1998. "Automotive Recycling as Reuse: Investigation to establish the Contribution of reuse as recycling" Society of Automotive Engineers publication No. 1430.
14. Franklin Associates Ltd, (1998) "Characterization of Municipal Solid Waste": 1997 Update (prepared for the USEPA), Prairie Village, Kansas, May.



### RESEARCH ARTICLE

## INVESTIGATING AN ADOPTION OF SMARTPHONE: A ROAD TO UBIQUITOUS BUSINESS MANAGEMENT.

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Adoption of smartphone, Organization  
and business, Diffusion of innovation

### Abstract

Telecommunication technology through smartphones currently provides many benefits and convenience to users. However, not all users are optimizing their smartphones. Currently, there are minimal knowledge of the reasons that entrepreneurs adopted and used smartphones to manage the organization and business. For this purpose, the operational framework applied to this research was adapted from Unified theory of Acceptance and Use of Technology. This quantitative approach research through questionnaires examined 104 respondents' perception on social influence, facilitating conditions, performance expectancy, effort expectancy, the importance of adopting and use of smartphones within entrepreneurs for managing business. The contribution of this research revealed the significance of smartphone usage for business management. The outcomes of this investigation indicated that there was no significant social influence toward entrepreneurs to use smartphone for managing business. Overall, entrepreneurs believed that smartphone was easy to use and managing business using smartphone can help them increase their performance. This contributed to an increase in their intention to use them. However, the findings showed that the smartphone usage for business management by entrepreneurs is low. Regarding the limitations, these happened because of finance and time factor. To overcome the limitations, this research recommends further studies that apply qualitative research.

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### Introduction:-

The success and importance of smartphone, especially for business users have very important implication in business management. The Internet has already profoundly changed the way entrepreneurs acquire information about business, managing their company and interact with others, and smartphone plays a large part in this process. The development of the mobile operating systems and software applications has impact on the usage and consumption to manage business.

Smartphone is a phone with an integrated computer feature that can perform more compare to standard phones. According to the Malaysian Communication and Multimedia Commission (2014), the number of smartphone user in Malaysia was 53.4% from 30,387,862 populations in 2014. The most popular operating system that used in Malaysia is Android (53%), iOS (23%) and Windows (10%). Today, smartphone not only for communication, it also use for

browsing, social networking, entertainment, and others. The smartphone is a phone that provides more functions and applications than standard phones. The arrival of smartphones has impacted not only to how people communicate but also to business, entertainment and journalism (The Denver Post, 2012).

The advancement of ubiquitous business management will accelerate the productivity of managing business. In order to survive, companies must quickly recognize these various changes that have a major impact on their business and react with the client in a timely manner. Utilizing the existing telecommunication technology, smartphone, it will increase the effectiveness and productivity of an organization. Using smartphone can offer flexibility that will always allow managing companies ubiquitously. According to SME Cloud Malaysia (2015), 91% of SMEs don't optimize their smartphone for business management. The most common application like telephone, SMS and in the meantime camera functionalities are widely used. This research recognizes the importance of smartphones for managing business. For this, an aim of this paper is to determine and examine the effect of smartphone adoption for business management by applying Unified Theory of Acceptance and Use of Technology (UTAUT).

#### **Small and Medium Enterprise (SME):-**

The main criterions that predominate to define SMEs are the number of employees, turnover and the balance total (Burns, 2001). For example, the European Union (EU) define an SME as enterprises that employ no more than 250 employees, a maximum annual turnover of 40 million Euros and a maximum annual balance sheet total of 27 million Euros (Levy et al., 2003). The few other defining characteristics of SMEs are: (a) Independent ownership and operations, (b) Close control by owners/managers who contribute most, if not all the operating capital and (c) Principal decision-making by the owners/managers (ABS, 2001).

SMEs are very large heterogeneous group of businesses usually operating, among others in the service, trade, agriculture, and manufacturing sectors. According to Ritchie and Brindley (2005), SMEs are significant because of their entrepreneurial spirit and adaptive capabilities. More importantly, SMEs are recognized for being the driver of economic growth and innovation that are crucial for fostering competitiveness (Levy et al., 2003). Their knowledge allows them to innovate on the product or process, which helps them form a competitive advantage to generate more profits (Loh and Koh 2004).

#### **Smartphone:-**

Cassavoy (2012) defined smartphone as a device that enables the user to make telephone call and at the same time has some features that allow the user to do some activities that in the past was not possible unless using a computer or a personal digital assistant (PDA), such as sending and receiving e-mails and amending an office document.

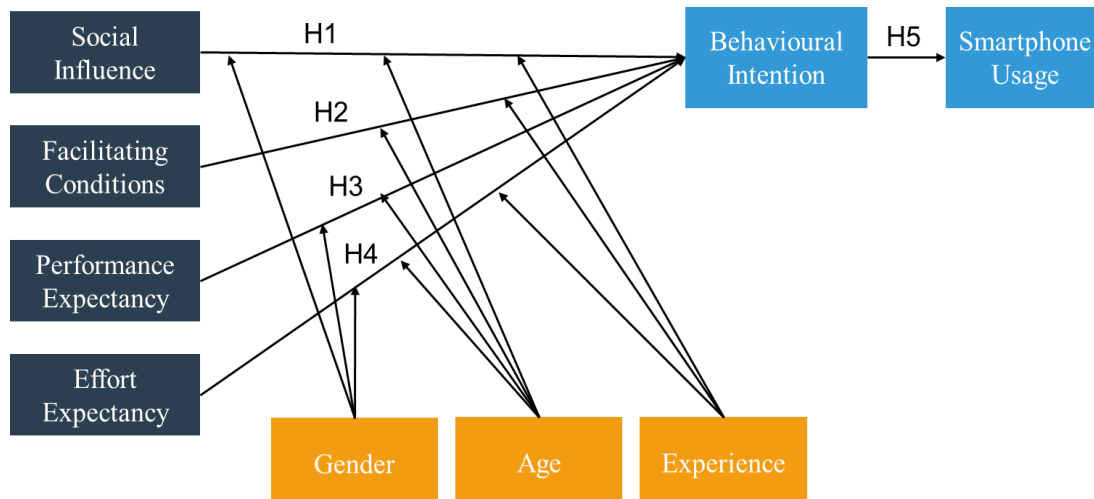
The important things that distinguished smartphone from cell phones are the feature. The operating system allows the smartphone to run its applications such as iPhone runs iOS, other kind of handsets runs Google's Android operating system such as Samsung and Lenovo, and some other runs Microsoft's Windows Phone. Cui and Roto (2008) found that the main use of smartphones was task-oriented with goals of information seeking, communications, online transactions, and managing personal information.

#### **Application of UTAUT:-**

Adoption and use are imperative in this research. The main theories applied in adoption studies are the Diffusion of Innovation (DOI) theory (Rogers, 2003); Unified Theory for the Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2012, 2003a) and Technology Acceptance Model (TAM) (Davis, 1989). It was found that TAM is the most popular, followed by UTAUT. For instance, DOI and TAM were combined to explain the adoption of smartphones in a logistic industry (Chen et al., 2009). However, UTAUT are preference within the perspective of adoption and use in this research.

The operational framework involved independent variables constructs include social influence, facilitating conditions, performance expectancy and effort expectancy that are drawn from UTAUT as shown in Figure 1. Theory also revealed that all the factors that affect user behavioral intention (Venkatesh, 2012). Finally, the mediating variable behavioral intention is influenced by the smartphone usage. Usage measured by the features of a smartphone, which are e-mailing, browsing, using social media, taking a photo and playing games.





Source: Venkatesh(2003)

**Figure 1:-** Operational Framework.

### Methodology:-

The UTAUT model integrates four core determinants, social influence, facilitating conditions, performance expectancy, and effort expectancy significantly predicts intention suggested by Venkatesh et al. (2003). The UTAUT model is well suited to the context of this study. Based on these observations, the hypotheses of this study are:

- Hypothesis 1: Social Influence has an influence on the behavioural intention moderated by gender, age and experience.
- Hypothesis 2: Facilitating Condition has an influence on the behavioural intention moderated by gender, age and experience.
- Hypothesis 3: Facilitating Condition has an influence on the behavioural intention moderated by gender, age and experience.
- Hypothesis 4: Effort Expectancy has an influence on the behavioural intention moderated by gender, age and experience.
- Hypothesis 5: Behavioural intention has an influence on the smartphone usage.

The questionnaire utilized in this research consisted of 3 sections meant to examine the demographics and background of respondents, questions related to independent variables and mediating variables namely the social influence, facilitating condition, performance expectancy, effort expectancy and behavioural intention, and questions to seek the smartphone usage as the dependent variable of this study. The questionnaires applied the Likert scale 1 to 5 except the demographic section.

The survey questionnaire was distributed among the SMEs in Malacca, Malaysia. The population was 72,806 comprises of enterprises registered with the Companies Commission of Malaysia (SSM) in Malacca, Malaysia. Krejcie and Morgon (1970) suggested the number of sample must depend on the number of population. From the population, the respondents targeted were 381 samples. This study applied simple random sampling where every single element in the population has a known and equal chance of being selected as a member of the sample.

Given the nature of the research topic, it is most suitable to employ both primary and secondary data collection method. Correlation analysis and regression analysis were applied using the Statistics Package for Social Science (SPSS) Version 20. The validity and reliability of the primary data was ascertained before further analysis of the data been computed. Pilot test were carried out involved 3 academicians, 5 students and 2 people at large adopting smartphone.

### Result:-

Data analyses were done after the process of cleaning up the data had been performed. From 600 questionnaires distributed only 104 respondents replied.



**Demographically:-**

The respondents represented by 46 males and 58 females. In term of age, 58.7% represent 21 – 30 years old, 22.1% represent 31 – 40 years old, 14.4% represent 41 – 50 years old, and 51 years old and above is the lowest at 4.8%. In term of race, majorities were Malay(74%) compared to Chinese, Indian and others. In term of position, 12.5% were owners, 10.6% were managers, 12.5% were executives, 8.7% were supervisors, 23.1% were administration staff, 28.8% were secretary/clerk and 3.8% were other positions. In term of monthly income, with more than half of the responses earn RM 3,000 and above in a month. All the respondents were smartphone user but only 55.8% use their smartphone for managing business. Approximately 42.3% of the respondents had experience using smartphone more than 6 years.

Total of 26 questions were used in the research. Reliability analysis showed that the Cronbach's alpha for overall variables was 0.943 indicates that very high and good reliable research.

**Correlation analysis:-**

Bivariate correlation was conducted to examine the interrelationships among the variables in this study. There were six variables investigated to understand the adoption of smartphone usage for managing business. As shown in Table 1, the mediator variable in this study (behavioural intention) was significantly and positively correlated with all four independent variables, namely social influence ( $r=.741$ ,  $p=.000$ ), facilitating condition ( $r=.803$ ,  $p=.000$ ), performance expectancy ( $r=.790$ ,  $p=.000$ ), and the highest correlate was effort expectancy ( $r=.860$ ,  $p=.000$ ).

Despite that, the independent variables namely the performance expectancy ( $r=.413$ ,  $p=.000$ ), effort expectancy ( $r=.452$ ,  $p=.000$ ), and the mediating behavioural intention ( $r=.512$ ,  $p=.000$ ) were significantly and moderately correlated to the smartphone usage. Nevertheless, social influence ( $r = .293$ ,  $p = .003$ ) and facilitating condition ( $r = .402$ ,  $p = .000$ ) were significantly and weakly correlated.

Table 1:0- Correlation Analysis for All Variables

Variables	SC	FC	PE	EE	BI	SU
Social Influence	1					
Facilitating Condition	.749**	1				
Performance Expectancy	.761**	.743**	1			
Effort Expectancy	.670**	.779**	.743**	1		
Behavioural Intention	.741**	.803**	.790**	.860**	1	
Smartphone Usage	.293**	.402**	.413**	.452**	.512**	1

Notes: Independent Variables: Social Influence, Facilitating Condition, Performance Expectancy, Effort Expectancy. Mediating Variable: Behavioural Intention. Dependent Variable: Smartphone Usage.

\*\* . Correlation is significant at the 0.01 level (2-tailed)

**Multiple regression analysis:-**

Table 2 shows the model summary of independent variables as predictors. It suggested two models where Model 1 was independent variables to mediating variable and Model 2 was independent variables to mediating variables includes moderating variables. Table 2 shows that R square value for Model 1 was 0.815, which means that 81.5% of independent variables influence the behavioural intention. However, R square for Model 2 after considering the moderator had slightly increased which was 0.818 (81.8%). It shows that 0.3% increasing when gender, age and experience moderated the social influence, facilitating condition, performance expectancy, and effort expectancy. This result shows the consistency of previous study which was all four independent variables have huge contribution when measuring behavioural intention on smartphone adoption.

**Table 2:-** Model Summary of Independent Variables.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.903 <sup>a</sup>	0.815	0.807	0.94915
2	0.904 <sup>b</sup>	0.818	0.804	0.95644

**Notes:**

**Predictors:** (Constant), Effort Expectancy, Social Influence, Performance Expectancy, Facilitating Condition

**Predictors:** (Constant), Effort Expectancy, Social Influence, Performance Expectancy, Facilitating Condition, Gender, Age, Experience

Table 3 shows the contribution of behavioural intention as mediator towards smartphone usage. The value of R square presented 0.262 of predictors, which was contributed 26.2% towards dependent variable.

**Table 3:- Model Summary of Mediating Variables**

Dependent Variable	R	R Square	Adjusted R Square	Std. Error of the Estimate
Smartphone Usage	0.512 <sup>a</sup>	0.262	0.255	4.49596

Notes:a. Predictors: (Constant), Behavioural Intention

#### Anova Analysis:-

Following to multiple regression, ANOVA was run simultaneously to check the F-test to compare the means of the groups and whether there is a significant difference in strength of independent variable. Table 4 shows the significance level of the multiple regression analysis (MRA). The result of dependent variable show (F=61.456, p=.000) for behavioural intention after considering the moderator and (F=36.200, p=.000) for smartphone usage where behavioural intention as predictors. This means that the probability of these accruing by chance was less than 0.05 means a significant relationship present between independent variables and dependent variable. In addition, there is also significant relationship when independent variables and dependent variable after considering the moderating variables. It can be seen that the regression model is a fit to the data.

**Table 4:- Anova.**

Dependent Variable		Sum of Squares	df	Mean Square	F	Sig.
Behavioural Intention	Regression	393.528	7	56.218	61.456	0.000 <sup>a</sup>
	Residual	87.818	99	0.915		
	Total	481.346	103			
Smartphone Usage	Regression	731.738	1	731.738	36.200	0.000 <sup>b</sup>
	Residual	2061.791	102	20.214		
	Total	2793.529	103			

Notes:

Predictors: (Constant), Effort Expectancy, Social Influence, Performance Expectancy, Facilitating Condition, Gender, Age, Experience  
Predictors: (Constant), Behavioural Intention

#### Hypotheses:-

The study sought to investigate the effects of social influence, facilitating condition, performance expectancy, and effort expectancy on entrepreneurs' behavioural intention, which in turn, influences smartphone usage to manage business. In order to test these hypotheses, a linear multiple regression analysis method was conducted to examine the effect of these predictors on mediator variable. Table 5 summarized the hypothesis findings.

**Table 5:- Result of Hypotheses Testing.**

No.	Hypotheses	Result
1	Social Influence $\geq$ Behavioural Intention	Not Supported
2	Facilitating Condition $\geq$ Behavioural Intention	Supported
3	Performance Expectancy $\geq$ Behavioural Intention	Supported
4	Effort Expectancy $\geq$ Behavioural Intention	Supported
5	Behavioural Intention $\geq$ Smartphone Usage	Supported

**H<sub>1</sub>:** Influence between social influence to behavioural intention moderated by gender, age and experience. The result of regression analysis shows that this construct yielded no significant and positive effect on behavioural intention on using smartphone for business management ( $\beta=.133$ ,  $t=1.804$ ,  $p=0.74$ ). Therefore, there was no evidence to reject  $H_0$ .

**H<sub>2</sub>:** Influence between facilitating condition to behavioural intention moderated by gender, age and experience. The result of regression analysis shows that this construct yielded significant and positive effect on behavioural intention on using smartphone for business management ( $\beta=.183$ ,  $t=2.280$ ,  $p=0.25$ ). Therefore,  $H_2$  was fully supported.

**H<sub>3</sub>:** Influence between performance expectancy to behavioural intention moderated by gender, age and experience. The result of regression analysis shows that this construct yielded significant and positive effect on behavioural intention on using smartphone for business management ( $\beta=.192$ ,  $t=2.475$ ,  $p=0.15$ ). Therefore, H<sub>3</sub> was fully supported.

**H<sub>4</sub>:** Influence between performance expectancy to behavioural intention moderated by gender, age and experience. The result of regression analysis shows that this construct yielded significant and positive effect on behavioural intention on using smartphone for business management ( $\beta=.486$ ,  $t=6.479$ ,  $p=0.00$ ). Therefore, H<sub>4</sub> was fully supported.

**H<sub>5</sub>:** Influence between behavioural intentions to smartphone usage. The result of regression analysis shows that this construct yielded significant and positive effect on using smartphone for business management ( $\beta=.512$ ,  $t=6.017$ ,  $p=0.00$ ). Therefore, H<sub>5</sub> was fully supported.

#### Effect of Demographic as Moderated Variables:-

The results of the moderated variables as shown in Table 6, disclosed that all the moderator as not significant to the independent variables ( $p>0.05$ ).

**Table 6:-** Exclude Variables.

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	Gender	0.049 <sup>b</sup>	1.095	0.276	0.110	0.934
	Age	0.004 <sup>b</sup>	0.087	0.931	0.009	0.755
	Experience	0.030 <sup>b</sup>	0.642	0.522	0.065	0.865

Notes: a. Dependent Variable: Behavioural Intention

b. Predictors in the Model: (Constant), Effort Expectancy, Social Influence, Performance Expectancy, Facilitating Condition

This means that the effect of social influence, facilitating conditions, performance expectancy, and effort expectancy not contributed by gender, age, and experience. The implications of these results are gender, age, and experience of individuals have no influence on adopting smartphone for business management.

#### Discussion:-

The total respondents were 104 entrepreneurs who involved in business in the area of Malacca, Malaysia. From the analysis, majority of the respondents agreed that social influence, facilitating condition, performance expectancy, effort expectancy, and behavioural intention influence them to use smartphone for managing business. However, this study find out the respondents utilize their smartphone to managing the business still low.

#### Smartphone Usage towards Business Management:-

It can be seen that there are several aspects of smartphone technologies that can be explored. Therefore this research on smartphone and entrepreneurs should provide a contribution that focuses not only on the device, but also the use aspect including the frequency of use for business activities. This research provides the relationship between the factors that influenced the behaviour intention that effect the usage of smartphone for managing business.

In terms of the use of smartphone, making phone calls, texting, e-mailing, general Internet browsing, downloading application, and online social networking proved to be the most popular cases among respondents. Previous research has shown that e-mail, an application offered by all smartphones is identified as an important feature (Kim, 2011). To achieve ubiquitous business management, one of the factors should be utilizing their smartphone for managing the business. However, the result showed that only small number of user used smartphone for managing business using Voice over IP and business management application where the means were 2.95 and 2.76. The percentage of respondents using business management application constantly low (18.3%), whereas 30.8% of respondents never used it before.

#### Social Influence and Behavioural Intention:-

Findings show a social influence is not supported in this research. It was suggested that respondents would not be influenced by their friends and family to use smartphone for managing business even though smartphone is a

necessity of today. Demographically, most of respondents are smartphone user and almost half of them used it for more than 6 years.

#### **Facilitating Condition and Behavioural Intention:-**

This research findings confirmed that entrepreneurs need to have time, money, knowledge, fit well and solving problem of using quickly in order to adopt smartphones for managing business. For a new adopter, familiarization of the smartphone and the application will be motivated by the performance expectancy.

#### **Performance Expectancy and Behavioural Intention:-**

In this study, the hypothesis was supported because entrepreneurs aware that smartphone can help them to increase their productivity and performance, to become a ubiquitous business management.

#### **Effort Expectancy and Behavioural Intention:-**

Effort Expectancy is related to the ease of use of smartphones for entrepreneurs for managing business. This hypothesis can lead to an understanding for smartphone developers and application developers that they should attempt to develop devices and technologies for entrepreneurs that are user friendly.

#### **Behavioural Intention and Smartphone Usage/Actual behaviour:-**

The effect of behavioural intention to smartphone usage can be identified with simple regression analysis. This study found there have positive relationship between behavioural intentions to smartphone usage.

There are limitation to the result such as lower response rate may have affected the analysis of cultural differences in the intention to use a smartphone. The overall response rate for the survey should be 30% to 60% (Fowler, 2009). The lacking of top level management as the respondents limits the generalizability of the results (Nenty, 2009). The third limitation was that 44.2% of the research participants not used their smartphones for managing business. This limits the generalization of the results those who do not use their smartphone for managing business, it is just a mere perception of individual.

#### **Conclusion:-**

This research focused on a trend that are currently occurring in society and in the technology sectors – an entrepreneurs and smartphone technology. Smartphones provide advanced telecommunication and mobile phone functions, which can provide seamless benefits to the users and to work productively that can contribute to better quality of life. From the statistical analysis it was found that many individuals are connected globally through their mobile phones. However, those entrepreneurs are using the smartphones at a basic level only for making a phone call, SMS, email, and browsing. Entrepreneurs were also likely to use their smartphones for online social networking and downloading application, but surprisingly more than half of them did not use smartphones for business management purposes. It can be concluded that smartphone adoption can offer critical mass adoption but the gap is still exists within entrepreneurs used towards business management.

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#### **Reference:-**

1. ABS (2001): Small Business in Australia. Australian Bureau of Statistics. Canberra.
2. Burns, P. (2001): Entrepreneurship and Small Business. Hampshire, UK, Palgrave.
3. Chen, J. V., Yen, D. C. and Chen, K. (2009): The Acceptance and Diffusion of the Innovative Smartphone Use: A Case Study of a Delivery Service Company in Logistics:Information &Management., 46 (4): 241–248.
4. Cui, Y., and Roto, V. (2008): How People Use the Web on Mobile Devices, International World Wide Web Conference 2008, Beijing, China, pp. 905 – 914.
5. Davis, F. D. (1989): Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology, MIS Quarterly, 13 (September): 319 – 340.
6. Fowler, F. J., Jr. (2009): Survey Research Method (4th ed.). Thousand Oaks, CA: Sage.
7. Kim, S. (2011): The Diffusion of the Internet: Trend and Causes. Social Science Research, 40 (2):pp.602–613.
8. Krejcie, R. V & Morgan, D.W. (1970):Determining sample size for research activities. EducPsycholMeas.

9. Levy, M., C. Loebbecke, et al. (2003): SMEs, Co-opetition and Knowledge Sharing: the Role of Information Systems, *European Journal of Information Systems*, 12(1): 3-17.
10. Loh, T. C. and S. C. L. Koh (2004): Critical elements for a successful enterprise resource planning implementation in small and medium-sized enterprises, *International Journal of Production Research*, 42 (17): 3433 - 3455.
11. Malaysian Communications and Multimedia Commission (2015): Hand Phone Users Survey 2014. <http://www.skmm.gov.my/Resources/Statistics/Hand-phone-Surveys.aspx>, [Accessed: 10 November 2015]
12. Nenty, H. J. (2009): Writing a Quantitative Research Thesis. *International Journal of Educational Sciences*, 1(1), 19-32.
13. Ritchie, B. and C. Brindley (2005): ICT adoption by SMEs: Implications for Relationships and Management." *New Technology, Work and Employment* 20(3): 205-217.
14. Rogers, E. M. (2003): *Diffusion of Innovations*. New York: Free Press.
15. Saunders, M., Lewis, P. & Thornhill, A. (2009): *Research Methods for Business Students*. London: Pearson Education Limited.
16. SME Cloud Malaysia (2015): [http://www.mscomalaysia.my/cloud\\_sme](http://www.mscomalaysia.my/cloud_sme) [Accessed: 28 October 2015]
17. The Denver Post. (2012). Smartphones Boost Economy. [http://www.denverpost.com/opinion/ci\\_21538000/editorial-smartphones-boost-economy](http://www.denverpost.com/opinion/ci_21538000/editorial-smartphones-boost-economy), [Accessed: 28 November 2015].
18. Venkatesh, V., Morris, M.G., Davis, G.B., & Davis, F.D. (2003): User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*.
19. Venkatesh, V. (2012) Technology Acceptance, [http://www.vvenkatesh.com/it/organizations/Theoretical\\_Models.asp](http://www.vvenkatesh.com/it/organizations/Theoretical_Models.asp) [Accessed: 24 November 2015].

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### RESEARCH ARTICLE

#### ADSORPTION STUDIES OF PB (II) FROM AQUEOUS SOLUTION BY USING MODIFIED DATE PALM TRUNK.

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Adsorption, Pb(II), ethylenediamine modified date palm trunk, adsorption isotherms

#### Abstract

Ethylenediamine modified date palm trunk an attractive approach for improvement of lead (II) uptake from aqueous solutions. Factors influencing Pb(II) adsorption onto MDPT such as initial Pb (II) concentration, pH, contact time, and adsorbent dosage were investigated. The adsorption equilibrium was established within 120 min. Before and after adsorption, MDPT was characterized by Fourier transform infrared spectroscopy (FTIR). The results showed that the pseudo-second order model fits the experimental data very well. The equilibrium data have been analysed using Langmuir and Freundlich isotherm models. The recovery of Pb(II) adsorbed on MDPT was found 98.5% using 0.2 M HCl. Desorption experiments showed the feasibility of the regeneration of MDPT.

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#### Introduction:-

A large variety of heavy metals is discharged into the environment and constitutes the most significant environmental pollutants found in wastewater. Long-term exposure to those solvated metal ions and consequently the effects on human health and natural ecosystems are critical issues. Lead is considered severe toxic and more hazardous to the environment and organisms compared to “the big three” of heavy metals (others are Cd and Hg) [1]. Lead is generated into the environment from various industrial effluents such as metal electroplating, mining, extractive metallurgy and battery manufacture [2]. Biosorption is a promising method for removal of heavy metals from waste water because of its advantage of low cost and good adsorption potential. Adsorption is the most preferred method for removal of heavy metals from aqueous solutions due to its simplicity and its high effectiveness [3-5].

In recent years, many agro wastes, including sawdust [6], carrot residue [7], sugar beet pulp [8], tree fern [9], rice husk [10], papaya seed carbon [11], eucalyptus bark [12] and date palm trunk [13], had been used to adsorb heavy metals from aqueous solution. The agricultural wastes being abundantly available with low cost mainly comprise of cellulose which is a natural biopolymer with sorption property. For improving the adsorption capacities of agro wastes, various chemical modifications have been reported [14, 15].

The purpose of this study is to utilize date palm trunk (cellulosic agro wastes) after its chemical modification as a potential adsorbent for treatment of wastewater containing Pb(II). The values of well-known kinetics and isotherms

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studies have been performed to elucidate the equilibrium adsorption behavior of Pb(II) onto the adsorbent. The effect of contact time, pH, concentration and dosage on the adsorption capacity has been investigated.

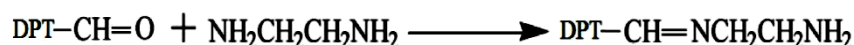
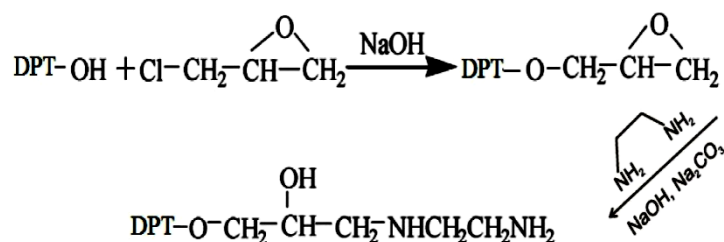
## Materials and Method:-

### Chemicals and Instrumentation:-

All the chemicals used were of analytical reagent grade. Stock solution of 1000 mg/L of Pb(II) was prepared by dissolving 1.6 g of Pb(NO<sub>3</sub>)<sub>2</sub> in distilled water and making the volume up to 1000 mL in a volumetric flask. The pH of each of the working solutions was adjusted by using 0.1M HCl or 0.1 M NaOH. Systronic digital pH meter was used for pH measurements. FTIR spectrometer (Perkin Elmer System- 1600) was used for IR spectral studies. UV-visible double beam spectrophotometer (Systronics UV-Vis-2203) was used for determination of Pb(II) concentration using 1,5- diphenyl thiocarbazone in aqueous micellar solution. An electrically thermostatic rotary shaker (IEC-56, India) was used for agitating the samples.

### Preparation of MDPT:-

Date palm trunk (DPT) was obtained from rural areas around Kanpur (India), cut into a length of approximately 1 cm, washed thoroughly with demineralized water (DMW) to remove water soluble materials, dried overnight at 100 ± 2°C in a hot air oven, and allowed to cool down to room temperature. It was ground and sieved to obtain an average particle size of 75 µm. DPT powder (10 g) was treated with 80 mL of NaOH solution (1.25 mol/L) and epichlorohydrin (30 mL) at 40 °C for 1 h. Then mixture was filtered, rinsed with water, oven-dried and stored in a desiccator. During the treatment, the hydroxyl groups of DPT reacted with epichlorohydrin. Modified date palm trunk was prepared by adding ethylenediamine (10 mL), water (100 mL) and Na<sub>2</sub>CO<sub>3</sub> (1 g) to the epichlorohydrin treated DPT. The mixture was stirred using magnetic stirrer at 60 °C for 2 h, MDPT was filtered, washed with water, dried and stored in desiccator. The following chemical reactions occurred during the modification.



### Batch Adsorption Studies:-

For adsorption studies, 0.1g MDPT was added to a series of Erlenmeyer flasks filled with 20 mL lead (II) solutions (12.5-100 mg/L) and pH (1-6) sealed with parafilm and then shaken at 30°C till equilibrium was reached. The sample solution was filtered using Whatman No. 4 filter paper and the filtrate was analyzed for Pb(II) by spectrophotometric method using 1, 5-diphenyl thiocarbozone in aqueous micellar solution [16]. The adsorption capacity (q<sub>e</sub>) and percentage removal of Pb(II) from aqueous solution is calculated by following equations,

$$q_e = \left( \frac{C_i - C_e}{M} \right) V \quad (1)$$

where, C<sub>0</sub> and C<sub>e</sub> (mg/L) are the initial and equilibrium concentrations of Pb(II) ions in solution; V is the volume (L) of the solution and M is the weight (g) of dry adsorbent.

$$\% \text{Removal} = \left( \frac{C_i - C_e}{C_i} \right) 100 \quad (2)$$

## Result and Discussion:-

### FT-IR analysis:-

FTIR spectra (fig. 1) shows MDPT and Pb(II) loaded MDPT. The broad peak around  $3410\text{ cm}^{-1}$  in MDPT is attributed to  $\text{-NH}$  stretching vibration. This absorption band is shifted towards lower wave number ( $3381\text{ cm}^{-1}$ ) in case of with Pb(II) adsorbed MDPT. This suggests the formation of complex between Pb(II) ions and N-atoms (The characteristics band at  $1056\text{ cm}^{-1}$  corresponding to C-O-C stretching is observed in both spectra ).

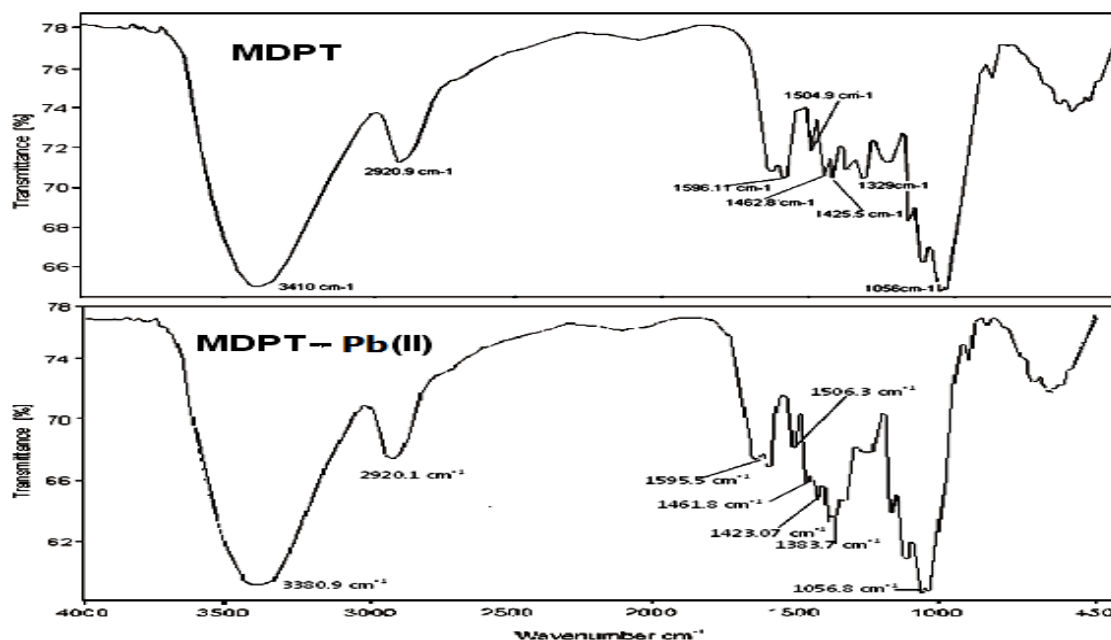


Figure 1:- FTIR spectra of MDPT and MDPT-Pb(II) loaded.

### Effect of pH:-

The pH of solution is an important controlling parameter in the adsorption process. Since, pH influences the solution chemistry of the heavy metals (i.e. hydrolysis, complexation, redox reactions and precipitation), and the solution chemistry of the heavy metals also strongly influences the speciation and the adsorption availability of the heavy metals. The binding of metal ions by surface functional group ( $\text{-NH}$ ) is strongly pH dependent [17]. Fig. 2 shows that Pb(II) removal is minimum at pH 1 and increases with the increase in pH. Removal of Pb(II) was found maximum at pH~5.

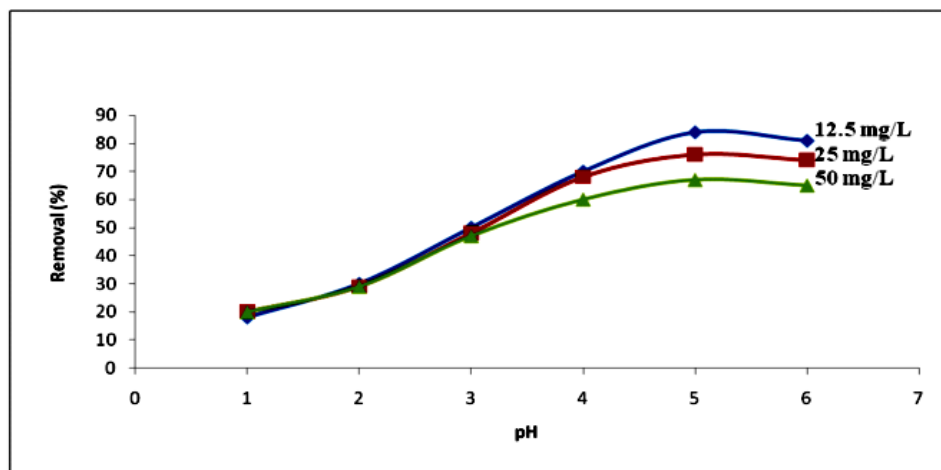


Figure 2:- Effect of pH of solution on the removal of lead(II).



**Effect of Adsorbent Dose:-**

Effects of dosage on the removal of Pb(II) ions is shown in Fig. 3. It was observed that the removal of lead(II) increases rapidly with increasing dosage from 0.0 to 0.5 g/L. After certain adsorbent dosage the removal efficiency does not increase significantly and reached the maximum at dosage of 0.6 g. The removal of Pb(II) for concentrations 12.5, 25 and 50 mg/L using 0.6 g/L MDPT was 98.2%, 95% and 90%, respectively. On increasing adsorbent dosage, more surface area is available for the adsorption due to an increase in active sites on the adsorbent and its availability for adsorption.

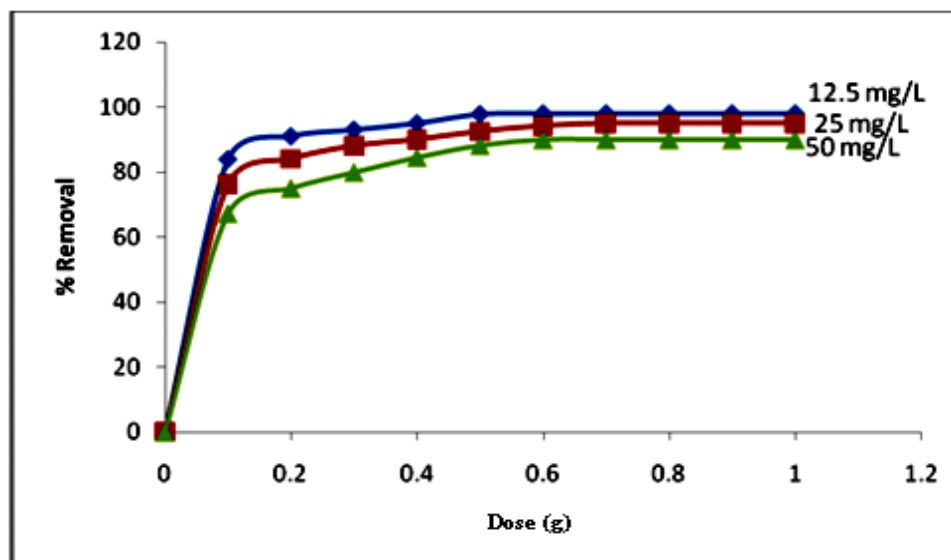


Figure 3:- Effect of adsorbent dose on the removal of lead (II).

**Effect of Contact Time:-**

Figure 4 shows that with increase in contact time removal increases rapidly during the first 15 min, and then it was moderate up to 30 min and there after remained constant. This behavior may be due to saturation of the available adsorption sites present on MDPT. At the initial stage, the removal efficiency was rapid due to abundant availability of active binding sites on the biomass and with gradual occupancy of these sites; sorption became less efficient in the later stages. The equilibrium is established with in 120 min.

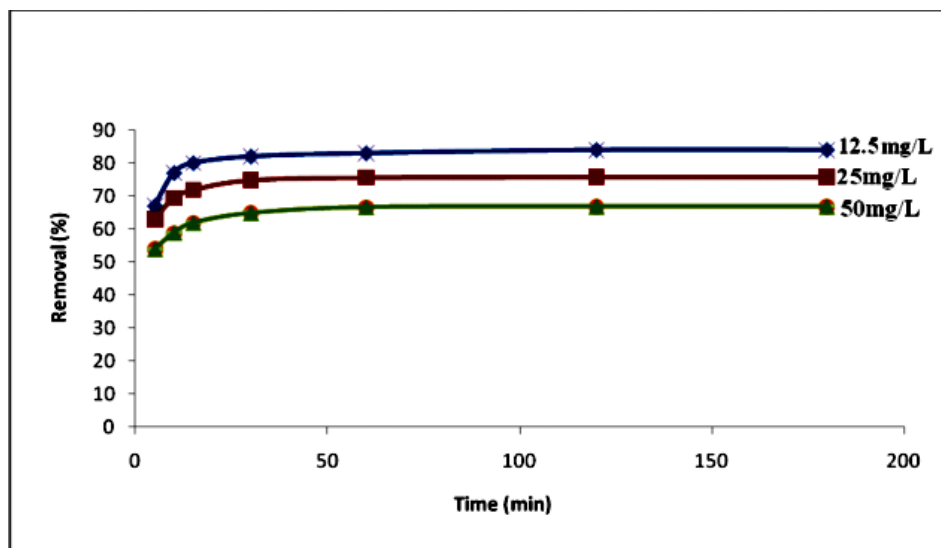


Figure 4:- Effect of contact time on the removal of lead(II).

**Adsorption Kinetics:-**

In order to evaluate the kinetic mechanism that controls the adsorption process, the pseudo-first-order and pseudo-second-order models were used. The pseudo first-order equation [18] is generally expressed as follows:

$$\log (q_e - q_t) = \log q_e - (k_1/2.303) t \quad (3)$$

where  $k_1$  ( $\text{min}^{-1}$ ) is the pseudo-first-order adsorption rate constant,  $q_t$  (mg/g) denotes the amount of sorption at time  $t$  (min), and  $q_e$  (mg/g) is the amount of sorption at equilibrium. The pseudo-second-order equation [19], based on adsorption capacity at equilibrium, can be expressed as:

$$t / q_t = 1/k_2 q_e^2 + (1/q_e) t \quad (4)$$

where  $k_2$  (g/mg min) is the rate constant of the pseudo-second-order equation,  $q_e$  (mg/g) is the maximum adsorption capacity, and  $q_t$  (mg/g) is the amount of adsorption at time  $t$  (min).

The values of pseudo-first order rate constants,  $k_1$  and  $q_e$  were calculated from the slopes and the intercepts of the plots of  $\log (q_e - q_t)$  versus time (Fig. 5). The  $k_1$  values, the correlation coefficient  $R^2$ , and theoretical and experimental equilibrium adsorption capacity  $q_e$  are given in Table 1. The  $R^2$  values in Table 1 suggest that adsorption of Pb(II) onto MDPT does not follow pseudo-first-order kinetics. In addition the theoretical and experimental equilibrium adsorption capacities,  $q_e$  obtained from these plots varied widely. This confirms that the pseudo-first-order model was not appropriate for describing the adsorption kinetics of Pb(II) onto MDPT. On the contrary, the kinetics data showed excellent fit to the pseudo-second-order equation. The plot of  $t/q_t$  against  $t$  at different concentrations is shown in Fig. 6. The pseudo-second-order rate constant  $k_2$ , the calculated  $q_e$  values, and the corresponding  $R^2$  values are given in Table 1. From Table 1, it is evident that the calculated  $q_e$  values agree with experimental  $q_e$  values well, and also the correlation coefficients for the pseudo-second order kinetics plots at all the studied concentrations are higher ( $R > 0.99$ ).

It can be concluded that the adsorption proceeds via pseudo-second-order mechanism rather than a pseudo first-order mechanism.

**Table 1:-** Adsorption kinetics for removal of Pb(II) onto MDPT

Conc. (mg/L)	$q_{e \cdot \text{exp.}}$ (mg/g)	Pseudo-first-order			Pseudo-second-order		
		$k_1$ ( $\text{min}^{-1}$ )	$q_e$ (cal) (mg/g)	$R^2$	$k_2$ (g mg <sup>-1</sup> min <sup>-1</sup> )	$q_e$ (cal) (mg/g)	$R^2$
12.5	21.0	0.024	5.97	0.875	0.0448	21.27	0.999
25	38.0	0.032	6.82	0.971	0.0242	38.46	0.999
50	67.0	0.032	9.35	0.997	0.0098	68.41	0.999

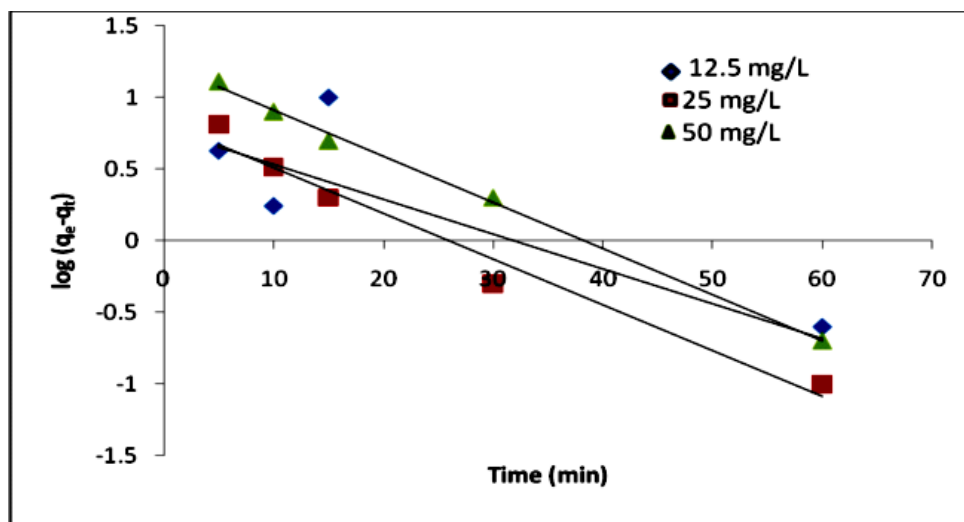


Figure 5:- Pseudo-first-order kinetic model for Pb(II) adsorption onto MDPT.

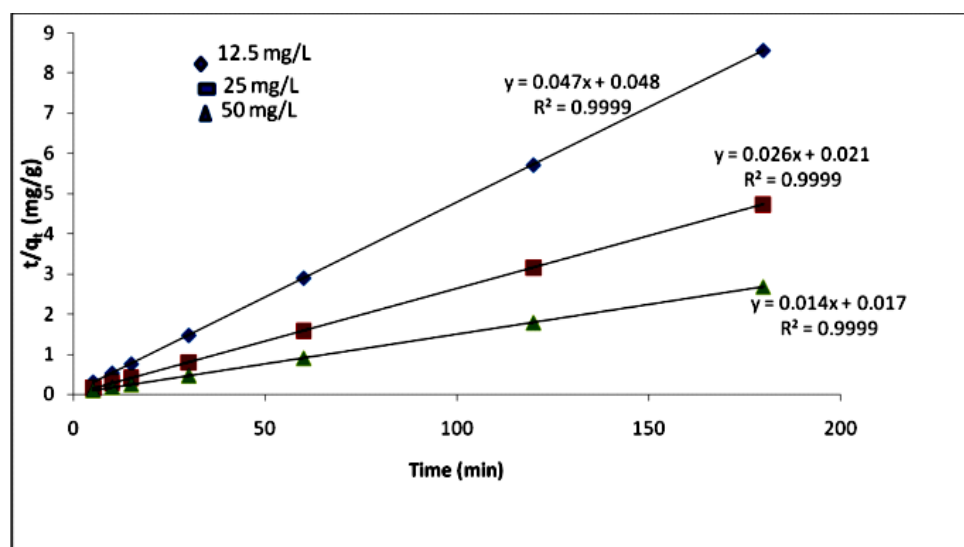


Figure 6:- Pseudo-second-order kinetic model for Pb(II) adsorption onto MDPT.

#### Adsorption Isotherms:-

Langmuir adsorption isotherm [20] was applied to equilibrium adsorption assuming monolayer adsorption onto a surface with a finite number of identical sites. The following Langmuir sorption isotherm equation can be used:

$$C_e / q_e = 1 / b K_L + C_e / b \quad (5)$$

where  $q_e$  is the amount of Pb(II) adsorbed per unit mass of adsorbent (mg/g),  $C_e$  is the equilibrium concentration of the Pb(II) in solution (mg/L),  $b$  is the maximum Pb(II) uptake (mg/g),  $K_L$  is the Langmuir biosorption constant (L/mg) relating the free energy of biosorption. The essential characteristics of the Langmuir isotherm can be conveniently expressed in terms of a dimensionless term  $R_L$  (a constant separation factor or equilibrium parameter for a given isotherm) and is defined as:

$$R_L = 1 / (1 + K_L C_0) \quad (6)$$

where  $C_0$  is the initial concentration of Pb(II) and  $R_L$  value indicates the type of the isotherm.

Freundlich adsorption isotherm [21] is an empirical relationship established upon adsorption onto a heterogeneous surface on the assumption that different sites with several adsorption energies are involved, and is given below:

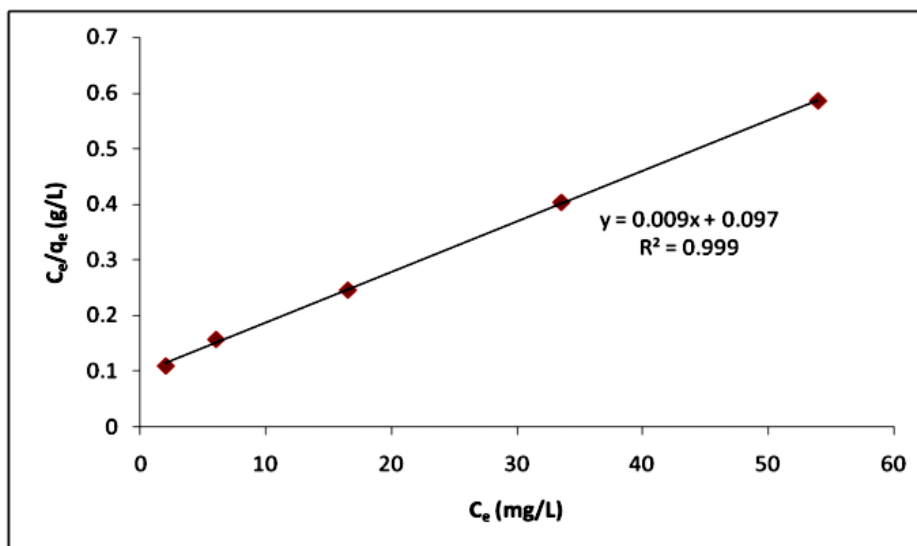
$$\ln q_e = \ln K_F + 1/n \log C_e \quad (7)$$

where  $q_e$  and  $C_e$  are the equilibrium concentrations of Pb(II) in the adsorbed and liquid phases in mg/g and mg/L, respectively.  $K_F$  and  $n$  are the Freundlich constants.

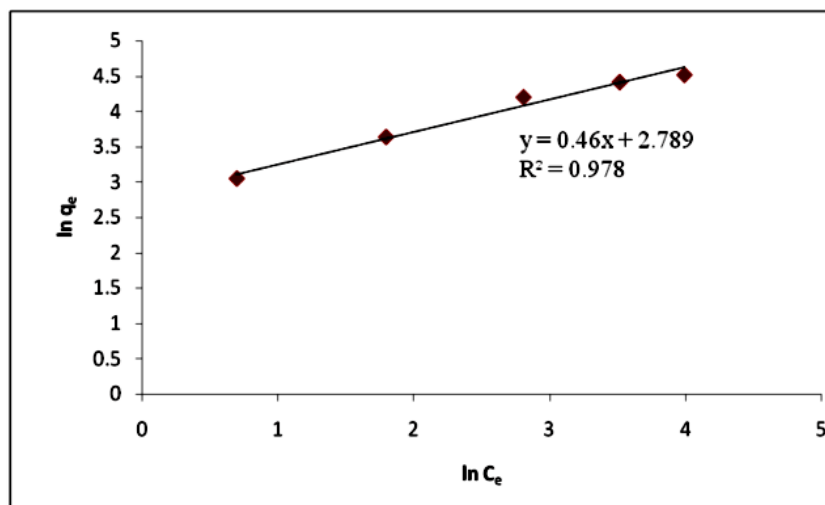
The correlation coefficients ( $R^2$ ) obtained using Langmuir (Fig. 7) and Freundlich (Fig. 8) have been listed in Table 2.  $R^2 > 0.99$  obtained with Langmuir model supports that the biosorption of Pb(II) onto MDPT followed the Langmuir model. According to McKay et al. [22]  $R_L$  values between 0 and 1 indicate the isotherm favourable, and it is unfavourable if  $R_L > 1$ . The obtained  $R_L$  values (0.089-0.439) indicate that the adsorption of Pb(II) onto MDPT is favourable and attributed to chemical ion-exchange mechanism.

**Table 2:-** Langmuir and Freundlich parameters for the adsorption of Pb(II) onto the MDPT.

<i>Isotherm</i>	<i>Parameters</i>	<i>Values</i>
Langmuir	$q_m$ (mg/g)	108.2
	$b$ (L/mg)	0.101
	$R^2$	0.997
Freundlich	$K_f$ (mg/g)	16.26
	$n$	2.17
	$R^2$	0.978



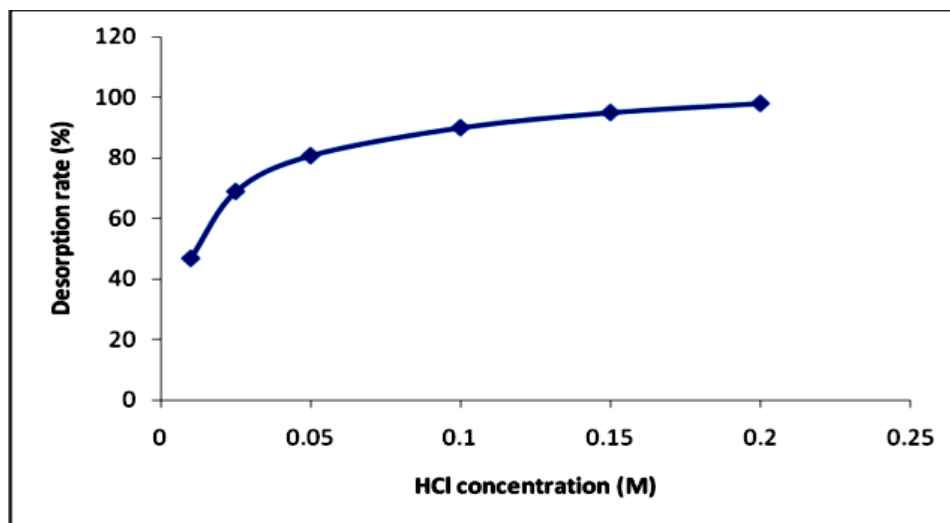
**Figure 7:-** Langmuir isotherm plot for Pb(II) adsorption onto MDPT.



**Figure 8:-** Freundlich plot for Pb(II) adsorption onto MDPT.

**Desorption:-**

Desorption studies were conducted in order to explore the feasibility of recovering both the metal ion and MDPT. MDPT (0.1g) was transferred into 20 mL of 0.01-0.2 M HCl solution in a conical flask, and shaken for 4 hours at room temperature ( $30 \pm 1^\circ\text{C}$ ). The rate of desorption increases with the increases in conc. of HCl upto 0.2 M and remains unchanged at higher conc. of HCl. The maximum percentage recovery of lead was 98.5% (Fig. 11). The results of desorption studies show that the most of Pb(II) ions on MDPT surface might be held through ion-exchange/ complexation type of binding. Therefore, recovery of the adsorbed lead(II) and repeated usability of MDPT is feasible as an adsorbent in the practical applications of treatment of industrial effluents containing Pb(II).



**Figure 9:-** Effect of HCl concentration on the desorption of Pb(II).

**Conclusions:-**

Adsorption of Pb(II) onto MDPT was studied. The adsorption was found greatly dependent on pH and contact time. The adsorption equilibrium was best described by the Langmuir isotherm model. The maximum adsorption for Pb(II) was found to be 108.2 mg/g at pH 5. The adsorption is followed by pseudo-second order kinetics, which shows the chemisorptions process. The adsorption capacity of MDPT is higher than many of the biosorbents reported earlier. The desorption percentage was 98.5% using 0.2 M HCl as an eluting reagent.

**References:-**

1. M. Hamidpour, M. Kalbasi, M. Afyuni, H. Shariatmadari, P.E. Hlm and H.C.B. Hansen, "Sorption hysteresis of Cd(II) and Pb(II) on natural zeolite and bentonite," *J. Hazard. Mater.*, vol. 181, pp. 686– 691, 2010.
2. H. Cheng and Y. Hu, "Lead(II) isotopic finger printing and its applications in lead pollution Studies in china: A review," *Environ. Pollut.*, vol. 58, pp. 1134-1146, 2010.
3. Dhruv Kumar Singh and Sunil Kumar Yadav, Kinetics, Isotherms and Mechanisms of Cr (VI) Adsorption onto Activated Date Palm Trunk (DPT), *International Journal of Scientific Research Engineering & Technology*, EATHD-2015, 14-15 March, (142- 147) 2015.
4. Sunil Kumar Yadav, Dhruv Kumar Singh & Shishir Sinha, Adsorption study of lead(II) onto xanthated date palm trunk: kinetics, isotherm and mechanism, *Desalination and Water Treatment* 51 (2013) 6798–6807.
5. M.T. Bisson, L. C. W. Maclean, Y. Hu, and Z. Xu, Characterization of mercury binding onto a novel brominated biomass ash sorbent by x-ray absorption spectroscopy, *Environ. Sci. Technol.*, 46 (2012) 12186–12193.
6. S. Larous, A.-H. Meniai and M.B. Lehocine, Experimental study of the removal of copper from aqueous solutions by adsorption using sawdust, *Desalination*, 185 (2005) 483–490.
7. B. Nasernejad, T.E. Zadeh, B.B. Pour, M.E. Bygi and A. Zamani, Comparison for biosorption modeling of heavy metals (Cr (III), Cu (II), Zn (II)) adsorption from wastewater by carrot residues, *Process Biochem.*, 40 (2005) 1319–1322.

8. Z., Aksu and I. A. Isoglu, Removal of copper(II) ions from aqueous solution by biosorption onto agricultural waste sugar beet pulp, *Process Biochem.*, 40 (2005) 3031–3044.
9. Y.S. Ho and C. C. Wang, Sorption equilibrium of mercury onto ground-up tree fern, *J.Hazard. Mater.*, 156 (2008) 398–404.
10. K.K. Krishnani, X. Meng, C. Christodoulatos and V.M. Boddu, Biosorption mechanism of nine different heavy metals onto biomatrix from rice husk, *J. Hazard. Mater.*, 153 (2008) 1222–1234.
11. S. K. Yadav, S. Sinha, D.K. Singh, Removal of Lead(II) from Aqueous Solution using Papaya Seed Carbon: Characteristics and Kinetics Study, *International Journal of Chemical and Environmental Engineering*, 4, (2013) 127-136.
12. I. Ghodbane and O. Hamdaoui, Removal of mercury (II) from aqueous media using eucalyptus bark: Kinetic and equilibrium studies, *J. Hazard. Mater.*, 160 (2008) 301–309.
13. Sunil Kumar Yadav, Shishir Sinha, and Dhruv Kumar Singh, Chromium(VI) Removal from Aqueous Solution and Industrial Wastewater by Modified Date PalmTrunk, *Environmental Progress & Sustainable Energy*, 34, (2015) 452–460.
14. Sunil Kumar Yadav, Dhruv Kumar Singh and Shishir Sinha, Adsorptive Removal of Hg(II) from Synthetic and Real Aqueous Solutions Using Modified Papaya Seed, *Journal of Dispersion Science and Technology*, 37(2016) 1613–1622.
15. T. Shu, P. Lu and N. He, Mercury adsorption of modified mulberry twig chars in a simulated flue gas, *Bioresource Technol.*, 136 (2013) 182–187.
16. M. Jamaluddin Ahmed and Md. Shah Alam, A rapid spectrophotometric method for the determination of mercury in environmental, biological, soil and plant samples using diphenylthiocarbazone, *Spectroscopy*, 17 (2003) 45–52.
17. Sunil Kumar Yadav, Dhruv Kumar Singh, and Shishir Sinha, Chemical carbonization of papaya seed originated charcoals for sorption of Pb(II) from aqueous solution, *Journal of Environmental Chemical Engineering* 2 (2014) 9–19.
18. S. Lagergren, About the theory of so called adsorption of soluble substances, *kungliga svenska vetenskap akademien, Handlingar*, 24 (04) (1898) 1-39.
19. H. Kim, K. Lee, Application of cellulose xanthate for the removal of nickel ion from aqueous solution, *J. Korean Soc. Eng.*, 20 (1998) 247–254.
20. I. Langmuir, The Adsorption of gases on plane surfaces of glass, mica and platinum, *J. Am. Chem. Soc.*, 40 (9) (1918) 1361-1403.
21. H. Freundlich, Ueber dye adsorption in loesungen, *Z. Phys. Chem.*, 57(1907) 385- 470.
22. G. McKay, H. S. Blair and J. R. Gardener, Adsorption of dyes on chitin-1, equilibrium studies, *J. Appl. Polym. Sci.*, 27 (1982) 3043–3057.

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### RESEARCH ARTICLE

#### EDUCATING ENVIRONMENTAL LITERATE CITIZENS IN ASTRITSI GORGE: A NARRATIVE REFLECTION.

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#### Abstract

For more than ten years, Astritsi gorge constituted a very useful learning environment for the interdisciplinary approach of many cognitive objects taught in Meleses Lyceum, in the projects of the Environmental Education. It offered ample opportunities and possibilities to activate, in collaboration, many teachers, students, scientists, authorities, bodies, etc. and promote the principles and values of Environmental Education and Education for the Sustainable Development. This paper (consists of ) is a narrative reflection of the two teachers who developed many educational activities in Astritsigorge, carrying out many school environmental projects following the UNESCO decade of Education for the Sustainable Development.

The purpose of the research was to present, in a summarized way, the extracting data from the collected archival material in a review study for teachers who materialize projects of Environmental Education in Secondary Education. The archival material of the applied projects studied, through a reflection point of view, the goals which have been explicitly expressed or implied, on the thematic subjects, the criteria of the issue selection, the purposes and objectives, the educational methodology, the educational activities, actions and interventions inside and outside the school and gorge, reflections and evaluation, recommendations and dissemination of the projects' results with impact on the local society.

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#### Introduction:-

The term "Sustainability" etymologically derives from the 'eternal' and 'bring' with the meaning that 'will bring forever', dealing with the exploitation of natural resources in ways that ensure their existence in the future as they exist today. The Sustainable Development (SD) is the development done with eyes on the future, trying to meet the needs of the present generation without compromising the effort of future generations to meet their own needs, as first reported by world Commission on Environment and Development (Brundtland Commission, 1987). Brundtland Commission's report considers ways and means by which the international community can deal more effectively with environment concerns and define shared perceptions of long-term environmental issues and appropriate efforts

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needed to deal successfully with the problems of protecting and enhancing the environment, a long term agenda for action during the coming decades and aspirational goals for the world community.

The main purpose of the ESD is to create Active Citizens (2014: thematic year of the UNESCO Decade for ESD). The profile of critical thinking, active citizen, as it is constructed through UNESCO documents for ESD, has two main characteristics, the participation and the action (Ziaka et al, 2000; UNESCO, 2005). The active citizen must have the ability of systematic and comprehensive consideration of social, economic, cultural, political components of a problem. ESD is political, and the political literacy is an essential core developed on five main axes of the public debate (Flogaiti, 2006): the resources and production, the distribution and redistribution, the power and decision making, the social organization, the culture and ideology. To promote ESD, each institution needs to have a shaped shared vision, broad-based, fully harmonized with the spirit and the social ethical values (Scott, 2007). The cultivation of Active Citizenship through ESD Projects (ESDPs) guides to the culture of active, creative, critical, global citizen, the citizen with democratic accountability and individual responsibility, who is able to combine theoretical knowledge with innovative ideas and practices, to develop initiatives, manage risks and overcome obstacles (Hernandez & Monroe, 2000; Huckle, 2006). Creating environmentally literate citizens requires a different culture, reorientation of the school education, which starts in school years and continues into adulthood, which introduces students, from a very early age, to/ into issues related to the care of the local, national and global environment, the sense of responsibility, the perception of daily life and capacity for intervention and change for better quality of life without harmful consequences for the Earth (Scott & Gough, 2003; Huckle, 2006). By ensuring the active participation of all relevant stakeholders and drawing on best practices and models with exploring new mechanisms to promote transparency and the effective engagement of civil society, guaranteed the way forward to SD (Rio+20, 2012).

The General Secretariat for Youth of Greek Ministry of Education, Lifelong learning and Religion developed a students' initiatives support Program "Inside, outside and on the same: Students in Action" of (Youth, 2012) which had the purpose to support actions and initiatives organized on the basis of volunteerism for secondary school students. Its purpose was to promote the collaboration between of students, teachers, local authorities and bodies, in the broader context of the curriculum and school activities, under the supervision of School Councils and local Councils of School Community. The program 'Youth' (2012) started (was initiated) in response to the experience of the European Year of Volunteering in order to mark and to actively promote the importance of volunteering of young people, from adolescence, giving added value to schools and local communities. The areas of the program concerned the environment, health, social assistance, innovation and entrepreneurship. In any educational process, the progress in the acquisition of knowledge and skills related to SD and global citizenship, needs to be monitored, even if it is not linked to changes in attitudes and behaviors (UNESCO, 2015).

Meleses Lyceum and Gymnasium participated in to this Program with activities concerning in (the areas of) environment and entrepreneurship. The tourist development of the area is of particular interest to locals, as the place is ideal for leisure and walks and the gorge is already used for summer cultural events. Astritsi Gorge has a total length of 3 km. It is about 300m from the village center. It is situated 8 km northeast of Meleses village where the school is located, and 25 km south of Heraklion, the capital of Crete, in the inland. The gorge has with its dense and lush vegetation and is crossed by the river Triton which is a tributary of Karteros, the river passing running close to Knossos and flows/ends into the Cretan Pelagos of Mediterranean Sea, in Karteros position. Alongside, it is crossed by narrow road with asphalt, associated with rural roads and paths. Many SPEEs, eight in number, were implemented in Astritsi gorge during the school years 2002-2013, some of them funded by national economic resources, but most of the times it was the teachers, students, parents and local authorities involved who supported the projects. The last SPEE, with the title "A Pathway from past to present and future in the natural and cultural heritage of Astritsi gorge" carried out by the Meleses Lyceum of Heraklion prefecture, in collaboration with the Meleses Gymnasium, during the school year 2012-2013, funded by the Youth (2012) Program, and summarized all the previous experience in EE applied in Meleses Lyceum. For more than ten years, Astritsi gorge constituted a very useful learning environment for the interdisciplinary approach of many cognitive objects taught in Lyceum. It offered ample opportunities and possibilities to activate, to many teachers, students, scientists, authorities, bodies, etc. to collaborate and promote the principles and values of EE and ESD through the school General Education. The educational purpose of all SPEEs was that students get acquainted with the synthesis of bio-communities of Astritsi ecosystem and ways of management and protection that have been already successfully implemented in Crete and elsewhere, enabling them to understand the need of the environmental care and the ecological sustainability.



This paper is a narrative reflection of the two teachers who developed many educational activities in Astritsi Gorge, carrying out eight school environmental projects during the UNESCO Decade of the Education for the Sustainable Development (UNESCO, 2005). It is based on the aims of the materialized SPEEs and derives as reflection on a long term educational design to incorporate in the teaching courses the EE and ESD, following the national and international upgrades.

### Research Method:-

Eight SPEEs, with many educational activities mentioned below, were carried out in Astritsi gorge from 2002 to 2013. Parentheses contain the numbers and dates on which these educational projects have been entered in the Register by the Teachers' Association of Meleses Lyceum & the School Activities Commission of Heraklion Secondary Education. 1. "The forests, water sources and gorges of municipality N Kazantzakis: getting awareness and sensitization of students for their protection" (14/20.11.2001 & 7/11.21.2001). 2. "Ways of intervention of students in conservation and enhancement of the natural environment on the water sources of Kato Vrisi in the Astritsi gorge" (9/26-9-2002 & 334/21-1-2003). This program was submitted for funding to the Aegean University, EPEAEK II Program and evaluated first, nationwide, in February 2003. 3. "Sound and Nature" (11/23-10-2003 & 128/10-1-2004). 4. "The sounds of Nature will release the soul and feelings of students and will guide thinking to the beginnings of human speech". This program was also submitted for funding to Aegean University, EPEAEK II Program and evaluated first by Cretan candidates in January 2004. 5. "The sound and art in Nature" (5/14-9-2004). 6. "Forest, biodiversity and quality of life" (17/15-10-2007). It was funded by the Ministry of Education 'Callisto Program' (Circular of Greek Ministry of Education 587/28-11-2008) with the subject 'Open Environmental Classes'. 7. "Diversity, a right in of life" (12/26-11-2010). 8. "Pathway from yesterday to tomorrow in the natural and cultural heritage of Astritsi gorge", in the framework of the Initiatives Support Program 'Inside, outside and on the same: Students in Action' of the General Secretariat for Youth, Greek Ministry of Education (Youth, 2012).

The purpose of the research was to present, in summarized way, the extracting data from the collecting huge archival material of the materialized SPEEs, in a review study for teachers who undertake SPEEs' implementation in Secondary Education. The researchers, focused only on the aims of the SPEEs, mainly written in the Application Forms (AFs), and with discourse analysis, extracted those references which are in accordance with the principles and objectives of EE and ESD. (By making synthesis like all the projects were only one with a unified conceptual and methodological framework, combining theory and practice, the research derived as a personal narration.)  
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In the archival material of the applied projects searched the aims which had been explicitly expressed or implied, on the subjects, the educational goals, methods and activities of the SPEEs, the recommendations and dissemination of the projects' results to the local society. Following the axial coding, firstly we fixed the categories and then inserted the data. The complexity of the research questions and their mixed character, theoretical and applied, permitted the use of the sentence, and not the word, as the recording unit in the examining of the research question from the point of view of the social and critical nature of EE. All the recorded data, concerning the design and implementation of the projects coded and entered in the following thematic areas (Kalathaki, 2016). The research material was the archival material of the projects, in printed and electronic form, which examined in a semi-structured manner by making qualitative Content Analysis (Bell, 1997; Bird, 1990).

The archival material of the above projects was studied through a reflection point of view, searching for data in the aims of the AFs, combined with the memories of the researchers, to answer the research queries: a. the thematic subjects, b. the criteria of the issue selection, c. the purposes and objectives, d. the educational methodology, e. the educational activities, actions and interventions inside and outside the school and gorge, f. reflections and evaluation, g. recommendations and dissemination of the projects' results with impact on the local society.

### Results and Discussion:-

The extracted data from the collected archival material is summarized in the thematic areas of the researched projects' design. Combining the past tense of the narrative and the future tense of the objectives and results, we decided that our presentation would be in the past tense, since the aims have been achieved through the many educational activities which took place in the SPEEs.

**The subject of the project:-****Selection criteria of the topics:-**

The gorge and the crossing river is part of the students' lives as they are close to their villages, namely the Project subject is linked to their experience. All these years, the Municipality of N. Kazantzakis cultivated, with great sensitivity, the cultural sector and supported all educational actions developed in the gorge. What emerged through discussions with our students, was a need to upgrade the gorge with participatory interventions. "The risk of pollution and aesthetic degradation of the gorge was high" (P1, P2) and it still remains high, the students realized it more and more each time they visited it. "The relatively easy access of environmental groups to the gorge, due to its proximity with the school, strengthens the choice for frequent and many visits. Most Students come from neighboring villages, so it was easy to work together in the afternoons and weekends" (P2, P3, P4, P8). Lyceum students are closer to adulthood and therefore the ESDP aim to the environmentally literate active citizen, that's why the Projects' themes were selected to correspond to scientific and cultural background of students and be compatible with many subjects taught in Lyceum. SPEEs supported us with educational material and innovative ideas since the school was a member of National and European Environmental Networks for many years, eg 'Young Reporters for the Environment', 'Sound and Nature', 'Biodiversity'.

**The content of the projects:-**

The "Path in the great natural and cultural heritage of Astritsi gorge-from the past, the present to the future", which was the title of the last materialized SPEE, summarized all previous knowledge and experience based on the conceptual frame 'Co-responsible in the past & Co-indebted in the future', conscious of the big capital that current generations have to manage in order to inherit to their descendants. This was the topic and the title of the student Conference which took place in 2010. The educational approach was enriched with activities inside the Astritsi gorge: "observation and recording of plant and zoo communities" (P2, P3, P8), "historical monuments that abound in the gorge" (P2, P3, P8), "navigation route signage" (P2, P3, P8), "cleaning interventions in the natural environment" (P2), "setting of billboards" (P2, P8), "waste bins" (P8), "localization of pollution sources and how to deal them" (P2), "promotion of Mythology with dramatization of the myth of Neraidos pilios in 2003" (P2), etc. According to Vygotsky (1997), cognitive development is a process inseparable from the historical-social dimension and the cultural context in which it occurs.

**Educational purpose and objectives:-****Purposes and conceptual frameworks**

The purpose of all projects that were implemented, related to the Astritsi Gorge, was the creation of the Environmentally literate Active Citizen based on the principles and values of ESD. The main objective of all actions was the initiative of the students and teachers of Meleses Lyceum, the volunteer spirit culture, the development of innovation and creativity as the basis for the enrichment and strengthening of the educational work, the promotion of critical and creative thinking of students and teachers, spearhead of the Decade of Education for Sustainable Development 2005-2014 (UNESCO, 2005). The 2009 was the European year dedicated to Innovation and Creativity. "It is the benefit of our students, their families and the local communities that we aim at through these projects, that promote public volunteering and youth creativity in entrepreneurship (P8). "We aim to become the school core of the local community, providing knowledge and experience, with two-way, through an intergenerational partnership that ensures lifelong learning in our students" (P6).

**Educational Objectives:-**

Cultivation of environmentally literate citizens requires reorientation of the educational process through the foundation of ESD in formal and non-formal Education by enhancing lifelong learning (Sterling, 1996; Rio+20, 2012, UNESCO, 2015). ESD is seen as a lifelong process that begins in early childhood, continuing through higher Education and adult Education, exceeding the limits of formal Education (EC, 2006). That's why the objectives of SPEEs must be harmonized with the ESD targets as set by UNESCO and the EU (UNECE, 2005; EC, 2007). Many cognitive, psychomotor, sensitive objectives are written in the AFs of the studied projects and some of them, even they are not explicitly mentioned, are derived from the educational activities which are referred in the projects' FR. The educational activities were designed "to exploit natural and cultural resources of the local community, the great heritage of students and their families, such as the Astritsi gorge" (P1, P2, P8) and "open the way to a school that seeks continuous improvement, change, conservation of biodiversity and cultural diversity" (P2, P6, P7) with new educational methods," with the development of youth entrepreneurship in the region" (P6, P8). From the educational point of view, "these actions are expected to bring added value to the existing school educational processes" (P6) and "to support the goal that students 'learn to learn', contributing to personal, social and professional development"

(P6, P8), "serving the objectives of the Lisbon Strategy and the Europe 2020 Strategy" (P6, P8, P10). Of course, a key question is the extent to which evaluation and assessment of school's performance can take into account the socio-economic and educational profile of students, thereby highlighting the school's added value. There is considerable variation across Europe in the extent to which schools have the autonomy to set their objectives, to shape their curricula, to select and remunerate their staff and to implement any changes that evaluations may show to be necessary (CEU, 2009; Chircop, 2015).

### **Educational Methodology:-**

20-30 students of A and B classes of Lyceum, ages 15-17 year old usually participated in each research project. The students attending, the last class didn't participate due to the burden of preparation for the National Exams at the end of school year. Some actions, took place in collaboration with students of the Meleses Gymnasium situated in the same building. Two teachers, one of Greek Language and one of Biology, the co-authors of this research paper were responsible for the projects, ensuring the interdisciplinary approach through history, literature and Natural Sciences. They collaborated with many teachers with the same or different specialties, scientists and bodies for carrying out various and specified activities.

### **Methodological framework and techniques:-**

EE and ESD are learner-centered Education programs using a wide variety of innovative methods in schools of Primary and Secondary Education. Projects' design was based on the principles of EE and ESD, as they were introduced by UNESCO declarations and European Community strategies (UNESCO, 2005; UNECE, 2005; EC, 2006, Rio+20, 2012). It was chosen, and utilized in practice, a combination of educational methods and techniques to achieve them. It combined the method of Research Essay (Method Project) with the "Problem Solving Method" (P2, P6) and "Role Play and Dramatization" (P2, P6). In all cases, bibliographic research in the school library and web, in Interdisciplinary / Multidisciplinary / Holistic approach was applied (Aegean 2004, NTUA, 2007). The method of Research Essay was implemented in all SPEEs with team and individual work in various ways. Many learning environments designed to support the SPEEs in the school science lab, in the field, in the Library, in cyberspace, with local authorities and communities (Kalathaki, 2016).

The modern labor market demands individuals who have the capacity for cooperation and communication within groups and networks. This makes the modern school imperative to cover the socialization deficit that exists in the families with a few members with the cultivation of group-cooperative spirit (Matsagouras, 2007). The collaborative nature of scientific and technological work should be supported again and again by the frequent group activity in classrooms. The paradigm is the scientists and engineers who usually work in groups and less frequently as isolated investigators (Meyer & Avery, 2001). Educational institutions that develop environmental ESD programs need "to promote social learning in the community" (P2, P6, P8) with a systemic view of the world, "to assess the environmental, experiential and exploratory learning as an instrument for effective engagement with original issues" (P6, P8).

### **Stages of the projects' implementation:-**

A. Preparation Stage: The whole information on the collected material and data about Astritsi gorge to the following environmental teams were undertaking each subsequent year, the two accountable teachers for SPEES applying in school. The topic selection, and the project's subjects clarifying, was hypothesis of the beginning of each school year, in the discussions of the Environmental and Pedagogic Teams.

B. Implementation Stage: Work in the school and the field took place inside the classrooms, school library and Science laboratory, with visits to places of high scientific and cultural interest, carrying out measurements of physico-chemical parameters (P2), observation and recording of organizations and monuments, "geological formations and other structures" (P2, P6), dramatization of the myth of Neraidospilios (P2), interviewing locals and discussing with authorities (P2, P6, P8). Within the framework of the ecological approach of the physical object, we made extensive/ detailed observations, surveys and discussions about the synthesis of the gorges' bio-communities and the special characteristics of the natural biotopes, the special geological formations which affect them, and additionally the effects of human interventions (P2, P6, P7, P8). The outcome of recording, analysis and reporting of the environmental problems that were identified in the gorge as aesthetic and chemical pollution helped us to make suggestions and recommendations to the Mayor and the President of the Cultural Association of Astritsi (P2). In 2001, a Conference with the local authorities, students, parents, and teachers took place, with initiative of the school environmental team, to discuss the existing situation of the gorge and future developmental plans. In this way,

students negotiated and were involved in solving environmental problems of their region, becoming part of the problem, and in a way complicit to the resolution.

C. Actions' Evaluation: Throughout the project, thoughts, opinions, feelings, and suggestions for improvements were expressed by the participants. Each year, experience and knowledge, along with youthful ideas (in a broad discussion and feedback, gave new impetus for creation and new horizons in the educational process. Capitalizing the needs and experiences of students, in grouped teachings with interchanging roles of teachers and students, resulted in a variety of attitudes and behaviors towards social and environmental problems. "With representation of situations, highlighted convergences, conflicts and disputes" (P6), students exercise in informed debate and find compromises (P6).

"The final evaluation is not considered complete by the Head teachers. There is a need for discussion among students and teachers in order to emphasize the strengths and highlight what could have been done, but was not achieved in the past years. This could be useful in future implementations" (FRs of P6, P8). "The objectives of the Project have been achieved without much anxiety and trouble, almost spontaneously. This, is attributed to the detailed design of the AFs of the projects" (P2) and the extended experience of the Head teachers and their collaborators.

#### **The funding of educational actions:-**

In the region of school, the municipality has invested a lot of money in basic infrastructure for hosting the Cultural Camping, inside the gorge for one month in the summer. As the years passed, it needs improvement but the economic crisis does not permit extra expenses. For this, the teachers made proposals of volunteering interventions of the students and their families which both the Municipality and the Secretariat of Youth supported, economically. The response of the Municipality to such proposals was always immediate and positive, so it established the cooperative promotion of all SPEEs' objectives, both of the school and the municipality. School years 2002-2003, 2003-2004, 2004-2005 and 2012-2013 Environmental Education projects involving Astritsi gorge funded by the Ministry of Education. The budgets concerned only the purchase of materials and the supplementary equipment available to the school. The rest of the expenses, were covered by the teachers and the students' parents.

#### **Educational Actions:-**

##### **Places of projects' implementation:-**

In terms of Constructivism, learning is not free but is embedded in the complex context of social, political and cultural environment, emerging from the biography and the learner's culture. Our individual mental structures, that shape the way we perceive the world, build through continuous interaction with the world around (Robottom, 2004). The activities and actions of SPEEs were planned and developed within and outside the school following the Aegean University (2004) guidelines. More specifically, we used: 1. the School Library for bibliographical research, 2. The Lab of Informatics for exploring in internet, to create Power Point presentations, handle correspondence via emails and to create the final product that was the 'Guide of Gorge Astritsi Gorge', 3. the Science Lab to create herbarium, which was exhibited in the school (P8), 4. the Hall of the City Council, for a meeting which was organized with the City Council on the subject of the gorge management and development. At the end of the P2, at a meeting with the City Council, students, with the help of their teachers, presented the results of the project and delivered the final product for utilization by the Municipality, 5. the school yard, at the end of the project, hosted all students, their parents and teachers of the two partner schools, in a final conference, where the results of the projects were announced and the final products were presented. There, the Municipality, Bodies and locals involved in the Astritsi gorge management were invited to be informed about the plans and current works of the environmental teams. This meeting was used to rewarding and public highlighting volunteerism, the initiative and good educational practices of students and teachers who carried out the projects, 6. Astritsi gorge for field work, study of bio-communities and geology and sign of tour-route of the trail with special marking on stones, trees and signs. Also, planting a particular area of the gorge and the school with species that already exist in the gorge and just enriched (P2, P8), action of pedagogic character.

##### **Projects' outcomes:-**

"Creating a herbarium with native species of the gorge for deeper understanding and retention in the school library. The herbarium will stay in the school library and in the Fresher of the gorge with the plant species collected in study visits" (P8). "Engrave of a path of history, ecology and culture in Astritsi gorge for highlighting our natural and cultural heritage, for maintaining it in the future (P2, P8). "The path will be marked as navigation route crossing the

gorge and will be described in text, audio and video in printed and digital material. All partners will be actively involved with the management, restoration and enhancement of the area, making interventions of pedagogical and aesthetic character" (P2, P8). At the trail tour which was engraved in 2004 were made improvements to labeling, description and reference points in the years later. "Production of printed 'Tour Guide of Astritsi Gorge', with the species of plants and ~~zoos~~ animals that a traveler may meet on the route, with useful historical and topographical information" (P5, P8). "The Tour Guide will utilize all the collected visual material and can, if it is used by businesses from the local community, ~~to~~ strengthen the demanding, alternative tourism in the region" (P5, P8). Artistic creations of students with gorge materials will decorate the school and the offices of the Municipality, artwork using natural materials, at no cost, promoting anti-consumerist model of living, according to the principles of ESD (P3, P8). "Plastic tabs on the species of the gorge plants will be placed in many points of the trail, next to the plants advising informing the traveler about the names of the plant and their possible use by the locals" (P8). "Construction of billboards deterrent for hunting and the use of pesticides" (P2, P8). Billboards had serenades related to death and imprisonment of birds and other animals, regret and complaint those they feel but they cannot express in words. "Commemorative Inscription of the project will place was placed in the gorge in a special visit of the whole school in the spring of 2004" (P2), "Information Posters of all project activities for the school and local community and the Project Results" (P2, P8). "Construction of cleaning bins and seats/ benches in harmony with the natural environment, CDs and DVDs with all materials (texts, photos and video) and notes useful to the travelers and participants" (P8). "Video Production of a theatrical happening in Neraidospilios of Astritsi gorge, near Kato Vrissi sources, where girls of the environmental team danced dressed as fairies and boys spent a few hours at a traditional cafe in the village, representing a forgotten myth about Neraidospilios" (P2). The theatrical happening constitutes educational improvisation, in the context of an unprecedented learning process, through which the participant enters the mentality of the locals at the beginning of the last century and gets to know their habits. The past came to present, the legend became reality!

#### **Impact to the local society:-**

"Apart from the students of the project, the local residents are also beneficiaries of the project, as well as every visitor of the gorge, and of course the university students who come every summer to camp in the gorge and participate in high quality artistic activities" (P8). Several visits of students and teachers from schools from Romania, Turkey and Cyprus participants to bilateral Educational Exchange Projects with Meleses Lyceum were organized at the gorge. What makes us really happy is that students who participated in SPEEs when they were in Meleses Lyceum, participated, also, in the creation of the Cultural Camping as university students, and continue to support and contribute in any cultural event that take place in the gorge, as residents of the region of the school and active, environmentally literate students.

#### **Management of Astritsi Gorge:-**

"The exploitation of project results and the continuation of educational activities and interventions, their viability after the implementation, was a key concern of all groups in perennial ESD developed in the learning environment of Astritsi gorge" (P8). The findings and proposals which addressed to the management bodies of Astritsi gorge concern the following (P2, P8): the adoption of certain areas inside the gorge by associations, residents, students, the disruption of the life of all organisms that have their habitat in the gorge by the human presence, the pollution of land and aquatic ecosystem which threatens biodiversity and balance, modifying the residential reformation of the gorge, study of required correct lighting with underground cabling, preparation of a Pavilion Information Desk for Visitors and Tourists, taking protection measures relating to free and uncontrolled grazing, hunting and use of pesticides, conservation of the historical monuments, meticulous cleanliness of the river, toilets, concert place, generally of the gorge.

#### **Dissemination of the projects' Results:-**

The presentations and dissemination of the project results were done with the expiration of each school year, where all the students of the school, the local community, Municipality, teachers, scientists and the educational authority were invited. In the final Conference a variety of activities were organized, lectures, open discussion, round table, the delivery, awarding of students and giving commemorative diplomas to the project's external partners. "Delivery of the Tour Guide to schoolchildren, local residents and the local council can be an important motivation for new business operations in the place of the gorge and the surrounding area" (P6, P8). "The placement of hunting prevention billboards in the gorge will contribute to jointly confrontation the reduction of biodiversity from human interventions" (P2, P8). With the multiple and various educational activities, actions and interventions, with questionnaires, conferences, roundtables, group discussions, were recorded knowledge, opinions and ideas relating

to the Astritsigorge expressed by the old, the present and the future generation of the school region. With meetings and presentation of the SPEEs, students and teachers came in contact with all stakeholders, parents and many other members of the local community, so they managed to disseminate the project results and motivate local people to cope with greater seriousness and rationality the exploitation of natural resources of the gorge. "With articles published, (and will continue to be published,) as well as interviews published in the local press, the local community will be encouraged by the younger members for more active participation" (P8). The studied SPEEs was adapted to local conditions and needs to create incentives for higher expectations, develop relationships and patterns similar to those attempted in Samaria Gorge, considering the Astritsi gorge as National Park. SPEEs functioned as vehicles carrying sustainable education policy from the local to national and global level. "In psychomotor and emotional level we aim to contribute to the strengthening of relations between students originating from different villages, between teachers residing in the city and the local agricultural and livestock society, changing attitudes and behavior of all of us towards the local community, the environment, for better quality of life" (P8).

### Conclusions:-

Materializing so many SPEEs, which had the Astritsi gorge as main learning environment, students practiced in the scientific observation of natural ecosystems and taking measurements of physicochemical parameters. They experienced the developmental policies of public bodies and local authorities. They experienced the value of a collaborative team spirit, based on equality, understanding, mutual support and open communication. Students became stakeholders and shared responsibility in the management of a habitat of their region, developed initiatives in organizing discussions, questionnaires, conferences and interviews and so realized the need for the evaluation of the initiatives, activities and actions whenever they choose. They came closer to their teachers, worked at a different level and experienced different pedagogical methods and procedures from those they had previously experienced in traditional classrooms. They were able to get acquainted with new technologies, computers, video, Fax, Internet, emails, with presentations, producing educational material and SPEEs' final products, also publication of articles on the Web, in the 'European Young Reporters Network for the Environment', in national and international Conferences and seminars. Developed artistic activities such as theater happenings, photography, painting structures with natural materials coming from the gorge. The theatrical happening about the Fairies of Astritsi gorge, adapted to two related legends of the region, was written and filmed in a short video on the experiential acquaintance and perception of a legend.

### Recommendations:-

In the end, remarks are given for further development of the educational activities in the future both at local and national level, regarding the way of students taught to be environmentally literate active citizens, in accordance with the principles and goals of UNESCO and European Union for SD. The produced knowledge in the materialized SPEEs and the tried methodology could be implemented in school curriculums as good educational practices and to be translated into educational policies.

The economic crisis, with the insecurity and the problems it has caused to schools, affected the last project's implementation. Strikes, student occupations, delays in implementation of educational reconstruction and many other created a negative atmosphere, causing inadequate disposal to all of us, we often got frustrated with significant impact on the activities and actions we desired, but finally we overcame it. Within a short time, we managed many outcomes and outputs, we pressed ourselves to achieve all the set objectives. We feel that these projects have not been over yet ... We hope that the gorge will become a source of life and social upgrading, so that neighboring settlements will not be affected. We had the need to establish that educational culture which will empower locals, students and parents, provide with responsibility opportunities, build rewards leadership and maximize collaboration, share responsibility, involve students in the planning and decision making, demonstrate innovation, assume the risk and safety, valuing the diversity of views with resilience and flexibility, where the experience reviews the progress and the people learn from everyone, as Scott (2007) suggests.

### References:-

1. Aegean (2004) Aegean Project Management Guide "School Projects of Environmental Education-SPEEs", 2002-2006, [www.Aegean/sppe.gr](http://www.Aegean/sppe.gr), was pulled 20/12/2005
2. Bell J. (1997) Methodological Design of Pedagogical and Social Research, Gutenberg Publications, Athens
3. Bird, R. W. (1990) Scientific inquiry and science teaching. In L. B. Flick, & N. G. Lederman (Eds.), Scientific inquiry and nature of science: Implications for teaching, learning, and teacher education (Chap. 1, pp. 1-14). Dordrecht, the Netherlands: Kluwer Academic Publishers.

4. Bruntland Commission (1987) Report of the World Commission on Environment and Development: Our Common Future, available 7/2/2016 on <http://www.un-documents.net/our-common-future.pdf>
5. CEU-Council of the European Union (2009) Council Conclusions on a strategic framework for European cooperation in education and training ("ET 2020") 2941th Education, Youth And Culture, Council meeting, Brussels, 12 May
6. Chircop D (2015) Education policy in the Europe 2020 Strategy, Briefing November 2015, European Parliamentary Research Service (EPRS), Members' Research Service PE 572.789
7. EC (2006) Key competences for lifelong learning. Recommendation 2006/962/EC of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning [Official Journal L 394 of 30.12.2006], available 050216 on <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERV:c11090>
8. EC (2007) Schools for the 21st Century, Commission Staff Working Document, Commission of the European Communities, Brussels, 11.07.2007, Sec(2007) 1009, available 23/09/2010 on [http://ec.europa.eu/education/school21/consultdoc\\_el.pdf](http://ec.europa.eu/education/school21/consultdoc_el.pdf) and 02/02/2016 on [http://e-learning.sch.gr/pluginfile.php/7824/mod\\_resource/content/0/geniko\\_meros/enothta\\_1/mathima\\_1/schools\\_for\\_the\\_20th\\_century.pdf](http://e-learning.sch.gr/pluginfile.php/7824/mod_resource/content/0/geniko_meros/enothta_1/mathima_1/schools_for_the_20th_century.pdf)
9. Flogaiti E. (2006) Education for Environment and Sustainability, publications Greek Letters, 2nd edition
10. Hernandez, O. and Monroe, M.C (2000) Thinking about behavior, in Environmental Education and Communication for a Sustainable World. Handbook for international Participants. USA: Academy for Educational Development
11. Huckle J (2006) Philosophical framework for ESD Understanding society and nature and sustainable development, University Notes Workshop 4-8 December, Post-Graduate Program "Environmental Education" TEPAES, Aegean University, Rhodes
12. Kalathaki M (2016) Environmental project plan for schools of secondary education, Asian Academic Research Journal of Social Sciences & Humanities ISSN 2278 – 859X, Year 2016, Volume-3, Issue- 5 (May - 2016), available 090916 on [http://www.asianacademicresearch.org/2016\\_paper/may2016/11.pdf](http://www.asianacademicresearch.org/2016_paper/may2016/11.pdf)
13. Matsagouras H. (2007) Teaching Strategies, 5th edition, Gutenberg, Athens
14. Meyer Z. D. & Avery M. L. (2001) A Science and Technology Studies Lens for Studying Teacher Practice, Paper presented at the annual meeting of the American Educational Research Association, Seattle, WA, April 12, available at <http://ei.cornell.edu/pubs/>
15. NTUA (2007) Educational material for Teachers and Executives Training Seminar of Environmental Education, EPEAEK II Writing Group with scientific responsible Professor Koutsopoulos K., National Technical University of Athens
16. Rio+20 (2012) "The\_Future\_We\_Want", Conference\_outcome\_document, Rio+20 United Nations Conference on Sustainable Development, Rio de Janeiro, 20-22 June 2012, <http://www.hellenicaid.gr/diethnes-plaisio/diethnes-plaisio/pagkosmia-diaskepse-gia-te-biosime-anaptuxe-ton-ee-rio-20.html>
17. Robottom I, (2004). Constructivism in Environmental Education: Beyond Conceptual Change Theory, Australian Journal of Environmental Education, vol. 20(2)
18. Scott W. (2007), Goodfellow M. and Andrew-Power K. (editors), Raising standards: making sense of the sustainable schools agenda, Specialist Schools and Academies Trust, London
19. Scott, W. & Gough, S. (2003) Sustainable Development and Learning, Framing the issues, London, Routledge Falmer
20. Sterling, S. (1996). Education in Change. In Huckle, J. & Sterling, S. (eds), Education for Sustainability, Earthscan
21. UNESCO (2005) Guidelines and Recommendations for Reorienting Teacher Education to Address Sustainability, United Nations Decade of Education for Sustainable Development (2005-2014), Education for Sustainable Development in Action, Technical Paper N° 2 – 2005 UNESCO Education Sector
22. UNESCO (2015) EDUCATION 2030, Indicators to monitor Education2030 global citizenship, <http://www.uis.unesco.org/Education/Documents/43-indicators-to-monitor-education2030.pdf>
23. UNECE (2005) Στρατηγική της UNECE για την Εκπαίδευση για την Αειφόρο Ανάπτυξη, Vilnius, 17-18 Μαρτίου 2005)
24. Vygotsky L.S. (1997) Mind in Society, Development of Higher Psychological Processes, translation Bibou A and Vosniadou S., Publisher Gutenberg, Athens
25. Youth (2012) Students initiatives support program "Inside, outside and on the same: Students in Action" of the General Secretariat for Youth, Greek Ministry of Education, Lifelong learning and Religion, [www.neagenia.gr](http://www.neagenia.gr)
26. Ziaka C., Robichon Ph., Souchon C. (2000) Environmental Education, six proposals for civil society, Publisher Islets, Thessaloniki



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### RESEARCH ARTICLE

## FIBULAR OSTEOSYNTHESIS WITH CANNULATED HIP SCREW FIXATION OF NEGLECTED FEMORAL NECK FRACTURE IN A YOUNG ADULT: CASE REPORT.

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Fibular graft, Osteosynthesis, Non-union, Avascular necrosis, Screw fixation

### Abstract

Neglected fracture neck of femur is a challenging condition to treat. Preservation of the head of femur is desirable in young patients. In order to preserve the femoral head in femoral neck non-union in young adults, the preferred option of treatment is open reduction and internal fixation. Where there are no facilities for microvascular surgery, non-vascularized fibular strut grafts can be used with screws. This paper describes the use of fibular strut graft and cancellous screws in the open reduction and internal fixation of a neglected femoral neck fracture associated with avascular necrosis of femoral head in a young adult that was followed up for four years. The use of non-vascularized fibular strut grafts and screws for fixation of non-united fractures of femoral necks, even in the presence of avascular necrosis, could lead to union. It is cost-effective and technically less demanding, and associated with good outcomes.

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### Introduction:-

Fracture neck of femur is popularly known as, "unsolved fracture." [6] The choice of treatment depends on the patient age, duration of injury, activity level, extent of displacement, and extent of osteoporosis. The treatment goals are anatomic reduction, stable fixation, preservation of blood supply to the bone fragments, and early active mobilisation to prevent stiffness. Treatment options include valgus osteotomy and osteosynthesis with or without bone grafting (muscle pedicle, free vascularised, or nonvascularised fibula), hemiarthroplasty, and total hip arthroplasty. [1,8] Nonunion and avascular necrosis are common complications. Recent studies have shown improved results with decreased rates of avascular necrosis (AVN) and nonunion. [2,9] But neglected fracture neck of femur still poses a major challenge for the treatment. Barnes et al. [3] showed that the rate of complication significantly increases once the treatment is delayed beyond 1-week. Thus some additional procedure to salvage the femoral head is warranted. For this, there are large numbers of options including osteotomies and bone grafting procedures. The dilemma today is to choose among these options, as the literature is not clear about the ideal treatment. One recognized treatment option is the combined use of open reduction, internal fixation with screws and non-vascularized fibular strut graft. This method is relatively easy to perform, does not require microvascular anastomosis, offsets both the biologic and biomechanical causes of non-union, contributes to the repair of any incidental avascular necrosis, and is not encumbered by the complications of intertrochanteric osteotomy like limping. This was the technique used in the current report for the subject who had a neglected femoral neck fracture and radiological evidence of aseptic necrosis of the index femoral head. His fracture healed after three months and

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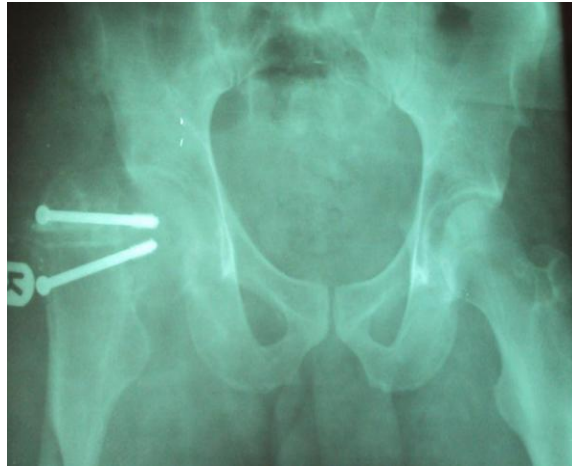
he had no evidence of aseptic necrosis. After a follow-up of two years, he had a Harris hip score of ninety seven. The rationale behind this option is discussed and the relevant literature is reviewed. The patient gave his consent for this study.

### Case Report:-

A 22 year old man presented to the outdoor patient department of our hospital with complaining of pain around groin, limping, not able to bear weight on right limb for the last 2 months. He had a history of fall from bike 2 months back. He was treated by a local bone setter. On examination affected limb was externally rotated and shortened. Anterior joint line was tender, vascular sign of Naranjo negative. Range of movement was restricted and painful. Limb length discrepancy by 3 cm. Telescopy test positive. Trendelenberg test could not be elicited. X ray pelvis with both hip AP view 20° internal rotation was taken. X ray showed displaced fracture of neck of femur with sclerosis of margins, patchy sclerosis of head. Shenton's line was broken. His Harris hip score (HHS) was 55. He was admitted and proximal transtibial skeletal traction given for seven days prior to surgery. An anterolateral approach was used to expose the right hip joint and to estimate the required length of fibular strut. Nine centimetres of the mid ipsilateral fibula was harvested subperiosteally through a lateral right leg incision. The graft was prepared by multiple drill holes along its length and nibbling of its interosseous border. Upon exposure of the hip, fibrous tissue and cartilage were noted to be covering the fractured ends. These were curetted off to freshen the ends with the aid of Steinman pins attached to separate the greater trochanter and femoral head as joysticks. The entire neck appeared shorter than normal. The neck was then reamed over the third guide wire using the 8 mm part of the triple reamer. The fibula strut graft was then hammered over the third guide wire. The graft was subsequently introduced into the reamed tract. Two cancellous screws were then used to fix the fracture. Unfortunately, varus could not be prevented because of the extent of neck resorption but the construct was stable. The wound was closed in layers over a suction drain which was removed after 2 days. Boot and bar cast was given. He was advised on strict non-weight bearing for 2 months. Mobilization was started on the third postoperative day depending upon the pain tolerance. Hip strengthening exercise was initiated 6 weeks after surgery. All the patients were kept nonweight bearing for initial 6 weeks. After which the patient was mobilized using crutches, with toe touch weight bearing. The weight bearing was increased gradually as tolerated by the patient, allowing full weight bearing after 12 weeks of surgery. All the patients were followed for 6 weeks, 3 months, and 6 months of surgery, and every 6 months thereafter. Partial weight bearing started with the use of walker for another six weeks. Serial radiographs showed progressive healing. Full-weight bearing was started about a 7 month post operatively when the right hip radiograph showed fracture consolidation with incorporation of the fibular strut graft. Twenty-two months postoperatively, the screws were removed. Patient was seen in the outpatient department 2 years postoperatively and the Harris hip score was ninety-four.



**Fig. 1:-** pre operative xray showing # neck of femur (right).



**Fig. 2:-** Ap view showing fibula graft between two ccs post fixation of neglected # neck of femur



**Fig 3:-** ap view after removal of screws.



**Fig. 4:-** frog leg lateral view of pelvis after removal of screws.

### Discussion:-

There is no proper definition for fracture neck of femur to be called neglected, Meyer's et al.[10] have considered a criteria of 1-month whereas most other workers including Nagiet al.[11] and Sandhu et al.,[14] have considered a criteria of 3 weeks, beyond which the fracture was considered neglected. The patient whose case was presented had neglected his femoral neck fracture for two months. He then presented with an ununited femoral neck fracture and radiographic features that suggested aseptic necrosis of the ipsilateral femoral head. He was placed on a seven-day skeletal traction in order to offset the effects of contracture of hip abductors, overlap of fracture fragments and limb shortening

- (1). The anterolateral approach was chosen because it avoided the posterior retinacular vessels and thereby limited the damage to the blood supply to the femoral head
- (2). Bone graft was used to assist union and treat aseptic necrosis. It had been shown with ample evidence including experiments in dogs that cortical grafts provided structural support to the necrotic femoral head preventing its collapse and, with time, provided scaffold for revascularisation and osteogenesis along the length of the graft to the subchondral bone [4,12]. By this means, union was achieved and the aseptic necrosis was treated. This had been demonstrated in recent studies . The triangular shape of the fibular strut used in this case report strengthened the immobilization of the fracture by providing rotational stability at the fracture site [7,14]. Additionally two cancellous screws were used to obtain compression and more stability at the fracture site . It had been stated that the

two-screw-and-fibular-strut-graft construct was sufficiently stable for one not to use hip spica [14]. The total period of restricted weight bearing was the time it took for union to be evident - three months. The emphasis on restricted weight bearing until obvious evidence of union has been shown to give better results [14]. In this case report, a fibular strut graft and internal fixation with two screws were chosen for the treatment of a neglected femoral neck fracture in a young adult with radiological features of aseptic necrosis of the femoral head. Fibula being cortical bone provides mechanical strength besides stimulating the union and getting incorporated. The trifin shape of the fibula stabilizes the fracture and prevents rotation. Hence is rightly described as a biological Smith-Petersen nail.[5] Union was achieved albeit with coxavarus. As per the meta-analysis of Roshan and Ram,[13] the results of nonvascular fibular grafting in neglected fracture neck by different authors have given nonunion rates between 0-17% and AVN rates of 0-33%. The functional outcome is difficult to compare as different studies have used the different criteria for evaluating the functional status of the patient. The 28 patients in the case series of Roshan and Ram[13] treated by this method had an average HHS of 87.1 at a mean follow-up of over 6 years. At two-year follow-up, there were no features of aseptic necrosis of the femoral head and his Harris hip score was 94%. The patient was told of the possibility of future osteoarthritis of the index hip and the need for regular follow-up. In conclusion, the use of non-vascularised fibular strut grafts and screws for fixation of non-united fractures of femoral necks, even in the presence of avascular necrosis, could lead to union. Fixation with cancellous screws and fibular strut grafts for neglected femoral neck fractures is cost effective and technically less demanding and associated with good outcomes. The femoral head is preserved; this can be converted to bipolar or total hip replacement if needed in future.

### References:-

1. Azam MQ, Iraqi A, Sherwani M, Sabir AB, Abbas M, Asif N. Free fibular strut graft in neglected femoral neck fractures in adult. *Indian J Orthop* 2009;43:62-6.
2. Bhandari M, Devereaux PJ, Swiontkowski MF, Tornetta P 3rd, Obremskey W, Koval KJ, et al. Internal fixation compared with arthroplasty for displaced fractures of the femoral neck. A metaanalysis. *J Bone Joint Surg Am* 2003;85-A:1673-81.
3. Barnes R, Brown JT, Garden RS, Nicoll EA. Subcapital fractures of the femur. A prospective review. *J Bone Joint Surg Br* 1976;58:2-24.
4. Compere, E.L. and Lee, J. The restoration of physiological and anatomical function in old ununited intracapsular fractures of the neck of the femur. *J Bone Joint Surg.* 1940; 22: 261-277.
5. Damany DS, Parker MJ, Chojnowski A. Complications after intracapsular hip fractures in young adults. A meta-analysis of 18 published studies involving 564 fractures. *Injury* 2005;36:131-41.
6. Dickson JA. The unsolved fracture; a protest against defeatism. *J Bone Joint Surg Am* 1953;35-A:805-22.
7. Elgafy, H., Ebraheim, N.A. and Bach, H.G. Revision internal fixation and nonvascular fibular graft for femoral neck nonunion. *J Trauma*. 2011;70: 169-173
8. LeCroy CM, Rizzo M, Gunneson EE, Urbaniak JR. Free vascularized fibular bone grafting in the management of femoral neck nonunion in patients younger than fifty years. *J Orthop Trauma* 2002;16:464-72
9. Loizou CL, Parker MJ. Avascular necrosis after internal fixation of intracapsular hip fractures; a study of the outcome for 1023 patients. *Injury* 2009;40:1143-6.
10. Meyers MH, Harvey JP Jr, Moore TM. Delayed treatment of subcapital and transcervical fractures of the neck of the femur with internal fixation and a muscle pedicle bone graft. *Orthop Clin North Am* 1974;5:743-56.
11. Nagi, O.N., Dhillon, M.S. and Goni, V.G. Open reduction, internal fixation and fibular autografting for neglected fracture of the femoral neck. *J Bone Joint Surg.* 1998; 80B:798-804.
12. Phemister, D.B. Treatment of the necrotic head of the femur in adults. *J Bone Joint Surg.* 1949; 31A: 55-66.
13. Roshan, A. and Ram, S. Early return to function in young adults with neglected femoral neck fractures. *Clin Orthop Relat Res.* 2006; 447:1
14. Sandhu, H.S., Sandhu, P.S. and Kapoor, A. Neglected fractured neck of the femur a predictive classification and treatment by osteosynthesis. *Clin Orthop Relat Res.* 2005;431:14-20.



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### RESEARCH ARTICLE

## IMPACT OF BLOODSTAIN PATTERN ANALYSIS IN CRIME SCENE INVESTIGATION.

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### Abstract

Bloodstain Pattern evidence can be used for sequencing events at a crime scene. Again, it can be used to trace the direction in which a body was dragged. In addition it can also be used to draw useful conclusions about the relative position of the victim/s, perpetrator/s and bystander/s (if any) in a crime scene. Stain patterns can be used for predicting the probability of events that might have occurred at a crime scene. Bloodstain Patterns cannot in particular be associated with an individual. DNA analysis of blood samples, blood serology test can be used as associative evidence for uniquely identifying an individual. This paper illustrates the process of bloodstain analysis in crime scene.

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### Introduction:-

Violent crimes accounted for roughly 26.6 % of the total number of crimes reported and hence recorded in the year 2014[1]. The FBI's (Federal Bureau of Investigation) Uniform Crime Reporting (UCR) Program, has defined offenses which involve force or threat of force as violent crime [2]. The investigation phase in itself can broadly be classified under the following 3 heads - 'Defining the Crime Scene', 'Processing the Crime Scene', and 'Information collection from and about the crime scene'[3]. The information in the form of testimony, hearsay evidence, real and original evidence is used for reconstruction of criminal events and thereby placement of such evidence before the juridical system to draw well analyzed conclusions [4]. So collection and interpretation of evidence does play an integral role in shaping the proceedings of a criminal case [4].

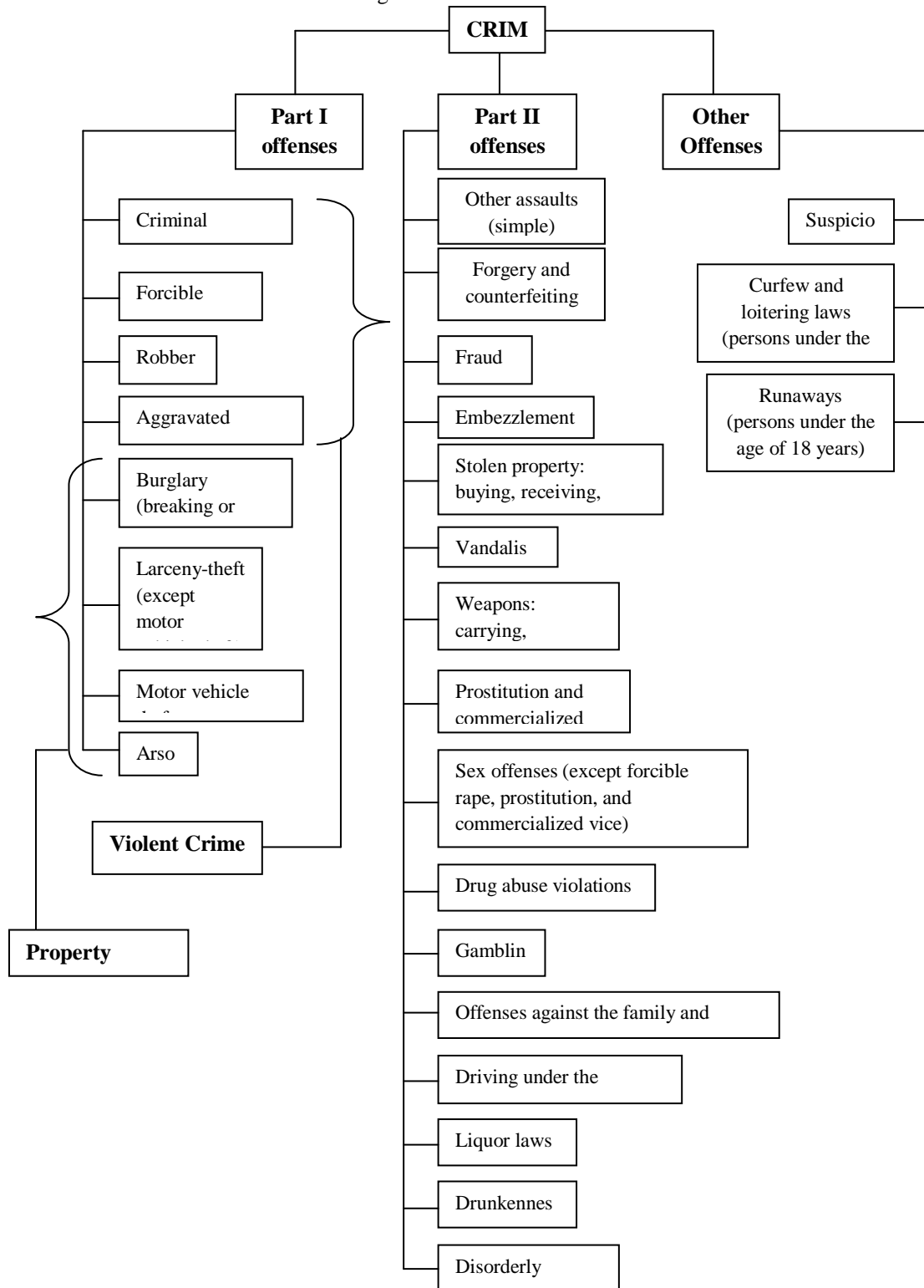
Most violent crime scenes are characterized by large scale blood spillage. The bloodstain patterns often are a static consequence of the dynamic events that had perspired at the crime scene. With a particular rise in homicide cases, stain patterns are often considered reconstructive evidences of great importance for reconstructing a crime scene, validating eyewitness testimony etc. Crime in itself forms the basis of 'Crime Scene Reconstruction'. Figure 1 provides a graphical description of the crime classification system endorsed by the UCR program conducted by the FBI [2].

As per the UCR program conducted by the FBI, Violent Crime primarily comprises of murder and non-negligent manslaughter, forcible rape, robbery and aggravated assault. The UCR program defines Violent Crime as those offenses which involve force or threat of force. In coherence with the crime definitions put forward by the UCR program, the National Crime Record Bureau, India, categorizes violent crime under the following heads – Murder, Attempt to Commit Murder, Culpable Homicide not amounting to murder, Rape, Kidnapping and Abduction, Preparation and assembly for Robbery, Riots, Arson and Dowry Deaths[1]. These crimes are under most circumstances accompanied by bloodletting events. It is this subset of crimes that we intend to work on this

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particular project. The 'Crime in India Report 2014' published by the National Crime Record Bureau, suggests that there has been a subsequent yet persistent increase in violent crime rate over the last 4 years (span 2010-2014). The crime classification chart is shown in figure 1.

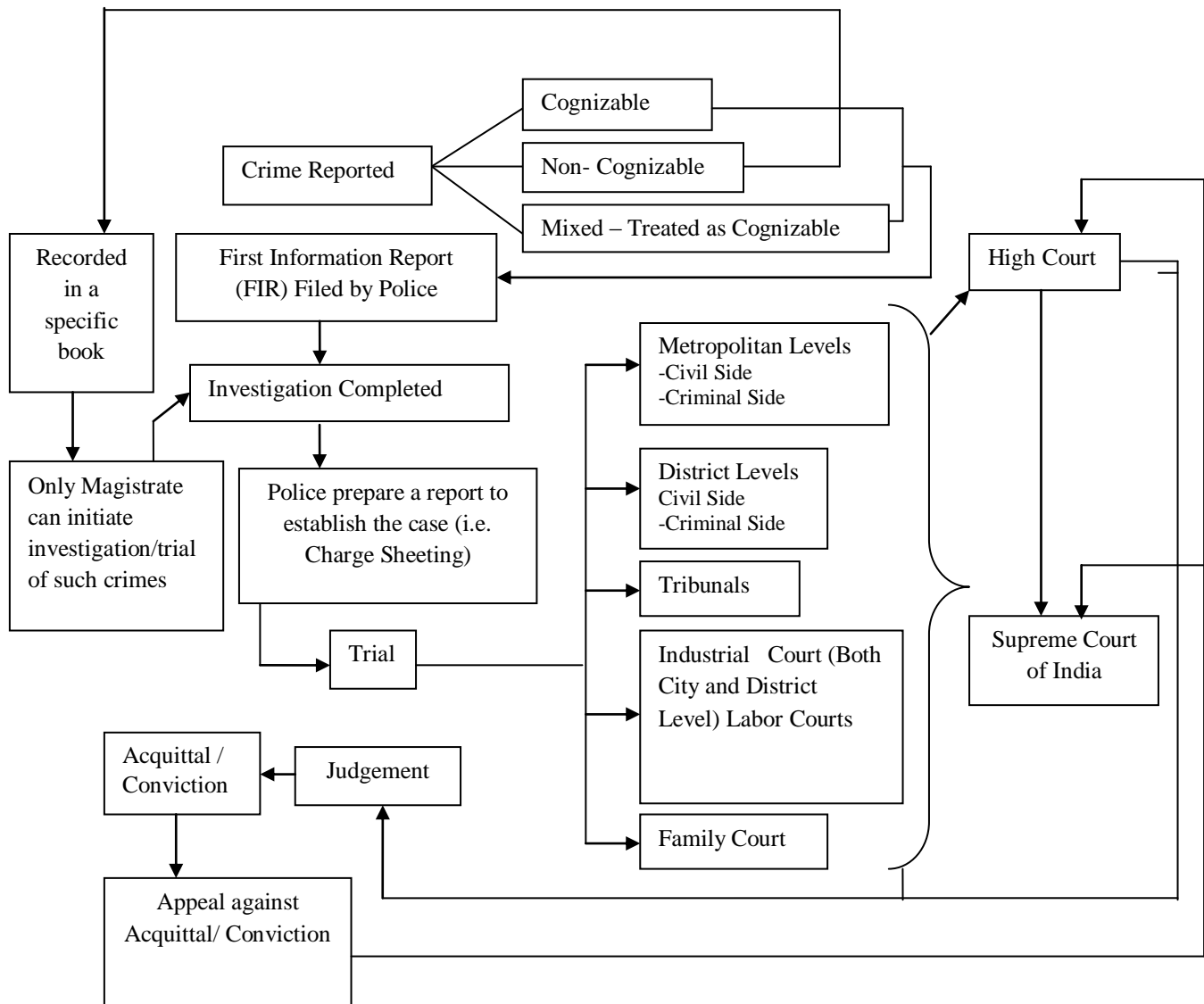


**Figure 1:- A Crime Classification Chart.**

### **Bloodstain Pattern Analysis:-**

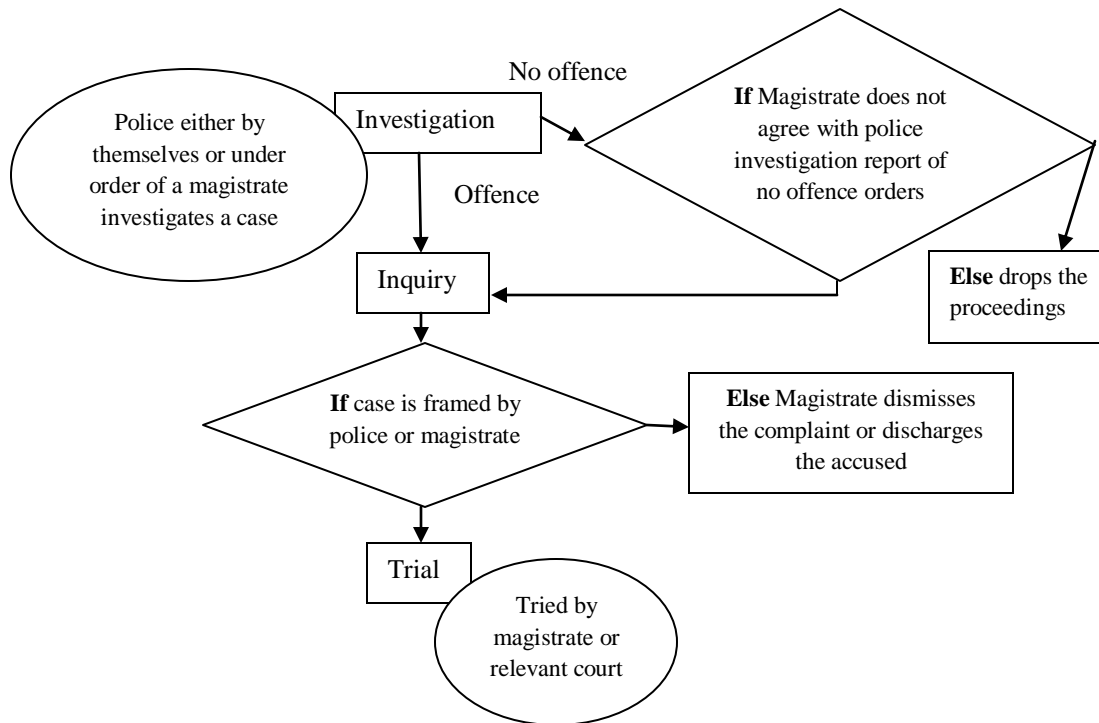
The Scientific Working Group on Bloodstain Pattern Analysis (SWGSTAIN) defines ‘Bloodstain Pattern’ as ‘a grouping or distribution of bloodstains that indicate through regular or repetitive form, order, or arrangement the manner in which the pattern was deposited’ [6]. J.J. Nordby, Ph.D., D-ABMDI defines ‘Bloodstain Pattern analysis’ as ‘the scientific study of the static consequences resulting from dynamic blood shedding events’ [7].

As a prelude to the use of Bloodstain pattern as a reconstructive evidence in a court of law, it would not be out of place to provide a graphical overview of how criminal offense is dealt with within the Indian juridical setting. Figure 2 summarizes the Juridical setting relevant to trial of a criminal complaint within the Indian juridical system [8].



**Figure 2:-** Flow Chart describing the trial of a criminal complaint within the Indian juridical setting [8]

Once a complaint is made, based on the crime type reported (refer Figure 2), the criminal proceedings that take place can broadly be classified into 3 basic phases - Investigation, Inquiry and Trial[8]. Figure 3 provides a graphical overview of the process of criminal case proceedings within the Indian juridical system [8].



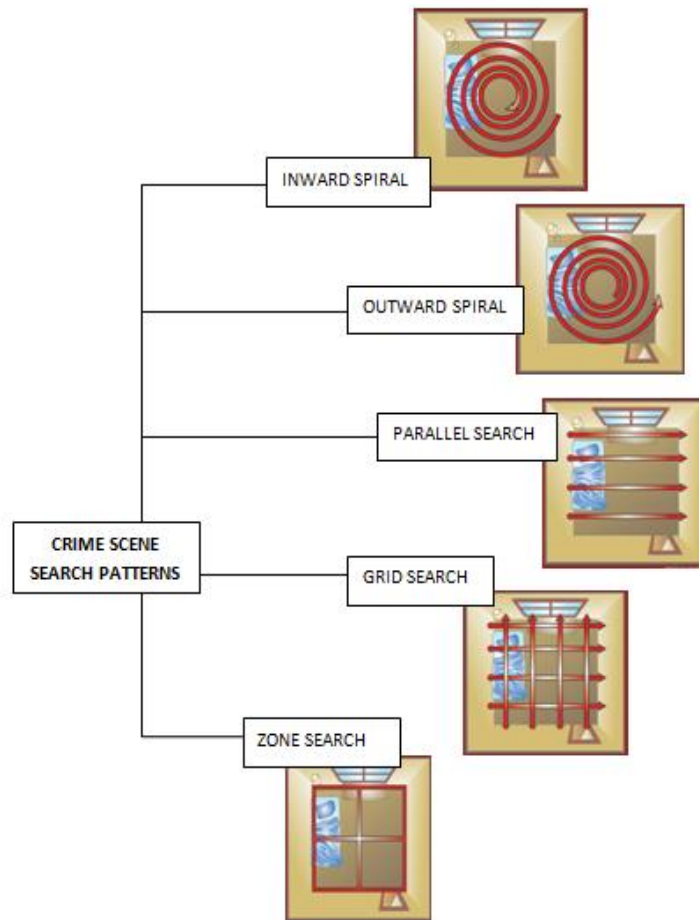
**Figure 3:-** A flowchart documenting how a criminal case is processed within the Indian juridical system [8]

### Crime Scene Investigation and Reconstruction:-

Crime Scene Investigation and thereby Reconstruction in its turn particularly involves 3 basic phases (refer Figure 4). They are,

- Defining the Crime Scene
- Processing the Crime Scene
- Information Collection from and about the Crime Scene [3]

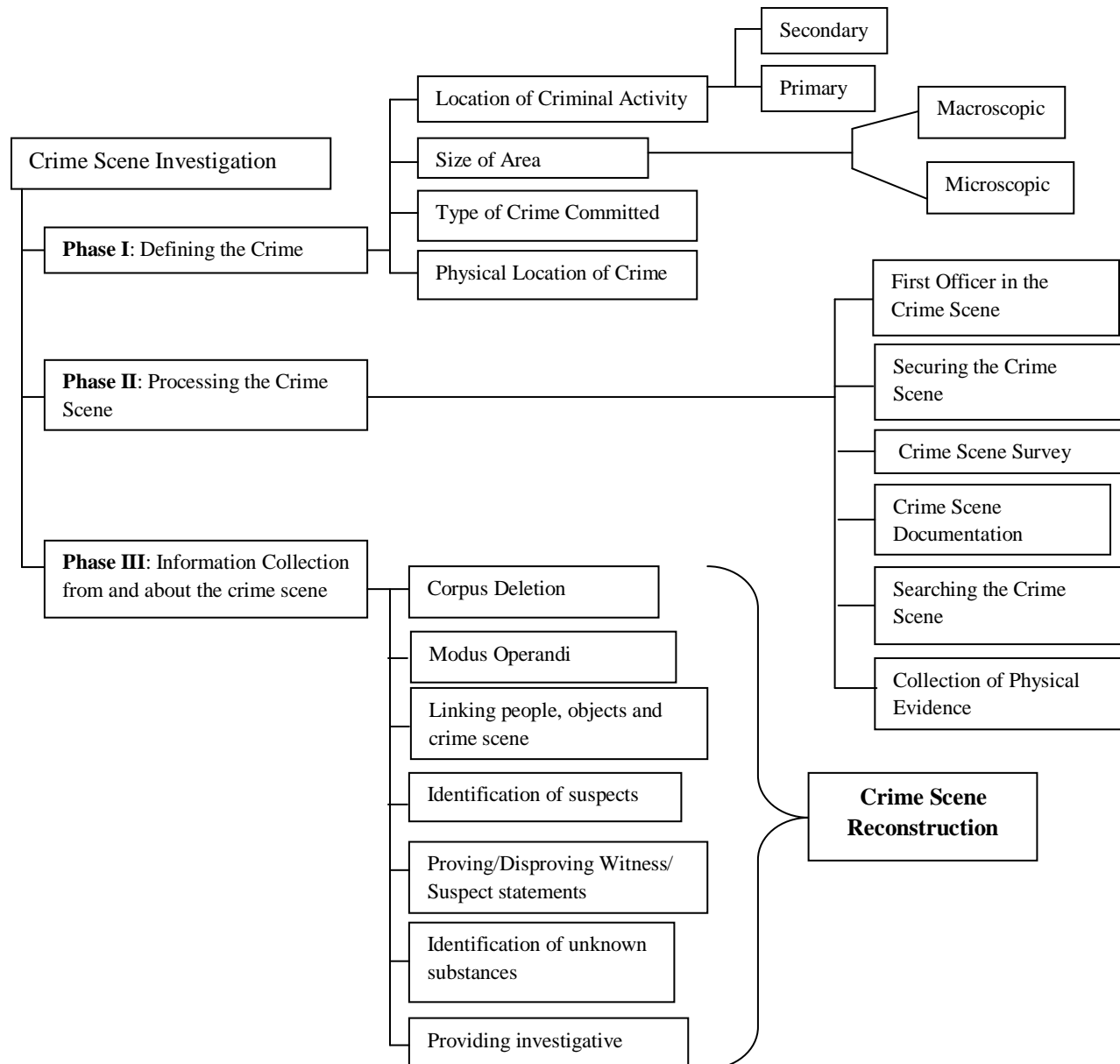
Defining the crime scene refers to identifying the activity areas relevant to a particular criminal event [3]. The Primary Crime Scene is the area where the original crime occurred. The Secondary Crime Scene comprises of the subsequent crime scenes [3]. The size of the crime scene can further be classified as Macroscopic and Microscopic [3]. While Microscopic focuses on specific type of physical evidence at the crime scene, Macroscopic refers to one particular crime location composed of many microscopic crime scenes [3]. In defining the crime scene, it is of utmost importance to understand the type of criminal offense that has been committed at the scene [3]. It can range from homicide, robbery, rape or an admixture of all. In analyzing evidence, it often stands integral to know the physical location of the crime scene (i.e. Indoors, Outdoors, Vehicle etc.)



**Figure 4:-** Crime Scene Investigation – a broad overview [3]

Once the Crime Scene is broadly defined, the next phase of the Investigation process deals with 'Processing of the Crime Scene'. At the very onset, the Crime Scene Investigator establishes contact with the Law Enforcement Officer in charge of the crime scene. Also he/she makes a list of other people such as other law enforcement officers, coroner's personnel, public safety personnel, civilians etc. who have or have had access to the crime scene in question. The next step towards processing a crime scene is securing the scene by use of police line tape or other means in order to prevent unwanted access to the scene by casual passerby, people with malicious intentions etc. The scene is secured in order to leave all evidence at the crime scene undisturbed by wandering individuals. Once secured, the scene is subjected to initial overall survey by investigating officials. At this point, the officials leave all evidence undisturbed and develop initial theories based on apparent understanding of the crime scene. The officials also mark out potential evidence in the initial walk through phase. The first responders as also enforcement officials take into account the entry /exit points in the scene that require attention. This phase also requires the officials to make a list of equipments and precautions that the officials would need to take in order to document as also search the crime scene. The crime scene is thoroughly documented by way of Notes, Videotaping, Photographing and Sketching [3]. Once clearly documented, systematic search patterns are used in order to avoid missing out on any piece of physical evidence present at the crime scene [9]. The different search patterns that are used to search a crime scene have been graphically documented in Figure 5[9].





**Figure 5:-** Search patterns used for collecting evidence from a crime scene [9]

#### **Evidence – Legal Perspective:-**

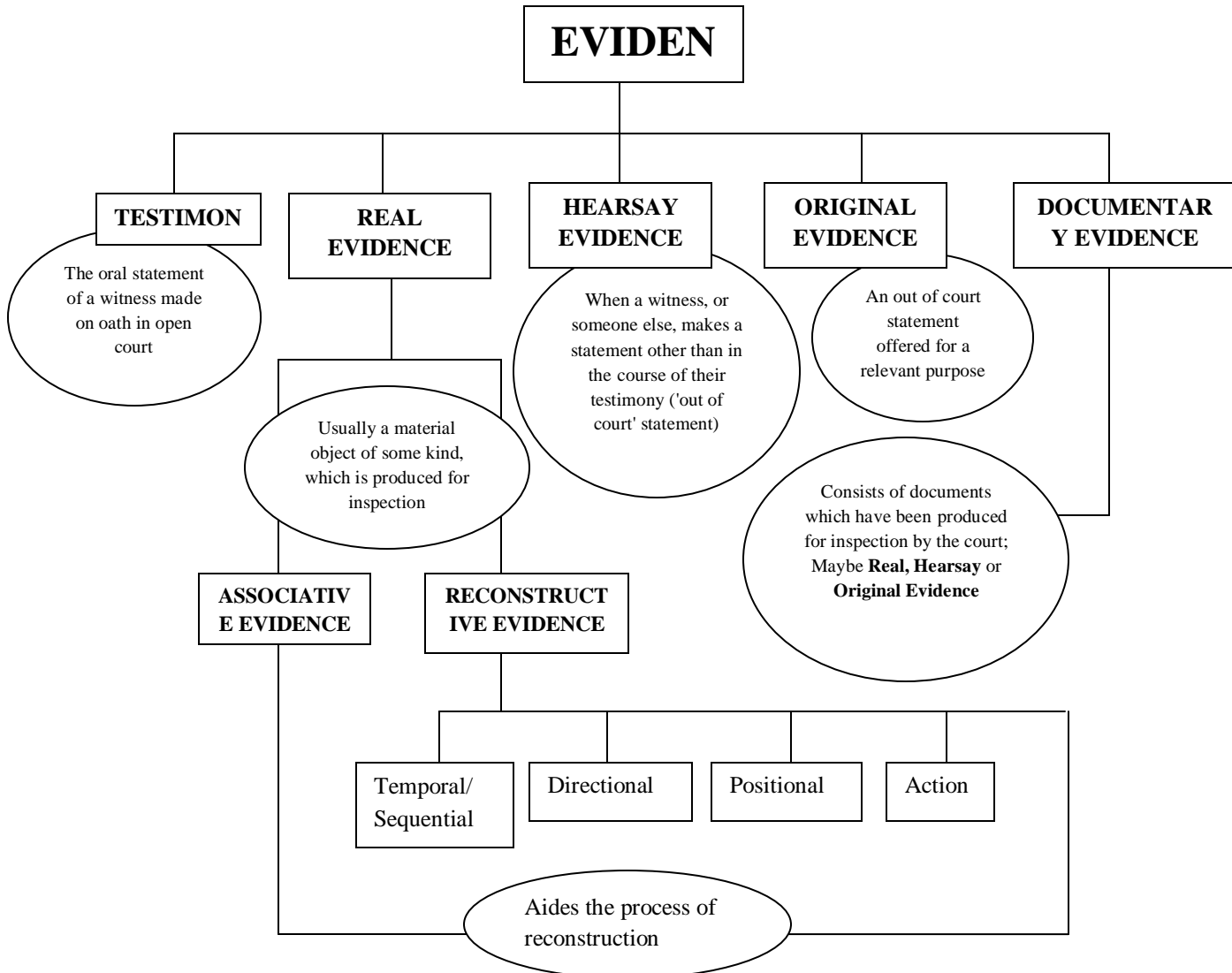
In order to prove/disprove a hypothesis formulated, the court warrants evidence and its interpretation by an expert. The legal system classifies evidence or rather ‘relevant’ evidence as – Testimony, Real evidence, Hearsay evidence, Original evidence, and Documentary evidence (refer Figure 6)[4]. Evidence is termed ‘relevant’, when the facts that are subject to prove or disprove in a court of law amount to

- Facts in issue, i.e. those which need to be proved by one party;
- Relevant facts, i.e. those which tend to prove the facts in issue;
- Collateral facts which may for example affect the credibility and/or competence of a witness [4].

Evidence based on its use in understanding a crime scene can broadly be classified into two broad groups – Associative Evidence and Reconstructive Evidence. Associative evidence, in its turn, can also be used for reconstructive purposes. While Finger-mark, Fingerprint, Foot-mark, DNA(from Hair, body fluids), Ear-mark, Bite-mark, Handwriting can particularly be used as associative evidence for uniquely identifying an individual, evidence

such as Firearm, Shoe-mark, Fibers, Paint, Glass, Tool-mark, Soil, Drugs, Fire debris, Explosives, Pollen Grain help, Bloodstain Pattern help in crime scene reconstruction.

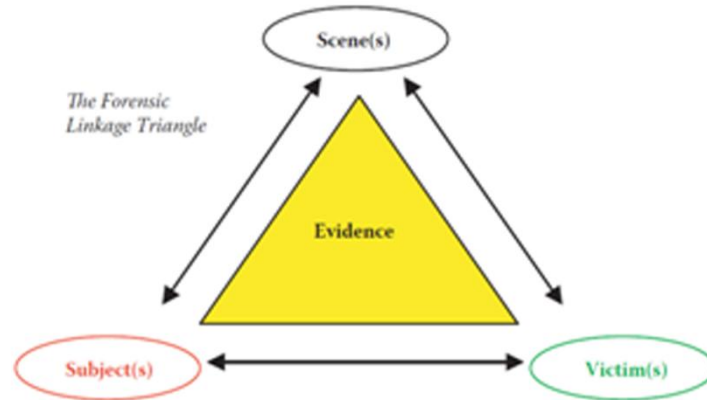
The different types of Reconstructive Evidence are Temporal/sequential evidence, Directional evidence, Positional Evidence, Action and Associative Evidence [10].



**Figure 6:-** Evidence classification table [4]

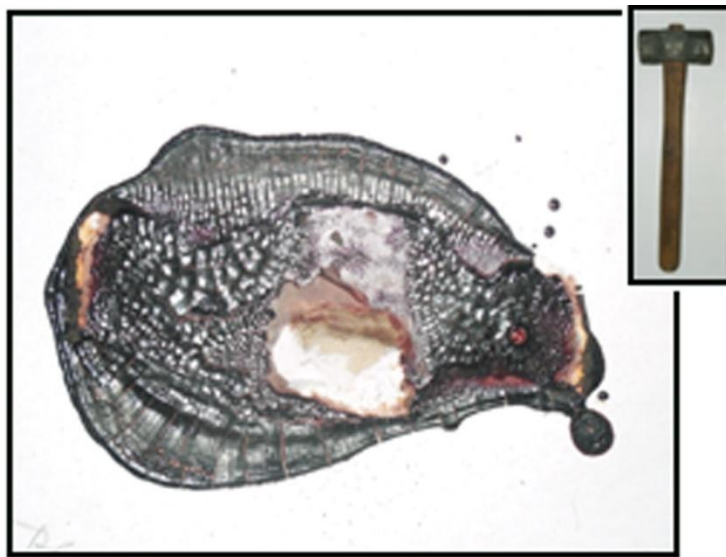
#### **Evidence Interpretation- a case study:-**

A core concept in crime scene analysis is that 'nothing is co-incidental, nothing just happens'. This core concept of crime scene reconstruction is based on four basic principles. They are, Locard's Exchange Principle, Nicolas Stenos Principle of Superposition, Principle of Lateral Continuity by Steno and the concept of chronology [13][14]. As of date, Locard's principle forms the backbone or rather the basics of forensic science and provides the foundation for the forensic linkage triangle (refer Figure 7) [13].



**Figure 7:-** Based on evidence and the principle of exchange, the forensic linkage triangle is used by forensic scientists to establish the interrelationship between the scene, subject and victim [13].

Based on the Principle of Superposition, it can be considered that the artifacts at a crime scene are also deposited in layers in a time order, from oldest to youngest, unless otherwise disturbed or altered [13]. Figure 8 represents an image from a crime scene that emphasizes this order or time sequence of events at the crime scene.



**Figure 8:-** A crime scene image exemplifying Steno's Principle of Superposition.

From the image it can be clearly predicted that The sledge hammer head was placed (had it fallen on the blood pool blood would have spilled on all sides of the pool) on the blood pool, was allowed to dry and later when it had almost dried the hammer was removed leading to the formation of the void in the stain pattern. The events that led to the formation of this stain pattern can clearly be sequenced.

In relation to the crime scene, Steno's Lateral Continuity states that two layers that are near in time and space but are not directly associated belong to the same time frame if they have sufficient evidence of similarity(i.e. similar spatter stains) and have only been dissociated due to subsequent alteration(refer Figure 9) [13].

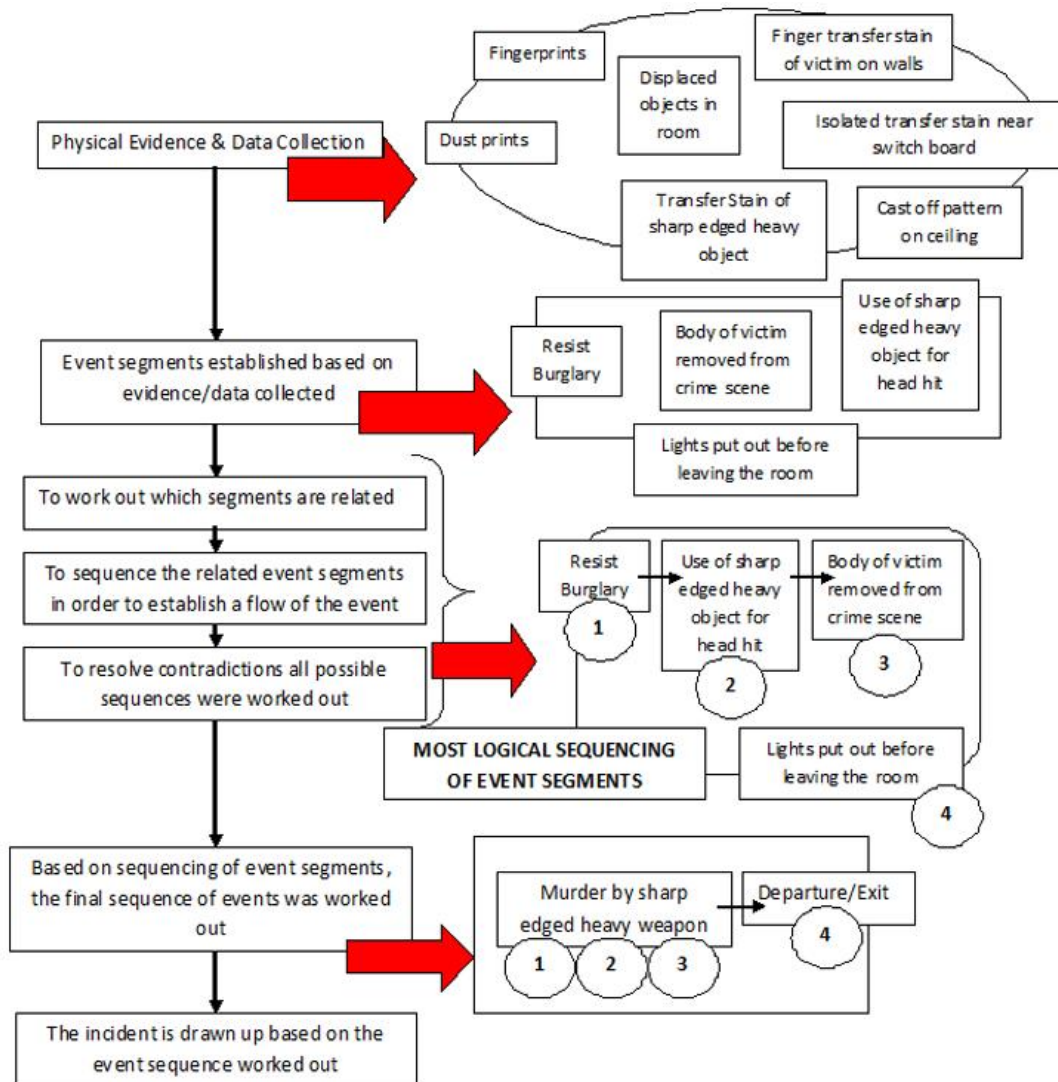


**Figure 9:-** A crime scene image exemplifying Steno's Principle of Lateral Continuity.

Though apparently dissociated, if substantial similarities exist (eg DNA, size dispersion) between the stain patterns deposited then they can be considered to be the result of a single deposition and caused by the same event. The void pattern in itself clearly mirrors the concept of Steno's Lateral Continuity [13]. When encountered with a void pattern the analyst can easily infer that, the pattern of blood did not stop abruptly but has been interrupted by the presence of an object or living being ; or has particularly been altered(i.e. removed) .

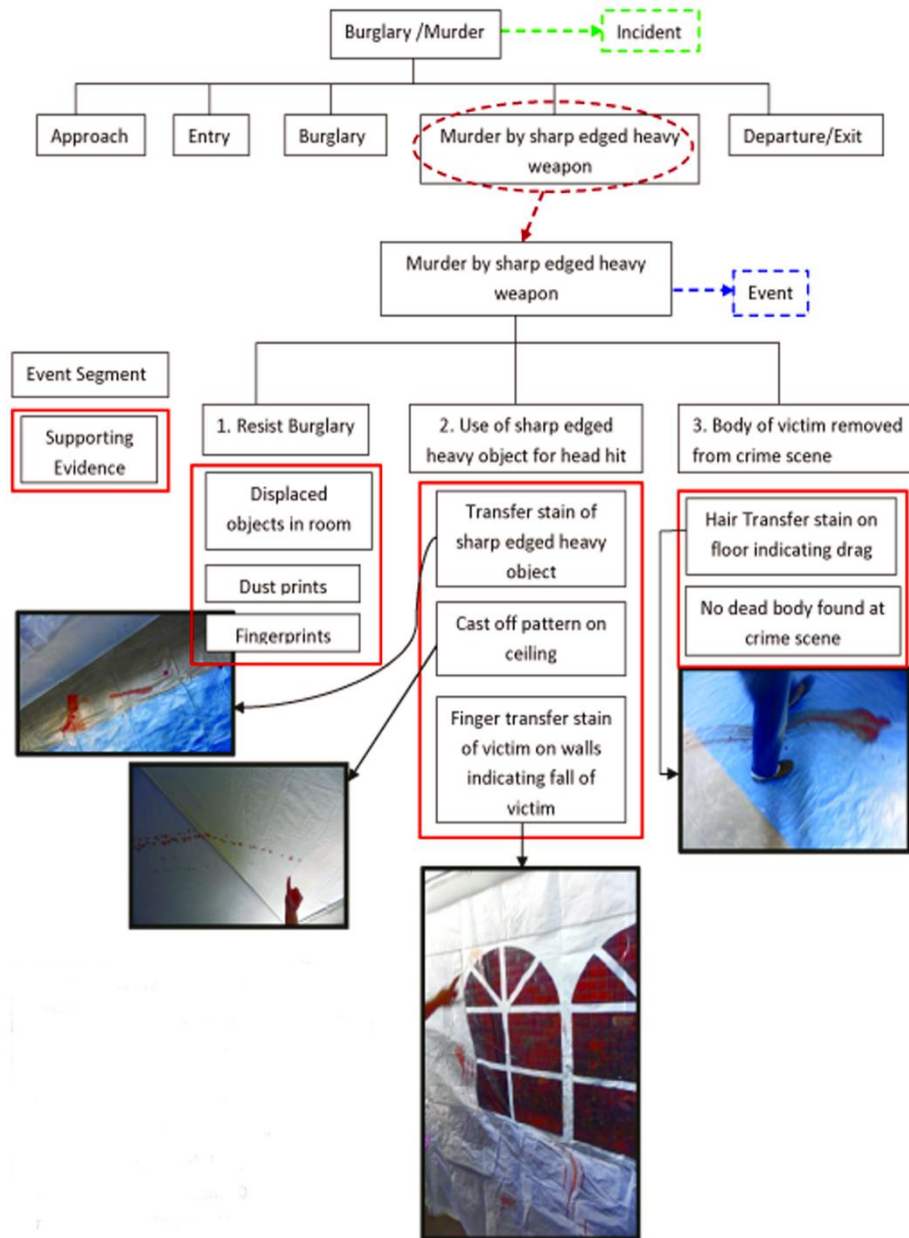
As per Bevel and Gardener [13], the steps taken to reconstruct a crime scene can be summarized as follows (refer Figure 10).

- Physical evidence and data collection from crime scene
- Specific event segments are established based on data/evidence collected(time snapshots)
- To work out which event segments are related to each other
- Sequencing the related event segments, to establish a flow of the event
- In order to resolve contradictions, all possible sequences are considered and auditing of evidence is done as and when required
- Based on sequence of the event segments, preparation of the final sequence of events is done.
- Finally the flowchart of the entire incident is prepared and the sequence is validated.



**Figure 10:-** Graphical representation of the different steps used for crime scene reconstruction.

The round structures numbered 1, 2, 3 and 4 represent the order of the associated event segments that contribute to a particular event. The event segment 'Resist Burglary' is marked as '1', the segment 'Use of sharp edged heavy object for head hit' is marked as '2' as it succeeds event segment 1. Similarly, event segment 3, 'Body of victim removed from crime scene' succeeds event segment 2 and logically precedes event segment 4, which is not related to event segments, 1, 2 and 3. Event segments 1, 2 and 3 in sequential order add up to form event 'Murder by sharp edged heavy weapon'. Event segment 4 is a part of the event segments that build up event 'Departure/Exit'.



**Figure 11:-** A crime scene reconstruction with the help of physical evidence, which directly contribute towards drawing up of respective event segments, which in their turn contribute to making up of event/events. The events add up to explain the criminal incident that has perspired [13]

A crime scene of burglary together with the murder of the victim was recreated/ simulated. Figure 10 represents a particular event from the scene and the ancillary event segments. The optimal sequence of events that had occurred at the crime scene was worked out based on available circumstantial evidence and data collected from the crime scene (refer Figure 11). A probability value is attributed to each event sequence based on previous similar crime events and logical reasoning. The sequences are ranked based on the probability value calculated. The optimal solution of the sequencing problem is found by marking out the sequence that has the highest probability. 4. Scope for Research

It is particularly difficult to backtrack what had perspired at a crime scene based on evidence. This is because uncertainty is a characteristic feature of most violent crime scenes. Even for an expert it is difficult to be sure of what has actually occurred at the crime scene. Often an expert's opinion is affected by contextual and confirmation

bias. One only gets to know the flaws in a crime scene reconstruction process when an individual present at the scene at the time of crime confesses without inhibitions. This uncertainty and overwhelming number of parameters that govern the flow, formation of a bloodstain pattern is what makes this domain a multi-disciplinary treasure trove of research opportunities.

Considerable interest has been taken towards tracing/backtracking the possible source dimensions for a passive drip stain from a weapon. A system has been proposed to predict the possible radius of a particular drip stain. Now the radius might be similar for two particular sources from which or along which blood drips. Herein lies the need for study of other circumstantial evidence at the crime scene. Again, passive blood drops often overlap. Someone might walk over the drip stains. All these parameters add to the complexity of the study and interpretation of bloodstain patterns at the crime scene. Complex, particularly mixed stain patterns, diluted stains even on plain, smooth, non-absorbent target surface are difficult to analyze. Temperature plays a crucial role in relation to blood flow characteristics. How does fat content in blood affect stain patterns? Does it at all have any effect on bloodstain patterns at a crime scene?

Fabrics are a common occurrence at any crime scene. Does a worn out piece of linen fabric of a certain thickness record stain patterns similarly to a 5 times washed linen fabric of similar weave, thickness? Is the difference statistically significant? The experiments undertaken and the work done by White and Slemko [14-16] on stain patterns recoded on fabric target surface answers the aforementioned questions only in part. On most occasions it is impossible to calculate the area of origin (i.e. the 3D position of impact) from impact spatter stains on fabric. No mathematical model has yet been devised to calculate the impact angle of a stain formed on fabric target surface. The reason for this being the large inter and intra class variability in fabric texture, thickness, absorption/porosity etc. Again salivation, sweating on fabric affects the stain patterns formed on fabric. However, human sweat as also saliva composition varies based on food habits of an individual, environmental condition in which he/she lives etc. As a result, experiments with sweat vary from one laboratory to the other and are difficult to standardize.

Transfer stains on fabric and smooth, plain, non-absorbent target surface often provide essential support for crime scene reconstruction. Interpretation of weapon transfer stains, foot, shoe, hand print transfer stains in relation to the amount of blood in contact, target surface texture etc. forms an important area of research.

Positional prediction of victim/s, bystander/s (if any), perpetrator/s in a crime scene involving blunt force trauma, rifle shot, sharp edged weapon can be done on the basis of bloodstain patterns. Unavailability of a wide benchmarked dataset, large number of variable parameters such as room dimensions, height of concerned individuals, human joint movement, fragile nature of stain patterns etc. make development of such a mathematical model complex thereby facilitating extensive research within the domain. Difference between a wipe and swipe stain still stand unexplored.

### **Conclusions:-**

Evidence or rather Physical evidence does not speak up for itself, Physical evidence warrants proper interpretation. Primarily, Associative and Reconstructive evidence contribute towards the reconstruction of a crime scene. Bloodstain Patterns can effectively be used in coherence with other circumstantial evidence for the reconstruction of a crime scene, to validate the statement of eyewitness/es (if any), to sequence events that might have occurred at a crime scene etc. Crime Scene Reconstruction in its turn aids the process of crime scene investigation and the presentation and interpretation of evidence in a criminal court.

However, evidence interpretation within a juridical setting as of date is largely dependent on the discretion of a skilled expert witness. A mathematical model could particularly help towards minimizing contextual, cognitive and confirmation bias and reinstate faith of the scientific system on the whole process in place for Crime Scene Investigation and presentation with a juridical setting.

Owing to the large number of environmental parameters that affect stain pattern formation and the uncertainty that plagues crime scene reconstruction Bloodstain pattern stands as a multidisciplinary domain that warrants inputs from research communities of widely varying disciplines.

**References:-**

1. National Crime Records Bureau, Ministry of Home Affairs, Government of India. (2016 June).
2. U.S. Department of Justice—Federal Bureau of Investigation. (2010, September).
3. Ebiary, H. , *Crime Scene Investigation* ( 2008 August).
4. Swindlehurst, J., & Hadzi-Vidanovic, V. (n.d.). Evidence: Types of Evidence Admissible in a Law Court. Retrieved March 30, 2015.
5. Oxford University Press. (n.d.). crime - definition of crime in English from the Oxford dictionary.
6. Scientific Working Group on Bloodstain Pattern Analysis. (2009, April). FBI — Standards and Guidelines - Scientific Working Group on Bloodstain Pattern Analysis: Recommended Terminology - April 2009.
7. Nordby, J. J. (2006). BASIC BLOODSTAIN PATTERN ANALYSIS. Retrieved February 26, 2015.
8. Central Board of Secondary Education, Union Ministry of Human Resource Development, Govt. of India, 2009.
9. Layton, J. (2009, October 20). How Crime Scene Investigation Works. Retrieved February 23, 2015.
10. Stauffer, E. (2006, June). Possibilities and Limitations of Forensic Laboratory Reconstruction.
11. Amin, T. M., & Sirs, J. A. (1985). The blood rheology of man and various animal species. Quarterly Journal of Experimental Physiology.
12. Christman, D.V., A Study to Compare and Contrast Animal Blood to Human Blood Product. International Association of Bloodstain Pattern Analysts News, 1996. 12(2): p. 10-25
13. Bevel, T., & Gardner, R. M. (2002). *Bloodstain pattern analysis: With an introduction to crime scene reconstruction* (3rd ed.).
14. Welding, S. (2012, 12). Locard's Exchange Principle - Forensic HandbookForensic Handbook.
15. White, B., *Bloodstain Patterns on Fabrics: The Effect of Drop Volume, Dropping Height and Impact Angle*. Journal of the Canadian Society of Forensic Science, 1986.19(1): p. 3-36.
16. Slemko, Joseph A, Bloodstains on Fabric, The Effects of Droplet Velocity and Fabric Composition, , December 2003 News, Page 3-11.





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### RESEARCH ARTICLE

#### ROLE OF S100P AS A NEW PROGNOSTIC MARKER IN WOMEN WITH METASTATIC BREAST CANCER AND ITS CORRELATION WITH BCL2 AND BAX EXPRESSION.

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Breast cancer, S100P, Bcl2, Bax, apoptosis, prognosis

#### Abstract

**Background;** Breast cancer is the commonest malignancy and the second cause of cancer-related death in women worldwide. Understanding the underlying molecular biology of breast cancer allow better management to decrease its mortality. The S100 P is a member of S100 family of Ca<sup>2+</sup>-binding proteins. Apoptosis is a physiologic mechanism of cell death that has been shown to play important role in cancer development. Bcl-2 is an anti-apoptotic gene that has the ability to block apoptotic signals, while Bax is another member of the Bcl-2 family that has an apoptosis-stimulating function.

**The aims** of our study were to elucidate the prognostic role of S100P, bcl2 and bax in breast cancer, clarify the relation between their expressions and the prognosis of that type of cancer.

**Method:** The plasma S100P levels ( by ELISA ) and expressions of bcl2 & bax ( by Immunohistochemistry ) were evaluated in 90 women; 70 metastatic breast cancer patients (MBC), 12 primary breast cancer patients (PBC) and 8 healthy controls, then we assessed the prognostic value of S100P, bax, bcl2 in breast cancer patients.

**RESULTS:** the plasma S100P level was nearly the same for PBC patients and controls, but was higher than that of MBC patients ( $p < 0.001$ ). There is significant correlations between the level of S100P with capsular invasion ( $p = 0.018$ ), stage, bcl2 and bax ( $P < 0.001$ ). In MBC there is a significant association between elevation of S100P level, number and site of metastasis ( $P < 0.001$ ).

Bcl2 expressions in breast cancer patients had negative significant correlations with grade ( $P < 0.001$ ), ki67 ( $P < 0.021$ ), molecular subtype ( $P < 0.050$ ), stage ( $P < 0.001$ ), and S100p ( $P < 0.05$ ), also its expression in MBC patients was statistically significant with number of metastasis ( $P = 0.014$ ).

Bax high expression is statistically significant with grade ( $P = 0.003$ ), stage ( $P < 0.001$ ), ER ( $P < 0.010$ ), PR ( $P < 0.023$ ), Her-2 neu ( $P < 0.002$ ),

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but in MBC patients it is statistically significant with the site of metastasis ( $P=0.003$ ).

The plasma of S100P level is significantly correlated with response to therapy, disease progression ( $P<0.001$ ) and Overall survival (OS) of patients ( $P=0.014$ ). Bcl2 expression is significantly correlated with response to therapy ( $P<0.001$ ), disease progression ( $P=0.004$ ) and OS ( $P=0.014$ ).

**Conclusion:** S100P, BCL2 and bax are promising prognostic markers in breast cancer patients

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## Introduction:-

Breast cancer is the most common neoplasm and the second leading cause of cancer-related death in women worldwide (1). In Egypt, breast cancer represent 33.8% of all cancer cases in females, and the estimated number of breast cancer in 2015 is 19105 cases (2). Understanding the underlying molecular biology of breast cancer allow earlier diagnosis and efficient treatment options that will help to decrease its mortality (2).

The S100 P is a member of S100 family which is EF-hand superfamily of  $Ca^{2+}$ -binding proteins that have intracellular and extracellular functions. It contributes to cancer progression by promoting cell proliferation, survival, angiogenesis, and metastasis. It is over expressed in many types of cancer such as pancreatic cancer, hepatocellular carcinoma, oral squamous cell carcinoma, esophageal cancer, gastric, colorectal cancer, lung cancer, prostatic cancer, ovarian cancer, cervical cancer. It correlates with poor prognosis in these cancer patients and also could be a promising therapeutic candidate. In addition, many studies suggested an important role of S100P in occurrence of chemoresistance. However, its diagnostic and prognostic value for metastatic breast cancer (MBC) is still unknown (3-6).

Apoptosis is a physiologic mechanism of cell death that has been shown to play a role in the onset and/or development of cancer (7). Defects in the cellular program that control apoptosis can lead to disturbances in tissue homeostasis, i.e., balance of cell proliferation and cell death (8, 9). Most anticancer agents, independently of their mechanisms of action, kill cancer cells by inducing apoptosis in response to a drug-induced damage. Alterations in the regulatory mechanisms of apoptosis are responsible not only for the progression of cancer, but also for different response to treatment (10). Apoptosis is controlled by several genes. Among the most crucial regulators of this process are members of the Bcl-2 gene family. Bcl-2 is an anti-apoptotic gene that was first identified in follicular non-Hodgkin lymphoma (11). Bax is another member of the Bcl-2 family, but in contrast to Bcl-2 it has an apoptosis-stimulating function (12).

## The aims of our study:-

were to elucidate the role of plasma S100P level in breast cancer prognosis, evaluate the immunohistochemical expression of bcl2 & bax in breast cancer patients, clarify the relation between their expressions and patient prognosis, and also to correlate plasma S100P level with bcl2 and bax immunohistochemical expressions in our patients.

## Patients & method:-

In our study, 90 women were included; 70 metastatic breast cancer patients (MBC), 12 primary breast cancer patients (PBC), and 8 healthy controls, the study was conducted in Clinical Oncology and Nuclear Medicine, Medical Oncology, Clinical Pathology, Pathology, General Surgery departments, faculty of medicine, Zagazig University, Egypt. Informed consent was obtained from all cases; the study protocol was approved by the Ethical Committee of Faculty of Medicine, Zagazig University. The patients' specimens and data were collected from March 2011 to February 2013 and were followed up till March 2016.

## Plasma S100P measurement:-

Plasma S100P level was measured using S100P ELISA kit (ElabScience, product code E-E1-H1294) and an ELISA plate reader b (Tecan-Austria GM bit.8 Gro dig. Austria, following the manual of the procedure. All plasma samples were measured in duplicates. Correlation coefficient between duplicate: 0.99, detection range (0.313-20 ng/ml), sensitivity: 0.188.

Sample collection and storage collect plasma using EDTA as anti-coagulant, centrifugation the sample at 1300g at 2-8°C for 20 minutes of collection the plasma. Collect the supernatant and stored at -80, then before the assay the sample kept at RT (8-25°C). Determine optical density (OD) value of each well at microplate reader (450nm).

**Tissue specimens:** Formalin fixed paraffin embedded blocks of PBC and MBC patients were collected. The seventh edition of the American Joint Committee on Cancer staging system (AJCC-7) classification was used for pathologic staging (13) and the Nottingham (Elston-Ellis) modification of the Scarff -Bloom-Richardson grading system was used for pathologic grading (14).

**Immunohistochemical staining:** Immunohistochemical staining was carried out using the streptavidin-biotin immunoperoxidase technique (15), the slides were incubated with mouse monoclonal Anti-Bcl-2 antibody [Bcl2/100] ab117115 was used at a dilution of 1:100 and primary rabbit polyclonal Anti-Bax antibody ab10813 diluted 1:1000 (Abcam, Cambridge, MA, USA) at 4°C overnight. Sections from normal tonsils were used as positive control for bcl2, sections from normal colon for bax and the negative control is by adding non-immune serum instead of the primary antibodies.

#### **Evaluation of immunohistochemical expressions of Bcl2 proteins:**

Cytoplasmic staining of bcl-2 was scored as followed; bcl2 negative—no tumor cells stain or weak heterogeneous positive stain in less than 10 % of tumor cells and bcl-2 positive—more than 10 % of tumor cells stained (16).

#### **Evaluation of immunohistochemical expression of bax:**

Bax cytoplasmic expression was scored as positive if at least 20% of tumor cells showed clear cytoplasmic immunostaining (17).

#### **Statistical Analysis:-**

Continuous variables were expressed as the mean  $\pm$  SD & median (range), and the categorical variables were expressed as a number(percentage). Continuous variables were checked for normality by using Shapiro-Wilk test. Percent of categorical variables were compared using Pearson's Chi-square test or Fisher's exact test when was appropriate. Receiver operating characteristic (ROC) curve analysis was used to identify optimal cut-off value of S100 level with maximum sensitivity and specificity for discrimination between breast cancer and control. Overall Survival (OS) was calculated as the time from diagnosis to death or the most recent follow-up contact (censored). Progression Free Survival (PFS) was calculated as the time from start of treatment to date of progression or the most recent follow-up contact that patient was known as progression free. Stratification of OS and PFS was done according markers. These time-to-event distributions were estimated using the method of Kaplan-Meier plot, and compared using two-sided exact log-rank test. All tests were two sided. A p-value <0.05 was considered significant. All statistics were performed using SPSS 22.0 for windows (SPSS Inc., Chicago, IL, USA) and MedCalc windows (MedCalc Software bvba 13, Ostend, Belgium).

#### **Results:-**

##### **Patient Characteristics**

Our study included 70 MBC patients, their age range was (29-65) years, mean  $\pm$  SD was 47.25  $\pm$  9.77. Forty four patients (62.9%) were less than 50 years while 26 patients (37.1%) were more than 50 years. Premenopausal and post menopausal patients were presented in 30 (42.9%) and 40 (57.1%) respectively. Fifty five patients (78.6%) had IDC, 12 patients (17.1%) had ILC while medullary and mucinous carcinoma were presented in only one and two patients respectively. The majority of our patients (70%) had G2 whereas only 30% had G3. Capsular invasion and positive Ki67 were demonstrated in 15 (21.4%) patients and 20 (28.6%) patients respectively. The majority of our patients had Luminal A subtype (57.1%) but luminal B and Her-2 amplified subtypes were presented in (15.7%) for each one. whereas the minority of our patients (15.7%) had triple negative subtype. T1, T2, T3 and T4 were present in 12, 19, 12 and 17 patients respectively where N0, N1, N2 and N3 were present in 16, 15, 2 and 37 patients respectively. S100P mean were 13.27  $\pm$  6.66, the median (range) were 13.10 (8.2-19.3). Negative bcl2 and bax expression were present in 47 and 23 patients respectively, while positive bcl2 and bax expression were present in 23 and 47 respectively (Table 2).

##### **Comparison between the studied groups as regard the 3 studied markers**

- The median of plasma S100 P level was nearly the same for PBC patients and healthy control, in addition its level in MBC patients was higher than both PBC patients and healthy control (near the double) ( $p_1 < 0.001$  between MBC vs Non-MBC;  $p_2 < 0.001$  between MBC vs control) both of them are significant while  $p_3 = 0.834$  between Non-MBC vs control (non significant).
- Regarding Bcl2 immunoexpression positive expression was found in 23 (32.9%) of MBC, 11 (91.7%) of Non-MBC and in 8 (100%) of the normal breast tissue ( $p_1 < 0.001$  between MBC vs Non-MBC;  $p_2 < 0.001$  between MBC vs control) both of them are significant while  $p_3 = 0.402$  between Non-MBC vs control (non significant).

•Regarding Bax immunoexpression; positive expression was found in 47 (67.1%) of cases of MBC but no positive expression was detected in either Non-MBC or in the normal breast tissue ( $p_3 < 0.001$ ). ( $p_1 < 0.001$  between MBC vs Non-MBC;  $p_2 < 0.001$  between MBC vs control;  $p_3 < 0.001$  between Non-MBC vs control all of them are significant (**Table 1**).

**Table (1):** Comparison between the studied groups as regard the 3 studied markers

Markers	MBC (N=70)		Non-MBC (N=12)		Control (N=100)		p-value	$p^1$	$p^2$	$p^3$
	No.	(%)	No.	(%)	No.	(%)				
S100										
Mean $\pm$ SD	13.27	$\pm 0.66$	6.88	$\pm 0.04$	6.53	$\pm 0.93$	<0.001*	<0.001	<0.001	0.834
Median (Range)	13.10	(8.2-19.3)	6.80	(4.9-8.5)	6.75	(4.9-7.6)				
Bcl2										
Negative	47	(67.1%)	1	(8.3%)	0	(0%)	<0.001‡	<0.001	<0.001	0.402
Positive	23	(32.9%)	11	(91.7%)	8	(100%)				
Bax										
Negative	23	(32.9%)	12	(100%)	8	(100%)	<0.001‡	<0.001	<0.001	---
Positive	47	(67.1%)	0	(0%)	0	(0%)				

**Table (2):** Effect of clinopathological parameters on immunohistochemical staining for ( Bcl2, bax )and plasma S100p level in metastatic breast cancer patients (N=70).

Characteristics	MBC (N=70)		Bcl2				p-value	Bax				p-value	S100				p-value	
			Negative (N=47)		Positive (N=23)			Negative (N=23)		Positive (N=47)			Mean	±SD	Median	(Range)		
	No.	(%)	No.	(%)	No.	(%)		No.	(%)									
Age (years)																		
Mean ± SD	47.25	±9.77	47.80	±9.84	46.13	±9.74	0.401	43.56	±10.24	49.34	±8.91	0.008						
Median (Range)	48	(29-65)	50	(33-65)	48	(29-63)		39	(29-56)	50	(33-65)							
≤ 50 years	44	(62.9%)	31	(70.5%)	13	(29.5%)	0.443 ‡	14	(31.8%)	31	(68.2%)	0.810 ‡	13.21	±2.34	13.20	(8.90 – 19.20)	0.803 *	
> 50 years	26	(37.1%)	16	(61.5%)	10	(38.5%)		9	(34.6%)	17	(65.4%)		13.37	±3.16	12.55	(8.20 – 19.30)		
Menopausal																		
Premenopausal	30	(42.9%)	17	(56.7%)	13	(43.3%)	0.106 ‡	14	(46.7%)	16	(53.3%)	0.033 ‡	13.59	±2.52	13.85	(8.90 – 19.20)	0.382 *	
Postmenopausal	40	(57.1%)	30	(75%)	10	(25%)		9	(22.5%)	31	(77.5%)		13.03	±2.76	12.40	(8.20 – 19.30)		
Pathology																		
IDC	55	(78.6%)	34	(61.8%)	21	(38.2%)	0.308 ‡	21	(38.2%)	34	(61.8%)	0.308 ‡	13.26	±2.58	13.10	(9.20 – 19.30)	0.892 •	
ILC	12	(17.1%)	10	(83.3%)	2	(16.7%)		2	(16.7%)	10	(83.3%)		13.38	±3.28	13.10	(8.20 – 19.20)		
Medullary	1	(1.4%)	1	(100%)	0	(0%)		0	(0%)	1	(100%)		14.10					
Mucinous	2	(2.9%)	2	(100%)	0	(0%)		0	(0%)	2	(100%)		12.3	±2.2	12.30	(10.70 – 19.30)		

		)		(%)							)			0	6		–	
																	(13.90)	
Grade																		
Grade II	49	(70%)	27	(55.1%)	22	(44.9%)	0.001	22	(44.9%)	27	(55.1%)	0.001	13.2	±2.8	12.90	(8.90)	0.827	
							‡					‡	7	3			–	(19.30)
Grade III	21	(30%)	20	(95.2%)	1	(4.8%)		1	(4.8%)	20	(95.2%)		13.2	±2.2	13.30	(8.20)		
													5	7			–	(17.90)
Capsular invasion																		
Absent	55	(78.6%)	34	(61.8%)	21	(38.2%)	0.119	21	(38.2%)	35	(61.8%)	0.119	12.7	±2.4	12.80	(8.20)	0.002	
							‡					‡	6	5			–	(19.20)
Present	15	(21.4%)	13	(86.7%)	2	(13.3%)		2	(13.3%)	13	(86.7%)		15.1	±2.6	14.90	(10.90)		
													2	2			–	(19.30)
KI-67																		
Negative		(71.4%)	30	(60%)	20	(40%)	0.044	22	(44%)	28	(56%)	0.002	13.1	±2.7	12.90	(8.90)	0.424	
							‡					‡	7	9			–	(19.30)
Positive	20	(28.6%)	17	(85%)	3	(15%)		1	(5%)	19	(95%)		13.5	±2.3	13.75	(8.20)		
													1	2			–	(18.40)
Molecular type																		
Luminal A	40	(57.1%)	22	(55%)	18	(45%)	0.050	22	(55%)	18	(45%)	<0.001	13.0	±2.7	12.40	(8.90)	0.326	
							‡					‡	2	6			–	(19.30)
Luminal B	11	(15.7%)	8	(72.7%)	3	(27.3%)		1	(9.1%)	10	(90.9%)		14.3	±3.1	14.30	(8.20)		
													0	5			–	(18.60)
Triple –ve	8	(11.4%)	8	(100%)	0	(0%)		0	(0%)	8	(100%)		13.6	±1.1	13.30	(12.10)		
													5	3			–	(15.30)
HER2 amplified	11	(15.7%)	9	(81.8%)	2	(18.2%)		0	(0%)	11	(100%)		12.8	±2.5	11.70	(9.50)		
													8	4			–	(18.40)
T																		
T0	10	(14.3%)	3	(30%)	7	(70%)	<0.001	7	(70%)	3	(30%)	<0.001	12.9	±1.8	13.15	(10.20)	0.088	
							1§					1§	0	7			–	(16.20)
T1	12	(17.1%)	8	(66.7%)	4	(33.3%)		4	(33.3%)	8	(66.7%)		13.4	±3.5	12.40	(8.90)		
													5	4			–	(19.20)
T2	19	(27.1%)	8	(42.1%)	11	(57.9%)		10	(52.6%)	9	(47.4%)		12.6	±2.2	12.20	(9.70)		
													0	5			–	(17.90)
T3	12	(17.1%)	11	(91.7%)	1	(8.3%)		1	(8.3%)	11	(91.7%)		12.3	±1.9	12.70	(8.20)		
													8	5			–	(14.70)
T4	17	(24.3%)	17	(100%)	0	(0%)		1	(5.9%)	16	(94.1%)		14.7	±2.8	14.90	(9.50)		
													4	2			–	(19.30)
N																		

N0	16	(22.9%)	1	(6.3%)	15	(93.8%)	<0.001§	14	(87.5%)	2	(12.5%)	<0.001§	12.4	±2.0	12.25	(9.70 - 15.60)	0.261•
N1	15	(21.4%)	7	(46.7%)	8	(53.3%)		9	(60%)	6	(40%)		12.9	±3.0	12.10	(8.90 - 19.20)	
N2	2	(2.9%)	2	(100%)	0	(0%)		0	(0%)	2	(100%)		16	±3.3	16	(13.60 - 18.40)	
N3	37	(52.9%)	37	(100%)	0	(0%)		0	(0%)	37	(100%)		13.6	±2.6	13.40	(8.20 - 19.30)	
Bcl																	
Negative	47	(67.1%)						8	(17.1%)	39	(82.9%)	<0.001‡	14.1	±2.2	13.90	(10.70 - 19.30)	<0.001•
Positive	23	(32.9%)						15	(65.2%)	8	(34.8%)		11.4	±2.5	10.80	(8.20 - 19.20)	
Bax																	
Negative	23	(32.9%)	8	(34.8%)	15	(65.2%)	<0.001‡						12.9	±2.5	12.30	(8.90 - 19.20)	0.450*
Positive	47	(67.1%)	39	(83%)	8	(17%)							13.4	±2.7	13.30	(8.20 - 19.30)	
S100																	
Mean ± SD	13.27	±0.66	14.14	±2.28	11.48	±2.50	<0.001•	12.92	±2.52	13.44	±2.73	0.450*					
Median (Range)	13.10	(8.2-19.3)	13.90	(10.70-19.30)	10.80	(8.20-19.20)		12.30	(8.90-19.20)	13.30	(8.20-19.30)						

Continuous variables were expressed as mean ± SD & median (range); categorical variables were expressed as number(percentage); \*Independent samples Student's test; • Mann Whitney U test; ‡ Chi-square test; § Chi-square test for trend; p<0.05 is significant.

### Effect of clinicopathological parameters on plasma S100p level in breast cancer patients

plasma level of S100 in all breast cancer patients showed statistical correlation with capsular invasion (p =0.018), T (p=0.031), stage, bcl2 and bax expression (P <0.001 for each of them ),while S100 level in metastatic breast cancer patients showed significant correlation with capsular invasion and bcl2(P =0.002&<0.001 respectively). Furthermore, there is a significant association between elevation of S100P level and both the number and site of metastasis (P<0.001 for both); {presence of liver metastasis P=0.002, brain metastasis P=0.009 and bone metastasis P<0.001} (Table 2, 3 ).

### Correlation between clinicopathological parameters and Bcl2 expression in breast cancer patients

Bcl2 was cytoplasmic and its protein expressions in breast cancer tissues were lower than those in the relatively healthy and adjacent breast tissues .Bcl2 was positively expressed in 41.5% of all studied breast cancer patients, 32.9% of MBC, and 91.7% of PBC . Moreover, its low expression in all breast cancer patients was significantly negatively correlated with grade(P 0.001), ki67 (P 0.021), molecular subtype (P 0.050) , and each one of T ,N , stage ,BAX( P <0.001 for each of them ) ,S100p (P<0.05 ) . But its expression in MBC patients was statistically significant with, ki67 (P 0.044), molecular subtype (P 0.050) , and each one of grade, T ,N ,BAX( P <0.001 for each of them), number of metastasis (P=0.014) and presence of bone metastasis (P=0.013) (Table 2,3 ).

**Correlation between clinicopathological parameters and bax expression**

Bax was cytoplasmic and its protein expression in breast cancer tissues was significantly higher than that in the relatively healthy, adjacent breast tissues. . Bax was positively expressed in 57.3% of all studied breast cancer patients, 67% of MBC, while all PBC didn't express bax.. Furthermore ,its high expression is statistically significant with grade (P=0.003) ,every one of molecular subtype ,T ,N and stage (P<0.001 for each ) ,ki67 (P<0.004) ,ER (P<0.010), PR(P<0.023) ,Her-2 neu (P<0.002) ,both bcl2 and BAX (P<0.001 for both) in all breast cancer patients . However in MBC patients it is statistically significant with grade (P=0.001), every one of molecular subtype, T, N (P<0.001 for each), ki67 (P<0.002) , site of metastasis (P=0.003), presence of brain metastasis (P=0.004) and lung metastasis (P=0.032)} (**Table 2,3**).

**Table (3):** correlations between distant metastasis and immunohistochemical expressions( bcl2, bax) and plasma S100 level in metastatic breast cancer patients

Characteristics	MBC (N=70)		Bcl2				p-value	Bax				p-value	S100				p-value
			Negative (N=47)		Positive (N=23)			Negative (N=23)		Positive (N=47)							
	No	(%)	No	(%)	No	(%)		No	(%)	No	(%)		Mean	±SD	Median	(Range)	
Time of metastasis																	
Synchronous	12	(17.1%)	11	(91.7%)	1	(8.3%)	0.088‡	1	(8.3%)	11	(91.7%)	0.088‡	13.80	±1.81	13.70	(11.50 – 17.80)	0.448*
Metachronous	58	(82.9%)	36	(62.1%)	22	(37.9%)		2	(37.9%)	36	(62.1%)		13.16	±2.80	12.90	(8.20 – 19.30)	
No. of metastasis																	
Single	47	(67.1%)	27	(57.4%)	20	(42.6%)	0.014‡	1	(36.2%)	30	(63.8%)	0.399‡	12.23	±2.21	12.10	(8.20 – 19.20)	<0.001*
Multiple	23	(32.9%)	20	(87%)	3	(13%)		6	(26.1%)	17	(73.9%)		2.213	±2.23	15.20	(11.10 – 19.30)	
Type of metastasis																	
Bone	27	(38.6%)	14	(51.9%)	13	(48.1%)	0.081‡	1	(40.7%)	16	(59.3%)	0.003‡	11.40	±1.62	11.20	(8.20 – 14.80)	<0.001*
Brain	7	(10%)	4	(57.1%)	3	(42.9%)		6	(85.7%)	1	(14.3%)		15.72	±2.50	15.30	(11.80 – 19.20)	
Lung	16	(22.9%)	14	(87.5%)	2	(12.5%)		1	(6.3%)	15	(93.8%)		13.45	±2.08	13.55	(9.50 – 17.50)	
Liver	5	(7.1%)	5	(100%)	0	(0%)		0	(0%)	5	(100%)		17.56	±2.02	17.90	(14.10 – 19.30)	
Lung+Liver	2	(2.9%)	2	(100%)	0	(0%)		0	(0%)	2	(100%)		16.80	±2.26	16.80	(15.20 – 18.40)	
Bone+Lung+Liver	13	(18.6%)	8	(61.5%)	5	(38.5%)		5	(38.5%)	8	(61.5%)		13.42	±1.84	13.50	(9.80 – 16.20)	
Bone metastasis																	

Absent	30	(42.9%)	25	(83.3%)	5	(16.7%)	0.013‡	7	(23.3%)	23	(76.7%)	0.142‡	14.89	±2.65	14.80	(9.50 – 19.30)	<0.001*
Present	40	(57.1%)	22	(55%)	18	(45%)		16	(40%)	24	(60%)		12.05	±1.93	12	(8.20 – 16.20)	
Brain metastasis																	
Absent	63	(90%)	43	(68.3%)	20	(31.7%)	0.676‡	16	(27%)	46	(73%)	0.004‡	135	±2.55	12.90	(8.20 – 19.30)	0.009*
Present	7	(10%)	4	(57.1%)	3	(42.9%)		6	(85.7%)	1	(14.3%)		15.72	±2.50	15.30	(11.80 – 19.20)	
Lung metastasis																	
Absent	39	(55.7%)	23	(59%)	16	(41%)	0.103‡	17	(43.6%)	22	(56.4%)	0.032‡	12.96	±3.02	12.30	(8.20 – 19.30)	0.953•
Present	31	(44.3%)	24	(77.4%)	7	(22.6%)		6	(19.4%)	25	(80.6%)		13.65	±2.09	13.80	(9.50 – 18.40)	
Liver metastasis																	
Absent	50	(71.4%)	32	(64%)	18	(36%)	0.376‡	18	(36%)	32	(64%)	0.376‡	12.66	±2.43	12.40	(8.20 – 19.20)	0.002*
Present	20	(28.6%)	15	(75%)	5	(25%)		5	(25%)	15	(75%)		14.79	±2.64	14.50	(9.80 – 19.30)	

Continuous variables were expressed as mean  $\pm$  SD & median (range); categorical variables were expressed as number(percentage); \*Independent samples Student's test for two groups and One Way ANOVA test for more than two groups; • Mann Whitney U test for two groups and Kraskall Wallis H test for more than two groups; ‡ Chi-square test; § Chi-square test for trend;  $p < 0.05$  is significant.

#### Effect of plasma S100p level, (bax and Bcl2) expression on treatment outcome in metastatic breast cancer patients:

The implication of plasma S100P levels on the prognosis of our 70 MBC patients was studied in our trial. Our patients were undergone follow up for 3 years (the median follow up period was 19 month) . The cut off points of plasma S100P was 7.6 ng / ml, which indicates that the values above it are high but the values below it are low.

Evaluation of the effect of the markers on treatment outcome (response to treatment , occurrence of progression and mortality ) was done , which reveals significant correlation between plasma S100P level with each one of the following; response , progression, and mortality (  $P < 0.001$  for each ) (**Table 4**) . Similarly ,Bcl2 expression is significantly correlated with response (  $P < 0.001$  ) , progression (  $P = 0.004$  ) and mortality (  $P = 0.01$  ) (Table 4 ) . However, bax expression bax was not significantly correlated with response (  $P = 0.78$  ), progression (  $P = 0.80$  ) or mortality (  $P = 0.80$  ) .



**Table (4):** immunohistochemical staining for( bcl2, Bax) and plasmaS100p level on treatment outcome and survival in metastatic breast cancer patients (N=70).

Outcome	MBC (N=70)		Bcl2		p-value	Bax		p-value	S100				p-value
			Negative (N=47)	Positive (N=23)		Negative (N=23)	Positive (N=47)		Mean	±SD	Median	(Range)	
	No	(%)	No	(%)		No	(%)						
Response to treatment													
PD	14	(20%)	12	(25.5%)	0.001 <sup>‡</sup>	4	(17.4%)	0.786 <sup>‡</sup>	17.22	±1.55	17.65	(14.90 – 19.30)	<0.001*
SD	17	(24.3%)	15	(31.9%)		6	(26.1%)		14.33	±0.68	14.10	(13.20 – 15.60)	
PR	25	(35.7%)	17	(36.2%)		7	(30.4%)		12.21	±0.83	12.20	(10.80 – 13.60)	
CR	14	(20%)	3	(6.4%)		6	(26.1%)		9.92	±0.82	9.85	(8.20 – 11.10)	
NR	31	(44.3%)	27	(57.4%)	0.002 <sup>‡</sup>	10	(43.5%)	0.924 <sup>‡</sup>	15.64	±1.85	15.20	(13.20 – 19.30)	<0.001*
OAR	39	(55.7%)	20	(42.6%)		13	(56.5%)		11.38	±1.38	11.50	(8.20 – 13.60)	
Progression													
Absent	41	(58.6%)	22	(46.8%)	0.004 <sup>‡</sup>	13	(56.5%)	0.808 <sup>‡</sup>	11.55	±1.47	11.70	(8.20 – 14.10)	<0.001*
Present	29	(41.4%)	25	(53.2%)		10	(43.5%)		15.69	±1.99	15.20	(11.10 – 19.30)	
Mortality													
Alive	50	(71.4%)	29	(61.7%)	0.010 <sup>‡</sup>	16	(69.6%)	0.809 <sup>‡</sup>	11.94	±1.62	12.10	(8.20 – 14.70)	<0.001*
Died	20	(28.6%)	18	(38.3%)		7	(30.4%)		16.59	±1.63	15.90	(14.80 – 19.30)	
PFS									≤median		>median		

								(N=36)	(N=34)	
Mean (month) (95%CI)	24.14 month (20.81-27.46)	19.69 month (15.84-23.54)	30.96 month (26.44-35.47)	0.005 †	19.78 month (15.42-24.14)	24.34 month (20.27-28.41)	0.86 0 †	35.36 month (34.14-36.59)	9.94 month (7.72-12.15)	<0.00 1 †
1 year PFS (%)	62.7%	52.9%	82.6%		60.9%	53.6%		100%	22.4%	
2 years PFS (%)	57.9%	44.8%	82.6%		56.2%	58.7%		96.9%	13.5%	
3 years PFS (%)	57.9%	---	82.6%		---	---		96.9%	---	
OS										
Mean (month) (95%CI)	30.75 month (27.68-33.82)	27.38 month (23.51-31.25)	36.30 month (32.72-39.89)	0.014 †	26.34 month (22.18-30.50)	30.93 month (27.17-34.68)	0.90 3 †	36 month	16.56 month (13.86-19.25)	<0.00 1 †
1 year OS (%)	84.3%	80.9%	91.3%		86.9%	80.9%		100%	67.7%	
2 years OS (%)	70.9%	60.7%	91.3%		69.1%	71.9%		100%	37.8%	
3 years OS (%)	70.9%	60.7%	91.3%		---	71.9%		100%	---	

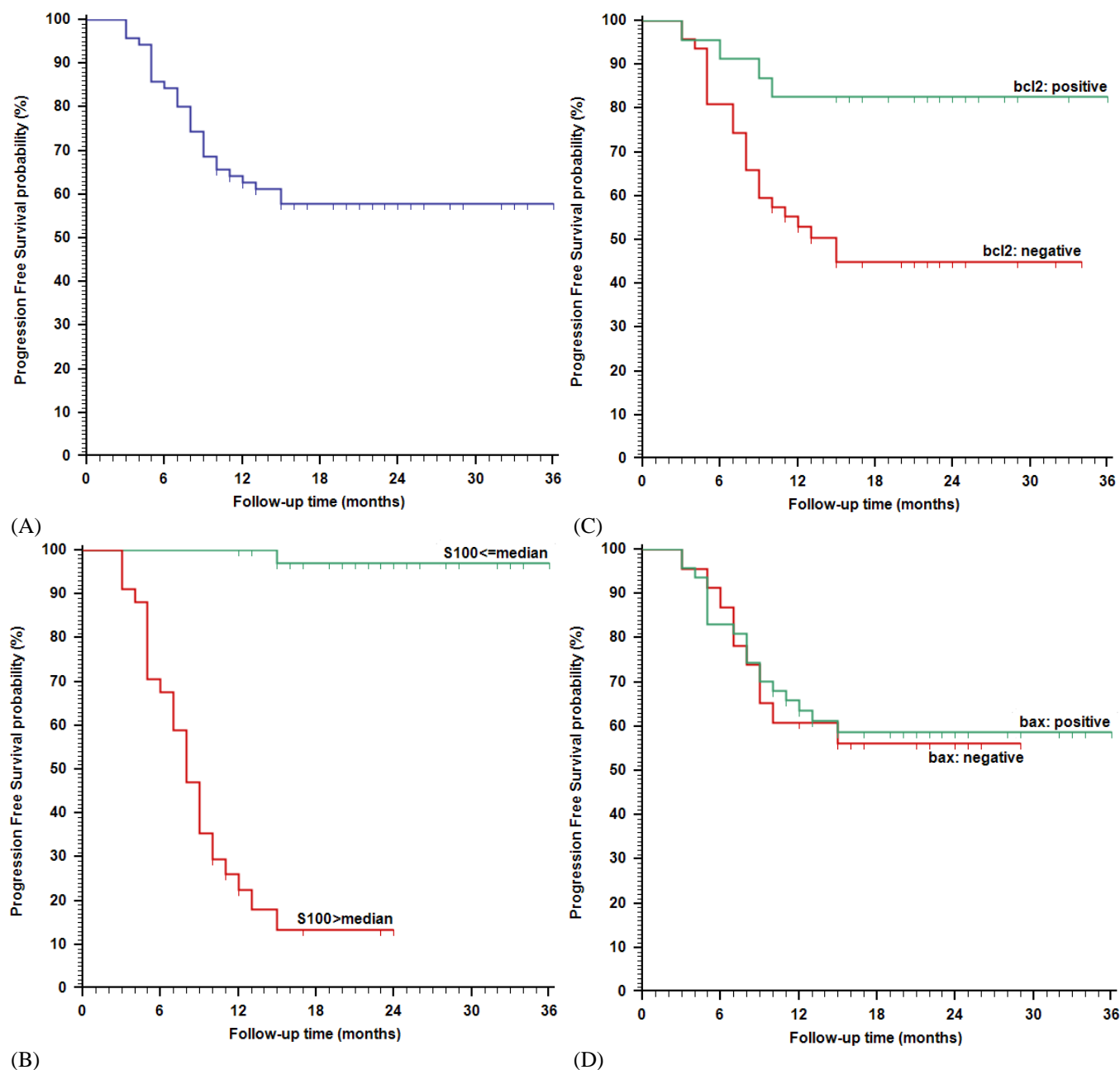
Continuous variables were expressed as mean (95%CI); categorical variables were expressed as number(percentage);

\*Independent samples Student's test for two groups and One Way ANOVA test for more than two groups; • Mann Whitney U test for two groups and Kraskall Wallis H test for more than two groups; ‡ Chi-square test; † Log rank test; p<0.05 is significant.

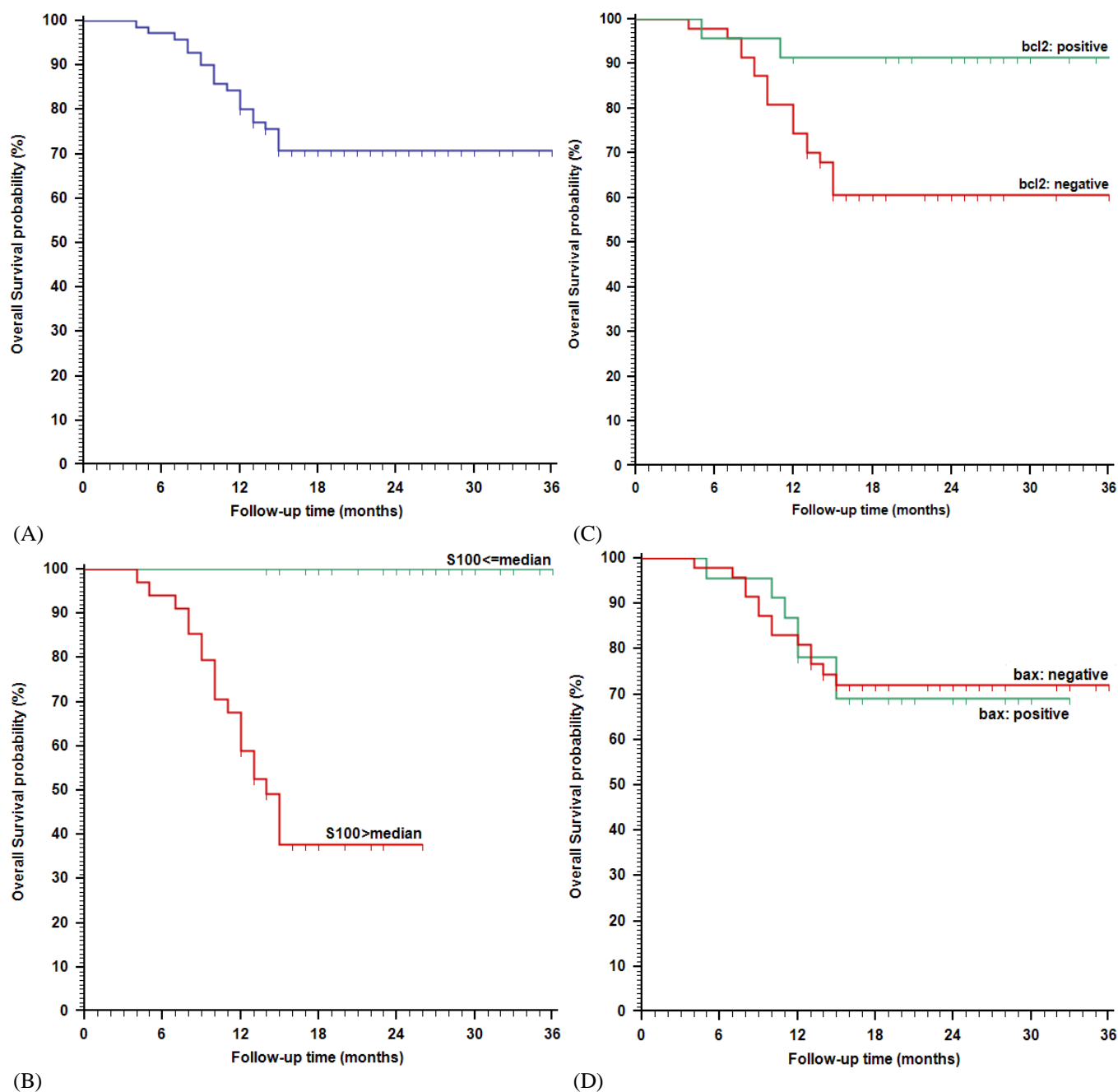
#### Effect of plasma S100p level, (bax and Bcl2) expression on Survival in metastatic breast cancer patients:

Mean PFS was 24.14 months, 3 y PFS was 57.9%. Mean OS was 30.75 month, 3y OS was 70.9%. The association between plasma S100P levels and PFS was assessed in our MBC patients. As illustrated in Kaplan-Meier curve, MBC patients with lower plasma S100P level had significantly longer PFS in comparison to those who had higher plasma S100P levels (the mean PFS 35.36 months VS 9.94 months respectively,  $P=0.000$ , **Fig.1B**). Moreover, patients with positive bcl2 expressions had significantly longer PFS when compared to those who had negative bcl2 expression (the mean PFS time was 30.96 months VS 19.69 months respectively,  $P=0.005$ , **Fig.1C**). While, there is insignificant increase in the mean PFS time for the patients who had BAX positive expression versus BAX negative patients (the mean PFS time was 24.34 months VS 19.78 months respectively,  $P=0.860$ , **Fig.1D**).

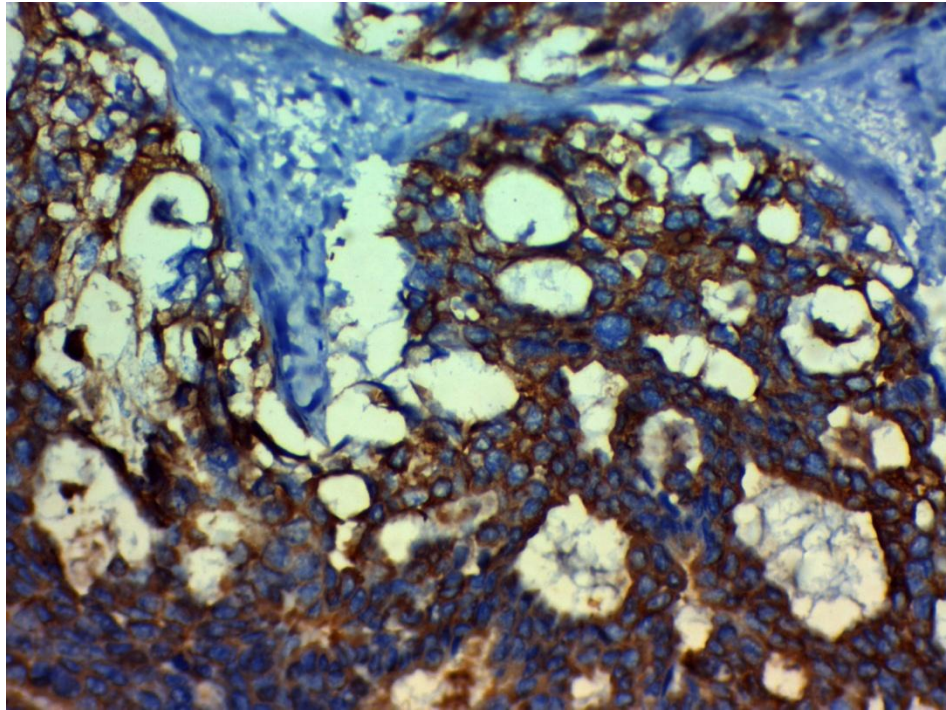
Overall survival (OS) in the studied MBC patients ( $N=70$ ) showed that, patients who had low plasma S100P levels had significantly better OS than those who had high plasma S100P levels (the mean OS was 36.3 months VS 16.56 months respectively,  $P=0.000$ , **Fig.2B**), as well, patients with positive bcl2 expressions had significantly longer OS when compared to those who had negative bcl2 expression (the mean OS was 36.30 months VS 27.38 months respectively,  $P=0.014$ , **Fig.2C**). Whereas there is insignificant increase in the mean OS for the patients with bax positive expression versus bax negative patients (the mean OS was 30.93 months VS 26.34 months respectively,  $P=0.903$ , **Fig.2D**).



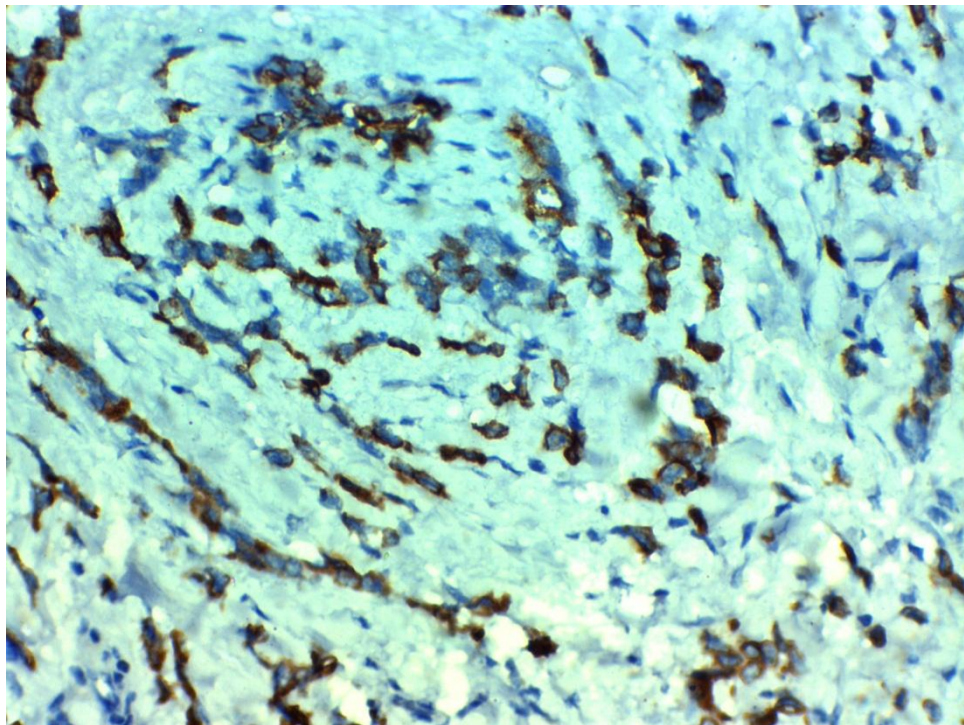
**Fig. (1):** Kaplan Meier plot of progression free survival (PFS) in the studied MBC patients (N=70): (A) All studied patients; (B) Stratified by S100; (C) Stratified by bcl2; (D) Stratified by bax.



**Fig. (2):** Kaplan Meier plot of overall survival (OS) in the studied MBC patients (N=70): (A) All studied patients; (B) Stratified by S100; (C) Stratified by bcl2; (D) Stratified by bax.

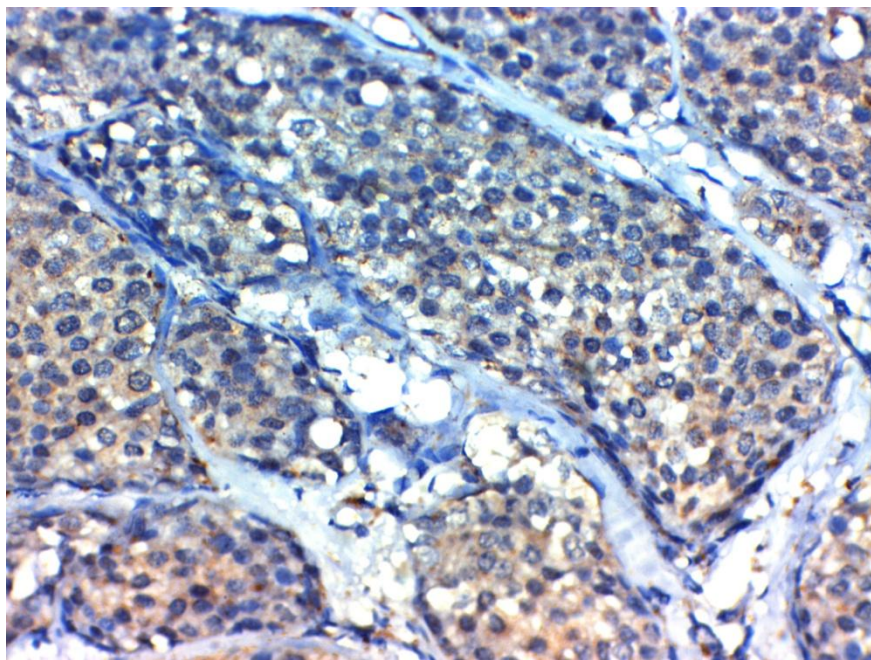


A



B

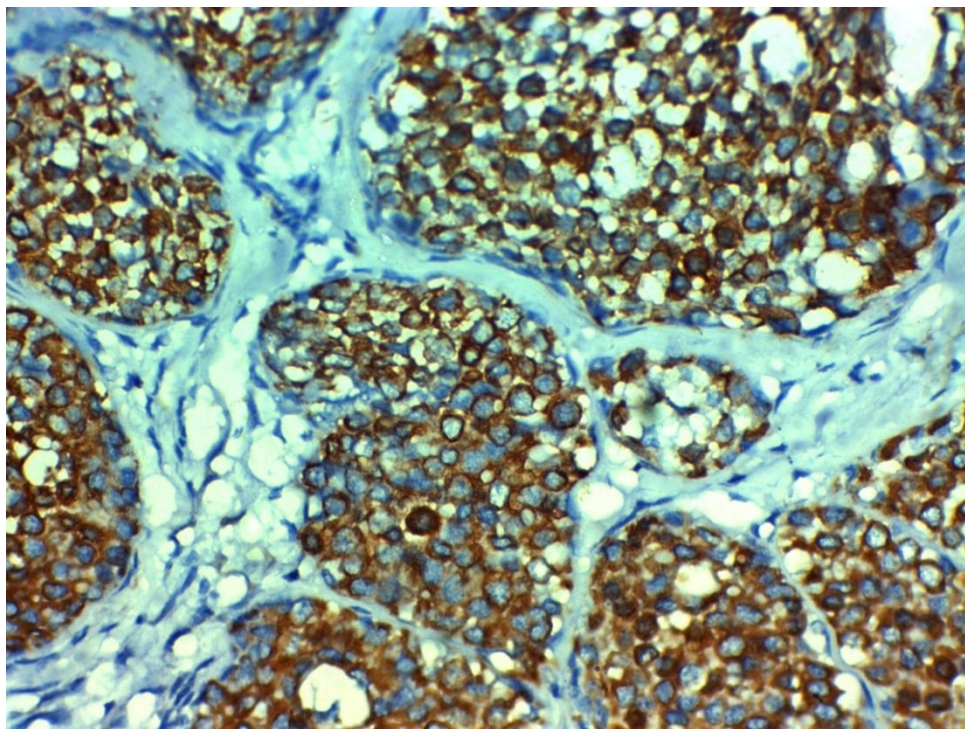




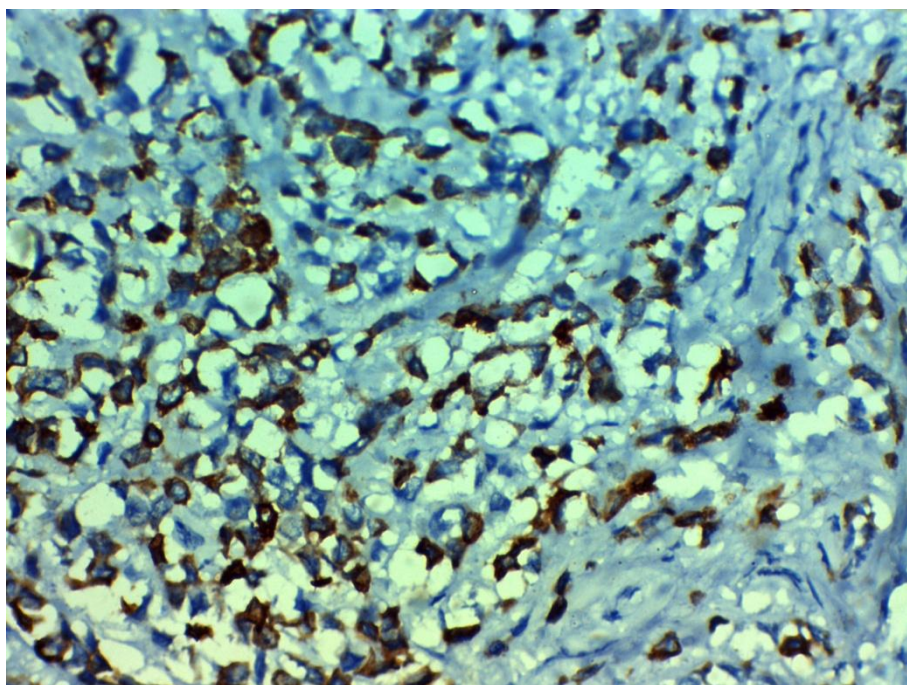
C

**Figure1.** Immunohistochemical staining of Bax in infiltrating carcinoma of the breast: (A) High Immunohistochemical expression in the cytoplasm of high grade infiltrating duct carcinoma of the breast x400. (B) High Immunohistochemical expression in the cytoplasm of infiltrating lobular carcinoma of the breast stage IV ;( C) Low Immunohistochemical expression in the cytoplasm of low grade infiltrating duct carcinoma of the breast x400.

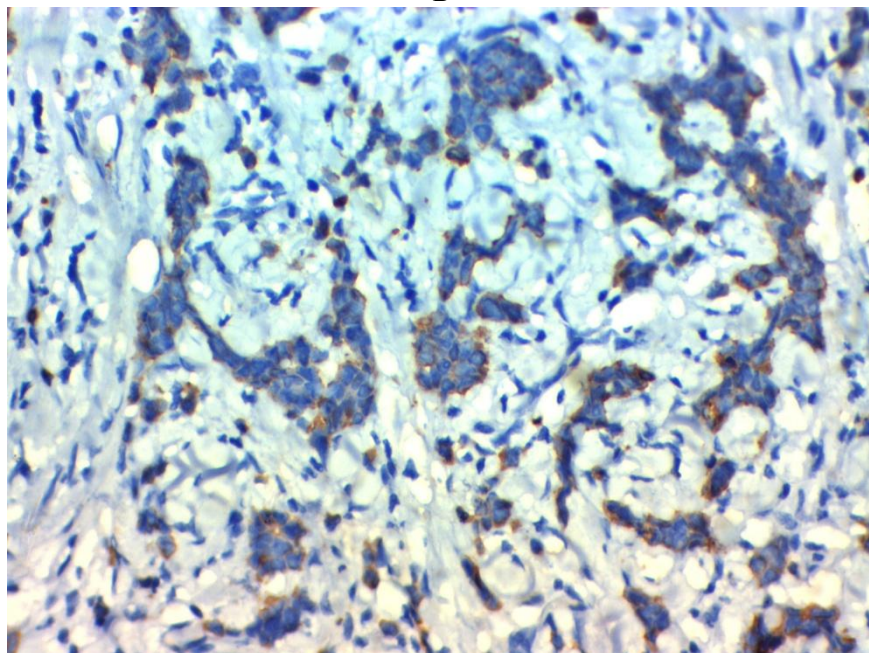
Note: High Bax immunohistochemical expression in high grade& stage carcinoma of the breast and low expression in low grade& stage carcinoma of the breast Magnification: A, B& C the original magnification was  $\times 400$







B



C

**Figure2.** Immunohistochemical staining of Bcl-2 in carcinoma of the breast: (A) High Immunohistochemical expression in the cytoplasm of low grade infiltrating duct carcinoma of the breast x400. (B) High Immunohistochemical expression in the cytoplasm of infiltrating lobular carcinoma of the breast ;( C) Low Immunohistochemical expression in the cytoplasm of high grade infiltrating duct carcinoma of the breast x400.

Note: High Bax immunohistochemical expression in high grade& stage carcinoma of the breast and low expression in low grade& stage carcinoma of the breast Magnification: A, B& C the original magnification was  $\times 400$

**Discussion:-**

Breast cancer is the most common diagnosed cancer all over the world and the main cause of cancer-related death among females (18). In addition, up to 30 percent of women with early-stage breast cancer at time of diagnosis will develop distant metastatic disease. Although metastatic breast cancer (MBC) is not curable; the introduction of newer systemic therapies leads to survival improvement (19-21).

In our study ; we followed the patients for 3 years (the median follow up period was 19 month). The cut off points of plasma S100P was 7.6 ng / ml, which indicates that the values above it are high but the values below it are low . S100P level in metastatic breast cancer patients are higher than PBC and healthy tissue. Elevation of Serum S100P level in metastatic breast cancer patients showed significant correlation with capsular invasion, bcl2(P =0.002 and <0.001 respectively), increased number of metastasis, metastatic site (P<0.001 for both ); { presence of liver metastasis P=0.002, brain metastasis P=0.009 and bone metastasis P<0.001}.

There is a significant correlation between plasma S100P level with response, progression, and mortality (P<0.001 for each). MBC patients with lower plasma S100P level had longer but non-significant PFS time in comparison to those who had higher plasma S100P levels (the mean PFS time 35.36 months VS 9.94 months respectively, log-rank test P=0.000) Patients who had low plasma S100P levels had better but non-significant OS than those who had high plasma S100P levels (the mean OS time was 36.3 months VS 16.56 months respectively, log-rank test P=0.000)

The small, calcium-binding protein S100P has gained the attention of researchers from different scientific fields due to its potential roles in both healthy and neoplastic tissues(22). S100P is a member of the large family of S100 calcium-binding proteins that mediate  $\text{Ca}^{2+}$  dependent signal transduction pathways (23). Its expression has been found frequently and at high levels, in a variety of different tumor types in addition to its role in chemoresistance (3, 4). S100P could potentially serve as diagnostic marker, prognostic ,predictive indicator and therapy target for different carcinomas through its inhibition or inhibition of its targets, or its interactions which result in a decrease of cellular motility and metastatic potential(7, 24).

S100P plays an important role in oncogenesis (tumor cell proliferation, differentiation, apoptosis, weakening of cell: cell adhesion contacts, stimulation of cell motility and invasion and metastasis (25, 26).

S100 P is expressed in tumor tissue and absent in most healthy tissues, so it was evaluated as a novel biomarker for detection of several cancers by using immunohistochemistry approaches (24). But in our study we used ELISA as a new modality for measurement of S100 P.

Indeed, anti-S100P antibodies have shown promising results (in vitro and in vivo) as single agents and in combination with other chemotherapeutic agents, such as gemcitabine in pancreatic cancer (3). So blocking S100P function is expected to improve responses to chemotherapeutic agents. However, this needs further investigations because there are other reports showed that overexpression of S100P (in vitro) led to sensitization of cancer cells to carboplatin, paclitaxel (27) and oxaliplatin (28) in ovarian and gastric cancer cells respectively. Despite this, S100P still represents a potentially very effective anti-cancer target, at least for in some cancer types, and further development of anti-S100P specific therapies will likely prove to be a fruitful and productive field of investigation (29).

In breast cancer, S100P expression is associated with immortalization of neoplastic cells and aggressive tumor behavior, indicating that this protein may have adverse prognostic value and poor survival in breast cancer patients (30).

Univariate and multivariate analyses in early breast cancer patients (stage II) showed that higher expression of nuclear S100P (S100Pn) was observed in cases of a shorter overall survival and disease-free time. No relationship could be documented between expression of S100P and sensitivity of breast cancer cells to cytostatic drugs. The preliminary data indicated that, this protein might become a therapy target and warrants further studies with respect to its prognostic, predictive and potentially therapeutic value.(30).

Plasma S100P levels were measured in 381 women, including 60 healthy controls, 48 primary breast cancer patients (PBC) patients, and 273 metastatic breast cancer (MBC) with correlation between increased its level and MBC . In addition, assessment of prognostic value of S100P with enumeration of CTC and clinicopathological factors were done .The follow up period was 3.5 years. They found that the plasma S100P cut off point was 7 ng / ml and also there is association between high plasma S100P level (>7 ng/mL) and poor prognosis of MBC patients (median progression-free survival time: 5.0 vs. 8.7 months, log-rank test  $p < 0.001$ ; median overall survival time: 22.5 vs. 31.6 months, log-rank test



$p < 0.001$ ). The plasma S100P level added additional prognostic relevance to the prognostication model with clinicopathological factors and CTC enumeration. Furthermore, The examination of the value of plasma S100P levels as treatment monitoring marker was done and revealed, its significant reduction after treatment, This indicates its value in evaluation of treatment outcome. They concluded that plasma S100P level is a simple and cost-effective marker for the prognosis of metastatic breast cancer (4).

The results of this trial are consistent with our result where, the cut off points of plasma S100P was 7.6 ng / ml, which indicate that the values above it are high but the values below it are low. S100P level in metastatic breast cancer patients are higher than PBC and healthy tissue. There is significant correlation between plasma S100P level with response, progression, and mortality ( $P < 0.001$  for each). MBC patients with lower plasma S100P level had significant longer PFS time in comparison to those who had higher plasma S100P levels (the mean PFS time 35.36 months VS 9.94 months respectively, log-rank test  $P = 0.000$ ) Patients who had low plasma S100P levels had significant better OS than those who had high plasma S100P levels (the mean OS time was 36.3 months VS 16.56 months respectively, log-rank test  $P = 0.000$ ).

There are many theories about the lack of activity of anti-cancer drugs in breast cancer. The disruption of the apoptotic pathways may be one of reasons. We therefore decided to assess the expression of those factors involved in apoptosis in the normal mammary gland, benign mammary dysplasia and primary cancer. The most significant findings of our study are that, Bcl2 positive protein expressions in breast cancer tissues were lower than those in the healthy and adjacent breast tissues. Moreover, its expression in all breast cancer patients was significantly correlated with good clinic pathological parameters like low grade and stage ( $P < 0.001$ ) and low ki67 level ( $P = 0.021$ ). Also its positive expression in MBC patients was statistically significant with low ki67 level ( $P = 0.044$ ), molecular subtype ( $P = 0.050$ ), and low grade, T, N, Bax ( $P < 0.001$  for each of them) decreased number of metastasis ( $P = 0.014$ ) and presence of bone metastasis ( $P = 0.013$ ).

Bax positive protein expressions in breast cancer tissues were higher than that in the relatively healthy, adjacent breast tissues. Furthermore, its positive expression was significantly correlated with poor clinic pathological parameters like high grade ( $P = 0.003$ ) and stage ( $P < 0.001$ ), high ki67 level ( $P < 0.004$ ), positive ER ( $P < 0.010$ ), PR ( $P < 0.023$ ), Her-2 neu ( $P < 0.002$ ) and negative bcl2 level ( $P < 0.001$ ) in all breast cancer patients. However in MBC patients its positive expression is statistically significant with high grade ( $P = 0.001$ ), every one of molecular subtype, T, N ( $P < 0.001$  for each), high ki67 level ( $P < 0.002$ ), and site of metastasis ( $P = 0.003$ ) {brain ( $P = 0.004$ ), lung ( $P = 0.032$ )}. However, bax expression is not significant with either response ( $P = 0.78$ ), progression ( $P = 0.80$ ) nor mortality ( $P = 0.80$ ). Similarly, Bcl2 expression is significantly correlated with response ( $P < 0.001$ ), progression ( $P = 0.004$ ) and mortality ( $P = 0.01$ ) Mean PFS was 24.14 months, 3 y PFS was 57.9%. Mean OS was 30.75 month, 3y OAS was 70.9%. Patients with positive bcl2 expressions had significantly longer PFS when compared to those who had negative bcl2 expression (the mean PFS time was 30.96 months VS 19.69 months respectively, log-rank test  $P = 0.005$ ). Meanwhile, there is insignificant increase in the mean PFS time for the patients who had Bax positive expression versus Bax negative patients (the mean PFS time was 24.34 months VS 19.78 months respectively, log-rank test  $P = 0.860$ ). Patients with positive bcl2 expressions had significantly longer OS when compared to those who had negative bcl2 expression (the mean OS time was 36.30 months VS 27.38 months respectively, log-rank test  $P = 0.014$ ). But, there is insignificant increase in the mean OS time for the patients who had Bax positive expression versus Bax negative patients (the mean OS time was 30.93 months VS 26.34 months respectively, log-rank test  $P = 0.903$ ).

**Liu et al.**, showed that a high apoptotic rate is associated with a high grade of tumor, large tumor size and with a shortened disease-free survival period (31). In the study of **Ioachim et al. (2000) (32)** Bcl-2 protein was detected in 85.2% of benign hyperplastic lesions of the mammary gland and 40% of breast cancers. On the other hand, **Bargou et al. (1995) (33)** observed no difference with regard to Bcl-2 (and Bcl-XL) expression between normal breast epithelium and breast cancer tissue. Similarly to **Bargou et al. (1995) (33)**, In the study by **Gee et al., (1994) (34)** Bcl-2 was detected in 70% of breast cancers. It has also been shown that Bcl-2-positive patients had a better prognosis than Bcl-2-negative patients (35).

**Rochaix et al. (1999) (36)** suggested that Bcl-2 and Bax expression were associated with a regulation of apoptosis in breast cancer. They found that Bcl-2 expression in tumours was associated with a better differentiation of the cancers (G1 — 100% of Bcl-2-positive tumours, G2 — 81%, G3 — 60%), but there was no relationship between Bax and tumor grade.

In the study of **Berardo et al. [1998] (37)** high Bcl-2 expression was associated with favourable prognostic factors such as ER positivity, low S phase fraction, a lower number of positive lymph nodes and overall survival. Our findings confirm the results of **Berardo et al. [1998] (37)** with regard to the favourable prognostic significance of Bcl-2 expression in breast cancer. **Honma et al., 2015 (38)** Compared Bcl-2 expression with other clinicopathological factors, Bcl-2 positivity was

significantly correlated with smaller tumor size, lower grade, ER positivity, PR positivity, and HER2 negativity, in both groups, confirming Bcl-2's association with favorable prognostic factors.

**Dawson et al 2010(39)** revealed that BCL2 continues to be associated with favorable outcome. BCL2 belongs to a group of related proteins that are key regulators of apoptosis or programmed cell death (**Cory et al, 2003(40)**).

BCL2 protein expression in breast cancer is associated with an indolent phenotype of low-grade, slowly proliferating, ER $\beta$  breast tumours (**Silvestrini et al, 1994; Lipponen et al, 1995(41,42)**). This 'paradoxical' favourable prognostic effect of BCL2 in breast cancer could be related to its non-apoptotic functions (**43**). Increased expression of BCL2 protein may also disrupt the balance with other members of the BCL2 family, including the expression of pro-apoptotic proteins (**40**). The exact mechanism of differential BCL2 protein expression in breast cancer is complex. BCL2 is expressed in normal breast glandular epithelium and is known to be upregulated by oestrogen, possibly as a direct result of transcriptional induction (**44**).

Also no differences in treatment response were found in patients with early breast cancer related to Bax expression in the tumor cells (**45**). While **Krajewski et al.** detected that, MBC patients with low Bax expression had poorer response to treatment and shorter OS (**46**).

**Pluta P, et al** studied 62 breast cancer patients and control group of 11 breast fibroadenoma patients, bax expression was assessed by flow cytometer, bax expression was found in 82% of patients. Bax expression was lower in breast cancer patients than in controls, and this could be one of the mechanisms of apoptosis escaping by tumor cells (**47**).

Novel markers that could be used to save women from unnecessary cytotoxic adjuvant therapy are urgently needed and BCL2 provides valuable additional prognostic information to guide clinical decision making in this setting. In summary our results proved that bcl2 and bax are independent and powerful prognostic protein marker in breast cancer patients more than other prognostic factors.

Our results indicate that overexpression of pro-apoptotic proteins could contribute to an increase in cell turnover and breast cancer development and progression, but we suggest that further studies should be carried out with increased sample size to fully assess Bax expression in breast cancer progression.

**Conclusion:** S100P, BCL2 and bax are promising prognostic markers in breast cancer patients but we recommend further studies with large sample size to be done to increase statistical power of the results.

## Reference:-

1. Siegel R, Ma J, Zou Z, et al (2014); Cancer statistics. CA: A Cancer J Clin. 64:9–29.
2. Amal S. Ibrahim, Hussein M. Khaled, et al (2014):- Cancer Incidence in Egypt: Results of the National Population-Based Cancer Registry Program. Journal of Cancer Epidemiology, Volume , Article ID 437971, 18
3. Dakhel S, Padilla L, Adan J, et al (2014):-S100P antibody-mediated therapy as a new promising strategy for the treatment of pancreatic cancer. Citation: *Oncogenesis* 3, 92; doi:10.1038/oncsis.2014.7
4. Peng C , Chen H , Wallwiener M (2016):-Plasma S100P level as a novel prognostic marker of metastatic breast cancer. *Breast Cancer Res Treat*; 157(2):329-38.
5. Ohuchida K, Mizumoto K, Egami T, et al (2006). S100P is an early developmental marker of pancreatic carcinogenesis. *Clin Cancer Res* 12(18):5411–5416.
6. Li Y, St John MA, Zhou X, et al (2004):- Salivary transcriptome diagnostics for oral cancer detection. *Clin Cancer Res* 10(24):8442–8450.
7. Thompson CB (1995):- Apoptosis in the pathogenesis and treatment of disease. *Science*. 267:1456–1462
8. Wyllie AH (1987):- Apoptosis: cell death in tissue regulation. *J Pathol* ; 153:313–316.
9. Kerr JF, Winterford CM and Harmon BV (1994):- Apoptosis. Its significance in cancer and cancer therapy. *Cancer* ; 73:2013– 2026.
10. Meterissian SH (1997):- Apoptosis: its role in the progression of and chemotherapy for carcinoma. *J Am Coll Surg* , 184:658-666.
11. Cleary ML, Smith SD and Sklar J (1986):- Cloning and structural analysis of cDNAs for bcl-2 and a hybrid bcl-2/immunoglobulin transcript resulting from the t(14;18) translocation. *Cell*; 47:19–28.
12. Adams JM and Cory S (1998):-The Bcl-2 protein family: arbiters of cell survival. *Science*; 281:1322–1326.
13. Edge SB and Compton CC. (2010) :-The American Joint Committee on Cancer: the 7th edition of the AJCC cancer staging manual and the future of TNM. *Ann Surg Oncol*. Jun; 17(6):1471-4. doi: 10.1245/s10434-010-0985-4.

14. Elston CW(2002) :- Pathological prognostic factors in breast cancer I. The value of histological grade in breast cancer: experience from a large study with long-term follow-up. *Histopathology* 1991, 19:403-410.
15. Hsu SM, Raine L and Fanger H (1981):- Use of avidin-biotin-peroxidase complex (ABC) in immunoperoxidase techniques: a comparison between ABC and unlabeled antibody (PAP) procedures. *J HistochemCytochem* ; 29:577-580
16. Zhang G-J, Kimijima I, Abe R, et al(1997):-Correlation between the expression of apoptosis-related bcl-2 and p53 oncoprotein and the carcinogenesis and progression of breast cancer. *Clin Cancer Res*; 3:2329-35.
17. Veronesi S, Francesco A. Mauri I, et al(1998): Bax immunohistochemical expression in breast cancer.A study with long term follow up .*Int. J. Cancer (Pred. Oncol.)*: 79, 13-18 .
18. Breast Cancer. <http://www.cancerresearchuk.org/cancer-info/cancerstats/world/breast-cancer-world/> (Accessed on March 04, 2013).
19. Early Breast Cancer Trialists' Collaborative Group (EBCTCG) (2005):- Effects of chemotherapy and hormonal therapy for early breast cancer on recurrence and 15-year survival: an overview of the randomised trials. *Lancet* ; 365:1687.
20. Chia SK, Speers CH, D'yachkova Y, et al (2007):- The impact of new chemotherapeutic and hormone agents on survival in a population-based cohort of women with metastatic breast cancer. *Cancer* ; 110:973.
21. Dafni U, Grimani I, Xyrafas A, et al.(2010):- Fifteen-year trends in metastatic breast cancer survival in Greece. *Breast Cancer Res Treat* ; 119:621.
22. Prica F, RadonT, Cheng Y,et al (2016):- The life and works of S100P - from conception to cancer. . *Am J Cancer Res*. 2016; 6(2): 562-576.
23. Donato R (2001):- S100: a multigenic family of calcium-modulated proteins of the EF-hand type with intracellular and extracellular functional roles. *Int J Biochem Cell Biol* ;33:637-668.
24. Parkkila S, Pan PW, Ward A,et al (2008):- The calcium binding protein S100P in normal and malignant human tissues. *BMC Clin Pathol* ;8:2.
25. Ciocca DR and Calderwood SK (2005):- Heat shock proteins in cancer: diagnostic, prognostic, predictive, and treatment implications. *Cell Stress Chaperones* ;10:86-103.
26. Johnson M, Sharma M, Henderson BR (2009):- IQGAP1 regulation and roles in cancer. *Cell Signal* ;21:1471-1478.
27. Wang Q, He Z, Gao J, et al (2008):- S100P sensitizes ovarian cancer cells to carboplatin and paclitaxel in vitro. *Cancer Lett.* ;272:277-284.
28. Zhao X, Bai Z, Wu P, et al (2013):- S100P enhances the chemosensitivity of human gastric cancer cell lines.*Cancer Biomark.* ;13:1-10.
29. Tong XM, Lin XN, Song T, et al (2010):- Calcium-binding protein S100P is highly expressed during the implantation window in human endometrium. *Fertil Steril*; 94:1510-1518.
30. Maciejczyk A, Lacko A, Ekiert M,et al (2013):-Elevated nuclear S100P expression is associated with poor survival in early breast cancer patients. *Histol Histopathol* ;28:513-52476
31. Liu S, Edgerton SM, Moore DH, et al (2001) :- Measures of cell turnover (proliferation and apoptosis) and their association with survival in breast cancer. *Clin Cancer Res*, 7: 1716-1723
32. Ioachim EE, Malamou-Mitsi V, Kamina SA, et al(2000):-Immunohistochemical expression of Bcl-2 protein in breast lesions: correlation with Bax, p53, Rb, C-erbB-2, EGFR and proliferation indices. *Anticancer Res*, 20: 4221-4225.
33. Bargou RC, Daniel PT, Mapara MY, et al (1995) :-Expression of the bcl-2 gene family in normal and malignant breast tissue: low bax-alpha expression in tumor cells correlates with resistance towards apoptosis. *Int J Cancer*, 60: 854-859.
34. Gee JM, Robertson JF, Ellis IO,et al (1994) :-Immunocytochemical localization of Bcl-2 protein in human breast cancers and its relationship to a series of prognostic markers and response to endocrine therapy. *Int J Cancer*, 59: 619-628.
35. Zhang GJ, Kimijima I, Abe R, et al (1998):- Apoptotic index correlates to bcl-2 and p53 protein expression, histological grade and prognosis in invasive breast cancers. *Anticancer Res*, 18: 1989-1998
36. Rochaix P, Krajewski S, Reed JC, et al(1999):- In vivo patterns of Bcl-2 family protein expression in breast carcinomas in relation to apoptosis. *J Pathol*, 187: 410-415.
37. Berardo MD, Elledge RM, de Moor C, et al(1998) :-Bcl-2 and apoptosis in lymph node positive breast carcinoma. *Cancer*, 82: 1296-1302.
38. Honma N, Horii R, Ito Y, et al (2015):-Differences in clinical importance of Bcl-2 in breast cancer according to hormone receptors status or adjuvant endocrine therapy. *BMC Cancer* , 15:698 DOI 10.1186/s12885-015-1686-y
39. Dawson S, Makretsov N, Blows FM, et al (2010) :- BCL2 in breast cancer: a favourable prognostic marker across molecular subtypes and independent of adjuvant therapy received .*British Journal of Cancer* ;103, 668 - 675
40. Cory S, Huang DC, Adams JM, et al (2003) :- The Bcl-2 family: roles in cell survival and oncogenesis. *Oncogene* 22: 8590-8607

41. Silvestrini R, Benini E, Veneroni S, et al (1996) :-P53 and bcl-2 expression correlates with clinical outcome in a series of node-positive breast cancer patients. *J Clin Oncol*, 14: 1604–1610.
42. Lipponen P, Pietilainen T, Kosma VM, et al (1995):- A poptosis suppressing protein bcl-2 is expressed in well-differentiated breast carcinomas with favourable prognosis. *J Pathol* 177: 49–55.
43. Pietenpol JA, Papadopoulos N, Markowitz S, et al (1994) :-Paradoxical inhibition of solid tumor cell growth by bcl2. *Cancer Res* 54: 3714–3717
44. Wang TT and Phang JM (1995):- Effects of estrogen on apoptotic pathways in human breast cancer cell line MCF-7. *Cancer Res* 55: 2487–2489
45. Krajewski S, Thor AD, Edgerton SM , et al (1997): Analysis of Bax and Bcl-2 expression in p53-immunopositive breast cancers. *Clin Cancer Res* , Feb; 3(2): 199-208.
46. Krajewski S, Blomqvist C, Franssila K , et al (1995): Reduced expression of proapoptotic gene BAX is associated with poor response rates to combination chemotherapy and shorter survival in women with metastatic breast adenocarcinoma. *Cancer Res* ; 55(19): 4471-78
47. Pluta P and Smolewsk P (2011): Significance of Bax expression in breast cancer patients. *Polish Journal of Surgery* , 83, 10, 549–553.

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### RESEARCH ARTICLE

#### TOPICAL ANTISEPTICS IN EAR SURGERIES AND OTOTOXICITY EFFECT: REVIEW ARTICLE

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##### Key words:-

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Chlorhexidine, Alcohol, ototoxicity,  
cochlear toxicity, vestibular toxicity.

#### Abstract

**Background:** There is a wide variation in practice in the use of surgical preparation solutions among otolaryngologists in ear surgery. Chlorhexidine gluconate, povidone-iodine and alcohol are common topical antiseptics solution. The literature for risk and mechanisms of the ototoxicity by Antiseptics solution if reaches the tympanic cavity and inner ear causing functional impairment and cellular damage to tissues is being reviewed and compared.

**Aim:** We present the current antiseptics solutions used during ear surgery and their risk of ototoxicity. Depending on the available clinical trials that have shown their clear effect on both animal models and human ears.

**Result:** The three widely used topical antiseptics preparations for ear surgeries and have been studied in literature are: Alcohol, Chlorhexidine gluconate and Povidone-iodine. Alcohol and chlorhexidine gluconate have a toxic effect on the vestibular and cochlear function proven by significant changes in Vestibular evoked myogenic potential (VEMP) and Auditory brainstem response (ABR). On the other hand, low concentration of Povidone-iodine (5%) does not have this adverse effect, However non-significant changes in the ABR was found to be related to a high concentration of Povidone-iodine (10%).

**Conclusion:** Chlorhexidine gluconate and alcohol have a clear ototoxic effect and are not safe in ear surgery especially with perforated tympanic membrane, whereas diluted low concentration povidone-iodine is safe and to date is the standard topical antiseptic solution to be used for ear surgeries.

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#### Introduction:-

Till date there is no current standards regarding which antiseptic solution should be used preoperatively to prevent surgical site infection in ear surgery(1). Povidone-iodine, Chlorhexidine and Alcohol are the commonly used in surgical preparation. Till date, there is a wide variation in practice in the use of surgical preparation solutions among otolaryngologists performing ear surgery. Lai Philip and colleagues 2011 did an electronic survey among members of the Canadian Society of Otolaryngology-Head and Neck Surgery. Under "do you perform tympanoplasty" in terms of the choice of preparation solution. The result was 96% used an antiseptic preparation solution at surgery,

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whereas 4% did not. 5% used a chlorhexidine-based preparation, 4% used an alcohol-based solution, 86% used aqueous povidone-iodine and 4% used others. 29% of the surgeon used a barrier method, 31% answered "always," 24% answered "sometimes" and 7% answered, "I don't know" (2).

The risk and mechanisms of the ototoxicity by Antiseptics solution if reaches the tympanic cavity and inner ear causing cellular damage to tissues and functional impairment are reviewed, and compared in our presented review.

The aim of this review is to highlight the use of current standards and safe antiseptics solutions during ear surgery with their risk of ototoxicity. Depending on the available clinical trials that have shown their clear effect on both animal models and human ear

### Methods:-

A systematic English articles search was performed looking at data base science pub-med. Since February 2016 in both, animal and human studies in the relevant key words. Including (Patient) human and animal going to ear surgery, (Intervention) use of antiseptic, (Compare) antiseptic type either Chlorhexidine and Alcohol or povidone-iodine and (Outcome) ototoxicity effect. After filtration, we found out 15 studies that closely match our aim of review.

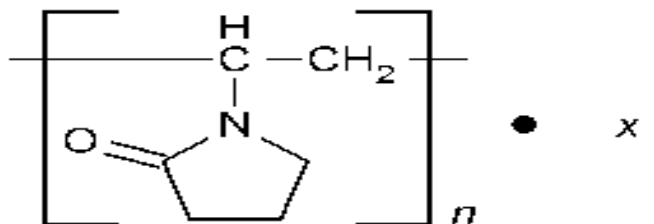
### Result:-

All in English. Two articles on both Chlorhexidine and Alcohol, only one Prospective controlled article on antiseptic was found. While seven specific articles on Chlorhexidine, five specific articles on povidone-iodine were included.

### Mechanism of action:-

#### Povidone-iodine:-

Iodine was first used in the treatment of wounds in (1839) (3). Iodine is complexed by iodide and polyvinylpyrrolidone via a hydrogen bond between the two pyrroles. It has affinity to deliver the iodine directly to the bacterial cell membranes. Depending on the concentration of the povidone-iodine solution, the free iodine can act as bactericidal component. Iodine and iodophors have a wide range of activity against Gram-negative bacteria and Gram-positive, tubercle bacilli, fungi, protozoa and viruses. At the same time, having some activity against bacterial spores (4, 5).

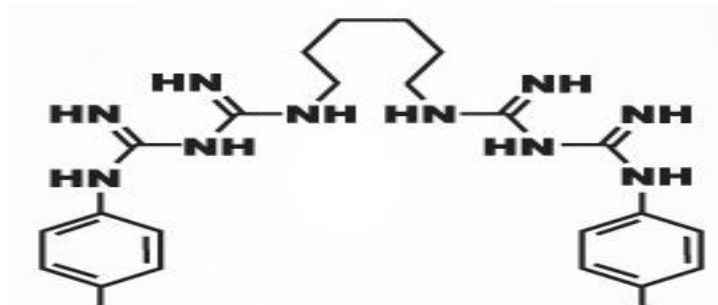


**Figure 1:-** Structure of povidone-iodine

The antiviral mechanism of action of iodine is not clear. However, lipid enveloped viruses are thought to be more sensitive than non-lipid enveloped viruses and parvoviruses (6). Manufacturer's data show that iodophors are bactericidal, virucidal, fungicidal and tuberculocidal but are not sporicidal at recommended use dilutions (7).

#### Chlorhexidine:-

In 1950s it was considered as an antiseptic agent in Manchester UK by Imperial Chemical Industries (8). Chlorhexidine is colorless and odorless. In addition, it is water insoluble and when formulated with acetic acid or gluconic becomes soluble. Chlorhexidine is a bisbiguanide that consists of two chloroguanide chains linked by a hexamethylene chain (9).

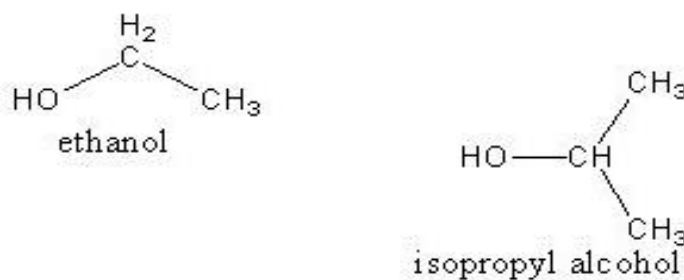


**Figure 2:-** Structure of chlorhexidine.

It disrupts the cytoplasmic membrane of bacteria at bacteriostatic concentrations and causing leakage of components of cytoplasm and bactericidal at higher concentrations via irreversible damaged the intracellular nucleic acids and adenosine triphosphate. The bactericidal effect increases with prolonged exposure for most bacteria. Chlorhexidine has an increased affinity for the cell wall of gram-positive organisms than for gram-negative bacteria. Also, has fungicidal, fungistatic, and some virus-killing properties. The antimicrobial activity of chlorhexidine is not affected by the body fluids such as blood (10).

#### **Alcohol:-**

Alcohols exhibit rapid broad-spectrum antimicrobial activity against vegetative bacteria (including mycobacteria), fungi and viruses but are not sporicidal. At the same time having activity against spore germination and sporulation (11), but reversible effect (12). Because of the lack of sporicidal activity, it not recommended for sterilization. Lower concentrations can be used as preservatives and to potentiate the activity of other biocides. Many alcohol products include low levels of other biocides (in particular chlorhexidine), which remain on the skin following evaporation of the alcohol, or excipients, which decrease the evaporation time of the alcohol (13).



**Figure 3:-** Structure of ethanol alcohol and isopropyl alcohol.

Dependent on the concentrations of both the active agent and the test microorganism, ethyl alcohol is more potent against viruses (14). Isopropyl alcohol considered slightly more efficacious against bacteria (15).

#### **Ototoxicity in animal studies:-**

Several animal studies have been performed to re-examine both histologic and electrophysiologic evidence of potential ototoxicity of Topical Antiseptics in ear. Özkiriş and colleagues, he investigated the ototoxic effects of different concentrations (5%, 7.5% and 10%) of povidone-iodine solutions applied to the middle ear cavity of rats using distortion product otoacoustic emissions. The animals were tested before, 1 and 10 days after solutions administration to the middle ear. The resulting of distortion product otoacoustic emissions were evaluated at different kHz. Reductions in distortion product otoacoustic emissions gram amplitudes were noted at high frequencies that is statistically significant in the group that received 5% at first day but this effect return at 10th day on. The other hand, significant differences were recorded in groups that received 7.5% and 10% povidone-iodine at low and high frequencies according to the control group at day 1 and 10. Based on results of this study, high concentration povidone-iodine solutions should not be used for ear surgery (16). Yagiz at, used fixed concentrations of povidone iodine (0.1ml of 10%) and investigated in guinea pigs by measuring transiently evoked otoacoustic emissions 10 days and four weeks. No change in transiently evoked otoacoustic emissions after 10 days and after 4

weeks of the application in the saline (negative control) group. Responses had cochlear toxic effect and disappeared in all ears of the gentamicin (positive control). Recording before and after povidone-iodine injection it similar to those done in positive control group with Pathological edema in the external auditory canal(17). Ichibangase T and colleagues used two different concentration of Povidone-Iodine (5% and 10%) in different age groups of the guinea pig and the compound action potential was measured at 24h, 7 days, and 28 days after application. The results of this study show mild hearing loss at 24h and 7 days using 10% solution, but no hearing loss with 5% solution at 7 days with the Outcome of the ototoxicity it affected by age of the animals and more toxic in infant(18). Morizono T, Sikoro MA, studied the ototoxic effect of povidone-iodine solution in the chinchilla and one day after topical application of dilutions of 1% povidone-iodine solution, a 1:4 dilution showed a substantial ototoxic effect on compound action potentials, while a 1:10 dilution did not(19). Aursnes J, did animal experiments that investigated ototoxicity of iodine when introduced into the tympanic cavity in guinea pigs and sacrificed 2 weeks later as surface preparations in phase-contrast microscopy. The duration of exposure was 10, 30, or 60 min. It was found that slight damage had occurred in the basal parts of the organ of Corti of those ears exposed to iodine or iodophor in 70% alcohol for 60 or 30 min and damage to the vestibular receptors was observed in ears exposed to iodophor in 70% alcohol for 60 min. on the other hand, chlorhexidine caused extensive damage to the neuroepithelial receptors of the inner ear(20).

The ototoxicity of the antiseptic combination chlorhexidine gluconate with cetrimide (savlon) is reviewed by Galle HG and colleagues on guinea pigs and observed the vestibular dysfunction in 15 clinical cases 12 dogs and 3 cats, in 8 animal ruptured tympanic membrane developed vestibular ototoxicity after applied this antiseptic combination(21). Further evidence, for the ototoxicity of chlorhexidine is demonstrated by Igarashi Y, Suzuki J, 0.05% or 2% chlorhexidine gluconate solutions were topically infused into the middle ear cavities of 12 test cats and observed the histologic change by both scanning and transmission electron microscope. Then 9 animals were decapitated 7 days after the third application, while the other three animals were sacrificed at 4 weeks. In the 2% chlorhexidine group, they found that hair cells in the organ of Corti had degenerated and had lost their hair bundles. In the animals sacrificed at 4 weeks, the injuries present seemed to have progressed. Even at a clinical concentration of 0.05%, chlorhexidine caused intracellular degeneration but with little surface damage(22). Aursnes J (1981) used two different solvents of chlorhexidine with different duration of exposure in guinea pigs and sacrificed at 2, 3, 4 or 10 weeks after exposure. The damage was extent to surface preparations of the organ of Corti in the Cochlea and the mucosal lining of the tympanic cavity was seen in almost all exposed ears with related to the concentration, the duration and to the time lapse after exposure(23). In addition, he did another study (1981) in guinea pigs with two different concentrations of chlorhexidine in two different solvents and the duration of exposure was varied. The result showed Vestibular neuroepithelial damage in most of the animals(24). Igarashi Y and Oka Y, found the chlorhexidine gluconate has an morphological ototoxic effect on the labyrinthine vestibule and observed in both the crista ampullaris and the macula with characteristic pronounced edema or amorphous dilatation of the nerve chalices with few small deformed mitochondria and even when used in dilute clinical concentration after intratympanic applications of 2% and 0.05% chlorhexidine gluconate in the cats (25). Morizono and colleagues supported this issue as well(26).

On other study Morizono T et al, demonstrated the ototoxicity of topically applied ethanol in guinea pigs quantitatively on cochlear microphones and the effect of ethanol with round window application on the endocochlear potential. Simultaneous recording of endocochlear Potential from the 1st and 3rd turn of the cochlea showed a more marked decline in the 1st turn. 70% ethanol caused an irreversible decline in endocochlear potential, while 35% ethanol caused a reversible(27).

Prospective controlled animal trial on all the antiseptics used in the ear surgery was conducted by Perez et al in (2000) to assess the function of the vestibular and cochlear parts of the 25 adult fat sand rat's inner ear after topical application of a different agent: chlorhexidine, povidone-iodine, and alcohol and based on the recording of vestibular evoked potentials (VsEPs) and auditory brainstem response (ABR). Administration of saline (control) affected neither VsEPs nor ABR. However, with gentamicin (ototoxic control) no responses in both VsEPs and ABR as expected. Povidone-iodine 10% did not affect VsEP recordings and had only a small effect on ABR after application. In contrast, chlorhexidine 0.5% had a clear toxic effect on the vestibular and cochlear function and all waves disappeared in all sand rats. In addition, 70% ethyl alcohol caused the waves to disappear not in all(28).



**Ototoxicity in humans studies:-**

Sade (1969) was first to question that a dead ear occasionally could result in a myringoplasty following the use of preparation solution during surgery (29). After that Ballantyne, recorded two patients with sudden sensorineural loss immediately after operation, whereas third patient developed a high-tone loss when seen 3 weeks postoperatively (30).

Again, why a simple procedure such as myringoplasty should result in a sensorineural hearing loss, by this question Bicknell's at 1971 start his study. He tried to find the possible etiology. In addition, performed a large study on series of 97 patients who had undergone myringoplasty. 0.05% chlorhexidine in 70% alcohol was used for perioperative antiseptic sterilization. Following that he recorded 14 patients developed severe SNHL in their operated ear within the first 6 months of the operation and 13 patients having a profound sensorineural hearing loss. An awareness amongst otologist was created following his article. Moreover, until date it serves as a landmark article on this subject (31).

**Conclusion:-**

Chlorhexidine has documented ototoxic effect and considered not safe in ear surgery especially with perforated tympanic membrane as concluded by Philip lai and colleagues in their literature review (32). In addition, alcohol also have clear ototoxic effects as discussed in various literature. Whereas diluted low concentration povidone-iodine is safe and to date is the standard topical antiseptic solution to be used for ear surgeries. A barrier method should also be considered during ear surgery if there is a concern. We recommend long-term multicenter clinical trials should be performed to evaluate the safe use of antiseptics during surgery.

**References:-**

1. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR.. Guideline for prevention of surgical site infection 1999: Hospital Infection Control Practices Advisory Committee. *Infect Control Hosp Epidemiol* 1999;20:250–78
2. Philip L, Chris C, David P, John R. Chlorhexidine Ototoxicity in Ear Surgery Part II: Survey of Preparation Solution Used by Otolaryngologists in Canada: Is There a Cause for Concern? *Journal of Otolaryngology -- Head & Neck Surgery*. 2011 Dec;40(6): 441-445.
3. Hugo WB. A brief history of heat and chemical preservation and disinfection. *J Appl Bacteriol* 1991;71:9–18.
4. Zamora JL. Chemical and microbiologic characteristics and toxicity of povidone-iodine solutions. *Am J Surg* 1986;151:400–6.
5. Larson EL. APIC guideline for hand washing and hand antisepsis in health care settings. *Am J Infect Control* 1995;23:251–69.
6. McDonnell G, Russell AD. Antiseptics and disinfectants: activity, action, and resistance. *Clin Microbiol Rev* 1999;12:147–79.
7. Rutala WA. APIC guideline for selection and use of disinfectants. 1994, 1995, and 1996 APIC Guidelines Committee. Association for Professionals in Infection Control and Epidemiology. *Am J Infect Control* 1996;24:313–42.
8. Davies GE, Francis J, Martin AR, Rose FL, Swain G.. 1:6-Di-49- chlorophenyldiguanidohexane (Hibitane); laboratory investigation of a new antibacterial agent of high potency. *Br J Pharmacol Chemother* 1954;9:192–6.
9. Lim KS, Kam PC. Chlorhexidine-pharmacology and clinical applications. *Anaesth Intensive Care* 2008;26:502–12
10. Denton GW. Chlorhexidine. In: Block S, editor. *Disinfection, sterilization, and prevention*. Philadelphia: Lippincott, Williams and Wilkins; 2000. p. 321–36.
11. Yasuda-Yasuki Y, Namiki-Kanie S, Hachisaka Y. Inhibition of germination of *Bacillus subtilis* spores by alcohols. In: Chambliss G, Vary J C, editors. *Spores VII*. Washington, D.C: American Society for Microbiology; 1978. pp. 113–116
12. Trujillo R, Laible N. Reversible inhibition of spore germination by alcohols. *Appl Microbiol*. 1970 Oct; 20(4):620-3.
13. Bush LW, Benson LM, White JH. Pig skin as test substrate for evaluating topical antimicrobial activity. *J Clin Microbiol*. 1986 Sep; 24(3):343-8.
14. Klein M, Deforest A. Principles of viral inactivation. In: Block S S, editor. *Disinfection, sterilization and preservation*. 3rd ed. Philadelphia, Pa: Lea & Febiger; 1983. pp. 422–434
15. Coulthard C E, Skyes G. Germicidal effect of alcohol. *Pharm J*. 1936;137:79–81

16. Özkiriş M, Kapusuz Z, Saydam L. Ototoxicity of Different Concentrations Povidone-Iodine Solution Applied to the Middle Ear Cavity of Rats. *Indian J Otolaryngol Head Neck Surg.* 2013 Apr; 65(2): 168–172.
17. Yagiz R, Tas A, Uzun C, Adali MK, Koten M, Karasalihoglu AF. Effect of topically applied povidone-iodine on transient evoked otoacoustic emissions in guinea pigs. *The Journal of Laryngology & Otology* September 2003 Sep;117: 700–703
18. Ichibangase T, Yamano T, Miyagi M, Nakagawa T, Morizono T. Ototoxicity of Povidone-Iodine applied to the middle ear cavity of guinea pigs. *International Journal of Pediatric Otorhinolaryngology* 2011;75(9):1078–1081
19. Morizono T, Sikoro MA. The ototoxicity of topically applied povidone-iodine preparations. *Arch Otolaryngol* 1982;108:210–3
20. Aursnes J. Ototoxic effect of iodine disinfectants. *Acta Otolaryngol* 1982;93:219–26
21. Galle HG, Venker-van Haagen AJ. Ototoxicity of the antiseptic combination chlorhexidine/cetrimide (Savlon): effects on equilibrium and hearing. *Vet Q* 1986;8:56–60.
22. Igarashi Y, Suzuki J. Cochlear ototoxicity of chlorhexidine gluconate in cats. *Arch Otorhinolaryngol* 1985;242:167–76
23. Aursnes J. Cochlear damage from chlorhexidine in guinea pigs. *Acta Otolaryngol (Stockh)* 1981;92:259–71
24. Aursnes J. Vestibular damage from chlorhexidine in guinea pigs. *Acta Otolaryngol (Stockh)* 1981;92:89–100
25. Igarashi Y, Oka Y. Vestibular ototoxicity following intratympanic applications of chlorhexidine gluconate in the cat. *Arch Otorhinolaryngol* 1988;245:210–7
26. Morizono T, Johnstone BM, Entjep J. Sensorineural deafness caused by preoperative antiseptics. *Otologia Fukuoka* 1974;20:97–9.
27. Morizono T, Sikora MA. Ototoxicity of Ethanol in the Tympanic Cleft in Animals *Acta Otolaryngol.* 1981 Jul-Aug;92(1-2):33-40.
28. Perez R, Freeman S, Sohmer H, Sichel JY. Vestibular and cochlear ototoxicity of topical antiseptics assessed by evoked potentials. *Laryngoscope.* 2000 Sep;110(9):1522-7.
29. Bicknell PG. Sensorineural deafness following myringoplasty operations. *J Laryngol Otol* 1971;85:957–61.
30. Ballantyne JC. Sensorineural deafness following myringoplasty operations. *J Laryngol Otol* 1970;84:967
31. Bicknell PG. Sensorineural deafness following myringoplasty operations. *The Journal of Laryngology & Otology* 1971 Sep;85(9): 957-962



### RESEARCH ARTICLE

## IMPACT OF STOCK DIVIDEND/BONUS ISSUE ON RETURNS OF STOCK LISTED IN KARACHI STOCK EXCHANGE.

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### Abstract

This paper investigated the impact of stock dividend/bonus issue on return of corresponding company. Event study approach has been used to explore the abnormal return. For this purpose, 81 days event window has been created with 40 days of a pre and post window on the event occurred respectively. 27 service sector companies have been selected and calculated AR (Abnormal Return), AAR (Average Abnormal Return) and CAAR (Cumulative Average Abnormal Return). Finally, t-test technique applied to check the significance of the findings. This study concluded that bonus issues have a positive effect on the stock returns but the results are insignificant.

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### Introduction:-

Bonus shares are the shares given by the company to its existing shareholders, according to the proportion of ownership they currently have in the company. An important point here is that, although the number of shares issued by the company increases but the value of the company remains the same. This is because the issued capital is subtracted from the retained earnings and added to the share capital of the company.

An issue of bonus shares is called bonus issue or stock dividend. When a company announces a bonus issue, it is also accompanied by the announcement of a "book closure date". It is the date when the company would temporarily close its books for the transfer of stock. This date is typically a couple of days before the bonus shares are actually issued and any person buying a share after the book closure date would not be entitled to receive any bonus shares.

In Pakistan the listed companies have been issuing stock as well as normal dividend. The topic of our research is to evaluate the effect of a stock dividend or a bonus issue on the returns of the individual stock. This effect of stock dividend is evaluated by event window analysis, the event window of our study is 80 days, 40 days before the event day and 40 days after the event day. The bonus issues included in the study range from 2008 to 2013, as announced in the KSE website and the sector included in the study is only the services sector.

### Modigliani–Miller theorem:-

It is a theorem on capital structure, arguably the most popular theorem for forming the capital structure of a company. The theorem states that, under the classical random walk approach of process and under some certain assumptions, i.e. in the absenteeism of taxes, bankruptcy costs, agency costs, and asymmetric information, i.e., in an efficient market, the value of a firm is unaffected by how that firm is financed. So it makes no difference what the

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firm's capital structure is of what its dividend policy is. Therefore, the Modigliani–Miller theorem is also often called the **capital structure irrelevance principle**.

Miller and Modigliani in 1961 theoretically verified that bonus issues and other type of dividends do not alter the company's share capital. The implication of bonus issues is that as the bonus shares are issued to the same shareholders, the value of the shares remains the same but the number of shares has increased, so the price of the shares falls. Hence, the value of the shares held by the investors remains the same.

Essentially, firms that pay more dividends offer less stock price appreciation that would benefit stock owners who could choose to profit from selling the stock. However, the total return from both dividends and capital gains to stockholders should be the same. If dividends are too small, a stockholder can simply choose to sell some portion of his stock. Therefore, if there are no tax advantages or disadvantages involved with these two options, stockholders would ultimately be indifferent between returns from dividends or returns from capital gains.

Since the publication of the papers by Modigliani and Miller, numerous studies have shown that it does not make any difference to the wealth of shareholders whether a company has a high dividend yield or if a company uses its earnings to reinvest in the company and achieves higher growth. However, the importance of a firm's dividend decision is still contested, with a number of theories arguing for dividend relevance.

#### **Semi-Strong Form Efficiency:-**

It is a class of EMH (Efficient Market Hypothesis) stating that all public information is calculated into a stock's current share price. Meaning, that neither fundamental nor technical analysis can be used to achieve superior gains i.e. beat the market.

This hypothesis characterizes that only the information that is secret i.e. not publically available can give the investors abnormal returns. Apart from that every other information is adjusted in the stock's price.

The theory says that the investors are not concerned with a company's dividend policy since they can sell a portion of their portfolio of equities if they want cash. The dividend irrelevance theory essentially indicates that an issuance of dividends should have little to no impact on stock price.

#### **SEC rules bonuses:-**

A listed company may issue bonus shares is subject to the following conditions, namely: – draft amendments to the Company (issued capital) Rules “, 1996

The Company's Board of Directors resolved to issue bonus shares shall be communicated to the Commission and the Stock Exchange, the day of the decision, communicated to the public;

The Company shall retain at least 25% of the enhanced paid-up capital as free reserves;

The certificate shall be obtained by the Company's auditors certify: –

After the issue of bonus shares reserved free reserves of not less than 25%, increasing the company's paid-up capital;

(B) all contingent liabilities are computed, the lowest 25% of remaining reserves and the certificate will be sent to the respective stock exchanges of information and the decision of the day for the public dissemination Commission has charged.

Purposes of this section, the term “free reserves” Explanation. \_\_ include any amounts already allocated all intangible assets or fictitious assets adjusted income or other surplus

Free, it is not retained in order to satisfy any impairment in the value of assets, specific liability at the balance sheet date, the contingency of existence or promise, but does not include

1. reserves as a result of the revaluation of fixed assets;
2. Goodwill reserves;

Of the impaired range of ordinary depreciation or Otherwise, the conditions of admissibility of Income Tax Ordinance, “2001 (2001 forty-ninth);

Development allowance reserve created under the Income Tax Ordinance, “2001 (2001) forty-ninth requirements;

Provides tax-deferred or the extent of the Company’s current liabilities;

1. Capital redemption reserve;
2. Unrealized capital gains.

#### **Need of study:-**

We want to analyze the bonus issues and the effect the announcements of bonus issues have on the return of the shares. We studied various articles and highlighted this issue, as we observed there is not much study conducted in Pakistan when it comes to bonus issues. Hence, the need exists to further elaborate the effect and to identify any new findings about the issue at hand.

#### **Problem Statement:-**

Companies often issue bonus in shape of stock but there is on study which is entirely focus on the impact of stock dividend on stock return.

#### **Research Questions:-**

- What is the return of stocks before the bonus issue announcement?
- Is there any abnormal return of the stock after the announcement?
- What is the overall effect of the announcement on the stock?

#### **Research objective:-**

To examine the effect of bonus issues on stock return

#### **Significance of the study:-**

The beneficiaries of the study would be the researchers, the firms and the investors. As our study would give them a detailed account of the effect of bonus issues on the stock returns, so if the return is higher after the announcement then the investors would invest more after the announcement, the firms would use it to generate more investment and the researchers would have a new topic to discuss, scrutinize and analyze.

#### **Literature Review:-**

##### **2013 Omer Subaih The Effect, of Stock Split Declarations on Stock Prices: an Empirical Inquiry for the Toronto Stock Exchange (TSX)**

This paper investigates the effect of stock split announcements on stock Prices in the Toronto Stock Exchange (TSX). Used event study to determine event window and estimation window, then calculated returns in estimation window and event window using CAPM model. Compared the two to determine abnormal returns and finally t-test was applied to check the significance. Cumulative abnormal return exists on short-term period surrounding the stock split announcement. On the other hand, there is no evidence support that the cumulative abnormal return would continue to exist when the size of the event window is expanded. Abnormal returns on short run, but no significant evidence to support that the market participants can generate abnormal returns in long run.

##### **2010 Hideki Hanaeda, Toshio Serita The Effects of Stock Splits on Stock Prices, Liquidity and Stock Ownership: Evidence from Japan.**

The purpose of the study is to investigate the effects of stock splits on stock prices, liquidity and stock ownership in Japan. A window of 80 days was taken, -10 and +70 days. The stock market reaction to the announcement of stock splits was estimated by using market-adjusted prediction errors ( $PE_{it}$ ).  $PE_{it}$  is the difference between daily rate of return on the common stock of splitting firms and daily rate of return on the Tokyo Stock Price Index. After taking their average, t-test is applied. The price, returns and ownership increase as a result of stock splits, but liquidity decreases in Japan, stock splits have a positive effect on returns, price and ownership, but a negative effect on liquidity. **2008 Dr. Satyajit Dhar, Market Reaction, around the Stock Splits and Bonus Issues: Some Indian Evidence.**

This paper examines the announcement effects of stock splits and bonus issues on the Indian Stock market during the period April 2000 to March 2007. An event window was constructed, -40 and +40 days, returns were calculated using CAPM, average abnormal returns were calculated by subtracting actual and expected returns and finally t-test was applied to check the significance. It was found that 77% of sample companies have positive mean return in respect of stock split whereas that for bonus issues is 57%. Stock splits may give an investor more return than that from bonus issues considering entire event window. But on announcement date of bonus, 83% of sample companies experienced positive return compared to 69% of sample companies having positive return on stock split announcement date. Thus on the announcement date, reaction of market participants to bonus issues found to be more positive than that to stock splits.

#### **Karachi Stock Exchange closes at all-time high:-**

#### **2010 Mikko Reinikainen, Effects of stock splits, on stock returns: An event study, of Finnish companies.**

The main idea of this study is to test the legitimacy of the signaling effect of stocks splits in Finnish stock markets. If the signaling effect prevails, then abnormal returns would be detected around the split announcement days. It means that the investors take stock splits as favorable positive information. The study uses event study methodology to investigate the effect of stock splits on shareholder wealth. The study found no abnormal returns before or after the event date. So the study conducted is unable to state whether the signaling effect holds or not. These results differ from that of the previous empirical studies.

#### **2012 Yague, Gomez-Sala and Pove-da-Fuentes Stock split size, signaling and earnings management: Evidence from the Spanish market.**

The study was done in order to examine the use of stock split announcements as signals of a firm's earnings performance. Event study was done, abnormal returns were calculated and then finally t-tests were applied to check the level of significance. Positive abnormal returns were calculated as a result of stock split. Result found a statistically significant relationship between abnormal returns around the split announcement and the surprise component of the split factor, especially in splits in which the factor is higher than expected given the pre-split share price level and the size of the firm.

#### **2005 Leledakis, Pa-paioannou, Trav-los, Tsangarakism stock splits on the athens stock exchange.**

This study analyzes the price effects of stock splits undertaken by firms whose stock is traded on the Athens Stock Exchange (ASE). It also tests empirically some of the hypotheses that have been advanced, by prior literature, to explain the abnormal price reaction to stock splits. To check the price effect, again an event window was determined, and abnormal returns calculated. Liquidity decreases as we move on from the event day, but prices and returns show a positive change. No price reaction on announcement day, but earnings improve in the years prior to the split but there is no evidence of future earnings improvement. Study confirmed that liquidity does not increase as the result of stock splits.

#### **2002 Christen Wolff the market reaction to stock splits evidence from germany.**

This paper investigates the market reaction to stock splits, using a set of German firms. A sample of stocks whose split date was announced were selected, and returns before and after the announcements were calculated, then abnormal returns were calculated. At the announcement date itself, the abnormal return is very low and insignificant, but the following day shows an abnormal return of 0.47%. This abnormal return is significant according to all test statistics, even at the 1% level. Using trade-to-trade returns, the abnormal return on day + 1 is even higher, yielding 0.56%. The cumulative abnormal return over the extended event window [-30; +30] differs by almost 4%, depending on the method used. As compared to US, the market reaction in Germany around announcement date is relatively lower, but still it shows a positive effect on the returns of the stock.

**2006 Mayank Joshipura Price and liquidity effects of stock split: An Empirical evidence from Indian stock market.** This paper studies the price and liquidity effect associated with stock split surrounding its announcement and effective day by using standard event study methodology which, measures significance of abnormal return and change in liquidity associated with an event. Event study methodology was used, with -51 and +51 day window to work on, then abnormal returns were calculated, and finally t-test was applied to check the significance. Excess return on announcement day, abnormal return on the effective day, effect not long term. Though there is a significant positive abnormal return of 1.08% and 1.66% found on announcement and effective day respectively it did not sustain and got reversed in less than a week's time, and there was a clear evidence of significant

improvement in traded volume (turnover) associated with stock split both surrounding announcement and effective day.

**2002 Patrick Dennis Deon Strickland The effect of stock splits on liquidity and excess returns: Evidence from shareholder ownership composition.**

This paper studies the impact of firm ownership composition on both the abnormal returns at the announcement of a stock split and liquidity changes following a stock split. A sample of firms giving stock split announcements was selected. For each firm in the sample, quarterly ownership composition data for two years before and after each split were collected. Monthly and quarterly return, volume, outstanding shares and price data for two years before and after each split were collected. 1392 observations were in the four-year sample. The estimated coefficient on the percentage change in turnover is positive and significant. The estimated coefficient for institutional ownership is negative and significant at the one percent level. This suggests that the different levels of institutional ownership lead to large economic differences in the wealth effect of a stock split. The largest post-split increase in institutional ownership occurs for firms that had low institutional ownership prior to the split. Changes in liquidity are negatively related to the level of institutional ownership prior to the split. The abnormal return following a split is negatively related to the level of institutional ownership prior to the split.

**2012 May Hu An examination of stock split and special dividends announcements in relation to market timing, opportunities, business cycle and monthly pattern.**

The principal aim of this research is to examine the macro determinant that can explain why firms issue stock split and special dividend, and to know are the aggregate patterns and abnormal returns of stock split and special dividend announcement are related to the monthly patterns of January effect & Halloween effect. Comparison of announcement date with pre and post announcement dates on daily weekly, 10 days, 15 days, 1 month 2 month and 6 month. Market reaction to stock split is normally stronger in January but firms do not have a tendency to issue stock split in January rather they want to issue in Halloween period. The powers of business cycle variables are stronger in abnormal returns than the investor variables and monthly effect. The abnormal returns of stock split announcements are higher in bull market. Co.'s prefer to pay special dividend in bear market, both short term and long term abnormal returns are higher when market is downward.

**2010 John Mwendwa Stock split and their effect on share prices, a study of the firms listed on the Nairobi stock exchange.**

To determine the reasons Kenyan firms undertake stock split within the Kenyan market. To determine if stock split have any effect on share price. 10 co.'s which did stock split from 2004-2009 were taken and their prices were analyzed on monthly basis of before and after split. Interviews were and conduct with questionnaire and were analyzed by using SPSS. Stock split is being done in order to bring down the stock prices. Another finding is that co.'s did so to give off a positive outlook that co. is going well. There were not any fix changes in prices of the share before and after split. In Kenya co.'s do stock split in order to bring prices to optimal level. Stock split did not have a direct effect on share prices.

**2003 Isil sevilyyalmiz An analysis of stock splits in the Istanbul stock exchange.**

this study investigates the stock split decisions of the Turkish companies. Firstly the study investigates the liquidity effect of the stock splits on Turkish stocks; secondly it determines the optimal trading range of different sized firms and firms with different investors. Lastly, the study analyzes by testing whether or not Turkish firms whose share prices rise above their optimal trading ranges are more likely to split their stocks as compared to firms whose share prices are at or below the optimal trading ranges. Companies are selected from 1992 to 2002 which split their stocks; this is composed of 740 split events by 263 firms. The study was unable to define the relationship between share price and stock split, as no of shareholders are not publically available and the proxy used for it didn't define the result.

**2005 Annad. S. Desai Changes in trading activity following stock splits and their effect on volatility and the adverse information component of the bid-ask.**

Examine the volatility of stock after splitting and the effect of adverse information component of the bid-ask spread. Extract the adverse information component from the total bid-ask spread, then relate changes in this component to changes in the number of trades after split, the spread and the adverse information component of the spread increases after the stock split. We also find a negative correlation between the change in the adverse information component and the change in the number of trades. Results shows that the increase in volatility cannot be attributed

solely to microstructure biases arising from the bid-ask bounce and price discreteness and after correcting these biases, we find a significant increase in the volatility after the split.

#### **2011 Kanwal Iqbal Khan Effect of Dividends on Stock Prices**

The effect of stock dividend on stock prices of chemical and pharmaceutical industry. The objective of this study is to see the effect of cash dividend and stock dividend on stock market prices. A sample of twenty five companies is taken from the period of 2001 to 2010. They used Panel data approach to measure the relation between stock dividend and stock prices. Fixed and random effect models are applied on the panel data. Cash Dividend, Retention ratio and return on equity has positive significant relation with stock market prices while stock dividend and earning per share has negative insignificant relation with stock market prices. Dividend Irrelevance theories are not applicable in case of chemical and pharmaceutical companies of Pakistan.

#### **1994 Mark. S Granblatt The Valuation effects of stock splits and stock dividends.**

To check the Reaction of companies and its return on announcement of stock splits and stock dividends Sample of companies who is announcing stock split and stock dividend. Take out the data of return post and pre-split announcement. On Average, companies react positively to stock dividend and stock split announcement. Found Positive excess return on and around the ex-dates of stock dividends and splits. They concluded Positive relationship between stock split and the stock price. Post announcement abnormal returns, particularly the ex-dates of splits and stock dividends.

#### **Karachi Stock Exchange DHIYAN (FORECAST) for Mon, 26th, Nov, 2012:-**

#### **2009 Neinsu Shih, The Impact of Employee stock bonus on equity market value.**

The objective was to relation between equity market value and the expense of employee stock bonus that is disclosed but not recognized under Taiwan's law. Sample data was drawn from listed companies in Taiwan Stock Exchange from 1997 – 2005. Divide it into sector wise and then compare it which sector issues more employee stock bonus. The two-stage estimation of Heckman is used in this study. In the first stage, the determinants of employee stock bonus equation are estimated using the probity analysis. In the second stage, the inverse Mill's ratio obtained from the first stage is included in the second stage regression models to test the hypotheses of this study. The market value of employee stock bonus has a negative effect on the firm's share price. Results indicate the negative side of employee stock bonus is its dilution of the existing shareholders' equity rights. Employee stock bonus plan has a motivational effect for employees. Empirical results show that the fair value of employee stock bonus reduces a firm's equity market price.

#### **2009 CAHIT ADAOGLU AND MEZIANE LASFER, The Market Valuation, of Bonus Distributions in an Inflationary Environment.**

The objective was to check the market valuation of an unusual form of stock dividends, referred to as bonus distributions, which are carried out by transferring the accumulated equity reserves, mainly the inflation revaluation equity reserves, to paid-in capital leaving the total equity unchanged. They used event study methodology and sample consists of 371 announcements over the period of 1995 -2006. They find average abnormal returns on the announcement day 0, and 0.94on day +1. They found that the pre-event CAAR are positive, but post event period are negative. Hence, market reacts positively to the bonus announcements in Istanbul.

#### **2001 Balasingham Balachandran\* & Sally Tanner, BONUS SHARE ISSUES AND ANNOUNCEMENT EFFECT: AUSTRALIAN INDICATION**

The objective of the study was to check share price reaction to announcement of bonus share issues of Australian companies. Took data from different resources like Bloomberg, IRESS... 139 Observations. Daily share price data for a period from 250 days before to 20 days after the announcement dates and market value for each company making a bonus issue one month prior to the bonus issue announcements Pre-announcement effect was found only for industrial non-financial companies and financial companies that announced bonus issues simultaneously with other market sensitive information such as interim or final results. The magnitude of price reactions to bonus issue announcements is statistically related to the size of the bonus issues and the pre-announcement effect the price reaction to bonus issues announcements. Bonus issue announcements led to statistically significant positive price reaction around announcement dates for uncontaminated and contaminated events.



**Research Methodology:-****Methodology:-****Research Design:-**

There are basically 3 major types of research designs:

**Exploratory study:-**

It is a study undertaken to explore some certain problem or issue of a variable about which no or very little is known.

**Descriptive study:-**

It is a study under taken to ascertain or describe the characteristics of a certain variable under consideration.

**Hypothesis testing:-**

It is a type of research which explains the nature of relationships between the considered variables or checks the independence of two or more factors.

Hence, as we have tried to investigate the relationship of stock dividend and stock splits with their stock returns, the research conducted by us is a hypothesis testing study.

Furthermore, the sub-type of the research was an event window study. In which we tried to determine the abnormal returns for the firms before and after an event date by comparing the actual and expected returns.

**Methodology Literature:-**

All of the articles we studied used the same research methodology of an event study, though their sample size differed. All of them chose an event date and determined the abnormal return by calculating the returns for a given window before and after the event date and then calculating the excess returns by CAPM and finally subtracting the expected return by the actual return.

**Data:-**

The sample of our research is the all the bonus issues of the companies belonging to service sector in KSE, a total of 27 companies and 61 issues from 2008 to 2012. The data about these companies and their issues was collected from various sources, like opendoorsforall.com, zhvsec.com, breccorder.com and Pakistan-stock.blogs.com.

**Statistics:-**

Market return and stock returns were the two variables considered by us. Here market return is the independent variable and stock return is the dependent variable. Abnormal return was calculated by subtracting the expected return and the stock return.

**Stock and market return:-**

Stock and market return was calculated by the simple formula for calculating the return of a stock, i.e,  
 $\text{Returns} = (\text{Current return}/\text{previous return}) \log$

**Expected Return:-**

Expected returns give the return that the investors are expecting for a given day or a period is calculated by:

**Abnormal Returns:-**

Abnormal returns are the returns that give the return of the stock in excess to what was expected by it, it could be in positive or negative, if positive it is favorable to the investors if negative then it is not good for the investor's perspective:

$\text{AR} = \text{Actual return} - \text{Expected Returns}$

$\text{Average AR} = \text{AR}/n$

**Average abnormal Returns:-**

is calculated by dividing the sum to returns of the security for the window dates by the number of bonus issues considered

### Cumulative average abnormal Return:-

Cumulative average abnormal return is calculated by adding the average abnormal returns of the event window dates

### Results:-

As we explained in the above discussion that we took event window of 40 days before and after the event date. This strategy is called event study.

The objective of our study was to determine whether stock dividend, i.e. bonus issues have any effect on the stock's returns. Meaning, that does an announcement of stock dividend by a company lead to abnormal returns.

The results of our study on Average Abnormal Returns (AAR) of bonus issues are given in the annexure 1. The results show that on the event date there exists an average abnormal return of 0.49% which is significant at 2.2%, meaning that the investors would be able to get 0.49% then what they expected to get. Table 1 shows the impact of stock dividend announcements on share price performance. It shows that around 37 companies out of a total of 61 were able to get a positive return during the event window, meaning that 61% of the companies show a positive return to the stock dividend announcements during the event window. The table also signifies that a total of 23 companies out of 61, i.e. 39% of the companies, got a negative response to their dividend announcements during the event window.

Now looking at the effect of stock dividends on the announcement date or the event date, we see that a total of 38 out of 61 companies have a positive mean return on the announcement date, that is almost 64% (63.4%) companies having a mean positive return which is better than the number of companies showing positive return during the event window. While the number of companies showing negative return on the announcement date fall to 22 from 23, i.e. fall from 39% to 36.6%, meaning that more companies show a positive reaction to stock dividend announcement on the event date then the number of companies having a positive return on event window.

### Impact of stock Dividend announcement on share price performance:-

**Table.1:-**

Particulars	Bonus Issues	
	No. of Companies	Percentage
Companies having positive mean return during event window	37	61%
Companies having negative mean return during event window	23	39%
Companies having positive mean return on announcement date	38	63.4%
Companies having negative mean return on announcement date	22	36.6%
Total	60	100%

The table 2 tracks the course of the mean CAAR along the days in the event window. The table shows that the CAAR in the post event days is more than the pre event days. Furthermore, the CAAR on the event date is the maximum as compared to other ranges meaning that the return of the selected stocks increase as they lead up to the event date and then don't show any drastic changes after the event has occurred. The CAAR for the entire window, i.e.  $t_{-40}$  to  $t_{+40}$  is 1.8%.

CAAR across the Event Windows

**Table 2:-**

Days	Bonus Issues	
	Mean CAAR	Variance
$t_{-40}$ to $t_{-21}$	0.005167	0.00005772
$t_{-20}$ to $t_{-1}$	0.02754	0.00011762
$t$ to $t_1$	0.053238	0.00000002
$t_1$ to $t_1$	0.051532	0.00000583
$t_{+2}$ to $t_{+20}$	0.033454	0.00036727
$t_{+20}$ to $t_{+40}$	0.050648	0.00000553
$t_{-40}$ to $t_{+40}$	0.018276	0.00035753

These results show a positive abnormal return for the companies and the bonus issues, meaning that the market is inefficient, and the results are significant for the event date. But when the overall significance is considered then we see that majority of the results and returns are insignificant. Table 3 gives the significance of all the results. From the table it can be seen that although the positive abnormal returns of the stocks are significant on the event day, but an overwhelming majority of them are insignificant. Almost 82% of the results are insignificant. This shows that the market is efficient and the relevant information about the stock was already incorporated in the price of the stock before the announcement was made.

**Table 3:-**

Particular	Bonus issue	
	Significance @ 10%	Percentage
$t_{-40}$ to $t_{-21}$ significance AAR	4	4.9%
$t_{-20}$ to $t_{-1}$ significance AAR	4	4.9%
$t$ significance AAR	1	1.23%
$t_1$ - $t_{20}$ significance AAR	5	6.17%
$t_{21}$ - $t_{40}$ significance AAR	1	1.23%
issues having no significant	66	81.48%
Total	81	100%

### Discussion:-

Our results are in accordance with almost all of the previous studies that we have analyzed. We studied an article named “Market Reaction, around the Stock Splits and Bonus Issues: Some Indian Evidence” written by Dr. SatyajitDhar during 2008. As the name suggests they, like us, also wanted to check the effect of stock split and bonus issues on the market. They came up with the same result, that bonus issues have a positive effect on the returns.

Another article, “Dividend Announcements and Stock Returns: A study on Karachi stock exchange”written by Shahid Mahmood, Muhammad FayyazSeikh and Abdul QayyumGhaffari during 2011 investigated the same issue, the effect of dividend announcements and stock returns. The results of this study are also consistent with our research and back our findings in a Pakistani market.

The article entitled, “Bonus issue announcements and its impact on share prices of Colombo Stock Exchange (CSE) in Sri Lanka” by Ramesh S and Nimalathan B written during 2007 investigated the same issue but in a Sri Lankan market. This study is one of the very few that shows a negative relation between stock dividends i.e. bonus issues and the stock returns. This difference could have been because of many reasons, Sri Lanka is a small market and in the days when this research was conducted, terrorism also prevailed in the country. So these factors may have affected the stock market and the shares trade volume in the country, hence leading to inconsistent results.

Another article was “A study on effect of bonus declaration, on share price volatility and liquidity and its impact on market wealth creation, in Bangalore NSE” written by Prof. Suresha B, Dr.Gajendra Naidu during 2012. They also tried to investigate the effect of bonus declaration on share price and wealth creation. They concluded that bonus issues are favorable to market price and market wealth. These results are consistent with our findings, they support and back out findings in Pakistani market context.

Another article “An examination of stock split and special dividends announcements in relation to market timing, opportunities, business cycle and monthly pattern” which was written by May Hu during 2012 also tries to examine the effect of stock splits and stock dividends on the market. He concluded that the bonus issues and stock dividends have a positive effect on the market and are favorable to the investors and stockholders. These findings are again consistent with our own results.

Another article “Effect of Dividends on Stock Prices” written by Kanwal Iqbal Khan during 2011 also tries to investigate the effect of dividends on the stock prices. They used panel data approach to investigate the effect of both the cash and stock dividends on the stock prices, and their result was that it has a significant positive effect on the stock prices. These results are in accordance to our findings, hence they support our results.

Another article studied by us entitled “The Impact of Employee stock bonus on equity market value” written by Neinsu Shih during 2009 investigates the effect of employee stock bonus on equity market. The research concludes that market value of employee stock bonus has a negative effect on the firm’s share price. This is not following our findings, but that is due to that fact that here only the effect on employee stock bonus is concerned and it has a negative impact on equity value of the firm because it dilutes the existing shareholders’ equity rights.

Another article entitled “BONUS SHARE ISSUES AND ANNOUNCEMENT EFFECT: AUSTRALIAN INDICATION” written by Balasingham Balachandran\* & Sally Tanner during 2001 examines the price reaction to announcement of bonus share issues of Australian companies. They also concluded the market reaction around bonus issues to be statistically significant. Similar to our findings, hence this research also backs our findings.

Furthermore, our findings are also backed by a number of other studies that we analyzed, such as The Effect of Stock Split Declarations on Stock Prices: an Empirical Inquiry for the Toronto Stock Exchange (2013), The Effects of Stock Splits on Stock Prices, Liquidity and Stock Ownership: Evidence from Japan (2010), Effects of stock splits, on stock returns: An event study, of Finnish companies (2010), Stock split size, signaling and earnings management: Evidence from the Spanish market (2012), Stock splits on the Athens stock exchange (2005), the market reaction to stock splits, evidence from Germany (2002), The effect of stock splits on liquidity and excess returns: Evidence from shareholder ownership composition (2002) and still some studies have supported our findings.

### **Conclusion:-**

In this paper we have tried to investigate the effect of stock dividend or bonus issues on the returns of the stock, whether or not they exceed the investor expectations or not, i.e. do they provide any abnormal returns or not. For this reason we selected 61 issues from 27 different companies from the service sector of Pakistan, and set an event window of 81 days, i.e. -40 and +40 days around the event date, which was the announcement date. As a result of a thorough and rigorous analysis we conclude that bonus issues have a positive effect on the stock returns but the results are insignificant.

### **Major Findings:-**

There was yet a lot of speculation about whether or not stock dividend is relevant or irrelevant when it comes to the value of the firm, and Modigliani and Miller theorem proposed that there won’t be any abnormal returns, that all the relevant information is already adjusted in the price of the stock, and our results are support this theory. Our research has shown that, firstly although on the event date there exists an average abnormal return of 0.49% which is significant at 2.2%, meaning that the investors would be able to get 0.49% then what they expected to get on the event day. An overwhelming majority of companies shown a positive return on the announcement date, specifically 64% of the companies analyzed have shown a positive mean return on the announcement date. Secondly, majority of the companies have also shown a positive mean return during the event window, i.e. the days before and after the announcement date and the CAAR has continued to grow while leading up to the announcement date, but when the overall significance is considered then this result is shown to be insignificant. Which shows that although 61% of the companies have shown a positive reaction to the stock dividend announcements, this result is insignificant because the significance of more than 81% of companies is more than 10% (our considered level of significance).

### **Policy Implications:-**

On the basis of our findings it can be suggested that the investors should not believe bonus issues to result in additional returns to them, because our research shows them to be insignificant. Showing that no abnormal returns can be generated, that the market is an efficient semi strong market in which the public information is already

incorporated into the price before the event has occurred. So the firms should not use it to increase their share price or generate investor interest.

#### **Research limitations:-**

The bonus issues are not very popularly used in Pakistan, so the sample was not as big as we would have liked it to be. Furthermore, the effect of macroeconomic variables, political and social situation of the country were not included in our study.

#### **Future Directions:-**

Considering the research limitations and other research opportunities there are some certain directions for future research. Firstly, although we included all the bonus issues we found in the period we selected, but the time span can be expanded to increase the sample size by including more bonus issues and also by include other macroeconomic factors and their effect on the stock prices in the research. Furthermore, the effect of stock splits should also be analyzed by the future researchers because both stock splits and stock dividends go hand in hand and there has not been much research conducted in Pakistan in this regard. These considerations would help the future researchers increase the conclusiveness of their findings and increase the significance of their study.

#### **References:-**

1. Brown, S. & Warner, J. (1983), 'Using daily stock returns: the case of event studies', Journal of Financial Economics, March, pp 3-31.
2. Chander Ramesh, Sharma Renuka, Mehta Kiran (2007), 'Dividend announcement & Informational efficiency: An empirical study of Indian stock market', The ICFAI Journal of applied Finance, Vol. 13, October, pp 29-42.
3. Vergos P. Konstantinos, Christopoulos G. Apostolos&Mylonakis John (2008), 'The impact of publicity announcement on share prices: An empirical study', ICFAI Journal of Management research, Vol VII, March, pp 35-55.
4. Balachandran Balasingham& Tanner Sally (2001), 'Bonus share issues & announcement effect: Australian evidence', Australian Economic paper, Vol 44, No. 3, pp 248-268.
5. Rao Spuma M. (1997), 'The effect of announcement of Bribery Scandal, White collar crime & illegal payment on returns to shareholders', Journal of Financial & strategic Decision, Vol 10, pp 55-62. Mulugetta Abraham et al (2002), 'The influence of Standard & Poor's ranking changes on stock price performance', Managerial Finance, Vol. 28, pp 19-30.
6. Adesola, W. A., &Okwong, A. E. (2009).An Empirical Study of Dividend Policy of Quoted Companies in Nigeria. Global Journal of Social Sciences , 8 (1), 85-101.
7. Afza, T., & Mirza, H. H. (2010). Ownership Structure and Cash Flows As Determinants of Corporate. International Business Research , 3 (3), 210-221.
8. Ahmed, H., &Javid, A. (2009).Dynamics and Determinants of Dividend Policy in Pakistan (Evidence from Karachi Stock Exchange Non Financial Firms). International Journal of Finance and Economics (25), 148-171.
9. Akbar, M., &Baig, H. H. (Summer 2010).Reaction of Stock Prices to Dividend Announcements and Market Efficiency in Pakistan. The Lahore Journal of Economics , 15 (1), 103-125.
10. Allen, D. E., &Rachim, V. S. (1996). Dividend Policy and Stock Price Volatility: Australian Evidence. Applied Financial Economics , 6 (2), 175-188.
11. Ambarish, R., Williams, J., & John, K. (1987).Efficient Signaling With Dividends and Investments. Journal of Finance (42), 321-343.
12. Amidu, M. (2007). How Does Dividend Policy Affect Performance of the Firm on Ghana Tock Exchange? Investment Management and Financial Innovations , 4 (2), 103-112.
13. Arnold, G. (2008). Corporate financial management. London: Financial Times Pitman Publishing. Asquith, P., & Mullins, D. W. (1986). The Impact of Initiating Dividend Payments on Shareholders' Wealth. Journal of Business , 1 (46), 77-96.
14. Effect Of Dividends On Stock Prices 20 Proceedings of 2 nd International Conference on Business Management (ISBN: 978-969-9368-06-6) Baker, H. K., & Powell, G. E. (2012). Dividend Policy in Indonesia:Survey Evidence from Executives. Journal of Asia Business Studies , 6 (1), 79 - 92.
15. Baker, H. K., Mukherjee, T. K., &Paskelian, O. G. (2006). How Norwegian Managers View Dividend Policy. Global Finance Journal , 17 (1), 155-176.
16. Baker, H. K., Powell, G. E., &Veit, E. T. (2002).Revisiting Managerial Perspectives on Dividend Policy. Journal of Economics and Finance (26), 267-283.

17. Barclay, M. J., & Smith, C. W. (1995). The Maturity Structure of Corporate Debt. The Journal of Finance, 1 (2), 609-631.

Tables:-

Annexure 1:-

Days	AAR	CAAR	t	Sig. (2-tailed)
t-40	-0.00089	-0.00089	-0.353	0.726
t-39	0.001466	0.000578	0.794	0.43
t-38	0.001791	0.002369	0.851	0.398
t-37	0.002199	0.004568	1.368	0.176
t-36	-0.00422	0.00035	-1.875	0.066
t-35	0.001558	0.001907	0.519	0.606
t-34	-0.00146	0.000448	-0.623	0.536
t-33	0.003089	0.003537	1.159	0.251
t-32	-0.00509	-0.00155	-1.707	0.093
t-31	-0.00201	-0.00357	-0.908	0.368
t-30	0.000962	-0.0026	0.439	0.662
t-29	0.001538	-0.00106	0.465	0.643
t-28	0.003213	0.002148	1.573	0.121
t-27	0.004469	0.006618	1.349	0.183
t-26	-0.00045	0.006169	-0.205	0.838
t-25	0.002957	0.009126	1.247	0.217
t-24	0.005418	0.014544	2.014	0.049
t-23	0.00294	0.017485	1.261	0.212
t-22	0.002988	0.020473	1.758	0.084
t-21	0.002226	0.022698	1.236	0.221
t-20	-0.00077	0.021927	-0.465	0.644
t-19	-0.00398	0.017944	-0.951	0.345
t-18	-0.00092	0.017025	-0.466	0.643
t-17	0.000179	0.017204	0.065	0.948
t-16	-0.00027	0.016932	-0.173	0.863
t-15	-0.00079	0.016145	-0.34	0.735
t-14	-0.00031	0.015831	-0.174	0.863
t-13	0.0001	0.015931	0.041	0.967
t-12	0.001925	0.017856	0.758	0.452
t-11	0.003514	0.02137	1.78	0.08
t-10	0.006547	0.027917	2.473	0.016
t-9	-0.00067	0.027244	-0.176	0.861
t-8	0.008055	0.035299	2.903	0.005
t-7	-0.00183	0.033467	-0.742	0.461
t-6	0.001189	0.034656	0.46	0.647
t-5	0.004155	0.038811	1.671	0.1
t-4	0.001458	0.040269	0.468	0.642
t-3	0.002125	0.042394	1.085	0.282
t-2	0.002053	0.044447	0.8	0.427
t-1	0.003672	0.048119	1.544	0.128
t0	0.004988	0.053107	2.347	0.022
t+1	0.000261	0.053368	0.102	0.919
t+2	0.002043	0.055411	0.981	0.33
t+3	-0.00379	0.051617	-1.542	0.128
t+4	-0.00099	0.050629	-0.423	0.674
t+5	-0.00178	0.048847	-0.704	0.484
t+6	0.002829	0.051676	0.968	0.337
t+7	0.000293	0.051969	0.086	0.932

t+8	-0.00255	0.049423	-0.654	0.516
t+9	0.005359	0.054783	1.164	0.249
t+10	-0.00278	0.051998	-1.143	0.258
t+11	-0.00242	0.049578	-0.805	0.424
t+12	-0.00816	0.041417	-2.21	0.031
t+13	-0.01354	0.027876	-2.239	0.029
t+14	-0.00617	0.021708	-1.88	0.065
t+15	0.00249	0.024198	0.655	0.515
t+16	-0.01105	0.013147	-2.807	0.007
t+17	-0.00566	0.007489	-1.968	0.054
t+18	-0.001	0.006486	-0.204	0.839
t+19	-0.00079	0.005697	-0.274	0.785
t+20	-0.00056	0.005135	-0.306	0.761
t+21	0.001128	0.006264	0.325	0.747
t+22	0.002192	0.008456	0.651	0.518
t+23	-0.00493	0.00353	-1.71	0.093
t+24	0.000637	0.004167	0.332	0.741
t+25	-0.00161	0.002557	-0.41	0.683
t+26	0.001165	0.003722	0.382	0.703
t+27	0.000634	0.004356	0.173	0.863
t+28	-0.00408	0.000272	-0.752	0.455
t+29	0.003897	0.004169	1.064	0.292
t+30	-0.00224	0.001932	-0.598	0.552
t+31	-0.00097	0.000959	-0.314	0.755
t+32	7.29E-05	0.001032	0.024	0.981
t+33	0.002832	0.003864	0.759	0.451
t+34	-0.00217	0.001696	-1.046	0.3
t+35	-0.00177	-7.5E-05	-0.778	0.439
t+36	-0.00185	-0.00192	-0.579	0.565
t+37	0.00402	0.002095	1.035	0.305
t+38	0.000987	0.003082	0.287	0.775
t+39	-0.00251	0.000573	-0.717	0.476
t+40	-0.00065	-7.6E-05	-0.253	0.801

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### RESEARCH ARTICLE

## KISSING NEVUS WITH OCULAR MELANOSIS: A CASE REPORT IN HAIL REGION, SAUDI ARABIA.

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### Manuscript Info

### Abstract

### Manuscript History

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### Introduction:-

Kissing nevus (also known as "congenital melanosis bulbi" or "nevus fuscoceruleus ophthalmomaxillaris") is a congenital nevus that affects parts of the upper and lower eyelid and owing to its name, because when the eyelids during closure approach and touch (kiss) each other [1]. The entire eye as conjunctiva, sclera, cornea, retina and optic disc could be involved in this disease. The malignant transformation was described in many cases especially in oral, uveal and leptomeningeal melanosis[2][3]. Unilateral presentation is classically seen in most cases. It is very frequent in Japanese descent and rarely in others descents [4]. This is the first report in northern region of Saudi Arabia.

### Case report:-

A 3 months old boy presented to the ophthalmology clinic in King Khalid Hospital, Hail, Saudi Arabia with a black discoloration of the left eyelids since birth, his family and medical histories were unremarkable. An Ophthalmic examination, the patient is fixing and following the objects normally, pupils equal, round and reactive to light and accommodation, Intraocular pressure is 14 mmHg on both eyes. On inspection, the left eye showed dark pigmentation covering the lateral third of left upper and lower lids, along with dark scleral pigmentation [Figure 1].



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**Figure. 1:-**The iris is normal in both eyes. Dilated fundus examination showed dark choroid in left eye. The cycloplegic refraction is not significant bilaterally. The patient is given follow up every 6 months for possible complication.

### Result and discussion:-

Congenital nevus occurs in about 1% of all newborns [11]. It is more common in asian population comparing to other ethnic groups. The nevus of Ota occurs due to migration of melanocytes during the fusion of upper and lower eyelids before splitting of both eye lids, then after the separation of upper and lower eye lids the touch (kiss) each other during eye closure giving us “kissing” or split nevus [12].

Mostly it is a benign unilateral melanocytosis, also 80% of the patients were females [5] and 48% of patients developed a nevus of Ota at or after birth compared to 11% between 1 and 10 years of age and 36% at puberty [6]. In our patient who is 3 months old, came with unilateral black discoloration of upper and lower eyelids, the sclera discoloration and dark choroid on fundoscopic examination furthermore the vision and ocular function was intact. In Caucasian decent there is an association between ota nevus and uveal melanoma well documented. It is valued of 1 in 400 patients with ota nevus they will developed uveal melanoma later in their life, comparison to one of 13,000 in the general population [7]. It is thought that in fair skin patients the prevalence of melanomas is higher due to lacking of the protective effect of darker pigmentation [8]. Even though the glaucoma is frequently associated with ota nevus in Black descent but we should consider it [9][10]. For that they need at least 6 months follow up to predict any of this well known complications.

### Conclusion:-

To our knowledge it is the first report in Northern Region of Saudi Arabia, which highlight the attention of this rare disease in our area. We recommend lifelong follow up (every 6 months) of diagnosed cases of ota nevus to catch any melanoma changes or development of glaucoma.

### References:-

1. McDonnell PJ, Mayou BJ. Congenital divided naevus of the eyelids. *Br J Ophthalmol* 1988;72:198-201.
2. M. Balmaceda, M. R. Fetell, J. L. O'Brien, and E. H. Housepian, “Nevus of Ota and leptomeningeal melanocytic lesions,” *Neurology*, vol. 43, no. 2, pp. 381–386, 1993.
3. V. Rahimi-Movaghar and M. Karimi, “Meningeal melanocytoma of the brain and oculodermal melanocytosis (nevus of Ota): case report and literature review,” *Surgical Neurology*, vol. 59, no. 3, pp. 200–210, 2003.
4. H. Tanino, Naevus fusco-caeruleus ophthalmomaxillaris (Ota), *Jpn. J. Dermatol.*, 46 (1939), pp. 107–111
5. A.W. Kopf, Al. Weidman, **Nevus of Ota**, *Arch. Dermatol.*, 85 (1962), pp. 195–208
6. Hidano, H. Kajima, S. Ikeda, H. Mizutani, M. Niimura, **Natural history of nevus of Ota**, *Arch. Dermatol.*, 95 (1967), pp. 187–195
7. Singh AD, De Potter O, Fijal BA, Shields CL, Shields JA, Elston RC et al. Lifetime prevalence of uveal melanoma in white patients with oculodermal melanocytosis. *Ophthalmology* 1998; 105: 195–198.
8. Harbour JW, Brantley MA, Hollingsworth H, Gordon M. Association between choroidal pigmentation and posterior uveal melanoma in a white population. *Br J Ophthalmol* 2004; 88: 39–43.
9. Liu JC, Ball SF. Nevus of Ota with glaucoma: report of three cases. *Ann Ophthalmol.* 1991;23(8):286-9.
10. Tanino H. Über eine in Japan häufig vorkommende Naevusform: “Naevus fusco-caeruleus ophthalmomaxillaris Ota”, I. Mitteilung: Beobachtung über Lokalisation, Verfärbung, Anordnung und histologische Veränderung *Jpn J Dermatol.* 1939;46:435-51.
11. Consensus conference: Precursors to malignant melanoma. *JAMA* 1984;251:1864-6.
12. Klotz S, Penn C, Negvesky G, et al. Fungal and parasitic infections 2000;13:662–85.

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### RESEARCH ARTICLE

## CARDIOVASCULAR ABNORMALITIES IN HIV INFECTED PEDIATRIC POPULATION IN KERALA.

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#### Abstract

Cardiac abnormalities associated with HIV infection increase the risk of mortality and morbidity among patients. Literature on the prevalence of these abnormalities in HIV-infected children is negligible, particularly from India. This study was conducted to evaluate and describe the cardiac anomalies associated with HIV infection in pediatric population. This cross-sectional study was done at Pediatric HIV Clinic, Medical College, Thrissur, Kerala, for a period of one year. All 64 participants of the study underwent thorough clinical evaluation and echocardiography. Data collected was analyzed using appropriate statistical methods. The mean age of the participants was  $9.62 \pm 3.19$  years. On physical examination, the symptoms noted were pallor (26.6%), lymph node enlargement (51.6%), opportunistic infections (79.7%), and clubbing (9.4%). Pulmonary artery hypertension (9.4%) and valvular regurgitations (26.6%) were the major echocardiographic findings among the participants. No significant association was noted between history of anti-retroviral therapy (ART) and pulmonary artery hypertension (PAH;  $\chi^2=2.676$ ,  $p=0.102$ ). Cardiac anomalies were not prevalent or were not of poor prognosis in the pediatric population in this study. Most of the cardiac anomalies seem to be subclinical in children with HIV infection. Main cardiac abnormalities noted were mild pulmonary hypertension and mild valvular regurgitations. None of the patients had cardiomyopathy. No association could be found between cardiac abnormalities and ART status.

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#### Introduction:-

The estimated number of people infected by HIV, worldwide, is around 34 million, out of which 3.4 million are children below the age of 15 years (WHO, 2014). Cardiac abnormalities in these children increase the risk of mortality, even when these symptoms are in subclinical stage. Early detection is the key for successful treatment of the condition (Lipshultz *et al.*, 2000). LV diastolic dysfunction, dilated cardiomyopathy, LV hypertrophy, LV systolic dysfunction, pulmonary hypertension, and pericardial effusion are the most frequently described cardiac problems in HIV-infected adult patients (Barbaro *et al.*, 2001; Khunnawat *et al.*, 2008). Earlier studies reported a high incidence of cardiac abnormalities in children infected with HIV (Lubega *et al.*, 2005). There are very few studies dealing with cardiac anomalies in HIV-infected pediatric population from India. This study was proposed to determine the prevalence of cardiac abnormalities in HIV-infected children and to describe the different cardiac symptoms using echocardiography, ECG, and x-ray. The study also aimed at finding the association of cardiac anomalies with anti-retroviral therapy (ART) status.

## Methodology:-

This is a cross sectional descriptive study conducted at Pediatric HIV clinic, Medical College, Thrissur, Kerala, from July 2011 to June 2012. Demographic, clinical, and echocardiographic data were collected from 64 children infected by HIV who attended the clinic. The study population consisted of children less than or equal to 15 years, for whom at least one parent has given an informed consent. All patients were subjected to clinical examination and details were recorded in the prescribed proforma. Name, age, gender, and the clinical stages as per WHO classification were entered for each participant. Documents from ART center were verified for drug compliance, ART regimen, and recent CD4 count. CD4 count estimation was done for all patients by flow cytometry using a BD FACS count system.

After clinical examination all patients were subjected to the following investigations- X-ray chest, ECG and ECHO. A 12-lead scalar electrocardiogram was taken to evaluate abnormalities in rate, rhythm, chamber enlargement, conduction abnormalities and ST-T changes. X-ray chest posteroanterior view was taken to note cardiac size, enlargement of specific cardiac chambers, pulmonary edema or venous congestion, pulmonary arterial hypertension, and lung parenchymal abnormality. Review of the X-rays was done by the radiologist who was blinded to patient's identity. All patients were evaluated using M-mode transthoracic ECHO cardiography and colour-flow Doppler examination using GE VIVID 3 machines with 5 MHz probe. Parasternal long axis view and apical 4 chamber view were conducted by the cardiologist. Left atrial dimensions, left ventricular end systolic and diastolic dimensions, ejection fraction, TR gradient, presence of pulmonary artery hypertension (PAH), presence of any mass, clot or effusion, structural valvular lesions, and approximate RV pressure obtained from TR jet gradient were studied using echocardiography. LV function were classified as, normal if ejection fraction (EF) is  $>55\%$ , mild impairment if EF  $40-55\%$ , moderate impairment if EF  $30-40\%$  or severe impairment if EF is  $<30\%$ . RV pressure was calculated from TR jet gradient if there is significant TR. PAH was classified as mild if calculated RV pressure is  $35-50$  mm of Hg, moderate if RV pressure is  $50-75$ , and severe if RV pressure is more than  $75$ . Data analysis was conducted using appropriate statistical package and methods.

## Results:-

There were 64 participants in the study with a male to female ratio of 1:1.1. The mean age group (mean  $\pm$  SD) of patients in the study was  $9.62 \pm 3.19$  years. About 50% of the patients belonged to the age group of 11-15 years. Mean weight grade (mean  $\pm$  SD) of the participants was  $22.38 \pm 7.5$  kg. About 21.9% of children had grade 1 and grade 2 protein-energy malnutrition (PEM), 11 had grade 3, and 4 had grade 4 PEM. About 26.6% ( $n=17$ ) had first degree stunting, while 10 participants (15.6%) each had 2<sup>nd</sup> and 3<sup>rd</sup> degree stunting. More than 60% of the patients ( $n=39$ ) had stage 2, 20.3% had stage 1, with relatively few in advanced disease stages, including 12.5% in stage 3 and 6.3% in stage 4 disease. Out of the 64 patients, 52% ( $n=33$ ) were on ART, of which 65% were on zidovudine, lamivudine, nevirapine (ZLN) therapy. Four children (13%) in the study were in zidovudine, lamivudine, efavirenz (ZLE) therapy, while 16% ( $n=5$ ) were on stavudine, lamivudine nevirapine combination therapy.

Among the different cardiac symptoms, 4 children had class 1 dyspnea on exertion. The different clinical features at presentation are given in **Table 1**. On clinical examination, the symptoms noted were pallor (26.6%), lymph node enlargement (51.6%), opportunistic infections (79.7%), and clubbing (9.4%). On x-ray examination, the symptoms observed were RA enlargement (15.6%), apex LV (85.9%), apex RV (14.1), and dilated hilar vessels (15.6%). No LA enlargement was present in any of the participants. The symptoms observed on x-ray examination and echocardiography are given in **Table 2**. PAH (9.4%) and valvular regurgitations (26.6%) were the major echocardiographic findings among the participants. ECG examination did not reveal significant changes in any of the features like ECG rate or rhythm, enlargement of chambers, ST or T wave, and conduction. Six patients (9.4%) had mild pulmonary hypertension. No significant association was noted between history of ART and pulmonary artery hypertension (PAH;  $\chi^2=2.676$ ,  $p=0.102$ ). Retroviral therapy did not have any significant association with echocardiographic mitral regurgitation (ECHO MR;  $\chi^2=0.288$ ,  $p=0.592$ ). Echocardiographic pulmonary regurgitation was also not significantly associated with ART in the patients (ECHO PR;  $\chi^2=1.939$ ,  $p=0.164$ ).

**Table 1:-** Clinical features at presentation in patients (PEM = Protein energy malnutrition; IAP = Indian Academy of Pediatrics, ZLN = zidovudine, lamivudine, nevirapine; ZLE = zidovudine, lamivudine, efavirenz; D4 T+3Tc +NVP = stavudine, lamivudine nevirapine)

	No: of cases	Percentage
<b>WHO clinical stage</b>		
Stage I	13	20.3
Stage II	39	60.9
Stage III	8	12.5
Stage IV	4	6.3
<b>Antiretroviral therapy</b>		
None	33	51.6
ZLN	20	31.25
ZLE	4	6.25
D4 T+3Tc +NVP	5	7.81
Others	2	3.12
<b>PEM (IAP classification)</b>		
No PEM	21	32.8
Grade 1	14	21.9
Grade 2	14	21.9
Grade 3	11	17.2
Grade 4	4	6.3
<b>Height grade</b>		
No stunting	27	42.2
Ist Degree	17	26.6
2 <sup>nd</sup> Degree	10	15.6
3 <sup>rd</sup> degree	10	15.6
<b>Clinical examination</b>		
Pallor	17	26.6
Clubbing	6	9.4
Lymph node enlargement	33	51.6
Opportunistic infections	51	79.7

**Table 2:-** Symptoms in x-ray examination and echocardiography.

Feature	No: of cases	Percentage
<b>X-ray examination</b>		
RA enlargement	10	15.6
Apex LV	55	85.9
Apex RV	9	14.1
Dilated Hilar Vessels	10	15.6
<b>Echocardiographic findings</b>		
Pulmonary artery hypertension	6	9.4
Valvular regurgitations	17	26.6

**Discussion:-**

The aim of the study was to analyze and describe the major cardiac abnormalities in a population of HIV-infected children. The various cardiac manifestations were determined by x-ray, ECG, and echocardiography. Out of the 64 children with HIV infection, 43.75% had grade 1 or 2 PEM. Analysis of symptoms that could result from cardiac anomalies showed that four participants had tachypnea and dyspnea on exertion. Out of these, one had underlying respiratory problem, while three had anemia. But there were no other symptoms suggestive of cardiac failure. Other studies have reported dyspnea, cough and tachycardia as prevalent clinical signs in pediatric patients with HIV infection (Cheloet *et al.*, 2015).

Radiological review of all the patients for significant symptoms revealed 10 cases suggestive of right atrial enlargement by criteria, and 9 cases of right ventricular type of apex. None of the participants had features of pulmonary venous congestion, pulmonary edema, or pulmonary hypertension. Moreover, there were no symptoms of cardiomegaly in any of the cases in the study. ECG abnormalities were also nil in all the cases, with evidence of chamber enlargement or ST-T changes totally lacking.

Pulmonary hypertension is one of the most frequently described abnormalities in HIV-infected patients (Barbaro *et al.*, 2001; Khunnawat *et al.*, 2008). Radiological review did not reveal any cases of pulmonary hypertension, but echocardiography detected 9.4% (6 participants) as having this symptom. Our report is comforted by the fact that pulmonary hypertension was present only in 7% of the children in a more recent study conducted by Cheloet *et al.* (2015). And this is higher than 3.6% reported in Zimbabwe by Miller *et al.* (2013). This symptom is of significance as outcome of patients with right-ventricular dysfunction is related to the degree of pulmonary hypertension, varying from a mild symptomless condition to severe cardiac impairment with cor pulmonale and death (Pellicelliet *al.*, 1998). And, pulmonary hypertension found on screening echocardiography or right-heart catheterisation warrants an aggressive investigation for treatable pulmonary infections. Of the total of 6 children with pulmonary hypertension one with 2yrs had previous history of 5mm ostium secundum atrial septal defect (ASD) at 6 months of age. Present ECHO or clinical review did not show any evidence of ASD. None others had underlying cardiac problem or chronic pulmonary problem to account for the pulmonary hypertension.

More than half of the patients (51.6%) were not on ART in this study. Majority of those on ART (31.25%) were on ART protocol containing ZLN (zidovudine, lamivudine, and nevirapine). Despite a good proportion being on this protocol, no significant association could be traced between ART and the presence of a cardiac abnormality. But, this study was cross sectional and not comparative, making it difficult to evaluate the influence of different treatment modules on cardiac anomalies. Echocardiographic studies did not reveal any case of LV dysfunction, and this does support the fact that ART containing Zidovudine has low risk for heart as mentioned in other studies (Miller *et al.*, 1993; Coodley *et al.*, 1994).

Earlier studies had reported high prevalence of LV systolic dysfunction and LV dilatation. Our study did not have any cases of these two symptoms. Study by Miller *et al.*, (1993) reported 10.9% of LV dilatation and 5% of LV systolic dysfunction. While in a Nigerian study, the prevalence of these symptoms were even higher – 33% and 33.7% of systolic dysfunction and dilated cardiomyopathy, respectively (Okoromah *et al.*, (2012). The large difference in findings could stem from the variation in the mean age of the participants in the study. In the Cohort chosen by Miller *et al.* (1993), the mean age of the participants was 15 years as against 9.2 years in our study. The Zimbabwe study also had late diagnosis and most of them were on late stages of infection at the time of diagnosis. In the Nigerian cohort, on the other hand, 83% of the children were in AIDS stage at the time of diagnosis. Thus, it is possible that prevalence of LV dysfunction increases with advanced stages of disease at the time diagnosis. Similarly in an Indian perspective, 64.2 % cases had left ventricular systolic dysfunction in a cross sectional observational study on 100 HIV infected children between 1 and 18 years of age (Singhet *et al.*, 2015). Larger sample size and advanced stage of the disease are the probable cause of the higher incidence of the symptom. Studies do show that early diagnosis and initiation of ART in HIV-infected children will reduce the incidence of anomalies of LV systolic dysfunction (Lubega *et al.*, 2005; Cheloet *et al.*, 2015).

High prevalence of LV dysfunction is reported in HIV-infected children who are malnourished. In Ugandan population of infected children, 50% were malnourished with growth retardation. This cohort showed a high prevalence of LV dysfunction (17%; Lubega *et al.*, 2005). Other studies too reported malnutrition as a worsening factor for LV abnormalities (Miller *et al.*, 1993). Malnutrition is also described as a worsening factor irrespective of ART in some of the studies. The nutritional status of the participants in the study was adequate. The incidence of

valvular regurgitations observed in the present study was high (26.6%) compared to that noted in general population, but all the cases were of trivial to mild type. This particular symptom needs follow up for a better understanding of its prevalence. Cardiomyopathy was not seen in any of the participants, although this is considered to be a prevalent cardiac abnormality in HIV-infected patients.

There was no statistically significant association between echocardiographic abnormalities and the clinical variables. One of the reasons for the difference might be earlier diagnosis of infection. Most of the participants in the study were in stage II (60.9%), when compared to the advanced stages of disease in participants of other studies (Lubega *et al.*, 2005; Singhet *et al.*, 2015). This study shows that most of the cardiac involvement is subclinical in HIV-infected children. Early diagnosis and treatment are thus the tools for reducing progression of the disease. This can prevent morbidity and mortality among the patients to a large extent.

### Conclusions:-

Cardiac anomalies were not prevalent or were not of poor prognosis in the pediatric population in this study. Most of the abnormalities seem to be subclinical in children with HIV infection. Valvular regurgitations and pulmonary hypertension were the echocardiographic findings from the study. Early diagnosis and treatment may help in reducing the incidence of cardiac abnormalities.

### References:-

1. Barbaro, G. (2002). Cardiovascular manifestations of HIV infection. *Circulation*, 106:1420-5.
2. Barbaro, G., Fisher, S, D, Lipshultz, S,E. (2001). Pathogenesis of HIV-associated cardiovascular complications. *Lancet Infect Dis*, 1:115-24.
3. Chelo, D., Wawo, E., Siaha, V, *et al.* (2015). Cardiac anomalies in a group of HIV-infected children in a pediatric hospital: an echocardiographic study in Yaounde, Cameroon. *CardiovascDiagnTher*, 5(6):444-53.
4. Coodley, G, O., Loveless, M, O., Merrill, T, M. (1994). The HIV wasting syndrome: a review. *J Acquir Immune Defic Syndr*, 7:681-94.
5. Khunnawat, C., Mukerji, S., Havlichek, D, Jr., *et al.* (2008). Cardiovascular manifestations in human immunodeficiency virus-infected patients. *Am J Cardiol*, 102:635-42.
6. Lipshultz, S,E., Easley, K,A., Orav, E,J., *et al.* (2000). Cardiac dysfunction and mortality in HIV-infected children: The Prospective P2C2 HIV Multicenter Study. *Pediatric Pulmonary and Cardiac Complications of Vertically Transmitted HIV Infection (P2C2 HIV) Study Group. Circulation*, 102:1542-8.
7. Lubega, S., Zirembuzi, G,W., Lwabi, P. (2005). Heart disease among children with HIV/AIDS attending the paediatric infectious disease clinic at Mulago Hospital. *Afr Health Sci*, 5:219-26.
8. Miller, R,F., Kaski, J,P., Hakim, J., *et al.* (2013). Cardiac disease in adolescents with delayed diagnosis of vertically acquired HIV infection. *Clin Infect Dis*, 56:576-82.
9. Miller, T,L., Evans, S, J., Orav, E, J., *et al.* (1993). Growth and body composition in children infected with the human immunodeficiency virus-1. *Am J ClinNutr*, 57:588-92.
10. Miller, T,L., Orav, E,J., Colan, S,D., *et al.* (1997). Nutritional status and cardiac mass and function in children infected with the human immunodeficiency virus. *Am J ClinNutr*, 66:660-4.
11. Okoromah, C,A., Ojo, O,O., Ogunkunle, O,O. (2012). Cardiovascular dysfunction in HIV-infected children in a sub-Saharan African country: comparative cross-sectional observational study. *J Trop Pediatr*, 58:3-11.
12. Pellicelli, A,M., Palmierim F., D'Ambrosio, C., *et al.* (1998). Role of human immunodeficiency virus in primary pulmonary hypertension: case reports. *Angiology*, 49: 1005–11.
13. Singh, P., Hemal, A., Agarwal, S., *et al.* (2015). Cardiac manifestations in HIV infected children. *Indian J Pediatr*, 82:230-4.
14. World Health Organization. Global HIV/AIDS Response, Epidemic update and health sector progress towards Universal Access, progress report 2011. Available online: [who.int/iris/bitstream/10665/44787/1/9789241502986\\_eng.pdf](http://who.int/iris/bitstream/10665/44787/1/9789241502986_eng.pdf)

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### RESEARCH ARTICLE

## ASPARTATE AMINOTRANSFERASE TO PLATELET RATIO INDEX VERSUS NEUTROPHIL TO LYMPHOCYTE RATIO FOR PREDICTION OF POST RADIOFREQUENCY ABLATION RECURRENCE OF HEPATOCELLULAR CARCINOMA.

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### Abstract

**Background & Aims:** Tumor recurrence after curative radiofrequency ablation (RFA) of hepatocellular carcinoma (HCC) is common. The burden of frequent post-ablation investigations especially triphasic computerized tomography (TCT) is high. We investigated whether post ablation measurement of aspartate aminotransferase to platelet ratio index (APRI) and neutrophil to lymphocyte ratio (NLR) as simple and cheap biomarkers can precisely predict HCC recurrence and which of them is more valuable.

**Methods:** In this retrospective study, the demographic, clinical, laboratory and imaging data of 42 HCC patients treated with RFA were statistically analyzed. Patients were classified into two groups; those with HCC recurrence (group I) and those without (group II). In order to test the value of baseline NLR versus that of APRI in predicting tumor recurrence and compare both to alfa fetoprotein (AFP), we used receiver operating curve (ROC) statistics.

**Results:** Mean values of AST, Platelets count, APRI, NLR and AFP showed significant correlation with HCC recurrence. Using logistic regression analysis, NLR was the only independent risk factor predicting HCC recurrence. NLR had the highest sensitivity and specificity for prediction of HCC recurrence (90.9 % and 85%) followed by that of AFP (86.4 % and 75%), and lastly by that of APRI (72.7% and 70%).

**Conclusion:** NLR is a promising, simple and cheap surrogate marker for prediction of HCC recurrence after radiofrequency ablation, and is far more significant than APRI.

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### Introduction:-

Hepatocellular carcinoma (HCC) is the fifth most common cancer worldwide (1). HCC is a primary malignancy of the liver and occurs predominantly in patients with underlying chronic liver disease and cirrhosis (2). The incidence of HCC is highest in Asia and Africa, where the endemic high prevalence of hepatitis B (HBV) and hepatitis C (HCV) strongly predisposes to the development of chronic liver disease and subsequent development of HCC (3). Radiofrequency ablation (RFA) became a main modality of loco-regional therapy for HCC, because of its

effectiveness and safety for small HCC (<5.0 cm), with a 3-year survival rate of 62–77%, a low treatment complication rate of 8–9%, and a low treatment mortality rate of 0–0.5% (4-6).

A number of factors, such as number and size of tumor nodules, increased levels of serum tumor markers, hepatitis C virus (HCV), HBV infections, diabetes mellitus and hyperglycemia, were reported to be related to HCC recurrence after RFA (7,8).

Despite the established role of alfa fetoprotein (AFP) in HCC diagnosis, it is of low significant value in prediction of HCC recurrence (9,10).

Aspartate aminotransferase (AST)-to-platelet ratio index (APRI) is a simple and feasible test validated in assessing the stage of fibrosis and in predicting prognosis for patients with chronic hepatitis (11,12). APRI shows reliable discriminative ability for predicting not only overall survival of HCC patients, but also tumor recurrence (13). APRI was also found to be a prognostic biomarker in small HCC patients after RFA therapy and surgical resection (14,15).

Some studies demonstrated that background liver inflammation and fibrosis play important roles both in the process of hepatocarcinogenesis and in recurrence after resection surgery (16,17). Moreover, there are increasing evidences that the presence of systemic inflammation correlates with poorer cancer-specific survival in certain cancers (18-20). Various markers of systemic inflammatory response, including cytokines, C-reactive protein (CRP), and absolute blood neutrophil or lymphocyte count as well as their ratio such as neutrophil-to-lymphocyte ratio (NLR) have been investigated for their prognostic roles in certain cancer populations (21,22). Patients with elevated NLR have a relative lymphocytopenia and neutrophilic leucocytosis which denote that the balance is tipped in favor of protumor inflammatory response and is associated with poor oncologic outcome (23). Significant elevation of NLR increases the risk of HCC recurrence and recipient death in patients undergoing transplantation for HCC (24). Several studies indicate that serum AFP level, AST level, AST-to-alanine aminotransferase (ALT) ratio, APRI and NLR have been associated with HCC recurrence and poor survival (11,12,25-27).

We conducted this study to compare the value of NLR and APRI for prediction of post RFA recurrence of HCC.

### **Patients and Methods:-**

This retrospective study had been carried out in Internal Medicine Department, Gastroenterology Unit, Faculty of Medicine, Zagazig University, from Aug. 2014 to Aug. 2016. All procedures performed were in accordance with the ethical standards of the institutional research committee and with the Helsinki Declaration and its later amendments.

**Inclusion criteria :** Patients with single focal lesion  $\leq 5$  cm or up to three lesions each  $\leq 3$  cm of HCC who received curative RFA.

**Exclusion criteria** included portal vein thrombosis, extra hepatic metastasis, class C liver cirrhosis (according to Child-Turcotte-Pugh score) (28,29). Also, we excluded patients with hematological disorders, active infection, heart failure, renal impairment (serum creatinine  $> 1.5$  mg/dl), pregnancy or history of drug abuse or ongoing chemotherapy intake and those who lost follow up.

Out of 50 HCC patients who underwent curative RFA, 42 patients who met our inclusion and exclusion criteria were selected and enrolled in the study. The studied 42 patients were divided into two groups; group I (recurrence group) including 22 patients with post-ablation recurrence of HCC, and group II (recurrence free group) including 20 patients without recurrence. Diagnosis of recurrence was made by radiologic evidence using triphasic CT (TCT).

All studied patients underwent baseline (one month after curative RFA) clinical examination, imaging studies including chest x ray, pelviabdominal ultrasonography and TCT, as well as laboratory investigations including complete blood count (CBC), liver function tests, kidney function tests, coagulation profile and serum AFP level, in addition to calculation of APRI and NLR. All participants were subjected to follow up reevaluation of AFP, APRI and NLR every 3 months for 2 years. And TCT every 6-12 months.

### **Statistical Analysis:-**

The quantitative variables were expressed as means  $\pm$  standard deviation (SD) and the categorical variables as count numbers and proportions. Statistical analysis was performed with SPSS package version 19 (SPSS Inc., Chicago, IL) using the suitable test e.g. ANOVA, chi square, Pearson's correlation and logistic regression analysis. The result was



considered significant if the  $P \leq 0.05$ . In order to test the predictive accuracy (sensitivity and specificity) of various markers in predicting tumor recurrence, we used receiver operating curve (ROC) statistics.

### Results:-

Table (1) showed comparison between group I and group II regarding demographic, clinical and laboratory parameters. There were significant differences between the two groups regarding the investigated tumor markers; APRI, NLR and AFP. HCC recurrence showed a significant positive correlation with each of AST, APRI, NLR and AFP, and a significant negative correlation with platelets count (table 2).

Using logistic regression analysis model, high NLR was the independent risk factor ( $p= 0.002$ ) for prediction of HCC recurrence (table 3). In order to test the predicting accuracy (sensitivity and specificity) of NLR in predicting tumor recurrence as compared to APRI and AFP, we used ROC curve statistics (table 4). NLR had the highest sensitivity and specificity (90.9 % and 85%) followed by AFP (86.4 % and 75%), and lastly by APRI (72.7% and 70%) (table 4, fig.1, fig. 2, fig. 3).

**Table 1:-** Demographic, clinical and laboratory parameters of all participants.

Parameters	All patients (n=42)	Group I (n=22)	Group II (n=20)	P
Age (mean±SD, years)	60.24 ± 10.30	58.14 ± 9.61	62.55 ± 10.78	NS
Male Gender (n, %)	26, 61.90	15, 68.20	11 ± 55.00	NS
Lesion(s) number (mean±SD)	1.29 ± 0.64	1.32 ± 0.72	1.25 ± 0.55	NS
Lesion(s) size (mean±SD, cm)	3.25 ± 1.19	3.38±1.19	3.12 ± 1.05	NS
<b>Possible HCC etiology</b>				
HCV infection (n, %)	30, 71.40	17, 77.30	13± 65.00	NS
HBV infection (n, %)	10, 23.80	5, 22.70	5 ± 25.00	NS
Non-viral (n, %)	4, 9.50	2, 9.10	2 ± 10.00	NS
Cirrhosis (n, %)	39, 92.90	20. 90.90	19 ± 95.00	NS
<b>Child's Class</b>				
A (n, %)	35, 83.30	19, 86.40	16 ± 80.00	NS
B (n, %)	7, 16.70	3, 13.40	4 ± 20.00	NS
Antiviral therapy (n, %)	15, 35.70	7, 31.80	8 ± 20.00	NS
AST (mean±SD, IU)	1.66 ± 0.72	1.86 ± 0.80	1.43 ± 0.56	NS
Platelet count (mean±SD, $\times 10^9/L$ )	112.79 ± 64.59	95.27± 45.34	132.05±77.36	NS
APRI (mean±SD)	1.82 ± 0.98	2.12 ± 0.74	1.49 ± 1.12	0.036
NLR (mean±SD)	1.78 ± 0.97	2.37 ± 0.82	1.13 ± 0.67	<0.001
AFP (mean±SD, ng/ml)	3818 ± 6053	6107 ± 6655	1300 ± 4168	0.008

NS: non significant.

**Table 2:-** Correlation between different clinicopathologic parameters and tumor recurrence.

Parameter	r	P
Age	- 0.217	NS
Sex	0.136	NS
Lesion(s) number	0.054	NS
Lesion(s) size	0.118	NS
HCC etiology	- 0.031	NS
Cirrhosis	- 0.079	NS
Child's Class	- 0.085	NS
Antiviral therapy	- 0.085	NS
AST	0.299	0.027
Platelet count	- 0.288	0.032
APRI	0.325	0.018
NLR	0.648	<0.001
AFP	0.401	0.004

NS: non significant.

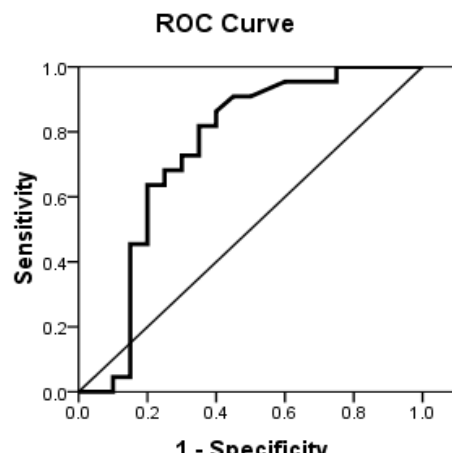
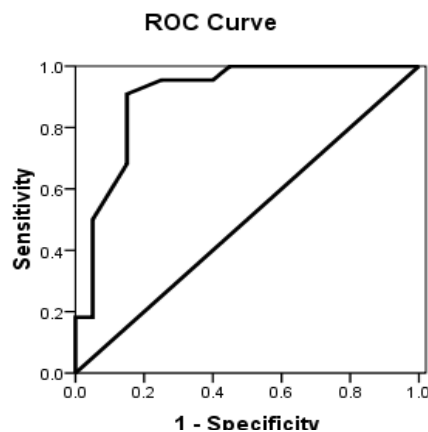
**Table 3:-** Independent risk factor(s) predicting tumor recurrence using logistic regression analysis.

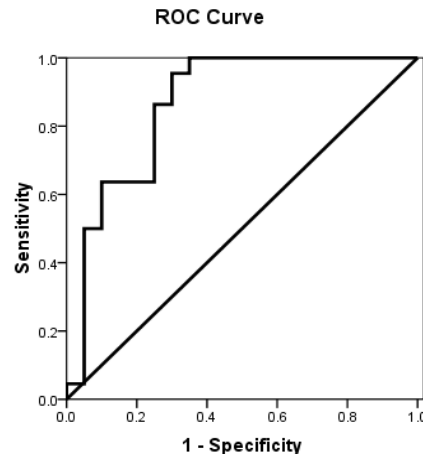
Predicting factor	P	95% Confidence Interval for B	
		Lower bound	Upper bound
AST	NS	- 0.125	0.524
Platelet count	NS	- 0.007	0.002
APRI	NS	- 0.499	0.060
NLR	0.002	0.121	0.519
AFP	NS	0.000	0.000

NS: non significant.

**Table 4:-** Comparison between sensitivity and specificity of APRI, NLR and AFP in predicting tumor recurrence using ROC curve statistics

Predictor	Cut-off value	Area under the curve (AUC)	95.0% Confidence Interval (CI)		P	Sensitivity	Specificity
			Lower bound	Upper bound			
APRI	1.66	0.744	0.581	0.907	0.007	72.7 %	70.0 %
NLR	1.55	0.903	0.801	1.000	< 0.001	90.9 %	85.0 %
AFP (ng/ml)	210	0.864	0.745	0.982	< 0.001	86.4 %	75.0 %

**Figure 1:-** ROC Curve for APRI sensitivity and specificity in predicting tumor recurrence**Figure 2:-** ROC Curve for NLR sensitivity and specificity in predicting tumor recurrence



**Figure 3:-** ROC Curve for AFP sensitivity and specificity in predicting tumor recurrence

### Discussion:-

The burden of HCC has been increasing in Egypt with a doubling in the incidence rate in the past 10 years (30). Several studies investigated predictors for prognosis and survival for patients of HCC after RFA but only few studies investigated the predictors of tumor recurrence after radiofrequency (31,32).

This study was conducted for evaluation of the postoperative NLR and APRI as predictors of post RFA recurrence of HCC. Both markers were compared together and to AFP. The mean values of the investigated markers (APRI, NLR and AFP) were significantly higher in the recurrence group than in the recurrence free group ( $2.12 \pm 0.74$  versus  $1.49 \pm 1.12$ ,  $P=0.036$ ;  $2.37 \pm 0.82$  versus  $1.13 \pm 0.67$ ,  $P<0.001$  and  $6107 \pm 6655$  versus  $1300 \pm 4168$ ,  $P=0.008$ , respectively).

In the current study, five parameters (AST, PLT, APRI, NLR and AFP) showed significant correlation with HCC recurrence ( $P$  values were: 0.027, 0.032, 0.018,  $<0.001$  and 0.004, respectively).

In this study, APRI showed a significant positive correlation to HCC recurrence ( $r = 0.325$ ,  $P = 0.018$ ). Similarly, APRI was validated in several previous studies as a simple, noninvasive way to assess the degree of liver fibrosis in patients with chronic hepatitis B or C and also had a reliable discriminative ability for predicting overall survival and HCC recurrence (14,33,34).

In our study, NLR showed a highly significant positive correlation to HCC recurrence ( $r = 0.648$ ,  $P < 0.001$ ). By using logistic regression analysis model, the only independent risk factor for prediction of tumor recurrence among the above five parameters was NLR ( $P=0.002$ ).

It is widely accepted that inflammatory process plays a significant role in several stages of tumor development and progression. The tumor increases the inflammatory process, which in turn predisposes to tumor progression, via inhibition of apoptosis and promotion of angiogenesis (21,22). Wu and colleagues reported that hepatic inflammatory activity was associated with early HCC recurrence (16).

NLR, a biomarker of tumor inflammation and host immunity, was associated with increased mortality in cancer (35). In agreement with the results of our study Chen et al. (36), Dan et al. (37) and Tajiriet al. (38) reported that high postoperative NLR is associated with high recurrence rate of HCC after RFA.

The association between the high level of NLR and the increased numbers of HCC recurrence in our study and in previous studies may be attributed to the fact that host's immune response to tumors depends on lymphocytes, whereas patients with a large NLR have relative lymphocytopenia, which results in the attenuation of lymphocyte-mediated antitumor immune responses in these patients (36). Another explanation is that the patients with a large NLR usually have an enhanced neutrophil response, which could promote the production of pro-angiogenic factors,

including vascular endothelial growth factor, interleukin-8, and matrix metalloproteinase. These pro-angiogenic factors may promote tumor growth and recurrence (39).

The comparison between sensitivity and specificity of APRI, NLR and AFP in predicting tumor recurrence, in our study, using ROC curve statistics revealed that NLR attained the highest level of sensitivity and specificity (90.9 % and 85%) with Cut-off value (1.55) compared to AFP (86.4 % and 75%) and APRI (72.7% and 70%).

In contrary to our results, in their study on 98 post RFA HCC patients, *Chung et al.* (40) reported that APRI was significantly higher in the recurrence group than in the recurrence free group ( $2.3 \pm 1.8$  vs.  $1.3 \pm 1.4$ ,  $P=0.018$ ), while there was no significant difference between the two studied groups regarding NLR. The difference between our results and that of *Chung et al.* may be attributed to the different etiologic background of HCC as in our current study the main etiology of HCC was chronic HCV infection (77.3%) while in study of *Chung et al.*, the main etiology was chronic HBV infection (55.6%).

### Conclusion:-

From the aforementioned findings, we can speculate that NLR is more valuable than APRI in predicting HCC recurrence after RFA. NLR is a promising surrogate marker in predicting post RFA HCC recurrence. Further studies are needed to validate the clinical relevance of NLR in follow up of HCC patients.

### References:-

1. Llovet JM, Burroughs A, Bruix J. Hepatocellular carcinoma. *Lancet* 2003; 362(9399): 1907-1917.
2. Alison MR. Liver stem cells: Implications for hepatocarcinogenesis. *Stem Cell Rev.* 2005; 1(3):253-60.
3. Llovet JM, Fuster J, Bruix J. The Barcelona approach: diagnosis, staging, and treatment of hepatocellular carcinoma. *Liver Transpl.* 2004; 10(Suppl 1):S115-20.
4. Mulier S, Mulier P, Ni Y, et al. Complications of radiofrequency coagulation of liver tumours. *Br J Surg* 2002; 89: 1206–1222.
5. Lau WY, Leung TW, Yu SC, Ho SK. Percutaneous local ablative therapy for hepatocellular carcinoma: a review and look into the future. *Ann Surg* 2003; 237:171–179.
6. Chen MS, Li JQ, Zheng Y, et al. A prospective and randomized trial comparing percutaneous local ablative therapy and partial hepatectomy for small hepatocellular carcinoma. *Ann Surg* 2006; 243: 321–328.
7. Shiina S, Tateishi R, Arano T, et al. Radiofrequency ablation for hepatocellular carcinoma: 10-year outcome and prognostic factors. *Am.J. Gastroenterol.* 2012; 107: 569–77; quiz 78.
8. Hosokawa T, Kurosaki M, Tsuchiya K, et al. Hyperglycemia is a significant prognostic factor of hepatocellular carcinoma after curative therapy. *World J. Gastroenterol.* 2013; 19: 249–57.
9. Yang X, Zhang Y, Zhang L, et al. Silencing alpha fetoprotein expression induces growth arrest and apoptosis in human hepatocellular cancer cell. *Cancer Lett* 2008; 271:281–293.
10. Arrieta O, Cacho B, Morales-Espinosa D, et al. The progressive elevation of alpha fetoprotein for the diagnosis of hepatocellular carcinoma in patients with liver cirrhosis. *BMC Cancer* 2007; 8:28.
11. Nunes D, Fleming C, Offner G, et al. Non invasive markers of liver fibrosis are highly predictive of liver-related death in a cohort of HCV-infected individuals with and without HIV infection. *Am J Gastroenterol.* 2010; 105:1346–1353.
12. Su CW, Chan CC, Hung HH, et al. Predictive value of aspartate aminotransferase to alanine aminotransferase ratio for hepatic fibrosis and clinical adverse outcomes in patients with primary biliary cirrhosis. *J Clin Gastroenterol* 2009; 43:876–883.
13. Wei-Yu Kao, Yi-You Chiou, Hung-Hsu H, et al. Risk factors for long-term prognosis in hepatocellular carcinoma after radiofrequency ablation therapy: the clinical implication of aspartate aminotransferase–platelet ratio index. *European Journal of Gastroenterology & Hepatology* 2011; 23:528–536.
14. Shen S-L, Fu S-J, Chen B, et al. Preoperative aspartate aminotransferase to platelet ratio is an independent prognostic factor for hepatitis B-induced hepatocellular carcinoma after hepatic resection. *Ann Surg Oncol.* 2014; 21(12):3802–9.
15. Kao W-Y, Chiou Y-Y, Hung H-H, et al. Risk factors for long-term prognosis in hepatocellular carcinoma after radiofrequency ablation therapy: the clinical implication of aspartate aminotransferase–platelet ratio index. *Eur J Gastroenterol Hepatol.* 2011; 23(6):528–36.
16. Wu JC, Huang YH, Chau GY, et al. Risk factors for early and late recurrence in hepatitis B-related hepatocellular carcinoma. *J Hepatol* 2009; 51:890–897.

17. Hung HH, Su CW, Lai CR, et al. Fibrosis and AST to platelet ratio index predict post-operative prognosis for solitary small hepatitis B related hepatocellular carcinoma. *Hepatol. Int.* 2010;4:691–699.
18. Jung MR, Park YK, Jeong O, et al. Elevated preoperative neutrophil to lymphocyte ratio predicts poor survival following resection in late stage gastric cancer. *J. Surg. Oncol.* 2011;104: 504–510.
19. Zahorec R. Ratio of neutrophil to lymphocyte counts—rapid and simple parameter of systemic inflammation and stress in critically ill. *Bratisl Lek Listy* 2001;102:5–14.
20. Thavaramara T, Phaloprakarn C, Tangjitgamol S, Manusirivithaya S. Role of neutrophil to lymphocyte ratio as a prognostic indicator for epithelial ovarian cancer. *J Med Assoc Thai* 2011; 94: 871–877.
21. Oh BS, Jang JW, Kwon JH, et al. Prognostic value of C-reactive protein and neutrophil-to-lymphocyte ratio in patients with hepatocellular carcinoma. *BMC Cancer* 2013; 13: 78.
22. Morris-Stiff G, Gomez D, Prasad KR. C-reactive protein in liver cancer surgery. *Eur J Surg Oncol* 2008; 34: 727-729.
23. Hashimoto K, Ikeda Y, Korenaga D, et al. The impact of preoperative serum C-reactive protein on the prognosis of patients with hepatocellular carcinoma. *Cancer* 2005; 103: 1856-1864.
24. Halazun KJ, Hardy M, Rana A. Negative impact of neutrophil lymphocyte ratio on outcome after liver transplantation for hepato-cellular carcinoma. *Ann Surg* 2009; 250: 141- 51.
25. Ng KK, Poon RT, Lo CM, et al. Analysis of recurrence pattern and its influence on survival outcome after radiofrequency ablation of hepatocellular carcinoma. *J Gastrointest Surg* 2008; 12:183–191.
26. N’Kontchou G, Mahamoudi A, Aout M, et al. Radiofrequency ablation of hepatocellular carcinoma: long-term results and prognostic factors in 235 Western patients with cirrhosis. *Hepatology* 2009; 50:1475–1483.
27. Tsai MC, Wang JH, Hung CH, et al. Favorable alpha-fetoprotein decrease as a prognostic surrogate in patients with hepatocellular carcinoma after radiofrequency ablation. *J Gastroenterol Hepatol* 2010; 25:605–612.
28. Durand F, Valla D. Assessment of the prognosis of cirrhosis: Child-Pugh versus MELD. *J Hepatol* 2005;42(suppl):S100-S107.
29. Pugh RN, Murray-Lyon IM, Dawson JL, Pietroni MC. Transection of the oesophagus for bleeding oesophageal varices. *Br J Surg* 1973;60:646-649.
30. Gomaa AI, Khan SA, Toledano MB, et al. Hepatocellular carcinoma: Epidemiology, risk factors and pathogenesis. *World J Gastroenterol* 2008; 14(27): 4300-4308.
31. El-Serag HB, Rudolph KL. Hepatocellular carcinoma: epidemiology and molecular carcinogenesis. *Gastroenterology*. 2007;132(7):2557–76.
32. Ji F, Fu SJ, Shen SL, et al. The prognostic value of combined TGF- $\beta$ 1 and ELF in hepatocellular carcinoma. *BMC Cancer* 2015;15(1):116.
33. Ma J, Jiang Y, Gong G. Evaluation of seven noninvasive models in staging liver fibrosis in patients with chronic hepatitis B virus infection. *Eur J Gastroenterol Hepatol.* 2013;25(4):428–34.
34. Boursier J, Brochard C, Bertrais S, et al. Combination of blood tests for significant fibrosis and cirrhosis improves the assessment of liver-prognosis in chronic hepatitis C. *Aliment Pharmacol Ther.* 2014;40(2):178–88.
35. Lai Q, Castro Santa E, Rico Juri JM, et al. Neutrophil and platelet-to-lymphocyte ratio as new predictors of dropout and recurrence after liver transplantation for hepatocellular cancer. *Transpl Int* 2014; 27: 32-41.
36. Chen TM, Lin CC, Huang PT, Wen CF. Neutrophil-to-lymphocyte ratio associated with mortality in early hepatocellular carcinoma patients after radiofrequency ablation. *J Gastroenterol Hepatol* 2012; 27: 553–561.
37. Dan J, Zhang Y, Peng Z, et al. Postoperative Neutrophil-to-Lymphocyte Ratio Change Predicts Survival of Patients with Small Hepatocellular Carcinoma Undergoing Radiofrequency Ablation. *PloS One* 2013;8(3):e58184.
38. Tajiri K, Baba H, Kawai K, et al. Neutrophil-to-lymphocyte ratio predicts recurrence after radiofrequency ablation in hepatitis B virus infection. *J Gastroenterol Hepatol.* 2016 Jul;31(7):1291-9
39. Fondevila C, Metges JP, Fuster J, et al. p53 and VEGF expression are independent predictors of tumour recurrence and survival following curative resection of gastric cancer. *Br J Cancer* 2004; 90: 206–215.
40. Chung HA, Kim JH, Hwang Y, et al. Non invasive fibrosis marker can predict recurrence of hepatocellular carcinoma after radiofrequency ablation. *Saudi J Gastroenterol* 2016;22:57-63.

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### RESEARCH ARTICLE

#### MULTIPLE ACTIVITY BASED BIO-BOTANICAL WATER DISPERSIBLE GRANULES FORMULATION & THEIR EFFICACY FOR PEST MANAGEMENT IN AGRICULTURE.

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WDG, Antifungal, & Nanoparticles

#### Abstract

WDG formulation containing neem oil and metallic nanoparticles were prepared and evaluated for their efficacy against different pests nematode, fungus and cotton leaf worm. Various metallic nano particle like Ag and Cu alone and in combinations were tested for their efficacy against different pest. The process parameters and composition were optimized to get more improved formulation in terms of performance & other quality parameters such as Suspending ability, Dispersibility & Particle size, which affects performance of formulation during its application. The prepared formulation was tested against different pests like fungus, nematodes and further for antifeedant activity. S3 (mixture of Cu + Ag) provides highest 42% antifeedancy, 73% mortality in nematodes, and no fungal growth even after 48hrs. The present formulation S3 shows antifungal, nematocidal and antifeedant properties all in one activities in single formulation. The present S3 WDG formulations are safe and promising alternates to minimize the risk of dustiness, contamination.

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#### Introduction:-

Pests have characteristics of damaging or harming agriculture through feeding on crops. Pests of different types either insects, fungus, nematodes infests variety of crops. These pests damage different parts of plant and are thus responsible for large loss in yield and also affect quality of crops. In order to protect crops from damage, pest management is a necessary tool. Different methods of pest control have been proposed by the investigators. For any pest control to be effective two important criteria are, improvement in quality of crop and crop protection.

To improve quality of crop, it is necessary to protect them from pests. Various synthetic pesticide formulations are used in agriculture against pests. But extensive use of these chemical pesticides has created environmental effects that are harmful to humans. These formulations are used for certain specific type of pest so user has to apply one or more different type of pesticide depending upon target pest. Because of such repetitive use of pesticide for different pests in crop protection, the problem associated with their use has become a major problem in recent years since there is issue of pesticide residue in most of the food commodities along with the soil. Pesticide residue accumulates in food, water and is toxic to human and environment (Lee et al; 2001). Harmful effects of synthetic pesticides are not limited to their toxicity alone, infact repetitive usage of pesticide has resulted in resistant pest, resistant pest are difficult to manage and required novel insecticide (Mecedo et al; 1997), which are bio botanical insecticide.

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Bio Botanical based pesticidal formulation can resolve above problem associated with synthetic pesticide since they are safe, biodegradable and non persistent in the nature.

Accordingly there is need for pesticide composition containing no chemical pesticide and possess wide range of activity in terms of pest control, which must be used against different pests. Neem oil commercially available is economical may be a safe alternative that can be used in place of synthetic pesticide. Neem itself has insecticidal, antifeedant (Shrivastava D.K. 2014) and also to some extent antifungal and nematocidal properties. The efficiency is not adequate, however neem oil has very superior antifeedant properties (Munetaka Ishida 1992). Whereas metallic nanoparticles

Having size range below 100nm are versatile agents with variety of properties (fungicidal, nematocidal) (Sahar M. Ouda 2014) because of high surface area the best part is that metallic nanoparticles used as antifungal and nematocidal agent are required in very low concentrations. i.e they are equally effective when used in small amount.

Keeping above facts in consideration, We have made efforts to develop a bio-botanical based WDG pesticide formulation with multifunctional activities like fungicidal, nematocidal, antifeedant and which will also decrease the load of pesticide in the environment by decreasing the number of sprays, replacing synthetic pesticide by bio-pesticide and at the same time to improve crop health along with enhancements of crop yield.

Water-dispersible granules (WG) are pesticide formulations that are almost free from dust and easy to handle in packing when compared to liquid formulation. They are used in a manner similar to the known water-dispersible powders (WP) (H.J. Niessen 1983). The WDG formulations are safe and promising alternative to WP formulations which have problem of dustiness, contamination and dilution.

WG formulations of pesticides are produced by different processes like Pan Granulation, Fluid-bed Spray Granulation and Extrusion (Knowles, 2008). The WDG were prepared by Extrusion process are easy to prepare also the process is industrial feasible. The formulations developed have been evaluated at laboratory scale.

## **Materials & Method:-**

### **Materials:-**

Neem oil, Silver Nitrate, Sodium borohydride and Lactose Monohydrate was obtained from Qualigens, Silica was obtained from Madhu silica pvt ltd, China Clay was obtained from IAC Minerals (Chennai, India), Wetting agent Sodium Naphthalene Sulphonate and Dispersing agent Lignin Sulphonate, Polycarboxylate were supplied by Albright & Wilson Ltd. (Mumbai, India),

### **Method:-**

#### **Preparation of Metallic Nanoparticles:-**

Metallic nano particles of silver and copper were prepared in laboratory by chemical reduction method using salts (Silver Nitrate and Copper sulphate pentahydrate) and reducing agent Sodium borohydride (Kandarp Mavani, 2013). PVP was used as capping agent for both salts. For copper nanoparticles Ascorbic acid was used as an antioxidant (LIU Qing-ming 2012). Prepared nanoparticles were characterized by Malvern Zetasizer.

#### **Preparation of WDG containing Metallic Nanoparticles and neem oil:-**

WDG was prepared by Extrusion method (D. Ian Wilson 2007) using laboratory mini screw extruder (Model-Caleva Mini Screw) fitted with screen of 1mm perforations. Neem oil and metallic nanoparticles were absorbed on silica; wetting and dispersing agents were added and mixed in mixer to get homogenous powder. Finally china clay was used as filler. Suitable amount of water was added to mixture and mixed properly with spatula. The final mixture was extruded in extruder to get granules. The extruded granules were dried in the oven. The composition of emulsion and WDG is given in Table 1



**Table 1:-** Composition of WDG.

Ingredients	% w/w
Neem oil	20
Metallic Nanoparticels (S1, S2 & S3)	5
Silica	30
Wetting Agent	5-10
Dispersing Agent	8-10
Lactose ( Dilutend)	20
China Clay (Dilutend)	q.s.
Total	100

Accordingly three samples were prepared **S1, S2 and S3**. Composition is same for all three samples only difference is **S1** contains Silver Nanoparticles, **S2** (Copper Nanoparticles) and **S3** (Copper nanoparticle + Silver Nanoparticles).

**Suspensibility Analysis:-**

Suspensibility (suspension stability) is the percent part of active ingredient suspended in a column of water after a given time period. Suspensibility of the WG formulations has significant role in the application of spray suspension. If the suspensibility is upto the mark, spray tank mixing requirement is less and homogeneity is maintained in the suspension. It ensures uniform distribution of active ingredient on the target area. The suspensibility of the samples was analyzed by method no. MT168 of CIPAC Handbook (CIPAC, 2007).

**Dispersibility Analysis:-**

Dispersibility is the percentage of active ingredient dispersed in water after stirring the suspension. The spray tank mixing requirement is minimum if the WG formulation has good dispersibility. The dispersibility is a major quality parameter of WG formulations. The dispersibility of the samples was analyzed by method no. MT174 of CIPAC Handbook (CIPAC, 2007).

**Particle Size Analysis:-**

The particle sizes of the samples were analyzed by particle size analyzer (Model- Malvern Master Sizer MS20) using distilled water as dispersant. The Suspensibility, Dispersibility & particle size shown in Table 3

**Bioefficacy Experiments:-**

The formulation developed was tested for antifungal, Nematicidal and Antifeedant activity. The formulation show remarkable activity against different types of pests.

**Antifungal Activity:-**

Antifungal activity was carried out according to food poisoning method (Siressha.O 2013) on fungus *Sclerotinia sclerotiorum* (SS). *Sclerotinia sclerotiorum* is a plant pathogenic fungus and can cause a disease called white mold. It infests wide range of vegetables. Potato dextrose Agar (PDA) was used as media. The dose was added into media. Fungus was allowed to grow on media in BOD at 25°C. The fungus growth was observed after 48h, 72h & 96h. After each time interval, fungus growth was recorded as radius of fungus growth, which is further compared with blank and control. The results are given in table 4

**Nematicidal Activity Test:-**

In vitro Nematicidal activity test was carried out on sample S1, S2 and S3. The root knot nematode *Meloidogyne graminicola* was tested on different sample concentrations. 500ul of nematode suspension containing 10 -15 nematodes count was treated with 500 ul of sample concentration. Mortality was observed after 24h, 48h and 96h. (Table 5 shows Nematodes count perml and No. of dead Nematodes at different time interval). % mortality is shown graphically in Graph 1.

**Antifeedancy Test:-**

Antifeedancy test was carried according leaf Disc no choice method (Jaipal Singh Choudhary 2014). The third instar larvae of *Spodoptera litura* was tested insect. It was allowed to feed on castor leaf. Third instar larvae of insects was starved for 24hrs. Castor leaf was properly washed with water and cut into uniform shape of equal diameter. 2% solution of WDG dispersed in distilled water was used. The different concentrations were sprayed on the leaves and



allow it to dry for 20s. Prestarved larvae were allowed to feed on treated leaf for 24h and 48h. Unconsumed area of leaf disc was recorded with leaf area meter. Larval mortality and pupal deformities was also recorded. The results are given in table 6

## Results and Discussion:-

### Suspensibility, Dispersibility and Particle size:-

The quality parameters Suspensibility, Dispersibility and Particle Size of three samples showed no remarkable difference when compared with each other. Sample S1 has highest suspensibility of 85% and Sample S3 has lowest Suspensibility 79%. Dispersibility of S1 is highest 88% and S3 has lowest 82%. The particle size corresponds to suspensibility. Higher the suspensibility lower is the particle size.

**Table 3:-** Suspensibility, Dispersibility and Particle Size of Samples

Sample Name	Suspensibility(%)	Dispersibility(%)	Particle size(microns)
S1	85	88	12
S2	82	86	10
S3	79	82	15

### Antifungal Activity:-

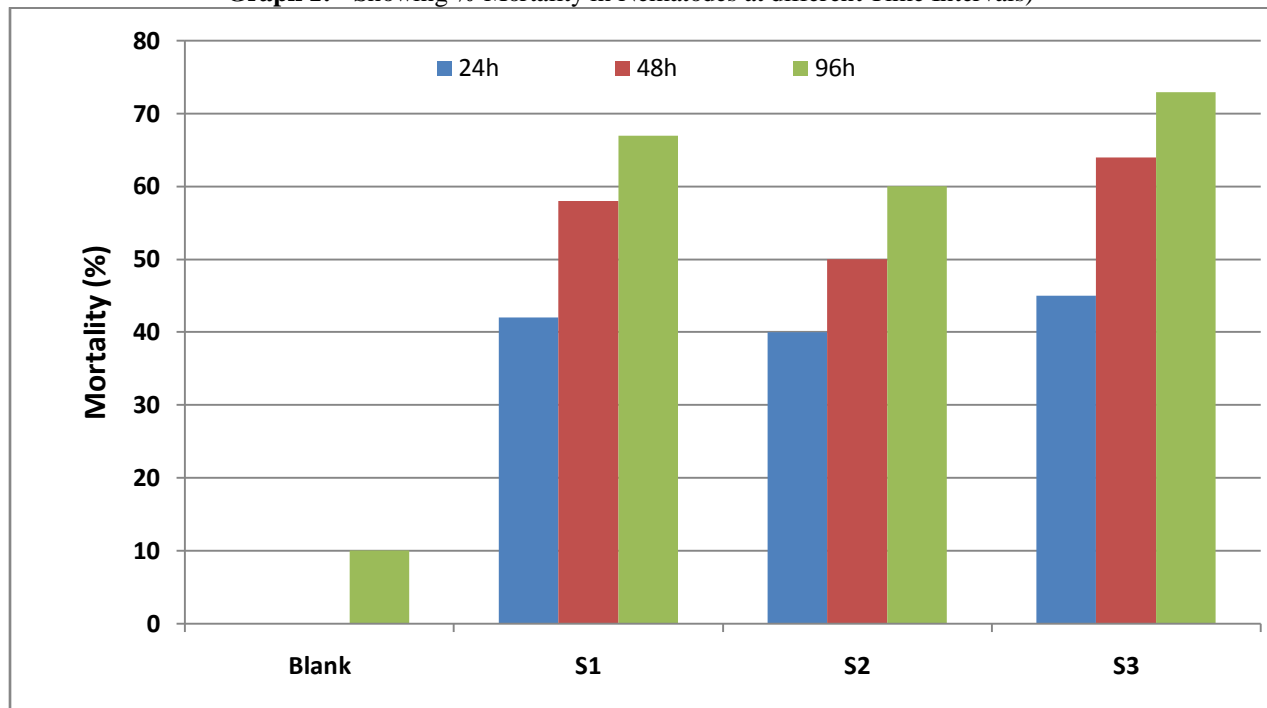
In sample S1 & S2 after 48hours growth has started, whereas no growth was observed in S3 till 96h. The blank at 48h has fungus growth of radius 4.1Cm which further reached to 8cm after 96h. Whereas in sample S1 after 96h has 4.2cm radius of fungus extended, 4.0cm in S2 and no growth in S3 compared to blank (8cm). S1 & S2 were showing almost same effect with negligible change. S3 can be considered best sample it showed no growth till 48h and even after 96h it has no fungus growth. *It can be because Sample S3 has mixture of nanoparticles suspension (Cu+Ag) which together suppressing fungal growth. Copper and silver nanoparticle both have their own antifungal properties as shown in S1&S2. when copper and silver Nanoparticle used in combination they show potential to suppress fungal growth.*

**Table 4:-** Antifungal activity in different samples

Time (hrs)	Blank	Sample(S1)	Sample(S2)	Sample(S3)
48	4.1	Growth started	Growth started	No Growth
72	6.3	3.4	3.2	Growth Started
96	8.0	4.2	4.0	0

### Nematicidal Activity:-

Nematicidal Activity of S3 was highest in 24h, 48h & 96h, Sample S1 has more mortality% as compared to S2 in 24h, 48h & 96h, whereas in blank the mortality % was only 10% in 96h and there was no mortality at 24h and 48h. The mortality in one nematode may be because of infirmity, so death of one single Nematode is considered negligible out of 10. Same trend is observed here also as was in case of antifungal activity here is also S3 has maximum mortality of 73% after 96h, the effect may be again attributed to mixture of nanoparticles used in combination in formulation which together enhancing the property.

**Graph 1:-** Showing % Mortality in Nematodes at different Time Intervals)**Antifeedancy Test:-**

Antifeedancy of S1 in 24h and 48h were 20% and 35% respectively and in S2 20% and 39% respectively and in S3 33% and 42% respectively, whereas in blank only 10% and 16% mortality was observed in 24h and 48h respectively. There is no significant difference in antifeedancy% in all three samples. All samples following almost same trend. Antifeedancy varies in  $39 \pm 5$  in 48h and in 24h S3 shows highest antifeedancy as compared to S1 and S2 with a difference of  $(33-20 = 13\%)$

**Table 6:-** Antifeedancy % of Samples

Sample	% Antifeedancy(24h)	% Antifeedancy (48h)
S1	20	35
S2	20	39
S3	33	42
Blank	10	16

**Conclusion:-**

All three samples have negligible changes in quality parameters suspensibility, Dispersibility and particle size. Suspensibility corresponds to particle size in all samples. As far as efficacy part is concerned all three samples have shown remarkable effect in antifungal activity and Nematicidal activity in comparison of blank. The antifeedancy of samples as compared to blank was not much significant. However when three samples compared to each other S3 was best among other two samples. It shows significant antifungal activity and has no fungal growth even after 48h and only 2.0 cm growth after 96h. S3 also show upto 73% mortality in nematodes population after 96h which was highest among all samples, also S3 provides heighest 42% antifeedancy after 48 hrs. Since S3 contains mxture of two nanopartcles (Cu+Ag) the two together attributes good performance in all activity. The prepared formulation shows antifungal, nematicidal and antifeedant properties so it can be said that there are multiple activities in single formulation.

**References:-**

1. H.J. Niessen, H. Hausmann, H. Neumaier(1983) dispersibility and friability of water-dispersible granules, Pesticide Chemistry: Human Welfare and the Environment 317-322
2. Knowles, A. (2008), Recent developments of safer formulations of agrochemicals. Environmentalist, **28**,35-44
3. D. Ian Wilson, Sarah L. Rough Chapter 3 Extrusion—Spheronisation, Handbook of Powder Technology, Volume 11, 2007, Pages 189-217,
4. CIPAC Handbook, (2007) Physico-chemical methods for technical and formulated pesticides. Vol. F. Collaborative International Pesticide Analytical Council, Harpenden, U.K.
5. CIFAP(1989) Catalogue of pesticide formulation types and international coding system. Technical monograph no. 2. International group of national associations of manufacturers of agrochemical products , Brussels
6. International Journal of Engineering Research & Technology (IJERT), Vol. 2 Issue 3, March – 2013, Synthesis of Silver Nanoparticles by using Sodium Borohydride as a Reducing Agent, Kandarp Mavani and Mihir Shah.
7. Trans. Nonferrous Met. Soc. China 22(2012) 2198–2203, Preparation of Cu nanoparticles with ascorbic acid by aqueous solution reduction method ,LIU Qing-ming, Takehiro YASUNAMI ,Kensuke KURUDA , Masazumi OKIDO.
8. *Research Journal of Microbiology*, 9: 34-42, Antifungal Activity of Silver and Copper Nanoparticles on Two Plant Pathogens, *Alternaria alternata* and *Botrytis cinerea*, Sahar M. Ouda , 2014.
9. Bioscience, Biotechnology, and Biochemistry, Several Antifeedants from Neem Oil, *Azadirachta indica* A. Juss., against *Reticulitermes speratus* Kolbe (Isoptera: Rhinotermitidae), Munetaka Ishida, Muney Serit, Katsuyasu Nakata, Lekh Raj Juneja, Mujo Kim & Shozo Takahashi 1992.
10. The Bioscan: screening for antifeedant activity of gymmema sylvestre leaf extracts against spodoptera litura f. (lepidoptera: noctuidae). jaipal singh choudhary, chitra srivastava, and suresh walia, 9(2): 633-638, 2014 .
11. *Int.J.Curr.Microbiol.App.Sci*, Antifungal Activity of leaf extract of Neem (*Azadirachta Indica* Linn), D.K.Shrivastava and Kshma Swarnkar, 2319-7706 Volume 3 Number 5 (2014) pp. 305-308.
12. Asian Journal of Phrmaceutical and clinical Research, in vitro evaluation of botanicals and panchagavya against leaf blast fungus *pyricularia grisea*, sireesha.o venkateswarlu. n, Vol 6, Suppl 5, 2013
13. Lee SE, Kim JE, Lee HS (2001) Insecticide resistance in increasing interest. Agric Chem Biotechnol 44:105-112
14. Macedo ME, Consoli RAGB, Grandi TSM, Anjos AMG, Oliveira AB, Mendes NM, Queiroz RO, Zani CL (1997) Screening of Asteraceae (Compositae) plant extracts for larvicidal activity against *Aedes fluviatilis* (Diptera: Culicidae). MemInstOswaldoCruz92:565-570
15. Trans. Nonferrous Met. Soc. China 22(2012) 2198–2203 LIU Qing-ming1, 2, Takehiro YASUNAMI 1, Kensuke KURUDA 1, Masazumi OKIDO, Preparation of Cu nanoparticles with ascorbic acid by aqueous solution reduction method



### RESEARCH ARTICLE

## FILLING DEFECT IN ABDOMINAL X-RAY POST RECTAL CONTRAST HELPS TO DIAGNOSE DESCENDING COLON PERFORATION

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Retroperitoneal descending colon injury,  
filling defect post rectal contrast

### Abstract

Penetrating trauma to the abdomen is an emergent and life-threatening event which needs immediate surgical attention. Moreover, retroperitoneal penetrating trauma is more challenging when managed based on clinical evaluation alone. We report a case of descending colon perforation due to a pellet gunshot wound. The patient had no clinical manifestations of colonic perforation, e.g. peritonitis. The diagnosis was based solely on the finding of a filling defect on delayed rectal contrast. No similar finding has been described in trauma setting.

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### Introduction:-

Penetrating trauma to the back or flank is associated with a lower likelihood of significant injury. However, these injuries can pose a problem because of the difficulty in evaluating the retroperitoneal organs with physical examination and focused assessment with sonography for trauma (FAST). Laparotomy in abdominal gunshot wound can be negative or non-therapeutic procedure in 15% to 25% of cases.<sup>1</sup>

Gunshot wounds most commonly injure the small bowel (50%), colon (40%), liver (30%), and abdominal vasculature (25%).<sup>2</sup>

To the best of our knowledge, we report the first case of a filling defect in post rectal contrast study after penetrating injury of posterior descending colon.

### Case report:-

A 19-years old man brought to the emergency department as a victim of pellet gunshot wound to the left flank from two meter distance, eight hours prior to the presentation. He was initially seen in a local hospital where he had a plain abdominal x-ray and referred to our hospital. He had no medical problem and was nonsmoker.

On examination: his vital signs were normal. Abdominal examination was unremarkable apart from a one cm entry wound in the left flank along the posterior axillary line with minimal tenderness at entry side (Figure 1). Bowel sounds were normal. Rest of physical examination was normal.

Laboratory investigation revealed WBCs of 23 k/ul and hemoglobin of 12.3 mg/dl. Abdominal X-ray showed a foreign body in the left flank area with free air around the left kidney (Figure 2). Abdominal computed tomography (CT) scan with IV and rectal contrast showed the foreign body in the left psoas muscle with a large amount of free air around the left kidney (Figure 3). There was no pneumoperitoneum. Delayed abdominal X-ray revealed a filling

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defect in the descending colon (Figure 4). These findings were suggestive of colon perforation although clinically the patient had no signs of peritonitis.

The patient underwent exploratory laparotomy which revealed two perforations in posterior descending colon two cm apart with no gross spillage. Primary repair was done (Figure 5). Foreign body was removed from left psoas muscle (Figure 6). No other injuries were identified.

Hospital course was uneventful and the patient was discharged on 4<sup>th</sup> post-operative day.



Figure 1:-

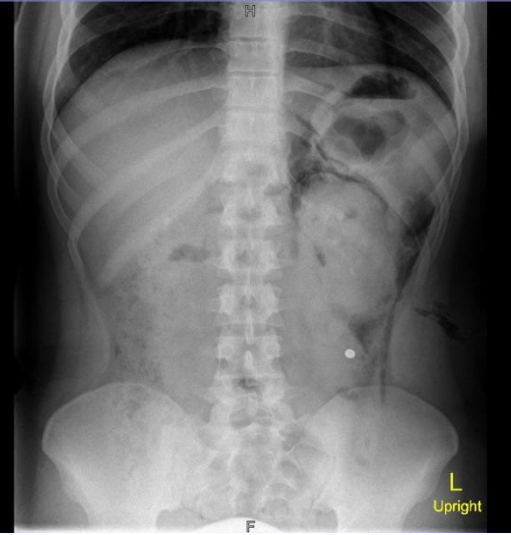


Figure 2:-



Figure 3:-

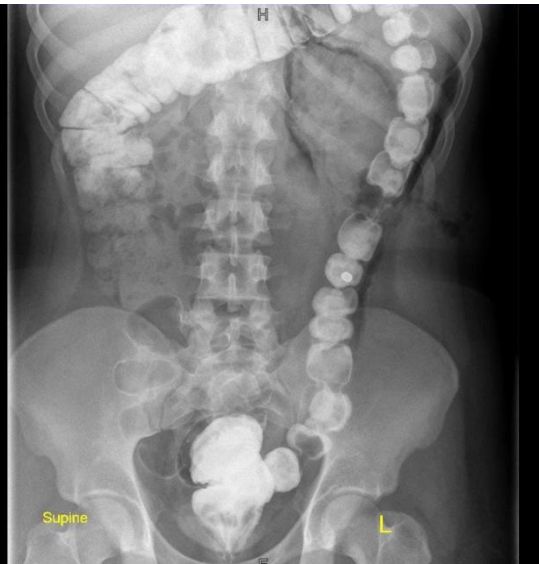


Figure 4:-



Figure 5:-Figure 6:-

### Discussion:-

Next to the small bowel, the colon is the second most common organ to be injured in penetrating abdominal trauma. Colon perforation is a life-threatening condition that needs early recognition and intervention.<sup>1</sup> Moreover, penetrating trauma to the back and flanks is associated with increased risk of injuring the retroperitoneal structures including the ascending and descending colon.<sup>2,3</sup>

Given the higher kinetic energy associated with gunshot wounds, the incidence of injury and therefore laparotomy are significantly higher than with stab wounds. Clinical evaluation is the mainstay to establish the diagnosis of colon injuries despite the availability of advanced imaging. Signs of hemodynamic instability and peritoneal irritation including rebound tenderness and non-voluntary guarding are highly suggestive of intra-abdominal injury.<sup>4,5</sup> These signs, however, may not be present in retroperitoneal injuries due to the propensity of the retroperitoneal structures to exert tamponade effect and confine the bleeding even in severe injuries.<sup>6,7</sup>

In addition to clinical examination, diagnostic tools such plain abdominal x-ray, peritoneal lavage, ultrasound, CT scan and laparoscopy have been advocated for determining the need for laparotomy. Plain abdominal radiograph may show air under the diaphragm or retroperitoneal air collection depending on the site of perforation. Other findings in CT scan are inflammatory changes, extraluminal fluid collection, and thickening of bowel wall around the perforation site.<sup>4</sup>

In a stable patient, CT scan is reliable for excluding significant injuries and plan the management.<sup>8,9</sup> Recently, the necessity of rectal contrast has been questioned. As demonstrated by our case, delayed abdominal films after rectal contrast revealed a filling defect at site of gunshot injury which raised suspicion of colon perforation despite the absence of clinical signs. Ultimately, the surgeon must exercise good clinical judgment in determining the most appropriate course of action.

Hemodynamic instability after penetrating injury should almost always prompt immediate laparotomy. Selective non-operative management is a good approach in hemodynamically stable patients with penetrating injuries. Indeed, this approach is well established in stab wounds. It goes without saying that selective non-operative management of gunshot injuries mandates the presence of experienced trauma surgeons.<sup>10,11</sup>

The presence of retroperitoneal air should raise suspicion of a perforated retroperitoneal viscus in both blunt and penetrating abdominal trauma.<sup>12</sup> It is still difficult to find a study in current medical literature in which single imaging method is compared directly with laparotomy. However, delayed abdominal films post rectal contrast can be considered in hemodynamically stable patients in cases where diagnosis is still controversial.



**Conclusion:-**

As demonstrated by our case, the amount of air not explainable by a penetrating track may predict injury to the descending colon. The presence of filling defect due to bowel wall edema and hematoma in post rectal contrast study with delayed imaging helps in locating and establishing the diagnosis.

We recommend routine plain abdominal X-ray four to six hours post CT scan with rectal contrast in case of no leak in CT scan. In addition, prospective studies are needed in future to establish the importance of post rectal contrast imaging studies in trauma setting.

**References:-**

1. Velmahos GC, et al. A selective approach to the management of gunshot wounds to the back. *Am J Surg*. 2013 Nov;174(3):342-6.
2. Emeklioglu I, Kayaalp C, Aydin C. Case report on the demonstration of minute colonic perforations caused by birdshot injury. *Eur J Trauma Emerg Surg*. 2010 Jun;36(3):260-2.
3. Tzovaras G, Hatzitheofilou C. New trends in the management of colonic trauma. *Injury*. 2005 Sep;36(9):1011-5.
4. Ball CG. Current management of penetrating torso trauma: nontherapeutic is not good enough anymore. *Can J Surg*. 2014 Apr;57(2):E36-43.
5. Pryor JP, Reilly PM, Dabrowski GP, Grossman MD, Schwab CW. Nonoperative management of abdominal gunshot wounds. *Ann Emerg Med*. 2004 Mar;43(3):344-53.
6. Burns RK, Sariol HS, Ross SE. Penetrating posterior abdominal trauma. *Injury*. 1994 Sep;25(7):429-31.
7. Daly KP, Ho CP, Persson DL, Gay SB. Traumatic retroperitoneal injuries: Review of Multidetector CT Findings. *Radiographics*. 2008 Oct;28(6):1571-90.
8. Khan S, Pardhan A, Bawa T, Haroon N. Conservative management of an abdominal gunshot injury with a peritoneal breach: wisdom or absurdity?. *BMJ Case Rep*. 2013. doi:10.1136/bcr-2013-201593.
9. Clark KR. Imaging assessment of gunshot injuries. *Radiol Technol*. 2016 Jul;87(6):627-44.
10. Stefanou C, Zikos N, Pappas-Gogos G, Koulas S, Tsimoyiannis I. Laparoscopic bullet removal in a penetrating abdominal gunshot. *Case Rep Surg*. 2016;2016:2712439.
11. Butt MU, Zacharias N, Velmahos GC. Penetrating abdominal injuries: management controversies. *Scand J Trauma Resusc Emerg Med*. 2009 Apr 17;17:19.
12. Singh JP, Steward MJ, Booth TC, Mukhtar H, Murray D. Evolution of imaging for abdominal perforation. *Ann R Coll Surg Engl*. 2010 Apr;92(3):182-8.

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### RESEARCH ARTICLE

#### DESIGN AND IMPLEMENTATION OF HIGH PERFORMANCE ANALOG CMOS BASED CIRCUITS USING PSPICE: AN OVERVIEW.

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Cascode Current Mirror, IAFCCM,  
Negative feedback gain, two stage  
current mirror.

#### Abstract

Current mirror is the basic key element in VLSI design. To obtain high performance analog circuit application, the output impedance and accuracy are the most important parameter to determine the performance of the current mirror. A new current mirror is proposed in this paper to provide high accuracy and very high output impedance. To increase the output impedance and matching accuracy significantly a novel feedback gain is used. The new proposed current mirror also has output swing similar as the traditional two stage cascode current mirror.

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#### Introduction:-

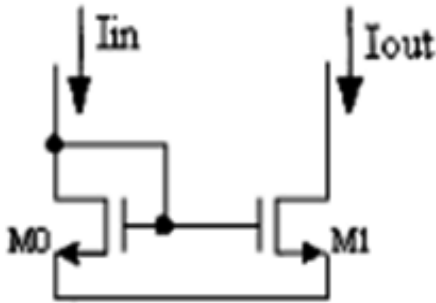
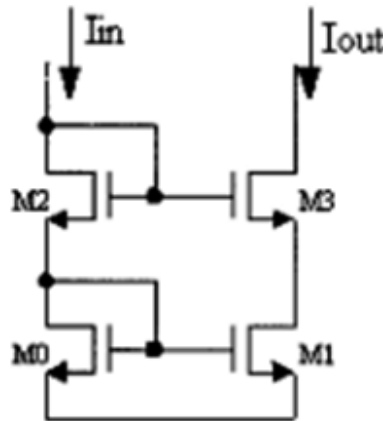
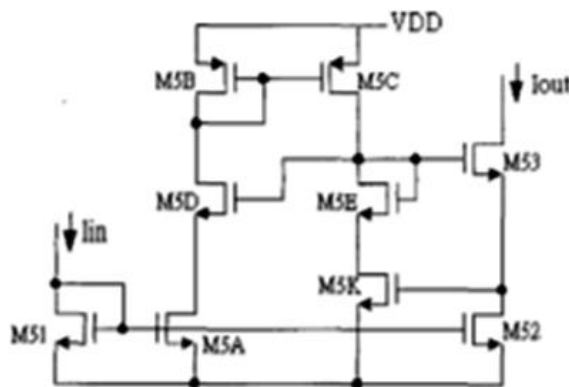
Due to the better performance the current mode approach [1] - [5] is gaining interest more and more. The decreasing power supply voltage of digital micro electronics makes it suitable for mixed mode application is the reason for using current mode circuit. The current mirror is used for biasing or loading elements in analog circuit design. The most important parameter used to determine the performance of current mirror are accuracy and output impedance. It can be used to find many researches that focus on these two points. To increase the output impedance the cascode current mirror [6] and the RGC current mirror [9] is used. IAFCCM [8] was proposed to increase the accuracy. To achieve higher output impedance, multi stage cascode mirror has been used, although its suffer from low output voltage swing. The output impedance of the two stage cascode current mirror is lower than the output impedance of RGC current mirror and the accuracy of the RGC current mirror is not good enough for high precision application.

The accuracy of IAFCCM is better than RGC current mirror and the output impedance of IAFCCM is equivalent to the RGC current mirror. A new high output impedance current mirror is proposed in the paper to improve the accuracy and the output impedance of the new current mirror, it is based on the RGC circuit. To increase the output impedance and matching accuracy significantly a novel feedback gain stage is used. The new current mirror is similar to the traditional two stage cascode current mirror, so the proposed current mirror is better than that of RGC and IAFCCM.

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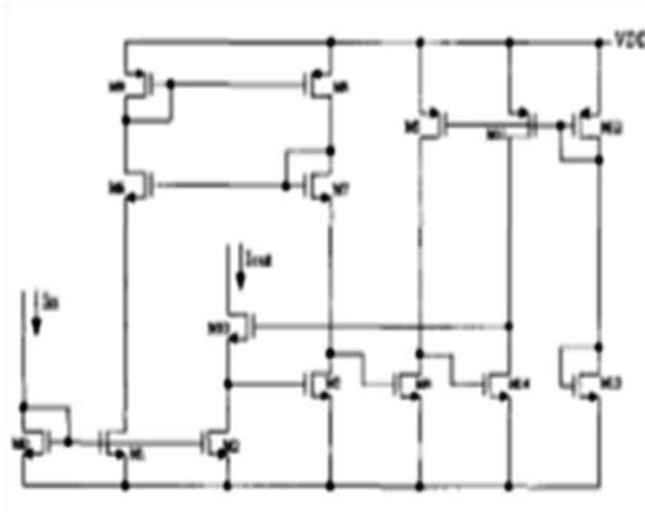


**Description of previous circuits and the new current mirror:-****Previous current mirror circuits:-****Fig. 1:- Traditional current mirror [1]****Fig 2:- Cascode current mirror [1]****Fig 3:- IAFCCM [1]**

The traditional current mirror is shown in fig.1. As the traditional current mirror's output impedance is not infinite, it will influence the output current  $I_{out}$  by the variation of the output node voltage  $V_{ds}$ . It is a drawback in the analog circuits. In fig.2 the cascode current mirror is shown. It has the matching accuracy [7] problem and it was proposed to improve the output impedance. In fig.3 the IAFCCM is shown. It was proposed to increase the output impedance,

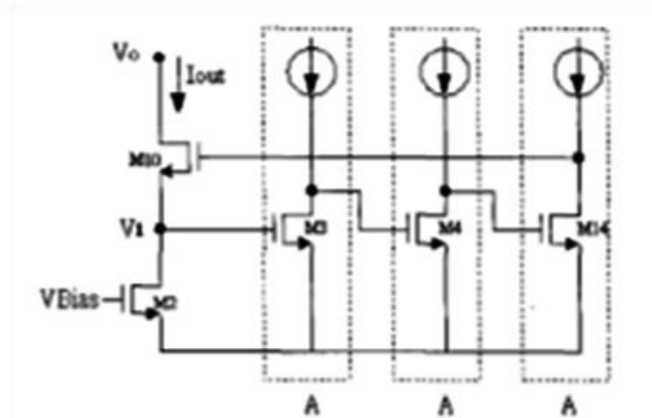
output voltage swing and matching accuracy. IAFCCM improves lots of output voltage swing, but the output impedance is not high enough. Meanwhile the output node voltage influences the output current  $I_{out}$ .

**The proposed new current mirror circuit:-**



**Fig 4:-** The proposed current mirror [1]

The proposed new current mirror improves the new key parameters of the current mirror, the matching accuracy and output impedance. The fig.4 shows the schematic diagram of the proposed new current mirror. Here are some MOS transistors such as M0, M2, M10 are used as a two stage cascode current mirror and some MOS transistors such as M1, M6, M9, M7 and M8 are used to improve the matching accuracy of the cascode current mirror. M3, M4 and M14 are the three novel negative feedback gain stages that can increase the output impedance of the current mirror significantly.



**Fig 5:-** The feedback circuit [1]

The feedback circuit of the current mirror is shown in fig.5 and the voltage gain of each gain stage is shown as A. The output impedance are out of the new proposed current mirror can be estimated by following.

$$V_1 = i \frac{1}{g_{d2}} \quad [1]$$

$$i = g_{m10} * (-|A|^3 - 1) * V_1 + g_{d10} * (V_0 - V_1)$$

[2]

$$\Rightarrow i * \left( 1 + \frac{g_{m10}}{g_{d2}} |A|^3 + \frac{g_{m10}}{g_{d2}} + \frac{g_{d10}}{g_{d2}} \right) = g_{d10} * V_0$$

$$\Rightarrow \frac{V_0}{i} = \left( 1 + \frac{g_{m10}}{g_{d2}} |A|^3 + \frac{g_{m10}}{g_{d2}} + \frac{g_{d10}}{g_{d2}} \right) \div g_{d10}$$

$$= \frac{gm_{10}}{gd_{10}} |A|^3 \frac{1}{gd_2} \quad [3]$$

$$R_0 = \frac{gm_{10}}{gd_{10}} \frac{1}{gd_2} |A|^3 \quad [4]$$

As shown in equation (4) where  $A \cong \frac{gm_i}{gd_i}$  ( $i=3, 4$  and  $14$  respectively), the proposed new current mirror has much larger  $R_{out}$  than that of the IAFCCM which has output impedance  $R_{out} = gm_{53} gm_{5k} \frac{1}{gd_{52}} \frac{1}{gd_{53}} \left[ \frac{1}{gd_{5k}} // \frac{1}{gd_{5c}} \right]$

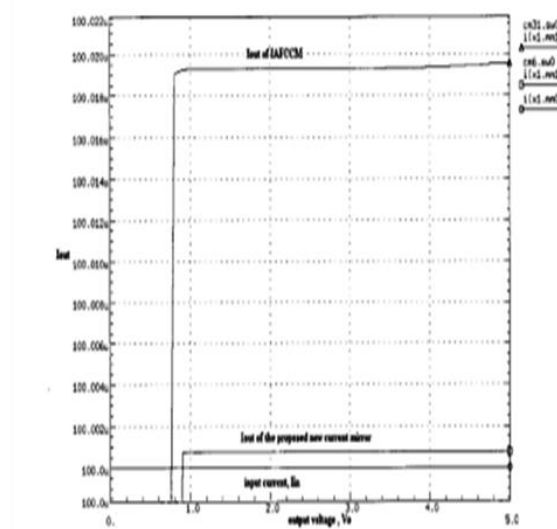


Fig 6:- The I-V curve of the simulation result [1]

In fig.5 the voltage  $V_1$  is independent of  $V_0$ . When  $V_0$  and  $V_1$  are increased then the  $V_{ds14}$  is decreased due to the three gain stages. The negative feedback signal is created by connecting  $V_{ds14}$  to the gate of  $M_{10}$ . Therefore decrease in  $V_{ds14}$  decrease the  $V_1$ . Thus the negative feedback loop locks  $V_1$  so that a stable  $I_{out}$  is obtained. Now the proposed new current mirror has high output impedance.

For a good current mirror another factor is the matching accuracy [10] between  $I_{in}$  and  $I_{out}$ . The MOS transistors  $M_6$ ,  $M_7$ ,  $M_8$  and  $M_9$  are used to match the current  $I_{m1}$  and  $I_{m2}$  in the new proposed circuit and further make  $V_{Gs3} = V_{Gs1}$ . From  $V_{Gs1} = V_{Gs0} = V_{Ds0}$  and  $V_{Gs3} = V_{Ds2}$ , we can find  $V_{Ds2} = V_{Ds0}$  which results  $I_{in} = I_{out}$ . The proposed new current mirror has better matching accuracy than the IAFCCM and it is proved by the HSPICE simulation results.

### Simulation Results:-

The HSPICE simulation results are based upon  $0.35\mu\text{m}$  1P4M CMOS process which has a supply voltage of  $3.3\text{V}$  where,  $L = 1\mu\text{m}$  for all transistors except  $M_8$ ,  $M_9$  transistors for which  $L = 3\mu\text{m}$ .  $W = 20\mu\text{m}$  for  $M_0$ ,  $M_1$ ,  $M_2$ ,  $M_3$ ,  $M_6$ ,  $M_7$ ,  $M_{10}$  and

$W = 40\mu\text{m}$  for  $M_8$ ,  $M_9$  to ensure  $I_{out} = 100\mu\text{A}$

$W = 5\mu\text{m}$  for  $M_4$ ,  $M_{14}$

$W = 10\mu\text{m}$  for  $M_5$ ,  $M_{11}$

$W = 1\mu\text{m}$  for  $M_{12}$ ,  $M_{13}$

The I-V curve simulation result of the proposed new current mirror and IAFCCM is shown in fig.6. The I-V plot of the input current  $I_{in}$  is the lowest line. The top line is the I-V plot of IAFCCM, it shows that the output impedance is not that much high to avoid the influence of  $V_{ds}$  i.e. under the variation of the output voltage  $V_0$  the  $I_{out}$  will be changed. The I-V plot of the proposed circuit is the middle line and it indicates that the output impedance of the proposed circuit is higher than IAFCCM. In fig.6 the comparison results of the accuracy is shown. The proposed circuit has a matching accuracy better than IAFCCM when the input current  $I_{in} = 100\mu\text{A}$ .

**Table 1:-** The proposed CM performance comparison with IAFCCM [1]

Issue	The proposed circuit	IAFCCM
Mirroring error $I_{in}=5\mu A$	0.016%	0.036%
Mirroring error $I_{in}=10\mu A$	0.012%	0.03%
Mirroring error $I_{in}=100\mu A$	0.001%	0.019%
Mirroring error $I_{in}=200\mu A$	0.005%	0.015%
Mirroring error $I_{in}=300\mu A$	0.012%	0.014%
Mirroring error $I_{in}=400\mu A$	0.026%	0.013%
Rout	$\propto \frac{1}{gd} \left( \frac{gm}{gd} \right)^4$	$\propto \frac{1}{gd} \left( \frac{gm}{gd} \right)^2$

Table 1 shows the comparison result between the proposed circuit and IAFCCM under various input circuit. Input current changes from  $5\mu A$  to  $400\mu A$ . When the input current is lower than  $400\mu A$  due to the MOS transistor sizes of the proposed circuit are smaller than IAFCCM. But the output impedance  $R_{out}$  of the proposed new circuit is larger than that of the IAFCCM.

### Conclusion:-

A high output impedance and high accuracy current mirror is proposed and analyzed in this paper. According to the simulation results the accuracy and the output impedance of the proposed circuit is better than IAFCCM. The proposed current mirror is much suitable for using in high linearly, high output impedance current output stages and the operational amplifiers design.

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### Reference:-

1. Kuo-Hsing Cheng, Chi-Che Chen and Chun-Fu Chung "Accurate Current Mirror with High Output Impedance"
2. Handkiewicz, A.; Kropidowski, M.; Lukowiak, M. "Switched-current technique for video compression and quantization" ASIC/SOC Conference, 1999. Proceedings. Twelfth Annual IEEE International , 1999 Page(s): 299 -303
3. Harb, A.; Sawan, M. "New low-power low-voltage high-CMRR CMOS instrumentation amplifier" Circuits and Systems, 1999. ISCAS '99. Proceedings of the 1999 IEEE International Symposium on , Volume: 6, 1999 Page(s): 97 -100 ~01.6
4. Zeki, A.; Kuntman, H. "High-output- impedance CMOS dual-output OTA suitable for wide-range continuous time filtering applications" Electronics Letters , Volume: 33 Issue: 16, 5 Aug. 1999 Page(s): 1295 -1296
5. Nooshabadi, S.; Visweswaran, G.S.; Nagchoudhuri, D. "Current mode ternary D/A converter" VLSI Design, 1998. Proceedings., 1998 Eleventh International Conference on , 1998 Page(s):244 – 248
6. P. E. Allen and D. R. Holberg, "CMOS Analog Circuit Design". New York: Holt, Rinehart and Winston, 1987 Page(s):233
7. Song, B.G.; Chang, I.K.; Kwon, O.J.; Park, J.G.; Kwack, K.D. "A simulation-based analog cell synthesis with improved simulation efficiency" TENCON 99. Proceedings of the IEEE Region 10 Conference , Volume: 2, 1999 Page(s): 1018 - 1021 v01.2
8. Zeki, A.; Kuntman, H. "Accurate and high output impedance current mirror suitable for CMOS current output stages" Electronics Letters , Volume: 33 Issue: 12 , 5 June 1997 Page(s): 1042 -1043.
9. Saclunger, E.; Guggenbuhl, W. "A high-swing, high-impedance MOS cascode circuit" Solid-state Circuits, IEEE Journal of, Volume: 25 Issue: 1 , Feb. 1990 Page(s): 289 -29
10. B. Razavi, Principles of Data Conversion System Design. New York: IEEE Press, 1995.

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### RESEARCH ARTICLE

## NANOPARTICLES: NEOTERIC PLATFORM AGAINST MULTI DRUG RESISTANCE TUBERCULOSIS

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### Abstract

Tuberculosis caused by Mycobacterium strains intracellular bacilli is a pernicious infection posing global menace to public health. It kills about 2 million people per year worldwide and has been declared as "Global emergency" by WHO. Nano particulate drug delivery systems are suitable for targeting chronic intracellular infections such as tuberculosis. Given the options for oral as well as parenteral therapy the very nature of the disease and its complex treatment urges one to emphasize on the oral route for controlled drug delivery. Treatment of drug susceptible TB continues for a period of 6 – 9 months, while Multi Drug Resistance TB requires rigorous treatment with second line anti-TB drugs that has many unacceptable systemic side effects. These arduous treatment regimens and lack of knowledge regarding the importance of completing the treatment course can cause non-adherence of patient to the medications that remains the most important reason for treatment failure. Targeted drug delivery in the form of nanoparticles holds significance in combating TB bacilli by prolonged and intracellular drug release. Pending are the discovery of more potent anti-tuberculosis drugs, nanotechnology based intermittent chemotherapy provides a novel and sound platform for an onslaught against tuberculosis. The current review discusses the traditional anti-TB drugs and the advantages of targeted delivery of nanoparticles over conventional treatment in terms of efficacy, reduced frequency of dosing, decreased duration of treatment regimens and reduced systemic toxicity.

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### Introduction:-

"Tuberculosis, commonly known as TB, is a contagious and an often severe airborne disease caused by a bacterial infection. TB typically affects the lungs, but it also may affect any other organ of the body."<sup>[1]</sup> In spite of tremendous efforts to surmount the TB epidemic across the world, it remains to be one of the most horrendous threats for the global health communities. As per Global TB control report of 2012, Mycobacterium, causing infection is the culprit for 1.3 million people's death and 8.6 million new active infections. It has been estimated that 64% of TB incidents were reported to National TB Programs in 2013.<sup>[2]</sup> According to reports of WHO, TB is one of the three major

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causes of deaths among females of age group 15 - 44 years and approximately 320000 women died due to TB in 2010. <sup>[3]</sup> Of 34,000 MDR patients enrolled on treatment in 2010, only 48% successfully completed treatment and 15% died. Among 795 XDR cases, mortality rate was approximately 50%. Only about 50% of detected cases in cohort study conducted in 2012 were successfully treated. <sup>[4]</sup>

Although the treatment of TB has been around for approximately 50 years but it remains to be the leading bacterial infection caused by Mycobacterium, which can produce either a silent, latent or active disease. A person's lifetime risk of active TB is 10% once infected by Mycobacterium bacilli, it becomes 4-16 times for patients with underlying immunosuppression (e.g.- Renal failure, cancer etc.) and it dreadfully becomes 100 times for HIV infected patients <sup>[5,6]</sup>

Treatment of drug susceptible, uncomplicated Tb typically requires minimum of 6 months. One of the major problems with such arduous and demanding regimen is poor medication compliance that can eventually lead to MDR-TB. Exhaustive undertakings have helped to resolve stumbling blocks of medication compliance, toxicity and frequency of dosing by targeting the site of infection via carrier based drug delivery system that can be important therapeutic approach for better health outcomes. In the era of nanotechnology, its most promising application is targeted drug delivery and nanoparticles forms kernel of nanomedicine. Owing to its nanoscale size and large surface to volume ratio, nanoparticles readily interact with biomolecules at cellular level, thus it can be potential diagnostic and therapeutic tool. Nanoparticles have been scrutinized for drug solubility, stabilization and targeted delivery. In uncomplicated TB, targeting lymph nodes has proved to be a propitious strategy. Nevertheless, so far diminutive evidence is available for determining its influence in drug-resistant TB. Even though developing new anti-TB drugs is of prime importance in an onslaught against intracellular bacilli, formulating anti-TB drugs in nanoparticle based drug delivery system appears to be a viable and effective alternative which not only reduces the duration of regimen, dosing frequency, systemic toxicity and drug interactions but also delivers the drug efficaciously and acts as silver lining in overcoming the blockades of the conventional orally administered drug regimens. Thus, eventually helps to improve patient compliance and completion rates, which has significant impact in preventing MDR-TB.

### Background:-

Nanoparticles as carriers of therapeutic agents in molecular targeted therapy and better diagnostic imaging are emerging as neoteric and promising platform in nanomedicine as novel therapeutics. <sup>[7]</sup> The primary intent of nanoparticles is to control and manipulate bio macromolecular constructs and supramolecular assemblies that plays a vital role to in improving the quality of human health. The advent of Nano therapeutics/ diagnostics will allow a profound understanding of both the diseases that have been a threat for human lives since ancient times and treatment to improve the human quality of life. Nanoparticles for the purpose of drug delivery can be defined as solid, submicron, colloidal particles that are of size 10-1000nm. <sup>[8]</sup> Because the diameter of smallest vessels in the human body is approx. 4micromts, the colloidal particles of >200nm are not pursued in nanomedicine. Based on their designing they are of two types:

- a) **Nanospheres:** (Matrix systems) monolithic nanoparticles in which drug is physically and uniformly dispersed throughout the polymeric matrix.
- b) **Nanocapsules:** (Vesicular systems) Nanoparticles in which the drug is concentrated in the core (hydrophilic/ hydrophobic) surrounded by a shell like wall or "capsule". <sup>[9]</sup>

### Polymeric nanoparticles:

Since the polymeric nanoparticles are more stable and have ease of surface modification, they are more heavily used in Nano therapeutics. <sup>[10]</sup> Nanoparticles have been made by a wide range of biocompatible and biodegradable Nano particulate substances for the sake of delivery of therapeutic compounds to their site of action. They can be made from both natural (e.g., gelatin, albumin) and synthetic (e.g., polylactides, polyalkylcyanoacylates). <sup>[11]</sup> The era 1960's and early 1970's has witnessed the birth of polymer microparticles by the use of acrylamide polymerization technique and since then different preformed polymers have been developed by using variety of polymerization methods. The most commonly used polymers now-a-days are listed below:

**Table 1: CARRIERS USED IN DRUG DELIVERY:**<sup>[12]</sup>

<b>NATURAL CARRIERS</b>	<b>SYNTHETIC CARRIERS</b>
<b>Proteins and polypeptides</b>	<b>Aliphatic polyesters and Hydroxy acids</b>
a. Albumin b. Fibrinogen/ fibrin c. Collagen d. Gelatin e. Casein	a. Polylactic acid b. Polyglycolic acid c. Poly (lactide-co-glycolide) d. Polyhydroxy butyric acid e. Polycaprolactone
<b>Polysaccharides</b>	<b>Polyanhydrides</b>
a. Alginic acid b. Starch c. Dextran/ Dextrin d. Hyaluronic acid e. Chitin f. Chitosan	Poly ortho esters
	Poly alkyl cyanoacrylate
	Polyamino acids
	Polyacrylamides
	Poly alkyl carbonates

**Drug release from nanoparticles:-**

Nanoparticles are surrounded by polymers through which the drug is released by either controlled diffusion or erosion from the core across the polymeric matrix. Although the rate of drug release is dependent upon the ability of the drug to dissolve and diffuse in the polymeric matrix but it is also affected by the ionic interactions between the drug and the auxiliary ingredients added, that results in the formation of a complex which is less water soluble that could cause slow drug release.<sup>[13]</sup>

**Drawbacks of conventional atd therapy:-**

Conventional ATD therapy is very effective; however, it does have its own downsides. Majority of TB cases reported are of pulmonary TB (more than 80%) that demands administration of high doses since only small fraction of the total dose given via oral route reaches the macrophages in the lungs. And this small fraction is cleared from the lungs within a short span of time thus requiring the administration of multiple ATDs regularly, a regimen to which not all the patients show good compliance. On top of that, the continuous increase in MDR TB incidences has to be addressed properly since the commonly used second line ATD are not only more costly and toxic but also has longer duration of regimens that contributes to patient non-compliance which is the cardinal reason for the development of MDR-TB.<sup>[14]</sup>

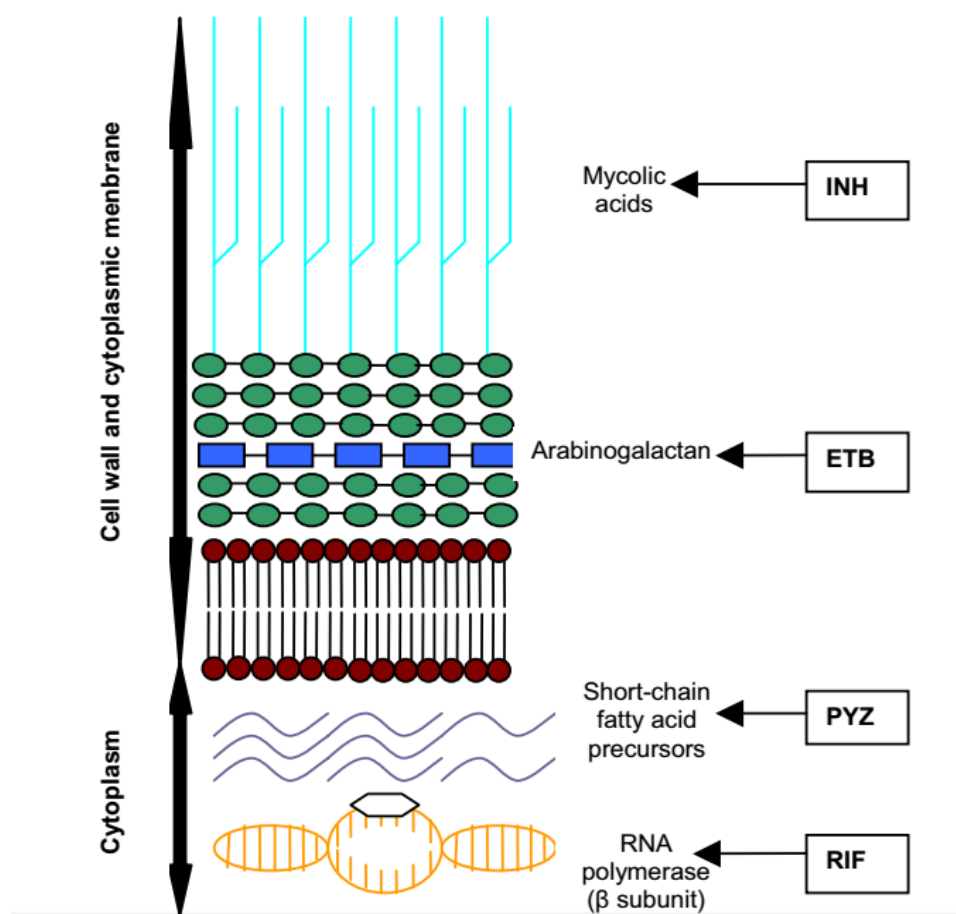


Figure1: Site of action of first line ATDs:<sup>[15]</sup>

Table2: First line agents of tuberculosis:<sup>[16,17]</sup>

DRUGS	MECHANISM OF ACTION	ACTS AGAINST
Isoniazid	Inhibiting the cell wall synthesis	Rapidly multiplying bacteria
Pyrazinamide	Inhibiting and depleting the membrane energy	Bacteria which can survive under acidic pH and has lower metabolic activity
Ethambutol	Inhibiting the cell wall synthesis	Rapidly multiplying bacteria and used against INH resistant strains
Rifampicin	Inhibiting the nucleic acid synthesis	Bacteria with spurts of metabolism, dormant stage followed by short and active span growth and metabolism

#### 4. Advantages of nanoparticle drug delivery over conventional atd therapy:

However, nanoparticle based drug delivery can be tailored to achieve sustained, controlled and targeted drug delivery, improve bioavailability, increased solubilization of drug.

It has been established by various studies that nanoparticle based drug delivery system has many advantages over the conventional therapy. Some of them are enumerated below:

1. The particle size and surface properties can be altered easily in order to target the drug by both mechanisms i.e., active and passive delivery
2. Controlled release and particle degradation can be readily manipulated by using appropriate matrix polymer
3. It can be administered by various routes such as oral, pulmonary, subcutaneous etc.



4. Improved bioavailability by enhancing water solubility
5. Increases the elimination half life of the drug
6. Targets the drug to specific locations in the body by binding the drug with specific ligands or by magnetic guidance.

This leads to reduction of dose and systemic toxicity, thus enabling the safe delivery of therapeutic agents to the target organ. <sup>[18]</sup>

**Table 3:** Properties of Anti TB drugs that can be improved with the use of proper drug delivery system: <sup>[12]</sup>

Anti- Tuberculosis Drugs	Properties
Rifampicin	Food interactions Drug-drug interactions
Ethambutol	Low shelf life
Streptomycin	Poor intestinal absorption
Metronidazole	Unpalatability
Danazol	Poor solubility in intestinal fluid
Azathioprine	Short duration of stay
Clotrimoxazole	Sub therapeutic levels in plasma

### Nanoparticles characteristics to be considered when used for drug delivery:

#### 1. Particle size:

With the particle size, one can determine the biological fate and the accuracy of target delivery of the system. It also influences other vital properties such as rate of drug release, stability, dose to be incorporated etc.

The size of the nanoparticles can be determined by two primary methods;

- a) Photon correlation spectroscopy
- b) Dynamic light scattering

Transmission electron spectroscopy (TES) and scanning electron spectroscopy (SEM) are then used to verify the results obtained. <sup>[18]</sup>

#### 2. Surface properties:

Once nanoparticles (surface non-modified/conventional) are in the blood stream, they are rapidly cleared and opsonized by the MPS (mononuclear phagocyte system). <sup>[19]</sup> Therefore, there is demanding need of coating the non-modified nanoparticles with polymer/ surfactants or formulating with the biodegradable polymers with hydrophilic properties.

Example: Polyethylene glycol (PEG), polyethylene oxide, polyoxamer, poloxamine and polysorbate 80 (Tween 80). <sup>[20]</sup>

It is important to determine the surface charge properties of the nanoparticles. The most common method is by using zeta potential. <sup>[21]</sup> The surface charge is greatly influenced by the medium of dispersion and composition of the particles. <sup>[22]</sup>

#### 3. Drug entrapment:

Drug loading/ entrapment primarily depends upon drug solubility with both the matrix and the excipients. <sup>[23]</sup> The macromolecules or proteins loaded within the nanoparticles has more loading efficacy when loaded at or near their isoelectric point (IP). <sup>[24]</sup> Studies have shown that in smaller molecules, the ionic interaction between the drug and the matrix can increase the drug loading. <sup>[13]</sup>

#### 4. Drug release:

In polymer coated nanoparticles, diffusion of the drug across the membrane is the rate limiting step. Ionic interactions influence the rate of drug release. Example; A poorly water soluble compound can be formed due to the

interaction between the drug and the excipient which will slow the rate of drug release. The rate of drug release can be increased by decreasing the interactions between drug and the matrix by adding the excipients like ethylene oxide-propylene oxide block copolymer (PEO-PPO) to chitosan.<sup>[25]</sup>

## 5. Target delivery:

This can be two types:

- ✓ Active delivery
- ✓ Passive delivery

**Active delivery** involves the release of encapsulated drug in the nanoparticle which is bonded to the carrier only when it comes in contact with the specific ligand or the tissue. Whereas in **passive delivery**, the drug encapsulated in the nanoparticles are passively released after it has reached the targeted organ.<sup>[26]</sup>

### Different delivery systems of ATDs:

1. Orally administered NP
  - ✓ Non-surface Functionalized
  - ✓ Surface Functionalized
- a. Inhalational NP
- b. Injectables NP
  - Intravenous
  - Subcutaneous
  - Intramuscular

#### a. Orally administered nanoparticles:

##### 1. Non-surface functionalized nanoparticles:

Panday et al. designed two therapeutic regimens and sub categorized each regimen into free drug or PLG based drugs.

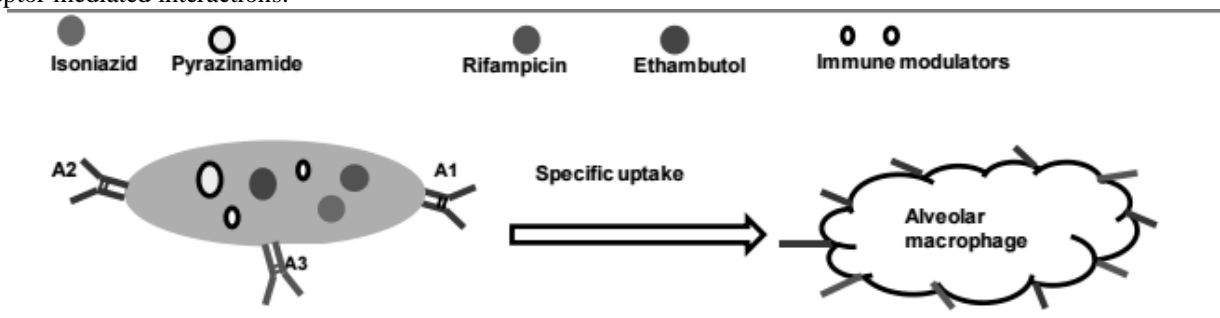
The three first line Anti-TB drugs INH, RIF and PZA were encapsulated in PLG based NP (prepared by solvent evaporation and double emulsion technique). This experiment concluded promising results after only one therapeutic dose of ATD-loaded PLG nanoparticles was administered. The MIC of ethambutol, rifampicin, isoniazid / pyrazinamide was found in the blood even after 3,6 and 8 days respectively which is a remarkable discovery since free drug concentrations were undetectable only after 12 h of oral administration. The first line drugs of TB i.e., Isoniazid, Rifampicin and Pyrazinamide when encapsulated with PLG nanoparticles and administered via oral route in mice have shown propitious results. The drugs were detected in the blood circulation even after 4 days (for RIM) and 9 days (for INZ and PYZ) and duration of drug stay in tissues was about 9-10 days, while, for free drugs duration of drug stay was up to 24 hours. ATD-loaded nanoparticles have efficacy equal to 46 conventional doses when administered IV or IM in mice and guinea pigs respectively. When the ATD nanoparticles were given (5 oral doses every 10<sup>th</sup> day), it resulted in complete sterilization of infection. The study has not shown any hepatotoxicity. With 10 X and 150 X therapeutic doses, the time of drug stay for free drugs in the tissues was 24 h, while, it was 9-10 days for PLG encapsulated drugs. However, 150 X therapeutic dose of free drugs was found to be lethal.<sup>[27]</sup>

In another study, o-stearyl amylopectin was tagged to liposomal encapsulated INH and RIF and administered intravenously in Mtb infected mice. The tagging with o-stearyl amylopectin facilitates targeting the bronchial tissue. The bacterial load was cleared within 6 weeks when it was given once a week by using a quarter of their total therapeutic dose. This study also has shown no sign of hepatotoxicity.<sup>[28]</sup>

##### 2. Surface Functionalized Nanoparticles:

The bioadhesive properties of the PLG - NP greatly influence bioavailability of the encapsulated drug. The bioadhesive drug delivery system helps to improve/ enhance the bioavailability of the administered drug by increasing its residence time in the GIT, which in turn increases its contact time with gastric mucosal epithelium. Bioadhesion of drug carriers to the mucosal surface in the GIT is limited by the turnover time of the mucosal layer, which is approximately few hours for almost all of the mucosal surfaces. Polymeric carriers conjugated with specific

cytoadhesive ligands that can undergo reversible and non-covalent binding with the gastric epithelial surface by receptor mediated interactions.<sup>[29]</sup>



**Figure 2:-** Surface functionalized encapsulated nanoparticles for the specific surface markers on the alveolar macrophages<sup>[30]</sup>

The role of Lectins as mucoadhesives has been exploited because of their biorecognition interactions with the glycosylated structures and their ability of resistant to proteolytic degradation. Lectins mediate:<sup>[31]</sup>

- ✓ Mucoadhesion
- ✓ Cytoadhesion
- ✓ Cytoinvasion of drugs

Lectins are structurally diverse group of proteins, which can be found in varied organisms such as viruses, plants and humans. Wheat germ agglutinin (WGA) has been preferably used in the drug delivery because of it is one of the least immunogenic lectins and also its receptor can be found on both gastric and alveolar epithelia. WGA functionalized poly (lactide-co-glycolide) nanoparticles based formulations of ATD of size 350- 400 nm showed dramatic improvement in the sustained released property. INZ and RIF was present in the plasma for 13 days and PYZ for 7 days and were detectable in tissues for up to 15 days well above their MIC. Three doses given for 15 days were as efficient as 45 doses of free drugs administered orally and Mycobacterium cfu was almost cleared following administration of 5 doses every 10th day. This study has reported that WGA functionalized PLG NP loaded with ATD results in enhanced bioavailability, decreased dosing frequency and duration of regimen which ultimately affects patient compliance because of cost effectiveness for a full course (1\$ vs 17\$ mg/kg) in guinea pigs.<sup>[29]</sup>

**b. INHALATIONAL NANOPARTICLES (Pulmonary route):-**Pulmonary route is the novel approach in delivering the ATDs directly and thus provides a more efficient platform in combating pulmonary TB.

**Potential advantages of pulmonary route:**<sup>[32,33]</sup>

- Administration of drug directly to the bronchial tissue.
- Less dose is required.
- Reduced dosing frequency
- Since the rest of the body is not exposed to the action of drug administered, the incidences of systemic side effects decreases.
- Onset of action is fast.
- Bioavailability is relatively high.
- Better mucosal adherence.
- Bypasses first pass metabolism.

**Disadvantages of Pulmonary route:**<sup>[32,33]</sup>

- Administration of drug requires specific device
- Supervision is required
- Administration of drug involves technique.

Because alveolar macrophages are known to be the pivotal abode of Mycobacterium tuberculosis, there have been renewed interests in targeting these cells. Phagocytic cells have relatively selective ability for cellular uptake of NP

which makes them easier targets for nanoparticle encapsulated ATDs. INH, RIF and PYZ were formulated in PLG based co-encapsulated nanoparticles and were administered to experimentally infected guinea pigs animal models via aerosol route. The mass median aerodynamic diameter was about 1.88 micrometers which is favorable for deep bronchial delivery. A single nebulization was enough to maintain therapeutic concentrations in plasma for approx. 6-9 days and in lungs for 9-11 days. There was drastic improvement in other properties as, such as, plasma elimination half-life, mean residence time and absolute bioavailability compared with the unconjugated or unbound drug. Further, 5 nebulized doses given on every 10<sup>th</sup> day resulted in undetected cfu which is equiefficient to 46 conventional oral doses.<sup>[34]</sup> This study has broadened the horizon for co-administering multiple ATD that has helped to substantially improve the therapeutic response.

- ✦ **Sung JC et al.**, formulated RIF for aerosol delivery in a dry powder 'porous nanoparticle-aggregate particle'(PNAP) form by solvent evaporation process and spray dried in PNAP, which has shelf stability, effective dispersibility and extended release in lungs and systemic drug delivery. The spray dried RIF administered to guinea pigs by intrathecal insufflation revealed that pulmonary drug levels was maintained for 8 hours and systemic drug levels were obtained within 6-8 hours.<sup>[35]</sup>
- ✦ In another study, RIF poly (lactic-co-glycolic acid) PLGA nanoparticles (RIF/PLGA nanoparticles) were formulated in mannitol microspheres. It was then administered in rats using four-fluid nozzle spray dryer in one step. In vivo studies have concluded that RIF's uptake for RIF/PLGA/MAN microspheres was higher, approx. 4% at 1 hr. of administration that has further increased to 9.3% at 4 hour; in contrast to uptake of RIF from RIF/PLGA microspheres which was relatively smaller.<sup>[36]</sup>
- ✦ Lectin receptors are quiet extensively distributed in the respiratory tract so the chemotherapeutic potential of lectin functionalized PLG-NP was assessed as well. Nebulization of Lectin functionalized PLG-NP to guinea pigs, resulted in maintenance of therapeutic drug concentrations in plasma for 6-10 days and in organs for 15 days. Various experimental studies has shown that 46 conventional doses can be reduced to 5 nebulized doses of PLG – NP, that can be further reduced to only 3 lectin based PLGNP<sup>[37]</sup>

### C. Injectable nanoparticles:

Different routes by which ATD – NP can be injected includes:

1. Intravenous
2. Subcutaneous
3. Intramuscular

Compared to conventionally administered ATD of 35 oral doses, when the infected mice were given only a single injection of drug loaded PLG-NP via subcutaneous route, it showed not only remarkable sustained drug levels in the plasma for about 32 days and in the organs (lungs/spleen) for about 36 days but also better efficacy by completing eliminating the Mycobacterial bacilli from the organs. At the site of injection, the nanoparticles form drug depot from which the drug is slowly released into the blood circulation.<sup>[38]</sup> Poly (butyl cyanoacrylate) nanoparticles loaded with INH and streptomycin showed elevated accumulation levels in the cultivated human blood monocytes. Thus, resulted in enhanced activity against intracellular M. tuberculosis bacilli. Similar results were shown by the encapsulated ciprofloxacin and RMP in the infected macrophages. However, previous in vitro studies has concluded that increased intracellular drug accumulation levels rarely, simultaneously increases the activity of the drugs against intracellular bacteria compared to the extracellular bacterial population.<sup>[39]</sup>

**Table 4:-** Techniques involved in preparation of PLGbased nanoparticles<sup>[12]</sup>

TECHNIQUES INVOLVED	MERITS/DEMERITS
Emulsion / evaporation	Poor entrapment of hydrophilic drugs
Double Emulsion / evaporation	Good entrapment of both hydrophilic and hydrophobic drugs
Salting out	Long purification method
Emulsification diffusion	Rapid technique
Solvent displacement / non precipitation	Hydrophilic drugs has poor entrapment
Emulsification-diffusion-evaporation	Size and shape of the nanoparticles are better controlled

### TOXICITY EVALUATION OF PLG NANOPARTICLES BASED ATDs:

The toxicity studies include single dose toxicity (or acute toxicity that determines median lethal dose LD<sub>50</sub> I.e., the single dose produces 50% mortality of animals within 14 days), and multiple dose toxicity which further includes sub-acute toxicity for 28 days and chronic toxicity for 90 days.

**Panday et al.**, reported detailed toxicological and chemotherapeutic evaluation of INH, RIF, PYZ and EMB loaded PLG- NP. The single dose administration of PLG based nanoparticles not only didn't show any sign of adverse effects but also when they were administered several times higher than the recommended therapeutic dose, showed similar results. On the other hand, conventional free drugs were lethal when given at equivalent higher doses. The acute and chronic toxicity studies conducted based on survival, gross pathology, histopathology, blood biochemistry and hematology observed no evidence of toxicity for the PLG-NP based ATDs.<sup>[40]</sup> The remarkably positive safety profile put forth by the above study provides a solid foundation for the researchers to scrutinize it further for oral administration and in higher animal models like guinea pigs.

### Mdr tuberculosis and nanoparticle technology:

The above studies are done in relation to the drug susceptible TB, however they are significantly relevant in paving the way for surmounting not only the drug susceptible TB but also the horrendous MDR-TB. The outstanding results of nanoparticles based ATD of improved bioavailability, sustained and targeted (intracellular) drug delivery and improved pharmacokinetic profiles has provided renewed approach against *Mycobacterium bacilli* as it directly affects the treatment duration, frequency of administration and pill burden. Since the researchers around the world have failed to categorize or put forth any anti-tuberculosis drug as the first line agent against MDR-TB, the most immediate and reliable approach is to treat the drug susceptible TB efficiently. However, the patient compliance and proper infection control are the two cardinal factors that effects the treatment of drug susceptible TB which can be improved by reducing the duration of regimen, frequency, pill burden, increased bioavailability, sustained therapeutic concentrations in the targeted tissues. Nanoparticles, being a cost effective alternative for lengthy and arduous regimens has potential to play significant role especially in the underdeveloped and developing countries and for the people below the poverty line who are more prone for the infection owing to their poor hygienic environments. According to WHO reports, these countries carry the burden with rates of 20 times higher than that of developed countries. The load of developing MDR TB can also be attributed to the lack of required diagnostic tools, proper health care and health care professionals. Above all, it is the financial condition of patients that is prime culprit that limits even the necessary education and transportation. These situations are ideal for the MDR TB to thrive and for the nanoparticles to unleash its possibilities. As there are no front line agents for MDR TB or XDR TB, nanotechnology can be applied to many second line agents as well. For MDR TB, the resistance profiles can vary. Recent studies have provided evidence that high dosage levels of first line ATDs, like high doses of INH can overcome the MDR TB. One of the hurdles that prevents its clinical practice is that it is irrational to believe that the regimen for which the patient developed DR TB will be successful and will have compliance for the increased regimen of the same. This is where the nanoparticle fits into the baffling puzzle against the DR TB, since, nanoparticle drug delivery of INH reduces the regimen while simultaneously increasing the therapeutic dosage levels. In ideal conditions it is unacceptable to increase the dose of the drugs for combating the infection, however, in resource constrained settings it is the only viable option that could be lifesaving not just for the patient but also for the community as a whole by reducing the epidemic.

### Barriers to overcome:

Despite being a feasible alternative, there are a number of barriers that has prevented the nanoparticles based ATDs to enter into the human trials.

**Table 5:-Barriers to overcome:**

- |  |
|--|
| <ul style="list-style-type: none"> <li>• Removing the residual organic solvent</li> <li>• High quality controls to maintain batch-batch uniformity</li> <li>• Specific Storage conditions required</li> <li>• Stability studies to evaluate shelf life of formulation</li> </ul> |
|--|

Effective pulmonary administration of drugs (insufflation and nebulization). In the large scale production of ATD based NP using synthetic polymers, removing the residual organic solvents is a limitation. It can be addressed by using temperature controlled vacuum drying, which will increase the production cost. Using a natural polymer like

alginate can be an affordable alternative. As in animal models certain pivotal issues have not been solved to mimic the human diseases and drug therapies, the technology has not entered the clinical trials. To maintain the batch-batch consistency of nanoparticles loaded drug, efficient quality control measures are required. PLG should be stored at low temperatures; hence the rigorous stability studies are required to evaluate the shelf life of the formulations. It becomes an obstacle in rural areas of developing countries with poor storage conditions. The sustained delivery of different formulations in animal models is not the representative of dosing schedule in human subjects, which can be commented upon once the clinical trials in human subjects have been done.<sup>[13]</sup>

### **Future prospects:**

The emergence of the MDR TB and XDR TB has posed an urgent threat globally that needs to be addressed effectively. As the researchers around the world has failed to propose first line drugs in MDR TB, it is the call of the hour to explore alternative and feasible strategies. Although the continuous efforts to discover new anti-TB drugs and to evaluate their efficacy and safety should be the priority, however, eradicating TB requires the new drug delivery systems as well. Animal studies of nanoparticle technology has given a new ray of hope to fight this trending global health threat. Due to the obstacles mentioned above, nanoparticle based ATDs have not entered the human trials. Studies should be directed towards overcoming these barriers and evaluating the performance of this novel delivery system in human trials.

### **Conclusion:**

The limitations with the conventional oral chemotherapy such as difficulty in targeting the MDR TB and latent bacteria, toxicity of second line agents and uncertainty of bacterial resistance development has pushed the researchers to explore alternative therapeutic strategies. This is where Nanotechnology fits in the 'puzzle' of combating TB epidemic.

Nanoparticle technology has proved to be most effective to enhance the therapeutic efficacy of first line ATDs among several carriers based controlled drug delivery systems. It can be administered by oral, pulmonary, intravenous, subcutaneous and intramuscular routes. It provides sustained targeted drug delivery which has the potential to reduce the frequency of drug administration and duration of treatment. Additionally, it increases the drug bioavailability and the therapeutic efficacy can be maintained even at sub-therapeutic dose levels. These favorable features eventually facilitate to improve the completion rates as it reduces the cost burden on the patients and on health infrastructure, making the DOT therapies more affordable. With respect to MDR TB Nanoparticle based chemotherapeutic drugs having advantages of improving patient adherence, reducing pill burden, and shortening duration of regimen has the potential to increase the completion rates, thus preventing an individual to progress towards MDR TB. Thus, the tremendous potential of nanoparticle technology in eradicating TB should not be understated. The performance of these neoteric modalities in human subjects is yet to be assessed and analyzed to evaluate their effectiveness in eliminating and controlling TB.

### **Conflict of interest:**

Authors have no conflict of interest.

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### **References:**

1. National Institute of Allergy and Infectious Disease NIAID. Available at <https://www.nih.gov/about-nih/what-we-do/nih-almanac/national-institute-allergy-infectious-diseases-niaid>.
2. World Health Organization (WHO) Report 2012. Global TB control. Available at [http://apps.who.int/iris/bitstream/10665/75938/1/9789241564502\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/75938/1/9789241564502_eng.pdf)
3. Russell DG, Barry CE 3rd, Flynn JA. Tuberculosis: what we don't know can, and does, hurt us. Science. 2010;328(5980):852–856.

4. Multi Drug-Resistant Tuberculosis (MDR\_TB) 2015 Update WHO. Available at [http://www.who.int/tb/challenges/mdr/mdr\\_tb\\_factsheet.pdf](http://www.who.int/tb/challenges/mdr/mdr_tb_factsheet.pdf)
5. McCary E, Weinbaum CM, Barden CR, Onorato IM. The epidemiology of tuberculosis in the- United States, Clin Chest Med 1997;18:99-113
6. Centre for disease control and prevention. Meeting the challenge of multi-resistant tuberculosis: Summary of a conference. MMWR 1992; 41:51-71.
7. Kang HW, Weissleder R, Bogdanov A Jr. Targeting of M-PEG protected polyamino acid carrier to human E-selectin in vitro. Amino acid 2002; 23 (1-3); 301-308
8. Langer R. Biomaterials in drug delivery and tissue engineering: one laboratory's experience. Acc Chem Res 2000; 33: 94-101.
9. Kreuter J. Nanoparticles as drug delivery system. In: Nalwa HS, editor. Encyclopedia of Nanoscience and Nanotechnology. New York: American Science Publishers; 2004. p. 161-80.
10. Herrero-Vanrell R, Rincón AC, Alonso M, Reboto V, Molina-Martinez IT, Rodríguez-Cabello JC. Self-assembled particles of an elastin-like polymer as vehicles for controlled drug release. J Controlled Release. 2005; 102:113-122.
11. Gelperina, S., Kisich, K., Iseman, M. D. & Heifets, L. (2005). The Potential Advantages of Nanoparticle Drug Delivery Systems in Chemotherapy of Tuberculosis. American Journal of Respiratory and Critical Care Medicine, 172(12), 1487- 1490
12. Z. Ahmad, M. Maqbool, A. F. Raja Nanomedicine for tuberculosis: Insights from animal models International Journal of Nano Dimension Int.J.Nano Dim. 2(1): 67-84, Summer 2011
13. Y. Chen, R.K. McCulloch, B.N. Gray Synthesis of albumin-dextran sulfate microspheres possessing favorable loading and release characteristics for the anti-cancer drug doxorubicin. Control Rel., 31 (1) (1994), pp. 49-54
14. Pandey R, Khuller GK. Antitubercular inhaled therapy: opportunities, progress and challenges J Antimicrob Chemother. 2005 Apr;55(4):430-5. Epub 2005 Mar 10.
15. Lisa Claire du Toit, Viness Pillay, and Michael Paul Danckwerts Tuberculosis chemotherapy: current drug delivery approaches. Respiratory Research, BioMed central the open access publisher, Volume 7(1); 2006
16. Mitchison D. Basic mechanism of chemotherapy. Chest, 1979; 76:771-781.
17. Zhang Y. The magic bullets and tuberculosis drug targets. Annu Rev Pharmacol Toxicol, 2005; 45:529-564.
18. Sagar R. Mudshinge, Amol B. Deore, Sachin Patil, Chetan M. Bhalgat Nanoparticles: Emerging carriers for drug delivery Saudi Pharmaceutical Journal Volume 19, Issue 3, July 2011, Pages 129-141
19. Muller RH, Wallis KH. Surface modification of i.v. injectable biodegradable nanoparticles with poloxamer polymers and poloxamine 908. Int. J. Pharm. 1993; 89: 25-31.
20. Bhadra D, Bhadra S, Jain P, Jain NK. Pegnology: a review of PEG-ylated systems. Pharmazie 2002; 57: 5-29. 3
21. Couvreur P, Barratt G, Fattal E, Legrand P, Vauthier C. Nanocapsule technology: a review. Crit Rev Ther Drug Carrier Syst 2002; 19: 99-134.
22. VJ Mohanraj and Y Chen, Nanoparticles – A Review, Tropical Journal of Pharmaceutical Research, June 2006; 5 (1): 561-573
23. Govender T, Stolnik S, Garnett MC, Illum L, Davis SS. PLGA nanoparticles prepared by nanoprecipitation: drug loading and release studies of a water soluble drug. J. Control. Rel. 1999; 57: 171-185.
24. Calvo P, Remunan-Lopez C, Vila-Jato JL, Alonso MJ. Novel hydrophilic chitosan-polyethylene oxide nanoparticles as protein carriers. J. Appl. Polymer Sci. 1997; 63: 125-132.
25. Calvo P, Remunan-Lopez C, Vila-Jato JL, Alonso MJ. Chitosan and chitosan/ethylene oxide-propylene oxide block copolymer nanoparticles as novel carriers for proteins and vaccines. Pharm Res. 1997; 14: 1431-1436.
26. Lamprecht A, Ubrich N, Yamamoto H, Schäfer U, Takeuchi H, Maincent P, Kawashima Y, Lehr CM Biodegradable nanoparticles for targeted drug delivery in treatment of inflammatory bowel disease J Pharmacol Exp Ther. 2001 Nov; 299(2):775-81.
27. Pandey R, Zahoor A, Sharma S, Khuller GK. Nanoparticle encapsulated antitubercular drugs as a potential oral drug delivery system against murine tuberculosis. Tuberculosis (Edinb) 2003; 83:373-378.
28. Deol P, Khuller GK. Lung specific stealth liposomes; stability, biodistribution and toxicity of liposomal antituberculosis drugs in mice. Biochem Biophys Acta; 1997: 1334:161-172.
29. Lehr, C. M. (2000), Lectin-mediated drug delivery: the second generation of bioadhesives. J Control Release, 65, 19-29.
30. Susmita Sarkar, Mavanur R. Suresh An Overview of Tuberculosis Chemotherapy – A Literature Review J Pharm Pharmaceut Sci (www.cspsCanada.org) 14(2) 148 - 161, 2011

31. The lectin- cell interaction and its implications to intestinal lectin-mediated drug delivery. Gabor F, Bogner E, Weissenboeck A, Wirth M.
32. Aulton M.E. (2002). *Pharmaceutics-The of Doasge Form Design* (pp. 463) Churchill Livingstone.
33. Sam, E., Jeanjean, A. P., Maloteaux, J. M., Verbeke, N. (1995). Apomorphin pharmacokinetics in Parkinsonism after intranasal and subcutaneous application. *European Journal of Drug metabolism and Pharmacokinetics*, 20(1), 27-33.
34. Pandey, R., Sharma, A., Zahoor, A., Sharma, S., Khuller, G. K. & Prasad, B. (2003), Poly (DL-lactide-co-glycolide) nanoparticle based inhalable sustained drug delivery system for experimental tuberculosis. *J Antimicrob Chemothe*,52, 981-986.
35. Sung, J. C., Padilla, D. J., Garcia-Contreras, L., Verberkmoes, J. L., Durbin, D. & Peloquin, C. A. (2009), Formulation and pharmacokinetics of self-assembled rifampicin nanoparticle systems for pulmonary delivery. *Pharm Res*,26, 1847-1855.
36. Ohashi, K., Kabasawa, T., Ozeki, T. & Okada, H. (2009), One-step preparation of rifampicin/poly (lactic-co-glycolic acid) nanoparticle-containing mannitol microspheres using a four-fluid nozzle spray dryer for inhalation therapy of tuberculosis. *J Control Release*,135, 19-24.
37. Sung, J. C., Garcia-Contreras, L., Verberkmoes, J. L., Peloquin, C. A., Elbert, K. J. & Hickey, A. J. (2009), Dry powder nitroimidazopyran antibiotic PA-824 aerosol for inhalation. *Antimicrob Agents Chemother*,53, 1338-1343.
38. Pandey, R. & Khuller, G. K. (2004), Subcutaneous nanoparticle based antitubercular chemotherapy in an experimental model. *J Antimicrob Chemother*,54, 266-268.
39. Anisimova YV, Gelperina SE, Peloquin CA, Heifets IB. nanoparticles as antituberculosis drugs carriers: effect on activity against m. tuberculosis in human monocyte-derived macrophages. *Journal of Nanoparticle Research*, 2000; 2: 165-171
40. Oral PLG NP based ATD: Toxicology and chemotherapeutic implications. R. Panday, Sadhna Sharma and G K Khuller.





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### RESEARCH ARTICLE

#### DIVERSITY, COMPTABILITY AND NITROGEN FIXATION OF WILD LEGMES RHIZOBIA.

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#### Abstract

The study aims at isolation, identification and preservation of rhizobia isolated from wild legumes and further to test their ability to fix nitrogen with their homologous crop legumes.

A field survey was carried out in Gezira State and Shendi area for the purpose of collecting samples of wild legumes for isolation and identification of their associated rhizobia. *Rhizobium* strains were isolated using YEMA media and presumptive test were carried out. Seedlings of some leguminous plants representing the main cross-inoculation groups were inoculated with isolates from the wild legumes.

The result showed that all collected wild legumes were found to bear nodules on their roots. Some isolates were found to be fast-growing and acid producing rhizobia while others were found to be slow-growing and alkaline. The cross inoculation classification of the isolates showed that isolates from *Phaseolus trilobus* plants can be grouped with *Rhizobium leguminosarum* bv. *Viciae* and *Rhizobium* spp. Isolates from *Sesbania sesban* and *Indigofera articulata* can be grouped with *Rhizobium leguminosarum* bv. *Viciae*, *Rhizobium leguminosarum* bv. *Phaseoli* and *Rhizobium* spp.

None of the isolates can be grouped with *Rhizobium leguminosarum* bv. *Trifoleae*, *Bradyrhizobium lupinus* or *Bradyrhizobium japonicum*. It was also noticed that all isolates formed nodules on roots of *Vigna unguiculata* and they are belonging to the miscellaneous cowpea group.

All of the RAPD primers gave amplification products and they were all reproducible. The most relative isolates were SH1 and ENRRI23 with 73% similarity; while the most distant were ENRRI21 and TAL380 with similarity percentage of 26%.

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#### Introduction:-

Wild legumes (herb or tree) are widely distributed in arid regions and actively contributed to soil fertility in these environments. These legumes in arid regions are subject to severe environmental conditions. They have a great variation in nodulation and nitrogen fixation in respect to site and locality. N<sub>2</sub> fixing activity and tolerance to drastic conditions may be higher in wild legumes than in crop legumes. Oref.

A great deal of *Rhizobium* research has been traditionally devoted to cultivated species, for which the rhizobial microsymbionts have been thoroughly characterized and described (Thies et al., 2001). In contrast, little attention has been dedicated to the root-nodule symbionts of truly wild legumes intended as those whose ecology is for the most part independent of human action or carry-over. Although there have been some surveys of 'wild' rhizobia, there has been little systematic comparison of the symbionts of wild and cultivated legumes, nor between populations in cultivated and uncultivated soils (Mutch, et al., 2004).

The rhizobia from wild legumes are expected to be adapted to environmental conditions like their symbiont plants. Accordingly, these rhizobia can serve as adaptive inoculant rhizobia if they prove to be highly effective in nitrogen fixation with their homologous crop legumes).

The diversity of rhizobia in a particular soil may be influenced by the method of its isolation. Several arrays of techniques are used for detecting and describing rhizobial diversity. These are host range, comparative growth in culture, intrinsic antibiotic resistance, tolerance in pH, and salt. These are among the most common methods that are considered as phenotypic characters and are used primarily to study rhizobial diversity (Maatallaah et al., 2002). The size, shape, color and).

Modern molecular tools which are more preferred to phenotypic methods can also be used to evaluate the specificity of the strains (Thies et al., 2001). Some of these molecular tools employed for rhizobial diversity identification includes: plasmid profiling (Broughton et al., 1987), restriction fragment length polymorphism (RFLP) (Odee et al., 2002), polymerase chain reaction based techniques (PCR) (Richardson et al., 1998).

### Materials and Methods:-

The study was conducted in the Faculty of Science and Technology, Shendi University, Sudan. Five *Rhizobium* strains were used throughout this study. Four strains were obtained from The Biofertilization Department, Environmental, Natural Resources and Desertification Research, Institute Khartoum, Sudan. The 5<sup>th</sup> strain (Shendi S1) was isolated from *Sesabania* plant grown in Shendi. The source and classification of *Rhizobium* and *Bradyrhizobium* strains is shown in table (1).

### Morphological Characteristics:-

The morphological characteristics of the isolates were determined according to Lupwayi and Haque (1994). A loopful of rhizobial isolates from 48 hrs old broth culture was inoculated by streak plating onto YEM Agar and incubated at  $28 \pm 2^\circ\text{C}$  for 3-5 days. After 5 days, colony diameter and morphology, colony texture were recorded.

**Gram Staining** The gram staining technique and motility test were done according to Benson (1994). **Biochemical and Physiological characteristics** The biochemical and Physiological tests were carried out in growth medium at  $28^\circ\text{C}$  for 48 hours incubation. All the tests were carried out with three replicates.

**Acid-base production** To determine the ability of the rhizobial isolates to produce acid or alkaline in the medium, YEMA containing bromothymol blue (0.025 w/v) was used. After the incubation of 72 h at  $28 \pm 10^\circ\text{C}$ , the pH changes was scored on the basis of color change of the medium (Chen and Lee, 2001).

**Oxidase test** A few drops of freshly prepared oxidase reagent was added on a piece of filtered paper in a clean Petri plate. Using a glass rod, a colony of the isolate was smeared on the filter paper and the paper was observed for any change in the colors of the reagent (Benson, 1994).

**Catalase test** A thick growth of the test culture was immersed in 3ml of 3%  $\text{H}_2\text{O}_2$  solution with the help of a sterile glass rod. Active bubbling within a few seconds showed a positive catalase activity (Benson, 1994).

### Growth rate reaction:-

A measurement was done by using spectrophotometer to measure growth rate of bacteria for six days.

### Phosphorus Solubilization:-

A single colony of rhizobial strains was streaked on pikovskaia medium containing tricalcium phosphate (Pikovskaia et al., 1948) and incubated at  $28 \pm 1^\circ$  for 3-5 days. The plates were observed for clear P-zone formation around colonies.

**Inoculation test:-**

A pot experiment was carried out at the Faculty of Science and Technology, Shendi University to study the nodulation of crop legumes (Beans, Kidney peas, Lupin and Bake) by the strains isolated from wild legumes.

Six samples of each crop were replicated four times. Five out of the six samples were injected each with one specific inoculant (strains isolated from wild legumes), while the sixth sample being control. complete Randomized

Six seeds were sown per plastic bag. After the seedling had reached 10-15 cm in length they were thinned to 3 seedlings per bag. The bags were watered daily in order to maintain the moisture at approximately 75% of the field capacity.

Inoculation was done aseptically 10 days after sowing.

Five ml of the broth media were injected by a sterile disposable syringe.

At harvest, nodules number, nodules dry weight, Dry shoot and roots were measured.

**Molecular Characterization of Rhizobium:-****Genomic DNA Extraction:-**

DNA extraction from isolates was done according to the boiling centrifugation method reported by Miller (1972). A single colony was grown over night at 28°C in YEM broth. Bacterial cell were precipitated by a centrifugation at 13000 rpm for 10 minute in a micro-centrifuge (Sanyo). The supernatant was discarded and the pellets were resuspended in 500ml deionized water. The suspension was boiled for 10 minutes in a water bath and then immediately cooled on ice. Extracted DNA was then stored refrigerated until used.

**Agarose gel electrophoresis of the extracted DNA:-**

The extracted DNA was electrophoresed in 1.5% agarose gel [0.75g agarose dissolved in 50 ml of 1x TBE buffer (0.089 mol/L Tris-borate, and 0.002mM EDTA, pH 8.00). Then 2 µl of ethidium bromide (10 mg/ml) were added. Prior to casting the gel, the comb was adjusted and the gel was poured (making sure that there were no bubbles). While the gel was solidifying, DNA mixtures were prepared for electrophoresis as follows: 1 µl of each DNA sample was transferred to a clean Eppendorf tube and 3µl of loading dye (bromo phenol blue dye) was added to the DNA sample. The content was mixed several times using a micropipette. The comb was removed with gentle back and forth motion and the gel was then immersed in 1x TBE buffer. The buffer was added until it reached a level approximately 3-5 mm above the gel surface. The sample mixtures were loaded into the wells using plastic-tipped micropipettes. 1Kb ladder (Invitrogen) was used as a molecular weight marker. The apparatus (Habaib, U.K, 9H 310083) was closed and the power was turned on, the voltage was adjusted to 75V (400mA) and the running was continued without cooling for 20 minutes after which the gel was visualized under trans illumination cabinet (Model TM-10E, Uvitec. Product) and image was captured and photographed. Extracted DNA was then stored refrigerated until used as a template for PCR amplification.

**Polymerase chain reaction (PCR):-**

For genetic diversity studies four RAPD primers were used to amplify the genomic DNA. The primers were purchased from Gene link, Inc. and Operon Tech., NY 10532. These were 10 oligonucleotide OPC9 primer (CTCACCGTCC), OPY14 (GGTCGATCTG), opl 18 (ACCACCACC) and opr 10(CCAATCCA).

PCR amplification reactions were carried out in a total volume of 20 µl. Each PCR mixtures contained (Final concentration): 5X FIRE Pol PCR Master Mix (Ready to load), 5 X reaction buffer (0.4 M Tris-HCL, 0.1 M (NH<sub>4</sub>) SO<sub>4</sub>, 0.1% w/v Tween 20), 12.5 Mm dNTPs, 50 ng of the primer under test, 1 U Taq polymerase and 20 ng template DNA.

The amplification program used consisted of one cycle at 94°C for 5min, followed by 35 cycles of initial denaturation at 94°C for 1min, annealing at 32°C for 3min, extension at 72°C for 2 min and a final extension step at 72°C for 10 min.

**Results and Discussion:-**

Table 2 showed the growth rate of the rhizobial isolates tasted. Three of the 5 rhizobia under test performed fast growing rate in (3 – 5) days to form separate colonies these were *Crotalaria senegalesis*, *Desmodium dichotomm*

and *Clitorea ternata*. It was understood that the fast growing nodule bacteria belongs to the genus *Rhizobium* were the slow growing ones belong to the *Bradyrhizobium*. *Sesbania sesban* belongs to *Isorhizobium* although it is a slow growing bacteria.

Progress in bacteria growth rate was observed during the second day – fourth day, while deterioration observed at fifth and sixth days. It was reported that the fast growing rhizobia belongs to *Rhizobium* and the slow growing ones were *Bradyrhizobium* (Hiatt 1990).

Acid base production reaction (Bromothymol) *Crotalaria senegalensis*, *Desmodium dichotomum* and *Clitoria ternata* changed the growth medium to acidic one were as the other two changed the medium to alkaline one (table 2). It was reported by many research workers the acid producing root nodule bacteria were classified as *Rhizobium* and the alkali producing ones were *Bradyrhizobium*.

The acid producing *Rhizobium* changed the color of the growing medium when Bromothymole blue added to the broth culture to yellow color producing acids. The alkaline producing *Bradyrhizobium* changed the color of the medium from blue to dark blue (Jordan, 1984)

Table (3) showed the some biochemical tests of the collected strain from wild legumes.

All the strains were found to be gram negative, catalase positive and solubilize phosphorus except strain SHS<sub>1</sub>, which was isolated from *Sesbania sesban* which did not solubilize phosphorus.

#### Inoculation test:-

As shown in Table (4) cross inoculation of legumes by the strains isolated from wild legumes it was clear that *Vicia faba* formed nodules by most of the strains, *Phaseolus vulgaris* only formed nodules by strain SHS<sub>1</sub> and non of the strains formed nodules in *Trifolium sp*. A previous study of *Rhizobium* isolates indicated that one isolate had the ability to nodulate both alfalfa and common bean (Eardly et al., 1985).

The presence of isolates from wild legumes cross-inoculating *Phaseolus vulgaris* is an important finding since it is known that this crop is poorly nodulated and rarely forms effective symbiosis with rhizobia (Herridge and Bergersen, 1988). Isolates from the wild legumes might serve as a solution for this problem and might prove to be effective in nitrogen fixation with *Phaseolus vulgaris*. This necessitates extensive research on the compatibility of isolates from wild legumes with leguminous crops and their ability to form effective symbiosis with their homologous crop.

The result of the experiment showed that some of the isolates belong to more than one cross-inoculation group. This finding reflects the weakness of the cross-inoculation classification of rhizobia which has been criticized by many researchers (Segovia et al; 1993). This entails that other systems of classification should be studied and adopted for the identification and classification of rhizobia.

#### Molecular Characterization of Rhizobium:-

The 9 isolates were amplified using 4 different Operon RAPD primers. The primers were: OPC9, OPL18, OPR10 and OPY14.

- All of the RAPD primers gave amplification products and they were all reproducible.
- A total of 141 fragments were detected for the 9 isolates representing 25 different loci with 100% polymorphism.
- 55.6% of the 9 isolates (ENRRI21, ENRRI22, USDA209, ENRRI2 and ENRRI8) didn't produce any amplification product with primer OPC9.
- Isolate 2 gave no product with primer OPL18.
- The Similarity indices were calculated using Jaccard's coefficient.
- The most relative isolates were SHS<sub>1</sub> and ENRRI23 with 73% similarity; while the most distant were ENRRI21 and TAL380 with similarity percentage of 26%.
- According to the similarity indices, the nine samples were grouped into three clusters each containing three isolates. Cluster 1 includes ENRRI23, SHS<sub>1</sub> AND ENRRI3; Cluster 2 contained ENRRI22, ENRRI2 and TAL380 while Cluster 3 includes ENRRI21, USDA209 and ENRRI8.

The results of PCR experiment are recorded in table 6 and depicted in figure number 8 as well. In figure 8 the uppermost cluster comprises the SH1, ENRRI3 and ENRRI23 isolates which are most genetically compatible. As the similarity reaches around 0.71 which gives rise to a far extent of genetic compatibility.

The RAPD technique was used to detect the compatibility between 9 isolates of rhizobia used in this study, which analysis clear the most relative isolates were SH1 and ENRRI23, this similarity could be attributed to compatible genetic characteristics. While the most distant were TAL380 and ENRRI21 which may be underlying to fewer shared genetic characteristics.

**Table 1:-** source and classification of rhizobia

No	Host Plant	Short name	Local name	Subfamily	Area of collection
1	<i>Crotalaria senegalensis</i>	ENRRI 3	Fartaga	<i>Papilionoidea</i>	Gezira
2	<i>Phaseolus trilobus</i>	ENRRI 21	Phillipsara	<i>Papilionoidea</i>	"
3	<i>Desmodium dichotomum</i>	ENRRI 22	Abu-Areeda	<i>Papilionoidea</i>	"
4	<i>Clitoria ternate</i>	ENRRI 23	Clitoria	<i>Papilionoidea</i>	"
5	<i>Sesbania sesban</i>	SHS 1	Sesban	<i>Papilionoidea</i>	Shendi

**Table 2:-** growth rate and growth reaction of Rhizobia

No	Host Plant	Short name	Growth rate	Growth reaction bromothymol
1	<i>Crotalaria senegalensis</i>	ENRRI 3	Fast	Yellow / Acidic
2	<i>Phaseolus trilobus</i>	ENRRI 21	Slow	Blue / Alkaline
3	<i>Desmodium dichotomum</i>	ENRRI 22	Fast	Yellow / Acidic
4	<i>Clitoria ternate</i>	ENRRI 23	Fast	"
5	<i>Sesbania sesban</i>	SHS 1	Slow	Blue / Alkaline

**Table 3:-** biochemical characteristics of *Rhizobium* strains

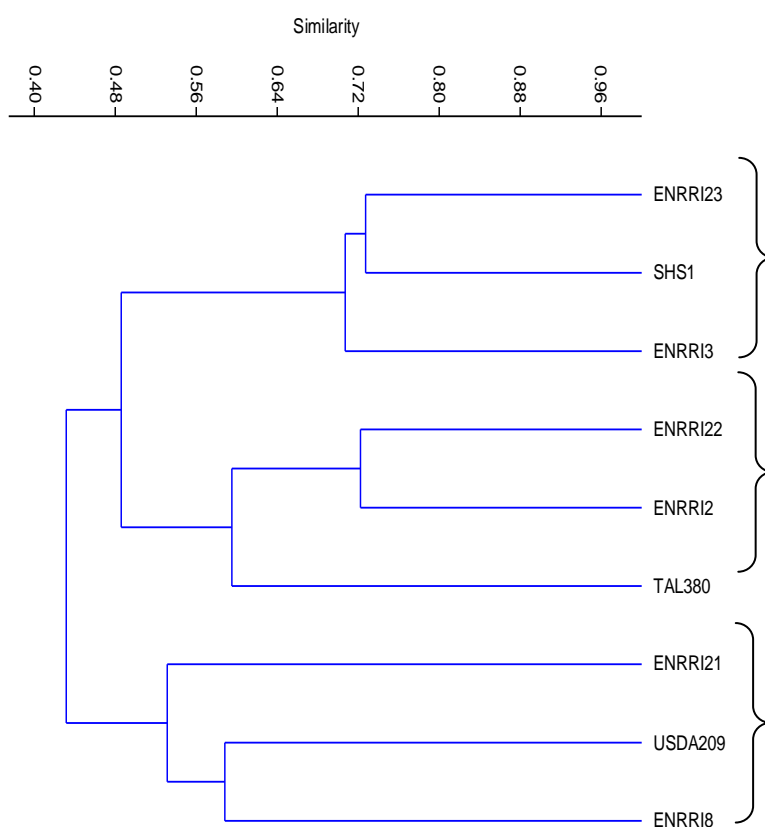
No	Host Plant	Short name	Gram Stain	Catalase test	Phosphorus sol
1	<i>Crotalaria senegalensis</i>	ENRRI 3	- Ve	+	+
2	<i>Phaseolus trilobus</i>	ENRRI 21	- Ve	+	+
3	<i>Desmodium dichotomum</i>	ENRRI 22	- Ve	+	+
4	<i>Clitoria ternate</i>	ENRRI 23	- Ve	+	+
5	<i>Sesbania sesban</i>	SHS 1	- Ve	+	-

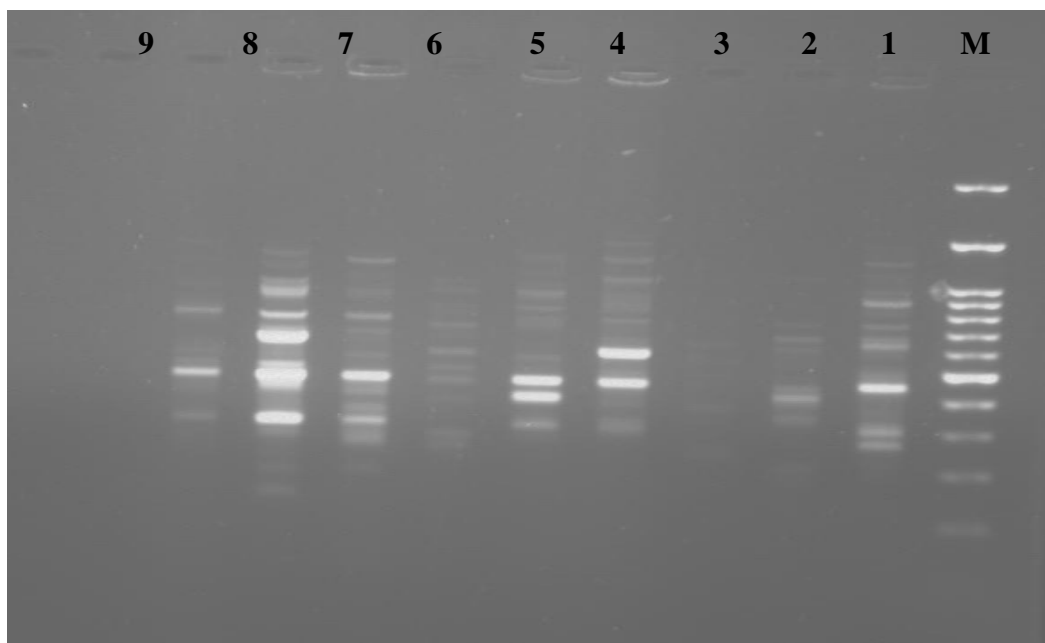
**Table 4:-** Nodulation and cross inoculation

No	Host Plant	Source	Vicia faba	Phaseolus vulgaris	Trifolium SP
1	<i>Crotalaria senegalensis</i>	Gezira	-	-	-
2	<i>Phaseolus trilobus</i>	"	+	-	-
3	<i>Desmodium dichotomum</i>	"	-	-	-
4	<i>Clitoria ternate</i>	"	+	-	-
5	<i>Sesbania sesban</i>	Shendi	+	+	-

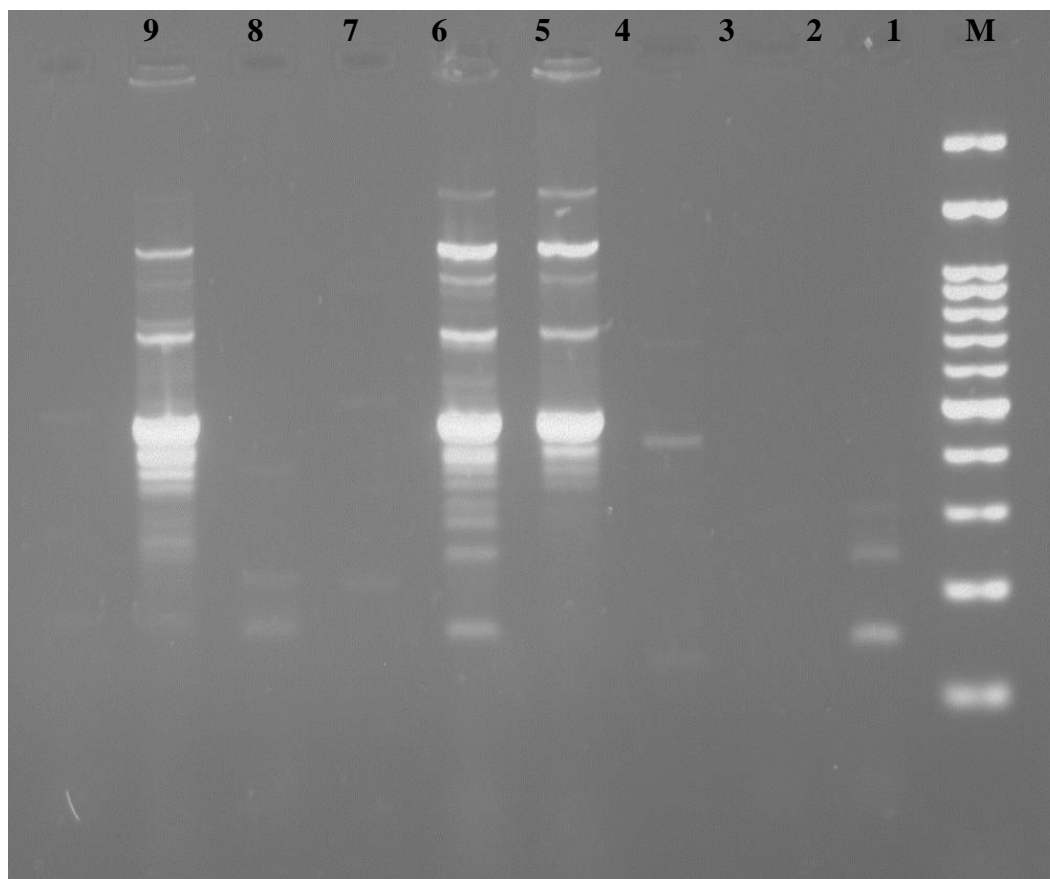
**Table 5:-** Similarity matrix between different tested isolates of *Rhizobium* constructed from RAPD – PCR banding pattern

	SHS1	ENRRI3	ENRRI21	ENRRI23	ENRRI22	USDA209	ENRRI2	TAL380	ENRRI8
SHS1	1.00								
ENRRI3	0.71	1.00							
ENRRI21	0.41	0.42	1.00						
ENRRI23	0.73	0.70	0.53	1.00					
ENRRI22	0.52	0.35	0.30	0.38	1.00				
USDA209	0.46	0.48	0.53	0.43	0.43	1.00			
ENRRI2	0.57	0.45	0.42	0.48	0.72	0.55	1.00		
TAL380	0.65	0.48	0.26	0.50	0.57	0.38	0.62	1.00	
ENRRI8	0.52	0.56	0.53	0.43	0.42	0.59	0.47	0.30	1.00

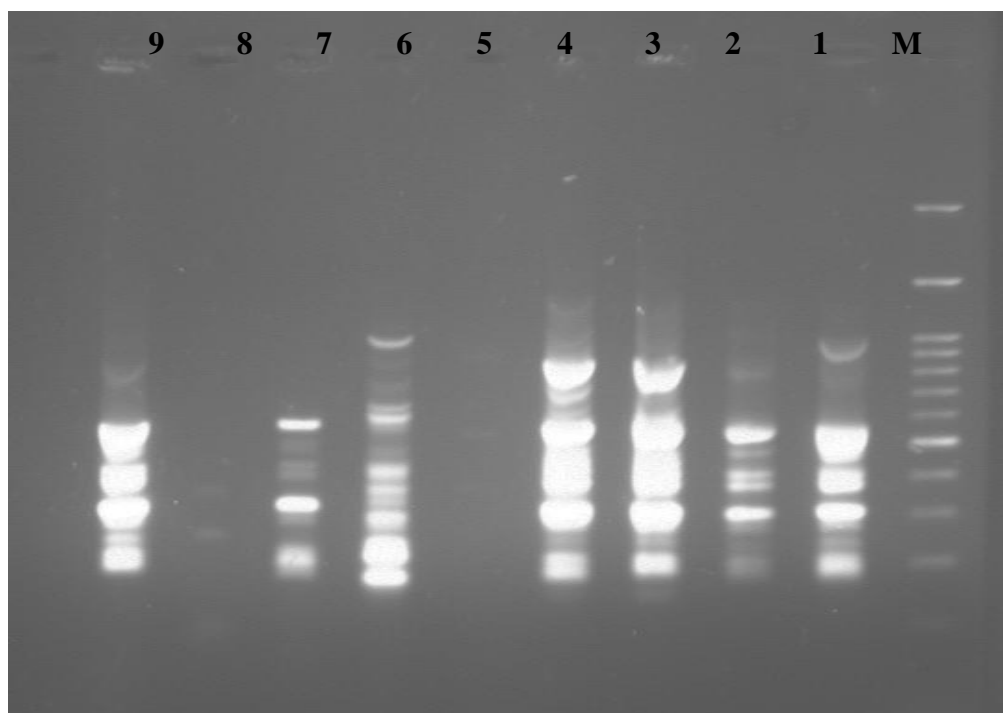
**Figure 1:-** Dendrogram tree of *Rhizobium* strains isolated from wild legumes based on RAPD - PCR



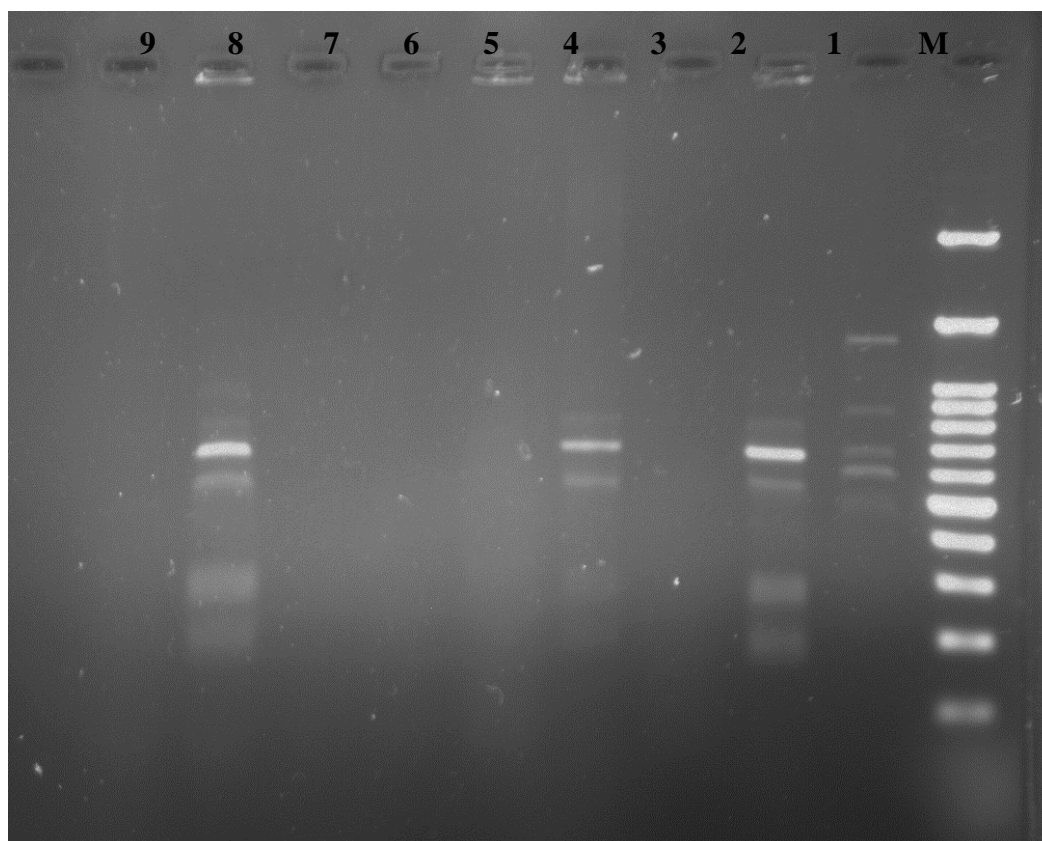
**Figure 2:-** .RAPD product of primer opr10 of *Rhizobium* strains



**Figure 3:-** RAPD product of primer opl18 of *Rhizobium* strains



**Figure 4:-** .RAPD product of primer opy14 of *Rhizobium* strains



**Figure 5:-** RAPD product of primer opc9 of *Rhizobium* strains



**References:-**

1. Benson, H. J., (1994). Microbiology application, Complete Version. Laboratory manual in general microbiology, 8th edition W.C. Brown Publishers, Dubuque, Mebourn, Oxford.
2. Broughton, W. J., Samery, U. and Stanley, J. (1987). Ecological genetics of *Rhizobium meliloti*: symbiotic plasmid transfer in the *Medicago sativa* rhizosp here. FEMS. Microbiol. Letters 40: 251-255.
3. Eardly, B, D., Hannaway, D, B, and Bottomley, P, J, (1985).
4. Characterization of rhizobia from ineffective alfalfa nodules; ability to nodulate bean plants (*Phaseolus vulgaris* (L.) Savi.J, of Appl, Environ, Microbiol.50: 1422-1427.
5. Herridge, D. F. and Bergersen, F. J. (1988). Symbiotic nitrogen fixation. In: Advances in Nitrogen Cycling in Agricultural Ecosystems (ed. J. R. Wilson) pp. 45-52.
6. Jordan, D. C. (1984). Family III. Rhizobiaceae. In: Bergey's Manual of Systematic Bacteriology, pp. 234-254, (Krieg, N. R. and Holt, J. G. eds). The Williams and Wilkins, Baltimore.
7. Lupway, N. Z. and Haque, I. (1994). Working document: legume- rhizobium technology manual. Environmental science division international livestock center for Africa, Addis Ababa, Ethiopia. PP 1-40.
8. Maatallah, J., Berraho, E. B., Sanjuan, J. and Lunch, C. (2002). Phenotypic characterization of rhizobia isolates from chickpea (*Cicer arrientium* growing in Moroccan soils. Agronomic. 22: 321-329.
9. Miller,(1972).Experiment in Molecular Genetics.Front. Cover. Jeffry H. Miller.Cold spring Harbr Laboratory, 1972,-Science-466 pages.
10. Mutch et al., 2004.Pesticide Biotransformation and Disposition. Ernest Hodgson.
11. Odee, D. W., Haukka, K., McInroy, S. G., Sprent, J. I, Sutherland, J. M. and Young, J. P W. (2002). Genetic and symbiotic characterization of rhizobia isolated from free. and herbaceous legumes grown in soils from ecologically diverse sites in Kenya. Soil Biol. Biochem. 34: 801-811.
12. Pikovskaia et al.,(1984).First International Meeting on Microbial Phosphate Solubilization.C. Rodrigucz-Barrueco, E.Velazques.
13. Richardson, A.E., Simpson, R. J., Djordjevie, M. A. and Rolfe, B. J. (1998). Expression of nodulation genes in *Rhizobium leguminosarum* biovar *trifolii* affected by low pH and by  $Ca^{2+}$  and  $Al$  ions. Appl. 2541-2548.
14. Segovia, L., Peter, J., Young, W. and Martinez-Romero, E. (1993).Reclassification of American *Rhizobium leguminosarum* bv. Phaseoli type 1 strain as *rhizobium etli* sp. Nov. Interl. J. of System. Bacteriol. 43(2):374-377.
15. Thies, J. E., Holmes, E. M. and Vachot, A. (2001). Application of molecular Techniques to studies in rhizobium ecology: a review Aust. J. Exp. Agr.
16. Zahran,H. H. (2001). Rhizobia of Wild Legumes: diversity, taxonomy, ecology, nitrogen fixation and biotechnology. Journal of Biotechnology.91: 143 – 153.

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### RESEARCH ARTICLE

#### PRODUCTION OF NUTRITIOUS JAM BY USING AN UNDERUTILIZED FRUIT AVVERHOA CARAMBOLA (STAR FRUIT).

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Carambola, jam making, preservation, shelf-life, nutritive value

#### Abstract

Making of jams is the common methods of preserving fruit, the main factor being high concentration of sugar that helps in preservation. Carambola is a sub-tropical fruit found in Indonesia, Malaysia, etc. In India the fruit is available in the months of September through October and January through February. The main health benefits of carambola are anti-inflammatory, analgesic, hypoglycemic, antimicrobial, hepatoprotective and anti-ulcer activity. Product development was carried out using carambola fruit. The jam was developed as a complete natural product with no added preservatives. Organoleptic properties of the product were assessed by sensory evaluation and the jam was found to be acceptable. Shelf-life study of the jam was carried out by microbial analysis and it was found that there was a decrease in the no. of microbial contaminants. Nutritive value of the product was also analyzed; the results obtained were Protein 0.88%, Fat 0.19%, Carbohydrates 44.89%, Energy 185 kcal, Dietary fiber 1.68%, Magnesium 156 mg and Vitamin C 5 mg per 100 gms.

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#### Introduction:-

Food is something that is consumed not only for its varied taste but also for its nutritional importance. Food usually provides the humans with ample nutrients such as proteins, carbohydrates, fats, vitamins, minerals & energy. The sources of food are plants and animals, plant sources being the fruits & vegetables. As most of the fruits are seasonal and perishable in nature, its processing is a must. To ensure the supply of wholesome, safe, nutritious and acceptable food to the consumers, there should be processing of fruits into various products that could be preserved for a long time and which adds value to the product. Processing of fruits not only serves as a purpose of its preservation but also several other purposes such as diversification of the economy, reduction of imports and meeting export demands, stimulate agricultural production by obtaining marketable products, generate employment, reduce fruit & vegetable losses, develop new value added products which are also available during off-seasons (Bakshi & Joshi; 2013).

*Avverhoa Carambola* or commonly called as star fruit is a native fruit to Tropical Asia, Indonesia, Malaysia and other exotic regions such as Australia, Brazil, Cambodia etc. India's Carambola season is throughout the year; but it flourishes during two times i.e. September through October & January through February. It prefers warm climate and can be grown in India on the hills up to 1,200 m. In spite of its high availability, it is an underutilized fruit in the

Indian market. The fruit have a high water content and is a rich source of dietary fiber, Vitamin C, antioxidant phyto-nutrients such as polyphenols and flavonoids, B-complex vitamins such as folates, riboflavin, and pyridoxine. It also carry small amount of minerals and electrolytes like potassium, phosphorus, and zinc and iron (Ferrera, 2009).

Carambola has a potent antioxidant and antimicrobial activity. It boosts the immune system to fight against toxic free radicals and other common infections. The insoluble dietary fiber helps in digestion and also in lowering blood cholesterol. According to the studies carried out by Dasgupta et.al in 2013 on *Avverhoa carambola*, the plant is proved to possess medicinal properties such as anti-inflammatory, analgesic, hypoglycemic, antimicrobial, hepatoprotective and anti-ulcer activity and therefore the plant & its fruit can be used as a potent medicine.

Carambola fruits have a very high nutritive value but a sour taste which makes it unpopular. The availability of the fruit throughout the year makes it a good choice to be used for development of new products with an appealing taste. Attempts have been made to develop commercial products from carambola such as essence, juice and wine (Nagy et.al, 1990; Napahde et.al, 2010). The present study aims to develop jam using carambola and to study its quality, stability and nutritional properties.

## **Materials and Methods:-**

### **Product development:-**

*Avverhoa carambola* was purchased from the local market. Experimental trial jams were prepared using the fruit pulp, different concentrations of granulated sugar and commercial pectin. Plate test was performed to determine the setting point of jam as described by Khanna and Gupta, 1993.

### **Sensory evaluation:-**

The trial samples were subjected to sensory evaluation by 10 semi-trained panelists to determine the acceptability of the samples. The jam was evaluated on a 5 point hedonic scale where 1 is the lowest point and 5 is the highest point for that particular characteristic. The characteristics on which the jam was evaluated were appearance, color, taste, texture, mouth-feel, aftertaste and overall acceptability (Lawless and Haymenn, 1999).

### **Nutritional analysis:-**

Nutritional analysis of the jam was carried out at Anazeal Analyticals & Research Pvt. Ltd. Labs. The overall content of proteins, fats, carbohydrates, energy, dietary fiber, calcium, phosphorus, potassium, magnesium, Vitamin C provided per 100 gm of jam sample was determined (Pathak and Chakraborty, 2006).

### **Shelf life and Stability studies:-**

A microbial challenge study was carried out by growth inhibition method on jam samples to evaluate the stability and safety of a product with respect to food borne pathogens and spoilage-causing microorganisms. The samples were challenged by inoculating them with common spoilage organisms and food-borne pathogens i.e. *Escherichia coli*, *Staphylococcus aureus*, *Bacillus cereus* and *Saccharomyces cerevisiae* individually and incubated at 28°C for 20 days (US FDA, 2009)

At different time intervals aliquots were obtained from these samples, adequately diluted and plated on selective media and incubated for growth of the contaminants. Nutrient agar, MacConkey's agar, Baird parker's agar and Sabourad's agar were used for enumeration of *Bacillus cereus*, *Escherichia coli*, *Staphylococcus aureus* and *Saccharomyces cerevisiae*, respectively.

Viable counts were determined at zero time, after 5 days, 10 days, 15 days and 20 days of storage of the samples at room temperature. Uninoculated controls were also maintained and total bacterial and mould counts were determined on Nutrient agar and Sabouraud's agar.

## **Results and Discussions:-**

### **Product Development:-**

The quality of jam is determined by the proportions of sugar and pectin added to the fruit pulp. Ideally jams contain 50-65% of sugars which gives the product a bright colour and natural stability. To optimize the sugar and pectin content in the final product, trial jams were developed using different variations as tabulated below (Table 1).

**Table 1:-** Optimization of sugar and pectin content

<b>Trials</b>	<b>Sugar Concentration %</b>	<b>Pectin Concentration %</b>
Trial 1	60	0
Trial 2	40	5
Trial 3	60	3
Trial 4	60	2
Trial 5	60	1

The production parameters, mainly the degree to which the pulp is homogenized and the time and temperature used for processing also affect drastically the quality of the jam produced, and this is well reflected in the sensory assessment of jams.

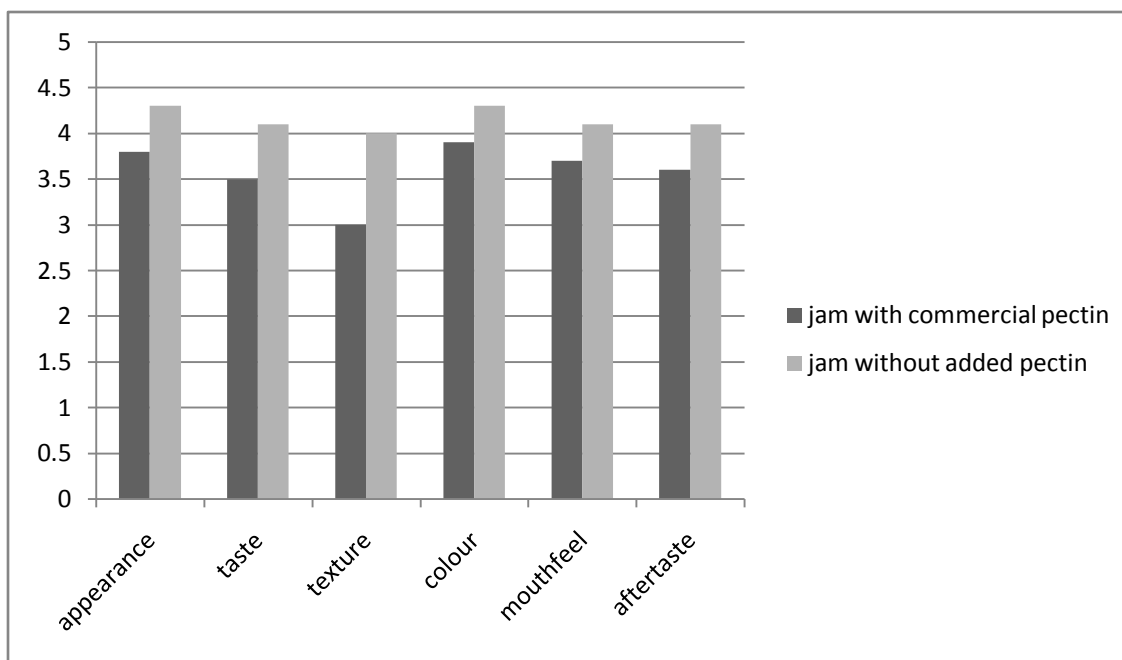
The product that was standardized was a pectin-free product as designed in trial 2. It constituted of pulp-125 gms and sugar- 75 gms and was processed for 25 minutes. At lesser concentrations the characteristic gel consistency is lost whereas higher sugar content cause crystallization in the jam. Jams with less sugar content were also susceptible to spoilage due to microbial fermentation and may need chemical preservatives (Sidappa and Lal; 1998).

The work carried out by Patil et al in 2010 has shown that the pectin content of mature fruits of carambola is very high (5 %). The jam formed using only pulp and sugar had a bright colour and smooth consistency which had set well as demonstrated by plate test. There was no need to add commercial pectin as the fruit itself was pectin-rich.

#### **Sensory Evaluation:-**

The sensory evaluation for the variations of the product showed that the jam with no pectin added was given the highest scores for all the parameters by the panelist. This was due to carambola having inherent pectin and therefore no commercial pectin was needed for a product with good consistency. Fig 1 gives the comparison of the mean scores obtained of the parameter studied for sensory evaluation for jams prepared with and without added commercial pectin.

Siddiqui et al in 2015 has used sapodilla for jam preparation. The source of pectin for this was the fruit peel. Sensory evaluation was carried out for the prepared jam and the consistency of the jam was approved. Commercial pectin was not required as the fruit peel was shown to possess gelling properties because of high pectin content. Fruit jams prepared without adding commercial pectin were found to be of acceptable quality if the fruit is rich in pectin.

**Fig.1:-** Comparison of acceptability for jam with and without added commercial pectin

**Nutritional analysis:-**

Table 2 gives the nutritive value of the jam as determined for 100 gm. According to these results, it can be stated that the product contains certain minerals, Vitamin C and is an abundant source of energy.

**Table 2:-** Nutritive value/100 gm

Nutrient	Nutrient value/100gm
Protein	0.88 %
Fat	0.19%
Carbohydrates	44.89%
Energy	185 kcal
Dietary fiber	1.68%
Calcium	0
Phosphorus – as P	0.08%
as P <sub>2</sub> O <sub>5</sub>	0.18%
Potassium	0.37%
Magnesium	156 mg
Vitamin C	5 mg

The pulp and seeds of quince fruit was used to prepare jam by Silva et al in 2004 and the antioxidant activity of the product as well as the raw pulp and seeds were studied. Their results showed that the product showed a very good activity which can be correlated to its Vitamin C content. A slight reduction in the activity was reported for the processed jams as compared to the raw pulp and seed.

**Shelf life and Stability testing:-**

Shelf-life study was carried out to check the keeping quality of the carambola jam. The primary reasons for the deterioration of the product are the micro-organisms, leading to change in the physical attributes and organoleptic properties of the product. The product standardized is a 100% natural jam with no added preservatives, with the ingredients only being carambola and sugar. Therefore, the only preserving factor in the jam is sugar. Caramola jam is an acid food, rich in carbohydrates, and is therefore vulnerable to the growth of microbial agents such as yeasts and molds. Therefore, shelf-life study of the standardized product was carried out by growth inhibition test for 20 days at an interval of 5 days with storage at room temperature. Before inoculating the challenge organisms, baseline level of microorganisms present in the product were determined as control. .

Control sample, without any inoculation of the challenge organisms showed product to be safe and of good quality microbiologically. The results obtained for challenged samples are mentioned in Table 3

**Table 3:-** Results of shelf life study.

No. of days	Inoculated Jam				Uninoculated Jam (Control)	
	<i>B.cereus</i> (cfu/gm)	<i>S.aureus</i> (cfu/gm)	<i>E.coli</i> (cfu/gm)	<i>S.cerevisiae</i> (cfu/gm)	Yeast (cfu/gm)	Bacteria (cfu/gm)
0	2* 10 <sup>3</sup>	2.5* 10 <sup>3</sup>	3* 10 <sup>3</sup>	1* 10 <sup>3</sup>	20	12
5	257	35	60	40	20	7
10	213	16	13	20	15	5
15	191	0	0	3	2	0
20	163	0	0	0	0	0

According to results obtained for the 20-day shelf life study, there is a decrease in the number of bacteria, yeasts and molds contaminants in the jam. The common spoilage causing micro-organisms which were used for shelf-life study were *Bacillus cereus* and *Saccharomyces cerevisiae*. The bottles in which micro-organisms were inoculated also showed a decreased gradation in the microbial population. This indicates that the sugar concentration in the jam i.e. 60% was enough for the inhibition of spoilage causing micro-organisms. At this concentration the microbial contaminants are not able to survive in the product and hence the product would not be spoiled quickly.

The studies carried out by Viberg et al in 1997 on blackcurrant jam prepared without chemical additives had shown that the jam can remain stable for a period of 13 months at low temperature. The sugar content of the jam was 23 %. Microbial analyses carried out at regular should no growth of bacteria, yeasts and molds, sporeformers and pathogens. The nutritional value and the minerals and vitamin content were found to be within the acceptable value. The colour, viscosity and appearance of the jam were stable.

### Conclusion:-

An acceptable product i.e. jam with the use of Carambola, an uncommon and underutilised fruit was formulated. This jam was developed as a 100% natural product with no added preservatives. The product was found to be acceptable based on the sensory evaluation using Hedonic-scale. It is also nutritious and beneficial for health serving as a good source of anti-oxidants, minerals and dietary fiber. It was found to have a stable product with a defined shelf-life. The sugar concentration added was enough to prevent the food contaminants like *B.cereus* and *S.cerevisiae* from growing and causing the deterioration of the product. Thus, a nutritious Carambola jam which was sensorily accepted with a good keeping quality was developed. Additionally, different products of carambola can be formulated like carambola juice, confectionary (candy) or marmalade.

### References:-

1. Abdullah A, Cheng TC. 2001. Optimization of reduced calorie tropical mixed fruits jam. *Food Qual Pref.* 12:63–68.
2. Bakshi AK, Joshi VK, Vaidya D, Sharma S. 2013. *Processing & Preservation of fruits of Himalayan region; Food processing & preservation- Part I*. New Delhi: Jagmander book agency, pp 288-292
3. Dasgupta P, Chakraborty P, Bala NN. 2013. *Averrhoa Carambola*: An Updated Review; *International Journal of Pharma Research & Review*. 2: 54-63
4. Ferrara L. 2009. Functional properties of *Averrhoa carambola L.* *Ingredienti Alimentari*. 8: 16-19
5. Khanna K, Gupta S. 1993. *Preservation of fruits & vegetables at home; the art & science of Cooking-A student's manual*. 2nd Edition. Elite Publishing House Pvt Ltd; pp 280-282
6. Lawless HT, Heymann H. 1999. *Introduction & overview; Sensory evaluation of food-principles & practice*. New York: Kluwer academic/ Plenum publishers, pp 1-24
7. Nagy S, Barros S, Carter R. 1990. Production and Characterization of Carambola essence. *Proceedings Florida State Horticultural Science*. 103: 27-279
8. Napahde S, Durve A, Bharti D, Chandra N. 2010. Wine Production from Carambola (*Averrhoa carambola*) Juice using *Sachharomyces cerevisiae*. *Asian journal of experimental biological sciences*. 20-23
9. Pathak PK, Chakraborty I. 2006. Studies on Physico-chemical characters of some potential underutilized tropical fruits. *Proceedings of the national symposium on production, utilization & export of underutilized fruits*. 4:271-274
10. Patil A, Patil D, Pathak A, Chandra N. 2010. Physical and Chemical Characteristics of Carambola (*Averrhoa carambola L.*) fruit at three stages of maturity. *International Journal of Applied Biology and Pharmaceutical Technology*. 1: 624-629.
11. Sidappa GS, Lal G. 1998. Jams, Jellies & Marmalades; Preservation of fruits and vegetables. *Indian council of agricultural research*. 157-170.
12. Siddiqui NH, Azhar I, Tarar OA, Masood A, Mahmood ZA. 2015. Influence of pectin concentrations on physico-chemical and sensory qualities of jams. *World Journal of Pharmacy and Pharmaceutical Sciences*. 4: 68-77
13. Silva BM, Andrade PB, Valentão P, Ferreres F, Seabra RM, Ferreira MA. 2004. Quince Fruit and Jam Antioxidant Activities. *J. Agric. Food Chem.* 52: 4705-12
14. US FDA. 2009. Chapter 6. Microbiological Challenge Testing. Available from: <http://www.fda.gov/Food/FoodScienceResearch/SafePracticesforFoodProcesses/ucm094154.htm>
15. Viberg U, Ekström G, Fredlund K, Öste RE, Sjöholm I. 1997. A Study of Some Important Vitamins and Antioxidants in a Blackcurrant Jam with Low Sugar Content and Without Additives. *International Journal of Food Sciences and Nutrition*. 48: 57-66



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### RESEARCH ARTICLE

#### EPIDEMIOLOGY OF OBESITY IN ARAR CITY, NORTHERN SAUDI ARABIA.

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Obesity; overweight; Northern Border University; Kingdom of Saudi Arabia

#### Abstract

**Background:** Obesity is a common health problem and rapidly increasing among Saudi Arabians. There is no studies that aim at identifying the prevalence and the main risk factors of obesity in Arar city.

**Objective:** to determine the prevalence of obesity and overweight among Northern Saudis of both gender, aged 15 years or older and to study some of obesity related risk factors in that population.

**Methods:** A cross-sectional study was carried out during the period from 1, January 2016 to 29, April 2016. A total of 592 subjects attending 3 randomly selected primary healthcare centers in Arar city. Each participant was interviewed separately, and confidentiality was assured. Data were collected by means of personal interview with the sampled women using a predesigned questionnaire covering the needed data.

**Results:** The majority of participant in the study was a females 75% , and only 25 % were male. The overall prevalence of obesity was 35.3% and the overall prevalence of overweight was 27.2%. Obesity was found in 32.2% of females and 44.6% of males while 26.1% of females and 30.4% of males were overweight. (P value = 0.002). 13.8% of obese have history of childhood obesity, 56.8% had family history of obesity in 1st degree relatives and 25.7% of overweight and obese prefer the takeaway meals. Regarding the previous trials of treatment of obesity, diet regulation was tried in more than half (57.3%) of patients while medical treatment was followed in only fifth (20.8%) and 15.1% tried surgical treatment of obesity. More than half (59.2%) of overweight and obese don't perform any muscular exercise, 13.0% performing daily muscular exercise, 27.8% performing muscular exercise 1-3 times/week.

**Conclusion and recommendations:** The results of this study indicate an increased rate of obesity and overweight in the Arar population. Male sex, middle age, history of childhood obesity, family history of obesity in 1st degree relatives and takeaway meals are risk factors for both overweight and obesity. Therefore, a community-based multiple strategies are required to combat with increasing rate of obesity and its subsequent complications such as diabetes, coronary artery disease, hypertension and osteoarthritis.

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## ..... Introduction:-

Obesity is actually an epidemic problem in the world; it has become truly a global problem affecting countries rich and poor. An estimated 500 million adults worldwide are obese and 1.5 billion are overweight or obese [1].

Much of the information about obesity among adults rest in the use of body mass index (BMI) to define obesity, which will be defined as a BMI  $30 \text{ kg/m}^2$  or greater unless otherwise stated [2]. The World Health Organization (WHO) categorizes adults with a BMI of 25 to 30 as overweight, whereas obesity is classified according to stages or grades - Grade 1: BMI 30.0-34.9, Grade 2: BMI 35.0-39.9 and Grade 3: BMI  $\geq 40.0$  [3].

Obesity is a consequence of many risk factors, as increased energy consumption and reduced physical exercise [4].

Obesity is a major risk factor for illness and death. It is associated with diabetes, hypertension, hyperlipidemia, obstructive sleep apnea, and osteoarthritis [5].

Previous studies in KSA indicate an increasing trend in the prevalence of obesity. Data from the late 1980s through mid-1990s show a prevalence of obesity averaging about 20%, ranging from as low as 13.1% among men to as high as 26.6% among women. However, all prevalence estimates from 1995 and beyond are above 35% [6,7,8].(11–13).

Obesity and overweight are increasing in KSA with an overall obesity prevalence of 35.5%. The prevalence of overweight was 36.9%. Overweight is significantly more prevalent in males (42.4%) compared to 31.8% of females. Females are significantly more obese with a prevalence of 44% than males 26.4%.Reduction in overweight and obesity are of considerable importance to public health [9].

In the (2013) survey all over the KSA, Of the 10,735 participants evaluated, 28.7% were obese (body mass index  $\geq 30 \text{ kg/m}^2$ ). Prevalence of obesity was higher among women (33.5% vs 24.1%). Among men, obesity was associated with marital status, diet, physical activity, diagnoses of diabetes and hypercholesterolemia, and hypertension. Among women, obesity was associated with marital status, education, history of chronic conditions, and hypertension [10].

Hence, the increased cost of obesity and its sequelae will put a strain on the resources of governments and individuals [11].

The influence of genetics on obesity is well established. Adoption studies and twin studies suggest that about 80% of the obesity risk is genetic. We designed a tool to predict outcomes of treatments in patients with sporadic or familial obesity [12].

Studies have linked a familial predisposition of obesity, CVD (hypertension, dyslipidaemia and thromboembolic events), and type 2 diabetes mellitus to BMI as well as other adiposity measures in children, suggesting degrees of familial aggregation of metabolic derangements. A pattern of predispositions arising from mothers, parents or grandparents as being most influential have been found, but further comprehensive studies are needed in order to specify the exact implications of familial predisposition [13]. Overweight children have an increased risk of being overweight as adults [14].

In Iranian, population-based cross-sectional study conducted to determine the prevalence rate of obesity, overweight, central obesity and their associated factors in the north of Iran. In the population aged 20-70 years, the



overall prevalence rates of obesity and overweight were 18.8% and 34.8% respectively. The overall prevalence rate of central obesity was 28.3%. The rate of obesity in women was higher than men. In both genders, particularly in the women, the rate of obesity was raised by increasing age. Marriage, history of parental obesity and parity  $>$  or  $=5$  were associated with increased risk of obesity. With respect to these findings, low level of activity and education, parity, family history of obesity, marriage at earlier age and ageing are responsible for both obesity and central obesity in the north of Iran [15].

### **Rationale:-**

obesity is a common health problem and rapidly increasing among Saudi Arabians. Moreover obesity is considered to be a burden on the health system. There is no studies that aim at identifying the prevalence and the main risk factors of obesity in Arar city. Since we are medical health workers, we saw the necessity of conducting a study that could give a vivid idea of prevalence and the main risk factors of obesity in Arar city, Northern Saudi Arabia.

### **Objective:-**

Obesity and overweight are well known risk factors for coronary artery disease (CAD), and are expected to be increasing in the Kingdom of Saudi Arabia (KSA) particularly among females. Therefore, we designed this study with the objective to determine the prevalence of obesity and overweight among Northern Saudis of both gender, aged 15 years or older and to study some of obesity related risk factors in that population.

### **Participants and methods:-**

**Study sitting:-** The present study was conducted in Arar which is the regional headquarter of the Northern Border Province of Saudi Arabia.

**Study type:-** A community-based cross-sectional study was carried out during the period from 1, January 2016 to 29, April 2016.

**Sampling:-** A total of 592 subjects aged 15 years and above (75.0% women) attending 3 randomly selected primary healthcare centers in Arar city. They were selected using a systemic random sampling procedure. Each participant was interviewed separately, and confidentiality was assured. Health centers provide healthy and sick citizens with healthcare services in an acceptable atmosphere of both privacy and confidentiality.

**Data collection methods:-** Data were collected by means of personal interview with the sampled women using a predesigned questionnaire covering the following items:

- (1) Socio-demographic characteristics , including age, educational and marital status.
- (2) Data related to obesity as physical activity, obesity of 1<sup>st</sup> degree relative, Family income/month , History of childhood obesity, Takeaway meals , consumption of milk, dairy products and egg, performing muscular exercise, history of consumption of fatty meals, consumption of fruits and vegetables, history of associated chronic diseased and history of trials of treatment of obesity among overweight and obese was obtained.

The exclusion criteria were, significant liver or kidneys disease and mal-absorption syndrome. Anthropometric examination included height and weight measurements with the use of a calibrated balance beam scale and a wall-mounted stadiometer and calculation of body mass index (BMI). Normal weight was defined as  $BMI < 25 \text{ kg/m}^2$ , overweight as  $25 \leq BMI < 30 \text{ kg/m}^2$  and obesity as  $BMI \geq 30 \text{ kg/m}^2$  [16].

### **Ethical considerations:-**

This study was reviewed and approved by the Research Ethics Committee of Faculty of Medicine, Northern Border University. Participants were informed that participation is completely voluntary, and written consent was obtained from each participant before being subjected to the questionnaire and after discussing the objective with the participants. No names were recorded on the questionnaires. Adequate training of data collectors took place to ensure protection of confidentiality, and all questionnaires were kept safe.

### **Statistical analysis:-**

Collected data were coded and analyzed using statistical package for the social sciences (SPSS, version 15). The chi square test was used as a test of significance, and differences were considered significant at P value 0.05 or less.

### **Results:-**

**Table 1: Sex, age group and family income/month of the studied population, Arar, KSA, 2016 (n= 592)**

Sex	No.	%
Female	444	75.0
Male	148	25.0
<b>Age group</b>		
15 – 25	229	38.7
26 – 35	211	35.6
36 – 50	122	20.6
> 50	30	5.1
<b>Family income/month (*SR)</b>		
< 5000	86	14.5
5000 - 10,000	305	51.5
> 10,000	201	34.0

\* Saudi Real

**Table (1)** shows the socio-demographic characters of studied male and female . The majority of participant in the study was a female 75% , and only 25 % were male .

38.7 % aged between 15 – 25 , while 35.6 % between 26 – 35 , and 20.6% were between 36 – 50 , and only 5.1 % were > 50 years old .The family income per month of the studied participant was between 5000 – 10,000 in nearly more than the half ( 51.5 % ) of the participant , and less than 5000 in 14.5 % while more than 10,000 was 34% of participant .

**Table 2:-** Obesity and its associated risk factors in the studied population, Arar, KSA, 2016 (n= 592)

Obesity	No.	%
Underweight	29	4.9
Normal	193	32.6
Overweight	161	27.2
Obese	209	35.3
<b>History of childhood obesity</b>		
Don't know	316	53.4
No	220	37.2
Yes	56	9.5
<b>Takeaway meals</b>		
Sometimes	313	52.9
No	116	19.6
Yes	163	27.5
<b>Family history of obesity in 1<sup>st</sup> degree relative</b>		
No	213	36.0
Don't know	57	9.6
Yes	322	54.4
<b>Associated chronic diseases</b>		
No	555	93.7
DM	23	3.9
DM and hypertension	8	1.3
Hypertension	6	1.01

**Table (2)** shows obesity and its associated risk factors beside presence or absence of chronic disease, according to BMI the table revealed that the majority of studied participant was classified as obese 35.3% while 32% of the participant was normal .

27.2% of participant was classified as overweight and only 4.9% of the studied participant was underweight . As regard History of childhood obesity , nearly more than the half of the participant 53.4% does not know whether they were obese in childhood or not , and more than one-third (37.2%) of them denied childhood obesity and about a 10<sup>th</sup> (9.5%) were obese in childhood. Takeaway meals habit was found as sometimes in more than the half (52.9%) of

participant , while (27.5%) of participant was regular on takeaway meals , and only (19,6%) don't mention takeaway meals . The highest percentage of studied participant (54.4%) reported that they have family history of obesity in 1<sup>st</sup> degree relative, and (9.6%) of participant don't know whether they have family history of obesity in 1<sup>st</sup> degree relative or not, and more than one-third (36.0%) don't have family history of obesity in 1<sup>st</sup> degree relative. As regards presence or absence of chronic disease, the highest percentage of participant (93.7%) mention no association with chronic disease, (3,9%) have only diabetes mellitus, while (1.3%) have both diabetes mellitus and hypertension and only (1.01%) have hypertension .

**Table 3: Trials of treatment of obesity among overweight and obese (Total =370)**

<b>Treatment of obesity by Diet regulation</b>	<b>No.</b>	<b>%</b>
No	158	42.7
Yes	212	57.3
<b>Medical treatment by drugs</b>		
No	293	79.2
Yes	77	20.8
<b>Surgical treatment of obesity</b>		
No	314	84.9
Yes	56	15.1
<b>Performing muscular exercise</b>		
Daily	48	13.0
1-3 times / week	103	27.8
No	219	59.2

Table (3) illustrates the trials of treatment of obesity among overweight and obese (n=370). Diet regulation was tried in more than half (57.3%) of patients while medical treatment was followed in only fifth (20.8%) and 15.1% tried surgical treatment of obesity. 13.0% of overweight and obese performing daily muscular exercise, 27.8% performing muscular exercise 1-3 times / week but unfortunately more than half (59.2%) don't perform any muscular exercise.

**Table 4:- Relationship between sex and age group and body weight among the studied population**

Variable	Obesity				Total (n=592)	P value
	Underweight (n=29)	Normal (n=193)	Overweight (n=161)	Obese (n=209)		
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	
Sex						
Female	26(5.9)	159(35.8)	116(26.1)	143(32.2)	444(100.0)	0.002
Male	3(2.0)	34(23.0)	45(30.4)	66(44.6)	148(100.0)	
Age group						
15 – 25	16(7.1)	77(34.2)	43(19.1)	89(39.6)	225(100.0)	0.000
26 – 35	4(1.9)	57(26.5)	63(29.3)	91(42.3)	215(100.0)	
36 – 50	6(4.9)	48(39.3)	47(38.5)	21(17.2)	122(100.0)	
> 50	3(10.0)	11(36.7)	8(26.7)	8(26.7)	30(100.0)	

Table (4) demonstrates the relationship between sex and age group and body weight among the studied population. From the table it is clear that, 26.1% of females and 30.4% of males are overweight , on the other hand, 32.2% of females and 44.6% of males are obese. With statistically significant difference between males and females (P value = 0.002). As regards age, 39.2% of overweight were from the age group 26-35 years old and 29.2% from 36-50 years and least proportion (26.7%) aged 15-25 years. As regards obesity, the highest proportion (43.5%) were from the age group 26-35 years followed by 42.6% from the age group 15-25 years and least proportion (3.8%) aged more than 50 years

**Table 5: History of childhood obesity, obesity in 1st degree relatives and takeaway meals and body weight among the studied population**

History of childhood obesity	Body weight			Total (n=592)	P value
	Underweight (n=29)	Normal (n=193)	Overweight and obese (n=370)		
	No. (%)	No. (%)	No. (%)	No. (%)	
Don't know	28(96.6)	159(82.4)	129(34.9)	316(53.4)	0.000
No	1(3.4)	29(15.0)	190(51.4)	220(37.2)	
Yes	0(0.0)	5(2.6)	51(13.8)	56(9.5)	
Obesity in 1 <sup>st</sup> degree relatives					
Don't know	3(10.3)	22(11.4)	32(8.6)	57(9.6)	0.349
No	8(27.6)	77(39.9)	128(34.6)	213(36.0)	
Yes	18(62.1)	94(48.7)	210(56.8)	322(54.4)	
Takeaway meals					
Sometimes	10(34.5)	118(61.1)	185(50.0)	313(52.9)	0.000
No	1(3.4)	25(13.0)	90(24.3)	116(19.6)	
Yes	18(62.1)	50(25.9)	95(25.7)	163(27.5)	

Table (5) illustrates the relationship between history of childhood obesity, obesity in 1st degree relatives and takeaway meals and body weight among the studied population. 13.8% of obese have history of childhood obesity, 56.8% had family history of obesity in 1<sup>st</sup> degree relatives and 25.7% of overweight and obese prefer the takeaway meals .

### Discussion:-

The present study was conducted in Arar city. Arar is the regional headquarters of the northern border province of Saudi Arabia. It has a watering station and a power station. It engages in a wide range of agricultural activities including the production of dates and the managing of livestock (camels, goats and sheep). Arar is the crossing point for many of the Iraqi pilgrims entering the Kingdom to perform Hajj.

Our study indicated high rates of overweight obesity in male and female population of Arar. Our findings showed that most Northern Saudis are physically inactive and don't perform regular muscular exercise.

In the current study, the overall prevalence of obesity was 35.3% and the overall prevalence of overweight was 27.2% .

The overall prevalence of overweight is less than findings of 2005 [9] study which reported prevalence of overweight 36.9%. The overall prevalence of obesity is in accordance with findings of 2005 [9] study (35.6%). while our figure was more than findings of 2013 study which found 28.7% of participants were obese (body mass index  $\geq 30$  kg/m<sup>2</sup>) [10]. These finding is in accordance also with Kavadar, et al, (2015) who found Mean ( $\pm$  SD) of BMI in non diabetic population were  $28.2 \pm 3.16$  kg/m<sup>2</sup>. [12].

On the other hand, in the current study, 32.2% of females and 44.6% of males were obese while 26.1% of females and 30.4% of males were overweight. Our findings are also not in accordance with findings of 2005 study that females are significantly more obese with a prevalence of 44% than males 26.4% [9] and those estimated for 2010 study who reported 23% for males and 36% for females respectively [13].

This overall increase in obesity prevalence in Arar city is bad news for the Arar's, Saudis' health. Over the last decade, the Saudi Ministry Of Health has implemented several public health programs to reduce obesity. Most of these programs have focused on awareness and behavioral changes [14].

In the current study, 56.8% of overweight and obese had family history of obesity in 1st degree relatives which is supported by findings of Thirlby and Randall (2002) who reported that, about 85% of patients who are candidates for bariatric surgery have elements in their history to suggest a genetic risk for morbid obesity. About 15% have extremely strong genetic Obesity Risk Index [17].

Familial predisposition to obesity and related cardiovascular disease (CVD) complications constitute the presence of obesity and/or obesity-related complications in primarily blood-related family members [18].

In the current study, 13.8% of overweight and obese had history of childhood obesity, which is supported by findings of Indian study which reported that, Overweight children have an increased risk of being overweight as adults [19].

### **Conclusion and Recommendations:-**

The results of this study indicate an increased rate of obesity and overweight in the north population of KSA. With respect to these findings, Sex, age, history of childhood obesity, family history of obesity in 1<sup>st</sup> degree relatives are responsible for both overweight and obesity in the north of KSA. Therefore, a community-based multiple strategies are required to combat with increasing rate of obesity and its subsequent complications such as diabetes, coronary artery disease, hypertension and osteoarthritis.

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### RESEARCH ARTICLE

## INTERNET ADDICTION AMONG STUDENTS OF HEALTH FACULTIES IN JAZAN UNIVERSITY, KSA.

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### Abstract

Aim: To determine the extent of internet addiction among students of health faculties in Jazan University and its effects on their academic performance and social relationships. Method: This study reports the results of surveyinvolved 400 students (198 males 202 females) from 4 health faculties in Jazan University to measure the prevalence of internet addiction among the students and its effects on the academic performance and social relationships. It is a cross sectional study in which a standardized self-administered questionnaire was used to classify the internet addiction into 4 levels according to the score of each student. Also some questions were asked about the academic performance and social relationships of the students. Results: Its found that males are more addicted to the internet than females although females stay home more than males and also we found that about 59% of the students have mild addiction to the internet but this could be considered normal because nowadays the access to the internet is much easier and available and makes life easier and things to be done faster and also mild addiction doesn't have negative effects as moderate and severe addiction.

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### Introduction: -

The internet nowadays is an essential media for communications, academic research, exchanging information and entertainment. With the advancement of Internet technology, the number of internet users is greatly increasing and it is considered a must in people's social life and education, but some users are considered heavy users for using the internet for a long time every day, which leads to a general weakness in all aspects of their life, academic performance or career and social relationships. Internet addiction leads to inattention to time passage, sometimes accompanied by skipping meal and insomnia. Internet addiction is a common problem, especially among young people and teenagers leading to weakness in the academic performance, achievements and social isolation. Sometimes internet addiction shows some signs, for example when the connection is down some signs of anger, nervousness or depression appears. We chose this topic to be our research title and we chose the students of health faculties in Jazan University for being in an important stage of education and which will determine the future of the student and also the future of health services in Jazan. We noticed that the students have time management problems especially before exams. Some of them said that they always can't finish reading the subject before exam takes place because they have not enough time. We think that they have time but they have bad time

management. We asked about something the students are interested in, some of them answered they spend a long time daily on social websites and others answered that they are interested more in online gaming. So it is all about being connected to the internet for hours and wasting their time.

#### **Aim:-**

To determine the extent of internet addiction among students of health faculties in Jazan University and its effects on their academic performance and social relationships.

#### **Objectives:-**

- 1- To determine the prevalence of internet addiction among the students of health faculties in Jazan University.
- 2- To compare between males and females in the prevalence of internet addiction.
- 3- To compare the academic performance of the students according to the pattern of internet using.
- 4- To determine the effects of internet addiction on social relationships.

#### **Literature Review:-**

##### **Defining Internet Addiction:-**

The American Psychiatric Association defined the Internet addiction disorder as the problematic use of the Internet, including the various aspects of its technology, such as electronic mail (e-mail) and the World Wide Web (American Psychiatric Association, 2000).

##### **The Effects of Internet Addiction:-**

A study by Robinson and Kestnbaum considers that as more time is spent online, it directly affects the person's other activities and in turn, his/her social life (Robinson, Kestnbaum, 1999).

Scott Hazelhurst, Yestin Johnson and Ian Sanders conducted an investigation of the academic performance and the internet use of 2153 undergraduate students. Data from university proxy logs allowed them to examine usage patterns and they compared the data to the students' academic performance. Their results showed a small but significant (both statistically and educationally) association between heavy internet using and poor academic results (lower marks, higher failure rates) (Scott Hazelhurst, Yestin Johnson and Ian Sanders).

Kubey, R. W., Lavin, M. J. and Barrows, J. R. conducted a study in 2001 on 572 students. The results of this study show that heavier recreational Internet use was shown to be correlated highly with impaired academic performance. Loneliness, staying up late, tiredness, and missing class were also intercorrelated with self-reports of Internet-caused impairment. Self-reported Internet dependency and impaired academic performance were both associated with greater use of all Internet applications, but particularly with much greater use of synchronous communication applications such as chat rooms and MUDs, as opposed to asynchronous applications such as email and Usenet newsgroups (Kubey, R. W., Lavin, M. J. and Barrows, J. R. 2001).

In a study conducted by Sadiq M. Sait, Khalid M. Al-Tawil, Syed Sanaullah and Mohammed Faheemuddin, the highest percentage among all employment types of internet users was for students and it was 32.4% (Sadiq M. Sait, Khalid M. Al-Tawil, Syed Sanaullah and Mohammed Faheemuddin, 2006).

Anderson (1998) collected data from a mixture of colleges in the US and Europe, yielding 1,302 respondents (with an almost equal gender split). On average, his participants used the Internet 100 min a day, and roughly 6% of the participants were considered as high-users (above 400 min a day).

Scherer (1997) studied 531 students at the University of Texas at Austin. Of these, 381 students used the Internet at least once per week and were further investigated. Based on the criteria paralleling chemical dependencies, 49 students (13%) were classified as Internet dependent (71% male, 29% female).

##### **The positive Impact of the Internet:-**

There also have been numerous studies that report a positive impact of the Internet on society (Robinson et. al., 2002; Cole, 2000; Cole, 2003). The results from these survey-based studies suggest that the Internet is mostly used to complement existing social activity and doesn't directly replace it. A study of international scholarly networks by Koku et al. shows that though the Internet helps in maintaining contact with different people, most of these are

almost always those who users also meet in real life; hence this only serves to further strengthen social interaction (Koku, Nazer& Wellman, 2001).

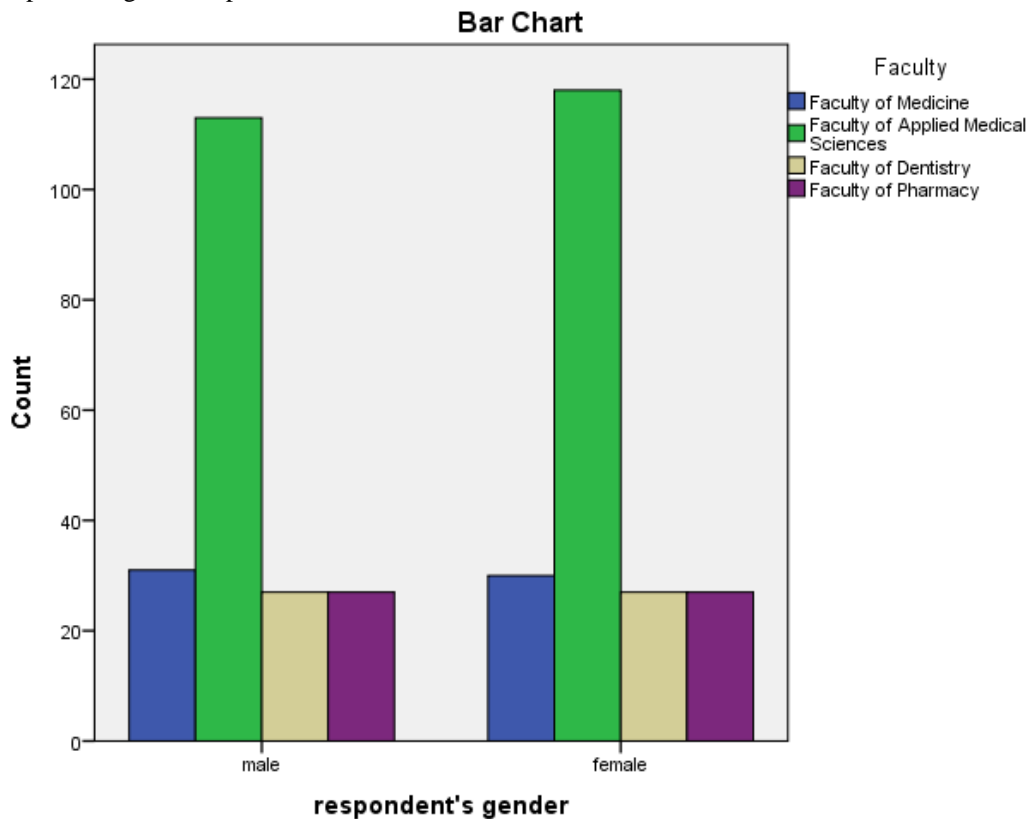
In another study by Nie and Erbring, most of the people who were surveyed, reported no change in their social lives, though excessive Internet users (logging more than 40 hours online per week) reported a decline in socializing, interaction, and other activities (Nie, Erbring, 2000).

#### Methods:-

The study design used is cross sectional and t we used the stratified random sampling method to determine the sample size for each faculty as the following table:

Count		Faculty				Total
respondent's gender		Faculty of Medicine	Faculty of Applied Medical Sciences	Faculty of Dentistry	Faculty of Pharmacy	
	male	31	113	27	27	198
	female	30	118	27	27	202
Total		61	231	54	54	400

Bar Chart representing the sample distribution:



The data was collected from each faculty using a self-administered questionnaire containing an internet addiction test developed by Dr.Kimberly Young. It is a reliable and valid measure of addictive use of internet consists of 20 items that measure mild, moderate and severe level of internet addiction. To answer each question of the questionnaire the following scale was used:



Answer	Score
Never	0
Rarely	1
Occasionally	2
Frequently	3
Often	4
Always	5

After totaling up the scores for each item the level of internet addiction was determined as follows:

Score	Level of Internet Addiction
Less than 20 points	No internet addiction
From 20 to 49 points	Mild internet addiction
From 50 to 79 points	Moderate internet addiction
From 80 to 100 points	Severe internet addiction

To assess the academic performance of the students we asked them to write down their GPA and also some questions about the performance and productivity were used. To assess the status of social relationships of the students we asked some questions about visiting relatives and meeting friends. After that we entered the data in the SPSS software for the data analysis, making tables and graphs.

### Results: -

After determining the level of internet addiction we found that the 58.8% of the students was considered having mild addiction to the internet.

A table showing the level of internet addiction of the students:

Level of internet addiction		Frequency	Percent
	No internet addiction	83	20.8
	Mild internet addiction	235	58.8
	Moderate internet addiction	76	19.0
	Severe internet addiction	6	1.5
	Total	400	100.0

Then we compared between males and females in each level of internet addiction and we found that males are more addicted to the internet.

A table of comparison between males and females in each level of internet addiction:

		level of internet addiction of respondent				Total
		No internet addiction	Mild internet addiction	Moderate internet addiction	Severe internet addiction	
respondent's gender	male	18	137	40	3	198
	female	65	98	36	3	202
Total		83	235	76	6	400

After that we compared between the mean of the GPAs according to gender and according to level of internet addiction. According to gender we found that the females' mean GPA is slightly more than that of males.

According to Gender:					
Gender	Mean	N	Std. Deviation	Minimum	Maximum
male	3.322711	166	.6109202	1.3000	4.7000
female	3.444765	170	.7602890	.8500	5.0000
Total	3.384464	336	.6922205	.8500	5.0000

According to the level of internet addiction:

INT-AD	Mean	N	Std. Deviation	Minimum	Maximum
No	3.390147	68	.7481729	2.0000	4.8700
Mild	3.432513	195	.6263232	1.3000	5.0000
Moderate	3.228088	68	.8106129	.8500	4.7000
Severe	3.560000	5	.3938908	3.2200	3.9900
Total	3.384464	336	.6922205	.8500	5.0000

Asking about the GPA Showed no significance may be because of high missing data and also the students were not equally distributed among the levels of addiction. However, we asked some questions about the grades and productivity of the students and the following are some examples:

		How often do respondent's grades suffer negatively because of the amount of time he/she spends online?						Total
		Never	Rarely	Occasionally	Frequently	Often	Always	
No internet addiction		66	11	4	0	2	0	83
Mild internet addiction		92	54	63	15	7	4	235
Moderate internet addiction		9	12	23	5	15	12	76
Severe internet addiction		0	2	0	0	0	4	6
Total		167	79	90	20	24	20	400

Level		How often does respondent's academic performance or productivity suffer negatively because of the amount of time he/she spends online?						Total
		Never	Rarely	Occasionally	Frequently	Often	Always	
No internet addiction		69	9	3	0	2	0	83
Mild internet addiction		105	63	43	14	8	2	235
Moderate internet addiction		5	21	23	4	13	10	76
Severe internet addiction		0	0	0	0	2	4	6
Total		179	93	69	18	25	16	400

In the previous two tables we can see that 4 of 6 students (66.7%) who are considered having severe internet addiction said that their grades, academic performance and productivity are always affected negatively because of the heavy use of the internet and the remaining 2 students answered (often).

Social Relationships:

		How often does respondent choose to spend more time online over visiting his/her relatives?						Total
		Never	Rarely	Occasionally	Frequently	Often	Always	
No internet addiction		73	8	2	0	0	0	83
Mild internet addiction		86	82	47	11	5	4	235
Moderate internet addiction		5	18	21	12	7	13	76
Severe internet addiction		0	0	1	0	1	4	6
Total		164	108	71	23	13	21	400

In the previous table we can see that 4 from 6 students (66.7%) who are considered having severe internet addiction said that they always choose to stay home using the internet over visiting their relatives and also we can see that those who are considered having no internet addiction didn't choose the answers (frequently, often and always).

		How often does respondent choose to spend more time online over going out with others?						Total
		Never	Rarely	Occasionally	Frequently	Often	Always	
f	No internet addiction	69	8	6	0	0	0	83
	Mild internet addiction	73	51	82	18	5	6	235
	Moderate internet addiction	9	14	19	13	11	10	76
	Severe internet addiction	0	0	0	2	1	3	6
Total		151	73	107	33	17	19	400

In the previous table we can see that 3 of 6 students (50%) who are considered having severe internet addiction said that they always choose to spend more time using the internet over going out with others while no one from those who are considered having no internet addiction choose this answer although they are 83 students.

### Discussion:-

The previous results reveal that 83 students (20.8%) are considered having no internet addiction and at this level we noticed excellent social relationships. 235 students (58.8%) are considered having mild internet addiction but could be considered as average users because they do not experience problems because of the internet. 76 students (19%) are considered having moderate internet addiction and experience occasional or frequent problems because of the internet and about 13% of them experience some sort of social isolation. Only 6 students (1.5%) are considered having severe internet addiction and experience significant problems because of the heavy use of the internet in which 4 students (66.7%) are socially isolated because of the internet and have problems in their academic performance and productivity more than the other levels.

In the comparison between males and females in each level we found that males are addicted to the internet more than females although males in Saudi Arabia can do much more activities than females do. These results resemble the results of Scherer study mentioned before. When we compared the mean of the GPAs between males and females we found that the mean of the GPAs of the females is slightly higher but we couldn't confirm the effect of the internet addiction on the academic performance using only the GPA because of missing data or may be some students were not telling the truth although we did not ask them about names or any other personal information. However, we can confirm that students with severe addiction are more affected in their grades using the questions mentioned before and matching the results with Kubey, R. W., Lavin, M. J. and Barrows, J. R. study mentioned before.

### Conclusion and Recommendations:

In general, internet addiction is an extremely broad topic with little guidance and definitions. Signs of internet addiction mentioned in the literature were clear and can be noticed easily and we can confirm internet addiction using these signs but confirming the effects of internet addiction is a little bit harder especially its effects on the academic performance. Controlled use of the internet can help both the academic performance and social relationships. However, the use of samples and data collection methods that minimize sampling bias is recommended. Also researchers should work to develop a standardized definition for internet addiction. Using more specific methods to measure the effects of internet addiction on the academic performance is recommended.

**References:-**

1. Diagnostic and Statistical Manual of Mental Disorders, fourth edition, text revision (2000), the American Psychological Association.
2. Robinson, J.P. & Kestnbaum, M. (1999). The Personal Computer, Culture and other uses of free time. Social Science Computer Review, Vol. 17(2) pp 209-216.
3. S. Hazelhurst, Y. Johnson, I. Sanders. An empirical analysis of the relationship between web usage and academic performance in undergraduate students. Proceedings of the Annual Conference of the South African Computer Lecturer's Association, Ballito, South Africa, July 2011, pp. 29-37.
4. Kubey, R. W., Lavin, M. J. and Barrows, J. R. (2001), Internet use and collegiate academic performance decrements: early findings. Journal of Communication, 51: 366–382. doi: 10.1111/j.1460-2466.2001.tb02885.x
5. Sadiq M. Sait, Khalid M. Al-Tawil, Syed Sanaullah and Mohammed Faheemuddin, Impact of Internet Usage in Saudi Arabia: A Social Perspective, 2006.
6. Anderson, K. J. (1998). Internet use among college students: An exploratory study.
7. Scherer, K. (1997). College life on-line: Healthy and unhealthy internet use. Journal of College Student Development, 38, 655–665.
8. Cole, J. I. (2000). Surveying the Digital Future. Technical report, UCLA: Center of Communication Policy.
9. Cole, J. I. et. al. (2003). The UCLA Internet Report - Surveying the Digital Future: Year Three. Technical report, UCLA: Center for Communication Policy, February.
10. Koku, E., Nazer, N., & Wellman, B. (2001). International Scholarly Networks. American Behavioral Scientist, Vol. 44(10).
11. Nie, N.H. & Erbring, L. (2000). Internet and Society: A preliminary report. Technical report, Stanford Institute for the Quantitative Study of Society (SIQSS).



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### RESEARCH ARTICLE

#### POTENTIAL RISK OF STREPTOCOCCUS PNEUMONIAE IN NASOPHARYNGEAL CARRIAGE DURING UMRAH AND HAJJ SEASONS IN MAKKAH, SAUDI ARABIA.

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#### Abstract

**Background:** Hajj and Umrah poses many health challenges and lead to a higher risk of acquiring and disseminating infectious diseases, as a result of mass gatherings and shared accommodation and air pollution. Nasal colonization by *Streptococcus pneumoniae* is a major contributing factor for pneumococcal disease that still one of the major causes of morbidity and mortality worldwide. The aim of this study was to the detection and evaluate of *S. pneumoniae* in the nasopharyngeal carriage and the antibiotic susceptibility patterns of *S. pneumoniae* isolates in different ethnic groups, during Umrah and Hajj Season.

**Methods:** A total of 3184 nasal swab were collected from 979/613 Umrah visitors/Pilgrims, swab from each one upon arrival and swab before leaving Saudi Arabia, during the period from March to November 2009 G. Samples were cultured for the presence of *S. pneumoniae* by stander laboratory procedures in the Microbiology research laboratory, Faculty of Medicine, Umm Al-Qura University.

**Results:** The carriage rate of *S. pneumoniae* was 0% before performing Umrah and 6.41% after performing Umrah and 80% from isolates after Umrah were sensitive to Cefotaxime, Ceftriaxone, Rifampicin and Meropenem antibiotics. The carriage rate of *S. pneumoniae* was 0.7% before performing Hajj and 1% after performing Hajj and 75% from isolates before Hajj and 66.7% after Hajj were sensitive to the previous antibiotics.

**Conclusion & Recommendations:** This study revealed that ethnic groups carries *S. pneumoniae* were more after performing Hajj and Umrah than before Hajj and Umrah. Thus, we recommend to repeat this study after few years to evaluate the carriage rate of *S. pneumoniae* in Umrah visitors and Pilgrims and adding controls from Saudi nationals to any upcoming study in order to compare the carriage rate of *S. pneumoniae* in Umrah visitors, Pilgrims and Saudi nationals, for designing control strategies for these infectious diseases during Umrah and Hajj seasons.

## Introduction:-

Hajj is the greatest ritual gathering of Muslims from around the world. It takes place in holy Makah. The congregation of so many people from different parts of the world in unavoidably overcrowded conditions within a confined area for a defined period of time presents many public health challenges and health risks are greatly increased with potential for both local and international consequences. One of the main health problems correlated with crowding is respiratory tract and meningitis infections due to its ease of transmission by air droplets<sup>1,2</sup>. These infections can be transmitted from infected people and more significantly from asymptomatic carriers due to absence of symptoms<sup>3,4</sup>. The human nasopharynx and nares are densely colonized by a broad variety of microorganisms including commensal bacteria as well as potentially pathogenic bacteria (PPB) such as *Streptococcus pneumoniae*. Studies have shown that colonization with PPB is a major contributing factor for respiratory and extra-respiratory infections including pneumonia and meningitis in PPB carriers as well as their closed contacts<sup>5-8</sup>. The reported rates of PPB colonization acquisition and carriage vary extensively between different studies and geographical sites<sup>9-13</sup>. These differences have been related to genetic background variables and socio-economic conditions including housing, access to health care, poor hygiene, and overcrowded living conditions<sup>14,15</sup>. *S. pneumoniae* (the pneumococcus) is a Gram-positive aerobic commensal bacterium which forms part of the normal flora in the nasophary<sup>16</sup>. The pneumococcus can evade the immune system through a combination of surface expressed and secreted virulence factors to cause mucosal diseases such as otitis media, sinusitis and pneumonia, as well as systemic diseases such as bacteremia and meningitis<sup>17,18</sup>. These diseases, collectively termed pneumococcal disease, can be classified as invasive or non-invasive disease. Otitis media, sinusitis and non-bacteremic pneumococcal pneumonia are examples of non-invasive disease which are confined to the mucosal surface, whereas bacteremic pneumonia, bacteremia and meningitis are examples of invasive disease. Bacteremic pneumococcal pneumonia, defined as having pneumonia and a positive blood culture<sup>19</sup>. Invasive pneumococcal disease is thought to progress from colonization to bacteremia, with or without pneumonia, only a minority of cases developing meningitis. Pneumonia accounts for 19% of all under 5 year old deaths worldwide, which makes it the most deadly infectious illness for this age group<sup>20</sup>. The pneumococcus is the leading cause of pneumonia in children and it has been reported to cause over 50% of severe pneumonia cases in Africa<sup>21,22</sup>. Pneumococcal disease is most prevalent in the young and the elderly. Pneumococcal pneumonia is treatable using antibiotic therapy. However, where treatment is delayed or unavailable mortality is high<sup>23,24</sup>. Previously, the developing world had focused on treating pneumococcal disease rather than preventing it, but with the current increase in antibiotic resistance, it is widely accepted that prevention is the key to minimizing the disease burden<sup>25</sup>. Vaccination offers the most efficient and cost-effective method of preventing this disease. However, there are more than 90 pneumococcal serotypes which make development of a vaccine to provide universal protection a big challenge. There are two formulations of pneumococcal vaccines that have been licensed thus far: polysaccharide vaccines (Pups) and protein conjugate vaccines (PCVs). The 23-valent pneumococcal polysaccharide vaccine, which contains purified capsular polysaccharide antigens from 23 serotypes, offers some protection against invasive pneumococcal disease in adults but is not effective in either children less than 2 years of age or immune compromised adults<sup>26,27</sup>. PCVs, which contain purified capsular polysaccharides conjugated to a carrier protein, offer protection against both pneumonia and invasive disease in children and immune compromised adults<sup>28,29</sup>. The availability of a vaccine against some *S. pneumoniae* serotypes has risen the concern of increasing colonization rate by other strains that are not part of the vaccines currently available, which may explain the continuous appearance of clinical cases in some areas. This information is important particularly in the crowding seasons due to gathering of millions of people in a confined area, which means an increasing chance of colonization and infection with those serotypes not included in the currently available vaccines. An example of this importance is what happened in the pilgrimages of 2000 and 2001 which were associated with an increased number of *Neisseria meningitidis* sero group W135 infections in pilgrims and their close contacts<sup>30</sup>. Many infections with this previously uncommon strain were subsequently reported from several countries in Europe, Africa and the Middle East with a high mortality rate resulting in the requirement of vaccination with quadrivalent polysaccharide vaccine (PS) before entering Saudi Arabia<sup>31,32</sup>. Although PS vaccination prevents the disease, it cannot prevent the carriage. The aim of the present study was to evaluate the potentially pathogenic bacteria in Umrah visitors, pilgrims and carriers during Umrah and Hajj seasons in order to determine: the Colonization of potentially pathogenic bacteria in different ethnic groups, to find out any significant correlation between carriage rate and ethnic group and the risk of transmission of highly virulent PPB circulating to other countries during the season by their returning Umrah visitors and Pilgrims.

## Material and Methods:-

### Study design:-

This study was performed on 979 Umrah visitors from different nationalities including; 129 Turkish, 127 Indonesian, 102 Pakistani, 99 Syrian, 98 Nigerian, 79 Egyptian, 77 Iranian, 71 Indian, 56 British, 56 Iraqi, 39 Malaysian, 27 Libyan, 14 Swedish, 4 American and 1 Jordanian, during the period from March to end of August 2009 G and also in 613 Pilgrims from different nationalities including; 161 Indian, 102 Nigerian, 95 Indonesian, 90 Libyan, 68 Syrian, 46 British, 35 Turkish, 11 Australian, 3 Swedish and 2 Iranian during the period from October to end of November 2009 G in the Microbiology research Laboratory, Faculty of Medicine, Umm al-Qura university.

### Samples collection:-

Around 3184 nasopharyngeal swabs were collected from 979/613 Umrah visitors/Pilgrims, swab from each Umrah visitor/Pilgrim at arrival to Saudi Arabia and swab before leaving the country. The swabs were collected at arrival of the Umrah visitors/Pilgrims to King Abdul-Aziz International Airport (KAAIA), and data forms including; nationality, age, sex, smoking, coughing, sore throat, antibiotic usage, date of collection, contacts numbers for the group's leaders, were recorded for each visitors/Pilgrims. While, the remaining swabs were then collected before departure from KAAIA from the same visitors/Pilgrims. All Samples were collected on Amies transport swabs media and transported to the Microbiology research laboratory without any delay.

### Laboratory procedures:-

All samples were cultured for the presence of *S. pneumoniae* in the Microbiology research laboratory, under complete aseptic conditions and incubated at 37°C and 5% CO<sub>2</sub>. *S. pneumoniae* was isolated from blood agar and chocolate agar plates after an overnight incubation and identified according to standard laboratory procedures, by colony morphology, alpha-hemolysis, Gram stain, optochin sensitivity disc and bile solubility test. The susceptibility tests were performed according to the Clinical and Laboratory Standards Institute (CLSI)<sup>33</sup>.

## Results and Discussion:-

### Overall prevalence of *S.pneumoniae* isolated from Umrah visitors during the Umrah season:-

Out of 1958 nasopharyngeal swabs were collected from 979 Umrah Visitors selected in this study, 129 were of Turkish nationality. The carriage rate of the potentially pathogenic bacteria among the 129 Turkish Umrah Visitors were 0 (0%) positive for *S.pneumoniae* before performing Umrah and 1 (0.8%) were positive after performing Umrah and this difference was not statistically significant (p-value = 1.0). 126 were of Indonesian nationality. The carriage rate of the potentially pathogenic bacteria among the 126 Indonesian Umrah Visitors were, 0 (0%) positive for *S.pneumoniae* before performing Umrah and 1 (0.8%) were positive after performing Umrah and this difference was not statistically significant (p-value = 1.0). 102 were of Pakistani nationality. The carriage rate of the potentially pathogenic bacteria among the 102 Pakistani Umrah Visitors were 0 (0%) no *S.pneumoniae* was isolated from Pakistani Umrah Visitors before or after performing Umrah. 99 were of Syrian nationality. The carriage rate of the potentially pathogenic bacteria among the 99 Syrian Umrah Visitors were 0 (0%) no *S.pneumoniae* was isolated from Syrian Umrah Visitors before or after performing Umrah. 98 were of Nigerian nationality. The carriage rate of the potentially pathogenic bacteria among the 98 Nigerian Umrah Visitors were 0 (0%) no *S.pneumoniae* was isolated from Nigerian Umrah Visitors before or after performing Umrah. 79 were of Egyptian nationality. The carriage rate of the potentially pathogenic bacteria among the 79 Egyptian Umrah Visitors were 0 (0%) positive for *S.pneumoniae* before performing Umrah and 1 (1.3%) were positive after performing Umrah and this difference was not statistically significant (p-value = 1.0). 77 were of Iranian nationality. The carriage rate of the potentially pathogenic bacteria among the 77 Iranian Umrah Visitors were 0 (0%) no *S.pneumoniae* was isolated from Iranian Umrah Visitors before or after performing Umrah. 71 were of Indian nationality. The carriage rate of the potentially pathogenic bacteria among the 71 Indian Umrah Visitors were 0 (0%) no *S.pneumoniae* was isolated from Indian Umrah Visitors before or after performing Umrah. 56 were of British nationality. The carriage rate of the potentially pathogenic bacteria among the 56 British Umrah Visitors were 0 (0%) were positive for *S.pneumoniae* before performing Umrah and 2 (3.5%) were positive after performing Umrah and this difference was not statistically significant (p-value = 0.5). 56 were of Iraqi nationality. The carriage rate of the potentially pathogenic bacteria among the 56 Iraqi Umrah Visitors were 0 (0%) no *S.pneumoniae* was isolated from Iraqi Umrah Visitors before or after performing Umrah. 39 were of Malaysian nationality. The carriage rate of the potentially pathogenic bacteria among the 39 Malaysian Umrah Visitors were 0 (0%) no *S.pneumoniae* was isolated from Malaysian Umrah Visitors before or after performing Umrah. 27 were of Libyan nationality. The carriage rate of the potentially pathogenic bacteria among the 27 Libyan Umrah Visitors were 0 (0%) no *S.pneumoniae* was isolated from Libyan Umrah

Visitors before or after performing Umrah. 14 were of Swedish nationality. The carriage rate of the potentially pathogenic bacteria among the 14 Swedish Umrah Visitors were 0 (0%) no *S.pneumoniae* was isolated from Swedish Umrah Visitors before or after performing Umrah. 4 were of American nationality. The carriage rate of the potentially pathogenic bacteria among the 4 American Umrah Visitors were 0 (0%) no *S.pneumoniae* was isolated from American Umrah Visitors before or after performing Umrah. 1 was of Jordanian nationality. No potentially pathogenic bacteria were isolated from the Jordanian Umrah Visitor before or after performing Umrah. Table 1. Summarize the prevalence of the potentially pathogenic bacteria isolated from Umrah visitors during the Umrah season. (Table 1) .

**Table 1:-** Overall prevalence of *Streptococcus pneumoniae* isolated from different nationalities of the Umrah visitors during the Umrah season

Nationality	Number of Umrah visitors tested	Before Umrah				After Umrah				P-value of difference between positive Umrah visitors before performing Umrah and positive Umrah visitors after performing Umrah
		+ Umrah visitors		- Umrah visitors		+ Umrah visitors		- Umrah visitors		
		No.	%	No.	%	No.	%	No.	%	
Turkish	129	0	0	129	100.00	1	0.78	128	99.22	P=1.0 Not Significant
Indonesian	127	0	0	127	100.00	1	0.79	126	99.21	P=1.0 Not Significant
Pakistani	102	0	0	102	100.00	0	0	102	100.00	-
Syrian	99	0	0	99	100.00	0	0	99	100.00	-
Nigerian	98	0	0	98	100.00	0	0	98	100.00	-
Egyptian	79	0	0	79	100.00	1	1.27	78	98.73	P = 1.0 Not Significant
Iranian	77	0	0	77	100.00	0	0	77	100.00	-
Indian	71	0	0	71	100.00	0	0	71	100.00	-
British	56	0	0	56	100.00	2	3.57	54	96.43	P = 0.5 Not Significant
Iraqian	56	0	0	56	100.00	0	0	56	100.00	-
Malaysian	39	0	0	39	100.00	0	0	39	100.00	-
Libyan	27	0	0	27	100.00	0	0	27	100.00	-
Sweden	14	0	0	14	100.00	0	0	14	100.00	-
American	4	0	0	4	100.00	0	0	4	100.00	-
Jordanian	1	0	0	1	100.00	0	0	1	100.00	-
Total	979	0	0	979	100.00	5	6.41	974	93.59	P=0.0622 Not Quite Significant

In this study 5 *Streptococcus pneumoniae* isolates were isolated. These isolates were distributed as the following according to different nationalities: 1 isolate was isolated from Turkish Umrah visitors, 0 before Umrah and 1 after Umrah, 1 isolate were isolated from Indonesian Umrah visitors, 0 before Umrah and 1 after Umrah, 1 isolate was isolated from Egyptian Umrah visitors, 0 before Umrah and 1 after Umrah, and 2 isolates were isolated from British Umrah visitors, 0 before Umrah and 2 after Umrah.

Out of the 979 Umrah visitors tested in this study for the presence of the potentially pathogenic bacteria, *Streptococcus pneumoniae* was isolated from 0 (0%) Umrah visitors before performing Umrah and 5 (6.41%) Umrah visitors after performing Umrah. The difference in the prevalence of positive *Streptococcus pneumoniae* from the Umrah visitors before and after performing Umrah was statistically not quite significant (p-value = 0.06).



**Overall prevalence of *Streptococcus pneumoniae* isolated from Pilgrims during the Hajj season:-**

In this study 1226 samples (2samples from each pilgrim, one at arrival to Saudi Arabia and one before leaving the country) were collected from 613 pilgrims from different nationalities including; 161 Indian, 102 Nigerian, 95 Indonesian, 90 Libyan, 68 Syrian, 46 British, 35 Turkish, 11 Australian, 3 Swedish and 2 Iranian. The carriage rate of the potentially pathogenic bacteria among the 161 Indian pilgrims were 1 (0.6%) positive for *Streptococcus pneumoniae* before performing Hajj and 3 (1.9%) were positive after performing Hajj and this difference was not statistically significant (p-value = 0.6). The carriage rate of the potentially pathogenic bacteria among the 102 Nigerian pilgrims were 1 (1%) positive for *Streptococcus pneumoniae* before performing Hajj and 1 (1%) were positive after performing Hajj and this difference was not statistically significant (p-value = 1.0). The carriage rate of the potentially pathogenic bacteria among the 95 Indonesian pilgrims were 1 (1.1%) were positive for *Streptococcus pneumoniae* before performing Hajj and 0 (0%) were positive after performing Hajj and this difference was not statistically significant (p-value = 1.0). The carriage rate of the potentially pathogenic bacteria among the 90 Libyan pilgrims were 1 (1.1%) were positive for *Streptococcus pneumoniae* before performing Hajj and 1 (1.1%) were positive after performing Hajj and this difference was not statistically significant (p-value = 1.0). The carriage rate of the potentially pathogenic bacteria among the 68 Syrian pilgrims were no *Streptococcus pneumoniae* was isolated from Syrian pilgrims before or after performing Hajj. The carriage rate of the potentially pathogenic bacteria among the 46 British pilgrims were no *Streptococcus pneumoniae* was isolated from British pilgrims before or after performing Hajj. The carriage rate of the potentially pathogenic bacteria among the 35 Turkish pilgrims were no *Streptococcus pneumoniae* was isolated from Turkish pilgrims before or after performing Hajj. The carriage rate of the potentially pathogenic bacteria among the 11 Australian pilgrims were 0 (0%) were positive for *Streptococcus pneumoniae* before performing Hajj and 1 (9.1%) were positive after performing Hajj and this difference was not statistically significant (p-value = 1.0). The carriage rate of the potentially pathogenic bacteria among the 3 Swedish pilgrims were no *Streptococcus pneumoniae* was isolated from Swedish pilgrims before or after performing Hajj. The carriage rate of the potentially pathogenic bacteria among the 2 Iranian pilgrims were no *Streptococcus pneumoniae* was isolated from Iranian pilgrims before or after performing Hajj. Out of the 613 pilgrims tested in this study for the presence of the potentially pathogenic bacteria *Streptococcus pneumoniae* was isolated from 4 (0.7%) pilgrims before performing Hajj and 6 (1%) pilgrims after performing Hajj. The difference in the prevalence of positive *Streptococcus pneumoniae* from the pilgrims before and after performing Hajj was not statistically significant (p-value = 0.8). (Table2).

**Table 2:- Overall prevalence of *Streptococcus pneumoniae* isolated from different nationalities of the Pilgrims during the Hajj season**

Nationality	Number of Pilgrims tested	Before Hajj		After Hajj		P-value of difference between positive pilgrims before performing Hajj and positive pilgrims after performing Hajj
		+ Pilgrims	- Pilgrims	+ Pilgrims	- Pilgrims	
Indian	161	1 (0.6%)	160 (99.4%)	3 (1.9%)	158 (98.1%)	0.6 not significant
Nigerian	102	1 (1%)	101 (99%)	1 (1%)	101 (99%)	1.0 not significant
Indonesian	95	1 (1.1%)	94 (98.9%)	0 (0%)	95 (100%)	1.0 not significant
Libyan	90	1 (1.1%)	89 (98.9%)	1 (1.1%)	89 (98.9%)	1.0 not significant
Syrian	68	0 (0%)	68 (100%)	0 (0%)	68 (100%)	-
British	46	0 (0%)	46 (100%)	0 (0%)	46 (100%)	-
Turkish	35	0 (0%)	35 (100%)	0 (0%)	35 (100%)	-
Australian	11	0 (0%)	11 (100%)	1 (9.1%)	10 (90.9%)	1.0 not significant
Swedish	3	0 (0%)	3 (100%)	0 (0%)	3 (100%)	-
Iranian	2	0 (0%)	2 (100%)	0 (0%)	2 (100%)	-
<b>Total</b>	<b>613</b>	<b>4 (0.7%)</b>	<b>609 (99.3%)</b>	<b>6 (1%)</b>	<b>607 (99%)</b>	<b>0.8 not significant.</b>

**Antibiotics susceptibility testing of *S.pneumoniae* isolated from Umrah Visitors during the Umrah season:-**

The following antibiotics were used for antimicrobial susceptibility testing: benzylpenicillin, cefoxitin, clindamycin, erythromycin, fosfomycin, gentamycin, clindamycin, lefloxacin, linezolid, moxifloxacin, mupirocin, oxacillin, rifampicin, teicoplanin, tetracycline, tigecyclin, tobramycin, trimetho-prim/sulfamethoxazole, vancomycin,

ceftriaxone, meropenem, ciprofloxacin, levofloxacin, azithromycin, augmentin and ceftazidime. For the 5 *Streptococcus pneumoniae* isolates isolated from Umrah Visitors in this study, (80%) isolates after Umrah were sensitive to Cefotaxime, Ceftriaxone, Rifampicin and Meropenem antibiotics. While, in the other side, (80%) isolates after Umrah were resistant to Erythromycin and Trimethoprim-sulfamethoxazole antibiotics. (Table3).

**Table 3:-** Antimicrobial Susceptibility of *S.pneumoniae* isolated from Umrah visitors during the Umrah season

ANTIBIOTICS	Before Umrah Total (0)				After Umrah Total (5)			
	Susceptible	%	Non-susceptible	%	Susceptible	%	Non-susceptible	%
Azithromycin	0	0.00	0	0.00	3	60.00	2	40.00
Cefotaxime	0	0.00	0	0.00	4	80.00	1	20.00
Ceftriaxone	0	0.00	0	0.00	4	80.00	1	20.00
Ciprofloxacin	0	0.00	0	0.00	3	60.00	2	40.00
Levofloxacin	0	0.00	0	0.00	3	60.00	2	40.00
Erythromycin	0	0.00	0	0.00	1	20.00	4	80.00
Rifampicin	0	0.00	0	0.00	4	80.00	1	20.00
Clindamycin	0	0.00	0	0.00	2	40.00	3	60.00
Meropenem	0	0.00	0	0.00	4	80.00	1	20.00
Augmentin	0	0.00	0	0.00	3	60.00	2	40.00
Chloramphenicol	0	0.00	0	0.00	2	40.00	3	60.00
Trimethoprim-sulfamethoxazole	0	0.00	0	0.00	1	20.00	4	80.00

**Antibiotics susceptibility testing of *Streptococcus pneumoniae* isolated from Pilgrims during the Hajj season:-**

For the 10 *Streptococcus pneumoniae* isolates isolated from pilgrims in this study, (75%) isolates before Hajj and (66.7%) isolates after Hajj were sensitive to Cefotaxime, Ceftriaxone Ciprofloxacin, Levofloxacin, Rifampicin, Meropenem and Augmentin antibiotics. (Table 4).

**Table 4:-** Antimicrobial Susceptibility of *Streptococcus pneumoniae* isolated from Pilgrims during the Hajj season

ANTIBIOTICS	<i>Streptococcus pneumoniae</i> isolates Before Hajj Total (4)		<i>Streptococcus pneumoniae</i> isolates After Hajj Total (6)	
	Susceptible No. (%)	Non-susceptible No. (%)	Susceptible No. (%)	Non-susceptible No. (%)
Azithromycin	3 (75%)	1 (25%)	2 (33.3%)	4 (66.7%)
Cefotaxime	3 (75%)	1 (25%)	4 (66.7%)	2 (33.3%)
Ceftriaxone	3 (75%)	1 (25%)	4 (66.7%)	2 (33.3%)
Ciprofloxacin	3 (75%)	1 (25%)	4 (66.7%)	2 (33.3%)
Levofloxacin	3 (75%)	1 (25%)	4 (66.7%)	2 (33.3%)
Erythromycin	3 (75%)	1 (25%)	2 (33.3%)	4 (66.7%)
Rifampicin	3 (75%)	1 (25%)	4 (66.7%)	2 (33.3%)
Clindamycin	3 (75%)	1 (25%)	2 (33.3%)	4 (66.7%)
Meropenem	3 (75%)	1 (25%)	4 (66.7%)	2 (33.3%)
Augmentin	3 (75%)	1 (25%)	4 (66.7%)	2 (33.3%)
Chloramphenicol	1 (25%)	3 (75%)	2 (33.3%)	4 (66.7%)
Trimethoprim-sulfamethoxazole	3 (75%)	1 (25%)	2 (33.3%)	4 (66.7%)

**Conclusion and Recommendations:-**

The carriage rate of *S.pneumoniae* among the Umrah visitors was more after Umrah than before Umrah and the carriage rate of *S.pneumoniae* among the pilgrims was more after Hajj than before Hajj. The Indonesian and Libyan pilgrims were the most ethnic groups carries *S.pneumoniae* before performing Hajj, while the Australian pilgrims were the most ethnic group carries *S.pneumoniae* after performing Hajj. The most effective antibiotics against

*S.pneumoniae* isolated from Umrah visitors and pilgrims were Cefotaxime, Ceftriaxone, Rifampicin and Meropenem. Thus we recommend to repeat this study after few years to evaluate the carriage rate of *S. pneumoniae* in Umrah visitors and Pilgrims and if there is any changes in the rate either increasing or decreasing. Adding controls from Saudi nationals to any upcoming study to compare the carriage rate of *S. pneumoniae* in Umrah visitors, Pilgrims and Saudi nationals.

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### References:-

1. Memish ZA, Zumla A, Alhakeem RF, ASSIRI A, Turkestani A, Al Harby KD, et al. Hajj: infectious disease surveillance and control. *Lancet* 2014;383:2073-82.
2. Al-Tawfiq JA, Memish ZA. Mass gatherings and infectious diseases : prevention, detection ,and control. *Infected Dis Clin North Am* 2012; 26: 725-37.
3. Qureshi H, Gessner B, Lebouilleux D, Hasan H, Alam S, Moulton L. The Incidence of vaccine preventable influenza-like illness and medication use among Pakistani pilgrims to the Hajj in Saudi Arabia. *Vaccine*. 2000;18.
4. Wilder-Smith A, Memish Z. Meningococcal disease and travel *Int. J. Antimicrobial Agents*. 2003;21:102-6.
5. A. Johary, A. E. Sorour, A. M. Momenah, A. Asghar, A. Alherbi, H. Elsayed. Prevalence of nasal carriage of *Staphylococcus aureus* among Umrah visitors and pilgrims during Umrah and Hajj seasons. *Egyptian J Med Microbiol*, 20 (2011), pp. 162-166.
6. Cardozo D, Nascimento-Carvalho C, Souza F, Silva N. Nasopharyngeal colonization and penicillin resistance among *Pneumococcal* strains: a worldwide 2004 update. *The Brazilian Journal of Infectious Diseases*. 2006;10(4):293-303.
7. Kadioglu A, Weiser J, Paton J, Andrew P. The role of *Streptococcus pneumoniae* virulence factors in host respiratory colonization and disease. *Nature Reviews*. 2008;6:288-99.
8. Peacock S, de Silva I, Lowy F. What determines nasal carriage of *Staphylococcus aureus*. *Trends Microbiol*. 2001;9(12):605-10.
9. Musher DM. *Streptococcus pneumoniae*. In: Mandell GL, Bennett JE, Dolin R (eds). *Principles and Practice of Infectious Diseases*. 6 ed. New York, NY: Elsevier Churchill Livingstone, 2005:2392-407.
10. Tenover F, Gaynes R. The epidemiology of *Staphylococcus* infection. In: Fischetti V, Novick R, Ferretti J, Portnoy D, Rood J (eds). *Gram-positive pathogens* Washington American Society for Microbiology, 2000:414 – 21.
11. Ruoff KL, Whitley RA, Beighton D. *Streptococcus*. In: Murray PR, Baron EJ, Jorgensen JH, Tenover FC, Tenover FC (eds). *Manual of Clinical Microbiology*. 8 ed. Volume 1. Washington, D.C: ASM Press, 2003.
12. Melles D, Bogaert D, Gorkink R, et al. Nasopharyngeal co-colonization with *Staphylococcus aureus* and *Streptococcus pneumoniae* in children is bacterial genotype independent. *Microbiology*. 2007;153:686-92.
13. Fontanals D, Bou R, Pons I, Sanfeliu I, Dominguez A, Pineda V. Prevalence of *Haemophilus influenzae* carriers in the Catalan preschool population *Eur. J. Clin. Microbiol Infect Dis*. 2000;19.
14. Gili Regev-Y., Meir R., Ron D, et al. Nasopharyngeal Carriage of *Streptococcus pneumoniae* by Adults and Children in Community and Family Settings. *Clin Infect Dis*. (2004) 38 (5):632-639.
15. Garcia –Rodriguez J, Martinez M. Dynamics of Nasopharyngeal colonization by Potential respiratory pathogens. *J Antimicrobial Chemotherapy*. 2002;50:59-73.
16. Hosseini SM, Poorolajal J, Karami M, Ammeri P. Prevalence of Nasopharyngeal Carriage of *Streptococcus pneumoniae* in Iran: A Meta-Analysis. *J Res Health Sci*. 2015 Summer;15(3):141-6.
17. Anh DD, Huong PT, Watanabe K, et al. Increased rates of intense nasopharyngeal bacterial colonization of Vietnamese children with radiological pneumonia. *Tohoku J Exp Med*. 2007;213: 167-172.
18. Bogaert D. *Streptococcus pneumoniae* colonisation: the key to pneumococcal disease. *Lancet Infect. Dis*. 2004;4:144–154.
19. Jover F. A comparative study of bacteremic and non-bacteremic pneumococcal pneumonia. *Eur. J. Intern. Med*. 2008;19:15–21.

20. Wardlaw T. UNICEF/WHO; 2006. Pneumonia: The Forgotten Killer of Children.
21. Adetifa IM, Antonio M, Okoromah CA, Ebruke C, Inem V, Nsekpong D, et al. Pre-vaccination nasopharyngeal pneumococcal carriage in a Nigerian population: epidemiology and population biology. *PloS One*. 2012;7:e30548.
22. Weinberger DM, Bruden DT, Grant LR, Lipsitch M, O'Brien KL, Pelton SI, et al. Using pneumococcal carriage data to monitor postvaccination changes in invasive disease. *Am J Epidemiol* 2013; 178:1488-95.
23. Al-Tawfiq JA, Memish ZA. Potential risk for drug resistance globalization at the Hajj. *Clin Microbiol Infect* 2015;21:109-114.
24. Turner D. APPG/UK Government; 2008. Improving Global Health by Preventing Pneumococcal Disease.
25. King J.C. Comparison of the safety and immunogenicity of a pneumococcal conjugate with a licensed polysaccharide vaccine in human immunodeficiency virus and non- human immunodeficiency virus-infected children. *Pediatr. Infect. Dis. J.* 1996;15:192– 196.
26. Cutts F.T. Efficacy of nine-valent pneumococcal conjugate vaccine against pneumonia and invasive pneumococcal disease in The Gambia: randomised, double-blind, placebo- controlled trial. *Lancet*. 2005;365:1139–1146.
27. Ansaldi F, de Florentiis D, Canepa P, Zancolli M, Martini M, Orsi A, et. Carriage of *Streptococcus Pneumoniae* 7 year after implementation of Vaccination program in a population with very high and long- lasting coverage, Italy. *Vaccine* 2012;30:2288-94.
28. Qazi S. UNICEF/WHO; 2007. Global Action Plan for the Prevention and Control of Pneumonia (GAPP): Report of an Informal Consultation.
29. Samir Benkouiten, Remi Charrel, Khadidja Belhouchat, et al. Respiratory Viruses and Bacteria among pilgrims during the 2013 Hajj. *Emerg Infect Dis*. 2014 November, 20(11):1821-1827.
30. S.S. Ashgar, H.M. El-said, A. Johargy, A. M. Momenah, A. E. Sorour, et al. Prevalence of nasal carriage of *Neisseria meningitidis* among Umrah visitors and pilgrims during Umrah and Hajj seasons. *Global Advan Res J Microbiol*, 2(2013), pp. 141-149.
31. Memish Z. Meningococcal disease and travel. *Clin Infect Dis*. 2002;34:84.
32. Benkouiten S., Gautret P., Belhouchat P., et al. Acquisition of *Streptococcus pneumoniae* Carriage in Pilgrims During the 2012 Hajj. *Clinical Infection Diseases* 2014;58(4):e106-9.
33. Wayne PA. Performance standards for antimicrobial susceptibility testing .34. USA: CLSI; 2014.



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### RESEARCH ARTICLE

#### HEALTH EFFECTS OF LOW LEVEL IONIZING RADIATION COMPARED TO ESTIMATED UV INDEX IN SHARM EL-SHEIKH, EGYPT.

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Ultraviolet index, clear sky global solar radiation, temperature, erythema, somatic, genetic, teratogenic and transgenerational.

#### Abstract

**Background:** The interest in solar ultraviolet (UV) radiation from the scientific community and the general population has risen significantly in recent years because of the link between increased UV levels at the Earth's surface and depletion of ozone in the stratosphere. However, Ultraviolet (UV) radiation is a well-known physical hazard responsible for photoaging, photoallergic, and phototoxic reactions as well as carcinogenesis. On the other side, ionizing radiation is known as one of the detrimental factors in the work environment that can cause serious, irreversible and irreparable damages in professional radiation workers, but the effects of low doses on human health has not been completely known.

**The Aim:** The study clarifies the late and low level effects of ionizing radiation on health and recognizes the adverse effects of excessive solar radiation on skin, eyes and the immune system. It also outlines new approaches on how to improve the effectiveness of the UVI as a public awareness tool toward encouraging sun protection behavior aiming to reach a simplified estimation method and accurate predictive results for daily clear sky global solar radiation (H) and daily maximum ultraviolet index (UVI<sub>max</sub>).

**Methods:** A simplified estimated model and accurate prediction results of UVI<sub>max</sub> are reached in this work. The linear multiple-regression model is used to forecast the UVI<sub>max</sub> for state of Sharm El-Sheikh. The precision of the developed forecasting model of daily UVI<sub>max</sub> is based on maximum temperature and accurate prediction results of daily H. The linear multiple- regression empirical model for estimating daily global solar radiation is based on three -predictor variables and one response variable.

**Results:** The predictor variables of the daily global radiation (H) developed model are different from predictors of other existing models. The developed model is considered as a simplified statistical approach because it depends on two constant predictors and one changeable predictor. It shows that the predicted global solar radiation

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overlaps the measured global solar radiation in all months of the year. The UVI refers to the daily maximum effective irradiance and serves as an indicator of the impact of UV-radiation on erythema (sunburn). It was developed as a tool to conceptualize the amount of harmful radiation and to encourage the general public to use sun protection, and it is recommended to be integrated with broader public health approaches. By comparing to late and low level effects of ionizing radiation, there are four types of delayed radiation effects: somatic, genetic, teratogenic, and transgenerational. The current radioprotection guidelines state that all exposures to radiation should be avoided if possible and that exposure should be kept as low as is reasonably achievable.

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### ..... Introduction:-

Ultraviolet (UV) radiation is a well-known physical hazard responsible for photoaging, photoallergic, and phototoxic reactions as well as carcinogenesis, including life-threatening melanomas (Zuba et al., 2016). Solar radiation is an important natural factor because it forms the Earth's climate and has a significant influence on the environment. The ultraviolet part of the solar spectrum (UV) plays an important role in many processes in the biosphere. It has several beneficial effects but it may also be very harmful if UV exceeds "safe" limits. If the amount of UV radiation is sufficiently high the self-protection ability of some biological species is exhausted and the subject may be severely damaged. This also concerns the human organism, in particular the skin and the eyes (Allinson et al., 2012). Overexposure to both natural and artificial UV radiation is a public health concern. 30% of cancers diagnosed worldwide are skin cancers. Approximately three million non-melanoma skin cancers and 132 000 new cases of melanomas are diagnosed globally each year. Sunburns, especially in childhood, are a very important risk factor for melanomas. Several studies demonstrated a positive association between sunbed use and an increased incidence of malignant melanoma (Zuba et al., 2016). The International Agency for Research on Cancer has noted that there is sufficient evidence from studies in animals and in man to establish ultraviolet radiation as a human carcinogen. Skin cancer has been the most commonly studied cancer site with respect to UV radiation. The nature and timing of sun exposure appear to be important determinants of both the degree of risk and the type of skin cancer. Cutaneous malignant melanoma and basal cell cancer are much more strongly related to measures of intermittent ultraviolet exposure (particularly those of childhood or adolescence) than to measures of cumulative exposure. In contrast, squamous cell cancer is more strongly related to constant or cumulative sun exposure. Lip cancer is causally related to lifetime sun exposure. It has been estimated that solar ultraviolet radiation accounts for approximately 93 percent of skin cancers and about half of lip cancers (Gallagher et al., 2010).

The diurnal and annual variability of solar UV radiation reaching the ground is governed by astronomical and geographical parameters as well as by the atmospheric conditions. As a consequence, solar UV radiation is a highly variable environmental parameter that differs widely in time and space. The need to reach the public with simple-to-understand information about UV and its possible detrimental effects led scientists to define a parameter that can be used as an indicator of the UV exposures. This parameter is called the UV Index (UVI) (Allinson et al., 2012). It was introduced in 1995 by the World Health Organization (WHO), the United Nations Environment Programme (UNEP), the World Meteorological Organization (WMO), and the International Commission for Non-Ionizing Radiation Protection (ICNIRP, 1995). UVI is a unit of measure of UV levels relevant to the effects on human skin. The UVI is now widely used in many operational weather reports and forecasts. In Europe, for example, there are more than a dozen forecasting centers that release estimated UVI values for countries or regional areas. Different methods are used to predict the UVI and all kinds of information systems and presentations are seen. Operational UVI forecasting has already been implemented in many countries. The forecast methods vary from simple statistical methods used for local areas to more complicated methods with global coverage and with forecast times from a few hours to several days, either for clear sky or all sky conditions (Allinson et al., 2012). Many researchers have a try to achieve to the best empirical models for estimating the daily global solar radiation by using different equations based on one independent variable such as: mean relative sunshine duration ( $S/S_0$ ). These equations represented in linear, exponential, power, logarithmic, quadratic, cubic, linear exponential and linear logarithmic (Marwal et al., 2012; Medugu and Yakubu, 2011; Muzathik et al., 2011; Khalil and Fathy, 2008; Corredor, 2013). Other researchers used multiple regression equations with different predictor variables (weather parameters) for estimating the daily global radiation such as: clearness index, mean relative sunshine duration ( $S/S_0$ ), mean daily maximum

temperature ( $T_{\max}$ ), mean daily relative humidity (Rh), mean daily rainfall (R), mean daily temperature ( $\bar{T}$ ), ratio of maximum and minimum daily temperature and other weather parameters (Falayi et al., 2008; Augustine and Nnabuchi, 2009; Ituen et al., 2012; Habbib, 2011). These researchers depend in their studies on different changeable predictors. However, using multiple regression models for estimating the daily global radiation give more accurate results than other equations that depends on one variable under condition of presence the mean relative sunshine duration parameter. So, to avoid damage from high UV exposures, both acute and chronic, people should limit their exposure to solar radiation by using protective measures (Allinson et al., 2012). In 2002, the concept of the UVI was expanded as a public awareness tool to help the public conceptualize the amount of harmful UV radiation and to alert people to the need for sun protection measures (WHO, 2002). After 10 years of use, a systematic review of the effectiveness of the UVI revealed that the UVI has raised public awareness of UV exposure to some extent, but that it has not significantly improved sun protection practices (Italia and Rehfuess, 2012).

Ionizing radiation, particularly X-ray and those emitted by radioactive substances, play a vital role in medicine, both in diagnosing and treating diseases (Calabrese et al., 2014). On the other side, ionizing radiation is known as one of the detrimental factors in the work environment that can cause serious, irreversible and irreparable damages in professional radiation workers, but the effects of low doses on human health has not been completely known (Klucinski et al., 2014). Considering and following up the health of persons who are occupationally exposed to long-term, low levels of ionizing radiation is of great importance. Basic studies on the biological response to radiation at low doses are considered a research priority in order to better understand the occupational risks associated with working in radiation departments with the possible development of long-term health effects (Heydarheydari et al., 2016). However, radiation may damage various cellular components including DNA, directly (molecule ionization) or indirectly (reactive oxygen species production). Irradiated cells protect themselves by many innate defense mechanisms such as removal of oxidative stress and damaged cells, and DNA repair. Remained damages of cells may cause tissue/organ dysfunction and malignant diseases. For radiation protection, the biological effects of radiation are conventionally categorized into two broad classes: stochastic and deterministic effects (or recently termed tissue reactions) (Seong et al., 2016). *Stochastic effects* have probability of occurrence depending on the irradiated doses without threshold. These effects can occur by chance and consist primarily of cancer and genetic effects such as inherited mutations. It often shows up years after exposure. In addition, because they can occur in individuals under background radiation levels without exposure, it can never be determined that an occurrence of these effects was due to a specific exposure (Mettler, 2012). *Deterministic effects* (or non-stochastic effects) are malfunctions of organs by irradiation at more than threshold. These effects do not exist below their threshold doses, for example, skin burns, cataracts, cardiovascular disease, intestinal damage, and hemopoietic system and central nervous system failure (Kadhim et al., 2013). Recent ICRP report referred to deterministic effects as tissue reactions because it was recognized that these effects are not decided at the moment of irradiation and can be modified through various biological responses (ICRP, 2012). This simplistic classification is not absolute. Deterministic effects can occur as a result from the loss of normally functioning large number of critical cells caused by stochastic killing of irradiated individual cells (Seong et al., 2016).

Over the last several years, there was a trend to investigate the biological effects of the radiation using hematological, biochemical, and cytogenetic parameters (Ossetrova et al., 2010). These investigations have demonstrated that stochastic effects may appear after the exposure to low level radiation (Elgazzar and Kazem, 2015). Deterministic effects are well-known and often need higher radiation doses than received by medical professionals (MPs) (Yang et al., 1995). Therefore the concern and unawareness of MPs are related to the stochastic effects of long-term exposure to low-dose radiation. The risk of stochastic effects, such as cancer, increase by dose without threshold (Muirhead et al., 2009; Venneri et al., 2009). Long-term exposure to low doses of ionizing radiation can affect proliferating cells (Fliedner et al., 2012) and tissues. The effect of radiation on hematopoietic and immune system (Hrycek et al., 2002; UNSCEAR, 2012) suggest that, long-term effects can disturb immunity of MPs by suppressing or stimulating the immune system and may induce various hematological diseases (Roguin et al., 2012; Venneri et al., 2009). However, the biological effects of chronic low-dose radiation on human health are complex and have not been well established. It seems that, hematological parameters survey could not be a reliable test as the biological indicator of long term exposure to very low dose of radiation exposure in medical professionals which their physical dosimetry values are lower than dose limits (Shafiee et al., 2016). Additionally, all the workers occupationally exposed showed an increase in DNA fragmentation after the workday. The amount of radiation in all three services is different, in Nuclear Medicine and Radiotherapy the workers showed a greater monthly dose of exposure and greater DNA damage than the Radiology workers. Most of the DNA damage detected by the comet assay is repaired; however a part of it may result in stable chromosomal rearrangements that may

represent a long-term health risk. It is important to sensitize exposed workers on their responsibility of working with radiation and the improvement of the hospital safety practices (Martínez et al., 2010). Fortunately, Low-level radiation exposure is generally considered to be less than the dose that produces immediate or short-term observable biological effects. In humans, low-LET gamma or X-radiation doses of less than 0.5 Gy do not produce prodromal symptoms or the hematopoietic subsyndrome; however, recent studies suggest that low-level radiation exposure does increase the probability that delayed effects will occur (Hall et al., 2012; Joiner and van der Kogel, 2009). There are four types of delayed radiation effects: (1) somatic, (2) genetic, (3) teratogenic, and (4) transgenerational. Irradiation enhances the naturally occurring frequency of the specific effect, and in some cases produces the observable endpoint by a process different than that of a natural process. Certain biological responses have such low thresholds that they are statistically indistinguishable, in many cases, from normal incidence (Joiner and van der Kogel, 2009; Miller et al., in press).

#### The Aim:-

The study clarifies the late and low level effects of ionizing radiation on health and recognizes the adverse effects of excessive solar radiation on skin, eyes and the immune system. It also outlines new approaches on how to improve the effectiveness of the UVI as a public awareness tool toward encouraging sun protection behavior aiming to reach a simplified estimation method and accurate predictive results for daily  $H$  and  $UVI_{max}$ .

#### Materials and Methods:-

In the current study,  $UVI_{max}$  is modeled for forecasting its daily value. The statistical prediction model is based on two independent variables (predictor variables) for constructing the linear multiple regression equation. The first predictor is daily clear sky global solar radiation on a horizontal surface ( $H$ ) and the second predictor is daily maximum temperature ( $T_{max}$ ). These model predictors are considered more accurate effective for  $UVI_{max}$  forecasting results than other weather parameters. Additionally, model is developed with multiple regression equation than other researchers to predict the daily global solar radiation future time ( $H$ ). The developed multiple regression models based on three predictors. These independent variables are: monthly average day length ( $S_0$ ), monthly average cosine solar zenith angle at mid-time between sunrise and solar noon ( $\cos(\theta_{ZMT})$ ) and monthly average daily temperature ( $\bar{T}$ ). Two predictors are calculated ( $S_0$  &  $\cos(\theta_{ZMT})$ ) and one predictor is measured ( $\bar{T}$ ). This model is considered a simplified statistical approach because it depends on two monthly constant predictors ( $S_0$  &  $\cos(\theta_{ZMT})$ ) and one daily changeable predictor ( $\bar{T}$ ).

The material data of monthly averaged clear sky global radiation on a horizontal surface ( $kWh/m^2/day$ ) and monthly average air mean and maximum temperature at 10m above the earth surface ( $\bar{T}$  &  $\bar{T}_{max}$ ) (degrees Celsius) is obtained from NASA meteorology (NASA., 2016). The data covered a period of 22 years (1983 – 2005) for Sharm El-Shiekh in Egypt at Latitude  $27.912^\circ$  and longitude  $34.33^\circ$ . UVI data is obtained from Weather2Travel climate guides [weather2travel]. The suggested modified empirical model of clear sky global solar radiation has been estimated on the basis of measurements of monthly averaged clear sky global radiation on a horizontal surface and monthly average air mean temperature for Sharm El-Shiekh. Also, the empirical model based on calculation of monthly mean daily extraterrestrial radiation, maximum possible sunshine duration and monthly average cosine solar zenith angle at mid-time between sunrise and solar noon.

#### Developed empirical model to estimate the daily global radiation ( $H$ ):-

The devolved model for estimating the daily global radiation based on three independent variables (predictor variable) and one dependent variable (response variable). The response variable is the variable to be predictable

$\bar{H}/\bar{H}_0$  and the three-predictor variables are  $S_0$ ,  $\cos(\theta_{ZMT})$  and  $\bar{T}$ .

The following modification empirical model is used to estimate the daily global radiation

$$\frac{\bar{H}}{\bar{H}_0} = 0.6857 - 0.010306(S_0) + 0.42213(\cos(\theta_{ZMT})) - 0.002947(\bar{T}) \quad (1)$$

$$\bar{H}_{calculated} = (0.6857 - 0.010306(S_0) + 0.42213(\cos(\theta_{ZMT})) - 0.002947(\bar{T})) \bar{H}_0$$



where,  $\frac{\bar{H}}{\bar{H}_0}$  is clearness index,  $\bar{H}$  is monthly mean daily clear sky global solar radiation on a horizontal surface,

$\bar{H}_0$  is monthly mean daily extraterrestrial radiation  $\text{KW/m}^2$ ,  $S_0$  is monthly average day length,  $\cos(\theta_{\text{ZMT}})$  is monthly average cosine solar zenith angle at mid-time between sunrise and solar noon and  $\bar{T}$  is monthly average daily temperature. The values of the monthly average daily extraterrestrial radiation ( $\bar{H}_0$ ) can be calculated from equation 2 (Duffie and Beckman, 2013).

$$\bar{H}_0 = \frac{24}{\pi} I_{\text{SC}} E_0 \left[ \cos \phi \cos \delta \sin w_s + \frac{\pi w_s}{180} \sin \phi \sin \delta \right] \quad (2)$$

$$E_0 = 1 + 0.033 \cos \left[ \frac{360 d_n}{365} \right]$$

where,  $I_{\text{SC}}$  is the solar constant ( $=1.367 \text{ KWm}^{-2}$ ),  $\phi$  is the latitude of the site,  $\delta$  is the solar declination,  $w_s$  is the mean sunrise hour angle for the given month, and  $d_n$  is the number of days of the year starting from the first of January (the Julian day number). The solar declination ( $\delta$ ) and the mean sunrise hour angle ( $w_s$ ) can be calculated by the following equations:

$$\delta = 23.45 \sin \left[ 360 \frac{(d_n + 284)}{365} \right]$$

$$w_s = \cos^{-1} (-\tan \phi \tan \delta)$$

The maximum possible sunshine duration ( $S_0$ ) (or monthly average day length) which is related to  $w_s$ , can be computed by using the following equation:

$$S_0 = \frac{2}{15} w_s \quad (3)$$

Monthly average cosine solar zenith angle at mid-time between sunrise and solar noon is calculated according the following formula (NASA., 2016):

$$\cos(\theta_{\text{ZMT}}) = f + g[(g - f) / 2g]^{1/2} \quad (4)$$

where,

$$f = \sin(\phi) \sin(\delta), \quad g = \cos(\phi) \cos(\delta)$$

Monthly average daily mean temperature ( $\bar{T}$ ) is calculated as follows:

$$\bar{T} = \frac{(T_{\text{maximum}} + T_{\text{minimum}})}{2} \quad (5)$$

#### Empirical model to estimate the daily maximum ultraviolet index (UVI<sub>max</sub>):-

The statistical estimation model of daily ultraviolet index is based on two independent variables for constructing the linear multiple regression equation. The first predictor is the monthly mean daily clear sky global solar radiation on a horizontal surface ( $\bar{H}$ ) and the second predictor is monthly average maximum temperature ( $\bar{T}_{\text{max}}$ ).

$$UVI_{\text{max}} = -4.5146 + 1.4178(\bar{H}_{\text{calculated}}) + 0.12697(\bar{T}_{\text{max}}) \quad (6)$$

$H$  and  $T_{\text{max}}$  are considered more accurate effective for  $UVI_{\text{max}}$  forecasting results than other weather parameters.

#### Statistical Evaluation:-

There are numerous works in literature which deal with the assessment and comparison of monthly mean daily solar radiation estimation models. The most popular statistical parameters are the mean bias error (MBE) and the root mean square error (RMSE) (Muzathik et al., 2011). In this study, to evaluate the accuracy of the estimated data,

from the models described above, the following statistical tests are used, MBE, RMSE, mean absolute percentage error (MAPE) (Sivamadhavi and Selvaraj, 2012; Corredor, 2013) and coefficient of correlation (R). The evaluation accuracy is based on the low error value and the high correlation coefficient value.

$$MBE = \frac{\sum_{i=1}^n (\bar{H}_{i,caculated} - \bar{H}_{i,measured})}{n}, \quad RMSE = \sqrt{\frac{\sum_{i=1}^n (\bar{H}_{i,caculated} - \bar{H}_{i,measured})^2}{n}}$$

$$MAPE = \frac{1}{n} \sum_{i=1}^n \left| \frac{\bar{H}_{i,measured} - \bar{H}_{i,caculated}}{\bar{H}_{i,measured}} \right| * 100$$

$$R = \frac{\sum_{i=1}^n (\bar{H}_{i,caculated} - \bar{H}_{i,caculated})(\bar{H}_{i,measured} - \bar{H}_{i,measured})}{\sqrt{\left( \sum_{i=1}^n (\bar{H}_{i,caculated} - \bar{H}_{i,caculated})^2 \right) \left( \sum_{i=1}^n (\bar{H}_{i,measured} - \bar{H}_{i,measured})^2 \right)}}$$

### Results:-

#### Devolved empirical equation for prediction of daily global solar radiation (H):-

The various meteorological data are related to global solar radiation (H). Empirical model is developed to estimate the daily global radiation. Multiple linear regression analysis of four parameters is employed to estimate the daily global solar radiation ( $\bar{H}/\bar{H}_0$ ,  $S_0$ ,  $\cos(\theta_{ZMT})$  and  $\bar{T}$ ).

The following modification empirical model is devised for global solar radiation estimation.

$$\frac{\bar{H}}{\bar{H}_0} = 0.6857 - 0.010306(S_0) + 0.42213(\cos(\theta_{ZMT})) - 0.002947(\bar{T})$$

$$\bar{H}_{calculated} = (0.6857 - 0.010306(S_0) + 0.42213(\cos(\theta_{ZMT})) - 0.002947(\bar{T})) \bar{H}_0$$

The calculated values for  $\bar{H}_0$ ,  $\bar{H}/\bar{H}_0$ ,  $S_0$ ,  $\cos(\theta_{ZMT})$ ,  $\bar{T}$  and  $\bar{H}_{calculated}$  for Sharm El-Sheikh are presented in Table 1.

**Table 1:-** Meteorological data and clear sky global solar radiation for Sharm El-Sheikh

MONTH	$\bar{H}_{measured}$ (KW/m <sup>2</sup> /day)	$\bar{H}_0$ (KW/m <sup>2</sup> /day)	$\bar{H}_{measured}/\bar{H}_0$	$S_0$	$\cos(\theta_{ZMT})$	$\bar{T}$	$\bar{H}_{calc}/\bar{H}_0$	$\bar{H}_{calculated}$ (KW/m <sup>2</sup> /day)
JAN	<b>4.55</b>	6.2563	0.72727	10.4467	0.47335	15.8	0.73129	<b>4.5751</b>
FEB	<b>5.58</b>	7.4431	0.74969	11.0364	0.53653	16.5	0.74982	<b>5.5810</b>
MAR	<b>6.88</b>	8.9678	0.76719	11.8304	0.61038	19.6	0.76368	<b>6.8485</b>
APR	<b>7.88</b>	10.3083	0.76443	12.6801	0.66447	24.0	0.76478	<b>7.8836</b>
MAY	<b>8.34</b>	11.0896	0.75206	13.3882	0.68588	27.7	0.75562	<b>8.3795</b>
JUN	<b>8.53</b>	11.3487	0.75163	13.7394	0.68930	30.0	0.74667	<b>8.4736</b>
JUL	<b>8.30</b>	11.1865	0.74197	13.5742	0.68823	31.3	0.74409	<b>8.3237</b>
AUG	<b>7.84</b>	10.5560	0.74270	12.9619	0.67545	31.4	0.74471	<b>7.8612</b>
SEPT	<b>6.98</b>	9.3964	0.74284	12.1415	0.63373	30.1	0.73938	<b>6.9475</b>
OCT	<b>5.69</b>	7.8727	0.72275	11.2938	0.56229	26.5	0.72857	<b>5.7358</b>
NOV	<b>4.72</b>	6.5046	0.72564	10.5924	0.48926	21.8	0.71882	<b>4.6757</b>
DEC	<b>4.22</b>	5.8725	0.71861	10.2591	0.45275	17.6	0.71922	<b>4.2236</b>

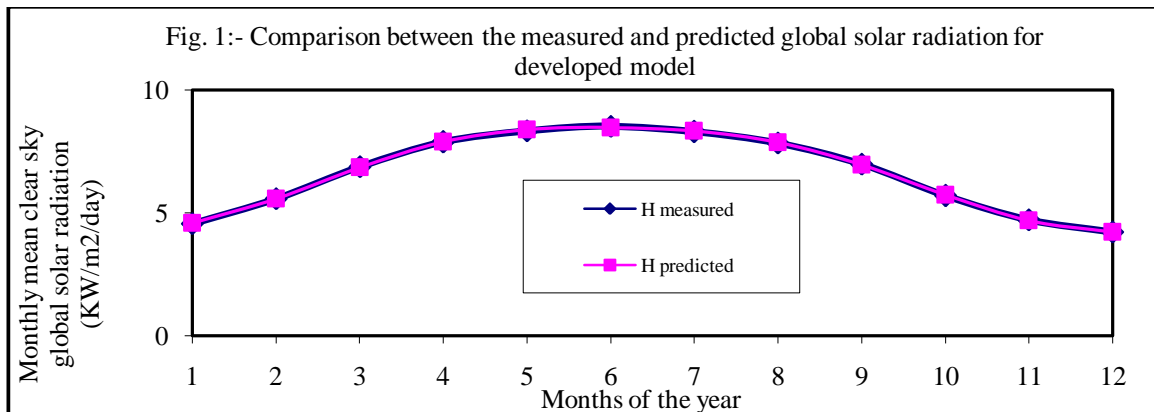
A number of linear multiple regression equations (7-10) were developed by other researchers to predict the relationship between global solar radiations with one or more combinations of weather parameters. Some researchers used different weather parameters such as: clearness index, The mean relative sunshine duration ( $S/S_0$ ), mean daily maximum temperature ( $T_{max}$ ), mean daily relative humidity ( $Rh$ ), mean daily rainfall ( $R$ ), mean daily

temperature ( $\bar{T}$ ), ratio of maximum and minimum daily temperature and other weather parameters. The suggested modified multiple regression model (eqn. 1) is developed using weather parameters different than that other weather parameters previously used. The suggested developed model and some researchers-developed models are tested for our and their applicability to predict the global solar radiation for State of Sharm El-Sheikh. The suggested developed model is considered a simplified statistical approach because it depends on constant predictors ( $\bar{H}_0$ ,  $S_0$  and  $\cos(\theta_{ZMT})$ ) and one inconstant predictor ( $\bar{T}$ ). The constant predictors are determinate according to its corresponding month (from Table 1). All constant predictors are calculated and the changeable predictor is measured. Table 2 shows some statistical indicators (R, MBE, RMSE and MAPE) for comparing the suggested developed model with some linear multiple regression models.

**Table 2:** Equations with regression and statistical indicators of accuracy

Equations	source	R	MBE	RMSE	MAPE
$\frac{\bar{H}}{\bar{H}_0} = 0.94736 + 0.06068(S/S_0) - 0.0407(T_{mini}/T_{maxi}) - 0.4528(Rh/100) - 0.00299(\bar{T}) \quad (7)$	(Falayi, 2008; Habbib, 2011)	0.998	-0.0005	0.0586	0.729
$\frac{\bar{H}}{\bar{H}_0} = 0.9697 + 0.0519(S/S_0) - 0.00342(T_{maxi}) - 0.495(Rh/100) \quad (8)$	(Ituen, 2012)	0.999	-0.0021	0.0600	0.732
$\frac{\bar{H}}{\bar{H}_0} = 0.956 - 0.5672(T_{mini}/T_{maxi}) + 0.0054(T_{maxi}) \quad (9)$	(Okunda-miya, 2011)	0.999	-0.0032	0.0652	0.787
$\frac{\bar{H}}{\bar{H}_0} = 1.582 + 0.05963(S/S_0) - 0.5407(T_{average}/T_{maxi}) - 0.125(\ln(Rh))(10)$	(Adhika-ri, 2013)	0.999	-0.0011	0.0687	0.832
$\frac{\bar{H}}{\bar{H}_0} = 0.6857 - 0.010306(S_0) + 0.42213(\cos(\theta_{ZMT})) - 0.002947(\bar{T})$		<b>0.9998</b>	<b>-0.000098</b>	<b>0.0323</b>	<b>0.422</b>

The results obtained show a remarkable agreement between the measured and the predicted values using different linear multiple regression models. The empirical developed model under study (eqn. 1) gives the best accuracy and more reliable results than other researchers' models (eqns. 7-10). The accuracy tests indicate that the error rate is reduced nearly by 40-50% in favor of our developed model. Therefore, the suggested developed model is preferred to use for prediction of global solar radiation on horizontal surface for Sharm El-Sheikh. Figure 1 shows comparison between the measured and predicted global solar radiation using the suggested empirical developed model. It is clear from the figure that there is an excellent correlation exists between the measured and predicted global solar radiation. However, the predicted global solar radiation overlaps the measured global solar radiation in all months of the year.



To predict the daily global solar radiation in Sharm El-Sheikh, substitute  $S_0$  and  $\cos(\theta_{ZMT})$  values in the developed empirical equation according to the corresponding month for this predictable day.  $\bar{T}$  is calculated from daily changing maximum and minimum temperature. For example, to predict daily global solar radiation of few days for some months, substitute the values of  $S_0$ ,  $\cos(\theta_{ZMT})$ ,  $\bar{H}_0$  (from Table 1) and  $\bar{T}$  (from eqn. 5) in equation 1. The results are presented in Table 3.

**Table 3:-**Some calculated values of daily global solar radiation.

Date	$\bar{H}_0$	$S_0$	$\cos(\theta_{ZMT})$	$\bar{T}$	$\bar{H}_{calc}/\bar{H}_0$	$H_{calculated}$ KW/m <sup>2</sup> / day
16-6-2015	11.34866	13.73937	0.689297	(35+26)/2=30.5	0.745201	<b>8.457026</b>
19-6-2015	11.34866	13.73937	0.689297	(40+29)/2=34.5	0.733414	<b>8.323262</b>
28-6-2015	11.34866	13.73937	0.689297	(36+27)/2=31.5	0.742254	<b>8.423585</b>
03-7-2015	11.18652	13.57424	0.68823	(34+27)/2=30.5	0.746452	<b>8.350196</b>
26-7-2015	11.18652	13.57424	0.68823	(40+28)/2 = 34	0.736138	<b>8.234825</b>
29-7-2015	11.18652	13.57424	0.68823	(41+29)/2 = 35	0.733192	<b>8.201861</b>
06-8-2015	10.55604	12.96194	0.67545	(40+31)/2 = 35.5	0.732636	<b>7.733736</b>
09-8-2015	10.55604	12.96194	0.67545	(43+33)/2 = 38	0.725269	<b>7.655973</b>
13-8-2015	10.55604	12.96194	0.67545	(43+32)/2 = 37.5	0.726743	<b>7.671525</b>

Table 3 shows that in the month range June-August (Fig.1) the global solar radiation value decrease with the increase in average temperature value. The given month range belongs to the maximum value in Fig. 1. The choice of the month range June-August (summer) is considered in this work because the effect of UVI is maximum. Moreover, the estimated high global solar radiation of the summer months is required for detailed study to get the maximum benefits of solar energy for electric power production.

#### Empirical equation for forecasting daily ultraviolet index (UVI):-

In this section, the strong relationship between  $H$ ,  $T_{max}$  (as independent variable) and UVI (as dependent variable) is illustrated by using the linear multiple regression equation which relating to these three variables. Two linear multiple regression equations are compared for attempt to deduce the best of them. The first equation (eqn. 6) is based on  $\bar{H}_{calculated}$  and  $\bar{T}_{max}$ . The second equation (eqn. 11) is based on  $\bar{H}_{measured}$  &  $\bar{T}_{max}$ .

$$UVI_{max predicted} = -4.5146 + 1.4178(\bar{H}_{calculated}) + 0.12697(\bar{T}_{max})$$

$$UVI_{max predicted} = -4.5156 + 1.4123(\bar{H}_{measured}) + 0.12823(\bar{T}_{max}) \quad (11)$$

The results of estimated  $UVI_{max}$  according to equations 6 and 11 are shown in Table 4.

**Table 4:-**Meteorological data and ultraviolet index for Sharm El-Sheikh

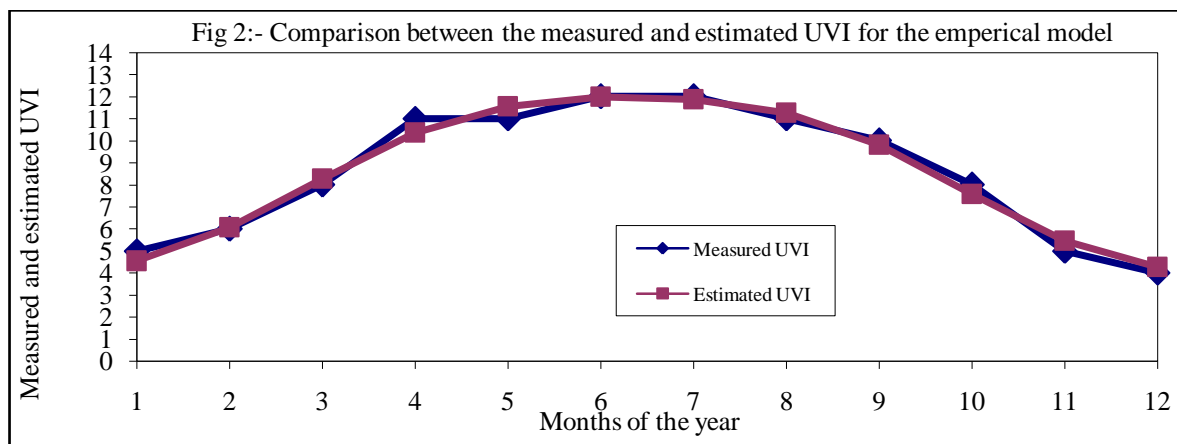
MONTH	( $UVI_{max}$ ) measured	$\bar{H}_{calculated}$ (KW/m <sup>2</sup> /day)	$T_{max}$	estimated ( $UVI_{max}$ ) from $\bar{H}_{calculated}$	$\bar{H}_{measured}$ (KW/m <sup>2</sup> /day)	estimated ( $UVI_{max}$ ) from $\bar{H}_{measured}$
JAN	<b>5</b>	4.5751	20.2	4.537	4.55	<b>4.500</b>
FEB	<b>6</b>	5.5810	21.0	6.064	5.58	<b>6.057</b>
MAR	<b>8</b>	6.8485	24.3	8.281	6.88	<b>8.317</b>
APR	<b>11</b>	7.8836	29.2	10.37	7.88	<b>10.36</b>
MAY	<b>11</b>	8.3795	33.0	11.56	8.34	<b>11.49</b>
JAN	<b>12</b>	8.4736	35.3	11.98	8.53	<b>12.06</b>
JUL	<b>12</b>	8.3237	36.1	11.87	8.30	<b>11.84</b>
AUG	<b>11</b>	7.8612	36.4	11.25	7.84	<b>11.22</b>
SEPT	<b>10</b>	6.9475	35.2	9.805	6.98	<b>9.856</b>
OCT	<b>8</b>	5.7358	31.2	7.580	5.69	<b>7.521</b>
NOV	<b>5</b>	4.6757	26.3	5.454	4.72	<b>5.523</b>
DEC	<b>4</b>	4.2236	21.9	4.254	4.22	<b>4.253</b>

The accuracy indicators, R, MSE, RMSE and MAPE, are used for measuring the powerful of empirical forecasting models and for illustrating the best estimator model, which gives the best prediction performance results. Table 5 displays the results of the accuracy indicators values.

**Table 5:-**Statistical indicators of accuracy

Accuracy Indicators	R	MSE	RMSE	MAPE
UVI <sub>max</sub> predicted from $\bar{H}_{calculated}$	0.9919	0.131	0.362	0.042342
UVI <sub>max</sub> predicted from $\bar{H}_{measured}$	0.9918	0.140	0.374	0.044359

According to the accuracy indicators, there are slightly differences between the results of the two models. The results show that, equation 6 gives the best prediction performance results comparing with equation 11. Therefore, using equation 6 is recommended. The value of  $H$  is calculated according to equation 1 and the value of  $T_{max}$  is determinate according to its daily changeable value. Figure 2 shows comparison between the measured and estimated UVI<sub>max</sub> using the empirical model. It is clear from that figure that there is a very good correlation exists between the measured and estimated UVI.



For example, to estimate the value of UVI<sub>max</sub> of the same days in Table 3, substitute the values of  $H_{calculated}$  and  $T_{max}$  (from Table 3) in equation 6. The results of UVI<sub>max</sub> values are presented in Table 6.

**Table 6:-**Some estimated values of daily UVI<sub>max</sub>

Date	$H_{calculated}$	$T_{max}$	Estimated UVI <sub>max</sub>
16-6-2015	8.457026	35	<b>11.92</b>
19-6-2015	8.323262	40	<b>12.36</b>
28-6-2015	8.423585	36	<b>12.00</b>
03-7-2015	8.350196	34	<b>11.64</b>
26-7-2015	8.234825	40	<b>12.24</b>
29-7-2015	8.201861	41	<b>12.32</b>
06-8-2015	7.733736	40	<b>11.53</b>
09-8-2015	7.655973	43	<b>11.80</b>
13-8-2015	7.671525	43	<b>11.82</b>

Table 6 shows that the value of UVI<sub>max</sub> increases with the increase in the value of maximum temperature, so that the increase is linked to the high values of  $H$  for each day in that month. As well, UVI<sub>max</sub> is extremely high in Jun, July and August. Therefore, estimate of UVI<sub>max</sub> and its health protection are recommended in those months of the year.

**The daily UV dose (DUVD) is calculated as an integral of UV index over the daylight time:-**

$$DUVD = \int_{T_0}^{T_{N+1}} UVI(t) dt$$

$T_0$  is the sunrise time and  $T_{N+1}$  is the sunset time.

**The calculations are performed again using the trapezoid rule that results in the following formula:-**

$$DUVD = \frac{1}{2} \sum_{j=0}^N (UVI_j + UVI_{j+1}) \cdot (T_{j+1} - T_j)$$

The daily UV dose is in UV Index hours (UVI h) if the units of  $T_j$  are hours. To convert UVI h units to  $\text{kJ/m}^2$ , units that are commonly used to express DUVD, the result from the last equation have to be multiplied by the factor:  $0.09 = 25 \times 3.6 / 1000$  (Kiedron et al., 2007).

### Discussion:-

The increase in the amount of solar ultraviolet (UV) light that reaches the earth is considered to be responsible for the worldwide increase in skin cancer and considered as the main etiological factor (Rivas et al., 2015). It has been reported that excessive levels of UVA and UVB light have multiple effects, which can be harmful to humans. There is a steady increase in the incidence of skin cancer in Africa, most probably due to the high levels of UV light and the latitude to which individuals are exposed throughout the year, as well as the accumulative effect of this type of radiation on the skin (Rivas et al., 2015). At the time of developing the UVI, the less energetic UVA (315-400 nm), which is 1,000-fold less efficiently absorbed by DNA than UVB, was believed to play little or no role in skin carcinogenesis as only UVB (280-315 nm) had been shown to damage DNA directly. On the basis of data, in 2009, the International Agency for Research on Cancer (IARC) classified UVA, both from sunlight and tanning devices, as carcinogenic to humans (IARC, 2012). Though less directly damaging to DNA than UVB, UVA is much more abundant in natural light. There is now convincing in vitro and in vivo evidence that UVA is able to cause damage to a variety of biomolecules via photosensitizer mediated processes, leading to oxidative damage to lipids and protein, and can create a number of molecules, including pyrimidine dimers and base oxidation products associated with DNA strand breaks (Ridley et al., 2009). The genotoxic effects of solar UV radiation may therefore derive from both UVB and UVA with the efficiency of DNA repair pathways such as base excision repair and nucleotide excision repair playing an important modulating role in determining the spectrum of mutations produced (Ridley et al., 2009; Ikehata and Ono, 2011). Additionally, The facts that UVA is more penetrating than UVB, reaching keratinocytic stem cells and melanocytes of the basal layer, and also substantially contributes to local immunosuppression (Halliday et al., 2011) provide a further layer of complexity in understanding the contribution of UVA to skin carcinogenesis (Allinson et al., 2012).

The UVI refers to the daily maximum effective irradiance and serves as an indicator of the impact of UV-radiation on erythema (sunburn), an acute skin effect that is closely related to the potential for chronic sun-induced skin damage like skin cancer and photoaging (Allinson et al., 2012). The current UVI formula is weighted around the clinical finding of erythema, which is primarily UVB associated. Moreover, the use of erythema as a surrogate for cancer risk is supported by consistent positive associations between sunburn and both melanoma and non-melanoma skin cancer (Dennis et al., 2008). Epidemiologic studies, however, are not able to quantify skin cancer risk at low levels of sun exposure (UVI 1-3) and cannot distinguish between the specific impact of UVA and UVB radiation. Outdoors, humans are virtually always exposed to UVA and UVB simultaneously, whose intensities vary broadly in parallel. The UVA-UVB ratio depends on the solar zenith angle and thus on the latitude, altitude, time of day, and season, but these variations are too small to capture as input parameters in epidemiologic studies. Thus, although the contribution of UVA to carcinogenesis has likely been underestimated in the past, minor modifications of the action spectrum to take this into account are not expected to have a significant impact on the UVI. The UVI was developed as a tool to conceptualize the amount of harmful radiation and to encourage the general public to use sun protection, and it is recommended to be integrated with broader public health approaches (Table 7) (WHO, 2002).

**Table 7:-UV Index and the corresponding exposure level as categorized by the World Health Organization (WHO)**

UV Index	0-2	3-5	6-7	8-10	$\geq 11$
Exposure level	Low	Moderate	High	Very high	Extreme

Studies examining the impact of the UVI on knowledge, attitudes, sun protection behavior and sun exposure generally showed no effect (**Italia and Rehfuess, 2012**). This suggests that the UVI can raise risk awareness to some extent, but given low levels of understanding in the general population, its potential as a tool to change behavior is limited. Nevertheless, the UVI can indicate usefully when sun protection is required, and several studies have shown population demand for UVI information (**Wester and Paulsson, 2000; Börner et al., 2010; Bulliard and Reeder, 2001**). As awareness about skin cancer prevention and vitamin D increases, so will the interest of the general population in the UVI. For this reason, promotion of the UVI is encouraged. The possible improvements in the utility of the UVI as a public awareness tool are discussed and agreed. It was confirmed that sun protection messages promoted at a UVI of 3 and above are of high public health relevance toward reducing skin cancer incidence and do not conflict with other health messages, especially regarding vitamin D and outdoor physical activities. There is currently insufficient evidence about the quantitative relationship of sun exposure, vitamin D, and human health to include vitamin D considerations in sun protection recommendations. The UVI continues to be a useful tool to estimate risk from solar exposure. However, the impact of the UVI on sun protection behavior is currently very limited, and primary research is needed to improve the effectiveness of the UVI as a public awareness tool. Additionally, well conducted studies are needed on the most effective strategies for using the UVI as part of sun protection efforts. On the other hand, the final goal of changing sun protection behavior in the population might be reached by developing health promotion campaigns that account for personal determinants, such as attitudes, self-efficacy, and self-affirmation (**Allinson et al., 2012**).

Fortunately, the UV Dose (UVD) is directly related to some health effect on humans. A 50% increase in erythral UVD would therefore increase the rate at which the skin reddens by 50% (**Wiegant et al., 2016**). However, **Hatfield et al., (2009)** found statistical relations between exceedance of threshold UVI values and cancer incidence rates by investigating the relation between UV exposure and non-melanoma skin cancer using a statistical model. On the other hand, Vitamin D production in the skin is directly related to UV irradiance weighted by the vitamin D action spectrum. Vitamin D may have beneficial effects regarding cancer incidence and survival rates (**Lim et al., 2006; Garland et al., 2006**). **Kelly et al., (2016)** study the vitamin D thresholds. They studied plasma vitamin D (25OHD) in blood samples in relation to a cumulative weighted vitamin D UVD. The vitamin D production is directly related to the UVD (unlike cancer to UVI, which is statistically related). The UVI threshold of 7 is relevant for skin cancer. Ozone concentrations (in the stratosphere) do not directly relate to any health effects, whereas the UVI and UVD do. Studying the health effects in these regions is the main interest, as this is the primary reason for translating ozone to surface UV irradiance. Interpretation of the results regarding skin cancer incidence and vitamin D can still be expanded, although this is largely dependent on how scientists in the field of medicine quantify the effect of UV irradiance on humans (**Wiegant et al., 2016**). However, **Juzeniene et al., (2014)**, found a direct relation between cancer incidence rates and UVD using sigmoidal curves.

Professional radiation workers are occupationally exposed to long-term low levels of ionizing radiation. Occupational health hazards from radiation exposure, in a large occupational segment of the population, are of special concern. The effective annual dose ranged from 0.05 to 6.84 mSv; radiation workers had a median exposure of  $0.68 \pm 1.58$  mSv/year. These doses, although below maximal permissible limits set by the International Commission of Radiation Protection (ICRP), can have clear biological effects (**Heydarheydari et al., 2016**). Fortunately, the late effects of ionizing radiation can be divided into three major groups: **Somatic damage** ranges from fibrosis and necrosis of individual organs to cataracts and cancer (**O'Sullivan et al., 2003; Stroian et al., 2008**). It can result from somatic mutations and accumulated damage, and include impaired circulation, necrosis, fibrosis of skin and muscle tissue, loss of hair, loss of taste, impaired bone growth, susceptibility to disease, immunodeficiency, aplastic anemia, cataracts, and increased incidence of cancer (**Joiner and van der Kogel, 2009**). Radiation-induced fibrosis (RIF) is one of the most predominant long-term adverse effects of ionizing radiation (**O'Sullivan et al., 2003; Stroian et al., 2008**). Typically, fibrotic response occurs due to the progressive onset of extra cellular matrix (ECM) deposition from stromal tissue such as lung, liver, kidney, and intestine. Chronic deposition leads to loss of elasticity and muscular dysfunction or atrophy in extreme cases. The severity of fibrosis depends on radiation dose, quality of radiation, and dose rate. Fibrosis may be accompanied by epilation, loss of vascularity, and even necrosis of the tissue (**O'Sullivan et al., 2003**). The lens tissue of the eye is particularly radiosensitive and radiation exposure can increase its opacity. Radiation cataractogenesis is the most common delayed radiation injury and is thought to result from damage to the anterior equatorial cells of the lens's epithelial tissue (**O'Sullivan et al., 2003; Stroian et al., 2008**). Most somatic effects require high threshold doses of radiation; cancer is the main health concern after exposure to low-level radiation. The three most common radiation-induced malignancies are leukemia, breast cancer, and thyroid cancer. The latency periods for the detection of cancer after

radiation exposure range from 2 years for leukemia to 30 to 40 years for some solid tumors. On the other hand, the acute effects of radiation exposure on skin are well known and result in severe skin burns (Miller et al., in press). However, low levels of chronic radiation to skin have been observed as well. The accompanying erythema, which resembled a burn, was painless; but, chronic radiation dermatitis following repeated exposure is usually extremely painful. Five progressive categories of radiation damage are observed in skin: (1) erythema, (2) transepithelial injury (moist desquamation), (3) ulceration, (4) necrosis, and (5) skin cancer. Radiation-induced erythema occurs in two stages: (1) mild initial erythema, usually appearing within minutes or hours on the first day after irradiation (occurring earlier with higher doses), and (2) the main erythema, appearing at 2 to 3 weeks and persisting for longer periods. In some cases, a third erythema may occur at 6 weeks. Radiation-induced erythema is a threshold phenomenon. Early erythema arises from the release of mediators and from increased capillary dilation and permeability. It is equivalent to a first-degree burn or mild sunburn, subsiding within 2 or 3 days. Although indomethacin and other prostaglandin-synthesis inhibitors have been used topically to prevent or reduce erythema caused by sunburn or ultraviolet light, they have not been widely used to treat radiation induced erythema. The second onset of erythema is attributed to impaired circulation in the arterioles, producing inflammation and edemas and accompanied by dry desquamation of the epidermal corneocytes. Upper cells are sloughed or abraded off, exposing cells that are not completely keratinized. Cell death and moist desquamation ensue. Both dry and wet desquamation occur about 1 to 4 weeks after irradiation. Regeneration of the stratum corneum requires 2 months to 4 years, and this regenerated tissue will be more sensitive to other skin-damaging agents. The new skin may be thinner than the original, with greater sensitivity to touch and pain. Reduction or loss of the dermal ridges making up the fingerprint has occurred from large or chronic exposures (Miller et al., in press). Fortunately, skin cancers are common in those using radiation equipment, although the incidence has decreased due to increased safety standards (Hall et al., 2012; Miller, 2007). In general, radiation skin cancers are readily diagnosed and treated at any early stage of development and maintain a high rate of curability (Miller et al., in press).

**Genetic or hereditary** effects are the second category of low-level or late effects of radiation. It is estimated that 5 to 65 additional genetic disorders will occur in the next generation for every million individuals receiving 0.01 Gy of gamma or low-LET radiation (Hall et al., 2012; Joiner and van der Kogel, 2009; Miller, 2007). These disorders will be mainly autosomal dominant and gender linked. If each succeeding generation were to receive an additional 0.01 Gy of radiation, equilibrium would be reached in the gene pool, and an average increase of 60 to 1,100 genetic disorders per million individuals would be observed in the population. This would result in a 1.5% increase in the overall incidence of genetic disorders. The normal incidence of genetic disorders in the population is 1 in 10 (Miller et al., in press). However, genetically induced malformations, cancers, and numerous other health effects in the children of populations who were exposed to low doses of ionizing radiation have been unequivocally demonstrated in scientific investigations (Schmitz-Feuerhake et al., 2016). The third category of late radiation damage is **teratogenic** effects. The primary teratogenic somatic effects seen in humans exposed in utero are microencephaly, intellectual disability, and growth retardation. These effects have been observed with an increased incidence in the atomic bomb survivors exposed in utero to doses of less than 0.10 Gy, although a neutron component may have enhanced the radiation effectiveness. In general, thresholds exist for the induction of birth defects by radiation, and effects below 0.10 Gy are negligible. The normal incidence of birth defects is 1 in 10 live births. One concern for low-level exposure to ionizing radiation in utero is the increased incidence of cancer in childhood. An estimated 25 additional cancer deaths are predicted for every million children receiving 1 cGy of radiation in utero. Preconceptional parental exposures leading to transgenerational effects have recently become a concern. The human data are inconclusive and controversial, so no risk estimates have been established. Further studies in epidemiology and with animal models will provide guidance (Miller et al., in press).

### Conclusion and Recommendation:-

Empirical model is developed to estimate the daily clear sky global radiation (H). Multiple linear regression models of four variables are employed to estimate H. According to statistical evaluation, the predicted clear sky global solar radiation overlaps the measured clear sky global solar radiation in all months of the year. The developed model is considered a simplified statistical approach because it depends on two monthly constant predictors ( $S_0$  &  $\cos(\theta_{ZMT})$ ) and one daily changeable predictor ( $\bar{T}$ ). The estimated high global solar radiation of the summer months is required for detailed study to get the maximum benefits of solar energy for electric power production and for estimating  $UVI_{max}$ . Consequently, the estimated H and  $T_{max}$  are used to construct accurate simplified estimation model of daily  $UVI_{max}$ . The results show that, the value of  $UVI_{max}$  increases with the increase in the value of maximum temperature, so that the increase be linked to the high values of H for each day in that month. Additionally, the study



recognized adverse effects of excessive solar radiation on the skin, the eyes and the immune system and outlines new approaches on how to improve the effectiveness of the UVI as a public awareness tool toward encouraging sun protection behavior. The study also clarifies the late and low level effects of ionizing radiation on health.

Although radiation biology cannot currently provide direct evidence of low dose effects in human health, a comprehensive understanding of radiobiological mechanism would facilitate epidemiological studies and improve the precision of a dose-response relationship at low dose levels. The integration of biological and epidemiological studies along with social science research will allow firmer conclusions about low dose effects on human health on the basis of social trust. Insights from health behavior theory and health communication science and recent developments in information technologies may offer opportunities to improve the effectiveness of UVI communication efforts. One important approach to increase the effectiveness of public health campaigns relies on strategic design of the intervention, including a specific definition of the target group and theory- and evidence-based development of the campaign message.

## References:-

1. **Adhikari, K.R., Bhattarai, B.K., and Gurung S. (2013):** Estimation of Global Solar Radiation for Four Selected Sites in Nepal Using Sunshine Hours, Temperature and Relative Humidity. *JPEE*, 1:1-9. <http://dx.doi.org/10.4236/jpee.2013.13003>.
2. **Allinson, S., Asmuss, M., Baldermann, C., Bentzen, J., Buller, D., Gerber, N., Green, A.C., Greinert, R., Kimlin, M., Kunrath, J., Matthes, R., Pölzl-Viol, C., Rehfuess, E., Rossmann, C., Schütz, N., Sinclair, C., Deventer, E.V., Webb, A., Weiss, W., and Ziegelberger, G.(2012):** Validity and use of the UV index: report from the UVI working group, SchlossHohenkammer, Germany, 5-7, *Health Phys.*,103(3): 301-306.
3. **Augustine, C. and Nnabuchi, M.N. (2009):** Empirical Models for the Correlation of Global Solar Radiation with Meteorological Data for Enugu, Nigeria, *PJST*, 10(1): 693-700. <http://www.akamaiuniversity.us/PJST.htm>.
4. **Authors on behalf of ICRP., Stewart, F.A., Akleyev, A.V., Hauer-Jensen, M., Hendry, J.H., Kleiman, N.J., Macvittie, T.J., Aleman, B.M., Edgar, A.B., Mabuchi, K., Muirhead, C.R., Shore, R.E., and Wallace, W.H. (2012):** ICRP publication 118: ICRP Statement on Tissue Reactions and Early and Late Effects of Radiation in Normal Tissues and Organs - Threshold Doses for Tissue Reactions in a Radiation Protection Context. *Ann ICRP.*, 41(1-2):1-322. doi: 10.1016/j.icrp.2012.02.001.
5. **Börner, F.U., Schütz, H., and Wiedemann, P. (2010):** The influence of the UV Index on attitudes toward sun exposure in the German population. *J Cancer Ed.*, 25(4):643-649.
6. **Bulliard, J.L. and Reeder, A. (2001):** Getting the message across: Sun protection information in media weather reports in New Zealand, *N Z Med J.*,114(1126):67-70
7. **Calabrese, E.J., Dhawan, G., and Kapoor, R. (2014):** Use of X-rays to treat shoulder tendonitis/bursitis: a historical assessment. *Arch Toxicol.*, 88(8):1503-17. doi.org/10.1007/s00204-014-1295-6. PubMed PMID: 24954447.
8. **Corredor, L.M.(2013):** Estimation of Solar Radiation Incident on Horizontal and Tilted Surfaces For 7 Colombian Zones. *IJER*, 2(5): 362-366.
9. **Dennis, L.K., Vanbeek, M.J., Beane Freeman, L.E., Smith, B.J., Dawson, D.V., and Coughlin, J.A.(2008):** Sunburns and risk of cutaneous melanoma: Does age matter? A comprehensive meta-analysis. *Ann Epidemiol.*, 18(8):614-27. doi: 10.1016/j.annepidem.2008.04.006.
10. **Duffie, J.A. and Beckman, W.A. (2013):** Solar Engineering of Thermal Processing, Fourth Edition. Published by John Wiley & Sons, Inc., Hoboken, New Jersey. Published simultaneously in Canada. pp. 1-910.
11. **Elgazzar, A.H. and Kazem, N. (2015):** Biological effects of ionizing radiation the pathophysiologic basis of nuclear medicine. Springer. pp. 715-726.
12. **Falayi, E.O., Adepitan, J.O. and Rabi A.B.(2008):** Empirical models for the correlation of global solar radiation with meteorological data for Iseyin, Nigeria. *Int. J. Phys. Sci.*, 3(9): 210-216.
13. **Fliedner, T.M., Graessle, D.H., Meineke, V. and Feinendegen, L.E.(2012):** Hemopoietic response to low dose-rates of ionizing radiation shows stem cell tolerance and adaptation. *Dose-Response*, 10(4):12-014. <http://dx.doi.org/10.2203/dose-response.12-014.Feinendegen>
14. **Gallagher, R.P., Lee, T.K., Bajdik, C.D. and Borugian, M.(2010):**Ultraviolet radiation.Chronic Dis Can. 29 Suppl 1:51-68.
15. **Garland, C.F., Mohr, S.B., Gorham, E.D., Grant, W.B. and Garland, F.C. (2006):** Role of Ultraviolet B Irradiance and Vitamin D in Prevention of Ovarian Cancer. *Am. J. Prev. Med.*, 31: 512-514
16. **Hall, E.J. and Giaccia, A. (2012):** Radiobiology for the Radiologist. Kindle edition 7th ed. Philadelphia, PA: Lippincott, Williams &Wilkins.
17. **Habbib, E, A.(2011):** Empirical Models for Solar Radiation Estimation by Some Weather Data for Baghdad City. *Al- Mustansiriya J. Sci* , 22(2): 177-184.

18. **Halliday, G.M., Byrne, S.N. and Damian, D.L.(2011):** Ultraviolet A radiation: Its role in immunosuppression and carcinogenesis. *SeminCutan Med Surg.*, 30(4):214-21. doi: 10.1016/j.sder.2011.08.002.
19. **Hatfield, L.A., Hoffbeck, R.W., Alexander, B.H. and Carlin, B.P.(2009):** Spatiotemporal and spatial threshold models for relating UV exposures and skin cancer in the central United States. *Comput. Stat. Data Anal.*,53(8): 3001-3015. doi: 10.1016/j.csda.2008.10.013
20. **Heydarheydari, S., Haghparsat, A. and Eivazi, M.T.(2016):**A Novel Biological Dosimetry Method for Monitoring Occupational Radiation Exposure in Diagnostic and Therapeutic Wards: From Radiation Dosimetry to Biological Effects.*J Biomed Phys Eng.*, 6(1): 21–26. Published online 2016 Mar 1. PMID: PMC4795325
21. **Hrycek, A., Czernecka-Micińska, A., Kluciński, P. and Badowski, R. (2002):** Peripheral blood lymphocytes and selected serum interleukins in workers operating X-ray equipment. *Toxicology letters*, 132(2), 101-107. [http://dx.doi.org/10.1016/S0378-4274\(02\)00030-9](http://dx.doi.org/10.1016/S0378-4274(02)00030-9)
22. **IARC (2012):** IARC monographs on the evaluation of carcinogenic risks to humans. A review of human carcinogens: Radiation. Lyon, France: International Agency for Research on Cancer, WHO, Volume 100D, page 1-341.
23. **Ikehata, H. and Ono, T. (2011):** The mechanisms of UV mutagenesis. *J Radiat Res.*, 52(2):115-125.
24. **ICNIRP (International Commission on Non-Ionizing Radiation Protection) (1995):** Global Solar UV Index VA joint recommendation of the World Health Organization, World Meteorological Organization, United Nations Environment Programme and the International Commission on Non-Ionizing Radiation Protection. Oberschleißheim, ISBN 3-9804789-0-4.
25. **Italia, N. and Rehfuess, E. (2012):** Is the Global Solar UV Index an effective instrument for promoting sun protection? A systematic review. *Health Educ Res.*, 27(2): 200-213.
26. **Ituen, E.E., Esen, N.U., Nwokolo, S.C. and Udo EG. (2012):** Prediction of global solar radiation using relative humidity, maximum temperature and sunshine hours in Uyo, in the Niger Delta Region, Pelagia Research Library, Nigeria *Advances in Applied Science Research.*, 3 (4):1923-1937.
27. **Joiner, M. and van der Kogel, A. (2009):** Basic Clinical Radiobiology. In: Dörr W. (ed): Biological response modifiers: normal tissue. 4<sup>th</sup> ed. London, England: Edward Arnold. pp. 301-316.
28. **Juzeniene, A., Grigalavicius, M., Baturaite, Z. and Moan, J. (2014):** Minimal and maximal incidence rates of skin cancer in Caucasians estimated by use of sigmoidal UV dose-incidence curves. *Int. J. Hyg. Env. Health*, 217(8): 839-844.
29. **Kadhim, M., Salomaa, S., Wright, E., Hildebrandt, G., Belyakov, O.V., Prise, K.M., Little and M.P. (2013):** Non-targeted effects of ionising radiation--implications for low dose risk. *Mutat Res.*, 752:84–98.
30. **Kasai, H., Allen, J.T., Mason, R.M., Kamimura, T. and Zhang Z. (2005):** TGF-beta1 induces human alveolar epithelial to mesenchymal cell transition (EMT). *Respir Res.*, 6:56.
31. **Kelly, D., Theodoratou, E., Farrington, S.M., Fraser, R., Campbell, H., Dunlop, M.G. and Zgaga. L. (2016):** The contributions of adjusted ambient ultraviolet B radiation at place of residence and other determinants to serum 25-hydroxyvitamin D concentrations. *Brit.J. Derm.*,174: 1068-1078.
32. **Khalil, S.A. and Fathy, A.M. (2008):** An Empirical Method for Estimating Global Solar Radiation over Egypt. *ActaPolytechnica*, 48(5): 48-53.
33. **Kiedron, P., Stierle, S. and Lantz K. (2007):**Instantaneous UV Index and Daily UV Dose Calculations, NOAA-EPA Brewer Network. 1-5;www.esrl.noaa.gov/gmd/grad/neubrew/docs/UVindex.pdf.
34. **Klucinski, P., Mazur, B., Sedek, L., Aptekorz, M., Cieslik, P., Hrycek, A.H. and Martirosian, G. (2014):** Assessment of selected B cells populations in the workers of X-ray departments. *Int J Occup Med Environ Health*, 27(3):467–73. doi.org/10.2478/s13382-014-0242-3. PubMed PMID: 24952144.
35. **Lim, H.S., Roychoudhuri, R., Peto, J., Schwartz, G., Baade, P. and Moller H. (2006):** Cancer survival is dependent on season of diagnosis and sunlight exposure. *Int. J. Cancer*, 119(7):1530-1536.
36. **Martínez, A., Coleman, M., Romero-Talamás, C.A. andFrias, S. (2010):** An assessment of immediate DNA damage to occupationally exposed workers to low dose ionizing radiation by using the comet assay.*Rev Invest Clin.*, 62(1):23-30.
37. **Marwal, V.K., Sengar, R.C., Sengar, N., Mahawar, S. and Dashora, P.A (2012):** comparative study of correlation functions for estimation of monthly mean daily global solar radiation for Jaipur, Rajasthan (India), *Indian J. Sci. Technol*, 5(5): 2729-2732.
38. **Medugu, D.W. and Yakubu, D.(2011):** Estimation of mean monthly global solar radiation in Yola–Nigeria using angstrom model, *Adv. Appl. Sci. Res.*, 2(2):414-421.
39. **Mettler, F. A.(2012):** Medical effects and risks of exposure to ionising radiation. *J Radiol Prot.*, 32:N9–N13.
40. **Miller, A.C.(2007):** Depleted Uranium: Properties, Uses, and Health Consequences. Boca Raton, FL: CRC Press/Taylor & Francis.
41. **Miller, A.C., Satyamitra, M. and Kulkarni, S. (in press):** "Late and Low Level Effects of Ionizing Radiation", *Textbook of Military Medicine*, Bender Press, Washington, DC [in press].

42. **Muirhead, C., O'Hagan, J., Haylock, R., Phillipson, M., Willcock, T., Berridge, G. and Zhang, W. (2009):** Mortality and cancer incidence following occupational radiation exposure: Third analysis of the National Registry for Radiation Workers. *BJC*,100(1): 206-212. <http://dx.doi.org/10.1038/sj.bjc.6604825>
43. **Muzathik, A.M., Nik, W.B.W., Ibrahim, M.Z., Samo, K.B., Sopian, K. and Alghoul, M.A. (2011):** Daily Global Solar Radiation Estimate Based on Sunshine Hours, *IJME*, 6(1):75-80.
44. **NASA Surface meteorology and Solar Energy–Choices (2016):** Atmospheric science data center, parameter definition. <https://eosweb.larc.nasa.gov/cgi-bin/sse/grid.cgi>.
45. **O'Sullivan, B. and Levin, W. (2003):** Late radiation-related fibrosis: pathogenesis, manifestations, and current management. *SeminRadiatOncol.*,13(3): 274–289.
46. **Okundamiya, M.S. and Nzeako, A.N.(2011):** Empirical Model for Estimating Global Solar Radiation on Horizontal Surfaces for Selected Cities in the Six Geopolitical Zones in Nigeria, *Journal of Control Science and Engineering* 2011: 1-7.
47. **Ossetrova, N.I., Sandgren, D.J., Gallego, S. and Blakely, W.F. (2010):** Combined approach of hematological biomarkers and plasma protein SAA for improvement of radiation dose assessment triage in biodosimetry applications. *Health phys.*, 98(2): 204-208. <http://dx.doi.org/10.1097/HP.0b013e3181abaabf>
48. **Ridley, A.J., Whiteside, J.R., McMillan, T.J. and Allinson. S.L. (2009):** Cellular and sub-cellular responses to UVA in relation to carcinogenesis. *Int J Radiat Biol.*, 85: 177-195.
49. **Rivas, M., Rojas, E., Araya, M.C. and Calaf, G.M.(2015):** Ultraviolet light exposure, skin cancer risk and vitamin D production. *Oncol Lett.*, 10(4): 2259–2264.
50. **Roguin, A., Goldstein, J. and Bar O. (2012):** Brain tumours among interventional cardiologists: A cause for alarm. Report of four new cases from two cities and a review of the literature. *Euro Intervention*, 7(9): 1081-1086. <http://dx.doi.org/10.4244/EIJV7I9A172>
51. **Sabatier, L., Martin, M., Crechet, F., Pinton, P. and Dutrillaux, B. (1992):** Chromosomal anomalies in radiation-induced fibrosis in the pig. *Mutat Res.*, 284(2): 257–263.
52. **Schmitz-Feuerhake, I., Busby, C. and Pflugbeil, S.(2016):** Genetic radiation risks: a neglected topic in the low dose debate.*Environ Health Toxicol*, 31:e2016001, 13 pages. <http://dx.doi.org/10.5620/eh.t.e2016001>
53. **Shafiee, M., Hoseinneshad, E., Vafapour, H., Borzoueisileh, S., Ghorbani, M. and Rashidfar, R. (2016):** Hematological Findings in Medical Professionals Involved at Intraoperative Fluoroscopy. *Glob J Health Sci.*, 8(12):232-238. doi: 10.5539/gjhs.v8n12p232.
54. **Sivamadhavi, V. and Selvaraj, R.S.(2012):** Prediction of Monthly Mean Daily Global Solar Radiation Using Artificial Neural Network, *Earth Syst. Sci.*,121(6):1501–1510.
55. **Seong, K.M., Seo, S., Lee, D., Kim, M.J., Lee, S.S., Park, S. and Jin, Y.W. (2016):** Is the Linear No-Threshold Dose-Response Paradigm Still Necessary for the Assessment of Health Effects of Low Dose Radiation? *J Korean Med Sci.*, 31 (Suppl 1):S10-S23. doi: 10.3346/jkms.2016.31.S1.S10. Epub 2016 Jan 28.
56. **Stroian, G., Martens, C., Souhami, L., Collins, D.L. and Seuntjens, J. (2008):** Local correlation between monte-carlo dose and radiation induced fibrosis in lung cancer patients. *Int J Radiat Oncol Biol Phys.*, 70(3): 921–930.
57. **United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)(2012):** Biological mechanisms of radiation actions at low doses: A white paper to guide the Scientific Committee's future programme of work, 1-35. ([www.unscear.org](http://www.unscear.org)).
58. **Venneri, L., Rossi, F., Botto, N., Andreassi, M.G., Salcone, N., Emad, A., Lazzeri, M., Gori, C., Vano, E. and Picano, E.(2009):** Cancer risk from professional exposure in staff working in cardiac catheterization laboratory: Insights from the National Research Council's Biological Effects of Ionizing Radiation VII Report. *AHJ*,157(1), 118-124. <http://dx.doi.org/10.1016/j.ahj.2008.08.009>
59. **Weather2travel–climate guides,** Egypt climate and weather, [www.weather2travel.com/climate-guides/](http://www.weather2travel.com/climate-guides/).
60. **Wester, U. and Paulsson, L.E. (2000):** The influence of a UV index on the attitudes of a Swedish population towards sun exposure. *Radiat Protect Dosim.*,91: 232-324.
61. **WHO(2002):** Global Solar UV Index: A practical guide; A joint recommendation of World Health Organization, World Meteorological Organization, United Nations Environment Programme and the International Commission on Non-Ionizing Radiation Protection. Geneva: World Health Organization.
62. **Wiegant, E., van Geffen, J., van Weele, M., van der, A.R. and Houweling, S. (2016):** Improving satellite based estimations of UV index and dose and first assessment of UV in a world-avoided. Utrecht University, Master Thesis, KNMI Scientific Report WR-2016-01. 1-65.<http://bibliotheek.knmi.nl/knmipubWR/WR2016-01.pdf>.
63. **Yang, F.E., Vaida, F., Ignacio, L., Houghton, A., Nautiyal, J., Halpern, H., Sutton, H. and Vijayakumar, S. (1995):** Analysis of weekly complete blood counts in patients receiving standard fractionated partial body radiation therapy. *Int J Radiat Oncol Biol Phys.*, 33(3): 617-617. [http://dx.doi.org/10.1016/0360-3016\(95\)00255-W](http://dx.doi.org/10.1016/0360-3016(95)00255-W)
64. **Zuba, E.B., Francuzik, W., Malicki, P., Osmola-Mańkowska, A. and Jenerowicz, D. (2016):** Knowledge about Ultraviolet Radiation Hazards and Tanning Behavior of Cosmetology and Medical Students. *Acta Dermatovenerol Croat.*, 24(1):73-7.

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### RESEARCH ARTICLE

#### SCREENING OF AGRO-RESIDUES FOR THE PRODUCTION OF MICROBIAL TANNASE.

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#### Abstract

Tannin Acyl Hydrolase (E.C 3.1.1.20) commonly referred as Tannase is one of the important hydrolytic microbial enzymes. It hydrolyses hydrolysable tannin and produces glucose and gallic acid. It is an industrially important enzyme and has several applications in various industries such as food, pharmaceutical, leather, animal feed and cosmetics. Realizing the importance of enzyme tannase, the present study aims to investigate the total phenolic content and hydrolysable tannin content from different agro-residues and utilize the efficient agro-residue as a substrate for potent tannase producing microorganism for the production of tannase. The amount of total phenols, were analyzed using a spectrophotometric technique, using Folin-ciocalteu reagent. Gallic acid was used as standard compound and the total phenols were expressed as mg/g gallic acid equivalents. The hydrolysable tannin content was analyzed by Mondal's method. The maximum phenolic content and hydrolysable tannin content was found in *Punica granatum* peel (pomegranate peel) and *Prunus dulcis* leaves (almond leaves) respectively. Thus out of the thirty one agro-residues; three agro-residues were selected for final screening having higher concentration of hydrolysable tannin content viz. *Prunus dulcis* leaves (almond leaves), *Annona reticulata* leaves (Custard apple leaves); *Azadirachta indica* leaves (Neem leaves). The selected agro residues were used for production of microbial tannase. Accordingly the actinomycetal isolate, *Streptomyces* sp.SKA1 and the leaves of *Azadirachta indica* were selected as potent combination for tannase production.

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#### Introduction:-

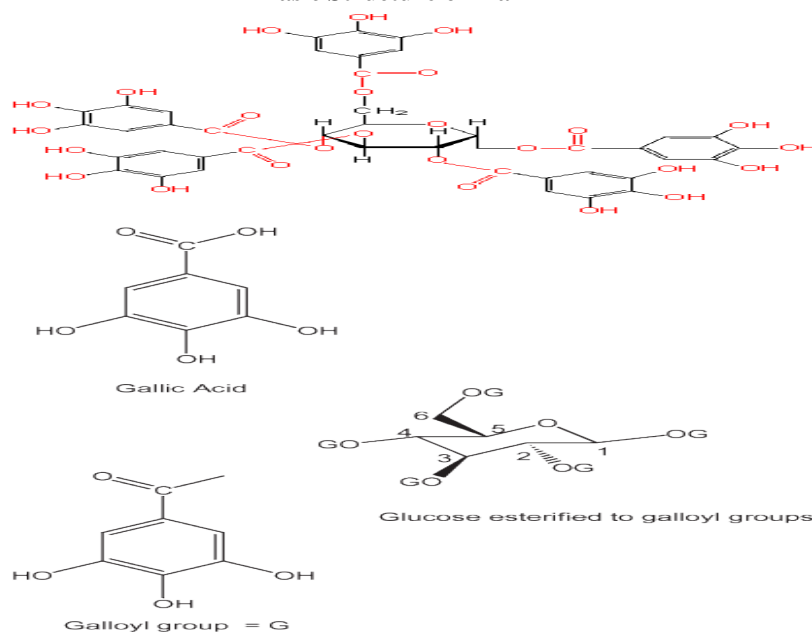
Phenolics compounds are broadly distributed in the plant kingdom and they are the most abundant secondary metabolites in plant. These plant phenolic are involved in defense against ultraviolet radiation or aggression by pathogens, parasites and predators. They are abundant in all plant organs therefore they are integral part of human diet. They are important constituents of plant food (Fruits, vegetables, cereals, olive, legumes, etc.) and beverages (Tea, coffee, beer, wine etc.) and they are also responsible for bitterness and astringency of fruit and fruit juices. (Jin, D. and Russell, J. M 2010)

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Plant phenolics include phenolic acids, flavonoids, tannins, the stilbenes and lignans. Tannins constitute a large group of complex organic, non-nitrogenous phenolic compounds of high molecular weight. Tannins are natural polyphenolic compounds that are widely distributed in several parts of vascular plants. They are the second most abundant group of phenolics in nature and are considered as secondary metabolic compounds of plants because they play no direct role in plant metabolisms (Pepi M, Lampariello L R, Altieri R *et al.* 2009). These secondary metabolites are present in solution form in the cell sap and also in distinct vacuoles. Chemically tannins contain the mixture of complex organic substrate in which polyphenol are present, generally with O-dihydroxy or O-trihydroxy group on a phenyl ring. (Fig. I) Tannins are soluble in water and alcohol; they form colloidal solution with water and are non crystalline. They have the capacity to combine with tissue proteins and precipitate them. Tannins are characterized by their ability to form strong complexes with different minerals and macromolecules, such as proteins, cellulose, and starch among others (Bele, A.A., Jadhav, V. M., Kadam, V. J. 2010). Tannins have several interesting biological activities. Active principles of medicinal plants are often polyphenolic compounds, and, in recent years, there has been a great scientific interest for this group of compounds due to their antioxidant, antiviral, and anticancer properties (Bors, W. Michel, C. 1999, Carretero-Accame M E. 2000). High concentrations of tannins in beverage such as ice tea, beer, wine, fruit juices, and coffee-flavored beverages can result in the formation of precipitates due to their interaction with other molecules present in these beverages. These undesirable effects of tannins can be reduced or eliminated by a chemical or enzymatic treatment. (Belmares, R., Contreras-Esquivel, J. C., Rodríguez-Herrera, R. Coronel, A. R., Aguilar, C. N. 2004). Tannins are toxic to fungi, bacteria, and viruses. However, many microorganisms have developed the mechanisms to overcome the effects of tannins. These mechanisms include tannin modification, degradation, dissociation of tannin-substrate complexes, tannin inactivation by high-affinity binders, membrane modification, and metal ion sequestration (Belur, P. D., Gopal, M., Nirmala, K. R., Basavaraj, N. 2010) Tannins are subdivided into two groups: 1) Hydrolysable tannins and 2) Condensed tannins.

#### Basic Structure of Tannin



Hydrolysable tannins undergo hydrolysis and produce gallic acid. According to acid produced, they are known as gallitannins or ellagitannins. Examples of hydrolysable tannins are gallotannin in nutgall, rhubarb, amla, clove and chestnut; ellagitannin from oak, myrobalans and pomegranate bark. Condensed tannins are oligomers or polymers of flavan-3-ol linked through an interflavan carbon bond.

Interest in tannins has considerably increased in recent year because of their broad spectrum of chemical and diverse biological properties. One of the important properties of tannin is that it is used as substrate for the production of enzyme tannase. Though these polyphenolic compounds are widely distributed, the health effects of dietary Polyphenols have come to the attention of nutritionists in recent year (Jin, D. and Russell, J. M. 2010) however using the enzyme tannase the nutritional quality of dietary products can be improved. Tannins are known for their

antimicrobial property and are resistant against microbes to protect plant bodies. They are toxic and release bacteriostatic compounds making non-reversible action with proteins (Bhat et al., 1998)

Tannase catalyzes the hydrolysis of bonds present in the molecule of hydrolysable tannins and gallic acid esters (Lekha and Lonsane, 1997). The systematic name of tannase is Tannin acyl hydrolase (3.1.1.20). It is an extracellular, inducible enzyme that catalyses the hydrolysis of ester and depside linkages in hydrolysable tannins yielding glucose and gallic acid as products. It can be obtained from fungi, bacteria, some yeasts, higher plants and animal sources (Belur and Mugeraya 2010). It has wide application in preparation of instant tea, acron wine, coffee flavored soft drinks, clarification of beer and fruit juices, detanification of food and increasing the nutritive property of feed and also in bioremediation of effluent from leather industries. Tannase has wide application in cosmetics, chemicals and brewing industries; in preparation of gallic acid (Brahmbhatt D. et al., 2014). Recently bacteria showing tannase activity is considered as a biomarker for colon cancer (Lekha and Lonsane, 1997; Das Mohapatra et al., 2012). Due to Production costs and insufficient knowledge of the enzyme the use of tannase on a large scale is severely limited. (C.N. Aguilar and G. Gutie 2001)

Tannase is known to produce by bacteria, yeast and fungi, no reports available with actinomycetes. Filamentous fungi of the *Aspergillus*, *Penicillium* genus and bacteria of the *Bacillus* and *Lactobacillus* genus have been investigated for tannase production (Banerjee et al. 2001; Mondal et al. 2001). Techniques for production of tannase have been extensively studied and commercial production of tannase is achieved using synthetic tannic acid. The industrial process makes use of chemical tannic acid for tannase production but this process involving synthetic substrates has adverse environmental consequences. Conventionally gallic acid is also produced chemically by acid hydrolysis of synthetic tannic acid and suffer from disadvantages like high cost to yield ratio and low purity. (Swaran Nandini et al. 2014).

Therefore it is very necessary to design a process for the production of tannase which is more economical and environmental friendly. This has led to generating interest in searching natural source for tannic acid that can be effectively utilized by microbes. This effort may reduce the dependency on synthetic tannic acid.

Realizing the importance of enzyme tannase, the aim of the present study was to estimate the total phenolic content and hydrolysable tannin content in the methanolic extract of various agro-residues, to select the efficient agro-residue for production of microbial tannase.

## **Materials and Methods:-**

### **Plant material:-**

Different agro-residues like fruits, leaves, fruit peels, seeds were collected from local area and botanical garden in January 2014 and shade dried.

### **Extraction:-**

Dried ground agro-residues were extracted with 99% methanol. The extract was concentrated by evaporation to yield gummy concentrate of greenish color.

### **Chemicals:-**

Gallic acid, Methanol, Folin-Ciocalteu (FC) reagent, Bovine Serum Albumin, Sodium acetate, Ferric chloride, Acetic acid, SDS, Triethanolamine was obtained from Hi media chemicals. All the chemicals used were of analytical grade.

### **Microorganisms for the production of Tannase:-**

The potent tannase producing fungal cultures SKF7, SKF11, Actinomycetal cultures SKA1, SKA2, and bacterial cultures SKB2, SKB3 were used for tannase production.

### **Screening of agro-residues:-**

The methanolic extracts of thirty one agro-residues were screened for the total phenolic content by the Folin Denis Method and hydrolysable tannin content by the Mondal's method.

### **Estimation of total Phenolic content:-**

A standard graph was prepared using different concentration of gallic acid ranging from 10 µg/ml-100 µg/ml was prepared. A volume of 1.5 ml FC reagent was added in each tube. After five minutes, 4 ml of 20% sodium carbonate

solution was added and the volume was made up to 10 ml with distilled water. The mixture was kept for 30 mins and absorbance was read at 738nm. (Premakumari K.B. *et.al.* 2010). Tannic acid was used as standard compound and the total phenols were expressed as mg/g gallic acid equivalents

#### Sample Preparation and estimation:-

Methanolic extract of all agro-residues in 100 ml volumetric flask were made up to 50 ml with distilled water. (As shown in figure 3). Further 0.1 ml of methanolic extract, 1.5 ml of FC reagent, and 4ml of 20% sodium carbonate solution were mixed and made up to 10 ml with distilled water. After 30 mins, absorbance was read at 738nm. Premakumari K.B. *et.al.*, 2010 detected antioxidant activity and estimated total phenolic content of *Muntingia calabura* by employing this method.

#### Estimation of hydrolysable Tannin content by Mondal's method:-

##### Tannase Assay:-

Standard graph of tannic acid was prepared by making the various concentration of tannic acid ranging from 1 mg/ml to 10 mg/ml in 0.2M acetate buffer (pH 5). Then 0.5 ml of tannic acid from each tube, mixed with 2ml of Bovine Serum Albumin (1mg/ml) which precipitates the tannic acid. A control reaction was also carried out with heat denatured enzyme. The tubes were then centrifuged (5,000 x g, 10 min) and the precipitate was dissolved in 2 ml of SDS-triethanolamine (1% w/v triethanolamine) solution (As shown in Figure 4) and the absorbance was measured at 530 nm after addition of 1 ml of FeCl<sub>3</sub> (0.13 M) (Mondal *et.al.*, 2001)

#### Sample Preparation and estimation:-

Methanolic extract of all agro-residues taken in 100 ml volumetric flask were made up to 50 ml with 0.2 M acetate buffer (pH 5). From this solution 0.5 ml was taken out in a test tube and mixed with 2ml of Bovine Serum Albumin (1mg/ml). A control reaction was also carried out with heat denatured enzyme. The tubes were then centrifuged (5,000 x g, 10 min) and the precipitate was dissolved in 2 ml of SDS-triethanolamine (1% w/v triethanolamine) solution and the absorbance was measured at 530 nm after addition of 1 ml of FeCl<sub>3</sub> (0.13 M)

### Results and Discussion:-

#### Phytochemical Screening:-

The observation revealed that methanolic extract of various agro-residues showed the presence of total phenols by Folin-Ciocalteu method. Mariela Gonzalez, Bernardo Guzman *et.al* 2003 reported that, due to its reproducibility, the Folin-Ciocalteu method is recommended for *Propolis* with high phenolic compound concentrations.

#### Estimation of total phenolic content:-

The amount of total phenols was determined with Folin-Ciocalteu reagent. Gallic acid was used as standard compound. The absorbance for various dilutions of gallic acid with Folin-Ciocalteu reagent and sodium carbonate were noted and are shown in table I. The total phenolic content (gallic acid equivalent) in methanolic extract was found to high in *Punica granatum* peel (pomegranate peel) which was shade dried (7.04 mg/ml). Sharma G.N. *et.al.*, 2011 reported the total phenol content of methanolic extract of *Aegle marmelos* as 65.20 mg/g

#### Screening of agro- residues for microbial tannase production:-

Out of thirty one agro-residues finally three agro-residues *Prunus Dulcis* leaves (Almond leaves) *Azadirachta indica* leaves (Neem leaves) and *Annona reticulate* leaves (Custard apple leaves) showed high hydrolysable tannin content, among these three agro-residues combination of *Azadirachta indica* leaves as a substrate and actinomycetal isolate SKA1, show promising tannase activity (As shown in figure 1). Paranthaman R. (2008) reported that Rice straw and Sugarcane can be used as substrate for the production of tannase. Kulkarni, A. patil, P. and Kinige, P. (2012) reported tannase production from *Aspergillus oryzae* NCIM 1032 using mixture of Jamun (*Syzgium cumini*) and Babul (*Acacia nilotica*) stem barks under solid state fermentation.

**Table 1:- Concentration of total phenolic content and hydrolysable tannic acid of different Agro-residues**

Sr.no.	Botanical Name of Agro-residues	Common name of Agro - residues	Conc. of total phenol mg/ml	Conc. Of hydrolysable tannin mg/ml
1	<i>Terminalia belirica</i>	Behda	4.75	2.52
2	<i>Phyllanthus emblica fruit</i>	Amla	5.34	3.33
3	<i>Terminallia chebula fruit</i>	Hirda	4.87	3.21

4	<i>Syzygium cumini</i> leaves	Jamun	3.96	3.27
5	<i>Citrus limun</i> leaves	Nimu	2.27	1.89
6	<i>Santalum alba</i> leaves	Chandan	3.24	2.97
7	<i>Sorghum</i> leaves	Jawar	3.85	2.55
8	<i>Manikara zapota</i> leaves	Chiku	3.71	2.88
9	<i>Nilgiritragus hylocrius</i> leaves	Nilgiri	4.67	0.6
10	<i>Tamarindus indica</i> leaves	Imli	5.09	0.87
11	<i>Pithecellobium dulce</i> leaves	Firangi Imli	2.34	0.03
12	<i>Saraca asoca</i> leaves	Asoca	3.12	2.01
13	<i>Ziziphus maritima</i> leaves	Ber	2.76	1.2
14	<i>Barleria cristata</i> leaves	Vajra danti	1.80	0.45
15	<i>Sapindus mukorossi</i> leaves	Ritha	4.07	1.11
16	<i>Phyllanthus emblica</i> leaves	Amla	5.38	2.67
17	<i>Azadirachta indica</i> leaves	Neem	4.95	3.51
18	<i>Annona reticulata</i> leaves	Custard apple	4.44	3.48
19	<i>Psidium guajava</i> leaves	Guava	5.34	3.39
20	<i>Mangifera indica</i> leaves	Mango	3.49	3.42
21	<i>Prunus dulcis</i> leaves	Almond	5.51	4.32
22	<i>Morus nigra</i> leaves	Mulberry	1.18	0.9
23	<i>Calotropis gigantea</i> leaves	Madar	2.98	1.74
24	<i>Ficus religiosa</i> leaves	Pipal	2.78	0.93
25	<i>Vachellia nilotica</i> leaves	Babul	6.48	1.5
26	<i>Citrus aurantium</i> peel	Orange	3.86	1.5
27	<i>Punica granatum</i> peel	Pomegranate	7.04	0.6
28	<i>Tamarindus indica</i> seeds	Imli	0.99	0.51
29	<i>Vitis vinifera</i>	Grape	0.41	0.006
30	<i>Saccharum officinarum</i> stalks	Sugarcane	0.12	0.001
31	<i>Cicer arietinum</i> leaves	Chana	0.23	0.003

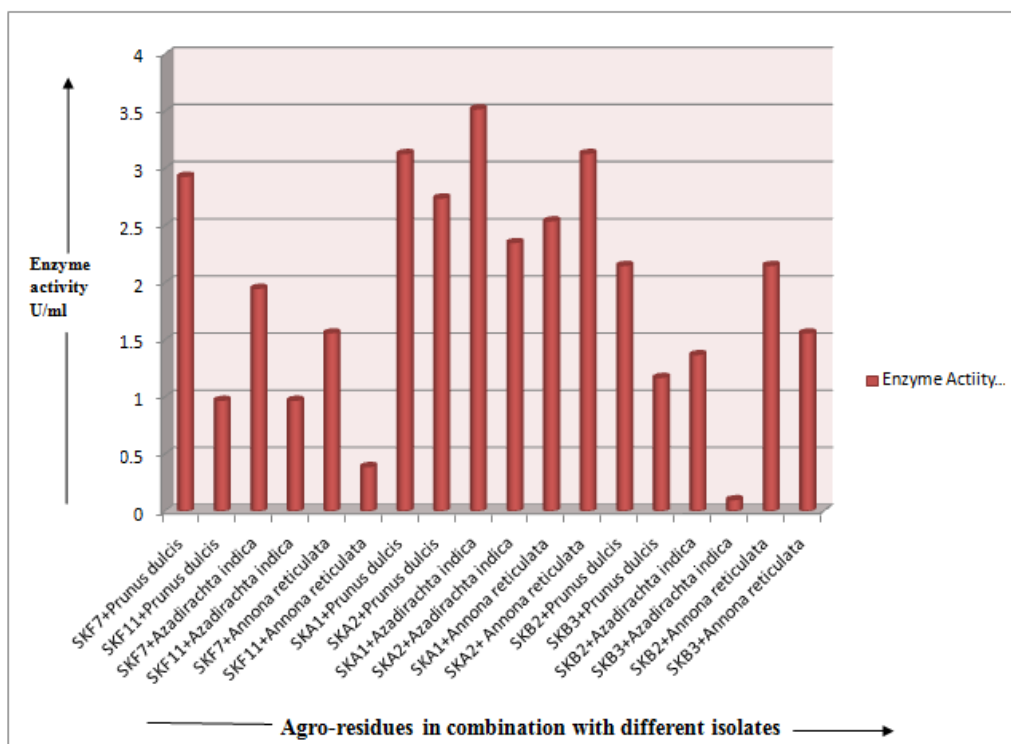


Figure 1:- Tannase activity of different isolates with combination of selected Agro-residues.





Figure 2:- Agro-residues Powder used for study



Figure 3:- Methanolic extraction of agro-residues.



Figure 4:- Mondal's Assay.

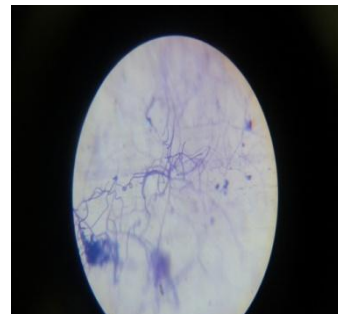
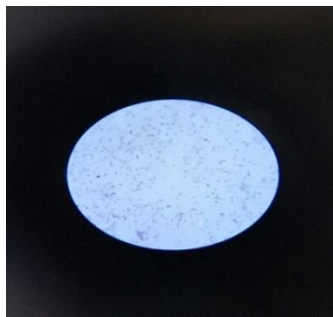


Figure 5:- Potent tannase producer fungal (SKF7), bacterial (SKB2) and actinomycetal (SKA1) isolates

### Conclusion:-

The total phenolic content of thirty one agro-residues was estimated using Folin-Ciocalteu reagent. The results of Phytochemical screening reveals that the maximum phenolic content was found in methanolic extract of pomegranate peel, whereas the maximum hydrolysable tannic acid concentration was found in methanolic extract of almond leaves. When different combinations of all the types of Isolates with three efficient agro-residues were carried out it was found that combination of actinomycetal culture *Streptomyces* sp. SKA1 and *Azadirachta indica* leaves (Neem leaves) as a substrate was found to be best combination for tannase production. Further study of process optimization will be carried out using this high tannin containing substrate.

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**References:-**

1. Aguilar, C. N. and Gutierrez-Sanchez, G. 2001. Review: sources, properties, applications and potential uses of tannin acyl hydrolase. *Food Sci. Tech. Int.* (7): 373–382.
2. Bajpai, B., and Patil, S. A. 2008. New approach to microbial production of gallic acid. *Braz. J. Microbiol.* 708–711.
3. Bele, A. A., Jadhav, V. M. and Kadam, V. J. 2010. Potential of tannins: a review. *Asian Journal of Plant Sciences*. 9(4): 209–214.
4. Belmares, R., Contreras-Esquivel, J. C., Rodríguez-Herrera, R., Coronel, A. R., and Aguilar, C. N., 2004. Microbial production of tannase: An enzyme with potential use in food industry. *LWT—Food Science and Technology*. 37(8):857–864.
5. Banerjee, D., Mondal, K. and Bikas, R. 2001. Production and characterization of extracellular and intracellular tannase from newly isolated *Aspergillus aculeatus* DBF9. *J. Basic Microbial.* (6): 313–318.
6. Belur, P. D., Gopal, M., Nirmala, K. R. and Basavaraj, N. 2010. Production of novel cell-associated tannase from newly isolated *Serratia ficaria* DTC. *Journal of Microbiology and Biotechnology*. 20(4):732–736.
7. Bhat, T. K., Singh, B. and Sharma, O. P. 1998. Microbial degradation of tannins-A current perspective. *Biodegradation*, 25: 343–357.
8. Biswas, K., Chatopadhyay, I., Banerjee, R. K. and Bandopadhyay, U. 2002. Biological activities and medicinal properties of neem (*Azadirachta indica*). *Curr Sci.* 82:1336.
9. Bors, W. and Michel, C. 1999. Antioxidant capacity of flavanols and gallate esters: pulse radiolysis studies. *Free Radical Biology and Medicine* 27(11-12): 1413–1426.
10. Chae, S. K. and Yu, T. J. 1983. Experimental manufacture of acron wine by fungal tannase. *Hanguk Sipkum Kwahakhoechi*. (15): 326–332.
11. Coggon, P. and Sanderson, G. W. Manufacture of instant tea. 1972. Patent Ger. offen 2.304073 (cl. A. 23f.) 16 August 1973.
12. Das Mohapatra, P. K., Mondal, K. C., Pati, B. R., Halder, S. K., Maity, C. and Jana, A. 2012. Rapid screening of tannase producing microbes by using natural tannin. *Braz. J. Microbiol.* 43(3):1080–1083.
13. Das Mohapatra, P. K., Mondal, K. C. and Pati, B. R. 2006. Production of tannase through submerged fermentation of tannin-containing plant extracts by *Bacillus licheniformis* KBR6. *Pol. J. Microbiol.* (55):297–301.
14. Jean, D., Pourrat, H. Pourrat, A. and Carnat, A. 1981. Assay of tannase (tannin acyl hydrolase E.C. 3.1.1.20) by gas chromatography. *Anal. Biochem.* (110): 369–372.
15. Iibuchi, S., Minoda, Y. and Yamada, K. 1967. Studies on tannin acyl hydrolase a new method determining the enzyme activity using the change of ultraviolet absorption. *Agric. Biol. Chem.* (31): 513–518.
16. Mondal, K. C., Banerjee, D., Jana, M. and Pati, B. R. 2001. Colorimetric assay method for determination of tannin acyl hydrolase (E.C. 3.1.1.20) activity. *Anal Biochem* 295:168–171.
17. Lekha, P. K., and Lonsane, B. K. Production and application of tannin acyl hydrolase: state of the art. In: Neidleman S Laskin A editors. *Advances in Applied Microbiology* Vol. 44. San Diego, Calif, USA: Academic Press; 1997. pp. 215–260.
18. Paranthaman, R., Vidyalakshmi, R., Muruges, S. and Singravadi, K. 2008. Optimisation of fermentation conditions for production of tannase enzyme by *Aspergillus oryzae* using sugarcane bbgasse and rice straw. *Global journal of Biotechnology and Biochemistry*. 3 (2):105–110.
19. Pepi, M., Lampariello, L. R. and Altieri R. *et al.* 2010. Tannic acid degradation by bacterial strains *Serratia* spp. and *Pantoea* sp. isolated from olive mill waste mixtures. *International Biodeterioration and Biodegradation*. 64(1):73–80.
20. Premakumari, K. B., Ayesha, Siddiqua, Shanaz, Banu. Josephine, J., Leno, Jenita. and Bincy, Raj. 2010. Comparative Antimicrobial Studies of Methanolic Extract of *Muntingia calabura*, *Basella alba* and *Basella rubra* Leaves. *Research Journal of Pharmacognosy and Phytochemistry*. 2(3): 246–248.
21. Sharma, G. and Dubey, S. *et. al* 2011. Phytochemical screening and estimation of total phenolic content in *Aegle marmelos* seeds. *International journal of pharmaceutical and clinical research*. 3 (2): 27–29.
22. Sharma, P. C., Bhatiya, V., Bansal, N. and Sharma A. 2007 A review on bael tree. *Natural products radiance*. 6 (2):171–78.
23. Singleton, V. L., Rossi, J. A. 1965. Colorimetry of total phenolics with phosphomolybdic-phosphotungstic acid reagents. *Am. J. Enol. Vitic.* (16): 144–158.

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## RESEARCH ARTICLE

### RARE CAUSE AND PRESENTATION OF SEVERE HYPERTRIGLYCERIDEMIA.

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#### Manuscript Info

#### Abstract

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#### Key words:-

hypertriglyceridemia, milky blood.

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#### Introduction:-

Hypertriglyceridemia (HTG) is defined as an increase in fasting serum triglyceride (TG) levels greater than 150 mg/dl<sup>1</sup>. Causes of HTG vary from hereditary to acquired causes, such as diet or medications. Presentation of patients with HTG ranges from being asymptomatic and being diagnosed incidentally, to having minor presentations, such as skin manifestations, and to life-threatening conditions, such as pancreatitis. High TG levels result in turbidity and cloudiness of the blood, and this subsequently interferes with laboratory results<sup>2</sup>.

We present a case of a 42-year-old woman who presented to the emergency department (ED) in an acute confusional state. She had milky white blood secondary to HTG. To the best of our knowledge, this is the first case with a similar clinical picture and initial presentation secondary to a pituitary macroadenoma to be described.

#### Case Presentation:-

A 42-year-old woman, not known to have any medical illnesses prior to presentation, was brought to the ED with an altered level of consciousness, which was noticed by her family. The patient's symptoms were confusion, abdominal pain, nausea, and vomiting. The patient was noticed to have had six to seven meals per day, and she also consumed large amount of powdered milk of approximately 5 to 6 L per day.

A physical examination showed that she had an average body mass index and was confused with a Glasgow Coma Scale score of 14/15. Vitals signs showed a temperature of 36.7°C, heart rate of 114 bpm, blood pressure of 135/87 mmHg, respiratory rate of 30, and O<sub>2</sub> saturation of 99%. The rest of the physical examination was unremarkable. A blood sample was collected from the patient to undergo laboratory testing. The blood was milky white (Figure 1). Findings from the initial laboratory investigations that were performed at the ED are shown in Tables 1 and 2.

The patient was then admitted to the intensive care unit and started on anti-lipemic medication, insulin, and heparin. She underwent plasmapheresis three times over 3 consecutive days (Figures 3). She then improved clinically and biochemically (Tables 1 and 2).

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During the patient's stay at the intensive care unit, she underwent magnetic resonance imaging (MRI) of the head because of the impaired level of consciousness. MRI showed a pituitary macroadenoma (Figures 3 and 4), which could explain the polyphagia experienced by the patient. Then patient was referred for surgical follow up and evaluation after discharge.



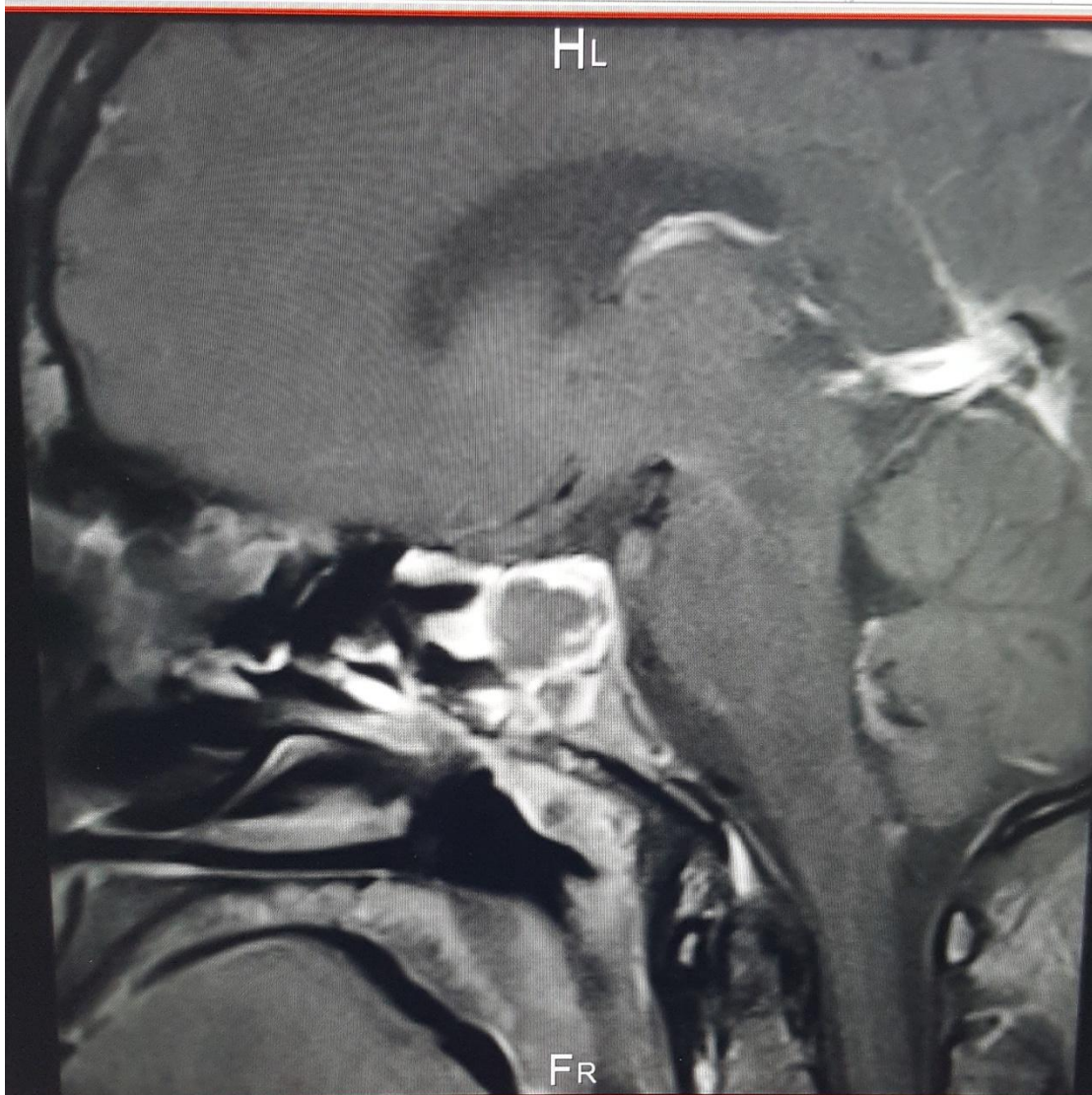
**Figure 1:-** Milky-colored blood sample upon presentation.

Image 2: Same sample shown at (image 1) few seconds after blood extraction

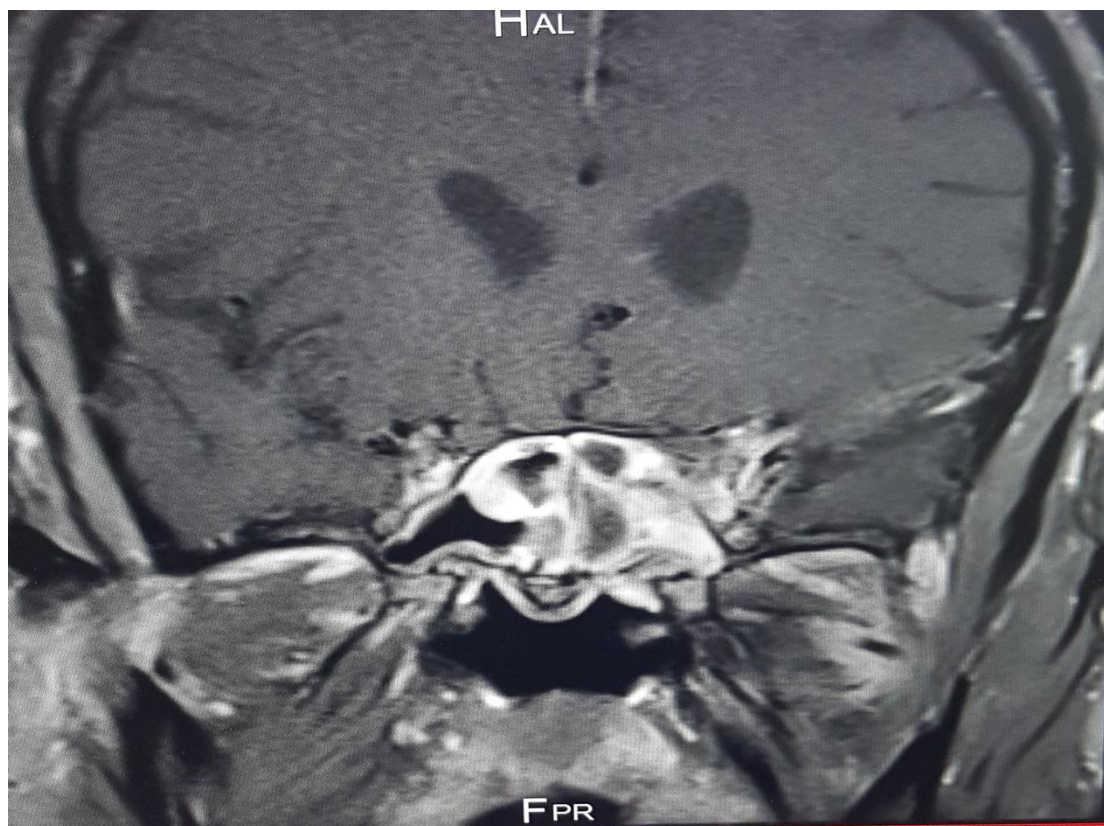


**Figure 2:-** Milky white blood during plasmapheresis





**Figure 3:-** Sagittal view of MRI showing a  $3 \times 2.3$ -mm pituitary macroadenoma with no enhancement.



**Figure 4:-** Coronal view of MRI showing the pituitary adenoma.

**Table 1:-**Laboratory blood tests results before and after treatment.

	CBC			Lipid profile				LFT					
	WBC	Hb	Plt	TG	Chol	LDL	HDL	T. Bil	D. Bil	AS T	GP T	AL P	GGT P
Before plasmapheresis	3.8 k/ul	8.9 g/dl	230 k/ul	3760 mg/dl	907 mg/dl	Unable to be processed because of lipidemic serum							
After plasmapheresis	5.2 k/ul	7.8/g/dl	174 k/ul	393 mg/dl	160 mg/dl	44 mg/dl	14 mg/dl	0.8 mg/dl	0.1 mg/dl	8 U/L	39 U/L	58 U/L	21 U/L

Table 1 CBC, complete blood count; WBC, white blood cell; Hb, hemoglobin; Plt, platelets; TG, triglycerides; Chol, cholesterol; LDL, low-density lipoprotein; HDL, high-density lipoprotein; LFT, Liver function test; T.Bil, Total bilirubin; D.Bil, Direct Bilirubin; AST, aspartate aminotransferase; ALT, alanine aminotransferase; ALP, alkaline phosphatase; GGTP, gamma-glutamyltranspeptidase.

**Table 2:-** Laboratory blood tests results before and after treatment.

	Amylase	Lipase	Renal panel					Others				ABG
			BU N	Creat	Na	K	Cl	RB S	Ca	Mg	P O <sub>4</sub>	
Before plasmapheresis	209 U/L	292 U/L	Unable to be processed			122mEq/L	3.0 mEq/L	90mEq/L	562 mg/dl	Unable to be processed		pH: 7.1, PaCO <sub>2</sub> : 27.5 mm Hg PaO <sub>2</sub> : 132 mm Hg ,HCO <sub>3</sub> : unable to

												processed
After plasmapher esis	156 U/L	57 U/L	5 mg/ dl	0.4 mg/ dl	144m Eq/L	3.6 mEq /L	114 mEq/L	197 mg/dl	7.3 mg/ dl	1.8 mEq/ L	0 . 8 m g / d l	pH:7.49, PaCO <sub>2</sub> : 39.6 mm Hg PaO <sub>2</sub> : 124 mm Hg, HCO <sub>3</sub> :30.7 mEq/L

BUN, blood urea nitrogen; Creat, creatinine; Na, sodium; K, potassium; Cl, chloride; RBS, random blood sugar; Ca, calcium; Mg, magnesium; PO<sub>4</sub>, phosphate; ABG, Arterial blood gas; PaCO<sub>2</sub>, partial pressure of CO<sub>2</sub>; PaO<sub>2</sub>, partial pressure of O<sub>2</sub>; HCO<sub>3</sub>, bicarbonate.

### Case Discussion:-

We report a case of severe HTG that was induced by excessive milk powder ingestion (polyphagia), which could be explained by the presence of a pituitary macroadenoma. To the best of our knowledge, this is the first reported case of severe HTG that was secondary to such a cause.

There have been few previously reported cases similar to our case, in which the patient presented with milky white blood. Most of the previously reported cases were from India, Nepal, and the USA. Sandhya reported a patient aged 43 years old, with type 2 diabetes mellitus on irregular treatment, who presented with abdominal pain. The patient had a random blood sugar level of 640 mg/dl. The patient's TG level was 17,300 mg/dl. The patient was treated accordingly as a case of diabetic ketoacidosis and severe HTG<sup>3</sup>. Another patient with milky white blood was reported from Nepal in 2010. A 66-year-old man, who had hypertension, and was an alcoholic and a smoker, complained of joint pain. The patient had a history of eating a large amount of fried pork and drinking a large amount of alcohol. The patient's TG level was 1621 mg/dL<sup>4</sup>. An asymptomatic case was reported in the USA, in which the patient had no complaints and was incidentally found to have white opaque blood upon a regular checkup<sup>5</sup>.

HTG is defined as an increase in fasting serum TG levels greater than 150 mg/dl. Recent Endocrine Society guidelines classified HTG into the following four categories: mild (150–199 mg/dL; 1.7–2.2 mmol/L), moderate (200–999 mg/dL; 2.3–11.2 mmol/L), severe (1000–1999 mg/dL; 11.2–22.4 mmol/L), and very severe (>2000 mg/dL; >22.4 mmol/L).<sup>1</sup> In our case, the patient was categorized as having severe HTG. Her HTG level at the ER was 3760 mg/dl. The underlying pathogenesis of HTG is due to increased production and/or intake, reduced catabolism, or a combination of both. HTG can be either primary or secondary. Primary HTG is mainly due to genetically-based familial hyperlipidemias.<sup>6</sup> Familial combined hyperlipidemia is the most common heritable dyslipidemia with a prevalence of 1–2% in the general population. It is an autosomal condition, associated with insulin resistance, obesity, and premature cardiovascular disease.<sup>6,7</sup> There are other less common heritable dyslipidemias, such as familial HTG, chylomicronemia syndrome, and type III hyperlipidemia or dysbetalipoproteinemia.<sup>7</sup> Secondary causes of HTG include a high carbohydrate and fat diet, drugs, such as bile acid sequestrants,<sup>8</sup> retinoids,<sup>9</sup> and antihypertensive drugs (thiazide, furosemide, and beta-blocker agents), especially in patients with underlying genetic hyperlipidemia.<sup>10</sup> Conditions with insulin resistance, such as diabetes mellitus type 2, metabolic syndrome, polycystic ovarian syndrome, acromegaly, and pregnancy, increase the production of TG, leading to HTG<sup>10,11</sup>. Acute hepatitis and nephrotic syndrome can also cause HTG.<sup>12,13</sup>

In our case, the patient did not have any previous medical illnesses, obesity, or the use of any drugs. She was consuming a high amount of carbohydrate and fat, which is thought to be secondary to the pituitary adenoma that was later diagnosed. Patients with HTG are usually asymptomatic, but they may present with some characteristic features, including eruptive xanthomas and fatty changes in the liver. The most feared clinical feature of HTG is the risk of developing life-threatening acute pancreatitis. Studies have shown that TG levels >500 mg/dL increase the risk of developing acute pancreatitis.<sup>14</sup> High serum TG levels can interfere with laboratory results. Chylomicrons and very-low-density lipoprotein are suspended particles that scatter light, which results in cloudiness or turbidity of the blood.<sup>2</sup> This may result in the delay or underestimation of electrolyte concentrations in the blood. This situation can

be minimized by ultra-centrifuging the sample by reducing the lipid or by using polymers to precipitate the lipids in the sample.<sup>15</sup>

Management of HTG should consist of non-pharmacological and pharmacological treatment, which is known as conventional management. Non-pharmacological therapy basically targets the life style of the patient. This therapy includes modification of the diet by restriction of carbohydrates and a fat-rich diet, or introducing a diet rich in omega-3 fatty acids,<sup>16</sup> exercise, and weight loss. Physicians recommend that in severe HTG (>1000 mg/dL), dietary fat intake should be less than 10% of total caloric intake. If TG levels are 400–1000 mg/dL, then dietary fat should be 20% of total of caloric intake<sup>17</sup>.

Pharmacological therapy should be considered according to clinical practice guidelines when TG levels are greater than 200mg/dl.<sup>17,18</sup> This therapy includes anti-lipidemic agents, insulin, and heparin. Anti-lipidemic agents include fibrates, statins, and niacin. Fibrates, such as gemfibrozil, are the first-line agent for controlling TG levels.<sup>18</sup> Fibrates can reduce up to 30–50% of TG in the serum by several mechanisms, including increased catabolism of TG by increasing oxidation and by decreasing production of very-low-density lipoprotein by the liver.<sup>19,20</sup> Statins are HMG-CoA reductase inhibitors (rate-limiting enzyme of cholesterol synthesis). Statins mainly lower cholesterol levels, and can lower TG levels by 25–30% with high doses.<sup>21</sup> Therefore, statins cannot be used alone. Statins can be used with fibrates, but with caution, by close monitoring of creatinine kinase because they may increase the chance of rhabdomyolysis.<sup>21,22</sup> Niacin can be used as well, but its effects in lowering TG levels are only 10–30%. Insulin and low-dose heparin can be used to lower TG levels, but both increase lipoprotein lipase, which degrades TG to glycerol and free fatty acids.<sup>23</sup>

Plasmapheresis is a therapeutic procedure where the plasma is separated from the blood and filtered, and then returned. Plasmapheresis should be indicated in case of failure of conventional treatment to lower TG levels. A previous study suggested that TG levels greater than 2000mg/dl should be an indication for plasmapheresis to avoid systemic complications, such as acute pancreatitis.<sup>24, 25</sup> A single session of plasmapheresis can reduce TG levels up to 70%, producing a clear, clinical, and laboratory improvement<sup>24, 25</sup>. Plasmapheresis is a relatively safe procedure with few complications, such as urticarial, paresthesia, rigors, headaches, hypotension, and muscle cramps.<sup>26</sup>

## Conclusion:-

To the best of our knowledge, this is the first case of Sever HTG secondary to excessive milk ingestion and polyphagia which was caused by macroadenoma of the pituitary gland. Physician must be aware of such etiology for further management considerations in addition to the usual medical therapy.

## References:-

1. Berglund L, Brunzell JD, Goldberg AC, Goldberg IJ, Sacks F, Murad MH, et al, Endocrine society. Evaluation and treatment of hypertriglyceridemia: an Endocrine Society clinical practice guideline.\
2. Kroll MH, Elin RJ. Interference with clinical laboratory analyses. ClinChem 1994;40:1996–2005.
3. Sandhya, V., Balasubramanian, A., Rajasekar, D., Kothai, G. and Sundari, S.M., Pink Blood. TC, 600, p.168.
4. Paudel, Y.P., Kasyap, A.K., Shrestha, A. and Baral, R., 2010. High lipemic serum: a case report. Nepal Med Coll J, 12(1), pp.61-62
5. Pillai, A.S., 2009. White, opaque fluid in a blood draw. Hypertriglyceridemia. American family physician, 79(8), p.699.
6. Yuan G, Al-Shali KZ, Hegele RA. Hypertriglyceridemia: its etiology, effects, and treatment. CMJA 2007;176:1113–1120.
7. Brunzell JD. Clinical practice. Hypertriglyceridemia. NEJM 2007;357:1009–1017.
8. Crouse 3rd JR. Hypertriglyceridemia: a contraindication to the use of bile acid binding resins. The American Journal of Medicine 1987;83:243–248.
9. Vu-Dac N, Gervois P, Torra IP, et al. Retinoids increase human apo c-iii expression at the transcriptional level via the retinoid x receptor. Contribution to the hypertriglyceridemic action of retinoids. The Journal of Clinical Investigation 1998;102:625–632.
10. Stone NJ. Secondary causes of hyperlipidemia. The Medical Clinics of North America 1994;78:117–141.
11. Carr MC, Brunzell JD. Abdominal obesity and dyslipidemia in the metabolic syndrome: importance of type 2 diabetes and familial combined hyperlipidemia in coronary artery disease risk. The Journal of Clinical Endocrinology and Metabolism 2004;89:2601–2607.



12. Luo L, Pu X, Wang Y, et al. Impaired plasma lipid profiles in acute hepatitis. *Lipids in Health and Disease* 2010;9:5.
13. Kronenberg F. Dyslipidemia and nephrotic syndrome: recent advances. *Journal of Renal Nutrition: The Official Journal of the Council on Renal Nutrition of the National Kidney Foundation* 2005;15:195–203.
14. Lindkvist B, Appelros S, Regnér S, Manjer J. A prospective cohort study on risk of acute pancreatitis related to serum triglycerides, cholesterol and fasting glucose. *Pancreatology* 2012;12:317.
15. Ryder KW, Glick MR. Erroneous laboratory results from hemolyzed, icteric, and lipemic specimens. *ClinChem* 1993;39:175–176.
16. Mensink RP, Zock PL, Kester AD, et al. Effects of dietary fatty acids and carbohydrates on the ratio of serum total to hdl cholesterol and on serum lipids and apolipoproteins: a meta-analysis of 60 controlled trials. *The American Journal of Clinical Nutrition* 2003;77:1146–1155.
17. Capell WH, Eckel RH. Severe hypertriglyceridemia with a history of treatment failure. *Nature ClinPractEndocrinolMetab* 2005;1:53–58.
18. Rosen IM, Sams RW 2nd. Common questions in managing hyperlipidemia. *Prim Care Clin Office Pract* 2006;33:903–921.
19. Abourbih S, Filion KB, Joseph L, et al. Effect of fibrates on lipid profiles and cardiovascular outcomes: a systematic review. *The American Journal of Medicine* 2009;122:e961–e968.
20. Rubins HB, Robins SJ, Collins D, et al. Gemfibrozil for the secondary prevention of coronary heart disease in men with low levels of high-density lipoprotein cholesterol. Veterans affairs high-density lipoprotein cholesterol intervention trial study group. *The New England Journal of Medicine* 1999;341:410–418.
21. Pasternak RC, Smith SC, Bairey-Merz CN, et al. ACC/AHA/NHLBI clinical advisory on the use and safety of statin. *J Am CollCardiol* 2002;40:567–572.
22. Graham DJ, Staffa JA, Shatin D, et al. Incidence of hospitalized rhabdomyolysis in patients treated with lipid-lowering drugs. *JAMA* 2004;292:2585–2590.
23. Berger Z, Quera R, Poniachik J, et al. Heparin and/or insulin treatment of acute pancreatitis caused by hypertriglyceridemia. *Rev Med Chil* 2001;129:1373–1378.
24. Furuya T, Komatsu M, Takahashi K, et al. Plasma exchange for hypertriglyceridemic acute necrotizing pancreatitis: report of two cases. *TherApher* 2002;6:454–458.
25. Ewald N, Kloer HU. Severe hypertriglyceridemia: an indication for apheresis? *AtherosclerSuppl* 2009;10:49–52.
26. Bramlage CP, Schröder K, Bramlage P, et al. Predictors of complications in therapeutic plasma exchange. *J ClinApher* 2009;24:225–231.



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## RESEARCH ARTICLE

### AUTONOMOUS EYE.

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#### Abstract

A powered wheel chair is a mobility-aided device for persons with moderate or severe physical disabilities. In order to take care of people with different disabilities, various kinds of interfaces have been developed for powered wheelchair control; such as joystick control, head control, chin control and sip-puff control. Many people with disabilities do not have the ability to control powered wheel chair using the above mentioned interfaces. In this project work, we propose and implement an eye controlled wheelchair system in which the control of the wheelchair is done as per the movement of eye. For this purpose, we use the optical-type eye tracking system to control powered wheel chair. User's eye movement are translated to screen position using the optical type eye tracking system. When user looks at appropriate direction, then computer input system will detect the direction, based on the coordinate position of pupil i.e., when user moves his eyes balls up (move forward), left (move left), right (move right), down (move backward) and in all other cases wheel chair will stop. The image captured by a camera after being processed it is fed to the microprocessor. The microprocessor will take a USB output from the laptop and convert the data into signals that will be sent to the wheelchair wheels for movement. Also, the object detection sensors will be connected to our microprocessor to provide necessary feedback for proper operation of the wheelchair system. In the case of the wheelchair, the front two wheels will be used for steering left and right and rear wheels provide the forward movement. All four wheels will be connected to our microprocessor that will send signals to control the wheels and thus the overall movement.

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#### Introduction:-

The Wheelchair is dependent system used by elderly and physical disable persons. Here introducing the design implementation models of totally independent Eye control electric wheelchair. As per requirement of the disabilities, different kind of automatic systems are available in market such as voice control or joystick control system. Sometime for totally paralysis person may be have very difficult to use that type of systems. Here the Eye control system provides the independence to make their life easy and more convenient. And also they save the huge amount

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of energy or external man power. Camera captured the image in real time and analysis the image as input to set the commands for interface the motor driver IC. The motor driver circuit is used to perform the different operation such as left, right, forward and stop.

Several application and algorithms are used to find out accurate pupil location detection and tracking of that. One of them is Haar cascade like features detection algorithm used to detects single or multiple face and detection of both eye. To detect the exact Eye pupil and locate its center point is the ultimate goal of this system. For automatically finding out Eye pupil and tracking eye pupil, many computer vision library of Image processing techniques like object detection, Motion detection, Image color conversion, Edge detection, Pattern matching etc. are used.

This is efficient as well as cost effective system. Here real time video image capturing based on Face, Eye and Eye Pupil detection with minimum delay of time is used. The system includes multistage that mainly track the Eye pupil center. An Eye tracking technique is used, which capture the image and detects the presence of human face. After detecting the face, it detects area of the eye location on the face detected image, and performs several operation of basic image processing like colour image to grey conversion, filtering, threshold, pattern matching, noise reduction and circle detection on it.

### **Literature Survey:-**

In paper [1], The main aim of this paper is to develop an efficient interface to track the iris movement and to use this information to control the direction of robotic vehicle. This paper gives information about morphological operations to detect eyeball movement and how we can use it to move a robot in direction of the line of sight of the user. Through a web camera, the photographs of either the left or the right eye is continuously captured. Send this information to the robotic vehicle through a wireless link. The robotic vehicle receives the digital data and performs some operation on it. According to the digital data the robotic vehicle controls its direction.

In Paper [2], deals control and navigation of the wheelchair for elderly and disabled based on kinematic model iris motion and image processing. A navigation system, based on iris movement and image processing, was real-time implemented in MATLAB. This navigation system identifies the user's eye movement in three directions: forward, left and right. Stop of the wheelchair is done by eye closing. Using a LabView platform, a graphic user interface has been designed and implemented, allowing user to control wheelchair movements. The whole set of information in the image processing includes eye detection, direction finding and validating it by averaging 10 frames.

In Paper [3], An Eye Controlled System which enables the movement of the patient's wheelchair depending on the movements of eyeball. The person sitting on the automated Wheel Chair with a camera mounted on it, is able to move in a direction just by looking in that direction by making eye movements. The captured camera signals are then send to PC and controlled MATLAB, which will then be send to the Arduino circuit which in turn will control motors and allow the wheelchair to move in a particular direction. It is easier and simple to handle, and User friendly. It has Poor gaze direction accuracy and costly.

This is a paper [4], implements a Smart Phone controlled Robot that uses ATMEGA328 Microcontroller. In this paper, a robot is designed that can be controlled using an application running on an android phone. It sends control command via Bluetooth which has certain features like controlling the speed of the motor, sensing and sharing the information with phone about the direction and distance of the robot from the nearest obstacle. The data received by the Blue-tooth module from Android smart phone is fed as input to the controller. Thereby, the controller acts accordingly on the DC motors to move in the entire robot in all the four directions using the Android phone. The robot is small in size so can be used for spying and it can be used in the borders for disposing hidden land mines.

The paper [5], implements a non-periodic signal digitalization using ATMega microcontroller. Sampling and quantization are accomplished but ATMega328 micro processor. A microprocessor ATMega328P, which was released by company of Atmel, was used to meet this requirement. ATMega328P is an eight bite processor with eight analogue input pins, fourteen digital input/output pins of it six pins have also PWM analogue output pins. Internal memory of microprocessor is 32KB Flash, 2KB SRAM an 1KBEEPROM. Clock frequency is 16MHz.

This paper [6], Develops a Bluetooth Electronic Scale for Water Intake using Arduino. The hardware part of the system mainly includes Arduino board UNO and development environments. Arduino is an open-source development of I/O interface control panel. There is a similar java, C language development environment, so that

users can use the Arduino language and other software to make interactive works. Many switches or sensors, LED, stepper motors, etc. There are many amazing interactive work can be developed through the Arduino. Arduino UNO R3 is the latest of a 2012 easy-to-open source controller, compared with the Arduino UNO and has not major changes in hardware. The biggest difference is that the USB-connected in series circuit, instead of a piece of ATmega16U2 microcontroller, costs will has increased, the software portion as before, there is not big changes.

This paper [7], aims in implementing a mobile robot system, which is capable of performing various tasks for the physically disabled. To avoid collision with unexpected obstacles, the mobile robot uses ultrasonic range finders for detection and mapping. This paper describes some features of a mobile nursing robot system, which is produced as an aid for bedridden who acquire constant assistance for the most elementary needs. The obstacle is detected with the ultrasonic rays being reflected is being sensed by the sensors. The amount of reflected sound energy depends strongly on the surface structure of the obstacle. It is accurate and make the disabled person independent but Ultrasonic is expensive.

In this paper [8], proposes a novel approach to obstacle detection and collision avoidance using ultrasonic sensors in indoor environment. For an intelligent quad-copter, detecting obstacles to avoid collisions is very important. If a robot can be made to avoid colliding with objects in the environment, then other higher-level capabilities can safely be incorporated into the system. A custom designed 'cap' with sensors fitted in, interfaced with the copter through Arduino Development Board has been used to make the quad-copter intelligent through feedback and correction. In this cap, four slots are created for fitting the ultrasonic sensors. As four sensors are used here, best results were obtained by placing them at an angular separation of  $90^\circ$ . These ultrasonic sensors are controlled using an Arduino development board. The sensors are placed one on each of the four faces of cap. A custom made shield has been used to create a common power supply for all the sensors. Arduino, along with the shield is glued inside the cap so that the wires or the modules don't dangle ensuring that the connections are not disturbed.

In thi paper [9] , presents both simple and complex obstacle detection using an ultrasonic sensor ring with overlapped beam pattern. It is assumed that a set of ultrasonic sensors of the same type are arranged along a circle of non-zero radius at regular spacings with their beams overlapped. To assess the positional uncertainty of an overlapped ultrasonic sensor ring in obstacle detection, the obstacle distances of three adjacent ultrasonic sensors are compared. First, the positional uncertainty for single obstacle detection can be determined based on the combination of ultrasonic sensors detecting an obstacle. Second, the positional uncertainty for multiple obstacle detection can be determined based on the inequality relationship among three adjacent obstacle distances. Third, the positional uncertainty for omnidirectional obstacle detection can be determined by overlapping all the uncertainty arcs obtained for every three consecutive ultrasonic sensors.

In paper [10] , Eye Ball Tracking System is a device which is intended to assist patients that cannot perform any voluntary tasks related to daily life. Patients who only can control their eyes can still communicate with the real-world using the assistive devices like one proposed in this paper. This device provides a human computer interface in order to take decisions based on their eye movement. A real time data stream is captured via webcam that transfers data serially to MATLAB. Then a sequential image processing scheme segments the iris of the eye and calculates the centroid, thereby generating control signal with the help of a reference axis. The control signals are then used to manipulate the position of a motorized platform via USB microcontroller interface. The data processing is done in a simplest way and low cost.

In this paper [11], it presents an effective albeit simple technique to perform mouse cursor movement by first detecting the user's eyes, and then calculating the position on screen at which the user is looking. The idea of our paper is to use a series of steps for image processing, and then use a certain algorithm to convert screen coordinates to world coordinates. Once pupil detection is done, we get the coordinates of the pupil in the image. Our algorithm uses a concept of distance of these coordinates from the midpoint of the screen to calculate the actual coordinates of the position on screen the user is looking at. These are then passed to a function in MATLAB to move the cursor. The captured image is converted to a grayscale image. The grayscale image then undergoes K-Means clustering after which it is converted to a binary image. This binary image undergoes further transformation, at the end of which we get a rectangular region containing the eyes of the user. Once these coordinates are calculated, a formula is applied factoring in the distance of the face from the screen, and the average radius of an eye. The output of this is the actual coordinates to which the cursor is moved.

The paper [12] is to, implements an Eye Movement Based Electronic Wheel Chair For Physically Challenged Persons. The main objective of segmentation is to remove non useful information, namely the pupil segment and the part outside the iris (sclera, eyelids, skin). Daugman proposes an integrodifferential operator to find both the pupil and the iris contour. The algorithm will perform the iris recognition in two phases. The algorithm used in the first phase, uses the knowledge that a pupil is a very dark blob of certain minimum size in the picture, and The second algorithm takes the information of the pupil canter and tries to find direction in which the eye looks. The input image given to the MATLAB for processing will produce an output image with the coordinates of iris and pupil. The input image given to the MATLAB for processing will produce an output image with the coordinates of iris and pupil.

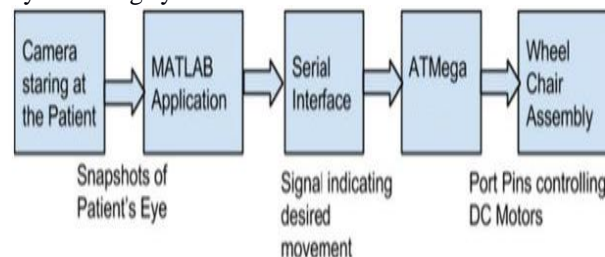
In this paper[13], mainly aims in describing the method of using Radio Frequency transmission as wheelchair user interface. Human-machine interface can be considered as an essential element in robotic wheelchair control mode. The purpose of this paper is to examine the functionality and efficiency of the manual control mode with the implementation of low cost RF Transmitter and Receiver modules for wireless transmission. A User's Controller Panel as well as a model of robotic wheelchair has been designed and developed to provide the testing of robotic wheelchair locomotion control via wireless data transfer. By using C programming algorithm, PIC16F877 has been used as the Microcontroller unit for robotic wheelchair while PIC16F88 as the Microcontroller unit for User's controller panel. The results prove that low cost RF modules have the feasibility to be used for simple-one way wireless data transfer with the capability of transmitting several basic instructions to the robotic wheelchair.

In Paper[14], implements a Mobile Robot Control over a Radio Frequency Communications Link. the operation of the robot was to be quite simple; it was to be able to move forward and backward and turn left or right. Keeping these commands separate simplified distance calculations, and with the use of optical encoders attached to the wheels, this data was easily gathered. The direction beading was measured with the use of a digital compass that output the direction in a binary number. The user controls robot movement in one of two ways. The first possibility is a real-time instruction that tells the robot to execute a particular command until another is given. Essentially, the operation is similar to that of a remote controlled car. The other possibility is a list of commands to be executed in a particular order. The data contained in this list includes the direction in which the robot is to go, the length at which the robot is to execute the command, and the speed at which the command is to be executed.

In Paper [15], implements RF Module Based – Speed Check and Seatbelt Detection System. This system will have to part 1)Transmitter and 2) Receiver System. Transmitter part will be on the Road Side at Speed Sign Board. The role of the transmitter is to transmit the maximum allowable speed limit of that road to receiver. Receiver part will be on the vehicle embedded with the system. Role of the receiver would be to compare received Speed Limit Data (received from transmitter) with current speed of the vehicle. It will generate a signal in case of over-speeding and after 10 seconds the engine will stop.

### Proposed system:-

A powered wheel chair is a mobility-aided device for persons with moderate or severe physical disabilities or chronic diseases as well as the elderly. In this project work, we propose and implement an eye controlled wheelchair system in which the control of the wheelchair is done as per the movement of eye. For this purpose, we use the optical-type eye tracking system to control powered wheel chair. User's eye movement are translated to screen position using the optical type eye tracking system.



**Fig:- Overall Block Diagram**

We capture the image using the camera, and after perfect capturing of image, it is send to the MATLAB software in the PC where segmentation of image is done and processing of finding the pupil and its direction is found out. Image

Capturing is to capture a sequence of iris images from the subject using a specially designed camera. The image is then changed from RGB to gray level for further processing. The final output of the MATLAB is then transmitted through the RF Modem Transmitter as Analog Data.

### Conclusion:-

Our project, Autonomous Eye consist of a wheelchair, the motion of which is controlled by the eye movements of the user. The aim of implementing an autonomous eye is to help physically disabled persons to make their life independent. A sequence of images of the eye will be captured and it is processed in MATLAB to obtain the direction of movement of the wheelchair. There the system used the ultrasonic sensor for obstacle detection. Low cost RF transmitter and receiver are capable of handling some basic wireless communication such as sending basic instruction to MCU of the robotic wheelchair.

### References:-

1. M.S.Ghute, A.A.Parkhi, K.P.Kamble, Mohsina Anjum, "Iris Movement Detection by Morphological Operations for Robotic Control", © 2013 IJESIT
2. Razvan Solea, Adrian Filipescu, Adriana Filipescu Jr, Eugenia Minca, Silviu Filipescu, "Wheelchair Control and Navigation Based on Kinematic Model and Iris Movement", © 2015 IEEE
3. Reona Cerejo, Valentine Correia, Neil Pereira,"Eye controlled wheel chair based on aurdinokit", © 2015 IJTRA
4. Aniket R. Yeole<sup>1</sup>, Sapana M. Bramhankar<sup>2</sup>, Monali D. Wani<sup>3</sup>, Mukesh P. Mahajan<sup>4</sup>, "Smart Phone Controlled Robot Using ATMEGA328 Microcontroller", © 2015 IJIRCCE
5. O. Kováč , M. Kovalčík, P. Fecil'ak, F. Jakab, " Learning module of non-periodic signal digitalization using ATMEGA328 microcontroller", © 2015 IEEE
6. Bin Dai Rung-Ching Chen , Wei-Bin Yang, "Using Arduino to Develop a Bluetooth Electronic Scale for Water Intake", © 2016 International Symposium on Computer, Consumer and Control
7. Johann Borensiein , Yoram Korean, "Obstacle Avoidance with ultrasonic sensors", © 2014 IEEE
8. Nischay Gupta, Jaspreet Singh Makkar , Piyush Pandey, "Obstacle Detection and Collision Avoidance using Ultrasonic Sensors for RC Multirotors", 2015
9. Sungbok Kim and Hyunbin Kim, "Simple and Complex Obstacle Detection Using an Overlapped Ultrasonic Sensor Ring" , © 2012 International Conference on Control, Automation and Systems
10. Osama Mazhar, Muhammad Ahmed Khan, Taimoor Ali Shah, Sameed Tehami, "A Real-time webcam based Eye Ball Tracking System using MATLAB", © 2015 IEEE
11. Surashree Kulkarni, Sagar Gala, "A Simple Algorithm for Eye Detection and Cursor Control", © 2013 International Journal of Computer Technology & Applications
12. Gunda Gautam, Gunda Sumanth, Karthikeyan K C, Shyam Sundar, D.Venkataraman, "Eye Movement Based Electronic Wheel Chair For Physically Challenged Persons", © 2014 International Journal of Scientific & Technology Research
13. M. Thamrin N.Sarmawi D. S., "Design and Analysis of Wireless Controller Panel using RF Module's for Robotic Wheelchair", © 2011 IEEE
14. Matthew B. Lister; Elizabethtown College; Elizabethtown, PA Joseph T. Wunderlich "Mobile Robot Control over a Radio Frequency Communications Link", © 2002 IEEE
15. Himesh Gupta, Aditya Pundir ,Dr.O.P. Sharma, "RF Module Based – Speed Check and Seatbelt Detection System", © 2016 Second International Conference on Computational Intelligence & Communication Technology



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### RESEARCH ARTICLE

#### USE OF PLANTS IN TRADITIONAL HEALTH CARE PRACTICE: AN ETHNOMEDICINAL SURVEY AT SUJANAGAR UPAZILA IN PABNA DISTRICT OF BANGLADESH.

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Kavirajes, Pabna, Sujanagar, Liliaceae,  
Solanaceae.

#### Abstract

Medicinal plants are the main component in traditional medicine system and most rural people of Bangladesh still depend on folk medicine practitioners (Kavirajes) for their primary health care needs and medicinal plants used by folk medicine practitioners actually differ from region to region. The present study was designed to record the use of medicinal plants in different health ailments by the folk medicine practitioners of Sujanagar upazila(subdistrict) of Pabna district of Bangladesh. A structured survey questionnaire was prepared to obtain all the information, informed consent was obtained from the interviewer and the interview was taken in local language (Bangla) so that kavirajes could easily understand and provide necessary information. In our present study, we recorded total 63 plant species from 45 different families used by folk medicine practitioners of Sujanagar upazila in different illness. Liliaceae and Solanaceae appears the most prominent family in this study each having 3 plant species followed by Fabaceae and Acanthaceae having 2 species. Folk medicine practitioners use different parts of the plants including whole plant, leaves, fruits, barks, and rhizome. In this study, we found that leaves along with other parts of the plant had highest percentage of use (36.507%, 23 species) and only leaf holds the second position in its usage percentage (17.46%, 11 species). This study revealed that kavirajes of Sujanagar upazila preferred oral route (60.32%) of administration for their different medicinal formulations. There were also some formulations for topical application (11.11%) and found some plant based formulations were also for both oral and topical application (28.57%). This study represents many medicinal plants used by folk medicine practitioners of study area could be important source to isolate new bioactive compounds and novel drugs through extensive research in future.

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#### Introduction:-

Human being experienced to diseases and ailments frequently during their whole life span and the nature blessed them to provide remedy to utilize plants and such type plants which are extensively used to treat health ailments are called medicinal plants. Medicinal plants are the best natural resources of traditional medicine system (Tumapa et al., 2014). Still in this modern world, 80% of people in developing countries extremely relies on traditional system

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of medicine as medicinal plants are easily accessible and cheap (Dey et al., 2014). Today plant based traditional knowledge is a recognized tool in search for new source of drug (Sahu et al., 2014). Ethnomedicinal survey which deals with ethnobotany and traditional knowledge of uses of plants is the most effective method identifying new medicinal plant and bioactive compounds, thus further study on these plants can easily lead to discovery of new therapeutic entity.

Bangladesh has a rich history of practicing traditional medicine among which unani, ayurvedic and folk medicine are quite popular in this country. Folk medicine practitioners commonly known as Kavirajes are primary health care provider to significant rural areas of the country (Salahuddin et al., 2015, Rahmatullah et al., 2010). Such traditional knowledge of uses of plants in different health ailments can be useful for planning of effective use of natural resources and conservation of biodiversity and cultural knowledge. Therefore, the main objective of this study was to document the use of plants in traditional health care practice at Sujanagar upazila (Subdistrict) in Pabna district of Bangladesh.

## Methods:-

### Study area:-

This study was conducted at Sujanagar upazila (subdistrict) of Pabna district. Pabna is a district having an area of 2372.5 square kilometers falls within Rajshahi division of Bangladesh. The district is roughly located between 88°55' -89°42' E and 23°48' - 24°22' N and Sujanagar sub-district (Upazila) with an area of 334.4 square kilometers is a part of Pabna district and is located between about 89°23' - 89°38' E and 23°48' - 24°00' N. The main occupation is agriculture and the major crops are paddy, jute, wheat, sugarcane, oil seeds, onion, garlic, betel leaf and pulses. The climate of Pabna is moderate and yearly temperature falls within a minimum of 9.6°C to a maximum of 33.9°C; the average rainfall is 1872 mm (District Statistics: Pabna District, 2011).

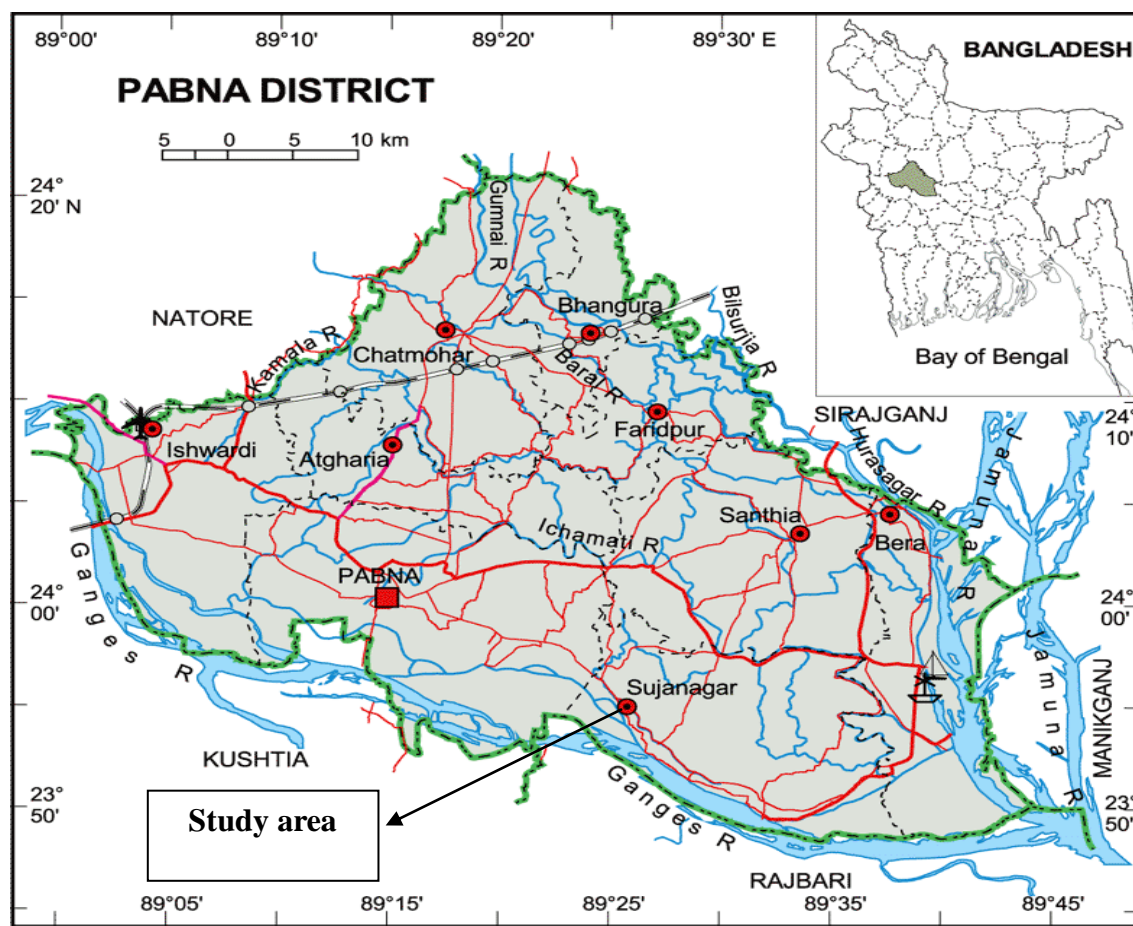


Figure 1:- Location map of Pabna district showing the study area.



**Data Collection:-**

A questionnaire was prepared to collect the required data on various aspects of the study. The questions were arranged systematically and presented clearly to be easily understood by the respondents. Data on age, sex, level of education, human diseases treated, local names of plants used, parts used, methods of remedy preparations, routes of administration, noticeable adverse effects of remedies, use of antidotes for adverse effects, indigenous knowledge transfer and other uses of the ethnomedicinal plant species were gathered during the interviews. The survey was conducted in Bangla language, which was spoken both by the folk medicine practitioners (Kavirajes) as well as the surveyor and is the national language of Bangladesh. Prior to the study, informed consents were obtained from the Kavirajes that the information may be disseminated both nationally and internationally and all the information obtained was cross checked. Total 15 kavirajes were participated in this study and data were collected from 17<sup>th</sup> August, 2016 to 24<sup>th</sup> August, 2016.

**Data analysis:-**

Responses of the completed questionnaires were numerically coded and analyzed. Microsoft Office Excel 2007 program was used to process all collected information. Descriptive statistics such as frequency and percentage distribution were used to analyze data. In addition, graphs and tables were used to interpret the findings.

**Results:-****Distribution of plants into families:-**

In this study, total 63 plant species including herb, shrub, and tree distributed into 45 different families were recorded that is used by folk medicine practitioners (Kavirajes) of Sujanagar upazila (subdistrict) of Pabna district of Bangladesh. Liliaceae and Solanaceae appears the most prominent family in this study, each having 3 plant species followed by Fabaceae and Acanthaceae having 2 species.

Plant species and families recorded in this study are illustrated in following table along with their usage parts and dispensing procedure to people.

**Table 1:- Scientific name, local name, family, parts used and indications.**

Scientific Name	Local name	Family	Part used	Consumption/dis pensing procedure	Route	Use
<i>Abroma augusta</i>	Ulotkombol	Sterculiaceae	Stem	Crushed stems are taken with sugar	Oral	Debility, Infertility in women due to problems in uterus
<i>Achyranthes paniculata</i>	Apang	Amaranthaceae	Root, Bark, Leaf	Paste of root bark and juice of roots are used, paste of leaves are applied to the affected area	Oral, Topical	Abortion, Eczema, Wound
<i>Aegle marmelos</i>	Bel	Rutaceace	Leaf, Fruit	Juice of young leaves, decoction of immature fruits and ripe fruits are taken.	Oral	Fever, Abscess, Indigestion, Dysentery
<i>Allium cepa</i>	Piaj	Liliaceae	Bulb	Juice of bulb/scales is used	Oral, Topical	Cough, Headache
<i>Allium sativum</i>	Roshun	Liliaceae	Bulb	Juice obtained from crushed bulb is taken orally.	Oral	Pain in the chest area- usually external muscle pain, Piles, Rheumatism
<i>Aloe barbadensis Mill</i>	Ghritokumari	Asphodelaceae	Leaf	Juice of leaves is applied to the affected area and leaf mucilage	Topical	Sexually transmitted diseases in men, Skin disorders,

				is used		Piles, Menstrual disease, Sexual problems
<i>Ananus comosus</i>	Anarosh	Bromeliaceae	Fruit, Leaf	Juice of unripe fruit, ripe fruit and leaves is used	Oral	Abortion, Cough, Diuretic, Fever, Helminthiasis.
<i>Andrographis paniculata</i> Nees.	Kalomegh	Acanthaceae	Leaf, Stem, Root	Root paste is taken with sugar for liver disorders. Leaf paste mixed with sugar is taken for helminthiasis. Stem is taken with sugar to reduce acidity.	Oral	Liver disorders, Helminthiasis, Gastric acidity
<i>Aristolochia indica</i> L.	Ishwarmul	Aristolochiaceae	Root	Crushed roots are used	Topical	Snake bite
<i>Artocarpus heterophyllus</i> Lamk.	Kathal	Moraceae	Bark, Leaf, Root	Juice made from young leaves, young roots and juice made from bark is also taken	Oral	Asthma, Itches, Diarrhea, Excessive menstrual discharge
<i>Asparagus racemosus</i>	Satamuli	Liliaceae	Whole plant, roots	An amulet containing whole plant is tied around the waist, Root paste mixed with sugar is taken for constipation	Oral, Topical	Constipation, Impotency in men.
<i>Averrhoa carambola</i>	Kamranga	Oxalidaceae	Fruits	Fruits are eaten	Oral	Jaundice, Fever, Piles
<i>Azadirachta indica</i>	Neem	Meliaceae	Leaf, Bark	Paste of the leaves is applied to the affected area and powder of bark is taken.	Oral, Topical	Rheumatic fever, Itches, Ring worm, Helminthiasis, Chicken pox.
<i>Blumea membranacea</i> DC.	Ukra, Uhra	Asteraceae	Leaf, stem	Juice from stem and leaves are applied to the scalp	Topical	Fever with mucus
<i>Cajanus cajan</i> (L).Huth	Aral	Fabaceae	Leaf	Young leaf juice is taken.	Oral	Jaundice, Diabetes
<i>Calotropis gigantea</i>	Akondo	Apocynaceae	Root, Leaf, Bark	Leaves are taken during pneumonia. Leaves are warmed in oil and applied to painful areas	Oral, Topical	Ulcer, Tooth pain, Chronic dysentery, Cold, Asthma, Pain
<i>Carica papaya</i> L.	Pepe	Caricaceae	Fruit, Latex	Fruit juice, Ripe fruits are taken and latex is used	Oral, Topical	Constipation, Itches, Indigestion, Liver disease, Diarrhea
<i>Cassia sophera</i> L.	Kolkashundia	Fabaceae	Whole plants	Paste of whole plant is applied to affected area	Topical	Eczema.
<i>Centella asiatica</i>	Chaka thankuni	Apiaceae	Leaf, Stem	Juice obtained from crushed leaves and stems is	Oral	Stomach disorders

				used.		
<i>Cissus quadrangularis L.</i>	Harjora	Vitaceae	Leaf, Stem	Paste of leaf and stem is applied to fractures	Topical	Bone fracture
<i>Coccinia grandis (L.) Voigt</i>	Telakucha	Cucurbitaceae	Leaf	Vegetables made from young leaves are eaten	Oral	Diabetes, Fever
<i>Curcuma longa L.</i>	Holud	Zingiberaceae	Rhizome	Raw rhizome is taken orally, paste of rhizome is applied to the affected area	Oral, topical	Wet dream, Scabies, Eczema
<i>Cuscuta reflexa</i>	Aloklata	Convolvulaceae	Leaf	Juice of the leaves is taken	Oral	Dysentery
<i>Cynodon dactylon</i>	Durva Ghash	Poaceae	Whole plant	Juice of the plant is taken with milk and applied to wound	Oral, Topical	Wounds, Acne.
<i>Datura metel L.</i>	Kalodhutura	Solanaceae	Leaf, Juice from stalk of fruits	Macerated leaves are taken with juice from stalk of fruits	Oral	Antidote to poisoning
<i>Eclipta prostrata</i>	Kalokeshi	Asteraceae	Leaf, Fruit, Flower	Paste made from leaves is used in affected area. Juice made from whole plants are used	Oral	Jaundice, Asthma, Gallbladder stone, Wounds, Itches, Skin diseases, Constipation.
<i>Ficus racemosa L.</i>	Dumur, Joggodumur	Moraceae	Fruits	Paste of fruit is taken with milk	Oral	Diabetes
<i>Garcinia cowa Raxb.</i>	Kaufol	Clusiaceae	Fruits	Fruits are eaten	Oral	Cold, Coughs
<i>Heliotropium indicum</i>	Hatishur	Boraginaceae	Root	Paste of root is mixed with sugar or honey	Oral	Wet dreams, STDs, Swelling of knees, Joint pain
<i>Hibiscus rosasinensis</i>	Joba	Malvaceae	Flower, Leaf	Paste of flower is applied on fresh cut and extract of flower is taken	Oral, Topical	Wound, Irregular menstruation.
<i>Ipomoea mauritiana Jacq.</i>	Bhuikumra	Convolvulaceae	Root	Root paste is applied to hair & penis	Topical	Blackening of hair in men and women, Erectile dysfunction
<i>Justicia adhatoda L.</i>	Basok	Acanthaceae	Leaf	Tablets made from paste are taken	Oral	Whooping cough
<i>Kalanchoe pinnata (Lam.) Pers.</i>	Patharkuchi	Crassulaceae	Leaf	Leaves are chewed with salt to dissolve gall bladder stones, Leaf paste is applied topically.	Oral, Topical	Remove gallbladder stones, Stomach pain, Headache
<i>Lawsonia inermis L.</i>	Mehedi	Lythraceae	Leaf	Juice from leaves is taken and paste from leaves are applied to the affected area	Oral, Topical	Cuts and wounds, Cracked skin, Diabetes, Burning sensations during urination.
<i>Leucas aspera</i>	Dondo kolosh	Lamiaceae	Stem	Crushed stems is	Oral	Diarrhea, Blood

				taken usually with parts of other medicinal Plants (Azadirachta indica, Coccinia cordifolia)		purifier, Loss of appetite, Indigestion, Skin disease
<i>Mangifera indica</i>	Aam	Anacardiaceae	Young leaves, Buds	Sap of young leaves is applied to the eyes, a syrup made from the buds along with Musa sapientum and ghee is taken orally	Oral, Topical	Conjunctivitis, Passing of sperm with urine.
<i>Mentha viridis</i>	Pudina	Lebiatae	Whole plant	Juice of the plants is taken	Oral	Metabolic disorder, Gastritis
<i>Mimosa pudica</i> L.	Lojjaboti	Mimosaceae	Leaf, Root, Fruit	Leaf juice are used externally and root and fruit juices are taken with honey	Oral, Topical	Piles, Boils, Dysentery, Bone injuries as painkiller, Tumor for early burst
<i>Moringa oleifera</i> Lam.	Sogina	Moringaceae	Leaf, Stem, Root	Juice obtained from crushed leaves and stems is taken.	Oral	Jaundice, Chickenpox, Paralysis, Fever
<i>Mormordica charantea</i> L.	Korola	Cucurbitaceae	Leaf, Fruit	Juice made from leaves is used. Curry made from unripe fruit are eaten	Oral	Chickenpox, Rheumatism, Diabetes
<i>Nigella sativa</i>	Kalojira	Ranunculaceae	Seed	Paste of seeds or seeds are taken along with water or honey and oil obtained from seeds are applied externally.	Oral, Topical	Rheumatic fever, Hypertension, Skin disease
<i>Nyctanthes arbortristis</i> L.	Sheuli	Verbenaceae	Leaf	Boiled and macerated leaves are taken	Oral	Fever due to metabolic imbalances in the body.
<i>Ocimum sanctum</i>	Tulsi	Lamiaceae	Leaf, Root	Juice of leaves are taken with honey	Oral	Rheumatic pain, Coughs, Constipation, Snake bite
<i>Ocimum tenuiflorum</i> L.	Kalo tulsi	Lamiaceae	Leaf	Juice of leaves is mixed with sugar and eaten	Oral	Coughs, Dysentery, Diuretics, Diabetes
<i>Paedaria foetida</i>	Gondho vadule	Rubiaceae	Leaf	Leaf juice is taken	Oral	Dysentery, Metabolic disorder, Cold, Arthritis
<i>Phyllanthus emblica</i> L.	Amlaki	Euphorbiaceae	Fruit	Ripe fruits and dried fruits are taken	Oral	Fatigue, Thirst, Burning sensation during urination, Biliary problem,

						Diabetes
<i>Plumbago zeylanica</i> L.	Kalpanath	Plumbaginaceae	Leaf	Paste of leaves is taken in empty stomach	Oral	Infertility in women
<i>Psidium guajava</i> L.	Piyara	Myrtaceae	Leaf, Fruit, Bark	Fruits and juice from leaves and stem barks are taken and decoction of leaves is taken.	Oral	Diarrhea, Debility, Bloody dysentery, Toothache, Worm
<i>Punica granatum</i>	Dalim	Lythraceae	Fruit, Leaf	Fruit and leaf juice is taken	Oral	Anemia, Erectile dysfunction, Osteoarthritis, Dysentery
<i>Rauwolfia canescens</i> L.	Boro chanda	Apocynaceae	Root	Paste of roots is applied to the affected areas and crushed roots taken.	Topical, Oral	Snake bite
<i>Rauwolfia serpentina</i> (L.) Benth. ex Kurz	Chotochanda	Apocynaceae	Root	Paste of roots is applied to the affected areas and crushed roots taken.	Topical, oral	Snake bite
<i>Solanum surattense</i> Burm. f.	Choroibaegun	Solanaceae	Fruits	Macerated fruits are taken	Oral	Tumor in humans, Swelling of throat in cattle.
<i>Syzygium cumini</i>	Jam	Myrtaceae	Bark, seed	Paste made from the bark is used externally, dry seed dust mixed with normal water taken	Oral, Topical	Dysentery, Wound, Diabetes
<i>Syzygium malaccense</i>	Jamrul	Myrtaceae	Roots	Macerated roots are taken	Oral	Helminthiasis.
<i>Terminalia arjuna</i>	Arjun	Combretaceae	Bark	Bark boiled in water is taken and paste of bark is applied	Oral, Topical	Chest pain due to heart disorders, Burning sensations during urination, Bone fracture.
<i>Terminalia bellirica</i> (Gaertn.)	Bohera	Combretaceae	Fruit, Seed	Fruits are eaten, oil extracted from the seeds and used	Oral, Topical	Loss of appetite, Headache, Rheumatic fever
<i>Terminalia chebula</i> Retz.	Haritaki	Combretaceae	Fruit	Ripe fruits and unripe fruits are used	Oral	Constipation, Indigestion, Rheumatism and Urinary disease.
<i>Tinospora cordifolia</i>	Pipolti	Menispermaceae	Stem	Plant juice and stem juice are taken	Oral	Swelling, Gastric trouble and ulcers
<i>Vitex negundo</i>	Nishinda	Lamiaceae	Root, Leaf	Tablets made from leaves are taken	Oral	To increase memory, Bloating, Rheumatism, Edema, Helminthiasis, Throat infections, Piles, Loss of

<i>Vitis pentagona</i>	Sonatola	Vitaceae	Flower, Leaf	Paste of flower is taken and leaf paste is taken with salt	Oral	appetite, Fever Rheumatic fever
<i>Withania somnifera</i> (L.) <i>Dunal</i>	Ashwagandha	Solanaceae	Fruits	Mixture of fruit, leaf and stem is taken	Oral	Sex stimulant
<i>Zingiber officinale</i> Roscoe	Ada	Zingiberaceae	Rhizome	Juice from rhizome is applied to the scalp daily.	Topical	Depression, Cough & cold
<i>Ziziphus jujuba</i> Mill	Boroi	Rhamnaceae	Leaf, fruits	Leaves and fruits are taken	Oral	Hypertension

A report described the wide therapeutic use of different plant families throughout the world and many of these plants from different families are also used in the study area (Joy et al., 1998).

#### Used plant parts:-

The various plant parts were used included whole plants, leaves, roots, barks, stems, seeds, fruits, and rhizome. The Kavirajes used different modes of preparation for using a particular plant or plant parts. Leaves along with other parts are most commonly used in different methods had highest percentage of use (36.507%, 23 species) and only leaf holds the second position in its usage percentage (17.46%, 11 species). The following table summarizes percent of curative plant parts used in different health ailments by kavirajes.

**Table 2:- Number of the medicinal plants with their curative parts and percentage.**

Serial No.	Curative plant parts	No. of species	Percentage (%)
1.	Leaf only	11	17.46
2.	Fruit	07	11.11
3.	Seed	01	1.59
4.	Root	06	9.52
5.	Whole plant	04	6.35
6.	Leaf with other parts	23	36.51
7.	Flower	00	0
8.	Bark	01	1.59
9.	Wood	00	0
10.	Rhizome	02	3.17
11.	Stem	03	4.76
12.	Bulb	02	3.17
13.	Bark & Seed	01	1.59
14.	Fruit & Seed	01	1.59
15.	Fruit & Latex	01	1.59

#### Percent of plant use in different Ailments:-

In this study, we recorded 63 different plant species from different plant family which are used by folk medicine practitioners in their regular practice. We calculated the percent of different plant used in different health ailments and summarized in the following table. (Table: 3).

**Table 3: Board categories of the ailments and percentage of plants used in each category**

Serial No.	Board categories of ailments	No of species	Percentage (%) of plant used
1.	Gastrointestinal disorders	33	52.38
2.	Cold and Flu related ailments	18	28.57
3.	Pain, Inflammation and Burning sensation	22	34.92
4.	Sexual problems	15	23.81
5.	Skin diseases	12	19.05
6.	Respiratory tract disorders	4	6.35

7.	Cardiovascular diseases	6	9.52
8.	Nerve disorders	4	6.35
9.	Oral and larynx health diseases	4	6.35
10.	Hepatic problems	8	12.70
11.	Antiseptic purposes	10	15.87
12.	Wound and Blood disorders	11	17.46
13.	Bone related ailments	15	23.81
14.	Renal diseases	3	4.76
15.	Miscellaneous	15	23.80

In this study, we revealed that most plant species were used in the treatment of different gastrointestinal tract disorders (33 species, 52.38%) followed by pain, inflammation and burning sensation (22 species, 34.92%), cold and flu related ailments (18 species, 28.57%). We also found that a single plant species or its different parts is being used in the treatment of many diseases. As a medicinal plant contains lots of chemical species, so a single medicinal plant or its different parts may have many therapeutic potential and that's why the total percentage of plants used in different diseases is more than 100 percent. Usages of plants to treat some diseases by kavirajes in our study area were also interesting.

#### Percent of administration routes of plant species:-

Folk medicine practitioners preferred oral routes of administration. In our study we found that, 60.32% (38 species) of their medicinal formulations were for oral route. Some of their formulations were for topical application (11.11%, 7 species). We also found some plant species formulations were for both oral and topical application (18 species, 28.57%).

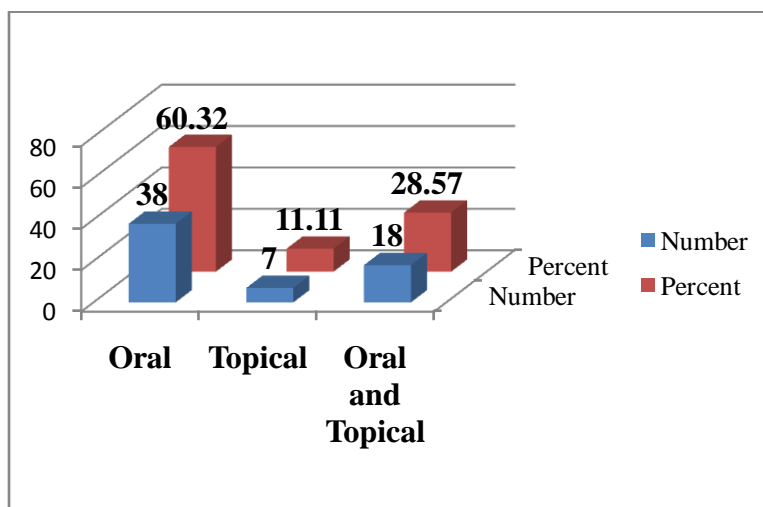


Figure 2:- Percent of routes of administration of different medicinal plant formulations.

#### Discussion:-

Plants have played a significant role in maintaining human health and in the treatment of different diseases. In our study, we recorded many medicinal plants used by the folk medicinal practitioners many of which have widely established medicinal value reported in many scientific journals and interestingly we found similar pattern of usage of medicinal plants in our study area.

Kavirajes of Sujanagar upazila of Pabna district frequently use *Justicia adhatoda* L.(Basok) in the treatment of cough and *Calotropis gigantea* (Akonda), *Eclipta prostrata* (Kalokeshi) in the treatment of asthma. It is reported in a review that the whole plant of *Justicia adhatoda* L is an ingredient of different cough formulation used in combination with Ginger (*Zingiber officinale*) and Tulsi (*Ocimum sanctum*) where it exerts its action as an expectorant and antispasmodic. The fluid extract and tincture were used in European medicine practitioners as an antispasmodic, expectorant and febrifuge (Dhankhar et al., 2011). Another study also reported broad spectrum antimicrobial activity of methanolic leaf extract of *Justicia adhatoda* L (Pa and Mathew, 2012).

Many review articles published authentic information regarding the medicinal properties of different parts of *Calotropis gigantean*. Various phytoconstituents like Calotropin, Calotoxin, Choline, D-arabinose, D-glucosamine,  $\beta$ -Sitosterol are isolated from different parts of this plant which may be responsible for its different pharmacological activity. It is reported that different parts of this plant have antimicrobial, anti-cancer, anti-pyretic/analgesic and anti-asthmatic potential (Quazi et al, 2013, Sharma et al, 2012, Parvin et al, 2014). Folk medicine practitioners of Sujanagar upazila of Pabna district use various plant species in the treatment of gastrointestinal disorder. In our study, we found indigestion is treated with *Leucas aspera* (Dondokolosh), *Terminalia chebula* Retz. (Horitoki), *Aegle marmelos* (Bel), *Carica papaya* L. (Pepe). Such activities of these plants are recorded in many ethnomedicinal system and folk medicine practitioners of Tripura of India also uses *Aegle marmelos* in the treatment of indigestion, dysentery, constipation (Das et al., 2012). We also found the use of *Carica papaya* L both in the treatment of indigestion and constipation by the folk medicine practitioners.

There are many literatures published about the main phytoconstituents curcumin isolated from *Curcuma longa* L which mainly responsible for its different medicinal property like anti-inflammatory and anticancer activity (Zari and Zari, 2015, Araujo and Leon, 2001). In this study we found that kavirajes frequently use this plant mainly in the treatment of eczema and scabies.

Rural people suffering from STD frequently visit to folk medicine practitioners for their treatment and in our study we found that kavirajes of our study area use *Ipomoea mauritiana* Jacq. (Bhuikumra), *Aloe barbadensis* Miller (Ghritokumari), *Heliotropium indicum* (Hatisur) in the treatment of STD. Researchers found antimicrobial activity of different crude extracts of these plant that may be responsible for this therapeutic potential and they becomes a promising source of new antimicrobial agents (Devi et al., 2012, Osungunna and Adedeji, 2011). *Abroma augusta* have many therapeutic potential like root and root barks are used as uterine tonic, used in the treatment of amenorrhea, dysmenorrhea, extracts of different parts of plant are reported to have anti diabetic, anti-inflammatory, wound healing, hypolipidemic, antifungal, antibacterial and insecticidal activity (Gupta et al., 2011). In our study, we found the use of this plant in the treatment of infertility. Kavirajes also use *Asparagus racemosus* (satamuli) in the treatment of impotency of men.

Kavirajes provide wide range to treatment option as primary health care practitioners and rural people frequently visit to them for their many health ailments. In our study we found the use of many medicinal plants dispensed to different health disorder and formulated in different way by the kavirajes. Medicinal properties of these plants are well established and we found the use of same medicinal plants in different health disorders. Plants contain wide range of phytoconstituents and such phytoconstituents are mainly responsible for their various medicinal properties.

### Conclusion:-

Knowledge about the medicinal properties of plants is usually transferred from generation to generation through informal educational system. Folk medicine practitioners are still playing a vital role in providing necessary remedy in this modern world and use of such plants in different health ailments are well established today. In our current study we recorded many plant species from different family which are also used by folk medicine practitioners of other parts of this country or even in other countries as well. Such documentation is very much necessary for preserving the knowledge and treatment pattern of different health ailments by folk medicine practitioners and such ethnomedicinal knowledge may lead to discovery of new drug compounds.

### References:-

1. Araujo, C., Leon, L. 2001. Biological Activities of *Curcuma longa* L. Mem Inst Oswaldo Cruz., 96 (5): 723-728.
2. Das, S., Choudhury, MD. 2012. Ethnomedicinal uses of some traditional medicinal plants found in Tripura, India. J. Med. Plants Res., 6(35): 4908-4914.
3. Devi, DL., Srinivas, B., Rao, N. 2012. An evaluation antimicrobial activity of *Aloe barbadensis* Miller (Aloe vera) gel extract. J Pharm Biomed Sci., 21 (03): 1-4.
4. Dey, AK., Rashid, MM., Millat, MS., Rashid, MM. 2014. Ethnobotanical survey of medicinal plants used by traditional health practitioners and indigenous people in different districts of Chittagong division, Bangladesh. Int J Pharm Sci Invent., 3(7): 01-07.



5. Dhankhar, S., Kaur, R., Ruhil, S., Balhara, M., Dhankhar, S., Chhill, AK. 2011. A review on *Justicia adhatoda*: A potential source of natural medicine. Afr. J. Plant Sci., 5(11): 620-627.
6. District Statistics: Pabna District, 2011. Statistics and Informatics Division, Bangladesh Bureau of Statistics. [http://www.bbs.gov.bd/WebTestApplication/userfiles/Image/PopCen2011/COMMUNITY\\_Pabna.pdf](http://www.bbs.gov.bd/WebTestApplication/userfiles/Image/PopCen2011/COMMUNITY_Pabna.pdf)
7. Gupta, B., Nayak, S., Solanki, S. 2011. *Abroma augusta* Linn f: A review. Der Pharmacia Sinica., 2 (4):253-261.
8. Joy, PP., Thomas, J., Mathew, S., Skaria, BP. 1998. Medicinal plants. Aromatic and Medicinal Plants Research Station, Kerala Agricultural University.
9. Osungunna, MO., Adedeji, KA. 2011. Phytochemical and antimicrobial screening of methanol extract of *Heliotropium indicum* leaf. J. Microbiol. Antimicrob., 3(8): 213-216.
10. Pa, R., Mathew, L. 2012. Antimicrobial activity of leaf extracts of *Justicia adhatoda* L. in comparison with vasicine. Asian Pac J Trop Biomed., S1556-S1560.
11. Parvin, S., Kader, MA., Chouduri, AU., Rafshanjani, MS., Haque, ME. 2014. Antibacterial, antifungal and insecticidal activities of the n-hexane and ethyl-acetate fractions of methanolic extract of the leaves of *Calotropis gigantean* Linn. J Pharmacogn Phytochem., 2 (5): 47-51.
12. Quazi, S., Mathur, K., Arora, S. 2013. *Calotropis procera*: An overview of its phytochemistry and Pharmacology. IJOD., 1(2): 63-69.
13. Rahmatullah, M., Ferdousi, D., Mollik, MAH., Jahan, R., Chowdhury, MH., Haque, WH. 2010. A survey of medicinal plants used by kavirajes of Chalna area, Khulna district, Bangladesh. Afr J Trad CAM., 7 (2): 91 – 97.
14. Sahu, PK., Masih, V., Gupta, S., Sen, DL., Tiwari, A. 2014. Ethnomedicinal plants used in the healthcare systems of tribes of Dantewada, Chhattisgarh, India. Am J Plant Sci., 5: 1632-1643.
15. Salahuddin, M., Rakib, HH., Biplob, A., Islam, MS., Foyasal, MK., Tanvir, RZ. et al. 2015. Medicinal plants used by a traditional ayurvedic practitioner at Asadnagar village in Narsingdi District, Bangladesh. J Pharmacogn Phytochem., 4(2): 269-275.
16. Sharma, R., Thakur, GS., Sanodiya, BS., Savita, A., Pandey, M., Sharma, A., Bisen, PS. 2012. Therapeutic potential of *Calotropis procera*: A giant milkweed. IOSR J Pharm Biol Sci., 4(2): 42-57.
17. Tumpa, SI., Hossain, MI., Ishika, T. 2014. Ethnomedicinal uses of herbs by indigenous medicine practitioners of Jhenaidah district, Bangladesh. J Pharmacogn Phytochem., 3 (2):23-33.
18. Zari, ST., Zari, TA. 2015. A review of four common medicinal plants used to treat eczema. J Med Plants Res., 9(24): 702-711.

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### RESEARCH ARTICLE

## DIAGNOSTIC VALUE OF CONVENTIONAL CYTOGENETIC ANALYSIS IN SELECTED CHILDREN WITH ATTENTION-DEFICIT HYPERACTIVITY DISORDER.

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ADHD, Pediatric psychiatry, karyotyping, chromosomal abnormalities.

#### Abstract

**Introduction:** Attention deficit hyperactivity disorder (ADHD) is a wide spread, highly heritable, disruptive, childhood-onset condition, the etiology and pathogenesis of which is poorly understood. ADHD in children have been associated with several cytogenetic aberrations. The most remarkable of these include; sex chromosome aneuploidies, fragile X syndrome, velocardiofacial syndrome, certain balanced translocations, and others. Some researchers have suggested that cytogenetic analysis should be considered in children with ADHD. However, most evidence to date suggests that these abnormalities are found with increased frequency in ADHD children with positive family history or abnormal clinical signs. **Objective:** The main goal of this study is to assess the potential diagnostic value of conventional cytogenetic analysis (karyotyping) in ADHD children with positive family history and / or abnormal clinical signs. **Method:** Blood samples were obtained from 19 ADHD children (13 boys) with positive family history and / or abnormal clinical signs, and analyzed for the presence of cytogenetic abnormalities using high resolution chromosomal banding. **Results:** three cases had chromosomal abnormalities. Two of them had numerical sex chromosome abnormalities; one had Klinefelter syndrome (47, XXY), while the other had triple X syndrome (47, XXX). The third case had balanced translocation as follow; [46,XY,t(4;21)(p16;q22.1)]. By comparing these findings with their respective prevalence among live births, there was highly significant statistical difference, which indicates high diagnostic value of karyotyping with these selection criteria. **Conclusions:** In the presence of abnormal clinical signs or positive family history, the cytogenetic assessments are indicated for children with ADHD as a component of investigations of this disorder.

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#### Introduction:-

With 5% prevalence, ADHD is among the most common psychiatric disorders in pediatrics. Moreover its symptoms usually continue throughout adulthood.<sup>1</sup>

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ADHD is described as a disorder of improper levels of attention and / or hyperactivity, which gives rise to hindrance in scholastic, family, and social circumstances. Regarding the clinical presentation, The Diagnostic and Statistical manual of Mental disorders, 5th edition (DSM-V) assigns three ADHD subtypes as: mainly inattentive, mainly hyperactive-impulsive and combined subtypes.<sup>2</sup>

ADHD is a heterogeneous disorder, regarding the clinical presentation, etiology, and pathophysiology. To date, no single factor has been identified as the cause of ADHD, also the etiology of ADHD is not completely clarified. There are developing confirmations for the contribution of hereditary and environmental factors in ADHD etiology.<sup>3</sup> Most of the ADHD environmental risk factors have negative impact on fetal and infantile wellbeing such as maternal smoking, maternal anemia, breech delivery, prematurity, low birth weight, hypoxic-ischemic encephalopathy, cocaine and alcohol exposure, meningitis, encephalitis, and head trauma.<sup>4</sup>

While ADHD is linked to genetic factors in about 80% of cases, molecular genetic studies suggest that the genetic architecture of ADHD is complex. Many studies show strong evidence for participation of several genes in the etiology of the ADHD, such as; The Dopamine D4 receptor (DRD4), The Dopamine 5 receptor (DRD5), and The Dopamine Transporter Gene (DAT, SLC6A3).<sup>5</sup>

Despite presence of significant number of syndromes associated with ADHD (include Prader-Willi, Klinefelter, Williams, velocardiofacial, Turner, fragile X, and others), these disorders are infrequently presented among ADHD-clinic patients. The prevalence of cytogenetic abnormalities was assessed in ADHD children with normal intelligence, and no significant difference from that expected in the general population had been found.<sup>4,6</sup>

So with lacking of positive family history or abnormal clinical signs, this expensive and time consuming test is not a routine for the children with ADHD.<sup>6</sup> However, no screening for the diagnostic value of cytogenetic analysis in a population of ADHD children with positive family history or abnormal clinical findings had been performed. The current exploratory study aims to assess the potential diagnostic value of conventional cytogenetic analysis (karyotyping) in ADHD children with positive family history and / or abnormal clinical signs.

## **Patients and methods:-**

### **Study design:-**

A cross-sectional study was conducted at the psychiatric department, El- Hussein Hospital, Al-Azhar University-Cairo, Egypt, over a period of 5 months from May to September 2016. Informed parental consent was obtained prior to enrollment in the study.

### **Study population:-**

A sample of 19 ADHD subjects aged between 5-18 years were consecutively enrolled. Each of them must fulfill at least one of the following criteria; 1) positive family history of a major neuropsychiatric disorder (ADHD, autism, mental retardation,...etc), or 2) abnormal clinical finding e.g. epilepsy, short stature, mental retardation, dysmorphic features,...etc. ADHD was diagnosed and categorized according to the DSM-V criteria for diagnosis and grading of ADHD.<sup>2</sup>

Cases that have typical phenotypic features of any specific syndrome or multiple congenital anomalies will be excluded from the study.

### **Methods:-**

All candidates were subjected to:

#### **History**

comprehensive history-taking including; Personal history (age, sex, residence, and school attendance), Perinatal history (complete obstetric and medical history of the mother stressing on prenatal, natal, and postnatal history, including intrauterine exposure to the teratogenic drugs), developmental history (including four major developmental milestones; fine motor, gross motor, social, and language), detailed family history of neurobehavioral disturbance (e.g. learning disability, language delay, autism, schizophrenia, or ADHD), and Medical history for major medical insults e.g. (CMV, meningitis ...etc).

**Clinical examination:-**

A detailed clinical examination was performed including; general examination, chest examination, cardiac examination, abdominal examination, and neurological examination.

**Intelligence quotient (IQ) assessment:-**

All the study cases were subjected to IQ assessment using the Arabic version of Stanford-Binet Intelligence Test (SBITA), the fifth edition.<sup>7</sup> Total IQ quotient was classified into: mentally retarded ( $\leq 67$ ), borderline intelligence (68-78), below average (79-88), average (89-110), above average (111-120), excellent (121-131) and genius ( $\geq 132$ ).<sup>7</sup>

**Conventional Cytogenetic analysis (Karyotyping):-****Sample collection and set up:-**

5 ml of venous blood were collected in heparinised vacutainers from every referred patient for a lymphocyte cell culture. Few drops of the sample were cultured in RPMI 1640 (Biochrom AG, Germany) medium supplemented with fetal calf serum, penicillin/streptomycin, Amphotericin B, and Phytohaemagglutinin (as a mitogenic agent), then incubated at 37°C for 72 h. The metaphases were arrested by adding a colchicine derivative (colcemid) (Euroclone) 2 hours prior to the harvest.<sup>8</sup>

**Harvesting:-**

At harvest, the culture solution is centrifuged at 800-1000 rpm for 8 minutes. Most of the supernatant of the tubes was discarded leaving only 0.5 ml for resuspension of the cells. This was done by gentle tapping of the tube at the bottom, 10 ml of hypotonic potassium chloride solution (0.56% KCl) was added slowly, incubated at 37 °C for 20 minutes, then centrifuged for 8 minutes at 800-1000 rpm, and the supernatant of the tubes was discarded.<sup>8</sup>

After that, 10 ml of freshly prepared fixative solution of a 3:1 mixture of methyl alcohol and glacial acetic acid is added, mixed gently by a clean glass Pasteur pipette and centrifuged for 8 minutes at 800-1000 rpm. The supernatant of the tubes was discarded, and the previous step was repeated twice with 10 ml then 5 ml of fixative solution respectively, until the supernatant becomes clear. Then, the culture tubes were left frozen.<sup>8</sup>

Chromosome staining and banding techniques were performed as described by Benn and Perle.<sup>9</sup> In every case, 20 cells were counted and at least 5 cells were analyzed, using two separate blood tubes from each patient. If there was any indication for mosaicism, in addition to the mentioned procedure, 200 metaphases were scanned again from that two separate blood tubes.<sup>10</sup>

All karyotypes had been performed using applied software and imaging system and were interpreted according to the International System for Human Cytogenetic Nomenclature (ISCN).<sup>11</sup>

**Statistical analysis:-**

Data were analyzed using IBM SPSS Advanced Statistics version 20.0 (IBM Corp., Armonk, NY, USA). Numerical data were expressed as mean, standard deviation, and range. Qualitative data were expressed as frequency and percentage. Chi-square test was used to examine the relation between the qualitative variables. The odd ratio (OR) is describing the strength of association or non-independence between two binary data values. Confidence interval (CI) is used to find the margins of accuracy given by a survey's sample size and results, for a chosen confidence level. The Z-value is a test statistic for Z-tests that measures the difference between an observed statistic and its hypothesized population parameter in units of the standard deviation. p-value < 0.05 was considered statistically significant.

**Results:-**

After reviewing 185 children with ADHD, consecutive enrollment of 19 cases in the study was done according to the inclusion criteria as follow; 10 cases had positive family history of major neuropsychiatric disorder [positive family history of; ADHD (6 cases), autism (3 cases), and mental retardation (1 case)], 8 cases had abnormal clinical findings [tall stature (1 case), short stature (1 case), cryptorchidism (1 case), mental retardation (2 cases), obesity (1 case), large head (1 case), and epilepsy (1 case)], and 1 case had both positive family history (autistic mother) and positive clinical findings (proband was mentally retarded). The age of the study population varied between 5 to 18 years of age (Mean  $\pm$ SD = 9.63  $\pm$ 4.09 years), and the IQ among them (Mean  $\pm$  SD = 76.63 $\pm$  12.16649). Other criteria of the study population are shown in table 1.

**Table (1):-** Criteria of the study population.

Criteria of the study population		n	%	X <sup>2</sup>	P-value
<b>Sex:</b>	<b>Female</b>	6	31.58	5.158	<b>0.023</b>
	<b>Male</b>	13	68.42		
<b>ADHD Sub classes</b>	<b>mainly inattentive</b>	1	5.26	51.859	<b>&lt;0.001</b>
	<b>mainly hyperactive-impulsive</b>	1	5.26		
	<b>combined</b>	17	89.47		
<b>Type of delivery</b>	<b>Vaginal delivery</b>	9	47.37	0.105	0.746
	<b>Caesarean section</b>	10	52.63		
<b>Birth weight</b>	<b>&gt;2.5 kg</b>	8	42.11	0.947	0.330
	<b>&lt;2.5 kg</b>	11	57.89		
<b>Duration of pregnancy</b>	<b>term</b>	3	15.79	48.976	<b>&lt;0.001</b>
	<b>preterm</b>	16	84.21		
<b>Perinatal insult</b>	<b>+ve</b>	13	68.42	5.158	<b>0.023</b>
	<b>-ve</b>	6	31.58		

Out of 19 patients that were karyotyped using conventional G-banding technique, three had chromosomal abnormalities. Two of them had sex chromosome aneuploidies SCA; one had Klinefelter syndrome (47, XXY) (fig. 1), while the other had triple X syndrome (47, XXX) (fig. 2). The third patient had structural autosomal abnormality in the form of balanced translocation between chromosome 4 and chromosome 21, with breaks in 4p16 and 21q22.1 [46,XY,t(4;21)(p16;q22.1)] (fig. 3).

Comparing our prevalence of major chromosomal abnormalities 3/19 (15.79%) to the expected prevalence of such abnormalities among live births 1/140 (0.714%)<sup>12</sup>, there is significant statistical difference (p=0.0059).

Also, our prevalence of sex chromosome aneuploidies 2/19 (10.53%) to the expected prevalence of these abnormalities among live births 1/426 (0.234 %) <sup>13</sup>, there is significant statistical difference (p=0.0017).

Furthermore, our prevalence of balanced translocations 1/19 (5.26%) to the expected prevalence of these abnormalities among live births 1/500 (0.2 %) <sup>14</sup>, there is significant statistical difference (p=0.0206).

**Table (2):-** Comparison between prevalence of chromosomal aberrations among the study population, and general population.

Karyotype results			Odd ratio	95% CI	z score	p-value
<b>Major chromosomal abnormalities</b>	<b>Study cases (+ve/total)</b>	3/19	0.0384	0.0038 to 0.3911	2.753	<b>0.0059</b>
	<b>General population (+ve/total)</b>	1/140				
<b>Sex chromosome abnormalities</b>	<b>Study cases (+ve/total)</b>	2/19	0.0200	0.0017 to 0.2315	3.131	<b>0.0017</b>
	<b>General population (+ve/total)</b>	1/426				
<b>Balanced translocation</b>	<b>Study cases (+ve/total)</b>	1/19	0.0361	0.0022 to 0.6000	2.316	<b>0.0206</b>
	<b>General population (+ve/total)</b>	1/500				

The subject with a chromosomal abnormality (47,XXY) was enrolled in the study due to unilateral left sided cryptorchidism, otherwise he was clinically indistinguishable from the other cases. He had below average intelligence (IQ = 85). He was delivered by caesarian section at 37 weeks of gestation , weighing 2,700 kg. Development during infancy passed with unremarkable events. He had combined subtype of ADHD. At the time of enrollment in this study, he was 7 years old and attended regular schools.

While the subject with a chromosomal abnormality (47,XXX) was enrolled in the study due to tall stature (height > 2SD), otherwise she was clinically indistinguishable from the remaining probands. She had below average intelligence (IQ = 88). She was delivered by normal vaginal delivery at 35 weeks of gestation, weighing 2,400 kg. Development during infancy passed within ordinary limits except for language delay, where her first plain word spoken after 20 months. Pubertal onset and sexual development occurs normally (Menarche at the age of 12.5

years). She had mainly inattentive subtype of ADHD. At the time of enrollment in this study, she was 15 years old and attended regular schools.

The only subject with autosomal structural balanced chromosomal aberration [46,XY,t(4;21)(p16;q22.1)] was enrolled in the study with positive family history of autistic mentally subnormal mother and the proband himself was mentally retarded (IQ = 65), without dysmorphic features. He was delivered by normal vaginal delivery at 37 weeks of gestation, weighing 2,800 kg. Development during infancy was globally delayed, where his first plain word spoken after 30 months, walking at 21 months. He had combined subtype of ADHD. At the time of enrollment in the study, he was 9 years old and attended special schools. The proband's parents accepted the option of being tested. The proband's mother has the same translocation.

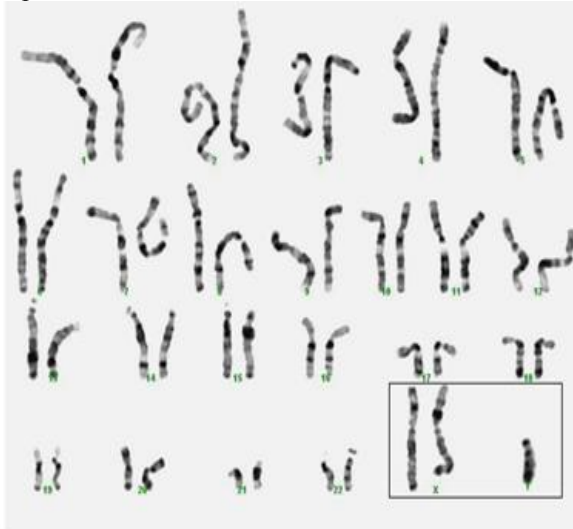


Figure (1)

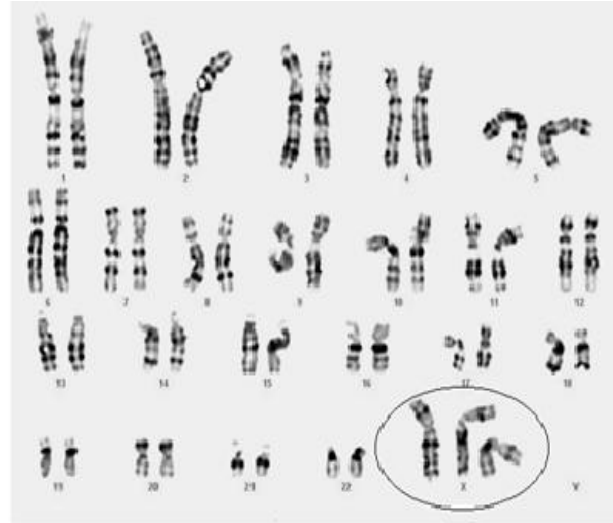


Figure (2)

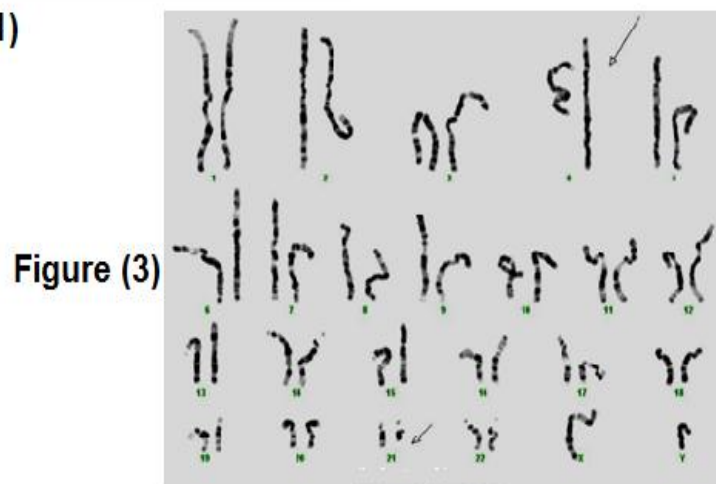


Figure (3)

**Figure (1):** Klinefelter syndrome (47, XXY).

**Figure (2):** triple X syndrome (47, XXX) (fig. 2).

**Figure (3):** balanced translocation [46,XY,t(4;21)(p16;q22.1)] .

### Discussion:-

Among 19 children with ADHD selected according to the inclusion criteria and enrolled in this study, 6 cases were females while 13 cases were males. Our study showed significant statistical difference between male to female ratio ( $p = 0.023$ ), which was also observed in several studies.<sup>15,16</sup> However, other studies lacked such difference.<sup>17,18</sup> The combined type was the commonest ADHD subtype among our cases 17/19 ( $p < 0.001$ ), where comparable results were described in several other studies.<sup>16,19,20</sup>

Also, we found statistically significant difference between the proportion of the ADHD children with history of premature delivery compared with term children ( $p < 0.001$ ). Analogous studies found that preterm children have higher risk for ADHD.<sup>21,22</sup>

Our results revealed statistically insignificant higher proportions of ADHD among low birth weight children ( $p = 0.330$ ), which make a matter of controversy with Valdimarsdottir et al. who reported statistically significant increased risk for ADHD associated with low birth weight.<sup>23</sup>

Significant statistical difference between ADHD children with positive past history of perinatal insult in comparison to those lacking such history had been reported in our study ( $p = 0.023$ ). Despite presence of several perinatal insults that associated with an increased risk for multiple neurologic sequelae, these perinatal risk factors have not been investigated sufficiently in relation to ADHD.<sup>24,25</sup>

In this study, conventional cytogenetic assessment identified three children with chromosomal aberrations; two cases with sex chromosome aberrations [one had Klinefelter syndrome (47, XXY), while the other had triple X syndrome (47, XXX)] and single case with balanced translocation between chromosome 4 and chromosome 21 [46,XY,t(4;21)(p16;q22.1)].

Our results were in agreement with the vast majority of studies that concerned with sex chromosomes aneuploidies SCA: (e.g. XXY, XXX, XYY, and XXYY). These studies stated that children and adolescents with SCA are at increased risk for ADHD symptoms.<sup>6,26</sup>

In agreement with our findings, Pacenza et al. stated that cryptorchidism is the commonest prepubertal presentation of Klinefelter syndrome.<sup>27</sup> Also, our findings were well matched with many studies that concerned with triple X syndrome; where their conclusions told that one of the early remarkable presentations among those patients is a tall stature, furthermore pubertal onset and sexual development are usually normal among them.<sup>28</sup>

Many cytogenetic literatures and studies stated that, about 6% of balanced translocation carriers have a wide range of behavioral disorders, and intellectual disability. A gene disrupted or deregulated at the breakpoint of the translocation is likely the cause of these symptoms. This is similar to our findings in our proband with balanced translocation.<sup>14</sup>

The break point of our proband [46,XY,t(4;21)(p16;q22.1)], which at 4p16 was described in other literatures and researches as one of the top three risk loci for Parkinson's disease.<sup>29</sup> Despite that no previous direct link between the 4p16 locus and the ADHD but, both Parkinson disease and ADHD originate from dopaminergic system disturbance<sup>5</sup>, which makes this locus one of the supposed gene loci for ADHD for further evaluation.

Despite absence of data about previous studies that screened for the diagnostic value of cytogenetic analysis in ADHD children with positive family history or abnormal clinical findings, Bastain et al. study assessed the prevalence of cytogenetic abnormalities in an unselected population of 100 children with ADHD and IQ >80. Only one subject had a clear cytogenetic abnormality (a girl with trisomy 47, XXX), and this did not differ significantly from that expected in the general population (1/426) ( $p = 0.21$ ). The conclusion of Bastain et al. study showed that in the absence of clinical signs or positive family history, these relatively expensive laboratory assessments are not clinically indicated.<sup>6</sup>

Regarding our prevalence of balanced translocations 1/19 (5.26%) to the expected prevalence of these abnormalities among live births 1/500 (0.2 %), there is statistically significant difference (odd ratio=0.0361, 95% CI=0.0022 to 0.6000,  $p = 0.0206$ ). Also, comparison between our prevalence (2/19) and the expected prevalence of sex chromosome abnormalities in general population (1/426) revealed highly significant difference (odd ratio=0.0200, 95% CI=0.0017 to 0.2315,  $p = 0.0017$ ).

As a whole, our prevalence of major chromosome abnormalities (3/19) in comparison to their expected prevalence in general population (1/140) was highly significant (odd ratio=0.0384, 95% CI=0.0038 to 0.3911,  $p = 0.0059$ ). These findings indicate high diagnostic value of karyotyping with this selection criteria.

In conclusion, This study indicates higher diagnostic value of karyotyping among ADHD children with positive family history and/ or abnormal clinical finding. Therefore, meticulous history taking, and examination by expert pediatrician are mandatory to select ADHD cases indicated for cytogenetic analysis.

#### Conflict of interest:-

The authors declare no conflict of interest.

#### Limitations:-

The low rates of the genetic abnormalities we studied is the primary limitation that can be applied to this study.

- We excluded ADHD children with typical phenotypic features of any specific syndrome or multiple congenital anomalies from the study, which decreased the likelihood of detecting chromosomal abnormalities.
- Sample size is low (only 19 cases). But we had reviewed 185 out clinic ADHD children to get these cases in respect of inclusion and exclusion criteria. In addition, we had limited resources regarding this expensive investigation.

#### References:-

1. Bădescu GM1, Filfan M, Sandu RE, Surugiu R, Ciobanu O, Popa-Wagner A. Molecular mechanisms underlying neurodevelopmental disorders, ADHD and autism. Rom J Morphol Embryol. 2016;57(2):361-6. PMID: 27516006
2. American Psychiatric Association. Diagnostic and statistical manual of mental disorders, 5th edition. Washington: American Psychiatric Association, 2013.
3. Thapar A and Cooper M. Attention deficit hyperactivity disorder. *The Lancet*. 2016Mar;387(10024):1240–50. DOI: [http://dx.doi.org/10.1016/S0140-6736\(15\)00238-X](http://dx.doi.org/10.1016/S0140-6736(15)00238-X)
4. Millichap JG. Etiologic classification of attention-deficit/hyperactivity disorder. *Pediatrics*. 2008 Feb;121(2):e358-65. doi: 10.1542/peds.2007-1332.
5. Faraone SV and Mick E. Molecular Genetics of Attention Deficit Hyperactivity Disorder. *Psychiatr Clin North Am*. 2010Mar;33(1):159–180. doi: 10.1016/j.psc.2009.12.004.
6. Bastain TM, Lewczyk CM, Sharp WS, et al. Cytogenetic abnormalities in attention-deficit/hyperactivity disorder. *J Am Acad Child Adolesc Psychiatry*. 2002;41:806–810. PMID:12108805
7. Farag S. The Stanford-Binet Intelligence Scale: Arabic Examiner's Handbook, 5th ed. Cairo: Anglo Egyptian Bookshop, 2011.
8. Gosden CM, Davidson C, Robertson M. Lymphocyte culture. In: Rooney DE, Czepulkowski BH, editors. *Human Cytogenetic: A Practical Approach*. 2nd Ed. 4th vol. New York, USA: Oxford IRL Press; 1992. pp. 31–54.
9. Benn PA, Perle MA. Chromosome staining and banding. In: Rooney DE, Czepulkowski BH, editors. *Human Cytogenetic: A Practical Approach*. 2nd ed. 4th vol. New York, USA: Oxford IRL Press; 1992. pp. 91–118.
10. Seabright M. A rapid banding technique for human chromosomes. *Lancet*. 1971;2:971–972.
11. Shaffer LG, Slovak ML, Campbell LJ. An International System for Human Cytogenetic Nomenclature (ISCN) Basel, Switzerland: S. Karger Publishers, Inc.; 2009.
12. Hsu LYF. Prenatal diagnosis of chromosomal abnormalities through amniocentesis. In: Genetic disorders and the fetus, 4th ed, Milunsky A (Ed), The Johns Hopkins University Press, Baltimore 1998. p.179.
13. Nielsen J, Wohler M. Chromosome abnormalities found among 34,910 newborn children: results from a 13-year incidence study in Arhus, Denmark. *Hum Genet*. 1991;87:81–83
14. Caroline Mackie Ogilvie; Paul N Scriven. "Meiotic outcomes in reciprocal translocation carriers ascertained in 3-day human embryos". *European Journal of Human Genetics*. European Society of Human Genetics. December 2002;10 (12): 801–806. doi:10.1038/sj.ejhg.5200895. PMID 12461686.
15. Amiri S, Fakhari A, Maheri M, Mohammad A. Attention deficit/hyperactivity disorder in primary school children of Tabriz, North-West Iran. *Pediatric Periapt Epidemiol* 2010;24:597-601.
16. Cardo E, Bustillo M, Servera M. The predictive value of DSM-IV criteria in the diagnosis of attention deficit hyperactivity disorder and its cultural differences. *Rev Neurol* 2007; 44: 19-22.
17. Kashala E, Tylleskar T, ElgeKayembe KT, and Sommerfelt K. Attention Deficit Hyperactivity Disorder Among School Children in Kinshasa, Democratic Republic of Congo, *Afr Health Sci* 2005; 5: 172-181.
18. Montiel-Nava C, Montiel-Barbero I, Peña JA. Clinical presentation of Attention deficit hyperactivity disorder as a function of the gender. *Invest Clin* 2007; 48:459-68.
19. Pelham WE, Fabiano GA, Massetti GM. Evidence-based assessment of attention-deficit hyperactivity disorder in children and adolescents. *J. Clin Child Adolesc Psychol* 2006;34: 449-476.



20. Possa A, Spanemberg L, Guardioli A. Attention-deficit hyperactivity disorder co-morbidity in a school sample of children. *Arq Neuropsiquiatria* 2005; 63:479-83.
21. Farooqi A, Hagglof B, Sedin G, Gothefors L, Serenius F. Mental health and social competencies of 10 to 12 year old children born at 23 to 25 weeks of gestation in the 1990s: a Swedish national prospective follow-up study. *Pediatrics* 2007;120:118 –133.
22. Delobel-Ayoub M, Arnaud C, White-Koning M, Casper C, Pierrat V, Garel M, et al. Behavioral problems and cognitive performance at 5 years of age after very preterm birth: the EPIPAGE Study. *Pediatrics* 2009; 123:1485–1492.
23. Valdimarsdottir M, Hrafnisdottir AH, Magnosson P. The frequency of some factors in pregnancy and delivery for Icelandic children with ADHD. *Laeknabladid* 2006; 92:609-614.
24. Lou H. C. Etiology and pathogenesis of attention-deficit hyperactivity disorder (ADHD): significance of prematurity and perinatal hypoxic-haemodynamic encephalopathy. *Acta Paediatrica*. 1996;85(11):1266–1271. doi: 10.1111/j.1651-2227.1996.tb13909.x.
25. Lindstrom K, Lindblad F, Hjern A. Preterm Birth and Attention-Deficit/Hyperactivity Disorder in Schoolchildren. *Pediatrics* 2011; 127: 858 -865.
26. Tartaglia NR, Ayari N, Huttaff-Lee C, Boada R. Attention-deficit hyperactivity disorder symptoms in children and adolescents with sex chromosome aneuploidy: XXY, XXX, XYY, and XXYY. *J Dev Behav Pediatr*. 2012 May;33(4):309-18. doi: 10.1097/DBP.0b013e31824501c8.
27. Pacenza N, Pasqualini T, Gottlieb S, et al. Clinical Presentation of Klinefelter's Syndrome: Differences According to Age *International Journal of Endocrinology*. Volume 2012, Article ID 324835. doi:10.1155/2012/324835
28. Tartaglia NR, Howell S, Sutherland A, Wilson R, Wilson L. A review of trisomy X (47,XXX). *Orphanet J Rare Dis*. 2010 May 11;5:8. doi: 10.1186/1750-1172-5-8.
29. Nagle MW, Latourelle JC, Labadorf A, Dumitriu A, Hadzi TC, Beach TG, Myers RH. The 4p16.3 Parkinson Disease Risk Locus Is Associated with GAK Expression and Genes Involved with the Synaptic Vesicle Membrane. *PLoS One*. 2016 Aug 10;11(8):e0160925. doi: 10.1371/journal.pone.0160925. eCollection 2016.

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### RESEARCH ARTICLE

#### THE ROLES OF LEADERS FOR SUSTAINABLE DEVELOPMENT OF ORGANIZATION

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#### Abstract

This article aims at studying the roles of leaders for sustainable development of organization, which include sustainable business development, quality development, merit development, cultural change development, and strategic development. The current paper finds that in order to create sustainable growth of business, profit and benefit of organization must be achieved ethically and legally. Sustainable business development depends on its response to the need of all stakeholders. Quality development is one of the most important factors which can guarantee a sustainable growth of an organization. Leaders should be adherent to merit and ethics, and be a good example of their followers. As change is constant and nothing is going without change, leaders must be able to manage cultural change appropriately with priority on services responded to the needs of customers, consumers, or public. Success of an organization is based on the good understanding of organizational environment and culture, marketing strategy, assessment of market trends, and analysis of competitors as well as social responsibility and social reward.

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#### Introduction:-

Leaders play a key role in the success of an organization. Good leaders are those who are knowledgeable, visionary, strategic, courageous, generous, and adherent to good ethics and virtue. William, James and Keith (1994) described that leaders are authority figures and role models in their companies. By setting a personal example of high ethical behavior, they can influence the others around them. Repeated studies over the years have arrived at the same conclusion that the behavior and ethical attitudes of an employees' boss are seen as the most important factors determining whether the employee will behave ethically or unethically on the job. Peter (2000) described that leaders have power and wield it to affect change in others. Leadership is an instrument of goal achievement in helping group members achieve their goals and meet their needs. This view includes leadership that transforms followers through vision setting, role modeling, and individualized attention. Nakai and Schultz (2003) identified the characteristics of a good leader that may consist of the following: (a) a good leader is visionary, (b) a good leader is courageous, (c) a good leader leads, follows, or gets out of the way, (d) a good leader is results-oriented, (e) a good leader has perspective, (f) a good leader is strategic, and (g) a good leader respects his or her people.

According to Buddhism, a good leader should consist of the following characteristics: (a) Endurance to physical and mental suffering, (b) Tolerance when being criticized, (c) Knowledge updater, (d) Being aware of things, (e) Having great endeavor and strong determination, (f) Being able to analyze situations, (g) Being able to put the right man on the right job, (h) Having kindness, compassion and fairness, (i) Be a problem shooter, (j) Be a friendship builder, and (k) Be a good communicator (Chakka. Ang., Chatuka. Ang., Pati. Dhi., & Dham. Khut; cited in Payutto, 2003).

Leaders must have a strong motivation and take full responsibility for both negative and positive outcome. They give credit for the success to followers and blame themselves when things go poorly. In this regard, Collins (2001) mentioned that level 5 leaders who have a strong motivation and dedicate themselves for the organization's success are necessary for organizational change in the age of competition. "Level 5" refers to a five-level hierarchy of executive capabilities, with level 5 at the top. Level 5 leaders embody a paradoxical mix of personal humility and professional will. They are ambitious, to be sure, but ambitious first and foremost for the company, not themselves. Level 5 leaders set up their successors for even greater success in the next generation; they look out the window to attribute success to factors other than themselves. When things go poorly, however, they look in the mirror and blame themselves, taking full responsibility. The comparison CEOs often did just the opposite - they looked in the mirror to take credit for success, but out the window to assign blame for disappointing results.

Leaders must have a leadership that is the power relationship existing between leaders and followers. Peter (2000) asserted that corporations want individuals who have "leadership abilities" because they believe these individuals provide special assets to their organizations. Fleishman (1991) views leadership as the focus of group processes; the leader is at the center of group change and activity and embodies the will of the group. Bass (1990) conceptualizes leadership from a personality perspective, which suggests that leadership is a combination of special traits or characteristics that individuals possess and that enables them to induce others to accomplish tasks.

Since leaders are the most important persons in organizations; success and failure of organizations mainly depend on the roles of leaders. This article focuses on the roles of leaders in various aspects such as the roles of leaders for sustainable business development, quality development, merit development, cultural change development, and strategic development.

#### **Purposes of research:-**

To study the roles of leaders for sustainable development of organization.

#### **Results:-**

##### **Sustainable Business Development:-**

The main purpose of business is to gain profit. However, in order to create sustainable growth of business, profit and benefit of organization must be achieved ethically and legally. Creating sustainability of business becomes the important goal of all businesses, starting from community business corporations to public business corporations. As business cannot be operated over the community objection, the interests of all stakeholders need to be given consideration by the company's managers. If their concerns are disregarded, stakeholders may damage the company's reputation or halt the company's operations. Yodthong, et al. (2012) mentioned that the sustainability of community business comes from the roles of leaders. Leaders must govern the business corporations with fairness and justice. Leaders must have good leadership characteristics, sacrifice and dedicate time and energy for organization, understand the ways of life, and be able to analyze the weakness and strength of the community. Moreover, they must be able to build collaboration with other people and create loyalty, unity and harmony of people in the community by applying good ethical principle in running business. Cheoravanon (2012) described that the sustainable growth of business depends on its response to the living organism. Business is alive, and must be operated to respond to the need of all stakeholders i.e. employees, business partners, and stockholders. Business should consider virtue and ethics as the most important factor leading to the sustainable development of the community and the country at large. According to Chutikorntaweasin, et al. (2016) described that the old businesses have to adapt themselves to develop, to grow, and to survive by generating the most wealth and profit, which is not an important thing to indicate the overall success; and Kaplan and Norton (1992; cited in Chutikorntaweasin, et al., 2016) mentioned that when the time of technology comes, it is very necessary for businesses to create value in the future through the investment about stakeholders. Channuwong (2014) found that in the current world of high competition, finding and retaining human talent has become a competitive battleground. Attracting, developing, and retaining individual with talent, skills, knowledge, and experiences sufficient to drive global business and solve social problems become the key strategies for creating sustainable growth of business.

Sustainable business comes from a well balance of benefits among each stakeholder. When the fit is good, it leads to create employee satisfaction and customer satisfaction and loyalty over the long run. Moreover, leaders must be able to help employees solve their physical and mental sufferings as these problems may lead to low productivity, inability to compete in the global markets, employees' morale deterioration, employees' strike, and job absenteeism. Leaders must figure out how to attract employees; how to train less educated and poorly skilled employees; and how to keep experienced employees when they have fewer opportunities for advancement. In addition, a well balance between physical and mental health of employees is a key strategy for sustainable business. This is because when employees are happy and satisfied with their jobs, they will help increase productivity to organization.

Brown (2005) described that business organization gaining advantage over competitors should not evaluate its performance by profit alone, but the evaluation should also cover a good relationship with customers, customer satisfaction and loyalty, new innovation, internal operation process, employees' knowledge and skill, and the ability of its human resources to work for sustainable profit. The concept of Balance Score Card (BSC) should be implemented to evaluate the efficiency, quality, innovation, and responsiveness to customer. In this regard, Samuel (2006) suggested that in order to create sustainable business, organization should be responsible for society in the following four aspects: (a) Economic responsibility, which includes production activity, service that responds to the need of consumers, job employment, fair payment of salary, and maintenance of staff security; (b) Life quality, which means that an organization should place great emphasis on life quality of society, for examples, producing high quality of products, fair treatment of employees and customers, and environmental protection; (c) Social capital, which means that an organization should consider the cost and human resources that organization uses to solve problems in society such as in education, merit activity, and art; and (d) Problem solving, which means that an organization should pay attention to social responsibility and improve its ability to solve social problem such as social participation in planning for community development over the long run, investigating the sources and origins of social problems and seeking for resolutions to those problems.

### **Quality Development:-**

In recent decades, there has been an intense debate regarding the role of leader in managerial work. Leaders must focus on quality development. Development with high quality is one of the most important factors which can guarantee a sustainable growth of organization. In the world of high competition, quality becomes a symbol of good reputation and credibility of organization. Channuwong (2010) found that the sustainability of organization is the result of high quality development. The important factor leading to the quality in development is the role of leaders.

Leaders must have dreams and be able to make the dreams come true. Moreover, leaders must have clear vision and strategy. They must be able to manage their resources effectively and take into account of product quality, service quality and work quality closely. Warren Bennis, Guru in leadership (cited in Brown, 2005), has set up the standard of social leaders in the future, which can be described as follows: Modern leaders are those who have their own stand points and tangible vision; persuade others to participate in the activities with practical, interesting and clear vision; and encourage the others to works on the assigned jobs with high quality standard. Achinsamajarn (2008) defined leaders with quality development as those who are able to increase moral of their followers, empower their groups, know how to improve creative ideas, pull out the talents of all group members to support their jobs, and practice in the principle of good governance. Good governance is the universal principle placing great emphasis on accountability, participation, law and legitimacy, transparency, morality, responsibility, effectiveness and efficiency which plays a key role for sustainable success and development of an organization.

In order to clarify the meanings of good governance, William, James, and Keith (1994) defined good governance as the development principles of the country, society, organization, institution and business with great emphasis on honesty, transparency, accountability, fairness, quality and efficiency as well as having general ethical and moral standard in order to increase the strength and sustainable growth of an organization. These definitions are relevant to the idea of Channuwong, (2010) which defined good governance as the principles of managing business effectively and ethically. It must be in accordance with philosophy of sufficiency economy in which organizational structure and code of ethics must be integrated in business operation. Good governance also includes a good relationship between board of directors, development team and stockholders with responsibility to all stakeholders.

### **Merit Development:-**

Merit is a symbol of human value. Those who are adherent to merit have more value than those who do not. Leaders must really know what is right and wrong, and what is appropriate and inappropriate. Leaders who practice in good

merit and ethics can be able to maintain their good reputation and become a good example of their subordinates. In Buddhism, merit is considered as righteousness. Everyone should sacrifice his wealth, organ and life in order to protect and maintain the righteousness. In this regard, there were Buddhist proverbs which stated that “Let a man sacrifice his wealth for the sake of his organ, let him sacrifice his organ for the sake of his life, but with respect to merit or righteousness, let him sacrifice his wealth, organ, life and all” (Khuddakanikaya, Jataka 28/147 cited in Thammasapa and Bunluetham Instituion, 1989).

Limsakdakul (2010) described that the sustainability of organizations depends on the characteristics of leaders; leaders must adhere to merit and ethics, be honest and apply ethics in development in the same way as His Majesty the King Bhumibol Adulyadej of Thailand expressed his first royal statement that “I will rule the land by virtue for the benefits and happiness of the Siamese people.” This statement should be considered as the model for administrators in private sector, public sector, and people at large. This virtue principle should be practiced and implemented by all Thai people. Channuwong (2014) described that there are six senses in human life i.e. eye, ear, nose, tongue, body and mind, which are needed to be developed by administrators. To be a good leader, he or she needs to use his or her own sense to screen, analyze, synthesize, distinguish each situation, and be able to apply his or her own wisdom in development appropriately. Leaders must be able to analyze which action is moral or immoral, ethical or unethical, and perform only the moral and ethical activities. Doing merits is a way leading to eternal happiness and peace.

Leaders should understand the principle of the four noble truths, which is the process of using wisdom to solve problem according to its causes and factors. In this principle, the wisdom of a person should be implemented to solve his or her problems. The principle of the four noble truths consists of the following: (a) the fact that there is suffering; (b) the fact that there is the cause of suffering, or origin of suffering; (c) the fact that there is the cessation of suffering, or extinction of suffering; and (d) the fact that there is the path leading to the cessation of suffering. The aforementioned principle can be implemented as development strategy for the success of organization with great emphasis on considering the cause and result of each problem (Anguttaranikaya Catukanipata cited in Payutto, 2003). Phradhammapidhok (2005) mentioned that in order to create a peaceful society, a leader must be a good example of followers, and must adhere to the following merit principles: (a) loving kindness, and friendliness, a leader should be gentle, kind and generous; (b) compassion, a leader should consider followers’ suffering as his or her own, and try to help them liberate from all kinds of physical and mental suffering; (c) sympathetic joy, a leader should be free from jealousy, and be delighted when followers are successful, or receive popularity or promotion; and (d) equanimity, poise and fairness, a leader should be free from bias and prejudice, be calm and be adhered to the justness and fairness. Buddhadasa Bikkhu (1957) described that the merit principles leading to success in all activities consist of the following four components: (a) will and aspiration; (b) effort and exertion; (c) thoughtfulness and active thought; and (d) consideration and reasoning.

#### **Cultural Change Development:-**

Leaders should understand the work culture of followers and be able to change it to increase more effectiveness in terms of product quality and service quality. Culture is the way we do things around here; it is the collection of overt and covert rules, values, and principles that guide organizational behavior and that have been strongly influenced by history, custom, and practice (Burke, 2001). Corporate culture is a blend of ideas, customs, traditional practices, a company’s values, and shared meanings that help define normal behavior for everyone who works in the company. There are five types of corporate culture which can be presented as follows: a caring climate, a law-and-code climate, a rule climate, and instrumental climate, and an independence climate (William, James and Keith, 1994). A caring climate concerns the good of all the people in the company as a whole. A law-and-code-climate expects people to comply with the law and professional standards over other considerations. A rule climate emphasizes on the rules and regulations of the company. An instrumental climate expects people to do anything to further the company’s interests, regardless of the consequences. An independence climate gives people freedom to be guided by their own personal ethics.

In the age of globalization, accelerating social and technological change requires leaders who do not merely manage change, but use it to gain competitive advantage. When things change, the structure and strategy of organization must be changed to conform to external changes. However, changing things that people in the organization get used to it for long is not an easy way, managers may confront with many resistances from inside and outside. Managers must be able to explain about change that it will lead to betterment and prosperity of organization. If managers do not have sufficient reasons to explain about change, change will be a tough and difficult task to do. Managers should

have enough leadership, clear vision and objective to motivate their people that only change can bring success, growth and prosperity to their organization; without change organization cannot survive and prosper. Philip and Robert (2000) asserted that the organizational change means servicing better and faster the needs of the customer, consumer, or public. Individuals can be trained to move toward a culture of continuous change, but the organization's way of doing things must also continuously reaffirm this norm of human behavior.

Sirisunhiran, et al. (2012) described that to better manage organizational energies, a strong culture offers a consistent set of implicit understandings that help in dealing with ambiguities of business politics and relationships. It is not only plant and equipment that can rust and deteriorate. Within human systems, values and norms, policies and practices, leadership and technologies can also lag or become obsolete. They may call for planned renewal when the people and their productivity are being undermined by outdated or archaic approaches or processes.

Corporate culture is dynamic, and leaders should not underestimate the adaptive changes necessary for survival. They should understand that the new organizational culture should enable people to spend their lives on something worthwhile that will outlast them, live a life of consequence without stress and undue cultural restraints, preserve for tomorrow what we can use up today, value the work as much as we did the work ethic and accept difference and appreciate similarities. The way people believe, think and behave in organization affects the productivity of organization. People in organization will explicitly represent the mission and strategies of the organization. As success of an organization mainly depends on corporate culture, thus, changing corporate culture should come together with changing organizational strategies (Michael, Courtland and John, 1999).

In the past, organizations had a close relationship with customers through face to face and personal touch. But, in the present, things change very quickly, the organizations use new technologies to communicate and disseminate the information to customers quickly and efficiently without personal touch. A decision making to do a business among each other is mainly based on a good reputation of each side. An online communication through internet and website plays an important role in business transaction of all organizations. The leaders of the organization and employees must learn how to use these new advance technologies to gain the advantages over competitors. The organizations may spend much money for training employees in technical skill and communicative skill.

Work culture must be changed to respond to current situations that customers hope for high quality products and rush service. The paradox of change is that it is inevitable and constant. It seems to have only two choices in the matter of change. We can direct the change or we can let change direct us. When change directs us, we are resistant, mad, not open to new ideas; we block our own growth, but probably out of innocence. We honestly do not know how to use change effectively. But, when we direct change, we will be able to be well prepared, and make a good plan to make change gradually. So, let change yourself at your discretion for your own prosperity and growth before the unavoidable situation forces you to change (Michael, Courtland and John, 1999). Organizations of the future will be excellent to the extent that maximize their human energy assets, and minimize their human energy losses. They must be able to capitalize on ad hoc, unstructured relationships among people, to cope effectively with uncertainty and accelerating change, and to cooperate in multicultural environments (Hessenbein, Goldsmith and Beckhard, 2001). New technologies are one of the most important factors for the success of each organization. The organization that neglects using these new technologies cannot compete in the global market (Pringpuangkaew, 1999).

#### **Strategic Development:-**

Strategic development is a positioning of the organization in its competitive environment and then formulating and implementing strategy. Managers must develop and maintain a keen understanding of the environment, in which their organization operates, from general economic conditions to the specific actions of competitors. If managers ignore or misjudge an important component of the organizational environment, any number of problems can result. Managing an organization's strategies includes analyzing environment, setting goals and objectives, and formulating and implementing strategies. When these multiple strategic processes are effectively integrated and managed, an organization is well positioned for long-term survival and prosperous operations.

In order to survive and to prosper, organizations need to manage their strategies, structure, and behavior carefully. Channuwong (2014) described that success of an organization is based on the good understanding of organizational environment and culture, marketing strategy, assessment of market trends, and analysis of competitors as well as social responsibility and social reward.

Leaders should understand the current environments surrounding their business situations. They should be able to think outside the box, predict the future outcomes precisely, and be able to develop appropriate strategies that are responsive to the situational changes. Strategy is about choice, which affects outcomes. In situation of the world today, the leaders must find the ways of success that fit their organizations. Although there is no one best strategy for using in all organizations, but finding the fit one is the leaders' duty and responsibility. Phillip and Robert (2000) stated that there must be a fit between people and their organizational culture if synergy is to occur, effective global leaders will direct more effort toward promoting that match.

Since change is constant and unavoidable, coping with change appropriately becomes the most important role of modern leaders. Leaders can cope with change effectively by means of farsightedness, strategic planning and development. One strategy is to carefully recruit and select knowledgeable and skillful personnel who are comfortable to work in the company, and then acculturate them to a strong culture. Another strategy is to adapt the organization to its people, especially in terms of a particular place or time.

Effective leaders must be able to anticipate resistance, diagnose it, and then manage it, or incorporate it into the system. The global managers should be sources of innovation, and skillful in managing change. Their revision might include a goal of learning to be knowledgeable and comfortable as possible wherever they are located. Within an organization, the initial concern would be to examine the change possibilities in ten categories:

1. Structure: the system of authority, communication, roles, and work flow.
2. Vision: clear direction, leading to go through for the same purposes.
3. Strategy: a plan of action designed to reach a particular goal.
4. Leadership: ability to motivate and lead people in organization
5. Technology: problem solving mechanisms, tools, and computers.
6. Tasks: activities accomplished, such as manufacturing, research, and service.
7. Processes: techniques, simulations, methods, such as development information systems.
8. Environment: internal or external atmosphere.
9. People: personnel or human resources involved; put the right man on the right job.
10. Culture: the way we do, act, and perform to offer better service and quality (William, James and Susan, 2001).

By practicing skill in planned change, leaders not only facilitate people's preparation and acceptance of change, but also reduce stress and energy waste. Maximum two-way communications about the proposed change can create the necessary readiness for its eventual implementation and defuse the negative impact of sudden changes. While proposing innovations, leaders can endeavor to reduce the uncomfortable threat of those involved. Thus, negative reactions like apathy or sabotage, protest or revolt can be minimized. Helping people become open to change and realize its benefits will facilitate change to become a much easier, more graceful process. And finally, change doesn't have to be painful (Louis and David, 1993).

### **Discussions and Conclusions:-**

Leaders need to understand and analyze the impact of culture on organizations. Furthermore, they should lead in influencing cultural change within their institutions. When a group of people formulates an organization, its culture reflects that of the larger community, and impacts behavior both within and without enterprise (William, James and Susan, 2001). The human and material energy exchanged through the organization is affected by culture, which may foster or undermine productivity and profits. Organizational culture may motivate or obstruct high performance (Burke, 2001).

The sustainability of organizations depends on the characteristics of leaders; leaders must adhere to the virtue and ethics, be honest and apply ethics in development. Leaders must have good leadership characteristics, sacrifice and dedicate time for organization; they should understand the ways of life, and be able to analyze the weakness and strength of community.

Quality development is one of the most important factors which can guarantee the sustainable growth of an organization. Quality becomes a symbol of good reputation and credibility of an organization. Customers are satisfied with the high quality products and services. Thus, quality is one of the most influencing indicators of customer satisfaction and loyalty. Merit is a symbol of human value. Leaders should be adherent to merit, virtue and ethics. In Buddhism, merit is considered as righteousness, which everyone should sacrifice his or her wealth, organ

and even life for the sake of maintaining the righteousness. Leaders should focus on the principle of the four noble truths which places great emphasis on investigating the causes and factors of situations, and using reasoning wisdom to solve each problem according to its causes and factors. Leaders should be able to analyze the current situations, think outside the box and be able to predict the future outcomes. Additionally, they need to develop appropriate strategies that are responsive to the situational changes.

Today's managers operate in a global environment that has changed more rapidly and extensively than any other period in human history. In order to survive and prosper, leaders so not only need new skills for coping with change, but must learn to build an environment that is open to dynamic change within their systems, as well as within the life-styles of their colleagues and themselves. Although the outlooks on change and the roles of leaders are culturally conditioned, leaders should realize that the new work culture worldwide requires them not only to be open to change, but also to build it into work environments and social systems. Thus, we must stay relevant in meeting human needs by creating new markets, processes, products, and services as well as maintaining employee satisfaction and loyalty (Bass, 1985).

Change is constant; nothing is going without change. Therefore, learning how to cope with change effectively is what the Buddha taught. The benefit of change is that we have an opportunity to make situations better, rather than to adhere to the old tradition which may be obsolete and out of date any time in this competitive age. Therefore, the global managers should be a source of innovation, and be skillful in managing change.

Leaders need to understand the general systems theory, which explains that all living organisms or systems interact with, and are affected by other forces in their host environments. The key to survival is the ability to adapt to be responsive to the changing conditions in the environment. For modern business corporation, systematic thinking provides a powerful tool to help managers appreciate the relationships between their companies and the rest of the world (William, James and Keith, 1994).

In the Buddhist concept, nothing can last forever; everything happens, exists at one moment and comes to an end. Change is constant and is expected to happen anytime and anywhere. It is the same as corporate culture and strategies that need to be changed from time to time. When the world and situations change quickly, organizational cultures and strategies need to be changed in order to cope with changing situations for the success, survival and prosperity of organizations in the age of competition. In this regard, leaders play a key role in changing organizational cultures and strategies for sustainable development of organization.

## References:-

1. **Achinsamajarn, A. (2008):** Development Theory According to Western Concepts. Bangkok: Panyachon Publishing
2. **Burke, W. (2001):** Organizational Development. Boston: Wesley.
3. **Bass, B. (1985):** Handbook of Leadership: A Survey of theory and research. New York: Free Press.
4. **Bass, B. (1990):** Bass and Stogdill's Handbook of Leadership: A Survey of Theory and Research. New York: Free Press.
5. **Brown, T. (2005):** A Collection of Modern Development Concepts. Bangkok: Pearson Education Indo-China.
6. **Buddhadhasa Bikkhu. (1957):** The Right Learning of Dharma. Bangkok: Mental Health Publishing.
7. **Channuwong, S. (2010):** The Use of Meditation for Getting Insight and Improving Wisdom within: An Effective Strategy for Modern Managers and Businessmen. Journal of Sahasart, 9(1): 88-100.
8. **Channuwong, S. (2014):** Buddhist Approaches to Managing Stress and Improving Mental Health. University of the Thai Chamber of Commerce Journal, 34 (2): 1-17.
9. **Cheoravanon, T. (2012):** Speaking with CP from Peter Drucker, a Development Kuru to Thanin, an Owner of Modern Development Concept. Retrieved on 10 December 2012 from <http://www.cpthailand.com/Default.aspx?tabid=129&articleType=ArticleView &articleId=42>.
10. **Chutikorntaweessin, O., Makingrilas, J., Lamsutthi, V., Sangthong, N., and Phongphaew, R. (2016):** The Causal Relationship between the Components of Social Entrepreneur and Economic and Social Security. International Journal of Advanced Research, 4(5): 470-474.
11. **Collins, J. (2001):** Good to Great: Why Some Companies Make the Leap...and Others don't. New York: Harper Collins.
12. **Fleishman, A. (1991):** Leadership. London: Sage.



13. **Hessenbein, F. Goldsmith, M. and Beckhard, R. (2001):** The Leader of the Future: New vision. San Francisco: Jossey-Bass.
14. **Limsakdakul, V. (2010):** Good Corporate Governance and Code of Conduct. Bangkok: Tipco Group.
15. **Louis, E. and David, L. (1993):** Contemporary Business. Orlando, FL: The Dryden Press.
16. **Michael, H. Courtland, L. and John V. (1999):** Business Today. New Jersey: Prentice Hall, Upper Saddle River.
17. **Nakai, P. and Schultz, R. (2003):** The Mindful Corporation: Liberating the Human Spirit at Work. Long Beach, CA: Leadership Press.
19. **Payutto, P. (2003):** Dictionary of Buddhism. Bangkok: Mahachularlongkorn Buddhist University.
20. **Phradhammapidhok. (2005):** The Teachings of the Lord Buddha. Bangkok: Dhammasara Publishing.
21. **Phillip, R. and Robert, T. (2000):** Managing Cultural Differences. Houston, TX: Gulf Publishing.
22. **Peter G. (2000):** Leadership Theory and Practice. London: Sage.
23. **Pringpuangkaew, S. (1999):** Leadership. Bangkok: Matichon Publishing.
24. **Samuel, S. (2006):** Modern development. Bangkok: Pearson Education Indo-China.
25. **Sirisunhiran, S, Amornwatana, J., Sornsri, G., Sajjarax Dhirathiti, N. and Kanjanapongtorn, A. (2012):** A Measurement of Learning Organization of Mahidol University. Journal of Sahasart, 11(1): 119-151.
26. **Thammasapa and Bunluetham Instituion. (1989):** Buddhist Proverbs in Pali and English Language. Bangkok: Thammasapa Publishing.
27. **William, G. James, M. and Susan, M. (2001):** Understanding the Business. Boston: Times Mirror.
28. **William, C. F. James E. P. and Keith D. (1994):** Business and Society: Corporate Strategy, Public Policy, and Ethics. New York: McGraw-Hill.
29. **Yodthong, T., Chutikorntaweessin, O., Ladnongkun, V., Chanchongrob, N. and Preeprem, T. (2012):** The Model for Sustainable Economy of Local Community of Handmade Quilt Handicraft in Supanburi Province, Thailand. European Journal of Social Sciences, 35(4): 560-567.

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### RESEARCH ARTICLE

#### ASSESSMENT OF AWARENESS OF MEDICAL STUDENTS IN THE CLINICAL PHASE IN KSAU-HS, COM, RIYADH TOWARDS ZIKA VIRUS

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#### Abstract

To assess the level of awareness of medical students in clinical years regarding Zika Virus, and to compare the level of awareness among male and female student.

This is a cross sectional survey of medical students in the clinical years in KSAU-HS, Riyadh, College of Medicine. Assessment was done by a self-administered questionnaire, and data entry analysis was done by using SPSS version 20.

Of the 152 participants out of 293 students, 114 were male (75%) and 38 were female (25%). 29 out of 152 reported that they had never heard of the virus before (19.1%). 36 (29.3%) of participants chose an infected Aedes species mosquito's bite, 40 (32.5%) chose that maternofetal transmission occurs during pregnancy, and only 9 (7.3%) chose that it can be transmitted through sexual contact. When asked about previous Zika disease outbreaks, 76 (61.8%) students said that they have heard of the 2015 Brazil outbreak, 6 (4.9%) students said that they had heard about the 2013 French Polynesia outbreak, and not a single student said that they had heard about the 2007 Yap outbreak. In conclusion, a low level of knowledge regarding Zika virus was found amongst medical students especially when compared to their knowledge of MERS-COV.

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#### Introduction:-

Zika virus is a single stranded RNA virus of the Flaviviridae family and the genus Flavivirus. It was first identified in 1947 in rhesus macaque monkeys in the Zika forest of Uganda. [1] Since then, reports of human cases were infrequent until an outbreak in 2007 in the island of Yap occurred where 49 confirmed serologically over a 4 month period and, over three years, an estimated 73% of the island's population were infected. [1] Two other outbreaks occurred afterwards, first in 2013 in French Polynesia with 294 confirmed cases over 10 weeks and more recently in May 2015 in Brazil where the Brazilian Ministry of Health estimates that the number Zika infections since the outbreak began is 0.5 – 1.5 million as of the 22<sup>nd</sup> of January 2016. [1-2]

The vector by which Zika virus is transmitted is the Aedes mosquito. Other confirmed modes of transmission include maternofetal, perinatal, and sexual transmission. [1, 3] The symptoms of Zika infections include fever, skin

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rashes, conjunctivitis, muscle and joint pain, malaise, and headache which usually last 2 – 7 days and are mainly mild, as such; no specific treatment is required. Presently, there is no vaccine for the Zika virus. Microcephaly and Guillain-Barré syndrome are potential complications of Zika virus infection. [3]

Based on what has been mentioned and since medical students are future physicians who are supposed to play an effective role in spreading awareness regarding Zika Virus in the community and seeing how rapidly the most recent outbreak has spread and the huge number of people infected, the study is aimed to assess the awareness and background knowledge of medical students at King Saud Bin Abdulaziz University for Health Sciences' (KSAU-HS) Riyadh College of Medicine and specifically targeting those in the clinical years regarding Zika Virus.

#### Methods:-

This is a cross sectional survey of all male and female medical students (approx. 293) in the clinical years (Fifth and sixth year medical students) at the College of Medicine (COM) of King Saud bin Abdulaziz University for Health Science (KSAU-HS) Riyadh, Saudi Arabia. Awareness of medical students regarding Zika Virus was assessed by a self-administered questionnaire and data entry analysis was done by using SPSS version 20.

#### Results:-

Out of 293 students in the clinical years, 152 participated in our study. Of the 152 participants, 114 were male (75%) and 38 were female (25%), while 84 were fifth year medical students (55.3%) and 68 were sixth year medical students (44.7%) (Table 1). 29 out of 152 reported that they had never heard of the virus before (19.1%).

Of the 123 students who have heard of the virus, when presented with multiple possible modes of transmission and spread of the virus (more than 1 answer can be chosen), 36 (29.3%) chose an infected Aedes species mosquito's bite (daytime biter), 40 (32.5%) chose that maternofetal transmission occurs during pregnancy, and only 9 (7.3%) chose that it can be transmitted through sexual contact as seen on table 2 which also includes the frequencies of the incorrect choices. When presented with multiple possible symptoms and signs of Zika infection (more than 1 answer can be chosen), 49 (39.8%) chose coughing, 16 (13.0%) chose joint pain, 22 (17.9%) chose conjunctivitis, and 37 (30.0%) chose sore throat as seen on table 3 which also includes the incorrect symptoms presented to the students and the number of times each symptom was chosen.

When presented with eleven knowledge assessing questions which include multiple choices in each question where only 1 choice is correct per question, the most correctly answered question was "Which of the following is a known complication of Zika virus" where 58 (47.2%) students answered Microcephaly which is the correct answer. The second most correctly answered question was "Is there a vaccination for Zika virus disease" where 52 (42.3%) students answered "No" which is the correct answer. The third most correctly answered question was "How is Zika disease infection treated" where 45 (36.6%) students answered "Supportive" which is the correct answer. All knowledge assessing questions and the percentage of correct answers for each question can be seen on Table 4.

When asked about previous Zika disease outbreaks, 76 (61.8%) students said that they have heard of the 2015 Brazil outbreak, 6 (4.9%) students said that they had heard about the 2013 French Polynesia outbreak, and not a single student said that they had heard about the 2007 Yap outbreak (Table 5).

The students were graded for each question and for the entire questionnaire according to their correct answers; however, no statistically significant difference was found between the students' grades when compared by age, gender, and medical year (Table 6).

**Table 1:-** Demographics.

		N	%
Age (Years)	22	41	27.0%
	23	63	41.4%
	24	22	14.5%
	25+	26	17.1%
Gender	Male	114	75.0%
	Female	38	25.0%

Medical year	Sixth Year	68	44.7%
	Fifth Year	84	55.3%
Have you ever heard of Zika virus	No	29	19.1%
	Yes	123	80.9%

**Table 2:- Spread and Transmission**

	Correct	N	%
Infected Aedes Species mosquito's bite (daytime biter)	Yes	36	29.3%
Infected Anopheles species mosquito's bite (nighttime biter)	No	27	22.0%
Air droplet	No	15	12.2%
Mother to fetus during pregnancy	Yes	40	32.5%
Breast feeding	No	7	5.7%
Sexual Contact	Yes	9	7.3%
Skin contact	No	2	1.6%
I do not know		40	32.5%

**Table 3:-Symptoms**

	Correct	N	%
Fever	Yes	49	39.8%
Coughing	No	19	15.4%
Joint pain	Yes	16	13.0%
Vomiting	No	14	11.4%
Conjunctivitis	Yes	22	17.9%
Sore throat	No	22	17.9%
Rash	Yes	15	12.2%
Diarrhea	No	16	13.0%
I don't know		64	52.0%

**Table 4:-General Knowledge Assessing Questions**

	Correct	N	%
What is the virus genera	Flavivirus	12	9.80%
What is the virus genome	Single stranded RNA	6	4.90%
What is the severity of the symptoms	Mild	20	16.30%
What is the estimated duration of the symptoms	2 - 7 days	7	5.70%
What is the mortality rate of Zika disease	No reported death	11	8.90%
Which of the following is a known complication of Zika virus	Microcephaly	58	47.20%
When was the virus first discovered	in 1947	4	3.30%
Where was the first discovered	Africa	26	21.10%
The first human case of Zika virus was detected in	in 1952	7	5.70%
How is Zika disease infection treated	Supportive	45	36.60%
Is there a vaccination for Zika virus disease	No	52	42.30%

**Table 5:- Outbreaks**

		Count	%
Yap in 2007	No	123	100.0%
	Yes	0	0.0%
French Polynesia in 2013	No	117	95.1%
	Yes	6	4.9%
Brazil in 2015	No	47	38.2%

	Yes	76	61.8%
I do not know	No	79	64.2%
	Yes	44	35.8%

**Table 6:-** Grade Summary and Comparison

Variable	Category	SP(Out of 8)		SM(Out of 9)		KN(Out of 11)		Total(Out of 28)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age (Years)	22	4.1	2.6	3.2	3	2.4	1.7	9.7	5.5
	23	3.2	2.9	2.7	3	1.8	2	7.7	6.4
	24	4.3	2.8	2.1	2.7	2.2	2.6	8.5	5.4
	25+	3.7	2.4	2.1	3	1.7	1.2	7.5	4.8
	P-value	0.359		0.464		0.396		0.401	
Gender	Male	3.4	2.8	2.6	3.1	1.9	1.9	7.9	6
	Female	4.3	2.3	2.8	2.5	2.4	1.6	9.6	4.8
	P-value	0.066		0.689		0.141		0.146	
Medical year	Sixth Year	3.6	2.7	2.6	2.9	2	2.2	8.2	5.9
	Fifth Year	3.7	2.7	2.7	3	2	1.6	8.4	5.7
	P-value	0.816		0.977		0.858		0.855	

**Discussion:-**

Even though Zika virus has been identified in Africa since 1947, its most recent outbreak in Brazil affecting the lives of many has brought it to the center of attention. In that light, serious measures need to be taken in order to spread awareness regarding this virus in case of a local outbreak, especially since more cases are reported in areas outside Brazil including Germany, France and United States of America. Since medical students play a major role in public education and are future health care providers, this study was done in order to assess the knowledge level of Zika virus amongst medical students in their clinical years in terms of basic science, symptoms, diagnosis, treatment and preventive measures.

This study included 152 male and female medical students 75% and 25% respectively in their fifth or sixth medical years. 19.1% of our population never heard of Zika virus. When comparing this result to a study conducted by Al-Mohrej, measuring level of awareness of MERS-COV which showed only 3% never heard of MERS-COV, we find significant difference. [4] In addition, when asked about modes of transmission, 32.5% of our population didn't know how the disease is spread. This result was compared to Al-Mohrej sample which showed only 2.9% didn't know how the disease is transmitted compared to 32.5% in our study. Out of the remaining students, 32.5% answered correctly with maternal-fetal transmission, which can be explained by the prevalence of microcephaly as one of the major and known complications of Zika. Also, while 29% were able to answer Aedes mosquito (daytime biter) correctly, 22% included Anopheles mosquito (nighttime biter) as another source of infection. Which indicates that although students recognized mosquitos as a major mode of transmission, they weren't able to identify which type of mosquitos are associated with the disease. Surprisingly, only 7.3% knew that sexual contact is a source of transmission.

The results also demonstrated around 48% of our students were familiar with Zika virus symptoms. However, when presented with multiple choices of symptoms (more than 1 answer can be chosen) there was marked inconsistency in answers. For example, although 39.8% identified fever as a major symptom, only 17.2% chose conjunctivitis which is a correct and 17.2% chose sore throat which is incorrect. Another example of inconsistency only 13% chose joint pain even though it's correct, and 13% chose diarrhea which is not a symptom of Zika. Likewise, 12.2% chose rash which is correct, and 11.4% chose vomiting which is incorrect. This can be explained by the non-specificity and vagueness of Zika virus symptoms. In comparison, in Al-Mohrej study 97.7% of their population knew the typical symptoms of MERS-COV. [4]

The questionnaire also included questions on basic sciences and general knowledge of Zika virus in which our students performed less than expected. While the students could fairly recognize Zika virus complications,

treatment and availability of vaccine with 36%-47% able to answer correctly, when presented with basic questions such as genera, genome and when the virus was discovered less than 10% of the students were able to answer. This could be attributed to the fact that the study population is composed of students in their clinical years.

Each student was graded for each question and for the entire questionnaire and then the students' grades were compared according to age, gender, and medical year, but no statistically significant difference was found in their grades. This could be explained by the general lack of knowledge about and exposure to the Zika virus in our population when compared to their knowledge about MERS-COV as seen in Al-Mohrej's study which has found a significant difference between males and females when asked about the possibility of people infected with MERS-COV to be asymptomatic. [4]

We compared our results to Al-Mohrej's study that tested medical students' knowledge of MERS-COV and found significant differences. Both studies showed low level of knowledge in terms of basic science and general knowledge questions, which can be explained by college's and students' heavy emphasis and focus on clinical aspect of the disease and lack of interest on basic sciences during the clinical years of medical college. Still from a clinical aspect, diagnosis and treatment, students showed better knowledge of MERS-COV. These differences can be attributed to the recent outbreak in Saudi Arabia, especially in Riyadh at King Abdul-Aziz Medical City where most of medical students spent their rotation. During the outbreak, students were informed about the risk of exposure in case of direct contact with patients infected with MERS-COV. Also, the ministry of health has made multiple efforts to educate the public regarding this disease, such efforts included public campaigns at malls and schools, infection control workshops and posts on multiple media outputs.

Our study has some limitations. First, we weren't able to compare our results to other studies that test Zika knowledge, since we couldn't find any while searching literature. Secondly, since the study only included students in their clinical years at KSAU-HS it might not be a representative of medical students in Saudi Arabia. The study can be expanded by comparing results from medical student from different universities. Also, our results can be compared to a control group from general population.

### **Conclusion:-**

The results of this study demonstrated a low level of knowledge regarding Zika virus amongst medical students especially when compared to their knowledge of MERS-COV. Which might indicate the need for an intervention in order to spread Zika virus awareness.

### **References:-**

1. Basarab M, Bowman C, Aarons EJ, Cropley I. Zika virus. BMJ. 2016 Feb 26;352:i1049. doi: 10.1136/bmj.i1049.
2. Zika situation report. World Health Organization 2016 Feb 19 [cited 2016 March 1]. Available from: [http://apps.who.int/iris/bitstream/10665/204454/1/zikasitrep\\_19Feb2016\\_eng.pdf?ua=1](http://apps.who.int/iris/bitstream/10665/204454/1/zikasitrep_19Feb2016_eng.pdf?ua=1)
3. Zika virus (Internet). World Health Organization 2016 [updated 2016 Feb; cited 2016 March 1]. Available from: <http://www.who.int/mediacentre/factsheets/zika/en/>
4. Ahmad Al-Mohrej, Sajida Agha. Are Saudi medical students aware of Middle East respiratory syndrome corona virus during an outbreak? Journal of Infection and Public Health. 2016. DOI: <http://dx.doi.org/10.1016/j.jiph.2016.06.013>
5. Perkins A, Siraj A, Warren Ruktanonchai C, Kraemer M, Tatem A. Model-based projections of Zika virus infections in childbearing women in the Americas. 2016.
6. Musso D e. Rapid spread of emerging Zika virus in the Pacific area. - PubMed - NCBI [Internet]. Ncbi.nlm.nih.gov. 2016 [cited 10 April 2016]. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24909208>
7. Duffy M, Chen T, Hancock W, Powers A, Kool J, Lanciotti R et al. Zika Virus Outbreak on Yap Island, Federated States of Micronesia. New England Journal of Medicine. 2009;360(24):2536-2543.
8. Omar A. Al-Mohrej, Sarah D. Al-Shirian, Salman K. Al-Otaibi, Hani M. Tamim, Emad M. Masuadi, Hana M. Fakhoury. Is the Saudi public aware of Middle East respiratory syndrome? Journal of Infection and Public Health. 2015. DOI: <http://dx.doi.org/10.1016/j.jiph.2015.10.003>



### RESEARCH ARTICLE

#### A UNIQUE CO-RELATION: POSTMENOPAUSAL ESTROGEN DEFICIENCY AND ANEURYSMAL SUBARACHNOID HEMORRHAGE.

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#### Abstract

**Background:** Rupture of aneurysms often present as subarachnoid haemorrhage (SAH). It is one of the most severe form of stroke especially in female population. Estrogen has a potential influence on the vascular pathophysiology. Several reports have come up with the hypothesis of establishing the role of estrogen on SAH. Hence, revisiting the hypothesis of the possible relationship of estrogen with SAH is utmost necessary to find a rationale therapeutics based on understanding of pathophysiology.

**Conclusion:** Estrogen deficiency has significant impact on SAH. A practical approach based on pathophysiology is vital in preventing this dreaded complication in peri-menopausal women harbouring unruptured aneurysms.

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#### Introduction:-

Rupture of intracranial aneurysms often results in subarachnoid haemorrhage which is a dangerous variety of stroke. 50% of cases often succumb and another 20% are often left with debilitating disability. Of the 30% cases who survive, 10% lose life due to delay in treatment.<sup>1,3,5</sup> SAH has higher incidence in females compared to males and so is the mortality rate associated with it. There is also higher incidence of multiple aneurysms in female population compared to male population. Several meta-analysis and systematic reviews have postulated that in younger ages the incidence is higher in male population and after 50 years the incidence steadily increases in female population<sup>2,6</sup>. And also, cerebral aneurysms are found to occur more commonly in women who achieve early menopause substantiating the role of estrogen as a protective factor against growth of aneurysms<sup>9</sup>. Here is a need for an insight into this hypothesis and its possible therapeutic implications.

#### Aneurysms:-

Abnormal dilatations in the vessel wall are termed as aneurysms. Morphologically there are 2 major types of aneurysms: saccular and fusiform. Saccular aneurysms are more common in cerebral vasculature. They are thin walled spherical expansion from the branching regions of the major cerebral arteries. Fusiform aneurysms are more elongated dilatations of the vessels and are often secondary to certain etiologies like atherosclerosis, dissections etc. SAH is more often associated with saccular aneurysms than fusiform aneurysms and been discussed in this context<sup>11,15,17</sup>.

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The layers of cerebral vasculature wall are from within outside: tunica intima, tunica media and tunica adventitia. Internal elastic lamina separates intima from media and is composed of elastin. Tunica media is mainly composed of smooth muscle cells and collagen fibrils. Tunica adventitia mainly consists of vasa-vasorum, fibroblasts, elastin and collagen fibres. Collagen fibres are mainly produced by fibroblasts. Fibroblasts are also responsible for repair and maintenance of connective tissue. It is the defect or loss of segments of tunica media that incites aneurysms. The production and degradation of collagen fibres is dependent on stretch of the wall of the vessels. The hemodynamic factors like shear stress and blood pressure play a vital role in the growth of aneurysms<sup>11,12</sup>.

The 3 important determinants of aneurysms are : hypertension, increased vessel fragility and hemodynamic shearing stress. And interestingly estrogen can affect all these factors and thereby increase the risk of cerebral aneurysm formation. Low dose estrogen reduces blood pressure and so is the hormone replacement therapy. It also has conducive effect on lipid profiles which directly contributes to reduced risk for atherogenesis and plaque formation which weaken the vessel walls. The tunica media is composed of collagen type 1 and 3 which is the main structural matrix of major arteries including internal carotid arteries<sup>14</sup>. During post-menopause, connective tissues of the internal carotid arteries undergo degeneration contributing to aneurysm formation. Low dose estrogen and hormone replacement therapy promote strengthening of the connective tissue by promoting the formation of collagen 1 and 3 by fibroblasts and thereby preventing aneurysm formation and growth. Hence estrogen plays an important role in vascular and aneurysmal integrity through the control of collagen production and maturation in the vessel wall<sup>17,18</sup>.

### **Estrogens:-**

Endogenous estrogens include: estrone(E1), estradiol (E2) and estriol (E3). Majority of estrogens are formed in the liver or in peripheral tissues from androstenedione. Major circulating form is estradiol(E2) which is formed mainly in ovaries. The source and plasma levels vary with age. In post-menopausal women, estrone(E1), testosterone and circulating androstenedione are the major precursors of estrogen production in peripheral tissues. E2 metabolism also depends on genetic background, ethnicity, menopausal status and the phase of menstrual cycle. This variation in metabolism has immense effect on vascular integrity<sup>11,18,19</sup>. Estrogen receptors have very high affinity and specificity to circulating estrogens. There are sex and age related differences in the expression of these estrogen receptors. However, estrogen itself regulates these receptors depending on the phase of menstrual cycle and age of the patient. Hence, estrogen treatment has profound effect on regulation of estrogen receptors thereby decreasing the major fluctuations. Estrogen receptors(ER) have protective effect on vasculature by production of Nitric Oxide( NO). Regulation of expression of these ER by mainly E2 plays a vital role in preventing aneurysmal growth and rupture.<sup>19,20</sup>

### **GPER:-**

A G-protein coupled estrogen receptor (GPER) is widely distributed in brain and cerebral vasculature. E2 has strong affinity to this receptor which is totally unrelated to traditional estrogen receptors. This GPER carries out non – genomic effects of estrogen which have regulatory role on collagen morphology of vessel wall.<sup>19,21</sup>

### **Contributing Factors:-**

In a study on Japanese women, earlier age of menarche and nulliparity were associated with increased risk of Sub arachnoid haemorrhage. Therefore sex specific hormonal factor may play a role in the pathogenesis of aneurysm formation and rupture<sup>27,29</sup>.

The collagen that is present in the bone and skin is similar to that found in the walls of proximal segments of cerebral arteries. In post-menopausal women, there is wasting of this collagen due to estrogen deficiency. This could possibly explain for the degeneration of this collagen in the proximal segments of cerebral arteries leading to aneurysm formation.<sup>23,28</sup>

Factors leading to relative deficiency of estrogen often increased the risk of aneurysm formation and SAH. But, estrogen deficiency alone is not sufficient to corroborate the hypothesis because men also show some deficiency of estrogen. So, it is not the absolute levels but dramatic changes in the estrogen levels is that which contributes to the pathogenesis. Hence men are at reduced risk because they do not experience that steep change in the levels of estrogen as it occurs at menopause. Hence periodicity in the levels of estrogen is the contributory factor.<sup>27,29</sup>



Harada et al found based on their observations that internal carotid artery( ICA) was more commonly involved in aneurysm formation as well as rupture in women whereas anterior cerebral artery (ACA) and middle cerebral artery (MCA) are more commonly affected by aneurysm formation in men. In men it is the hemodynamic factors that contribute to evolution of aneurysms whereas in females it is the intrinsic deficiency in the wall of vessel which is more contributory. Hence estrogen is a potential target for preventing the evolution of aneurysms in peri-menopausal women.<sup>32</sup>

#### **Role of hormone replacement therapy (HRT):-**

Regulation of inflammatory cascades and vascular wall integrity are the main areas where estrogen has its conducive effects. Dysregulation of this mechanism promotes growth and rupture of aneurysms. Hence , hormone replacement therapy(HRT) with E2 could be a therapeutic strategy. However, various randomized control trials have shown negative effects of HRT and the reasons could be: age related changes in ER numbers, changes in distributions of ER, down streaming of ER signaling pathways and age related changes in the collagen components in vessel walls. Estrogen cannot reverse the pre-existing vascular pathology although it can give relief from menopausal symptoms<sup>31,32</sup>. In various randomized control studies, HRT might not have been administered early enough so has to have conducive effect and contributing to negative effects. Hence, the time of HRT administration is vital in preventing aneurysm growth and rupture. The HRT should begin soon after the depletion of endogenous E2 to have positive effect in preventing aneurysm growth and rupture<sup>33,35</sup>.

And coming to the mode of administration, oral HRT increases the risk of venous thrombo-embolism whereas transdermal HRT has little impact on thrombosis. And also the risks of coronary heart diseases are reduced in women who start HRT within 10 years of menopause. Other effects of HRT are : increased risk of breast cancer and meningiomas in women<sup>35,36</sup>.

#### **Selective estrogen receptors modulators (SERM):-**

Specific estrogen agonists targeted on modulating cerebral vascular ER activity without having any other detrimental effects on other systemic circulation have been recently developed providing a boost to HRT. A superior effect of these selective estrogen receptor modulators (SERM) with favorable tissue specificity have been documented on preventing the growth and rupture of aneurysms compared to E2.<sup>39,40</sup>

#### **Phytoestrogens:-**

Isoflavones such as Genistein which are chiefly found in soya-bean derived products mediate estrogenic effects through ER and also GPER thereby promoting genomic and non-genomic actions on cerebral vasculature. Genistein has also conducive effects on extra-cellular matrix (ECM). ECM has vital role in regulating vascular wall integrity and remodeling and hence these provide an alternate strategy to HRT.<sup>36,41</sup>

#### **Future trends:-**

The current strategies of management of unruptured intracranial aneurysms is controversial. Medical management is largely limited to: smoking cessation, control of blood pressure, radiological surveillance, neurosurgical and endovascular interventions. There is no documented pharmacological treatment available to decrease the risk of aneurysm growth and rupture. Pathophysiology based therapies like HRT, SERMS and Phytoestrogens may play a vital role in preventing rupture of intracranial aneurysms in post-menopausal women thereby reducing the morbidity and mortality due to SAH in this segment of population.<sup>2,9,42</sup>

New generation HRT, SERMS and Phytoestrogens may have beneficial role in prevention of rupture of aneurysms if initiated at right timing of peri-menopausal women diagnosed with having small un-ruptured aneurysms. Although conducive effects of these agents are much less in older women due to pre-existing cerebrovascular diseases and cardiovascular pathologies, future investigations are needed to devise novel strategies. Appropriate route of administration, dosage, periodicity of administration and timing of administration provide a pragmatic approach for increasing the benefits of these therapies and subsequent preventing the growth and rupture of aneurysms causing SAH.<sup>49,50</sup>

#### **Conclusion:-**

Estrogen deficiency has a significant impact on the pathophysiology of aneurysmal rupture and SAH. An understanding of this subtle relationship between estrogen and SAH might have significant implication on women's health.

**References:-**

1. J. van Gijn, R. S. Kerr, and G. J. Rinkel, "Subarachnoid haemorrhage," *The Lancet*, vol. 369, no. 9558, pp. 306–318, 2007. View at Publisher · View at Google Scholar · View at Scopus
2. J. C. Torner, "Epidemiology of subarachnoid hemorrhage," *Seminars in Neurology*, vol. 4, no. 03, pp. 354–369, 1984. View at Publisher · View at Google Scholar
3. C. Ayala, J. B. Croft, K. J. Greenlund et al., "Sex differences in US mortality rates for stroke and stroke subtypes by race/ethnicity and age, 1995–1998," *Stroke*, vol. 33, no. 5, pp. 1197–1201, 2002. View at Publisher · View at Google Scholar · View at Scopus
4. J. R. Ostergaard and E. Hog, "Incidence of multiple intracranial aneurysms. Influence of arterial hypertension and gender," *Journal of Neurosurgery*, vol. 63, no. 1, pp. 49–55, 1985. View at Publisher · View at Google Scholar · View at Scopus
5. S. Juvela, K. Poussa, and M. Porras, "Factors affecting formation and growth of intracranial aneurysms: a long-term follow-up study," *Stroke*, vol. 32, no. 2, pp. 485–491, 2001. View at Publisher · View at Google Scholar · View at Scopus
6. M.-H. Li, S.-W. Chen, Y.-D. Li et al., "Prevalence of unruptured cerebral aneurysms in Chinese adults aged 35 to 75 years: a cross-sectional study," *Annals of Internal Medicine*, vol. 159, no. 8, pp. 514–521, 2013. View at Publisher · View at Google Scholar · View at Scopus
7. K. Harada, K. Fukuyama, T. Shirouzu et al., "Prevalence of unruptured intracranial aneurysms in healthy asymptomatic Japanese adults: differences in gender and age," *Acta Neurochirurgica*, vol. 155, no. 11, pp. 2037–2043, 2013. View at Publisher · View at Google Scholar · View at Scopus
8. L. Zhao, L. Zhang, X. Zhang, Z. Li, L. Tian, and Y.-X. J. Wang, "An analysis of 1256 cases of sporadic ruptured cerebral aneurysm in a single Chinese institution," *PLoS ONE*, vol. 9, no. 1, Article ID e85668, 2014. View at Publisher · View at Google Scholar · View at Scopus
9. N. K. de Rooij, F. H. H. Linn, J. A. Van Der Plas, A. Algra, and G. J. E. Rinkel, "Incidence of subarachnoid haemorrhage: a systematic review with emphasis on region, age, gender and time trends," *Journal of Neurology, Neurosurgery and Psychiatry*, vol. 78, no. 12, pp. 1365–1372, 2007. View at Publisher · View at Google Scholar · View at Scopus
10. C. Ding, V. Toll, B. Ouyang, and M. Chen, "Younger age of menopause in women with cerebral aneurysms," *Journal of NeuroInterventional Surgery*, vol. 5, no. 4, pp. 327–331, 2013. View at Publisher · View at Google Scholar · View at Scopus
11. F. H. H. Linn, G. J. E. Rinkel, A. Algra, and J. Van Gijn, "Incidence of subarachnoid hemorrhage: role of region, year, and rate of computed tomography: a meta-analysis," *Stroke*, vol. 27, no. 4, pp. 625–629, 1996. View at Publisher · View at Google Scholar · View at Scopus
12. M. H. Young, S. K. Karri, and C. S. Ogilvy, "Exploring the use of estrogen & progesterone replacement therapy in subarachnoid hemorrhage," *Current Drug Safety*, vol. 7, no. 3, pp. 202–206, 2012. View at Publisher · View at Google Scholar · View at Scopus
13. W. T. Longstreth Jr., L. M. Nelson, T. D. Koepsell, and G. Van Belle, "Subarachnoid hemorrhage and hormonal factors in women. A population-based case-control study," *Annals of Internal Medicine*, vol. 121, no. 3, pp. 168–173, 1994. View at Publisher · View at Google Scholar · View at Scopus
14. K. Okamoto, R. Horisawa, T. Kawamura et al., "Menstrual and reproductive factors for subarachnoid hemorrhage risk in women: a case-control study in Nagoya, Japan," *Stroke*, vol. 32, no. 12, pp. 2841–2844, 2001. View at Publisher · View at Google Scholar · View at Scopus
15. T. Stober, S. Sen, T. Anstätt, G. Freier, and K. Schimrigk, "Direct evidence of hypertension and the possible role of post-menopause oestrogen deficiency in the pathogenesis of berry aneurysms," *Journal of Neurology*, vol. 232, no. 2, pp. 67–72, 1985. View at Publisher · View at Google Scholar · View at Scopus
16. M. Brincat, C. F. Moniz, J. W. W. Studd, A. J. Darby, A. Magos, and D. Cooper, "Sex hormones and skin collagen content in postmenopausal women," *British Medical Journal*, vol. 287, no. 6402, pp. 1337–1338, 1983. View at Publisher · View at Google Scholar · View at Scopus
17. J. L. Bolognia, I. M. Braverman, M. E. Rousseau, and P. M. Sarrel, "Skin changes in menopause," *Maturitas*, vol. 11, no. 4, pp. 295–304, 1989. View at Publisher · View at Google Scholar · View at Scopus
18. J. A. Baron, C. La Vecchia, and F. Levi, "The antiestrogenic effect of cigarette smoking in women," *American Journal of Obstetrics and Gynecology*, vol. 162, no. 2, pp. 502–514, 1990. View at Publisher · View at Google Scholar · View at Scopus

19. T. Horiuchi, Y. Tanaka, and K. Hongo, "Sex-related differences in patients treated surgically for aneurysmal subarachnoid hemorrhage," *Neurologia Medico-Chirurgica*, vol. 46, no. 7, pp. 328–332, 2006. View at Publisher · View at Google Scholar · View at Scopus
20. K. Igase, I. Matsubara, M. Igase, H. Miyazaki, and K. Sadamoto, "Initial experience in evaluating the prevalence of unruptured intracranial aneurysms detected on 3-tesla MRI," *Cerebrovascular Diseases*, vol. 33, no. 4, pp. 348–353, 2012. View at Publisher · View at Google Scholar · View at Scopus
21. M. H. M. Vlak, A. Algra, R. Brandenburg, and G. J. E. Rinkel, "Prevalence of unruptured intracranial aneurysms, with emphasis on sex, age, comorbidity, country, and time period: a systematic review and meta-analysis," *The Lancet Neurology*, vol. 10, no. 7, pp. 626–636, 2011. View at Publisher · View at Google Scholar · View at Scopus
22. M. Aarhus, C. A. Helland, and K. Wester, "Differences in anatomical distribution, gender, and sidedness between ruptured and unruptured intracranial aneurysms in a defined patient population," *Acta Neurochirurgica*, vol. 151, no. 12, pp. 1569–1574, 2009. View at Publisher · View at Google Scholar · View at Scopus
23. T. Inagawa, "Site of ruptured intracranial saccular aneurysms in patients in Izumo City, Japan," *Cerebrovascular Diseases*, vol. 30, no. 1, pp. 72–84, 2010. View at Publisher · View at Google Scholar · View at Scopus
24. G. L. Kongable, G. Lanzino, T. P. Germanson et al., "Gender-related differences in aneurysmal subarachnoid hemorrhage," *Journal of Neurosurgery*, vol. 84, no. 1, pp. 43–48, 1996. View at Publisher · View at Google Scholar · View at Scopus
25. M. W. Vernooij, M. A. Ikram, H. L. Tanghe et al., "Incidental findings on brain MRI in the general population," *The New England Journal of Medicine*, vol. 357, no. 18, pp. 1821–1828, 2007. View at Publisher · View at Google Scholar · View at Scopus
26. M. Chen, B. Ouyang, L. Goldstein-Smith, and L. Feldman, "Oral contraceptive and hormone replacement therapy in women with cerebral aneurysms," *Journal of NeuroInterventional Surgery*, vol. 3, no. 2, pp. 163–166, 2011. View at Publisher · View at Google Scholar · View at Scopus
27. T. Mizutani, Y. Miki, H. Kojima, and H. Suzuki, "Proposed classification of nonatherosclerotic cerebral fusiform and dissecting aneurysms," *Neurosurgery*, vol. 45, no. 2, pp. 253–260, 1999. View at Publisher · View at Google Scholar · View at Scopus
28. R. H. Sacho, G. Saliou, A. Kostynskyy, et al., "Natural history and outcome after treatment of unruptured intradural fusiform aneurysms," *Stroke*, vol. 45, no. 11, pp. 3251–3256, 2014. View at Publisher · View at Google Scholar · View at Scopus
29. J. C. Serrone, Y. M. Gozal, A. W. Grossman et al., "Vertebrobasilar fusiform aneurysms," *Neurosurgery Clinics of North America*, vol. 25, no. 3, pp. 471–484, 2014. View at Publisher · View at Google Scholar · View at Scopus
30. G. A. Holzapfel, T. C. Gasser, and R. W. Ogden, "A new constitutive framework for arterial wall mechanics and a comparative study of material models," *Journal of Elasticity*, vol. 61, no. 1–3, pp. 1–48, 2000. View at Publisher · View at Google Scholar · View at Scopus
31. T. Eriksson, M. Kroon, and G. A. Holzapfel, "Influence of medial collagen organization and axial in situ stretch on saccular cerebral aneurysm growth," *Journal of Biomechanical Engineering*, vol. 131, no. 10, Article ID 101010, 2009. View at Publisher · View at Google Scholar · View at Scopus
32. S. Kondo, N. Hashimoto, H. Kikuchi, F. Hazama, I. Nagata, and H. Kataoka, "Apoptosis of medial smooth muscle cells in the development of saccular cerebral aneurysms in rats," *Stroke*, vol. 29, no. 1, pp. 181–188, 1998. View at Publisher · View at Google Scholar · View at Scopus
33. H. Handa, N. Hashimoto, I. Nagata, and F. Hazama, "Saccular cerebral aneurysms in rats: a newly developed animal model of the disease," *Stroke*, vol. 14, no. 6, pp. 857–866, 1983. View at Publisher · View at Google Scholar · View at Scopus
34. J. D. Robinson, H. L. Judd, P. E. Young, O. W. Jones, and S. S. Yen, "Amniotic fluid androgens and estrogens in midgestation," *Journal of Clinical Endocrinology and Metabolism*, vol. 45, no. 4, pp. 755–761, 1977. View at Publisher · View at Google Scholar · View at Scopus
35. T. Lind, E. C. Cameron, W. M. Hunter et al., "A prospective, controlled trial of six forms of hormone replacement therapy given to postmenopausal women," *British Journal of Obstetrics and Gynaecology*, vol. 86, supplement 3, pp. 1–29, 1979. View at Google Scholar · View at Scopus
36. J. Calleja-Agius and M. Brincat, "The effect of menopause on the skin and other connective tissues," *Gynecological Endocrinology*, vol. 28, no. 4, pp. 273–277, 2012. View at Publisher · View at Google Scholar · View at Scopus

37. Y. M. Baron, R. Galea, and M. Brincat, "Carotid artery wall changes in estrogen- treated and -untreated postmenopausal women," *Obstetrics and Gynecology*, vol. 91, no. 6, pp. 982–986, 1998. View at Publisher · View at Google Scholar · View at Scopus
38. L. M. Kadasi, W. C. Dent, and A. M. Malek, "Cerebral aneurysm wall thickness analysis using intraoperative microscopy: effect of size and gender on thin translucent regions," *Journal of NeuroInterventional Surgery*, vol. 5, no. 3, pp. 201–206, 2013. View at Publisher · View at Google Scholar · View at Scopus
39. R. A. Khalil, "Estrogen, vascular estrogen receptor and hormone therapy in postmenopausal vascular disease," *Biochemical Pharmacology*, vol. 86, no. 12, pp. 1627–1642, 2013. View at Publisher · View at Google Scholar · View at Scopus
40. C. J. Gruber, W. Tschugguel, C. Schneeberger, and J. C. Huber, "Production and actions of estrogens," *The New England Journal of Medicine*, vol. 346, no. 5, pp. 340–352, 2002. View at Publisher · View at Google Scholar · View at Scopus
41. C. Stirone, S. P. Duckles, and D. N. Krause, "Multiple forms of estrogen receptor- $\alpha$  in cerebral blood vessels: regulation by estrogen," *The American Journal of Physiology—Endocrinology and Metabolism*, vol. 284, no. 1, pp. E184–E192, 2003. View at Publisher · View at Google Scholar · View at Scopus
42. K. H. Kim and J. R. Bender, "Membrane-initiated actions of estrogen on the endothelium," *Molecular and Cellular Endocrinology*, vol. 308, no. 1-2, pp. 3–8, 2009. View at Publisher · View at Google Scholar · View at Scopus
43. G. Kalesnykas, U. Roschier, J. Puoliväli, J. Wang, and R. Miettinen, "The effect of aging on the subcellular distribution of estrogen receptor-alpha in the cholinergic neurons of transgenic and wild-type mice," *European Journal of Neuroscience*, vol. 21, no. 5, pp. 1437–1442, 2005. View at Publisher · View at Google Scholar · View at Scopus
44. V. M. Miller and S. P. Duckles, "Vascular actions of estrogens: functional implications," *Pharmacological Reviews*, vol. 60, no. 2, pp. 210–241, 2008. View at Publisher · View at Google Scholar · View at Scopus
45. C. M. Revankar, D. F. Cimino, L. A. Sklar, J. B. Arterburn, and E. R. Prossnitz, "A transmembrane intracellular estrogen receptor mediates rapid cell signaling," *Science*, vol. 307, no. 5715, pp. 1625–1630, 2005. View at Publisher · View at Google Scholar · View at Scopus
46. Y. Tada, H. Makino, H. Furukawa et al., "Roles of estrogen in the formation of intracranial aneurysms in ovariectomized female mice," *Neurosurgery*, vol. 75, no. 6, pp. 690–695, 2014. View at Publisher · View at Google Scholar · View at Scopus
47. Y. Tada, K. Wada, K. Shimada et al., "Estrogen protects against intracranial aneurysm rupture in ovariectomized mice," *Hypertension*, vol. 63, no. 6, pp. 1339–1344, 2014. View at Publisher · View at Google Scholar · View at Scopus
48. J. Lin, C. Steenbergen, E. Murphy, and J. Sun, "Estrogen receptor-beta activation results in S-nitrosylation of proteins involved in cardioprotection," *Circulation*, vol. 120, no. 3, pp. 245–254, 2009. View at Publisher · View at Google Scholar · View at Scopus
49. F. Naftolin, H. P. G. Schneider, and D. W. Sturdee, "Guidelines for hormone treatment of women in the menopausal transition and beyond," *Climacteric*, vol. 7, no. 4, pp. 333–337, 2004. View at Publisher · View at Google Scholar · View at Scopus
50. M. E. Mendelsohn and R. H. Karas, "HRT and the young at heart," *The New England Journal of Medicine*, vol. 356, no. 25, pp. 2639–2641, 2007. View at Publisher · View at Google Scholar · View at Scopus
51. D. A. Schreihöfer and Y. Ma, "Estrogen receptors and ischemic neuroprotection: who, what, where, and when?" *Brain Research*, vol. 13, no. 1514, pp. 107–122, 2013. View at Publisher · View at Google Scholar · View at Scopus

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### RESEARCH ARTICLE

#### DIABETIC CONTROL AND ATYPICAL ANTIPSYCHOTICS: A CASE REPORT.

**Dhai Salim Alqurashi, Rougaih Abdullah Habib, Shada Abdurahman Alharthi, Waleed Shuwayyikh Alanazi, Doaa Mohammed Alayed, Mustafi Jamal Alkhanani, Ahmed Salim Mohmoud Elshigagi, Racan Talat Sharbini, Albaraa Ahmed Izzudeen, Abdulrahman Saleh Alhadlag, Mohammed abobakr Alammari, Taghreed Kamel Alnajjar, Khadeejah Talib Aljifri, Alanoud mohammed Aljadeed, Asma Ali Alharbi, Nourah Hdayban Almukhlifi, Bayan Abdulkarim Kharsan, Asma Saad AL ahmari and Sabah Abdulrahman Khozam.**

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#### Abstract

risk of developing metabolic disturbances. This risk may be further exacerbated by the use of antipsychotic agents. Research is still ongoing to determine the metabolic impact of antipsychotics on glucose regulation. In this case report we review some of the possible mechanisms of action of antipsychotic medication on glucose regulation.

**Case presentation:-** We present the case of a 50-year-old man diagnosed with paranoid schizophrenia who developed type 2 diabetes mellitus whilst on treatment with second generation antipsychotics (SGA). His diabetes was controlled by a combination of antidiabetic drugs that were associated with his psychotropic treatment. Due to deterioration in his mental state, the patient was admitted on two occasions to a psychiatric unit during which his prescribed medication (olanzapine and risperidone) was discontinued and changed to aripiprazole. On both occasions, the patient suffered hypoglycaemic episodes and his antidiabetic treatment had to be adjusted accordingly. The patient did not require any antidiabetic treatment whilst on aripiprazole during the follow up period.

**Conclusion:-** Clinicians face regular dilemmas in trying to find the right balance between achieving control over a patient's mental illness and reducing any adverse effects associated with the prescribed medication. In patients receiving concomitant antidiabetic therapy, caution should be exercised when changing from one SGA to another. Whilst more longitudinal data are required, a trial of alternative SGAs, including aripiprazole in those developing type 2 diabetes and impaired glucose tolerance may be a worthwhile therapeutic option.

**Introduction:-** People with schizophrenia are at increased

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#### Introduction:-

Second generation antipsychotics (SGAS) have been adopted as first line treatment for people with schizophrenia [1]. This has been based on a superior safety profile with regards to adverse events such as extrapyramidal symptoms in comparison to first generation (or 'conventional') antipsychotics [2]. However, many studies have

provided convincing evidence for a high risk of metabolic abnormalities associated with the use of some of these agents [3]. These are of major concern owing to the additive effect on morbidity and mortality in a population with already increased prevalence of obesity, type 2 diabetes mellitus and cardiovascular disease [4].

The prevalence of diabetes mellitus among people with schizophrenia is approximately two to four times higher than in the general population, and schizophrenia appears to be an independent risk factor for diabetes mellitus [5]. The development of metabolic abnormalities within an individual patient can depend on the contribution of drug effects (for example, weight gain) as well as individual host factors, such as race, family history, disease or lifestyle. The part played by antipsychotic medication in the development of diabetes mellitus is an ongoing focus of research. Apart from increased adiposity, there are still unanswered questions about the mechanism of action involved in altering insulin sensitivity or secretion by these agents [5, 6].

We present a patient with paranoid schizophrenia who developed type 2 diabetes whilst on treatment with SGAS. He suffered hypoglycaemic episodes on two separate occasions when the treatment was changed to aripiprazole with no change to his antidiabetic treatment.

### **Case presentation:-**

The patient, a 50-year-old Asian man diagnosed with paranoid schizophrenia when in his late twenties, had been treated with a variety of first generation antipsychotics for several years. Whilst an inpatient at age 42 years, he had been prescribed SGAS. He was medically fit, apart from suffering from hypertension controlled with perindopril 4 mg/day. He was discharged once clinically stable on olanzapine 20 mg/day. His records revealed that at age 48 years, whilst on 20 mg olanzapine, his random glucose levels were 17.6 and his glycosylated haemoglobin was 10.9%. He was started on oral hypoglycaemic agents by his general practitioner, a combination of gliclazide MR 30 mg/day and metformin 500 mg twice daily, which was later increased to 1 g twice daily because of poor response.

His diabetes mellitus was under control, but as his mental state continued to deteriorate, olanzapine was increased to 25 mg/day and subsequently changed to aripiprazole reaching a dose of 20 mg/day. After 2 months, the patient experienced gradual weight loss associated with episodes of hypoglycaemia. Gliclazide was consequently discontinued and he remained on metformin 1 g twice daily.

The patient was re-admitted to hospital 7 months later owing to poor compliance with medication and exacerbation of his psychiatric symptoms. Whilst in the community, his general practitioner restarted his diabetic medication (gliclazide 30 mg/day and metformin 500 mg twice daily) and combined it with a lipid-regulating drug (simvastatin 20 mg/day) and antihypertensive treatment (amlodipine 10 mg/day and perindopril 4 mg/day). On admission, his fasting glucose levels were between 3.7 and 6 mmol/l and he was overweight with a body mass index (BMI) of 27. Risperidone was added to the medication regime reaching a dose of 6 mg/day. His fasting glucose levels were between 4.2 mmol/l and 6 mmol/l. After 3 months, despite controlling his psychiatric symptoms, risperidone use resulted in intolerable side effects in the form of urinary incontinence, therefore it was discontinued and aripiprazole restarted reaching a dose of 15 mg daily. Six weeks later, the patient presented with symptomatic episodes of hypoglycaemia with fasting glucose levels between 2.1 and 3 mmol/l with no changes in body composition or other metabolic parameters. In consultation with his diabetologist, the oral hypoglycaemic medication was discontinued. The patient remained physically well with fasting glucose levels within normal range (3.5 to 6 mmol/l) during the 6 months that he remained in the unit.

### **Discussion:-**

The majority of studies indicate that SGA drugs which induce more weight gain (for example, clozapine and olanzapine) are associated with increased risk of diabetes mellitus and interpretations in the literature in relation to specific differences among these drugs have been controversial [7]. The increased prevalence of abnormalities in glucose regulation (for example, insulin resistance) and under-diagnosis of type 2 diabetes in patients with schizophrenia, prior to the commencement of antipsychotic medication, is a confounding factor [4, 6]. In addition, the issue is complicated by the nature (mostly retrospective) and heterogeneity of the data with studies funded primarily by pharmaceutical companies [6, 7].

Differing weight gain risk across the SGA agents seems to run alongside the variation in relative risk for metabolic disturbances [7]. One of the proposed mechanisms appears to be related to a greater H1 histamine receptor affinity

associated with complex interplay among many other receptors (alpha1, H1, muscarinic, 5 hydroxytryptamine type 2A-2C and so on). Increased adiposity is linked to decrease in insulin sensitivity and changes in plasma glucose and lipid levels [6, 8]. Emerging evidence in animal studies suggests that direct drug effects on beta-cell function and insulin action could be involved as factors independent from changes in body composition in up to a quarter of treatment-related new onset diabetes [7, 9]. Rapid induction of hyperglycaemia sometimes accompanied by ketoacidosis has been reported in patients on clozapine and olanzapine without weight gain [9]. It seems likely that the hepatic insulin resistance develops with acute dosing, whereas weight gain and hyperlipidemia occur following repeated dosing. An alternative mechanism is inhibition of glucose transport into peripheral tissues, with suppression of cholinergic-stimulated insulin secretion by direct action on the pancreas, which involves antagonism of muscarinic M3 on beta-cells [6, 9]. In addition, it is likely that the central nervous system plays an important role through the hypothalamus and its action over sympathetic and parasympathetic pathways on glucose regulation [6, 8].

Data on the metabolic impact of aripiprazole suggest that it has little or no detrimental effect relative to other SGAs. However, two cases of diabetic ketoacidosis were reported in people with schizophrenia after starting aripiprazole [10, 11, 12] and further reports claim that it may even have a favourable impact on metabolic parameters [12]. The debate is still ongoing as a result of fewer long-term data owing to the limited time this medication has been on the market.

Our patient, who has diabetes treated with oral hypoglycaemic agents, experienced changes in body composition such as gradual weight loss and reversal of metabolic parameters towards normal levels associated with hypoglycaemia when the antipsychotic medication he was on was switched to aripiprazole for the first time. When his antipsychotic medication was changed to aripiprazole once again ten months later, following the discontinuation of risperidone owing to side effects, a second episode of hypoglycaemia occurred. On both occasions this led to review of his antidiabetic treatment. The hypoglycaemic episode could be explained by the discontinuation of olanzapine and/or risperidone as described in the literature [13] or the combination of oral hypoglycaemic medication with aripiprazole. However, it is relevant to note that the patient did not require any antidiabetic treatment whilst on aripiprazole during the follow up period.

### **Conclusion:-**

Clinicians face regular dilemmas in trying to find the right balance between achieving control over the patient's mental illness and reducing the adverse effects associated with the prescribed medication. Whilst research in the area is ongoing, psychiatrists should perform regular general health monitoring (including screening for diabetes mellitus) in all patients with schizophrenia. In patients receiving concomitant antidiabetic therapy, caution should be exercised when changing from one SGA to another. Whilst more longitudinal data is required, a trial of alternative SGAs, including aripiprazole in those developing type 2 diabetes and impaired glucose tolerance may be a worthwhile therapeutic option.

Further research is required to determine the potential of aripiprazole to prevent complications or reverse metabolic abnormalities in those patients with pronounced disturbances at baseline. If present, these properties could enhance treatment options in patients receiving concomitant antidiabetic therapy and in those patients with treatment resistance on combination therapy with drugs known to have a poor safety profile [14].

### **Consent:-**

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

### **Abbreviations:-**

#### **Bmi:-**

Body mass index

#### **Sga:-**

Second-generation antipsychotic.

**Declarations:-****Acknowledgements:-**

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1. American Diabetes Association, American Psychiatric Association, APA, American Association of Clinical Endocrinologists, North American Association for the Study of Obesity: Consensus development conference on antipsychotic drugs and obesity and diabetes. *Obes Res.* 2004, 12: 362-368. **View ArticleGoogle Scholar**
2. Geddes J, Freemantle N, Harrison P, Bebbington P: Atypical antipsychotics in the treatment of schizophrenia: systematic overview and meta-regression analysis. *Br Med J.* 2000, 321: 1371-1376. 10.1136/bmj.321.7273.1371. **View ArticleGoogle Scholar**
3. Newcomer JW: Metabolic risk during antipsychotic treatment. *Clin Ther.* 2004, 26: 1936-1946. 10.1016/j.clinthera.2004.12.003. **View ArticlePubMedGoogle Scholar**
4. Sermayak MJ, Gulanski B, Rosenheck R: Undiagnosed hyperglycemia in patients treated with atypical antipsychotics. *J Clin Psychiatry.* 2005, 66 (11): 1463-1467. **View ArticleGoogle Scholar**
5. Gough S, Peveler R: Diabetes and its prevention: pragmatic solutions for people with schizophrenia. *Br J Psychiatry.* 2004, 184 (Suppl 47): 106-111. 10.1192/bjp.184.47.s106. **View ArticleGoogle Scholar**
6. Newcomer JW: Abnormalities of glucose metabolism associated with atypical antipsychotic drugs. *J Clin Psychiatry.* 2004, 65 (Suppl 18): 36-46. **PubMedGoogle Scholar**
7. Newcomer JW: Second generation (atypical) antipsychotics and metabolic effects: a comprehensive literature review. *CNS Drugs.* 2005, 19 (Suppl 1): 1-93. **PubMedGoogle Scholar**
8. Duncan E, Dunlop B, Boshoven W, Woolson S: Relative risk of glucose elevation during antipsychotic exposure in Veterans Administration Population. *Int Clin Psychopharmacol.* 2007, 22: 1-11. 10.1097/01.yic.0000285500.87524.5a. **PubMedGoogle Scholar**
9. Houseknecht K, Robertson A, Zavadski W, Gibbs EM, Johnson DE, Rollema H: Acute effects of atypical antipsychotics on whole body insulin resistance in rats: implications for adverse metabolic effects. *Neuropsychopharmacology.* 2007, 32: 289-297. 10.1038/sj.npp.1301209. **View ArticlePubMedGoogle Scholar**
10. De Hert M, Hanssens L, Van Winkel R, Wampers M, Van Eyck D, Sheen A, Peuskens J: A Case Series: evaluation of the metabolic safety of aripiprazole. *Schizophr Bull.* 2007, 33: 823-830. 10.1093/schbul/sbl037. **View ArticlePubMedGoogle Scholar**
11. Reddymasu S, Bahta E, Levine S, Manas K, Slay L: Elevated lipase and diabetic ketoacidosis associated with aripiprazole. *JOP.* 2006, 7: 303-305. **PubMedGoogle Scholar**
12. Church CO, Stevens DL, Fugate SE: Diabetic ketoacidosis associated with aripiprazole. *Diabet Med.* 2005, 22: 1440-1443. 10.1111/j.1464-5491.2005.01628.x. **View ArticlePubMedGoogle Scholar**
13. Melkersson KI, Dahl ML, Hulting AL: Guidelines for prevention and treatment of adverse effects of antipsychotic drugs on glucose-insulin homeostasis metabolism. *Psychopharmacology.* 2004, 175: 1-6. 10.1007/s00213-004-1922-7. **View ArticlePubMedGoogle Scholar**
14. De Hert M, Hanssens L, van Winkel R, Wampers M, Van Eyck D, Sheen A, Peuskens J: Reversibility of antipsychotic treatment-related diabetes in patients with schizophrenia; a case series of switching to aripiprazole. *Diabetes Care.* 2006, 29: 2329-2330. 10.2337/dc-06-1393. **View ArticlePubMedGoogle Scholar**





### RESEARCH ARTICLE

#### EVALUATION OF SYSTOLIC DYSFUNCTION IN PATIENTS WITH LYMPHOPROLIFERATIVE DISORDERS AFTER STEM CELL TRANSPLANT: A SINGLE CENTER EGYPTIAN EXPERIENCE.

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#### Abstract

**Background:** The long-term prognosis after Hematopoietic stem cell transplantation (HSCT) has greatly improved. However, HSCT survivors are at risk of developing long term complications. Cardiac complications are potentially life-threatening and there is a need to elucidate the incidence, severity and underlying mechanisms of these complications. We assessed the systolic cardiac function by echocardiography in patients who underwent autologous and allogeneic hematopoietic stem cell transplantation for lymphoproliferative disorders and evaluated the association between the conditioning regimens used and the decline in ejection fraction.

**Materials and methods:** 100 patients were enrolled in this retrospective study, 72 patients underwent autologous and 21 patients underwent allogeneic stem cell transplantation. 39 patients had multiple myeloma, 30 patients had NHL, 21 patients had acute lymphoblastic lymphoma, 10 patients had HD. LVEF was assessed by echocardiography and compared to a healthy control group as well as 50 positive control of patients who received chemotherapy without undergoing transplant.

**Results:** The mean ejection fraction of cases after transplant is significantly reduced compared to the negative control group. The ejection fraction decline was highly pronounced in older age groups, male patients and more in patients with larger surface area, with the use of TBI-based regimens followed by patients who received high-dose cyclophosphamide in the conditioning regimens.

**Conclusion:** LVEF was reduced in patients with lymphoproliferative disorders after autologous and allogeneic hematopoietic stem cell transplantation and was correlated with the use of TBI-based conditioning regimens and high-dose cyclophosphamide.

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#### Introduction:-

Allogeneic or autologous HSCT offers a possibility of cure or long-term remission in hematological malignancies. However, gastrointestinal, pulmonary, infectious and immunological complications are major problems and limiting factors for HSCT<sup>1</sup>.

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Finally, in the last few years reduced-intensity conditioning regimens have been applied to patients undergoing allogeneic HSCT to reduce drug toxicity while maintaining the potential for achieving disease remission exploiting the graft-versus-leukemia effect<sup>2</sup>.

The long-term prognosis after haematopoietic stem cell transplantation (HSCT) has greatly improved. However, HSCT survivors are at risk of developing long term complications, and mortality rates remain four- to ninefold higher than in the general population<sup>3</sup>.

Cardiac complications have been documented in several series, with reported incidence varying among investigators from 0 to 43%, and mortality up to 9% in earlier studies<sup>1</sup>.

Cardiovascular complications can be grouped into three main categories: vascular abnormalities, cardiac structural problems and myocardial dysfunction and heart failure.

Evaluation of cardiac toxicity in patients includes consideration of biomarkers such as cardiac troponins and B-type natriuretic peptides, together with noninvasive imaging in the form of 2D-, 3D-, or strain echocardiography, multiple gated radionuclide angiography, quantitative gated blood-pool SPECT, or cardiac magnetic resonance imaging<sup>3</sup>.

**The purpose of this study is to** evaluate systolic dysfunction in patients with lymphoproliferative disorders after hematopoietic stem cell transplantation.

## **Patients and Methods:-**

### **Study Design:-**

#### **Patients and Control:-**

The study was conducted in the bone marrow transplantation unit (department of clinical hematology at Ain Shams university hospital) during a period from June 2015 to August 2016.

#### **Participants were grouped into:-**

Group (1): included 100 patients with lymphoproliferative disorders who underwent BMT in our unit, 79 patients underwent autologous transplant and 21 underwent allogeneic transplant, 30 patients with NHL, 10 patients with HD, 39 patients with multiple myeloma and 21 patients with acute lymphoblastic leukemia.

Group (2) (healthy control group): included participants without known cardiovascular disease, hypertension or DM. They were matched 1:1 based on age, sex, blood pressure and surface area with the cases.

Group (3) (positive control): 50 patients with lymphoproliferative disorders who received chemotherapy without undergoing BMT. They included 25 males and 25 females, 46% had MM, 42% had NHL and 12% had HD.

Informed consents were obtained from all participants. The study was conducted in accordance with the stipulations of the local ethical and scientific committees of Ain Shams University and the procedures respected the ethical standards in Helsinki declaration of 1964.

### **Methods:-**

All patients were subjected to full history and physical examination including the presence of B-symptoms like weight loss, fever, drenching sweats and pruritis, anemic manifestations or bleeding or the presence of bone fractures and the presence of lymphadenopathies or hepatosplenomegaly.

#### **To confirm the diagnosis of NHL and HD:-**

- Excision lymph node biopsy for fresh frozen and formaline-fixed samples for histopathological assessment.
- Immunohistochemistry for B-cell markers like CD20,CD19,CD79a,CD10 and T-cell markers like CD3,CD4,CD8,CD7,CD5,CD2 , markers of immature lymphoblast like TdT, immunoglobulin Kappa and Lambda light chain restriction and for CD15 and CD30 for characterization of Reed-Sternberg cells.
- Chest X-ray, contrast-enhanced CT scans of the neck, chest and pelviabdomen.
- Baseline, interim and end of therapy PET was carried out whenever available for staging and response assessment.

- Bone marrow aspiration and trephine biopsy.
- Cytogenetic analysis using conventional cytogenetics and FISH for certain specific chromosomal abnormalities.
- Staging is carried out according to Ann-Arbor staging system Examination.
- Cerebrospinal fluid and triple intrathecal chemotherapy prophylaxis was given to certain patients like: (1): patients with DLBCL with bone marrow, testicular, paranasal and epidural involvement. (2): lymphoblastic lymphoma. (3): primary CNS lymphoma.
- Upper GI endoscopy in those with suspected GI involvement eg. Mantle cell lymphoma.

#### **To confirm the diagnosis of multiple myeloma:-**

- Complete blood counts and serum chemistries especially for serum calcium, serum creatinine to detect CRAB features.
- Detection of monoclonal M-protein in the serum and urine by serum protein electrophoresis.
- Characterization of heavy and light chains in the serum and urine sample by immunofixation.
- Bone marrow aspiration and biopsy to evaluate the percentage of plasma cells.
- Conventional chromosomal analysis and FISH for high-risk myeloma like t(4;14), (14;16) and 17p.
- Skeletal survey for evaluation of lytic bone lesions using X-ray of spine, skull, pelvis, humerus and femur.
- MRI to evaluate symptomatic bony sites even if skeletal survey is negative or in case of spinal cord compression.
- Serum free light chains and Kappa/Lambda ratio for the detection of stringent CR whenever possible.

#### **To confirm the diagnosis of acute lymphoblastic leukemia:-**

- Complete blood count and differential for the detection of peripheral blasts.
- Bone marrow aspiration and trephine biopsy for the detection of the percentage of blast cells.
- Immunophenotyping for lymphoid and myeloid markers.
- Conventional cytogenetics and FISH for Philadelphia chromosome.
- CT scans for the neck, chest and pelviabdomen.
- CSF examination and triple intrathecal chemotherapy for prophylaxis and/or therapy in case of CNS involvement.

#### **Patients who underwent autologous transplant were subjected to:-**

- Complete blood count using (LH Beckman coulter).
- Serum chemistries including liver and renal function tests (AU 680 chemistry autoanalyzer).
- Viral markers for hepatitis B, hepatitis C and HIV using Rosh diagnostics and performed by copus instruments.
- Polymerase chain reaction (PCR) for CMV using kits supplied by Qiagen and performed by rotor gene instrument for automated real time PCR.
- Serology for herpes simplex (HSV), Toxoplasma and Epstein Bar virus (EBV).
- Pulmonary function tests.
- Renal scan.
- Electrocardiogram and echocardiography.
- Mobilization was done using different regimens ranging from G-CSF alone to G-CSF and cyclophosphamide or other chemotherapeutic regimen depending on the specific disease.
- Conditioning regimens: for patients with MM high dose melphalan 200mg/m<sup>2</sup> on day -2, for patients with NHL and HD they received a conditioning regimens consisted of cyclophosphamide 60mg/kg/d -3 and -2, etoposide 15mg/kg/d -3 and -2, carboplatin 400mg/m<sup>2</sup> -3 and -2.

#### **In addition, patients undergoing allogeneic transplant are subjected to:-**

- Donors received (after informed consent) 4 days of treatment with SC G-CSF (10ug/kg/d) before stem cells were collected.
- Mononuclear cells were isolated using a Cobe Spectra separator (Lakewood, Co, USA).
- The number of CD34 cells transfused was calculated using flowcytometric analysis.
- GVHD prophylaxis consisted of cyclosporine and methotrexate.
- Engraftment was defined as absolute neutrophilic count of more than 500 for three consecutive days.
- Chimerism analysis by variable number of tandem repeats (VNTR) was done at +28 and +56 after transplant.

- Conditioning regimen consisted of TBI 2.5GY days -7 to -4 /Cyclophosphamide 60mg/kg days -3 and -2, TBI 2.5 GY days -7 to -4 /etoposide 60mg/kg d-3, Fludarabine 30mg/m<sup>2</sup> days -6 to -2 /oral Busulfan 1mg/kg/6hours days -6 to -3.

All patients in both autologous and allogeneic transplant were treated using the same anti-infectious and transfusion policy of our transplant center.

#### Transthoracic echocardiography:-

- All patients were evaluated during transplant in case of occurrence of any minor or major cardiac events according to the international guidelines recommended by ACC and AHA.
- Transthoracic echocardiograph was done before transplant and 6 months after transplant.
- Transthoracic echocardiography was carried out using 2-4 MHz phased array transducer attached to a vivid S5 echocardiography machine by a cardiologist who was blinded to clinical details of each subject. Inter-observer variability was reduced by taking the mean of three reading during each echocardiography.
- The following parameters were examined: left ventricular end-diastolic diameter (LVEDD) and left ventricular end-systolic diameter (LVESD), intraventricular end-diastolic diameter (IVSDD), posterior wall end-diastolic diameter (PWEDD), right ventricular end-diastolic diameter (RVEDD), left atrium diameter (LA) and aorta diameter (Ao). The systolic function was determined by left ventricular ejection fraction (LVEF) using M-mode and modified Simpson's formula. Left ventricular diastolic function was evaluated with pulsed Doppler and tissue Doppler imaging (TDI). The following parameters of the diastolic function of left ventricle were determined: early filling velocity E wave (E) and A wave (A) of mitral inflow, Doppler-derived mitral deceleration time of early filling (DT), isovolumetric relaxation time (IVRT) and early diastolic velocity of mitral annulus wave (E0).

#### Statistical analysis:-

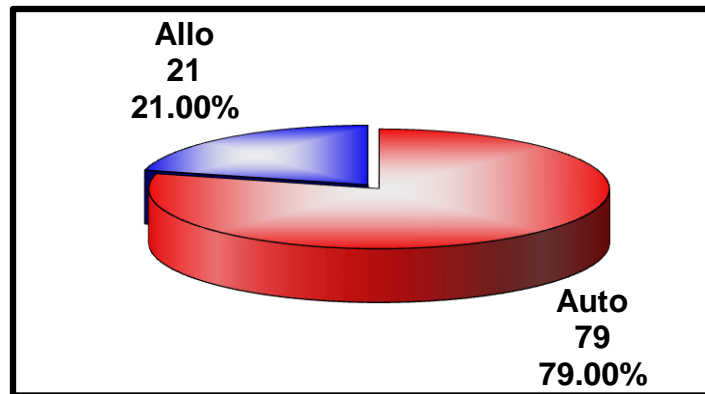
- All analyses of the present study were done using SPSS version 17 software.
- Statistical presentation and analysis of the present study was conducted, using the mean, standard deviation, student t-test, chi square.
- Data were expressed as mean value  $\pm$  SD for continuous variables, and as percentages for categoric variables. In this study, statistical significance was established as follows:  $p > 0.05$  insignificant,  $p \leq 0.05$  significant,  $p \leq 0.01$  highly significant.
- Comparisons between continuous variables were performed using the paired t-test or unpaired t-test. For comparisons of categorical variables, frequency tables and chi-square tests were used.

#### Results:-

100 patients were enrolled into the study (39 patients with MM, 30 patients with NHL, 10 patients with HD and 21 patients with ALL) (table 1). There were 50 males and 50 females, 55 patients aged <45 years, 21 aged 45-55 years and 24 aged >55 years (table 5). Healthy control group included participants without known cardiovascular disease, hypertension or DM. They were matched 1:1 based on age, sex, blood pressure and surface area with the cases. Positive control included 50 patients with lymphoproliferative disorders who received chemotherapy without undergoing BMT. They included 25 males and 25 females, 46% had MM, 42% had NHL and 12% had HD. 72 patients underwent autologous and 21 patient underwent allogeneic stem cell transplantation (figure 1).

**Table 1:-** Percentages of patients with lymphoproliferative disorders in our study:

Lymphoproliferative disorder		
	N	%
MM	39	39.00
NHL	30	30.00
HD	10	10.00
ALL	21	21.00
Total	100	100.00



**Figure 1:-** Percentages of autologous and allogeneic stem cell transplant patients in our study group.

The mean ejection fraction of cases after transplant is significantly reduced compared to the negative control group with highly statistically significant difference (P-value <0.001) (table 2). There is a highly statistically significant difference between ejection fraction in the initial echocardiography before therapy in all patients and the follow up echocardiography after either chemotherapy only in group III or transplanted patients in group I (P-value<0.001).

Also, these results show that group I (transplant group) had higher initial ejection fractions compared to group III with highly statistically significant difference by using unpaired t-test (P-value <0.001) (table 3).

**Table 2:-** The mean ejection fraction of group I patients that underwent transplant and that of healthy group II (negative control) included in the study:

ECHO	GROUPS		T-test	
	Group I (cases) after transplant	Group II (Negative control)	T	P-value
Range	49-70	59-75	-5.322	<0.001*
Mean $\pm$ SD	59.590 $\pm$ 6.299	66.760 $\pm$ 4.728		

**Table 3:-** Correlation between the ejection fraction in the initial echocardiography before therapy in all patients and its decline in the follow up echo after either chemotherapy only in group (3) or transplant in group (1):

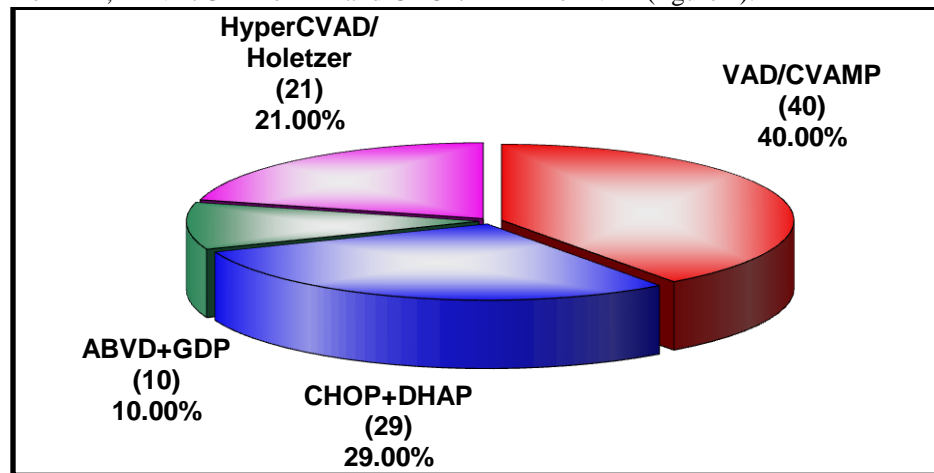
Echo		Group I (cases)	Group III (Positive control)	T-test	
				T	P-value
Initial echo	Range	55-75	52-73	5.261	<0.001*
	Mean $\pm$ SD	67.290 $\pm$ 4.123	62.880 $\pm$ 6.033		
Follow up echo	Range	49-70	45-62	5.883	<0.001*
	Mean $\pm$ SD	59.590 $\pm$ 6.299	53.820 $\pm$ 4.084		
Paired difference	Mean $\pm$ SD	7.700 $\pm$ 5.519	9.060 $\pm$ 5.464		
Paired samples test	T	13.953	11.725		
	P-value	<0.001*	<0.001*		

Conditioning regimens used during transplant included high dose melphalan in 39 patients with multiple myeloma, Cyclophosphamide/Carboplatin/Etoposide in 36 patients with NHL and HD, Fludarabine/Busulfan and TBI-based regimens in patients with ALL (table 4).

**Table 4:-** Percentages of conditioning regimens used in our study:

Conditioning regimen		
	N	%
High dose melphalan	39	39.00
Cyclophosphamide/Carboplatin/Etoposide	36	36.00
Fludarabine/Busulfan	14	14.00
TBI-based	11	11.00
Total	100	100.00

Chemotherapy regimens used prior to transplant included hyperCVAD/Holezer protocols for patients with ALL, VAD/CVAMP for MM, ABVD/GDP for HD and CHOP/DHAP for NHL (figure 2).



**Figure 2:-** Type of chemotherapy used prior to transplant

The ejection fraction decline was highly pronounced in older age groups compared to younger group with highly statistically significant difference (P-value 0.001) (table 5). The ejection fraction decline was seen more in male cases compared to females (P-value 0.009) (table 5). Also, the decline of ejection fraction was more in patients with surface area >1.8 than those with surface area <1.8 (P-value 0.040) (table 5). There is no statistically significant difference between the type of transplant and the decline in ejection fraction (table 5).

**Table 5:-** Relation of the different age groups, sex, surface area and type of transplant of the cases and the decline in their ejection fraction:

	EF decline						Chi-Square	
	Negative		Positive		Total		X <sup>2</sup>	P-value
	N	%	N	%	N	%		
<b>Age Groups</b>							13.638	0.001*
<45 Years	52	63.41	3	16.67	55	55.00		
45-55 Years	15	18.29	6	33.33	21	21.00		
>55 Years	15	18.29	9	50.00	24	24.00		
Total	82	100.00	18	100.00	100	100.00		
<b>Sex</b>							6.775	0.009*
Male	36	43.90	14	77.78	50	50.00		
Female	46	56.10	4	22.22	50	50.00		
Total	82	100.00	18	100.00	100	100.00		
<b>Surface area &gt;1.8</b>							4.225	0.040*
Negative	40	48.78	4	22.22	44	44.00		
Positive	42	51.22	14	77.78	56	56.00		
Total	82	100.00	18	100.00	100	100.00		
<b>Type of transplant</b>							2.013	0.156
Auto	67	81.71	12	66.67	79	79.00		
Allo	15	18.29	6	33.33	21	21.00		
Total	82	100.00	18	100.00	100	100.00		

There is a statistical significance between the decline in ejection fraction and the conditioning regimen used for the transplant with patients in the TBI-based regimens are more affected followed by patients who received high dose cyclophosphamide (table 6).

Comparing TBI-based regimens to non-TBI regimens there is highly statistically significant difference between the decline in ejection fraction and the use of TBI (P-value 0.012) (table 7).

**Table 6:-** Correlation between the conditioning regimens used to prepare group (1) patients and the decline in ejection fractions:

Conditioning regimen	EF decline						Chi-Square	
	Negative		Positive		Total		X <sup>2</sup>	P-value
	N	%	N	%	N	%		
Melphalan	36	43.90	3	16.67	39	39.00	8.587	0.035*
Endoxan/Carboplatin/Etoposide	29	35.37	7	38.89	36	36.00		
Fludarabine/Busulfan	11	13.41	3	16.67	14	14.00		
TBI-based	6	7.32	5	27.78	11	11.00		
<b>Total</b>	82	100.00	18	100.00	100	100.00		

**Table 7:-** Correlation between the use of TBI-based conditioning regimens to prepare cases and decline in their ejection fraction:

Conditioning regimen TBI	EF decline						Chi-Square	
	Negative		Positive		Total		X <sup>2</sup>	P-value
	N	%	N	%	N	%		
<b>Negative</b>	76	92.68	13	72.22	89	89.00	6.312	0.012*
<b>Positive</b>	6	7.32	5	27.78	11	11.00		
<b>Total</b>	82	100.00	18	100.00	100	100.00		

**Discussion:-**

The current standard for cardiac monitoring during cancer therapy is mainly based on LVEF assessment, but it can underestimate early potentially progressive cardiotoxicity, and preserved cardiac function is generally required for enrollment in clinical trials of high dose chemotherapy. This is commonly defined as LVEF>50% and no other significant cardiac disease.

Many studies reported a significant association between pretransplant LVEF and cardiotoxicity. However, measurement of LVEF before high dose chemotherapy is not the only determinant factor as 2/3 major cardiac events reported in patients with normal LVEF<sup>2</sup>.

In the current study, we found that the mean ejection fraction of cases after transplant is significantly reduced compared to the negative control group with highly statistically significant difference (P-value <0.001). Also, there is a highly statistically significant difference between ejection fraction in the initial echocardiography before therapy in all patients and the follow up echocardiography after either chemotherapy only in group III or transplanted patients in group I (P-value<0.001).

A wide variety of conditioning regimens have been used prior to stem cell transplantation. Including, TBI-based regimens and high-dose cyclophosphamide, and cardiac toxicity has been associated mostly with the use of these regimens with a wide spectrum of incidence, manifestation and severity.

HD cyclophosphamide-associated cardiac toxicity is thought to depend upon toxic endothelial damage followed by extravasation of toxic metabolites with resultant myocyte damage and interstitial hemorrhage and edema. HD cyclophosphamide-associated cardiotoxicity occurs during or soon after (within 3 weeks) administration. It is manifested clinically as acute or subacute onset of congestive heart failure (CHF) with pulmonary congestion, weight gain and oliguria. Pericardial effusion, in some cases with cardiac tamponade. Although HD cyclophosphamide-associated cardiac toxicity is potentially reversible, in patients who develop severe, progressive CHF, this complication may lead to death within few weeks<sup>2</sup>.

In our study, we found that ejection fraction decline is higher in patients with a body surface area >1.8 than those with a body surface area <1.8 reflecting a higher dosage of chemotherapeutic agents used in those patients.

In fact, optimal chemotherapy dosing in obese patients is one of the most controversial aspects of HD chemotherapy since obese patients have altered pharmacokinetics for many medications including chemotherapeutic agents when compared with the non-obese.

Indeed, association of obesity with cardiac toxicity can be spotted throughout the literature. As a practical approach, reduction of HD cyclophosphamide dosage in patients whose actual BW exceeds by >20% of the IBW is a safety measure that doesn't affect the efficacy of chemotherapy and minimizes the risk of toxicity<sup>2</sup>.

In the current study, the ejection fraction decline was highly pronounced in older age groups compared to younger group with highly statistically significant difference (P-value 0.001). The ejection fraction decline was seen more in male cases compared to females (P-value 0.009).

The comparison between autologous and allogeneic recipients is especially important. More pronounced cardiotoxic effects could be expected in allogeneic recipients as a result of a different spectrum of conditioning regimens, infectious complications and also an effect of GVHD.

In our study, no difference was found between the incidence of EF decline and the type of transplant. However, the number of allo HSCT in this study is much fewer than the auto patients.

Hernstein et al found that despite the speculation of higher incidence of cardiotoxic complications in patients undergoing allo-HSCT, a higher incidence heart failure was found in autologous recipients in their study. However, the number of autologous patients in their study was small<sup>4</sup>.

There is a statistical significance between the decline in ejection fraction and the conditioning regimen used for the transplant with patients in the TBI-based regimens are more affected followed by patients who received high dose cyclophosphamide.

Comparing TBI-based regimens to non-TBI regimens there is highly statistically significant difference between the decline in ejection fraction and the use of TBI (P-value 0.012).

The epidemiology of RICVD is complicated by the continual improvements in radiation dosimetry and shielding that tend to reduce cardiovascular exposure and the latent effects of radiation, which takes years or decades to manifest.

Several large studies have been published over the last few years that analyzed the outcome of RT administered between one and four decades ago.

Radiation-induced pericarditis is the earliest form of RICVD to occur following mediastinal irradiation. It may occur in either of two forms, early and acute or delayed and chronic, which should be regarded from a histopathological standpoint as two distinct disease entities<sup>5</sup>.

The risk of radiation-induced cardiomyopathy increases after 5 years, but it can evolve decades after initial RT<sup>6</sup>. Pathologically, RICM is characterized by inflammation followed by the development of a diffuse, patchy interstitial fibrosis of the myocardium and effacement of perimyocyte and endothelium<sup>7</sup>.

More recently, researchers at the Netherlands Cancer Institute found a stepwise decrease in 30-year cumulative incidence of valvular heart disease (VHD) corresponding to diminishing doses of RT, from 12.4% at doses greater than 40 Gy to 3.0% at doses less than 30 Gy<sup>8</sup>.

A large case control study of breast cancer survivors in Denmark and Sweden undertaken in 2013 found that the risk of a major CHD event begins to increase within the first 5 years post-treatment and continues to significantly exceed that of the general population through at least 20 years of follow-up. These patients experienced increased risk of angina pectoris, MI, and sudden cardiac death despite having been treated with a modest mean heart dose of 3.6 Gy RT between 1958 and 2001<sup>9</sup>.

Another large study of women in Denmark and Sweden ( $n=35000$ ) comparing incidences of MI in breast cancer survivors observed an incidence ratio of 1.22 in patients undergoing left-sided vs right-sided RT<sup>10</sup>.



In the current study 36.4% of lymphoma patients that underwent autologous transplant with cyclophosphamide-based regimens developed a decline in their LVEF. Previous reports showed that CY cardiotoxicity is correlated with the dose of CY is being higher in patients received 200 >120 >100 mg/kg<sup>11</sup>.

In a previous report, higher age, administration of cyclophosphamide and higher glucose concentrations represented independent risk factors for the worsening of left ventricular diastolic function<sup>12</sup>.

Several methods were investigated to reduce anthracycline cardiotoxicity, most cardioprotective strategies are not in common clinical practice. Other approaches to mitigate the cardiotoxic impact of anthracyclines employ potentially cardioprotective medications, such as ACE inhibitors and beta blockers. Although promising data have been published recently, convincing evidence from large randomized and prospective trials is still needed<sup>3</sup>.

There are some limitations of our current analysis. First, this was a retrospective study from a single institution. Second, early CY-induced cardiotoxicity appears to be characterized by LV diastolic rather than systolic dysfunction.

### Conclusion:-

LVEF was reduced in patients with lymphoproliferative disorders after autologous and allogeneic hematopoietic stem cell transplantation and was correlated with the use of TBI-based conditioning regimens and high-dose cyclophosphamide.

### References:-

1. **Lehmann S, Isberg B, Ljungman P, et al.** Cardiac systolic function before and after hematopoietic stem cell transplantation. *Bone marrow transplantation* 2000; 26(2): 187-192.
2. **Morandi P, Ruffini PA, Benvenuto GM.** Cardiac toxicity of high-dose chemotherapy. *Bone marrow transplantation* 2005; 35(4): 323-324.
3. **Roziakova L, Mistrik M, Batorova A.** Can We Predict Clinical Cardiotoxicity with Cardiac Biomarkers in Patients After Haematopoietic Stem Cell Transplantation? *Cardiovasc Toxicol* 2015; 15:210–216.
4. **Hertenstein B, Stefanic M, Schmeiser T et al.** Cardiac toxicity of bone marrow transplantation: predictive value of cardiologic evaluation before transplant. *J Clin Oncol* 1994; 12:998–1004.
5. **Cuomo JR, Sharma GK, Conger PD et al.** Novel concepts in radiation-induced cardiovascular disease. *World journal of cardiology* 2016; 26; 8(9): 504-519.
6. **Aleman BM, van den Belt-Dusebout AW, De Bruin ML et al.** Late cardiotoxicity after treatment for Hodgkin lymphoma. *Blood* 2007;109: 1878-1886.
7. **Heidenreich PA, Kapoor JR.** Radiation induced heart disease: systemic disorders in heart disease. *Heart* 2009; 95: 252-258.
8. **Cutter DJ, Schaapveld M, Darby SC et al.** Risk of valvular heart disease after treatment for Hodgkin lymphoma. *J Natl Cancer Inst* 2015; 107(4):djv008.
9. **Darby SC, Ewertz M, McGale P et al.** Risk of ischemic heart disease in women after radiotherapy for breast cancer. *NEngl J Med* 2013; 368: 987-998.
10. **McGale P, Darby SC, Hall P et al.** Incidence of heart disease in 35,000 women treated with radiotherapy for breast cancer in Denmark and Sweden. *Radiother Oncol* 2011; 100: 167-175.
11. **Ishida S, Doki N, Shingai N et al.** The clinical features of fatal cyclophosphamide-induced cardiotoxicity in a conditioning regimen for allogeneic hematopoietic stem cell transplantation (allo-HSCT). *Ann Hematol* 2016; 95:1145-1150.
12. **Poręba M, Gać P, Usnarska-Zubkiewicz L.** Echocardiographic evaluation of the early cardiotoxic effect of hematopoietic stem cell transplantation in patients with hematologic malignancies. *Leukemia and lymphoma* 2016; 57(9): 2119-2125.



### Abstract

#### THE PREVALENCE OF HTN AMONG WORKING PERSONNEL, FACULTY OF EDUCATION AT TAIBAH UNIVERSITY.

**Abdullah Al-johani, Abdullah Allam, Ibrahim Al-sehli, Marwan Al-Lohabi and Mohammed Sa'ad.**  
 Under the supervision of Dr. Khalid Qasim.

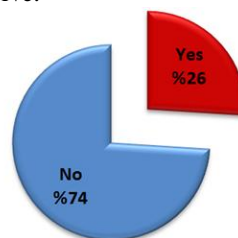
### Manuscript Info

#### Manuscript History

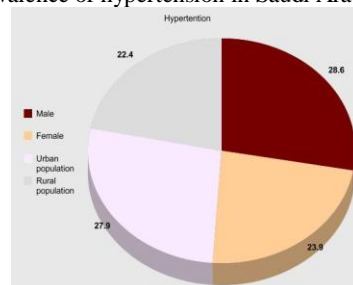
Received: 03 November 2016  
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### Abstract

**Introduction:** Hypertensive is defined as an abnormal elevation in diastolic pressure and/or systolic pressure; mean arterial pressure is also elevated in hypertension, but it is not usually measured in people. In past years, the diastolic value was emphasized in assessing hypertension. However, elevations in systolic pressure ("systolic hypertension") are also associated with increased incidence of coronary and cerebrovascular disease (e.g., stroke). Therefore, we now recognize that both systolic and diastolic pressure values are important to note. High blood pressure, termed "hypertension" is a condition that afflicts almost 1 billion people worldwide and is a leading cause of morbidity and mortality. About 26% of Saudis are hypertensive. For males, the prevalence of hypertension is 28.6%, while for females; the prevalence is significantly lower at 23.9%. The urban population show significantly higher prevalence of hypertension of 27.9%, compared to rural population's prevalence of 22.4%. One-third of them are not even aware they are hypertensive.

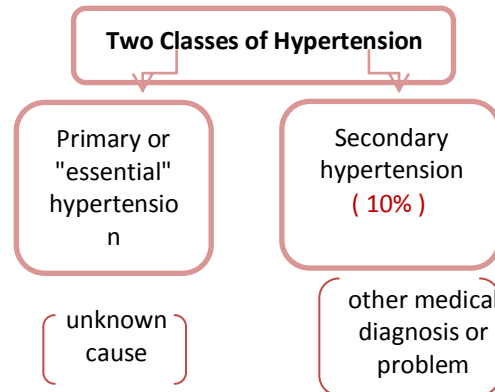


The Prevalence of hypertension in Saudi Arabia is 26%



The following represents different stages of hypertension:

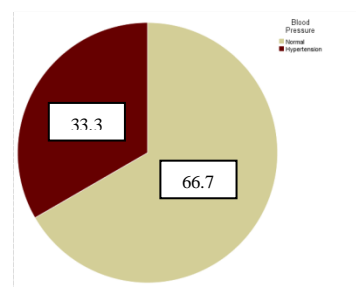
Classification	Systolic (mmHg)	Diastolic (mmHg)
Normal	<120	<80
Prehypertension	120-139	80-89
Stage 1	140-159	90-99
Stage 2	>160	>100



**Objectives:** The study aims to decrease HTN among working personnel in Al-medina. Also to determine the prevalence of HTN among working personnel, faculty of education at Taibah University and Identify associated risk factors that may contribute in the disease.

**Research question:** What is the prevalence of hypertension among working personnel, faculty of education at Taibah University?

**Methodology:** Our research is considered a type of observational study which is cross sectional (survey, prevalence) study. We started our research by doing survey on working personnel, faculty of education (30 subjects/men) who are between 25 – 55 . The data collected included the main risk factors of hypertension (age, exercise, smoking, stress, and family history) by self- administrated questionnaires. We aimed to get completeness and avoid complexity. We have made sure that all of collected data are highly confidential and for the purpose of scientific research only. The statistical analysis was conducted by SPSS program.

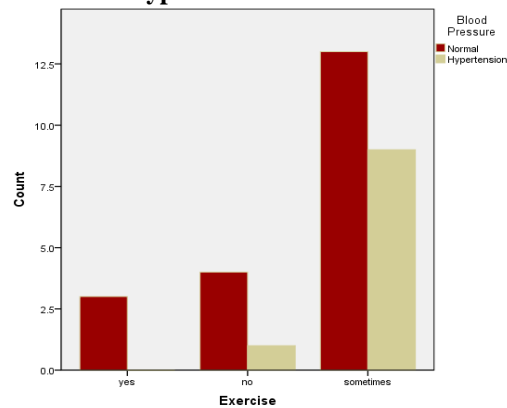


The Prevalence of hypertension among working personnel is 33.3%

#### Age & hypertension

		AGE		
		>45	45-30	<30
		Count	Count	Count
Blood Pressure	Normal	7	2	10
	Hypertension	5	1	4

The risk of hypertension may increase with age

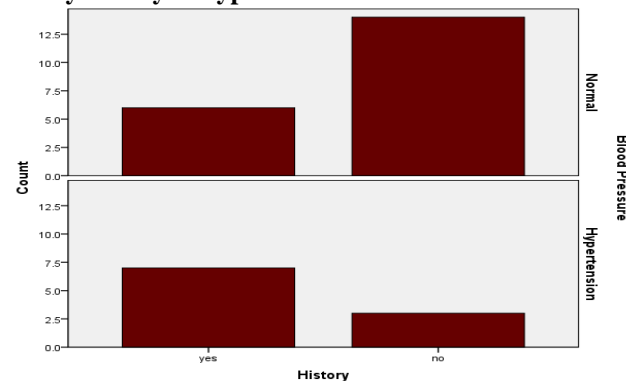
**Exercise & hypertension**

Exercise may decreases the risk of hypertension

**Weight & hypertension**

		Weight		
		Normal weight	Overweight	Obese
		Count	Count	Count
Blood Pressure	Normal	8	7	3
	Hypertension	2	2	6

Obesity may increases the risk of hypertension

**Family history & hypertension**

Hypertension tends to run in families.

**Smoking & hypertension**

		Smoking	
		yes	no
		Count	Count
Blood Pressure	Normal	9	11
	Hypertension	7	3

smoking may increases the risk of hypertension.

**Results:** The prevalence of HTN among working personnel, faculty of education at Taibah University is 33.3 %. According to the study exercise may decrease the risk of hypertension. The main risk factors are age, obesity, family history and cigarette smoking.

**Conclusion:** The research conducted indicates a higher prevalence in working employees at the University of Taibah. than in the general population. The prevalence is % higher than in the general population. A factor that may contribute to the higher prevalence is the small sample size of our research. Also, another factor may be the type of job that is performed by the employees of the university, the stress level of this form of job may have increased the prevalence and also the sedentary level of this type of job may have increased the prevalence as well. It is a concern that may need to be addressed to decrease the likelihood of heart disease in this population.

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### RESEARCH ARTICLE

#### IMPACT OF ECONOMIC REFORMS IN EXPENDITURE PATTERN OF TAMIL NADU

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##### Key words:-

Public Expenditure, Pre Reform, Post Reform, Compound Annual Growth Rate, Income Elasticity.

#### Abstract

India is described as a union of states and the bulk of responsibility for social and economic development lies with the state governments. It is accepted that it is the duty of the state governments to ensure that every citizen can enjoy the primary necessities of life proportionate with need. Therefore state government expenditure is an important instrument for the protection and promotion of socio-economic welfare of the people. An important issue which has gained prominence in the recent years is the impact of economic reforms on the expenditure pattern of state governments. The core of this study is to analyze the pattern of public expenditure in Tamil Nadu during pre and post reform period in order to understand the impact of economic reforms on that.

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#### Introduction:-

Public expenditure is the sum of all types of expenses incurred by the government of a country and its authorized agencies during the period of one financial or accounting year. Only in the beginning of the 20<sup>th</sup> century it was realised that public expenditure was far more important in its implications and bearing on public welfare than public revenue. The main reason for the early neglect of the subject of public expenditure seems to be that the amount of public expenditure was very small as the field of governmental activity was restricted. In recent times, public expenditure has increased enormously. The main reason is that the functions of the state have increased manifold. Unlike the past when the state was considered as a 'police state', now the state is regarded as a welfare state which is concerned with promoting the welfare of its citizens.

In India, public expenditure has increasing year by year due to the expansion of state activities. In the sphere of development most of the functions and responsibilities pertain to State Governments. For a due discharge of this wide array of functions, State Governments have perforce to spend more and ever more. Therefore state governments face an explosive cycle of current expenditure growth and are in the throes of a debt trap in recent years.

Mathur K.P.L analysed fiscal reforms and public expenditure management in state governments of India and found that the reduction in total expenditure to GDP ratio from 16.37 per cent in 1985-90 to 15.44 per cent in 1995-2000 is only because of a reduction in capital expenditure to GDP from 3.21 per cent to 2.11 per cent. The increases in interest payment and pensions have been at the cost of capital expenditure of the state governments. While analyzing the state finances during the period 1985-86 to 2001-02, Narasimhulu stated that the problems of the Central

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government are reflected at the level of States since the framework of fiscal federalism within which India functions makes Centre-State resource flows an important component of State budgets.

The core of this study is to analyze the pattern of revenue and capital expenditure in Tamil Nadu during the pre and post reform period to understand the impact of economic reforms on that. Therefore, this study is related with the following special problems. Have the expenditure on revenue account been affected during the post reform period? Whether economic reform compresses capital expenditure of Tamil Nadu? Is there any growth in the volume of expenditure after removing the adverse effect of rise in population and price level? How far revenue and capital expenditure are responsive to the growth of the economy during pre and post reform period?

#### Objectives:-

1. To compare the growth pattern of revenue expenditure in Tamil Nadu during the pre and post reform period.
2. To estimate the growth pattern of capital expenditure in Tamil Nadu during the pre and post reform period.

#### Hypotheses:-

1. There is no significant difference between pre and post reform period in the growth pattern of revenue expenditure.
2. Economic reforms do not have the impact of curtailment on capital expenditure in Tamil Nadu.

#### Nature and Sources of Data:-

Secondary data form the basis of this study. The data on expenditure for the years from 1971-72 to 2013-14 were collected from RBI Bulletins and RBI Website. The data on Net State Domestic Product was collected from Economic Surveys and Hand Book of Statistics on Indian Economy.

#### Methodology:-

Expenditure devoted per head of population was calculated to eliminate the influence of population change. Compound Annual Growth Rate was used to estimate the growth rate of expenditure in Tamil Nadu during the pre and post reform period. The functional form used to estimate the compound growth rate is  $Y = ab^t$ . To assess the growth of public expenditure in real terms, the influence of price changes should be eliminated and for this national income deflator at 1980-81 prices has been made use of. To trace the income elasticity of state expenditures in revenue and capital account, regression coefficient was calculated by employing the following formula:  $\log Y = a + b \log X$

#### Results and Discussion:-

Public expenditure in India is generally divided for accounting purposes into two broad categories, namely, expenditures on revenue account and capital account. Revenue Expenditures are those that are routine, recurring and periodical with no enduring value beyond the financial year in which they are incurred. Capital expenditures are those that are spent on assets from which income is generated. These are normally enduring in nature.

**Table 1 :- Revenue Expenditure of Tamil Nadu - Pre Reform**

Year	Current Price		Constant Price		% to TE	% to NSDP
	AE	PE	AE	PE		
1971-72	357.36	86.74	769.28	186.72	90.97	13.25
1972-73	417.03	99.48	811.56	193.60	92.17	14.69
1973-74	472.63	110.84	783.69	183.79	93.32	13.77
1974-75	528.36	121.85	754.55	174.01	93.04	14.52
1975-76	557.92	126.56	827.52	187.72	89.14	14.99
1976-77	628.36	140.25	874.49	195.18	91.91	14.60
1977-78	706.12	155.11	923.67	202.89	94.57	14.99
1978-79	753.51	162.94	970.41	209.84	92.81	15.00
1979-80	849.55	180.89	949.67	202.20	92.63	13.94
1980-81	1152.25	241.63	1152.25	241.63	93.13	15.96
1981-82	1359.89	280.92	1233.19	254.75	90.45	15.67
1982-83	1576.08	320.65	1318.78	268.30	91.27	17.87
1983-84	1910.80	382.94	1472.75	295.15	91.28	18.69

1984-85	2210.34	436.45	1578.55	311.70	93.03	18.38
1985-86	2449.75	476.71	1637.83	318.72	94.14	17.90
1986-87	2775.70	532.42	1735.83	332.96	94.26	18.14
1987-88	3374.81	638.22	1927.18	364.45	94.95	18.58
1988-89	3763.04	701.75	1991.15	371.32	95.19	18.43
1989-90	4730.79	870.13	2312.22	425.28	95.68	19.77
1990-91	5641.29	1023.57	2486.57	451.17	96.21	20.38
<b>CAGR</b>	<b>15.60</b>	<b>13.88</b>	<b>6.04</b>	<b>4.51</b>		
<b>REGRESSION CO-EFFICIENT :</b>			<b>1.15</b>			

Source: AE at Current Price- RBI Bulletins and RBI Website; PE, AE & PE at Constant Price, % to AE, % to NSDP, Regression Co-efficient - Computed.

Note: AE - Absolute Expenditure, PE- Per capita Expenditure, TE- Total Expenditure( Revenue and Capital Expenditure), NSDP – Net State Domestic Product

From 1971-72 to 1990-91, there was a striking increase in total expenditure on revenue account in money terms. It rose from Rs.357.36 crores in 1971-72 to Rs.5641.29 crores in 1990-91, thus registered growth by nearly 16 per cent within a period of 20 years. In per capita term, the expenditure increased by 14 per cent from Rs.86.74 in 1971-72 to Rs.1023.57 in 1990-91. At constant price, the compound annual growth rate for total and per capita expenditure was 6.04 and 4.51 per cent respectively.

In 1971-72, revenue expenditure as a proportion of total expenditure claimed 90.97 per cent of total expenditure. In 1990-91, it increased to 96.21 percent. The share of revenue expenditure in net state domestic product had also increased from 13.25 per cent to 20.38 per cent prior to economic reforms.

**Table 2 :- Revenue Expenditure of Tamil Nadu - Post Reform**

Year	Current Price		Constant Price		% to TE	% to NSDP
	AE	PE	AE	PE		
1991-92	8679.52	1553.83	3375.24	604.24	96.88	26.64
1992-93	8542.53	1511.59	3051.94	540.03	96.36	22.53
1993-94	8758.00	1531.97	2835.99	496.08	94.09	16.96
1994-95	9634.95	1666.28	2838.97	490.98	93.41	15.72
1995-96	10910.57	1865.76	2941.25	502.97	94.86	15.65
1996-97	13064.89	2209.43	3266.51	552.41	93.42	16.51
1997-98	14950.85	2500.68	3504.87	586.22	91.06	16.13
1998-99	17697.40	2928.00	3822.23	632.38	93.88	16.74
1999-2000	20727.83	3392.63	4359.02	713.46	96.98	17.32
2000-01	21752.44	3522.59	4427.92	717.06	93.36	16.68
2001-02	21556.97	3454.31	4255.39	681.89	92.38	16.41
2002-03	25687.70	4053.01	4875.94	769.33	94.04	18.58
2003-04	25270.94	3926.95	4625.86	718.83	87.56	16.42
2004-05	29154.87	4462.99	5040.90	771.65	86.46	15.06
2005-06	32008.67	4827.91	5306.77	800.43	88.76	13.99
2006-07	38264.97	5688.06	5950.60	884.55	86.54	13.83
2007-08	42975.01	6297.09	6291.22	921.85	85.20	13.69
2008-09	53590.26	7742.12	7215.79	1042.46	85.48	14.91
2009-10	59375.35	8458.94	7525.14	1072.07	87.38	13.81
2010-11	72916.30	10245.99	8449.17	1187.25	85.43	13.81
2011-12	83838.04	11621.74	8918.94	1236.35	83.69	13.91
2012-13	97067.44	13276.49	10596.88	1449.40	86.95	14.45
2013-14	109824.7	14824.02	12175.68	1643.46	86.48	14.23
<b>CAGR</b>	<b>12.52</b>	<b>11.07</b>	<b>6.4</b>	<b>5.02</b>		
<b>REGRESSION CO-EFFICIENT</b>			<b>0.91</b>			



Source: AE at Current Price- RBI Bulletins and RBI Website; PE, AE & PE at Constant Price, % to TE, % to NSDP and Regression Co-efficient - Computed.

During the post-reform period, the total expenditure increased far less rapidly by comparison. The total expenditure which amounted to Rs.8679.52 crores in 1991-92, went up to Rs.109824.67 crores in 2013-14, that is, a growth by 12.52 per cent in a period of 23 years. In 1991-92, per capita expenditure was Rs.1553.83 and it increased to Rs. 14824.02 in 2013-14. Hence, per capita expenditure increased by 11 per cent during the post-reform period.

In 1991-92, the proportion of revenue expenditure to total expenditure was at the level of 96.88 per cent. The share was more than 90 per cent till 2002-03. After that, it formed 85 to 89 per cent of total expenditure. Likewise the share of revenue expenditure has declined from 26.64 per cent to 14.23 per cent after reforms in Tamil Nadu.

It could be ascertained that the growth rate of total and per capita revenue expenditure was less during the post-reform period when compared with pre-reform period. A considerable fall in the proportion of revenue expenditure to total expenditure was noticed in the post reform period. Besides there was a significant decline in the proportion of total expenditure to state domestic product during the post reform period. Moreover prior to economic reforms, one per cent increase in per capita income led to 1.15 per cent increase in per capita expenditure, but after reforms, one per cent increase in per capita income has ruled to only 0.91 per cent increase in per capita expenditure. Hence, our first hypothesis, there is no significant difference between pre and post reform period in the growth pattern of revenue expenditure in Tamil Nadu is disproved.

It is contradictory to the findings of the study made by Seema Joshi(2006) which shows that fiscal adjustments in India during the reform period have been brought about by reducing public investment (i.e, capital expenditure) rather than by revenue expenditure. Anil Kumar Jain (2010) also found that, in India, government expenditure has tilted in favour of revenue expenditure and capital expenditure had to bear the brunt. In the words of Ashok K.Lahiri, “one of the most striking features of Indian public finances at the sub national level has been the crowding out of capital and other essential expenditures including developmental and maintenance expenditures – by increasing revenue expenditure mainly owing to higher interest payment and wages”.

**Table 3:- Capital Expenditure of Tamil Nadu - Pre Reform**

Year	Current Price		Constant Price		% to TE	% to NSDP
	AE	PE	AE	PE		
1971-72	35.46	8.61	76.33	18.53	9.03	1.32
1972-73	35.42	8.45	68.93	16.44	7.83	1.25
1973-74	33.82	7.93	56.08	13.15	6.68	0.99
1974-75	39.55	9.12	56.48	13.03	6.96	1.09
1975-76	67.97	15.42	100.82	22.87	10.86	1.83
1976-77	55.31	12.35	76.98	17.18	8.09	1.29
1977-78	40.53	8.90	53.02	11.65	5.43	0.86
1978-79	58.34	12.62	75.13	16.25	7.19	1.16
1979-80	67.59	14.39	75.56	16.09	7.37	1.11
1980-81	85.06	17.84	85.06	17.84	6.87	1.18
1981-82	143.53	29.65	130.16	26.89	9.55	1.65
1982-83	150.75	30.67	126.14	25.66	8.73	1.71
1983-84	182.51	36.58	140.67	28.19	8.72	1.79
1984-85	165.64	32.71	118.29	23.36	6.97	1.38
1985-86	152.48	29.67	101.94	19.84	5.86	1.11
1986-87	168.96	32.41	105.66	20.27	5.74	1.10
1987-88	179.54	33.95	102.53	19.39	5.05	0.99
1988-89	190.29	35.49	100.69	18.78	4.81	0.93
1989-90	213.35	39.24	104.28	19.18	4.32	0.89
1990-91	222.49	40.37	98.07	17.79	3.79	0.80
<b>CAGR</b>	<b>11.85</b>	<b>10.08</b>	<b>3.25</b>	<b>1.61</b>		
<b>REGRESSION CO-EFFICIENT</b>			<b>0.89</b>			

Source: AE at Current Price- RBI Bulletins and RBI Website; PE, AE & PE at Constant Price, % to TE, % to NSDP and Regression Co-efficient - Computed.

The total capital outlay increased from Rs.35.46 crores in 1971-72 to Rs.222.49 crores in 1990-91 and registered 11.85 percent growth. In per capita terms, it was Rs.8.61 in 1971-72. But it enlarged to Rs.40.37 in 1990-91 after a chequered growth in between 1971-72 and 1990-91. The compound annual growth rate was 10.08 percent. At constant price, the growth rate registered by total outlay was 3.25 percent. But per capita expenditure fell down from Rs.18.53 to 17.79 which accounted for 1.61 percent change. Capital outlay as a proportion of total expenditure in 1971-72 claimed 9.03 percent. But in 1990-91, it declined to 3.79 percent. The share was the maximum of 10.86 per cent in 1975-76. The percentage share of capital expenditure to net state domestic product also decelerated. In 1971-72, the share was 1.32 per cent and in 1990-91, it dipped to 0.80 per cent. "Since 1970s Tamil Nadu has opted for large current expenditure at the expense of capital outlays"(M.S.Guham 1979). The present study supported this.

**Table 4:- Capital Expenditure of Tamil Nadu - Post Reform**

Year	Current Price		Constant Price		% to TE	% to NSDP
	AE	PE	AE	PE		
1991-92	279.09	49.96	108.53	19.43	3.12	0.86
1992-93	322.37	57.04	115.17	20.38	3.64	0.85
1993-94	550.52	96.30	178.27	31.18	5.91	1.07
1994-95	679.95	117.59	200.35	34.65	6.59	1.11
1995-96	590.94	101.05	159.30	27.24	5.14	0.85
1996-97	919.64	155.52	229.93	38.88	6.58	1.16
1997-98	1467.79	245.50	344.09	57.55	8.94	1.58
1998-99	1153.32	190.81	249.09	41.21	6.12	1.09
1999-2000	644.93	105.56	135.63	22.20	3.02	0.54
2000-01	1546.88	250.50	314.88	50.99	6.64	1.19
2001-02	1777.91	284.89	350.96	56.24	7.62	1.35
2002-03	1627.54	256.79	308.93	48.74	5.96	1.18
2003-04	3589.90	557.85	657.13	102.11	12.44	2.33
2004-05	4563.97	698.65	789.11	120.80	13.54	2.36
2005-06	4054.56	611.55	672.21	101.39	11.24	1.77
2006-07	5952.37	884.81	925.66	137.60	13.46	2.15
2007-08	7462.23	1093.43	1092.41	160.07	14.80	2.38
2008-09	9104.30	1315.29	1225.87	177.10	14.52	2.53
2009-10	8572.59	1221.30	1086.48	154.79	12.62	1.99
2010-11	12436.27	1747.51	1441.40	202.54	14.57	2.36
2011-12	16335.65	2264.47	1737.84	240.90	16.31	2.71
2012-13	14567.68	1992.51	1590.36	217.52	13.05	2.17
2013-14	17173.07	2318.00	1903.89	256.98	13.52	2.23
<b>CAGR</b>	<b>20.92</b>	<b>19.36</b>	<b>14.34</b>	<b>12.86</b>		
<b>REGRESSION CO-EFFICIENT :</b>						
<b>1.39</b>						

Source: AE at Current Price- RBI Bulletins and RBI Website; PE, AE & PE at Constant Price, % to TE, % to NSDP and Regression Co-efficient - Computed.

During the post reform period, the total capital outlay shot up tremendously from Rs.279.09 crores to Rs.17173.07 crores which accounted 20.92 percent growth rate. Per capita expenditure also surged voluminously from Rs.49.96 to Rs.2318.00 and registered 19.36 percent growth rate during the same period. At constant price also, growth rate of total and per capita capital outlay was high during the post reform period.

Regarding the percentage share of capital outlay to total expenditure, it moved up largely. In 1991-92, it was only 3.12 percent. But in 2013-14, it jumped to 13.52 percent. The percentage share of capital expenditure to net state domestic product also accelerated. In 1991-92, the share was only 0.86 per cent. But in 2013-14, it has augmented to 2.23 per cent. It is inferred from the analysis that growth rate of capital outlay during post reform period is very much higher than pre reform period. Besides, the share of capital outlay in total expenditure is increased in post reform period against pre reform period. The regression co-efficient representing the income elasticity of capital

expenditure implies that the increase in per capita income by one per cent has led to an increase in the per capita capital outlay by 1.39 per cent in the post reform period, but it was 0.89 in the pre reform period.

C.Rangarajan stated that “Over the last several years the proportion of capital expenditures to the total has shown a sharp decline. For the Central Government this proportion has declined from 24 per cent in 1992-93 to 15 per cent in 2000-2001” “Capital expenditure was expanded at a lower rate and hence capital expenditure as percentage of NSDP dipped to 3.33 in 1997-98 from 5.01 in 1990-91 in Gujarat. This indicates that the reduction in fiscal deficit was achieved by compressing capital expenditure”(Atul Sarma). Various studies show that economic reforms have the impact of compressing capital expenditure in India and the states.( Seeta Prabhu 1994, Mahendra Dev 2000, Mathur 2001, Manoj Dolli 2012).

The result of the study undertaken by Jegadish Gandhi deviated from this opinion. It revealed that Tamil Nadu did not opt for reductions in their capital outlays. The Gross Fiscal Deficit of Tamil Nadu has increased for Rs.8,548 crores in 2008-09 to Rs.16,880 crores in 2011-12. The capital outlay increased by 57.3 per cent for Rs.9,104 crores to Rs.15,880 crores in the same period. The present study endorses the same view and disregards the general opinion that economic reforms compress the capital expenditure in order to reduce fiscal deficit. So, it is inferred that, as far as, the state Tamil Nadu is concerned, economic reform does not have adverse impact on the capital outlay. Hence the second hypothesis “Economic reforms do not have the impact of curtailment on capital expenditure in Tamil Nadu” is proved.

### **Conclusion:-**

The present study exhibits that in Tamil Nadu total public expenditure is reduced because of the reduction of revenue expenditure. And there is no adverse impact on the capital expenditure. The study suggested that reduction of fiscal deficit should not be done at the cost of bringing down the public expenditure. States may take efforts to collect more revenue from non-tax sources for reducing fiscal deficit. The government should increase the expenditures well enough to counter balance the impact of price rise and increase in population.

### **References:-**

1. Ashok K.Lahiri, (2000) “Sub National Public Finance in India”, Economic and Political Weekly, Vol.XXXV, No.18, April 29, p.1543.
2. Atul Sarma(2000), “Gujarat Finances: Reform of Budgetary Management”, Economic and Political Weekly, Aug26-Sep2, pp.3125-3136
3. Guhan ,M.S.(1979), State Finances in Tamil Nadu, Madras Institute for Developmental Studies, Madras, p.259.
4. Jegadish Gandhi,P. (2013), “Socio- Economy of Tamil Nadu : An Overview”, Tamil Nadu Economy Issue, December 15, p.29
5. Mahendra Dev,(2000), “Economic Reforms, Poverty, Income Distribution and Employment”, Economic and Political Weekly, Vol.35, No.10(Mar 4-10), pp.823-835.
6. Manoj Dolli(2012), “Trends and Growth of Public Expenditure in India During 2001-12, International Journal of Research in Commerce, Economics and Management, Vol.2, No.4, April, pp.55-56.
7. Mathur, K.P.L.(2001), “ India: Fiscal Reforms and Public Expenditure Management”, JBIC Research Paper No.11, Sep, pp.70-71
8. Narasimhulu.M., “State Finances In India – An Analysis”, Southern Economist, Vol.41, No.9, September1, 2002. Pp.5-7
9. Rangarajan,C.(2001), “Better Expenditure Management will Accelerate Growth”, Southern Economist, Vol.40, No.60, July 15, P.10
10. Seema Joshi(2006), “ Impact of Economic Reforms on Social Sector Expenditure in India”, Economic and Political Weekly, Jan 28, pp.359-360.
11. Seeta Prabhu, K. (1994), “ Structural Adjustment with a Human Face”, Economic and Political Weekly, April 16-23, p.1021
12. RBI Bulletin – Various Issues
13. Economic Survey – Various Surveys
14. Hand Book of Statistics on Indian Economy – Various Issues.
15. RBI Website

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### RESEARCH ARTICLE

#### ASSESSMENT OF CADMIUM TOXICITY ON THE RED BLOOD CELLS OF AQUATIC LIFE.

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##### Key words:-

Cadmium toxicity, *Labeo rohita*, Impact on RBC, Heavy metals.

#### Abstract

Concentration of aquatic environment with heavy metals has become a matter of great concern because of their toxicity, persistence and bioaccumulation. Cadmium is widely distributed in aquatic environments and is an extremely toxic metal commonly found in industrial settings as a key component in the production of batteries, pigments, coatings and electroplating. Fish play an integral role in the aquatic ecosystem food web and any effects that change the population structure of fish may also alter community and food web dynamics. The consumption of fish is recommended because it is a good source of omega-3 fatty acids, which have been associated with health benefits due to its cardio-protective effects. However, the content of heavy metals such as Cadmium discovered in some makes it difficult to establish clearly the role of fish consumption on a healthy diet. The present study is planned to determine the abnormal morphology of RBC in fish *Labeo rohita* at different concentration of Cadmium.

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#### Introduction:-

A Wide range of adverse effects on aquatic organisms have been observed due to heavy metals entering aquatic ecosystem through effluents discharged from industries, mining, fossil fuel combustion, sewage treatment plants and drainage from urban and agricultural areas. Heavy metals are important pollutants because of their environmental persistence and undegradable nature. Cadmium is a well known heavy metal which is extremely toxic. Among heavy metals, Cadmium has been listed in "Blacklist" of European community<sup>4</sup>. It is a non corrosive and highly toxic metal. It is a nonessential element with no known biological function. It is used in batteries, plastics, metal alloys, dye and metal plating industries. Effluents from such activities are sources of Cadmium in aquatic environment. A higher concentration of Cadmium in the aquatic environment is lethal to many organisms<sup>3, 9</sup>. Cadmium has been considered as an important xenobiotic, persistent and nonbiodegradable chemical pollutant in the aquatic environment<sup>5</sup>. The adverse causative factors and the sources of contamination of the essential and non-essential heavy metals, such as zinc, copper, cadmium, in aquatic environment are numerous due to increased urbanization, expansion of industrial activity, untreated industrial wasteful effluents, exploration of natural resources, municipal wastes, and the increased use of automobiles<sup>2, 6, 7, 8</sup>.

Cadmium is naturally occurring as well a product of industry and agriculture. Cadmium from fertilizers, manure parent soil and air gets deposited into oceans and seas and is taken up easily by certain seafood. Effluent from electroplating industries manufacturing vinyl plastics, metallurgical operations and mining are the major sources of Cadmium into aquatic environments. Fishes occupy the upper trophic level in aquatic ecosystem and there are

greater chances of transferring Cadmium to higher organism particularly to human. Cadmium is a recognized carcinogen in mammals. Cadmium has become the focus of global research due to its toxicity to terrestrial and aquatic organisms. The significance of the present study lies in the fact of conservation and protection of aquatic biota which is useful as a food factor for man in long run which needs protection on priority basis.

### Methodology:-

#### Processing of the fresh water fingerlings major carp *Labeo rohita* for study:-

Live and healthy fresh water fingerlings major carp *Labeo rohita* of both sexes were collected from the local fish farms. The fingerlings were transported in polythene bag containing O<sub>2</sub> saturated water and brought to the aquarium of the size of 4' x 2' x 2' nearly 125 to 160 fingerlings of *Labeo rohita* and were kept as stock. Aquarium containing normal fresh water, commercial fish food was given twice a day. Dissolved Oxygen level and pH of water was maintained in the laboratory. Experiments were commenced after acclimatizing the fishes to the lab condition for a period ranging from 15 to 20 days. Different concentrations of Cadmium were made by dissolving appropriate amount of analytical grade Cadmium chloride in the fresh water. Live and healthy fresh water fingerlings exposed to different concentration of Cadmium chloride. After exposing to different concentration for different duration 2-3 fingerlings were remove and sacrifice for blood smear study. The thin blood smears were prepared for observing the cellular alterations in the blood cells. The smears were stained with Leishmann's stain and the observations were noted in a tabular form.

#### Preparation of Cadmium Chloride Samples and Processing of Fingerlings:-

Different concentration of Cadmium was made by dissolving appropriate amount of analytical grade Cadmium chloride in the fresh water. These sets of different concentration of Cadmium chloride (5, 10, 15 ppm) were prepared for treatment. The fish were divided into different group of 3 individuals each in separate polythene boxes. Commercially available fish food was provided twice a day and water medium with Cadmium chloride was changed every alternate day.

#### Preparation of Blood Smear:-

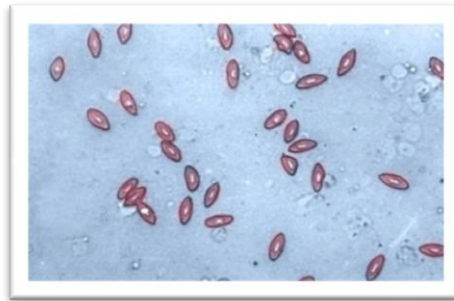
Live and healthy fresh water fish subjected to different concentration of Cadmium chloride (5, 10, 15 ppm). The blood smear was prepared for observation. After an interval of 15 days fish were removed from each container and the blood was drawn from the dorsal aorta or from pressing of gills. A drop of blood was taken on a glass slide and a thin smear was made. It was allowed to dry at room temperature. The slide was then stained with Leishmann's stain for 10 minutes. Then it was washed with distilled water and allowed to dry at room temperature and studied under light microscope. After an interval of 15 days 3 fish were taken from each of the container and made inactive by general hypothermia.

#### Result of Hematological Studies on Fish *Labeo rohita*:-

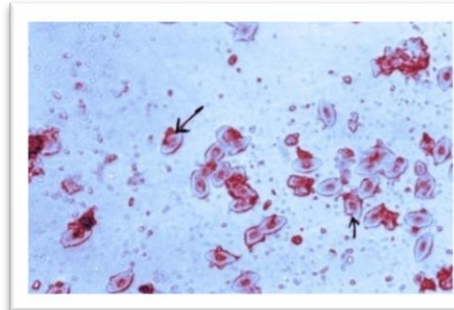
**Table:-** Effect of Varying Concentrations of Cadmium Chloride on the Normal Blood Cells of *Labeo rohita*

Cadmium chloride Concentration	Effect on RBC after Exposure for		
	15 days	30 days	45 days
5 ppm	The cell membrane damaged.	The cell membrane damaged and vacuolation observed.	The nucleus damaged and vacuolation observed.
10 ppm	The nucleus enlarged and cell membrane damaged.	The nucleus damaged and the cell membrane wrinkled.	The nucleus damaged and the cell membrane wrinkled.
15 ppm	The cell membrane wrinkled.	The cell membrane destroyed.	The cell membrane destroyed and the nucleus enlarged and damaged.

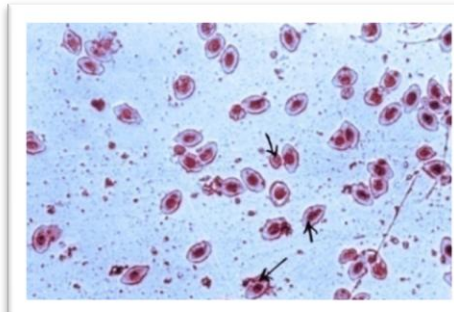
**Normal Blood Smear of Fish *Labeo rohita***



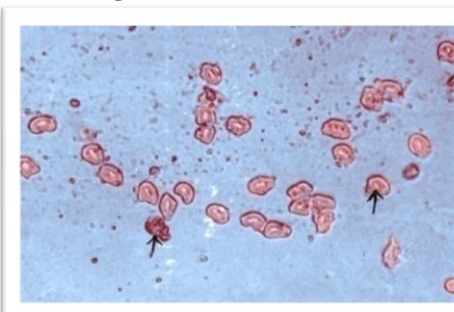
**Fish *Labeo rohita* exhibiting damage to the cell membrane of RBCs**

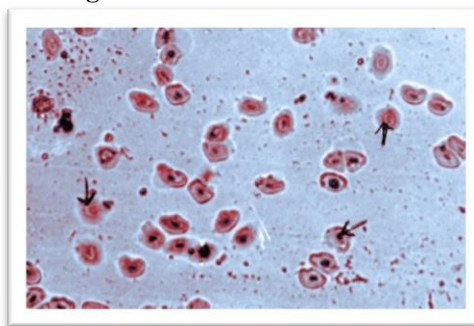


**Fish *Labeo rohita* exhibiting both cell membrane of RBCs damaged with vacillation.**



**Fish *Labeo rohita* exhibiting total destruction of the cell membrane of RBCs.**



**Fish *Labeo rohita* exhibiting destruction or damage of cell membrane of RBCs with enlargement of nucleus****Discussion:-**

During the study of Cadmium Chloride on RBCs 5 ppm concentration exposed to fish on 15<sup>th</sup> day the cell membrane damaged but in longer duration it was observed on 30<sup>th</sup> day the cell membrane damaged and vacuolation observed. While on 45<sup>th</sup> day nucleus damaged and vacuolation observed. 10 ppm of Cadmium Chloride concentration leads to damage cell membrane and enlarge nucleus even in short term exposure of 15 days. While on 30<sup>th</sup> and 45<sup>th</sup> day exposure, there was damaged cell membrane, vacuolation and damaged nucleus, accomplished by wrinkled cells. 15 ppm concentration leads to wrinkled cell membrane on 15<sup>th</sup> day and on 30<sup>th</sup> day cell membrane was destroyed, while on 45<sup>th</sup> day cell membrane was damaged or destroyed and nucleus enlarged or damaged<sup>1</sup>.

**Conclusion:-**

These types of condition like wrinkled cell membrane, damaged nucleus or enlarged nucleus, vacuolation lead either to death of cell in long run or are responsible for anemic condition of animals. Anemic conditions and less iron content have been reported by several workers in fish, bird and mammal following exposure to pollutants. It is also reported that RBCs count was declined by higher concentration of endosulfan subjected to fish. Researchers have postulated that the reduction of RBCs count might be due to inhibition of RBCs production and destruction of RBCs by pollutant. Heavy metals effect on reticulo-endothelial system and haematopoiesis.

**References:-**

1. Anusha (1994). Effect of endosulfan on oxygen consumption, red blood cell count and food utilization of fresh water fish *Clarius dussumieri* – I J. Env. And toxicology; 4(1): 1-63.
2. Ashraj W(2005). Accumulation of heavy metals in kidney and heart tissues of *Epinephelus microdon* fish from the Arabian Gulf. Environmental Monitoring Assessment; 1-3(103): 311-316.
3. Bhattacharyya, M H., A K Wilson, S S Rajan, and M Jonah (2000). Biochemical pathways in Cadmium toxicity. In Molecular Biology and Toxicology of Metals (RK Zalups and J Koropatnick, Eds.): 34-74, Taylor and Francis, London.
4. Manson, C F(1996). Biology of fresh water pollution. III Edition. Longman, U.K. ; 1-4.
5. McGeer, C J., Cheryl Szebedinszky, D Gordan McDonald, Chris M Wood (2000). Effects of chronic sublethal exposure to water borne Copper, Cadmium and Zinc in Rainbow trout: tissue specific metal accumulation. Aquatic Toxicology; 50: 245-256.
6. Saxsena R, Garg P (2011). Vitamin E provides protection against *In vitro* oxidative stress due to pesticide (Chlorphrifos and Endosulfan) in goat RBC, GERF Bull. Biosci. Article, press.
7. Vinodhini R, Muthuswamy N (2008). Effect of heavy metals induced toxicity on metabolic biomarkers in common carp. *Cyprinus carpio*. Maejo Int. J. Sci. Technol; 2: 192-200.
8. Vosyliene MZ, Jankaite ZA (2006). Effect of heavy metal model mixture on rainbow trout biological parameters *Ekologija*, Nr; 4: 12-17.
9. Zyadah, MA, and TE Abde-Baky (2000). Toxicity and bioaccumulation of Copper, Zinc and Cadmium in some aquatic organisms. Bull Environ Contam Toxicol; 64:740-745.





### RESEARCH ARTICLE

## TRANSPIRATION DYNAMICS OF PEPPER (*CAPSICUM CAPSAULARIS*) IN RESPONSE TO ATMOSPHERIC DROUGHT AND SOIL TYPE UNDER SEVERAL VAPOUR PRESSURE DEFICIT (VPD) LEVELS.

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Vapour pressure deficit, Transpiration rate, Water-use efficiency, Days after sowing, Water holding capacity

### Abstract

Vapour pressure deficit (VPD) is considered as an important environmental factor that affect transpiration rate (TR) in plants. In this study, transpiration rate were observed in Pepper (*Capsicum capsularis*) in 3 different soil conditions (organic, sand and mineral) subjected to low (0.10-1.5) and high VPD (2.50-3.90). The highest transpiration rate noted in mineral soil (2.08) but organic one showed more exponential results under high VPD (3.29), comparing lower leaf area to other soil conditions. The lowest TR indicated in sands (0.17) with lower VPD level and large leaf area. The results showed that sand has the lowest transpiration rate and organic soil has the highest transpiration rate. Adding more substrate will be better to compare the transpiration

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### Introduction:-

Plants lose a copious amount of water by transpiration. Plants take up and transpire a great deal of water by their rooting system. The speed and amount of water moving from the root to shoot in turn determine the concentration of solutes arriving at the shoot (Markhart and Smith 1990).

VPD is a good indicator of plant stress, brought about by either excessive transpiration of water (high VPD values) or the inability to transpire adequately (low VPD values). VPD alone does not provide a perfect model of crop water stress. However, if the measurements of VPD calculation are taken in a manner that provides an accurate representation of the current crop conditions, it could be used to influence key environmental control management decisions. Saturated vapour pressure are increasing exponentially with increasing temperature to impact on plant growth (Sinclair *et al.*, 2007). Temperature and vapor pressure deficit (VPD) effects on plant growth are almost always confounded in experiments because VPD is increasing with the decreasing temperature. Increasing VPD rate raise up the atmospheric demand, and consequently higher plant transpiration (Sinclair *et al.*, 2007). A large number of researchers showed that higher leaf to air, VPD decreased stomatal conductance (Bunce 2006, Lopez-Berenger *et al.*, 2006). Stomatal closure limits the transpiration rate and sometimes a decrease at high VPD (Oren *et al.*, 2001). Therefore, stomatal closure restricts the corresponding decrease in plant water potential and prevents excessive water loss.

Different types of soil play a distinguishing role in the plant's ability to extract water. It is noted that water holding capacity depends on soil texture and the effects of soil organic matter are strongest in more sandy soils (Hudson

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1994; Minasny *et al.* 1999; Rawls *et al.* 2003). Texture, structure and porosity influences the movement and retention of water in the soil, which subsequently affects the plants transpiration (Moyano *et al.* 2013).

The original intent of this experiment was to study the effect of transpiration rate, as manipulated by several vapor pressure deficit levels in combination with different soil conditions. Pepper (C3) showed substantial differences in their rate and sensitivity to the VPD and limitations in transpiration rate at high VPD. Most of the studies have been conducted in a specific growth phase of the crop, while there is little information on transpiration rate over the plants ontogeny but these studies has been conducted for checking the soil effects on plant transpiration rate.

#### Objectives:-

To measure the effect of transpiration rate on Pepper (C3) plants in response to changes the atmospheric vapour pressure deficit.

#### Hypothesis:-

The hypotheses are

Soil has the effects on transpiration rate

#### Materials and Methods:-

The experiment was carried out during the summer season under greenhouse conditions (22-35 °C; light: dark = 16:8 hours).

#### Plant material:-

Pepper (*Capsicum capsularis*) seeds were used to getting seedlings. This was needed at least 6-8 hours of sunlight per day. Support each pepper plant with a stake, to help bear the weight of the broad leaf and fruits.

#### Plants growing strategy:-

The whole experiment was split into three sub divisions

1. Pepper plants were raised in three (organic, mineral and sand) different conditions in controlled environments.
2. Transpiration rates were measured in the climate chamber and biomass harvested.

**Table 1:-** Species and their photosynthetic metabolism, life form, substrate and corresponding family of Pepper plant

Species	Photosynthetic metabolism	Life form	Substrate	Family
<i>Capsicum capsularis</i>	C3	Perennial Dicotyledonous	Organic soil Sand Mineral soil	Piperaceae

#### Soil properties:-

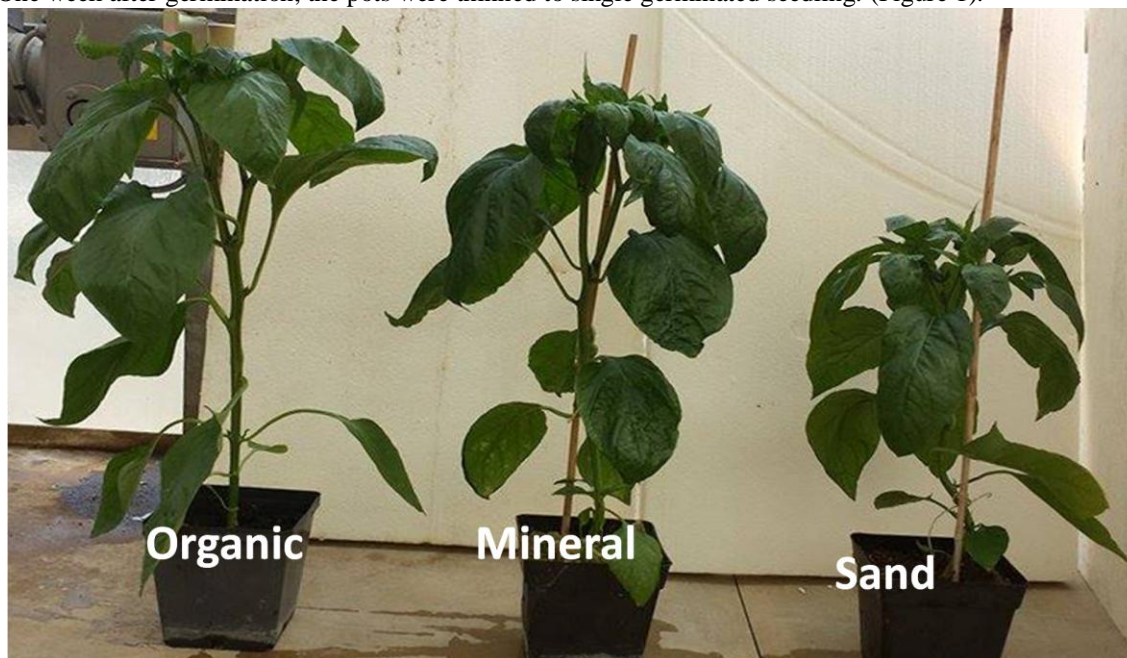
Pepper was raised in three different (organic, mineral and sand) conditions in controlled environment. Each soil has different properties (Table 1)

**Table 1:-** Guinea grass in different substrates

Species	Soil type	Soils description
<i>Capsicum capsularis</i>	Organic soil	Its contain more than 20% organic carbon Fine textured soil High water retention capacity
	Sand	less nutrient and Low water holding capacity large particles (2.0 mm -0.05 mm)
	Mineral soil	Derived from minerals or rocks and containing little humus or organic matter Less than 20% of carbon contend

**Seedling were raising in three different soil conditions:-**

Three seeds of pepper were placed in three (mineral, sand and organic) different soil conditions in each and every pot. One week after germination, the pots were thinned to single germinated seedling. (Figure 1).



**Fig 1:-** Pepper (C3) plants are growing in three different soil conditions (organic, mineral and sand respectively).

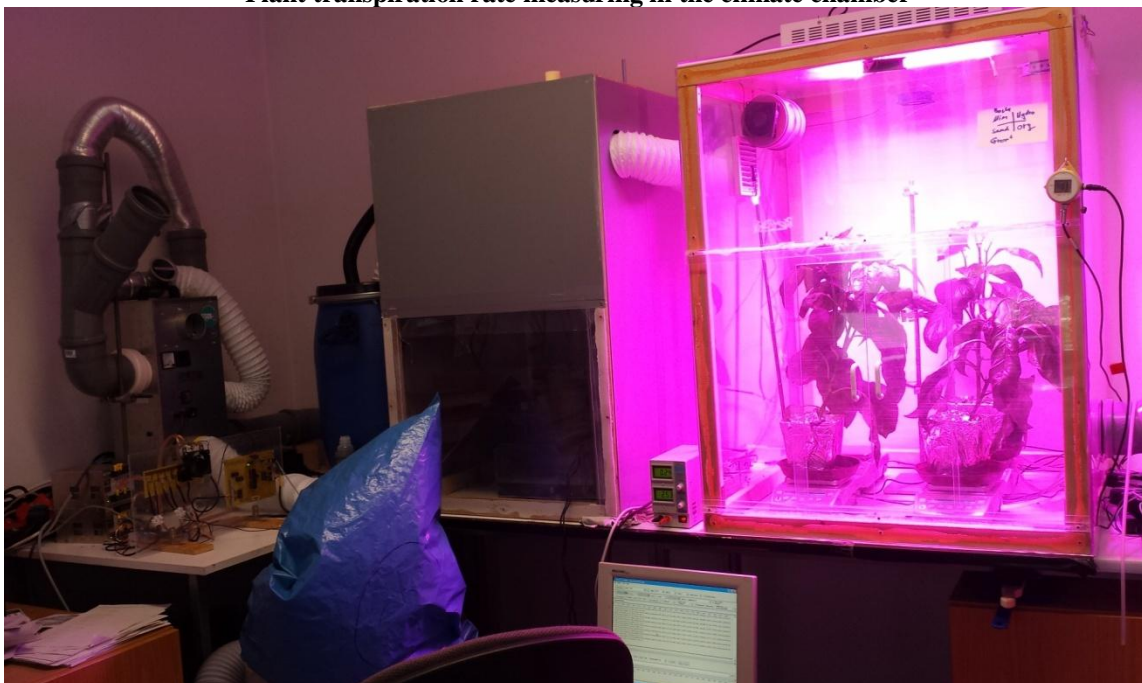
**Technical set-up for climate chamber:-**

The plant transpiration rate was measured in a climate chamber (80×80×100cm) with PVC transparent side and top elements. LED light was installed 15cm away from the top of the climate chamber for providing photosynthetic photon flux (PPF) at  $600\mu\text{mol m}^{-2}\text{s}^{-1}$  at the bottom and  $1200\mu\text{mol m}^{-2}\text{s}^{-1}$  near the top. Uninterrupted air flow through the VPD chamber excluded the possibility of carbon dioxide deficit in the chamber. The temperature and the relative humidity were recorded every minute for calculating the accurate atmospheric VPD by using Tinytag data loggers (Type-TV4505, Gemini Data Loggers., UK). Four individual balances (KERN KB 2400-2N d=0.01g, with a maximum load of 2400g) arranged symmetrically in order to maintain equal light conditions which are connected to a PC for every minute weight information with GrassLog software version 0.1. Four box fans are installed on the top of the chamber for mixing the inside air by continuously adjustable intensity.

A desiccant dehumidifier (Consort DC-10, Seibu Giken, Sweden) was used to generate dry air at a flow rate of max.  $190\text{ m}^3/\text{h}$ . The air flow at  $60\text{ m}^3/\text{h}$  was simultaneously used to counterbalance temperature losses of the wet air produced by ultrasonic nebulizers (Fogstar 100, Seliger GmbH, Germany). Both air streams were saturated before entering the chamber from a side entrance. The speed of each air stream was adjustable with throttle flaps placed inside PVC tubes before mixing.

The actual atmospheric VPD was measured by calculating the recorded every 60 seconds relative humidity and temperature. Different humidity levels were reached by adjusting throttle flaps of wet and dry airstreams while targeting four VPD levels between 0.40 and 3.80.

### Plant transpiration rate measuring in the climate chamber



**Figure 2:-** Transpiration rate measuring in climate chamber

Figure 2. Showing the transpiration rate measurement in climate chamber. The pot was covered with aluminum foil to reduce evaporation. VPD was maintained approximately 0.5 kPa and increased stepwise to almost 4.0 kPa. After the equilibrium condition in the chamber, the entire unit of plants and pot were weighed on a balance. Plant transpiration rates were recorded based on the mass loss. Four humidity levels in the chamber were established by adjusting the humid and dry air. Transpiration rate were started to measure from low VPD to higher VPD. Transpiration rates were recorded over 20 minutes for each VPD levels with an interval of 5 minutes for adjusting VPD until the starting of the higher VPD levels. The measurements for each replicate consisted of four VPD levels for around 2 hours in total.

#### Determination of transpiration rate and dry biomass:-

After measuring the transpiration rates, plants were clipped at the stem base and separated into shoot and root. The total leaf area was measured in green house by using LI-3100 area meter. Every pot was immersed in water to remove sand, soil and inert materials. Roots were further washed, cleaned and sealed separately in leveled paper bags. Whole plant tissues were dried in an oven at 70°C for 48 hours to get the constant weight.

#### Statistical Calculation:-

##### Transpiration rate calculation:-

Plant transpiration rates (TR) were calculated per unit of leaf area ( $\text{mmol H}_2\text{O m}^{-2}\text{s}^{-1}$ ), based on their pot weight changing in every minute's interval.

$$\text{TR} = \{(W_0 - W_1) / 18\} / \text{Time} \times \text{Leaf Area}$$

W<sub>0</sub> = the initial weight

W<sub>1</sub> = weight after 60 seconds

VPD were calculated by using recorded temperature and relative humidity. The data were analyzed by plotting TR against VPD using Software package SAS.

##### Root-Shoot ratio calculation:-

Root dry weight (g) was divided by Shoot dry weight (g) in each and every replication.

$$\text{Root - Shoot ratio} = \frac{\text{Root dry weight (g)}}{\text{Shoot dry weight (g)}}$$

**Normalizing transpiration rate to VPD:-**

VPD in the chamber were manipulated by manually through adjusting the relative humidity while keeping the temperature constant. Therefore, the exact VPD couldn't be fixed at exactly 0.5, 1.90, 2.90, 3.70 KPa. All the TR values were plotted against their respective VPD to produce regression line compare with TR and VPD.

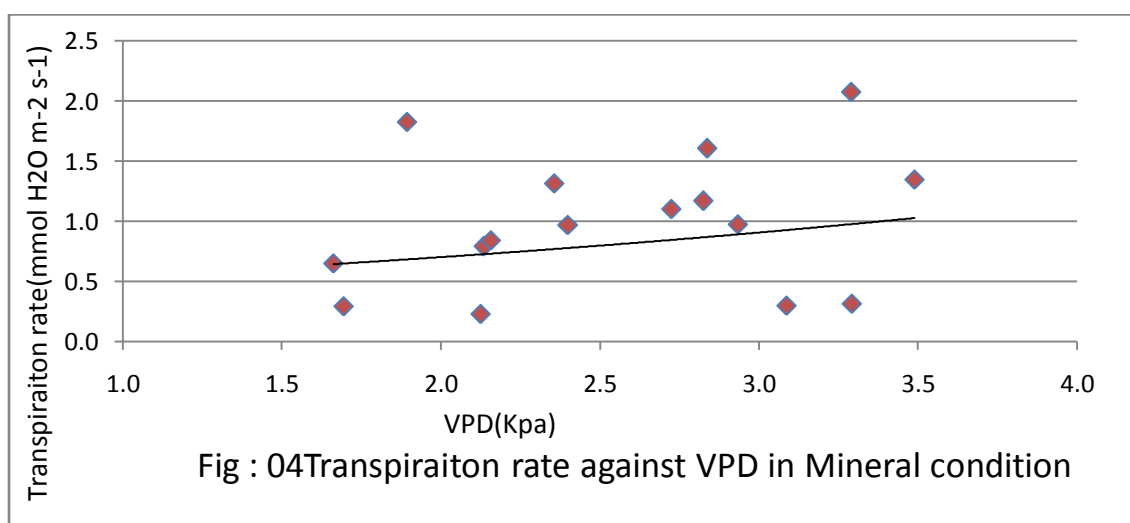
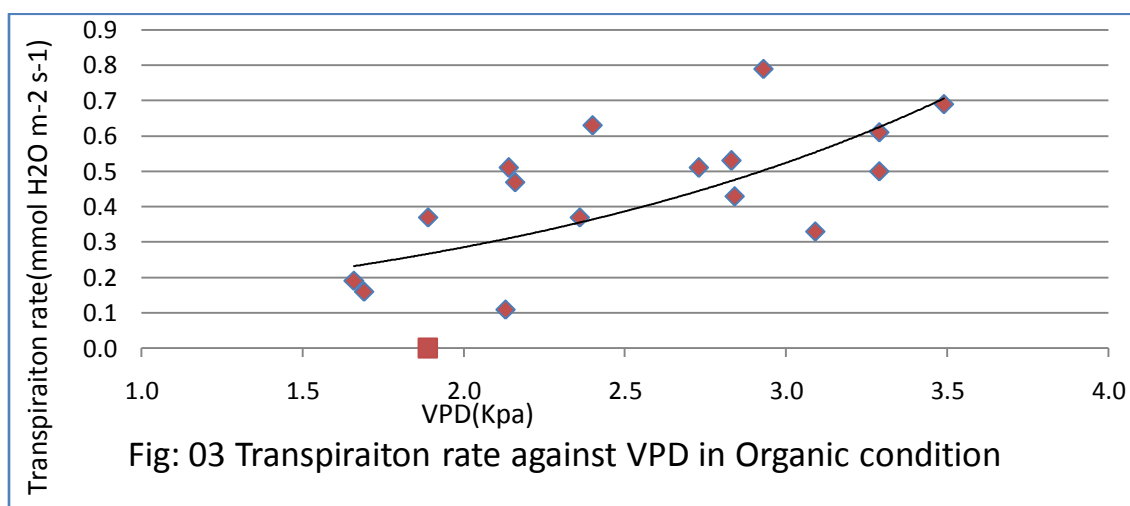
**Results:-****Root-Shoot ratio:-****Table 3:-** Root-Shoot ratio (root dry weight (g) / shoot dry weight (g)) in three soil conditions respectively).

Soil condition	Root/Shoot
Organic	0.3053
Mineral	<b>0.4365</b>
Sand	0.2798

Table 03 showed that root-shoot ratio was higher in mineral soil and lower in sand. In organic condition the ratio is in between two of them. Root-shoot ration is higher in mineral and transpiration rate also higher but less exponential then organic condition with their increasing VPD.

**Transpiration rate measurement in different soil condition:-**

Transpiration rate were measured in different soil condition in the climate chamber and three exponential lines were indicated different transpiration rate in the figure 03, 04 and 05.



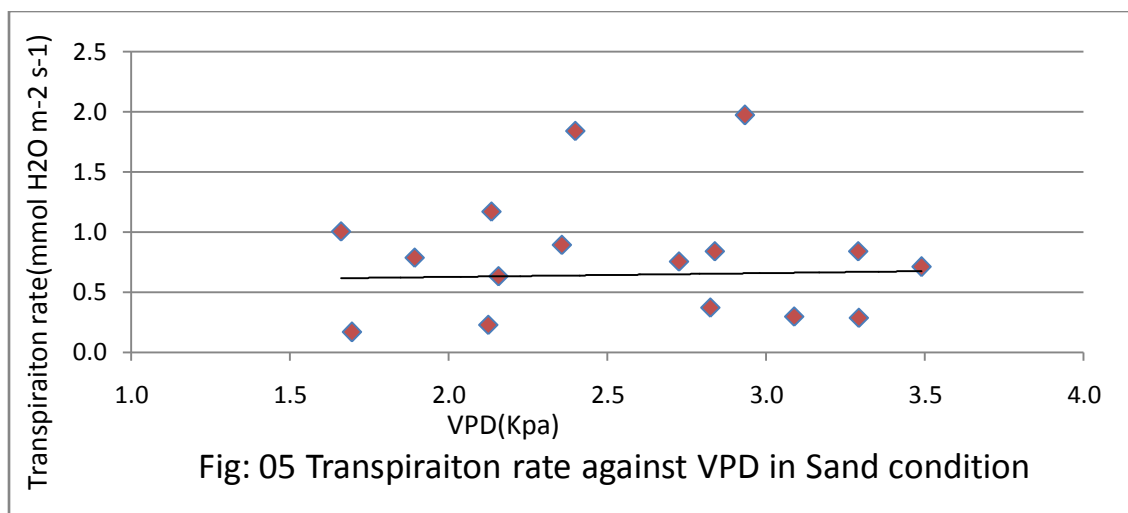


Figure 03 showed that, transpiration rate were gradually increasing with their increasing VPD Exponential line of transpiration rate showed organic condition that, it's increasing with the increasing VPD. Figure 04 indicated that, transpiration rate in mineral soil were increasing but the line were less exponential compare to the organic condition. In figure 05 showed that, transpiration rate were vibrating the same way with their increasing VPD.

**Table 4:-** Analysis of variance

Analysis of variance	VPD	TR
Organic	2.558	0.4502
Mineral	2.557	0.9860
Sand	2.557	0.7997
P value at 0.05	0.002	0.687
Sig. Level	NS	NS
CV (%)	0.05	53.29

Table 04 showed that, transpiration rate of each and every substrate is not significant with their respective VPD. The organic one indicated more transpiration compare to the other soil condition.

## Discussion:-

### Biomass measurement in relation to transpiration rate:-

The rate of water supply to the plant shoot is dependent on both the conductance of water in the soil and in the roots (Hogg and Hurdle, 1997; Meiner and Grantz, 1990). In that case, the organic soil has the huge possibility for water, root conductance and transpired more water than the mineral soil followed by sand. The fine textured soil has the more ability to preserve and continuous water supply around the root zones compare to the sandy soil.

### Root-Shoot ratio:-

The rate of transpiration tends to increase with higher root-shoot ratio (Devlin, 1975). He also mentioned that it is expected that a plant with a higher root: shoot value will tend to transpire faster than another plant with a lower root to shoot. In this experiment it's observed that, the root-shoot ratio was higher in mineral soil. Higher leaf area against root volume compare to the others could be the reason (Table 03).

### Soil properties in terms of transpiration rate:-

Soil texture highly influences water infiltration, pH, permeability and water holding capacity. Soil texture refers to the composition of the soil in terms of the proportion of small, medium and large particles (clay, silt and sand respectively) in a specific soil mass. Brady (1990) mentioned that sandy soils have low porosity and the movement of air and water is rapid. Soil porosity refers to the space between soil particles, which consists of various amounts of water and air. A fine soil has smaller but more numerous pores than a coarse soil. A coarse soil has bigger particles than a fine soil, but it has less porosity or overall pore space.

Smettem and Collis-George (1985) reported that a single continuous pore of 0.3 mm diameter can conduct more water than the rest of a 100 mm diameter sample. Water can be held tighter in small pores than in large ones, so fine soils can hold more water than coarse soils.

In that case, available water was higher in organic and mineral soil and transpires more water than the sandy soils (appendix 03). Naiman *et al.*, (1994) also mentioned that higher levels of organic matter result in a greater number of cation exchange sites which tend to decrease the pH. He also added sandy soils with a low CEC are generally unsuited for septic systems since they have the little adsorptive ability and there is potential for groundwater. The main effect of soil pH is on the availability of plants nutrients which have the specific preference range of soil pH. So pH could be varied and it might have the effects on nutrients absorption, even extra nutrients was supplied in sand and mineral growth medium for equal plant growth but the effects still unclear.

In this study, transpiration difference was isolated by comparing similar size individual pot weight in each plant. Results showed that organic substrate transpire much of water by generating the shoot biomass. (Fig: 03).

Measurement of 55 days old Pepper (C4) plant showed large leaf area in mineral soil condition but the effect of less transpiration rate. Plants may sense different soil condition and hence send inhibitory signals to the shoots which harden the plants against the consequences of a degrading environment, especially if the plants water supply is at risk. Transpiration rate can be interpreted as anticipated rates to the soil becoming too dry. Since different substrates condition varying degree of the inhibitory signals may affect and different stomatal conductance, cell expansion, cell division and the rate of leaf appearance.

### Acknowledgment:-

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### Conclusion:-

In the present study, it shows different rate of foliar transpiration over its ontogeny under lowers to higher VPD levels. Although little or no change in leaf appearance was shown in this study, differences were observed in overall plant leaf area under low and high VPD. But the results showed that leaf area expansion is a key difference to high VPD. Under high VPD, higher TR was associated with lower leaf area expansion rates as shown in the results for Pepper (C3) plant. Including by more substrates and growth stages should be the preference for further research. Checking the rewetting data could be the possible way to know plant recovering and soil texture.

Including by more substrates and growth stages would be the preference for further research. Checking the rewetting data could be the possible way to know plant recovering. Tying a small around among the all exposed leaves would be the way in order to obtain the exact amount transpired from the water source into the atmosphere. This will be able to provide more details on the exact time and amount of water was transpired.

### References:-

1. Moyano, F., Manzoni, S. and Chenu, C., 2013. Responses of soil heterotrophic respiration to moisture availability: An exploration of processes and models (review). *Soil Biology and Biochemistry* 59, 72–85.
2. Minasny, B., McBratney, A.B. and Bristow, K.L., 1999. Comparison of different approaches to the development of pedotransfer functions for water-retention curves. *Geoderma* 93, 225 – 53.
3. Rawls, W.J., Pachepsky, Y.A., Ritchie, J.C., Sobecki, T.M. and Bloodworth, H., 2003. Effect of organic carbon on soil water retention. *Geoderma* 116, 61 – 76.
4. Hudson, B.D., 1994. Soil organic matter and available water capacity. *Journal of Soil and Water Conservation*. 49, 1898 – 194.
5. Adams, H.D., Guardiola-Claramonte, M., Barron-Gafford, G.A., Villegas, J.C., Breshears, D.D., Zou, C.B., Troch, P.A., Huxman, T.E. 2009. Temperature sensitivity of drought-induced tree mortality portends increased regional die-off under global-change-type drought. *Proceedings of the National Academy of Science, USA* 106: 7063–7066.
6. Bouchabké, O., Tardieu, F., Simonneau, T., 2006. Leaf growth and turgor in growing cells of maize (*Zeamays* L.) respond to evaporative demand under moderate irrigation but not in water-saturated soil. *Plant, Cell and Environment* 29:1138–1148.



7. Bunce, J.A., 2006. How do leaf hydraulics limit stomatal conductance at high water vapour pressure deficits? *Plant, Cell and Environment* 29:1644- 1650.
8. Clifton-Brown, J.C. and Jones, M.B., 1999. Alteration of TR, by changing air vapour pressure deficit, influences leaf extension rate transiently in *Miscanthus*. *Journal of Experimental Botany* 50: 1393–1401.
9. De Boodt, M. and Verdonck, O., 1972. The physical properties of the substrates in horticulture. In: Penningsfeld, F. (Ed.), *Peat in Horticulture*. Acta Horticulture. 26: 37–44.
10. Ehler, C., Maurel, C., Tardieu, F.O., Simonneau, T., 2009. Aquaporin-mediated reduction in maize root hydraulic conductivity impacts cell turgor and leaf elongation even without changing transpiration. *Plant Physiology* 150: 1093–1104.
11. Fletcher, A.L., Sinclair, T.R., Allen Jr, L.H., 2007. Transpiration rates to vapor pressure deficit in well-watered slow wilting and commercial soybean. *Environmental and Experimental Botany* 61: 145–151.
12. Hirasawa, T. and Hsiao, T.C., 1999. Some characteristics of reduced leaf photo synthesis at midday in maize growing in the field. *Field Crop Resources* 62: 53-62.
13. Lopez-Berenguer, C., Garcia-Viguera, C., Carvajal, M., 2006. Are Root Hydraulic Conductivity rate to Salinity Controlled by Aquaporins in Broccoli Plants? *Plant and Soil* 279:13-23.
14. Markhart, A.H. and Smit, B. 1990. Measurement of root hydraulic conductance. *Hort Science* 25:282-287.
15. Meyers, R.J.K., Foale, M.A., Done, A.A., 1984. Rate of grain sorghum to varying irrigation frequency in the Ord irrigation area. II. Evapotranspiration water-use efficiency. *Australian Journal of Agricultural Research* 35: 31–42.
16. Monteith, J.L., 1993. The exchange of water and carbon by crops in a Mediterranean climate. *Irrigation Science* 14:85-91.
17. Munns, R., Passioura, J.B., Guo, J., Chazen, O., Cramer, G.R., 2000. Water relations and leaf expansion: importance of time scale. *Journal of Experimental Botany* 51:1495–1504.
18. Ocheltree, T.W., Nippert, J.B. and Prasad, P.V.V., 2013. Stomatal rate to change in vapour deficit reflect tissue specific difference in hydraulic conductance *Plant, Cell and Environment* .1-8.
19. Oren, R., Sperry, J.S., Ewers, B.E., Pataki, D.E., Philips, N. and Megonigal, J.P., 2001. Sensitivity of mean canopy stomatal conductance to vapour pressure deficit in a flooded *Taxodium distichum* L. forest: hydraulic and non-hydraulic effects. *Oecologia* 126:21-29.
20. Peterman, W., Waring, R.H., Seager, T., Pollack, W.L., 2012. Soil properties affect pinyon pine-juniper rate to drought. *Ecohydrology*. doi:10.1002/eco.1284.
21. Sinclair, T., Fiscus, E., Wherley, B., Durham, M., Rufty, T., 2007. Atmospheric vapor deficit is critical in predicting growth rate of “cool-season” grass *Festuca arundinacea* to temperature change. *Planta* 227. 273-276.
22. Sinclair, T.R., Hammer, G.L., van Oosterom, E.J., 2005. Potential yield and water-use efficiency benefits in sorghum from limited maximum transpiration rate. *Functional Plant Biology* 32: 945–952.
23. Tardieu, F. and Tuberosa, R., 2010. Dissection and modelling of abiotic stress tolerance in plants. *Current Opinion in Plant Biology* 13: 206–212.
24. Welcker, C., Boussuge, B., Bencivenni, C., Ribaut, J.M., Tardieu, F., 2007. Are source and sink strengths genetically linked in maize plants subjected to water deficit? A QTL study of the rates of leaf growth and of Anthesis-Silking Interval to water deficit. *Journal of Experimental Botany* 58: 339–349.
25. Wherley, B.G. and Sinclair, T.R., 2009. Differential sensitivity of C3 and C4 turf grass species to increasing atmospheric vapour pressure deficit. *Environmental and Experimental Botany* 67:372-376.

**Appendix 01:-****Nutrient solution preparation:-**

A number of chemical with their exact amount were added for stock solution

**Table 2:-** Nutrient solution preparations for hydroponic system

label	Chem. substance	Conc. stock	Molecular weight	Sample weight per 1L stock	Sample weight per 2L stock	Final conc.	Dil. factor	ml of stock for 1L final solution	
A	K <sub>2</sub> So <sub>4</sub> KCL	0.35M	174.26g	60.99 g	121.98g	0.7mM	500	2	
		0.05M	74.55 g	3.73 g	7.45g	0.1 mM		2	
B	KH <sub>2</sub> PO <sub>4</sub>	0.1 M	136.09 g	13.61 g	27.22g	0.1 mM	1000	1	
C	MgSO <sub>4</sub> *7H <sub>2</sub> O	0.5 M	246.48 g	123.24 g	246.48g	0.5 mM	1000	1	
D	Ca(NO <sub>3</sub> ) <sub>2</sub> *4H <sub>2</sub> O	1 M	236.15 g	236.15 g	472.30g	2.0 mM	500	2	
				472.30 g		1000	1		
E	MnSO <sub>4</sub> *H <sub>2</sub> O ZnSO <sub>4</sub> *7H <sub>2</sub> O CuSO <sub>4</sub> or CuSO <sub>4</sub> * 5H <sub>2</sub> O (NH <sub>4</sub> ) <sub>6</sub> Mo <sub>7</sub> O <sub>24</sub> *4H <sub>2</sub> O	0.5mM	169.09 g	84.51mg	169.02mg	0.5μM	1000	1	
		0.1 mM	287.54 g	28.75 mg	57.51mg	0.1 μM			
		0.2 mM	159.60 g	31.92 mg	63.87mg	0.2 μM			
		0.01m	249.68 g	49.54 mg	99.88mg	1*10 <sup>-8</sup> M			
			1235.86 g	12.36 mg	24.72mg				
F	H <sub>3</sub> BO <sub>3</sub>	10 mM	61.83 g	618.3 mg	1.237g	10 μM	1000	1	
				309.1 mg	618.3mg	20 μM	500	2	
G	FeNaEDTA	50 mM	367.05 g	4.6g 5.5g	in 250ml in 300 ml	50 μM	1000	1	





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### RESEARCH ARTICLE

#### THE IMPACT OF BOXING EXPERIENCE ON SHOULDER INTERNAL ROTATOR MUSCLES CONCENTRIC AND ECCENTRIC STRENGTH.

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Amateur boxing, shoulder torque,  
 internal /external rotation

#### Abstract

The aim of the study was to determine the impact of boxing experience on shoulder internal rotators concentric and eccentric strength of amateur male boxers. Forty amateur boxing athletes participated voluntarily in the study. Measurements of internal rotators concentric and eccentric strength of both shoulders were done under static conditions on a Kin-ComTM (Chattecx, Chattanooga, TN) dynamometer at angular velocities of 60, 120 and 180°/sec. One way analysis of data revealed the following significant differences: At 60°/sec: Between boxing experience and shoulder internal rotators concentric and eccentric strength both in dominant arm ( $p < 0.001$  &  $p < 0.03$  respectively) and in non-dominant arm ( $p < 0.03$  &  $p < 0.04$ ). At 120°/sec: Between boxing experience and shoulder internal rotators concentric and eccentric strength of the dominant arm ( $p < 0.001$  and  $p < 0.005$ ). At 180°/sec: Between boxing experience and shoulder internal concentric and eccentric contraction in dominant arm ( $p < 0.016$  and  $p < 0.019$ ). Post hoc corrections with bonferroni method revealed: At 60°/sec: Boxers who had experience more than 10 y had greater shoulder internal rotators concentric and eccentric strength in dominant hand, in relation to athletes with experience 5 y ( $p < 0.002$  and  $p < 0.04$ ). Boxers who had experience more than 10 y had greater shoulder internal rotators concentric and eccentric strength in non-dominant arm, in relation to the athletes with experience 5 y ( $p < 0.002$  and  $p < 0.005$ ). At 120°/sec: Boxers who had experience more than 10 y had greater shoulder internal rotators concentric and eccentric strength in dominant hand, in relation with the athletes with experience 5 y ( $p < 0.001$  and  $p < 0.05$ ). At 180°/sec: Boxers who had experience more than 10 y had greater shoulder internal rotators concentric and eccentric strength in dominant hand, in relation with the athletes with experience 5 y ( $p < 0.017$ ). It is concluded that the boxing experience has positive effects on shoulder internal rotators concentric and eccentric strength of amateur male boxers.

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## Introduction:-

Boxing is one between combat sports that demands both physical and mental characteristics. As with other sports the participation in the boxing requires agility optimal coordination, endurance, speed, strength and stamina (Koutedakis and Jamurtas, 2004; Chaabène, et al, 2014). The number of rounds is the main difference that characterized the amateur boxing to the professional one. However participation in both, the scope of the boxers is to earn points and to win the round by delivering clear punches to opponent's target areas, using different tactics and strategies. The three types of the boxing punches are, a) the straight, b) the hook and c) the uppercut.

It is known that supraspinatus, infraspinatus, teres minor and subscapularis are the muscles group that comprise the rotator cuff of the shoulder joint.

These muscles are grouped together because they have rotational functions of the humerus and because their tendon interwoven into the capsule to form the musculotendinous cuff around the joint. They act together to hold the head of the humerus bone against the glenoid fossa and thus to stabilize the shoulder joint against downward dislocation of the mentioned bone. These muscles are activated with the help of deltoid muscle during abduction and flexion of the shoulder joint. The power line of these muscles contributes to the dynamic stability of the joint. The infraspinatus, teres minor and subscapularis when acting generate a force that moves the humerus downwards (Stergioulas and Aggelidis, 2001). Thus, this force reduces the shearing stress between the head and glenoid, which is higher at 45 degrees abduction.

The infraspinatus and teres minor except for the stabilizing role contribute to the movement of abduction external rotation causing the humerus, which does not allow the impact on major humeral tuberosity at the acromion process. The deltoid contraction causes displacement of humerus upwards and the contraction the muscles infraspinatus, teres minor and subscapularis creates a force couple. In the power pair, the traction forces cause pure rotation movement, in this case the head of the humerus rotating around a fixed axis of rotation, (Stergioulas and Aggelidis, 2001; Stergioulas, 2005). Thus, the humeral head is stabilized in the glenoid fossa and the supraspinatus with the deltoid can lift the upper extremity during the abduction (Stergioulas, 1991).

As by the above analysis one can be understood, the shoulder internal rotators are involved in the initial segments of the straight and hook punches, while with the uppercut the external ones. External and internal shoulder rotators muscles maintain glenohumeral joint, stabilize the rotator cuff and promote the integrity throughout the range of movements, that included in the hook, uppercut and straight punches (Pędzich et al., 2012).

The isokinetic dynamometer is an accepted modality used to assess functional parameters of antagonist/agonist muscles involved in different physical activities (Ellenbecker & Davies, 2000; Koutedakis et al., 1998). However, we found no published data on shoulder rotator muscle dynamometer characteristics in relation to amateur boxing. So, in the current literature there is a lack of knowledge regarding the impact of boxing experience in power of concentric/eccentric internal rotations muscle of the shoulder in the amateur boxing sportsmen in different speeds.

Therefore, to bridge this literature the purpose of the present study was to confirm if the boxing experience has any impact on shoulder internal rotation concentric and eccentric strength of amateur boxer athletes at the angular velocities of 60, 120 and 180°/sec.

## Materials and Method:-

### Samples:-

Volunteers for this investigation (n = 40) were uninjured members of amateur Greek boxing clubs, recruited from a larger study sample. To be eligible for participation in the investigation, the amateur boxers were required to have competed the 5 consecutive years before the study primarily as a boxer in organized amateur boxing matches in any category, to be uninjured and unrestricted in boxing activities at the time of testing. All participants were informed on the purpose of the study and signed the agreement forms before tests. That study was approved by the Ethic Committee of the University Peloponnese Review Board in January 2015.

**Measurements:-**

The Kin-Com<sup>TM</sup> (Chattecx, Chattanooga, TN) dynamometer was used for the determination of the peak torque of the internal/external rotators of both shoulders, during concentric and eccentric contractions at the angular velocities of 60, 120 and 180°/sec.

After the general warm-up exercises, male amateur boxers informed on the Kin-com apparatus system. The sitting position in 45 degrees of shoulder abduction in scapular plane, gives more anatomical advantages without any rate difference with upright in 90 degrees of shoulder abduction and frontal plane, (Hellwig, & Perrin., 1991), while it seems to be the most reliable power evaluation positions for internal and external rotation (Eduard et al., 2011). The device tilted to up 45 degrees (to allow 45 degrees of abduction of the shoulder) and adjusted to the lowest available rate. The joint rotation axis aligned with the axis of the arm by changing the height of the seat. The best alignment determined by visual inspection, the frontal and scapular position and seat height adjusted for each subject. The lower ends of each testing subject, supported in a chair throughout the test procedure.

The trunk and hips stabilized during the warm-up and testing repetitions. The stabilization of the trunk became with a belt that is positioned horizontally across the chest and is secured to the back of the chair and the stabilization of the hip provided with a belt positioned about 45 degrees across the pelvis and is secured to the chair. The movable seat stabilized at the position where finds the best test position.

The elbow placed in 90 degrees of flexion. The elbow/shoulder supported by the use of belt. The length of the lever arm was inserted into the computer. The peak torque of the internal/external rotators of the shoulders, during concentric contractions were measured at the angular velocities of 60, 120 and 180°/sec for all subjects.

Before the maximum effort measurements, warm up contractions were executed, consisted of three sub maximal repetitions and two maximal ones, both concentric and eccentric contractions in accordance with the test protocol (continuous or intermittent). After this procedure two minutes break in the warm-up and test followed.

The evaluation processes consisted of three repetitions of maximal voluntary eccentric and concentric contraction at internal and external rotation at the angular velocities of 60°/sec and 180°/sec. Each maximal concentric contraction was measured first, followed by an eccentric contraction. There was a two-minute rest between tests of two muscle groups. Any subject tested first in rotation at the angular velocities of 60°/sec and 180°/sec (Wilhite et al., 1992). A 2-minute rest was between the two angular velocities. During the maximum contraction test, the subjects were not allowed to use the other upper extremity of stabilization. The range of motion during the tests of the internal rotation was from 90° to 0° and from 0° to 90° for the external rotation.

The intermittent contraction protocol allowed 5 sec break in concentric and eccentric contraction. Verbal encouragement is not used during the warm-up period or during the test. All measurements were conducted in the Skordis rehabilitation center (<http://www.skordis.gr>)

**Statistics:-**

The data were statistically analyzed by statistical package for social sciences program (*version* 21.0). Analysis of variance (ANOVA) and post hoc Bonferroni method was used to compare the experience years with of the peak torque of the internal rotators of the dominant hand, during concentric/eccentric contraction. The level of significance was set at  $p = 0.05$  probability level.

**Results:-**

The age of the subjects was  $25.48 \pm 3.49$  y, the height  $1.77 \pm 6.01$  cm and body weight  $78.80 \pm 8.76$  kg. Nine athletes had 0-5 y experience, 17 athletes had 6-10 y experience and 14 of athletes had up to 10 y experience.

In the table 1 are presented the statistics of the internal concentric and eccentric contraction of the shoulder muscles according to boxing experience (One way ANOVA).

**At angular velocity of 60°/sec:-**

There was a significant difference between boxing experience and shoulder internal rotators concentric strength in dominant arm ( $F_{2,37} = 7.55$ ,  $p < 0.002$ ). Further correction by Bonferroni method showed that boxers who had

experience more than 10 y ( $57.36 \pm 4.62$  N), had greater shoulder internal rotators concentric strength in dominant arm, in relation to athletes with experience 5 y ( $50.33 \pm 2.45$  N,  $p < 0.002$ ).

There was a significant difference between boxing experience and shoulder internal rotators concentric strength in non-dominant arm ( $F_{2,37} = 3.72$ ,  $p < 0.034$ ).

Further correction by Bonferroni method showed that boxers who had experience more than 10 y ( $51.85 \pm 3.79$  N), had greater shoulder internal rotators concentric strength in non-dominant arm, in relation to athletes with experience 5 y ( $48.66 \pm 4.36$ ).

There was a significant difference between boxing experience and shoulder internal rotators eccentric strength in dominant arm ( $F_{2,37} = 4.034$ ,  $p < 0.026$ ). Further correction by Bonferroni method showed that boxers who had experience more than 10 y ( $69.21 \pm 8.70$  N) had greater shoulder internal rotators eccentric strength in dominant arm, in relation to athletes with experience 5 y ( $59.67 \pm 10.19$  N,  $p < 0.05$ ).

There was a significant difference between boxing experience and shoulder internal rotators eccentric strength in non-dominant arm ( $F_{2,37} = 3.39$ ,  $p < 0.044$ ). Further correction by Bonferroni method showed that boxers who had experience more than 10 y ( $62.29 \pm 4.53$  N), had greater shoulder internal rotators eccentric strength in non-dominant arm, in relation to athletes with experience 5 y ( $56.22 \pm 8.08$  N,  $p < 0.05$ ).

*At angular velocity of 120°/sec:*(i) There was a significant difference between boxing experience and shoulder internal rotators concentric strength in dominant arm ( $F_{2,37} = 12.73$ ,  $p < 0.001$ ). Further correction by Bonferroni method showed that boxers who had experience more than 10 y ( $51.50 \pm 5.85$  N), had greater shoulder internal rotators concentric strength in dominant arm, in relation to athletes with experience 5 y ( $43.56 \pm 1.94$  N,  $p < 0.002$ ).

There was a significant difference between boxing experience and shoulder internal rotators eccentric strength in dominant arm ( $F_{2,37} = 4.00$ ,  $p < 0.05$ ). Further correction by Bonferroni method showed that boxers who had experience more than 10 y ( $63.93 \pm 9.09$  N), had greater shoulder internal rotators concentric strength in dominant arm, in relation to athletes with experience 5 y ( $54.00 \pm 9.34$  N,  $p < 0.05$ ).

*At angular velocity of 180°/sec:* (i) There was a significant difference between boxing experience and shoulder internal rotators concentric strength in dominant arm ( $F_{2,37} = 4.66$ ,  $p < 0.016$ ). Further correction by Bonferroni method showed that boxers who had experience more than 10 y ( $45.57 \pm 5.58$  N), had greater shoulder internal rotators concentric strength in dominant arm, in relation to athletes with experience 5 y ( $39.00 \pm 4.35$  N,  $p < 0.017$ ).

There was a significant difference between boxing experience and shoulder internal rotators eccentric strength in dominant arm ( $F_{2,37} = 6.77$ ,  $p < 0.019$ ). Further correction by Bonferroni method showed that boxers who had experience more than 10 y ( $60.50 \pm 6.69$  N), had greater shoulder internal rotators eccentric strength in dominant arm, in relation to athletes with experience 5 y ( $50.00 \pm 6.77$  N,  $p < 0.035$ ).

**Table 1:** - Comparison between mean values of IRcon and IRecc at 60,120, 180°/sec of boxers and years of experience (Analysis of variance).

		Sum of Squares	df	Mean Square	F	Sig.
IRcon60D <sup>1</sup>	Between Groups	282.92	2	141.46	7.54	.002
	Within Groups	693.45	37	18.74		
	Total	976.37	39			
IRcon60ND <sup>2</sup>	Between Groups	98.02	2	49.01	3.72	.034
	Within Groups	487.95	37	13.188		
	Total	585.97	39			
IRecc60D <sup>3</sup>	Between Groups	522.02	2	261.00	4.03	.026
	Within Groups	2394.36	37	64.71		
	Total	2916.37	39			
IRecc60ND <sup>4</sup>	Between Groups	217.08	2	108.54	3.40	.044
	Within Groups	1184.29	37	32.00		
	Total	1401.37	39			
IRcon120D <sup>5</sup>	Between Groups	416.25	2	208.12	12.72	.000

	Within Groups	605.25	37	16.36		
	Total	1021.50	39			
IRcon120ND <sup>6</sup>	Between Groups	85.34	2	42.67	2.04	.145
	Within Groups	774.56	37	20.93		
	Total	859.90	39			
IRecc120D <sup>7</sup>	Between Groups	545.11	2	272.56	4.00	.050
	Within Groups	2523.99	37	68.22		
	Total	3069.10	39			
IRecc120ND <sup>8</sup>	Between Groups	197.80	2	98.90	2.30	.115
	Within Groups	1593.80	37	43.08		
	Total	1791.60	39			
IRcon180D <sup>9</sup>	Between Groups	254.47	2	127.23	4.66	.016
	Within Groups	1009.31	37	27.28		
	Total	1263.77	39			
IRcon180ND <sup>10</sup>	Between Groups	34.68	2	17.34	.884	.422
	Within Groups	726.09	37	19.62		
	Total	760.77	39			
IRecc180D <sup>11</sup>	Between Groups	646.24	2	323.12	6.77	.019
	Within Groups	1765.74	37	47.72		
	Total	2411.98	39			
IRecc180ND <sup>12</sup>	Between Groups	171.88	2	85.94	2.63	.297
	Within Groups	1209.90	37	32.70		
	Total	1381.78	39			

1. IRcon60D= Concentric contraction at 60°/sec of dominant hand
2. IRcon60ND= Concentric contraction at 60°/sec of non-dominant hand
3. IRecc60D= Eccentric contraction at 60°/sec of dominant hand
4. IRecc60ND= Eccentric contraction at 60°/sec of non-dominant hand
5. IRcon120D= Concentric contraction at 120°/sec of dominant hand
6. IRcon120ND= Concentric contraction at 120°/sec of non-dominant hand
7. IRecc120D= Eccentric contraction at 120°/sec of dominant hand
8. IRecc120ND= Eccentric contraction at 120°/sec of non-dominant hand
9. IRcon180D= Concentric contraction at 180°/sec of dominant hand
10. IRcon180ND= Concentric contraction at 180°/sec of non-dominant hand
11. IRecc180D= Eccentric contraction at 180°/sec of dominant hand
12. IRecc180ND= Eccentric contraction at 180°/sec of non-dominant hand

### Discussion:-

We conducted the present investigation to confirm if the boxing experience has any impact on shoulder internal concentric/eccentric strength of amateur boxing athletes.

Although in several sports in which the athletes using the hand above the horizontal plane have been conducted many studies, the present investigation is the first, that determined the effects of training experience of shoulder internal concentric/eccentric strength in amateur boxers.

We hypothesized initially that concentric and eccentric internal rotators strength at angular velocity of 60°/sec could be increased bilateral and symmetrical over the years of training and competitive boxing. Our results confirmed this hypothesis, since we found differences between boxers who had experience 0 to 5 y and those with up to 10 y, in concentric and eccentric internal rotation strength in both shoulders (dominant and non-dominant arm).

It seems that the internal rotators act concentrically during the acceleration phase of the boxing punches such as the hook, straight and uppercut. This loads, which occurs in training activities and fighting increases the biomechanical adaptations of muscle tendon units of internal rotators. These adaptations of the subscapularis and inner deltoid, improved because of neuromuscular adaptations of the number and the type motor units that are recruited and activated, the frequency of each pulse of the motor unit, the size of the muscle fibers, the sarcomere length and the speed of contraction. More, the effect of neuromuscular training in the boxing punches and the participation in non-

dominant hand during these synergies, increase the internal rotators power simultaneously (Andrade et al., 2010; Bompa and Buzzichelli, 2015).

Other researchers confirmed that sport specific training with regular, repeated throwing motions causes an increase in the shoulder internal rotator muscle torques in the dominant arm, thus contributed to glenohumeral stability (Ellenbecker, 1991; Ellenbecker, 1992; Elliot, Marsh, and Blanksby, 1986; Roetert, Ellenbecker, Chu and Bugg, 1997).

Beneka et al. (2002), in a classical study determined the effect of shoulder muscle training using exercises over a period of six weeks: one group followed multi-joint dynamic resistance training for the rotator cuff muscles and another one group of young healthy people trained following an isokinetic exercises program. The results showed statistically significant improvement in the internal and external rotator muscles strength after six weeks of training.

Alderink and Kuckl (1986), determined the isokinetic shoulder strength in twenty four high schools and college baseball pitchers ranging in age between fourteen to twenty one. No significant difference was found between torque output in the dominant and non-dominant internal rotators.

Codine et al. (1997), investigated shoulder internal rotation using an isokinetic device in baseball players, runners, tennis players and non-athletes, at angular velocities of 60°/s and 180°/s. The results showed that the tennis players had greater torques produced by internal rotator muscles.

Mikesky et al. (1995), assessed bilateral isokinetic concentric muscular strength of the shoulder's internal rotator muscles in a twenty five collegiate baseball pitchers. They found no significant differences in concentric strength were observed between dominant and non-dominant arms of shoulder internal rotation.

Ivey et al., (1985), determined the shoulder strength in an isokinetic device in 18 males and 13 females athletes with an age range of 21 to 50. No statistical differences were observed between the dominant and non-dominant hand. However, the mean torque values of the dominant side were higher.

Saccol et al. (2007), evaluated concentric isokinetic strength of shoulder rotators in 26 males and 14 females elite junior tennis players at 60 and 180°/s. They showed in their study that the internal rotation strength on the dominant shoulder was greater in comparison to non-dominant hand.

Andrade et al. (2010), conducted a study to establish the isokinetic profile of shoulder rotator muscles strength in female handball players. They found that the internal rotation concentric strength in the dominant hand was greater than in the non-dominant hand. The authors suggested concentric strength exercises for internal rotators to improve their adaptations.

Brown et al. (1988), investigated the shoulder rotation in an isokinetic apparatus in professional baseball players. They found that shoulder internal rotator muscles of the dominant arm produced greater torque in comparison with the muscles of the non-dominant arm.

McMaster et al (1991), in their study determined the peak torques produced by the shoulder internal rotator muscles in elite water polo players. They found that there were significantly greater in the dominant arm than in the non-dominant arm muscles.

Ellenbecker and Bleacher (1999), investigated the internal rotation strength in 38 females aged between 25 45 years using the Cybex norm dynamometer. After analysis of their results, they found that the internal rotation shoulder strength was greater in dominant hand in comparison to non-dominant hand. The measurement of concentric and eccentric shoulder internal rotation, was done with the subjects in a seated position in 45° of shoulder abduction in the scapular plane.

The second hypothesis of our study was that would be significant differences between years of experience and concentric/eccentric internal rotators strength at angular velocity of 120°/sec in dominant in dominant hand. Our results confirmed that boxers that had experience up to 10 years had better concentric and eccentric internal rotation strength in dominant shoulder, than the boxers who had boxing experience until 5 years. These adaptations at the

same angular velocities, are mentioned in other sports in which the hand is used up to horizontal plane, lead to substantial gains in muscular strength (Ellenbecker and Roetert, 2002).

The third hypothesis of our study was that would be significant differences between years of experience and concentric and eccentric internal rotators strength at angular velocity of 180°/sec only in dominant hand. Our results confirmed that boxers that had experience up to 10 years had better concentric and eccentric internal rotation strength in dominant shoulder, than the boxers that had boxing experience until 5 y.

The next hypothesis was that would be significant differences between years of experience and concentric/eccentric internal rotators strength at 180°/sec in dominant hand. The analysis showed that boxers who had experience up to 10 years had better concentric/eccentric internal rotation strength in dominant shoulder, than the boxers who had boxing experience until 5 years. These adaptations are mentioned in other sports such as collegiate tennis (Chandler et al., 1992), elite junior and players (Koziris et al., 1991), in collegiate swimmers (McMaster, Long and Caiozzo, 1991), water polo players (McMaster, Long and Caiozzo, 1991), as well as wheelchair athletes (Burnham, et al., 1993).

#### **Reliability of isokinetic assessment of shoulder internal rotator strength:-**

For the assessment of concentric/eccentric shoulder internal rotation strength, we used for the present study, the seated position of 45° of shoulder abduction in the scapular plane. This position seemed the most reliable for IR strength assessment, since its reliability has been studied in most methodologically high-quality studies (Codine et al., 2005; Davies, 1992; Dauty et al., 2003; Meeteren, Roebroek and Stam, 2002; Plotnikoff and MacIntyre, 2002). The mentioned position has many advantages because is more comfortable, physiological and safe. More, it elicits optimal torque; and it showed good to excellent reliability for concentric/eccentric shoulder internal rotation strength (Davies, 1992; Edouard et al., 2011).

#### **Conclusions:-**

The present study showed that the training experience can increase the concentric power of shoulder internal rotation in the measurement angular velocities of 60, 120 and 180°/sec. These results confirm that the boxing experience plays an important role on the increase of internal shoulder rotators strength not only in the dominant hand, but in the non-dominant hand as well. However, it is unclear if bilateral symmetry in strength is adequate for long-term effective and injury-free sports performance in this group of boxing amateur athletes.

Further studies are necessary to elucidate the action of the shoulder internal rotators during a boxing punches, i.e., whether they act as primary propulsions or shoulder stabilizers. In addition, other factors such as shoulder flexors and extensors strength, punching and timing may be important determinants of glenohumeral stabilization and merit future study. More, future studies that incorporate a prospective design will be necessary to determine whether a point exists at which inadequate muscle strength is a risk factor for injury or negatively affects punching effectiveness without rotator cuff injuries.

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#### **Conflict of Interest:-**

The authors reports no conflict of interest in the reporting of the present data.

#### **References:-**

1. Andrade, Mdos, S., Fleury, A.M., de Lira, C.A., Dubas, J.P. and da Silva, A.C. (2010): Profile of isokinetic eccentric-to-concentric strength ratios of shoulder rotator muscles in elite female team handball players. *J. Sports Sci.*, 28(7):743-9.
2. Alderink, G.J., and Kuck, D.J (1986): Isokinetic shoulder strength of high school and college-aged pitchers. *J. Orthop. Sports Phys. Ther.*, 7: 163-172.
3. Beneka, A., Malliou, P., Giannakopoulos, K., Kyrialanis, P., and Godolias, G.(2002): Different training modes for the rotator cuff muscle group. A comparative study. *Isokinet. Exerc. Sci.*, 10:73-79.
4. Bompá, T., and Buzzichelli, C. (2015): Periodization Training for Sports, 3E: Human Kinetics.

5. Brown, L.P., Niehues, S.L., Harrah, A., Yavorsky, P. and Hirshman, H.P. (1988): Upper extremity range of motion and isokinetic strength of the internal and external shoulder rotators in major league baseball players. *Am. J. Sports Med.*, 16(6):577- 85.
6. Burnham, R.S., May, L., Nelson, E., Steadward R., Reid, D.C. (1993): Shoulder pain in wheelchair athletes: The role of muscle balance. *Am. J. Sports Med.*, 21 :238-242.
7. Chaabène, H., Tabben, M., Mkaouer, B., Franchini, E, et al. (2014): Amateur boxing: physical and physiological attributes. *Sports Med.*, 34: 1-16.
8. Chandler, T.I., Kibler, W.B., Stracener, E.C., Ziegler, A.K., and Pace, B (1992): Shoulder strength, power, and endurance in college tennis players. *Am. J. Sports Med.*, 20:455-458.
9. Codine, P., Bernard, P.L., Pocholle, M., Benaim, C., Brun, V. (1997): Influence of sports discipline on shoulder rotator cuff balance. *Med. Sci. Sports Exerc.*, 29:1400–1405.
10. Codine, P., Bernard, P.L., Sablayrolles, P. and Herisson, C.(2005): Reproducibility of isokinetic shoulder testing. *Isokinet. Exerc. Sci.*, 13:61–62.
11. Dauty, M., Delbrouck, C., and Huguet, D. (2003): Reproducibility of concentric and eccentric isokinetic strength of the shoulder rotators in normal subjects 40 to 55 years old. *Isokinet. Exerc. Sci.*, 11:95–100.
12. Davies, G. (1992): A compendium of isokinetics in clinical usage and rehabilitation techniques. 4th ed. Onalaska, WI: S & S.
13. Edouard, P., Samozino, P., Julia, M., GleizesCervera, S., et al. (2011): Reliability of isokinetic assessment of shoulder-rotator strength: A systematic review of the effect of position. *J. Sport Rehabil.*, 20(3): 367-383.
14. Ellenbecker, T.S. and Roetert, E.P. (2002): Effects of a 4-month season on glenohumeral joint rotational strength and range of motion in female collegiate tennis players. *J. Strength and Cond. Res.*, 16(1): 92–96.
15. Ellenbecker, T. S., and Davies, G. J. (2000): The application of isokinetics in testing and rehabilitation of the shoulder complex. *J. Athl. Train.*, 35(3): 338-350.
16. Ellenbecker, T.S. (1991): A total arm strength isokinetic profile of highly skilled tennis players. *Isok. Exerc. Sci.*, 1:9–21.
17. Ellenbecker, T. S., and Bleacher, J. (1999): A descriptive profile of bilateral glenohumeral joint internal and external rotation strength in uninjured females using the cybex NORM dynamometer. *Phys. Ther.*, 79, S80.
18. Ellenbecker, T.S. (1992): Shoulder internal and external rotation strength and range of motion of highly skilled junior tennis players. *Isokinet. Exerc. Sci.*, 2:1–8.
19. Elliot, B., Marsh, T. and Blanksby, B. (1986): A three-dimensional cinematographic analysis of the tennis serve. *Int. J. Sport Biomech.*, 2:260–271.
20. Hellwig, E. V., and Perrin, D. H. (1991): A comparison of two positions for assessing shoulder rotator peak torque: the traditional frontal plane versus the plane of the scapula. *Isok. Exerc. Scie.*, 1(4): 202-206.
21. Hinton, R.Y. (1988): Isokinetic evaluation of shoulder rotational strength in high school baseball pitchers. *Am. J. Sports Med.*, 16(3):274-279.
22. Ivey, F.M., Calhoun, J.H., and Rusche, K. (1985): Isokinetic testing of the shoulder strength. Normal values. *Arch. Phys. Med. Rehabil.*, 66: 384-386.
23. Radcliffe, J.C. (1984): Farentinos RC. Plyometrics: Explosive power training. Boulder, CO: Exer Technics Publishers.
24. Koziris, L.P., Kraemer, W.J., Triplett, N.T., Fry, I., et al. (1991): Strength imbalances in women tennis players. *Med. Sci. Sports Exerc.* 23(Suppl): 253, (Abstract).
25. Koutedakis, Y. and Jamurtas, A.Z. (2014): The dancer as a performing athlete: physiological considerations. *Sports Med.*, 34: 651-61.
26. McMaster, W.C., Long, S.C., and Caiozzo, V. (1992): Shoulder torque changes in the swimming athlete. *Am. J. Sports Med.*, 20:323- 327.
27. McMaster, W.C., Long, S.C., and Caiozzo, V. (1991): isokinetic torque imbalances in the rotator cuff of the elite water polo player. *Am. J. Sports Med.*, 19:72-75.
28. Meeteren, J., Roebroek, M.E., and Stam, H.J. (2002): Test–retest reliability in isokinetic muscle strength measurements of the shoulder. *J. Rehabil. Med.*, 34:91–95.
29. Mikesky, A.E., Eduards, J.E., Wiggelesworth, J.K. and Kunkel, S. (1995): Eccentric and concentric strength of the shoulder and arm musculature in collegiate baseball pitchers. *Am. J. Sports Med.*, 23(5):638-42.
30. Pędzich, W., Mastalerz, A. and Sadowski, J. (2012): Estimation of muscle torque in various combat sports. *Acta Bioeng. Biomech.*, 14: 107-112.
31. Plotnikoff, N.A. and MacIntyre, D.L. (2002): Test–retest reliability of glenohumeral internal and external rotator strength. *Clin. J. Sport Med.*, 12:367–372.



32. Ratamess, N. A. (2012): ACSM's foundations of strength training and conditioning: Wolters Kluwer Health/Lippincott Williams & Wilkins.
33. Roetert, E.P., Ellenbecker, T.S., Chu, D.A. and Bugg, B.S. (1997): Tennis-specific shoulder and trunk strength training. *Strength Cond.* 19:31–39.
34. Saccol, M.F., da Silva, R.T., Gracitelli, G., Frota, C. et al. (2007): Concentric and eccentric isokinetic strength profile of shoulder rotators in elite junior tennis players XXV ISBS Symposium 2007, OuroPreto – Brazil, 608-11.
35. Stergioulas, A. and Aggelidis, Ch. (2002): *Kinesiology*. O.E.D. Publ. Athens, Greece.
36. Stergioulas, A. (2005): *Biology of exercise*. Simmetria Publ. Athens, Greece.
37. Stergioulas, A. (1991): *Sport injuries*. Simmetria Publ. Athens, Greece.
38. Tillin. N.A. (2010): Neuromuscular performance of explosive power athletes versus untrained individuals. *Med. Scie. Sports Exerc.*, 42(4): 781-790.
39. Wilhite, M. R, Cohen, E. R, and Wilhite, S. C. (1992): Reliability of concentric and eccentric measurements of quadriceps performance using the KIN-COM dynamometer: the effect of testing order for three different speeds. *J.Orth.SportsPhys.Ther.*, 15(4): 175-182.
40. Wilk, K.E., Andrews, C.A., Arrigo, M.A., Kerns, M.A., et al., (1993): The strength characteristics of internal and external rotator muscles in professional baseball pitchers. *Am. J. Sports Med.*, 21:61–66.



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## RESEARCH ARTICLE

### IMMUNOHISTOCHEMICAL EXPRESSION OF CYTOKERATIN 20 (Ck20) IN COLORECTAL TUMORS AMONG SUDANESE PATIENTS.

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Immunohistochemical, Ck20, colorectal tumor, Sudanese

#### Abstract

**Background and Objective:** Cytokeratin 20 (CK20) is a widely expressed epithelial protein used as immunohistochemical marker for routine diagnosis. The aim of the current study was to detect the immunohistochemical expression of Ck20 tumor marker in colorectal tumors among Sudanese patients.

**Methods:** Retrospective analytical case control study was conducted at Khartoum state. One hundred and fifty previously diagnosed colorectal tumor blocks were enrolled including 100 malignant tumors and 50 benign colorectal tumors. The paraffin sections were tested by immunohistochemical method for CK20 expression.

**Results:** Females were significantly at greater risk of getting colorectal malignant tumors than males (p. value 0.003). Malignant tumors were significantly more common in the rectal site than the colon site (p 0.000). Significant positive immunohistochemical expression of Ck20 was noticed in colorectal malignant tissues (58%) when compared to benign tumors (22%) (p 0.000).

**Conclusion:** The study concluded that colorectal cancer was more distributed in females and the rectal was the most affected site. Immunohistochemical expression of Ck20 in malignant tissues was twice that of benign colorectal tumors confirming the importance of CK20 staining colorectal carcinogenesis regardless of cancer grade.

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#### Introduction: -

Colorectal cancer is a major cause of morbidity and mortality throughout the world. It accounts for over 9% of all cancer incidence<sup>(1)</sup>. It is the third most common cancer worldwide and the fourth most common cause of death<sup>(2)</sup>. Cytokeratin 20 (CK20) is a polypeptide with molecular weight of 48.5 kDa encoded by a gene located on chromosome 17q21.2<sup>(3, 4)</sup>. The immunohistochemical expression of CK20 marker was considered suitable for the localization and therapy checks. The levels of Ck20 reflect the success of surgery, radiotherapy and chemotherapy on the patients<sup>(5)</sup>. Immunohistochemical studies with highly specific antibodies showed that CK20 expression in normal tissues is limited to epithelial cells of the gastrointestinal (GI) tract, the urothelium and Merkel cells, and that

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this profile is maintained in malignant tumors of these cells. Both the specificity of CK20 antibodies and the restricted CK20 expression make CK20 a valuable diagnostic marker. Accordingly, CK20 IHC is a useful diagnostic tool for the classification of tumors, especially in the case of distant metastasis where the tissue of origin is unknown, as well as for the detection of disseminated tumor cells<sup>(6)</sup>. The objectives of this study were to detect the immunohistochemical expression of Ck20 tumor marker in colorectal tumors among Sudanese patients and to correlate immunohistochemical expression of Ck20 tumor marker with cancer grades and demographical data of patients.

## **Materials and Methods: -**

### **Study subjects: -**

A retrospective analytical case control study aimed to detect the immunohistochemical expression of Ck20 tumor in colorectal tumors among Sudanese patients. The study was conducted at Khartoum state in IbnSina and Soba Teaching Hospitals during the period April 2014 – December 2015. One hundred and fifty blocks of colorectal tumors were enrolled in the study including one hundred blocks previously diagnosed as colorectal cancer and fifty benign colorectal tumor blocks.

### **Immunohistochemical staining: -**

Sections of 5µm in thickness were obtained from each formalin-fixed paraffin embedded tissue block using rotary microtome. Sections were immune stained using monoclonal antibodies by new indirect techniques. Briefly, sections placed on coated slides were dewaxed in hot plate oven and cleared in two changes of xylene for two minutes. Sections were then hydrated through a series of ethanol concentrations (100%, 90%, 70%, 50%) and a final wash in water for two minutes for each. Slides were retrieved by water bath heat retrieval technique and treated with hydrogen peroxide for fifteen minutes. After that, sections were washed in phosphate buffer saline (PBS, pH 7.4) for five minutes and treated with protein blocker solution for fifteen minutes. Sections were treated with anti- Ck20 primary antibodies for thirty minutes, and then rinsed in PBS before being treated with secondary polymer conjugate for thirty minutes and rinsed in PBS. Slides were treated with DAB for seven minutes then washed in PBS for five minutes. For the staining step, sections were counter stained in Mayer's hematoxylin for one minute washed and blued in running tap water before they were dehydrated through ascending concentrations of ethanol (50%, 70%, 90% & 100%). Sections were finally cleared in xylene and mounted in DPX<sup>(7)</sup>.

### **Statistical analysis: -**

The data were analyzed using SPSS computer program, frequency, means and chi-square values were calculated.

### **Ethical consideration: -**

Before the study, was conducted the proposal of the study were ethically approved by ethical committee of the Sudan University of Science and Technology and Ministry of Health research committee. An official written permission to conduct the study was obtained by the investigator from responsible authorities.

## **Results: -**

A total of 150 paraffin blocks previously diagnosis as colorectal tumors were collected in the study. According to the histopathological diagnosis, 100 tumors were classified as malignant cases and 50 as benign controls.

According to gender, 44% were males and 56% were females among patients with malignant tumors, while the majority of benign tumors were among males (70%). Females were found to be at significant greater risk of getting malignant tumors (p. value= 0.003, OR= 2.9, CI= 1.25-3.5) as malignant tumors constituted 79% of all tumors among females. According to age group, patients with malignant tumors were slightly older at presentation (41% were less than 50 years old and 59% were more than 50 years), while the opposite was among patients with benign tumors in which 58% were less than 50 years and 42% were more than 50 years, with significant relation between the elder age group and malignant histopathological diagnosis (p 0.049). Concerning the site of the tumor, colon site was less presented among malignant tumors (41%) when compared to rectal site tumors (59%), while the majority of benign tumors were at the colon site (72%), with significant relation between the rectal site of tumor and malignant histopathological diagnosis (p 0.000) (Table 1).

Positive immunohistochemical expression of Ck20 was represented in 58% of malignant tissues. While only 22% of benign tissues were positive for this marker with significant relation between immunohistochemical expression of Ck20 and histopathological diagnosis (Table 2) (Fig. 1).

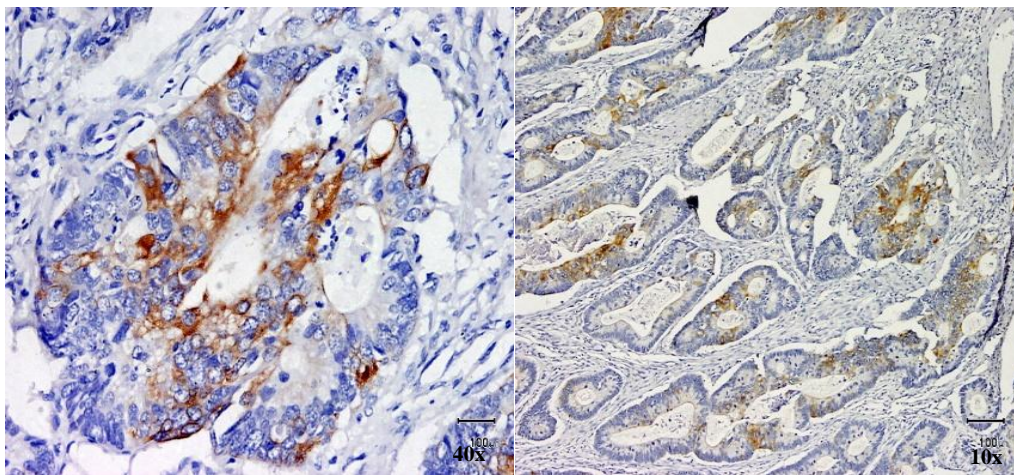
The immunohistochemical expression of Ck20 was mostly positive in moderately differentiated and well differentiated tumors (65% and 54% respectively), with no significant relation between the immunohistochemical expression of Ck20 and cancer grade (p 0.123) (Table 2).

**Table 1:-**Relation between demographical data and histopathological diagnosis among study population.

Demographical Data		Histopathological diagnosis		P. value
		Malignant	Benign	
		NO. (%)	NO. (%)	
Gender	Male	44 (44%)	35 (70%)	0.003
	Female	56 (56%)	15 (30%)	
	Total	100 (100.0%)	50 (100.0%)	
Age	< 50	41(41%)	29 (58%)	0.049
	≥ 50	59 (59%)	21 (42%)	
	Total	100 (100.0%)	50 (100.0%)	
Site of tumor	Colon	41(41%)	36 (72%)	0.000
	Rectal	59 (59%)	14 (28%)	
	Total	100 (100.0%)	50 (100.0%)	

**Table 2: -**Relation between Ck20 immunohistochemical expression, histopathological diagnosis and cancer grade.

Ck20 Immunohistochemical expression	Histopathological Diagnosis		Cancer Grade		
	Malignant	Benign	Well Differentiated	Moderately Differentiated	Poorly Differentiated
	Number (%)	Number(%)	NO. (%)	NO. (%)	NO. (%)
Positive	58 (58.0%)	11 (22.0%)	22 (54.0%)	33 (65.0%)	3 (37.5%)
Negative	42 (42.0%)	39 (78.0%)	19 (46.0%)	18 (35.0%)	5 (62.5%)
Total	100 (100%)	50 (100%)	41 (100%)	51 (100%)	8 (100%)
P. Value	0.000		0.123		



**Figure 1: -**Moderately differentiated colorectal cancer showing positive CK20 expression (10X and 40X).

### Discussion: -

Colorectal adenocarcinoma is a heterogeneous disease that involves multiple tumorigenic pathways. The disease is one of the most commonly diagnosed cancers, and a leading cause of cancer deaths, around the world<sup>(8)</sup>.

According to the literature, colorectal cancer has higher prevalence among elder individuals<sup>(9)</sup>. In the current study, patients with malignant tumors were slightly older at presentation (59% were more than 50 years) with a mean age of  $52 \pm 15$  years while the opposite was observed among patients with benign tumors (58% were less than 50 years) with a mean age of  $50 \pm 15$  years. Marginal significant relation between the elder age group and malignant histopathological diagnosis ( $p = 0.049$ ) was noticed in the study.

In contrast to most of the reported data<sup>(9, 10)</sup>, females were found at greater risk of developing malignant tumors constituting 79% (56/71) of all tumors, while the majority of benign tumors were among males (70%). Colorectal cancer is broadly considered to be an environmental disease with a wide range of cultural, social, and lifestyle factors<sup>(11)</sup>. Thus, the higher presentation of females might be due to some differences in the predisposing factors among Sudanese or might be due to sampling error that lowered the presentation of females among benign tumors. However, and according to data in hand, being a female increases the risk of getting malignant colorectal tumors by three times among Sudanese.

Concerning the site of the tumor, colon site was less presented among malignant tumors (41%) when compared to rectal site tumors (59%), while the majority of benign tumors were at the colon site (72%), with significant relation between the rectal site and malignant histopathological diagnosis. Interestingly, when gender was included in the analysis, malignant tumors were equally distributed between the two sites among females while 70% of males had tumors at the rectal site supporting other reports of sexual differences in the site of the disease. Male: female ratio of rectal was reported to be higher in most high incidence populations in contrast to low incidence populations where the sex ratio between these two sites is comparable. Therefore, it's reasonable to correlate such changes with adopting modernized life style among Sudanese population. The results of this study also supports that the differences under the influence of environmental factors are site-specific<sup>(12)</sup>.

Cytokeratin 20 (CK20) is a low molecular weight member of the Cytokeratin family of proteins that is expressed in primary colorectal tumors and their metastatic cells. It was considered a relevant marker for colorectal diagnosis, since its expression is restricted to gastric and intestinal epithelium, urothelial, and Merkel cells, as well as cancers originating from these tissues<sup>(13)</sup>. Thus, CK20 levels can provide clinically valuable information on the postoperative prognosis of patients with colorectal cancer<sup>(14)</sup>. The accumulative effects of such gene may play an important role during carcinogenesis<sup>(15)</sup>. Moreover, Cytokeratin-based tumor marker assays were considered as a simple and cheap tool for efficient management before conventional methods<sup>(16)</sup>. In concordance with other studies, CK20 expression in the current study presented a good indicator for malignancy even though it was expressed in both malignant and benign tumors (22% and 58% respectively). Thus, our data agrees with several other studies in considering cytokeratin 20 (CK20) a well-established marker for colon cancer. The detected expression in the current study was lower than most of the reported data<sup>(9, 14)</sup>. For instance reported higher expression values of CK20 in colorectal cancer (80%)<sup>(9)</sup>. Moreover, other studies showed higher frequencies of CK20 in colorectal adenocarcinomas reaching 81% and 84%<sup>(17, 18)</sup>. It's also important to highlight the significance of the reported negative immunohistochemical expression of CK20 in this study (42%) which was associated with higher microsatellite instability in previous studies and thus bad prognosis<sup>(19)</sup>.

In general, the analyzed subset of samples showed differential expression of CK20 throughout the different histological grades representing 53.6% of well differentiated tumors, 64.7% of moderately differentiated samples and 37.5% of poorly differentiated tumors. However, immunohistochemical expression of CK20 among malignant tumors was not significantly correlated with cancer histological grade ( $p > 0.05$ ). Several studies reported no relevance between cancer grade and CK20 expression<sup>(5, 20)</sup>. Accordingly, CK20 can be considered an indicator to primary colorectal cancer tumors or malignancy in general but that elevated expression can be disingenuous afterwards in the tumor.

### Conclusion: -

The study concludes that colorectal cancer was more distributed in female and the rectal was the most affected site. CK20 expression was higher in the colorectal malignant tumors in general regardless of the histological grade of tumors. Our results sustain the data published in literature concerning the importance of immunohistochemical expression of CK20.

**References: -**

1. Siegel R, DeSantis C, Virgo K, Stein K, Mariotto A, Smith T, et al. Cancer treatment and survivorship statistics, 2012. *CA: a cancer journal for clinicians*. 2012;62(4):220-41.
2. Ferlay J, Shin HR, Bray F, Forman D, Mathers C, Parkin DM. Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. *International journal of cancer*. 2010;127(12):2893-917.
3. Bragulla HH, Homberger DG. Structure and functions of keratin proteins in simple, stratified, keratinized and cornified epithelia. *Journal of anatomy*. 2009;214(4):516-59.
4. Schweizer J, Bowden PE, Coulombe PA, Langbein L, Lane EB, Magin TM, et al. New consensus nomenclature for mammalian keratins. *The Journal of cell biology*. 2006;174(2):169-74.
5. Awad-Elkareem A, Mohammed S, Osman. Immunohistochemical Expression of Cytokeratin 20 in Colorectal Cancer. *European Academic Research*. 2016;III(11):11683-91.
6. Lassmann S, Bauer M, Soong R, Schreglmann J, Tabiti K, Nährig J, et al. Quantification of CK20 gene and protein expression in colorectal cancer by RT-PCR and immunohistochemistry reveals inter-and intratumour heterogeneity. *The Journal of pathology*. 2002;198(2):198-206.
7. Bancroft JD, Gamble M. *Theory and practice of histological techniques*: Elsevier Health Sciences; 2008.
8. Ferkolj I, Gangl A, Galle P, Vucelic B. *Pathogenesis and clinical practice in gastroenterology*: Springer; 2008.
9. Zlatian OM, Comănescu M, Roșu A, Roșu L, Cruce M, Găman A, et al. Histochemical and immunohistochemical evidence of tumor heterogeneity in colorectal cancer. *Romanian journal of morphology and embryology= Revue roumaine de morphologie et embryologie*. 2014;56(1):175-81.
10. Al-Attraqchi AA, Abdulhassan BA, Mahmood FM, Hana DB. Molecular and Immunohistochemical Detection of JC Polyomavirus in Human Colorectal Polyps in sample of Iraqi Patients. *Int J Curr Microbiol App Sci*. 2015;4(2):743-55.
11. Hagggar FA, Boushey RP. Colorectal cancer epidemiology: incidence, mortality, survival, and risk factors. *Clinics in colon and rectal surgery*. 2009;22(04):191-7.
12. Koo JH, Leong RW. Sex differences in epidemiological, clinical and pathological characteristics of colorectal cancer. *Journal of gastroenterology and hepatology*. 2010;25(1):33-42.
13. Kust D, Šamija I, Kirac I, Radić J, Kovačević D, Kusić Z. Cytokeratin 20 positive cells in blood of colorectal cancer patients as an unfavorable prognostic marker. *Acta Clinica Belgica*. 2016:1-9.
14. Li W, Xiao H, Hong X, Niu W. Predictive value of CK20 in evaluating the efficacy of treatment and prognosis after surgery for colorectal cancer. *Genetics and molecular research: GMR*. 2015;14(2):5823.
15. Wang Y, Liu S, Hao D. [Mutations of APC gene MCR region in sporadic colorectal adenomas and carcinomas]. *Zhonghua zhong liu za zhi [Chinese journal of oncology]*. 1998;20(4):284-6.
16. Barak V, Goike H, Panaretakis KW, Einarsson R. Clinical utility of cytokeratins as tumor markers. *Clinical biochemistry*. 2004;37(7):529-40.
17. Bayrak R, Haltas H, Yenidunya S. The value of CDX2 and cytokeratins 7 and 20 expression in differentiating colorectal adenocarcinomas from extraintestinal gastrointestinal adenocarcinomas: cytokeratin 7-/20+ phenotype is more specific than CDX2 antibody. *Diagnostic pathology*. 2012;7(1):1.
18. Wong SCC, Chan CML, Ma BBY, Hui EP, Ng SSM, San Lai PB, et al. Clinical significance of cytokeratin 20-positive circulating tumor cells detected by a refined immunomagnetic enrichment assay in colorectal cancer patients. *Clinical Cancer Research*. 2009;15(3):1005-12.
19. McGregor DK, Wu T-T, Rashid A, Luthra R, Hamilton SR. Reduced expression of cytokeratin 20 in colorectal carcinomas with high levels of microsatellite instability. *The American journal of surgical pathology*. 2004;28(6):712-8.
20. Vrabie CD, Ceausu M, Petrescu A, Waller M, Dina I. The usefulness of immunohistochemistry in sporadic colorectal cancer. *Romanian Journal of Morphology and Embriology*. 2008;49(4):525-36.



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### RESEARCH ARTICLE

#### PRETERM LABOUR: A STUDY OF ETIOLOGICAL RISKFACTORS AND PERINATAL OUTCOME.

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preterm labour, perinatal outcome,  
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membranes,

#### Abstract

**Objective:** To study the causes associated with preterm labour and the perinatal outcome in preterm labour.

**Methods:** This prospective observational study was conducted in the department of obstetrics and gynaecology NDMC Medical College and Hindu Rao Hospital over a period of 6 months (Jan to June 2016). All patients presented with preterm labour, preterm premature rupture of membrane and with conditions where labour was iatrogenically induced prematurely were included in the study. All the patients were divided into four groups depending upon the gestational age – less than 28 weeks, 28 to 31 weeks, 32 to 34 weeks and more than 34 weeks. Risk factors and the perinatal outcome were analyzed.

**Results:** Out of 4382 patients delivered 946 were preterm delivery (21.5%). 54 out of 946 preterm deliveries had come with intrauterine death. The commonest risk factor of preterm delivery was preterm premature rupture of membrane followed by infection, anemia, preeclampsia and abruption. 73.2% of patients went into spontaneous preterm labour and 26.8% had caesarean section. Maximum perinatal complications and death were seen in group with gestational age less than 28 weeks.

**Conclusions:** The most common associated cause for preterm birth was preterm premature rupture of membrane. Perinatal outcome improves with gestational age. All preterm deliveries should be conducted in tertiary care hospital where better neonatal care is available.

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#### Introduction:-

WHO defines preterm birth as the delivery of an infant between 20 and less than 37 weeks of gestation. Preterm delivery is responsible for 70% of mortality and 75% of morbidity in the neonatal period [1]. Approximately 12.9 million babies worldwide are born too early every year, representing an incidence of preterm birth of 9.6% [2]. About 85% of all preterm births occur in Africa and Asia [3]. Preterm birth can be due to spontaneous preterm labour with intact membrane, preterm premature rupture of membranes and delivery for maternal and fetal indications. Spontaneous preterm labour and PPRM contributes to 70% of cases [4]. About 70% of cases are seen at late gestational age (34-36 weeks) [5]. The precise etiology is still unknown. Many factors like prior preterm

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deliveries, low social-economic status, extremes of maternal age, (<17, >35 years of age) and present obstetric complications like over distension of uterus, pre-eclampsia and antepartum haemorrhage are thought to be mainly responsible for onset of preterm labour [6].

#### **Aims and objective:-**

1. To find out the incidence, etiological risk factors responsible for preterm labour.
2. To evaluate the perinatal outcome in preterm births.

#### **Material and Methods:-**

This prospective observational clinical study was carried out in 946 cases, between 20 weeks to less than 37 weeks of gestation, who presented with preterm labour, preterm premature rupture of membrane and with conditions where labour was iatrogenically induced prematurely were included in the study. The patients who presented with following signs and symptoms were included in the study:-

1. Painful uterine contractions four in 20 min with progressive cervical changes.
2. Cervical effacement of more than 80% and dilatation more than 1 cm.

The duration of study was 6 months. All the cases were admitted in the labour room and the progress of labour was monitored. Obstetric management was done as per the findings in the individual case. Paediatricians were available at the time of delivery. All subjects and their babies were followed throughout their hospital stay. Associated maternal risk factors and perinatal outcomes were analyzed. Babies were transferred to premature baby care unit for neonatal care and neonatal outcome was analyzed.

#### **Results:-**

Total number of delivery in 6 months study period were 4382. Out of 4382 deliveries, 946 were preterm birth (21.5%). It was observed that 40% women were from poor social-economic status. 44.5% of cases had pregnancy duration of 34 to 37 weeks. 70% cases had some associated risk factor responsible for preterm labour. PPROM, hypertension and anemia were the common risk factors associated with preterm labour (Table 1). 73.2% delivered vaginally and 26.8% cases were delivered by caesarean section. Perinatal mortality was 17.8% (Table 2). Early neonatal death was seen in 7.1% of cases. 4.4% of preterm deliveries came with intrauterine death. Antepartum haemorrhage, hypertension and fetal congenital malformation were common causes of still births (Table 3) whereas respiratory distress syndrome, birth asphyxia and septicaemia were common causes of early neonatal deaths (Table 4). Neonatal outcome was directly proportional to gestational age (Table 5) and birth weight of the baby. Neonatal mortality was highest in the babies born with birth weight less than 750 grams.

**Table 1:** Risk factors associated with Preterm Labour

RISK FACTORS	No. OF CASES	PERCENTAGE
PPROM	180	19.1
HYPERTENSION	159	16.9
ANAEMIA	104	11
ANTEPARTUM HAEMORRHAGE	58	6.2
IUD	54	5.7
HYDRAMNIOS/MULTIPLE PREGNANCY	52	5.4
CONGENITAL MALFORMATIONS	30	3
OTHERS	25	2.7
TOTAL	662	70

**Table 2:** Perinatal mortality in Preterm Births

TYPE OF DEATH	NO. OF CASES	PERCENTAGE
MACERATED STILL BIRTH	42	4.4
FRESH STILL BIRTH	59	6.3
EARLY NEONATAL DEATH	68	7.1
TOTAL	169	17.8

**Table 3:** Risk factors associated with Still Birth in Preterm Labour



RISK FACTORS	NO. OF FRESH STILLBIRTHS	NO. OF MACERATED STILL BIRTHS
ANTEPARTUM HAEMORRHAGE	22	10
PREGNANCY INDUCED HYPERTENSION	19	10
FETAL CONGENITAL MALFORMATION	6	8
MATERNAL ANAEMIA	-	6
BIRTH ASPHYXIA	4	-
MATERNAL HEPATITIS	2	4
OTHERS	6	4
TOTAL	59	42

**Table 4:** Causes of Neonatal Deaths

CAUSES	NO. OF CASES	PERCENTAGE
R.D.S	26	38.3
BIRTH ASPHYXIA	16	23.5
SEPTICAEMIA	11	16.3
FETAL CONGENITAL MALFORMATION	5	7.3
MECONIUM ASPIRATION	6	8.8
PULMONARY HAEMORRHAGE	4	5.8
TOTAL	68	100

**Table 5:** Association of Perinatal Mortality with Gestational Age.

GESTATIONAL AGE (weeks)	NO. OF CASES	PERCENTAGE
<28	63	37.6
28-32	50	29.8
32-34	33	19
>34	23	13.6
TOTAL	169	100

**Discussion:-**

This clinical prospective study was carried out in a tertiary care teaching hospital for duration of 6 months. In the present study, the incidence of preterm birth was 21.5% which was higher than reported by Bangal et al [7] and Devi et al [8] where incidence were 13.2% and 12.18% respectively. The higher incidence could be due to many preterm high risk pregnancies referred to our hospital and associated risk factors necessitating a preterm birth for maternal and fetal indication. In the present study, 40% women were from poor socio-economic status whereas in a study reported from Bangal et al [7] 95% of cases were from poor socio-economic class. The reason for high poor socio-economic class was that their study was carried out in a rural tertiary care teaching hospital catering patients from surrounding villages.

In the present study, it was found that 70% of preterm deliveries had associated risk factors. Molly et al [9](1970) found that 67% of premature births had some obvious risk factors associated with preterm labour and Bangal et al [7](2012) found the associated risk factor in 57% of cases. In the present study the common risk factors were preterm premature rupture of membrane followed by hypertension, anemia and antepartum haemorrhage.

In the present study, 44.5% of preterm births were between 34 to < 37 weeks of gestation. Similar reports were reported by Bangal et al [7]. In their study 50% cases had pregnancy duration of 32 to 34 weeks. The reason for the selective rise in the "late preterm" group possibly was due to an increase in medical reasons necessitating a preterm delivery, changes in obstetric practice or both [10].

The perinatal mortality among premature babies is very high in developing countries due to low birth weight and prematurity. In the present study it was observed that perinatal mortality was directly related to birth weight and

gestational age of the baby. Similar outcome was observed by Devi et al (1974) [8], Singh et al (1980) [11] and Bangal et al (2012) [7].

In the present study, the perinatal mortality was 17.8% as compared to 42.4% seen in a study conducted by Bangal et al [7]. The reason for low perinatal mortality in our hospital was due to availability of better neonatal care unit. The main risk factor associated with fresh still birth in the present study are acute placental insufficiency as a result of antepartum haemorrhage and severe hypertension. Fetal congenital malformation, severe anemia and hepatitis were responsible for antepartum fetal death. The most common cause for early neonatal death was respiratory distress syndrome seen in 38.3% of cases followed by birth asphyxia and septicemia. Similar results were observed by Bangal et al (2012) [7] in their study.

Preventive measures like regular antenatal check-ups, screening of high risk cases, diagnosis and treatment of lower genital tract infections [12][13] by performing prophylactic encirclage in cases of cervical incompetence [14], use of short term tocolysis and glucocorticoids for improving lung maturity [15,16], improving maternal nutrition leads to reducing the incidence of preterm labour and thereby reducing perinatal mortality. Neonatal septicemia can be reduced by improving the aseptic conditions in the labour room and in the neonatal care unit and by use of broad spectrum antibiotics in preterm labour. Birth asphyxia can be reduced by improvement in neonatal care facilities.

### Conclusion:-

Preterm onset of labour has a multifactorial etiology. Early detection and correction of risk factors like control of blood pressure in preeclampsia, correction of anemia, treatment of cervicovaginal infections and asymptomatic bacteriuria, avoidance of coitus in late pregnancy and cervical encirclage in proven cases of cervical incompetence can reduce the incidence of preterm labour. Maternal betamethasone for enhancing the fetal pulmonary maturity and reducing the incidence of respiratory distress syndrome in new born babies should be administered. All preterm deliveries should be conducted in tertiary care hospital where better perinatal care is available.

### Declaration of interest statement:-

The authors report no declarations of interest.

### References:-

1. Mc Cormick MC. (1985): The contribution of low birth weight to infant mortality and childhood morbidity. *N Engl J Med.*, 312: 82-90
2. Beck S, Wojdyla D, Say L, et al. (2010): The worldwide incidence of preterm births, a systematic review of maternal mortality & morbidity. *Bulletin of world health org* 88:31.38
3. World Health Organization (2006): Neonatal and perinatal mortality: country, regional and global estimates. WHO, Geneva
4. Tucker JM, Goldenberg, RL, Davis RO, et al. (1991): Etiologies of preterm birth in an indigent population: Is prevention a logical expectation. *Obstet Gynecol.*, 77: 343-347
5. Raju TNK. (2006): Epidemiology of late (near-term) preterm birth. *Clin perinatal.*, 33:751-763
6. Preterm labour in Textbook of obstetrics by D.C Dutta 6<sup>th</sup> ed. (2004): Published by new central book agency, Calcutta. Page 314-315
7. Bangal VB, Shinde KK, Gayatri KK, Patil NA. (2012): A study of risk factors and perinatal outcome in preterm labour at tertiary care hospital. *International journal of Biomedical research.*, 3(3):147-150
8. Devi PK, Krishna Menon MK, Bhasker Rao K. (1980): Post Graduate Obstetrics and Gynaecology, 3<sup>rd</sup> ed., Published by orient Longman Ltd Madras. Page 204-209
9. Molly P, Jain P.C and Prasad B.G. (1970) Environmental factors in preterm labour. *J. Obstetrics and Gynaec India.*, 20: 728.
10. Preterm birth trends in Greece, (1980-2008): A rising concern. Baroutis G, Mousiolis A, Mesogitis S, Costalos C, Antsaklis A. *Acta obstet Gynecol Scand.* 2013;92.
11. Singh M, Khare UN and Bhargava SK. Third International seminar on Maternal Mortality, Perinatal Mortality and Sterilisation, 3<sup>rd</sup> -5<sup>th</sup> October 1980, New Delhi
12. Leitich H, Bonder-Adler B, Brunbauer M, Kaider A, Egarter C, Husslein P. (2003): Bacterial vaginosis as a risk factor for preterm delivery: A meta-analysis *Am J Obstet Gynecol.*, 189(1): 139-147
13. Morency AM, Bujold E. (2007): The effect of second trimester antibiotic therapy on the rate of preterm birth, *J Obstet Gynecol Can.*, 29(1):35-44

14. BerghellaU, Baxter JK, Hendrix NW. Cervical assessment by ultrasound for preventing preterm delivery. Cochrane database of systematic reviews 2009; Issue 3. Art.no; CD 007235
15. American college of Obstetrician and Gynaecologists. Antenatal corticosteroid therapy for fetal maturation. Committee opinion no 419. (2008): Obstet Gynecol., 112: 963- 965.
16. American College of obstetrician and gynaecologists. (2008): Antenatal corticosteroid therapy for fetal maturation. COG committees opinion no 402. Obstet Gynecol., 111: 805.



### RESEARCH ARTICLE

## IMPROVEMENT OF LEAST FREQUENCY USED WEB CACHE REPLACEMENT TECHNOLOGY USING INTELLIGENT AGENTS.

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LFU; proxy cache; removable policies;  
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### Abstract

The rapid development of the Internet needs to meet development and improvement of techniques to increase the performance of browsing and decrease the overload on the network traffic. To overcome this situation, Web caching techniques have been used. Web cache reduces the high traffic over the Internet so that users can access the web content faster.

The ALFUR replacement algorithm is developed by taking advantage of LFU, LRU and SIZE cache replacement algorithms. This algorithm separates the operation of the algorithm into three main agents, that we use it because to have the benefit of agents. This paper introduces the new proposed technique and compares between traditional LFU and ALFUR.

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### Introduction:-

Nowadays, the rapid development of computer networks and internet services, the interactive web pages especially the social media have been accompanied by a mass and an extension in the speed of browsing and access to information at high speed. This speed is the causative agent that is dealing with the cache memory on browser side, proxy or origin server side. In order to be in a high speed browsing, should be dealing mainly with the cache memory of web caching concepts, since these pages must be carried into cache memory. While the main issues lie in the cache memory on any side have some limitations of size, it might be possible to the main memory to be fully occupied depending on the data or object that is stored in it. So, looking at this scenario in a serious way at this important junction, the proposed web caching policy of this study tends to tackle this issues immediately as it is continuously happening.

The sample of data is generated using webtraff generator, to compare between LFU and ALFUR the researcher generated 5 sample of data with cache size 1Mb, 6Mb, 500Mb, 800Mb and 1Gb.

There are different points at which we can set up a cache such as browser at client site, proxy server and close to original server. When a user requests web page, firstly it is checked in cache, if the requested web page is available then is sent back to the user. If the web page is not found in the cache, then the request is redirected to the web server and the response is sent to the client. Because of the limited size of the cache memory, it becomes so hard to save all objects in this memory [1].

The new proposed algorithm to improve LFU web cache replacement is named ALFUR - the proposed algorithm - combines between main web caching replacement strategies: LFU, Least Redundancy Used (LRU) and SIZE respectively; to take advantage of their features.

ALFUR is designed to solve the problem of the traditional web caching replacement strategies; to decrease the overhead of network traffic and to increase the speed of browsing. This paper is implemented using artificial intelligent that is play main role to improve algorithms.

#### **LFU replacement strategy:-**

LFU replacement strategy is one of web cache replacement strategy. That used to remove object from cache memory to free space for new objects. The cache memory play main role with increase the speed of browsing throw internet. Mainly LFU depends on frequency number, Frequency number is increased once when web object is requested. The object with least frequency is removed from the cache [1].

#### **Disadvantage of LFU:-**

Since LFU is a frequency-based strategy, it considers the frequency of access. This is valuable in static environments where the status of objects does not change very much over a specific time period (day, week).

#### **The disadvantages are as follows [1]:-**

Complexity. LFU-based strategies involve a more complex cache administration. LFU cannot be implemented, for example without a priority queue.

Cache pollution. Frequency counts are static for dynamic changes in the Workload. Therefore, aging was introduced. But aging is nothing but a recency- based technique. It is questionable if sophisticated aging techniques are better than simple recency-based techniques in dynamically changing environments. Furthermore, they add complexity to the replacement process.

Similar values. Many objects can have the equivalent frequency count. In this case, a tie breaker factor is required.

#### **Category of cache page Replacement policy:-**

Cache page replacement policies can be divided into four categories as follows:

##### **Recency-based:-**

In this category, time is the main issue, i.e. time to access the last references of object. An example of this category is LRU (Least Recently Used) that has been applied in a number of proxy caching servers.

##### **Size-based:-**

In this category, object size is the basic parameter. LFU-Size based algorithm is considered an example of this category.

##### **Frequency-based:-**

In this category, the frequency of the object is functioned, that number of times an object is accessed is worked on. An algorithm of this category is LFU.

##### **Function-based:-**

This category involves multiple parameters which are related to performance metric that was used to determine a cost based function algorithms. Most suggestive algorithm of this category is Greedy-Dual Size. [3], [4], [7].

##### **Agent:-**

There is no commonly recognized definition of the word agent. Russel and Norvig (1995) define an agent as an entity that can be viewed as perceiving its environment through sensors and acting upon its environment through effectors.

(Coen, 1995) views software agents as programs that engage in dialogs and negotiate and coordinate the transfer of information.

Wooldridge and Jennings (1995) state that an agent is a hardware and/or software-based computer system displaying the properties of autonomy, social adeptness, reactivity, and proactivity. Others (Brustolini, 1991; Franklin and Graeser, 1996; Maes, 1995; Hayes-Roth et al, 1995; Gilbert et al, 1995) offer variants on this theme.

There is an agreement with Autonomy; the ability to act without the involvement of humans or other systems, is a significant feature of an agent. Furthermore, different attributes take on different importance based on the domain of the agent. [5]

#### **Intelligent agent:-**

Wooldridge and Jennings (1995) define an intelligent agent as one that is capable of flexible autonomous action to meet its design objectives.

#### **Flexible means:-**

##### **Reactivity:-**

Intelligent agents identify and respond in a timely fashion to changes that arise in their environment in order to fulfill their design objectives. The agent's aims and/or rules that form the root for a process that is currently executing may be affected by a changed environment and a different set of actions might be needed to be accomplished.

##### **Pro-activeness:-**

In a changed environment, intelligent agents have to recognize opportunities and take the initiative if they are to produce meaningful results. The challenge to the agent designer is to integrate effectively goal-directed and reactive behavior.

##### **Social ability:-**

Intelligent agents are proficient of cooperating with other agents (and possibly humans), through negotiation and/or collaboration, to satisfy their design objectives [5], [6].

#### **Proposed system:-**

This technique was developed based on LFU policy with some significant improvements that let the web object near to end user to reduce the network traffic and increase the availability of web object in cache.

ALFUR technique used additional factors to select the victim- object to be deleted- and remove it from cache to free space for another object. All calculations to select the object to remove is done using multi-agent system.

Although ALFUR technique can be implemented in cache memory at end user side, proxy server side or original server side; it has been implemented at proxy cache memory side; because proxy server caching is widely operated by computer network administrators to reduce user delays and to alleviate Internet overcrowding.

#### **ALFUR technique common properties:-**

1. Distributed Manner: The knowledge required to solve some problems does not reside in a single resource or agent, so that cooperation of many individual agents is needed to solve the problems.
2. Speed: Each agent has its own local processor and memory.
3. Efficiency: Not all knowledge is needed for all tasks, the agent uses the only part of the knowledge required to solve the problem.
4. Reliability: Multi-agent system is more reliable because there would be multiple agents in the setup which provide particular functionality or service. If an agent resource providing some functionality dies, another agent may take over.

#### **ALFUR Technique:-**

##### **ALFUR properties rotate around three issues:-**

First, it provides the characteristics of intelligent agent which have been discussed here before, beside this Agents in ALFUR Technique can act independently that states Autonomous. Each agent is independent with local tasks, it has the capabilities of problem-solving and decision-making and acts as a centralized management system.

##### **Second, ALFUR considers four mechanisms in dealing with multi agents system:-**

Cooperation: It is the process of sharing responsibilities in satisfying shared goals and generating dependent roles in joint activities.

**Coordination:** It is the process of management of agents' activities so that they coordinate their deeds with each other in order to share resources, meet their own interests.

**Independence:** every agent in ALFUR technique is able to work concurrently and relatively independently, it has its own goal to increase hit ratio and byte hit ratio, but it is also capable of coordinating with other agents in order to achieve a common goal.

**Agents Communication:** Agents communicate among themselves by message passing, an agent can be permanently ready to receive messages from other agents and, at the same time, carry out its own computational tasks.

Third, ALFUR technique contains some artificial intelligence techniques such as:

**Learning:** learning provides an excellent method for optimizing agent's action. Reinforcement learning (RL) is a generic name given to a family of techniques in which an agent tries to learn a task by directly interacting with the environment. In multi-agent reinforcement learning, many agents are simultaneously learning by interacting with the environment and with each other.

There are two popular learning algorithms for single-agent systems: value iteration and Q-learning, and they can be extended to multi-agent systems.

#### **ALFUR Description:-**

ALFUR is a new multi agent technique that consists of four big agents: Reader agent, Analyzer agent, Removal agent and Performance agent, which are disused as following:

**Reader Agent:** The reader agent reads the object date from "access log file" which is created by the proxy server.

**Analyzer Agent:** The main task of the analyzer agent is the calculations of frequency, size and request time for objects, in order to prepare object's information and then send it to the removal agent.

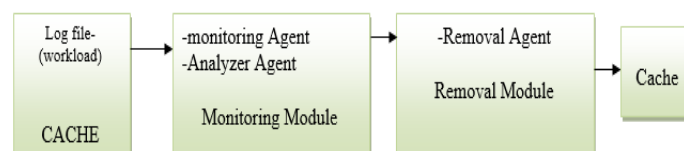
**Removal Agent:** Its main task is to remove objects to create free space in cache for other object, depending on the analyzer agent results.

**Performance evaluator Agent:** calculates the number of hit ratio and number of byte hit ratio that are used to measure the performance of ALFUR.

#### **Model Architecture:-**

The model architecture consists of three modules as shown in figure1:

1. The Monitoring Module: contains the monitoring agent and analyzer agent. It is a reactive agent that monitors the proxy cache. This agent works by using a fast response behavior. It provides information that allows the analyzer agent to take a decision.
2. The Removal Module: contains the parent cache removal agent that cleans up the cache according to web object frequencies, sizes, and times.



**Figure1:-** Model Architecture

#### **Algorithm Methodology:-**

Proposed ALFUR new technique reads the objects in cache memory using a reader agent, then it analyzes the cache object using an analyzer agent that calculates average of frequencies, object's frequency, size and time, and then removes the object using a removal agent based on the following conditions:

If object's frequency is greater than the average of frequencies, then don't remove the object, otherwise remove the object.

If object's frequency equals to the average of frequencies, then compare the object's size with the average, if it's greater, it must be removed.

If object's frequency equals the average frequencies and the average equals to the object's size, then calculate the average of the web objects' time stamp, if it is less than the web object time stamp, don't remove the object, otherwise remove the object.

Finally, the performance agent calculates the number of hit ratio and number of byte hit ratio to measure the performance of this new technique.

#### **ALFUR algorithms:-**

- Read web object
- Calculate web object frequency, size ,request time
- Calculate Average of web object frequency, size and request time
- IF object Freq>Average objects Freq THEN
- ((Don't remove object
- else
- Remove object)
- Else IF object Freq=Average objects and object size>average objects size THEN
- (Remove object
- else
- Don't remove object)
- Else IF object Freq=Average object and object size=average object size and object request time>average request time THEN
- (Don't remove object
- Else
- remove object))
- end

#### **Performance Metrics:-**

To accomplish the objective, cache replacement policy depends on several key metrics. Based on these performance metrics, we can compare the performance of different algorithms. These performance metrics play a very important role in web cache performance calculation. Such replacement policy aims to optimize performance metrics. To evaluate the performance of the cache, performance metrics are being used. The most commonly used are hit rate, byte hit rate saved bandwidth, and delay saving ratio.

#### **Hit rate:-**

The percentage of all object requests which are found in the cache instead of transferring from the requested server.

#### **Byte hit:-**

The percentage of all data that is transferred straight from the cache rather than from the requested server.

This paper measures the performance of proposed ALFUR model using Hit and Byte hit ratio for the new cache file after implement the model.

The hit ratio calculates the summation of requested objects found in new cache file divided by the number of all objects in original cache.

$$HitRatio = \frac{\sum_{i=1}^n \partial i}{n}$$

The byte hit ratio calculates the summation of requested objects size found in new cache file divided by total objects in original cache.



$$\text{ByteHitRatio} = \frac{\sum_{i=1}^n b_i \partial_i}{\sum_{i=1}^n b_i}$$

When n: total Number of requests

$\partial_i$ : 1 if the request i is in the cache

$\partial_i$ : 0 otherwise

$b_i$ : size in bytes

### Result:-

The following figures show the comparison of ALFUR with traditional LFU removable algorithms in terms of Hit ratio. For different cache size shows above the figures.

Hit ratio Comparison figure 2 Tested with cache size 1MB

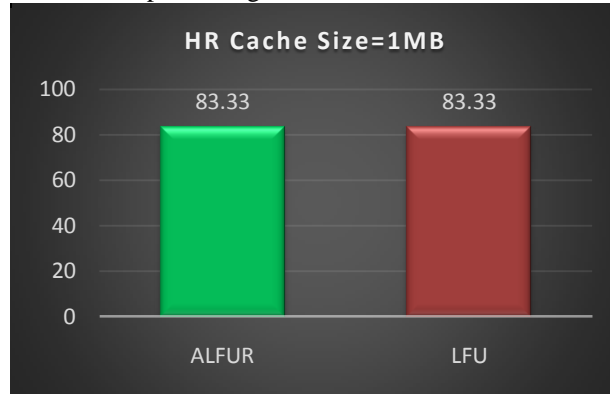


Figure 2:- HR (ALFUR vs. LFU cache size 1Mb)

Hit ratio Comparison figure 3 Tested with cache size 6MB

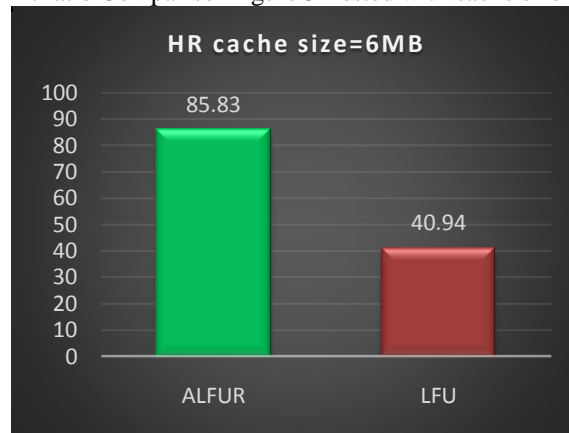
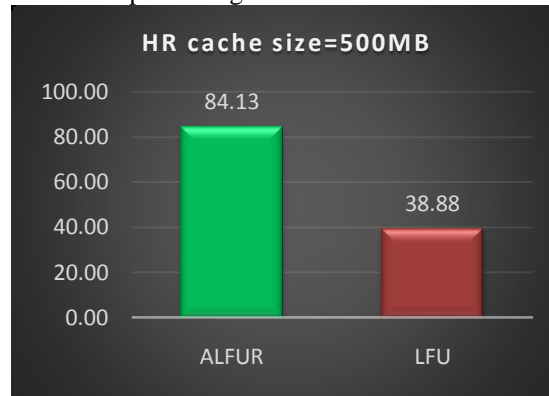


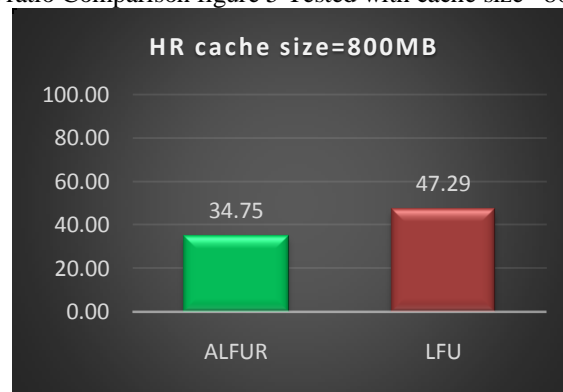
Figure 3:- HR (ALFUR vs. LFU cache size 6Mb)

Hit ratio Comparison figure 4 Tested with cache size 500MB



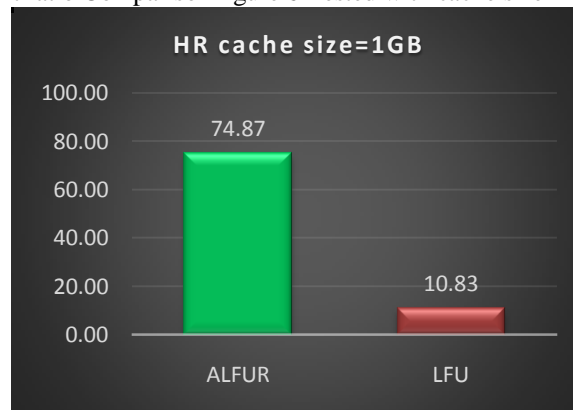
**Figure 4:-** HR (ALFUR vs. LFU cache size 500MB)

Hit ratio Comparison figure 5 Tested with cache size 800MB



**Figure 5:-** HR (ALFUR vs. LFU cache size 800MB)

Hit ratio Comparison figure 6 Tested with cache size 1GB

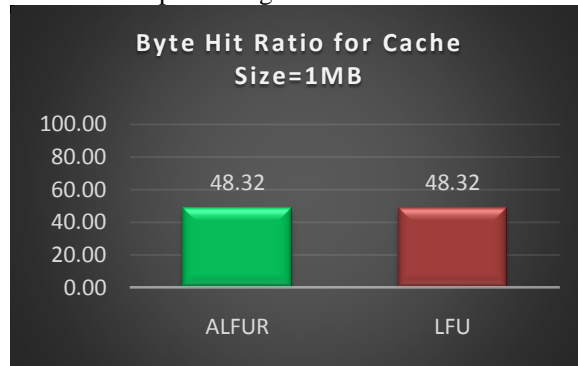


**Figure 6:-** HR (ALFUR vs. LFU cache size 1GB)

**Byte Hit Ration Performance comparison (ALFUR vs. LFU):-**

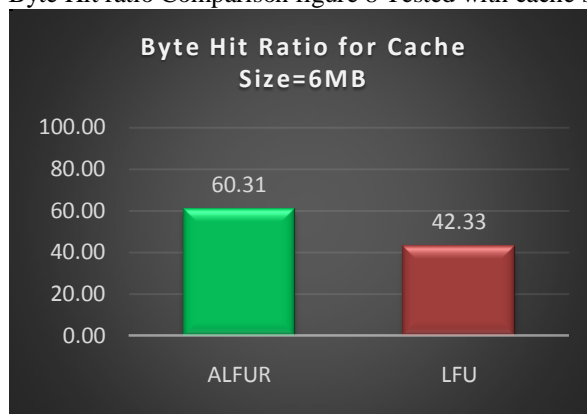
The following figures show the comparison of ALFUR with traditional LFU removable algorithms in terms of Byte Hit ratio. For different cache size shows above the figures.

Byte Hit ratio Comparison figure 7 Tested with cache size 1MB



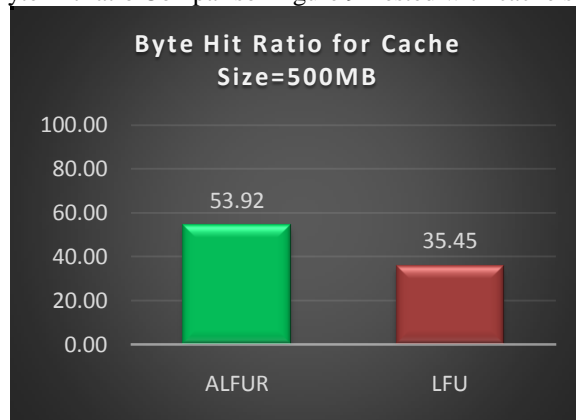
**Figure 7:-** BHR (ALFUR vs. LFU cache size 1MB)

Byte Hit ratio Comparison figure 8 Tested with cache size 6MB



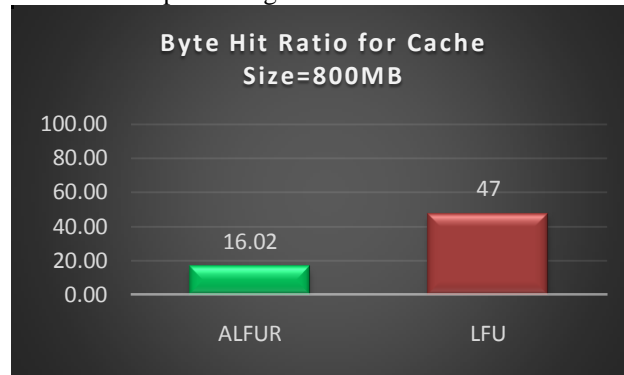
**Figure 8:-** BHR (ALFUR vs. LFU cache size 6MB)

Byte Hit ratio Comparison figure 9 Tested with cache size 500MB



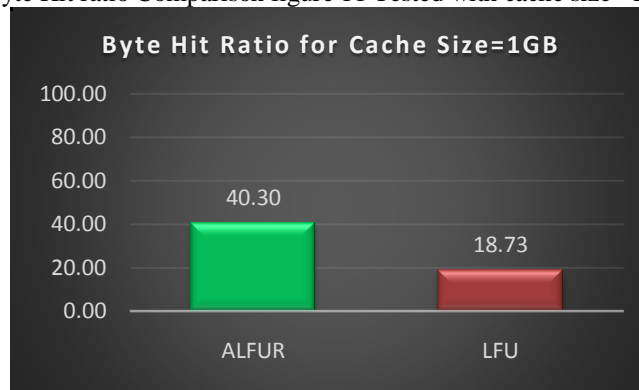
**Figure 9:-** BHR (ALFUR vs. LFU cache size 500MB)

Byte Hit ratio Comparison figure 10 Tested with cache size 800MB



**Figure 10:-** BHR (ALFUR vs. LFU cache size 800MB)

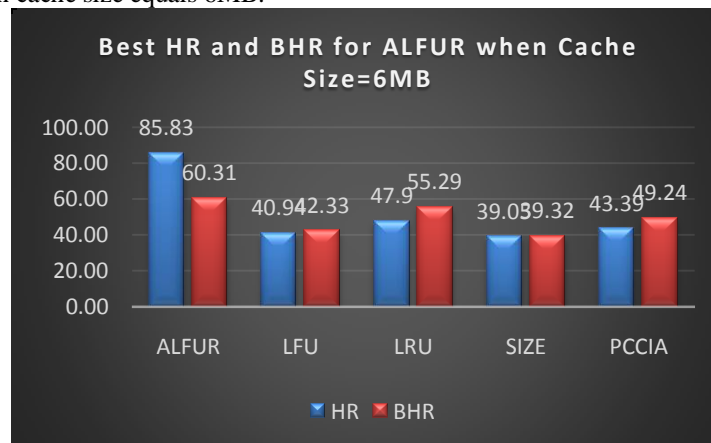
Byte Hit ratio Comparison figure 11 Tested with cache size 1GB



**Figure 11:-** BHR (ALFUR vs. LFU cache size 1GB)

#### **ALFUR Best Result In Hit Ratio and Byte Hit Ratio:-**

The figure 12 shows the best result of ALFUR in term of Hit Ratio and Byte Hit Ratio for generated data using webtraff simulator, when cache size equals 6MB.



**Figure 12:-** Best HR and BHR for ALFUR

#### **ALFUR Worst Result In Hit Ratio and Byte Hit Ratio:-**

The figure13 shows the best result of ALFUR in term of Hit Ratio and Byte Hit Ratio for generated data using webtraff simulator, when cache size equals 800MB

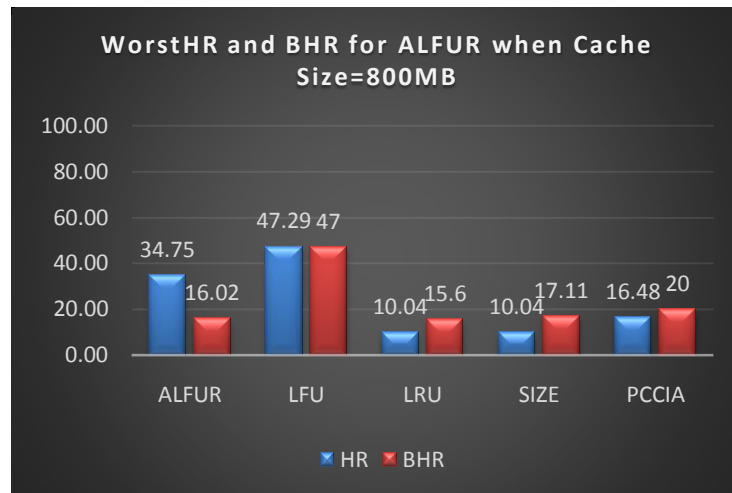


Figure 13:- Worst HR and BHR for ALFUR

### Result Discussion:-

The webtraff simulation results illustrated that the cache size plays a main role in improving the performance of the web cache. There is a difference when the cache size increases and decreases. the new ALFUR algorithm has better performance over traditional LFU replacement algorithms in terms of Hit Rate and Byte Hit Rate.

### Result Discussion in terms of Hit Ratio (ALFUR vs. LFU):-

This section consists of performance result discussion for data generated using webtraff in terms of Hit Ratio between ALFUR and LFU.

- Figure 2, cache size is equal to 1Mb the ALFUR and LFU are same result with hit ratio 83.33%. This rate of hit ratio is forth range for all samples.
- Figure 3, cache size is equal to 6Mb the ALFUR is in the better rate than LFU in this size with hit ratio 85.83% and LFU hit ratio is equal to 40.94%.ALFUR is better than LFU in this size with +44.89% rate of hit ratio. This rate of hit ratio is the third range for all samples.
- Figure 4, cache size is equal to 500Mb the ALFUR is in the better rate than LFU in this size with hit ratio 84.13% and LFU hit ratio is equal 38.88%.ALFUR is better than LFU in this size with +45.25% rate of hit ratio. This rate of hit ratio is the second range for all samples.
- Figure 5, cache size is equal to 800Mb the LFU is in the better rate than ALFUR in this size with hit ratio 47.29% and ALFUR hit ratio is equal to 34.745%.ALFUR is worse than LFU in this size with -12.54% rate of hit ratio. This rate of hit ratio is the fifth range for all samples.
- Figure 6, cache size is equal to 1 GB the ALFUR is in the better rate than LFU in this size with hit ratio 74.87% and LFU hit ratio is equal to 10.83%.ALFUR is better than LFU in this size with +64.04% rate of hit ratio. This rate of hit ratio is the first range for all samples.

### Result Discussion in terms of Byte Hit Ratio (ALFUR vs. LFU):-

This section consists of performance result discussion for data generated using webtraff in term of Byte Hit Ratio between ALFUR and LFU.

- Figure 7, cache size is equal to 1Mb, the ALFUR and LFU are same result with byte hit ratio 48.32%. This rate of byte hit ratio is forth range for all samples.
- Figure 8, cache size is equal to 6Mb the ALFUR is in the better rate than LFU in this size with byte hit ratio 60.31% and LFU byte hit ratio is equal to 42.33%.ALFUR is better than LFU in this size with +17.98% rate of byte hit ratio. This rate of byte hit ratio is the third range for all samples.
- Figure 9, cache size is equal to 500Mb the ALFUR is in the better rate than LFU in this size with byte hit ratio 53.92% and LFU byte hit ratio is equal to 35.45%.ALFUR is better than LFU in this size with +18.47% rate of byte hit ratio. This rate of byte hit ratio is the second range for all samples.
- Figure 10, cache size is equal to 800Mb the LFU is in the better rate than ALFUR in this size with byte hit ratio 47.00% and ALFUR byte hit ratio is equal to 16.02%. ALFUR is worse than LFU in this size with -30.98% rate of byte hit ratio. This rate of byte hit ratio is the fifth range for all samples.

- Figure 11, cache size is equal to 1Gb the ALFUR is in the better rate than LFU in this size with byte hit ratio 40.30% and LFU byte hit ratio is equal to 18.73%.ALFUR is better than LFU in this size with +21.57% rate of byte hit ratio. This rate of byte hit ratio is the first range for all samples.

### Conclusion:-

This paper introduces a new LFU web cache replacement using intelligent agent, this algorithm used more than one factors for removing object from cache memory. ALFUR compares between averages number of frequency with object request and removes the least frequency, if more than object have same frequency, it compares average object size with object size, and remove object with the biggest size, if more than object have same average object size, then finally it compares between time stamps of object and average of time stamp and remove the object with old request time. The comparison condition illustrated ALFUR algorithm. ALFUR is best performance when comparing Hit, Byte Hit, and Miss Ratio, The average ALFUR hit rate is equal to 72.58%, and from above result the ALFUR is better than average LFU which is equal to 44.25%. This means that ALFUR algorithm has better performance than LFU in terms of Hit Ratio with +28.33% rate. The average ALFUR byte hit rate is equal to 43.77%, from above result the ALFUR is better performance than average LFU which is equal to 38.37%. This mean that ALFUR algorithm has better performance than LFU in the terms of Byte Hit Ratio with +5.41% rate.

### References:-

1. Waleed Ali, Siti Mariyam Shamsuddin, and Abdul Samad Ismail "A Survey of Web Caching and Prefetching",Universiti Teknologi Malaysia, ICSRS Publication, 2011.
2. Abdullah balamash and Marwan krunz, "An Overview of Web Caching Replacement Algorithms", IEEE Communications Surveys &Tutorials, 2004, Vol.6 (2).
3. K.Geetha, Dr.N.Ammasai Gounden, Monikandan S., "SEMALRU: An Implementation of modified web cache replacement algorithm", IEEE,2009.
4. Kapil Arora, Dhawaleswar Rao ChWeb Cache Page Replacement by Using LRU and LFU Algorithms with Hit Ratio: A Case Unification, International Journal of Computer Science and Information Technologies, Vol. 5 (3) , 2014, 3232 – 3235.
5. Rudowsky, Proceedings of the Americas Conference on Information Systems, New York, New York, August 2004
6. Rudowsky, Proceedings of the Americas Conference on Information Systems, New York, New York, August 2004
7. Hiba. A. Nasir, Yahia. A. Mohammed, Amir. A. Eisa, "Agent-based Proxy Cache Cleanup Model using Fuzzy Logic", proceedings of International Conference of Computing Electrical and Electronic Engineering (ICCEEE), Khartoum, Sudan, August 2013.



### RESEARCH ARTICLE

## SOME VERY SPECIAL PYTHAGOREAN TRIANGLES WITH THEIR PERIMETERS AS BOTH TRIANGULAR AND PENTAGONAL NUMBERS.

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### Abstract

To find out the Special Pythagorean Triangles, where their perimeters are Triangular numbers and Pentagonal numbers both is the main objective of this paper. A few interesting results are observed.

#### Key words:-

Pythagorean Triangles, Triangular Numbers, Pentagonal numbers.

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### Introduction:-

Figure Numbers, first studied by Pythagoras, played very important role in Pythagorean science of numbers. Pythagorean Theorem, which gave the world, a powerful method of proof, *reductio ad absurdum*, also called **Proof by Contradiction**, continues to ignite the minds of those who love to play with numbers. Rana and Darbari [1] obtained special Pythagorean Triangles, with their legs to be consecutive, in terms of Triangular Numbers while Darbari [2] explored their perimeters as triangular numbers. Gopalan and Janaki [3] and Darbari [4] have studied special Pythagorean Triangles in terms of Pentagonal Numbers. Extending the problem further, existence of special Pythagorean triangles with their perimeters as Triangular Numbers and Pentagonal numbers both is explored in this paper.

### Method of Analysis:-

The primitive solutions of the Pythagorean Equation,

$$X^2 + Y^2 = Z^2 \quad (2.1)$$

is given by [5]

$$X = m^2 - n^2, Y = 2mn, Z = m^2 + n^2 \quad (2.2)$$

for some integers  $m, n$  of opposite parity such that  $m > n > 0$  and  $(m, n) = 1$ .

#### Perimeter is a Triangular number:-

Definition 2.1.1: A natural number  $p$  is called a Triangular number if it can be written in the form

$$\frac{\gamma(\gamma+1)}{2}, \gamma \in \mathbb{N}$$

Definition 2.1.2: A natural number  $p$  is called a Pentagonal number if it can be written in the form

$$\frac{\beta(3\beta-1)}{2}, \beta \in \mathbb{N}$$

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If the perimeter of the Pythagorean Triangle (X, Y, Z) is Triangular and Pentagonal number  $p$ , then

$$X + Y + Z = \frac{\gamma(\gamma+1)}{2} = \frac{\beta(3\beta-1)}{2} = p \quad (2.3)$$

By virtue of equation (2.2), equation (2.3) becomes

$$2m^2 + 2mn = \frac{\gamma(\gamma+1)}{2} = \frac{\beta(3\beta-1)}{2} = p, \gamma \text{ \& } \beta \in N \quad (2.4)$$

Using *Mathematica* for  $0 < \gamma < 10^{20}$ ,  $0 < \beta < 10^{20}$ , there are just 18 numbers which are both Triangular and Pentagonal numbers. They are as follows:

**Table 2.1:-** Numbers which are both Triangular and Pentagonal

S.N.	$\beta$	$\gamma$	$\frac{\gamma(\gamma+1)}{2} = \frac{\beta(3\beta-1)}{2}$
1.	1	1	1
2.	12	20	210
3.	165	285	40755
4.	2296	3976	7906276
5.	31977	55385	1533776805
6.	445380	771420	297544793910
7.	6203341	10744501	57722156241751
8.	86401392	149651600	11197800766105800
9.	1203416145	2084377905	2172315626468283465
10.	16761424636	29031639076	421418033734080886426
11.	233456528757	404358569165	81752926228785223683195
12.	3251629977960	5631988329240	15859646270350599313653420
13.	45289363162681	78443478040201	3076689623521787481625080301
14.	630799454299572	1092576704233580	596861927316956420835951924990
15.	8785902997031325	15217630381229925	115788137209866023854693048367775
16.	122371842504138976	211954248632985376	22462301756786691671389615431423376
17.	1704419892060914337	2952141850480565345	4357570752679408318225730700647767185
18.	23739506646348661740	41118031658094929460	845346263718048427044120366310235410530

Since perimeter is even, investigating even such numbers from the Table 2.1 using software *Mathematica*, only the following six numbers have corresponding Pythagorean Triangles: 297544793910, 11197800766105800, 15859646270350599313653420, 596861927316956420835951924990, 22462301756786691671389615431423376 and 845346263718048427044120366310235410530.

**Case 1:** For  $\gamma = 771420$  and  $\beta = 445380$ ,  $\frac{\gamma(\gamma+1)}{2} = \frac{\beta(3\beta-1)}{2} = 297544793910$ ,  $0 < m < 10^{20}$ ,  $0 < n < 10^{20}$ , we get 07 (X, Y, Z) which are given below:

**Table 2.2:-** (X, Y, Z) with  $p = 297544793910$  (Triangular and Pentagonal No.)

S.N.	m	n	X	Y	Z	X + Y + Z
1.	275793	263642	35209270941	128804961460	133530561509	297544793910
2.	288535	227078	80300244885	93781558468	123462990557	297544793910
3.	290465	221722	86262074885	88031908068	123250810957	297544793910
4.	319189	146906	95049293885	78940172148	123555327877	297544793910
5.	323661	135994	134369999309	26262379860	136912414741	297544793910
6.	330609	119386	6554674685	145421236212	145568883013	297544793910
7.	368295	35654	31688028141	131039901460	134816864309	297544793910



**Table 2.3:-** Verification of  $X^2 + Y^2 = Z^2$ 

S.N.	$X^2$	$Y^2$	$X^2 + Y^2 = Z^2$
1.	42963760226179849225	21147335941426300108944	21190299701652479958169
2.	1004131127464807915881	17171455774646510131600	18175586902111318047481
3.	1239692760196747025481	16590718096712085331600	17830410856908832357081
4.	6448129328590968663225	8794980708686902507024	15243110037277871170249
5.	7441145563465347763225	7749616838092803492624	15190762401558151255849
6.	9034368268037098393225	6231550778755874933904	15265919046792973327129
7.	18055296714300660477481	689712595910933619600	18745009310211594097081

**Case 2:** For  $\gamma = 149651600$  and  $\beta = 86401392$ ,  $\frac{\gamma(\gamma+1)}{2} = \frac{\beta(3\beta-1)}{2} = 11197800766105800$ ,  $0 < m < 10^{20}$ ,  $0 < n < 10^{20}$ , we get 42 (X, Y, Z) out of which first five are given below:

**Table 2.4:-** (X, Y, Z) with  $p = 11197800766105800$  (Triangular and Pentagonal No.)

S.N.	m	n	X	Y	Z
1.	52932221	52842679	9471296095800	5594160726120118	5594168743889882
2.	53815300	50223893	373647086014551	5405627737925800	5418525942165449
3.	54351525	48661231	586172867390264	5289624226454550	5322003672260986
4.	54404196	48508829	606710051455175	5278167681292968	5312923033357657
5.	54418764	48466711	612379800130175	5274997015530408	5310423950445217

**Table 2.5:-** Verification of  $X^2 + Y^2 = Z^2$  with  $p = 11197800766105800$ 

S.N.	$X^2$	$Y^2$	$X^2 + Y^2 = Z^2$
1.	89705449734316322777640000	31294634229664765872185764333924	31294723935114500188508541973924
2.	139612144887165273496983731601	29220811241032801487686305640000	29360423385919966761183289371601
3.	343598630464524024686081989696	27980124457094896460063215702500	28323723087559420484749297692196
4.	368097086536741096135034280625	27859054071845586219420246249024	28227151158382327315555280529649
5.	375009019607473080946945530625	27825593513854711458745572646464	28200602533462184539692518177089

**Case 3:** For  $\gamma = 5631988329240$  and  $\beta = 3251629977960$ ,  $\frac{\gamma(\gamma+1)}{2} = \frac{\beta(3\beta-1)}{2} = 15859646270350599313653420$ , we get 23 (X, Y, Z) out of which first five are given below:

**Table 2.6: (X, Y, Z) with  $p = 15859646270350599313653420$  (Triangular and Pentagonal No.)**

S.N.	m	n	X	Y	Z
1.	2021846845270	1900222303403	477019863378048335992491	7683916938894096670907620	7698709468078454306753309
2.	2032160737355	1870002605047	632767519564651022523816	7600291745456164728861370	7626587005329783562268234
3.	2064809999165	1775651417809	1110502375084655418336744	7332765605047064712258970	7416378290218879183057706
4.	2075508496570	1745156727533	1262163515680572101498811	7244175231682075910123620	7353307522987951302030989
5.	2101164876678	1672847921267	1616473671297951917430395	7029858592380049417022052	7213314006672597979200973

**Table 2.7:-**  $X^2$  and  $Y^2$ 

S.N.	$X^2$	$Y^2$
1.	227547950057211900027952596044157366090008385081	59042579523823624952392355159463208940074574064400
2.	400394733816001014565247114702198963754287201856	57764434616049115071458553580638467208256678276900
3.	1233215525068660711246312063387769132271380521536	53769451418561245031525809224593719641000345460900
4.	1593056740315141777140530505499837901792634413721	52478074787316058189023847851283404548003681904400
5.	2612987129999479100589174330360538919819669856025	49418911828859609783418564170720369588487854290704

**Table 2.8:-**  $X^2 + Y^2 = Z^2$  and  $X + Y + Z = 15859646270350599313653420$ 

S.N.	$X^2 + Y^2 = Z^2$	$X + Y + Z$
1.	5927012747388083685242030775507366306164582449481	15859646270350599313653420
2.	58164829349865116086023800695340666172010965478756	15859646270350599313653420
3.	55002666943629905742772121287981488773271725982436	15859646270350599313653420
4.	54071131527631199966164378356783242449796316318121	15859646270350599313653420
5.	5203189895885908884007738501080908508307524146729	15859646270350599313653420

**Case 4:** For  $\gamma = 1092576704233580$  and  $\beta = 630799454299572$ ,  $\frac{\gamma(\gamma+1)}{2} = \frac{\beta(3\beta-1)}{2} =$

596861927316956420835951924990,  $0 < m < 10^{26}$  and  $0 < n < 10^{26}$ , we get 50 (X, Y, Z) out of which first ten are given below:

**Table 2.9:-** (X, Y, Z) with  $p =$  (Triangular and Pentagonal No.)

S.N.	m	n	X	Y	Z
1.	387027573899585	384056927009662	2290619774493883266221817981	297281241399758964188625580540	297290066142703573381104526469
2.	388900007057443	378471960653522	8002190488358110294170693765	294375496338397990420948528492	294484240490200320120832702733
3.	392733138913605	367149168151214	19440806726804549316884422229	288383290515090496996643732940	289037830075061374522423769821
4.	398695204052845	349823866718126	36581128009118528407615642149	278946195847476996608846736940	281334603460360895819489545901
5.	398779965191097	349580006994238	36819279347721045980362862765	278811006041331350876495798172	281231641927904023979093264053

**Table 2.10:-**  $X^2$  and  $Y^2$ 

S.N.	$X^2$	$Y^2$
1.	5246938951302408627554725755668643721876815108694916361	88376136488181763109545570783716129636717530754052026691600
2.	64035052611969011723463457972078835464765370181409875225	86656932844478168665653143651541636111498725799580135794064
3.	377944966188969014618818061671633414963576493407149328441	83164922248311084608572697422486591664011006888578041043600
4.	1338178926419516109784395520830021602497785068541625338201	77810980177778992826348660996309110263321213562485560563600
5.	1355659331685517533155543348444117070786121538786223445225	77735577089779307036137831051492572047797468613171358541584

**Table 2.11:-**  $X^2 + Y^2 = Z^2$  and  $X + Y + Z = 596861927316956420835951924990$ 

S.N	$X^2 + Y^2 = Z^2$	$X + Y + Z$
1.	88381383427133065518173125509471798280439407569160721607961	596861927316956420835951924990
2.	86720967897090137677376607109513714946963491169761545669289	596861927316956420835951924990
3.	83542867214500053623191515484158225078974583381985190372041	596861927316956420835951924990
4.	79149159104198508936133056517139131865818998631027185901801	596861927316956420835951924990
5.	79091236421464824569293374399936689118583590151957581986809	596861927316956420835951924990

**Case 5:** For  $\gamma = 211954248632985376$  and  $\beta = 122371842504138976$ ,  $\frac{\gamma(\gamma+1)}{2} = \frac{\beta(3\beta-1)}{2} =$

5111330288523464647151142894071942298207292530339862362047627796736,  $0 < m < 10^{30}$  and  $0 < n < 10^{30}$ , we get 13 (X, Y, Z) out of which first ten are given below:

**Table 2.12:-** (X, Y, Z) with p = (Triangular and Pentagonal No.)

S.N.	m	n	X	Y	Z
1.	78614658 03264125 3	6424865981 9992643	20523741689239888060 18990823284560	10101772841608439904 112816636603358	10308154746254262961 257807971535458
2.	79085050 95413662 1	6292852484 6763707	22944460450286284340 43080040915792	99534111879499203361 72032364828094	10214444523808142901 174503025679490
3.	81806709 76035546 1	5548216191 4032547	36140674711601137480 72494097215312	90776262331566167767 57365286378334	97706080524699611465 59756047829730
4.	87628440 89659342 3	4053943203 9166633	60352981039095566355 01069026300240	71048144488511581766 29603097709518	93221892040259768592 58943307413618

**Table 2.13:-**  $X^2$  and  $Y^2$ 

S.N.	$X^2$	$Y^2$
1.	421223972926643373884283467992496796675583 5836639745386266734393600	102045814543457854678865189716222350170701983 648689758136091416876164
2.	526448265354751481953019630623111324910328 5991584762312822034987264	990703942764066443715293640382852192826055064 03987514433554171672836
3.	130614836860976596181630161454925636718631 99328749815107072887257344	824032980288931874114656564139449109578590289 51673303872370184615556
4.	364248232030542894834486219709878157010692 55757302270604822624057600	504783883526041865264271503078677090119292942 98083756869857907792324
5.	378391094664185142552394373005524321141280 22644963700347352765954304	489376668854294719432810803043715542567582385 81181784328555042529796

**Table 2.14:-**  $X^2 + Y^2 = Z^2$  and  $X + Y + Z = 22462301756786691671389615431423376$ 

S.N.	$X^2 + Y^2 = Z^2$	$X + Y + Z$
1.	1062580542727242884177080243961473181374578194853295035223 58151269764	2246230175678669167138961543142 3376
2.	1043348769299541591910595603445163325317087923955722767463 76206660100	2246230175678669167138961543142 3376
3.	954647817149908470296286725594374746297222828042311897944 3071872900	2246230175678669167138961543142 3376
4.	8690321155565847600987577227885552471299855005538602747468 0531849924	2246230175678669167138961543142 3376
5.	8677677635184798619852051760492398637088626122614548467590 7808484100	2246230175678669167138961543142 3376

**Case 6:** For  $\gamma = 41118031658094929460$  and  $\beta = 23739506646348661740$ ,  $\frac{\gamma(\gamma+1)}{2} = \frac{\beta(3\beta-1)}{2} =$

845346263718048427044120366310235410530,  $0 < m < 10^{30}$  and  $0 < n < 10^{30}$ , we get 1194 (X, Y, Z) out of which first ten are given below: +

**Table 2.15:-** (X, Y, Z) with p = (Triangular and Pentagonal No.)

S · N	m	n	X	Y	Z
1.	1700707004 7924250415	7845719448 912824176	22768511794395321582 2273080167337593249	26686540048804409642 8916610630980066080	35079574528605111479 2930675511917751201
2.	1776493775 9082954231	6027610100 698743584	27926093005804577781 3182858666259636305	21416023654986583587 9863770185353807808	35192509711013681335 1073737458621966417
3.	1845860060 7691997615	4439837949 068880496	32100777538029522056 0863735378436482209	16390639092947365976 0036435691904034080	36043209740827954672 3220195239894894241
4.	1514716915 2872275295	1275726154 2606886672	66689011279248760219 228015989616101441	38647279702659762307 2695838569700736480	39218445541220204375 2196511750918572609
5.	1672132055 0497456663	8556176557 615200992	20639440366740465628 3194551083005311505	28614114181307129275 6600141447109219392	35281071823757247800 4325673780120879633

**Table 2.16:-**  $X^2$  and  $Y^2$

S.N.	$X^2$	$Y^2$
1.	518405129331518866650886685889121399347490 86909392487499286743954367770376001	712171419776441662604698457844791506264620347 63235489599355021390321166566400
2.	779866670568847357927349350643338427219869 37474752262854982822349270874053025	458646069190944906630902228093515495799154520 62335979637960666388925001764864
3.	103045991854606070335378694325477351851573 050128048304847215752296722773519681	268653049875254452066329610731702601943794044 45650373767294601976177801446400
4.	444742422540376836197278922365527144233379 1103610299361238167461283602276481	149361222841561724565620423677702648181947272 888786763299820469625854402790400
5.	425986498652235806314092518357488294012613 41535439639411437100248042085365025	818767530380881765085221266137634200169038719 34115466996680922609323588849664

**Table 2.17:-**  $X^2 + Y^2 = Z^2$  and  $X + Y + Z = 845346263718048427044120366310235410530$ .

S.N.	$X^2 + Y^2 = Z^2$	$X + Y + Z$
1.	1230576549107960529255585143733912905612111216726279770986 41765344688936942401	8453462637180484270441203663102 35410530
2.	1238512739759792264558251578736853923019023895370882424929 43488738195875817889	8453462637180484270441203663102 35410530
3.	1299112968421315155420116553986476120459524545736986786145 10354272900574966081	8453462637180484270441203663102 35410530
4.	1538086470669654929275932129013579196242810639923970626610 58637087138005066881	8453462637180484270441203663102 35410530
5.	1244754029033117571399313784495122494181652134695551064081 18022857365674214689	8453462637180484270441203663102 35410530

### Observations and Conclusion:-

We observe that

1.  $X + Y + Z = 0 \pmod{2}$ .
2.  $Y + Z - X = 0 \pmod{2}$ .
3.  $(X + Y + Z) (X + Y - Z) = 0 \pmod{8}$ .
4.  $(Y + Z - X)^2 = 2(Y + Z)(Z - X)$ .
5.  $(X + 2Y + Z)^2 = (Z - X)^2 + 4(X + Y)(Y + Z)$ .

In conclusion, other special Pythagorean Triangle can be found which satisfy the conditions other than discussed in the above problem.

**References:-**

1. Rana S.S., Darbari Mita; *Special Pythagorean Triangles in terms of Triangular Numbers*; Journal of Ultra Scientist of Physical Sciences; Vol. 23(2); 2011; 559-562
2. Darbari Mita; *Special Pythagorean Triangles and Triangular Numbers*; IJSET - International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 7, July 2015; 406-409.
3. Gopalan M.A., Janaki G.; *Pythagorean triangles with perimeter as a pentagonal number*; Antarctica J. Math.;5(2) (2008); 15-18.
4. Mita Darbari; *Special Pythagorean Triangles and Pentagonal Numbers*; Proceedings of 17<sup>th</sup> Asian Technology Conference in Mathematics (**ATCM 2012**), December 16-20, 2012, **organized by** Suan Sunandha Raja Bhat University, Bangkok, Thailand;208-214
5. Ivan Niven, Herbert S. Zuckerman; *An Introduction to the Theory of Numbers*; Wiley Eastern Limited; New Delhi; 1976; Page No. 106.

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## RESEARCH ARTICLE

### SYNTHESIS AND X-RAY ANALYSIS OF COMPLEX FERRITE $\text{BiLiFe}_2\text{O}_5$

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#### Abstract

The paper describes the synthesis and X-ray study of a complex structure of ferrite  $\text{BiLiFe}_2\text{O}_5$ . Ferrite with mixed complex oxide  $\text{BiLiFe}_2\text{O}_5$  was synthesized by high temperature solid state reaction. The structure of the ferrites, type of syngony, parameters of the unit cells, radiographic and pycnometric densities were determined by X-ray phase analysis for a first time:  $a=5,277$ ,  $c=13,86\text{\AA}$ ,  $V_{\text{un.cell}} = 1054,6 \text{\AA}^3$ ,  $Z=12$ ,  $\rho_{\text{rad}} = 7,7022$ ,  $\rho_{\text{pcn}} = 7,7031 \text{ g/cm}^3$ . A comparative analysis of the relationship between crystal lattice parameters with parameters of the crystal lattice of initial oxides and complex ferrites has been performed.

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#### Introduction:-

Semiconductor materials, which functionality is stipulated by electron charge are generally used in modern electronics. Increasing requirements to electronic devices expose the problem of search and implementation of alternative materials, working on non-classical principles. The basis of future electronic can become spintronics devices that use both electron charge and its spin [1].

Spintronics became known after opening the effect of discovery of "giant" magnetoresistance (GMR), which is stipulated by different scattering on ferromagnetic impurities of two groups of electrons' spins with "up" and "down". This selection requires the significant difference between the average lengths of free path of the electrons with "up" and "down" directions of the spins. This occurs in ferromagnetic materials characterizing by differences in the density of the free states of electrons caused by exchange splitting of 3d zone. This principle lays in the basis of magnetoresistive devices implementing the effects of the giant and tunnel magnetoresistance [2].

Literature data analysis shows that orthoferrites  $\text{BiFeO}_3$  or so-called multiferroics are the most studied of ferrites that simultaneously have the electric polarization and magnetic ordering. The orthoferrites are prospective for implementation as the working environment in the data storage and processing devices. At the present time, the search of new materials with ferroelectric properties and specific electronic and magnetic structures is performed using the most famous multiferroic for. Substituted perovskites based on the bismuth ferrites often combine ferroelectric and weak ferromagnetic properties with the dominant antiferromagnetic ordering [2, 3].

This study is to investigate the conditions for obtaining and X-ray features of new classes of complex mixed bismuth ferrites, in which  $\text{Bi}^{+3}$  is partially substituted by the ions of rare-earth elements and sodium.

#### Experimental part:-

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New polycrystalline complex of bismuth ferrites were synthesized by ceramic processing technology. Bismuth oxide (III) (mark “chemically pure”), lithium carbonate (mark “highly-pure”) and iron oxide (III) (mark “chemically pure”) were used as the initial components. Solid-phase synthesis was carried using the thermal data of the initial components taking into account Tamman conditions for ceramic reactions [4,5]. Stoichiometrically calculated mixtures of initial components preliminary annealed in a muffle furnace at 400°C for one hour, were thoroughly stirred and the calculated mixture of the starting components are thoroughly mixed and grinded in an agate mortar, placed in an alundum crucibles, and annealed in a silite furnace. Annealing was performed by two stages: first stage at 600°C for 48 h and second stage at 800°C for 20 h [6].

Formation of new phases was controlled by X-ray scattering analysis performed using the radiologic diffractometer X-ray MiniFlex 600 (Rigaku). The conditions of analysis included: CuK $\alpha$  – radiation, Ni – filter, U=40 kV, I=10 mA, rotation rate – 1000 impulses/s, and time constant  $\tau$ =5 s,  $2\theta$  = 10° – 90°. Diffraction peaks were evaluated using hundredpoint scale. Radiographs of the synthesized polycrystalline powders were indexed by the homology method (homologue is distorted structure type of perovskite) [7]. Pycnometric density of manganites was determined by the method described in [8]. Toluene served as indifferent liquid. The density of each ferrite was measured 4 – 5 times and the data were averaged. Table below shows the results of indexing of radiographs of ferrites. In a [Table 1] shows the results of X-ray indexing ferrites.

**Table 1:-** Indexing of radiographs of the synthesized phase composition BiLiFe<sub>2</sub>O<sub>5</sub>

№	[°2Th.]	d[Å]	Int. [%]	$\frac{4}{10} \frac{2}{d} \text{ эксп.}$	hkl	$\frac{4}{10} \frac{2}{d} \text{ теор.}$
1	12.29	7.198	0.1	193	(1,1,0)	197
2	17.41	5.089	1.2	386	(2,0,0)	384
3	21.37	4.156	2.6	578	(2,1,1)	579
4	24.72	3.599	18.1	772	(2,2,0)	777
5	27.69	3.219	100.0	965	(3,1,0)	963
6	30.40	2.938	24.3	1158	(2,2,2)	1156
7	32.90	2.720	67.9	1351	(3,2,1)	1355
8	35.24	2.545	3.1	1543	(4,0,0)	1547
9	37.45	2.399	5.7	1737	(3,3,0)	1735
10	39.56	2.276	6.9	1930	(0,2,4)	1935
11	41.58	2.170	10.4	2123	(3,3,2)	2121
12	43.52	2.078	10.5	2315	(4,2,2)	2318
13	45.40	1.996	13.7	2510	(1,3,4)	2515
14	48.97	1.858	5.2	2896	(5,2,1)	2893
15	50.69	1.799	0.2	3089	(4,4,0)	3086
16	52.37	1.746	31.4	3280	(0,3,5)	3284
17	54.01	1.696	15.4	3476	(6,0,0)	3474
18	55.61	1.651	23.1	3668	(5,3,2)	3669
19	57.19	1.609	0.4	3862	(6,2,0)	3867
20	58.74	1.571	2.3	4051	(5,4,1)	4055
21	60.26	1.535	2.2	4244	(6,2,2)	4242
22	61.76	1.501	15.3	4438	(6,3,1)	4436
23	63.24	1.469	1.4	4634	(4,4,4)	4638
24	64.70	1.440	6.8	4822	(3,4,5)	4825
25	66.15	1.412	1.7	5015	(0,4,6)	5017
26	67.57	1.385	3.5	5213	(7,2,1)	5211
27	68.99	1.360	1.5	5406	(2,4,6)	5408
28	70.39	1.337	1.1	5594	(0,3,7)	5592
29	73.15	1.293	3.2	5981	(6,5,1)	5981
30	74.52	1.272	0.3	6180	(8,0,0)	6184
31	75.87	1.253	2.0	6369	(1,4,7)	6366
32	77.22	1.234	0.8	6567	(0,2,8)	6567
33	78.57	1.217	9.4	6751	(3,5,6)	6755
34	79.90	1.200	8.6	6944	(6,6,0)	6946

35	81.23	1.183	7.1	7145	(1,3,8)	7147
36	82.56	1.168	0.2	7330	(6,6,2)	7334
37	83.88	1.153	1.9	7522	(2,5,7)	7520
38	85.20	1.138	0.5	7721	(8,4,0)	7724
39	86.51	1.124	2.0	7915	(9,1,0)	7917
40	87.83	1.111	2.6	8101	(8,4,2)	8103
41	89.14	1.098	3.6	8294	(9,2,1)	8296
42	90.45	1.085	0.5	8494	(6,6,4)	8492
43	91.77	1.073	2.7	8685	(7,5,4)	8684

### Results:-

On the basis of X-ray diffraction of the synthesized compounds indexing  $\text{BiLiFe}_2\text{O}_5$  found that ferrite crystallized in the tetragonal structure with the following unit cell parameters:  $a=5,277$ ,  $c=13,86\text{\AA}$ ,  $V_{\text{un.cell}} = 1054,6 \text{\AA}^3$ ,  $Z=12$ ,  $\rho_{\text{rad}} = 7,7022$ ,  $\rho_{\text{cm}^3}$ ,  $\rho_{\text{picn}} = 7,7031 \text{ g/cm}^3$ .

The correctness of the results of the ferrite indexing confirmed the good agreement of the experimental and calculated values of the reciprocals of the squares of the distances between planes ( $10^4/d^2$ ), consistency of values of X-ray and pycnometric densities.

### Conclusions:-

$\text{BiLiFe}_2\text{O}_5$  crystallizes in the tetragonal system, analysis of the relationship between the parameters of the crystal lattice parameters of the original  $\delta\text{-Bi}_2\text{O}_3$  shows equality and parameter and increase the value of the parameter to twice the sum of the values of the even squares Miller index ( $h^2 + k^2 + l^2$ ) shows a body nature of the crystal lattice.

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### References:-

1. *Mustafin E. S., Mataev M. M., Kasenov R. Z., Pudov A. M., Kaikenov D. A. and Bogzhanova Zh. K.* X-ray Diffraction Study of the  $\text{YbFe}_5\text{O}_{12}$  (MII = Mg, Ca, Sr) Ferrites // *Inorganic Materials*, 2014 - Vol. 50, No. 6, pp. 622–624.
2. *Cobva L.M., Trunov B.K.* X-ray phase's analyze// M.: Pub.house MGU.-1976.-256 p.
3. *Kivilis S.S.* Technique density measurement of liquids and solids. M.: Standartgis.-1959.-191 p.
4. *Ramesh R. and Spaldin N. A.* Multiferroics: progress and prospects in thin films// *Nature Materials* 6, 21 (2007).
5. *Gavrilova L.Ya., Aksenova T.B., Cherepanova V.A.* Phase equilibria and crystal structure of complex oxides in the system  $\text{Ln-M-Fe-O}$  (M-Ca,Sr) // *Journal of Inorganic Chemistry*, 2008. – T.53, №6. – p.1027-1033.



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### RESEARCH ARTICLE

## WOMEN EMPOWERMENT AND DEVELOPMENT IN NEW INDIA

**Shail Mishra**

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Education, Women empowerment,  
Development, Economic Development.

### Abstract

Women education guarantees better advancement of human progress, as well as to instruct after that era as well. Education is point of interest of women empowerment since it encourages them to react to the difficulties, to stand up to their standard appearance and upset their living. Women education in India has additionally been a noteworthy distraction of both the administration and common society as taught women can assume an essential part in the improvement of the nation. Education is point of reference of women empowerment since it empowers them to reacts to the difficulties, to go up against their conventional part and change their life. With the goal that we can't disregard the significance of education and development in reference to women empowerment India is ready to getting to be superpower, a created nation by 2020. The development of women's education in country regions is moderate. This clearly implies still extensive womenfolk of our nation are uneducated, the powerless, in reverse and misused. Education of women in the perspective of training and development is the most effective apparatus of progress of position in the public eye. This paper looks at the issue of women's access to education in India. Drawing on existing writing and different insights concerning women's education, the paper gives a diagram of the condition of education as for women and highlights a portion of the issues and obstructions to women's education. In view of an investigation of rising issues, a few proposals and recommendations are offered as far as grassroots level intercessions, key activities and empowering strategy system, towards enhancing women's access to education.

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### Introduction:-

Women education in India assumes an essential part in the general advancement of the nation. It not just aides in the improvement of half of the human resources, however in enhancing the personal satisfaction at home and outside. Educated women not just have a tendency to advance education of their young lady kids; additionally can give better direction to every one of their youngsters. In addition educated ladies can likewise help in the diminishment of newborn child death rate and development of the populace.

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In spite of the fact that in the Vedic period, women had permission to education in India, they had bit by bit lost this privilege. In the British time frame, there was increment of enthusiasm for women's education in India. Amid this period, different socio religious operations drove by prominent people like Raja Ram Mohan Roy, Iswar Chandra Vidyasagar underlined on women's education and connection with external world in India. However women's education got a quick augmentation after the nation got autonomy in 1947 and the government has taken different measures and activities to give education to all Indian ladies. Subsequently women's proficiency rate has become over the three decades and the development of female proficiency has in certainty been higher than that of men education rate for little a long time. While in 1971 just 22% of Indian women were proficient, before the end of 2001 54.16% female were proficient.

#### **Significance of women education in India:-**

Sexual orientation disparity in education is extraordinary. In India young women were less inclined to get to school, to stay in school or to accomplish in education. Be that as it may, now the situation is changing and families understand the significance of education. Women education in India assumes an essential part in the general development of the nation. It not just makes a difference in the advancement of half of the human capital, however in enhancing the standard of living. Taught women not just have a tendency to advance training of their young women children; however additionally can give better direction to every one of their youngsters and their future. Also taught women can likewise help in the lessening of neediness and unemployment by supporting their families' completely.

#### **Women empowerment in India:-**

Women empowerment alludes to expanding the otherworldly, political, social, instructive, sexual orientation or monetary quality of people and groups of women. Women empowerment in India is intensely reliant on a wide range of factors that incorporate topographical area (urban/rustic) instructive status societal position (standing and class) and age. Approaches on Women empowerment exist at the national, state and nearby (Panchayat) levels in numerous divisions, including wellbeing, training, monetary open doors, sexual orientation based viciousness and political interest. However there are huge hole between strategy headways and genuine practice at the group level.

Women empowerment is basically the procedure of upliftment of financial, social and political status of ladies, the generally underprivileged ones, in the general public. It is the way toward guarding them against all types of brutality. Women empowerment includes the working up of a general public, a political situation, wherein women can inhale without the dread of abuse, misuse, worry, segregation and the general sentiment oppression which runs with being a lady in a customarily male ruled structure.

Women constitute just about half of the total populace yet India has indicated unbalanced sex proportion whereby female's populace has been relatively lower than guys. To the extent their societal position is concerned, they are not regarded as equivalent to men in every one of the spots. In the Western social orders, the ladies have measure up to right and status with men in all kinds of different backgrounds. However, gender disabilities and discriminations are found in India even today. The dumbfounding circumstance has with the end goal that she was in some cases worried as Goddess and at different times only as slave.

#### **Status of women Empowerment:-**

The status of Women Empowerment can't be pictured with single measurement rather multidimensional appraisal regarding different segments of women' life and their status would bring a reasonable origination. In this way, this paper tries to give a fundamental thought regarding the condition and status of women in wording of empowerment, education, and economic development.

#### **Hindrances of women Empowerment:-**

The main Problems that were faced by women in past days and still today up to some extent:

1. Gender discrimination
2. Lack of Education
3. Female Infanticide
4. Financial Constraints
5. Family Responsibility
6. Low Mobility
7. Low ability to bear Risk

8. Low need for achievement
9. Absence of ambition for the achievement
10. Social status
11. Dowry Marriage in same caste and child marriage (still existing)
12. Atrocities on Women (Raped, Kicked, Killed, Subdued, humiliated almost daily.)

#### **Objectives of the study:-**

- To study the status and scenario of women education and women empowerment in India.
- To study the significance of women education and Women Empowerment in India.
- To analyze the Factors influencing the Economic Empowerment of Women.
- To identify the Hindrances in the Path of Women Empowerment with particular reference to education.

#### **Review of Literature:-**

**H. Subrahmanyam (2011)**<sup>1</sup> looks at women education in India at present and Past. Author highlighted that there has a decent advance in general enrolment of young women understudies in schools. The term engage intends to give legitimate power or power to act. It is the way toward securing a few exercises of women.

**M. BhavaniSankaraRao (2011)**<sup>2</sup> highlighted that soundness of women individuals from SHG have surely taken a swing to better. It unmistakably demonstrates that health of women individuals talk about among themselves about wellbeing related issues of different individuals and their youngsters and make them mindful of different Government arrangements uniquely implied for them.

**Doepke M. Tertilt M. (2011)**<sup>3</sup> *Does Female Empowerment Promote Economic Development?* This study is an observational investigation recommending that cash in the hands of moms advantages youngsters. This study built up a progression of non-helpful family dealing models to comprehend what sort of grindings can offer ascent to the watched observational relationship.

**Duflo E. (2011)**<sup>4</sup> *Women's Empowerment and Economic Development*, National Bureau of Economic Research Cambridge The study contends that the bury connections of the Empowerment and Development are presumably too powerless to be in any way self-managing and that consistent approach duty to similarly for its own particular purpose might be expected to achieve equity amongst men and ladies.

**Sethuraman K. (2008)**<sup>5</sup> *The Role of Women's Empowerment and Domestic Violence in tyke Growth and under sustenance in a Tribal and Rural Community in South India*; This examination paper investigates the relationship between Women's Empowerment and Domestic Violence, maternal nutritious status and the dietary status and development more than six months in kids matured 6 to 24 months in a provincial and tribal group.

**Venkata Ravi and Venkatraman (2005)**<sup>6</sup> concentrated on the impacts of SHG on women cooperation and practicing control over basic leadership both in family matters and in gathering exercises.

#### **Research Methodology:-**

This paper is fundamentally descriptive and analytical in nature. In this paper an endeavor has been taken to examine the women empowerment and development in India. The data and information utilized as a part of it is absolutely from auxiliary sources as indicated by the need of this study.

#### **Findings of the Study:-**

- Globalization, Liberalization and other Socio - Economic strengths have given some relief to a vast extent of the populace. Be that as it may, there are still a significant number regions where women empowerment in India is to a great extent lacking.
- There should be an ocean – change in the attitude of the general population in the nation. Not only the women themselves, but rather the men need to wake up to wake up to a world that is moving towards balance and value. It is better this is grasped sooner than later for our own great.
- There are a few Government projects and NGOs in the Country, there is still a wide crevice that exists between those under assurance and those not.

- Neediness and ignorance add to these intricacies, The Empowerment of Women starts with an assurance of their wellbeing and security.
- Empowerment of Women must be accomplished if their monetary and societal position is made strides. This could be conceivable just by receiving distinct social and monetary arrangements with a perspective of aggregate improvement of women and to make them understand that they can possibly be solid people.
- Keeping in mind the end goal to make a feasible world, we should start to Empower Women.

#### **Suggestions of the Study:-**

- The most importantly need ought to be given to the women's education, which is the grassroots issue. Consequently, training for women must be given careful consideration.
- Mindfulness programs should be sorted out for making mindfulness among women particularly having a place with weaker segments about their rights.
- Women ought to be permitted to work and ought to be sufficiently given security and support to work. They ought to be given legitimate wages and work at standard with men so that their status can be hoisted in the general public.
- Strict execution of Programs and Acts ought to be there to control the mal-hones common in the general public.

#### **Conclusion:-**

"At the point when women push ahead the family moves, the town moves and the country moves". It is basic as their idea and their esteem frameworks lead the advancement of a decent family, great society and at last a decent country. The most ideal method for empowering is maybe through drafting women in the standard of advancement. Women empowerment will be genuine and successful just when they are enriched pay and property with the goal that they may remain on their feet and develop their personality in the general public. The Empowerment of Women has gotten to be a standout amongst the most essential worries of 21st century at national level as well as at the global level. Government activities alone would not be adequate to accomplish this objective. Society must step up with regards to make an atmosphere in which there is no sexual orientation segregation and women have full chances of self-basic leadership and taking an interest in social, political and monetary existence of the nation with a feeling of equity.

#### **References:-**

1. Duflo E. (2011). Women's Empowerment and Economic Development, *National Bureau of Economic Research*, Cambridge.
2. Doepke M. Tertilt M. (2011). *Does Female Empowerment Promote Economic Development?* News Paper Article.
3. Dasarati Bhuyan (2006). "Empowerment of Indian Women: A challenge of 21st Century" Orissa Review.
4. Dhruva Hazarika (2011). "Women Empowerment in India: a Brief Discussion" International Journal of Educational Planning & Administration. Volume 1, Number 3 (2011)
5. Kishor, S. and Gupta, K. (2009). Gender Equality and Women's Empowerment in India, NATIONAL FAMILY HEALTH SURVEY (NFHS-3) INDIA, 2005-06, and International Institute for Population Sciences, Deonar, Mumbai.
6. M. Bhavani Sankara Rao (2011). Education for Women Empowerment and Economic Development, *IJRCMT* Vol-1, pp; 17-18.
7. Pankaj Kumar Baroi & Rahul Sarania (2011). "Employment and Educational Status: Challenges of Women Empowerment in India", A Peer-Reviewed Indexed International Journal of Humanities & Social Science.
8. Sethuraman K. (2008). Empowerment of Women in India- *Amovement for Tribal women education*.
9. Suguna, M., (2011). Education and Women Empowerment in India. *ZENITH: International Journal of Multidisciplinary Research*, 1(8), 19-21.
10. Venkata Ravi and Venkatraman (2005). Empowerment of Women in India: *A review of women's SHGs Movement in India*.
11. Vinze, Medha Dubashi (1987) "Women Empowerment of Indian: A Socio Economic study of Delhi" Mittal Publications, Delhi.



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### RESEARCH ARTICLE

#### CARDIOVASCULAR SYSTEM PROBLEMS AMONG GERIATRIC POPULATION OF ARAR CITY, KINGDOM OF SAUDI ARABIA: PREVALENCE AND DETERMINANTS

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elderly; cardiovascular diseases;  
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Arar; Northern Saudi Arabia.

#### Abstract

##### Abstract:

**Background:** Over the last twenty years, Saudi Arabia has witnessed major socioeconomic development leading to significant changes in its standard of living and lifestyle. This transformation of the society resulted in changes in dietary habits, compounded by a lack of exercise among elderly have contributed to the emergence of diseases, including hypertension and IHD and other important cardiovascular diseases. **Objectives:** To estimate the prevalence of cardiovascular system diseases, its types and its determinants among the elderly population of Arar city, Kingdom of Saudi Arabia. **Participants and methods:** A cross sectional study included 276 participant aged 60 years and above, attending 5 randomly selected primary healthcare centers in Arar city. Data was collected through personal interviews with the sampled elderly and filling the questionnaire which guided us to the data of socio-demographic characteristics, smoking status and diabetes millets. BMI was calculated. The questionnaire included questions regarding the cardiovascular system diseases, its types and its determinants, after ensuring the diagnosis and by reviewing the accompanied health reports and prescriptions and asking the caregivers about the case. **Results:** The overall prevalence of cardiovascular diseases was 73.2%, hypertension was found in about half (44.9%) of them, ischemic heart diseases in 18.9%; Myocardial infarction was found in 10.9%, Ischemia in 8.0% and Arrhythmias in 6.5% of the studied elderly population. There is insignificant relationship between the occurrence of hypertension and sex, age group, DM and obesity ( $P>0.05$ ). But there is significant relation between the occurrence of hypertension and smoking in studied elderly population ( $P<0.05$ ). There is significant relation between the occurrence of ischemic heart diseases and sex, age group, smoking and DM in studied elderly population ( $P<0.05$ ). But there is insignificant relationship between the occurrence of ischemic heart

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diseases and obesity ( $P>0.05$ ). **Conclusion and recommendations:** The study revealed that elderly were suffering from many cardiovascular diseases. Such common comorbidities as DM, obesity, and Smoking need decision makers to plan and implement more effective preventive, curative and rehabilitative services to improve the health status and the quality of life of those vulnerable group.

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## Introduction:

Aging is a natural biological process which is associated with deterioration of health status of elderly people. The ageing is inevitable and it is a concern of every one. Ageing is known as a process of deterioration in the functional capacity of a person that results from structural changes, with advancement of age [1].

The world will have more elderly people than children because economies are globalizing and the technologies are evolving rapidly [2].

Elderly life is full of problems- physical, social and economic. Older people are helpless and a disability is more likely to occur in the old age [3]. From 1990 through 2010, there was a decline in age-specific mortality in KSA. During the same time, life expectancy increased from 72.5 to 75.0 for men and from 76.3 to 79.9 for women. During the same time, healthy life expectancy increased from 61.8 to 63.9 for men and from 63.5 to 66.6 for women [4].

Over the last twenty years, Saudi Arabia has witnessed major socioeconomic development leading to significant changes in its standard of living and lifestyle. The transformation of the society has also resulted in changes in dietary habits and related social practices. This has been compounded by a lack of exercise among large segments of the society. These factors and others have contributed to the emergence of life style-related diseases, including hypertension and diabetes mellitus.[5].

Cardiovascular disease (CVD) is a class of diseases that involve the heart or blood vessels which are the leading cause of death globally. In the Cardiovascular Health Study which the prevalence of cardiovascular diseases in older Americans, the prevalence rates of definite myocardial infarction and angina were 11% and 15%, respectively, among men aged 65–69 years, 18% and 17% among men aged 80–84 years, 4% and 8% among women aged 65–69 years, and 3% and 13% among women aged 80–84 years [6].

In southwest Saudi Arabia, Al-Modeer study found that, the most prevalent cardiovascular disease is hypertension (59.1%) followed by ischemic heart diseases (16.7%) and arrhythmias occurred among 8.1% of study population; 8.9 in females % and 7.0% in males. Most of the cardiovascular morbidities have the same percent in both genders. Some diseases show significant ( $P < 0.005$ ) high prevalence among males such as hypertension, its prevalence among males was 63.7% compared to 55.5% in females [7].

In Fayum, Egypt, hypertension was the second prevalent disease (37.4) with more prevalence among males (19.3%) than Females (18.2%). CHD was 5.9% 3.6% in males and 2.2% in females [8].

In a national study in KSA conducted by Al-Nozha et al., the overall prevalence of Coronary Artery Diseases obtained from this study is 5.5% in KSA. The prevalence in males and females were 6.6% and 4.4% ( $P<0.0001$ ). Urban Saudis have a higher prevalence of 6.2% compared to rural Saudis of 4% ( $P<0.0001$ ). The following variables are found to be statistically significant risk factors in KSA: age, male gender, body mass index (BMI), hypertension, current smoking, fasting blood glucose, fasting cholesterol and triglycerides [9].

In a study conducted in Dubai, the most common prevalent disease was hypertension (67.5%) [10].

In Udaipur, Rajasthan Vishnoi et al., found hypertension among elderly was 25% it was 38.7 in females and 15.3 in males [11].

Assessment of the cardiovascular morbidity profile will help in the application of interventions, to keep and improve vision and the quality of life of the elderly. Yet, up to our knowledge, there is little or no baseline information on the prevalence of cardiovascular diseases in the elderly population in our region.

## Objectives:

To estimate the prevalence of previously diagnosed cardiovascular system diseases, its types and its possible determinants among the elderly population of Arar city, Kingdom of Saudi Arabia.

## Participants and methods:

### Study design and setting :

The present cross sectional study was conducted in Arar city, which is the regional headquarter of the Northern Border Province of Saudi Arabia.

**Study period and target population:** During the period from 1 June to 30 September 2016, on elderly people of age 60 years and more.

**Sampling:**

The sample size was calculated using the sample size equation:  $n = z^2 p(1-p)/e^2$ , considering target population more than 1000, and study power 95%. Data was collected from 276 elderly participant aged 60 years and above, attending 5 randomly selected primary healthcare centers in Arar city. They were selected using a systemic random sampling procedure. Each participant was interviewed separately, and confidentiality was assured. Health centers provide healthy and sick citizens with healthcare services in an acceptable atmosphere of both privacy and confidentiality.

**Data collection:**

Data were collected by means of personal interview with the sampled elderly using a predesigned questionnaire covering the following items:

- (1) Socio-demographic characteristics including age, sex, educational and marital status.
- (2) Smoking status and certain types of diseases that may be prevalent among elderlies suggested to affect cardiovascular system diseases such as diabetes mellitus and thyroid gland diseases.
- (3) Questions regarding the previously diagnosed cardiovascular system diseases, its types and its determinants, after ensuring the diagnosis and by reviewing the accompanied health reports and prescriptions and asking the caregivers about the case.
- (4) Anthropometric examination included height and weight measurements with the use of a calibrated balance beam scale and a wall-mounted stadiometer and calculation of body mass index (BMI). Normal weight was defined as  $BMI < 25 \text{ kg/m}^2$ , overweight as  $25 \leq BMI < 30 \text{ kg/m}^2$  and obesity as  $BMI \geq 30 \text{ kg/m}^2$  [16].

**Ethical considerations**

Data collector gave a brief introduction to the participants by explaining the aims and benefits of the study. Informed written consent was obtained from all participants. Anonymity and confidentiality of data were maintained throughout the study. There was no conflict of interest.

**Statistical analysis**

We utilized the statistical package for social sciences, version 16 (SPSS Inc., Chicago, Illinois, USA) to analyze the study data. The results were displayed as counts and percentages. The X<sup>2</sup> test was used as a test of significance, and differences were considered significant at P value less than 0.05.

**Results:**

Table (1) illustrates the socio-demographic characteristics and BMI status of the studied elderly population. The table showed that mean age ( $\pm$  SD) was 70 ( $\pm 9.25$ ) years, male to female ratio was 47.8 to 52.2, married were 88.4 while 9.4 were widow, illiteracy constitutes 52.9% and 20.3% completed primary education, 13% preparatory and 13.8% completed the secondary education. Regarding working status, most of the participants (38.4%) haven't work while 33.3% were retired, 15.2% house wives and 10.9% were Shepherd. D.M was found in 37.0% and 44.9% were hypertensive. About half (45.7%) were obese, 26.8% underweight and only 24.6% had normal weight.

Table (2) illustrates the percentage distribution of cardiovascular diseases among the studied elderly population. The overall prevalence of cardiovascular diseases was 73.2%, hypertension was found in about half (44.9%) of them, ischemic heart diseases in 18.9%; Myocardial infarction was found in 10.9%, Ischemia in 8.0% and Arrhythmias in 6.5% of the studied elderly population.

Table (3) illustrates the relationship between hypertension and socio-demographic characters, obesity and D.M in the studied elderly population. There is insignificant relationship between the occurrence of hypertension and sex, age group, DM and obesity ( $P > 0.05$ ). But there is significant relation between the occurrence of hypertension and smoking in studied elderly population ( $P < 0.05$ ).

Table (4) illustrates the relationship between ischemic heart diseases and socio-demographic characters, obesity and D.M in the studied elderly population. There is significant relation between the occurrence of ischemic heart diseases and sex, age group, smoking and DM in studied elderly population ( $P < 0.05$ ). But there is insignificant relationship between the occurrence of ischemic heart diseases and obesity ( $P > 0.05$ ).

**Table (1): Socio-demographic characteristics, chronic diseases and BMI status of the studied elderly population, Arar, 2016**

Age group	No. (n=276)	%
• 60-	180	65.2
• 70-	72	26.1

• 80+	24	8.7
Mean age (± SD)	70±9.25	
Sex		
• Female	144	52.2
• Male	132	47.8
Marital status		
• Widow	26	9.4
• Married	244	88.4
• Divorced	6	2.2
Educational level		
• Illiterate	146	52.9
• Primary	56	20.3
• Preparatory	36	13.0
• Secondary	38	13.8
Working status		
• Shepherd	30	10.9
• House wife	42	15.2
• Military	6	2.2
• No work	106	38.4
• Retired	92	33.3
Chronic diseases		
• DM	102	37.0
BMI (kg/m <sup>2</sup> ) status		
• Underweight	8	2.9
• Normal	68	24.6
• Overweight	74	26.8
• Obese	126	45.7
Mean BMI (± SD)	29.99±9.73	
• Shepherd	30	10.9
• House wife	42	15.2

**Table (2): Percentage distribution of cardiovascular diseases in the studied geriatric population, Arar, 2016**

Cardiovascular diseases	No. (n=276)	%
<b>Yes</b>	<b>200</b>	<b>72.5</b>
Hypertension	124	44.9
Ischemic heart diseases	52	18.9
• Myocardial infarction	30	10.9
• Angina pectoris	22	8.0
Arrhythmias	18	6.5
Coronary artery bypass operation	2	.7
Hypertension and previous myocardial infarction	2	.7
Valve diseases	2	.7
<b>No</b>	<b>76</b>	<b>27.5</b>

**Table (3): the relationship between Hypertension and sex, age group, obesity and D.M in the studied elderly, Arar, 2016**

Sex	Hypertension		Total (n=276)	Chi-square	P value
	No	Yes			



	(n=150)	(n=126)			
• Female	74 (49.3)	70 (55.6)	144 (52.2)	0.531	0.289
• Male	76(50.7)	56(44.4)	172(47.8)		
Age group					
• 60 -	102(68.0)	78(61.9)	180(65.2)	0.755	.561
• 70 -	36(24.0)	36(28.6)	72(26.1)		
• 80 +	12(8.0)	12(9.5)	24(8.7)		
Smoking history					
• Non smoker	90(60.0)	100(79.4)	190(68.8)	5.98	0.050
• Smoker	14(9.3)	6(4.8)	20(7.2)		
• Ex-smoker	46(30.7)	20(15.9)	66(23.9)		
Diabetes					
• Diabetic	54(36.0)	48(38.1)	102(37.0)	0.065	0.469
• Non diabetic	96(64.0)	78(61.9)	174(63.0)		
Obesity					
• Non obese	82(54.7)	68(54.0)	150(54.3)	0.007	0.535
• obese	68(45.3)	58(46.0)	126(45.7)		

**Table (4): the relationship between ischemic heart diseases and sex, age group, obesity and D.M in the studied elderly, Arar, 2016**

Sex	Ischemic heart diseases		Total (n=276)	Chi-square	P value
	No (n=224)	Yes (n=52)			
• Female	128(57.1)	16(30.8)	144(52.2)	5.88	0.01
• Male	96(42.9)	36(69.2)	132(47.8)		
Age group					
• 60 -	156(69.6)	24(46.2)	180(65.2)	14.03	0.001
• 70 -	44(19.6)	28(53.8)	72(26.1)		
• 80 +	24(10.7)	0(0)	24(8.7)		
Smoking history					
• Non smoker	156(69.6)	34(65.4)	190(68.8)	5.98	0.050
• Smoker	10(4.5)	10(19.2)	20(7.2)		
• Ex-smoker	58(25.9)	8(15.4)	66(23.9)		
Diabetes					
• Diabetic	72(32.1)	30(57.7)	102(37.0)	5.91	0.015
• Non diabetic	152(67.9)	22(42.3)	174(63.0)		
Obesity					
• Non obese	118(52.7)	32(61.5)	150(54.3)	0.668	0.276
• Obese	106(47.3)	20(38.5)	126(45.7)		

## Discussion:

Saudi Arabia like most countries in the world is facing the challenge of an ageing population. The recent increases in the proportion of elderly has raised attention to issues concerning the morbidity profile of this potentially vulnerable age group. The Physical functioning and psychological wellbeing of elderly are influenced by their morbidities. (12)

This study is a cross-sectional study was carried out in Arar city, the capital of the Northern Province of KSA, during the period from 1 June to 30 September 2016, on 138 elderly people of age 60 years and more.

In this study hypertension was the most common among these morbidities (44.9%) and is also found to be more prevalent among females (55.6%) than males (44.4%), however the gender difference was insignificant ( $P>0.05$ ) .

In Al-Modeer study hypertension was the most common among these morbidities (59.1%) and is also found to be more prevalent among males than females this isn't in agreement with findings of our study [7]. In Dubai study, the most common prevalent disease among studied elderly was hypertension (67.5%) [10] which is more than our figure. In Fayoum, Egypt, hypertension was the second prevalent disease (37.4) with more prevalence among males than females [8]. Other studies found hypertension was (73.6% and 67.9% among males) [13,14]. In Udaipur, hypertension among elderly was 25%, it was more prevalent in females than males (38.7 Vs. 15.3) [11] which is consistent with our result, but the figure is less than our figure.

The gender differences may result from biological differences, but they may be due to other comorbidity as obesity. A systematic review of the overall worldwide prevalence of hypertension, showed no gender difference [15] This study further supports this finding.

Results of the current study showed that Ischemic Heart Diseases was found in 18.9% of studied elderly population, it was more encountered among males compared to females ( $P < 0.05$ ). Results of the Fayoum, Egypt study showed that 5.9% of elderly had coronary heart disease (CHD) which was more encountered among males compared to females [8] this was greeted with our result but the figure is far less than us. Al-Modeer study found IHD in 16.7% of elderly (18% in males and 15% in females) with insignificant difference between males and females ( $P > 0.05$ ) [8]. In Dubai study, Ischemic Heart Diseases was found in 15% of studied elderly population, with more prevalence among males than females (17.9% Vs. 13.7%) [10]. All are consistent with our findings. Results from the National Community Based Survey in the Saudi Arabia revealed that the prevalence of IHD was 9.3% and male gender was a risk factor [16].

In the current study arrhythmias occurred among 6.5% of study population, this finding is in accordance with Al-Modeer et al. findings, arrhythmias occurred among 8.1% of study population; 8.9 in females % and 7.0% in males [8].

In the current study, there is significant relation between the occurrence of ischemic heart diseases and age group, smoking and DM in studied elderly population ( $P < 0.05$ ). But there is insignificant relationship between the occurrence of ischemic heart diseases and obesity ( $P > 0.05$ ). National Community Based Survey in the Saudi Arabia revealed that the prevalence of IHD among elderly aged 60-70 years was lower [16].

In a national study in KSA conducted by Al-Nozha et al., the following variables were found to be statistically significant risk factors of ischemic heart diseases: age, male gender, obesity, hypertension, current smoking and Diabetes [9].

### **Conclusion and recommendations:**

The study revealed that elderly were suffering from many cardiovascular diseases. Such common comorbidities as DM, obesity, and Smoking need decision makers to plan and implement more effective preventive, curative and rehabilitative services to improve the health status and the quality of life of those vulnerable group.

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### **References:**

- 1-Harman D. The free radical theory of aging (2003). *Antioxid Redox Signal*, 5(5):557-561.
2. Banker K1, Prajapati B, Kedia G: Study Of Health Profile Of Residents Of geriatric Home In Ahmedabad. *District National Journal of Community Medicine*, 2 .(3) 2011 Page 378.
3. Balamurugan J, Ramathirtham G. Health problems of aged people, *IJRSS*, 2012 ; 2(3) : 139-150.
- 4- Memish ZA, Jaber S, Mokdad AH, AlMazroa MA, Murray CJ, Al Rabeeah AA, et al. Burden of Disease, Injuries, and Risk Factors in the Kingdom of Saudi Arabia, 1990–2010. *Prev Chronic Dis* 2014;11:140176.
- 5- Bani IA. Prevalence and related risk factors of Essential Hypertension in Jazan region, Saudi Arabia. *Sudanese J Public Health*. 2011;6:45–50

- 6- Mittelmark MB, Psaty BM, Rautaharju PM, Fried LP, Borhani NO, Tracy RP, Gardin JM, O'Leary DH. Prevalence of Cardiovascular Diseases among Older Adults. The Cardiovascular Health Study. *Am. J. Epidemiol.* (1993) 137 (3): 311-317.
- 7- Al-Modeer M, Hassanien S, Jabloun C. Profile of morbidity among elderly at home health care service in Southern Saudi Arabia (2013). *J Family Community Med*, 20(1):53-57.
- 8- Hassan SK. A Study of Morbidity Pattern among Geriatric Population in Fayoum Governorate, Egypt. *Journal of American Science* 2015;11(4).
- 9- Al-Nozha MM, Arafah MR, Al-Mazrou YY, Al-Maatouq MA, Khan NB, Khalil MZ, et al. Coronary artery disease in Saudi Arabia. *Saudi Med J.* 2004;25:1165–71. [PubMed]
- 10- AnoodAlShaaliAmal Al Jaziri. Health profile of elderly patients registered in the Elderly Home Based Primary Care, Dubai, United Arab Emirates. *Middle East Journal of Age and Ageing* Volume 12 Issue 1, February 2015
- 11- Mohammed Ubaidula, Inamdar IF Aswar NR Doibale MK. Medical and psychosocial profile of geriatric population *IOSR-JDMS* 2014; 13(3): 29-33.
- 12- Joshi K, Kumar R, Avasthi A. Morbidity profile and its relationship with disability and psychological distress among elderly people in Northern India (2003). *International Journal of Epidemiology*, 32(6):978-987.
- 13- Bani IA. Prevalence and related risk factors of Essential Hypertension in Jazan region, Saudi Arabia. *Sudanese J Public Health.* 2011;6:45–50.
- 14- Al-Nozha MM, Abdullah M, Arafah MR, Khalil MZ, Khan NB, Al-Mazrou YY, et al. Hypertension in Saudi Arabia. *Saudi Med J.* 2007;28:77–84. [PubMed]
- 15- Kearney P, Whelton M, Reynolds K, Muntner P. Global burden of hypertension: analysis of worldwide data. *Lancet.* 2005;365:217-23. [PubMed]
16. Al-Nozha MM, Arafah MR, Al-Mazrou YY, Al-Maatouq MA, Khan NB, Khalil MZ, et al. Coronary artery disease in Saudi Arabia. *Saudi Med J.* 2004;25:1165–71. [PubMed]



### RESEARCH ARTICLE

## AN AUTOPSY BASED COMPARATIVE STUDY OF PATTERN OF INJURIES IN PEDESTRIANS INVOLVED IN RAILWAY TRACK DEATHS.

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Railway accidents, pedestrians in rail deaths, pattern of railway deaths, comparison of patterns, Amputation, Fractures.

### Abstract

**Background:** The purpose of all accident investigations is to establish the cause of the incident. This information will be sought for a number of reasons which may overlap. The victims or their families may want to see what can be done to prevent recurrence. The patterns of injuries in railway track deaths may vary according to the position of the person or the different situations when struck. In forensic literature only few systematic studies of the respective injury pattern are available. In many instances the forensic pathologists are asked to reconstruct the event after medicolegal autopsy. Hence an attempt is made to study the pattern of injury in pedestrians involved in railway track incidences with relative position of victim and train so that this study may help the forensic pathologist to reconstruct the events and rule out foul play.

**Materials and methods:** A cross sectional study of all railway track deaths brought for medicolegal autopsy at Thiruvananthapuram Medical College, Kerala, from 1<sup>st</sup> March 2010 to 28<sup>th</sup> February 2011 were analyzed. A total of 104 cases of railway track deaths were studied excluding cases with advanced decomposition. Data regarding nature of incidents were collected from the Kerala Police Form 102 (KPF 102), investigating officers and relatives. Clinical case records were studied in treated cases. A meticulous external and internal examination was made and the details regarding nature, dimensions and location of injury was entered in a proforma. The data were entered in MS Excel and statistical analysis was done.

**Results:** Among 104 cases of railway accidents in the study period 17 (16.3%) cases were those with history of hit by train while they were walking along the side of or through the track (GROUP I) and 34 (32.7%) cases were those with history of crossing the track (GROUP II). All the cases showed external injuries. In all cases of Group I, there was lacerated wound on the head, and in 82.4% external injury was present on the face also. Among these, 6 cases (35.3%) showed crushed lacerated wounds on the head and face. In 14 cases (82.4%) there was skull fracture. Facial bone was fractured in 52.9% of cases and showed intracranial haemorrhages associated with skull fracture. Injury to brain was seen in 17.6% of cases. Two (11.8%) cases showed fatal neck injury, one was a case with decapitation injury and the other showed fracture of the cervical spine with contusion of the cord. Nine cases (52.9%) showed injury to chest and 8 among them

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(47%) showed injury to abdomen also.. Thoracic spine was fractured in 23.5% of cases. Transection had occurred in 2 cases (11.8%) .

The most prominent injury in group II was lacerated wound (91%). Head and face were injured in 31 cases (91%). In this, 9 cases (26.5%) showed fracture fragmentation of skull bone with extrusion of the brain. Skull fracture was seen in 18 cases (52.9%). Out of which, Intra cranial haemorrhage was present in 8 cases (23.5%) and another 2.9% showed isolated intra cranial haemorrhage. Brain showed injury in 9 cases (26.5%).Decapitation was seen in 6 cases (17.6%). In 7 cases (20.5%) soft tissue injury with cervical spine fracture was seen. One case (2.9%) showed only soft tissue injury on the neck region. Chest and abdomen were injured in 38.2% cases and 32.4% showed chest injury alone. Abdominal injury alone was present in one case, that too was a transection injury. In 20 cases (58.8%) ribs were fractured. Sternum and thoracic spine were fractured in 4 (11.8%) and 8 (23.5%) cases respectively. The chest viscera were injured in 10cases (29.4%) .Lumbar spine was fractured in 2.9 % of cases.

**Conclusion:** Head injuries were common in cases with history of crossing the track. Cases with history of walking along the side of or through the train showed characteristics pattern of lacerated wound with fracture on the back of head. Transection injuries were common in cases with history of walking along the track and while crossing the track. In cases with history of crossing the track, most of the injuries were distributed on the upper part of the body. In the case where hit occurring in the upright position, lacerated wounds can be caused on the upper part of the body due to hitting against the projecting parts of train like buffer head, hand rail, or platform in front of loco engine.

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## Introduction:-

### Background:-

Large number of people use some form of mass transportation systems such as trains, buses or aero planes, and accidents involving these are disastrous. Being a huge system of transportation, railway is an agent causing accidents during operations and any type of trauma may be seen in this. It traverses the length and breadth of the country covering 6909 stations over a total route length of more than 63273 km (39350 miles) through both urban and rural areas<sup>1</sup>. Railway deaths are usually because of a person trying to cross the track/collision between trains, automobile accident in unmanned crossings, passengers who hang out of doors & are hit by trees/poles or during outbreak of fire.<sup>2</sup>In the absence of case history it is difficult to distinguish between, accident/Suicidal death or criminal violence.<sup>3</sup> Railway wheel mark, dirt & grease contamination, pattern of injuries over the body deserve careful observation to rule out criminal violence.<sup>4</sup>The patterns of injuries in railway track deaths may vary according to the position of the person or the different situations when struck. The victims or their families may want to know why they were injured or killed; the regulatory authorities may wish to fix the responsibility and the safety authorities will want to see what can be done to prevent recurrence<sup>5</sup>. This study may help the forensic pathologist to a considerable extent in their proceedings in suspicious cases of railway incidences.

### Aims & Objectives:-

1. To find out the pattern of injuries among pedestrians involved in accidents while walking along the side, through or crossing the railway tracks.
2. To compare the pattern of injuries in pedestrians involved in accidents while walking along the side or through tracks with those during crossing the railway tracks.

### Materials And Methods:-

A cross sectional study of all railway track deaths brought for medicolegal autopsy at Thiruvananthapuram Medical College, Kerala, from 1<sup>st</sup> March 2010 to 28<sup>th</sup> February 2011 were analyzed. A total of 104 cases of railway track

deaths were studied excluding cases with advanced decomposition. Data regarding nature of incidents were collected from the Kerala Police Form 102 (KPF 102), investigating officers and relatives. Clinical case records were studied in treated cases. A meticulous external and internal examinations was made and the details regarding nature, dimensions and location of injury was entered in a proforma. From the history given by the informant, the victims were classified in to two groups. Group I was persons walking along the side or through the track and group II was persons crossing the railway track. The data were entered in MS Excel and statistical analysis was done.

### **Results:-**

#### **GROUP I- WALKING ALONG THE SIDE OF OR THROUGH THE TRACK**

In the study population (104 cases) 16.3% of victims were those with history of hit by train while they were walking along the side of or through the track. All the cases showed external injuries. These cases showed high rate of incidence of abrasion and lacerated wounds (TABLE 1). In all the cases there was lacerated wound on the head, and in 82.4% external injury was present on the face also. Among these, 6 cases (35.3%) showed crushed lacerated wounds on the head and face. In 14 cases (82.4%) there was skull fracture. Facial bone was fractured in 52.9% of cases and showed intracranial haemorrhages associated with skull fracture. Injury to brain was seen in 17.6% of cases. In this group only 2 (11.8%) cases showed fatal neck injury, one was a case with decapitation injury and the other showed fracture of the cervical spine with contusion of the cord. Nine cases (52.9%) showed injury to chest and 8 among them (47%) showed injury to abdomen also. Rib fractures were present in 52.9%. Associated lung injury was seen in 29.4% of cases. Thoracic spine was fractured in 23.5% of cases. Among the abdominal organs liver was the frequently affected organ. Laceration of liver was seen in 17.6% of cases. Transection had occurred in 2 cases (11.8%) at the level of abdomen with evisceration of viscera in one case. Traumatic amputation of the upper limb occurred in one case and in the lower limb the frequency was 17.6% (FIGURE 1).

#### **GROUP II- WHILE CROSSING THE RAIL TRACK**

Of the 104 cases studied 32.7% occurred while crossing the rail track. All the cases showed external injuries. Among the external injuries the most prominent group was lacerated wound (91%)(TABLE1). Head and face were injured in 31 cases (91%). In this, 9 cases (26.5%) showed fracture fragmentation of skull bone with extrusion of the brain. Skull fracture was seen in 18 cases (52.9%). Out of which, Intra cranial haemorrhage was present in 8 cases (23.5%) and another 2.9% showed isolated intra cranial haemorrhage. Brain showed injury in 9 cases (26.5%).Decapitation was seen in 6 cases (17.6%). In 7 cases (20.5%) soft tissue injury with cervical spine fracture was seen. One case (2.9%) showed only soft tissue injury on the neck region. Among the 34 cases analyzed, chest and abdomen were injured in 38.2% cases and 32.4% showed chest injury alone. Abdominal injury was present in one case, that too was a transection injury. In 20 cases (58.8%) ribs were fractured. Sternum and thoracic spine were fractured in 4 (11.8%) and 8 (23.5%) cases respectively. The chest viscera were injured in 10cases (29.4%) . The chest structure most commonly involved was rib (58.8%) and among the thoracic viscera, the organ which showed a high frequency of injury was lung (32.4%). Among the abdominal organs liver (20.5%), intestine and mesentery (14.7%), spleen (11.8%) and kidneys (8.8%) were the organs frequently injured. Liver showed the highest frequency. Lumbar spine was fractured in 2.9 % of cases. In 2 cases (5.8%) there was transection through the abdomen, with one showing extrusion of abdominal viscera. In one case there was transection through the pelvic region with missing of pelvic viscera. Excluding this case another 6 cases (17.6%) also showed pelvic bone fracture. Frequency of traumatic amputation of the limbs was higher in this group. 23.5% of cases showed amputations in the upper limbs and 5.8 % in lower limbs. In the upper limbs multiple sites were involved in 11.7 % cases and in lower limb only one case showed amputation at multiple sites. In four cases the same limb showed fracture at multiple sites and amputation

Excluding the sites of amputation, incidence of fracture was also high in this group. In 8 cases (23.5%) upper limb showed fracture at single site and in 7 cases (20.5%) at multiple sites (FIGURE 2). In lower limbs, fracture of a single bone was seen in 23.5% of cases and more than one bone is fractured in 5.8% of cases. In one case amputation of lower limb was seen on one side and fracture of limb bones on the opposite side. If the person was hit by train at the moment of entering into the track, it will cause injury to the preceding parts of the body. In 21 (61.76%) cases the injuries were concentrated on the upper parts of the body especially on the head, shoulder and upper limbs. In this group 6 cases (17.6%) showed decapitation injury.

## Discussion:-

An attempt was made to compare and correlate the pattern of injury derived by the study in accordance with the nature of incidence and the history provided by the informant.

### Cases with history of walking along the side of or through the track.

Seventeen cases (16.3%) comprise this group. Abrasions were mostly distributed in the upper limbs (88.2%) and lower limbs (70.5%). This was in agreement in study done by Ammamulla<sup>6</sup> and Pathak et al<sup>7</sup>. Lacerated wounds were seen in all cases in the head region followed by lower limbs in 64.7% of cases. The chest region was free of lacerated wounds. Contusions were also frequent on the head (35.2%). Decapitation was present only in a single case (5.8%). The type of injury which dominated was lacerated wound involving the head region. Transection injury was present in 2 cases (11.8%); one at the level of abdomen and the other at the pelvic region (5.8%) each. Traumatic amputations and fracture of limbs showed high rates of incidence. Incidence of fracture was very high when compared to the incidence of amputation.

### Cases with history of crossing the rail track:

The study populations came under this group was 32.7%. This was the largest group. All the victims gave a history of trespassing on to the Railway track. Using the railway track as a short cut to cross to the other side, to reach the other platform, to reach the railway station or to reach home is a common practice which is endangering the safety of humans and railway track. This is in agreement with the study done by Ramesh wasnik<sup>8</sup>. Laceration of head (91%) was the most frequent external injury seen among this group. In all the cases there was fracture of the skull bones as observed in other studies<sup>9,10</sup>. In 26.4% of cases there were contusions and lacerated wounds with fracture fragmentation of the skull bones and in these cases the brain was found extruded. Membrane haemorrhage was present in 26.5% of cases.

Fracture of the skull bone was seen in 14 cases (82.3%). Facial bones were fractured in 52.9% of the cases. Intracranial haemorrhages were present in 5 cases (29.4%); subarachnoid haemorrhage was present in (29.4%) of cases and subdural haemorrhage in 11.8% of cases. Brain injury was present in 17.6% of cases. In 58.8% of cases there was rib fracture which was the most commonly affected structure on the chest. There were associated injuries to other chest structures and chest viscera in 29.4 % of cases. Sternum alone was fractured in 11.8% of cases.

Transection of trunk was present in 8.8% of cases; 5.9% of cases at the level of abdomen and 2.9% cases through the pelvic region due to run over. This is in agreement with V.V pillay<sup>11</sup>. Limb fracture was common in this group which showed upper limb fracture in 48.5% cases and the lower limbs fracture in 41% cases. Amputations were also frequently seen (23.5% in upper limb and 5.8% in lower limbs at single site and 11.7% in upper limbs and 2.9% in lower limbs at multiple sites ).

## COMPARISON OF INJURY PATTERNS AMONG THE ABOVE GROUPS

The cases in these groups involved pedestrians who were hit in an upright position. Hence the injuries in these two groups should show a similar pattern. When the injury pattern of two groups were compared pedestrians with history of crossing the track showed more extensive injuries than the ones who were walking along the side or through the track (TABLE 2). In Group I, head was involved in 82.3%, upper limbs in 41% & lower limbs in 47%. In Group II, the head was involved in 91% and the upper and lower limbs showed a frequency of 47% and 32.4%. A significant difference was observed in the distribution of injuries to neck, chest and lower limbs. In Group II victims, neck was involved in 38.2% cases while in the other group it was only 5.8%. The basic reason could be the increased chance of upper part of the body which is proceeding while climbing up to the rail track to cross it. In this group the lower limbs were less involved (32.4%). There is more chance of being thrown out of the track when the train hit the upper part of the body. The study by Dr. Kishorkumar in 2005 also showed similar values<sup>12</sup>.

In the case where hit occurring in the upright position, lacerated wounds can be caused on the upper part of the body due to hitting against the projecting parts of train like buffer head, hand rail, or platform in front of loco engine. If the victim was walking through the side of the track, the hand rail may hit against the shoulder or back of head causing characteristic lacerated wounds on these parts. This is in agreement with Sahoo et al<sup>13</sup>.

The frequency of traumatic amputation of upper limbs and lower limbs in Group I was 5.8% and 17.6% respectively, while in the other group the rates were 23.5% and 5.8% respectively. This also showed a reduced involvement of the lower parts of body while crossing the track. In Group I and II, the person might have been hit in the upright

position. The chance of falling in the track and run over by the train is more. In cases where hit can occur in the upright position, lacerated wound can be caused on the upper part of the body due to hitting against the projecting parts of train like buffer head, hand rail, or platform in front of loco engine as discussed by Umadathan<sup>14</sup>.

If the train hit the person while at the middle of the track, he may get pushed down and the degree of mutilation will be high. Injuries to head and limbs followed the similar pattern as the one which is observed in cases with history of walking along the side of or through the track. While crossing the track, train is hitting usually on the side of the body and in the other case it is hitting on the back or in the front aspect. In both the cases the victim is in the upright position.

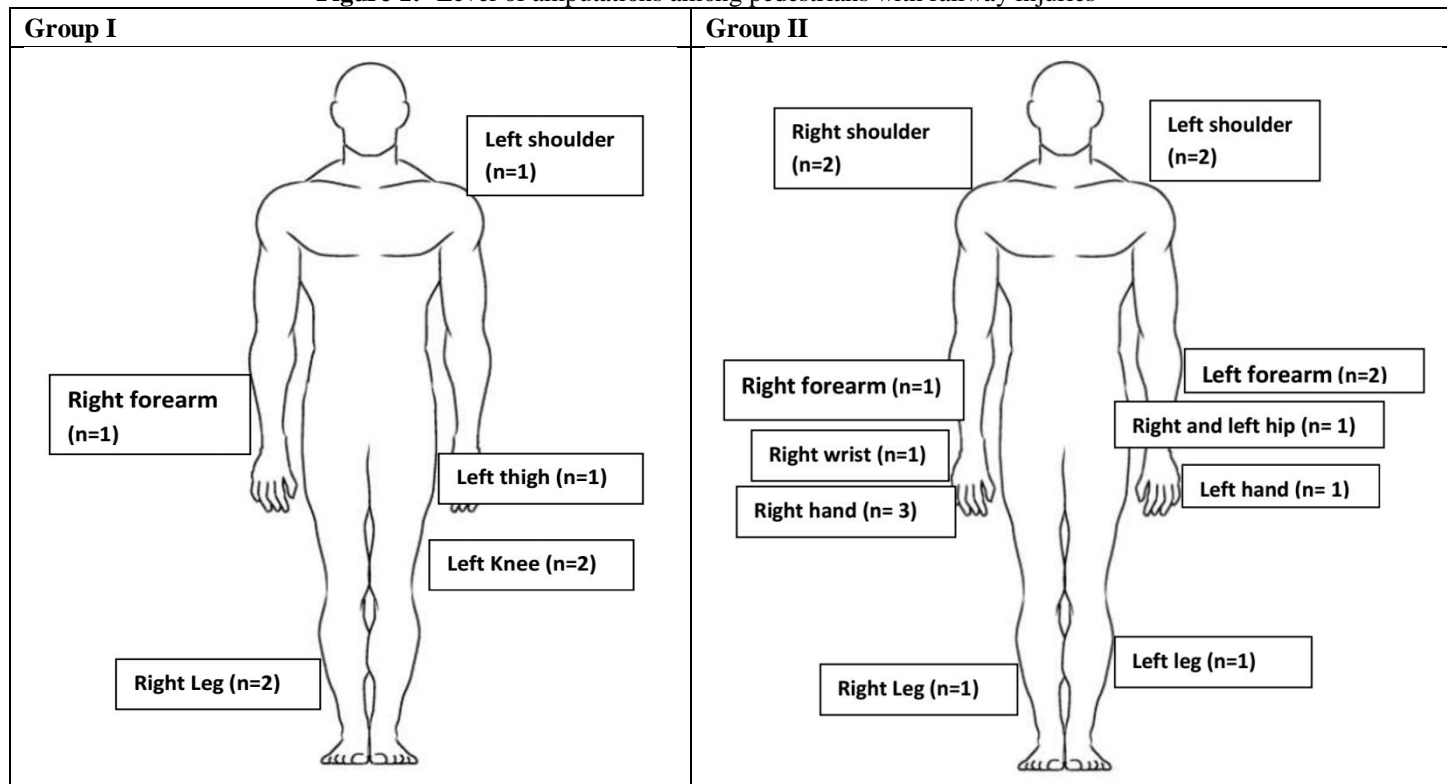
**Table 1:-** Distribution of external injuries among the pedestrians walking along the side or through the track (Group I, n=17) & crossing the track (Group II, n=34).

Injury	Groups	Head (n)	Neck (n)	Upper limbs (n)	Chest (n)	Abdomen (n)	Pelvic region (n)	Lower limbs (n)
Abrasion	Group I	8 (47.1)	1 (5.8)	12 (70.6)	11 (64.7)	10 (58.8)	4 (23.5)	15 (88.2)
	Group II	14 (41.2)	4 (11.8)	24 (70.6)	13 (38.2)	9 (26.4)	1 (2.9)	26 (76.4)
Contusion	Group I	6 (35.3)	0 (0.0)	1 (5.8)	0 (0.0)	1 (5.8)	0 (0.0)	3 (17.6)
	Group II	11 (32.4)	1 (2.9)	2 (5.8)	2 (5.8)	2 (5.8)	0 (0.0)	1 (2.9)
Abraded contusion	Group I	0 (0.0)	1 (5.8)	1 (5.8)	1 (5.8)	0 (0.0)	0 (0.0)	0 (0.0)
	Group II	2 (5.8)	1 (2.9)	5 (14.7)	2 (5.8)	2 (5.8)	1 (2.9)	1 (2.9)
Lacerated wound	Group I	17 (100.0)	1 (5.8)	9 (52.9)	0 (0.0)	4 (23.5)	4 (23.5)	11 (64.7)
	Group II	31 (91.2)	3 (8.8)	25 (73.5)	5 (14.7)	2 (5.8)	1 (2.9)	22 (64.7)

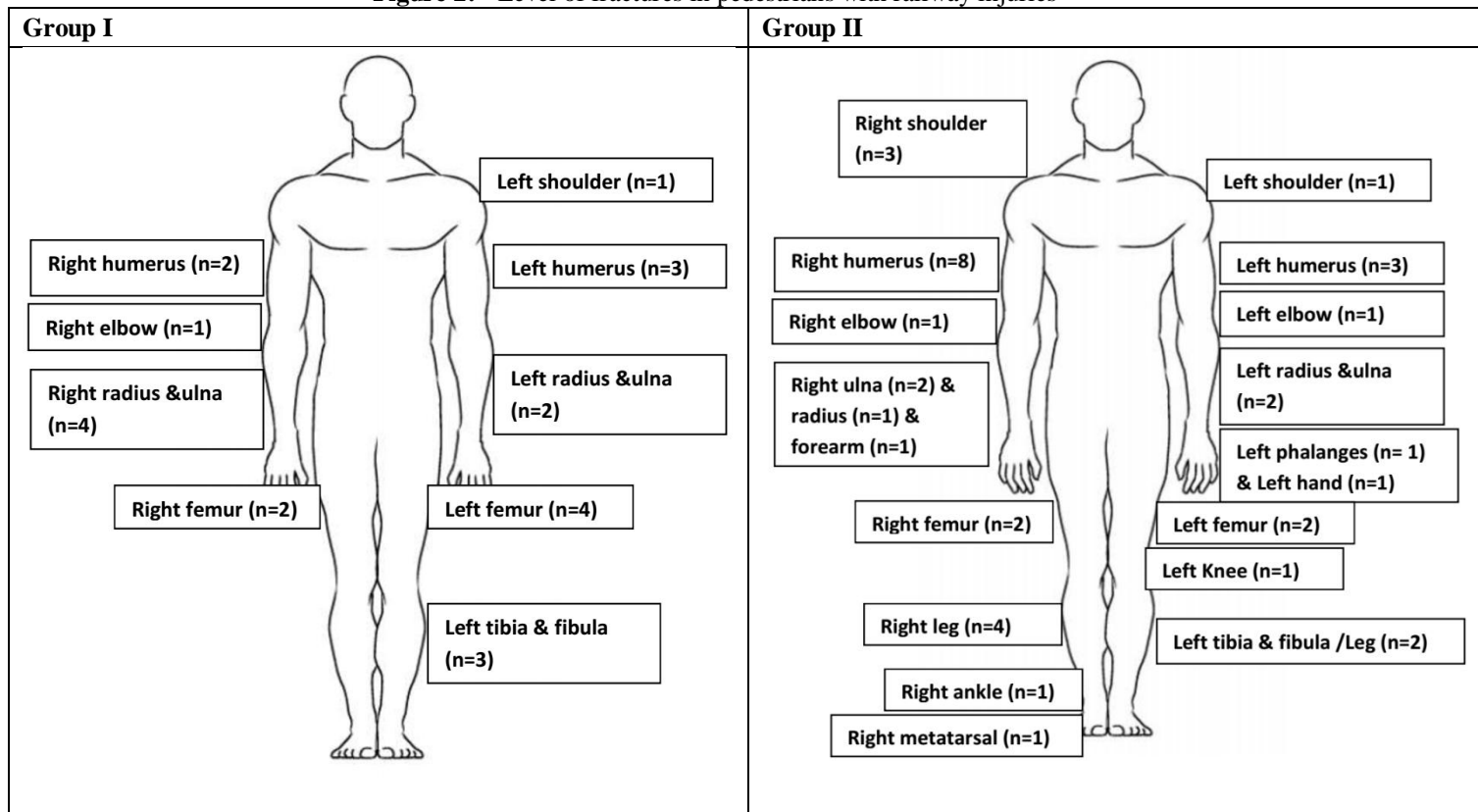
**Table 2:-** Distribution of pedestrians with injury according to body part affected and in different railway injury groups (Groups I and II)

Group (N=51)	Head n(%)	Neck n(%)	Chest n(%)	Abdomen n(%)	Upper limb n(%)	Lower limb n(%)
Group I (n=17)	14 (82.3)	2 (11.8)	9 (52.9)	8 (47.0)	7 (41.0)	8 (47.0)
Group II (n=34)	31 (91.0)	13 (38.2)	24 (70.5)	14 (41.0)	18 (52.9)	11 (32.4)



**Figure 1:-** Level of amputations among pedestrians with railway injuries

*\*pedestrians walking along the side or through the track (Group I) & crossing the track (Group II).*

**Figure 2: - Level of fractures in pedestrians with railway injuries****Conclusion:-**

High frequency of head injury was seen in cases with history of crossing the track (91%). Cases with history of walking along the side of or through the train showed characteristics pattern of lacerated wound with fracture on the back of head. Transection injuries were common in cases with history of walking along the track and while crossing the track. In cases with history of crossing the track, injury to lower limbs were less. Most of the injuries were distributed on the upper part of the body. In the case where hit occurring in the upright position, lacerated wounds can be caused on the upper part of the body due to hitting against the projecting parts of train like buffer head, hand rail, or platform in front of loco engine. To conclude, the causation of majority of instances of railway track deaths are due to adult male trespassers who take short cut routes by walking along the railway tracks to reach their destinations and crossing the track carelessly.

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**Bibliography:-**

1. Rao.M.A, Indian Railways. India the land and the people, National Book Trust India.
2. ApurbaNandy (2010). Principles of forensic medicine including toxicology (3<sup>rd</sup>edn) New Central Book agency, Howrah: 473-474.
3. Lerer L.B &matzopolulos R.G (1997) fatal railway injuries in cape town south Africa AM.J Forensic Medicine & Pathology 19, 144-7.
4. SarveshTandon, Ajay aggarwal, Sharma KL P.S Suicide Simulating homicide – A Railway track mystery, a case report JKAMLS 2001, 10(3): 60-63.
5. RudramD, Determination of cause; over view. The Forensic Science Service, London, Encyclopedia of Forensic Medicine, Volume 2 Academic press

6. Ammamullah S. Railway Death in Jammu & Kashmir. Medical News Medicine & Law, 1983; 101-105.
7. PathakA, Barai P, Mahajan AK, Rathod B, Desai KP, Basu S. Risking Limbs and Life – Railway fatalities in Vadodara: (A Retrospective Study). Journal of Forensic Medicine and Toxicology, 2009, Volume 26, Issue 1, Print ISSN: 0971-1929.
8. Ramesh NanajiWasnik. Analysis of Railway Fatalities in Central India. J Indian Acad Forensic Med, 32(4)
9. Sabale PR, Mohite SC. Railway Fatalities in South West Mumbai. Medico-Legal Update - An International Journal, 2010; Volume 10, Issue 1, Print ISSN: 0971-720X.
10. Mohanty MK, Panigrahi MK, Mohanty S, Patnaik KK. Death due to traumatic railway injury. Med Sci Law, 2007; 47: 156-160.
11. V.V pillay . Textbook of forensic medicine and toxicology ,17th edition : 185
12. Kishorekumar. B pattern of injuries in Railway track death submitted to the University of Calicut for MD Forensic Medicine examination 2005
13. Sahoo, P.C. Kar, S.M., Dash B.K., “Pattern of injuries in Railway deaths a retrospective study”, 4th medicolegal 4. Basu R, Bose TK. Batabyal S, Paul PB, Railway Fatalities bulletin- Forensicon, 1998, pp 71-5.
14. B.Umadathan.Forensicmedicine;CBS publishers and distributors pvtltd;newdelhi, 1st ed 2011 :192



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## RESEARCH ARTICLE

### CERVICOFACIAL TERRATOMA IN NEWBORN BABY-AN UNUSUAL TUMOR.

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#### Abstract

Teratomas are tumors consisting of tissues derived from all three germ cell layers: endoderm, mesoderm, and ectoderm, in different proportions. There are often solid and cystic components to the mass. If the neoplastic tissue is uniformly mature, the tumor is termed Mature teratoma. The presence of any immature tissue with an embryonal appearance warrants a designation of immature teratoma. Cervical teratomas are rare, found once in every 20,000 births. They can block the baby's esophagus and affect the baby's ability to swallow amniotic fluid. This can lead to an increase in the fluid level around the baby (polyhydramnios). Increased fluid can lead to preterm labor. Cervical teratomas have increased blood flow which can result in fetal heart failure (hydrops). The cervical teratoma is a rare entity. Its prognosis mostly depends on the risk of neonatal respiratory distress, its extension and potential malignancy. Surgical management must be as complete as possible to avoid recurrences and malignant transformation. We present a case of a cervicofacial teratoma in an infant with total excision and cure.

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#### Introduction:-

A twenty five days old male child weighing 2.54 kgs, admitted with cystic swelling at the left side of neck as well as face. CBC shows neutrophilic leucocytosis, CRP level raised -29.19mg/dl. AFP levels is more than 400 IU/ml. Provisional diagnosis was made either Lymphangioma or Dermoid cyst. Although the patient remained asymptomatic except slight dyspnea. In my case the patient belongs to low socioeconomic category from a remote area so antenatal ultrasound was not done thereby detected at birth only. On local examination, there was a solitary left neck mass which was irregular, of size about 10 x 7cm<sup>2</sup>, soft cystic to firm consistency, nontender, local temperature not raised, visible veins present, overlying skin is smooth and more firm on lower part of the swelling. MRI showed a 11x8x4 cm<sup>3</sup> mass, with solid and cystic components with contralateral airway displacement. CT scan revealed tumoral calcifications. The infant underwent surgical excision and the specimen was sent for histopathological examination. The infant was discharged without any particular complaints. Gross examination shows a greyish white cystic structure measuring 10x7x3cm<sup>2</sup>, outer surface is partly nodular with hard consistency. Microscopy shows predominantly solid with areas of cystic changes. Multiple sections studied from tumor showed mature as well as immature elements derived from all 3 germ layers. Mature elements comprised of

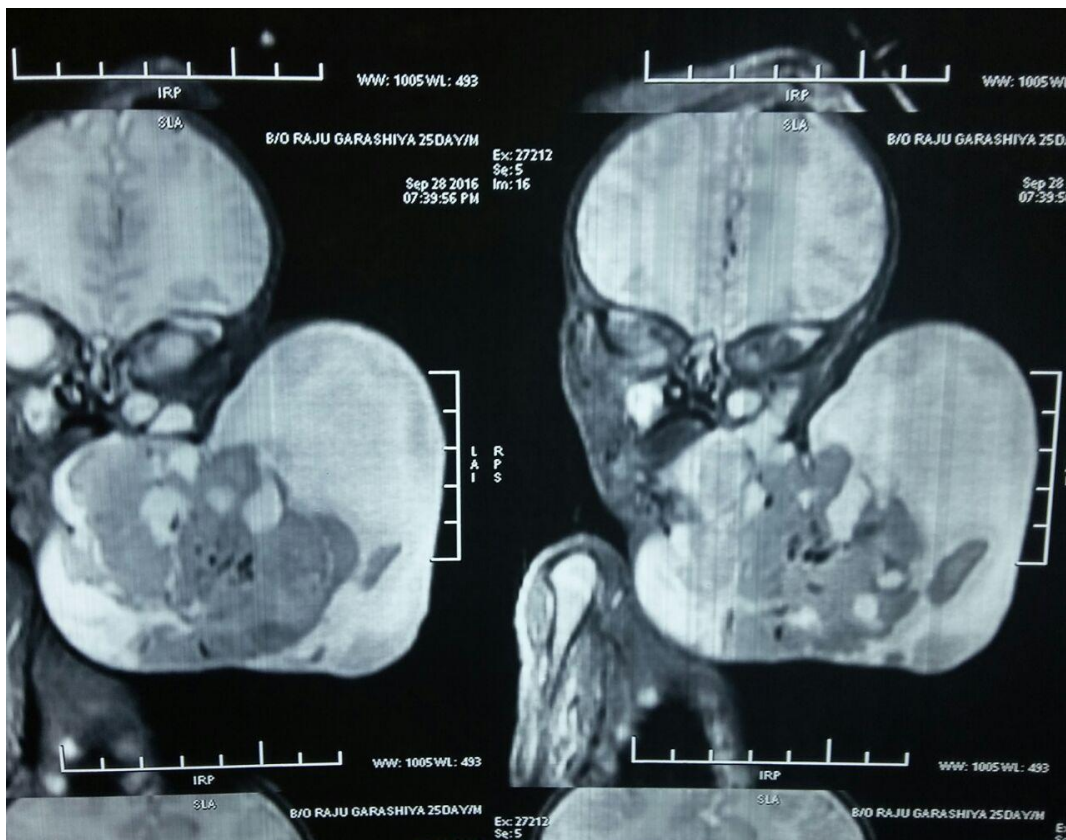
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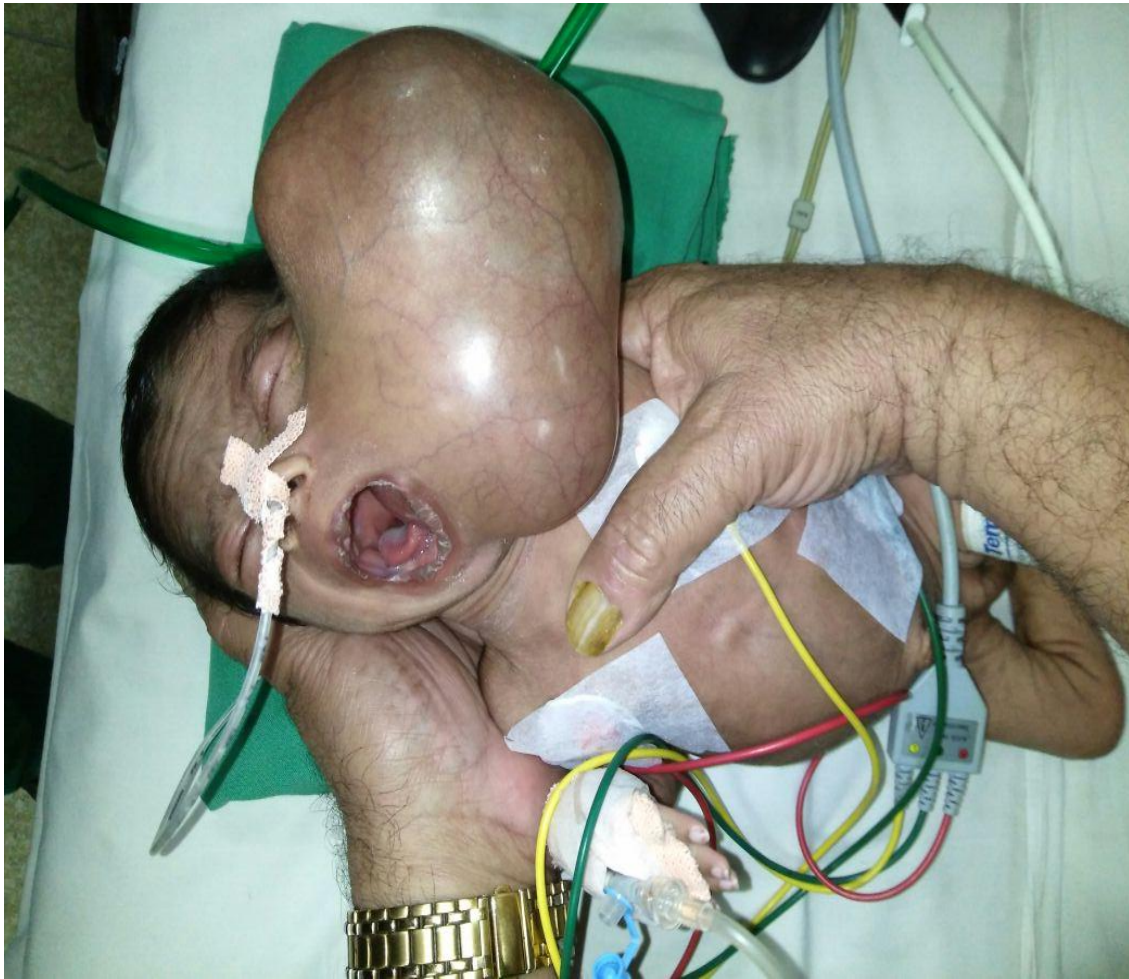
glands, mature cartilage, and neural tissue and foci of calcification. Immature elements included neuroepithelial elements, neuroectodermal rosettes, and immature cartilage. Final diagnosis was immature cervical teratoma with no evidence of malignancy.

### Discussion:-

Cervical teratomas are rare neoplasms found once in every 20,000 births. Teratomas are the most common congenital tumor<sup>1-3,11</sup>. The most common location of teratomas is sacrococcygeal followed by intracranial. 5% of fetal teratomas are located in the cervical region<sup>7,12</sup>. Fetal teratomas consist of ectodermal, endodermal and mesodermal germ-cell tissue including neuroepithelial tissue. Mature and immature teratomas are distinguished by the degree of differentiation of the tissue. The differential diagnosis of fetal cervical teratoma includes cystic hygroma, lymphangioma, hemangioma, cervical meningocele, thyroglossal duct cyst, esophageal diverticula, dermoid cyst, brachial cleft cyst, epignathus and congenital goiter<sup>13</sup>. Usually a teratoma is often a non-threatening mass; however, the malignant transformation of fetal cervical teratomas has been reported. Ultrasound diagnosis is done in early pregnancy which help in planning the surgery thereby preventing complications. The sonographic findings of cervical teratomas typically include solid and cystic structures within a heterogeneous mass. In up to 50% of cases calcifications might be seen within the mass while cartilage or bone tissue is less common<sup>14</sup>. The extent of vascularization can be assessed by Doppler flow imaging. Magnetic resonance imaging has also been described as providing essential information about the localization and diagnosis of giant fetal neck masses. MRI showed a 11x8x4 cm mass, with solid and cystic components with contralateral airway displacement. The tumor was capsulated and not infiltrating the surrounding tissues. It was completely excised. At birth, patient was stable with slight dyspnoea. The alpha fetoprotein (AFP) level was elevated at 400 IU/ml. Immature cells produce a protein called alpha-fetoprotein (AFP) which can be monitored with a blood test. AFP levels in the blood are used as a screening tool to check for tumor regrowth, in addition to regular check-ups and imaging. CBC shows neutrophilic leucocytosis, CRP level raised -29.19mg/dl. Pathological examination revealed an immature teratoma, which consisted of a mixture of tissue such as embryonic cartilage, immature mesenchymal substrate, endodermal glands, respiratory epithelial and immature neuroepithelial tissue with necrosis. A teratoma with immature cells presents a small risk of recurrence.







### Conclusion:-

Cervical teratomas are rare entity mostly presenting at birth. antenatal diagnosis can be done with the help of ultrasound, MRI, CT scan and AFP levels. Although they are benign but in some cases malignant transformation can occur. Airway obstruction and esophageal compression can occur. Complete surgical excision is done to cure the patient.

### References:-

1. Jordan RB, Gauderer MWL. Cervical teratomas: an analysis. Literature review and proposed classification. *J Pediatr Surg* 1988; 23: 583–91.
2. Gundry SR, Wesley JR, Klein MD, Barr M, Coran AG. Cervical teratomas in the newborn. *J Pediatr Surg* 1983; 18: 382–6.
3. Trecet JC, Claramunt V, Larraz J, Ruiz E, Zuzuarregui M, Ugalde FJ. Prenatal ultrasound diagnosis of fetal teratoma of the neck. *J Clin, Ultrasound* 1984; 12: 509–11.
4. Isaacs H, Jr. Perinatal (fetal and neonatal) germ cell tumors. *J Pediatr Surg*. 2004;**39**(7):1003–13.
5. Tonni G, De Felice C, Centini G, Ginanneschi C. Cervical and oral teratoma in the fetus: a systematic review of etiology, pathology, diagnosis, treatment and prognosis. *Arch Gynecol Obstet*. 2010;**282**(4):355–61.
6. Figueiredo G, Pinto PS, Graham EM, Huisman TA. Congenital giant cervical teratoma: pre- and postnatal imaging. *Fetal Diagn Ther*. 2010;**27**(4):231–2.

7. Langer JC, Tabb T, Thompson P, Paes BA, Caco CC. Management of prenatally diagnosed tracheal obstruction: access to the airway in utero prior to delivery. *Ther* 1992; 7: 12-16.
8. Daskalakis G, Efthimiou T, Pilalis A, et al. Prenatal diagnosis and management of fetal pharyngeal teratoma: a case report and review of the literature. *J Clin Ultrasound* 2007;35: 159-163.
9. Azizkhan RG, Haase GM, Applebaum H, Dillon PW, Coran AG, King PA, *et al.* Diagnosis, management, and outcome of cervicofacial teratomas in neonates: A Childrens Cancer Group study. *J Pediatr Surg* 1995;30:312-6.

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## RESEARCH ARTICLE

### ANGIOLEIOMYOMA OF THE NASAL CAVITY An Unusual Tumor.

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Nasal Cavity, Angioleiomyoma.

#### Abstract

**ABSTRACT:** Angioleiomyoma is a benign tumor arising from the vascular smooth muscle (tunica media) and presents commonly between third and fifth decades of life. Although there are sporadic reports about this tumor in the literature, none describes all the information in detail. It is an extremely rare benign tumor. Since the first case reported by Maesaka et al in 1966, only 30 cases of angioleiomyoma of the nasal cavity have been published in English literature. Angioleiomyoma presents as a painful mass in approximately 60% of the cases. Pre-operative diagnosis is difficult, but with a high index of suspicion and awareness, it is possible. The use of ultrasound and magnetic resonance imaging should be considered. It causes minimal morbidity and excision is usually curative. Histological examination using smooth muscle Actin stain portrays the smooth muscle bundles clearly. We report here a case of angioleiomyoma of nasal cavity in a 33 years old female presented with a mass in Rt. Nasal cavity, manifested mainly with nasal obstruction.

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#### Introduction:-

**OBJECTIVE:** To describe rare benign nasal lesion like Angioleiomyoma that present as a nasal mass and can be cured by simple surgical excision. Angioleiomyoma is uncommon benign tumor of the nasal cavity and are relatively rare. Reporting and assisting the systematization of more accurate diagnostic methods in clinical and complementary investigation of vascular leiomyoma in the nasal cavity. It is extremely rare tumor of nasal cavity that represents less than 1% of all vascular leiomyomas. It is more prevalent in women between the fourth and sixth decades, reaching primarily the inferior nasal turbinates.

It is composed of smooth muscle cells with a variable amount of fibrous stroma in the vascular wall or by remnants of embryonic tissue, commonly found in the uterus (95%), skin (3%) and gastrointestinal tract (1.5%)<sup>1,2</sup>

Less than 1% of all vascular leiomyomas occur in the nasal cavity<sup>3,4</sup> Hachisuga et al describe only 48 cases (8%) of angioleiomyoma in the head & neck in a study with 562 cases. Only 5 of the 48 cases were located in the nasal cavity, accounting for 1% of all angioleiomyomas.<sup>5</sup>

Leiomyoma has many variants. They are classified in three groups: leiomyoma, angioleiomyoma and epithelioid leiomyoma.<sup>6</sup> Angioleiomyoma or vascular leiomyoma accounts for approximately 4% of benign soft tissue tumors.

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Most angioleiomyomas occur in the extremities, especially the lower extremity, and other sites include the head & the trunk.<sup>7</sup> The tumors are usually located in the subcutis and less often in the deep dermis.

Maesaka et al reported the first case of angioleiomyoma in the nasal cavity in 1966.<sup>8</sup> Only 30 cases have been documented in English literature. Forty nine additional cases have been reported in the Japanese literature.<sup>9</sup>

The origin of angioleiomyoma of the nasal cavity is uncertain, partly due to the scarcity of smooth muscle in the nasal cavity. Three hypotheses have been proposed for the origin of smooth muscle tumors in the nasal cavity: from aberrant undifferentiated mesenchymal cells; from elements of smooth muscle in the walls of blood vessels and of pilorector muscles; or from both previous hypotheses, simultaneously.<sup>2, 10-13</sup> Some articles indicate that sexual hormones and Epstein- Barr virus infection can affect the genesis of nasal angioleiomyoma.<sup>3,14</sup>

The literature shows a prevalence of angioleiomyomas of the nasal cavity in female patients (in a 2:1 ratio between females and males) between the fourth and sixth decades of life, and affecting mainly the inferior nasal conchae.<sup>9,11</sup> These angioleiomyomas develop in the mucosa of the nasal cavity as single solid small cutaneous masses. They can be painful or not and can expand.<sup>4, 14</sup> They usually manifest as epistaxis and with nasal obstruction.<sup>11</sup>

Computed tomography (CT) and magnetic resonance do not conclude the diagnosis. Cytologic examination does not provide a conclusive diagnosis. Surgical excision with histologic examination is the only way to make a definite diagnosis.<sup>4</sup> In addition to that, conventional light microscopy studies for the identification of angioleiomyoma after staining with hematoxylin- eosin can be performed using special staining, such as Masson trichrome stain, or immunohistochemical markers such as smooth muscle actin, desmin, myoglobin, S-100 protein, and vimentin. The absence of atypias is the most important histologic indication of benignity. The treatment of choice is total excision of the lesion.<sup>2,10, 12-15</sup> Recurrence is extremely rare after total excision.

### Case report:-

A 33 years old female admitted in the ENT Department of KingSaud Medical City with complaints of nasal obstruction and episodes of small volume epistaxis. The patient's medical and family histories were unremarkable. Physical examination and nasal endoscopy, showed the presence of a reddish mass which occupied the whole rt. nasal cavity and preventing the progression of the nasofibroscope. CT scan showed a lobulated enhancing soft

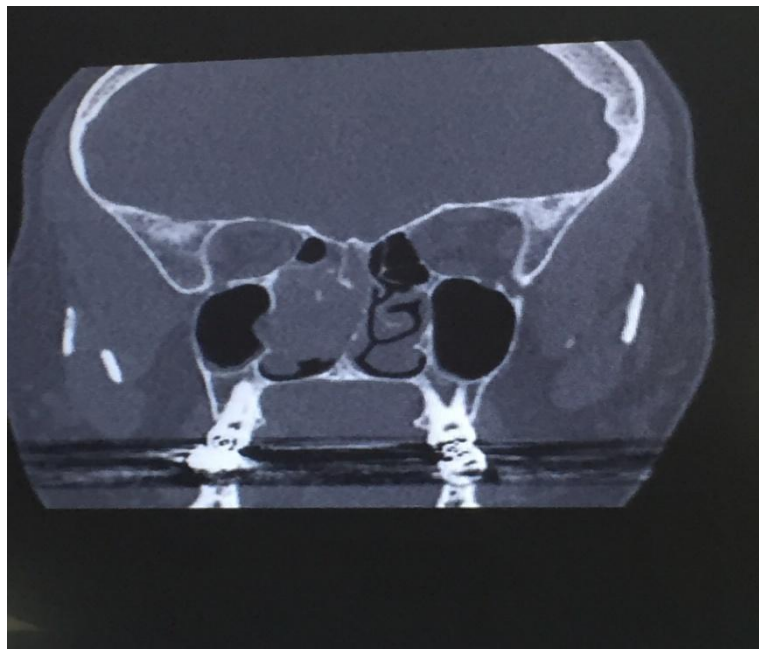


Fig:1 CT scan showing mass involving Rt. nasal cavity

tissue mass in Rt. nasal cavity extending upward to involve the posterior ethmoid sinus (Fig 1). No intracranial extension of the lesion seen and no bony defect seen in the skull base. The patient underwent surgical excision of the mass. Grossly, the excised specimen measured 3x3x1 cm and was soft. On microscopic examination the tumor (Fig: 2 A, B, C) demonstrated a proliferation of thick walled blood vessels admixed with a monomorphic spindle cell population without necrosis, vessels & admixed spindle cells ( intermediate magnification) pleomorphism or increase in mitosis. This spindle cell proliferation stained positive for Vimentin and h- Caldesmon and smooth muscle actin (SMA) immunostain. Postoperatively, the surgical wound healed well with normal scarring.

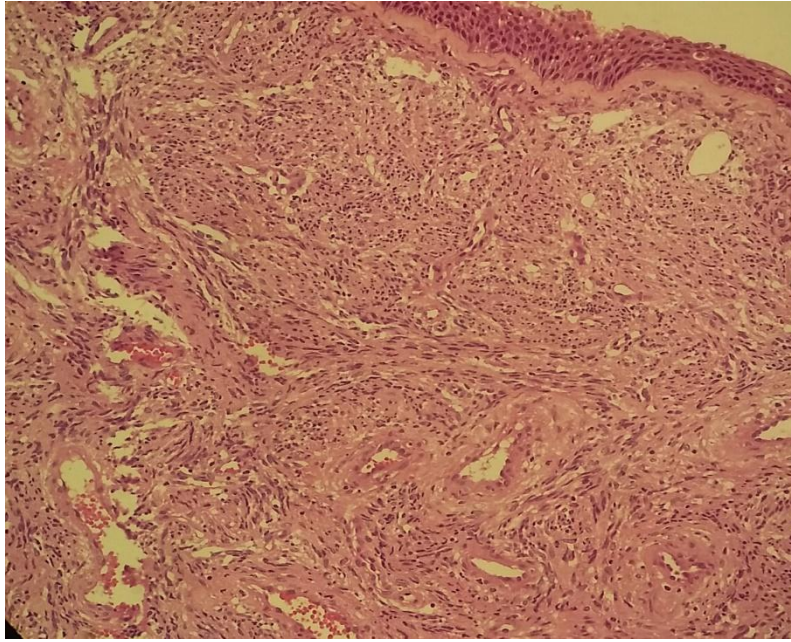


Fig: 2A Showing proliferation of blood

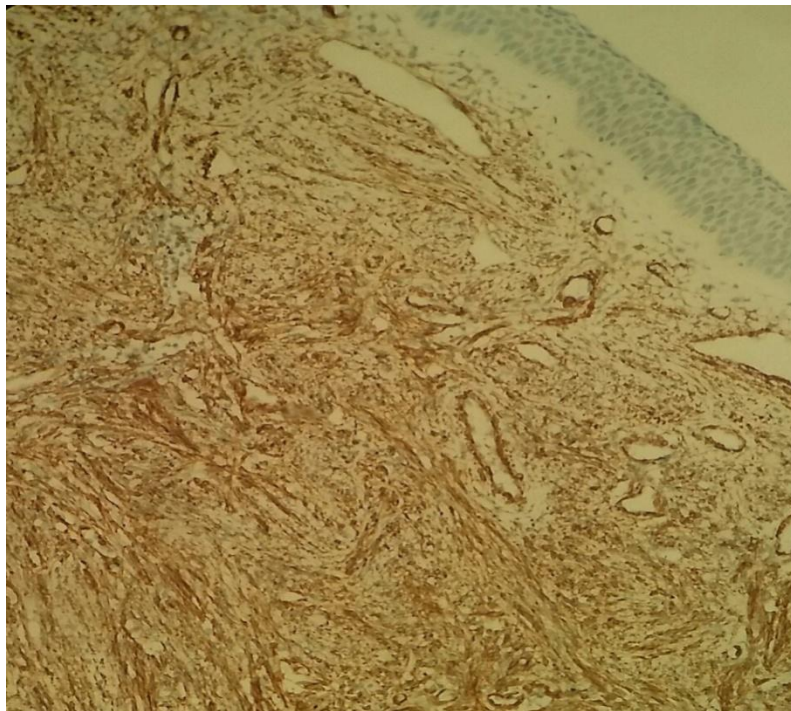


Fig: 2B Showing staining patterns with h-Caldesmon immunostain (intermediate magnification)

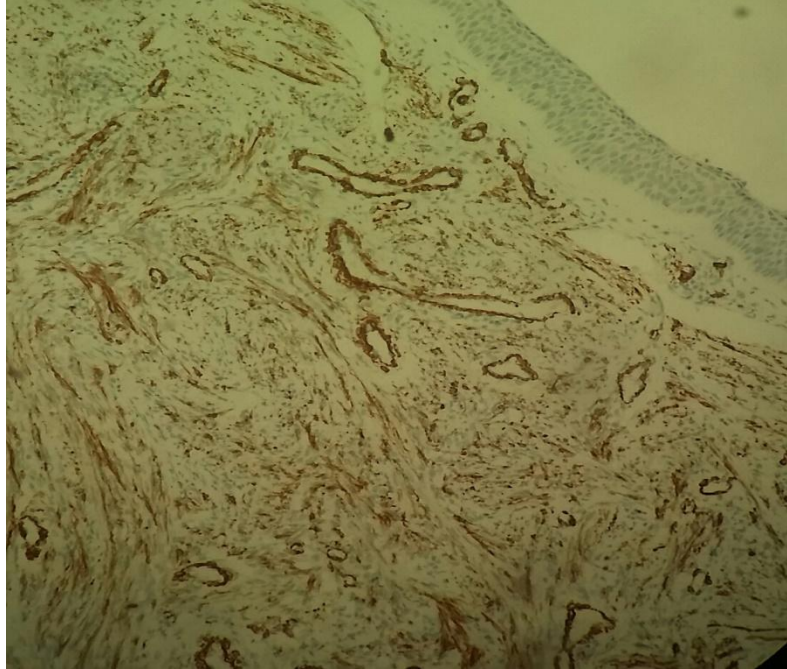


Fig: 2C Showing focal staining pattern with SMA immunostain (intermediate magnification)

### Discussion:-

Angioleiomyoma is a rare, benign, smooth muscle tumor arising from the tunica media of veins and is seldom diagnosed before surgery. Angioleiomyoma can be found throughout the body but occurs most frequently in the lower extremities.<sup>5, 16-20</sup> It commonly arises in the dermis or subcutaneous tissue.<sup>17</sup> A majority of these tumors are quite small, generally less than 2 cm in diameter.<sup>16-19</sup> Nasal cavity angioleiomyomas are extremely rare. The paucity of smooth muscle in the nasal cavity might explain why the tumors were rare. It is rarely included in the differential histopathologic diagnosis.<sup>4</sup> Other tumors of the nasal cavity are: nasal angiofibroma, inverted papilloma, malignant lymphoma, fibromyoma, leiomyoblastoma, hemangiopericytoma, angiosarcoma, angiomyolipoma, and vascular leiomyosarcoma.<sup>12</sup> The most affected nasal sites are the nasal septum, the inferior turbinate and the vestibule. The other sites are superior and middle turbinate. The most common symptoms are nasal obstruction associated frequently with epistaxis. The other symptoms are headache and facial pain.

Radiologically, the images are not specific,<sup>11</sup> but CT and MRI could provide the information about the extent of the lesion. It usually presents, macroscopically, as a solitary, well circumscribed or lobulated mass ranging from 5 to 20mm. Microscopically, angioleiomyoma is separated into three subtypes: solid, venous and cavernous. It is characteristically composed of smooth muscle cells which are mature and well differentiated and numerous walled vessels. Mitotic figures are usually absent or very rare.

Most angioleiomyoma was diagnosed by microscopy with conventional Hematoxylin and Eosin staining. Differential diagnosis arise rarely with other spindle cell tumors such as angiofibroma, fibroma angiomyolipoma and angiosarcoma. Immunohistochemical examination can be helpful in these cases.

The etiology of sinonasal angioleiomyoma remains uncertain. Nasal cavity contains smooth muscle tissue in the walls of blood vessels and in the hair erecting muscles of the anterior vestibule.<sup>11</sup> The advanced theories of this neoplasm are that the tumor cells derive from the wall of vessels, from the hair erecting muscles or from some aberrant undifferentiated mesenchyma. Some authors documented case of a nasal leiomyoma and angioleiomyoma which express progesterone receptor.<sup>2, 22</sup> They suggest that the growth of this tumor may be hormone dependent.

The treatment of choice is local surgical excision.<sup>2</sup> No recurrences were reported in follow up studies of nasal cavity angioleiomyoma.



### Conclusion:-

Angioleiomyoma of the nasal cavity is a rare benign tumor that is difficult to diagnose clinically and requires a detailed and invasive investigations. The complementary tests should guide the diagnostic reasoning; however, we concluded that it is essential to perform postoperative histopathological study to make a definite diagnosis of angioleiomyoma of the nasal cavity.

### References:-

1. Enzinger FM, Lattes R, Torloni H. *Classificação histológica de tumores: tipagem histológica dos tumores de tecidos moles*. 2a ed. Geneva, Switzerland: Organização Mundial de Saúde- Springer Verlag; 1969
2. Marioni G, Marchese Ragona R, Fernandez S, Bruzon J, Staffieri M, Staffieri A. Progesterone receptor expression in angioleiomyoma of the nasal cavity. *Acta Otolaryngol*. 2002 Jun; 122(4): 408-412.
3. Wang CP, Chang YL, Sheen TS. Vascular leiomyoma da cabeça e pescoco. *Laryngoscope* 2004; 114:661-665.
4. Chen CJ, Lai MT, Chen CY, Fang CL. Vascular leiomyoma of the nasal cavity: case report. *Chin Med J (Engl)* 2007; 120(4):350-352.
5. Hachisuga T, Hashimoto H, Enjoji M. Angioleiomyoma: a clinicopathologic reappraisal of 562 cases. *Cancer* 1984; 54:126-130. [PubMed] Michael RC, Shah S. Angioleiomyoma of the nasal cavity. *Indian J Pathol Microbiol*. 2009 Jul-Sep; 52 (3):386-8.
6. Fletcher C.D.M., Unni K.K., Mertens F. (Eds.): *World Health Organization Classification of Tumors. Pathology and Genetics of Tumors of Soft Tissue and Bone*. IARC Press: Lyon 2002.
7. Maesaka A, Keyaki Y, Nakahashi T. Nasal angioleiomyoma and leiomyosarcoma-report of 2 cases. *Otologia (Fukuoka)* 1966; 12:42-47.
8. Singh R, Hazarika P, Balakrishnan R, Gangwar N, Pujary P. Leiomyoma of the nasal septum. *Indian J Cancer* 2008; 45(4):173-175.
9. Michael RC, Shah S. Angioleiomyoma of the nasal cavity. *Indian J Microbiol Pathol* 2009; 52(3):386-388.
10. Campelo VES, Neves M, Nakanishi MC, Voegels RL. Angioleiomyoma de Cavidade nasal: relato de um caso e revisão de literatura. *Braz J Otorhinolaryngol* 2008; 74(1):147-150.
11. Shankar PR, Subish P. Disease mongering. *Singapore Med J* 2007; 48(4):275-280.
12. Ikeda K, Kuroda M, Sakaida N, Maehara M, Ohmura N, Sawada S. Cellular leiomyoma of the nasal cavity: findings of CT and MR imaging. *AJNR Am J Neuroradiol* 2005; 26:1336-1338.
13. Fonseca MT, Araujo PAK, Barreiros AC. Leiomyoma de seio paranasal: Relato de um caso e revisão da literatura. *Braz J Otorhinolaryngol* 2002; 68(3):434-39.
14. Cintra C. PPV, Lima WTA, AR Junior. Leiomyoma da Cavidade nasal: relato de caso. *Braz J Otorhinolaryngol* 2007; 73(6); 851.
15. Duhig JT, Ayer JP. Vascular leiomyoma: a study of 61 cases. *Arch Pathol*. 1959; 68:424-430. [PubMed]
16. Morimoto N. Angioleiomyoma (vascular leiomyoma): a clinicopathologic study. *Med J Kagoshima Univ*. 1973; 24:663-683.
17. Freedman AM, Meland NB. Angioleiomyomas of the extremities: report of a case and review of the Mayo Clinic experience. *Plast Reconstr Surg*. 1989; 83:328-331. [PubMed]
18. Domanski HA. Cytologic features of angioleiomyoma: cytologic- histologic study of 10 cases. *Diagn Cytopathol*. 2002; 27:161-166. [PubMed]
19. Hasegawa T, Seki K, Yang P, et al. Mechanism of pain and cytoskeletal properties in angioleiomyomas: an immunohistochemical study. *Pathol Int*. 1994; 44:66-72. [PubMed]
20. He J, Zhao LN, Jiang ZN, Zhang SZ. Angioleiomyoma of the nasal cavity: a rare cause of epistaxis. *Otolaryngol Head Neck Surg*. 2009 Nov; 141(5); 663-4.
21. Tseng PY, Lai YS, Chen MK, Shen KH. Progesterone receptor expression in sinonasal leiomyoma: a case report and review of the literature. *Int J Clin Exp Pathol* 2014; 7(3):1224-1228.



## RESEARCH ARTICLE

### The Knowledge and Behaviour of Female Sex Workers towards the Risk of HIV/AIDS: A Review.

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sex workers – behaviour – HIV/AIDS – prevention.

#### Abstract

**Background:** Various strategies and policies have been implemented in order to prevent the transmission of HIV infections. However, the prevention programs are associated with a number of issues and challenges in each country as well. Most of new HIV infections occur through sexual contacts and most of them are commercial sex workers who are a challenging and hard-to-reach population. Therefore, ideas in HIV/AIDS prevention programs, particularly for sex worker groups, should be well-arranged continuously.

**Methods:** Electronic journals and reports were accessed by using Cochrane, BioMed, DOAJ, Proquest, PubMed, Bioline, Taylor & Francis, Google, and Google Scholar. The search strategy was limited to English and published year from the last ten years with the keywords of HIV/AIDS, cognitive-attitude-practice, sex workers, and prevention. The literature review generated 28 articles, with 19 studies meeting the inclusion criteria.

**Results:** Generally, financial need is the reason for initiating and maintaining sex work. Most of sex workers knew and were aware of HIV/AIDS, but their needs did not allow any fear and health consciousness, also they did not see any other options outside sex work. Unfortunately, many sex workers reported the inconsistency of condom use.

**Conclusion:** Social, psychological, and environmental-structural factors, such as supports from the establishment owner (employers), manager trainings, peer influences, accessibility of condoms, promotion of condom use, knowledge about condom use, and supports from community health care providers are very necessary to be increased.

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#### Background:-

Based on the report from The Joint United Nations Program on HIV and AIDS (UNAIDS), the total number of new HIV cases is gradually declining by more than 50% in 26 countries between 2001 and 2012, and between 25% and 49% in an additional 17 countries (UNAIDS, 2013), with the annual AIDS-related deaths have decreased in 2016 by 43%. These numbers have shown an important progress of the HIV/AIDS prevention as the HIV/AIDS pandemic has become the most challenging health and social problems worldwide since first time discovered in 1983 (The U.S. Department of Health & Human Services, 2006). Various strategies and policies have been implemented in order to

prevent the transmission of HIV infections. Comprehensive and continuous approaches are needed as HIV/AIDS contributed to 1.6 million of death in the world in 2012(UNAIDS, 2013) and 2.1 million new HIV infections reported by UNAIDS in 2015.

Over 75% of new HIV infections occur through sexual contacts (WHO, 2013) and most of them are commercial sex workers who are a challenging and hard-to-reach population(OHTN, 2012). Sex workers and their clients are at the highest risk for HIV/AIDS(Giri, Hiremath, & Kasbe, 2012) as they have high risk sex or sex with high risk partners, illicit drug use, unstable living and working environments, young age, tattooing or body piercing, and a history of sexual abuse which are the most potential HIV transmission(OHTN, 2012). Each country has been implementing various methods to increase the sex workers knowledge and motivation in HIV/AIDS preventions. However, based on the fact that the prevalence of HIV/AIDS among sex workers estimates higher than the general population (Chipamaunga, Muula, & Mataya, 2010), more effective programs should be identified and implemented. Decisions about further programs should be based on best available information (Pattanaphesaj & Teerawattananon, 2010). Therefore, this paper will try to analyze and discuss knowledge, behavior, perception, attitude, and practice of female sex workers towards HIV/AIDS in several countries, in order to find out some new ideas about HIV/AIDS prevention programs particularly for sex worker groups.

### **Methods:-**

Electronic journals and reports were accessed by using Cochrane, BioMed, DOAJ, Proquest, PubMed, Bioline, Taylor & Francis, Google, and Google Scholar. The search strategy was limited to English and published year from the last ten years with the keywords of HIV/AIDS, cognitive-attitude-practice, sex workers, and prevention. The literature review generated 28 articles, with 19 studies meeting the inclusion criteria. The aim of this process is to gather information about knowledge, behavior, perception, attitude, and practice of female sex workers towards HIV/AIDS in several countries, particularly in Asia. Purposefully, new programs which are more effective and efficient to prevent HIV transmission among sex workers could be developed based on the literature review and research that will be done in the nearest future.

### **Findings and Discussions:-**

#### **1. Become a sex worker:-**

The most effective method to prevent HIV transmission among sex workers is by stop the sex work. However, a research reported that sex work could give them more money and pleasure, also because they did not regard life outside sex work as a viable option (Chipamaunga et al., 2010). Generally, studies found that financial need is the reason for initiating and maintaining sex work, because in some countries most of sex workers were from poor socio-economic status and broken family (Giri et al., 2012). Other factors such as lack of education, poverty, domestic violence, marital breakup, family responsibility, lack of support by family members, harassment, and abuse in society and in workplace are the main reasons for women coming to this profession as well(Charles et al., 2013).

#### **2. Knowledge of HIV/AIDS:-**

In many discussions about knowledge, attitude, and practice model, knowledge has been known as a prerequisite for the intentional performance of health-related behavior(Chipamaunga et al., 2010). Individual perception of susceptibility to HIV/AIDS and benefits of condom use are important factors in determining condom use and cognitive information through health education is an effective promotion (Ye et al., 2012). Most of sex workers knew and were aware of HIV/AIDS and the common source of information about HIV/AIDS was from television (Giri et al., 2012) and doctors (Lau, Tsui, Siah, & Zhang, 2010). However, studies found that knowledge is not always directly associated with behavior change (Pattanaphesaj & Teerawattananon, 2010).

A study in Durban shows that 100% female sex workers knew of HIV/AIDS and aware that HIV/AIDS is a major health concern in South Africa, but their work did not allow a situation of fear, too much health consciousness, and HIV awareness has only little impact on choice of either client or personal partners (Varga, 2010). Denial is the most common response of sex workers towards HIV transmission. They believed that they could not easily get HIV in the future because they use condoms with “most” clients (Varga, 2010). Other sex workers used fatality (prioritize life concern and justify lack of any active effort to protect themselves from HIV infection), economic rationalization, partner categorization through selective condom use (love or

unknown clients), purposeful ignorance of HIV status, and abnegation of responsibility (too weak to control clients who are disagree using condoms) as their coping mechanism towards HIV transmission risk (Varga, 2010).

### 3. Sexual Risk Behavior:-

From several researches, condoms use, street outreach programs, programs for the prevention of mother-to-child HIV transmission, circumcision, and needle and syringe programs were the only interventions with strong evidence of reducing HIV infection (Pattanaphesaj & Teerawattananon, 2010). Voluntary HIV counselling and testing, peer education, and male and female condom use have been proved to be effective and cost-effective for female sex workers (Pattanaphesaj & Teerawattananon, 2010). From those interventions, condoms are believed as the most effective prevention for HIV transmission because consistent condom use results in 80% reduction in the spread of the disease (Giri et al., 2012).

Because there is no cure or vaccine, HIV prevention depends on the ability to modify risky behaviors, consistent, and appropriate condom use (Morisky, Stein, Chiao, Ksobiech, & Malow, 2006). Unfortunately, many sex workers reported the inconsistency of condom use. Various factors such as situational factors (including female condom availability) the type of client, desire for sexual pleasure, and financial considerations could affect the decision whether condoms were used or not (Chipamaunga et al., 2010). In China, the primary reason for not using condoms during sexual contact was the clients' refusal to use condoms (Lau et al., 2010). Moreover, one study found that 61% of Haitian women felt that the decision on condom use was exclusively the male's right (Couture, Soto, Akom, Joseph, & Zunzunegui, 2010). Most of them are generally poor and with dependent family members and there have little power to negotiate use of condom. Other interesting fact is that about 10% of the total respondents in a study in China thought that condoms could be used repeatedly and no expiration date (Lau et al., 2010).

Varga(2010) found that 67.3% of sex worker respondents in a study in Durban would forego condoms for extra payment, while the average of condom utilization among female sex workers in Thailand was only 51% (Buckingham, Moraros, Bird, Meister, & Webb, 2007). In Thailand, factors contributed to the use of condoms are ethnicity of patron (western have willingness to utilize condoms than foreign Asian or native Thai patrons) and bargaining capacity with potential patrons (Buckingham et al., 2007). Similar report from Ye et al. (2012) stated that sex workers capability to negotiate safe commercial sex takes a part to persuade clients into using condoms consistently during sexual intercourse. Interestingly, although sex workers are able to be convinced to use condoms with clients, it was more difficult for sex workers in Shanghai to initiate condom usage with non-paying partners (Cai et al., 2010). It based on their boyfriend/husband/partner's perception that their partners were not having unprotected sex with anyone else.

### 4. Prevention Programs:-

Due to the inconsistency condom use by sex workers, it is very important to identify factors that could motivate and influence the sex workers' decision on condom use. Approximately 13% of respondents in a study in China reported that it was difficult to get condoms when needed particularly for younger, 59,3% said that pharmacy shops were the most convenient place to buy a condom and 7,9% stated that they did not know how to use a condom (Lau et al., 2010). Condom availability may not be a major factor affecting condom use, as a research in China with 504 respondents investigated that social, psychological, and environmental-structural factors are very important in determining consistency condom use among female sex workers and their clients (Ye et al., 2012). Therefore, supports from the establishment owner (employers), accessibility of condoms, supports from community health care providers are very necessary(Morisky et al., 2006; Ye et al., 2012). Besides that, the peer influences, promotion of condom use and knowledge about condom use must be an important component of future prevention programs(Lau et al., 2010; Morisky et al., 2006).

In the Philippines, one of the most useful program in order to prevent HIV prevention is the manager training intervention. The training series consist of regular meeting, monitoring, providing educational materials on HIV/AIDS, and making condom available (Morisky et al., 2006). Besides that, the training also encourages the manager to provide positive reinforcement of their employees' healthy sexual practices.

### Conclusion and Recommendations:-

For some groups of population, become a sex worker is "the only option". Social-economic status and family background are the most reason for this decision. Therefore, they did not see other way for live although based on the studies from some countries, almost all female sex workers knew and were aware the risk of HIV transmission.

Unfortunately, sex workers decisions to use HIV prevention methods are often difficult when it depends on their customer as well. Various programs to increase the motivation of female sex workers to prevent HIV transmission, including the problem of the inconsistency of condoms use should be developed. Interventions should also include social, psychological, and environmental-structural factors, such as supports from the establishment owner (employers), manager trainings, peer influences, accessibility of condoms, promotion of condom use, knowledge about condom use, and supports from community health care providers.

### References:-

1. Buckingham, R. W., Moraros, J., Bird, Y., Meister, E., & Webb, N. C. (2007). Factors associated with condom use among brothel-based female sex workers in Thailand. *AIDS Care: Psychological and Sociomedical Aspects of AIDS/HIV*, 17(5), 640-647.
2. Cai, Y., Shi, R., Shen, T., Pei, B., Jiang, X., Ye, X., . . . Shang, M. (2010). A study of HIV/AIDS related knowledge, attitude and behaviors among female sex workers in Shanghai China. *BMC Public Health*, 10(377).
3. Charles, B., Jeyaseelan, L., Sam, A. E., Pandian, A. K., Thenmozhi, M., & Jeyaseelan, V. (2013). Trends in risk behaviors among female sex workers in south India: Priorities for sustaining the reversal of HIV epidemic. *AIDS Care: Psychological and Socio-medical Aspects of AIDS/HIV*, 25(9), 1129-1137.
4. Chipamaunga, S., Muula, A. S., & Mataya, R. (2010). An assessment of sex work in Swaziland: barriers to and opportunities for HIV prevention among sex workers. *Journal of Social Aspects of HIV/AIDS*, 7(3).
5. Couture, M.-C., Soto, J. C., Akom, E., Joseph, G., & Zunzunegui, M.-V. (2010). Determinants of intention to use condoms among clients of female sex workers in Haiti. *AIDS Care: Psychological and Socio-medical Aspects of AIDS/HIV*, 22(2), 253-262.
6. Giri, P. A., Hiremath, R. C., & Kasbe, A. M. (2012). Sexual Behaviour, Knowledge, Attitude and Practices Regarding HIV/AIDS amongst Female Sex Workers (FSWs) in Red Light Area of Mumbai City. *International Journal of Medical Science and Public Health*, 1(2).
7. Lau, J. T. F., Tsui, H. Y., Siah, P. C., & Zhang, K. L. (2010). A study on female sex workers in southern China (Shenzhen): HIV-related knowledge, condom use and STD history. *AIDS Care: Psychological and Socio-medical Aspects of AIDS/HIV*, 14(2), 219-233.
8. Morisky, D. E., Stein, J. A., Chiao, C., Ksobiech, K., & Malow, R. (2006). Impact of a Social Influence Intervention on Condom Use and Sexually Transmitted Infections Among Establishment-Based Female Sex Workers in the Philippines: A Multilevel Analysis. *Health Psychology, the American Psychological Association*, 25(5) 595-603.
9. OHTN. (2012). Sex Worker HIV Risk. *Rapid Review No. 58, July 2012*. Retrieved February 2014, from <http://www.ohntn.on.ca/pages/Knowledge-Exchange/Rapid-Responses/RR58-2012-Sex-Worker-HIV-Risk.pdf>
10. Pattanaphesaj, J., & Teerawattananon, Y. (2010). Reviewing the evidence on effectiveness and cost-effectiveness of HIV prevention strategies in Thailand. *BMC Public Health*, 10(401).
11. The Alliance. (2010). Who are Vulnerable and Most-At-Risk Populations? *The International HIV/AIDS Alliance. Campaign Briefing 1*.
12. The U.S. Department of Health & Human Services. (2006). A Timeline of AIDS. *The U.S. Department of Health & Human Services*. Retrieved February 2014, from <http://aids.gov/hiv-aids-basics/hiv-aids-101/aids-timeline/>
13. UNAIDS. (2013). AIDS by The Numbers. *The Joint United Nations Programme on HIV and AIDS*. Retrieved February 2014, from [http://www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2013/JC2571\\_AIDS\\_by\\_the\\_numbers\\_en.pdf](http://www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2013/JC2571_AIDS_by_the_numbers_en.pdf)
14. Varga, C. A. (2010). Coping with HIV/AIDS in Durban's commercial sex industry. *AIDS Care: Psychological and Socio-medical Aspects of AIDS/HIV*, 13(3), 351-365.
15. Wasti, S. P., Simkhada, P., Randall, J., & Teijlingen, E. v. (2009). Issues and Challenges of HIV/AIDS Prevention and Treatment Programme in Nepal. *Global Journal of Health Science*, 1(2).
16. WHO. (2013). Sex Work Tool Kit. *WHO*. Retrieved March 2014, from <http://www.who.int/3by5/en/factsheet.pdf>
17. Ye, X., Shang, M., Shen, T., Pei, B., Jiang, X., & Cai, Y. (2012). Social, psychological, and environmental structural factors determine consistent condom use among rural-to-urban migrant female sex workers in Shanghai China. *BMC Public Health*, 12(599).





### RESEARCH ARTICLE

#### The Effect of Interferon/Ribavirin Therapy on the Levels of Angiopoietin-2 and TIE-2 in Chronic Hepatitis C Patients.

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#### Abstract

**Aim:** to identify the effect of hepatitis C virus treatment by pegylated interferon and ribavirin on the level of angiogenic factor (Angiopoietin -2 and its receptor Tie-2) and detection of their levels as a predictor of response to treatment.

**Methods:** one hundred and sixteen patients with chronic hepatitis C, who were candidate for interferon and ribavirin combination therapy according to the Egyptian Ministry of Health Program, enrolled in this study where the levels of Angiopoietin -2 and its receptor Tie-2 were determined before and after the combination therapy.

**Results:** There was a significant decline of serum Ang-2 after the end of treatment, week 48 ( $330.8 \pm 73.0$ ) compared to the baseline values ( $544.7 \pm 64.1$ ) in all patients ( $P < 0.01$ ), while There was a significant increase of serum sTie-2 after the end of treatment, week 48 ( $31.2 \pm 1.04$ ) compared to the baseline values ( $17.7 \pm 2.1$ ) in all patients ( $P < 0.01$ ). However there was no difference between responders ( $212.5 \pm 87.1$ ) and non-responders ( $228.3 \pm 22.9$ ) at week 48 regarding serum Ang-2, and also there was no difference between responders ( $13.4 \pm 2.4$ ) and non-responders ( $14.22 \pm 2.39$ ) at week 48 regarding serum Tie-2 ( $P < 0.01$ ).

**Conclusion:** Angiopoietin -2 and its receptor Tie-2 may not be a useful predictors for treatment responses to pegylated interferon and ribavirin.

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#### Introduction:-

About 3% of the world's population is infected with HCV, mostly found in the developing countries, while the prevalence ranging from 0.1–5% in different European countries<sup>(1)</sup>. Egypt has the largest epidemic of hepatitis C virus (HCV) in the world; the released Egyptian Demographic Health Survey [EDHS] tested a representative sample of the entire country for HCV antibody where over 11,000 individuals were tested, the sample included both urban and rural populations and included all 27 governorates of Egypt, The overall prevalence positive for antibody to HCV was 14.7%<sup>(2)</sup>. Unfortunately, most of the patients with HCV infection will progress to chronic liver diseases

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(CLDs), liver cirrhosis and a respectable significant ratio will have hepatocellular carcinoma (HCC)<sup>(3-4)</sup>. Several mechanisms were identified in the pathogenesis of CLDs, the formation of new blood vessels is a key mechanism, where neovascularization and establishment of an abnormal angioarchitecture are related to its pathological progression<sup>(5)</sup>; moreover, the pathophysiology of portal hypertension is linked to an increased hepatic and splanchnic neovascularization<sup>(6)</sup>, nevertheless, angiogenesis is a pivotal factor in the pathophysiology of HCC<sup>(7)</sup>. As suggested by Yoshiji et al., 2003<sup>(8)</sup>, the close relationship between the progression of CLDs and angiogenesis brings about two potential clinical goals, first the detection of selected pro-angiogenic molecules that may serve as a non-invasive way to monitor both disease progression, as well as therapeutic response; second, anti-angiogenic therapy may be an effective tool for blocking or slowing down fibrogenic progression of CLDs. Although the recent advances in treatment of HCV, interferon and ribavirin combination therapy still the essential therapy in Egypt due to various reasons. The high prevalence of HCV in Egypt, progression of the disease to chronicity and liver cirrhosis which may be complicated by hepatocellular carcinoma, and the role of angiogenesis factors in the pathogenesis, motivated us to study the effect of Interferon/Ribavirin therapy on angiogenesis marker (Angiopoietin-2 and its receptor TIE-2) in chronic hepatitis C patients, and if we can use its pre-treatment level as a predictor of response to therapy or not?

### **Aim of the work:-**

The aim of this work was to identify the effect of hepatitis C virus treatment by pegylated interferon and ribavirin on the level of angiogenic factor (Angiopoietin -2 and its receptor Tie-2) and detection of their levels as a predictor of response to treatment if any.

### **Subjects and Methods:-**

A prospective study was conducted among one hundred and sixteen (116) patients at the center for treatment of viral hepatitis in Ismailia fever Hospital, Egypt, in the period from November, 2011 to December, 2013. All the patients have chronic liver disease due to HCV infection, and were candidate for interferon and ribavirin combination therapy according to the Egyptian Ministry of Health Program. Besides, the known exclusion criteria for the drugs contraindications and hypersensitivity, patients with co-infection with hepatitis B virus or other causes for CLDs, were excluded based on the laboratory data and liver biopsy. Pre-enrollment data included complete medical history, thorough clinical examination, abdominal ultrasound (CT if needed), ECG, fundus examination, and laboratory investigations including liver function tests, CBC, coagulation profile, Blood Chemistry, thyroid function, Viral markers, Auto-antibodies and liver biopsy. Finally, Serum Angiopoietin-2 (Ang-2) and Serum solubleTie-2 were determined by ELISA (Quantikine, R&D Systems, UK) before and after combination therapy. Then the patients were divided into 2 equal groups; 58 each according to type of peg-interferon given to each group. According to the national committee of viral hepatitis treatment, the patients received either Peg-interferon alfa 2a (pegferon 180µg) as a fixed dosage (manufactured by Memphis farm - Egypt) (Zeuzem et al., 2003)<sup>(9)</sup>, or Peg-interferon alfa 2b (pegintron 100, 120 and 150 µg) by a dose of 1.5µg/kg body weight (manufactured by Schering Corp., a subsidiary of Merck & Co., Inc.), plus a Dose of ribavirin (600 -1200 mg), as a weight adjusted dosage, given orally each day in two divided doses with food<sup>(10)</sup> (manufactured by Sigma Pharm industries –Egypt /S.A.E. and Schering CO. /U.S.A.). All patients included in this study were submitted to follow up records at 12th weeks included: CBC with reticulocyte count- Liver enzymes (ALT/AST) - Bilirubin total and direct - Serum creatinine - HCV RNA PCR [for early viral response (EVR)]. Finally follow up records at 48th week included: Serum Angiopoietin-2 and serum-CBC with reticulocyte count- ALT and AST- Bilirubin total and direct - Serum creatinine - HCV RNA PCR [end of treatment response (ETR)].

### **Data analysis:-**

Gathered data was processed using Statistical Package of Social Sciences version 10 (SPSS version 10 Inc., Chicago, IL, USA). Quantitative data was expressed as median or means  $\pm$  standard deviation (SD) as appropriate. Qualitative data was expressed as frequency (numbers) and percentages. The results for all categorical variables were given in the form of rates (%). Student t test was used to test significance of difference for quantitative variables that follow normal distribution. Chi Squares and Fishers Exact tests were used to test significance of difference for qualitative variables. The independent data of the study was conducted and analyzed. Definitive statistics was used for the analysis of the socio-demographic and other variables. Firstly, the relation between the dependent and independent variables was studied using the Chi-square test and the t-test. Second, the significant variables were subjected to multivariate logistic regression analysis.

## Results:-

In this study, (116) hepatitis C patients were involved, where all of them received interferon and ribavirin therapy at the center of viral hepatitis treatment at Ismailia fever hospital, Their age ranged between 23 and 57 years (mean =  $42.5 \pm 8.2$ ), the majority (51.7%) were at age group from 40 to 50 year, and regarding their gender, 80 patients were males (69%) and 36 patients were females (31%). **Table (1)** shows the distribution of the patients according to response to treatment at week 12 {Early Virological Response (EVR)}, and week 48 {End of Treatment Response (ETR)}. Of the 116 patients included in the study, 99 patients (85.3%) had EVR where they completed the course to week 48 and 90 of them (90.9%) had ETR while 9 patients relapsed; so Sustained Virological Response (SVR) was obtained in 81 out of the 116 patients (69.8%). **Table (2)** shows the effect of combination therapy IFN/RBV on the serum level of Ang-2. There is a significant decline of serum Ang-2 after the end of treatment, week 48 ( $330.8 \pm 73.0$ ) compared to the baseline values ( $544.7 \pm 64.1$ ) in all patients whether had end of treatment response (ETR) or those who had no ETR ( $P < 0.01$ ). **Table (3)** shows the effect of combination therapy IFN/RBV on serum sTie-2 ( $n=99$ ). There is a significant increase of serum sTie-2 after the end of treatment, week 48 ( $31.2 \pm 1.04$ ) compared to the baseline values ( $17.7 \pm 2.1$ ) in all patients whether had end of treatment response (ETR) or those who had no ETR ( $P < 0.01$ ). **Table (4)** shows a comparison between the mean pre-post changes ( $\Delta$ ) in Angiopoietin-2 & Tie-2 between responders & non-responders at week 48. There is no difference between responders ( $212.5 \pm 87.1$ ) and non-responders ( $228.3 \pm 22.9$ ) at week 48 regarding serum Ang-2 and also there is no difference between responders ( $13.4 \pm 2.4$ ) and non-responders ( $14.22 \pm 2.39$ ) at week 48 regarding serum Tie-2 ( $P < 0.01$ ). **Table (5)** shows the Correlation between Biopsy findings and baseline Angiopoietin-2 & Tie-2. There was a significant correlation between baseline sTie-2 and grade of inflammation (0.242) ( $P < 0.01$ ). There was no correlation between baseline level of Ang-2 or sTie-2 and stage of fibrosis, Spearman's Rank Correlation Coefficient (-0.020) and (-0.056) respectively ( $P < 0.01$ ). There was no correlation between baseline level of Ang-2 and grade of Inflammation, Spearman's Rank Correlation Coefficient (-0.061) and (-0.242) respectively ( $P < 0.01$ ). **Table (6)** shows the correlation between Lab. & clinical findings and baseline Angiopoietin-2 & its receptor TIE-2. There was a positive correlation between age and serum level of Tie-2 by 0.199 ( $p < 0.05$ ) that means that with increasing age there was an elevation of the serum level of Tie-2. Also, there was a negative correlation between white blood cell count and serum Ang-2 by 0.233 ( $p < 0.05$ ).

## Discussion:-

Our prospective study was performed on the data collected from 116 patients with chronic HCV infection who were candidate for combination therapy in the center for treatment of viral hepatitis in Ismailia Fever Hospital, Egypt. The primary objectives of this study were to identify the effect of pegylated interferon and ribavirin therapy on the level of angiopoietin-2 and its receptor Tie-2 and to correlate the level of angiogenic factor angiopoietin-2 and its receptor Tie-2 with end of treatment response in chronic hepatitis C patients under combination therapy interferon/ribavirin. We have to admit that Information on the pathophysiological role of the Ang/Tie-2 system in chronic inflammatory liver disease is rather scarce. Most of our knowledge gained by oncology studies, such as in hepatocellular carcinoma, in which the fundamental pathophysiological role played by angiogenesis has been well established<sup>(11)</sup>, but generally speaking Ang-2 promotes a rapid increase in capillary diameter, remodeling of the basal lamina and vessel growth by facilitating sprouting<sup>(12)</sup>, while the soluble form of the Tie-2 receptor functions as a natural inhibitor of Ang-2, and is therefore antiangiogenic<sup>(13)</sup>. The mean age of our patients was  $42.5 \pm 8.2$  years with a range of 23 – 57 years, where the frequency of male patients was higher than female patients (69% versus 31%, respectively); This comes in agreement with Several previous researches, which indicated a greater proportion of males are infected versus females<sup>(14-16)</sup>. In our study, there was a baseline elevated level of serum Angiopoietin-2 (Ang-2) in all patients ( $544.7 \pm 64.1$  in patients who achieved EVR, and  $553.9 \pm 24.9$  in those who didn't achieve EVR at 12 weeks of therapy). Similarly, Salcedo et al. (2005)<sup>(17)</sup> found that the serum level of Ang-2 is a significantly higher in chronic hepatitis C (CHC) group compared to a control group, which indicated that Ang-2 may be more relevant to the pathophysiology of the disease; also in another study<sup>(18)</sup> it was reported that the mean levels of sAng-2 were significantly elevated in HCV, HBV and HCC patients when compared to that in the healthy control subjects. Regarding the response to the combination therapy with interferon and ribavirin in our study, there was a marked reduction in the serum marker Ang-2 before and after therapy at week 48 ( $545.1 \pm 66.8$  and  $332.6 \pm 75.7$ ) respectively; more interestingly, the same reduction was observed also between patients who achieved ETR and those who didn't achieve it ( $540.7 \pm 26.1$  and  $312.3 \pm 33.8$ ) respectively. Similarly, Salcedo et al. (2005)<sup>(17)</sup> founded that antiviral combination therapy markedly decreased Ang-2 levels in CHC patients. Also, Wada et al. (2007)<sup>(19)</sup> reported that interferon alpha treatment decreased the level of Ang-2 in hepatocellular carcinoma patients although it was combined with 5-fluorouracil and concluded that this combination has anti-proliferative and anti-

angiogenic effects, which we can say also for our combination therapy regardless the virological response; this can be powered by the fact that also, IFN-alpha has been successfully used in patients with pulmonary hemangiomatosis, <sup>(20)</sup> angioblastomas <sup>(21)</sup> and hemangioendotheliomas <sup>(22)</sup> which was via its anti-proliferative and anti-angiogenic effects by decreasing Ang-2 level. On the other hand, in our study, we found that combined therapy by IFN/RBV raised the level of serum sTie-2 from baseline levels to end of treatment levels ( $17.7 \pm 2.1$  and  $31.2 \pm 1.04$ ) respectively; this finding is similar to that mentioned by Salcedo et al. <sup>(17)</sup> where he found a low level of the Ang-2 inhibitor sTie-2 receptor in 36 CHC patients were comparable to the 15 healthy controls which was markedly increased after combination therapy by IFN/RBV. However, in our study, serum Ang-2 and sTie-2 didn't express statistically significant change between responders and non-responders at 48 weeks, while Salcedo et al. <sup>(17)</sup> demonstrated a close relationship between variations in serum levels of angiogenesis markers and response to therapy in CHC patients; this may be due to the smaller number of their patients or differences in samples. As regards the relation between the angiogenic factors and viremia, we found that high level of viremia was associated with increased serum levels of Ang-2 and is inversely related to level of sTie-2 Vice versa; while in a study conducted by Helaly and Abou Shamaa <sup>(23)</sup> who studied the Influence of hepatitis C virus infection on circulating levels of VEGF (another angiogenic factor similar in action to Ang-2) in patients with hepatitis C and hepatocellular carcinoma (HCC), they found a weak correlation between the level of viremia and VEGF. In contrast to Salcedo et al. <sup>(17)</sup> who mentioned that determination of Ang-2 and sTie-2 in parallel to the viral load and fibrosis markers may provide complementary information to assess response to treatment and disease progression. Our results showed no statistically significant correlation between the grade of inflammation and stage of fibrosis and serum levels of Ang-2 and sTie-2; this also comes in agreement with the results of Salcedo et al. <sup>(17)</sup> However, Hernandez et al. <sup>(24)</sup> found that Ang-2 serum concentrations raised progressively with the stage of fibrosis. Although it was interesting to discover the effect of combination therapy by IFN/RBV on liver biopsy findings through its effect on Ang-2 and sTie-2, but for many ethical causes and of invasiveness of liver biopsy, we did not repeat the biopsy post-treatment. Finally, in our study, a significant correlation of Ang2 levels with prothrombin time was found and negative correlation for the albumin level; this comes in agreement with Kasztelan-Szczerbinska et al. <sup>(25)</sup> who mentioned that Ang-2 levels is related to synthetic liver function parameters, being positive for INR and negative for the albumin level, which suggested that Ang2 may be a relevant biomarker of liver function impairment and indicated the potential for its use in clinical practice. Moreover, in our study, we found a positive correlation of plasma Ang-2 concentrations with the liver enzyme ALT but no correlation with AST, which was Similar also to Kasztelan-Szczerbinska et al <sup>(25)</sup>, who described a positive correlation of plasma Ang-2 concentrations with liver enzymes.

**Table 1. Distribution of patients according to response to treatment at week 12 (EVR) and week 48 (ETR)**

	Week 12 (EVR)		Week 48 (ETR)	
	No.	%	No.	%
<b>Responders</b>	99	85.3%	90	90.9%
<b>Non-responders</b>	17	14.7%	9	9.1%
<b>Total</b>	116	100.0%	99	100.0%

**Table 2. the effect of combination therapy IFN/RBV on serum Ang-2 (n=99)**

Markers	Response at 48-Week (ETR)	n	Mean $\pm$ SD (Range)		Mean $\pm$ SD	p-value
			Before Treatment "Baseline"	After Treatment "week 48"		
Angiopoetin-2	Responders (ETR)	90	545.1 $\pm$ 66.8 (460.0 – 927.0)	332.6 $\pm$ 75.7 (179.0 – 512.0)	212.5 $\pm$ 87.1	<0.001**
	Non-responders (no ETR)	9	540.7 $\pm$ 26.1 (487 – 568)	312.3 $\pm$ 33.8 (270 – 357)	228.3 $\pm$ 22.9	<0.001**
	Total	99	544.7 $\pm$ 64.1 (460.0 – 927.0)	330.8 $\pm$ 73.0 (179.0 – 512.0)	213.9 $\pm$ 83.4	<0.001**

\*\* Statistically significant difference at  $p < 0.01$ ; paired t-test

**Table 3. the effect of combination therapy IFN/RBV on serum sTie-2(n=99)**

Markers	Response at 48-Week (ETR)	n	Mean $\pm$ SD (Range)		Mean Difference $\pm$ SD	p-value
			Before Treatment "Baseline"	After Treatment "48-week"		
TIE-2	Responders (ETR)	90	17.8 $\pm$ 2.1 (15.0 – 24.1)	31.2 $\pm$ 1.01 (28.8 – 33.1)	13.4 $\pm$ 2.4	<0.001**
	Non-responders (no ETR)	9	16.9 $\pm$ 1.4 (15.5 – 19.4)	31.1 $\pm$ 1.39 (28.8 – 32.5)	14.22 $\pm$ 2.39	<0.001**
	Total	99	17.7 $\pm$ 2.1 (15.0 – 24.1)	31.2 $\pm$ 1.04 (28.8 – 33.1)	13.5 $\pm$ 2.41	<0.001**

\*\* Statistically significant difference at  $p < 0.01$ ; paired t-test

**Table 4. Comparing the mean pre-post changes ( $\Delta$ ) in Angiopoetin-2 & TIE-2 between responders & non-responders at week 48 (N=99)**

Pre-Post changes (Mean $\pm$ SD)	Response To Treatment (at Week 48)		Mean Difference $\pm$ SE	p-value
	Responders (n= 90)	Non-responders (n= 9)		
$\Delta$ Angiopoetin-2	212.5 $\pm$ 87.1 (30.0 – 537.0)	228.3 $\pm$ 22.9 (192.0 – 256.0)	15.8 $\pm$ 29.3	0.590
$\Delta$ TIE-2	13.4 $\pm$ 2.4 (6.4 – 17.6)	14.22 $\pm$ 2.39 (10.1 – 16.8)	0.81 $\pm$ 0.84	0.340

\*\* Statistically significant difference at  $p < 0.01$ ; Independent samples t-test

**Table 5. Correlation between Biopsy findings and baseline Angiopoetin-2 & its receptor TIE-2 (N =116)**

Spearman's Rank Correlation Coefficient (p-value)		
	Angiopoetin-2	TIE-2
<b>Stage of Fibrosis</b>	-0.020 (0.828)	-0.056 (0.548)
<b>Grade of Inflammation</b>	-0.061 (0.513)	<b>-0.242(0.009<sup>**</sup>)</b>

<sup>\*\*</sup> Statistically significant difference at p<0.01

**Table 6. Correlation between Lab. & clinical findings and baseline Ang-2 & TIE-2 (N = 116)**

	Pearson's Correlation Coefficient (p-value)	
	Angiopoetin-2	TIE-2
<b>Age (years)</b>	0.083 (0.377)	<b>0.199 (0.032<sup>*</sup>)</b>
<b>S. Albumin (g/dl)</b>	0.108 (0.294)	0.028 (0.764)
<b>S. Alkaline Phosphatase (IU)</b>	0.074 (0.427)	-0.014 (0.882)
<b>S. AST (IU)</b>	-0.071 (0.447)	0.012 (0.894)
<b>S. ALT (IU)</b>	-0.035 (0.706)	0.029 (0.754)
<b>T. Bilirubin (mg/d)</b>	-0.007 (0.942)	-0.097 (0.298)
<b>Indirect Bilirubin (mg/d)</b>	-0.074 (0.427)	0.088 (0.348)
<b>AFP</b>	-0.056 (0.549)	-0.003 (0.977)
<b>WBC × 10<sup>3</sup></b>	<b>-0.233 (0.012<sup>*</sup>)</b>	-0.045 (0.631)
<b>Hemoglobin (g/dl)</b>	-0.005 (0.961)	-0.110 (0.241)
<b>Prothrombin Time (sec.)</b>	0.039 (0.675)	0.042 (0.654)
<b>Blood Glucose (mg/d)</b>	-0.167 (0.073)	0.004 (0.968)
<b>S. creatinine (mg/d)</b>	0.064 (0.494)	-0.033 (0.726)
<b>TSH (IU)</b>	0.035 (0.713)	-0.122 (0.191)
<b>Interferon Dose</b>	0.071 (0.448)	0.134 (0.150)
<b>Ribavirin Dose</b>	0.109 (0.244)	0.135 (0.148)
<b>HCV-RNA PCR</b>	0.004 (0.967)	-0.017 (0.859)

<sup>\*</sup> Statistically significant difference at p<0.05

### Conclusion:-

Although Ang-2 and sTie-2 can't be used as a predictors of response to therapy, antiviral combination therapy markedly decreased serum Ang-2 levels and increased sTie-2 levels so it may be beneficial as a protective factor to reduce angiogenesis and consequently reducing hepatitis C related liver cirrhosis and HCC.

### Ethical considerations:-

This study was approved by the University's Research Ethical Committee and an informed consent was taken from all the participants prior to recruitment into the study.

### Conflicts of interest:-

We have not any conflict of interest to declare.

### References:-

- 1- Lavanchy D. Evolving epidemiology of hepatitis C virus. Clin Microbiol Infect 2011; 17: 107–15.
- 2- El-Zanaty F and Way A. Egypt Demographic and Health Survey 2008. Egyptian:Ministry of Health (El-Zanaty and Associates and Macro International, Cairo), 2009; pp 431.
- 3- Fattovich G1, Stroffolini T, Zagni I, Donato F. Hepatocellular carcinoma in cirrhosis: incidence and risk factors. Gastroenterology. 2004 Nov;127(5 Suppl 1):S35-50.
- 4- Esteban JI, Sauleda S, Quer J. The changing epidemiology of hepatitis C virus infection in Europe. J Hepatol. 2008; 48:148–162.
- 5- Stewart S, Day C. The management of alcoholic liver disease Hepatol 2003; 38 (Suppl 1. 1): S2–13.
- 6- S. Coulon, F. Heindryckx, A. Geerts, C. Van Steenkiste, I. Colle, H. Van Vlierberghe. Angiogenesis in chronic liver disease and its complications. Liver Int, 31 (2011), pp. 146–1627.
- 7- Yamamoto T, Hirohashi K, Kaneda K, et al. Relationship of the microvascular type to the tumor size, arterIALIZATION and dedifferentiation of humanhepatocellular carcinoma. Jpn J Cancer Res 2001; 92: 1207–13.

- 8- Yoshiji H, Kuriyama S, Fukui H. Blockade of reninangiotensin system in antifibrotic therapy. *J Gastroenterol Hepatol* 2007; 22(Suppl.1): S93–5.
- 9- Zeuzem S, Welsch C, Herrmann E. Pharmacokinetics of peginterferons. *Semin Liver Dis* 2003; 23(Suppl 1):23-28.
- 10- Mangia A, Minerva N, Bacca D, et al. Individualized treatment duration for hepatitis C genotype 1 patients: A randomized controlled trial. *Hepatology*. 2008; 47:43-50.
- 11- Semela D and J.-F. Dufour. "Angiogenesis and hepatocellular carcinoma," *Journal of Hepatology*. 2004; vol. 41, no. 5, pp. 864–880.
- 12- Visconti RP, Richardson C, Sato T. Orchestration of angiogenesis and arteriovenous contribution by angiopoietins and vascular endothelial growth factor (VEGF). *Proc Natl Acad Sci USA*. 2002; 99:8219-8224.
- 13- Carmeliet P. Angiogenesis in health and disease. *Nat Med*. 2003; 9:653-660.
- 14- Afdhal NH, Dieterich DT, Pockros PJ, et al. Epoetin alfa maintains ribavirin dose in HCV-infected patients: a prospective, double-blind, randomized controlled study. *Gastroenterol*. 2004; 126:1302-1311.
- 15- World Health Organization: Hepatitis C – global prevalence. *Weekly Epidemiological Record*, (2009); 75(3): 18–9.
- 16- Mohamed A. Abdel Mohsen, Neveen A. Hussein, Abeer A. Ghazal, et al. Angiogenic output in viral hepatitis, C and B, and HCV-associated hepatocellular carcinoma, *Alexandria Journal of Medicine*. 2014; vol 50, 235–240.
- 17- Salcedo X, Medina J, Sanz-Cameno P, et al. The potential of angiogenesis soluble markers in chronic hepatitis C. *Hepatology*. 2005; 42: 696-701.
- 18- Abdel-Mohsen M1, Deng X2, Danesh A2, Liegler T3, Jacobs ES2, Rauch A4, Ledergerber B5, Norris PJ6, Günthard HF5, Wong JK7, Pillai SK8. Role of microRNA modulation in the interferon- $\alpha$ /ribavirin suppression of HIV-1 in vivo. *PLoS One*. 2014 Oct 2;9(10).
- 19- Wada; Nagano; Yamamoto; et al. Combination therapy of interferon- $\alpha$  and 5-fluorouracil inhibits tumor angiogenesis in human hepatocellular carcinoma cells by regulating vascular endothelial growth factor and angiopoietins, *Oncol Rep*. 2007; Oct;18(4):801-9.
- 20- White CW, Sondheimer H, Crouch E, et al. Treatment of pulmonary hemangiomatosis with recombinant interferon alfa-2a. *N Engl J Med*. 1989; 320:1197-1200.
- 21- Marler JJ, Rubin JB, Trede NS, Connors S, et al. Successful antiangiogenic therapy of giant cell angioblastoma with interferon alpha 2b: Report of 2 cases; *pediatrics* 2002, 109: E 37.
- 22- Palmieri G, Montella L, Martignetti A et al., Interferon alpha-2b at low doses as long-term antiangiogenic treatment of a metastatic intracranial hemangioendothelioma: a case report. *Oncol Rep*. 2000; 7:145-149.
- 23- Helaly GF, Abou Shamaa LA. Influence of hepatitis C virus infection on circulating levels of sICAM-1 and VEGF in patients with hepatitis C and hepatocellular carcinoma (HCC) and their role in enhancing detection of HCC, *Egypt J Immunol*. 2006; 13(1):27-38.
- 24- Ángel Hernández-Bartolomé, Rosario López-Rodríguez, Yolanda Rodríguez-Muñoz, et al. Angiopoietin-2 Serum Levels Improve Noninvasive Fibrosis Staging in Chronic Hepatitis C: A Fibrogenic-Angiogenic Link, *PLOS ONE* | www.plosone.org 9 June 2013 | Volume 8 | Issue 6
- 25- Beata Kasztelan-Szczerbinska, 1 ,\* Agata Surdacka, 2 Maria Slomka, 1 Jacek Rolinski, 2 Krzysztof Celinski, 1 Halina Cichoz-Lach, 1 Agnieszka Madro, 1 and Mariusz Szczerbinski 1. Angiogenesis-Related Biomarkers in Patients with Alcoholic Liver Disease: Their Association with Liver Disease Complications and Outcome. *Mediators Inflamm*. 2014; 2014: 673032. Published online 2014 May 18. doi: 10.1155/2014/673032.



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### RESEARCH ARTICLE

#### Effect of diode laser depigmentation on gingival tissue of dogs.

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##### Key words:-

Depigmentation-diode laser-gingiva-histology-ultrastructure.

#### Abstract

**Introduction:** Intraoral soft tissue esthetics has become a significant aspect of dentistry and clinicians are faced with achieving acceptable gingival esthetics as well as addressing biologic and functional problems.

**Aim of study:** was to evaluate the effect of diode laser irradiation on gingival depigmentation.

**Materials and methods:** 3 watts continuous mode diode laser was used to remove gingival hyperpigmentation of dogs. Specimens were divided according to the follow up periods of (1, 2, 4 and 8 weeks) where the experimental specimens were contralateral to the control ones. Specimens were evaluated pre- and post-treatment histologically using H&E, histochemically using Masson Fontana and ultrastructurally by transmission electron microscope.

**Results:** histological, histochemical and ultrastructural evaluation revealed a statistically significant decrease in melanin content in the follow up periods compared to the baseline. Meanwhile, the recurrence of melanin was observed more in groups of 4 and 8 weeks after laser irradiation yet did not reach the baseline.

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#### Introduction:-

A smile expresses a feeling of joy, success, sensuality, affection and can reflect self-confidence and kindness. The harmony of a smile is not only determined by the shape, position and color of the teeth, but also by the gingival tissues. Gingival health and appearance became of a great concern since they are essential components of an attractive smile. Melanin pigmentation of the gingiva occurs in all ethnicities. Therefore, an increasing number of persons are found seeking treatment for this condition (Lagdive et al., 2009).

Melanin, a brown pigment, is the most common natural pigment contributing to endogenous pigmentation of gingiva and is produced by melanocytes in the basal and suprabasal cell layer of the gingival epithelium. The gingiva is the most frequently pigmented tissue of the oral cavity (Rosa et al., 2007).

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Gingival hyperpigmentation is increased pigmentation beyond the normally expected degree of the oral mucosa. Several physiologic and pathologic factors can cause hyperpigmentation (Dummett and Gupta, 1964). However, the most common cause is physiologic or ethnic hyperpigmentation which is genetically determined and is clinically manifested as variable amounts of diffuse or multifocal melanin pigmentation in different ethnic groups (Hegde et al., 2013).

Numerous intrinsic and extrinsic factors, including body distribution, ethnicity/gender differences, variable hormone-responsiveness, genetic defects, hair cycle- dependent changes, age, UV-R, climate/season, toxin, pollutants, chemical exposure and infestations, are responsible for a whole range of responses in melanosome structure and distribution (Costin and Hearing, 2007).

Depigmentation is the treatment of removal of melanin hyperpigmentation. Various methods have been used for this procedure including gingivectomy, electrosurgery, cryosurgery, chemically using phenol and alcohol and abrasion with diamond bur (Atsawasuwan et al., 2000).

Laser has been used in dentistry since the beginning of the 1980s. Recent research has centered on using diode laser for oral surgery of the tongue and gingiva and to remove infected epithelium in chronic periodontitis. Diode laser has offered some advantages over the others, such as easy gingival reshaping, reduced need of local anesthesia and dry operative field due to excellent hemostasis associated with significant decrease in pain and inflammatory postoperative score. Minimal scarring and satisfactory clinical outcome on the long term have also been achieved. Moreover, there is evidence in the recent literature of successful depigmentation using diode laser (Hedge et al., 2013).

### **Aim of the study:-**

The aim of the present study was to evaluate the effect of diode laser irradiation on gingival depigmentation, histologically, histochemically and ultrastructurally.

### **Materials and methods:-**

Twenty-eight adult male dogs were evenly divided into 4 main groups; groups (I, II, III and IV) correspondent to post-operative follow-up periods of (1, 2, 4 and 8 weeks) respectively. Specimens of each group were divided into 2 groups; control (A) and experimental (B), where specimens of group B (right side) were selected from contralateral area to group A (left side).

The melanin pigmented gingiva at the region of the canines was ablated by diode laser irradiation with a flexible, fiber-optic delivery system (320 microns diameter) in a contact technique, air cooling handpiece with 3 W continuous mode under standard protective measures. The procedure was performed on pigmented areas until blister formation occurred. Laser ablation started from the mucogingival junction towards the free gingival margin including the inter-dental papilla. The laser beam was guided in brush stroke movements until the entire pigmented spot had disappeared without causing any bleeding which was beneficial for clear visualization (Agarwal et al., 2014). This procedure was repeated until the desired depth of tissue removal was achieved. Remnants of the ablated tissue were removed using sterile gauze damped with saline so as to allow clear visibility of the field. Gingival specimens were examined by light microscope using Hematoxyline and Eosin stain and Masson Fontana special stain and by electron microscope.

### **Results:-**

Histologically, before laser irradiation, the gingiva of dogs showed extensive physiologic pigmentation of a brown color. The specimens showed that most of the melanin is located in the basal and suprabasal layers. After 1, 2, 4 and 8 weeks of the laser irradiation, the specimens were free of the the brown coloration. Complete re-epithelialization was seen after 1 week (subgroup IB) of the application. Some cytoplasmic vacuoles were seen in the granular layer after 2 weeks (subgroup IIB) of the irradiation. Also the granular cells were of faintly stained and less dense cytoplasm. A remarkable thickening in the keratin layer of subgroup IIIB (4 weeks after irradiation) was observed. Normal epithelial cells were seen after 8 weeks (subgroup IVB) of laser irradiation. Lamina propria was normal with some inflammatory cell infiltration (Fig. 1).

Using Masson Fontana, the specimens before laser irradiation showed positive reaction throughout the entire epithelial layers. After 1 and 2 weeks (subgroups IB and IIB), there was a remarkable decrease in the melanin concentration. But at 4 and 8 weeks (subgroups IIIB and IVB), there was a little increase in the melanin concentration compared to subgroups IB and IIB but yet didn't reach the baseline (Fig. 2).

Our histological and histochemical results were confirmed with the histomorphometry where subgroups IB and IIB were highly statistically significant with our histological results as the melanin concentration in the basal layer was significantly decreased while subgroups IIIB and IVB statistically significant where melanin concentration in basal layer was decreased but yet more than subgroups IB and IIB (Fig. 3).

Electron microscopic examination of the gingiva of the control subgroup showed the basal cells of their two types; the serrated basal cells which are a single layer of cuboidal or high cuboidal cells with protoplasmic processes projecting from their basal surface towards the connective tissue. They contain some melanin granules in their cytoplasm around the nucleus. The other population of the basal cells which are the non-serrated could also be seen. They give rise to a population of cells amplified for cell division. Considerable amount of melanosomes of variable sizes and electron density were seen inside their cytoplasm (Fig. 4a). Melanocytes with many melanin granules were scattered between lower prickly layer. Some melanocytes had a large rounded nucleus and others with elongated or ellipsoid nucleus containing a nucleolus. The nuclear membrane was smooth with regular outline which may however exhibit a single small cleft. The cytoplasm was relatively clear or electron lucent surrounding the nucleus. Numerous electron dense melanin granules (melanosomes) of different size and shape correspondent to their maturative stage were seen throughout the cytoplasm (Fig. 4b). Relatively less melanin granules were seen between upper prickly cell layer. The granular cell layer consisted of flatter, wider and larger cells than those of the prickly layer. Their nuclei showed signs of degeneration and pyknosis. A cytoplasmic vacuole surrounded the nucleus and some melanosomes were detected in it (Fig. 4c). The keratin layer presented some melanosomes and pyknotic nuclei. Gingival specimens of subgroup IB showed that almost all basal cells were devoid of melanin granules meanwhile few of them presented some. The nuclear outline tended to be more irregular (Fig. 4d). Most of the prickly cells were devoid of melanin granules and normal desmosomal attachments were seen between them (Fig. 4e). The specimens of subgroup IIB showed the basal cells with variable sized electron dense melanin granules (Fig. 4f). Cells of the prickly layer were almost devoid of melanin granules similar to those of subgroup IB. However, some of them presented cytoplasmic vacuoles (Fig. 4g). Subgroup IIIB showed prominent melanin granules in some of their prickly cells (Fig. 4h). A remarkable thickening of the keratin layer was noticed in this subgroup (Fig. 4i). Abundant melanin granules were seen between adjacent keratinocytes of subgroup IVB (Fig. 4j).

### Discussion:-

Laser was used in the current study because its use is currently the most common technique in gingival depigmentation. Laser depigmentation is a superior treatment modality for a number of conditions when compared to traditional techniques in terms of precision cutting, hemostasis and lowering the risk of other complications commonly seen such as pain, edema and infection (Romeo et al., 2014).

Gingival depigmentation performed in this study was carried out by a 970 nm wave length diode laser and a 3 W irradiation power settings as it has near optimal absorption for melanin and hemoglobin (Lagdive et al., 2010). In the present study there was minimal side effects such as the very slight coagulation on the treated surface as laser has been recognized as one of the most effective, comfortable and reliable techniques for the gingival depigmentation (Shenawy et al., 2015).

In the present study, dogs have been chosen for the gingival depigmentation procedures rather than any other experimental animal due to the marked presence of melanin pigments in their gingiva. Dummett et al., 1964 declared the presence of melanin pigments in the stratum spinosum and the basal layers of the dog's attached gingiva through a heavy patchy distribution.

It is known that the nature of the pigmentation and the depth or the degree of its penetration into the tissue are decisive factors in the outcome of the laser treatment (Sharon et al., 2000). In the current study, the utilized laser wavelength was 970nm. Such wavelength is known to induce relatively deep tissue penetration (Atsawasuwan et al., 2000).

In the present study, the light microscopic examination of subgroup IB (1 week after laser irradiation) revealed the completion of re-epithelialization and normal maturation of the epithelium manifested by the presence of all layers

till the stratum corneum. It also showed the absence of the brown colored melanin pigmentation in the basal cell layer compared to the control subgroup (IA). The results of subgroup IIB (2 weeks after laser irradiation), showed that the basal and prickle cells presented almost normal histological features. The granular cells were of faintly stained cytoplasm. Also some cells showed a relatively large vacuolar spaces. A remarkable thickening in the keratin layer of subgroup IIIB (4 weeks after irradiation) was observed. Normal epithelial cells were seen in subgroup IVB.

These findings were supported by Yousuf et al., 2000 who evaluated the possibility of the removal of canine gingival melanin pigmentation in dogs with the semiconductor diode laser using a 3 W in a continuous mode. They also checked for the brown pigmentation after 3 weeks of the laser irradiation and they did not find any repigmentation when examined by H&E stain.

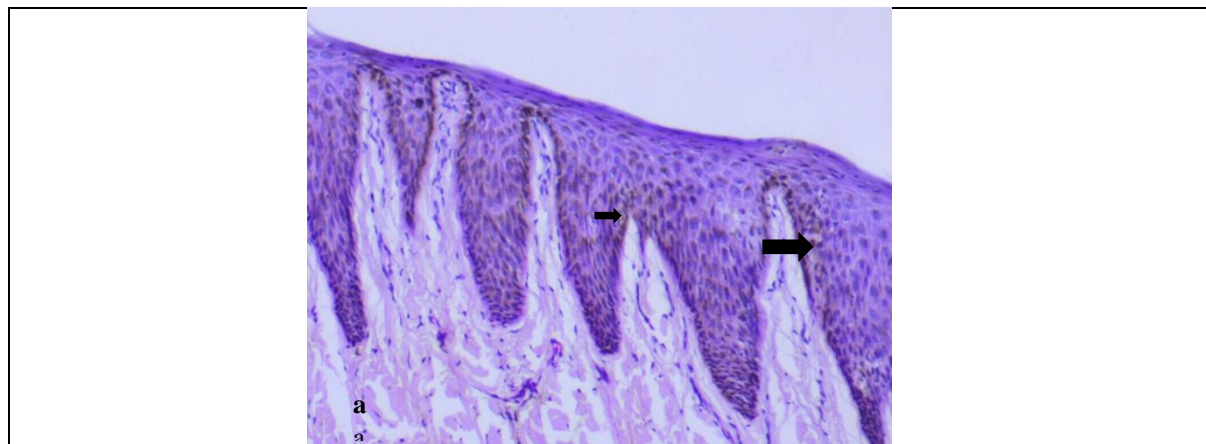
However, in our study using Masson Fontana stain reflected that there was rare amount of melanin in basal and suprabasal layers of the epithelium of the dog gingiva after 1 week (subgroup IB) of the diode laser application. Also after 2 weeks (subgroup IIB) of laser application, Masson Fontana stain revealed very small spots of melanin. And according to the statistical analysis of the histomorphometric results, these two groups showed a highly statistically significant decrease in melanin concentration in the basal and suprabasal layers of the gingival epithelium in comparison to the baseline treatment of each subgroup.

Masson Fontana results of subgroups IIIB and IVB (4 and 8 weeks postoperative respectively) revealed a slight to moderate appearance of melanin throughout the whole thickness of the epithelium. The statistical analysis of the histomorphometry revealed a statistically significant decrease in amount of melanin in relation to the baseline of each subgroup.

In the present study, the ultrastructural changes observed in the epithelial cells after laser irradiation were consistent with the histological and histochemical examinations.

Despite the different technique of erbium:YAG laser that was utilized by Attwa et al., 2015 in treatment of melasma of skin (acquired hyperpigmentation involving cheeks, nose, upper lip and forehead) in humans. Skin of the face was treated with 2 consecutive passes. This treatment was repeated monthly for a total of 6 months. Evaluation was done at baseline, before each session and at 1, 3 and 6 months after final treatment. Similarly, their electron microscopic results seemed similar to those of the current study. Their results showed that there was a decrease in the aggregation of melanin granules within keratinocytes and melanocytes of the epidermis.

In accordance to the results of this study, it may be concluded that the application of diode laser appears to be a safe and effective alternative method for gingival depigmentation procedure. However, the esthetic outcome may not last for long time. Therefore, further studies are recommended with different laser treatment parameters for a better understanding of the potential benefits of laser depigmentation.



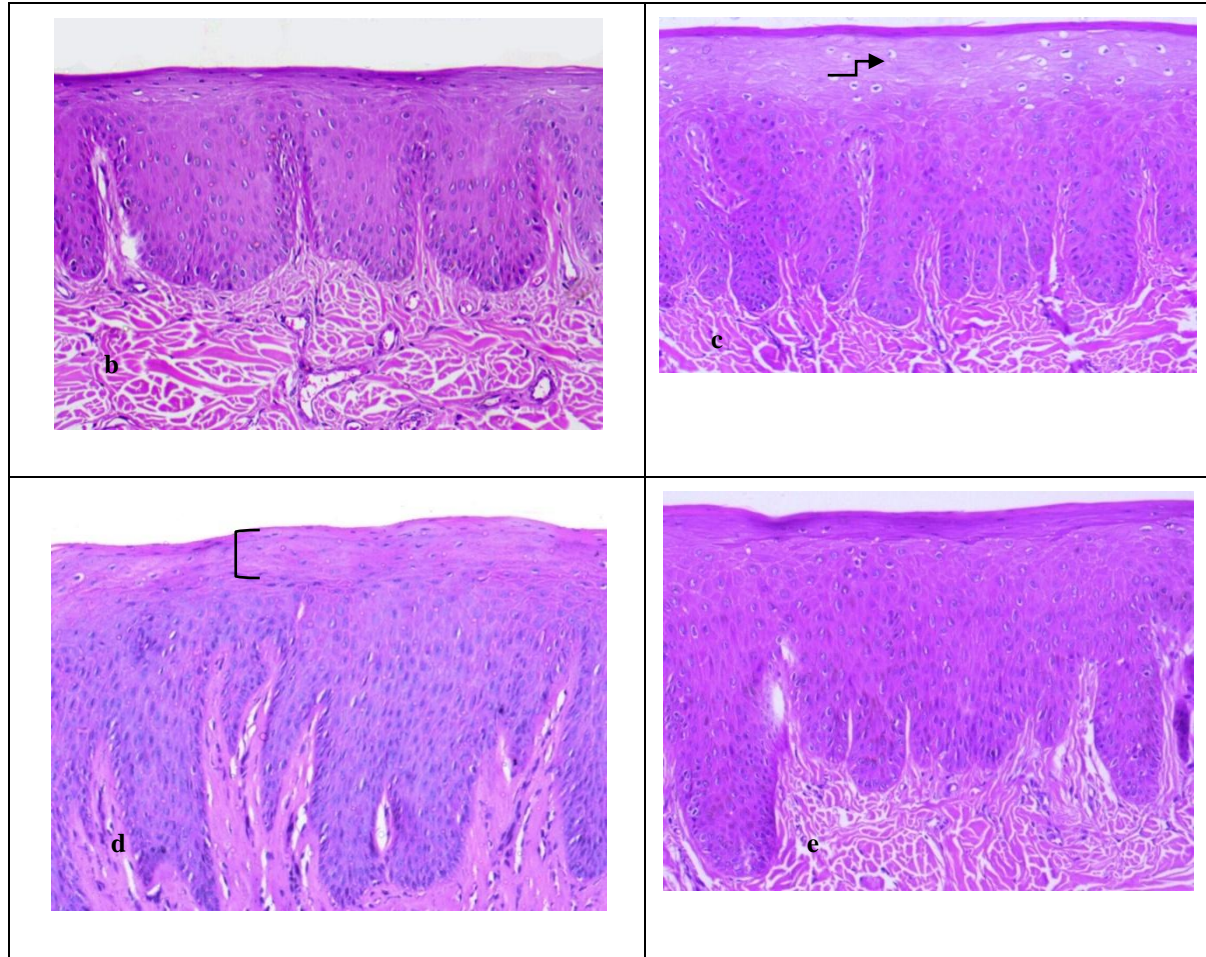
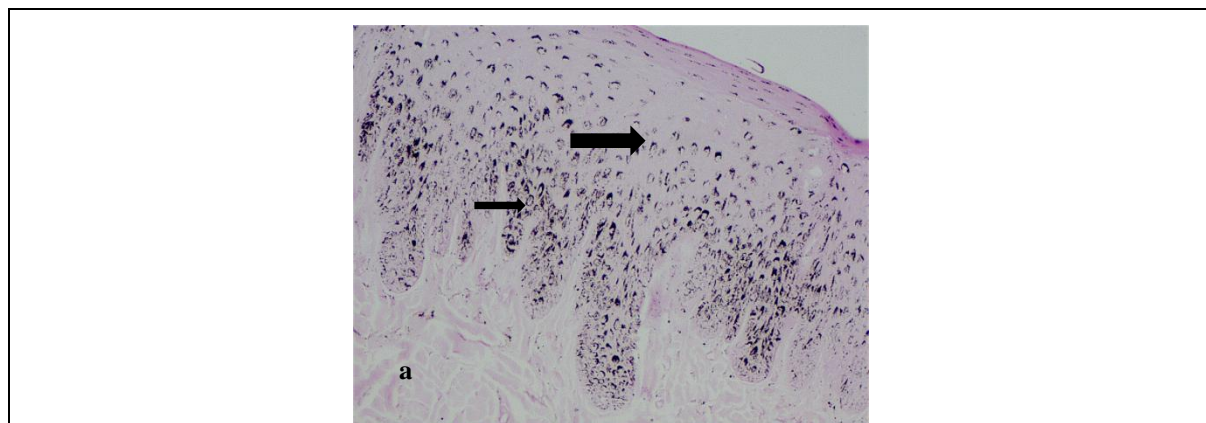


Fig. 1: Photomicrograph of the gingiva of the control subgroups showing: (a) the brown pigmentation in basal layer. (b) 1 week after irradiation no brown pigments. (c) 2 weeks after irradiation showing some vacuoles in granular layer. (d) 4 weeks after irradiation showing remarkable thickening of keratin layer. (e) 8 weeks after irradiation showing normal epithelial cells (H&E org. mag. X 200).





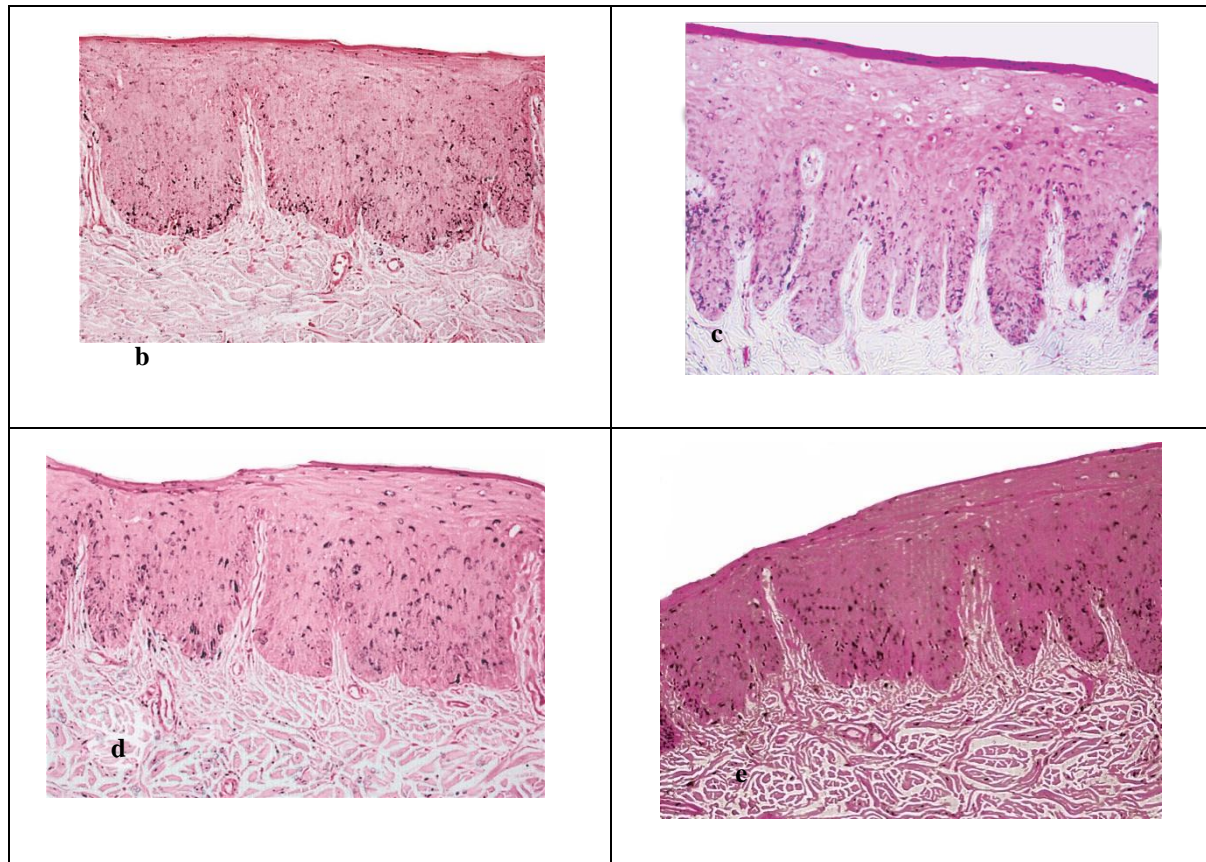


Fig. 2: Photomicrograph of the gingiva of the control subgroups showing: (a) melanin pigmentation in full thickness of epithelium (b) 1 week after irradiation scarce amount of melanin. (c) 2 weeks after irradiation showing few amount of melanin. (d) 4 weeks after irradiation showing scattered areas of melanin (e) 8 weeks after irradiation showing scattered areas of melanin (Masson Fontana org. mag. X 200).

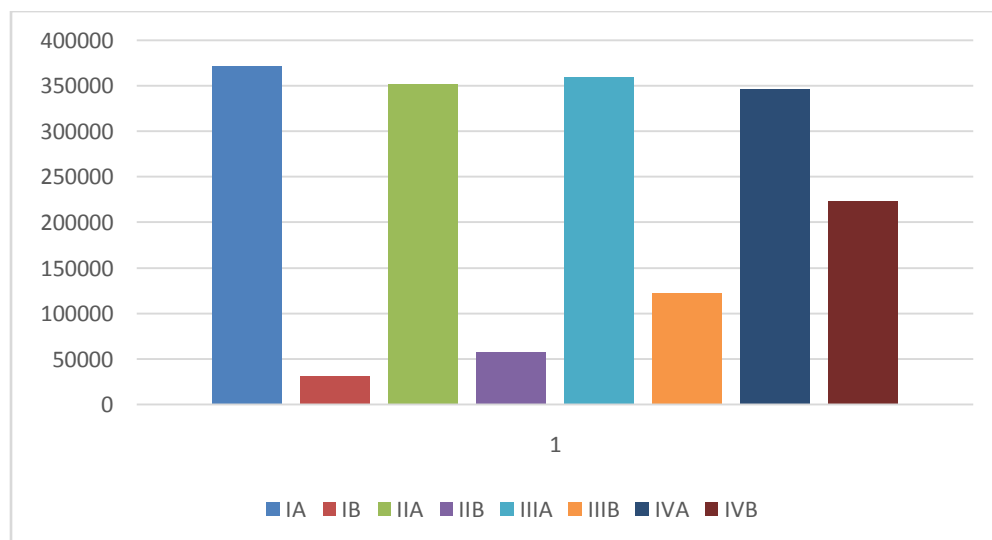
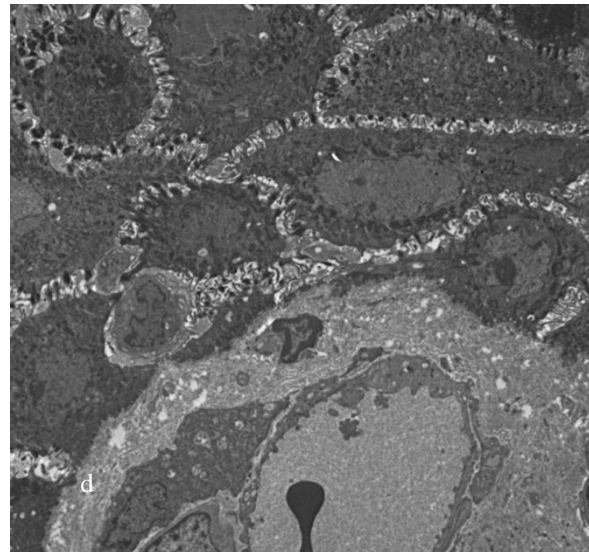
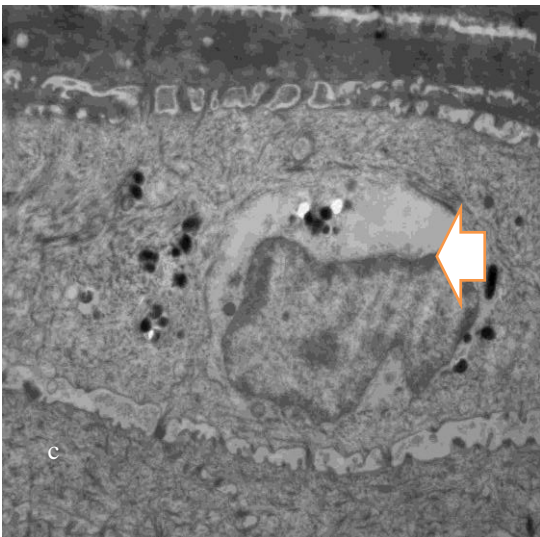
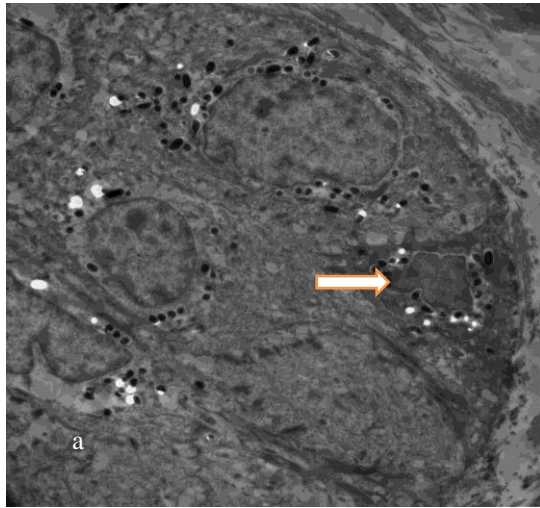
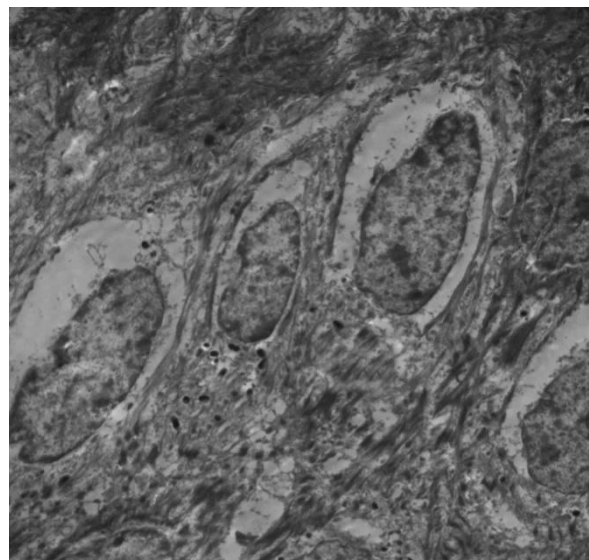
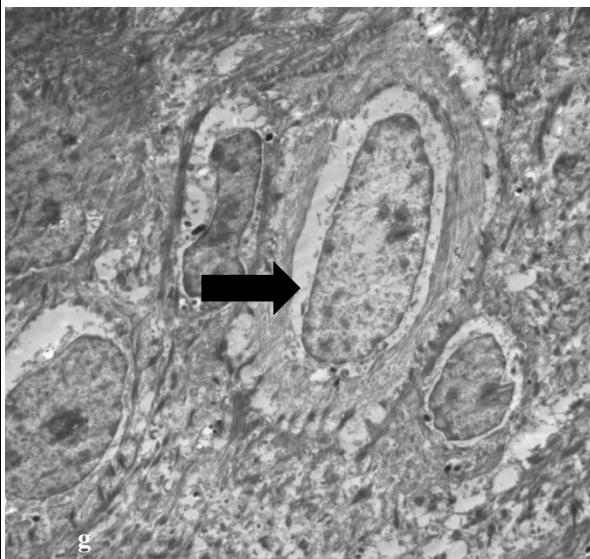
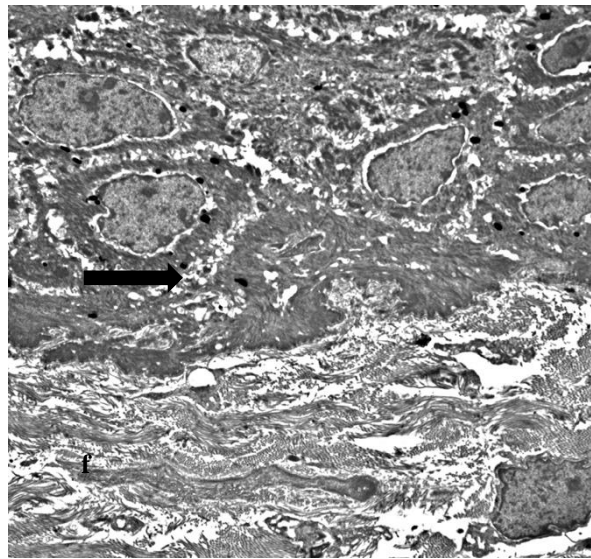
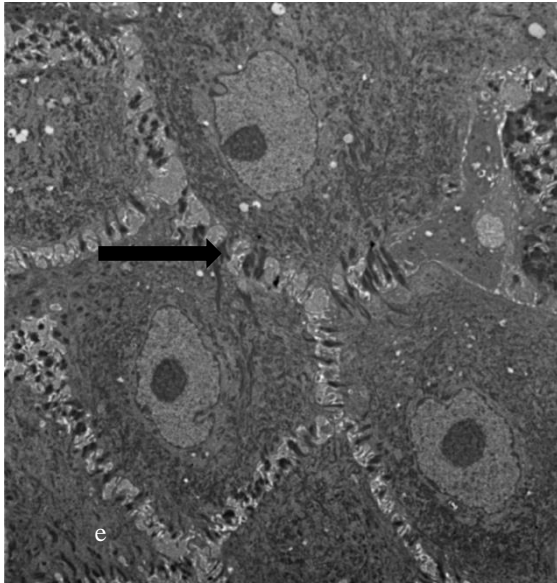


Fig.3: Bar chart showing melanin mean area percent expression in gingiva between all the subgroups.







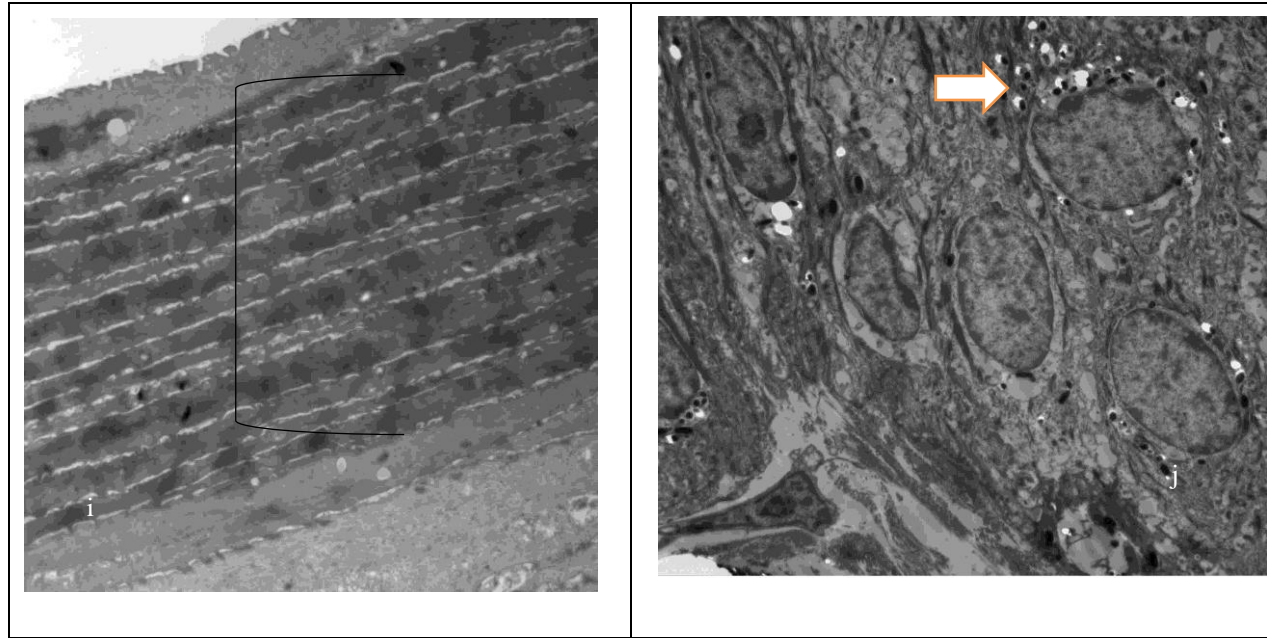


Fig. 4: An electron photomicrograph of the gingiva of the control subgroups showing: (a) the serrated type of basal cells with melanin pigmentation (b) showing the the melanocytes with variable sized melanosomes in control group. (c) granular cell with pyknotic nucleus and some melanosomes (d) basal cells of group IB devoid of melanosomes (e) prickle cells with desmosomal attachments in group IB (f) basal cells showing some melanosomes in group IIB. (g) prickle cells of group IIB with cytoplasmic vacuoles. (h)prickle cells of group IIIB with scanty amount of melanosomes and cytoplasmic vacuoles. (i) thickening of keratin layer in group IIIB. (j) basal cells of group IVB with few melanosomes.

### Conclusions:-

- Using diode laser of 970nm wave length and 3 watts power caused significant decrease in gingival pigmentation in all follow-up periods.
- Gingival pigmentation began to reappear on the 8th week after laser irradiation yet did not reach the baseline.

### References:-

1. Attwa E., Khater M., Assaf M. and Abdel Halim M.(2015): Melasma treatment using an erbium:YAG laser: a clinical, immunohistochemical and ultrastructural study. *International Journal of Dermatology*; 54:235-244
2. Atsawasuan P., Greethong K. and Nimmanon V.(2000): Treatment of gingival hyperpigmentation for esthetic purposes by Nd:YAG laser: report of 4 cases. *J Periodontol*;71:315-21
3. Costin G-E. and Hearing V. J.(2007): Human skin pigmentation: melanocytes modulate skin color in response to stress. *FASEB J.* 21, 976–994
4. Dummett CO and Gupta OP. (1964): Estimating the epidemiology of oral pigmentation. *J Natl Med Assoc*;56:419- 20.
5. Dummett O.G.T.B, D.V.M. and Theodore E.B. (1964): Oral Pigmentation in Canis Familiaris Clifton *Journal of Periodontology*; 35 (5):416-423
6. Hegde R., Padhye A., Sumanth S., Jain A.S., and ukral N.(2013):Comparison of surgical stripping; Erbium-doped:yttrium, alu- minum, and garnet laser; and carbon dioxide laser techniques for gingival depigmentation: a clinical and histologic study, *Journal of Periodontology*; 84(6):738–748.
7. Lagdive S., Doshi Y. and Marawar P.P. (2009): Management of gingival hyperpigmentation using surgical blade and diode laser therapy: A comparative study. *J Oral Laser Appl*; 9:41–7.
8. Lagdive S.B., Lagdive S.S., Marawar P.P., Bhandari A.J., Darekar A. and Saraf V. (2010): Surgical Crown Lengthening of the Clinical Tooth Crown by Using Semiconductor Diode Laser: A Case Series. *J Oral Laser Appl*; 10:53–57
9. Romeo U., Russo C. and Palaia G.(2014): Biopsy of different oral so tissues lesions by KTP and diode laser: histological evaluationthe *Scientific World Journal*



10. Rosa D.S., Aranha A.C., Eduardo Cde. P. and Aoki A.(2007).: Esthetic treatment of gingival melanin hyperpigmentation with Er:YAG laser: short-term clinical observations and patient follow-up. J Periodontol; 78(10):2018-25.
11. Sharon E., Azaz B. and Ulmanky M. (2000): Vaporization of melanin in oral tissues and skin with carbon dioxide laser: A canine study. J Oral Maxillofac Surg; 58:1387-1393.
12. Shenawy H.M, Nasry S.A, Zaky A.A and Quriba M.A. A.(2015).: Treatment of Gingival Hyperpigmentation by Diode Laser for Esthetical Purposes. Macdonian Journal of Medical Sciences; 3(3):447-454.
13. Yousuf A, Hossain M, Nakamura Y, Yamada Y., Kinoshita J. and Matsumoto K. (2000):Removal of gingival melanin pigmentation with the semiconductor diode laser: a case report. J Clin Laser Med Surg;18:263-6.



### RESEARCH ARTICLE

#### BACTERIA EXTRACT ACTIVITY ASSOCIATED WITH SPONGES *Haliclona* sp.2 AND *Axinellid* sp. AS ANTIBACTERIAL.

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#### Abstract

Isolation of bacteria for antibacterial activity was conducted on sponge-associated marine bacteria, *Haliclona* sp.2 and *Axinellid* sp. from Ngege Island, Sibolga. Seventeen isolates were obtained from the two sponges. Based on antibacterial test, 11 isolates (64%) were potential as antibacterial, whereas 6 isolates (35%) were not indicated as antibacterial. Isolate H2, A1, and A2 with broad spectra of antibacterial activity were further separated for extraction of secondary metabolites. Based on screening results of isolates, ethyl acetate extract of isolate H2, A1, A2 and n-hexane extract of isolate A2 displayed antibacterial activity against *Staphylococcus aureus* and *Escherichia coli*, whereas methanol extract A2 was only able to inhibit the growth of *Escherichia coli*. For bioactive compound test, EH2, EA1 and EA2 were positive for alkaloid, whereas HA2 and MA2 were positive for alkaloid and saponin. Based on purification of secondary metabolite using Thin Layer Chromatography (TLC), there were 22 fractions with solvents of different polarities. Screening of antibacterial activity for isolate extract fractions showed that MA2 of fraction 2 had a strong inhibitive effect against *E. coli* and *S. Aureus* about 10,15 mm and 9,95 mm consecutively. The antagonistic activity of EH2 of fraction 3 against *S. aureus* and *E. coli* were about 7,05 mm and 7,45 mm consecutively, whereas EA1 of fraction 3 was about 6,55 mm against *P. Aeruginosa*. The results of phytochemical secondary metabolite of isolate extract fractions showed that MA2 of fraction 2 and MA2 of fraction 3 were positive for saponin, while EH2 fraction 3 and EA1 fraction 3 were positive for alkaloid. Bacteria associated with sponges *Haliclona* sp.2 and *Axinellid* sp. had activity as antibacterial against bacteria *S. aureus*, *E. coli* and *P. aeruginosa*.

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#### Introduction:-

Pathogenic microbe has been considered as a crucial problem in human healthy and can cause various diseases. The use of chemical compounds that acts as antibacterial such as irrational antibiotic to treat various diseases caused by pathogen, could make a negative side effect even it could cause bacteria becomes resistance against specific

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antibacterial. In order to overcome this issue, it is important to explore antibacterial originated from bioactive compounds of plants, animals and microorganisms.

Sponge is one of corral reef components that has a potential bioactive but not has been explored. Exploration of sponges as bioactive source has been reported in various researches. However, the use of secondary metabolites produced by bacteria associated with sponges as antibacterial source is more beneficial as compared to isolation from its host. The excessive exploration of sponges to produce new bioactive could cause overfishing that could damage marine ecology. In addition to the growth of sponges that is relatively slow will inhibit the biomass availability as source of secondary metabolites. Therefore, the use of bacteria associated with sponges will be efficient because the bacteria could be cultured in laboratory and could be multiplied in relatively fast (Abubakar et al., 2011).

Capability of sponges in producing bioactive compounds due to its symbiosis with bacteria. The relationship sponges with bacteria will produce secondary metabolite as a form of defense against natural enemies such as predators, pathogenic microorganisms, competitor and fouling organisms (Taylor et al., 2007). This relationship includes a generous supply of nutrients through metabolism translocation such as nitrification, nitrogen fixation, photosynthesis, and an enhancement of chemical defenses. Due to the roles, symbiotic bacteria with sponges is estimated has a great potential on the production of bioactive compounds isolated from sponges (Kennedy et al., 2008).

Some researchers of marine explore a new bioactive compounds from sponge-symbiotic bacteria. Peptide was isolated from both sponge *Hyatella* sp. and an associated *Vibrio* sp. that has antibacterial activity (Taylor et al., 2007). New metabolites from sponge-symbiotic bacteria contribute to has antibacterial and antiplasmodial activity. Extract of n-hexane and ethyl acetate from 4 (four) potential species of bacteria isolated from sponges have antibacterial activity (Dash et al., 2009; Inbaneson et al., 2012). One of antibacterial compounds was isolated from bacteria *Pseudovibrio* spp. associated with sponges *Axinella dissimilis* (Halloran et al., 2011).

Bacteria associated with sponges include representative of the Proteobacteria, Bacteroidetes, Firmicutes, and Actinobacteria (Taylor et al., 2007). Selvin et al., (2009) reported that potential microbe which produce active compounds are Cyanobacteria, Fungi and Actinomycetes. The active compound resulted by sponge *Dendrilla nigra* associated with Actinomycetes *Nocardioopsis dassonvillei* MAD08 was as antimicrobial compound against gram-negative bacteria (*Staphylococcus aureus* MTCC 2940, *Staphylococcus aureus* MTCC 96, *Micrococcus luteus* MTCC 106, *Rhodococcus rhodochrous* MTCC 265) and gram-positive bacteria (*Vibrio cholerae* PC6, *Pseudomonas aeruginosa* MTCC 2453 and *Escherichia coli* MTCC 2939). Some bacteria isolates associated with sponges *Jaspis* sp. are antibacterial because of inhibiting the growth of *Staphylococcus aureus*, *Vibrio harveyi*, *Escherichia coli*, *Pseudomonas aeruginosa* and EPEC K-11 (Abubakar et al., 2011). Correlation between production of antibacterial compound by bacterial symbionts with sponges has been investigated by Narsinha and Anil (2000), that antibacterial compound produced by bacterial symbionts such as *proteobacterium* MBIC 3368, *Idiomarina* sp and *Pseudomonas* sp. were very affected by protein recombinant of *Suberites domuncula* as host. This research confirmed that there is a collaboration in biosynthesis of secondary metabolite between symbiont microbe and sponges.

Based on various results research, an investigation for sponge-associated bacteria as antibacterial which easy to be cultured, was needed to be conducted. The isolation results will be tested for antibacterial activity against *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Escherichia coli*.

## Materials and Methods:-

### 2.1 Sample collection

The marine sponges were collected off from Ngge Island, Sibolga by SCUBA diving at 2-10 m. Temperature, salinity, and pH were determined at the moment of sample collection. Sponges samples were collected as needed then put into plastic bag filled marine water and oxygen then put into cool box. Sponges were identified at Laboratory of Marine Biology of Fishery Faculty of Riau University.

### 2.2 Extraction of Secondary Metabolite from Potential Bacterial Isolate

Suspension was made with turbidity justified with Standard of McFarland  $10^8$  CFU/ml, then spreaded with cotton swab on the surface of NA media. Some suspensions were made on petri disk and incubated for 5-6 days at 25°C. Bacterial cultures which obtained were cut into small pieces then put into erlemeyer 500 ml then it was added  $\pm 150$  ml solvent n-hexane, macerated for 3 x 24 hours. It was filtered with Whatman 42, thus resulted macerate and residual. Residual was reextracted with ethyl acetate and filtered. With the same way, residual was extracted with methanol. Each macerate was centrifuged with 3000 rpm for 15 minutes, thus result supernatant. Then the

supernatant was separated with each their solvent by using rotary evaporator at 45°C. It was obtained extract n-hexana, ethyl acetate and methanol secondary of potential bacterial isolate(Nofiani *et al.*, 2009). The series levels of extraction was shown in appendix 4a.

### 2.3 Screening Bacterial Extract for Antibacterial Activity

Bacterial suspension of *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Escherichia coli* were as tested bacteria. For extract activity test, suspension of test bacterial culture was prepared by inoculation each them into nutrient broth media and incubated for 24 hours at 25°C. Activity test conducted by inoculated 200µl suspension of bacterial test that was rejuveniled into agar media and spread out with hockey stick thus test bacterial suspension mix on media surface. Then it was kept for a few moment to let the bacterial test fuse with the media. Then it was put into oxoid disk that was dropped with 10 µl of extract –n- hexana secondary metabolite potential bacteria into agar media that was inoculated with *Staphylococcus Aureus*, *Pseudomonas aeruginosa* and *Escherichia coli*. Then incubated for 24 hours at 25oC and investiged inhibition zone formed with vernier caliper. The same treatment was applied against extract ethyl acetate and methanol of secondary metabolites of potential bacteria.

### 2.4 Identification of Chemical Compound in Potential Isolate Extract n-Hexana, Ethyl acetate and Methanol.

Preliminary test of secondary metabolite was carried out on each potential isolate extract. 5 ml aquadest and chloroform were added into the extract then mixed strongly and let it for a few minute until two layers formed. Water layer was used for metabolite secondary assay of flavonoid, fenolik, and saponin whereas Chloroform layer was used for terpenoid and steroid (Harbone, 2006).

### 2.5 Identification and Isolation Secondary Metabolite Potential Isolate Extract by Preparative Thin Layer Chromatography.

Chamber was saturated with raising solvent by covered chamber with filter paper, then raising solvent was put into chamber until all filter paper throughly wet by the solvent. Extract solvent contained secondary metabolite of potential isolate spotted on preparative TLC with 20 x 20 cm until the plate saturated by extract solvent (1.5 cm from under line), plate was let until dry for ±15 minutes. Previous plate was marked upper and down limit. Then plate put into chamber that was saturated and eluted until the solvent reached upper limit line. Node formed was checked under UV light and pattern formed of node was drawn with pencil. Then the pattern was scraped with spatula and each node was separated into vial furthermore was washed and separated from its silica. Compounds that were separated from the silica, the solvents was volatiled and antimicrobe test was conducted.

### 2.6 Screening of Antibacteria Activity Fraction of n-hexana, Etil Acetate and Methanol of Potential Bacteria Isolate.

Bacterial suspensions of *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Escherichia coli* were as bacterial test. For screening, the suspensions were inoculated nutrient broth media and was incubated for 24 hours at 25°C. Identification of antibacterial activity was used disc diffusion assay (Bauer *et al.*, 1996). 200 µl suspensions that already rejuveniled were inoculated into nutrient agar media and spreaded out with hockey stick, thus bacterial suspension test was mixed throughly on surface media.

Then it was waited for a few minute until the bacterial suspension fused with media. Then it placed on the empty oxoid disk that already spotted with 10µl fraction n- hexana secondary metabolite of potential bacteria into media NA that was inoculated with bacteria *S. aureus*, *P. aeruginosa* and *E. coli*. The culture was incubated for 24 hours at 25° C and inhibition zone formed was observed with vernier caliper. The same treatment was applied on fraction ethyl acetate and methanol of secondary metabolite of potential bacteria. Furthermore, result of screening antibacterial activity was tested for phytochemical identification of potential isolate extract fraction.

## Results and Discussions:-

### 3.1 Sponges Characteristic

Sponges were taken from Ngge Island, Sibolga from 2- 10 m with purposive sampling method by scuba diving. Determination of pH with pH – meter shown that pH of marine water of sponge sampling was 7.5; salinity 30‰ and temperature 29°C. Collecting sponges was located based on GPS that were N. 01. 39. 001. E. 098. 47. 661. N. 01. 34. 379. E. 098. 45. 251. N. 01. 34. 361. E. 098. 45. 252. N. 01. 35. 419. E. 098. 41. 831. Measurement of sampling location condition was to create suitable environment for symbion bacterial test thus symbiont bacteria was able survive to live. Sponges sample were taken as needed then put into plastic bag that filled with marine water and oxygen and then put into cool box. The sponges from Ngge Sibolga were *Haliclona* sp.2 and *Axinellid* sp.

(Figure 4.1). In addition, *Haliclona* sp.2 has oscula on each branch and blue colour, whereas *Axinellid* sp. has a shape like fan, yellowness, and oscula on whole surface (Gosliner *et al.*, 1996)



Figure 4.1. Sponges (a) *Haliclona* sp.2 and (b) *Axinellid* sp.

### 3.2 Isolation and Purification of Symbiont Bacteria

Based on isolation results, there were 17 isolates from mesophyl of the two sponges that consisted of 8 isolates of *Haliclona* sp.2 and 9 isolates of *Axinellid* sp. (Appendix 2b). Bacteria in mesophyl was bacteria that has a similarity secondary metabolite with the sponges. Thiel *et al.* (2007) had discovered bacteria in large amount on sponges mesophyl *Chondrilla nucula*. The bacteria was isolated based on morphology, size and shape of colony. Seventeen isolates were isolated based on color and colony shape (Table 1). It showed possibility many differences of activity for each isolate that used for further test. Isolation and purification of symbiont bacteria could be shown as follows:

Table 1. Characterization morphology of bacterial isolate that was isolated based on colour and shape on sponges *Haliclona* sp.2 and *Axinellid* sp.

Species	Isolate Code	Colony form	Color	Elevation	The edge of the colony
<i>Haliclona</i> sp.2	H1	Round	Yellow	Flat	Entire
	H2	Round	Beige	Flat	Entire
	H3	Bobbin	Beige	Raised panel	Round
	H4	Round	Yellow	flat	Wave
	H5	Round	Beige	Flat	Entire
	H6	Bobbin	Yellowish beige	Arise	Entire
	H7	Round	Beige	Flat	Irregular
	H8	Irregular	Beige	Flat	Curly
<i>Axinellid</i> sp.	A1	Round	Beige	Flat	Wave
	A2	Bobbin	Yellow	Arised panel	Entire
	A3	Irregular	Beige	Panel	Curly
	A4	Round	Beige	Flat	Entire
	A5	Round	slightly yellow	Flat	Entire
	A6	Round	Beige	curve	Entire
	A7	Root like	Beige	Flat	Curly
	A8	Irregular	Beige	Flat	Jagged
	A9	Irregular	Beige	Flat	Blade

Various microorganisms associated with sponges. For instance, unicellular algae, Cyanobacteria, dinoflagellates and Archaea. Among these microorganisms, bacteria are the most dominant that constituted up to 40% of the biomass or 60% of the tissue volume of certain sponge species (Lee *et al.*, 2006). According to Vasanthabharathi *et al.*, (2012), bacterial density that associated with sponges *H. cribriformis*, *S. carnosa*, *C. diffusa* and *S. officinalis* Var. *ceylonensis* was in the range was  $13 \times 10^3$  -  $1.6 \times 10^7$  CFU/g,  $6.77 \times 10^3$  -  $1.5 \times 10^7$  CFU/g,  $7.68 \times 10^3$  -  $1.1 \times 10^7$  CFU/g and  $2.69 \times 10^3$  -  $1.4 \times 10^7$  CFU/g. In Taylor *et al.* (2007) described that associations between sponges and microorganisms can be maintained by two ways that is filter feeding which microbes can be recruited from the surrounding water to the sponges (horizontal transmission) or by reproductive stages (vertical transmission). In vertical transmission, oocyte from the adult mesohyl of sponge can phagocytosis to the microbial cells so bacterial symbiont could be found on embryo/ sponges larva.

Differentiation of diversity and number of bacterial isolates of each kind of sponges might be due to isolation technic and growth media that used for isolation bacteria associated with sponges. Nutrient contents of culture media would affect bacterial growth. According to Haloran *et al.* (2011), there were 73 from the marine sponges

*Axinella dissimilis*, *Polymastia boletiformis* and *Haliclona simulans* and identified as being *Pseudovibrio* spp. by 16S rRNA genesequencing and phylogenetic analysis. Radjasa *et al.* (2008) reported, there were 32 bacterial isolates from sponges *Haliclona* sp. in North Java Sea. Murniasih and Rasyid (2010) also reported that there were 75 bacterial isolates from sponges *Theonella* sp., *Aaptos* sp., *Melophlus sarasssinorum*, *Callyspongia* sp., *Ircinia* sp., *Stylissa flabeliformes*, *Lisoclinum* sp., and *Clarithria* sp. by direct plating. Abdullah (2006) also had obtained 7 bacterial isolates associated with sponges *Axinella* sp. by using marine broth agar media.

Symbiont bacteria produce a wide array of secondary metabolites as antibacterial (Lee *et al.*, 2001). Although the mechanism of association between sponges and bacteria is not known well, the association could produce secondary metabolite. Secondary metabolite production by sponges has similarity with microorganisms associated with sponges itself, include bacteria (Radjasa *et al.*, 2007). In addition, bacteria associated with organisms have probability an interaction with the host organisms (Lee *et al.*, 2001). The biochemical interaction makes a possibility that symbiont bacteria produces the same bioactive compound with its host. In Taylor *et al.* (2007), was explained that bacteria symbiosis with sponges are able to photosynthesis, oxidize methane, nitrification, nitrogen fixation, sulphat reduction and dehalogenase.

### 3.3 Extraction of Secondary Metabolite from Potential Bacteria

Extraction of secondary metabolite was carried out by maceration (Appendix 4b). In Nofiani *et al.* (2009) was described that maceration can produce intracellular antimicrobe compound thus bacterial cell need to be broken to obtain antibacterial compounds. Different polarity of solvents in maceration were n-hexane (nonpolar), ethyl acetate (semipolar) and methanol (polar). According to Dash *et al.* (2009) polarity differences on solvent used in order to isolate secondary metabolite and identification of following stage.

Extraction of secondary metabolites with different polarity of solvent was conducted serially. The isolates for this stage were determined based on the ability to inhibit some bacteria tests, that were H2, A1 and A2. Then, results of secondary metabolite extraction were extract of n-hexane, ethyl acetate and methanol of potential bacteria isolates. Taylor *et al.* (2007) described that, secondary metabolites produced by symbiont bacteria is potential as precursor of biosynthesis of sponges metabolite.

### 3.4 Screening Activity of Extract Antibacteria of Isolate Potential Bacteria

Results of screening for antibacteria activity of potential bacteria isolate extract were each isolates of extract ethyl acetate (EH2, EA1 and EA2) and extract n-hexane A2 showed antagonistic capability against bacteria test *S. aureus* and *E. coli*.

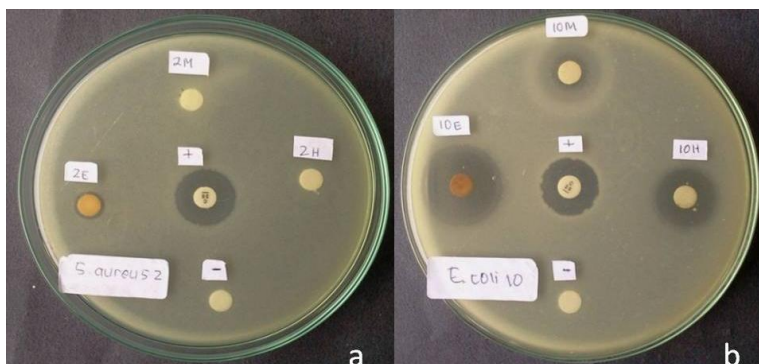


Figure 3. Sampling of antibacterial activity (a) extract ethyl acetate of isolate H2 (EH2) against *S. Aureus* and (b) Extract n-hexane, ethyl acetate and methanol of isolate A2 (HA2, EA2 and MA2) against *E. coli*.

Based on screening results of antibacteria activity, H2 and A1 were able to inhibit growth of *P. Aeruginosa*, while screening results of secondary metabolite extract showed that both isolates did not perform antibacterial activity against *P. aeruginosa* (Table 4.3). Extract hexane and ethyl acetate of isolate A2 (HA2) resulted inhibition zone against *S. aureus* and *E. coli* (Table 4.3) but not for *P. Aeruginosa*. For antagonist test of isolate showed that isolate A2 was capable of inhibiting growth of both bacteria *S. aureus* and *E. coli* (Table 4.3). According to Tinambunan *et al.* (2012) extract of bacteria associated with sponges with concentration 10% showed largest zone inhibition of antibacterial activity against *S. aureus* and *E. coli*. Extract ethyl acetate of isolate A2 (EA2) had broad spectrum activity because it was capable of inhibiting gram positive and gram negative bacteria and according to David and Stout (1971) it was included as active compound with strong inhibition capacity (diameter of inhibition zone against *S. aureus* and *E. coli* were 20,05 mm and 23,00 mm consecutively).



Extracts of three isolates (H2, A1 and A2) showed negative results against bacteria test *P. aeruginosa*. While extract MA2 only capable of inhibiting growth of bacteria test *E. coli* (Table 4.3). This might due to MA2 was suggested contain secondary metabolite that was facilitated to disturb permeability cell membrane of gram negative bacteria thus cell bacteria lysis. In Nofiani et al. (2009) explained that there are some suggestions that caused bacterial isolates did not show antibacterial activity namely (1) isolat has gene code formation secondary metabolite compound but it is not expressed at normal condition and will be expressed when it is induced previously; (2) symbiont bacteria produces antimicrobe compound intracellularly but it does not have antibacteria activity against bacteria test. Radjasa *et al.* (2007) stated that the production of secondary metabolite from the sponges has similar with microorganisms associated with sponges. It indicate that the production of secondary metabolite from simbiotic bacteria is affected by host sponge. Thus when simbiotic bacteria is isolated from host sponge, it will affect secondary metabolite as antibacteri.

### 3.5 Test Chemical Compound of Extract n-Hexana, Ethyl Acetate and Methanol of Potential Isolate

Identification of secondary metabolite content is an important initial step in searching new bioactive compound from natural material and as precursor for synthesis new medicine or as a medicine prototype with certain activity (Harborne, 2006). Capability of antagonistic activity against bacteria test is due to presence of secondary metabolite produced by isolate of symbiont bacteria. Test component of extract chemical compounds, n-hexana, ethylacetate and methanol of isolate potential bacteria was conducted as initial test to investigate the characteristic of secondary metabolite. Alkaloid was positive for each extract ethylacetate isolate (H2, A1 and A2) by used dragendorff reagent and resulted red sediment (Appendix 5b). Furthermore, extract n-hexana and methanol of isolate A2 were positive contained alkaloid and sapoin (Table 4.4). Alkaloid and sapoin indicated antagonist ability against bacteria test (Tabel 4.3) whereas identification other secondary metabolite such as steroid, terpenoid, fenolic and flavonoid showed negative result.

### 3.6 Identification of Secondary Metabolites in Potential Bacteria Isolates by using Thin Layer Chromatography (TLC) Preparative

Identification secondary metabolite compounds of symbiont bacteria was conducted with TLC (Penesyan et al., 2011). Based on preparative TLC results were found 22 fractions observed under UV from five extracts (EH2, EA1, EA2, HA2 and MA2) with different polarity. Movement phase was used to eluted the samples and varied based on polarity gradient (Yuhernita, 2011). Movement phase drained through static phase and carried components of extract potential bacteria isolate. Different component will move with different rate. Based on preparative chromatography results, separation of compounds in extracts of bacteria isolates into pure substances were obtained 6 fractions in HA2 (nonpolar) while EH2, EA1, EA2 and MA2 (semipolar and polar) obtained 4 fractions for each. (Figure 4).

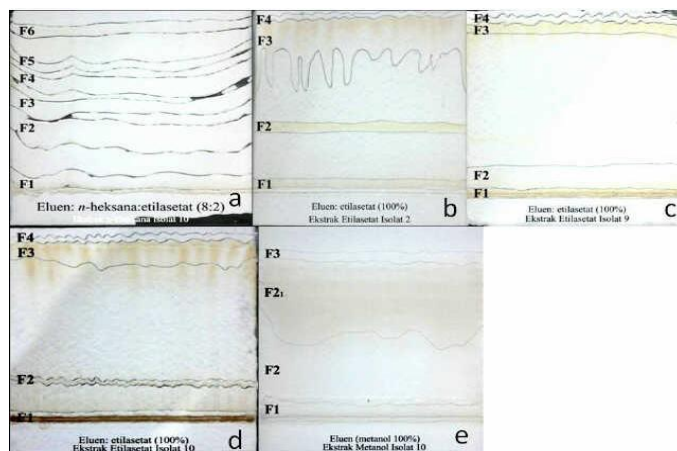


Figure 4. Results of *Thin Layer Chromatography (TLC) preparative* for secondary metabolite of extract potential bacteria isolate. (a) HA2; (b) EH2; (c) EA1; (d) EA2; (e) MA2.

### 3.7 Screening Antibacteria Activity on Extract Fraction of Potential Bacterial Isolate

Secondary metabolite fraction of extract potential bacterial isolate showed antagonist ability against bacteria test. Based on screening results of antibacterial activity, the largest antagonist ability of secondary metabolite extract

fraction was MA2F2 against *E. coli* and *S. aureus* bacteria with diameter 10,15 mm and 9,95 mm consecutively (Fig.5). MA2 was obtained from sponges *Axinellid sp.* that contained saponin.

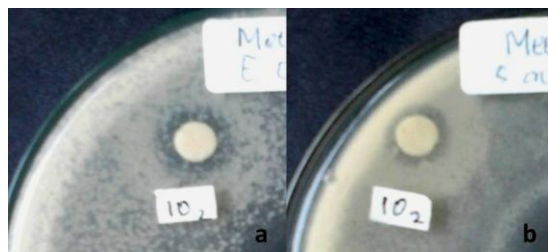


Figure.5. Examples of antibacteria activity of extract methanol of Isolates A2 fraction 2 (MA2F2) against bacteria (a) *E.coli* and (b) *S. Aureus*

Antibacteria activity was also found on EH2F3 against bacteria *S. aureus* and *E. coli*. Isolate H2 was obtained from sponges *Haliclona sp.2* with secondary metabolite alkaloid. Antagonist ability was indicated with the formation clear zone against bacteria *S. aureus* and *E. coli* with diameter 7,05 mm and 7,45 mm consecutively. Research about antibacteria activity of sponges genus *Haliclona* was also conducted previously. Radjasa et al. (2007) stated that symbiont bacteria of sponges *Haliclona sp.* showed antibacteria activity against some bacteria test, one of them was *S. aureus* with diameter > 9 mm.

Screening results of antibacteria activity of extract fraction of Isolate EA1F3 showed clear zone with diameter 6.55mm against *P.aeruginosa*. This result was different from antibacteria activity screening of isolate extract, where extract isolate EA1 did not have antibacteria activity against *P. Aeruginosa*. Extract fraction screening result of isolate MA2 was also showed differences from extract screening of bacterial isolate. For initial screening, isolate MA2 was only showed antagonistic ability against bacteria *E. coli* whereas extract fraction screening of bacterial isolate MA2F2 and MA2F3 showed antagonistic ability against *E. coli* and *S. Aureus*.

A research conducted by Nofiani et al. (2009) stated that extract methanol of bacteria associated with sponges showed antibacteria activity but based on minimum inhibition concentration value, antimicrobe activity still categorized as weak. Both extract fractions of n-hexana and ethyl acetate of isolate A2 did not show presence of antibacterial activity. This might due to the presence of other secondary metabolites that associated in each other and this indication has not detected thus capable of producing antibacterial activity against bacteria test. Other factors was the amount of secondary metabolite fraction obtained was small thus it was not capable of inhibiting the bacteria test growth.

### 3.8 Chemical Compound Assay of Extract Fraction n-Hexana, Ethyl Acetate and Methanol of Potential Bacterial Isolate

Based on screening results of antibacterial activity extract fraction of EH2F3, EA1F3, MA2F2, and MA2F3 have antagonist ability against bacteria test. Furthermore, test of chemical compound for secondary metabolite was conducted. It showed that MA2F2 and MA2F3 were positive contained saponin while EH2F3 and EA1F3 was positive contained alkaloid. Saponin for MA2F2 and MA2F3 and alkaloid for EH2F3 and EA1F3, have the same result with previous test of secondary metabolite compound. Secondary metabolite such as alkaloid and saponin are potential as antibacterial. According to Zheng (2005), secondary metabolite alkaloid of bacteria associated with sponges *Himeniacidon parve* also showed antibacterial activity against *S. aureus*. Antibacteria activity produced by symbiont bacteria of sponges *Haliclona sp.2* and *Axinellid sp* are enable competition occur in the sea ecosystem. According to Dash et al (2009), symbiont bacteria which produces antibacterial compound is enable to form colony on the sponges surface. Saponin, tanin and flavonoid are secondary metabolites that have antibacterial activity. Saponin is bioactive compound to increase membran permeability thus cell hemolysis occur, when saponin interacts with bacterial cell, the bacterial cell will be broken or lysis. This could be made as opportunity to develop secondary metabolite for further research (Ganiswarna, 1995).

### Conclusions:-

Based on research results, the conclusion of this research were as this following:

1. Extracts of EH2, EA1, EA2, HA2 and MA2 have antibacterial activity on bacteria *S. Aureus*, *E. Coli* and *P. Aeruginosa*.
2. Extract of EH2 was very potential against *S. aureus* and *E. Coli* compared with extracts EH2, EA1, HA2 and MA2.



3. It was found 4 (four) extract fractions of secondary metabolites (EH2F3, EA1F3, MA2F2 and MA2F3) which have an activity against *S. aureus*, *E. coli* and *P. Aeruginosa*.
4. Based on phytochemical screening of secondary metabolite fractions (EH2F3, EA1F3, MA2F2 and MA2F3) that has antibacterial activity were alkaloid and saponin.

### References:-

- 1 Abdullah, A. 2006. Isolasi dan Identifikasi Mikroba Simbion Sponge *Axinella* sp. *Jurnal Ilmu Pertanian Indonesia*. 11 (3): 1-5.
- 2 Abubakar, H., Wahyudi, A.T. and Yuhana, M. 2011. Skrining Bakteri yang berasosiasi dengan Spons *Jaspis* sp. Sebagai Penghasil Senyawa Antimikroba. *Jurnal Ilmu Pertanian Indonesia*. 11(3): 1-5.
- 3 Bauer, A.W., Kirby, W.M., Sherris, J.C. and Turek, M. 1996. Antibiotic Susceptibility Testing By a Standardized Single Disk Method. *American Journal Clinic Pathology*. 45: 493-498.
- 4 Campbell, N.A. and Reece, J.A. 2009. *Biology 8<sup>th</sup> Edition*. Benjamin Cummings. San Fransisco.
- 5 Dash, S., Jin, C., Lee, O.O., Xu, Y. and Qian, Y.P. 2009. Antibacterial and Antilaval-Settlement Potential and Metabolite Profiles of Novel Sponge-Associated Marine Bacteria. *Journal of Industrial Microbiology Biotechnology*. 36: 1047-1056.
- 6 Ginting, E. L., Warouw, V. dan Suleman, R.W. 2010. Aktivitas Antibakteri dari Ekstrak Kasar Bakteri yang Berasosiasi dengan Sponge *Acanthostrongylophora* sp. *Jurnal Perikanan dan Kelautan Tropis*. 6(3): 160-163.
- 7 Gosliner, T.M., Behrens, D.W., and William, G.C., 1996. Coral Reef Animals of the Indo Pacific. Sea Challengers. Monterey
- 8 Halloran, J.A.O., Barbosa, T.M., Morrissey, J.P., Kennedy, J., O' Gara, F. and Dobson, A.D.W. 2011. Diversity and Antimicrobial Activity of *Pseudovibrio* spp. from Irish Marine Sponges. *Journal of Applied Microbiology*. 110: 1495-1508.
- 9 Harborne, J.B. 2006. Metode Fitokimia: Penuntun Cara Modern Menganalisis tumbuhan. Edisi IV. Kokasih P. dan I. Soediro. (penterjemah). ITB, Bandung: 35.
- 10 Inbaneson, S.J. and Ravikumar, S. 2012. In Vitro Antiplasmodial Activity of *Clathria vulpina* Sponge Associated Bacteria Against *Plasmodium falciparum*. *Asian Pacific Journal of Tropical Disease*: 319-323.
- 11 Irianto. 2008. Petunjuk Praktikum Mikrobiologi Dasar. Laboratorium Mikrobiologi Fakultas Biologi. Universitas Jendral Soedirman Purwokerto. Purwokerto
- 12 Kennedy, J., Codling, C.E., Jones, B.V., Dobson, A.D.W. and Marchesi, J.R. 2008. Diversity of Microbes Associated with the Marine Sponge, *Haliclona simulans*, Isolated from Irish Waters and Identification of Polyketide Synthase Genes from the Sponge Metagenome. *Applied Environmental Microbiology* 10(7): 1888-1902.
- 13 Lee, Y.K., Lee, J. H. and Lee, H.K. 2001. Microbial Symbiosis in Marine Sponges. *The Journal of Microbiology*. 39 (4): 254-264.
- 14 Lee, O.O., Lau, S.C.K., and Qian, P.Y. 2006. Consistent Bacterial Community Structure Associated with the Surface of the Sponge *Mycale adhaerens* Bowerbank. *Microbial Ecology*. Volume 52, 693-707
- 15 Murniasih, T. and Rasyid, A. 2010. Potensi Bakteri yang Berasosiasi dengan Spons Asal Barrang Lompo (Makassar) Sebagai Sumber Bahan Antibakteri. *Jurnal Oseanologi dan Limnologi di Indonesia* 36 (3): 281-292.
- 16 Narsinha, L.T. and Anil, A.C. 2000. Antibacterial activity of the sponge *Ircinia ramosa*: Importance of its Surface-Associated Bacteria. *Journal of Chemical Ecology*. 26(1): 57-71.
- 17 Nofiani, R., Nurbetty, S. and Sapar, A. 2009. Aktifitas Antimikroba Ekstrak Metanol Bakteri Berasosiasi Spons dari Pulau Lemukutan Kalimantan Barat. *Jurnal Ilmu dan Teknologi Kelautan Tropis*. 1 (2): 33-34.
- 18 Pastra, D.A., Melki. and Surbakti, H. 2012. Penapisan Bakteri yang Bersimbiosis dengan Spons Jenis *Aplysina* sp. sebagai Penghasil Antibakteri dari Perairan Pulau Tegal Lampung. *Maspari Journal*. 4(1): 77-82
- 19 Penesyan, A., Tebben, J., Lee, M., Thomas, T., Kjelleberg, S., Harder, T. and Suhelen, E.S. 2011. Identification of the Antibacterial Compound Produced by the Marine Epiphytic Bacterium *Pseudovibrio* sp. D323 and Related Sponge-Associated Bacteria. *Marine Drugs*. 9: 1391-1402.
- 20 Radjasa, O.K., Sabdono, A., Junaidi and Zocchi, E. 2008. Growth Inhibition of Medically Antibiotic Resistant Bacteria by Sponge-Associated Bacteria. *Journal of Coastal Development*. 11 (2): 75-80.
- 21 Radjasa, O.K., Sabdono, A. and Junaidi, J. 2007. Richness of Secondary Metabolite-Producing Marine Bacteria Associated with Sponge *Haliclona* sp. *International Journal of Pharmacology*. 3(3): 275-279.
- 22 Selvin, J., Shanmughapriya, S., Gandhimathi, R., Kiran, G.S., Ravji, T.R., Natarajaseenivasan, K. and Hema, T.A. 2009. Optimization and Production of Novel Antimicrobial Agents from Sponge Associated Marine Actinomycetes *Nocardiopsis dassonvillei* MAD08. *Applied Microbiology Biotechnology*. 83: 435-445.

- 23 Thiel, V., Leininger, S., Schmaljohann, R., Brummer, F. and Imhoff, J.F. 2007. Sponge-specific Bacterial Associations of the Mediterranean Sponge *Chondrilla nucula* (Demospongiae, Tetractinomorpha). *Microbial Ecology*. 54: 101–111.
- 24 Tinambunan, H., Melki and Isnaini. 2012. Efektifitas Ekstrak Bakteri yang Berasosiasi dengan Spons dan Karang Lunak sebagai Antibakteri dari Perairan Pulau Tegal Lampung. *Maspari Journal*. 4 (2): 225-230.
- 25 Taylor, M.W., Radax, R., Steger, D. and Wagner, M. 2007. Sponge-Associated Microorganisms: Evolution, Ecology, and Biotechnological Potential. *Microbiology Molecular Biology Review*. 71 (2): 295-347
- 26 Vasanthabharathi, V. and Jayalakshmi, S., 2012. Bioactive Potential of Symbiotic Bacteria and Fungi from Marine Sponges. *African Journal of Biotechnology*. 11 (29): 7500-7511
- 27 Yuhernita and Juniarti. 2011. Analisis Senyawa Metabolit Sekunder dari Ekstrak Metanol Daun Surian yang Berpotensi sebagai Antioksidan. *Makara Sains* 15(1): 48-52
- 28 Zheng, L. 2005. Marine Bacteria Associated with Marine Macroorganisms: The Potential Antimicrobial Resources. *Annals of Microbiology*. 55 (2): 119-124.

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### RESEARCH ARTICLE

## COMPLETE NUCLEOTIDE SEQUENCE OF A MONOPARTITE TOMATO LEAF CURL NEW DELHI VIRUS AND BETASATELLITE DNA ASSOCIATED WITH LEAF CURL DISEASE OF TOMATO IN INDIA.

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Begomovirus, Tomato leaf curl virus,  
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### Abstract

A begomovirus was isolated from tomato plants showing typical leaf curl and stunting symptoms in tomato fields near the Delhi, India. Viral genomic components were enriched by rolling-circle amplification; PCR amplified and were cloned and sequenced. The genome organization of this virus was found to be similar to those of Old World monopartite begomovirus, with DNA-A and a betasatellite component. The alphasatellite or DNA-B component was not detected. The complete nucleotide sequence of DNA-A shared highest similarity with Tomato leaf curl New Delhi (ToLCNDV) virus while betasatellite DNA showed similarity with betasatellite DNA reported from infected leaves of Tomato, Sunflower and Potato. The data present here strongly support the association of a monopartite ToLCNDV and betasatellite DNA with the leaf curl disease of tomato.

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### Introduction:-

Tomato leaf curl disease (ToLCuD), caused by Tomato leaf curl virus (ToLCV) is one of the most devastating causal agents for the loss of tomato (*Solanum lycopersicum*) crop which has spread substantially and covers new areas in tropical and subtropical continents every year. This virus belongs to the genus Begomovirus, a whitefly (*Bemisia tabaci*) transmitted virus which comes under family Geminiviridae. Begomoviruses infect dicotyledonous plants and have either a bipartite genome with two single-stranded (ss) DNA components designated as DNA A and DNA B, each one about 2.7 kb in size, or a monopartite genome with one ssDNA component analogous to DNA-A (Bridson et al., 2012; Kumar et al., 2011). Begomovirus genes required for virus replication and encapsidation by coat protein are encoded by DNA-A component and those for virus movement (both intra and intercellular) by DNA-B. In monopartite begomoviruses, genes for replication, encapsidation and movement are present in a single component (DNA-A) (Murthi et al., 2007).

In Indian subcontinent, ToLCV is a major problem in tomato-growing regions and several reports on new strains have been documented from New Delhi, Lucknow, Bangalore, Varanasi, Mirzapur, Vadodara, and Western Uttar Pradesh (Chakraborty et al., 2003). In recent years, another component designated as betasatellite (single stranded DNA) has been found to be associated with Old World monopartite begomoviruses. This small, circular DNA has

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size approximately half (~1.3 kb) to that of DNA-A, and is capable of inducing symptom in plants. It is dependent on DNA-A for replication, encapsidation and transmission (Briddon et al., 2001; Briddon et al., 2008). In addition to betasatellites, monopartite viruses are sometimes found to be associated with another type of satellite designated as alphasatellite, which encodes one replication initiation protein. The role of these alphasatellites in pathogenesis is not yet clear (Briddon et al., 2008).

Indian ToLCV isolates are mostly monopartite (DNA-A) in nature with few isolates possessing bipartite (DNA-A and DNA-B) genome organization such as tomato leaf curl New Delhi virus (ToLCNDV) and tomato leaf curl Palampur virus (ToLCPaV) (Briddon et al., 2008). Here we report the presence of monopartite ToLCNDV and betasatellite DNA associated with the leaf curl disease of Tomato from New Delhi region.

## Materials and Methods:-

### Virus source and DNA isolation:-

During the month of May-June, 2012, leaves were collected from tomato plants showing typical leaf curl, vein thickening and stunting symptoms in the fields near Delhi (Latitude: 28.61 and Longitude: 77.20), India. Total DNA was isolated (Dellaporta et al., 1983) and viral genomic components were enriched via rolling-circle amplification, and PCR amplified using specific primers for full-length (DNA-A) and betasatellite DNA (Briddon et al. 2001; Kumar et al. 2011).

### Cloning and sequencing:-

PCR amplified product was run on agarose gel and visualized in UV illumination. DNA fragments representing CP gene and betasatellite DNA were excised from the gel and purified using HiPura gel extraction kit (Hi Media Pvt.Ltd. India) following manufacturer's instruction. The DNA fragments were cloned into pDrive vector (QIAGEN, Germany). The recombinant plasmid was then transformed into *Escherichia coli* DH5 $\alpha$  cells and positive clones containing desired DNA fragments were sequenced using automated sequencer.

### Sequence analysis:-

Nucleotide sequences of full-length genome of ToLCuV and betasatellite DNA under study were aligned with those of other begomovirus sequences from Gen Bank using CLUSTAL W (Tamura et al., 2013) alignment program. Following multiple sequence alignments, phylogenetic analysis was done using MEGA software version 6.0 (Tamura et al., 2013). Default parameters used were character- based algorithm (Maximum Parsimony), and distance-based algorithms (Minimum Evolution and Neighbour-Joining). A consensus dendrogram was generated using bootstrap value of 1000 replicates for these algorithms. The expasy proteomic server tool was used to translate set of protein encoding genes.

## Results and Discussion:-

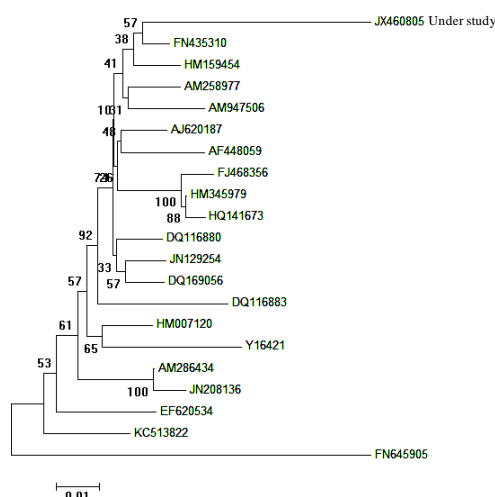
### Phylogenetic analysis:-

The sequences obtained were combined using several sequences available in the GenBank. The complete nucleotide sequence data of DNA-A of the begomovirus consisted of 2,730 nucleotide (Acc. no. JX460805), which shared highest (90%-94%) nucleotide identity with DNA-A component of several isolates of ToLCNDV (FN435310, HM159454, U15015, JN129254, HM159454), followed by <90% similarity with Squash leaf curl china virus [Pum:IARI], Bhendi yellow vein Haryana virus, Squash leaf curl China virus [Pum: Lucknow] (JN587811, FJ561298, DQ026296). The genome organization of this virus was found to be similar to those of Old World monopartite begomovirus, with DNA A and a betasatellite component. However, an attempt to amplify alphasatellite or DNA B component was unsuccessful.

The betasatellite DNA consisted of 1359 nt and was assigned accession number JX679002. The betasatellite DNA shared maximum identity (90-97%) with betasatellite DNA of Tomato leaf curl virus (AY438557), Sunflower leaf curl virus (JX678964), Potato apical leaf curl disease (EF043234), Papaya leaf curl virus (DQ118862, JX050199) etc. However it shared less sequence similarity (<70%) with betasatellite DNA from Cotton leaf curl Multan virus or Cotton leaf curl Burewala virus. The sequence of betasatellite DNA shows the typical arrangement of betasatellites, (1) a single open reading frame (ORFs) in the complementary sense (known as  $\beta$ C1; coordinates 557–201); (2) a region of sequence rich in adenine (coordinates 706–986); and (3) a sequence motif highly conserved between all betasatellite DNA satellites, known as the satellite conserved region (SCR; coordinates 1260–14). The ORF  $\beta$ C1 is predicted to encode a 119-amino-acid protein.

The phylogenetic analysis of complete sequence of ToLCNDV under study showed its clustering with ToLCNDV has been reported from Pakistan. The betasatellite DNA clustered with betasatellite reported mostly from non-Solanaceae family. This kind of incidence may occur due to high inoculum pressure or high adaptation capability of the host. This report of monopartite ToLCNDV associated with betasatellite DNA may give some insight into the types of Tomato leaf curl virus infecting tomato crops in north India. There were earlier reports of bipartite ToLCV associated with leaf curl disease of tomato in North India, and monopartite ToLCV in South India (Chowda et al., 2005), but due to more and more sample analysis across the country this opinion is no longer valid, as both types are found from infected tomato plants in all parts of the country (Tiwari et al., 2013). However, monopartite Tomato leaf curl Gujarat virus (ToLCGuV) is now a dominant monopartite begomovirus with betasatellite associated with tomato leaf curl disease in India (Jyothsna et al., 2013).

The search on the available literature and sequences present in NCBI suggests only bipartite ToLCNDV without betasatellite DNA is associated with leaf curl disease of tomato. The report of a monopartite ToLCNDV naturally infecting tomato will add to the variability of ToLCV. Additionally, the data present here strongly supports the association of a monopartite ToLCNDV and non-solanaceous betasatellite with leaf curl disease of tomato in North India.



**Fig. 1:-** Phylogenetic analysis of DNA-A molecules of this study with other DNA-A molecules of different ToLCV. The optimal tree with the sum of branch length = 0.44812555 is shown. The tree was generated using the Neighbor-Joining method in MEGA 6.0 (software). The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test (500 replicates) is shown next to the branches. The evolutionary distances were computed using the Maximum Composite Likelihood method and are in the units of the number of base substitutions per site.



**Fig. 2:-** Dendrogram showing a relationship of betasatellite (this study) with other betasatellite associated with begomoviruses. The optimal tree with the sum of branch length= 0.86863634 is shown. The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test (500 replicates) is shown next to the

branches. The evolutionary distances were computed using the Maximum Composite Likelihood method, and the evolutionary history was inferred using Neighbor-Joining method in MEGA 6.0 software.

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### References:-

1. Briddon, R.W., Ghabrial, S., Lin, N.S., Palukaitis, P., Scholthof, K.B.G., Vetter, H.J. (2012): Virus taxonomy: classification and nomenclature of viruses. Ninth Report of the International Committee on Taxonomy of Viruses. In: King AMQ, Adams MJ, Carstens EB, Lefkowitz EJ (eds) *Satellites and other virus dependent nucleic acids*. Elsevier, San Diego., pp 1211–1219.
2. Briddon, R.W., Mansoor, S., Bedford, I.D., Pinner, M.S., Saunders, K., Stanley, J., Zafar, Y., Malik, K.A., Markham, P.G., (2001): Identification of DNA components required for induction of cotton leaf curl disease. *Virology*, 285: 234-243.
3. Briddon, R.W., Brown, J.K., Moriones, E., Stanley, J., Zerbini, M., Zhou, X., Fauquet, C.M., (2008): Recommendations for the classification and nomenclature of the DNA- $\beta$  satellites of begomoviruses. *Arch. Virol.*, 153: 763–781.
4. Chakraborty, S., Pandey, P.K., Banerjee, M.K., Kalloo, G., Fauquet, C.M., (2003): Tomato leaf curl Gujarat virus, a new begomovirus species causing a severe leaf curl disease of tomato in Varanasi, India. *Phytopathology*, 93(12): 1485–1495.
5. Chowda, Reddy, R.V., Colvin, J., Muniyappa, V., Seal, S., (2005): Diversity and distribution of begomoviruses infecting tomato in India. *Arch. Virol.*, 150: 845–867.
6. Dellaporta, S.L., Wood, J. and Hicks, J.B., (1983): A plant DNA miniprep: Version III. *Plant Molecular Biology Reporter*, 1: 19–21.
7. Jyothsna, P., Rawat, R., Malathi, V.G., (2013): Predominance of tomato leaf curl Gujarat virus as a monopartite begomovirus: association with tomato yellow leaf curl Thailand betasatellite. *Arch. Virol.*, 158: 217-224.
8. Kumar, A., Kumar, J., Khan, J. A., (2010): Sequence characterization of cotton leaf curl virus from Rajasthan. Phylogenetic relationship with other members of geminivirus and detection of recombination. *Virus. Genes*, 40: 282-289.
9. Kumar, A., Snehi, S.K., Raj, S.K., Kumar, J., Khan, J.A., (2011): Association of *Cotton leaf curl Burewala virus* and an alphasatellite with cotton leaf curl disease in India. *New Disease. Reports*, 24: 18.
10. Murthi, M.N., Rekha, A.R., Mirza, S.H., Alam, S.N. and Colvin, J., (2007): A novel begomovirus with distinct genomic and phenotypic features infects tomato in Bangladesh. *Virus. Genes*, 34: 373-385.
11. Tamura, K., Stecher G, Peterson D, Filipski A, Kumar, S., (2013): Molecular Evolutionary Genetics Analysis (MEGA) Software Version 6.0. *Mol.Biol.Evol.* 30: 2725-2729.
12. Thompson, J.D., Higgins, D.G., Gibson, T.J., (1994): CLUSTAL W: Improving the sensitivity of progressive multiple sequence alignment through sequence weighting, position-specific gap penalties and weight matrix choice. *Nucleic Acid Res.* 22: 4673-4680
13. Tiwari, N., Singh, V.B., Sharma, P.K., Malathi, V.G., (2013): Tomato leaf curl Joydebpur virus: a monopartite begomovirus causing severe leaf curl in tomato in West Bengal. *Arch. Virol.*, 158: 1-10.





## RESEARCH ARTICLE

### ENHANCED SECURE CLOUD DATA PROTECTION MODEL BY INTEGRATING DUAL SYSTEM ENCRYPTION TECHNOLOGY WITH SELECTIVE PROOF TECHNIQUE.

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Cloud storage, data integrity, privacy preserving, identity-based cryptography.

#### Abstract

This paper, proposes a new Secure Cloud Data as an enhancement for the framework model in data security and cloud storage model by integrating the dual system encryption technology with selective proof technique. While the introduced scheme supporting any standard access structures is built in the composite structure bilinear group, it is verified adaptively CCA secure in the standard technique without threatening the expressiveness of access policy. In this paper, we attempt in addition to make an enhancement for the model to obtain more efficiency in the re-encryption key generation and re-encryption phases. Proxy Re-Encryption (PRE) is an effective cryptographic essential model that permits a data owner to nominee the access rights of the encrypted data which are stored on a cloud storage system to remaining entities without leaking the information of the data to the honest-but-curious cloud server. It implements the effectiveness for data sharing as the data owner even working with limited resource devices (e.g. mobile devices) can offload most of the computational activity to the cloud. Since its establishment many variants of PRE have been recommended and proposed. SecRBAC Based Proxy Re-Encryption (SecRBAC - ABPRE), which is observed as a regular approach for PRE, engages the PRE technology in the attribute-based encryption cryptographic framework as like that the proxy is granted to make change an encryption down an access policy to another encryption under a new access policy. CP-ABPRE is suitable to numerous real time network appliances, like sharing secure data in the network or cloud applications.

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#### Introduction:-

Cloud computing [1], which has received considerable attention from research communities in academia as well as industry, is a distributed computation model over a large pool of shared-virtualized computing resources, such as storage, processing power, applications and services. Cloud users are provisioned and release resources as they want in cloud computing environment. This kind of new computation model represents a new vision of providing computing services as public utilities like water and electricity. Cloud computing brings a number of benefits for cloud users. For example, (1) Users can reduce capital expenditure on hardware, software and services because they pay only for what they use; (2) Users can enjoy low management overhead and immediate access to a wide range of applications; and (3) Users can access their data wherever they have a network, rather than having to stay nearby their computers. However, there is a vast variety of barriers before cloud computing can be widely deployed.

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A recent survey by Oracle referred the data source from international data corporation enterprise panel, showing that security represents 87% of cloud users' fears<sup>1</sup>. One of the major security concerns of cloud users is the integrity of their outsourced files since they no longer physically possess their data and thus lose the control over their data. Moreover, the cloud server is not fully trusted and it is not mandatory for the cloud server to report data loss incidents. Indeed, to ascertain cloud computing reliability, the cloud security alliance (CSA) published an analysis of cloud vulnerability incidents. The investigation [2] revealed that the incident of data Loss & Leakage accounted for 25% of all incidents, ranked second only to "Insecure Interfaces & APIs". Take Amazon's cloud crash disaster as an example<sup>2</sup>. In 2011, Amazon's huge EC2 cloud services crash permanently destroyed some data of cloud users. The data loss was apparently small relative to the total data stored, but anyone who runs a website can immediately understand how terrifying a prospect any data loss is. Sometimes it is insufficient to detect data corruption when accessing the data because it might be too late to recover the corrupted data. As a result, it is necessary for cloud users to frequently check if their outsourced data are stored properly [4].

These same ranges of possibilities imply surrender of control over physical security, sharing resources with cotenants and lacking the knowledge of where cloud resources are hosted [2]. In a nutshell, user assets become vulnerable to various security issues and challenges that are exacerbated by the lack of monitoring capabilities and decreased visibility into the security status of assets being hosted by the Cloud Service Providers (CSPs) [3, 4]. Nevertheless, users have over the years gained appreciable understanding of the need to monitor assets and the threats associated with the benefits of cloud computing, and to some extents, methods have been devised by CSPs to effectively provide users with monitoring capabilities so as to increase the adoption of cloud services. For instance, CSPs offer dashboards for tracking service availability, timely discovery of service outages and performance metrics [5]. These attempts by CSPs although sufficient for performance and functional requirements, cannot be said to be sufficiently convincing for end-users to rely on, particularly whose proclivity is the monitoring of security related metrics.

Data de duplication enables data storage systems to find and remove duplication within data without compromising its availability. The goal of data de duplication is to store more data in less space by storing and maintaining files (blocks in fine-grained de duplication manner) into a single copy, where the redundant copies of data are replaced by a reference to this copy [11]. It means that data de duplication storage system could reduce the storage size of  $u$  clients, who share the same data copy  $m$ , from  $O(u - jmj)$  to  $O(u + jmj)$  if some implementation-dependent constants are hidden [6]. Also, clients do not need to upload their data to the cloud storage server when there has been one copy stored, which will not only greatly reduce the communication cost of clients and cloud server, but also save the network bandwidth [7].

Since the data from different clients is encrypted with different secret keys, it is difficult to conduct cipher text data de duplication among clients. A secure cross-client de duplication scheme should enable a storage server to detect data de duplication over the data encrypted by different clients, and efficiently prevent the practical attacks [10], [13], [14] from poor de duplication. Douceur et al. [21] proposed the first solution for secure and efficient data de duplication, and they call it convergent encryption. This idea promoted many significant applications, where various schemes [15], [16] are implemented or designed based on convergent encryption. Recently, Bellare et al. [17] defined a new primitive, Message- Locked Encryption (MLE), which brought rigor to security de duplication, and captured various security aspects of MLE. Also, they constructed several schemes and provided some detailed analysis over them [18].

To strengthen the notions of security by considering plaintext distributions depending on the public parameter, two approaches (fully random scheme and deterministic scheme) that are secure even for lock-dependent message in realistic. It answered the question: Can message-locked encryption be secure for lock dependent message [19]. The tag randomization design makes the fully random scheme, R-MLE2 for short, satisfy the standard secure notion of data confidentiality. Also, the overhead in the length of the cipher text is only additive and independent of the message length [20].

#### **Contribution and plan of this paper:-**

The work in this paper seeks to unravel the issue of tool based cloud security monitoring by discerning the approaches and tools for enabling users attain security visibility in the cloud. It augments existing literatures in the area of cloud security by using a systematic approach that reflects on real-life requirements to help cloud users address one of the most pressing concerns associated with gaining visibility. We present a real-world case study to



evaluate the ability of the tools and approaches to meet the security requirements based on published properties and functionality. We believe that this paper contributes to existing work by forming the first step to creating a framework for identifying cloud security monitoring requirements and implementing solutions to meet such requirements.

The paper is structured as follows: section two discusses related works and section three covers problem definition and the parameters behind it. Section four presents the motivations of this project. Section five presents the proposed system and tools that can be employed for cloud monitoring and section six presents the implementation of the proposed system. Section seven draws conclusions and outlines future work.

### **Literature survey:-**

There are several existing works in the area of cloud monitoring. Alhamazani et al [6] reviewed commercial cloud monitoring tools by considering applications within the various cloud layers. Aceto et al [7] analyzed the properties that are key to monitoring cloud systems and adopted a methodology that analyses state of the art cloud monitoring techniques. Similarly, Fatema et al [8] identified essential features that are desired for operational monitoring in the cloud, reviewed and analyzed a broad range of monitoring tools that are being used to observe cloud functional resources.

Krizanic et al [33] performed a review and categorization of monitoring tools according to Operating Systems (OS), notification and other services being supported by the cloud, while Rimal et al [34] presented taxonomy of cloud services based on comparative study of different CSPs and their systems. Although, our work does not include a systematic literature review of the tools, it is a significant contribution and differs from other literatures by using a case study to reflect on how the tools can fulfill real-life monitoring requirements. It also focuses on cloud security monitoring in addition to a selection criteria of suitable tools.

Bellare et al. [27] formalized this primitive as message locked encryption, and explored its application in space efficient secure outsourced storage. An MLE scheme  $MLE = (P; K; E; D; T)$  is composed of five polynomial time algorithms. In MLE, the parameter generation algorithm  $P$  is used to generate the public parameter. The key generation algorithm  $K$  is used to generate the message-derived key. On inputting a key and a message the encryption algorithm  $E$  outputs the cipher text. The decryption algorithm  $D$  reverses the process, whose output is used to compute the cipher text/plaintext, and the tag generation algorithm  $T$  is used to generate the tag of the cipher text. In the scheme, tag generation maps the cipher text to a tag and identical plaintext result in one equal tag.

To enhance the security of de duplication and protect the data confidentiality, Bellare et al. [25] showed how to protect the data confidentiality by transforming the predictable message into an unpredictable message. In their system, a third party called key server is introduced to generate the file tag for duplication check. Li et al. [26] addressed the key management issue in block-level de duplication by distributing these keys across multiple servers after encrypting the files. Li et al. [29] considered the hybrid cloud architecture consisting of a public cloud and a private cloud and efficiently solved the problem of de duplication with differential privileges. Yuan et al. [30] proposed a de duplication system in the cloud storage to reduce the storage size of the tags for integrity check. Recently, Bellare and Keelveedhi [31] proposed a new primitive iMLE, which adopted interaction as a new ingredient to provide privacy for messages that are both correlated and dependent on the public system parameters.

Abadi et al. [28] provided stronger security guarantee for secure de duplication. The first approach was to avoid using tags that are derived deterministically from the message. They designed a fully randomized scheme that supported equality test over cipher text. More precisely, there were three components in the fully randomized scheme, namely a payload, a tag and a proof of consistency. The second approach was a deterministic scheme. It was made secure subject to the condition where the distributions were efficiently more sampler using at most  $q$  queries to the random oracle. Thus, the security of the second approach was guaranteed by limiting the computational power of the adversarial message distributions.

### **Problem Statement:-**

#### **Problem Definition:-**

In cloud data storage, the client stores the data in cloud via cloud service provider. Once data moves to cloud he has no control over it i.e. no security for outsourced data stored in cloud, even if Cloud Service Provider (CSP) provides

some standard security mechanism to protect the data from attackers but still there is a possibility threats from attackers to cloud data storage, since it is under the control of third party provider, such as data leakage, data corruption and data loss. We note that the client can verify the integrity of data stored in cloud without having a local copy of data and any knowledge of the entire data. In case clients do not have the time to verify the security of data stored in cloud, they can assign this task to trusted Third Party Auditor (TPA). The TPA verifies the integrity of data on behalf of clients using their public key.

**System Architecture:-**

The network representation architecture for cloud data storage, which consists four parts: those are Client, Cloud Service Provider (CSP), Third Party Auditors (TPAs) and SUBTPAS. Clients are those who have data to be stored, and accessing the data with help of Cloud Service Provider (CSP). They are typically desktop computers, laptops, mobile phones, tablet computers, *etc.* Cloud Service Provider (CSP):- Cloud Service Providers (CSPs) are those who have major resources and expertise in building, managing distributed cloud storage servers and provide applications, infrastructure, hardware, enabling technology to customers via internet as a service. Third Party Auditor (TPA):- Third Party Auditor (TPA) who has expertise and capabilities that users may not have and he verify the security of cloud data storage on behalf of users. SUBTPAS: the SUBTPAs verifies the integrity of data concurrently under the control of TPA

**Security Threats:-**

The cloud data storage mainly facing data corruption challenge: Data Corruption: cloud service provider or malicious cloud user or other unauthorized users are self interested to alter the user data or deleting.

There are two types of attackers are disturbing the data storage in cloud: 1) Internal Attackers: malicious cloud user, malicious third party user (either cloud provider or customer organizations) are self interested to altering the user's personal data or deleting the user data stored in cloud. Moreover they decide to hide the data loss by server hacks or Byzantine Failure to maintain its reputation. 2) External Attackers: we assume that an external attacker can compromise all storage servers, so that he can intentionally modify or delete the user's data as long as they are internally consistent.

**Goals:-**

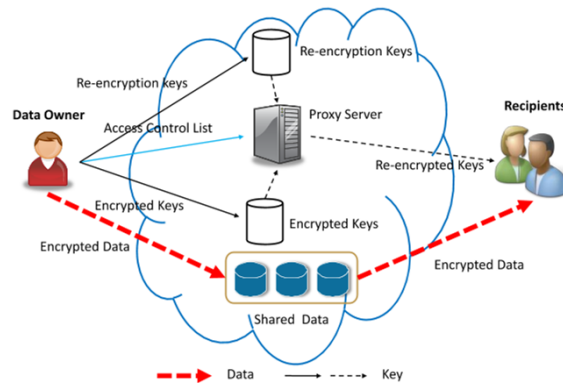
In order to address the data integrity stored in cloud computing, we propose an Efficient Distribution Verification Protocol for ensuring data storage integrity to achieve the following goals: Integrity: the data stored safely in cloud and maintain all the time in cloud without any alteration. Low-Overhead: the proposed scheme verifies the security of data stored in cloud with less overhead.

**Motivation:-**

Unfortunately, despite being free from secret key distribution, PEKS schemes suffer from an inherent security problem regarding the keyword privacy, namely (inside) off-line Keyword Guessing Attack (KGA). Specifically, given a trapdoor, the adversarial server can choose a guessing keyword from the keyword space and then use the keyword to generate a PEKS cipher text. The server then can test whether the guessing keyword is the one underlying the trapdoor. This guessing-then-testing procedure can be repeated until the correct keyword is found. As the keyword always could leak some sensitive information of the user data, it is therefore of practical importance to overcome this security threat for secured and searchable encrypted data outsourcing.

**Proposed system:-**

We first provide the basic RDPC scheme only for static data integrity checking. Furthermore, we show the advanced RDPC scheme supporting fully dynamic block operations based on ORT. A. Basic RDPC Scheme We use the homomorphism hash function defined in [20] to construct our basic RDPC scheme.



**Figure 1:-** Proposed system architecture

#### System model:-

System Components and its Security consists of six algorithms namely Setup, Extract, Tag Gen, Challenge, Proof Gen and Proof Check are involved in a CP-ABPRE system.

**Setup (1k)** is a probabilistic algorithm run by the KGC. It takes a security parameter  $k$  as input and outputs the system parameters  $PARAM$  and the master secret key  $MSK$ .

**Extract (PARAM; MSK; ID)** is a probabilistic algorithm run by the KGC. It takes the system parameters  $PARAM$ , the master secret key  $MSK$  and a user's identity  $ID$  as input, outputs the secret key  $SKID$  that corresponds to the identity  $ID$ .

**Tag Gen (PARAM; F; SKID)** is a probabilistic algorithm run by the data owner with identity  $ID$ . It takes the system parameters  $PARAM$ , the secret key of the user  $SKID$  and a file  $F$  to store as input, outputs the tags  $\tau = (\tau_1; SKID; n)$  of each file block  $m_i$ , which will be stored on the cloud together with the file  $F$ .

**Challenge (PARAM; FN; ID)** is a randomized algorithm run by the TPA. It takes the system parameters  $PARAM$ , the data owner's identity  $ID$ , and a unique file name  $FN$  as input, outputs a challenge  $CHAL$  for the file named  $FN$  on behalf of the user  $ID$ .

**Proof Gen (PARAM; ID; CHAL; F)** is a probabilistic algorithm run by the cloud server. It takes the system parameters  $PARAM$ , the challenge  $CHAL$ , the data owner's identity  $ID$ , the tag(a), the file  $F$  and its name  $FN$  as input, outputs a data possession proof  $P$  of the challenged blocks.

**Proof Check (PARAM; ID; CHAL; P; FN)** is a deterministic algorithm run by the TPA. It takes the system parameters  $CHAL$ , the challenge  $CHAL$ , the data owner's identity  $ID$ , the file name  $FN$  and an alleged data possession proof  $P$  as input, outputs 1 or 0 to indicate if the file  $F$  keeps intact.

#### Pseudo code of proposed Method:-

##### Step 1:-

Start Procedure

If User is registered then go to Step1

Else go for User registration

##### Step 2:-

User is going for user logs in

If User go for LDAP Authentication

If spoofed IP detected then, Block user until admin authentication.

If user is authorized by cloud admin go to step 2

Else block user permanently by cloud admin

Else forward user and go to Step 3

Else User forward to user logs in go to step2

**Step 3:-**

Compress the user data

IF User data is sensitive then *go to* step 4

Else go for cloud storage and *go to* step 5

**Step 4:-**

Apply two way encryption algorithms

**Step 5:-**

Stored user data in cloud storage

**Step 6:-**

End procedure

We consider three security properties namely completeness, security against a malicious server (soundness), and privacy against the TPA (perfect data privacy) in identity-based remote data integrity checking protocols. Following the security notions due to Shacham and Waters [7], an identity-based RDIC scheme is called secure against a server if there exist no polynomial-time algorithm that can cheat the TPA with non-negligible probability and there exists a polynomial-time extractor that can recover the file by running the challenges response protocols multiple times. Completeness states that when interacting with a valid cloud server, the algorithm of Proof Check will accept the proof. Soundness says that a cheating identifier who can convince the TPA it is storing the data file is actually storing that file. We now formalize the security model of soundness for identity-based remote data integrity checking below, where an adversary who plays the role of the un trusted server and a challenger who represents a data owner are involved.

**Implementation:-**

The proposed system is divided into three major modules and described as below.

1. Key distribution
2. Verification process
3. Validating integrity

**Key Distribution:-**

In key distribution, the TPA generates the random key and distributes it to his CP-ABPRE as follows: The TPA first generates the Random key by using SOBOL Random Function. After that TPA chooses CP-ABPRE and distributes  $n$  pieces to them. The procedure of key distribution is given in algorithm 1.

**Algorithm 1: Key Distribution:-**

1. Generates a random key  $K$  using SOBOL Sequence  
 $K = f * I * k$
2. Then, the TPA partition the  $K$  into  $n$  pieces using  $(m, n)$  secret sharing scheme
3. TPA select the Number of SUBTPA<sub>s</sub>:  $n$ , and threshold value  $m$ ;
4. **for**  $I=1$  to  $n$  **do**
5. TPA sends  $K_I$  to the all SUBTPA<sub>I</sub> s
6. **end for**
7. end

**Verification Process:-**

In verification process, all SUBTPAs verify the Integrity of data and give results to the TPA; if  $m$  SUBTPAs responses meet the threshold value then TPA says that Integrity of data is valid. At a high level, the protocol operates like this: A TPA assigns a local timestamp to every SUBTPA of its operations. Then, every SUBTPA maintains a timestamp vector  $T$  in its trusted memory. At SUBTPA<sub>I</sub>, entry  $T[j]$  is equal to the timestamp of the most recently executed operation by SUBTPA<sub>I</sub> in some view of SUBTPA<sub>I</sub>. To verify the Integrity of data, each SUBTPA creates a challenge and sends to the CSP as follows: first SUBTPA generates set of Random indices  $c$  of set  $[1, n]$  using SOBOL Random Permutation (SRP) with random key  $j(c) K_j = \pi(4)$  Where local and key(a) is a SOBOL Random Permutation (SRP), which is indexed under key:  $\{0,1\}^{\log_2(l)} \times \text{key} - \{0,1\}^{\log_2(l)}$ . Next, each SUBTPA

also chooses a fresh random key  $RJ$ , where  $RJ = (a)^{2*f*l}$ . Then, creates a challenge  $CHAL = \{j, RJ\}$  is pairs of random indices and random values.

The CSP computes a response to the corresponding SUBTPA challenges and send responses back to SUBTPAs. When the SUBTPA receives the response message, first he checks the timestamp, it make sure that  $V-T$  (using vector comparison) and that  $V[I] = T[I]$ . If not, the TPA aborts the operation and halts; this means that server has violated the consistency of the service. Otherwise, the SUBTPA COMMITS the operation and check if stored metadata and response (integrity proof) is correct or not? If it is correct, then stores TRUE in its table and sends true message to TPA, otherwise store FALSE and send a false signal to the TPA for corrupted file blocks. The detailed procedure of verification processes is given in algorithm 2.

#### Algorithm 2: Verification Process

1. Procedure: Verification Process
2. Timestamp  $T$
3. Each SUBTPA<sub>i</sub> computes
4. Compute  $j(c) = \pi$
5. the Generate the SOBOL random key  $RJ$
6. Send  $(CHAL=(j, RJ))$  as a challenge to the CSP;
7. the server computes the Proof  $PR_i$  send back to the SUBTPAs;
8.  $PR_i = \text{Receive}(V)$ ;
9. **If**  $(V * V[I] = T[I])$
10. return COMMIT **then**
11. **if**  $PR_i$  equals to Stored Metadata **then**
12. **return** TRUE;
13. Send Signal,  $(\text{PACKET}_i, \text{TRUE}_i)$  to the TPA
14. **else**
15. **return** FALSE;
16. Send Signal,  $(\text{PACKET}_i, \text{FALSE}_i)$  to the TPA;
17. **end if**
18. **else**
19. ABORT and halt the process
20. **end if**
21. **end**

#### Validating Integrity:-

To validate the Integrity of the data, the TPA will receive the report from any subset  $m$  out of  $n$  SUBTPAs and validates the Integrity. If the  $m$  SUBTPAs give the TRUE signal to TPA, then the TPA decides that data is not corrupted otherwise he decides that data has been corrupted. In the final step, the TPA will give an Audit result to the Client. In algorithm 3, we given the process of validating the Integrity, in which, we generalize the Integrity of the verification protocol in a distributed manner. Therefore, we can use distribution verification on scheme.

#### Algorithm 3: -Validating Integrity

1. Procedure: validation(i)
2. TPA receives the response from the  $m$  SUBTPAs
3. **for**  $I=1$  to  $m$  **do**
4. **If**  $(\text{response} == \text{TRUE})$
5. Integrity of data is valid
6. **else if**  $(\text{response} == \text{FALSE})$
7. Integrity is not valid
8. **end if**
9. **end for**
10. **end**

### Experiment Results:-

To evaluate the efficiency of our scheme in experiments, we implement the scheme utilizing the GNU Multiple Precision Arithmetic (GMP) library and Pairing Based Cryptography (PBC) library. The following experiments are based on coding language C on a Linux system (more precise, 2.6.35- 22-generic version) with an Intel(R) Core(TM) 2 Duo CPU of 3.33 GHZ and 2.00 GB RAM. For the elliptic curve, we choose an MNT curve with a base field of size 159 bits,  $\text{jpg}=160$  and  $\text{jpg}=80$ .

We mainly analyze the computation cost of PEKS generation, trapdoor generation and testing in the schemes of our scheme. The computation cost of our scheme is only slightly higher than that of the BCOP scheme in terms of PEKS generation and trapdoor generation. It is because that the computation involved in the underlying CP-ABPRE scheme is quite small. Since our solution does not introduce any additional operation in the testing phase, the corresponding computation cost remains the same as the underlying PEKS system. As for the scheme which achieves a certain level of security against off-line KGA, the computation cost is more than that of the PEKS scheme and our scheme in terms of all the operations. Particularly, it takes about 2 seconds to generate a PEKS cipher text for the scheme when the keyword number is 50, while that of the scheme of Keyword Time of Testing (s) BCOP XJWW Our Scheme.

Computation Cost of Testing in our scheme is around 0.9 second and 1 second, respectively. For the trapdoor generation, the computation is slightly higher than that of our scheme as the exponentiation in  $G_1$  is usually more expensive than the exponentiation in  $Z_N$ . To be more precise, the time of trapdoor generation for 50 keywords is about 0.12 seconds while that of our scheme is 0.08 seconds. Regarding the testing operation, the computation cost is almost twice that of our scheme. Specifically, the computation cost of testing is around 1.6 second for the scheme and 0.8 seconds for our scheme. This is because the testing requires an additional pairing computation.

### Conclusion:-

This paper provides a general architecture based on CP-ABPRE and hardly any guiding principle that can be espoused by cloud retailer in categorize to store and progression the data steadily. A refuge architecture that provides security as a service model and this model provides to its multiple tenants and consumers of its tenants. The security as a service model while proffering a baseline safety measures to the provider to save from harm its own cloud infrastructure also make available of flexibility to tenants and have supplementary precautions functionalities that costume their security necessities.

The future of this work would be to test the tool on real prospective cloud consumers to check if it can effectively help with cloud provider selection.

### Reference:-

1. T. Jiang, X. Chen, Q. Wu, J. Ma, W. Susilo, and W. Lou, "Towards efficient fully randomized message-locked encryption," in Information Security and Privacy - 21st Australasian Conference, ACISP 2016, Melbourne, VIC, Australia, July 4-6, 2016, Proceedings, Part I, 2016, pp. 361–375.
2. Dropbox, "Dropbox," <https://www.dropbox.com/>, your stuff, anywhere.
3. Google, "Google drive," <http://drive.google.com>, all your files, ready where you are.
4. NetApp, "Netapp," <http://www.netapp.com/us/products/platform-os/dedupe.aspx>, universal Storage System.
5. C. Batten, K. Barr, A. Saraf, and S. Trepetin, "pstore: A secure peer-to-peer backup system," MIT Laboratory for Computer Science, progress report, 2001.
6. M. Storer, K. Greenan, D. Long, and E. Miller, "Secure data de duplication," in Proc. of the 4th ACM International Workshop on Storage Security and Survivability, VA, USA, Oct. 2008, pp. 1–10.
7. L. Marques and C. Costa, "Secure de duplication on mobile devices," in Proc. of the 2011 Workshop on Open Source and Design of Communication, Lisboa, Portugal, Jul. 2011, pp. 19–26.
8. D. X. Song, D. Wagner, and A. Perrig, "Practical techniques for searches on encrypted data," in Proc. of IEEE Symposium on Security and Privacy, CA, USA, May 2000, pp. 44–55.
9. R. Curtmola, J. A. Garay, S. Kamara, and R. Ostrovsky, "Searchable symmetric encryption: improved definitions and efficient constructions," in Proc. of the ACM Conference on Computer and Communications Security, VA, USA, Oct. 2006, pp. 79–88.

10. D. Cash, S. Jarecki, C. Jutla, H. Krawczyk, M. Rosu, and M. Steiner, "Highly-scalable searchable symmetric encryption with support for boolean queries," in CRYPTO 2013, ser. Computer Science, R. Canetti and J. A. Garay, Eds. Springer, 2013, vol. 8042 of LNCS, pp. 353–373.
11. S. Kamara, C. Papamanthou, and T. Roeder, "Dynamic searchable symmetric encryption," in Proc. of the ACM Conference on Computer and Communications Security, NC, USA, Oct. 2012, pp. 965–976.
12. S. Kamara and C. Papamanthou, "Parallel and dynamic searchable symmetric encryption," in Proc. of Financial Cryptography, Okinawa, Japan, Apr. 2013, pp. 258–274.
13. M. Naveed, M. Prabhakaran, and C. Gunter, "Dynamic searchable encryption via blind storage," in Proc. of IEEE Symposium on Security and Privacy, CA, USA, May 2014, pp. 639–654.
14. R. Agrawal, J. Kiernan, R. Srikant, and Y. Xu, "Order preserving encryption for numeric data," in Proc. of ACM SIGMOD, Paris, France, Jun. 2004, pp. 563–574.
15. H. Hacigumus, B. Iyer, C. Li, and S. Mehrotra, "Executing sql over encrypted data in the database-service-provider model," in Proc. of ACM SIGMOD, Madison, Wisconsin, Jun. 2002, pp. 216–227.
16. H. Kadhemi, T. Amagasa, and H. Kitagawa, "A secure and efficient order preserving encryption scheme for relational databases," in Proc. of the International Conference on Knowledge Management and Information Sharing, Valencia, Spain, Oct. 2010, pp. 25–35.
17. R. A. Popa, C. M. S. Redfield, N. Zeldovich, and H. Balakrishnan, "Cryptdb: Protecting confidentiality with encrypted query processing," in Proc. of ACM Symposium on Operating Systems Principles, Cascais, Portugal, Oct. 2011, pp. 85–100.
18. R. A. Popa, F. Li, and N. Zeldovich, "An ideal-security protocol for order-preserving encoding," in Proc. of IEEE Symposium on Security and Privacy, CA, USA, May 2013, pp. 463–477.
19. X. Chen, J. Li, J. Ma, Q. Tang, and W. Lou, "New algorithms for secure outsourcing of modular exponentiations," IEEE Transactions on Parallel and Distributed Systems, vol. 25(9), pp. 2386–2396, Jul. 2014.
20. X. Chen, J. Li, J. Weng, J. Ma, and W. Lou, "Verifiable computation over large database with incremental updates," in ESORICS 2014, ser. Computer Science. Springer-Verlag, 2014, vol. 8712 of LNCS, pp. 148–162.
21. J. Douceur, A. Adya, W. Bolosky, D. Simon, and M. Theimer, "Reclaiming space from duplicate files in a server less distributed file system," in Proc. of IEEE International Conference on Distributed Computing Systems, Macau, China, Jun. 2002, pp. 617–624.
22. D. Harnik, B. Pinkas, and A. Shulman-Peleg, "Side channels in cloud services: De duplication in cloud storage," in Proc. of IEEE Symposium on Security and Privacy, CA, USA, Jan. 2010, pp. 40–47.
23. M. Mulazzani, S. Schrittwieser, M. Leithner, M. Huber, and E. R. Weippl, "Dark clouds on the horizon: Using cloud storage as attack vector and online slack space," in Proc. of USENIX Security Symposium, CA, USA, Aug. 2011, pp. 65–76.
24. J. Stanek, A. Sorniotti, E. Androulaki, and L. Kencl, "A secure data de duplication scheme for cloud storage," in Proc. of Financial Cryptography, CA, USA, Mar. 2014, pp. 99–118.
25. M. Bellare, S. Keelveedhi, and T. Ristenpart, "Dupless: Server-aided encryption for de duplicated storage," in Proc. of the USENIX Security Symposium, DC, USA, Aug. 2013, pp. 179–194.
26. J. Li, X. Chen, M. Li, J. Li, P. Lee, and W. Lou, "Secure de duplication with efficient and reliable convergent key management," IEEE Transactions on Parallel and Distributed Systems, vol. 25, pp. 1615–1625, Nov. 2013.
27. M. Bellare, S. Keelveedhi, and T. Ristenpart, "Message-locked encryption and secure de duplication," in EUROCRYPT 2013, ser. Computer Science, T. Johansson and P. Q. Nguyen, Eds. Springer, 2013, vol. 7881 of LNCS, pp. 296–312.
28. M. Abadi, D. Boneh, I. Mironov, A. Raghunathan, and G. Segev, "Message-locked encryption for lock-dependent messages," in CRYPTO 2013, ser. Computer Science, R. Canetti and J. A. Garay, Eds. Springer, 2013, vol. 8042 of LNCS, pp. 374–391.
29. J. Li, X. Chen, M. Li, J. Li, P. P. C. Lee, and W. Lou, "A hybrid cloud approach for secure authorized de duplication," IEEE Transactions on Parallel and Distributed Systems, vol. PP, pp. 1–12, Apr. 2014.
30. J. Yuan and S. Yu, "Secure and constant cost public cloud storage auditing with de duplication," in Proc. of IEEE Conference on Communications and Network Security, MD, USA, Oct. 2013, pp. 145–153.
31. M. Bellare and S. Keelveedhi, "Interactive message-locked encryption and secure de duplication," in PKC 2015, ser. Computer Science, J. Katz, Ed. Springer, 2015, vol. 9020 of LNCS, pp. 516–538.

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### RESEARCH ARTICLE

## POTENTIAL TARGETS FOR ANTI-INFLAMMATORY AND ANTICANCER ACTIVITIES OF MARINE ALGAE *GELIDIUM SESQUIPEDALE* AND *LAMINARIA OCHROLEUCA*

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### Abstract

Marine algae are a source of compound endowed with ingenious structure and potential biological activities. In this study, extracts of red marine algae *Gelidium sesquipedale* and brown marine algae *Laminaria ochroleuca*, harvested from the coast of El Jadida-Morocco were investigated for their anti-inflammatory activity against phospholipase A<sub>2</sub> and Elastase and for their cytotoxic activity using the test of brine shrimp lethality for larvae and then both algae were tested on KB cell lines (human buccal epidermal carcinoma), K562 cell lines (Human chronic myelocytic leukemia) and HeLa cell lines (human epitheloid cervix carcinoma). For anti-inflammatory activity, both algae showed anti-elastase activity higher than 80%, however, only *Gelidium sesquipedale* showed a total inhibition of phospholipase A<sub>2</sub> activity. *Gelidium sesquipedale* showed an anticancer activity against all cells lines used, however, *Laminaria ochroleuca* showed significant cytotoxic activity of 100% inhibition against *Artemia salina* and an antitumor activity against KB cells lines.

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### Introduction:-

The inflammatory and cancer diseases are among the most common diseases all over the world. The prevalence, severity, and complexity of these diseases are rapidly rising and considerably adding to the burden of healthcare costs. Although, the synthetic and combinatorial chemistry have given rise to notable successes in the development of novel anti-inflammatory and anti-cancer drugs (Vo et al., 2012). Meanwhile, the perceived value of natural products in the treatment of these diseases has yet to be fully explored. Thus, the extensive studies of alternative anti-inflammatory and anti-allergic drugs from natural products are essential. Notably, marine algae have been utilized in food products as well as in pharmaceutical products due to their biological activities and health benefit effects. Algae are an important source of various bioactive compounds such as antioxidants, antimicrobials and antivirals (Pulzet al., 2004). These compounds are also important for protecting the algal cells against stressful conditions. To enable rapid adaptation to new environmental conditions, algae produce a great variety of secondary metabolites that cannot be found in other organisms (Rodriguez-Meizoso et al., 2010). The biomass of macroalgae, represented mainly by a few species of Rhodophyta and Phaeophyta, is traditionally used to produce phycocolloids such as agar-agar, alginates and carrageenan.

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Recently, marine algae have attracted a special interest as great sources of anti-inflammatory and anti-cancer properties (Lee et al., 2013). Inflammation has molecular links to carcinogenesis (Vendramini-Costa et al., 2012; Poehlmann et al., 2012). Therefore, pro-oxidant natural products are commonly chosen when developing anti-cancer drugs (Martin-Cordero et al., 2012; Farooqi et al., 2012; Yen et al., 2012).

In this study, we evaluated the anti-inflammatory and anti-cancer activities of two marine algae *Gelidium sesquipedale* and *Laminaria ochroleuca* collected from the coast of El Jadida-Morocco.

## **Material and Methods:-**

### **Algal materials:-**

Seaweeds *Gelidium sesquipedale* and *Laminaria ochroleuca* were collected at low tide and during the spring tide by hand-picking in the period of March to April from Sidi Bouzid-El Jadida coast (33°- 33°16'09''N, 8°30'-8°45'W). The algae were cleaned, washed in distilled water, then dried at room temperature and crushed until a fine powder was obtained.

### **Preparation of extracts:-**

The powder of dried algae was extracted in methanol, hexane, dichloromethane, dichloromethane /methanol and water as described by Caccamese and Azolina (1979). The resulting extracts were concentrated to dryness in a rotary evaporator under reduced pressure (at 45°C) until a crude extract was obtained and was conserved at 4°C.

### **Anti-inflammatory activity:-**

#### **PLA<sub>2</sub> inhibition assay:-**

Bioassay was based on a colorimetric bioassay (De Araujo et al., 1987). Each extract (10 µg dissolved in DMSO (10 µL)) was incubated in 96 well plates for 1h at 25°C, with *Apis mellifera* venom PLA<sub>2</sub> (Sigma, 2 µL of a 1 mg/mL DMSO stock solution). Substrate solution (198 µL) containing L- $\alpha$ -phosphatidylcholine (L- $\alpha$ -lecithin, 3.5 mM), red phenol (0.055 mM), NaCl (100 mM), CaCl<sub>2</sub> (10 mM) and Triton (7 mM) at pH 7.6 were added. Mannitol was used as a positive control. Colorimetric measurements were made as duplicates at time 0 and after 5 min thereafter read at 550 nm.

#### **Elastase Inhibition assay:-**

This activity is measured by the calorimetric method (La Barre et al., 1996). Bioassay was monitored by measuring the inhibition of the amidolysis of N-succinyl-alanylalanyl-prolyl-leucyl p-nitroanilide (Sigma) by the elastase (EC 3.4.21.36 Type II-A) from porcine pancreas (Sigma) at 410 nm. The reaction was carried out in 0.2M Tris-HCl buffer (pH 8.0) containing 200 µL elastase (0.2 mg/mL), 100 µg of each extract prepared in 10 µL of DMSO was added to the reaction mixture, and the elastase inhibition was assessed at 25 °C. The reaction mixture was preincubated for 10 min before addition of 2 µL the substrate (7.2 µg/100 µL of DMSO). The change in absorbance was measured at 410 nm in a 96-well reader.

### **Cytotoxic activity test:-**

#### **Brine shrimp lethality bioassay:-**

Brine shrimp lethality test for larvae nauplii was used to determine the toxicity of methanol/dichloromethane extract of seaweeds (McLanghlin et al., 1993). The eggs of brine shrimp (*Artemia salina* Leach) were collected and hatched in an Erlenmeyer at 30 °C with constant oxygen supply. Two days were allowed to hatch and mature the nauplii. Stock solution of the extract sample was prepared by dissolving 25, 50, 75, 100, 250 and 500 µg of extract in 4 µL of pure dimethyl sulfoxide (DMSO). 10 living nauplii were taken to each of the vial containing different concentrations of test sample with pipette Pasteur. Then, specific volumes of sample were transferred from the stock solution to the vials to get final sample concentration. In the control vials, same volumes of DMSO (as in the sample vials) were taken. After 24 hours, the vials were observed and the number of nauplii survived in each vial was counted. As controls, *A. salina* nauplii were submitted to seawater and that containing 1% DMSO (100% survival).

The number of survivors was counted and the percentage of death was calculated. Larvae were considered dead when they did not exhibit any internal or external movement during several seconds of observation. The 50% lethal concentrations (LC<sub>50</sub>) of the extracts were determined, values of LC<sub>50</sub> that were greater than 100 µg/mL were considered to represent an inactive extract (Moshi et al., 2009), the test was repeated five times.

**In vitro antitumor activity assay:-**

KB cells (human buccal epidermal carcinoma), Cell strains K562 (Human chronic myelocyticleukemia) and HeLa cell lines (human epitheloid cervix carcinoma) were used using the method of Arisawa et al. (1997) with minor modifications. The cell suspension  $3.10^3 \text{ ml}^{-1}$  was placed in 96-well tissue culture microplates. Sample were dissolved in 0.2% DMSO and added to the cell suspension at  $10 \mu\text{g} \cdot \text{ml}^{-1}$ . The cells lines were counted by using neutral red as dye and absorbance were measured at 540 nm in a microplate reader.

**Statistical Analysis:-**

The results were analyzed by one-way ANOVA using the SPSS 17 statistical software to compare the mean values of each treatment. The results are expressed as means  $\pm$  SD. Probability levels of less than 0.01 were considered highly significant. All tests were performed in triplicate.

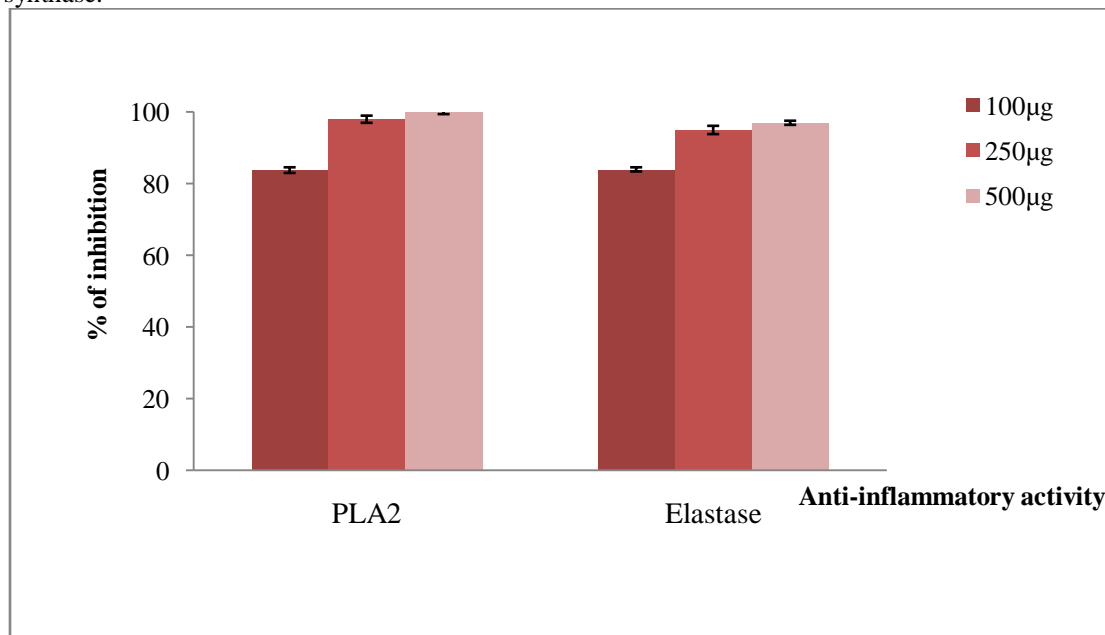
**Results and Discussion:-*****Gelidium sesquipedale*:-****Anti-inflammatory activity:-**

The search for anti-inflammatory activity of *Gelidium sesquipedale* was evaluated through the inhibition of phospholipase  $A_2$  and the inhibition of elastase. Extracts of the algae were tested for their anti-inflammatory capacity in quantity of extracts of 100, 250 and 500  $\mu\text{g}$ . Only the dichloromethane / methanol extract is represented, the other extracts prepared in methanol, hexane, dichloromethane and water showed no positive activity (Fig 1).

The results of the inhibition of phospholipase  $A_2$  and elastase by different quantity of *Gelidium sesquipedale* extracts show that the inhibition is proportional to the amount of extract tested. They show that 100% of inhibition of phospholipase  $A_2$  and 98% of the elastase was obtained with 500  $\mu\text{g}$  of extract.

In literature, studies on phospholipase  $A_2$  activity and elastase in seaweed are infrequent. The most significant works are those of Mayer et al. (1993) which showed an anti-phospholipase  $A_2$  activity in 10 species of algae.

Many researches reports that marine algae possess anti-inflammatory activity. Chen et al. (2013) showed that an aqueous extract of *Gracilariatenuistipitata* suppressed virus-induced inflammation; also, Lim et al. (2006) indicated that the anti-inflammatory effects of a methanol extract of *Neorhodomelaaculeata* in neurological diseases included inhibiting cellular reactive oxygen species (ROS) generation,  $\text{H}_2\text{O}_2$ -induced lipid peroxidation, and inducible nitric oxide synthase.



**Figure 1:-** Percent inhibition of  $\text{PLA}_2$  and elastase according to the quantity of DC / MeOH extract of the algae *Gelidium sesquipedale*.

**Cytotoxic activity:-**

Since the isolation of the Halomon by Fuller et al. (1992), special attention was paid to the cytotoxic activity of the algae. Several species were tested for cytotoxicity on cancer cells, hepatocytes or tumors. In our study, the cytotoxic activity was investigated in the dichloromethane / methanol extract of *Gelidium sesquipedale* (Table 1).

The extract of *Gelidium sesquipedale* showed significant cytotoxic activity of 100% inhibition for a quantity of 100 µg against *Artemia salina*. *Gelidium sesquipedale* extract was also tested against KB cells, against cervical carcinoma Human cell lines (HeLa) and against chronic myelogenous leukemia cell lines of (K562).

The extract showed a high antitumor activity against KB with 100% of cytotoxicity, also, anticancer activity against HeLa and K562 cell lines. IC<sub>50</sub> values of the MTT test is 36.01 µg / ml for HeLa and 17.41 µg / ml for K562.

**Table1:-** Cytotoxic activity of dichloromethane/methanol extract of *Gelidium sesquipedale*.

<i>A. salina</i>	KB	HeLa	K562
100 % of death	100 % of death	IC <sub>50</sub> : 36,01 µg/ml	IC <sub>50</sub> : 17,41 µg/ml

Metidji et al. (2015) showed that methanolic extracts of *Gelidium sesquipedale* showed prominent result in brine shrimp cytotoxicity assay. The LD<sub>50</sub> value was 2.22 µg/ml. In addition, they found that the degree of lethality was found to be directly proportional to the concentration of the extract.

Many of the secondary metabolites produced by the marine red algae are well known for their cytotoxic property. As noted by Harada et al. (1997), the extract from a red alga, *Amphiroa zonata* exhibited strong cytotoxicity to human leukemic cell line. El-Baroty et al. (2007) demonstrated the cytotoxic activities of powdered *Asparaguses taxiformis* and its water extract on *Daphna magna*.

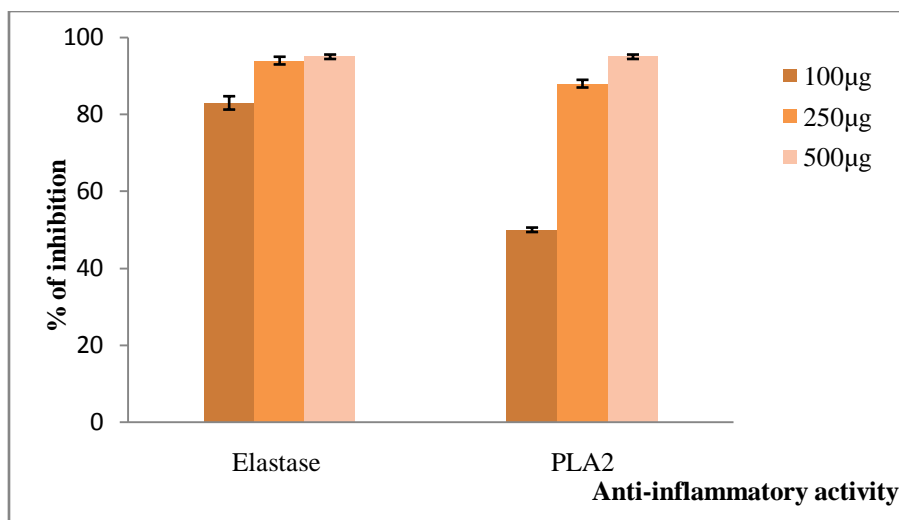
Many studies of cytotoxic activity of other red algae are already reported. Zubia et al. (2009) reported that *Asparagopsis armata* had a strong cytotoxic activity against cancer cell lines. Similarly, Manilal et al. (2009) reported the cytotoxicity of active fraction of *Laurencia brandeni* showed value of 93 µg/ml for the LC<sub>50</sub> from brine shrimp lethality.

Zandi et al. (2010a,b) showed that aqueous extracts of *Gracilariacorticata* and *Sargassum oligocystum* inhibited the proliferation of human leukemic cell lines. Yeh et al. (2012a,b) reported that both ethanol and methanol extracts of *Gracilariatenuistipitata* had anti-proliferative effects on Ca9-22 oral cancer cells and were involved in cellular apoptosis, DNA damage, and oxidative stress. Similarly, caspase-dependent apoptosis induced by a methanol extract of *Plocamium telfairiae* has been demonstrated using HT-29 colon cancer cells (Kim et al. 2007).

***Laminaria ochroleuca*:-****Anti-inflammatory activity:-**

The dichloromethane / methanol extract of *Laminaria ochroleuca* was tested for its ability to inhibit phospholipase A<sub>2</sub> and elastase in 100, 250 and 500 µg. Extracts prepared in methanol, hexane, dichloromethane and water showed no activity.

The results represented in figure 2 showed that the extract of *Laminaria ochroleuca* showed a low anti-PLA<sub>2</sub> activity with a percent inhibition less than 60%, by cons, this extract has a high ability to inhibit elastase with percentage inhibition greater than 80% at 100 µg of extract.



**Figure 2:-** Percent Inhibition of elastase and PLA<sub>2</sub> depending on the quantity of DC / MeOH extract of *Laminaria ochroleuca*.

The work of Etahiri (2002) is in agreement with our results, it showed that the extract of *Laminaria ochroleuca* has a weak anti-PLA<sub>2</sub> activity.

In literature, Kim et al. (2007) indicated that a murine asthma model showed that an ethanol extract of *Ecklonia cava* reduced allergic airway reactions and inflammation and inhibited LPS-induced inflammation in human endothelial cells (Kim et al. 2010). An ethanol extract of *Ishigeokamurae* also showed anti-inflammatory effects (Kim et al. 2009).

Additionally, anti-inflammatory effects have been demonstrated for the *Myagropsismyagroides*-derived carotenoid fucoxanthin (Heo et al. 2010), for *Eiseniabicyclis*, *Ecklonia cava*- and *Eckloniakurume*-derived polyphenol phlorotannins (Kim et al. 2011), and for *Sargassumsiliquastrum*-derived sargachromanol G (Yoon et al. 2012). Phloroglucinol, a monomer of phlorotannins that is abundant in brown algae, reportedly had an anti-oxidative stress effect and inhibited the production of inflammatory mediators in LPS-stimulated cells (Kim et al. 2010).

#### **Cytotoxic activity:-**

Marine macroalgae belonging to the group of Pheophyceae possess anti-tumor activity against several culture cell lines (Tang et al., 2002).

Several cytotoxic compounds such as fucoidans, laminarians and terpenoids, reported to be abundant in brown algae, have anti-cancer, anti-tumor and antiproliferative activities (Gerwick et Bernat, 1993 ; Carte, 1996 ; Smit, 2004 ; Manilal et al., 2009 ; Synytsya et al., 2010 ; Vinayak et al., 2010 ; Ayyad et al., 2011).

The dichloromethane / methanol extract of *Laminaria ochroleuca* showed significant cytotoxic activity of 100% inhibition for 100 µg against *Artemia salina*. The extract of *Laminaria ochroleuca* was also tested against KB, HeLa and against K562. The extract showed an antitumor activity against KB cells lines with 100% of activity.

Studies of brown algae have shown that glycoproteins from *Laminaria japonica* (Go et al., 2010) and fucoidans from *Sargassumhornery*, *Ecklonia cava*, and *Costariacostata* (Ermakova et al., 2011) had anti-cancer effects on human colon cancer cells. Heterofucans from *Sargassumfilipendula* exhibited anti-proliferative effects on cervical, prostate, and liver cancer cells (Costa et al., 2011). A carotenoid fucoxanthin could inhibit the growth of LNCap prostate cancer cells by arresting these cells in the G1 phase via the GDD45A and SAPK/JNK pathways (satomi et al., 2012).

## Conclusion:-

The results of the present work showed that dichloromethane/methanol extract of both algae *Gelidium sesquipedale* and *Laminaria ochroleuca* offer potential for use as anti-inflammatory and anticancer candidate. These findings of this work are useful for further research to identify, isolate and characterize the specific compound which is responsible for these activities.

## References:-

1. Arisawa, M., Hayashi, K., Nikaido, T., Koike, K., Fujita, D., Nunomura, N., Tanaka, M. and Sasaki, T. (1997): Screening of some Marine Organism extracts for cAMP Phosphodiesterase Inhibition, Cytotoxicity and antiviral activity against HSV-1. *Inter. J. Pharm.*, 35 (1): 6-11.
2. Ayyad, N.S., Ezmirly, S.T., Basaif, S.A., Alarif, W.M., Badria, A.F. and Badria, F.A. (2011): Antioxidant, cytotoxic, antitumor, and protective DNA damage metabolites from the red sea brown alga *Sargassum* sp. *Pharmaco. Res.*, 3: 160-165.
3. Caccamese, S. and Azzolina, R. (1979): Screening for antimicrobial activities in marine algae from eastern Sicily. *Planta Med.*, 37 : 333-339.
4. Carte, B.K. (1996): Biomedical potential of marine natural products. *Biosci.*, 46: 271-286.
5. Chen, K.J., Tseng, C.K., Chang, F.R., Yang, J.I., Yeh, C.C., Chen, W.C., Wu, S.F., Chang, H.W. and Lee, J.C. (2013): Aqueous extract of the edible *Gracilariatenuistipitata* inhibits hepatitis C viral replication via cyclooxygenase-2 suppression and reduces virus-induced inflammation. *PLoS One.*, 8(2):e57704.
6. Costa, L.S., Fidelis, G.P., Telles, C.B., Dantas-Santos, N., Camara, R.B., Cordeiro, S.L., Costa, M.S., Almeida-Lima, J., Melo-Silveira, R.F. and Oliveira, R.M. (2011): Antioxidant and antiproliferative activities of heterofucans from the seaweed *Sargassum filipendula*. *Mar. Drugs.*, 9(6):952-966.
7. De Araujo, A. L. and Radvani, F. (1987): Determination of phospholipase A<sub>2</sub> activity by a colorimetric assay using a pH indicator. *Toxin.*, 25: 1181-1188.
8. El-Baroty, G.S., Moussa, M.Y., Shallan, M.A., Ali, M.A., Sabh, A.Z. and Shalaby, E. A. (2007): contribution to the aroma, biological activities, minerals, protein, pigments and lipid contents of the red alga: *Asparagopsis taxiformis* (Delile) Trevisan. *J. App Sci. Res.*, 3: 1825-1834.
9. Ermakova, S., Sokolova, R., Kim, S.M., Um, B.H., Isakov, V. and Zvyagintseva, T. (2011): Fucoidans from brown seaweeds *Sargassum hornery*, *Ecklonia cava*, *Costariacostata*: structural characteristics and anticancer activity. *Appl. Biochem. Biotechnol.*, 164(6):841-850.
10. Etahiri, S. (2002): Isolement et caractérisation de composés pharmacologiquement actifs à partir des algues marines de la côte d'El Jadida (Maroc). Thèse de doctorat en Science. Fac. Sci. El Jadida, Maroc. p68-92.
11. Farooqi, A.A., Butt, G. and Razzaq, Z. (2012): Algae extracts and methyl jasmonate anti-cancer activities in prostate cancer: choreographers of 'the dance macabre'. *Cancer Cell Int.*, 12(1):50.
12. Fuller, R. W., Cardellina, J. H., Kato, Y., Brinen, L. S., Calrdy, J., Snader, K. M. and Boyd, M. R. (1992): A pentahalogenated monoterpene from the red alga *Portierahorremenni* produces a novel cytotoxicity profile against a diverse panel of human tumor cell lines. *J. Med. Chem.* 35: 3007-3011.
13. Gerwick, W.H., Bernart, M.W. (1993): In: *Marine Biotechnology*. (Eds.): Attaway, D. and Zaborsky, O., Plenum Press, New York 101-152.
14. Go, H., Hwang, H.J. and Nam, T.J. (2010): A glycoprotein from *Laminaria japonica* induces apoptosis in HT-29 colon cancer cells. *Toxicol.*, 24(6):1546-1553.
15. Harada, H. and Kamei, Y. (1997): selective cytotoxicity of marine algae extracts to several human leukemic cell lines. *Cytotech.*, 25: 213-19.
16. Heo, S.J., Yoon, W.J., Kim, K.N., Ahn, G.N., Kang, S.M., Kang, D.H., Affan, A., Oh, C., Jung, W.K. and Jeon, Y.J. (2010): Evaluation of anti-inflammatory effect of fucoxanthin isolated from brown algae in lipopolysaccharide-stimulated RAW 264.7 macrophages. *Food Chem. Toxicol.*, 48(8-9):2045-2051.
17. Kim, J.Y., Yoon, M.Y., Cha, M.R., Hwang, J.H., Park, E., Choi, S.U., Park, H.R. and Hwang, Y.I. (2007): Methanolic extracts of *Plocamium telfairiae* induce cytotoxicity and caspase-dependent apoptosis in HT-29 human colon carcinoma cells. *J. Med. Food.*, 10(4):587-593.
18. Kim, S.K., Lee, D.Y., Jung, W.K., Kim, J.H., Choi, I., Park, S.G., Seo, S.K., Lee, S.W., Lee, C.M. and Yea, S.S. (2008): Effects of *Ecklonia cava* ethanolic extracts on airway hyperresponsiveness and inflammation in a murine asthma model: role of suppressor of cytokine signaling. *Biomed. Pharmacother.*, 62(5):289-296.
19. Kim, M.M., Rajapakse, N. and Kim, S.K. (2009): Anti-inflammatory effect of *Ishigeoakamurae* ethanolic extract via inhibition of NF-kappaB transcription factor in RAW 264.7 cells. *Phytother. Res.*, 23(5):628-634.

20. Kim, M.M. and Kim, S.K. (2010): Effect of phloroglucinol on oxidative stress and inflammation. *Food Chem. Toxicol.*, 48(10):2925-2933.
21. Kim, T.H. and Bae, J.S. (2010): *Ecklonia cava* extracts inhibit lipopolysaccharide induced inflammatory responses in human endothelial cells. *Food Chem. Toxicol.*, 48(6):1682-1687.
22. Kim, S.K. and Himaya, S.W. (2011): Medicinal effects of phlorotannins from marine brown algae. *Adv. Food Nutr. Res.*, 64:97-109.
23. La Barre, S., Longeon, A., Barthlemy, M. and Guyot, M. (1996): Characterization of a novel elastase inhibition from a fan coral, *Life Sci.*, 319(5):365-370.
24. Lee, J.C., Hou, M.F., Huang, H.W., Chang, F.R., Yeh, C.C., Tang, J.Y. and Chang, H.W. (2013): Marine algal natural products with anti-oxidative, anti-inflammatory, and anti-cancer properties. *Cancer Cell Int.*, 13(55): 1475-2867.
25. Lim, C.S., Jin, D.Q., Sung, J.Y., Lee, J.H., Choi, H.G., Ha, I. and Han, J.S. (2006): Antioxidant and anti-inflammatory activities of the methanolic extract of *Neorhodomela aculeate* in hippocampal and microglial cells. *Biol. Pharm. Bull.*, 29(6):1212-1216.
26. Manilal, A., Sujith, S., Kiran, G.S., Selvin, J. and Shikar, C. (2009): Cytotoxic potentials of red alga, *Laurenciabrandeni* collected from the Indian Coast. *Global J. Pharma.*, 3: 90-94.
27. Manilal, A., Sujith, S., Selvin, J., Kiran, G.S., Shakir, C., Gandhimathi, R. and Panikkar, M.V.N. (2009): Biopotentials of seaweeds collected from southwest coast of india. *J. Mar. Sci. Tech.*, 17 (1): 67-73.
28. Martin-Cordero, C., Leon-Gonzalez, A.J., Calderon-Montano, J.M., Burgos-Moron, E. and Lopez-Lazaro, M. (2012): Pro-oxidant natural products as anticancer agents. *Curr. Drug. Targets.*, 13(8):1006-1028.
29. Mayer, A. M. S., Paul, V. J., Fenical, W., Norris, J. N., DeCarvalho, M. S. and Jacobs, R. S. (1993): Phospholipase A<sub>2</sub> inhibitors from marine algae. *Hydrobiol.*, 260: 158-168.
30. McLaughlin, J.L., Chang, C. and Smith, D.L. (1993): Simple bench-top bioassays (brine-shrimp and potato discs) for the discovery of plant antitumor compounds, in: *Human Medicinal Agents from Plants*. (Eds.): Kinghorn, A.D., Balandrin, M.F., Washington, D.C.: Amer. Chem. Soc., 112-137.
31. Metidji, H., Dob, T., Toumi, M., Krinat, S., Ksouri, A. and Nouasri, A. (2015): antimicrobial and cytotoxic properties of *Gelidium sesquipedale* Thuret et Bornet red seaweed from Algeria. *J. Mater. Environ. Sci.* 6 (11) :3184-3196.
32. Moshi, M.J., Innocent, E., Masimba, P.J., Otieno, D.F., Weisheit, A., Mbabazi, P., Lynes, M., Meachem, K., Hamilton, A. and Urassa, I. (2009): Antimicrobial and brine shrimp toxicity of some plants used in traditional medicine in Bukoba District, north-western Tanzania. *Tanz. J. Health Res.*, 11: 23-28.
33. Poehlmann, A., Kuester, D., Malfertheiner, P., Guenther, T. and Roessner, A. (2012): Inflammation and Barrett's carcinogenesis. *Pathol. Res. Pract.*, 208(5): 269-280.
34. Pulz, O. and Gross, W. (2004): Valuable products from biotechnology of microalgae. *Appl. Microbiol. Biotechnol.*, 65: 635-648.
35. Rodriguez-Meizoso, I., Jaime, L., Santoyo, S., Señoráns, F. J., Cifuentes, A. and Ibáñez, E. (2010): Subcritical water extraction and characterization of bioactive compounds from *Haematococcus pluvialis* microalga. *J. Pharm. Biomed. Anal.*, 51: 456-463.
36. Satomi, Y. (2012): Fucoxanthin induces GADD45A expression and G1 arrest with SAPK/JNK activation in LNCap human prostate cancer cells. *Anticancer Res.*, 32(3):807-813.
37. Smit, A.J. (2004): Medicinal and pharmaceutical uses of seaweed natural products. A review. *J. Applied Phycol.*, 16: 245-262.
38. Synytsya, A., Kim, W.J., Kim, S.M., Pohl, R., Synytsya, A., Kvasnicka, F., Copikova, J. and Park, Y. (2010): Structure and antitumor activity of fucoidan isolated from sporophyll of Korean brown seaweed *Undaria pinnatifida*. *Carbohydrate Polymers.*, 81: 41-48.
39. Tang, H. F., Yang-hua, Y., Yao, X. S., Xu, Q. Z., Zhang, S. Y. and Lin, H. W. (2002): Bioactive steroids from the brown alga *Sargassum carpophyllum*. *J. Asian. Nat. Prod. Res.*, 4(2): 95-105.
40. Vendramini-Costa, D.B. and Carvalho, J.E. (2012): Molecular link mechanisms between inflammation and cancer. *Curr Pharm Des.*, 18(26): 3831-3852.
41. Vinayak, R.C., Sabu, A.S. and Chatterji, A. (2010): Bioprospecting of a few brown seaweed for their cytotoxic and antioxidant activities. *eCAM.*, 1-9.
42. Vo, T.S., Ngo, D.H. and Kim, S.K. (2012): Potential targets for anti-inflammatory and anti-allergic activities of marine algae: an overview. *Inflamm. Allergy Drug Targ.*, 11(2):90-101.
43. Yeh, C.C., Tseng, C.N., Yang, J.I., Huang, H.W., Fang, Y., Tang, J.Y., Chang, F.R. and Chang, H.W. (2012a): Antiproliferation and induction of apoptosis in Ca9-22 oral cancer cells by ethanolic extract of *Gracilariatenuistipitata*. *Molecules.*, 17(9):10916-10927.

44. Yeh, C.C., Yang, J.I., Lee, J.C., Tseng, C.N., Chan, Y.C., Hseu, Y.C., Tang, J.Y., Chuang, L.Y., Huang, H.W. and Chang, F.R. (2012b): Anti-proliferative effect of methanolic extract of *Gracilariatenuistipitata* on oral cancer cells involves apoptosis, DNA damage, and oxidative stress. BMC Complement Altern. Med., 12(1):142.
45. Yen, C.Y., Chiu, C.C., Haung, R.W., Yeh, C.C., Huang, K.J., Chang, K.F., Hseu, Y.C., Chang, F.R., Chang, H.W. and Wu, Y.C. (2012): Antiproliferative effects of goniothalamin on Ca9-22 oral cancer cells through apoptosis; DNA damage and ROS induction. Mutat. Res., 747(2): 253-258.
46. Yoon, W.J., Heo, S.J., Han, S.C., Lee, H.J., Kang, G.J., Kang, H.K., Hyun, J.W., Koh, Y.S. and Yoo, E.S. (2012): Anti-inflammatory effect of sargachromanol G isolated from *Sargassum siliquastrum* in RAW 264.7 cells. Arch. Pharm. Res., 35(8):1421-1430.
47. Zandi, K., Tajbakhsh, S., Nabipour, I., Rastian, Z., Yousefi, F., Sharafian, S. and Sartavi, K. (2010a): In vitro antitumor activity of *Gracilariacorticata* (a red alga) against Jurkat and molt-4 human cancer cell lines. Afr. J. Biotechnol., 9(40):6787-6790.
48. Zandi, K., Ahmadzadeh, S., Tajbakhsh, S., Rastian, Z., Yousefi, F., Farshadpour, F. and Sartavi, K. (2010b): Anticancer activity of *Sargassum oligocystum* water extract against human cancer cell lines. Eur. Rev. Med. Pharmacol. Sci., 14(8):669-673.
49. Zubia, M., Fabre, M.S., Kerjean, V., Le Lann, K., Stiger-Pouvreau, V., Fauchon, M. and Deslandes, E. (2009): antioxidant and antitumor activities of some Pheophyta from Brittany coasts. Food. Chem., 116(3): 693-701.

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### RESEARCH ARTICLE

#### PYRAMIDAL ROOF THAT HOLDS UP THE BEST.

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#### Manuscript Info

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#### Abstract

Pyramidal roof is a hip type of roof. It has no vertical sides or gables. The purpose of the project is to provide the roofing design with a small modification of installing draining water pipes from roof to the ground surface and ventilation facility. Pyramidal roof withstands and gives strength against hurricanes. Due to their aerodynamic shape, a pyramidal roof is less likely to be damaged by high winds than most other roof styles. With its even sides and overhanging eaves, the pyramidal roof gives the home a striking and distinctive appearance. This roof style looks good from all angles. The roofing design contains with a small modification of installation of draining water pipes from roof to ground surface and ventilation facility.

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#### Introduction:-

Pyramidal roof is a hip type of roof. It has no vertical sides or gables. This is a type of roof where all sides slope downwards to the walls, with a fairly gentle slope. Pyramidal roof is a shape of square hip roof. They almost have same pitch or slope, which makes them symmetrical about the centerlines. They often have a consistent level gutter that can be fitted all around.

#### Objective:

The various objectives to provide pyramidal roof are as follows:

1. To resist the wind. Due to equal pitch on both sides, it has good aerodynamics which gives ability to withstand strong winds.
2. To use pyramidal roof in coastal regions where tough winds & storm are common occurrence.
3. To provide natural insulation.
4. To maintain low interior temperature of room, this saves cost of air conditioner.
5. To provide efficient drainage.

As we know that, in India there are many regions which face wind storms and hurricanes. The problem to be found out is that during the weather of high winds or hurricanes, the houses in those areas are destroyed. Also during the rains the water makes the houses weak due to leakage and moisture. The houses become weak in the coastal regions. The pyramidal roof house gives resistance to the high winds or storms or hurricanes. It is also provided with the drainage and ventilation facility on the roof which helps draining the rain water immediately and gives light through ventilation windows in daytime.

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**Framing of roof:**

The process of framing a pyramid roof may get complicated sometimes, or easy to do it. The framing of roof depends on the size of roof and structure. Time taken for the framing of roof also depends on the size of roof.

The basic steps of the framing of roof are as follows:-

- i. A circular saw, a measuring tape, a 2-by-6 lumber, nails and a hammer will be needed.
- ii. The pitch of the pyramid roof should be decided as the pitch determines the final length of the hip rafters.
- iii. Section the rafters as per the decided pitch.
- iv. At initial install the two pairs of rafters in opposite direction that leans at each other. They should be diagonally joined by nailing them together.
- v. Again install the next pair of rafters. Do this till the frame of roof is obtained.
- vi.



**Fig.1:- ROOF FRAME**

**Rooflight in pyramidal roof:-**

The pyramidal roof light has no internal hip framework. It ensures that the maximum natural light will be given to room beneath. It also has greatly improved thermal efficiency resistance. The roof light can be used in double glazed or triple glazed. The thermal resistivity in both the roof light are more. They are provided with toughened safety glass.



**Fig.2:- ROOF LIGHT**

**Drainage in pyramidal roof:**

The drainage facility in roof plays one of the important role. According to drainage in roof, it decided the draining of rain water from roof. It can be done by providing the gutters at the end of roof at each side of roof with equal slope at all sides. At the end of gutters draining pipes should be connected which allows rain water to reach the ground level.



**Fig.3:- DRAINING GUTTER**

**Implementation:**

Earlier, prior to 1930's pyramidal roofing was a popular constructing structure for American houses which still in use are considered as American bungalows, log cabins and modern Victoria style homes.

As we know a pyramid roof is one of the type of hip roof which lacks gables or vertical sides, having constructed on top of a square or rectangular base the pyramidal roof is suitable for small structures of house. A pyramid roof having all the sides sloping downwards towards the wall may have three or more rectangular faces depending on the structure size and design preference of the individual.

Considering the conservative construction of the pyramid roof displays the efficiency of the structure in places with high winds which makes them less prone to wind damages, hence constant roof maintenance and repair is minimized.

Besides this, following are the reasons why pyramid roofs are implemented:

- A. Resistant to wind
  - B. Natural insulation
  - C. Efficient drainage capabilities
- a) Resistant to wind: - This is considered to be the most admirable feature for an individual looking to build a pyramid roof. Due to the shape with equal pitch on both sides, the structure allows to have a good aerodynamic feature, which gives the ability to withstand strong winds compared to roofs with normal gable, with this quality the pyramidal roof is therefore ideally suitable for coastal regions where winds and storms are considered as common occurrence.
- b) Natural insulation: - Insulation is considered to be the important aspect in all components of a building, which eventually determines the energy bills, considering especially in very hot and very cold seasons. These excellent insulating capability of pyramidal roof comes from the fact that they have eaves on all sides. With proper implement of pyramid roof, builders can allow sufficient roof for insulation materials. This design allows the interior temperature to remain low which on a long term helps in saving the cost of continuous air conditioning.
- c) Efficient drainage capabilities: - Drainage is considered to be the most bothersome problem which most of the usually roof faces. With poor drainage capabilities the collected rain water fails to direct it away, eventually causes major problems not only to the roof but also to other structures of the roof. Constructing pyramid roof allows an efficient drainage capabilities because of the equal slopes of the structure, which always drains away almost immediately. Therefore, problems like mold growth or leaking of the roofs is not experienced.

Therefore, the structure designed gives the best possible solution for the above described capabilities of the pyramid roof. The pyramidal roof typed structure can be implemented in coastal area where there is high wind storms and hurricanes. In the coastal regions, during hot seasons it gives cooling effect in the house. Due to sloping sides warm winds are resisted and it is converted into cooling effect which also saves electricity bills. In cold seasons, the electricity consumption is at minimum.

**Conclusion:-**

As we know that pyramidal roof is a high wind resistant roof, it can be applied to various places. Pyramidal roofs are generally used for the small structures like garages, cottages, etc. and it has been also used for bungalows. Pyramidal roof gives qualities such as traditional design, solidness and more comfort. It is mostly used for the advance architecture.

In the project, the design gives the strength to withstand the high winds, hurricanes, or storm like places. It also gives the facility of rain water drainage and roof lighting windows. Roof lighting windows allows beneath rooms the natural light in daytime.

**References:-**

1. Research report RP06-2: “Residential Hip Roof Framing Using Cold-Formed Steel Members” by Sutton F. Stephens & Roger A. LaBoube
2. International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181- “Analysis and Design of Pyramidal Roof Slab” by Patil S.S & Kondekar A.R (Walchand Institute of Technology, Solapur, India)
3. Hip roof framing and building: <http://myrooff.com/hip-roof-framing-and-building/>
4. Top 15 roof types and their pros & cons: <http://www.roofcalc.net/top-15-roof-types-and-their-pros-cons/>
5. Hip roof: [https://en.wikipedia.org/wiki/Hip\\_roof](https://en.wikipedia.org/wiki/Hip_roof)
6. Pyramid roof framing: <https://www.carpentry-pro-framer.com/pyramid-roof-framing.html>
7. How to build a hip roof: <http://www.wikihow.com/Build-a-Hip-Roof>
8. Pros and cons of pyramidal roof: <http://www.roofingkey.com/roofing-styles/the-pros-and-cons-of-the-pyramidal-roof.html>
9. List of roof shapes: [https://en.wikipedia.org/wiki/List\\_of\\_roof\\_shapes](https://en.wikipedia.org/wiki/List_of_roof_shapes)
10. How to frame a hip roof: <http://www.carpentry-tips-and-tricks.com/hipped-roof.html>
11. Pyramid truss home: <http://www.pyramidtruss.ca/>
12. Roof framing: [http://www.constructionknowledge.net/public\\_domain\\_documents/Div\\_6\\_Woods\\_Plastics/Partial%20Carpentry%20pdfs/Framing\\_Roofs\\_NAVEDTRA\\_14044.pdf](http://www.constructionknowledge.net/public_domain_documents/Div_6_Woods_Plastics/Partial%20Carpentry%20pdfs/Framing_Roofs_NAVEDTRA_14044.pdf)

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### RESEARCH ARTICLE

## SOCIO-ECONOMIC STATUS OF FARMER'S OF THE BASIS OF FAMILY PROFILE AND MATERIALS POSSESSED INVOLVED IN POTATO CULTIVATION ACTIVITIES.

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Potato Growers, Family Profile, Monthly Income, Potato Cultivation.

### Abstract

Potato is one of the most important food crops grown in more than 100 countries in the world. Over one billion people consume potato worldwide and it is the staple diet of half a billion people in developing countries. Present study entitled “**Socio-Economic Status of Farmer's of the Basis of Family Profile and Materials Possessed involved in Potato Cultivation activities**” The pre-coded interview schedule was constructed in order to elicit information needed to obtain the objectives of the study. Multistage purposive random sampling technique was followed to select the state, district, blocks and finally respondents. District Kannauj is purposively selected as this is one of the largest potato producer districts while two blocks namely Kannauj and Jalabad were randomly selected. Two villages from each selected block i.e. Basirapur and Mahmoadpur paith from **Kannauj** and, Badlepurwa and Kheda from **Jalalabad**, selected randomly. Forty farmers from each selected village, Total sample size 160 respondents were randomly selected for final data collection. Majority of head of respondent's family were farmer and earning Rs. less than 10,000 per month. Prevalence of nuclear family was seen in rural areas as majority of respondents were belonging to nuclear family, having up to five members, living in mixed type of houses, belonging to small farmer category and holding upto two animals. Rural areas were also witnessing technological advancement as majority respondents were having improved chulha and mobile phones while considerable per cent were having gas connection, television and other asstes.

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### Introduction:-

Potato (*Solanum tuberosum* Linn.) ranks fourth among the major food crops of the world. It is the staple food of almost half of the world's population. The global area under potato during 2009 was about 18.28 million ha, with a total production of 343.91 million t. India ranks 3rd in area (1.86 million ha) 2nd in production (42.34 million t) in the world. The production and productivity of the crop have been improved by a number of technological interventions viz., improved varieties, quality and quantity of fertilizers. Irrigation schedule, seed size, seed rate,

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planting distance and pest management. In Jammu division, it occupies highest area cover after rice, wheat and maize and has 16 per cent share in area and 18 per cent share in production under vegetables.

### Research Methodology:-

The study was conducted in Kannauj district of Uttar Pradesh during the year 2015. The pre-coded interview schedule was constructed in order to elicit information needed to obtain the objectives of the study. Multistage purposive random sampling technique was followed to select the state, district, blocks and finally respondents. District Kannauj is purposively selected as this is one of the largest potato producer districts while two blocks namely Kannauj and Jalabad were randomly selected. Two villages from each selected block i.e. Basirapur and Mahmoadpur paith from **Kannauj** and, Badlepurwa and Kheda from **Jalalabad**, selected randomly. Forty farmers from each selected village, Total sample size 160 respondents were randomly selected for final data collection.

### Result and Discussion:-

**Table 1.1:-** Distributions of Respondents on the Basis of Occupation of head of family

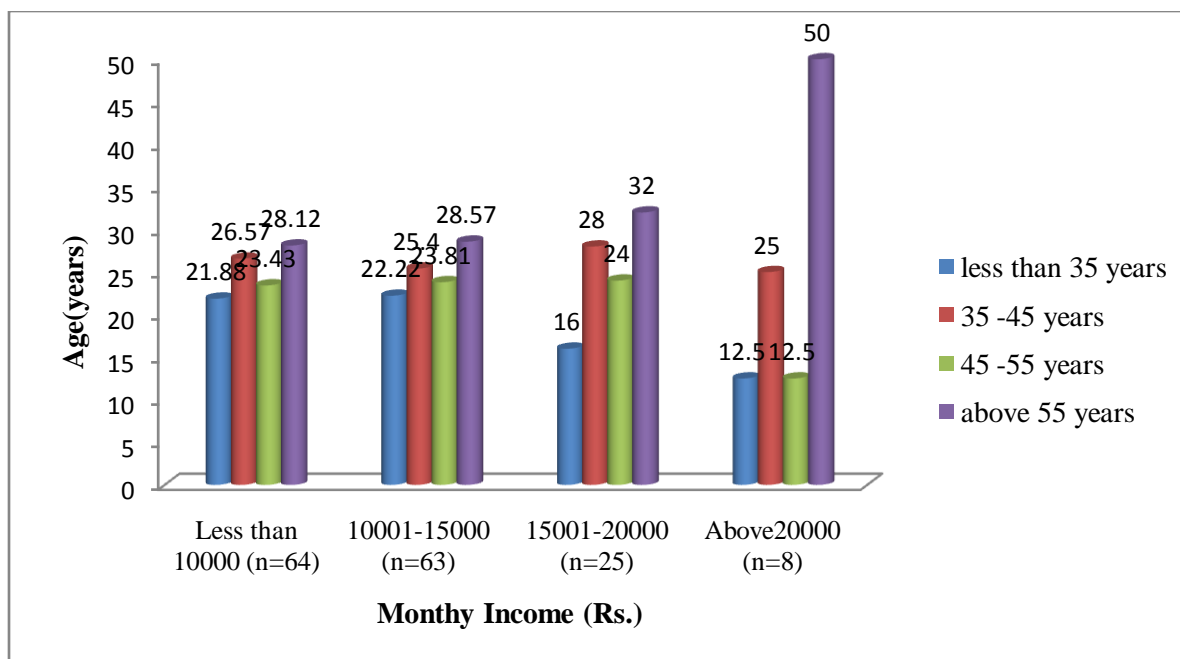
S.No	Occupation of head of family	Frequency	Percentage
1	Labour	62.00	38.75
2	Farming	64.00	40.00
3	Business	25.00	15.62
4	Service	09.00	05.63
	<b>Total</b>	<b>160.00</b>	<b>100.00</b>

Majority (40.00%) of heads of respondent's family were farmers while little less i.e. 38.75 per cent were labours. About sixteen per cent heads of respondents family were doing business while only 5.63 per cent heads of family were service man.

**Table 1.2:-** Distributions of Respondents on the Basis of Monthly Income

S.No	Monthly Income (Rs)	Frequency	Percentage
1	Less than 10000	64.00	40.00
2	10001-15000	63.00	39.37
3	15001-20000	25.00	15.63
4	Above 20000	08.00	05.00
	<b>Total</b>	<b>160.00</b>	<b>100.00</b>

Table 1.2 inferred that forty per cent and 39.37 per cent respondents were having monthly family income less than Rs. 10,000 and Rs. 10001-15,000 respectively, whereas 15.63 per cent respondents were earning Rs. 15, 0001-20,000 month. Only five per cent respondents were having income above Rs. 20,000 per month. **Fig. 01** revealed that maximum respondents from all income groups were identified as above 55 years age group. It shows that as age increases the income level of the respondents also increases.



**Fig. 01:-** Monthly Income of the Respondents According to Age

**Table 1.3:-** Distributions of Respondents on the Basis of Type of Family

S.No	Type of Family	Frequency	Percentage
1	Nuclear	97.00	60.63
2	Joint	55.00	34.37
3	Extended	08.00	05.00
	<b>Total</b>	<b>160.00</b>	<b>100.00</b>

Table 1.3 depicts that more than sixty per cent respondents were from nuclear family followed by 34.37 per cent respondents belonging to joint family. Very few i.e. only five per cent respondents were from extended family.

**Table 1.4:-** Distributions of Respondents on the Basis of Size of Family

S.No	Size of family	Frequency	Percentage
1	Up to 5 members	95.00	59.37
2	6-7 members	50.00	31.25
3	Above 7 members	15.00	09.37
	<b>Total</b>	<b>160.00</b>	<b>100.00</b>

It is evident from the figures presented in Table 1.4 that majority (59.37%) of respondents under study were having upto 5 members in their family followed by 31.25 per cent having 6-7 members. Little less than ten per cent respondents were having above 7 members in their family.

**Table 1.5:-** Distributions of Respondents on the Basis of Type of house

S.No	Type of house	Frequency	Percentage
1	Kachcha Type	43.00	26.87
2	Mixed Type	73.00	45.63
3	Pacca Type	44.00	27.50
	<b>Total</b>	<b>160.00</b>	<b>100.00</b>

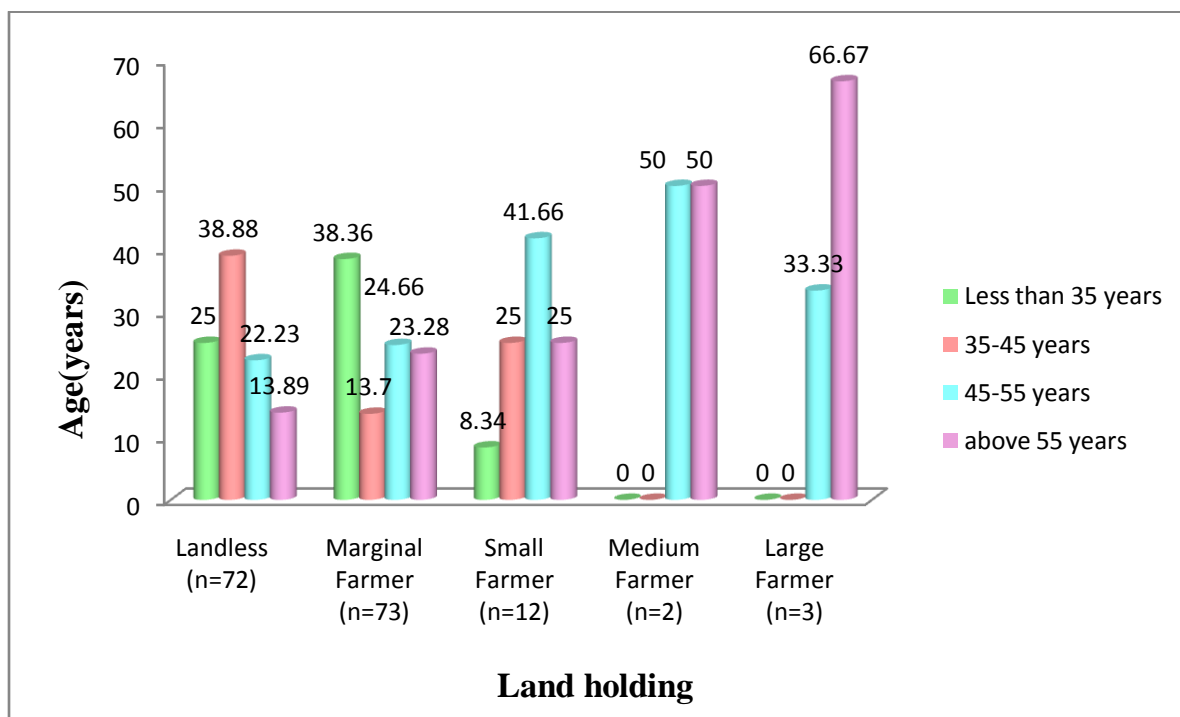
It is clear from Table 1.5 that more than forty five per cent respondents were living in mixed type of houses i.e. Kachcha and Pacca mixed while approximately 26.87 per cent and 27.50 per cent respondents were having Kachcha type and Pacca type house respectively.



**Table 1.6:-** Distributions of Respondents on the Basis of Type of land holding

S.No	Type of land holding	Frequency	Percentage
1	Landless	70.00	43.75
2	Marginal Farmer(Less than 1ha)	73.00	45.62
3	Small Farmer (1-2ha)	12.00	07.50
4	Medium Farmer(2-4ha)	02.00	01.25
5	Large Farmer(4ha and above)	03.00	01.87
	<b>Total</b>	<b>160.00</b>	<b>100.00</b>

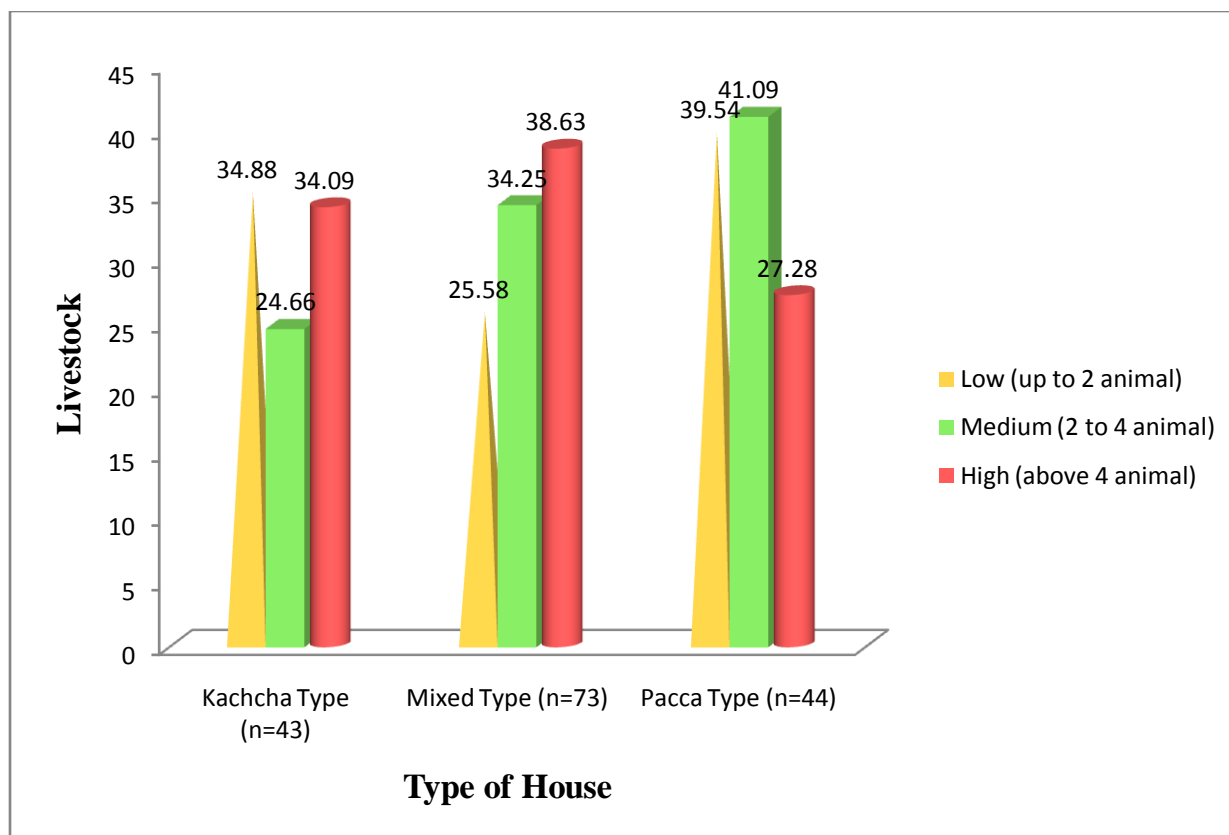
Land holding has direct bearing upon economic condition of family. Enquiry regarding land holding revealed that more than forty three per cent respondents were falling in landless and 45.62 per cent were in marginal farmer category respectively. While about eight per cent respondents were from small farmers group. Two respondents identified from medium farmer category, whereas about two per cent respondents were from large farmer category. **Fig. 02** explicit that majority of small farmers were belonging to the age group 45- 55 years and large farmer were belonging to above 55 years.

**Fig. 02:-** Land Holding of the Respondents According to Age**Table 1.7:-** Distributions of Respondents on the Basis of Livestock

S.No	Livestock	Frequency	Percentage
1	Low (up to 2 animal)	80.00	50.00
2	Medium (3 to 4 animal)	61.00	38.12
3	High (above 4 animal)	19.00	11.87
	<b>Total</b>	<b>160.00</b>	<b>100.00</b>

The data presented in Table 1.7 reveals that fifty per cent respondents were having up to 2 animals and falling in low category followed by 38.12 per cent respondents having 2-4 animals and belonged to medium category. About twelve per cent respondents had more than 4 animals and thus belonging to high category in holding the livestock. It is very clear from **Fig. 03** that majority respondents were holding up to two animals and living in kachcha house while medium (2 to 4 animals) and high (above 4 animals) livestock holding respondents were living in pacca house.





**Fig. 03:-** Distribution of Livestock on the Basis of Type of House Existing

**Table 1.8:-** Distributions of Respondents on the Basis of Materials Possessed  
N=160

S.No.	Materials possessed	Frequency	Percentage
1	Improved Smokeless Chulha	134.00	83.75
2	Gas connection	66.00	41.25
3	Mixer Grinder	12.00	07.50
4	Refrigerator	08.00	05.00
5	Solar Cooker	-	-
6	Sewing machine	24.00	15.00
7	Television	46.00	28.75
8	Tape recorder/cd player	30.00	18.75
9	Mobile phone	106.00	66.25
10	Fan	60.00	37.50
11	Wooden Furniture	14.00	08.75
12	Others	40.00	25.00

Table 1.8 dealing with material possessed by selected respondents revealed that majority (83.75%) of respondents having improved smokeless chulha followed by 66.25 per cent respondents were having mobile phone. About forty one per cent respondents were having gas connection in their homes while little less i.e. 37.50 per cent respondents were having fans. More than twenty five per cent respondents were having television, whereas about nineteen per cent respondents were having tape recorder/CD player. Fifteen per cent respondents were having sawing machine in their homes while about nine per cent respondents were having wooden furniture. Minimum, only five per cent respondent were having refrigerator, whereas 7.50 per cent respondents were also possessing mixer and grinder. About one quarter respondents were having other materials like cycles, solar panel and washing machine etc.

### Conclusion:-

It can be concluded from the Tables that majority (40.00%) of heads of respondent's family were farmers, whereas,

forty per cent and 39.37 per cent respondents were having monthly family income less than Rs. 10,000 and Rs. 10001-15,000 respectively. More than sixty per cent respondents were from nuclear family and majority (59.37%) of respondents under study were having up to 5 members in their family. More than forty five per cent respondents were living in mixed type of houses and belonging to landless category. Fifty per cent respondents were having up to 2 animals and identified in low category. Majority (83.75%) respondents having improved smokeless chulha followed by 66.25 per cent respondents were having mobile phones. About forty one per cent respondents were having gas connection in their homes while little less i.e. 37.50 per cent respondents were having fans.

### References:-

1. **Agricultural Statistics at a Glance, Registrar General of India. (2004)**  
<http://agricoop.nic.in/statatglance2004/atglance.pdf>. Retrieved on 3rd September 2011 at 11.30 am
2. **Chobitkar, N.; Meshram, V. and Singh, K.K. (2013)** A Study on effect of socio-economic attributes (Age, Education and Caste) on adoption of the potato growers of shahdol District (MP). *Indian journal of research*. **5**(5): 307-309.
3. **Peer, Q.J.A.; Ahmad, N.; Kaur, J.; Chesti, M.N.; Ahmad, H.S.; Bhat, A. and Bhat, B.A. (2013)** Study on economics of potato growing towards livelihood security. *African Journal of Agricultural Research*. **8**(45): 5639-5644.
4. **Peer, Q.J.A.; Dar, M.A.; Malik, H.A. and Kaur, J. (2014)** Multiple regression analysis for adoption studies of potato growers in Jammu division. *Journal of Applied and Natural Science*. **6**(2): 664-671.
5. **Prakash, V. (2007)** Impact of socio-economic profile on potato growers. *Internat. J. Plant Sci.* **2**(1): 247-250.
6. **Rana, R.K.; Sharma, N.; Arya, S.; Kadian, M.S.; Singh, B.P. and Pandey, S.K. (2014)** Status of potato husbandry and farmer's socio-economic profile in moisture and heat prone karnataka, india. *Pak. J. Agri. Sci.* **51**(1): 7-16.
7. **Zafar, A.; Mukul, A.; Rayhan, S.J. and Hassan, M.M. (2013)** Farmer's profitability of potato cultivation at Rangpur district: the socio-economic context of Bangladesh. *International Journal of Economics, Finance and Management Sciences*. **1**(3): 136-144.



### RESEARCH ARTICLE

## EVALUATION OF GREEN AREAS ACCORDING TO THE DETERMINANTS OF URBAN BENEFITS AND, REFLECTION UPON “GREEN AREA STANDARDS”

Sema Karaguler

### Manuscript Info

#### Manuscript History

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green areas, green areas per capita, green area standards, urban planning, green urban areas, urban greenery.

### Abstract

Energy consumption that will affect our future is highly related to green areas in urban and the environment. Green areas have the qualities to reduce the energy consumption of cities as well as buildings. Therefore, green areas now are taking over much more missions than ever before.

In this paper, a different calculation method as “effecting green area” has been introduced depending on coefficients of different qualified green area groups according to their performances. This method is not determined new green area standard value, just put on reducing the green areas sizes as temporarily by purposing more efficiency on urban benefits.

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### Introduction:- The Importance of Green Area Planning

Energy consumption is the main subject that will affect the future of our World. International Energy Agency (IEA) declares that buildings are responsible for at least % 40 of the primary energy consumption and % 24 of the global carbon dioxide emission of the world (Mira, 2013).

In cities, building masses constitute the main part of the areas that we are settled. It is obviously true that each one of these building masses is an energy consumption source. That is the reason why as the masses increase, the energy consumption increases.

However, due to needs of civilisation, each day the need for these building masses is getting inevitable. Consequently, the subject of decreasing the energy consumption of building masses is getting more and more important.

As the result, the concept of decreasing the energy consumption by increasing the relation of building masses with nature is maturing.

This new concept is an economic and sustainable approach in harmony with nature.

This way of thinking diverts the architects and city planners to pay much more attention to the importance of sustainable architecture and urbanism and especially to the effect of plants on city life. “Green architecture,” “roof gardens,” “green terraces,” “vertical vegetation, etc. are designing approaches which are all included in the concept of “sustainability”. They are designings implying that the plants placed on buildings show that inside or around the cities the tendency to green is relatively increasing. Today, the effects of green terraces and green roofs decreasing the energy consumption regarding heat losses for buildings and indirectly for the cities are plainly noticed. For example, the importance of green on the building, reducing the value of the heat conduction coefficient of the

building envelope that is very effective on the construction of the energy efficient buildings is very often agreed upon (Voss, 213). In the same way, the positive effect of the green covered areas both on cities and surroundings in reaching the various objectives in lessening energy consumption can not be ignored. Various scientific works prove that these above mentioned positive effects are correct. The mentioned objectives are reducing noise, controlling of the wind and solar radiation and removing the environmental and visual pollution. Also, various positive effects of areas with green structures on the psyche- social subjects are very well known and accepted (Lyle, 1985).

All these developments show that the amount of green spaces in the city, open areas and providing the necessary standard of green area per capita are getting more and more important. That is why we may conclude that more detailed investigations must be made on this subject.

### **Performance of Green Area Standards in Planning:-**

The distribution of the green areas in and around the cities depend on one single standard value as the quantity of green area per person; at during preparation phase of the development plans. Not taking into consideration the functions and the qualifications at all, the area sizes are added up on each other on the m<sup>2</sup> basis and then the total is divided by the population of the city and as the result, the green area per person is obtained. The obtained amount of green area per person is checked by how much it is in compliance with the green area standards to be followed in urbanism discipline (Karagüler, 1983). In this respect, these are three critical issues that may be considered as problems that need attention:

1. Green area standards applications in our World differs from 2m<sup>2</sup>/person to 80m<sup>2</sup>/person. This huge variation in value causes and unprevented chaos. Consequently, the acceptable standard value of needed green area becomes flue and a standard value that can be accepted as satisfactory can not be obtained (Yıldızci, 1982).
2. The distribution of green spaces in and surroundings of the cities follow a special hierarchy. A city may be rich in mountainous, rough, historical and /or archaeological conditions. In this case, the distribution mentioned above, can not often be provided especially in the cities developing from the past till today.
3. Green areas with various functions have various factorial values like “ The amount of green surfaces”, “usability” etc. The problem is that these different values of green areas have not been evaluated regarding benefits to the city and have not been reflected in planning.

The sufficiency of green areas in the development plan, regarding all the benefits of them to the cities, especially energy control can be clarified by solutions of these three issues.

The required standard of the first subject can be determined by taking the city groups in the World showing common standards into consideration. That determination can only be done by the decisions and certain assumptions of city planners by examining the economic, geographical and social specialities of the planning area (Karagüler, 2004). However, the solution requires a detailed evaluation.

As the second issue, even if the total green area is numerically suitable to the determined standard; the distribution in the city and around may not be planned as hierarchical. This problem can be solved again by city planners; taking city planning discipline as the main concept and regarding the developing tendency of the planned area by giving priority to green area hierarchy and can only be solved by a conscious planning.

The third important point is; even if a proper planning has been done for the first and second points; the planned green facilities may not be evaluated and calculated considering green area performance. In other words, even if a standard is provided and a green hierarchy system is built up at the planned area; the planned green areas may not be evaluated regarding the usefulness of the green area effectiveness to the city. The solution to this subject will be explained in this article, by proposing an effective green area evaluating method.

### **Effective Green Area Method:-**

The approach mentioned above will be explained by proposing the “ Effective Green Area Method.” This method depends on reducement of green area bignesses to effective green area bignesses. The “Effective Green Area” concept will be explained at below. Following the explanation, the phases of the method will be put forward for consideration.

**Effective Green Area Concept:-**

When the subject is considered in regards to the effectiveness of the green areas, have quite a lot in number and various benefits. The characteristics of these areas change by the effects of various factors. As very well known, because of their qualifications, the green areas on the plan may be as big as other green areas; but may not perform the same green area performances. The distinction of active and passive green areas is not satisfactory necessarily to reveal these different performances. Some active green areas are closed to public like building gardens. In the same way, some passive green areas are closed public because of their different statuses like Consulate gardens or military green areas although they have intensity green tissues. Usability of green area is so important as well. So, the subject is the benefit of cities from the green areas; the main reason of this matter may be explained by two factors. These factors must be the quantity of planted surfaces in the green areas (Schipperijn *et al.* 2010a) and the public ownership. Therefore, the effect of some subfactors determined by the mentioned two main factors should be reflected in city planning to show out the effectiveness of the green area species. The samples of green areas with different quantity of green tissues are illustrated in figure 1 and 2. In this respect, we may determine ratios considering the effects of the factors mentioned above. These ratios are multiplied by the sum of green areas, and new area bignesses are obtained. They should be considered as effective green area values. In this respect, the control of the standard of green area per person should be made by using effective green areas.

Consequently, this article defends that; in city planning, the calculation of effective green areas should be done according to the main factors determining the benefits of green areas in cities. Then it is emphasised that green areas should be evaluated by considering their suitability degree to the mentioned main factors and then calculated regarding the effective green area values. In other words, the article claims that at first the bignesses of areas having green area status on the plan must be reduced to different values considering green performance and then their appropriateness to the standard should be controlled (Figure 1 and Figure 2).



**Figure 1:-** Poor Vegetated Green Areas Examples From Istanbul.



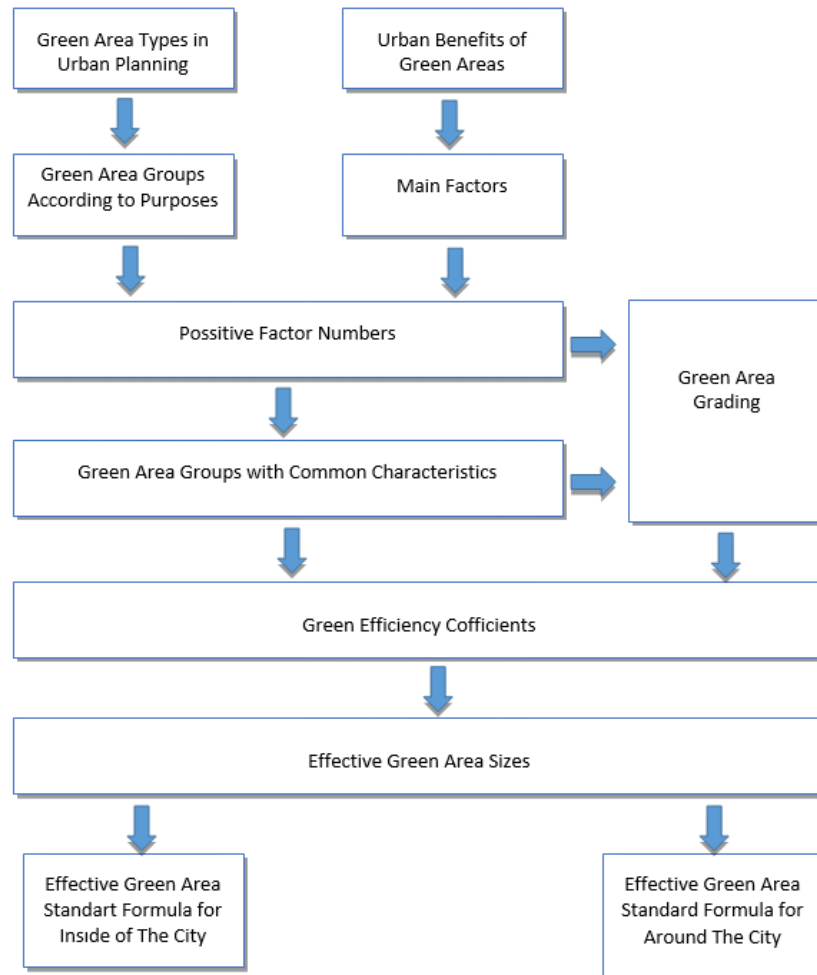
**Figure 2:-** Dense Vegetated Green Areas Examples From Barigui.

**The Stages of Effective Green Area Method:-**

The method contains the following steps in succession:

1. Determination of green area types
2. Determination of positive factor numbers
3. Determination of green efficiency coefficients
4. Determination of green area sizes

Figure 3 shows the “Flowing Scheme of the Effective Green Area Method” prepared in compliance with the steps mentioned above.



**Figure 3:-** Flowing Scheme of the Effective Green Area Method.

#### **Determination of Green Area Types and Positive Factor Numbers:-**

Green areas have various functions in respect with usage aims of their times. The aims depend on upon the visiting reasons of the time (Schipperijn *et al.* 2010b). For that reasons, the green areas in and around the city can be grouped in functions in compliance with today's objectives as follows:

1. Green areas for resting purposes
2. Green areas for gardening use
3. Green areas for sports and play facilities
4. Green areas for entertaining purposes
5. Green areas for agricultural purposes
6. Green areas with spatial status

During the determination of six main groups, the existing groupings are taken into consideration with literature and discipline subjects and also, new groups are added to the present day's conditions (Çetiner, 1979), (Öztürk, 2004), (Germann and Seeland, 2002).

The green area types forming the above-mentioned main groups are shown in Table 1.

**Table 1:-** Factor Numbers for Green Spaces.

Function	Green Areas	Place in the Plan		Factors									Positive Factor Number
	Species	In the City	Around the City	Expropriation Obligation	Low User Density	Usability	Lack of Solid Ground Rate	Possibility of Low Construction Density	Active Usage	Protection of Natural Environment Impression	Contribution to Ecological Improvement	Plurality of Plant Diversity	
RECREATIONAL AREAS	Wooded Areas	+	+	+	+	+	+	+	-	+	+	+	8
	State Woods	+	+	+	+	+	+	+	-	+	+	+	8
	Private Woods	+	+	-	+	-	+	+	-	+	+	+	6
	State Forests	-	+	+	+	-	+	+	-	-	+	+	8
	Private Forests	-	+	-	+	-	+	+	-	-	+	+	6
	Cemeteries	+	+	+	+	-	-	+	+	+	+	+	5
	Neighborhood Parks	+	-	+	+	+	+	+	+	+	-	+	9
	District Parks	+	-	+	+	+	+	+	+	+	-	+	9
	City Parks	+	-	+	+	+	+	+	+	+	-	+	9
	Regional Parks	-	+	+	+	+	+	+	+	-	+	+	9
	National Parks	-	+	+	+	+	+	+	+	-	+	+	9
	Roadside Parks	-	+	+	+	+	+	+	+	-	+	+	9
	Refuges	+	+	+	+	-	+	+	-	+	-	+	7
	Squares- Pedestrian Areas	+	-	+	-	+	-	+	+	+	-	-	5
	Nature Parks	-	+	+	+	+	+	+	+	-	+	+	9
GARDENS	Dwellings and Other Buildings Gardens	+	-	-	+	-	+	+	+	+	-	+	7
	Public Teahouse	+	-	+	-	+	-	-	+	+	-	-	4
	Private Teahouse	+	-	-	-	+	-	-	+	+	-	-	3
	Playgrounds	+	-	+	-	+	-	+	+	+	-	-	5
	Zoos	-	+	+	+	+	-	-	+	-	+	+	7
	Botanic Gardens	+	+	+	+	+	+	+	-	+	+	+	8
	Arboretums	-	+	+	+	+	+	+	-	-	+	+	8
PLAY-SPORT AREAS	Stadiums	+	+	+	-	-	-	-	+	+	+	-	3
	Public Outdoor Water Sports Areas	+	+	+	-	+	-	-	+	+	+	-	3
	Private Outdoor Water Sports Areas	+	+	-	-	-	-	+	+	+	+	-	2
	Public Volleyball, Basketball, Tennis Areas	+	+	+	-	-	-	+	+	+	-	-	4
	Private Volleyball, Basketball, Tennis Areas	+	+	-	-	-	-	+	+	+	-	-	2
	Archery, Golf, etc. Areas	-	+	-	-	+	+	+	+	-	+	+	7
	Horse Racing Tracks and Stud Farms	-	+	-	-	-	-	+	+	-	+	-	3
	Climbing and Hunting Areas	-	+	+	+	+	+	+	-	-	+	-	7
ENTERTAINMENT AREAS	Picnic Areas	-	+	+	+	+	+	-	+	-	+	-	7
	Outdoor Show Areas	-	+	+	-	+	-	-	+	-	+	-	3
	Public Amusements, Theme parks	+	+	+	-	+	-	-	+	+	+	-	4
	Private Amusement, Theme parks	+	+	-	-	+	-	-	+	+	+	-	3
	Fair Areas	-	+	+	-	+	-	-	+	-	+	-	4
	Outdoor Market Places	+	-	+	-	+	-	-	+	+	-	-	4
	Beach and Coastal Areas	-	+	+	-	+	-	-	+	-	+	-	4
AGRICULTURE-CULTIVATED AREAS	Public Plant Nursery	-	+	+	+	-	+	-	-	-	+	+	7
	Private Plant Nursery	-	+	-	+	-	+	-	-	-	+	+	4
	Kaleryards	-	+	-	+	-	+	+	-	-	+	-	4
	Vineyards and Orchards	-	+	-	+	+	+	+	-	-	+	+	7
	Apple Orchards and Olive Groves	-	+	-	+	+	+	+	-	-	+	+	7
	Crop Fields	-	+	-	+	-	+	+	-	-	+	-	4
	Greenhouse Areas	-	+	-	-	-	-	-	-	-	+	-	2
GREEN AREAS IN SPECIAL SITUATION	Military Green Areas	+	+	+	+	-	+	+	-	+	+	+	7
	Consulates Gardens	+	-	-	+	-	+	+	-	+	-	+	6



The main factors that will determine the suitability degrees of the green area types can be presented in relation to the environmental and urban benefits of the green areas.

Today, the environmental and urban benefits of the green areas may be listed briefly as follows:

1. Protection of ecological balance
2. Control of the solar radiation and wind
3. Prevention of environmental pollution (air, visual, noise, etc.)
4. Control of natural disasters (flood, erosion, earthquake, etc.)
5. Fulfillment of open air social activities
6. Providing of psychological satisfaction (improvement of mental health, rest, touristic actions, getting in close touch with nature, focusing on human scale) (Schipperijn *et al.* 2010b), (Karagüler, 1993)

These benefits such as protection of ecological balance, control of the wind and solar radiation, prevention of environmental pollution and control of natural causes can only be provided at green areas with intense green tissue. Environmental and urban benefits directed towards psychological satisfaction such as resting, getting close to nature, focusing on human scale and improvement of mental health; can be provided if the use of the green is open for public use and concentrated green tissue. Taking these evaluations into consideration, the factors affecting the values such as the concentration of green tissue on green areas and being open to public use only be determined by the main effective factors provide the urban and environmental benefits of green areas. Green tissue concentration on green areas varies according to factors mentioned below:

1. The amount of construction
2. The ratio of hard ground
3. Density of users
4. Diversity of plants
5. Difference of plant sizes
6. Preservation of natural surrounding impression

The use of green areas open to public change in respect to three main factors mentioned below:

1. Being in possession of public
2. Usability
3. Being active

On this green space if the amount of construction and ratio of the hard ground is plenty the areas covered with green tissue will be accordingly small. On the other hand, as the user density gets higher, it will become harder and harder to keep the ratio of green tissue high. The increase in the diversity of plants and difference of plant sizes depend on the highness of the concentration of green tissue. Therefore, these factors may be accepted as the main factors of protection of ecological balance, improvement of urban climate, contribution to urban landscape and prevention of noise in the achievement of urban and environmental benefits of green spaces. While arranging the green areas using natural and especially materials and objects made of plants increase the density of green. At the same time, it plays a very efficient role in providing all the benefits of psychological satisfaction because it was not disturbing the impression of natural atmosphere and characteristic. On the other hand, urban citizens can only use this green area type if the ownership belongs to the public. The usage of private and judicial owned green areas is very limited because they do not belong to the public. Areas like pedestrian refuges, military green areas and small woods belonging to the foreign country representatives have special statuses and special place in the planning area. For those reasons, these green areas are closed to direct public use, and this plainly shows the importance of the “usability” factor.

Considering the analyses mentioned above the nine main factors that are listed below can be determined in providing urban and environmental benefits for green area types:

1. Expropriation obligation
2. Usability
3. Lack of “solid ground rate.”
4. Possibility of low-density construction
5. Low user density
6. Active usage
7. Plurality of diversity of plants



8. Variety of plant heights
9. Protection of natural environment impression

“ Positive Factor Numbers” are determined by evaluating the appropriateness of these factors to each green area type. In this case, green areas can be categorised gradually in respect to positive factor numbers as shown in Table 1.

#### Determination of Green Efficiency Coefficient for Green Areas:-

In planning, it has been considered necessary that green area types in and around the city should be classified into two main groups as shown in Table 1 (Ratcliffe, 1974). Considering the determined factors and positive factor numbers as mentioned in the second section; green area types in and around the cities show common green area characteristics forming different groups of green area types. For this reason, the green area types are grouped considering the common features ( see Table 2 and 3). In another study, starting from the biggest to the fewest, a green area grouping with different percentages is prepared as good, moderate, poor and barren (Wang *et al.* 2014). In this mentioned study green area categorisation is made using the filtering percentages of green tissues and depending on the water filtering capacity. At the result, the importance of covered with plants is emphasized. In this article, priority is given to spaces covered with plants while classifying the groups. However, also, other factors determining the benefits of the green areas to the cities explained in chapters 3,2 and 1. are taken into consideration. In each one of the green areas groups with common characteristics formed by this method, the positive factor numbers of the green area types will be equal or very close to equal.

**Table 2:-** Efficiency Percentage of Green Areas in the City.

QUALITY		GREEN AREAS IN THE CITY	WITHIN STANDART	CODE NO	POSITIVE FACTOR NUMBER	I. DEGREE GREEN AREAS	II. DEGREE GREEN AREAS	III. DEGREE GREEN AREAS	IV. DEGREE GREEN AREAS	GREEN EFFICIENCY %
A	Public Spaces With Plenty of Green Area	Neighborhood Parks	+	A <sub>1</sub>	9	X				100
		District Parks	+	A <sub>2</sub>	9	X				
		City Parks	+	A <sub>3</sub>	9	X				
		Botanic Gardens	+	A <sub>4</sub>	8	X				
		State Woods	+	A <sub>5</sub>	8	X				
		Wooded Areas	+	A <sub>6</sub>	8	X				
B	Spaces with Plenty of Green Without Public Usage	Military Green Areas	-	B <sub>1</sub>	7		X			75
		Dwellings and Other Buildings Gardens	-	B <sub>2</sub>	7		X			
		Refuges	-	B <sub>3</sub>	7		X			
		Private Woods	-	B <sub>4</sub>	6		X			
		Consulates Gardens	-	B <sub>5</sub>	6		X			
C	Public Spaces with Partial Green Areas	Cemeteries	+	C <sub>1</sub>	5			X		50
		Squares and Pedestrians Areas	+	C <sub>2</sub>	5			X		
		Playgrounds	+	C <sub>3</sub>	5			X		
		Outdoor Market Places	+	C <sub>4</sub>	4			X		
		Public Teahouse	+	C <sub>5</sub>	4			X		
		Public Amusements and Themeparks	+	C <sub>6</sub>	4			X		
D	Rekreational Open Spaces with Little Green Areas	Private Teahouse	-	D <sub>1</sub>	3				X	25
		Public Outdoor Water Sports Areas	+	D <sub>2</sub>	3				X	
		Public Volleyball, Basketball, Tennis Areas	+	D <sub>3</sub>	3				X	
		Private Amusement ve Themeparks	-	D <sub>4</sub>	3				X	
		Private Volleyball, Basketball, Tennis Areas	-	D <sub>5</sub>	2				X	
		Private Outdoor Water Sports Areas	-	D <sub>6</sub>	2				X	
		Stadiums	+	D <sub>7</sub>	2				X	

**Table 3:-**Efficiency Percentage of Green Areas in the City.

QUALITY	GREEN AREAS IN THE CITY	WITHIN STANDART	CODE NO	POSITIVE FACTOR NUMBER	I. DEGREE GREEN AREAS	II. DEGREE GREEN AREAS	III. DEGREE GREEN AREAS	IV. DEGREE GREEN AREAS	GREEN EFFICIENCY %
E	Public Spaces with Plenty of Green Areas	National Parks	+	E1	9	X			100
		Regional Parks	+	E2	9	X			
		Nature Parks	+	E3	9	X			
		Roadside Parks	+	E4	9	X			
		State Woods	+	E5	8	X			
		Arboretums	+	E6	8	X			
		Botanic Gardens	+	E7	8	X			
		Wooded Areas	+	E8	8	X			
		State Forests	+	E9	8	X			
F	Public Green Spaces Lacking Usability of Green Tissue	Picnic Areas	+	F1	7		X		75
		Climbing and Hunting Areas	+	F2	7		X		
		Zoos	+	F3	7		X		
		Public Plant Nursery	+	F4	7		X		
		Vineyards and Orchards	-	F5	7		X		
		Apple Orchards and Olive Groves	-	F6	7		X		
		Military Green Areas	-	F7	7		X		
		Refuges	-	F8	7		X		
		Private Forests	-	F9	6		X		
		Private Woods	-	F10	6		X		
		Archery, Golf, etc. Areas	-	F11	6		X		
G	Green Spaces Lacking of Usability or Landscape Contribution	Cemeteries	+	G1	5			X	55
		Kale yards	-	G2	4			X	
		Crop Fields	-	G3	4			X	
		Private Plant Nursery	-	G4	4			X	
		Fair Areas	+	G5	4			X	
		Beach and Coastal Areas	+	G6	4			X	
		Public Amusements and Theme Parks	+	G7	4			X	
		Public Volleyball, Basketball, Tennis Areas	+	G8	4			X	
H	Recreational Open Spaces with Little Green Lacking Landscape Contribution	Outdoor Show Areas	+	H1	3				35
		Stadiums	+	H2	3				
		Horse Racing Tracks and Stud Farms	-	H3	3				
		Public Outdoor Water Sports Areas	+	H4	2				
		Private Amusement, Theme parks	-	H5	2				
		Private Outdoor Water Sports Areas	-	H6	2				
		Private Volleyball, Basketball, Tennis Areas	-	H7	2				
		Greenhouse Areas	-	H8	2				

Common characteristic groups of “green areas in city”:

1. Public Spaces with plenty of green areas
2. Spaces with plenty of green areas but without public usage
3. Public spaces with partial green areas
4. Sports, entertainment and rest areas with little green areas

Common characteristic groups of “green areas around the city”:

1. Public spaces with plenty of green areas
2. Green areas lacking an adequate level of usability or green tissue
3. Green areas lacking usability and landscape contribution
4. Recreational open spaces with little green area lacking landscape contribution

The breakdown of green areas that the groups of characteristics contain are shown in Tables 2 and 3 with the positive factor numbers. If a grading is prepared from green area-specific groups with high factor numbers to green area-specific groups with low factor numbers:

1. Group A is green areas in city with positive factor numbers 9 and eight as 1st degree
2. Group B is green areas in city with positive factor numbers 7 and six as 2nd degree
3. Group C is green areas in city with positive factor numbers 5 and four as 3rd degree
4. Group D is green areas in city with positive factor numbers 3 and two as 4th degree

**In the same way:-**

1. Group E is green areas surrounding the city with positive factor numbers 9 and eight as 1st degree
2. Group F is green areas surrounding the city with positive factor numbers 7 and six as 2nd degree
3. Group G is green areas surrounding the city with positive factor numbers 5 and four as 3rd degree
4. Group H is green areas surrounding the city with positive factor numbers 3 and two as 4th degree
5. These determinations above are accepted grading for green areas in and around the city.

Assuming that the accepted performances of the highest degree green areas will be the highest considering the green areas; a “Green Efficiency Coefficient” should be defined reflecting the performances of the characteristic groups of all green areas with certain hierarchy and percentage ratios. In short, “Green Efficiency Coefficient” can be explained as the expected performance degree from green areas and determined by the percentage ratio. This coefficient is revealed as parallel to the green area gradation determined according to the numbers of positive factor describe in the second section. “Green Efficiency Coefficients,” are shown in Tables 2 and three separately for green area groups in and around the city.

It can be clearly seen that the green areas, both in and around the city, four different green area hierarchy is valid. In this case, green efficiency coefficient for the first-degree green areas (highest factor number being 8 and 9) may be accepted as % 100. Then the average unit ratio per each factor number can be calculated as 11,76 ( $100 / 8,5$ ). When this value is multiplied by the average positive factor numbers of the 2nd, third and 4th-degree green areas; the green efficiency coefficients can be obtained. To show it more clearly:

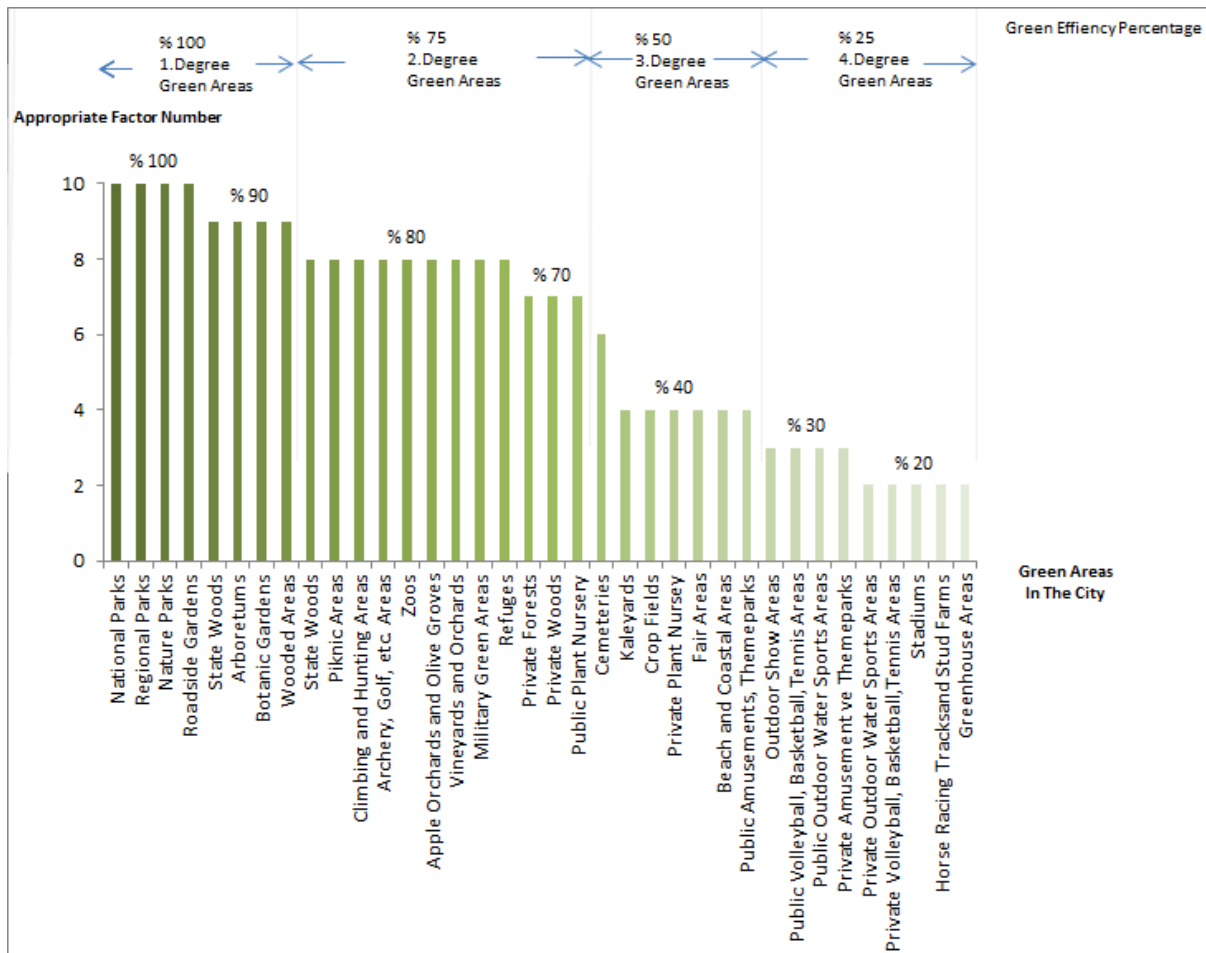
1. The green efficiency coefficient is approximately % 29 ( $11,76 \times 2,5$ ) for fourth-degree green areas with positive factor number 2 and 3.
2. The green efficiency coefficient is approximately % 52 ( $11,76 \times 4,5$ ) for third-degree green areas with positive factor number 4 and 5.
3. The green efficiency coefficient is approximately % 76 ( $11,76 \times 6,5$ ) for second-degree green areas with positive factor number 6 and 7.

These values can be considered as % 25, % 50, and % 75 for easy calculation in practice.

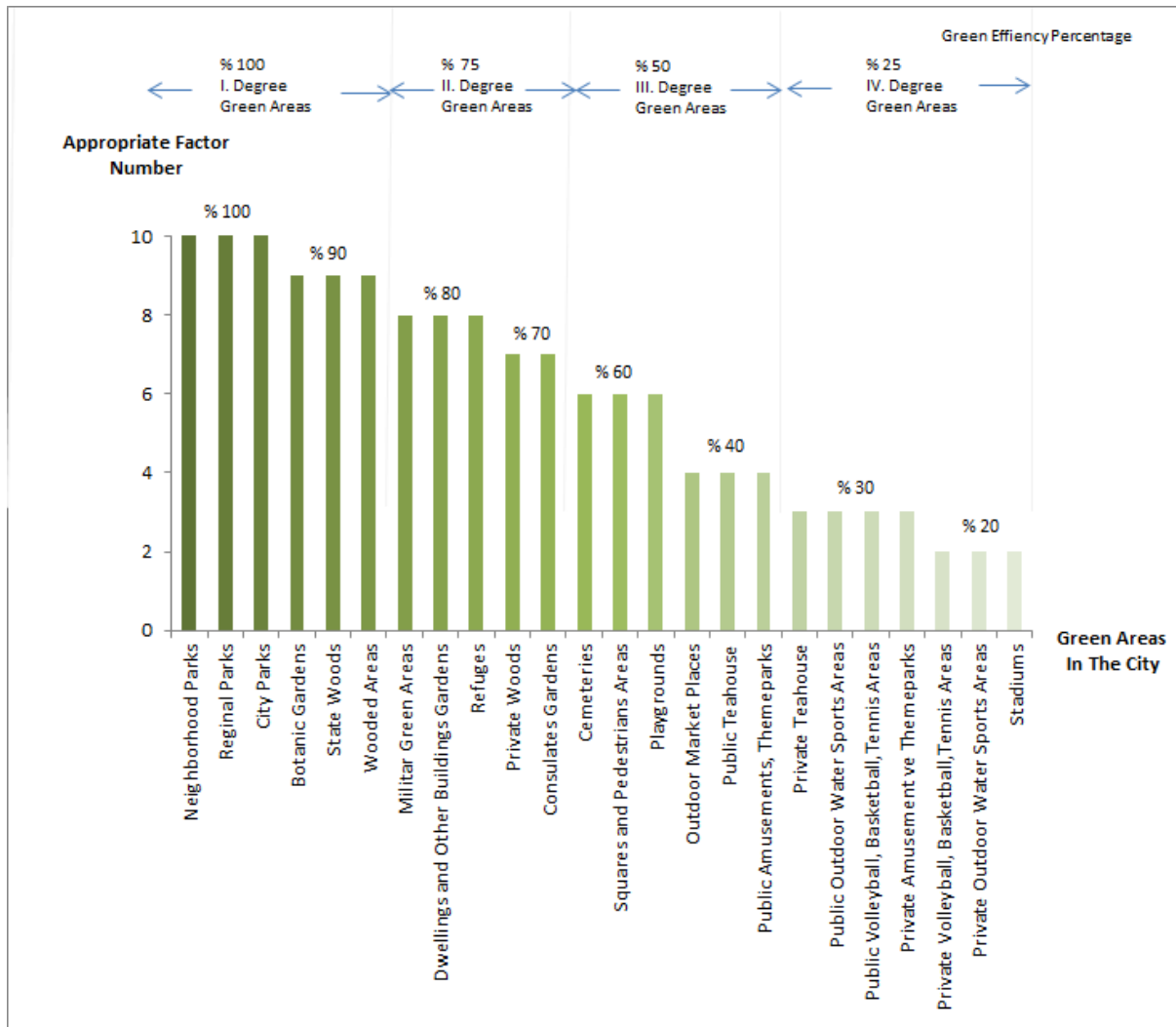
As the result, with respect to the above determinations, the green efficiency coefficients in and around the cities, starting from the highest to the lowest can be categorized as follows: (see Table 2 and 3).

1. % 100 for first-degree green areas
2. % 75 for second-degree green areas
3. % 50 for third-degree green areas
4. % 25 for fourth-degree green areas

Figures 4 and 5 indicate the distributions of green area types, classified in and around the city; showing the effective values of “Green Efficiency Coefficient” with respect to the green area characteristics.



**Figure 4:-** Green Areas Efficiency Percentage Distribution Graph in the City based on Factor Numbers.



**Figure 5:-** Green Areas Efficiency Percentage Distribution Graph around the City based on Factor Numbers.

#### Determination of Effective Green Area Sizes:-

As explained above, the sums of green area sizes of 1st, 2nd, third and 4th degrees are the sums of A+ B+ C+ D in the cities and E + F + G + H around the cities. Their actual openings in and around the city can be seen in Tables 2 and 3.

#### In the city:-

1. Public Areas with Plenty of Green:  $A = A_1 + A_2 + A_3 + A_4 + A_5 + A_6$  ( Green Efficiency Coefficient : % 100 )
2. Areas with Plenty of Green but Without Public Usage:  $B = B_1 + B_2 + B_3 + B_4 + B_5$  ( G.E.C : % 75 )
3. Public Areas with Partial Green:  $C = C_1 + C_2 + C_3 + C_4 + C_5 + C_6$  ( G.E.C : % 50 )
4. Recreational Open Areas with Little Green:  $D = D_1 + D_2 + D_3 + D_4 + D_5 + D_6 + D_7$  ( G.E.C : % 25 )

#### Around the city:-

1. Green Areas with Plenty of Green and High Usage:  $E = E_1 + E_2 + E_3 + E_4 + E_5 + E_6 + E_7 + E_8$  ( Green Efficiency Coefficient: % 100)
2. Public Green Areas Lacking an AduquateLevel of Usability or Green Tissue:  $F = F_1 + F_2 + F_3 + F_4 + F_5 + F_6 + F_7 + F_8 + F_9 + F_{10} + F_{11} + F_{12}$  ( G.E.C : % 75 )
3. Green Areas Lacking Usability and Lanscape Contribution:  $G = G_1 + G_2 + G_3 + G_4 + G_5 + G_6 + G_7$  ( G.E.C : % 50 )
4. Recreational Open Areas with Little Green and Lacking Landscape Contribution :  $H = H_1 + H_2 + H_3 + H_4 + H_5 + H_6 + H_7 + H_8 + H_9$  ( G.E.C : % 25 )

If all of these green area sizes should be transformed into effective green area sizes, each one of the green area size in green area group must be multiplied by the above-mentioned “Green Efficient Coefficient.”

In this case, the sizes of effective green areas in and around the city are formulated as follows:

Total effective green area sizes in city =  $A + 0,75 B + 0,50 C + 0,25 D$

Total effective green area sizes around the city =  $E + 0,75 F + 0,50 G + 0,25 H$

### **Formulation of Green Area Standart by Effective Green Area Method:-**

Green area standard is explained as the green area size per capita in the planned area. The value that this standard will get shows differences depending on the cities and countries according to the planning conditions and applications. The definition of this standard value and the problems in reaching the mentioned standard value are detailly explained in Chapter 2.

In this article, the standard value determined as the green area size per capita in planning is not noticed. Highlighted topic is the way to calculate it by the effective green area view in fact. For this aim, a new calculation system has been brought as “Effective Green Area Method”. The “green area size capita” used as “green area standard” can be formulated below as “effective green area size per capita” as explained above considering effective green area sizes.

Effective Green Area Standard (E.G.A.S) = Green Area Size x Green Efficiency Coefficient / Population

Therefore, the formulas of the effective green area standard per person are obtained by dividing the effective green area sizes in and around the city to the population of the planning area, as explained above. Those formulas are below:

$$\text{E.G.A.S}_{\text{in city}} (\text{m}^2 / \text{person}) = (A + 0,75 B + 0,50 C + 0,25 D) / \text{population} \quad (1)$$

$$\text{E.G.A.S}_{\text{around the city}} (\text{m}^2 / \text{person}) = (E + 0,75 F + 0,50 G + 0,25 H) / \text{population} \quad (2)$$

In reality, generally in urban conception, a green area standard value per person is not used for around the city. The green area types around the city as mentioned in Table 3, are generally found in the green belt surrounding the city. The reason for this is because the green belt around the city is the belt which protects the city. Therefore the green tissue belong this belt is also under protection.

Still, nowadays, considering some mega-cities such as Tokyo, Sydney, and Beijing, there is no success so much for the protection of green belts from activities and construction (Ratcliffe, 1974). Whereas, these areas are green areas where citizens can use for long periods. That is why their efficiency in city life is vital. For this reason, considering their positive effect on the city, their necessity can not be denied. So, if a standard value should be used in the concept of the green areas around the city; the green area sizes that will be used in the standard calculation, must be calculated by the effective green area method, just like the green areas in the city.

Determined formulas (1) and (2) are very flexible in adding or extracting, various green area types to planning as can be understood by the formation of the effective green area method as well. The important main idea is into which group the mentioned green area type should be included.

### **Evaluation and Discussion:-**

Concerning the planning discipline, areas with a green character belonging to private possession are not included in determined green area standard per person. The reason is that considering both the construction regulations and the urban planning discipline; the green areas in the city are accepted as public owned places assigned for general services (Gül, 2001).

On the contrary in this article, private green areas especially in the city such as houses and establishment gardens (Erkun, 1999) with expropriation obligation factor negative; are included into green areas when calculating the efficient green area standard. Because these mentioned areas own positive values for different characteristics other than the “expropriation obligation” factor. For that reason, even though they can not completely be used by the public, that kind of green areas; have the green area performance of their green efficiency coefficient ratio determined by this method.

Also, the areas of private status like the military green areas and green areas of foreign representatives; although closed for public use; are %100 include to the determined green area standard conventionally used. The efficient green area calculation explained in this article eliminates the contradiction by including such areas into the total green area by the green efficiency coefficient rate.

In this article, green areas have been grouped according to the green efficiency coefficients that explained above for their benefits to urban. However, in this regard that kind of mistake should not be done like “low green efficiency coefficient” means poor green quality. Because, no matter what type, every kind of green area is essential for urban with its function. That is why all kinds of green areas are not given up in planning. Green efficiency coefficient explained in this paper, reveals the importance of two main factors as the amount of green tissue and opening to public use regarding their benefits to city climate and energy-saving. Therefore, Efficiency Green Area Standard (E.G.A.S) must be used in a sense of efficiency of green control together with green area standard conventionally used.

Consequently, in this article, a more efficient method is proposed to reach the green area standard accepted legally and by discipline in planning. A brand new green area standard value is not determined.

As very well known, all of the green area types do not need to take place in every planning area. Certain green area types can only take place in in the planning area concerning characteristics such as population etc. The emphasis in this article is, determining the weights of green area types regarding opening to public use and green tissue amount shall be included in the standard.

As long as the planned urban settlement area gets large, some of the green areas around the city or almost all just as in the metropolitan areas may stay in the city. Such a case will cause no difference in the calculation; the mentioned green area type will be included in urban green area formula with its green efficiency coefficient.

Therefore the two different effective green area standard formulas suggested in this article can be simplified in practice and transformed into one formula. In this case, the sizes of effective green areas in the standard formula can be calculated as;  $(A+E) + \%75 (B+F) + \%50 (C+G) + \%25 (D+H)$  and divided by the area population. So, one single standard control can be made as effective green area per person.

Besides, in time, considering the improvements in life conditions such as new green area types and placing green on buildings, green roofs (Werthmann, 2007), etc. innovations can continuously be added. This method is in a structure that enables to determine the green efficiency coefficients of the new types by the determined factors.

This approach, on one side, by including all types of green areas into calculation; enables to increase the standard value of green areas in and around the city above the standard values applied up today. On the other hand, it will be much more useful concerning the performance of the planned green areas.

## Conclusions:-

1. The green area standard that should be obeyed in urban settlement planning depending on the size of the settlement must be divided into two sections being inside the city and around the city if needed.
2. Green areas can be evaluated in six general categories being resting, garden use, entertainment, games and sports, agriculture and private status.
3. Green areas have five main urban benefits being control of ecological balance, prevention of environmental pollution, control of natural disasters, fulfilment of social activities and psychological satisfaction.
4. The more green tissue and being open to public use characteristics; the more suitable are the green areas to urban end environmental benefits.
5. The nine main factors that are effective on the urban and environmental benefits of green areas are determined. These factors are; the obligation of expropriation, low user density, usability, lack of solid ground ratio, be active usage, a variation on heights of plants, low construction density, a plurality of diversity of plants and protection of natural environment impression.
6. Green area groups are evaluated according to the number of positive factors. Consequently being both insides of the city and around the city, four green area groups with varying positive factor numbers are determined.

7. When calculating the green area standards regarding m<sup>2</sup> per person, the sizes of green areas both in and around the city should be calculating considering the “green efficiency coefficients” that determine the green area performances.
8. The green efficiency coefficients of green area types are determined depending on the bigness of the positive factor numbers explained in this article. If the positive factor number increases, the green efficiency coefficient also increases.
9. Green area sizes in plans can be transformed into “effective green area sizes” if multiplied by green efficiency coefficients. In city planning divided the total of effective green area sizes pay the population of the plan we find the size of effective green area per person. Of course, it is a must to control if this value in compliance with the green area standard value conventionally used of the plan.
10. “Effective Green Area Standard” formulas have been developed as (1) and (2) for in and around the city. These formulas are improved by reducing the green areas coded with A, B,C,D,E,F,G and H shown in Table (1) and (2), into effective green area sizes by their green efficiency coefficients.
11. As explained in the “evaluation and discussion” section, if there is no need for distinction of in and around the city, this mentioned “Efficient Green Area Standard” formulas can be reduced to one single formula as follow:
12.  $E.G.A.S = [(A+E) + \%75 (B+F) + \%50 (C+G) + \%25 (D+H)] / \text{population of plan}$
13. Effective green size formula can be generalized as shown below:
14.  $E.G.A = \text{Green Area Size} \times \text{Green Efficiency Coefficient}$

### References:-

1. Çetiner, A. 1979.Şehir planlamasında Çalışma Yöntemleri ve İfade Teknikleri,İstanbul, İTÜ Mimarlık Fakültesi, Baskı Atölyesi, s.235-236
2. Erkün, S. 1999.Türk İmar Hukukunun Ana Çizgileri, İstanbul, Yapı Endüstri Merkezi Yayınları, Acar Matbaacılık A.Ş., s. 41-42
3. Germann-Chiari C, Seeland K. 2002.Are Urban Green Spaces Optimally Distributed to Act As Places For Social Integration? Results of a Geographical Information System (GIS) Approach for Urban Forestry Research, Forest Policy and Economics 6:3-13
4. Gül, A. 2001.Kentsel Açık- Yeşil Alanlar ve Isparta Kenti Örneğinde İncelenmesi,Isparta, Süleyman Demirel Üniversitesi,Orman Fakültesi Dergisi, Seri A, Sayı 2, ISSN:1302-7085, pp.27-48.
5. Karagüler, S. 1993. “Yapılaşma Sonucu Yeşil Alan Azalmasındaki Sakıncaların Giderilmesi İçin Binalarda Bitki Kullanımları”, Doktora Tezi, İstanbul,İTÜ, Fen Bilimleri Enstitüsü, s.33-36.
6. Karagüler, S. 2004. “Kent Planlamasında Yeşil Alan Gereksinimi”, Mimarist Dergisi, Sayı 11, s.103.
7. Lyle, T. J. 1985. “Design for Human Ecosystem: Landscape, Land Use, and Natural Resources”, Van Nostrand Reinhold, New York.
8. Mira, O. 2013. “Houses Think Green”, Instituto Monsa de Ediciones,S.A. Intro.
9. Öztürk, B. 2004.Kentsel ve Açık Yeşil Alan Sistemi Oluşturulması, Ankara, Ankara Üniversitesi, Fen Bilimleri Enstitüsü, Peyzaj Anabilim Dalı.
10. Schipperijn, J., Stigsdotter, U.K., Randrup, T.B.,Troelsen, J. 2010a.“Influences on the Use of Urban Green Spaces- A case study in Odense, Denmark”,Elsevier,Urban Forestry & Urban Greening 9: p.27.
11. Schipperijn, J. et al. 2010b.“Factors influencing the use of green space results from a Danish national representative survey”, Landscape and Urban Planning, Vol. 95, No. 3, 2010, p. 130-137
12. Ratcliffe, J. 1974.An Introduction to Town and Country Planning,London, The Anchor Press Ltd, s. 7-10.
13. Voss, K.,Musall, E. 2013.Net Zero Energy Buildings, EnOB, Detail Green Books, GmbH & Co. KG, Munich. p.139.
14. Wang, H.B. et al. 2014.Past land use decisions and socioeconomic factors influence urban greenbelt development: a case study of Shanghai, China,Landscape Ecology, 10/2014; DOI: 10.1007/s10980-014-0104-1
15. Werthmann, C. 2007.Green Roof – A case Study,PartI: Essay, The Reclamation of Roofs,New York, Princeton Architectural Press, s.18.
16. Yıldızci, A.C. 1982.“Kentsel Yeşil Alan Planlaması ve İstanbul Örneği”,Doğentlik Tezi, İstanbul, İTÜ Mimarlık Fakültesi Matbaası.



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### RESEARCH ARTICLE

## PROGNOSTIC AND PREDICTIVE SIGNIFICANCE OF PROGRAMMED DEATH LIGAND (PD-L1) AND FOXP3 EXPRESSIONS IN TUMOR CELLS AND TUMOR MICROENVIRONMENT IN OVARIAN CANCER PATIENTS

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### Abstract

**Background:** The microenvironment of epithelial ovarian cancer (EOC) continued to be an important point of research to discover new therapeutic targets for such malignancy. It was discovered that any cells that were in the microenvironment of the EOC may be associated with cancer prognosis like tumor-infiltrating lymphocytes (TILs) and T-regulatory cells (Tregs).

The PD-1/PD-L1 pathway was a T-cell checkpoint pathway that sent inhibitory signals to T cells that can inhibit immunity. PDL1, a PD-1 ligand, is detected in lymphocytes, dendritic cells, macrophages and tumor cells. Tregs (mature T lymphocytes) that start in the thymus after stimulation of naïve T cells and responsible for the reduction of autoimmune diseases, but its over production will inhibit endogenous protection against infection and tumors. Forkhead/winged-helix transcription factor box P3 (Foxp3) is an intracellular molecule for Tregs growth and maturation and was found to be the most specific Tregs marker. It was found that Foxp3 is not only found in Treg cells that originated in the thymus but also in malignant cells and its difference in expression can affect the outcome of cancer patients.

**Aim of our study:** was to assess PD-L1 and FOXP3 expression in epithelial ovarian carcinoma a trial to detect their prognostic value and their impact on survival in patients with such type of cancer.

**Methods:** The expressions of PD-L1 and FOXP3 in both tumor cells and stromawere evaluated in sections of 50 paraffin blocks that were retrieved from 50 patients with EOC using immunohistochemistry. We assessed the relation between their expressions, clinicopathological parameters, survival and prognosis of those patients

**Results:** Expression of PDL-1 in tumor cellswas positively correlated with; grade, stage of the tumor, LN metastasis ( $p=0.001$ ) and histopathological type (0.011), type of surgery and residual disease after surgery ( $P=0.010$ ). Expression of PDL-1 in TILswas positively correlated with grade ( $p = 0.033$ ) and stage of the tumor ( $p = 0.029$ ). Expression of FOXP3in tumor cellswas positively correlated with; age of the patients ( $p=0.017$ ), grade ( $p = 0.010$ ), stage of the tumor ( $p<0.001$ ) and distant metastases ( $p=0.002$ ). Whereas the expression of

FOXP3 in TILs was correlated with histological type ( $P=0.038$ ). Combined low PDL1 & FOXP3 expressions in tumor cells were significantly associated with higher progression free survival (PFS) ( $p<0.045$ ).

There were highly significant statistical relations were found between expression of each marker in tumor cells and Pdl1 in TILs and both Pdl1 & FOXP3 in TILs ( $p<0.001$ ).

There were highly significant statistical relations between expression of both markers in TILs and each one of the following ( Pdl1 in tumor cells ( $P<0.001$ ), FOXP3 expression in tumor cells ( $p=0.007$ ) and both markers in tumor cells ( $P<0.001$ )).

**Conclusion:** PD-L1 and FOXP3 are considered poor prognostic markers in EOC patients with bad impact on progression free survival.

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## Introduction:-

Epithelial ovarian cancer (EOC) is the 4<sup>th</sup> most common cancer in women. The serous and mucinous carcinoma are the commonest EOC subtypes (1). It was found that EOC microenvironment has an important role in its initiation, progression and prognosis (2). So it continued to be an important point of research to discover new therapeutic targets for such malignancy. The cells that were in the microenvironment of the EOC may be associated with a good or poor prognosis like tumor-infiltrating lymphocytes (TILs) and T-regulatory cells (Tregs) (3, 4).

The PD-1/PD-L1 pathway was a T-cell checkpoint pathway that sent inhibitory signals to T cells that can inhibit immunity (5). PD-L1, a PD-1 ligand named also B7 homolog 1 (B7-H1) or CD274, is detected in T lymphocytes, B lymphocytes, dendritic cells, macrophages and various tumor cells (6). PD-L1 expression and relation to both pathological, clinical parameters and prognosis were studied in many cancers, but the exact mechanism of how PD-L1 and its effect on tumor microenvironments can have a role in cancer immunity is not adequately understood (7). PD-L1 expression in EOC was not done in details and has many conflicting results (8).

Tregs are mature T lymphocytes that start in the thymus after stimulation of naïve T cells and responsible for the reduction of autoimmune diseases but their over production will inhibit endogenous protection against infection and tumors (9). Forkhead/winged-helix transcription factor box P3 (Foxp3) is an intracellular molecule specified for Tregs growth and maturation and was found to be the most specific Tregs marker (10). It was found that Foxp3 is not only found in Treg cells of thymus origin but also in cancer cells with different expression pattern which can affect the outcome of cancer patients (11). However, the role of Foxp3 in the prognosis of cancers is still a point of research, so FoxP3+ Tregs are investigated as a prognostic factor and they can be used as a novel therapeutic target.

**Aim of our study:** was to assess immunohistochemical expression of PD-L1 and FOXP3 in both tumor cells and stroma of epithelial ovarian carcinoma in a trial to detect their prognostic value and relation to survival of patients with such type of cancer.

## Patients and Methods

In our retrospective study fifty archived formalin fixed paraffin embedded blocks of EOC collected from Pathology Department, Faculty of Medicine, Zagazig University in the period from August 2011 to July 2015. We used the tumor-node-metastasis (TNM) and International Federation of Gynecology and Obstetrics (FIGO) classifications for staging of EOC and the WHO grading system for their pathologic grading (12,13). We identified age, grade, stage, lymph node, distant metastasis of the cases, type of surgery which was done for those patients, response to chemotherapy according to RECIST criteria of the patients and the patients outcome from the patients' records at Clinical Oncology and Nuclear Medicine and Medical Oncology Departments, Faculty of Medicine, Zagazig University by retrospective examination of the patient's files at the involved departments and the slide files of the pathology department. Our patients had follow-up records for 4 years. Progression was defined by radiological diagnosis according to the RECIST criteria or as doubling of the nadir serum CA-125 (14). The chemotherapy regimen was 6 cycles of paclitaxel (175 mg/ m<sup>2</sup>) with carboplatin (AUC 6), administered every 3 weeks. Histopathological examination and evaluation of PD-L1 and FOXP3 expression in both tumor cells and stroma by using immunohistochemistry were done in the pathology department, Faculty of Medicine, Zagazig University. We

assessed the relation between their expressions, clinicopathological parameters, response to chemotherapy, survival and prognosis of those patients. Patients with nonepithelial ovarian cancer, patients treated before operation, and patients who were not treated surgically were excluded from this study. Local Research Ethics Committee approval of the study was obtained.

#### **Immunohistochemical staining:**

Immunohistochemical staining was carried out using streptavidin–biotin immunoperoxidase technique (15). The slides were incubated with rabbit monoclonal anti- PD-L1 antibody [28-8] ab205921 was used at a dilution of 1:200 and Mouse monoclonal anti-FOXP3 antibody (ab22510) diluted 1/50 at 4°C overnight (Abcam, Cambridge, MA, USA). Normal human tonsil is used as a positive control for both PD-L1 and FOXP3 but the negative controls by replacing the primary antibodies by the non-immune serum.

#### **Evaluation of immunohistochemical expressions of PD-L1:**

##### **1. PD-L1 expression in tumor cells;**

The expression of PD-L1 was evaluated according to the intensity of the staining and scored as follows: 0, negative; 1, weak expression; 2, moderate expression and 3, strong expression. Cases with scores 0 and 1 were defined as the low-expression group, and cases with scores 2 and 3 were the high-expression group (16).

##### **2. PD-L1 expression in tumor infiltrating lymphocytes (TILs)**

Five tumor areas in a 400x magnification (high power fields (HPF) were assessed in areas with higher intratumoral TILs density. The non-tumor areas (e.g. stroma, necrosis) will be separated from areas of pure tumor. PD-L1 positive TILs that were in direct contact with tumor cells were called intratumoral TILs or PD-L1 positive TILs within the stroma were called stromal TILs. The total number of TILs was added to obtain TILs/5 HPF (17). The cut off (no vs any expression) was used for statistical analysis; no expression in TILs was considered low expression and any expression in TILs considered high expression.

#### **Evaluation of immunohistochemical expressions of FOXP3:**

##### **1. FOXP3 expression in tumor cells;**

The expression intensity was classified into four grades as follows: no staining was scored as zero; weak staining was scored as one; moderate staining was scored as two; strong staining was scored as three. Scores for the positive cells were as follows: (score 0) means less than or equal 5% positive cells; (score one) means 6-24% positive cells; (score two) means 25-49% positive cells; and (score three) means 50-74% positive cells; and (score four) means more than or equal 75% positive cells. The scores of percentage and intensity reflect the sums of scores, with total scores of 0 indicated as (-); 1-2 as (+); 3-5 as (++); and 6-7 as (+++) (18). We use total score 5 as a cut off value above which is considered high expression and below which is low expression.

##### **2. FOXP3 expression in tumor infiltrating lymphocytes (TILs).**

TILs in tumor stroma were counted in ten high-power field (HPF, at 400 magnification). TILs count of more than five per HPF was defined as high TILs, and TILs counts of less than 5 per HPF was defined as low TILs (19).

#### **Statistical analysis:-**

The statistics were done by usage of SPSS 22.0 for windows (SPSS Inc., Chicago, IL, USA) and MedCalc (MedCalc Software bvba 13, Belgium Ostend,). All the Continuous variables were made as the mean (95%CI). Percent of categorical variables were compared using Chi-square test or by Fisher's exact test. Trends of changes in distribution of the relative frequencies between ordinal data were compared by using Chi-square test. Overall Survival rate (OS) was assessed from the time of cancer diagnosis to death or to the most recent follow-up data. Progression Free Survival rate (PFS) was assessed from time of starting cancer treatment to time of progression or till the most recent follow-up data when patients were known to be progression free. Assessments of OS and PFS rates were made according to our markers. These time-to-event rates were assessed using Kaplan-Meier plots and compared by using two-sided log-rank test. We included patients with suboptimal surgery with residual cancer in response evaluation but the others were excluded. All tests were two sided. A p-value less than 0.05 were considered significant.

**Results:-****Patient Characteristics**

The clinical characteristics of the 50 ovarian carcinoma (OC) patients that were included in our study are summarized in (Table1) with age ranged from (25-75) years (Mean: 55.08±10.80 years), 30(60%) cases were serous carcinoma, 15(30%) were mucinous carcinoma and 5 (10%) were carcinoma of other types. The most prevalent stage is stage III which is present in 27 patients (54%) whereas stage II and IV are present in 7(14%) patients and 14 (28%) patients respectively. Only two patients had stage Ic. Forty three patients (86%) had high grade OC. Lymph node and distant metastasis are present in 33(66%) patients and 14 (28%) patients respectively. The suboptimal surgery with residual disease more than 1cm, was present in 22 (44%) patients but optimal surgery was done for 28 (56%) patients. The median of follow up duration was 25.50. While its range was 10-48 months.

**Table 1:-**clinopathological parameters,PDL-1& FOXP3 immunohistochemical expressions and outcome of our patients

Characteristics	Number	Percent	Characteristics	Number	Percent
<b>Age (years)</b>			<b>PD-L1 in TILs</b>		
Mean ± SD	55.08	±10.80	Low	30	60%
Median (Range)	56.50	(25-75)	High	20	40%
≤ 60 years	39	78%	<b>FOXP3 in TILs</b>		
> 60 years	11	22%	Low	30	60%
			High	20	40%
<b>FIGO stage</b>			<b>PD-L1 &amp; FOXP3 in TILs</b>		
Stage IC	2	4%	Low/Low	17	34%
Stage II	7	14%	Low/High	13	26%
Stage III	27	54%	High/Low	13	26%
Grade IV	14	28%	High/High	7	14%
<b>Histological type</b>			<b>Surgery</b>		
Serous	30	60%	Suboptimal	22	44%
Mucinous	15	30%	Optimal	28	56%
Other	5	10%			
<b>Grade</b>			<b>Residual</b>		
Low grade	7	14%	Absent	28	56%
High grade	43	86%	Present	22	44%
<b>Lymph node</b>			<b>Response (in patient underwent suboptimal surgery, N=22)</b>		
Negative	17	34%	CR	11	50%
Positive	33	66%	PR	4	18.2%
<b>Distant metastasis</b>			SD	4	18.2%
Negative	36	72%	NR	3	13.6%
Positive	14	28%	OAR	15	68.2%
			NR	7	31.8%
<b>PD-L1 in tumor cells</b>			<b>Follow-up duration (months)</b>		
Low	19	38%	Mean ± SD	24.70	±10.61
High	31	62%	Median (Range)	24	(9-48)
<b>FOXP3 in tumor cells</b>			<b>Progression</b>		
Low	25	50%	Absent	15	30%
High	25	50%	Present	35	70%
<b>PD-L1 &amp; FOXP3 in tumor cells</b>			<b>Mortality</b>		
Low/Low	12	24%	Alive	27	54%
Low/High	7	14%	Died	23	46%
High/Low	13	26%			
High/High	18	36%			

**PDL-1 immunoexpression and their correlation with clinicopathological features of OC patients: (Fig 5)****1.PDL-1 expression in tumor cells**

High cytoplasmic expression of PD-L1 in tumor cells was detected in 31 out of 50(62 %) cases of our patients, and it was significantly positively correlated with; histopathological type ( $p = 0.011$ ), grade, stage of the tumor and lymph node metastases ( $p=0.001$ ), type of surgery and absence of residual disease after surgery ( $P=0.010$ ). No significant correlation was found between PD-L1 in tumor cells expression and distant metastases or age of the patients (**Tables 2, 4**).

**2.PDL-1 expression in tumor infiltrating lymphocytes (TILs)**

High cytoplasmic expression of PDL-1 in TILs was detected in 20 out of 50(40 %) cases of our patients and it was significantly positively correlated with grade ( $p = 0.033$ ) and stage of the tumor ( $p = 0.029$ ). No significant correlation was found between PD-L1 expression, histopathological type of the tumor, lymph node metastases, distant metastases or age of the patients, type of surgery and residual disease after surgery (**Tables 2,4**).

**Table 2:-** correlations between clinicopathological parameters PDL-1& FOXP3 immunohistochemical expressions in tumor cells and TILs in our patients

Char acteri stics	All (N=50)		PD-L1 in tumor cells				p- value	FOXP3 tumor cells				p-value	PD-L1 TILs				p-value	FOXP3 TILs				p-value
			Low (N=19)		High (N=31)			Low (N=25)		High (N=25)			Low (N=30)		High (N=20)			Low (N=30)		High (N=20)		
			No	(%)	No	(%)		No	(%)	No	(%)		No	(%)	No	(%)		No	(%)	No	(%)	
<b>Age (year s)</b>																						
Mean ± SD	55.08	±10.80	51.68	±7.25	57.16	±12.13	0.007*	52.96	±7.96	57.12	±12.86	0.066*	55.20	±7.84	54.90	±14.38	0.933*	54.93	±12.02	55.30	±8.94	0.908*
Medi- an (Rang e)	56.50	(25-75)	55.00	(35-65)	58.00	(25-75)		55.00	(35-68)	58.00	(25-75)		55.50	(35-68)	57.00	(25-75)		57.50	(25-75)	55.50	(38-75)	
≤ 60 years	39	(78%)	17	(43.6%)	22	(56.4%)	0.170‡	23	(59%)	16	(41%)	0.017‡	24	(61.5%)	15	(38.5%)	0.736‡	23	(59%)	16	(41%)	1.000‡
> 60 years	11	(22%)	2	(18.2%)	9	(81.8%)		2	(18.2%)	9	(81.8%)		6	(54.5%)	5	(45.5%)		7	(63.6%)	4	(36.4%)	
<b>FIGO stage</b>																						
Stage IC	2	(4%)	2	(100%)	0	(0%)	0.001§	2	(100%)	0	(0%)	<0.001§	2	(100%)	0	(0%)	0.029§	2	(100%)	0	(0%)	0.498§
Stage II	7	(14%)	7	(100%)	0	(0%)		7	(100%)	0	(0%)		7	(100%)	0	(0%)		5	(71.4%)	2	(28.6%)	
Stage III	27	(54%)	7	(25.9%)	20	(74.1%)		14	(51.9%)	13	(48.1%)		14	(51.9%)	13	(48.1%)		14	(51.9%)	13	(48.1%)	
Grade IV	14	(28%)	3	(21.4%)	11	(78.6%)		2	(14.3%)	12	(85.7%)		7	(50%)	7	(50%)		9	(64.3%)	5	(35.7%)	
<b>Histol ogical type</b>																						
Serous	30	(60%)	9	(30%)	21	(70%)	0.011‡	17	(56.7%)	13	(43.3%)	0.513‡	19	(63.3%)	11	(36.7%)	0.153‡	15	(50%)	15	(50%)	0.038‡
Mucin ous	15	(30%)	10	(66.7%)	5	(33.3%)		6	(40%)	9	(60%)		10	(66.7%)	5	(33.3%)		13	(86.7%)	2	(13.3%)	
Other	5	(10%)	0	(0%)	5	(100%)		2	(40%)	3	(60%)		1	(20%)	4	(80%)		2	(40%)	3	(60%)	

1885

## 2.FOXP3 expression in tumor infiltrating lymphocytes (TILs)

High nuclear expression of FOXP3 in TILs was detected in 20 out of 50(40 %) cases of our patients and it was significantly positively correlated with histopathological type of the tumor ( $p = 0.038$ ). No significant correlation was found between FOXP3 expression, grade and stage of the tumor, lymph node metastases, distant metastases or age of the patients , type of surgery and residual disease after surgery . There were highly significant statistical relations were found between PD-L1 expression in both tumor cells and TILs ( $p<0.001$ ) There were highly significant statistical relations between expression of PD-L1 expression in TILs and FOXP3 expression in tumor cells ( $p=0.001$ )(Tables 2 ,4).

**Table 3:-** correlations between clinopathological parameters, PDL-1& FOXP3 immunohistochemical expressions in tumor cells and TILs in our patients

Characteristics	All (N=50)		PD-L1& FOXP3 in tumor cells										p-value	PD-L1& FOXP3 in TILs										p-value
			Low/Low (N=12)		Low/High (N=7)		High/Low (N=13)		High/High (N=18)		Low/Low (N=17)			Low/High (N=13)		High/Low (N=13)		High/High (N=7)						
			No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)		No.	(%)	No.	(%)	No.	(%)	No.	(%)			
<b>Age (years)</b>																								
Mean ± SD	55.08	±10.80	48.08	±6.27	57.85	±3.93	57.46	±6.70	56.94	±15.09	0.006	54.82	±9.24	55.69	±5.86	55.07	±15.34	54.57	±13.55	0.891				
Median (Range)	56.50	(25-75)	45.50	(35-56)	55.00	(55-65)	58.00	(47-68)	58.25	(25-75)		55.00	(35-68)	56.00	(45-65)	58.00	(25-75)	49.00	(38-75)					
≤ 60 years	39	(78%)	12	(30.8%)	5	(12.8%)	11	(28.2%)	11	(28.2%)	0.076	13	(33.3%)	11	(28.2%)	10	(25.6%)	5	(12.8%)	0.910				
> 60 years	11	(22%)	0	(0%)	2	(18.2%)	2	(18.2%)	7	(63.6%)		4	(36.4%)	2	(18.2%)	3	(27.3%)	2	(18.2%)					
<b>FIGO stage</b>																								
Stage IC	2	(4%)	2	(100%)	0	(0%)	0	(0%)	0	(0%)	<0.001	2	(100%)	0	(0%)	0	(0%)	0	(0%)	0.020				
Stage II	7	(14%)	7	(100%)	0	(0%)	0	(0%)	0	(0%)		5	(71.4%)	2	(28.6%)	0	(0%)	0	(0%)					
Stage III	27	(54%)	3	(11.1%)	4	(14.8%)	11	(40.7%)	9	(33.3%)		5	(18.5%)	9	(33.3%)	9	(33.3%)	4	(14.8%)					
Grade IV	14	(28%)	0	(0%)	3	(21.4%)	2	(14.3%)	9	(64.3%)		5	(35.7%)	2	(14.3%)	4	(28.6%)	3	(21.4%)					
<b>Histological type</b>																								
Serous	30	(60%)	8	(26.7%)	1	(3.3%)	9	(30%)	12	(40%)	0.019	8	(26.7%)	11	(36.7%)	7	(23.3%)	4	(13.3%)	0.059				
Mucinous	15	(30%)	4	(26.7%)	6	(40%)	2	(13.3%)	3	(20%)		9	(60%)	1	(6.7%)	4	(26.7%)	1	(6.7%)					
Other	5	(10%)	0	(0%)	0	(0%)	2	(40%)	3	(60%)		0	(0%)	1	(20%)	2	(40%)	2	(40%)					
<b>Grade</b>																								
Low grade	7	(14%)	7	(100%)	0	(0%)	0	(0%)	0	(0%)	<0.001	5	(71.4%)	2	(28.6%)	0	(0%)	0	(0%)	0.085				
High grade	43	(86%)	5	(11.6%)	7	(16.3%)	13	(30.2%)	18	(41.9%)		12	(27.9%)	11	(25.6%)	13	(30.2%)	7	(16.3%)					
<b>Lymph node</b>																								
Negative	17	(34%)	8	(47.1%)	4	(23.5%)	3	(17.6%)	2	(11.8%)	0.007	8	(47.1%)	4	(23.5%)	3	(17.6%)	2	(11.8%)	0.545				
Positive	33	(66%)	4	(12.1%)	3	(9.1%)	10	(30.3%)	16	(48.5%)		9	(27.3%)	9	(27.3%)	10	(30.3%)	5	(15.2%)					

		(%)		(%)		(%)		(%)		(%)		(%)		(%)		(%)		(%)	
<b><u>Distant metastasis</u></b>																			
Negative	36	(72%)	12	(33.3%)	4	(11.1%)	11	(30.6%)	9	(25%)	0.013†	12	(33.3%)	11	(30.6%)	9	(25%)	4	(11.1%)
Positive	14	(28%)	0	(0%)	3	(21.4%)	2	(14.3%)	9	(64.3%)		5	(35.7%)	2	(14.3%)	4	(28.6%)	3	(21.4%)
<b><u>PD-L1 in tumor cells</u></b>																			
Low	19	(38%)										12	(63.2%)	7	(36.8%)	0	(0%)	0	(0%)
High	31	(62%)										5	(16.1%)	6	(19.4%)	13	(41.9%)	7	(22.6%)
<b><u>FOXP3 in tumor cells</u></b>																			
Low	25	(50%)										12	(48%)	9	(36%)	3	(12%)	1	(4%)
High	25	(50%)										5	(20%)	4	(16%)	10	(40%)	6	(24%)
<b><u>PD-L1 &amp; FOXP3 in tumor cells</u></b>																			
Low/Low	12	(24%)										7	(58.3%)	5	(41.7%)	0	(0%)	0	(0%)
Low/High	7	(14%)										5	(71.4%)	2	(28.6%)	0	(0%)	0	(0%)
High/Low	13	(26%)										5	(38.5%)	4	(30.8%)	3	(23.1%)	1	(7.7%)
High/High	18	(36%)										0	(0%)	2	(11.1%)	10	(55.6%)	6	(33.3%)
<b><u>PD-L1 in TILs</u></b>																			
Low	30	(60%)	12	(40%)	7	(23.3%)	9	(30%)	2	(6.7%)	<0.001†								
High	20	(40%)	0	(0%)	0	(0%)	4	(20%)	16	(80%)									
<b><u>FOXP3 in TILs</u></b>																			
Low	30	(60%)	7	(23.3%)	5	(16.7%)	8	(26.7%)	10	(33.3%)	0.906†								
High	20	(40%)	5	(25%)	2	(10%)	5	(25%)	8	(40%)									
<b><u>PD-L1 &amp; FOXP3 in TILs</u></b>																			
Low/Low	17	(34%)	7	(41.2%)	5	(29.4%)	5	(29.4%)	0	(0%)	<0.001§								
Low/High	13	(26%)	5	(38.5%)	2	(15.4%)	4	(30.8%)	2	(15.4%)									
High/Low	13	(26%)	0	(0%)	0	(0%)	3	(23.1%)	10	(76.9%)									
High/High	7	(14%)	0	(0%)	0	(0%)	1	(14.3%)	6	(85.7%)									



### Correlation between the clinopathological parameters on immunohistochemical staining for PD-L1 and FOXP3 in tumor cells and TILs in epithelial ovarian carcinoma women

The combination between the two markers in tumor cells were significant with age (P=0.006), grade and stage (P<0.001), histological type (P=0.019), LN metastasis (P=0.007), distant metastasis (P=0.013), type of surgery and residual disease after operation (P=0.020) .

The combination between the markers in TILs were significant with stage (P=0.020) only.

No significant correlation was found between combinations of the markers in TILs with the age, grade and stage, histological type, LN metastasis, distant metastasis, type of surgery or residual disease after operation .

There were highly significant statistical relations were found between expression of both markers in tumor cells and PD-L1 in TILs and both PD-L1 & FOXP3 in TILs (p<0.001).

There were highly significant statistical relations between expression of both markers in TILs and PD-L1 in tumor cells (P<0.001), FOXP3 expression in tumor cells (p=0.007) and both markers in tumor cells (P<0.001) (**Tables 3, 5**).

### The response and the outcome and their correlation with the markers (Tables 1, 4& 5, Figs 1, 2, 3& 4)

Patients with residual disease (22patients) were included in evaluation of response otherwise other patients were excluded. Fifteen (68.2%) patients had response to treatment; 11 (50%) patients had CR whereas 4 (18.2%) patients had PR .Only 7 (31.8%) patients had no response (SD&NR) .Overall 35 patients (70%) had progression and 23 (46%) patients died. Table 1There were high response rate and less progression and less mortality in patients with low PD-L1 expression in tumor cells or TILs but with no significant correlation between them with each marker or their combination with FOXP3 . There were high 4 y- DFS and 4y-OS in patients with low PD-L1 expression in tumor cells or TILs but with no significant correlation with each marker . Combined low PDL1& FOXP3 expressions in tumor cells were significantly associated with higher progression free survival (PFS) (p<0.045). There were high response rate and less progression in patients with low FOXP3 expression in tumor cells or TILs but the mortality was less in patients with low FOXP3 in tumor cells only ,with no significant correlation between them with each marker or their combination with PD-L1 . The mortality was higher in patients with low FOXP3 in TILs only but without any significance .There were high 4 y- DFS in patients with low FOXP3 expression in tumor cells or TILs but with no significant correlation with each marker . However there were low 4y-OS in patients with low FOXP3 expression in tumor cells or TILs but with no significant correlation with each marker . Combined low PD-L1& FOXP3 expressions in tumor cells were significantly associated with higher progression free survival (PFS) (p<0.045). so:-

- There are no significant correlations between PD-L1 or FOXP3 expression or their combination in tumor cells or in TILs with response to treatment , progression, or mortality(P>0.05)
- There are no significant correlations between PD-L1 expression in tumor cells or TILs with progression free survival (PFS)& overall survival (OS) rates (p >0.05).
- There are no significant correlations between FOXP3 expression in tumor cells or in TILs with overall survival (OS) or progression free survival (PFS) (P>0.05)
- Combined low PD-L1& FOXP3 expressions in tumor cells were significantly associated with higher progression free survival (PFS) (p<0.045).

**Table 4:-** correlations between PDL-1& FOXP3 immunohistochemical expressions in tumor cells and TILs and outcome of our patients

Characteristic s	All (N=50)		PD-L1 in tumor cells				p- valu e	FOXP3 tumor cells				p- value	PD-L1 in TILs				p- value	FOXP3 in TILs				p- value
			Low (N=19)		High (N=31)			Low (N=25)		High (N=25)			Low (N=30)		High (N=20)			Low (N=30)		High (N=20)		
	N o.	(%)	N o.	(%)	N o.	(%)		No. o.	(%)	N o.	(%)		N o.	(%)	N o.	(%)		N o.	(%)	N o.	(%)	
<b><u>Surger y</u></b>																						
Subopti mal	22	(44 %)	4	(21 %)	18	(58 %)	0.010‡	10	(40 %)	12	(48 %)	0.569‡	13	(43 %)	9	(45 %)	0.907‡	15	(50%)	7	(35 %)	0.295‡
Optima	28	(56 %)	15	(78 %)	13	(41 %)		15	(60 %)	13	(52 %)		17	(56 %)	11	(55 %)		15	(50%)	13	(65 %)	

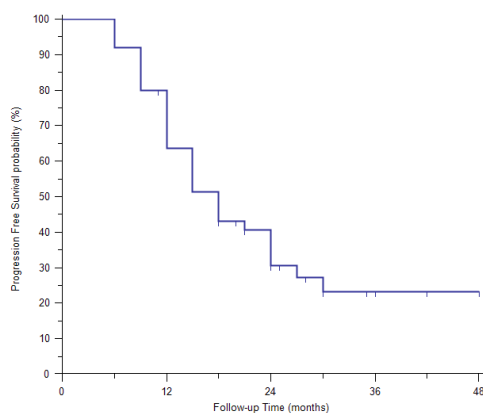
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Mean (month) (95%CI)	32.6 mon (28.2-37.2)	36 mon (28.5-43.8)	31 mon (26-36.8)	0.428†	33 mon (27.4-39.4)	31.6 mon (24.9-38.4)	0.706†	33.9 mon (27.9-39.8)	31 mon (24.3-38.1)	0.568†	31.4 mon (25.2-37.5)	34.7 mon (28.3-41.2)	0.448†
1 year OS (%)	92%	94.7%	87.1%		100%	71.4%		89.8%	80%		79.6%	95%	
2 years OS (%)	66.5%	63.1%	60.6%		63.9%	58.5%		62.5%	60%		56.3%	68.9%	
3 years OS (%)	44.9%	63.1%	38.9%		43.1%	46.1%		50%	40%		44.4%	47.3%	
4 years OS (%)	44.9%	63.1%	38.9%		43.1%	46.1%		50%	40%		44.4%	47.3%	

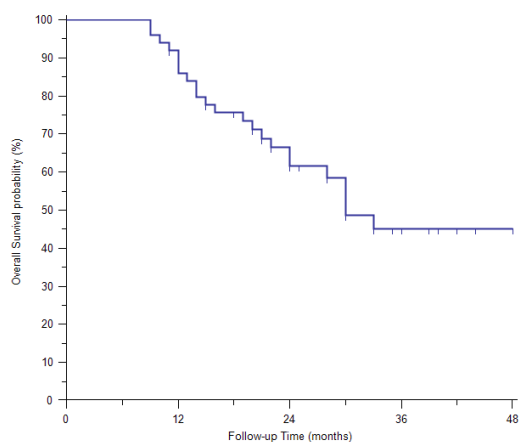
**Table (5):** correlations between PDL-1& FOXP3 immunohistochemical expressions in tumor cells and TILs and outcome of our patients

Outcome	All (N=50)		PD-L1& FOXP3 in tumor cells								p-value	PD-L1& FOXP3 in TILs								p-value	
			Low/Low (N=12)		Low/High (N=7)		High/Low (N=13)		High/High (N=18)			Low/Low (N=17)		Low/High (N=13)		High/Low (N=13)		High/High (N=7)			
			No.	(%)	No.	(%)	No.	(%)	No.	(%)		No.	(%)	No.	(%)	No.	(%)	No.	(%)		
<b><u>Surgery</u></b>																					
Suboptimal	22	(44%)	2	(16.7%)	2	(28.6%)	8	(61.5%)	10	(55.6%)	0.020§	9	(52.9%)	4	(30.8%)	6	(46.2%)	3	(42.9%)		0.709§
Optimal	28	(56%)	10	(83.3%)	5	(71.4%)	5	(38.5%)	8	(44.4%)		8	(47.1%)	9	(69.2%)	7	(53.8%)	4	(57.1%)		
<b><u>Residual</u></b>																					
Absent	28	(56%)	10	(83.3%)	5	(71.4%)	5	(38.5%)	8	(44.4%)	0.020§	8	(47.1%)	9	(69.2%)	7	(53.8%)	4	(57.1%)		0.709§
Present	22	(44%)	2	(16.7%)	2	(28.6%)	8	(61.5%)	10	(55.6%)		9	(52.9%)	4	(30.8%)	6	(46.2%)	3	(42.9%)		
<b><u>Response</u></b>	(N=22)		(N=2)		(N=2)		(N=8)		(N=10)			(N=9)		(N=4)		(N=6)		(N=3)			
CR	11	(50%)	2	(100%)	2	(100%)	2	(25%)	5	(50%)	0.522§	4	(44.4%)	3	(75%)	3	(50%)	1	(33.3%)		0.294§
PR	4	(18.2%)	0	(0%)	0	(0%)	0	(0%)	4	(40%)		3	(33.3%)	1	(25%)	0	(0%)	0	(0%)		
SD	4	(18.2%)	0	(0%)	0	(0%)	4	(50%)	0	(0%)		1	(11.1%)	0	(0%)	2	(33.3%)	1	(33.3%)		
PR	3	(13.6%)	0	(0%)	0	(0%)	2	(25%)	1	(10%)		1	(11.1%)	0	(0%)	1	(16.7%)	1	(33.3%)		
OAR	15	(68.2%)	2	(100%)	2	(100%)	2	(25%)	9	(90%)	0.896§	7	(77.8%)	4	(100%)	3	(50%)	1	(66.7%)		0.353§
NR	7	(31.8%)	0	(0%)	0	(0%)	6	(75%)	1	(10%)		2	(22.2%)	0	(0%)	3	(50%)	2	(33.3%)		
<b><u>Progression</u></b>	(N=50)		(N=12)		(N=7)		(N=13)		(N=18)			(N=17)		(N=13)		(N=13)		(N=7)			
Absent	15	(30%)	7	(58.3%)	1	(14.3%)	2	(15.4%)	5	(27.8%)	0.114§	7	(41.2%)	3	(23.1%)	4	(30.8%)	1	(14.3%)		0.248§

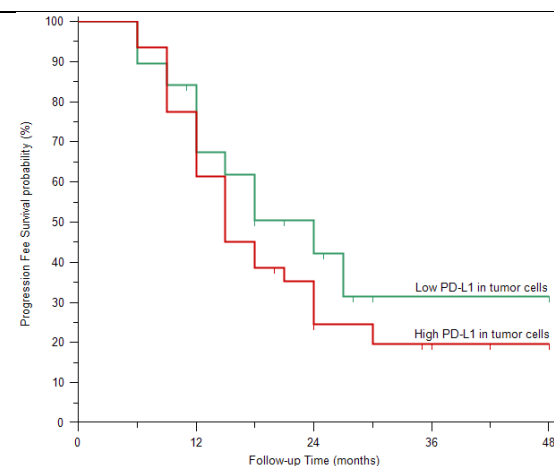
Present	35	(70%)	5	(41.7%)	6	(85.7%)	11	(84.6%)	13	(72.2%)		10	(58.8%)	10	(76.9%)	9	(69.2%)	6	(85.7%)	
<b>Progression Free Survival (PFS)</b>																				
Mean (month) (95%CI)	23 mon (18.6-27.5)		32.5 mon (22.6-42.4)		12.9 mon (8.9-17)		18.3 mon (13.5-23.1)		23.2 mon (15.7-30.6)		0.045†	24.8 mon (16.1-33.5)		20.1 mon (15.1-25.1)		21.2 mon (14.6-29.7)		21 mon (11.1-30.9)		0.968†
1 year PFS (%)	80%		75%		53.6%		53.9%		66.7%			57.4%		69.2%		61.5%		71.4%		
2 years PFS (%)	40.7%		62.5%		-----		19.2%		27.8%			40.8%		19.2%		30.8%		38.5%		
3 years PFS (%)	23.3%		46.9%		-----		9.6%		27.8%			30.5%		19.2%		30.8%		14.3%		
4 years PFS (%)	23.3%		46.9%		-----		-----		27.8%			30.5%		-----		-----		14.3%		
<b>Mortality</b>																				
Alive	27	(54%)	9	(75%)	4	(57.1%)	5	(38.5%)	9	(50%)	0.155§	9	(52.9%)	9	(69.2%)	7	(53.8%)	2	(28.6%)	0.367§
Died	23	(46%)	3	(25%)	3	(42.9%)	8	(61.5%)	9	(50%)		8	(47.1%)	4	(30.8%)	6	(46.2%)	5	(71.4%)	
<b>Overall Survival (OS)</b>																				
Mean (month) (95%CI)	48 mon (28.2-37.2)		38.6 mon (29.8-47.5)		25.6 mon (14.6-36.6)		29 mon (22.8-35.5)		32 mon (24.7-39.8)		0.652†	30 mon (21.6-38.4)		33.6 mon (28.3-38.9)		29.7 mon (22.4-37.1)		29.3 mon (18.7-39.8)		0.492†
1 year OS (%)	92%		100%		51.4%		100%		77.8%			81.6%		100%		76.9%		85.7%		
2 years OS (%)	66.5%		66.8%		51.4%		60.6%		60.6%			51.8%		76.2%		61.5%		57.1%		
3 years OS (%)	44.9%		66.8%		51.4%		30.3%		45.5%			38.8%		63.5%		49.2%		28.6%		
4 years OS (%)	44.9%		66.8%		-----		-----		45.5%			38.8%		63.5%		-----		28.6%		



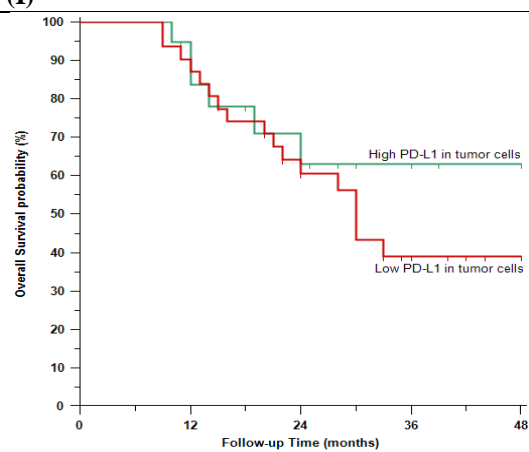
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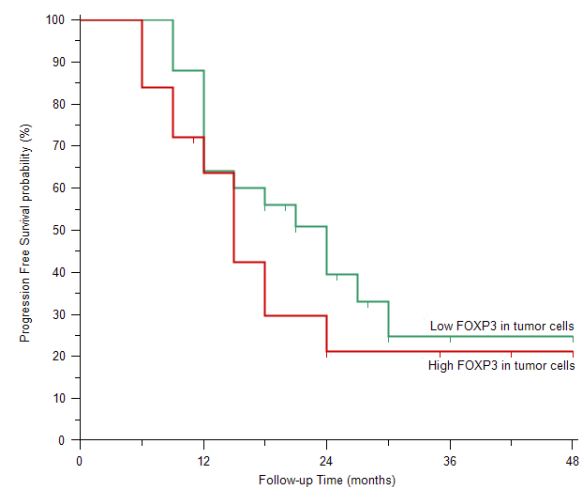
(I)



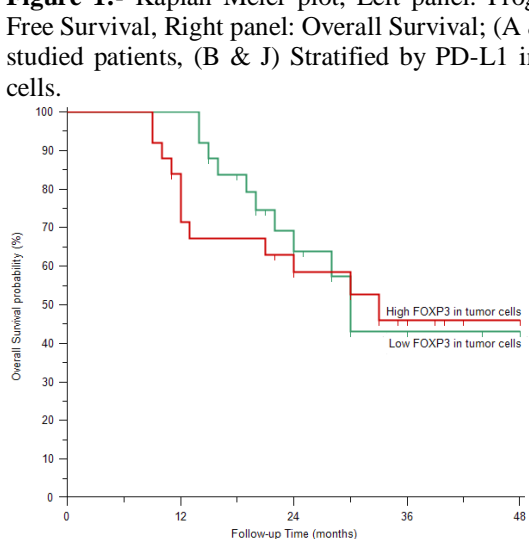
(B)



(J)

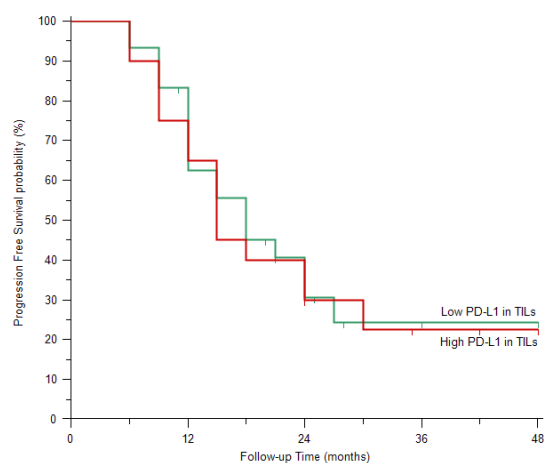


(C)

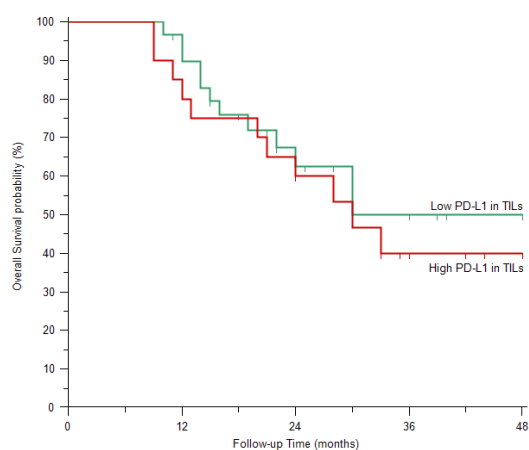


(K)

**Figure 1:-** Kaplan Meier plot, Left panel: Progression Free Survival, Right panel: Overall Survival; (A & I) All studied patients, (B & J) Stratified by PD-L1 in tumor cells.

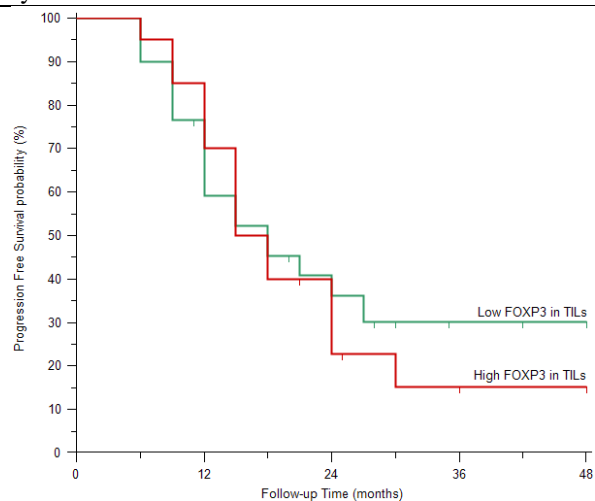


(D)

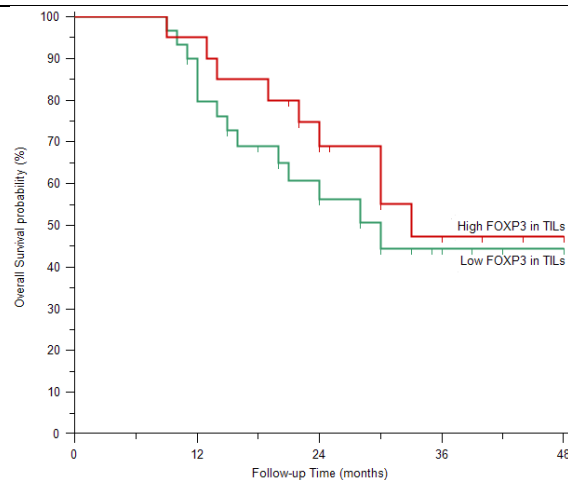


(L)

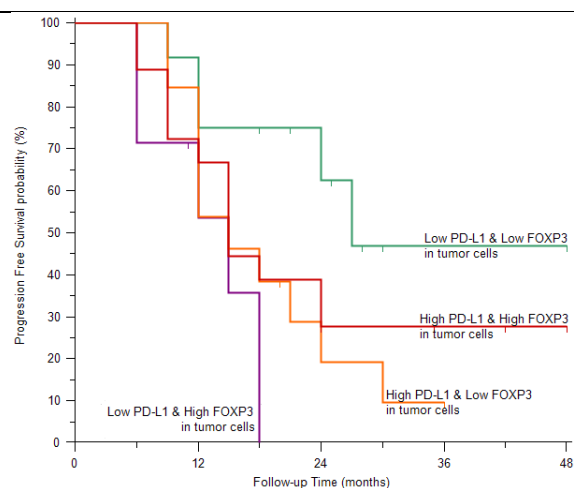
**Figure 2:-** Kaplan Meier plot, Left panel: Progression Free Survival, Right panel: Overall Survival; (C & K) Stratified by FOXP3 in tumor cells, (D & L) Stratified by PD-L1 in TILs.



(F)

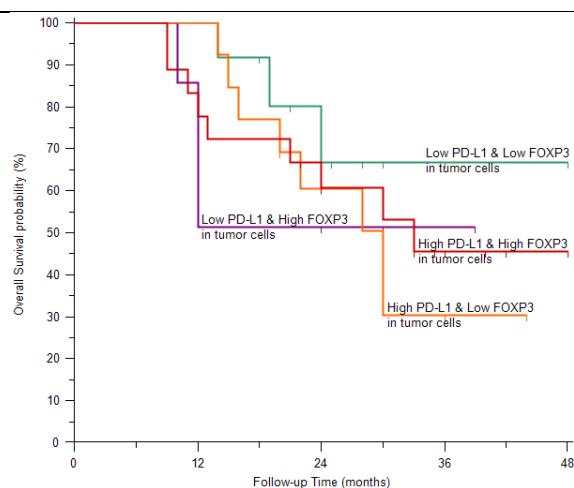


(M)

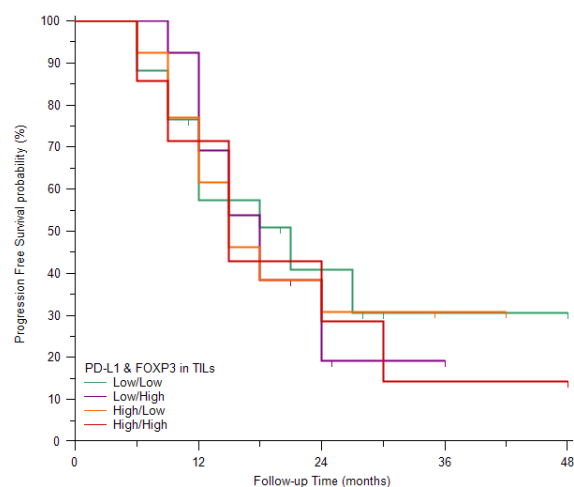


(G)

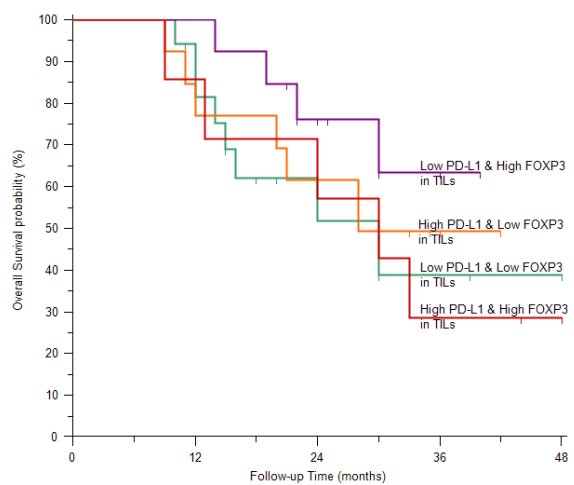
**Figure 3:-** Kaplan Meier plot, Left panel: Progression Free Survival, Right panel: Overall Survival; (F & M) Stratified by FOXP3 in TILs, (G & N) Stratified by PD-L1 & FOXP3 in tumor cells



(N)



(H)



(O)

**Figure 4:-** Kaplan Meier plot, Left panel: Progression Free Survival, Right panel: Overall Survival; (H & O) Stratified by PD-L1 & FOXP3 in TILs.

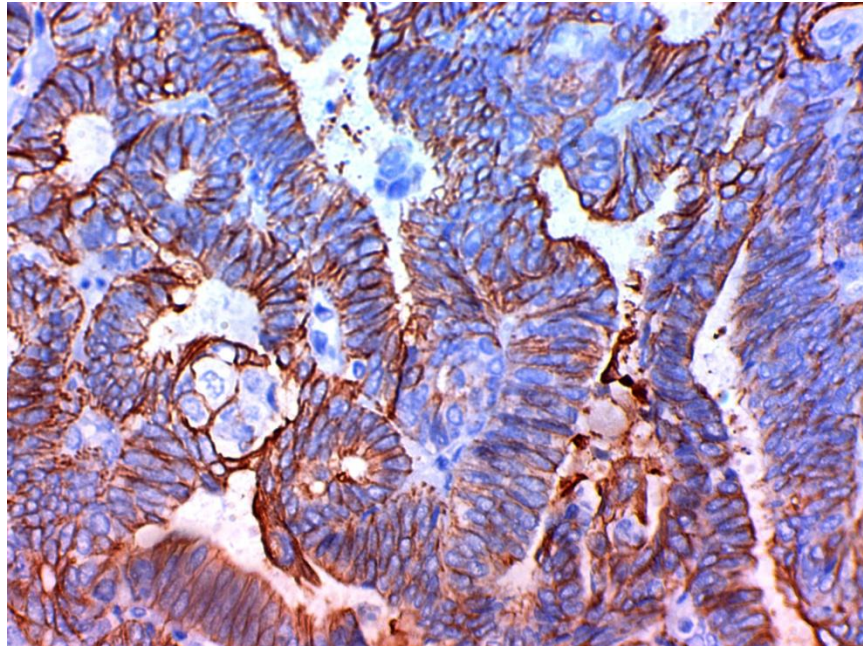


Fig 5:- A

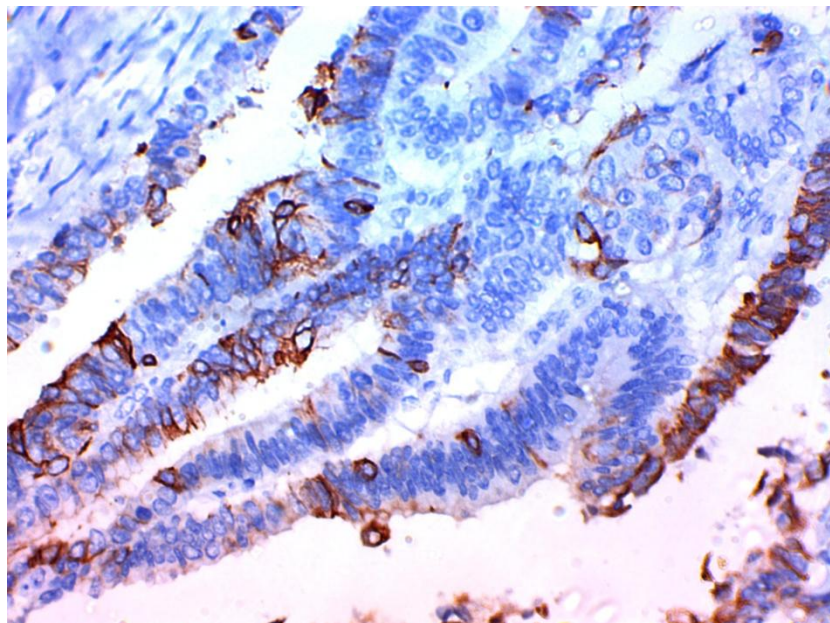
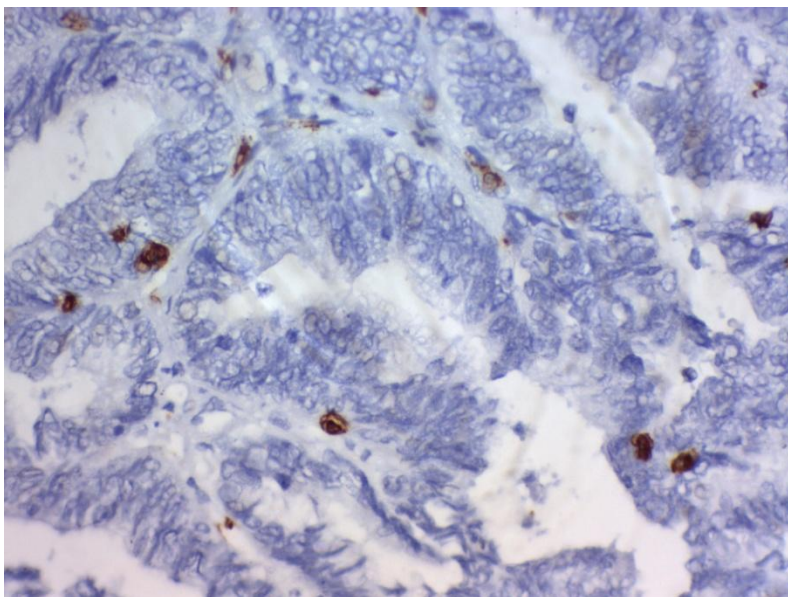
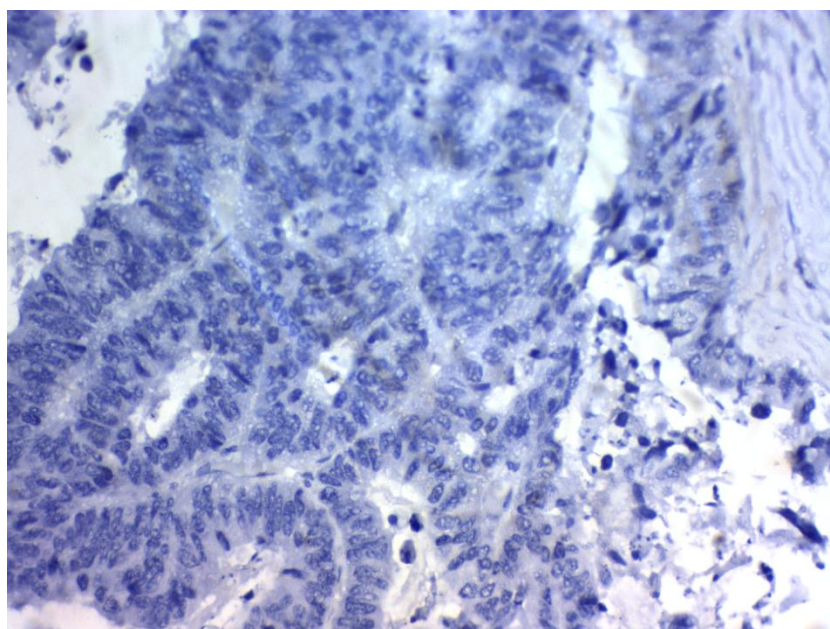
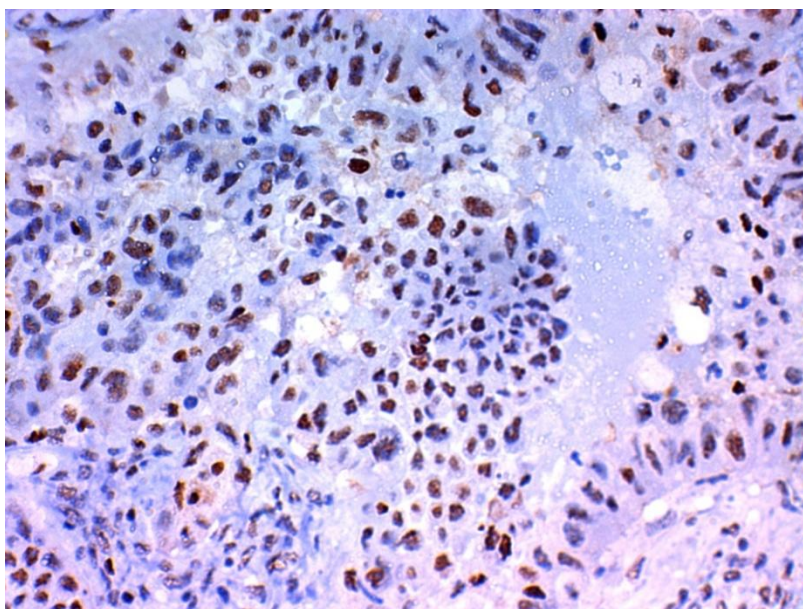
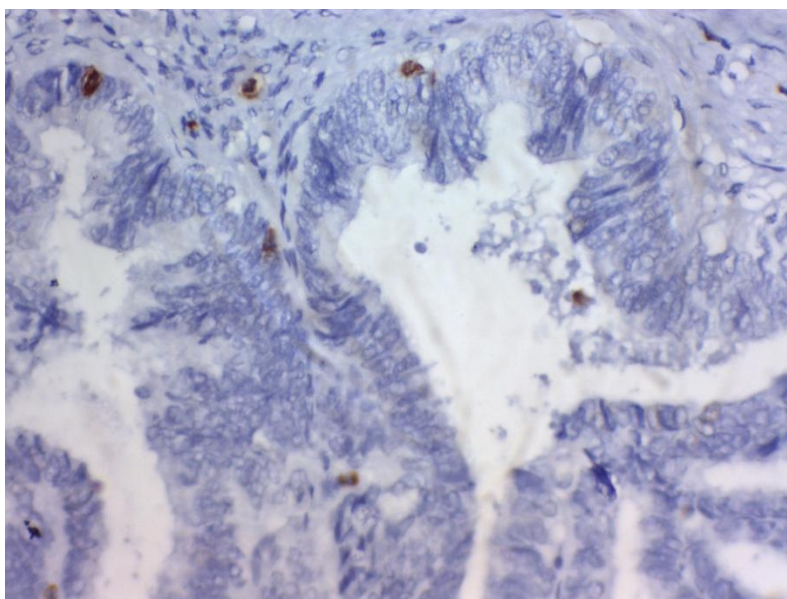


Fig 5:- B



**Fig 5:- C****Fig 5:- D**

**Figure 5:-** Immunohistochemical expression of PD-L1 in epithelial ovarian carcinoma cells and tumor infiltrating lymphocytes (TILs) :( **A**) High expression of PD-L1 in papillary serous cystadenocarcinoma of the ovary high grade, stage IIIx400. (**B**) Low expression of PD-L1 in papillary serous cystadenocarcinoma of the ovary low grade, stage IIx400. (**c**) High expression in TILs of papillary serous cystadenocarcinoma of the ovary high grade, stage III x400 (**D**) Low expression in the TILs of papillary serous cystadenocarcinoma of the ovary low grade, stage IIx400. **Note:** High PD-L1 immunohistochemical expression in high grade & stage ovarian carcinoma and low expression in low grade & stage ovarian carcinoma: A, B, C&D the original magnification was x400

**Fig 6:- A****Fig 6:- B**

**Figure 6:-** Immunohistochemical expression of FOXP3 in epithelial ovarian carcinoma cells and tumor infiltrating lymphocytes (TILs) :**(A)** High expression in tumor cells and TILs in papillary serous cystadenocarcinoma of the ovary high grade, stage IIIx400 . **(B)** Low expression in the cells and TILs in papillary serous cystadenocarcinoma of the ovary low grade, stage IIBx400.

**Note:-** High FOXP3 expression in high grade & stage ovarian carcinoma and low expression in low grade & stage ovarian carcinoma: A& B the original magnification was  $\times 400$

### **Discussion:-**

The microenvironment of epithelial ovarian cancer (EOC) is heterogeneous and various immune cell populations have been associated positively or negatively with clinical prognosis, including tumor-infiltrating lymphocytes (TILs) (3). In ovarian cancer; TILs express the immune receptor programmed cell death 1 (PD-1) , but cancer cells express its ligand PD-L1 (20,16).

We found that high expression of PD-L1 in tumor cells was significantly positively correlated with histopathological type, high grade, advanced stage of the tumor and high lymph node metastases, type of surgery with presence of residual disease after surgery. High expression of PD-L1 in TILs was significantly positively correlated with grade, stage of the tumor. In addition, there were, in our result, Fifteen of 22 with residual disease (68.2%) patients had response to treatment; 11 (50%) patients had CR whereas 4 (18.2%) patients had PR Only 7 (31.8%) patients had no response (SD&PD). Overall 35 patients (70%) had progression and 23 (46%) patients died. We found high response rate, less progression and less mortality in patients with low PD-L1 expression in tumor cells or TILs but with no significant correlation between them with each marker or their combination with FOXP3. There were high 4 y- DFS and 4y-OS in patients with low PD-L1 expression in tumor cells or TILs but with no significant correlation with each marker. Combined low PD-L1& FOXP3 expressions in tumor cells were significantly associated with higher progression free survival (PFS) ( $p<0.045$ ).

**Hamanishi et al., 2007(16)** found similar results to ours that over expression of PD-L1 has been associated with poor clinicopathological parameters and poor overall survival in EOC, which meant that there will be a benefit from PD-1/ PD-L1 inhibition in EOC patients. **Hamanishi et al., 2015 (21)** gave another proof of the therapeutic benefits of the PD-1/ PD-L1 pathway in EOC. **Wu et al., 2015 (22)** mentioned that tumor expression of PD-L1 was positively correlated with cancer progression and poor prognosis of malignancies of many organs, but full accurate data are not available and are conflicting. This problem might be due to usage of different antibodies clones which had different specificity with variable scoring methods (8).

Similar results proved by **Taube, et al., 2014 (23)** that PD-L1 was expressed in the cancer microenvironment, mainly in TILs and had the strongest association with response to nivolumab. These results clarified measuring, not only PD-L1 positivity in tumor cell, but also PD-L1 positivity in TILs for immune checkpoint therapy response prediction. **Sabatier et al., 2015 (24)** proved in his mRNA study results that were different from our results in that high/unregulated PD-L1 expression was associated with better survival, However, **Baptista et al , 2016 (25)**, found that high PD-L1 protein expression was associated with shorter survival which was like our results. PD-L1 expression in malignant cells is a recent prognostic marker that could prove the antitumor immunity interruption. Previous studies proved that PD-L1 overexpression was an important prognostic factor in malignancies of many organs (26). PD-L1 overexpression and relations to patient prognosis differ according to cancer type (27).

So, our data revealed that PD-L1 overexpression by EOC cells is a significant prognostic factor and such expression allow better evaluation of host-tumor immunity that allow better treatment of ovarian cancer. Recently, many researches proved that cancers with PD-L1-positive TILs had a high response rates to cancer immunotherapies, proving the role of PD-L1 as a predictive marker of response to anti-PD-1 antibody therapy (28).

Usage of immunotherapy in treatment of cancer is rapidly evolving from therapies that non-specifically stimulate the immune system to more specific and targeted activation of specific components of the immune system with decreased toxicity and increased efficacy of immunotherapy. Therapies that inhibit the interaction between programmed death ligand 1 (PD-L1) and programmed death 1 (PD-1), are generating much excitement, even in malignancies that are not traditionally considered to be immunogenic (29). Anti-PD therapy has become the backbone of cancer immunotherapy and a major modality of cancer treatment. It is important to learn from this successful therapy for better understanding of the immune system and its role in cancer and to improve future therapies (30).

We found that high expression of FOXP3 in tumor cells was significantly positively correlated with poor clinicopathological parameters like younger age of the patients, high grade, distant metastases and advanced stage of the tumor. High expression of FOXP3 in TILs was significantly positively correlated with histopathological type of the tumor only. There were high response rate and less progression in patients with low FOXP3 expression in tumor cells or TILs but the mortality was less in patients with low FOXP3 in tumor cells only, with no significant correlation between them with each marker or their combination with PD-L1. The mortality was higher in patients with low FOXP3 in TILs only but without any significance. There were high 4 y- DFS in patients with low FOXP3 expression in tumor cells or TILs but with no significant correlation with each marker. However there were low 4y-OS in patients with low FOXP3 expression in tumor cells or TILs but with no significant correlation with each marker. Combined low PD-L1& FOXP3 expressions in tumor cells were significantly associated with higher progression free survival (PFS) ( $p<0.045$ ).

Our results were in agreed with previous studies in ovarian carcinoma (31). **Curiel et al., 2004, (5)** who proved that FOXP3 over expression in cancer cells is associated with poor prognosis and decreased survival which could be due to their suppressive effects on anticancer immune responses. Recently, Foxp3 was found to be not only specifically expressed in Treg cells which were normally arose in the thymus, but also in the malignant cells and its expression is positively correlated to cancer progression and prognosis (32). This relation has been reported in a many metastatic or non-metastatic cancers (11).

There are several studies proved an inverse correlation between FOXP3 expression in Tregs and survival in certain kinds of tumors (33), in contrast to us as we found no significant correlations between FOXP3 expression in tumor cells or TILs and worsened survival rates of the patients like many other studies which indicated that there were no significant correlation between FOXP3+ Tregs and survival (34,35,36)

So, conflicting data had been reported about the prognostic role of FOXP3+ Tregs infiltration in cancers which may play a negative, positive or non-significant role in cancer patient prognosis and survival(11). The association of FOXP3 positivity and poor prognosis could be explained by that FOXP3+ Tregs cells in ovarian carcinomas express intracellular FOXP3, inhibit host immunity and stimulate cancer growth (18). Also, **Hinz et al 2007(37)** added another explanation for that as inhibition of an effector T-cell response allow cancer immune escape. **Merlo et al, 2009 (38)** found that FOXP3 over expression was associated with decreased overall and metastasis free survival rates but not with local recurrence; so, FOXP3 expression was related to the cancer metastatic ability rather than to a specific immune response suppression.

These data therefore provide direct evidence that human FOXP3 positive Treg cells have an important immunopathological role in human cancer by suppressing endogenous T cell immunity (39). FOXP3 was found to be a novel therapeutic target so vaccines that eradicate FOXP3-expressing cells increase host immunity against cancer (40), the specific mechanism underlying the role of Foxp3 in cancer pathogenesis is uncertain. Foxp3 expressing Tregs can increase the occurrence of metastasis in cancers. **Ma et al 2013(41)**, found that Foxp3 was markedly expressed in the gastric carcinoma cells and activate the apoptosis pathways so induce gastric cancer cells apoptosis and inhibit the cancer progression so predicted a better prognosis (41,19). Above findings suggest that Foxp3 role in the cancer cells are still conflicting as it may had a tumor suppressor effect to inhibit cancer progression or stimulate cancer growth by inhibiting immunity but the specific mechanism is still uncertain.

In our study, absence of significance between each one of PDL1 in tumor cells and TILs and FOXP3 in tumor cells and TILs with the response, progression and survival may be due to small number of our patients which is a limitation of our study which may limit our statistical power.

## Conclusions:-

EOC is one of the most life-threatening malignancies and immunotherapy may be a promising supplementary treatment for it in the near future. The role of microenvironment cells in EOC remains controversial and may not be informative for survival prediction after resection of the primary tumor. We found that combination of PDL-1 and FOXP-3 expressions in EOC were correlated with poor prognosis but further studies on large number of cases were recommended to prove our results and clarify the possible use of them as therapeutic targets in cancer.

## References:-

1. **Konstantinopoulos PA and Matulonis UA (2013):-** Current status and evolution of preclinical drug development models of epithelial ovarian cancer. *Front Oncol* ; 3: 296.
2. **Hanahan D and Coussens LM (2012):-** Accessories to the crime: Functions of cells recruited to the tumor microenvironment. *Cancer Cell* 21:309-322.
3. **Zhang L, Conejo-Garcia JR, Katsaros D, et al (2003):-** Intratumoral T cells, recurrence, and survival in epithelial ovarian cancer. *N Engl J Med* 348:203-213.
4. **Curiel TJ, Coukos G, Zou L, et al (2004):-** Specific recruitment of regulatory T cells in ovarian carcinoma fosters immune privilege and predicts reduced survival. *Nat Med* 10:942-949
5. **Chen J, Jiang CC, Jin L, et al (2016):-** Regulation of PD-L1: a novel role of pro-survival signaling in cancer. *Ann Oncol* ; 27:409-16.
6. **Reiss KA, Forde PM, Brahmer JR et al (2014):-** Harnessing the power of the immune system via blockade of PD-1 and PD-L1: a promising new anticancer strategy. *Immunotherapy*; 6:459-75.



7. **Berretta M, Stanzione B, Di Francia R, et al (2015):-** The expression of PDL1 APE1 and P53 in hepatocellular carcinoma and its relationship to clinical pathology. *Eur Rev Med PharmacolSci* ; 19:4207–9.
8. **McLaughlin J , Han G , Schalper K A , et al (2015):-**Frequent PD-L1 expression in testicular germ cell tumors. *Br. J. Cancer* , 113, 411–413.
9. **Sakaguchi S (2005):-** Naturally arising Foxp3-expressing CD25+CD4+ regulatory T cells in immunological tolerance to self and non-self. *Nat Immunol* ; 6: 345-352.
10. **Kerdiles YM, Stone EL, BeisnerDR,et al (2010):-** Foxo transcription factors control regulatory T cell development and function. *Immunity* ; 33: 890-904.
11. **Tan B, Anaka M, Deb S, et al (2014):-** FOXP3 over-expression inhibits melanoma tumorigenesis via effects on proliferation and apoptosis. *Oncotarget* ; 5: 264-276.
12. **Prat J (2014):-** FIGO Committee on Gynecologic Oncology. Staging classification for cancer of the ovary, fallopian tube, and peritoneum. *Int J Gynaecol Obstet.* 124 (1):1-5.
13. **Kurman RJ, Carcangiu ML, Herrington CS, et al (2014):-** WHO Classification of Tumours of Female Reproductive Organs. 4th ed.Lyon: International Agency for Research on Cancer. <https://shop.iarc.fr/products/who-classification-of-tumours-of-female-reproductive-organs>
14. **Rustin GJ (2003):** Use of CA-125 to assess response to new agents in ovarian cancer trials. *J ClinOncol.* , 21 (10 Suppl): 187s-193s.
15. **Hsu SM, Raine L and Fanger H (1981):-** Use of avidin-biotin-peroxidase complex (ABC) in immunoperoxidase techniques: a comparison between ABC and unlabeled antibody (PAP) procedures. *J HistochemCytochem* ; 29:577-580.
16. **Hamanishi J , Mandai M , Iwasaki M , et al (2007):-**Programmed cell death 1 ligand 1 and tumorinfiltrating CD8\_ T lymphocytes are prognostic factors of human ovarian cancer , (PNAS) *ProcNatAcadSci USA* , vol. 104 , no 9 ,3360–3365 .
17. **Darb-Esfahani1 S, Kunze1 C, Kulbe H, et al (2016):-**Prognostic impact of programmed cell death-1 (PD-1) and PD-ligand 1 (PD-L1) expression in cancer cells and tumor infiltrating lymphocytes in ovarian high grade serous carcinoma ,*Oncotarget.* 2016 Jan 12;7(2):1486-99. doi: 10.18632/oncotarget.6429.
18. **Luo Q, Zhang S, Wei H, et al (2015):-** Roles of Foxp3 in the occurrence and development of cervical. cancer . *Int J ClinExpPathol* ;8(8):8717-8730
19. **Ma1 G, Miao1 Q, Liu Y, et al (2014):-**High FoxP3 expression in tumour cells predicts better survival in gastric cancer and its role in tumour microenvironment . *British Journal of Cancer* , 110, 1552–1560 .
20. **matsuzakiJ,GnjaticS,Mhawech-FaucegliaP,et al (2010):-** Tumor-infiltrating NY-ESO-1-specific CD8 + T cells are negatively regulated by LAG-3 and PD-1 in human ovarian cancer. *ProcNatAcadSci U S A*;107:7 875–80.
21. **Hamanishi J, Mandai M, Ikeda T, et al (2015):-** Safety and antitumor activity of anti–PD-1 antibody, nivolumab, in patients with platinum-resistant ovarian cancer. *J ClinOncol* , 1;33(34):4015-22.
22. **Wu P , Wu D , Li L ,et al (2015):-** PD-L1 and survival in solid tumors: A meta-analysis. *PLoS ONE* , 10 (6);, e0131403. doi:10.1371/journal.pone.0131403.
23. **Taube J.M , Klein A , Brahmer J.R, et al (2014):-** Association of PD-1, PD-1 ligands, and other features of the tumor immune microenvironment with response to anti-PD-1 therapy. *Clin. Cancer Res*, 20, 5064–5074.
24. **Sabatier R, Finetti P, Mamessier E, et al (2015);-** Prognostic and predictive value of PDL1 expression in breast cancer. *Oncotarget* ;6: 5449–64
25. **Baptista MZ, Sarian LO, Derchain SF, et al(2016):-** Prognostic significance of PD-L1 and PD-L2 in breast cancer. *Hum Pathol* ;47:78–84.
26. **Thompson RH, Kuntz SM, Leibovich BC, et al (2006) :-**Tumor B7-H1 is associated with poor prognosis in renal cell carcinoma patients with long-term follow-up , *Cancer Res* 66 (7):3381– 3385.
27. **Konishi J, Yamazaki K, Azuma M, et al(2004):-**B7-H1 Expression on Non-Small Cell Lung Cancer Cells and Its Relationship with Tumor-Infiltrating Lymphocytes and Their PD-1 Expression*Clin Cancer Res* 10:5094– 5100.
28. **Herbst RS, Soria JC, Kowanetz M, et al (2014):-** Predictive correlates of response to the anti-PD-L1 antibody MPDL3280A in cancer patients. *Nature* ; 515(7528):563–7.
29. **Swaika A, Hammond W, JosephR ,et al (2015):-**Current state of anti-PD-L1 and anti-PD-1 agents in cancer therapy ' *Molecular immunology*,vol 67.issue 2,p 4-17.
30. **Chen L and Han X (2015):-**Anti-PD-1/PD-L1 therapy of human cancer: past, present, and future . *Journal of clinical investigation* ;125(9):3384-3391.
31. **Leffers N, Gooden MJ, de Jong RA, et al (2009):** Prognostic significance of tumor-infiltrating T-lymphocytes in primary and metastatic lesions of advanced stage ovarian cancer. *Cancer Immunol Immunother*;58(3):449-59

32. **Karanikas V, Speletas M, Zamanakou M, et al (2008):-** Foxp3 expression in human cancer cells. J Transl Med ; 6: 19.
33. **Ladoire S, Martin F and Ghiringhelli (2011):-**Prognostic role of FOXP3+ regulatory T cells infiltrating humancarcinomas: the paradox of colorectal cancerCancerImmunolImmunother , 60:909–918
34. **Fu J, Xu D, Liu Z,et al (2007):-** Increased regulatory T cells correlate with CD8 T-cell impairment and poor survival in hepatocellular carcinoma patients. Gastroenterology ; 132: 2328-2339.
35. **Grabenbauer GG, Lahmer G, Distel L, et al (2006) :-**Tumor-inWltrating cytotoxic T cells but not regulatory T cells predict outcome in anal squamous cell carcinoma. Clin Cancer Res 12:3355–3360
36. **Loddenkemper C, Schernus M, Noutsias M, et al (2006):-** In situ analysis of FOXP3+ regulatory T cells in human colorectal cancer. J Transl Med 4:52
37. **Hinz S, Pagerols-Raluy L, Oberg HH, et al (2007):-** Foxp3 expression in pancreatic carcinoma cells as a novel mechanism of immune evasion in cancer. Cancer Res 67:8344-8350.
38. **Merlo A, Casalini P, Carcangiu ML, et al (2009):-** FOXP3 expression and overall survival in breast cancer. J ClinOncol ,27:1746-1752.
39. **Hori S, Nomura T, Sakaguchi S, et al (2003):-** Control of regulatory T cell development by the transcription factor Foxp3. Science 299:1057-1061.
40. **Nair S, Boczkowski D, Fassnacht M, et al (2007):-** Vaccination against the forkhead family transcription factor Foxp3 enhances tumor immunity. Cancer Res 67:371- 380.
41. **Ma GF, Chen SY, Sun ZR, et al (2013):-**FoxP3 inhibits proliferation and induces apoptosis of gastric cancer cells by activating the apoptotic signaling pathway. BiochemBiophys Res Commun ; 430: 804-809.

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### RESEARCH ARTICLE

## COMPARITIVE EVALUATION OF SALIVARY Ig A LEVELS AND DENTAL CARIES IN OBESE AND NON OBESE CHILDREN.

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Salivary Ig A, Obese, Non obese, deft, DMFT

#### Abstract

**Aim:** The aim of the present study was to compare the S ig A levels and dental caries in obese and non obese children.

**Materials and Methods:** Eighty normal healthy children in the age group of eight to twelve were selected and divided into two groups, Obese(Group I, n=40) and Nonobese(Group II, n=40). Each group was further divided into two sub groups as carious (n=20), and non carious (n=20) based on deft/DMFT score. From all the children 2 ml of unstimulated saliva collected and S IgA levels were estimated by using ELISA method.

**Results:** The difference between S Ig A levels and dental caries in obese and non obese was not statistically significant where as intragroup(carious and non carious) S IgA levels were significantly higher in carious free sub group than carious sub group in both groups.

**Conclusion:** Higher levels of S ig A in caries-free mouth can be attributed for protection against dental caries. From the present study, it was concluded that obesity has no effect on S Ig A levels.

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#### Introduction:-

Dental caries is an infectious microbial disease with a multifactorial origin that continues to be the most common chronic disease in humans affecting nearly the entire population.<sup>1</sup> Human saliva not only lubricates the oral tissues, making oral functions such as speaking, eating, and swallowing possible, but also protects teeth and oral mucosal surfaces in different ways. Recent studies have revealed a large number of functions, mediated by both the inorganic and organic components of saliva, that should be considered in assessments of the effects of human saliva on dental caries. Some genetically regulated salivary components like immunoglobulins may influence both the colonization and the clearance of microorganisms from the oral cavity.<sup>2</sup> Out of all five classes (IgA, IgD, IgE, IgG, IgM) of immunoglobulins secretory IgA is the main immunoglobulin in salivary secretions. Salivary secretory immunoglobulin A (S IgA) has an immunological control over dental caries and presumably prevents the adherence of cariogenic microorganisms to hard surfaces and may also inhibit the activity of glucosyltransferases.

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Childhood obesity is also one of the most serious public health challenges of the 21<sup>st</sup> century. The problem is global and is steadily affecting many low and middle income countries, particularly in urban settings, and prevalence has increased at an alarming rate. Worldwide, the numbers of overweight children under the age of five is estimated to be over 42 million, and close to 35 million of these are living in developing countries.<sup>4</sup> Diet plays an important role in the increased prevalence of obesity due to the higher consumption of foods rich in fat and carbohydrates. Overweight or obese children and adolescents reported higher consumption of sugary drinks and foods such as “fast food” compared with those who reported normal weight. Besides being directly associated with obesity, eating habits, especially regarding the intake of sucrose, have a well established causal relationship with tooth decay.<sup>5</sup> Recent studies have revealed that there are significant relations which occur between salivary immunoglobulin A (SIgA) levels and dental caries<sup>6,7,8</sup> body mass index (B.M.I) and dental caries in children.<sup>9,10,11</sup> The purpose of the present study is to compare the salivary IgA levels and dental caries in obese and non obese children.

## **Methodology:-**

### *Sample selection:*

The present study was conducted in the Department of Pedodontics and Preventive Dentistry, Mamata Dental College and Hospital, Khammam in association with Department of Microbiology and Immunology, Mamata General Hospital, Khammam. The study was approved by Ethical Review Board.

A total of 80 school going children aged between 8-12 years were selected randomly for the present study based on the following inclusion and exclusion criteria after obtaining informed consent from the parents.

### *Inclusion criteria:*

- Children with normal growth and development
- Children with good oral hygiene.
- Children without any systemic disorders.

### *Exclusion criteria:*

- Children with upper respiratory tract infection
- Medically compromised children and children with systemic disorders.
- Children having history of antibiotics intake in past 7 days.
- Children have oral exposure to food before two hours of sample collection.

### *Anthropometric measurements:*

Anthropometric measurements were taken prior to the dental examination. The height without shoes was measured with a height measuring charts. The weight was assessed using a digital weighing machine. The BMI was calculated as the weight divided by the square of the height (kg/m<sup>2</sup>). The calculated BMI was considered as obese according to the Centers for Disease Control and Prevention's (CDC) BMI-for-age growth charts.

## **Dental examination:**

A caries assessment was performed with a mouth mirror and a probe under clinical conditions by single examiner. All the children were selected during routine dental camps conducted by the department of pediatric and preventive dentistry, Mamata Dental College & Hospital, Khammam.

Each group was again divided into two sub groups of each 20 as Carious and Non carious groups based on the WHO criteria 1997.

## **Saliva Collection<sup>12</sup>:**

Salivary samples were collected between 10 AM to 12 PM in order to prevent any differences in the concentration of saliva due to circadian rhythm. Patients were informed not to eat or drink one hour before saliva collection to minimize possible food debris and stimulation of saliva. The child was seated in a well-ventilated and well-lit room. The head was kept at 45 degrees flexion with one hand holding a disposable vial for 2 minutes in a calm atmosphere to simulate unstimulated conditions. The saliva was allowed to drip into the sterile vial held to the lower lip for collection of 2 ml of unstimulated saliva. If the saliva sample was insufficient within 2 minutes, the collection was continued until 3 ml of saliva per subject was obtained.

## **Determination of S Ig A level:**

Saliva collected from children were centrifuged and supernatant was added to prepared salivary diluents. Diluted antibody enzyme conjugate was added to standard, control, unknown samples and incubated for 90 minutes at room temperature. 50µl of sample from each tube was added to appropriate wells and covered plate with adhesive plate sealer. Washed wells 6 times with wash buffer and added TMB solution. 50µl of stop solution was added to all wells



and waited until all wells turned from blue(fig 3) to yellow (fig 4). Then read in a plate reader at 450 nm for S IgA levels.



Fig 1. S Ig A Elisa kit



Fig 2 - Collected saliva samples

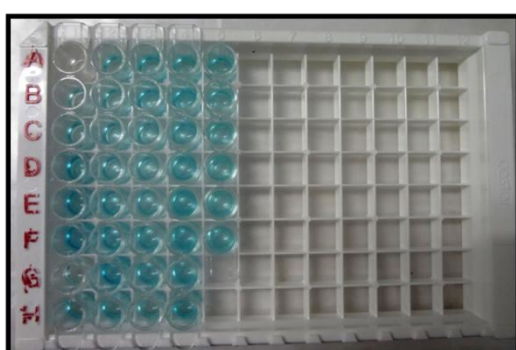


Fig 3 Before adding stop solution

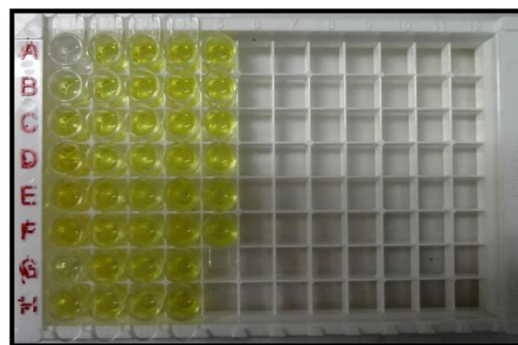


Fig 4 After adding stop solution

### Results:-

The results obtained were subjected to statistical analysis. The mean values, standard deviation (SD) for both the groups were analyzed using the “Statistical Package for the Social Sciences” (SPSS) software, version 16.0. A  $p$  value of  $<0.05$  was considered as statistically “significant” and a  $p$  value  $<0.001$  was considered as statistically “highly significant”.

Intra group comparison shows mean S Ig A levels for obese carious children is  $157.05 \mu\text{g/ml}$  and  $182.8 \mu\text{g/ml}$  for non carious children (Graph 1& Table 1). Intra group comparison of mean S Ig A levels for Non obese group is  $158.55 \mu\text{g/ml}$  in carious and  $183.8 \mu\text{g/ml}$  for non carious children (Graph 2& Table 2). S IgA levels were significantly higher in carious free sub group than carious sub group in both obese and non obese groups (Graph 3 & Table 3). Inter group comparison of mean S IgA levels for Obese children is  $169.92 \mu\text{g/ml}$  and  $171.17 \mu\text{g/ml}$  in Non obese children (Graph 4&Table 4). There is difference between S Ig A levels and dental caries in Obese and Non obese group but the difference is not statistically significant ( $p:0.9963$ )

		Age	BMI	DMFT/deft	S Ig A( $\mu\text{g/ml}$ )
Carious	Mean	10.7	34.33	3.85	157.05
	SD	1.38	6.81	0.93	42.14
Non carious	Mean	10.7	30.3	0.00	182.80
	SD	1.45	0.97	0.00	33.95

**Table 1:-** Mean & SD for age, BMI, DMFT/deft & S-Ig A values for Obese group

		Age	BMI	DMFT/deft	S Ig A( $\mu\text{g/ml}$ )
Carious	Mean	10.00	21.02	3.8	158.55
	SD	1.33	1.93	1.00	30.24
Non carious	Mean	8.9	20.12	0.00	183.80

	SD	0.71	1.97	0.00	19.37
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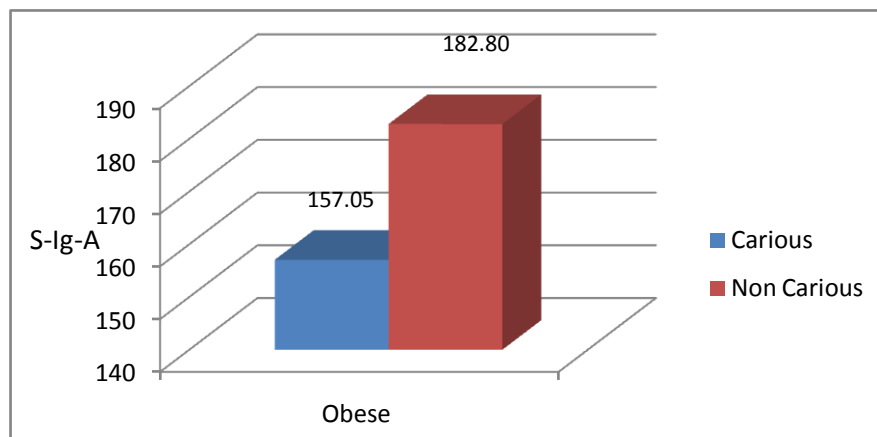
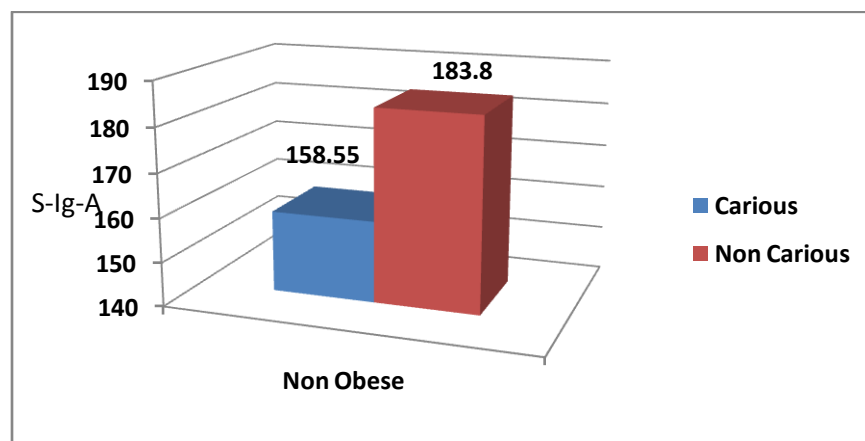
**Table 2:-** Mean & SD for age, BMI, DMFT/deft & S-Ig A values for Non obese group

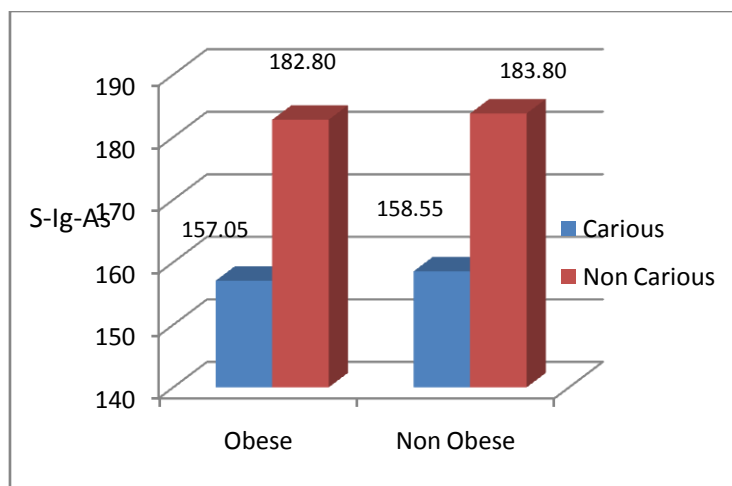
Group	Sub group		DMFT/deft	S Ig A( $\mu\text{g/ml}$ )	p-value
Obese	Cariou	Mean	3.85	157.05	0.0032*
		SD	0.93	42.14	
	Non carious	Mean	0.00	182.80	
		SD	0.00	33.95	
Non obese	Cariou	Mean	3.8	158.55	0.0399*
		SD	1.00	30.24	
	Non carious	Mean	0.00	183.80	
		SD	0.00	19.37	

\*p&lt;0.05

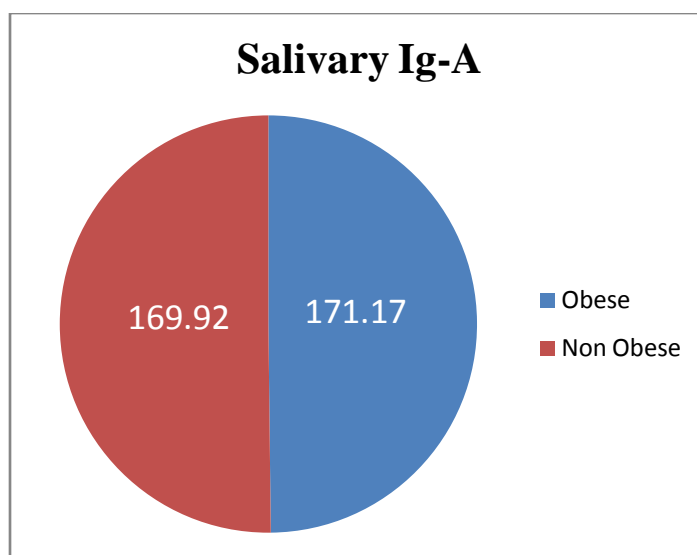
**Table No 3:-** Intra group comparison of dental caries status and salivary IgA levels by Unpaired t- test

Group		DMFT/deft	S Ig A ( $\mu\text{g/ml}$ )	p-value
Obese	Mean	1.925	169.92	0.9963
Non obese	Mean	1.9	171.17	

**Table No 4:-** Inter group comparison of dental caries status and salivary IgA levels by ANOVA test**Graph 1:-** Intra group comparison of S IgA levels in Obese children**Graph 2:-** Intra group comparison of salivary IgA levels in Non obese children



**Graph 3:-** Inter group comparison of salivary IgA levels



**Graph 4:-**Inter group comparison of mean salivary Ig A levels

### Discussion:-

Dental caries is a multifactorial disease and one of the major contributing factors is saliva. Secretory immunoglobulin A (S IgA) is the prominent immunoglobulin in whole saliva and is considered to be the main specific defence mechanism in the oral cavity. S IgA helps in prevention of dental caries by inhibition of bacterial adherence, reduction of hydrophobicity, agglutination of bacteria and inactivation of bacterial enzymes and toxins. Several studies on the role of S IgA in prevention of dental caries showed contradictory results.<sup>13</sup>

Overweight and obesity among children are a major public health concern, especially in developing countries. There are many reasons for the obesity like fast food contributes to a high-energy consumption, and a sedentary life style reduces energy expenditure. Indeed, many of the foods, including soft drinks and refined-wheat breads, are low in micronutrients.<sup>14</sup>

Increased SIgA levels are seen in Wiskott-Aldrich syndrome, Cirrhosis of the liver, IgA myeloma, Autoimmune disorders, Rheumatoid arthritis, Lupus erythematosus etc. Whereas decreased SIgA levels are seen in Hereditary ataxia, Telangiectasia, Malabsorption syndromes, Lymphoid aplasia, Chronic lymphoblastic leukemia etc. Because of changes in salivary IgA levels in different diseases, present study excluded the children having health problems.<sup>15</sup>

Saliva was collected by the method suggested by Colin Dawes<sup>16</sup> as it was easy to obtain the child's cooperation. All the samples were collected between 10-11am. This time was two hours after any oral or visual exposure to food stuffs. This was done to prevent the effect of circadian rhythms on salivary concentrations. Edgar M<sup>17</sup> found that the IgA & protein concentration decreased with increased salivary flow from the parotid and submandibular salivary glands. Stimulated saliva could have decreased the concentration of the IgA, hence unstimulated whole saliva was collected for the study.

After collection of saliva, it is important to keep samples at or below -20°C within 4 hours of collection from children to avoid bacterial growth in the specimen. In the present study salivary samples were stored at -70°C in cryo refrigerator to prevent bacterial growth in collected salivary samples.

According to Fontana et al<sup>18</sup> establishment of disease depends on the relative incapacity of the host to provide effective specific and nonspecific protective barriers and on the ability of the microorganism to adhere and to overcome these barriers. Pathogenic microorganisms must overcome the host nonspecific defence barriers (e.g., cleansing mechanisms such as coughing, swallowing, and fluid flow) and must also escape recognition by soluble immune or non immune host molecules in host secretions. Secretory IgA antibodies may bind to surface antigens of microorganisms in saliva, causing them to agglutinate, thereby facilitating their rapid elimination and prevent from dental caries. Salivary IgA antibodies can mediate *S. mutans* colonization. If glycosyltransferase (GTF) enzyme is bound to *S. mutans* fimbriae, enzyme neutralization by IgA antibody may inhibit *S. mutans* enzyme activities and, therefore, cariogenicity by reducing both the colonization by *S. mutans* and the virulence of the organism.

Fontana et al<sup>18</sup> suggests that caries free subjects may be protected immunologically from dental caries by salivary IgA antibody against *S. mutans* antigens. In the present study also salivary IgA levels were more children with less dental caries to give protection against dental caries. The results of present study were not in agreement with Thaweboon<sup>6</sup>, Chawda GJ<sup>7</sup>, Ranadheer E<sup>8</sup> found higher salivary IgA levels in children with more dental caries which are contradictory to the present study.

The contradictory results seen in the literature may be due to difference in sampling methods, different criteria for patient selection, and different laboratory tests used between the studies. Moreover, the concentration of salivary immunoglobulin may change depending upon the salivary flow rate, hormonal factors, emotional states, and physical activity.<sup>6</sup>

A few studies conducted to find out the relation between body mass index (B.M.I) and dental caries in children and concluded that there was no relation between BMI and dental caries Tripathi<sup>11</sup>, Toumi et al<sup>19</sup>, Pinto<sup>20</sup>. On contradictory to these studies Larsson B<sup>9</sup>, Nava FV<sup>10</sup>, investigated the association between dental caries and BMI and concluded as there was an association between BMI and dental caries.

### Conclusion:-

Dental caries is a complex and dynamic process where a multitude of actors influence and initiate the progression of disease. Till to date studies on comparative evaluation of salivary Ig-A levels and dental caries in Obese and Non obese children are very less. The present study shows that there is a significant difference in IgA levels among carious and non carious children in both obese and non-obese conditions, but there is no significant difference between obese and non-obese conditions. From this present study it can be concluded that obesity does not make any difference in production of salivary immunoglobulins especially S IgA. Further studies are needed to confirm the role of S IgA on caries activity.

### References:-

1. Omar OM, Khattab NMA, Rashed LA. Glucosyltransferase B, Immunoglobulin A, and caries experience among a group of Egyptian preschool children. *J Dent Child* 2012;79(2):63-8.
2. Lumikari ML, Loimaranta V. Saliva and dental caries. *J Dent Res* 2000;14:40-7.
3. Pal S, Mitra M, Mishra J, Saha S, Bhattacharya B. Correlation of total salivary secretory immunoglobulin A (S-IgA) and mutans specific SIgA in children having different caries status. *J Indian Soc Pedod Prevent Dent* 2013;31(4):270-4.
4. Guare RO, Ciamponi AL, Santos MTBR, Gorjao R, Diniz MB. Caries experience and salivary parameters among overweight children and adolescents. *J Dent* 2013;1:31-40.

5. Silva AMR, Menezes AMB, Demarco FF, Ferreira FV, Peres MA. Obesity and dental caries: systematic review. *Rev Saude Publica* 2013;47(4):799-812.
6. Thaweboon S, Thaweboon B, Nakornchai S, Jitmaitree S. Salivary secretory IgA, pH, flow rates, mutans streptococci and candida in children with rampant caries. *Southeast Asian J Trop Med Public Health* 2008;38(5):893-9.
7. Chawada JG, Chaduvula N, Patel HR, Jain SS, Lala AK. Salivary SIgA and dental caries activity. *Ind Pediatrics* 2011;48:719-22.
8. Ranadheer E, Nayak UA, Reddy NV, Rao VAP. The relationship between salivary IgA levels and dental caries in children. *J Indian Soc Pedod Prevent Dent* 2011;29(2):106-12.
9. Larsson B, Johansson I, Hallmans G, Ericson T. Relationship between dental caries and risk factors for atherosclerosis in Swedish adolescents. *Community Dent Oral Epidemiol* 1995;23:205-10.
10. Francisco VN, Rodriguez EMV, Gonzalez AHS, Ochoa DL, Perales GMM, Velquez VMJ. Association between obesity and dental caries in a group of preschool children in Mexico. *J Public Health Dent* 2010;70:124-30.
11. Swati T, Kiran K, Kamala B. Relationship between obesity and dental caries in children - A preliminary study. *J Int Oral Health* 2010; 2 (4):65-72.
12. Katie P. Relationship between unstimulated salivary flow rate and saliva composition of healthy children in Taiwan. *Chang Gung Med J* 2008; 31:281-6.
13. Harry W, Schroeder, Cavacini L. Structure and function of immunoglobulins. *J Allergy Clin Immunol* 2010;125(2):S41-54.
14. Willershausen B, Moschos D, Azrak B, Blettner M. Correlation between oral health and body mass index (BMI) in 2071 primary school pupils. *Eur J Med Res* 2007;12:295-9.
15. Paniker CKJ. Text book of microbiology. 7th Ed, Orient Blackswan publisher 2005, Pg no 37-39.
16. Dawes C. Circadian rhythms in the flow rate and composition of unstimulated and stimulated human submandibular saliva. *J Physiol* 1975:535-48.
17. Edgar M, Dawes C, Mullane DO. Saliva and oral health. 4th Ed, Stephen Hancocks Limited, 2012, Pg no 8-12.
18. Fontana M, Fell LEG, Gregory RL. Characterization of preparations enriched for streptococcus mutans fimbriae: Salivary immunoglobulin A antibodies in caries-free and caries-active subjects. *Clin Diagn Lab Immunol* 1995;2(6):719-25.
19. Tuomi T. Pilot study on obesity in caries prediction. *Community Dent Oral Epidemiol* 1989;17:289-91.
20. Pinto A, Kim S, Wadenya R, Rosenberg H. Is there an association between weight and dental caries among pediatric patients in an urban dental school? A correlation study. *J Dent Edu* 2007;71(11):1435-40.



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### RESEARCH ARTICLE

#### THE RISK OF EMPHASIS ON ENTREPRENEUR SKILLS AS A DRIVER FOR SUCCESSFUL BUSINESS PERFORMANCE IN BOTSWANA: A CASE STUDY.

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#### Abstract

Studies show that many parastatals and government departments worldwide Botswana included are over-supporting and value the acquisition of entrepreneurial skills as a key driver for business performance through various intervention programs. The support is reflected in the effort and amount of scarce resources that are committed to pre-tertiary, tertiary and post-tertiary levels of training to impart entrepreneurial skills. Entrepreneurial skills of creativity and innovation (unique business idea), among others is perceived by private and public resources supporters of business promoters as a basic requirement for viability. This effort directed towards reducing the risk of business failure, has so far not yielded anticipated level of results. Many business projects fail within the first few years of establishment despite of the resources support provided to the promoters. This article seeks to explore the reasons attributable to the failure of such well-planned and initially well-executed business ventures. Twenty business investments covering different industry sectors at varying investment levels in Gaborone were purposefully sampled, observed and interviewed, in addition to archival literal studies. The studies and entrepreneurial interviews, when qualitatively analyzed reveals that successful performance of a business venture continuously requires surmountable business management skills with varying levels of unique combinations of entrepreneurial skills along the business investment life cycle. These findings are presented in a practical E-M business model that is a suggested remedy to the failures.

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#### Introduction:-

Entrepreneurship has been viewed by many researchers and authors as the messianic key driver for business success and consequently national economic growth (Shemi and Procter, 2013, Hurley 1999). Studies show that Entrepreneurship is thought of as a risky rigorous process of conceptualizing, organizing, creating a new economic entity centered on a novel product or service with unique differences from other market offerings (Deakins and Freel, 2012, Hisrich and Peters, 1998, Dollinger, 1995, Theresa et al 2012). This understanding has made most national economies and institutions to craft various supportive intervention programs towards this course. For example, in Botswana, some of the national programs that have been designed to heavily support entrepreneurship are taught programs in pre-tertiary, tertiary and post-tertiary knowledge stages, intended to impart an entrepreneurial

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mind in learners. This is intended to support the economic diversification, which is a major policy for the government of Botswana (NDP9 2003-2009, NDP 10 2010-2006). For example, all tertiary institutions in Botswana offer entrepreneurial studies or related disciplines as part of the curriculum. This course is supported by an understanding that this entrepreneurial mindset will then either at individual level or at corporate level influence the way a business venture operates (Pinchot, 1985 and Thornberry 2001) because corporate entrepreneurship is demonstrated through the behaviour and practices of individuals working within the business (Geisler, 1993, Kuratko et al. 2005, Zampetakis and Moustakis 2007). Every year, 66,500 students from 1,600 universities around the world gather to demonstrate their entrepreneurial capabilities through the Enactus programme (Kristia van Heerden, 2014).

There is no doubt whatsoever that entrepreneurial qualities of innovativeness, risk taking, networking, integration, opportunism, non-system-bound orientation, change orientation, flexibility informality and results orientation (Theresa et al, 2012) are critical elements which should drive a business towards realizing its set objectives. Parastatals and government departments in Botswana provide resources to support businesses based on a well-crafted business proposal whose underlying characteristics are based on a viable entrepreneurial idea. Institutions like; Botswana Development Corporation (BDC) established in 1970, Botswana Export Development and Investment Authority (BEDIA) established in 1997, Local Enterprise Authority (LEA) established in 2004, Citizen Empowerment Development Authority (CEDA) established in 2001, International financial services Centre (IFSC) established in 2003, The Ministry of Youth, Sports and Culture Youth Fund, just to list a few, carry out evaluation of business investment proposals on the basis of a viable entrepreneurial idea. Most of these institutions provide direct interventions in the form of capital financing to support the government's policy on employment creation, economic diversification and growth. The need for economic diversification is because Botswana is over-dependent on the mining sector, with exportation of cosmetic diamonds that contribute 35% of Gross Domestic Product (Central Statics Office 2005) in addition to beef exports to the European Economic Community. However, this diversification policy is not being realized as most of these supported ventures fail a short period after establishment (BICA 2013, Sserwanga and Rooks 2013, Sekwati 2010) or do not achieve the set objectives. For example, since it was established in 2007, LEA has assisted 14,400 clients of whom only 1500 are active businesses, (President Khama, 2011) and CEDA notes that the impairment charge on its portfolio continues to increase at an increasing rate (CEDA 2011/12 financial report). Questions as to why these interventions are not yielding fruit are abound in many minds. This is not a problem experienced in Botswana alone. Studies carried out by Dan & Bradstreet Inc. in the United States of America indicate that this is a continuous problem as more than 140 businesses closed doors during the month of June 2013. The Euler Hermes economic research studies echo along the same scenario by emphasizing on a likely ongoing global economic fragility and vulnerability in many investment sectors (Economic Outlook June-July 2014).

This paper aims to address and consequently establish the inherent causes of failure in businesses after establishment despite the much drummed up and available support that is extended to individual and organizational business promoters by government, parastatals and non-government institutions in the world including Botswana. The paper proposes a remedy for the failure in the form of an E-M business Model.

## **Review of related Literature:-**

### **Business Failures and the Business Environment:-**

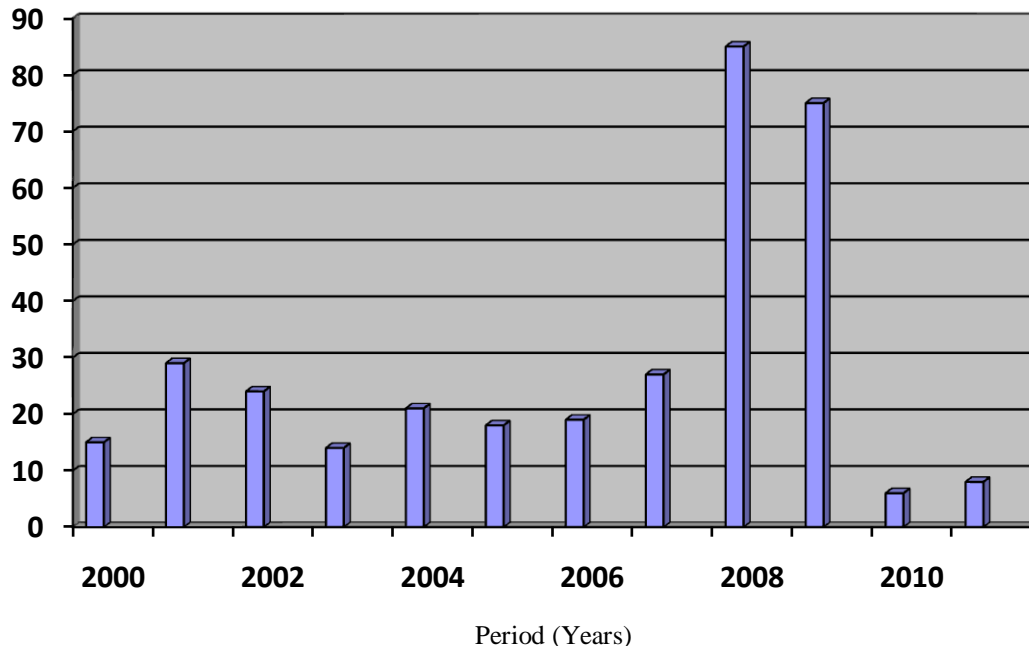
The twenty first century era is characterized by increasing need for resources investment in various businesses as a means of providing self-employment for socioeconomic independence or as an alternative to a shrinking job market as demonstrated by most world economies (Anyona 2013), Botswana included. Resources are inevitably scarce and when investors spot a viable opportunity, a good return for investment is anticipated from the investment. However, this has not always turned out to be the case in many parts of the world including Botswana and consequently created suffering and misery to the investors and stakeholders. For example, Air America, an American radio network, specializing in progressive talk programming, with four million unique listeners every week went off the air in January 2010 after operating only for six years. This investment failed in an economy 'perceived' to be relatively strong as shown in Figure 1.

Though the large number of business failures in Figure 1 occurred in 2008 and 2009 can be attributed to broader unfavourable economic conditions, Dun and Bradstreet Corporation in their world business failure report (2011) put the number of failed investments at 83,384 (cited by Anyona, 2013). This scenario is not unique to USA. Studies carried out by Sserwanga and Rooks (2013), observed that 30% of all businesses established in Uganda during



2003-2004 actually failed to meet objectives and consequently closed down. Botswana continues to experience failures across investment levels a situation detestable particularly at a time that economic diversification is being embraced.

**Figure 1:-Documented Business failures in the USA (2000 – August 2011)**



**Source:** Adapted from [www.wikipedia.org](http://www.wikipedia.org) (accessed 27.08.2011:0930hrs)

This article explores the much documented and over-emphasized entrepreneurial skills (Shemi and Procter 2013) that are perceived as a prerequisite for successful investments. This school of thought has now been negated by many investments made by well-grounded entrepreneurs that have failed to realize the set objectives. Amit, Glosten and Muller (1993) have categorically expressed fears on the alarming failure rate of new ventures demonstrated by low returns on seed financing. This scenario is equally of concern in Botswana as many Botswana government and institutional investments in such programs have not met the set objectives as alluded earlier.

However, the author of this article views management as a continuous activity of organizing and coordinating the activities of an investment in accordance with prior determined policies and in achievement of defined objectives (Anyona, 2013). This latter school of thought is particularly critical during the 21st century and beyond due to the continuously dynamic and increasing hypercompetitive investment environment emanating from a/an;

- Highly informed workforce;
- Fairly educated consumers;
- Broadened access to information for businesses;
- Increase in virtual organizations;
- Increase in nontraditional staffing;
- Declining motor and brick outlets;
- Upsurge in the utilization of market space;
- Demand for flexible (multi-skilled/cross-trained) workforce by employers;
- Increase in outsourcing of activities by businesses;
- An upsurge of computer links among businesses, suppliers and customers;
- Increase in new learning technologies resulting in increased staff training and development;
- Continued globalization an important feature creating more competition among businesses
- Businesses continuously attracting more females both at employers and employee levels; and
- Increasing emphasis on a triple bottom line (financial, social and environmental performance) for businesses.



The interrelationships of the foregoing characteristics, presents market place and space conditions that are highly complex and cannot be successfully manipulated by an emphasis on traditional entrepreneurial skills.

#### **Entrepreneurial Theories/Concepts:-**

The study of entrepreneurship is relatively young (Hurley 1999) and did not attract any scholarly studies until late 1980s, even then with minimal theoretical foundations (Bygrave and Hofer 1991). Definition of entrepreneurship is as varied as there are researchers. Entrepreneurship has been defined as; innovation (Schumper, 1958), initiating, maintaining, and developing a profit oriented business (Cole, 1965), making significant decisions about changes that affect resources of an organization (Sawyer, 1958), risk-bearing (Mill, 1848), ultimate formal authority within an organization (Weber, 1917) or making changes in strategy for an existing firm that alter the state or pattern of resources deployment (Ginsberg, 1988).

However within a short time, studies on the method of predicting the individual who can become an entrepreneur or which conditions lead to entrepreneurship have been done. Hurley (1999) proposes two streams of theory that lead to entrepreneurship; psychological and sociological. The psychological theory reflects on the psychological influences, personal characteristics and effects of past exposure on the person while sociological theory has a thrust on the influence of environment. For example, high economic and social growth in some societies tends to boost emergence of entrepreneurship especially when a new venture is being established (Aldrich, 1990). Other relevant societal aspects include; political, cultural, financial, location and geographical issues.

Examining the many definitions and concepts, the key words in approaching defining entrepreneurship and consequently identifying entrepreneurial individuals are; risk-taking, creativity and innovation (Amit, Glosten and Muller, 1993). It is risk-taking because it is impossible to predict the future events within an environment with certainty. Creativity emanates from a perceived opportunity within the operating environment which is pursued using an innovative (unique) product (organization) or service. The numerous definitions, precise as they may be lack cognitive ability of an organization (business) being 'alive'; born, grow, mature and decline (Rwigema and Venter 2007). This philosophy is supported by Hannan and Freeman (1977) who draw similarity of organizations to the process of population ecology in which there is birth, survival and death.

#### **Management thinking (theories/concepts):-**

Knowledge from extant literature on management is abounding. Studies by Taylor's scientific management (1911) postulated the Classical School of Management that emphasized organizational structure, Weber (1864-1920) introduced the system of bureaucracy in organizations, distinguishing kinds of organizations based on the source of authority; Fayol (1916) who advocated the administrative management school who defined management as to forecast, plan, organize, command, coordinate and control; Elton Mayo and Hawthorne (1927-1932), viewed management from the Human Relations School that stressed the understanding of the human part of the organization in order to improve its performance; The systems theory (Lwidi 1951 and Boulding 1956) viewed organizations as a systems of levels and that they have a symbiotic relations with its environment; the contingency theory of Woodward (1958), Burns and Stalker (1961) postulated the mechanistic and organic systems based on the premise that there isn't one single approach to successfully managing an organization except to consider entire variables within its environment.

#### **Contemporary theories:-**

Peters and Waterman (1983) formulated the Contemporary Theories that emphasize excellence in organizations as being dependent on value systems. Theory X and Y (McGregor 1960) argue that human beings do not like work naturally and require to be compelled by rewards in order to be more productive. These two theories developed simultaneously gave rise to democratic view of managing organizations. Ouchi's Theory Z (1981) emphasizes organizational performance as being dependent on participation and the commitment of all the employees. It is noteworthy that the later contemporary theories are philosophically biased towards leadership in organizations and form the basis of the practice of management as we know it today. Though management has many definitions, it can be broadly viewed as an activity of organizing and coordinating the activities of a business in accordance with prior determined policies and in achievement of defined objectives (Anyona 2013 and Olum 2004). This definition is in tandem with the extant studies and the philosophy underlying the management theories that exist.

Definition of management notwithstanding, one would imagine that the most recognized management theories of Quantitative Approach, The Systems approach and The Contingency Approach, would have developed a view of the 'living' nature of organizations, the manner they are understood today (Rwigema and Venter 2007). The more recent Chaos Theory (Peters 1987, Weick 1936) explain the concept using biological systems with emphasis on increasing volatility resulting from increasing complexity and so letting organizations thrive by themselves. It is also silent on the 'living' nature of an organization.

#### **The Research methodology/Approaches:-**

The aim was to find out an explanation for the perceived and observed different business performance levels in situ overtime. Just like majority of management studies, this research was based on case study approach within the interpretive paradigm. This approach was found convenient because entrepreneurship is holistic in nature. A number of both internal and external interrelated factors will inform the behaviour or decisions made by the business management. These factors include; leader-management style, business structure, business policy and regulations, employee skills and motivation, political climate, general state of the economy, technology, sociocultural aspects, just to list a few. Consequently, entrepreneurship can only render itself to studies based on non-algorithmic analysis since it is essentially a conscious action (Penrose 1989) that deals with sudden changes and discontinuities within the environment. Regression analysis is inherently reductionist and consequently generates smoothly changing analytic functions which cannot be applied to entrepreneurial actions.

A purposeful method of sampling (Huberman and Miles 2002) was employed to select a representative of twenty (20) businesses within Gaborone that dealt in products and services. These businesses also operated at different levels in the market segments in terms of volume in daily transactions and had operated for at least more than three (3) years. The industry sectors that were involved in the study are; Departmentalized stores, supermarkets, wholesaler/distributor, motor vehicle showrooms, food stores, apparel and textiles, training providers, motor vehicle repairers, motor vehicle replacement parts dealers and tuck shops.

The businesses were then subjected to a six month long periodical critical physical observations of their in-store situation. The visits to the outlets and observations were made during the first week of the month (day 1-4) and the third week (day 15-18). The observations whenever possible during the same visit were combined with unstructured in-depth face-to-face interviews of the respondents for further explanations on the observable in-store state or the resultant features. The explanations provided referred to the volume or number of transactions. This informant interview (Ghauri and Gronhaug 2005; Healey and Rawlinson 1994; and Robson 2002) allowed the business owner/manager to guide the conduct of the interview. The narratives behind the observable changes or attributes of the business were then recorded.

#### **Data collection, Analysis and Discussion:-**

Data in this study was recorded information in the form of a number of sentences/statements. The data was then analyzed using qualitative categorization approach. Though the underlying principle was to establish the reasons for poor or failed businesses, there weren't predetermined categories into which to group the statements/sentences. The categories that were used in the study are those that emerged (Saunders, Lewis and Thornhill, 2007) during the course of the face-to-face interviews. Four distinct categories emerged; no change with reducing transactions (NCRT), no change same transactions (NCST), no change increasing transactions (NCIT), change with increasing transactions (CIT).

The entire study involved 240 visits and observations, whose category statements were tabulated as shown in Table 1.

**Table 1:-Distribution of Category statements**

<b>Category</b>	<b>No change Reducing Transactions (NCRT)</b>	<b>No Change Same Transactions (NCST)</b>	<b>No Change Increasing Transactions (NCIT)</b>	<b>Change with Increasing Transactions (CIT)</b>
<b>Businesses/Entrepreneurs</b>	8	8	1	3
<b>Percentage(%)</b>	40	40	5	15

**CIT:-**

The fifteen percent (15%) of outlets in which there was a continuous upsurge of transactions took place across all sectors disregarding the levels of transactions and target market. The entrepreneurs/business managers explained this by their ability to focus on monitoring the environment and responding with activities to increase the traffic flow into the store. "We fix our eyes on the break-even graph", the entrepreneurs of these businesses claimed. An unfavourable shift of the profits would immediately be met with staff meeting to craft an appropriate activity to improve the shopping experience of the customers. Some of the activities sounded and looked very simple. A swift or change in the position of the same merchandise within the floor space was all that was required to increase customer traffic and transactions. More elaborate changes also included; introduction of new departments, new products or services to meet customer needs. This observation is supported by Deakins and Freel (2012), Theresa et. al.(2012), and Schumper (1958) who view entrepreneurship as a continuous process of creating and innovating products or services. These businesses exhibited a life cycle phase of either growth or sustained growth within strategic life cycles. This phenomenon was characteristic of departmental stores, super markets and apparel and textile sectors.

**NCIT:-**

Five percent (5%) of the businesses observed increased traffic flow and transactions. The business did not implement any changes within the six months. They have kept their products/services and business formats same during the periods when they did not have resources to effect any changes except for minor store repairs. These businesses claimed to be experiencing increased traffic flow since they have stuck to what they claimed to be knowledgeable. "Customers know us for who we are and what we do" the entrepreneurs/business managers claimed. This was particularly observed in motor vehicle repair services. The outcome could demonstrate a business or product/service that is experiencing a growth phase (Rwigema and Venter 2007, Hannan and Freeman 1977), despite having selected participating businesses aged more than three years. This was evident mainly in the motor vehicle replacement parts dealers.

**NCRT:-**

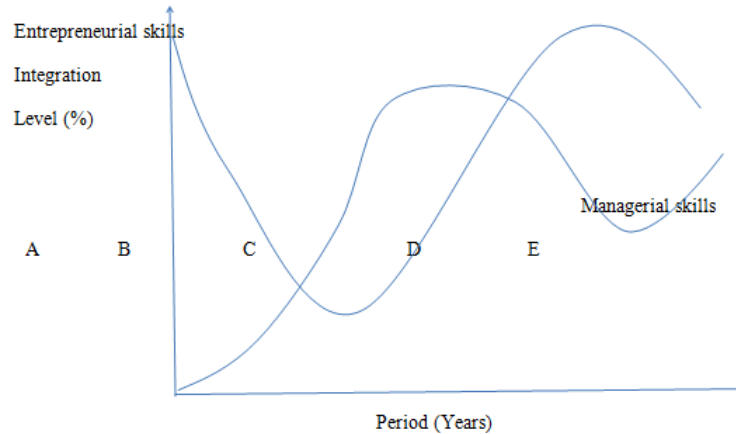
Forty percent (40%) of the businesses experienced reduced traffic flow and transactions. The businesses have maintained the same or similar merchandise and business formats since establishment. The entrepreneurs attributed the observable business situation to inflation affecting their customers. "People have no money to spend", the managers claimed. The only response management has made is to focus on controlling expenditure by reducing the payroll. This situation is characteristic of a product or service at the decline phase of a Product/Business Life Cycle (Rwigema and Venter 2007, Hannan and Freeman 1977) that is often associated with chaos within the labour force. This phenomenon was observed within wholesaling/distribution, retailing, tuck-shops and motor vehicle repair services.

**NCST:-**

Forty percent (40%) of businesses claimed a no effect on volume of traffic and transactions. The face-to-face interviews did not reveal any ambition to change the merchandise or the business format. The business has maintained offering the same or similar products and services since inception. The most likely position in the life stage of these businesses is maturity phase (Rwigema and Venter 2007, Hannan and Freeman 1977) in which the entrepreneur could be focusing more on managing the business activities (Anyona, 2013 and Olum, 2004) with a lot of complacency for survival.

**Conclusions:-**

Business life cycle is a model whose premise is that requirements in terms of internal strengths to exploit external opportunities while reducing threats to the business will vary depending on the stage of development in which the business finds itself (Figure 1). Five growth phases are observable within business organizations; birth or start-up (A), growth (B), maturity (C), decline (D) and revival or bust (E).

**Figure 1:-Business Life Cycle.**

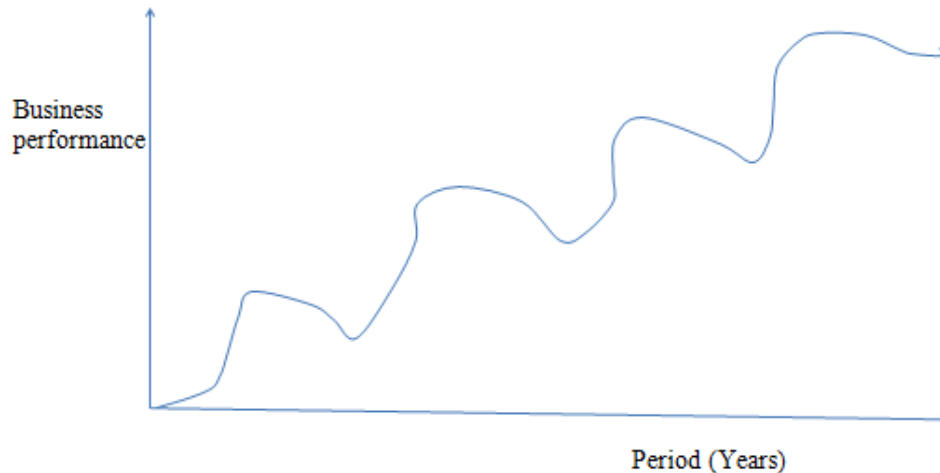
For example the threats at the start-up phase are different from threats at the maturity phase. Businesses inevitably move from one phase to another in an attempt to create a 'fit' with its environment for survival. This 'fit' is attained by efficiency and effectiveness in meeting or exceeding the needs of customers. The implication of a business life cycle (BLC) therefore, is that different objectives, strategies, managerial processes (planning, organizing, directing and controlling), technology, culture, and decision-making should be crafted to ensure a businesses is aligned with the environment. Continuous change in the managerial processes using management skills must be in tandem with the volatile hypercompetitive and complex external environment. The managerial processes alone cannot adequately address changing customer needs but both the managerial skills and entrepreneurial skills are required in order to meet or exceed the dynamic customer needs. The extent of entrepreneurial skills and managerial skills required at each different BLC phase will vary from one type of business or product/service to another. Apparel and textile fashion houses have an extremely short BLC (Kotler and Armstrong 2008) in contrast to motor vehicle repair services. This article seeks to point out the need to blend the skills but not necessarily to provide absolute arithmetical values. The differential skills requirement at different phases can be explained in Table 2.

**Table 2:-Entrepreneurial and Managerial Skills at different BLC Phases (E-M Model)**

BLC Phase	Entrepreneurial Skills	Managerial Skills
Birth (A)	Sporting and exploiting the opportunity by creating an innovative product or service requires a very high level of practical entrepreneurial skills.	Minimal managerial skills in planning to support the new innovation will be demanded.
Growth (B)	Entrepreneurial skills start reducing to monitoring the performance of the innovation and the activities within the task environment. Internal and external stakeholder's interests are important.	More sophisticated and formalized managerial skills are demanded to achieve the growth objective. Organizing and directing authority is delegated to lower levels of management.
Maturity (C)	At the start of maturity phase, entrepreneurial skills are at a minimum. The skills start increasing in demand into the 2 <sup>nd</sup> quarter of the phase, so that during the 4 <sup>th</sup> quarter, an innovation should be evident to restart the life cycle.	This phase requires the highest demand of managerial skills. Processes for fast decision-making are hampered by inherent bureaucracy and a higher need for superior coordination and control becomes a priority.
Decline (D)	Maximum entrepreneurial skills are required to create another innovation to avoid the business proceeding into death or bust. The highest level of entrepreneurial skills will ensure the business is revamped into sustained growth.	Though the business will be starting all over again, the managerial skills demanded will be a lot higher than the initial creation of a unique product. The business will be having resources but require planning and organizing to reload resources onto the plans.
Revival, Bust (E)	The business demands a similar level of entrepreneurial skills like in the growth phase. If the business is void of such skills, it will bust and close doors.	The innovation must be managed just like in the initial growth phase. However, the skills required exist in the business and requires refocusing.

The implication of the BLC explained in Figure 2 is that an operating business set-up consists of a series of BLCs. The number and shape of BLCs and the period occupied by the various phases is determined by the type of product or service, the industry of establishment and the nature of the complexity created by environmental factors. A graph of business success plotted against period (years) is shown in Figure 3.

**Figure 3:- BLC Graph**



In practice, the dynamic interplay of environmental factors creating a highly complex business environment leaves both entrepreneurs and business managers gasping for knowledge, and becoming casualties of indecisiveness.

The different school of thought in this article, demonstrated by the E-M model, while supporting the former school of thought with a bowl of salt, views ‘blending’ the entrepreneurial and business skills along the business life cycle, in a ‘unique’ combination as the messianic dose for success in investments, not only in Botswana but entire economic world. While emphasis has been on the entrepreneurial skills when developing an investment idea, success of a business demands application of management skills at differing levels along the life of the investment.

#### **Challenges of The e-m model:-**

The BLC concept is applicable to businesses and also to products (PLC) or services (SLC). The critical dimension to the simple E-M Model is the capability of the entrepreneur or business manager to practically determine the current phase of the business, product or service, in order to generate appropriate response. The expected appropriate response is the optimum levels of blended entrepreneurial and management skills. The optimum quantifiable skills levels provide a scope for future studies.

A befitting quote from Charles Darwin (1863) on the appropriate balance between theory and observation: “Let theory guide your observation, but till your reputation is well established, be sparing in publishing theory. It makes persons doubt your observations”.

#### **Delimitation:-**

This article is not based on observation research conducted outside Botswana.

#### **Definition of terms:-**

Entrepreneur in this article is interchangeably used with investor or business manager. The same applies to business and investment.

**List of References:-**

1. Amit, R. Glosten, L. and Muller, E. (1993). Challenges to Theory Development in Entrepreneurship Research, *Journal of management studies* 30:5 September 1993, 0022-2380
2. Anyona, N. A. (2013). *Modern Business Handbook; the Building Blocks for Successful Entrepreneurs*. W. Germany. Lambert.
3. BIDPA. Small, Medium and Large Enterprises Database, Sector mapping and validation in Botswana “findings and strategies” for Local enterprise Authority in the republic of Botswana 2007.
4. Bygrave, D. W. and Hofer, W. C. (1991). *Theorizing about Entrepreneurship*. Baylor University.
5. Dollinger M. J. (1995). *Entrepreneurship: Strategies and resources*. Boston. Austen Press.
6. Dan and Bradstreet Small Business Health Index 2013, USA
7. Ghauri, P. and Grohaug, K. (2005). *Research Methods in business Studies: A practical Guide*. 3rd ed. Harlow Financial times Prentice Hall.
8. Hisrich R D and Peters M. P. (1998). *Entrepreneurship*. 4<sup>th</sup> ed. Ny. McGraw-Hill
9. Hurley, E. A. (1999). Incorporating feminist theories into sociological theories of entrepreneurship’ *Women in Management Review*, Vol.14 Iss.2, pp.54-62.
10. Healey M. J. and Rawlinson, M. B. (1994). *Interviewing Techniques in Business and management research*, in Wass, VJ. And Wells, P.E. (eds) *Principles and Practice in Business and management Research*, Aldershot, Dartmouth, pp. 123-146.
11. Hannan, M. T. and Freeman, J. (1977). *The population ecology of organizations*. *American journal of Sociology*, 82(5), 929-964
12. Huberman, A. M. and Miles M. B. (2002). *The Qualitative Researchers Companion*. London. Sage Publications.
13. Kotler, P. and Armstrong, G. (2008). *Principles of Marketing*. 12th Edition. New Jersey. Pearson prentice Hall.
14. Kuratko, D. F., Ireland, R. D., Covin, J. G. and Hornsby, J. S. (2005). *A Model of middle-level managers’ entrepreneurial behaviour*. *Entrepreneurship theory and Practice*, Vol.29 No.6 pp.699-716.
15. Modise, T. Botswana Institute of Chartered Accountants (BICA) (2013) *Promoting the Growth of Small and Medium Enterprises (SME)* “Africa Congress of Accountants PAFA event-Ghana May 2013
16. Pinchot, G. (1985) *Intrapreneuring*. NY. Harper and Row
17. President Lt. Gen. Seretse Khama Ian Khama, Republic of Botswana. (2011). *State of the Nation Address to the 3<sup>rd</sup> Session of the 10<sup>th</sup> Parliament*
18. Peters, T. (1987). *Thriving on Chaos*. NY. Harper Collins.
19. Penrose, R. (1989). *The emperor’s new mind: Concerning computers, minds and the laws of physics*. New York. Oxford University Press.
20. Rwigema H and Venter, R (2007). *Advanced Entrepreneurship*. RSA. Oxford University Press
21. Robson, C. (2002). *Real World Research*. 2nd Edn. Oxford, Blackwell
22. Shemi, P. A. and Procter, T. C. *Challenges of e-commerce adoption in SMEs: An Interpretive case study of Botswana*; *Botswana journal of Business* Volume 6 No.1 (2013).
23. Sekwati L. (2010). *Botswana; a note on economic Diversification*; *Botswana Journal of economics*
24. Theresa, L. M., Lau, Margaret, A., Shaffer Kwong Fai Chan, Thomas Wing Yan Man. (2012). *The entrepreneurial behaviour inventory*. *International Journal of Entrepreneurial Behaviour and Research*, Vol.18 Iss 6 pp.673-696.
25. Zampetakis, I. and Moustakis, V. (2007). *Entrepreneurial behaviour in the Greek public sector*. *International Journal of Entrepreneurial Behaviour and Research*, Vol.13 No.1, pp. 19-38



## RESEARCH ARTICLE

### SURVEY OF MINOR FOREST PRODUCTS AND THEIR VALUES IN SIRSI TALUK

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#### Abstract

Minor forest products or Non-timber forest products (NTFPs) have an important role in forest social life from different aspect. The knowledge related to forest and forest products have developed among forest communities for generations. Non-timber forest products (NTFPs) are any product or service other than timber that is produced in forests. NTFPs are used and managed in complex socioeconomic and ecological environments. In traditional forest communities, many NTFPs may be used for subsistence while others are the main or only source of income. Some NTFPs have significant cultural value, as totems, incense, and other ritual items.

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#### Introduction:-

Non-timber forest products (NTFPs) are wild plants and fungi that people gather and use for food, medicine, crafts, spiritual, aesthetic, and utilitarian purposes. The NTFPs includes plants that can be found in a variety of habitats across the forested landscape. Therefore, in this sense, we will find plants that make their home in old fields and wetlands as well as the woods. The many species commonly used today were first introduced to the area by settlers because of their medicinal or edible properties.

A NTFPs is literally any and every natural resource from the forest except timber. This is illustrated in the definition of Wickens (1991) that NTFPs are 'all the biological material (other than industrial roundwood and derived sawn timber, wood chips, wood-based panels and pulp) that may be extracted from natural ecosystems, managed plantations, etc. and beautified within the household, be marketed, or have social, cultural or religious significance'.

They cover a wide range of products including bamboo, thatching materials, fruits, seeds, nuts, tubers and medicinal plants. In India there are about 15,000 plant species out of which nearly 300 species (20%) yield NTFPs. However, only about 126 species (0.8%) have been commercially developed (Murthy *et al.*, 2005). Non-timber forest products (NTFPs) contribute significantly to a rural household's livelihood in the African semi-arid tropics. On average, income from NTFPs accounted for 39% of total household income and had a strong equalizing effect on it. However, the economic relevance of NTFPs differs between households: Poorer households are relatively more dependent on NTFPs in order to full fill basic needs than wealthier households. This is mainly due to a significant greater land holding. Moreover, the study revealed that net income from NTFPs reflects traditional sources of livelihoods of different ethnic groups (Heubach *et al.*, 2011).

#### Materials and Methods:-

The present study is the outcome of exhaustive field survey undertaken during year of 2014.

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**Study area.**

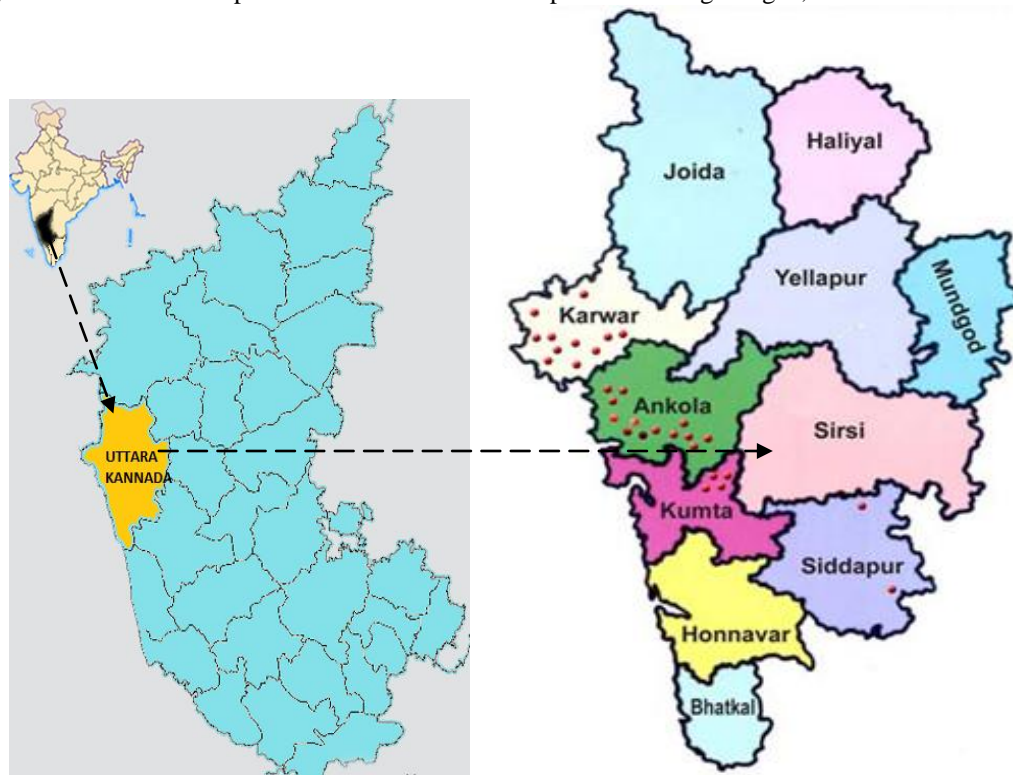
Sirsi taluk is located in Western Ghats of Uttar Kannada district, Karnataka state, India. It lies in 14°70' N latitude and 74°80' E longitude. Mean annual rainfall ranges from 2,000 mm to 6000mm. About 95% of the rainfall is received during the month of June to September, when the southwest monsoon is at its climax. Temperature range from 22°C to 36°C with relative humidity of dry month and monsoon month were less than 35% and 75% respectively. (Fig.1)

**Collection of plant material:-**

Some of the important non-timber forest products were collected from the forest of Sirsi taluk, Uttar Kannada District, Central Western Ghats of Karnataka.

**Identification of Plants:-**

Diagnostic features of all the specimens were studied and relevant field notes were made on fresh plant materials. Photographs were also taken for each species. Specimens were identified with the help some of the tribal community. Authentications of species were done with the help of Panduranga Hegde, Prakruthi Institution.



**Fig. 1:-** Location map of Sirsi Taluk, Uttar Kannada District.

**Results and Discussion:-**

***Acacia concinna* Willd:-**

**Family:-** Fabaceae

**Parts used:-** Leaves, Fruits

**Harvesting:-** April to May

**Collection and Processing:-**

The fruit pods, leaves were collected and dried in direct sun light these dried were ground into a powder. Made a pack it should be free from moisture.

**Medicinal uses:-**

*Acacia concinna* Willd. has been used traditionally for hair care since long time in India. Fruits are used for washing hair, for promoting hair growth, expectorant, emetic and pungitive. Aqueous extract of this fruit has been used as detergent and natural shampoo preparations. It had antimicrobial activity and also it contains secondary metabolites



such as alkaloids, flavonoids, phytosterols, saponin, tannins, phenolic compounds, gums (Todkar *et al.*, 2010). Leaves were used as anti-dandruff, pods were used for some skin diseases. It acts as anti-dermatophytic (Natarajan and Natarajan 2009).

***Ailanthus triphysa* (Dennst.) Alston:-**

**Family:-** Simaroubaceae

**Parts used:-** Gum or Resin.

**Processing:-** In mature plant, cut or hole made on the stem portion up to 2-3 inches in depth. Polythene cover or plastic bowls attached below the cut portion to collect the gum or resin. It is in the form of semi liquid state then it solidifies in 15-20 days at room temperature.

**Medicinal uses:-**

Traditionally used as dhupa or resin to release mental stress. Its pleasant smell gives relaxation to the mind and also used in bronchitis problems, treatment of cough, cold, fever. Bark is used as antibacterial and in chronic rheumatism treatment.

**Other uses:-**

Resin of the plant is mixed with coconut oil and used in candle making in rural areas.

***Artocarpus gomezianus* Wall:-**

**Family:-** Moraceae

**Harvesting:-** April and May varies from region to region.

**Parts used:-** Fruits, Bark.

**Processing:-** The fruits are made into thin half-moon shaped slices and they dried under the direct sunlight for 8-10 days. The seeds are separated and discarded simultaneously. The dried slices treated with common salt. The processed product is known as 'Huli Seppe.' The processed slices are powdered along with 2-3% of cooking salt or without salt. The processed product earn up to 70-80 per kg.

**Medicinal uses:-**

*A. gomezianus* Wall. The powder is used in treatment of dysentery, dry cough in local areas. The fruits are edible it contains high nutritive value.

**Other uses:-**

It is used in preparations of sambar, fish curry, papad in Sirsi taluk. It is used replace of tamarind and most important ingredient for the preparation of dishes in Western Ghats (Sarala and Krishnamurthy 2014).

***Calamus rotanga* Linn:-**

**Family:-** Arecaceae

**Parts used:-** Bark

**Processing:-** Mature plant stems are pulled out and the dead leaf sheaths removed using a sharp knife. Then the soft upper most part is dipped or immersed in the lake or river 15-20 days. After fibers became very elastic in nature, brittleness is completely removed.

**Uses:-**

It is one of the most useful forest products next to timber plants. It plays an important role in the rural economy, employing many people in rural areas. Fiber is used to make mat, bucket, flower basket, protecting sheath for small houses.

***Canarium strictum* Roxb:-**

**Family:-** Burseraceae

**Harvesting:-** Rainy season

**Parts used:-** Resin

**Medicinal uses:-**

*C. strictum* Roxb. species producing resin, is a rich source for making fragrance smoke (Sambrani or Blackdammer) and it is given for the treatment of bronchial diseases and orally given resin powder used to cure rheumatism and it is one of the major drug in Siddha medicine. Black dammer resin is also used as an alternate for burgundy pitch in making medical plasters. Extreme usage of resin in industry as well as in traditional medicine (Muthuswamy and Senthamarai, 2014).

***Cinnamomum tamala* (Buch-Ham) T. Nees:-****Family:-** Lauraceae**Parts used:-** Leaves.**Medicinal uses:-**

Leaves are used as astringent, stimulant, carminative and also used in treatment of rheumatism, colic, diarrhea, nausea and vomiting. The essential oil of leaves used as diuretic, anti-flatulent and cardiac disorders. It is also used in pharmaceutical preparations because of its hypoglycemic and carminative properties (Sharma and Nautiyal 2011). The antimicrobial potentials of essential oil and oleoresins were reduced the growth of food born fungi and bacteria ( Kapoor *et al.*, 2008 ). It is also used as anti-gonorrhoeic and antidote for scorpion sting (Shah and Panchal, 2010).

**Other uses:-**

It is commonly called “Bay Leaf” it is used as spices. It is one of the major exporting spice. It also used as food preservatives.

***Cinnamomum zeylanica* J. Presl:-****Family:-** Lauraceae**Parts used:-** Bark.**Medicinal uses:-**

*Cinnamon* is used in flatulence control and indigestion, bark used in mouth washes. *C. zeylanica* J. Presl. Used in the treatment of dyspeptic conditions such as mild spastic condition of the gastrointestinal tract, loss of appetite, abdominal pain and diarrhoea. Ayurveda and folklore system of medicine in India from the era of Charakasamhita. It is used for the treatment of inflammation of the eye, leukorrhoea, vaginitis and toothache problems (Manosi *et al.*, 2013). It acts as antioxidant, anti-parasitic, antimicrobial, it lowers the blood glucose level and blood pressure (Ranasinghe *et al.*, 2013).

***Entada rheedii* Spreng:-****Family:-** Fabaceae**Parts used:-** Seed.**Medicinal uses:-**

The plant is used as a topical ointment against jaundice, toothache, ulcers and to treat muscular-skeletal problems.

**Other uses:-**

The seeds are sought after as pieces of jewelry and as good-luck charms.

***Garcinia cambogia* (L.) Roxb.****Family:** Clusiaceae**Harvesting:** June to July.**Parts used:** Fruit and seed.

**Processing:** The ripe fruit is halved or sectioned and spread in thin layers, dried in the fire smoke for three to seven days to moisture level of about 15 to 20 percent. Commercially available rind is loaded with considerable amounts of common salt, which is added during drying. Seed is completely dried and crushed and then boiled the crushed seeds in water and skimming off the fat from the top. This fat is commonly called *G. cambogia* ghee. It is stored in plastic bottles.

**Medicinal uses:-**

The fruits having sour taste are help to promote digestion. The fruit juice possesses anti-scorbutic, anthelmintic, antibacterial and cardio tonic properties. Also used in the treatment of piles, dysentery, tumors, pains and heart complaints. The decoction of the fruit rind is given in rheumatism and bowel complaints. Rind of the fruit also reduces blood cholesterol level. It is also possess antioxidant, anti-helmintic, anti-cancer and antimicrobial activity (Tharachand *et al.*, 2013).

**Other uses:-**

The fruit rind and extracts of *Garcinia* species are used in many traditional recipes. The dried rind is also used for polishing gold and silver. The yellow resin obtained from the fruit is used as varnish. Fat of *G. cambogia* used replace of ghee for making some sweet dishes, like halwa, barffi, banana sweets.

***Garcinia indica* (Thouars) Choisy:-****Family:-** Clusiaceae**Harvesting:-** April-May.**Parts used:-** Fruit and seed.

**Processing:-** The ripe fruit is halved, fleshy portion containing the seed is removed and spread the skin of the fruit in thin layers, dried in the sun light for three to seven days to moisture level of about 15 to 20 percent. Commercially available rind is loaded with considerable amounts of common salt, which is added during drying. Kokam butter: Seed is completely dried and crushed and then boiled the crushed seeds in water and skimming off the fat from the top. This fat is in the form of flakes. Kokum syrup: Kokum rind by adding cane sugar at the rate of 1:2. The mixture is kept in sun light then syrup is obtained it is filtered with the help of cleaned muslin cloth. Then it is stored in bottles.

**Medicinal uses:-**

The fruit has an agreeable flavour - and a sweetish acid taste. Kokum has been traditionally used as an acidulant. The fruit of *G. indica* is anti-helminthic and cardio tonic and useful for treatment of piles, dysentery, tumors, pains and heart complaints. Kokum butter is considered nutritive, demulcent, astringent and emollient. It is suitable for ointments, suppositories and other pharmaceutical purposes (Braganza *et al.*, 2012). It is used for local application to ulcerations and fissures of lips, hands etc. The cake left after extraction of oil is used as manure. Kokum butter is used as a specific remedy for diarrhea and dysentery (Kureel *et al.*, 2009).

**Other uses:-**

The traditional fish curry, Sambar Kokum rind is a usual ingredient. The dried rind, strained in water, is boiled into a soup called solkadi. Spiced and sweetened with jaggery it is a must for marriage feasts and functions in Sirsi taluk. Red syrup, extracted from the rind of the ripe fruit with the help of sugar is stored in the households of this region for making cool drinks in summer.

***Mangifera indica* L:-**

**Family:-** Anacardiaceae

**Parts used:-** Fruit, leaves, bark.

**Processing:-** This particular pickle makes use of very tender, small, unripe mangoes. This pickle is known to last for long. You can use the tiniest mangoes too. Take a jar, any kind will do, for instance a 'Bharani' (traditional ceramic jar) would be perfect. Boil and cool some water. When the water is warm, add the rock salt so that it dissolves. Filter the brine. Wash the small, tender mangoes. The tip of the stalk, or the knob should be included and not discarded. Pour the saline solution in the jar. Drop the mangoes in the brine. The salt water level should be an inch or two inches above the level of the tiny mangoes. Close the jar. The lid should not have even a trace of rust, so it is best to avoid using a metal lid and store for two weeks. This lasts for a year to up to three years.

**Medicine uses:-**

The leaves make a plaster to remove warts and also act as a styptic. Seeds are used to treat stubborn colds and coughs, obstinate diarrhoea and bleeding piles. The bark is astringent, homeostatic and anti-rheumatic. Mango kernel decoction and powder (not tannin-free) are used as vermifuges and as astringents in diarrhoea, hemorrhages and bleeding hemorrhoids. The fat is administered in cases of stomatitis. Extracts of unripe fruits and of bark, stems and leaves have shown antibiotic activity (Bharati R.P, 2013). Dried flowers are of medicinal value and used for curing dysentery and catarrh of bladder. It is a cure for wasp sting, rubbed between hands and left to dry.

**Other uses:-**

Unripe ripe and processed (at various stages of maturity, in the form of pickles or chutneys, dried slices, canned slices in syrup, juice and puree or paste). The fruit is surrounded by golden, juicy flesh. The green fruit is also used to flavour fish and meat dishes in the same way as tamarind and other sour fruits. The kernels are important as a famine food, but the astringency has to be removed by boiling, roasting and soaking them for a long time. Young leaves are cooked as a vegetable.

***Mammea suriga* (Buch-Ham. ex Roxb.) Kosterm:-**

**Family:-** Clusiaceae

**Harvesting:-** March-July.

**Parts used:-** Flower and root

**Medicinal uses:-**

Flower buds mild stimulant, carminative, astringent and used in dyspepsia. It is used in many skin diseases like ringworm, intertrigo, eczema, dandruff (Bhat *et al.*, 2014). Its root paste is used in the treatment of partial headache. The extract of the plant root contain antibacterial and antifungal activity (Mahesh *et al.*, 2015).

**Other uses:-**

Flowers used in Hindu worship and for decorating hair. Manly flower is used to prepare scents.

***Murraya koenigii* L:-****Family:-** Rutaceae**Parts used:-** Leaf.**Medicinal uses:-**

*Murraya koenigii* leaves is boiled with coconut oil reduced to blanked residue which is then used as natural hair tonic and hair growth promoter. It can be used as anti-helmentics, it also acts as febrifuge, blood purifier, antifungal, depressant, anti-inflammatory, body aches, for kidney pain and vomiting *Murraya koenigii* is used as a stimulant and anti-dysentric. It is also effective against diabetes Mellitus. Leaves are applied externally to bruises and eruption. The leaves and roots are bitter in taste analgesic, cure inflammation and itching. It is also useful in leucoderma and blood disorders and also cures diseases like piles. It can be also used to stop vomiting by infusion of the toasted leaves. If someone is bitten by poisonous animals, local application of the leave paste is effective. In an ancient systems of medicine including Ayurveda, Siddha and Unani, *Murraya koenigii*, a medicinally important herb (Jain *et al.*,2012).

**Other uses:-**

Fresh leaves, dried leaf powder, and essential oil are widely used for flavouring soups, curries, fish and meat dishes, eggs dishes, traditional curry powder blends, seasoning and ready to use other food preparations. The essential oil is also utilized by soap and cosmetic aromatherapy industry (Kumar *et al.*,2013).

***Myristica malabarica* Lam:-****Family:-** Myristicaceae**Parts used:-** Fruit.**Medicinal uses:-**

Seeds are used in external application for indolaent ulcer, crude fat from seeds analgesic and used in rheumatism, gangrene. It acts as antioxidant. Mainly it is used as spices.

***Myristica dactioides* Gaertn:-****Family:-** Myristicaceae**Parts used:-** Fruit.**Medicinal uses:-**

The yellowish mace is used as an adulterant for true mace (*Myristica fragrans* Houtt). Seeds are used in external application for indolaent ulcer, crude fat from seeds analgesic and used in rheumatism, gangrene. It acts as antioxidant. Mainly it is used as spices.

**Parts used:-** Fruit and leaves.

**Uses:** Its fruit is sweet in taste and used as nutritive food. Leaves were dried and used to make preparation of mat, bucket, cap.

***Phyllanthus emblica* Linn:-****Family:-** Phyllanthaceae**Parts used:-** Fruit.**Medicinal uses:-**

The fruits are sour, astringent, bitter, acrid, sweet, cooling, anodyne, ophthalmic, carminative, digestive, stomachic, laxative, alterant, aphrodisiac, rejuvenative, diuretic, antipyretic and tonic. They are useful in vitiated conditions of tridosha, diabetes, cough, asthma, bronchitis. It acts as anticancer, antitussive, antioxidant (Khan, 2009). Plant reveals its analgesic, antiatherogenic, neuroprotective, chemo modulatory properties (Dasaroja and Gottumukkala, 2014). It also act as immune-modulatory, anti-inflammatory (Singh *et al.*,2011).

***Sapindus emarginatus* Vahl:-****Family:-** Sapindaceae**Parts used:-** Fruit.**Medicinal uses:-**

The members of genus *Sapindus* are well known or their medicinal values. For thousands of years it has been used for various purposes. The fruits of *Sapindus emarginatus* are commonly used for hair problems and also in preparation of shampoos. Traditionally it used as anti-inflammatory and antipyretic. The plant has antimicrobial, antiulcer, fungicidal, anti-inflammatory activity (Pelegrini *et al.*, 2008).

***Strychnous nux-vomica* L:-****Family:-** Loganiaceae**Parts used:-** Fruit and seed.**Medicinal uses:-**

The properties of *nux-vomica* are substantially those of the alkaloid Strychnine. The motor or sensory ganglia of the spinal cord; during the convulsion there is great rise in blood pressure; in some types of chronic lead poisoning it is of great value. In cases of surgical shock and cardiac failure large. It has hepatoprotective, anti-snake venom, immuno-modulatory effect (Kumar *et al.*, 2012). It has antioxidant and anti-diabetic property (Chitra *et al.*, 2010).

***Terminalia belerica* Roxb:-****Family:-** Combretaceae**Parts used:** Fruit.**Medicinal uses:-**

The fruit rind (pericarp) is astringent, laxative, anthelmintic, pungent, germicidal and antipyretic. It is applied in a diverse range of conditions including cough, tuberculosis, eye diseases, anti-HIV-1, dyspepsia, diarrhoea, dysentery, inflammation of the small intestine, biliousness, flatulence, liver disease, leprosy, cleanse the blood and promote hair growth in the Ayurvedic drug. *Terminalia belerica*. Roxb is growing widely throughout the Indian subcontinent, Sri Lanka and SE Asia. In the Traditional system of medicine like Ayurveda, Siddha and Unani, medicinal uses have been described as it works in disease of every system. It is used as antioxidant, antimicrobial, antidiarrheal, anticancer, antidiabetic, antihypertensive and hepatoprotective agent (Motamarri., 2012).

***Terminalia chebula* Retz:-****Family:-** Combretaceae**Parts used:-** Fruit.**Medicinal uses:-**

Traditionally used as used this plant in the treatment of asthma, sore throat, vomiting, hiccough, diarrhea, dysentery, bleeding piles, ulcers, gout, heart and bladder diseases. The plant has been demonstrated to possess multiple pharmacological and medicinal activities, such as antioxidant, antimicrobial, anti-diabetic, hepatoprotective, anti-inflammatory, anti-mutagenic, anti-proliferative, radio-protective, cardio-protective, antiarthritic, anticaries, gastrointestinal motility and wound healing activity (Surya Prakash *et al.*, 2012).. Bio-active compounds isolated from *T. chebula* has prospective use in alleviating ageing, cancer and various disorders (Sawant *et al.*, 2013).

***Zingiber cassumunar* Roxb:-****Family:-** Zingiberaceae**Medicinal uses:-**

The decoction is prescribed for asthma, and as a topical for rheumatism. Pulverized rhizome also used for diarrhea. The fluid squeezed from the swollen ends of club-shaped stems is used for shampoo. Rhizome is used like the common ginger, as a remedy for coughs, asthma, parasitism, and variety of skin diseases. Compressed rhizomes used for bruises and cuts and to treat headaches, toothaches, ringworm, joint sprains.

**Other uses:-**

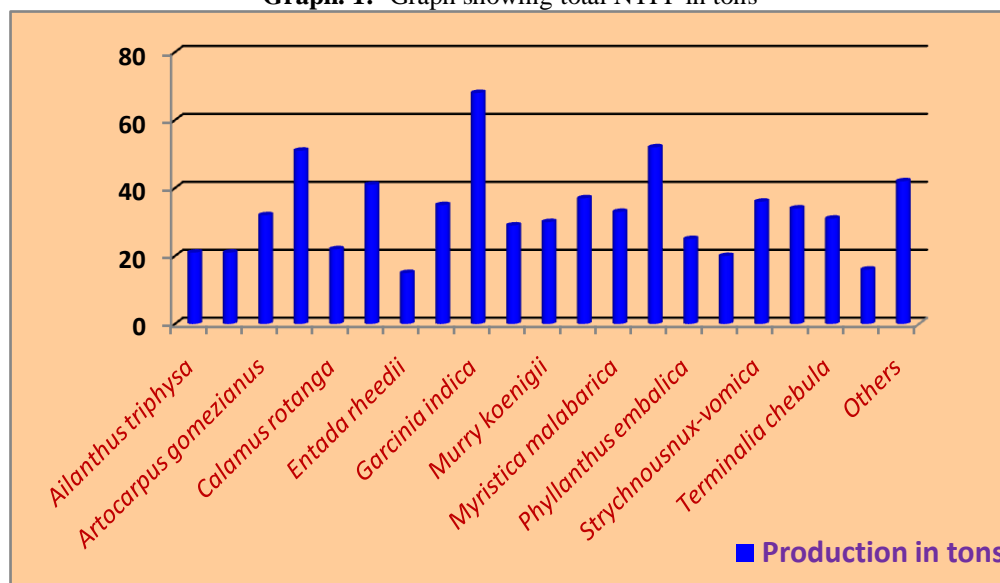
Powdered rhizomes used as perfume.

**Table. 1:-** The production of Minor forest product in Sirsi taluk

Sl.No.	Plants name	Production in tons
1.	<i>Acacia concinna</i>	21
2.	<i>Ailanthus triphysa</i>	21
3.	<i>Artocarpus gomezianus</i>	32
4.	<i>Canarium strictum</i>	51
5.	<i>Calamus rotanga</i>	22
6.	<i>Cinnamomum species</i>	41
7.	<i>Entada rheedii</i>	15
8.	<i>Garcinia cambogia</i>	35
9.	<i>Garcinia indica</i>	68
10.	<i>Mangifera indica</i>	29

11.	<i>Murraya koenigii</i>	30
12.	<i>Myristica dactiloides</i>	37
13.	<i>Myristica malabarica</i>	33
14.	<i>Mammea suriga</i>	52
15.	<i>Phyllanthus embalica</i>	25
16.	<i>Sapindus emarginata</i>	20
17.	<i>Strychnousnux-vomica</i>	36
18.	<i>Terminalia belerica</i>	34
19.	<i>Terminalia chebula</i>	31
20.	<i>Zingiber cassumunar</i>	16

Graph. 1:- Graph showing total NTFP in tons



### Conclusion:-

Minor forest products or Non-timber forest products (NTFPs) have an important role in forest social life from different aspect. Till date, the state Forest Department succeeded to enlist several forest resources from the uses by native villagers. The knowledge related to forest and forest products have developed among forest communities for generations. Therefore, for the configuration of states own sustainable forest governance policy, more academic research on such indigenous forest based social life is extremely essential. Non-timber forest products (NTFPs) are any product or service other than timber that is produced in forests. They include fruits and nuts, vegetables, medicinal plants, gums, resins, essences and a range of barks and fibres such as bamboo, rattans, and a host of other palms and grasses. NTFPs are used and managed in complex socioeconomic and ecological environments. In traditional forest communities, many NTFPs may be used for subsistence while others are the main or only source of income. Some NTFPs have significant cultural value, as totems, incense, and other ritual items. Others have important medicinal value and contribute to the community's health and wellbeing. The role of forests in nutrition and health, land tenure change, the increasing move by small communities to monetary based economies and the cultural importance of NTFPs.

### Acknowledgment:-

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**References:-**

1. Bharati R P.,2013, Studies on antimicrobial activity and photochemical profile of *Mangifera indica* leaf extract., IOSR Journal of environmental science, Toxicology and food technology., Vol.7(3):74-78.
2. Bhat P, Hegde G.R, Hegde G and Mulgund G.S.,2014., Ethnomedicinal plants to cure skin diseases-An account of the traditional knowledge in the coastal parts of Central Western Ghats, Karnataka, India., Journal of Ethnopharmacology., Vol.151:493-502.
3. Braganza M, Shiroadkar A, Bhat J, Krishnan S.,2012, Resoure book on kokum *Garcinia indica* Choisy., Western Ghats kokum foundation, Panaji.
4. Chitra V, Verma V.P, Krishnaraju M.V, Prakash K.J.,2010.,Study of Antidiabetic and free radical scavenging activity of the seed extract of *Strychnous nux-vomica*. IJPPS., Vol.2(1):106-110.
5. Dasaroja S and Gottumukkala K.M., 2014. Current trends in the research of *Embllica officinalis*: A pharmacological perspective. Int.J.Pharm.sci.Rev.Res., Vol.24(2):150-159.
6. Heubach K, Wittig R, Nuppenau E.A and Hahn., 2011, The Economic importance of non-timber forest products for livelihood maintenance of rural West African communities., Vol.70(11).
7. Jain V, Momin M and Laddha K.,2012, *Murraya koenigii*: An updated review., International Journal of Ayurvedic and Herbal medicine., Vol.2(4):607-627.
8. Kapoor I.P.S, Singh B, Singh G, Isidorov V, Szczepaniak L., 2009, Chemistry, antimicrobial and antioxidant potential of *cinnamomum tamala* Nees & E. Berm. Essential oil and oleoresins., Vol.8(2) : 106-116.
9. Khan K.A.,2009., Roles of *Embllica officinalis* in medicine., Botany Research international., Vol.2(4) : 218-228.
10. Kumar M.A, Subrat J, Nisha O and Abhimanya K.,2012,A comprehensive review on effects of sodhan karma (Detoxification procedure) and therapeutic potential of Visha-Tinduka (*Strychnosnux-vomica*).,IJRAP., Vol.3(2) : 211-213.
11. Kumar R.S, Loveleena D and Godwin S.,2013, Medicinal property of *Murraya koenigii* – A review., Int.Res.J.Biological Sci., Vol.2(9) : 80-83.
12. Kureel R.S, Kishor R, Pandey A, Dutt D.,2009, Kokum A potential tree Borne oilseed., National; oil seed and vegetable oils development Board. 1-16.
13. Mahesha M, Poojary, Kanivebagilu A, Vishnumurthy, and Vasudeva Adhikarin A.,2015., Extraction, characterizationandbiologicalstudies of phytochemicals from *Mammea suriga*., Journal of Pharmaceutical Analysis:1-8
14. Manosi D, Mandal s, Mallick B and Hazra J.,2013, Ethanobotany, phytochemical and pharmacological aspects of *cinnamomum zeylanicum* Blume., Int.Res.J.Pharm., Vol.4(4):58-63.
15. Motamarri N S, Karthikeyan M, Kannan M and Rajasekar S.,2012.,*Terminalia belerica*. Roxb-A Phytopharmacological Review., International Journal of Research in Pharmaceutical and Biomedical Sciences., Vol.3(1):96-99.
16. Murthy I. K., Bhat P. R., Ravindranath N. H. and Sukumar R. 2005. Financial valuation of non-timber forest product flows in Uttara Kannada district, Western Ghats, Karnataka. Current Science, Vol.88 (10):1573-1579.
17. Muthuswamy R and Senthamarai R.,2014.,Pharmacognostical studies on stem bark of *Canarium strictum* Roxb.,Phcog J., Vol.6(1):12-18.
18. Natarajan V and Natarajan S.,2009, antidermatophytic activity of acacia concinna., Global Journal of pharmacology., Vol. 3(1):6-7.
19. Pelegrini D.D, Joyce K, Tsuzuki, Ciomar A.B. Amado, Diógenes A.G. Cortez and Izabel C.P. Ferreira.,2008., Biological activity and isolated compounds in *Sapindus saponaria*L. and other Plants of the Genus *Sapindus*., Lat. Am. J. Pharm. Vol.27 (6): 922-927.
20. Ranasinghe P, Pigera S, Sirimal Premakumara G.A, Galappaththy P, Godwin R., Constantine and Katulanda P.,2013, Medicinal properties of ‘true’ cinnamon (*Cinnamomum zeylanicum*): A systematic review., BMC Complementary and Alternative Medicine., Vol.13:1-10.
21. Sarala P and Krishnamurthy S.R, 2014, Monkey Jack: underutilized edible medicinal plant, nutritional attributes and traditional foods of western ghats, Karnataka india., Indian journal of traditional knowledge., Vol.13(3):508-518.
22. Sawant R, Sandeep V. Binorkar, Bhoyar M Gangasagre N.S., 2013., Phyto-constituents bioefficacy and phytopharmacological activities of *Terminalia chebula* - A review., International journal of ayurveda & alternative medicine., Vol.1 (1):1-11.
23. Shah M and Panchal M.,2010, Ethnopharmacological properties of *cinnamomum tamala* – a review.,International Journal of Pharmaceutical Sciences Review and Research., Vol. 5(3):141-144.

24. Sharma G and Nautiyal A.R.,2011, *Cinnamomum tamala*:A valuable tree from Himalayas., Int.J.Med.Arom. plants., Vol.1(1):1-4.
25. Singh E, Sharma S, Pareek K, Dwivedi J, Yadav S and Sharma S.,2011., Phytochemistry traditional uses and cancer chemopreventive activity of amla: The sustainer., Journal of applied pharmaceutical science., Vol.2(1):176-183.
26. Surya Prakash DV, Sreesatya N, Avanigadda S and Vangalapati M.,2012., Pharmacological Review on *Terminalia Chebula*., International Journal of Research in Pharmaceutical and Biomedical Sciences., Vol. 3 (2):679-683.
27. Tharachand, Selvaraja I, Avadhani M.,2013, Medicinal properties of Malabar Tamrind [*Garcinia camnogia* (Gaertn.) Desr.], Int.J.Pharm.Sci. Rev. Res.,Vol.19 (2):101-107.
28. Todkar S.S, Chavan V.V and Kulkarni A.S.,2010, Screeninf of secondary metabolites and antibacterial activity of *Acacia concinna*., Research journal of microbiology., Vol.5 (10) : 974-979.



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### RESEARCH ARTICLE

#### OBSERVATIONAL STUDY OF ETOMIDATE AND THIOPENTONE AS INDUCTION AGENT IN CARDIAC SURGERY PATIENTS.

Dr. chanshetty rajnish, Dr. nimish jain, Dr. suhas kumar mall and Dr. rama upadhyaya.

#### Manuscript Info

#### Abstract

#### Manuscript History

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#### Introduction:-

The Induction of general anesthesia allowed Surgeons to operate with careful deliberation on patients made totally unaware and pain free.

With this arose the problem of inducing quick and reversible unconsciousness with minimal side effects. This was initially tried with inhalation agents and later intravenous agents.

The ideal intravenous induction agent would provide hypnosis, amnesia, analgesia, muscle relaxation without undesirable cardiac and respiratory depression and pleasantly induce anesthesia in one arm brain circulation time and completely wears off in a few minutes.

Thiopentone has been the routine induction agent of anesthesia since 1930's because of its rapid and predictable action. The main drawbacks are cardiovascular and respiratory depression, increased incidence of Laryngospasm, bronchospasm, allergic reactions. Thiopentone has survived the test of time as an intravenous anesthesia drug.

The research for a better inducing agent which has good control of hemodynamic changes during intubation, The different agent like Etomidate have been tried with varied success.

The Etomidate was introduced into clinical practice in 1972. Its properties include hemodynamic stability, minimal respiratory depression, cerebral protection and rapid recovery after either a single dose or a continuous infusion. In practice these patients are compromised by trauma, serious illness, shock or cardiovascular co- morbidity. The fast onset of anesthesia and high therapeutic index for cardiovascular side effects are helpful during a rapid sequence induction.

Our study allows evaluation of Etomidate in comparison with Thiopentone sodium as an induction agent. This study aims an attempt to compare hemodynamic changes and other untoward effects of both the drugs.

#### Aims and objectives:-

Among patients who come to a tertiary care hospital with select chronic disease (cardiovascular disease).

- To study hemodynamic changes after ETOMIDATE and THIOPENTONE usage.

- To study any complication arising as result of side effect of the etomidate and thiopentone if any

### **Methodology:-**

#### **Source and method of collection of data:-**

An observational study of etomidate with thiopentone as an induction agent in cardiac surgery patients. After permission and clearance from the ethical committee, this study was conducted in Dhiraj general hospital in Department of Anesthesiology. We did this study on 60 patients of Grade-I, II and III of American Society Of Anesthesiologist's (ASA) classification who were admitted for elective cardiac surgeries. The study was prospective in nature. All the patients participating in the study were explained clearly about the purpose and nature of the study in the language they can understand. They were included in the study only after obtaining a written informed consent. A cross sectional analysis was made at the time of presentation. We collected the data for 1.5 years and analyze the data statistically.

#### **Inclusion criteria:-**

Patients between the age group of 45 to 65 years of both sex belonging to American society of anesthesiology grade II to III undergoing elective cardiac surgery under general anesthesia.

#### **Adult patients posted for CABG:-**

##### **Patients were randomly divided into 2 groups of 30 each**

- a. Group E(30 patients) to be induced with inj.etomidate 0.3mg/kg IV
- b. Group T(30 patients) to be induced with inj. thiopentone 5mg/kg IV

#### **Exclusion criteria:-**

1. Patient refusal
2. History of allergic reaction to the drug under study.
3. Patients with renal and hepatic disease.
4. Patients with history of epilepsy
5. Carotid insufficiency.
6. Adrenal insufficiency.
7. ASA GRADE IV
8. Presence of hypotension
9. History of arrhythmia

#### **Reoperative preparation:-**

Tab. Alprazolam 0.5 mg were given on the night prior to surgery. Patients were asked to restrict fluids and solids by mouth at least eight hours before operation. The patients were reassured, the procedure of anesthesia explained and a written informed consent was obtained from them.

Patient were taken inside the operation theater. Oxygen was given by face mask. Intravenous line was secured with 16G or 18G cannula and the patients were given I.V.Fluids (NS) according to the requirement. Multipara monitors were attached and base line pulse rate, respiratory rate, non-invasive blood pressure, SPO<sub>2</sub> and ECG were recorded. Under local anaesthesia a right radial artery is cannulated for invasive pressure monitoring and central venous line in right internal jugular vein for CVP monitoring was inserted.

Patient were premedicated with inj.glycopyrrolate 0.2 mg, inj. ondansetron 4mg. Intravenous inj.fentanyl 5mcg/kg was given over one minute before induction. Patients were randomized into two groups group E and group T, for patients receiving etomidate and thiopentone respectively. After preoxygenation with 100% oxygen for 3-5 mins, Induction of anaesthesia was done either with etomidate 0.3 mg/kg or thiopentone 5 mg /kg. Loss of eye lash reflexes and lack of response to verbal commands was considered to be as end point of induction. Followed by this inj succinylcholine in doses of 1.5-2mg/kg was given (depolarizing muscle relaxant) to facilitate tracheal intubation, patient was intubated after 1min of interval.

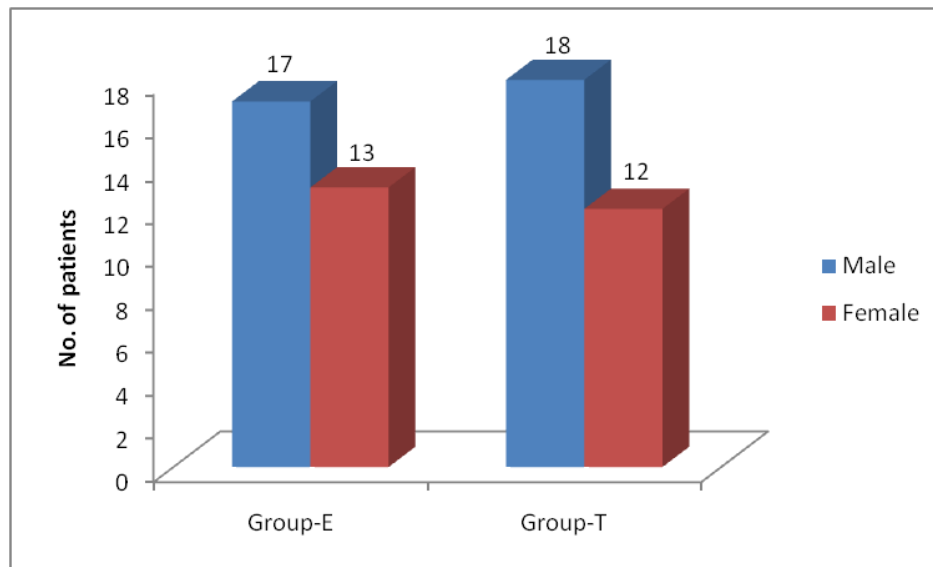
After confirming the proper position of endotracheal tube, it was connected to anaesthesia circuit. Patient was ventilated with 50% oxygen and 50% air along with inhalation agent and maintained with intravenous inj vecuronium. 0.1 mg/kg

**Observation and Results:-**

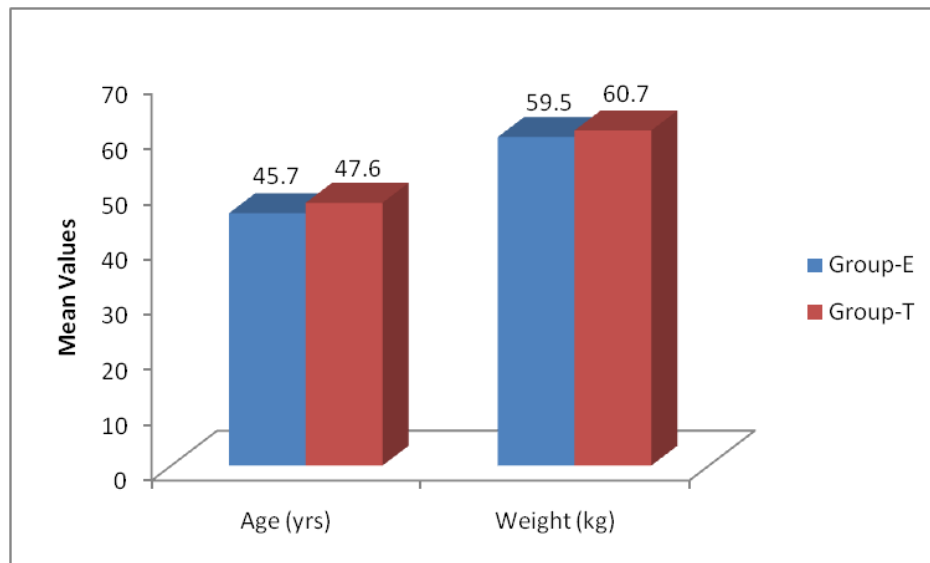
Sixty patients of grade-II and III of American Society Of Anesthesiologists (ASA) classification were taken for study in elective cardiac surgeries. They were allocated randomly in two equal groups. (Group E - inj. Etomidate 0.3mg/kg and Group T- inj.Thiopentone 5 mg/kg )

**Demographic data:-****Table 1:-** Demographic Characteristics

Variable	Group E	Group T	p-value
Age (years)	45.70 ± 9.15	47.60 ± 9.27	0.427
Weight (kg)	59.50 ± 8.56	60.70 ± 9.27	0.604
Sex (M/F)	17(56.7%) / 13(43.3%)	18(60%) / 12(40%)	0.793



The distribution of patients with respect to sex were comparable in both groups.( p=0.793)



Fairly stable distribution of age confirms the hypothesis that the two groups were not different in the age. The mean Age in Group E was 45.70 ± 9.15years while in Group T it was 47.60±9.268 years which was statistically non significant(p>0.05.)

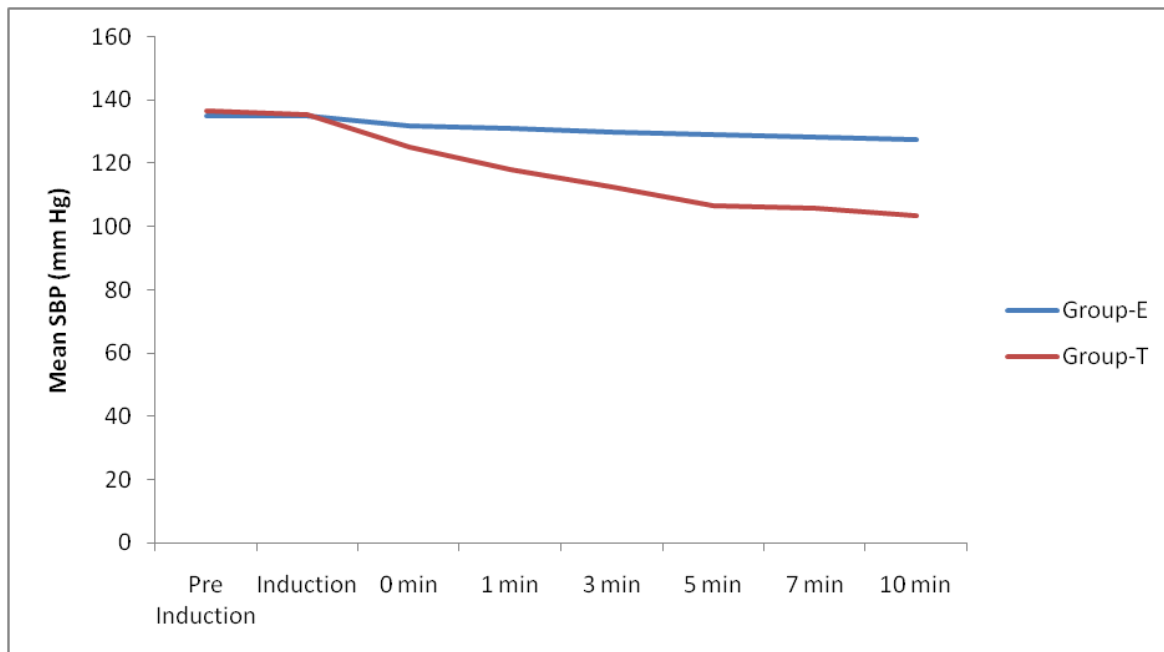
Fairly stable distribution of weight confirms the hypothesis that the two groups were not different in the weight. The mean weight in Group E was  $59.50 \pm 8.561$  years while in Group T it was  $60.70 \pm 9.267$  years which was statistically non significant ( $p > 0.05$ .)

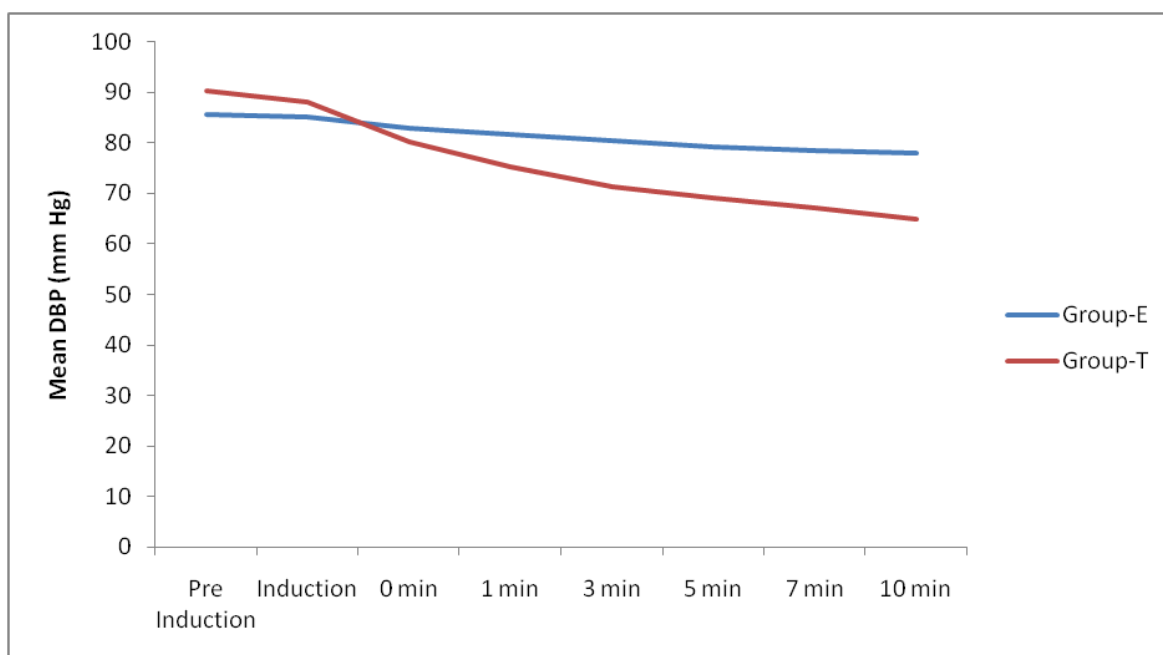
:Mean systolic blood pressure at different intervals in both the groups

SBP	Group-E	Group-T	p-value
Pre Induction	$134.8 \pm 19.782$	$136.67 \pm 20.044$	0.718
Induction	$134.93 \pm 19.713$	$135.6 \pm 19.871$	0.897
0 min	$131.73 \pm 19.446$	$125.33 \pm 17.223$	0.182
1 min	$130.87 \pm 19.339$	$118.07 \pm 15.892$	0.007
3 min	$129.6 \pm 19.521$	$112.4 \pm 14.087$	<0.001
5 min	$128.87 \pm 19.622$	$106.6 \pm 10.994$	<0.001
7 min	$128.2 \pm 19.243$	$105.8 \pm 11.146$	<0.001
10 min	$127.4 \pm 19.206$	$103.33 \pm 10.175$	<0.001

**Table 8:-** Mean diastolic blood pressure at different time intervals in both the groups

DBP	Group-E	Group-T	p-value
Pre Induction	$85.53 \pm 11.927$	$90.33 \pm 14.143$	0.161
Induction	$84.93 \pm 11.408$	$88 \pm 15.447$	0.385
0 min	$82.8 \pm 11.418$	$80.13 \pm 13.224$	0.407
1 min	$81.67 \pm 11.722$	$75.13 \pm 11.881$	0.036
3 min	$80.33 \pm 11.46$	$71.27 \pm 12.233$	0.004
5 min	$79.27 \pm 11.246$	$69 \pm 13.023$	0.002
7 min	$78.4 \pm 11.294$	$67.13 \pm 11.916$	<0.001
10 min	$78 \pm 11.179$	$64.87 \pm 11.163$	<0.001





SBP and DBP were recorded at preinduction, induction, intubation, 1, 2, 3, 5, 7 & 10 min from the start of the injection of the drug. Both systolic blood pressure and diastolic blood pressure changes were very minimal in group-E. There was a fall in systolic blood pressure and diastolic blood pressure in Group-T at 3, 5, 7 minute and 10 minutes. The difference in both SBP & DBP between group E and group T at 3, 5, 7 & 10 min was statistically highly significant ( $P < 0.001$ ).

## Discussion:-

### Systolic blood pressure:-

In etomidate group pre induction SBP was  $134.8 \pm 19.782$ . In post induction SBP  $134.93 \pm 19.713$ . Again SBP after intubation 0 min, 1 min, 3 min, 5 min, 10 min were  $131.73 \pm 19.446$ ,  $130.87 \pm 19.339$ ,  $129.6 \pm 19.521$ ,  $128.87 \pm 19.622$ ,  $127.4 \pm 19.206$  respectively. There was no significant change in SBP in post induction and after intubation compared to pre induction value and also no significant change after intubation compared to pre induction and post induction value.

In thiopentone group pre induction SBP was  $136.67 \pm 20.044$ . In post induction SBP  $135.6 \pm 19.871$ . Again SBP after intubation 0 min, 1 min, 3 min, 5 min, 10 min were  $125.33 \pm 17.223$ ,  $118.07 \pm 15.892$ ,  $112.4 \pm 14.087$ ,  $106.6 \pm 10.994$ ,  $103.33 \pm 10.175$  respectively. There was no significant change in SBP in post induction and after intubation compared to pre induction value and also no significant change after intubation compared to pre induction and post induction value.

### Diastolic blood pressure:-

In etomidate group, pre induction DBP was  $85.53 \pm 11.927$ . In post induction, DBP was  $84.93 \pm 11.408$ . After intubation 0 min, 1 min, 3 min, 5 min, 10 min DBP were  $82.8 \pm 11.418$ ,  $81.32 \pm 4.78$ ,  $81.3 \pm 4.7$ ,  $79.9 \pm 4.9$  and  $78.93 \pm 5.0$  respectively. There was no significant change in DBP in post induction and after intubation compared to pre induction and after intubation compared to post induction.

In thiopentone group, pre induction DBP was  $90.33 \pm 14.143$ . In post induction, DBP was  $88 \pm 15.447$ . After intubation 0 min, 1 min, 3 min, 5 min, 10 min DBP were  $80.13 \pm 13.224$ ,  $75.13 \pm 11.881$ ,  $71.27 \pm 12.233$ ,  $69 \pm 13.023$  and  $64.87 \pm 11.163$  respectively. There was significant change in DBP in post induction and after intubation compared to pre induction and after intubation compared to post induction.

## Summary:-

The present study was conducted on 60 patients' age group between 45-65 years belonging to ASA grade II AND III. These patients were scheduled for elective cardiac surgeries.

Sixty patients were randomly selected, and divided into two groups with thirty patients in each group. Group E patients were induced with Inj. Etomidate 0.3mg/kg and Group T patients were induced with Inj. Thiopentone 5mg/kg. as an induction agent.

The following parameters were compared between the group E and group T, pain on injection, myoclonus, induction time and hemodynamic parameters.

Incidence of pain on injection is about 50% of the patients induced with Etomidate and absent in Thiopentone group. Myoclonus occurred in about 43% patients in etomidate group compared to 13% patients in thiopentone group.

Induction time was faster with Inj. Etomidate, which induced anesthesia at an average about  $25 \pm 3.2$  seconds. Thiopental induced anesthesia at an average about  $31 \pm 4.5$  seconds.

Hemodynamic changes with respect to the heart rate and blood pressure changes after premedication were minimal in both groups. At the time of induction there was minimal fall in blood pressure in Etomidate group but blood pressure significantly decreased in Thiopentone group.

After the intubation there were minimal changes in Etomidate group. heart rate and blood pressure were significantly raised in Thiopentone group.

To summarize both the groups shared complications like Pain on injection was present after inducing with Etomidate and it was absent in Thiopentone Myoclonus. It was more significant in Etomidate group than Thiopentone group. The induction time was faster and smoother in Etomidate group, when compared with Thiopentone group. Etomidate has reduced cardiovascular response to laryngoscopy and tracheal intubation in comparison with Thiopentone in elective cardiac surgeries.

### Conclusion:-

By the present study it can be concluded the induction time is lesser with Inj. Etomidate than Inj. Thiopentone. Etomidate is an effective and rapid acting induction anesthetic agent with good cardiovascular stability.

Finally, we conclude that Inj. Etomidate can be safe, hemodynamically stable and effective alternative to Inj. Thiopentone for the induction of general anesthesia in elective cardiac surgeries.

### Bibliography:-

1. Lee AJ, S Atkinson, Rushman GB, NJH Davies. Lee's Synopsis of Anaesthesia. 11<sup>th</sup> ed. Butterworth-Heinemann international; 1993; 157-170
2. Stoelting RK, Simon MD, Hillier MB. Pharmacology and Physiology in Anesthetic practice. 4th ed. Lippincott Williams and Wilkins c ; 2006; 126-139,163-167
3. Thomas E J Healy and Paul R Knight, Andrew R A Rushton and Robert Sneyo Wylie and Churchill-Davidson's A Practice of Anesthesia Seventh Edition, chapter 35 clinical pharmacology and anesthetic techniques 2003; 572-577
4. Ronald D. Miller, J.G. Peter S, et al. Millers Anesthesia 6 Edition chapter 10 Intravenous non opioid anesthetic Elsevier Churchill Livingstone vol(1)s;317-355
5. Reich DL, Hossain S, Krol M, et al: Predictors of hypotension after induction of general anesthesia. Anesth Analg 101:622-628, 2005
6. Doenicke A, Gabanyi D, Lemce H, et al: [Haemodynamics and myocardial function after administration of three short-acting i.v. hypnotics, etomidate, propanidid, methohexital (author's transl)]. Anaesthesist 23:108-115, 1974
7. Hempelmann G, Piepenbrock S, Hempelmann W, et al: Influence of althesine and etomidate on blood gases (continuous PO<sub>2</sub>-monitoring) and hemodynamics in man. Acta Anaesthesiol Belg 25:402-412, 1974
8. Rifat K, Gamulin Z, Gemperle M: [Etomidate: cardiovascular effects of a new intravenous anesthetic agent]. Can Anaesth Soc J 23:492-504, 1976
9. Creagh O, Torres H, Rodriguez N, et al: Alpha-2B adrenergic receptor mediated hemodynamic profile of etomidate. P R Health Sci J 29:91-95, 2010
10. Paris A, Philipp M, Tonner PH, et al: Activation of alpha 2B adrenoceptors mediates the cardiovascular effects of etomidate. Anesthesiology 99:889-895, 2003.



## RESEARCH ARTICLE

### A CRITICAL REVIEW ON PARAMETRIC INFLUENCE OF JOURNAL BEARING

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#### Abstract

The innovatory modifications in the field of journal bearing are at quite slow speed. In the field of tribology tools requires high stiffness to improve accuracy. Thus it is necessary for the designer to study the parametric influence of journal bearing quantitative as well as qualitative. This article provides a brief review for journal bearing from available literature in recent years. Since there have been lot of developments in design, the parametric optimization has been performed by many researchers. Numbers of researchers have been working on different aspects of performance of the journal bearing, ranging from temperature rise, geometry of grooves, damping, eccentricity ratio and clearance etc. Based on the state of art in bearing identification, valuable discussions are made with future directions.

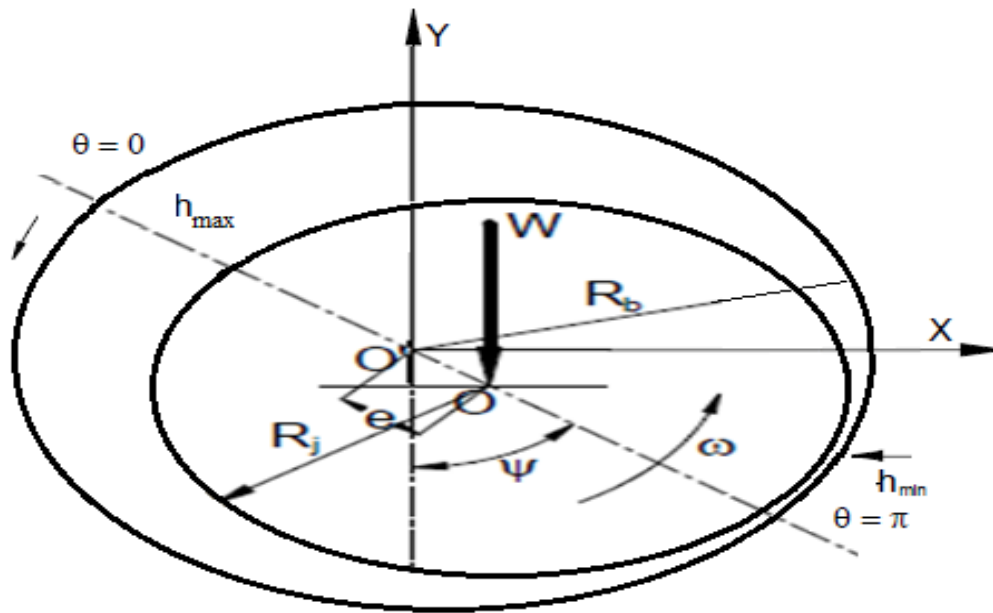
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#### Introduction:-

Now a days, hydrodynamic journal bearing are in high demand for their excellent properties such as long-term performance, negligible friction and almost zero wear particularly in Diesel engine, centrifugal compressors, pumps, motors, etc. Now a day, hydrodynamic journal bearing are in high demand for their excellent properties such as long-term performance, negligible friction and almost zero wear particularly in Diesel engine, centrifugal compressors, pumps, motors, etc. This type of bearing works on hydrodynamic principle, which involves with the rotation of shaft, creates an oil wedge that supports the shaft and relocates it within the bearing clearances. The shaft spinning within a journal bearing is actually separated from the journal bearing's metal facing by an extremely thin film of continuously supplied oil that prohibits metal to metal contact. In other words the hydrodynamic journal bearing works on hydrodynamic lubrication theory, which is concerned with separation of two surfaces in relative motion.

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**Figure 1:-** Journal bearing geometry

Journal bearings shown in figure 1 have many designs to compensate for varying load requirements, machine speeds, cost, or dynamic properties. A stable bearing design holds the rotor at a fixed attitude angle during transient periods such as machine start-ups/shutdowns or load changes. The performance of a hydrodynamic journal bearing is governed by a number of bearing parameters, such as radial clearance length, diameter, viscosity, groove geometry, location, etc. There are few assumption regarding hydrodynamic journal bearing are as the flow is laminar and isothermal with a constant vertical load  $W$  is applied on the journal. Geometry and co-ordinate system of the journal bearing is shown in fig 1. The journal rotates with angular velocity  $\omega$  and remains in equilibrium position under the action of external load,  $W$ . The journal centre  $O$  is eccentric to bearing centre  $O'$ . The film thickness  $h(\theta)$  varies from its maximum value  $h_{max}$  at bearing angle  $\theta = 0$  to its minimum value,  $h_{min}$  at  $\theta = \pi$ .

In this article, we present a review of hydrodynamic journal bearing from literature available in recent years. Since there have been lot of developments in design, the parametric optimization has been performed by many researchers. Numbers of researchers have been working on different aspects of performance of the journal bearing, ranging from temperature rise, geometry of grooves, damping, eccentricity ratio and clearance etc. Based on the state of art in bearing identification, valuable discussion is made and future directions are suggested.

### Literature Review:-

First a remarkable work on Thermo-hydrodynamic study of journal bearing was done by Hughes and Osterle [1] and describes a relation between viscosity as a function of temperature and pressure of the lubricant inside the journal bearing for adiabatic conditions with examples Basri and Gethin [2] have investigated the thermal aspects of various noncircular journal bearing using adiabatic model. Cupillard et al. [3] have presented an analysis of lubricated conformal contact to study the effect of surface texture on bearing friction and load carrying capacity using computational fluid dynamics. The authors have reported that the coefficient of friction can be reduced if a texture of suitable geometry is introduced. Gertzos et al. [4] have investigated journal bearing performance with a Non-Newtonian fluid i.e. Bingham fluid considering the thermal effect. Huiping Liu et al.[5] studied hydrodynamic journal bearings with elastic insert and found that the elastic deformation of the bearing had a significant influence on the rotor–bearing system, particularly for the polymeric-based materials. Jaw-Ren Lin et al. [6] numerically calculated oil film pressure by using Fourth Runge-Kutta method and this pressure is utilized to evaluate the load carrying capacity and the friction parameter. A comparison of the results between the Darcy model and Brinkman model is made to show the viscous shear effects provide an increase in the load capacity, as well as a decrease in the friction parameter. Nabhan et al.[7] solved Navier-Stokes equation with the aid of Simpson rule and calculated the pressures, drags and load carrying capacities by taking binary fluid mixture with different viscosity ratio. Hassan E.



Rasheed [8] theoretically presented the effects of circumferential, axial and combined surface waviness on the performance of the hydrodynamic journal bearings by using Reynolds equation for Newtonian isoviscous lubricant. It was observed that when waviness number is approximately below nine, then circumferential waviness increases the load carrying capacity and decreases the friction variable. But the axial waviness is to always have an opposite effect on the load carrying capacity and friction variable. S.k.guha [9] analyzed the effect of isotropic roughness on the steady-state characteristics of hydrodynamic journal bearings terms of load capacity, attitude angle, end leakage flow rate, misalignment moment and friction coefficient are estimated for different values of roughness parameter, eccentricity ratio and degree of misalignment at unit slenderness ratio. Finite difference method is also used to measure steady-state oil film pressures by using Reynolds equation. Myung-Rae Cho et al.[10] presented the effects of circumferential groove on the minimum oil film thickness in engine bearings and used mobility method for journal locus analysis. It was observed that the circumferential 360° groove only decreases the magnitude while 180° half groove affects the shape and position of the minimum oil film thickness. NabarunBiswas and PrasunChakraborti[11] used physical properties of SAE-50 lubricant for analysis purpose in journal bearing. They involve with six time steps 10, 30, 50, 70, 90, and 110 sec for unsteady analysis and found out that after 110 sec the flow becomes steady. It was also observed that maximum pressure is observed at minimum oil film thickness with increasing value of roughness.

Sep et al.[12] analysed new design of the journal bearing with two-component surface layer and experimentally proved its usefulness in the case, where oil is contaminated by hard particles. In this new design the helical grooves are made on the bearing journal surface that should enable to eliminating contaminants from the frictional contact zone and concluded that if soft material is placed in the immediate vicinity of the grooves it will restrict the hard particles driving into the bearing surface which also decreases sensitivity. Byoung-Hoo Rho et al. [13] investigated acoustical properties of hydrodynamic journal bearing. The universal Reynolds equation is solved at each step of time using the finite difference method and the nonlinear transient motion of the journal centre is obtained by numerical integration of its acceleration using fourth order Runge-Kutta method. Byoung-Hoo Rho et al [14] investigated the effects of design parameters on the noise of rotor-bearing system supported by oil lubricated journal bearing. The Reynolds equation for finite width bearing under unsteady condition is applied for calculating pressure. It was observed that the radial clearance, mass eccentricity of the rotor and the width of the bearing considerably affect the A-weighted sound pressure level of the bearing. Wu et al.[15] studied wall slip problem by parametric quadratic programming method and generalized Reynolds equation with wall slip for two-dimensional flow is applied. It is observed that if limiting shear stress at bearing surface should be more than that at the journal surface, the wall slip avoided. Nikolakopoulo et al.[16] developed an analytical modal which shows the relationship among the friction force, wear depth and misalignment angles The Reynolds equation is used to calculate the friction force in equilibrium condition and found that friction function dependent on wear and misalignment of the bearing. Singh et al [17] theoretically performed steady-state thermodynamic analysis of an axial groove bearing by using Reynolds equation, energy equation and heat conduction equation with appropriate boundary conditions in the journal bearing. It was found that the fluid film temperature increases due to frictional heat resulting viscosity and load carrying capacity decreases. It was also observed that groove angle of 360° and groove length (Half of the bearing length) promoted to decrease the maximum temperature and increase the load carrying capacity. Ron A.J. Van Ostayen [18] presented a mathematical optimization procedure to find the optimal film height distribution for a hydrodynamic bearing. Firstly this methodology is applied for a bearing with constant load and sliding speed. Then subsequently applied for a bearing with periodic load and sliding speed. Slider bearings with different shapes, loads and speeds are analyzed by new heuristic load optimization procedure along with Reynolds equation and found more efficient than general purpose optimization routine. Andras Z. Szeri [19] modified the structure of lubricant film by using double layer of lubricant into clearance space of bearing surfaces in place of single layer of lubricant. Basic Reynolds equation was used for composite films under the restrictive assumptions by applying boundary conditions. The low-viscosity lubricant reduced viscous dissipation, while the high-viscosity lubricants maintained the desirable thickness to separate out the bearing surfaces. It was also found that composite-film bearings have considerably lower frictional losses in comparison to other traditional bearings. Lui et al.[20] designed and fabricated a test rig to investigate the stability nature of the JRHB. It was found that the rolling bearing plays a protective role under IHP condition. K. M. Panday et al [21] analysis thin film lubricated journal bearing with different L/D ratios such as 0.25, 0.5, 1, 1.5, and 2. It was observed that maximum pressure present at minimum oil film thickness. Also reported that shear stress is reduces on bearing and journal surface with increase in L/D ratio whereas turbulent viscosity of lubricant rises with increase in L/D ratio. NacerTala-Ighil et al [22] developed a numerical model based on finite difference method by using Reynolds equation to study the cylindrical textures shape effect on the performance of hydrodynamic journal bearing. Based on geometric arrangement of textures on the bearing surface, a comparison of

considered twenty five cases is conducted. It was found that the minimum oil film thickness increased approximately by 1.8% and friction torque is decreased approximately by 1.0%. Meybodi et al [23] developed a general methodology, to design the proper bearing in order to eliminate the deviation of final product in extrusion process. Three smooth curved dies with non-symmetric T-shaped sections at different off-centricities have been taken and for each die proper bearing has designed. It was found that the deviation of final product is eliminated to a great extent. McAllister and Rohde [24] optimized the load-carrying capacity of one-dimensional journal bearings for a given minimum film thickness by using a long bearing approximation, which is inaccurate in most practical design ranges. Hashimoto [25] presented an optimum study for high speed short journal bearings using successive quadratic programming. For Eccentricity  $> 0.8$  and  $L/D > 0.3$ , the short bearing approximation predicts highly unreliable results. Peeyush vats et al [26] presented thermal analysis of journal bearing by using FEM analysis. Parameters like heat generated, temperature distribution and heat dissipation are studied. From results it is reported that difference between heat dissipated and heat generated in oil film was very large, which causes increase in temperature of the bearing and damaged the bearing pads.

Currently, due to advancement in computer technology, many researchers trying to use commercial computational fluid dynamics (CFD) programs in their investigations. The CFD code is differ from other relevant codes because full Navier–Stokes equations is used with provides a solution to complex flow problem, whereas finite difference codes are based on the Reynolds equation. Moreover, the CFD packages are applicable in very complex geometries. Authors used different computational codes to study the parametric influence of hydrodynamic journal bearing are listed below with their outcomes.

Ref.	Technique used	Bearing type	Parameter	Analysis /Results
[27 ]	CFD	journal bearing with smooth and textured surface	Surface texture on eccentricity ratio and frictional force	Light loading condition increased minimum film thickness and reduced frictional force and for high loading conditions increasing pressure zone decreases the frictional force.
[28]	CFD	Central circumferential groove of hydrodynamic journal bearing	Bearing carrying capacity, cavitations zone and vapour fraction.	Groove depth affect the load zone, bearing carrying capacity, cavitations zone and vapour fraction.
[29]	CFD	Hydrodynamic journal bearing	$L/D$ and eccentricity ratios, pressure	FSI approach is used to find out pressure, stress and deformation of hydrodynamic journal bearing
[30]	CFD	Journal bearing with bingham fluid.	Eccentricity ratio, yield stress	Fluent software compared with experimental and theoretical results of Newtonian as well as Bingham lubricants and found good agreement. It is also concluded that the effect of yield stress is small for low eccentricity ratio on the journal bearing
[31]	CSD and CFD	Full 360° journal bearing.	Deformation and stress distribution	The paper presented, these techniques is effectively used for To finite element method (FEM) was used to calculate stress distribution .finding the surface deformation of bearing under static load.effect of resulting forces is also discussed. The simulation of elasto-hydrodynamic lubrication have validated with standard lubrication result
[32]	CFD-FSI	Journal bearing	Deformation, eccentricity ratios and speeds	Investigate interaction between elastic behavior of bearing and fluid by developing models for different eccentricity ratios and speeds. this technique developed accurate performance of the bearing
[33]	CFD and	Thermo-	Pressure,	Finite volume and finite element method is used

	FSI.	hydrodynamic and thermo-elastohydrodynamic analysis of full journal bearing	temperature and velocity distribution in the fluid film, and bearing surface deformation	to determine the characteristics under static load condition. Distortion due to pressure is important factor for determining the behavior of bearing.
[34]	COMSOL models	Hydrodynamic bearing	Pressure distribution, eccentricity ratio	Pressure distribution is found out on infinite (short as well as long) bearing under steady state condition. It was predicted that increasing pressure is proportional to eccentricity ratio and pressure increases along the direction of eccentricity
[35]	ANSYS. MATLAB software	Bush type journal bearing	Temperature	It is showed that around 12% variations observe between two methods. But Ansys gave more exact solution than numerical method.
[36]	CFD	Journal bearing	Pressure, temperature viscosity, L/D ratio, rotational speed, Eccentricity ratio, pressure distribution	Software results validated with numerical results got from Raimondi and Boyd chart method. It is predicted that increasing temperature raises pressure but decreases of attitude angle
[37]	CFD (Gambit and using fluent 6.3.26 )	Plain journal bearing	Pressure distribution, temperature and viscosity	It is observed that increasing frictional force increases the temperature and reduces viscosity as well as maximum pressure of lubricant
[38]	CFD	Circular journal bearing	Pressure and temperature distribution	When the viscosity is put constant , temperature as well as pressure increases
[39]	CFD and FSI	Infinitely long journal bearing	Pressure and temperature variation	It is found that maximum pressure occurred nearer to the region of minimum film thickness
[40]	CFD	Journal bearing	Pressure distribution, friction force, friction coefficient	It is observed that dimple is useful for lubrication performances and reduces friction force but there is loss of load capacity.

### Common observations:-

From the available literature it is clear that researchers have listed almost all aspects regarding performance characteristics of journal bearing, however there is a need to develop new mathematical models based on behaviour of rotor-bearing systems. Similarly more experimental work also needed to study the influencing parameters on performance of hydrodynamic journal bearings. CFD code set new level of precision in the research of journal bearing with accuracy. New experiments can be used available data more effectively, especially with the inherent practical constraints for measurements and development of new identification techniques. The load carrying capacity, fluid film thickness and eccentricity ratio of journal bearing are discussed briefly but the effect of time duration is also hidden in the available literature which may influence performance characteristics of journal bearing.

**References:-**

1. W. Hughes and F. Osterle, "Temperature Effects in Journal Bearing Lubrication," ASLE Transactions, Vol. 1, no.1, pp 210-212, 1958
2. S. Basri and D.T. Gethin, "A Comparative Study of The Thermal Behaviour of Profile Bore Bearings," Tribology International, Vol. 23, pp 265-276, 1990
3. S. Cupillard, S. Glavatskih, M.J.Cervantes, "Computational Fluid Dynamics Analysis of A Journal Bearing with Surface Texturing," Proc. IMechE, Engineering Tribology, Vol. 222, no.2, pp 97-107, 2008
4. K.P. Gertzog, P.G. Nikolakopoulos, C.A. Papadopoulos, "CFD Analysis of Journal Bearing Hydrodynamic Lubrication by Bingham Lubricant," Tribology International, Vol. 41, no.12, pp 1190-1204, 2008
5. H. Liu, H. Xu, P. J. Ellison, Z. Jin, "Application of Computational Fluid Dynamics And Fluid-Structure Interaction Method to The Lubrication Study of A Rotor-Bearing System," Tribology Letters, Vol. 38, pp 325-336, 2010
6. J. Lin, C. Hwang and R. Yang, "Hydrodynamic Lubrication of Long, Flexible, Porous Journal Bearings Using The Brinkman Model," Wear, Vol. 198, pp 156-164, 1996
7. M.B.W. Nabhan, G.A. Ibrahim and M.Z. Anabtawi, "Analysis of Hydrodynamic Journal Bearings Lubricated With A Binary Water-Based Lubricant," Wear, Vol. 209, pp 13-20, 1997
8. H. E. Rasheed, "Effect of Surface Waviness on The Hydrodynamic Lubrication of A Plain Cylindrical Sliding Element Bearing," Wear, Vol. 223, pp 1-6, 1998
9. S.K. Guha, "Analysis of Steady-State Characteristics of Misaligned Hydrodynamic Journal Bearings with Isotropic Roughness Effects," Tribology International, Vol. 33, pp 1-12, 2000
10. M. Cho, H. Shin and D. Han, "A Study on The Circumferential Groove Effects on The Minimum Oil Film Thickness in Engine Bearings," KSME International Journal, Vol. 14, pp 737-743, 2000
11. N. Biswas and P. Chakraborti, "Transient Analysis Of 3 Lobe Bearing Considering Surface Roughness Effect For Gas Turbine," 6th BSME International Conference On Thermal Engineering (ICTE ), 2014
12. J. Sep, A. Kucaba-Pietal, "Experimental Testing of Journal Bearings With Two-Component Surface Layer in The Presence of An Oil Abrasive Contaminant," Wear, Vol. 249, pp 1090-1095, 2001
13. B. H. Rho, K.W. Kim, "Acoustical Properties of Hydrodynamic Journal Bearings," Tribology International, Vol. 36, pp 61-66, 2003
14. B. H. Rho, D.G. Kim and K.W. Kim, "Effects of Design Parameters on The Noise of Rotor-Bearing Systems," Tribology International, Vol.37, pp 599-605, 2004
15. C.W. Wu, G.J. Ma, "Abnormal Behaviour of A Hydrodynamic Lubrication Journal Bearing Cause by Wall Slip," Tribology International, Vol. 38, pp 492-499, 2005.
16. P. G. Nikolakopoulos, C. A. Papadopoulos, "A Study of Friction in Worm Misaligned Journal Bearings Under Severe Hydrodynamic Lubrication," Tribology International, Vol.41, pp 461-472, 2008
17. U. Singh, L. Roy and M. Sahu, "Steady-State Thermo-Hydrodynamic Analysis of Cylindrical Fluid Film Journal Bearing with An Axial Groove," Tribology International, Vol. 41, pp 1135-1144, 2008
18. R.A.V.Ostayen, "Film Height Optimization of Dynamically Loaded Hydrodynamic Slider Bearings," Tribology International, Vol. 43, pp 1786-1793, 2010
19. A.Z. Szeri, "Composite-film Hydrodynamic Bearings," International Journal of Engineering Science, Vol. 48, pp 1622-1632, 2010
20. D. Lui, W. Zhao, B. Lu and J. Zhang, "A Zero Wear Assembly of A Hydrodynamic Bearing and A Rolling Bearing Assembly and Manufacturing," IEEE Conference, pp 1-4, 2011
21. K. M. Panday, P. L. Choudhury and N. P. Kumar, "Numerical Unsteady Analysis of Thin Film Lubricated Journal Bearing," International Journal of Engineering And Technology, Vol. 4, No. 2, 2012
22. N. Tala-Ighil, M. Fillon and P. Maspeyrot, "Effect of Textured Area on The Performances of A Hydrodynamic Journal Bearing," Tribology International, Vol. 44, pp 211-219, 2011
23. A. K. Meybodi, A. Assempourand and S. Farahani, "A General Methodology for Bearing Design in Non-Symmetric T-Shaped Sections in Extrusion Process," Journal of Materials Processing Technology, Vol. 212, pp 249- 261, 2011
24. G.T. McAllister and S.M. Rohde, "Optimum Design of One-Dimensional Journal Bearings," J. Optimization Theory and Application, Vol.41, no. 4, pp 599-617, 1983
25. H. Hashimoto, "Optimization of Oil Flow Rate and Oil Film Temperature Rise in High Speed Hydrodynamic Journal Bearings," Journal of Tribology Series, Vol. 34, pp 205-210, 1998
26. P. Vats, B.C. Sharma, S. Sharma, "Heat Transfer Through Journal Bearing: A Case Study," International Journal of Research in Engineering and Technology, Vol.3, no.10, pp 216-221, 2014

27. Samuel Cupillard, Michel J. Cervantes And Sergei Glavatskih, "A CFD study of a Finite Textured Journal Bearing," 24th Symposium on Hydraulic Machinery and Systems, pp 1-11, 2008
28. H. Jin, W. Zuo, "Simulation And Heat Transfer Calculation on A Journal Bearing with Center Circumferential Groove in Load Zone," International Journal of Advancements in Computing Technology, Vol. 5, no.1, 2013
29. S. C. Kumar, R. Ganapathi, "CFD Analysis on Hydrodynamic Plain Journal Bearing using Fluid Structure Interaction Technique," International Journal of Engineering Research & Technology, Vol. 4, no.7, 2015
30. K.P. Gertzog, P.G. Nikolakopoulos, C.A. Papadopoulos, "Lubrication By Bingham Lubricant," Tribology International, Vol.41, pp 1190-1204, 2008
31. B. S. Shenoy, R. S. Pai, D. S. Rao, R. Pai, "Elasto-Hydrodynamic Lubrication Analysis Of Full 360° Journal Bearing Using CFD And FSI Techniques," World Journal of Modelling and Simulation, Vol. 5, no. 4, pp. 315-320, 2009
32. D. Dhande, D. W. Pande, V. Chatarkar, "Analysis Of Hydrodynamic Journal Bearing Using Fluid Structure Interaction Approach," International Journal of Engineering Trends and Technology, Vol.4, no.8, 2013
33. A. Ouadoud, A. Mouchtachi, N. Boutammacht, "Hydrodynamic Journal Bearing," Journal of Advanced Research in Mechanical Engineering, Vol. 2, no.1, pp. 33-38, 2011
34. R. M. Mane, S. Soni, "Analysis of Hydrodynamic Plain Journal Bearing," The Proceedings of COMSOL Conference in Bangalore, 2013
35. S. Torgal, R. Saini, "Calculation of Equivalent Oil Film Temperature of Journal Bearing Using ANSYS," International Journal of Science Technology & Engineering, Vol. 1, no. 12, 2015
36. A. Panthi, J. Balwanshi, A. Chandravanshi, G. Gupta, "Design and Analysis of Hydrodynamic Journal Bearing Using Raimondi and Boyd Chart," International Journal of Core Engineering & Management Vol. 2, no. 3, 2015
37. M. Sahu, A. K. Giri, A. Das, "Thermohydrodynamic Analysis Of A Journal Bearing Using CFD As A Tool," International Journal Of Scientific And Research Publications, Vol. 2, no. 9, pp 2250-3153, 2012
38. A. Singla, A. Kumar, S. Bala, P. Singh, A. Chauhan, "Thermo-Hydrodynamic Analysis On Temperature Profile Of Circular Journal Bearing Using Computational Fluid Dynamics," Proceedings of RAECS Chandigarh, 2014
39. P. Tiwari and V. Kumar, "Analysis Of Hydrodynamic Journal Bearing Using CFD And FSI Technique," International Journal Of Engineering Research & Technology, pp 2278-0181, Vol. 3, no. 7, 2014
40. H. Yong, R. Balendra, "CFD Analysis on The Lubrication Behaviours Of Journal Bearing With Dimples," Proceedings of IEEE International Conference on Mechatronics And Automation, Changchun, China, 2009



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### RESEARCH ARTICLE

#### Assessment of Water quality in terms of physico – chemical parameters of East Godavari mangrove ecosystem (Coringa Wildlife Sanctuary) East Godavari, Andhra Pradesh, India.

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##### Key words:-

Mangrove, Water quality parameter, estuary, Coringa.

#### Abstract

A study was conducted on physico-chemical parameters of water from the estuary region in Coringa Wildlife Sanctuary. Physico-chemical parameters play an important role in the structuring the fish species and other aquatic organisms in mangrove swamp, estuaries and coastal areas. The baseline study was carried out for two successive years that is from January 2015 to December 2016 respectively. Monthly water samples were collected and 10 water parameters were analyzed. Data on temperature and pH were obtained from the field using mercury-in-glass thermometer and portable pH pen. Dissolved Oxygen, Salinity, Alkalinity, Hardness, Calcium and Magnesium were analyzed by using the standard protocols. Temperature varied between 33.8-26; pH, 8.5-7.15; salinity 24-0; dissolved oxygen 7.8-4; Ammonia 1.2 - 0.05; alkalinity, 340-80; Nitrite 1 – 0.01; Hardness 3500-110; Calcium 250-80; Magnesium 450-180. The water parameters favored the growth of the aquatic organisms. However, due to the ever increasing discharge of the effluents from the industries, municipality drainages and the aqua culture ponds contribute to the pollution of the estuarine ecosystems. This study is baseline data towards future ecological study, conservation and management of the resources in the East Godavari estuarine ecosystem.

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#### Introduction:-

Water quality is defined in terms of the chemical, physical and biological contents of water. The water quality of rivers and lakes changes with the seasons and geographic areas, even when there is no pollution present. Water quality guidelines provide basic scientific information about water quality parameters and ecologically relevant toxicological threshold values to protect specific water uses. Important physical and chemical parameters that majorly influencing the aquatic environment are temperature, pH, salinity, dissolved oxygen, Ammonia, Nitrite, Alkalinity Hardness, Calcium and Magnesium. These parameters are the limiting factors for the survival of aquatic organisms (flora and fauna) of the particular water bodies. Poor water qualities may be caused by low water flow, municipal effluents and industrial discharges (Chitmanat and Traichaiyaporn, 2010). Water temperature is probably the most important environmental variable. Temperature is also a limiting factor in the aquatic environment Odum

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(1971) and Boyd (1979). The salt concentration directly affects the salinity which impacts circulation with estuaries and coastal regions can derive from or be strongly influenced by the density variation associated with salinity. Mangrove vegetation is considered to be highly productive tropical ecosystems (Clough, 1992). The mangrove forests are the important source of carbon and nutrients to the adjacent lagoonal and coastal systems (Odum and Heald, 1972, 1975; Twilley, 1988; Wattayakorn et al., 1990; Robertson et al. 1992).

The Godavari Mangroves are located in Godavari Estuary of East Godavari District, Andhra Pradesh. Total area under Godavari mangroves is 33,263.32 ha. and is the second largest mangrove patch along the east coast of India. This area also supports a wide range of other flora and fauna that include 35 species of mangrove and associated species, 277 benthic organisms, 609 Fin Fish species, 269 bird species, 26 species of Reptiles and 18 species of terrestrial mammals. Coringa Wildlife Sanctuary comprises of 34 creeks, canals including the Coringa and Godavari rivers.

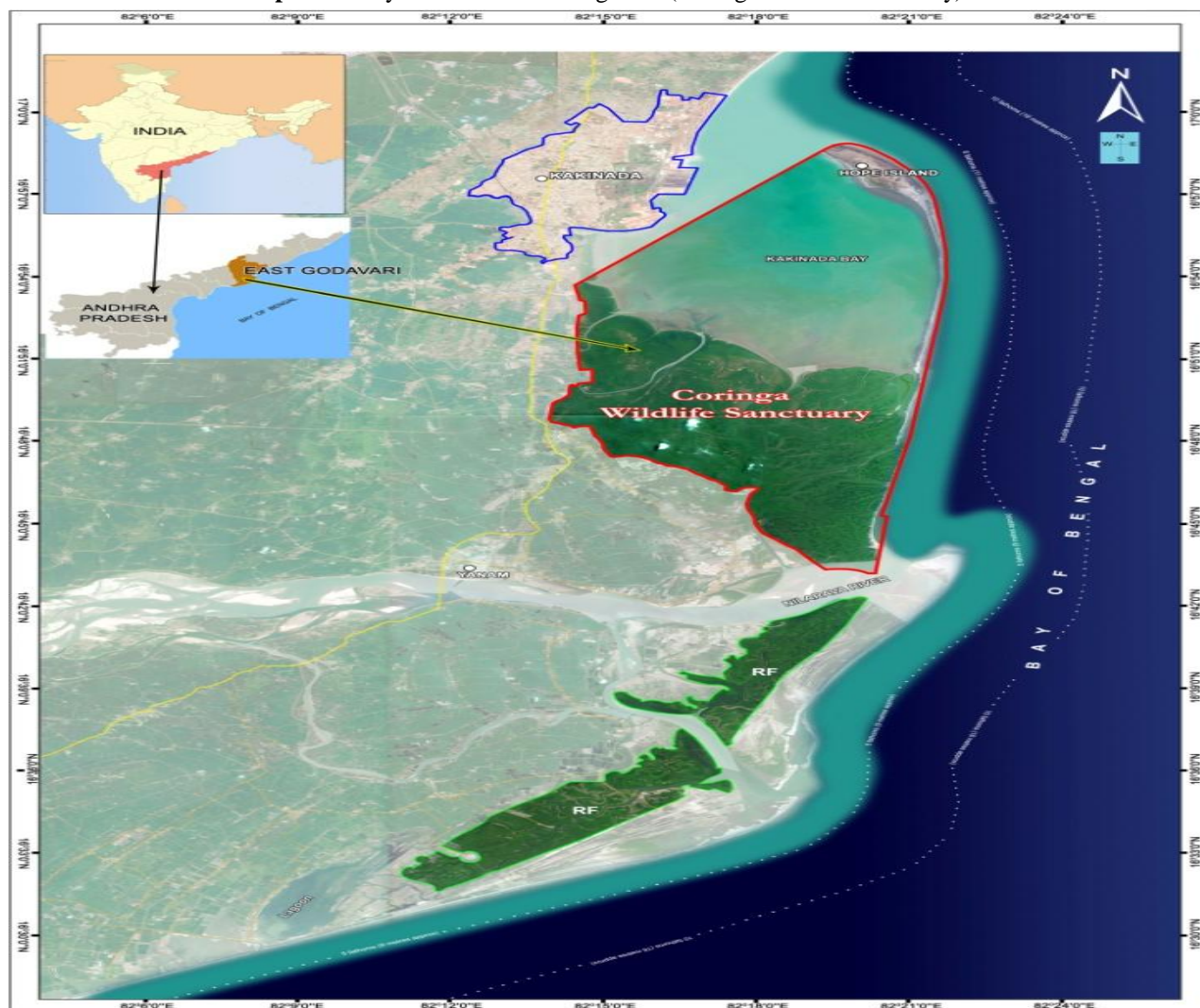
Due to rapid development of Kakinada port and erection of large scale industries changed urbanization of the Kakinada town, the mangrove fringed Coringa became a victim due to drastic urbanization and intensive commercial aquaculture practices. These factors have been identified as possible attributes towards a steady increase in eutrophication of waters in this area (Murthy, 1997). Although Coringa mangroves declared as Wildlife Sanctuary since 1972, this rich but fragile ecosystem has undergone serious alterations largely induced by human activities. Most of the mangrove areas are being converted for aquaculture culture areas. It is therefore necessary to understand the possible role of mangroves in ecosystem functioning. Selvam et al. (1992) studied the diurnal variation in physical – chemical properties and primary production in the interconnected marine, mangrove and freshwater biotopes of Kakinada coast, Andhra Pradesh. Bhaskara Rao et al. (1992) studied the mangrove environment and its sediment characters in Godavari estuary, east coast of India. Tripathy et al. (2001) studied the Water quality assessment of Gautami Godavari mangrove estuarine ecosystem of Andhra Pradesh, India.

#### **Materials And Methods:-**

##### **Study Area:-**

‘Coringa Wildlife Sanctuary’ is located between 16°44’ to 16° 53’ N and 082° 14’ to 082° 22’ E and at the confluence of the river Godavari with the Bay of Bengal in the East Godavari District of Andhra Pradesh. The sanctuary is a part of the Godavari Estuary and has extensive mangrove cover. The total area is 235.7 sq.km. The average temperature of the region is 17°C to 40°C. Average Rainfall is greater than 1,000 mm. The Northern part of sanctuary is covered by the back waters of the Kakinada Bay and covers an area of about 100 sq. km.



**Map -1:-** Study area Godavari mangroves (Coringa Wildlife Sanctuary)

Due to seasonal distribution of rainfall, East Godavari estuary ecosystem experiences seasonal flooding which introduces a lot of detritus and pollutants from the land. The estuary region presently serves as a major drainage channel receiving domestic wastes as well as industrial effluents from the industrial area of Kakinada.

#### Activity in the field:-

Water samples were collected to study the physico-chemical parameters of the estuary region of the Coringa Wildlife Sanctuary, these samples were collected from both surface and bottom of the creek. Usually water samples were collected between 6 AM to 10 AM, samples were collected from two different points between January 2015 to December 2015 and January 2016 to December 2016.

Water parameters like pH and salinity were analyzed at the sampling station by using portable pH pen and digital salinometer. The water was collected by dipping cans 50-60 cm beneath the water surfaces. Fixation of the DO samples were done immediately after the sample collection in the DO bottles with the Wrinklers A and Wrinklers B reagent. The sample bottles were filled fully with water from each sample station, labelled and stored on ice for transport to the laboratory for water quality analysis. Samples collected in the 500ml plastic bottles and DO bottles were analyzed for general parameters viz., pH, Dissolved Oxygen, Salinity, Alkalinity, Hardness, Calcium and Magnesium using the standard protocols and calibrated methods.



## Results and Discussions:-

The results were primarily influenced by seasonal variations and inflow of the Godavari and Coringa river influencing the water quality parameters. The results were tabularize in (Table -1).

In the present study atmospheric temperature ranges from 26<sup>0</sup> C to 33.8<sup>0</sup>C. Minimum recorded in the month of December and February 2015 and maximum in the month of May 2015 and 2016. The temperature is important factor which considerably fluctuated during study period. Lower temperature in the above months due to cloudy sky and rainfall brought down the temperature to the minimum.

The Hydrogen ion concentration or pH is one of the important proxy of water quality conditions, since pH of water is easily changed by chemical pollution. It is one of the vital environmental characteristics decides the survival, metabolism, physiology and growth of aquatic organisms. The pH is influenced by acidity of the bottom sediment and biological activities. High pH may result from high rate of photosynthesis by dense phytoplankton blooms. pH higher than 7 but lower than 8.5 according to (Abowei 2010) is ideal for biological productivity, but pH at <4 is detrimental to aquatic life. pH may be affected by total alkalinity and acidity, run off from surrounding rocks and water discharges. Ramanathan et al. (2005) recommended optimum range of pH 6.8-8.7 for maximum growth and production of shrimp and carp. The Hydrogen ion concentration has been recorded to be maximum of 8.5 to 7.15 minimum during the two years of study. Hence, the pH is at the permissible limit for the favorable growth of the aquatic fauna in this region.

Salinity is a dynamic indicator of the nature of the exchange system. It determines distribution of organisms in aquatic environments. The salinity of the water within the estuary tells us how much fresh water has mixed with sea water. Oxygen solubility decreases slightly as salinity increases, but oxygen solubility decreases more as temperature goes up regardless of salinity. Alkalinity of a water body is a measure of its capacity to neutralize acids to a designated pH ( APHA, 1980 and Edokpayi, 2005.) In the present study the lower salinity was recorded during the month of October 2016(0 ppm), The zero level of the salinity was because of the inflow of the Godavari River during the monsoon season. and higher salinity was recorded in the month of March 2016 (24ppm), the result was corroborated with the (Muduli Bipra Prasanna et al., 2010) When river water mixes with seawater, a large number of physical and chemical processes take place, which may influence of water quality.

Dissolved oxygen (DO) affects the solubility of and availability of nutrients. Dissolved Oxygen is essential for the survival of fish and other aquatic life and is an important indicator of pollution and/or eutrophication in rivers. The solubility of oxygen in river waters depends mainly on the water temperature and salinity. Its low levels can result in damages to oxidation state of substances from the oxidized to the reduced form thereby increasing the levels of toxic metabolites. In the present study Dissolved oxygen ranges in between 4 to 7.8 ppm. The highest (7.8 ppm) D.O recorded in the month of July 2016 and lowest (4ppm) D.O recorded in the month of April 2016 and September 2105.

Ammonia acts as indicator of the pollution from excessive usage of ammonia especially from fertilizers. Ammonia is the initial product of the decomposition of nitrogenous organic wastes and respiration. Ammonia concentration in waters must not exceed the recommended limit because it is very dangerous and can harm an aquatic life in the river water. High concentrations of ammonia causes an increase in pH and ammonia concentration in the blood of the fish which can damage the gills, the red blood cells, affect osmoregulation, reduce the oxygen-carrying capacity of blood and increase the oxygen demand of tissues (Lawson, 1995). Present study confirms the maximum level of 1.2 ppm and the lowest 0.05 ppm and the mean for the two successive years was 0.47782.

Alkalinity is a measure of the capacity of unfiltered water to neutralize acid. In almost all natural waters alkalinity is produced by the dissolved carbon dioxide species, bicarbonate and carbonate.

Alkalinity is the water's ability to resist changes in pH and is a measure of the total concentration of bases including carbonates, bicarbonates, hydroxides, phosphates and borates, dissolved calcium, magnesium, and other compounds in the water. According to Moyle (1946) the range of total alkalinity as 0.0 - 20.0 ppm for low production, 20.0 - 40.0 ppm- low to medium, 40.0 - 90.0 ppm- medium to high production and above 90.0 ppm productive of the aquatic organisms especially fish fauna. Hence, the present study determines the good alkalinity levels in the study for the good environment for the growth of fishes.

Nitrite is an intermediate product of the aerobic nitrification bacterial process, produced by the autotrophic *Nitrosomonas* bacteria combining oxygen and ammonia. The ideal and normal measurement of nitrite is zero in any aquatic system. Stone and Thomforde (2004) suggested that the desirable range 0-1 mg L<sup>-1</sup> NO<sub>2</sub> and acceptable range less than 4 mg L<sup>-1</sup> NO<sub>2</sub>. The results shows that the Nitrite rate from 1 ppm. and 0.01 ppm and most of the months was recorded to be nil thus the study area has permissible limit for the survival of the aquatic organisms.

Hardness is the measure of alkaline earth elements such as calcium and magnesium in an aquatic body along with other ions such as aluminium, iron, manganese, strontium, zinc, and hydrogen ions. Hardness was recorded maximum 3500ppm during September 2015 and minimum 110 ppm during October 2016 from the study area.

Calcium salts and Calcium ions are the most commonly occurring salts in Nature. They can come from natural or manmade. The concentration of calcium in water samples detected in between the range of 250-80 ppm with mean level of 155.24 ppm. It can be attributed to Hydro-chemical processes and also by anthropogenic sources like domestic wastes. Mean value of Magnesium was found to be 352.205 ppm and showed between the range of 450-180ppm, which may be attributed to basaltic inflows due to natural process in the study area, sea water influx, Aqua culture waste water and industrial waste waters.

**Table : 1 Physico-Chemical Water Parameters of the Godavari estuary during 2015-2016**

Months	Temp( <sup>o</sup> c)	pH	Sal (ppm)	DO (ppm)	NH <sub>3</sub> (ppm)	NO <sub>2</sub> (ppm)	Alk (ppm)	Hrd ppm	Ca (ppm)	Mg (ppm)
Jan-15	27	7.15	1	4.5	1	NIL	110	150	200	410
Jan-16	28	7.5	20	5	0.8	NIL	80	1500	120	300
Feb-15	26	7.7	15	7	0.1	NIL	250	890	110	390
Feb-16	29.2	7.9	12	4.9	0.4	0.01	170	750	130	450
Mar-15	27	8.4	7.5	6.2	0.2	0.9	190	567	250	450
Mar-16	27.3	8.3	24	5	0.8	NIL	340	2900	140	300
Apr-15	28	7.38	12	5	0.6	NIL	120	780	130	380
Apr-16	31	8.3	6	4	0.8	1	160	290	120	300
May-15	33.5	7.9	22	4.7	NIL	0.08	150	3100	150	300
May-16	33.8	7.4	16	6.7	0.4	NIL	190	2400	80	210
Jun-15	29	7.8	5	5	0.4	0.03	120	750	160	300
Jun-16	27.3	7.8	12	6	NIL	NIL	200	1800	140	300
Jul-15	27	7.9	6	6.2	0.05	NIL	220	900	80	210
Jul-16	32.1	7.2	5	7.8	0.1	0.02	120	750	90	180
Aug-15	28	7.3	23	5.8	1.2	0.4	180	3450	90	180
Aug-16	32	8.1	12	6.8	0.2	NIL	140	1800	150	300
Sept-15	27	8.3	23	4	0.5	0.03	200	3500	150	300
Sept-16	27.3	8.5	23	4.9	NIL	0.01	140	3200	140	300
Oct-15	31	8.4	18	5.8	0.9	NIL	250	2700	130	380
Oct-16	33.6	8.3	0	6	NIL	NIL	300	110	140	280
Nov-15	28	8.1	7	5.9	NIL	0.3	140	1050	140	300
Nov-16	31.2	7.51	23	7	1.2	NIL	120	3400	120	300
Dec-15	26	8.3	18	5.4	NIL	NIL	300	2800	140	300
Dec-16	27.3	8.5	23	7.2	NIL	0.01	140	3500	160	390
Average	29.06	7.91	13.89	5.7	0.56	0.25	180.41	1793.20	135.83	312.91
Max	33.8	8.5	24	7.8	1.2	1	340	3500	250	450
Min	26	7.15	0	4	0.05	0.01	80	110	80	180
Mean	32.76	8.89	15.47	6.42	0.47	0.16	205.43	2018.34	155.24	352.20

\*ppm = parts per million

It is perceived that the chemical run off from aquaculture may also contribute to the pollution of the estuarine ecosystems. The discharge of these effluents into the environment poses a threat to the coastal ecosystem and it is natural resources (Chua et al. 1989) and cause eutrophication of receiving water such as lakes and rivers (Cripps and Berghem, 2000). A study by Rangarao et al. (2003) indicates that pollutants are not flushed out completely due to the existing water circulation pattern and tend to accumulate in the southern part of the bay where mangroves are located. A small percentage (9%) of the fishermen of the Godavari mangroves attributes aquaculture effluents as the main cause of declining harvests (Dahdouh- Guebas et al. 2006). Untreated waste water loaded with uneaten feed

and fish faeces may contribute to nutrient pollution to the creeks which are near to the fish ponds. Industrialization, municipality drainage discharges, discharge of untreated water from the aqua culture ponds which were adjacent to the creeks and canals of the Coringa Wildlife Sanctuary contribute the estuary ecosystem. And when quantities of nitrogen wastes such as ammonia and nitrite are greater than creek waters can assimilate, water quality can deteriorate to a level that is toxic to aquatic organisms.

### Recommendations:-

Proper disposal of industrial wastes, agricultural runoff, and the municipal waters while outlet in to the marine waters. Industrial sectors, governmental authorities and aqua cultural farmers have to take responsibility to ensure that chemical use in view of environmental quality and human health as well.

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### References:-

1. **Abowei, J.F.N. (2010):** Salinity, dissolved oxygen, pH and surface water temperature conditions in Nkoro River, Niger Delta, Nigeria. *Adv. J. Food Sci. Technol.*, 2(1): 16-21.
2. **American Public Health Association (APHA), (1980):** Water Pollution Method for the Examination of Water and Wastewater. 18 th ed., Washington D.C., pp: 1437.
3. **Bhaskara Rao, V., Narasimha Nao, G. M., Sarma, G. V. S. and Krishna Rao, B. (1992):** Mangrove and its sediment characters in Godavari estuary, east Coast of India. *Indian Journal Marine Science* 21: pp 64-66.
4. **Boyd, C.E. (1979):** Water Quality in Warm Water Fish Ponds. University, Press, Alabama, USA, pp: 59.
5. **Chitmanat, C. and Traichaiyaporn, S. (2010):** Spatial and temporal variations of physical- chemical water quality and some heavy metals in water, sediments and fish of the Mae Kuang River, Northern Thailand. *International Journal of Agriculture and Biology*, 12(6) : 816-820. ISSN; 1560-8530.
6. **Chua, T.E., Paw J. and Guarin F. (1989):** "The Environmental Impact of Aquaculture and the Effects of Pollution on Coastal Aquaculture Development in Asia," *Marine Pollution Bulletin*, Vol. 20, No. 7, pp. 335-343.
7. **Clough, B. F. (1992):** Primary productivity and growth of mangrove forests, In: *Tropical mangrove ecosystems*; (eds) Robertson A I and Alongi D M, American Geophysical Union, Washington, D.C., Pp. 225-249.
8. **Cripps, S.J, Bergheim, A. (2000):** Solids management and removal for intensive land-based aquaculture production systems. *Aquaculture Eng* 22: 33-56
9. **Dahdouh-Guebas, F., Vrancken, D., Ravishankar, T., Koedam, N., (2006):** Short term mangrove browsing by feral water buffaloes: conflict between natural resources, wildlife and subsistence interests? *Environ. Conserv.* 34, 157- 163.
10. **Edokpayi, C.A. (2005):** Variation of chemical constituents of a brackish water prawn habitat in southern Nigeria. *Acta SATECH*, 2(1): 11-18.
11. **Lawson, T. B. (1995):** indices of lake productivity, *Transactions of the American Fisheries Society*, 76, pp 322-334.
12. **Muduli Bipra Prasanna, Panda Chitta Ranjan. (2010):** Physico chemical properties of water collected from Dhamra Estuary. *International Journal of Environmental Sciences*, 3, 2010.
13. **Murthy, N.V.S.S. (1997):** Hydrography. In: "An assessment of the ecological importance of Mangroves in Kakinada area, Andhra Pradesh, India", Final report European Community INCO-DC Project: 16-25.
14. **Odum, E.P. (1971):** Fundamentals of Ecology. 3rd Edn., W.B. Saunders. Philadelphia, pp: 574.
15. **Odum, W. E. and Heald, E. J. (1972):** Trophic analysis of an estuarine mangrove community; *Bull. Mar. Sci.* 22 671-738.
16. **Odum, W. E. and Heald, E. J. (1975):** The detritus based food web of an estuarine mangrove community, In: *Estuarine Research*; (ed.) Cronin L E, Academic Press, New York, Pp. 265-286.

17. **Ramanathan, N., Padmavathy, P., Francis, T., Athithian, S. and Selvaranjitham, N. (2005):** Manual on polyculture of tiger shrimp and carps in freshwater. Tamil Nadu Veterinary and Animal Sciences University, Fisheries College and Research Institute, Thothukudi, pp: 1-161.
18. **Ranga Rao, V., Reddy, B. S. R., Raman, A. V. & Ramana Murthy, M. V. (2003):** Oceanographic features of the Bay-mangrove waterways of Coringa, East coast of India. *Proc. AP Akad. Sc.*, 7 (2): 135-142.
19. **Robertson A I., Alongi, D. M. and Boto, K. G. (1992):** Food chains and carbon fluxes In: *Tropical mangrove ecosystems* (eds) Robertson A I and Alongi D M, American Geophysical Union, Washington, D.C., Pp. 293-326.
20. **Selvam, V., Azariah, J. and Azariah, H. (1992):** Diurnal variation in physical – chemical properties and primary production in the interconnected marine, mangrove and freshwater biotopes of Kakinada coast, Andhra Pradesh, India. *Hydrobiologia*, 247: pp 181-186.
21. **Stone, N. M. and Thomforde H. K. (2004):** Understanding Your Fish Pond Water Analysis Report. Cooperative Extension Program, University of Arkansas at Pine Bluff Aquaculture / Fisheries.
22. **Tripathy. S. C., Ray, A. K., Patra, S. and Sarma, V. V. (2005):** Water quality assessment of Gautami-Godavari mangrove estuarine ecosystem of Andhra Pradesh, India during September 2001 *Journal of Earth System. Science*. 114, No. 2, April 2005, pp. 185-190.
23. **Twilley, R. R. (1988):** Coupling of mangroves to the productivity of estuarine and coastal waters, In: *Coastal-Offshore Ecosystem Interactions*; (ed.)Jansson B O, Germany: Springer-Verlag, Pp. 155-180.
24. **Wattayakorn, G., Wolanski, E. and Kjerfve, B. (1990):** Mixing, trapping and outwelling in the Klong Ngao mangrove swamp, Thailand; *Estuar. Coast. Shelf Sci.* 31 667-688.

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### RESEARCH ARTICLE

## IDENTIFYING EPIGENETIC ENDPOINTS OF PESTICIDE EXPOSURE CAN CURTAIL RISK TO DEVELOP CANCER: A REVIEW.

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### Abstract

Potential for carcinogenicity of pesticides is identified on the basis of its potential for causing genotoxicity. But, there are some pesticides that do not cause mutation at very early stage of exposure but result in silencing certain genes which make the cells addicted to oncogenic products to become neoplastic. This review throws light on the epigenetic changes brought about by pesticides, which effect the expression of genes without change in their DNA sequence. If certain epigenetics based tests are included in the panel of screening pesticides before they are introduced into the market, then not only will it help in deciding norms for regulating exposure to these chemicals but will also solidify our knowledge for that pesticide.

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### Introduction:-

Pesticides are group of chemicals designed to eliminate pests, including insects, molds and unwanted plants, in order to protect crops. Based on their targets the pesticides are categorized as fungicides, insecticides, herbicides etc.

Pesticides are neurotoxins, nephrotoxins, genotoxins, hemotoxins and endocrine disrupters for the target organisms. Thus regulation of their exposure and usage is important for protecting the non-target organisms. One of the most undesirable effects of the pesticides on the non-target organisms is development of cancer. The pesticides are tested for genotoxicity and carcinogenicity before authorization for marketing (Bull, Fletcher, Boobis and Battershill, 2006). But, there are several epidemiological studies that indicate association of chronic exposure to certain pesticides with increased risk of cancer (See Table I). This suggests that possibly long term exposure to pesticides eventually brings about neoplastic changes to the cells via mechanisms other than genotoxicity (Tsai and Baylin, 2011; Baccarelli and Bollati, 2009; Mostafalou & Abdollahi, 2013).

Pesticides can result in carcinogenesis via multiple mechanisms like oxidative stress, several receptor mediated pathways and aberrant epigenetic changes (Alavanja, Ross and Bonner, 2013). Epigenetic modifications of tumor suppressor genes and oncogenes are considered important molecular drivers for tumorigenesis and are crucial for cancer diagnostics. Study of epigenetic signatures for exposure to environmental chemicals is a developing field (Hou, Zhang, Wang, & Baccarelli, 2012).

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**Table I:-** Some epidemiological studies to study role of pesticide exposure on different cancer types prevalent in the population

S. N O.	TYPE OF CANCER	TYPE OF PESTICIDE EXPOSURE	POPULATION STUDIED	AGE OF SUBJECTS	TYPE OF DATA COLLECTION	TIME SPAN OF STUDY	REMARKS / CONCLUSIONS	References
1	Brain tumor	Occupational pesticide exposure	Rio-de-Janerio	Men (age >18)	Death certificates from health centers	1998-2005	Agricultural workers showed higher mortality risk due to brain cancer than non-farm workers	(Miranda-Filho, Monteiro, & Meyer, 2012)
2	Prostate cancer	OP: Malathione . Fonofos, Turbufos ; OC: Aldrein	Iowa and North Carolina	Men (age not defined)	Interviews based on questionnaire	1993-2007	Association of increased risk of total prostate cancer with increased use of Fonofos and Aldrein in those with family history.	(Koutros et al., 2013)
3	Multiple sites	Occupational pesticide exposure	Andalusia (Spain)	Men and women (average age 37)	Hospital records	1998-2005	Prevalence higher in areas with higher exposure. Males show higher cases of lung, prostate, and testicular cancers. Females show higher cases of ovary and breast cancer.	(Parrón, Requena, Hernández, & Alarcón, 2013)
4	Childhood leukemia ALL, AML	Occupational pesticide exposure	Europe (13 nationwide studies)	Children (mostly of age 15) and parents	Data from study done by CLIC	Variable	Increased risk of AML with maternal exposure to pesticides during pregnancy. Slight increase in the ALL with paternal exposure to	(Bailey et al., 2014)

							pesticides	
5	Non-Hodgkin's Lymphoma	Many lifestyle associated factors, diet, occupational exposure to pesticides	Mumbai (India)	Men (average age 46)	Data from TATA memorial hospital followed by interview	1997-1999	3X increase in lymphoma on exposure to pesticides.	(Balasubramani am, Saoba, Sarade, & Pinjare, 2013)
6	Hodgkin's Lymphoma	Multiple pesticides	6 provinces of Canada	Men (age >19)	Data from CCSPH followed by interview	1991-1994	Association of Hodgkins Lymphoma with fungicides and insecticides specially acetylcholine esterase inhibitors	(Navaranjan et al., 2013)
7	Childhood leukemia ALL, AML	Occupational pesticide exposure	India	Children (age<18) and parents	Patients from (PBD SHUS) followed by questionnaire	2008-2012	Increase in the risk leukemia in children whose mothers are working in agricultural field during pregnancy	(Kumar, Vashist, & Rathee, 2014)
8	Stomach Pancreatic Leukemia	Organochloric pesticides DDT	Sardinia (Italy)	Men and Women (age not defined)	.....	1984-1986	Mortality from stomach cancer increased up to 2X in high exposure. But no exposure-response trend was observed.	(Cocco et al., 1997)
9	Colorectal Cancer	50 Occupational pesticide exposure	Iowa and North Carolina	Not defined	Exposure details by questionnaire	1993-1997	Chlorpyrifos and Aldicarb exposure associated with colorectal cancer	(Lee et al., 2010)
10	Bladder Cancer	Occupational pesticide exposure	France	men (age 35-74)	Data from Pesticide Exposure Index for 89 units in France	1984-1986	A significant link with PEI in vineyards was found	(Viel & Challier, 1995)

12	Stomach, Kidney etc	Occupational pesticide exposure	Central Italy	Men (age 35-80)	Data from Municipal registration	Data from 1953-1985	Increased risk of stomach and kidney cancer among men with >10 years of pesticide exposure	(Forastiere et al., 1993)
13	Thyroid Cancer	Fungicide Mancozeb	Norway	Men and Women (age 30-75) and children (age<10)	data from different census reports	1974-1989	Mild association between Mancozeb and Neural tube defects and no association was found between mancozeb exposure and thyroid cancer	(Nordby, Andersen, Irgens, & Kristensen, 2005)

Even before the genetic mutations show up, there are a set of modifications in the genome without changing the sequence of DNA, events that can change the fate of a cell. These are called epigenetic modifications. These modifications in a normal cell maintain a stable state of suitable gene expression and are responsible for cell differentiation and genomic imprinting. Their aberrations lead to aberrant gene expression and ultimately render the cell addicted to oncogenic product. There are piling reports that have proved association of epigenetic aberrations with development of chronic disorders, especially if the aberration occurs in the early stage of life (Sharma, Kelly and Jones, 2010). (See Box I)

Genetic changes are rare and take time to show up, epigenetic changes get perturbed easily in response to change in the micro-environment of its cell. There are certain attributes that makes epigenetics an attractive field medical advances (See Box II).

Epigenetics can help understand the molecular mechanisms altered by non-genotoxic Carcinogens. These can prove to be the key to solve issues associated with rising cases of cancers associated with occupational exposure of pesticides and also give some insight into mechanisms involved in environment influenced disease pathogenesis. Pesticide exposure during early stages of life results in epigenetic modifications in the cell. This may form the basis for developing diseases later in life (Shuk-Mei Ho, et. al., 2012). Malansky in 1981 suspected epigenetic mode for tumorigenicity in hepatocytes by organochloric pesticides which had no observable genotoxicity (Maslansky & Williams, 1981). Over the decades immense reporting has been done to unveil different mechanisms involved in influence of ecotoxicants on our epigenome.



**BOX I: EPIGENETICS - BASIC INTRODUCTION**

The Branch of Biology that studies interaction between genotypes and phenotypes of a cell that decides the final outcome of a locus, without altering a DNA sequence of a cell (Goldberg, Allis and Bernstein, 2007). It reflects the transcription status of the cell based on its past cellular events. Epigenetic changes are heritable (Bonasio, Tu and Reinberg, 2010). Epigenetic pattern are decided by DNA methylation at CpG islands in genic or non genic regions of the genome, post translational histone modifications like methylation, acetylation, ubiquitylation, phosphorylation and micro RNA.

**DNA Methylation:** Major proportion of 5-methyl cytosines are located at CpG islands in the genome. These changes are brought about by DNA methyltransferases (DNMTs).

**Covalent modifications of Histone Tails:** Histones are basic octamer proteins that help in packaging of DNA. Histones constitute of 2 H3, 2 H4 and dimers of H2A and H2B. The covalent modifications of histone tails are dynamically and strictly regulated by different enzymes. Histone acetyltransferases (HATs) and histone methyltransferases (HMTs) add acetyl and methyl groups, respectively, whereas histone deacetylase (HDACs) and histone demethylases (HDMs) remove acetyl and methyl groups, respectively. Histone acetylation at lysine is strictly associated with transcription activation of genes. But histone methylation has different impact on the transcription status of the gene based on the position of methyl group. Histone modifications have been shown to be important in altering chromatin structure and therefore DNA accessibility. Histones modifications along with DNA methylation can regulate gene expression, chromatin remodeling, cell survival and cell death.

**MiRNA:** These are single-stranded RNAs of about 21–23 nucleotides in length that are transcribed from DNA but not translated into proteins (non-coding RNAs). Their functional role is gene expression regulation mediated by a control of messenger RNA (mRNA) stability or translation. ncRNA can be small or long. Small ncRNA interact with RNA, DNA or RNA-DNA triplet or recruit modifiers. Long ncRNA form complex structures that have domains to interact with modifier or RNA Polymerase II and target base pair sequence (Bonasio et al., 2010).

Simple epigenetic assays can be introduced in the panel of tests that are performed for approval of pesticides and as biomarkers for post marketing assessment for toxicity of pesticides. This can make understanding the efficacy of pesticides clearer and can complement the assays for carcinogenicity. .

This review discusses about different epigenetic alterations that are brought about by some of the known pesticides. Studies on aberrant epigenetic alterations caused by pesticide exposure would not only help us to identify the chemicals that are potential carcinogens, but also open new arenas to assess health of non-target population exposed to pesticides at chronic or acute levels, thereby define better safety biomarkers (Thomson, et. al., 2013) because Epigenetic aberrations pave path for cancer development or development of chronic diseases later in life (Feinberg and Tycko, 2004).

**Epigenetic link between pesticides and chronic diseases:-**

The pesticides are approved based on antimicrobial testing, movement of pesticides in soil, water, plant and environment and residues in the food-feed, animal commodities and extensive carcinogenicity testing before regulatory approval. But pesticide exposure has repeatedly been associated with various cancers. The usual tests that are used to validate carcinogenicity are based on genotoxicity that include mutagenicity. Several ecotoxicants that were traditionally known to be non-mutagenic are now considered as epimutagens owing to their detrimental effects on the epigenome of the people coming in contact with these (Hou, Zhang, Wang and Baccarelli, 2012). Some of these chemicals are summarized in Table II.

Mammalian germ cells and pre-implantation embryos undergo critical process of imprinting, regulated epigenetically, that lays grounds for differential reprogramming (Sasaki and Matsui, 2008). Presence of xenobiotics or their derivatives during these critical periods can induce persistent and heritable epigenetic changes. Anway et al. showed gestational exposure of endocrine disruptor **Vinclozolin**, a common dicarboximide fungicide, induced

**BOX II: EPIGENETICS - CLINICAL APPLICATIONS**

Epigenome off lately has caught attention of the medical field also. Apart from its implications in environmental issues, it has now started being considered as important as the genome of the individual for diagnosis of cancer. There are number of genes whose expression is involved in normal cell cycle, apoptosis, cell adhesion, angiogenesis or some way or the other associated with suppression of tumor. But as cancer develops the expression of these genes is suppressed by genetic or epigenetic mechanisms. Genetic alterations like mutations show up later in the cancer development if the cause is not congenital. Silencing by hypermethylation of genes like RASSF1A, p16, APC, MLH1, SEPT9, CDH1 have been implicated in many cancers and can be detected early in tumor development (Li, Jin, & Wang, 2014)(Y.-J. Zhang et al., 2007)(Brock et al., 2008).

Genetic mutations are not always conclusive about malignancy of the tumor, the signature of cancer. Certain disorders that exploit the same pathways for its development as cancer may also show similar genetic mutations, like the case of Chronic Obstructive Pulmonary Disorder (COPD) and lung cancer. Rather epigenetic alterations are more conclusive about cancer development eg. CDKN21 hypermethylation (Brothers et al., 2013).

Frequency of hypermethylation of SFRP and Basonuclein 1 has been found to be associated with survival of renal cell carcinoma patients. These modifications are better markers than tumor dimension (Ricketts, Hill, & Linehan, 2014).

Inclusion of such panels of non-invasive, highly sensitive and specific genome-wide epigenetic biomarkers for different types of cancers can drastically improvise the efficiency of cancer diagnosis.

Versatility and recognition of epigenetics can be appreciated by the fact that FDA has approved some anti cancer drugs like Azacitidine, Decitabine that exploit epigenetic mechanisms to suppress cancer development.

**Table II:-** Epigenetic pathways exploited by different pollutants

<b>POLLUTANTS</b>	<b>CARCINOGEN</b>	<b>MUTAGEN</b>	<b>EPIGENETIC MECHANISM OF ACTION</b>	<b>REFERENCES</b>
<b>Metals</b>				
Cadmium	Yes	Mild	Inhibit DNMT by interfering in enzyme-DNA interaction	(Takiguchi, Achanzar, Qu, Li, & Waalkes, 2003)
Arsenic	Yes	Yes in high concentration	Inhibit DNMT by limiting availability of SAM for DNMT	(Srivastava, D'Souza, Sen, & States, 2008)
Nickel	Yes	Inhibit excision repair	<i>In vitro</i> studies reflect reduced histone acetylation	(Ke, Davidson, Chen, Kluz, & Costa, 2006)
Chromium	Yes	Only by hexavalent salts	<i>In vitro</i> studies reflect altered histone modifications	(Schnekenburger, Talaska, & Puga, 2007)
Methyl Mercury	Yes	Moderate	Epigenetic suppression of BDNF	(Onishchenko, Karpova, Sabri, Castrén, & Ceccatelli, 2008)
<b>TCE, DCA, TCA</b>	Rodent carcinogen	Only in very high doses	Decreased methylation of 2 proto-oncogenes	(Moore and Harrington Brock, 2000)
<b>Air Pollution</b>	PAH is carcinogenic	PAH is mutagenic	Reduced global DNA methylation levels	(Ehrlich, 2002) (Alexandra Ya. Khesina, 2004)
<b>Benzene</b>	Yes	Benzene oxide is mutagenic	Changes in the DNA methylation pattern	(Bollati et al., 2007) (R P Chilcott, 2007)
<b>RDX</b>	Yes	Yes	Modify miRNA expression	(Zhang & Pan, 2009) (Bhuvan B. et al 2003)
<b>Endocrine-disrupting Chemicals</b>				
Diethylstilbe	Yes	No	Inhibit methylation by	(H.R. Glatt, 1979)

strol (DES)			inhibiting COMT gene transcription	
Bisphenol A (BPA)	Yes	No	Modify DNA methylation pattern	(Dolinoy, Huang, & Jirtle, 2007)

From data obtained from Epigenetics and environmental chemicals (Baccarelli & Bollati, 2011) and other sources

multiple abnormalities in the mice offsprings for at least 3 generations (Nilsson, Anway, Stanfield and Skinner, 2008). Presence of ecotoxins in the microenvironment during early stages of life can greatly perturb epigenome thereby the whole cellular function especially thereby making the organism susceptible to develop disorders during later stages of life (Jirtle and Skinner, 2007).

**Arsenic**, a semi-metal frequently used as pesticide, easily found to contaminate water sources and has been linked to cancer of the bladder, lungs, skin, kidney, nasal passages, liver, and prostate. Arsenic is used in wood preservatives, paints, dyes, metals, drugs, soaps and semi-conductors. Though its genotoxic effects are known it's also known to affect the epigenome. Hypomethylation of *LINE* repeat has also being associated with low level Arsenic exposure in Mexican children (Alegría-Torres et al., 2016). Arsenic is also associated with hypermethylation mediated silencing of p16 and p53 genes in a dose dependent manner in the people of West Bengal, one of the most Arsenic contaminated regions in the world, and is strongly correlated to arsenic induced skin lesions in people (Chanda et al., 2006). High Pesticide Exposure Events has been correlated with elevated DNA methylation of GSTP1 promoter among pesticide applicators older than 59 years of age (Rusiecki et al., 2016). GSTP1 promoter hypermethylation is associated with prostate cancer (Gonzalvo et al., 2003). Inorganic arsenic is biologically detoxified by methylation catalyzed by S-adenosine methionine methyltransferase (reviewed by Ajees and Rosen, 2015). Excess arsenic in the body lowers activity of DNMTs by cofactor restriction, required to maintain the proper methylation status of the cell. Hyper and hypomethylation due to arsenic exposure are reported at both, gene specific and genome specific levels and the mechanism of its action is not yet clearly elucidated (reviewed by Reichard and Puga, 2010).

Arsenic has been shown to alter miRNAs expression, involved in a carbon metabolism, in human lymphoblastoid cells (Marsit, Eddy and Kelsey, 2006).

For its adverse effects on human health all arsenic derivative pesticides except Monosodium methanearsonate (MSMA) have been banned under EPA 2009. The residual Arsenic content present in soil and water still pose severe health risks.

Persistent Organic Pollutants (POPs) are chemical substances that persist in the environment, bioaccumulate through the food web and pose a risk of causing adverse effects to human health and the environment. POPs are global concern because POPs can be transported across international boundaries far from their sources. Their effects on wildlife species, even in areas where these are not produce have raised alarm on their implications in humans. Human exposure in the arctic regions is among the highest in world. Their main route to enter is via food and its endocrine disrupting role linked them to reproductive impairment in humans. They are also reported to cause immune system disruption. 12 of these POPs have been targeted by UNEP for global elimination based on the extensive reports of their persistence, though association of these chemicals with chronic diseases in humans is incomplete.

Most POPs are either insecticide related products or are produced in industries. Rusiecki et al reported association of high serum concentration of a panel of POPs including DDT, Chlordane Mirex, PCB, hexachlorobenzene and Toxaphene with decrease in the global methylation status in the *Alu* repeat regions of Greenlandic Inuit population (Rusiecki et al., 2008). The association between global hypomethylation with genomic instability might explain the increasing rate of cancer in this area. Similar results were obtained by a different group of investigators for a population (South Korea) with much lower biological concentration of POPs as compared to Greenlandic Inuit (Kim et al., 2010).

Another study done by Shutoh et. al. reported DNA hypomethylation at 6 specific gene promoter sites and at global level on vivo exposure to DDT in a dose dependent manner (Shutoh et al., 2009). DDT can induce production of reactive oxygen species (Pérez-Maldonado et al., 2005). Low levels of 5mC induced by Hypoxia is responsible for solid tumor formation in presence of ROS (Shahrzad, Bertrand, Minhas, & Coomber, 2007). Another recent report

suggests tumor hypoxia mediated reduction in the activity of Ten Eleven Translocase (TET) enzyme results in hypermethylation of promoter regions as TET mediates oxidative demethylation of 5mC (Thienpont et al., 2016).

**DDT** is now banned for agricultural purposes but is used for vector control in some countries. Due to lack of mutagenicity it is considered only a probable carcinogen to humans by EPA 1987. Similarly **Chlordane** is now banned but its non-mutagenicity do not compliment its link to prostate and breast cancers development and affects the nervous system. An occupational study reported association between chlordane exposure and non-Hodgkins's lymphoma. EPA has classified chlordane as a Group B2, probable human carcinogen. **Mirex** is banned as pesticide in US but is used in other products. It is a non mutagen but is a carcinogenic risk to humans. **PCBs** have widespread utilities apart from pesticides and are known to be associated with liver cancer in spite of being a non-mutagen. According to EPA, PCBs are probable human carcinogens (B1). **Toxaphene** (EPA Group B2) has limited mutagenicity but is highly toxic to liver, kidney, spleen, adrenal and thyroid glands, CNS, and the immune system. Chronic oral exposure to **hexachlorobenzene** (EPA Group B2), now banned in US is associated with a liver disease with associated skin lesions. Epidemiologic studies of people exposed to hexachlorobenzene have not shown an increased cancer incidence. However, animal studies have reported cancer of the liver.

**Dieldrin**, another dreaded POP insecticide, is associated with non-mutagenic carcinogenesis in mouse but lack of human evidence makes it most probable human carcinogen (Stevenson et al., 1999) and is linked to Parkinson's disease, breast cancer and immune, reproductive and nervous system damage. Its persistence, like other POP has made it one of the red listed chemicals for EPA. Aberrant histone modifications were observed under the influence of this POP by Song et. al. they observed short term and long term in-vitro effect on mammalian cell. Long term, small dose treatment was more environmentally relevant and was observed to result in hyperacetylation of H3 and H4 after 6-24 hrs of treatment on the dopaminergic neuronal cells. In-vivo treatment of the same resulted in hyperacetylation of H4 in striatum of mice brain, the part associated with Parkinson's. They linked this finding to accumulation of a HAT. The epigenetic impact on the dopaminergic neuronal cells may give some clue to understand relation between Parkinson's and dieldrin exposure (Song, Kanthasamy, Anantharam, Sun, & Kanthasamy, 2010).

Apart from these 7 of the 12 United Nations Environment Programme (UNEP) targeted POPs for global elimination (May 2001), there are other organic pollutants also that are not so much a threat in terms of persistence. **Fonofos** is a commonly used pesticide in most of the countries and is non carcinogenic. **Parathion** is a commonly used insecticide for many crops. No epidemiological information is available on reproductive, developmental, or carcinogenic effects of parathion in human population. Limited data on animals are available; increased adrenal cortical tumors were observed in rats orally exposed to parathion. EPA has classified parathion as a Group C, possible human carcinogen. Both, Parathione (Velázquez, Xamena and Creus, 2009) and Fonofos are non-mutagenic. But Zhang et al reported alteration in the methylation status of 712 genes in response to treatment of these organophosphate pesticides (X. Zhang et al., 2013). This may account for sparse reports that are available on the chronic impacts of these pesticides (Bonner et al., 2010).

**Triazophos** and **Dichlorovos** are organophosphate pesticides that are used for agricultural purposes in most of the countries in the world. No information is available on the reproductive, developmental, or carcinogenic effects of dichlorovos on humans. A study by the National Toxicology Program (NTP) reported an increased incidence of tumors of the pancreas, mammary glands, and forestomach in animals. EPA has classified dichlorovos as a Group B2, probable human carcinogen though mutagenicity of dichlorovos is disputed (Ashwood-Smith, Trevino and Ring, 1972; Carere, Ortali, Cardamone and Morpurgo, 1978). There is no active registration for Triazophos under EPA but Triazophos is non mutagenic (Velázquez et al., 2009). It is non carcinogenic in animals but carcinogenicity is controversial in human. Ross et al analyzed tumorigenic triazophos and dichlorovos, and non tumorigenic **myclobutanil**, a fungicide, and observed that though all the three pesticides result in the negative fold change of 19 different miRNAs, the alteration observed for the two tumorigenic pesticides was times more than the non tumorigenic pesticide. These alterations can be potential markers for effect of tumorigenic conazoles in mouse at 90 day of exposure, when there was no tumor or neoplasticity observed. Secondly, the genes whose mRNAs are targeted by these miRNAs are probably important for tumorigenesis. They also concluded that there probably a threshold of downregulation of miRNAs is required to be attained for causing tumorigenesis, which is not attained by the non-tumorigenic myclobutanil (Ross et al., 2010). The epigenetic aberrations reported for these OP pesticides, might give clue to the chronic neurotoxicity associated impacts of organophosphorus pesticides (Rastogi, Tripathi and Ravishanker, 2010).

There are many pesticides that are not Persistent Organic Pollutants, but are associated with occurrence of chronic disorders. **Paraquat**, a herbicide, is associated with respiratory disorder on high exposure (Dalvie et al., 1999). It shows mild direct mutagenicity and is categorized as a Group E pesticide (showing no evidence of carcinogenicity). Song et al reported impact of Paraquat on epigenome of mammalian cells. They observed that Hyperacetylation is responsible for paraquat induced neurotoxicity using N27 Dopaminergic Neuronal cells with decrease in the total HDAC activity after Paraquat exposure (Song, Kanthasamy, Jin, Anantharam and Kanthasamy, 2011). Such hyperacetylation might lead to aberrant activation of genes.

**Propiconazole** is a fungicide and anti microbial pesticide. No mutagenicity is associated with this pesticide and EPA has classified propiconazole as Group C for carcinogenicity (possible human carcinogen). **Fipronil**, a insecticide, is associated with no evident chronic impact and U.S. EPA classified fipronil as Group C - possible human carcinogen. In a vivo study on zebrafish showed alteration in miRNA levels after treatments with propiconazole and fipronil. Alteration of different miRNAs expression was observed in response to individual and combinatorial treatments. It suggests that efficacies of exposure to these pesticides in isolation or in combination, may be varied or summative (Xingxing Wang, Zhou, Ding, Zhu and Guo, 2010).

### BOX III: EPIGENETICCS vs. GENETICS

It is now established that cancer progression in due to interplay between epigenetic and genetic mechanisms. Now studies have shifted from studying silencing classical Tumor Suppression Genes to studying candidate TSGs based on the hyper or hypomethylation of promoter regions of cells with characteristic neoplastic phenotype. Following are certain aspects that make packing of DNA as important as the sequence of the genome.

- ✓ Genetic changes involve premutagenic damage like strand breakage, mutagenic damage and chromosomal aberrations. Epigenetic changes involve changes in the DNA methylation pattern histone acetylation pattern and altered miRNA expression.
- ✓ Epigenetic alterations can be detected at the early stages of cancer. The genetic alterations characterize the tumor formation or metastatic stage of cancer. Thus effect of any alteration in the microenvironment can be understood more quickly with the help of epigenetic alterations it causes.
- ✓ Familial genetic mutation may not show up in a population till it is homozygous. It gets diluted by mating with non-mutants. Whereas epigenetic silencing can occur in multiple individuals and appear to be more persistent. It raises the probability of developing a disorder later in life.
- ✓ Genetic mutations are more stable and irreversible than the epigenetic alterations. Thus the latter opens good prospects for treatment of chronic disorders before occurrence of severe mutations restrict the treatment.
- ✓ For a given tumor growth there are seldom multiple mutations because only one hit is sufficient to disrupt the complete pathway. Whereas for gene silencing there are many such disruptions that can be associated with a single tumor suppressing pathway. These aberrations recruit other modifiers also. Their notoriety makes them detectable over a wide range.

These all evidences of impact of pesticides on our epigenome suggest there are many other mechanisms that may give rise to environment induced cancer. There are several mechanisms at play that lead to altered cell physiology, epigenomic aberrations being one of them. So if we restrict the use of pesticide with proper regulations, we can curtail the threat (Alavanja et al., 2013). The carcinogenicity status assigned to these pesticides by EPA, IARC and NTP and usage status in India have been summarized in table III.

**Table III:-** Brief overview of some common pesticides.

PESTICIDES	TYPE	IARC / EPA / NTP	USAGE IN INDIA	MECHANIS M STUDIED IN THE REVIEW	REFERENCES
Dichloro Diphenyl Trichloroethane (DDT)	Organochloric Insecticide	IARC 2B NTP - RAHC	largest producer and sole exporter with restricted use	DNA Methylation	(cibrc.nic.in/ibr2012.doc)
Mirex	Organochloric Insecticide	IARC - 2B NTP - RAHC	banned for manufacture, import and use	DNA Methylation	(Bhuvaneshwari, Rajendran, & Nadu, 2012)
L-chlordane	Organochloric Insecticide	IARC - 2B	banned for manufacture, import and use	DNA Methylation	(cibrc.nic.in/ibr2012.doc) (IARC, 1991)
Polychlorinated biphenyls (PCBs)	Organochloric Insecticide	IARC - 2A NTP - RAHC	Present in dietary intake	DNA Methylation	(IARC, 1991)
Monosodium methanearsonate (MSMA) – OAP	Herbicide	Only Arsenical pesticides permitted by US EPA 2009	High concentrations of arsenic have been measured in drinking-water include large areas in West Bengal. Used mainly for cotton crops.	DNA Methylation	IARC Monograph (post 2004 on Arsenic And Arsenic Compounds)
Disodium methanearsonate (DSMA)	Herbicide	IARC - 3 Prohibited under US EPA 2009		DNA Methylation	
calcium acid methanearsonate (CAMA)	Herbicide	Prohibited under US EPA 2009		DNA Methylation	
cacodylic acid	Herbicide	Prohibited under US EPA 2009		DNA Methylation	
Fonofos	OP insecticide	Not Classified by IARC Category E in US EPA	Common agricultural usage	DNA Methylation	EPA Red Facts (Fonofos 1999)
Terbufos	OP nematocide and insecticide	Not classified by IARC 15 percent or more terbufos are classified as RUPs	Used to control corn rootworms.	DNA Methylation	US EPA
Parathion	OP insecticide and	IARC - 3 Category C by US EPA	Methyl parathion under	DNA Methylation	(cibrc.nic.in/ibr2012.doc)(IARC, 1991)

	acaricide.		restricted use. Ethyl parathion banned for manufacture, import and use		
Dieldrin	OC insecticide	IARC - 3 No current use in US	banned for manufacture, import and use	Histone modification	(cibrc.nic.in/ibr2012.doc)(IARC, 1991)
Paraquat	Herbicide	Not classified by IARC Category E by US EPA 1997 Though restricted or banned in many countries	Paraquat Dimethyl Sulphate banned for manufacture, import and use. Paraquat dichloride is avidly used and registered	Histone modification	(cibrc.nic.in/ibr2012.doc) (PANAP Feb 2011)
Triadimefon	Fungicide	Not Classified by IARC Category C by US EPA	Registered under CIBRC and used in many states	miRNA based regulation	(www.cdms.net/ldat/) State of pesticide regulations in India (CSE)
Propiconazole	Fungicide	Not Classified by IARC Propiconazole is a General Use Pesticide.	Registered under CIBRC and used in many states for many crops	miRNA based regulation	State of pesticide regulations in India (CSE) (http://www.toxipedia.org/)
Myclobutanil	Fungicides	Not Classified by IARC Myclobutanil is a General Use Pesticide.	Registered under CIBRC and used in many states for Apple	miRNA based regulation	State of pesticide regulations in India (CSE) (http://www.toxipedia.org/ )
Fipronil	Insecticides	Not Classified by IARC Category C by US EPA	Registered under CIBRC and used in many states for sugarcane and cotton (no MRL)	miRNA based regulation	State of pesticide regulations in India (CSE) (NPIC)

Triazophos	OP insecticide	Not registered with the EPA for use as pesticide in the US Banned in the EU for use	Registered under CIBRC and used in many states for paddy and cotton	miRNA based regulation	State of pesticide regulations in India (CSE) ( <a href="http://hazmap.nlm.nih.gov/">http://hazmap.nlm.nih.gov/</a> )
Dichlorovos	OP insecticide	Not Classified by IARC Category B2 by US EPA (probable human carcinogen)	Broad application	miRNA based regulation	( <a href="http://www.epa.gov/">http://www.epa.gov/</a> )

### Conclusion:-

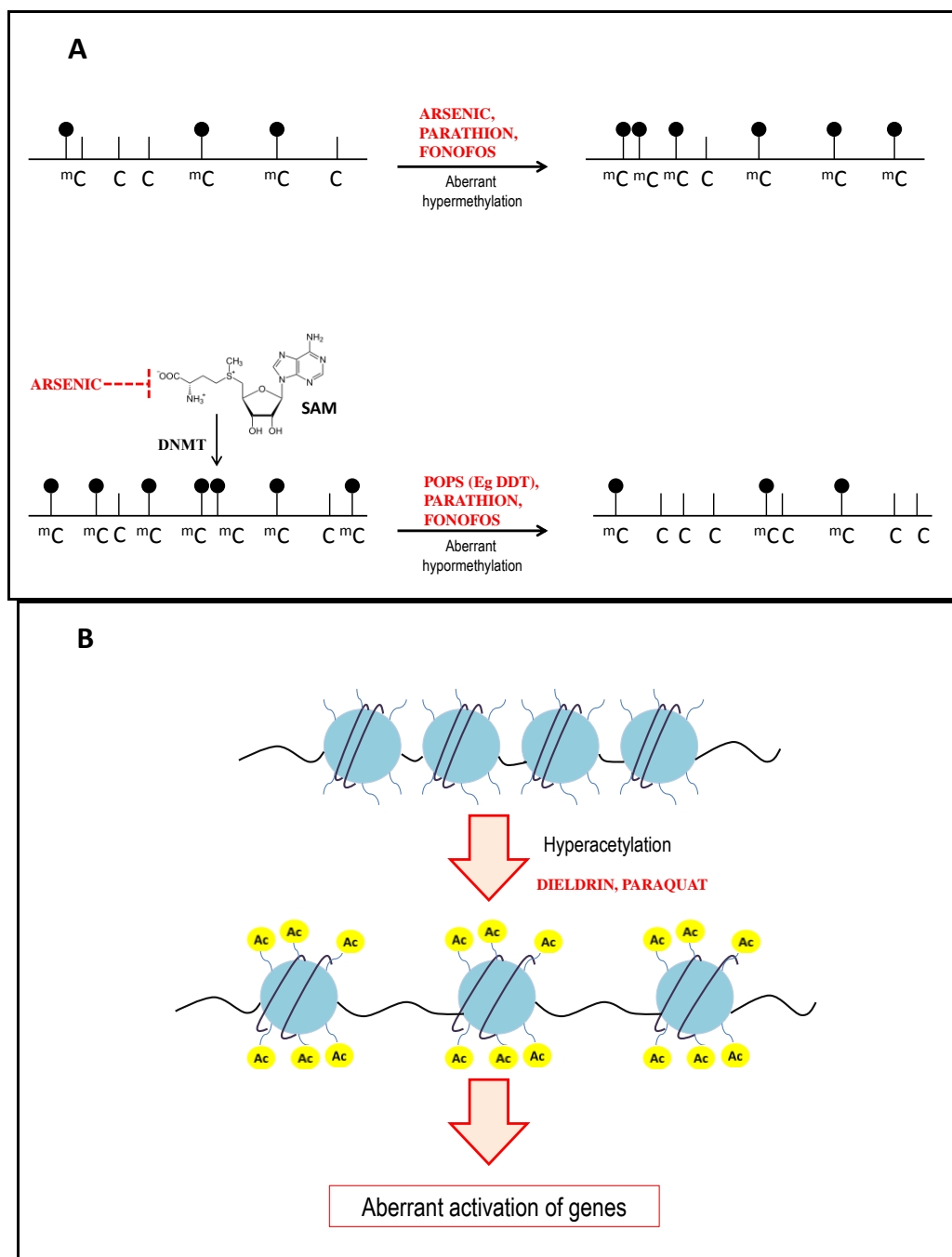
To minimize the risk of cancer due to pesticide usage, strategically refined regulatory parameters need to be laid down. These parameters should be based on the research aimed to correctly identify the chemicals that are potential carcinogens. This would help in successful reduction of harmful exposure to workers and general public thereby curbing the risk of developing cancer.

Genotoxicity testing includes identification of genetic alterations such as mutation in genes involved in tumorigenesis or the chromosomal aberrations in number or structure. But such tests are not complete for identification of non-genotoxic carcinogens (Thomson, Moggs, Wolf and Meehan, 2013). For now it is well known that not only our genome, but our epigenome also regulates the cellular functions. Early appearance and higher plasticity of epigenetic changes as compared to genetic changes (Box III) make them attractive subject to determine the disease endpoints for different pesticides.

To assess this scenario of increasing cases of cancer in pesticide exposed population we need to look beyond just the genotoxic effects of pesticides. Heritability of epigenetic changes makes them crucial biomarkers for studying the long term and short term effect of the pesticide exposure on the gene expression. Thus integrating epigenetic and transcriptomic studies can give insight into effects at early stages of exposure and predict the long term effect of the chronic exposure of the pesticides more accurately (Thomson et al., 2013).

Eventually pesticide exposure specific signature databases can be generated based on epigenomic and transcriptomic research data. The pinnacle authorities for pesticide approval like EPA, CIRBC etc can bring about suitable amendments in their guidelines for approval and registration. But prior to this sufficient scientific research is required to understand the role of epigenetic endpoints in the toxicity. Though epigenetic safety is a developing field of research but it holds the promise to deeper understanding of xenobiotic exposures and their role in disease progression in the long term and understanding the environment associated pathology of different diseases.





**Fig I:-** Role of pesticides in aberrant activation of genes via DNA methylation and histone acetylation.

Pesticides are reported to alter the DNA methylation (A) and histone acetylation (B) status of the cells. Both these mechanisms contribute to abnormal activation of certain genes and genomic instability, making the cells vulnerable to become neoplastic.

1. Ajees, A. A., & Rosen, B. P. (2015). As(III) S-adenosylmethionine methyltransferases and other arsenic binding proteins. *Geomicrobiol J.*, 32, 570–576.
2. Alavanja, M. C. R., Ross, M. K., & Bonner, M. R. (2013). Increased Cancer Burden Among Pesticide Applicators and Others Due to Pesticide Exposure. *CA: A Cancer Journal for Clinicians*, 63, 120–142.
3. Alegria-Torres, J. A., Carrizales-Y, L., Rosso-Camacho, F., Motta, V., Tarantini, L., & Bollati, V. (2016). DNA Methylation Changes in Mexican Children Exposed to Arsenic From Two Historic Mining Areas in San Luis Potosi. *Environmental and Molecular Mutagenesis*.
4. Ashwood-Smith, M. J., Trevino, J., & Ring, R. (1972). Mutagenicity of Dichlorvos. *Nature*, 240, 418–420.
5. Baccarelli, A., & Bollati, V. (2009). Epigenetics and environmental chemicals. *Curr Opin Pediatr.*, 21(2), 243–

- 251.
6. Bonasio, R., Tu, S., & Reinberg, D. (2010). Molecular Signals of Epigenetic States. *Science*, 330, 612–616.
7. Bonner, M. R., Williams, B. A., Rusiecki, J. A., Blair, A., Beane, L. E., Hoppin, J. A., Dosemeci, M., Lubin, J., Sandler, D. P., Alavanja, M. C. R. (2010). Occupational Exposure to Terbufos and the Incidence of Cancer in the Agricultural Health Study. *Cancer Causes Control*, 21(6), 871–877.
8. Brock, M. V., Hooker, C. M., Ota-Machida, E., Han, Y., Guo, M., Ames, S., Glöckner, S., Piantadosi, S., Gabrielson, E., Pridham, G., Pelosky, K., Belinsky, S.A., Yang, S.C., Baylin, S.B., Herman, J. G. (2008). DNA methylation markers and early recurrence in stage I lung cancer. *The New England Journal of Medicine*, 358,1118-1128.
9. Brothers, J. F., Hijazi, K., Mascaux, C., El-zein, R. A., Spitz, M. R., & Spira, A. (2013). Bridging the clinical gaps : genetic , epigenetic and transcriptomic biomarkers for the early detection of lung cancer in the post-National Lung Screening Trial era. *BMC Medicine*, 11(1), 1.
10. Bull, S., Fletcher, K., Boobis, A. R., & Battershill, J. M. (2006). Evidence for genotoxicity of pesticides in pesticide applicators : a review. *Mutagenesis*, 21(2), 93–103.
11. Carere, A., Ortali, V. A., Cardamone, G., & Morpurgo, G. (1978). Mutagenicity Of Dichlorvos And Other Structurally Related Pesticides In Salmonella And Streptomyces\*. *Chem.-Biol. Interactions*, 22, 297–308.
12. Chanda, S., Dasgupta, U. B., Guhamazumder, D., Gupta, M., Chaudhuri, U., Lahiri, S., Das, S., Ghosh, N., Chatterjee, D. (2006). DNA Hypermethylation of Promoter of Gene p53 and p16 in Arsenic-Exposed People with and without Malignancy. *Toxicological Science*, 89(2), 431–437.
13. Dalvie, M. A., White, N., Raine, R., Myers, J. E., London, L., Thompson, M., & Christiani, D. C. (1999). Long term respiratory health effects of the herbicide , paraquat , among workers in the Western Cape. *Occup Environ Med*, 56, 391–396.
14. Feinberg, A. P., & Tycko, B. (2004). The history of cancer epigenetics. *Nature Reviews Cancer*, 4, 143–153.
15. Goldberg, A. D., Allis, C. D., & Bernstein, E. (2007). Essay Epigenetics : A Landscape Takes Shape, *Cell*, 128, 635–638.
16. Gonzalgo, M. L., Pavlovich, C. P., Lee, S. M., Nelson, W. G., James, T., & Brady, B. (2003). Prostate Cancer Detection by GSTP1 Methylation Analysis of Postbiopsy Urine Specimens. *Clinical Cancer Research* 2673, 9, 2673–2677.
17. Ho, S. -M., Johnson, A., Tarapore, P., Janakiram, V., Zhang, X., Leung, Y. -K., (2012). Environmental Epigenetics and Its Implication on Disease Risk and Health Outcomes. *ILAR J.*, 53, 289–305.
18. Hou, L., Zhang, X., Wang, D., & Baccarelli, A. (2012). Environmental chemical exposures and human epigenetics. *International Journal of Epidemiology*, 41, 79–105.
19. Jirtle, R. L., & Skinner, M. K. (2007). Environmental epigenomics and disease susceptibility. *Nature Reviews Genetics*, 8, 253–262.
20. Kim, K., Kim, D., Lee, S., Lee, I., Kang, J., & Chang, Y. (2010). Association of Low-Dose Exposure to Persistent Organic Pollutants with Global DNA Hypomethylation in Healthy Koreans, 370(3), 370–374.
21. Li, J., Jin, H., & Wang, X. (2014). Epigenetic Biomarkers : Potential Applications in Gastrointestinal Cancers. *Hindawi* 1-10.
22. Marsit, C. J., Eddy, K., & Kelsey, K. T. (2006). MicroRNA Responses to Cellular Stress MicroRNA Responses to Cellular Stress, *Cancer Research*, 66, 843–848.
23. Maslansky, C. J., & Williams, G. M. (1981). Evidence for an epigenetic mode of action in organochlorine pesticide hepatocarcinogenicity : A lack of genotoxicity in rat , mouse , and hamster hepatocytes. *Journal of Toxicology and Environmental Health : Current Issues*, 8, 121–130.
24. Mostafalou, S., & Abdollahi, M. (2013). Pesticides and human chronic diseases: Evidences, mechanisms, and perspectives. *Toxicology and Applied Pharmacology*, 268, 157–177.
25. Nilsson, E. E., Anway, M. D., Stanfield, J., & Skinner, M. K. (2008). Transgenerational epigenetic effects of the endocrine disruptor vinclozolin on pregnancies and female adult onset disease. *Reproduction*, 135, 713–721.
26. Pérez-Maldonado, I. N., Herrera, C., Batres, L. E., Gonza, R., Di, F., & Ya, L. (2005). DDT-induced oxidative damage in human blood mononuclear cells. *Environmental Research*, 98, 177–184.
27. Rakitsky, V. N., Koblyakov, V. A., & Turusov, V. S. (2000). Nongenotoxic ( Epigenetic ) Carcinogens : Pesticides as an Example . A Critical Review. *Teratogenesis, Carcinogenesis, and Mutagenesis*, 20, 229–240.
28. Rastogi, S. K., Tripathi, S., & Ravishanker, D. (2010). A study of neurologic symptoms on exposure to organophosphate pesticides in the children of agricultural workers. *Indian Journal of Occupational and Environmental Medicine*, 14(2).
29. Reichard, J. F., & Puga, A. (2010). Effects of arsenic exposure on DNA methylation and epigenetic gene Regulation. *Epigenomics*, 2(1), 87–104.
30. Ricketts, C. J., Hill, V. K., & Linehan, W. M. (2014). Tumor-Specific Hypermethylation of Epigenetic

- Biomarkers , Including SFRP1 , Predicts for Poorer Survival in Patients from the TCGA Kidney Renal Clear Cell Carcinoma ( KIRC ) Project. *PLOS One*, 9(1), 1-13.
31. Ross, J. a, Blackman, C. F., Thai, S.-F., Li, Z., Kohan, M., Jones, C. P., & Chen, T. (2010). A potential microRNA signature for tumorigenic conazoles in mouse liver. *Molecular Carcinogenesis*, 49(4), 320–323.
  32. Rusiecki, J. A., Baccarelli, A., Bollati, V., Tarantini, L., Moore, L. E., & Bonefeld-jorgensen, E. C. (2008). Global DNA Hypomethylation Is Associated with High Serum-Persistent Organic Pollutants in Greenlandic Inuit. *Environmental Health Perspectives*, 116(11), 1547–1552.
  33. Rusiecki, J. A., Freeman, L. E. B., Bonner, M. R., Alexander, M., Chen, L., Andreotti, G., Barry, K. H., Moore, L. E., Byun, H., Kamel, F., Alavanja, M., Hoppin, J. A., Baccarelli, A. (2016). High Pesticide Exposure Events and DNA Methylation among Pesticide Applicators in the Agricultural Health Study. *Environmental and Molecular Mutagenesis*, 1-11.
  34. Sasaki, H., & Matsui, Y. (2008). Epigenetic events in mammalian germ-cell development : reprogramming and beyond. *Nature Reviews Genetics*, 9, 129–140.
  35. Shahrzad, S., Bertrand, K., Minhas, K., & Coomber, B. L. (2007). Induction of DNA hypomethylation by tumor hypoxia. *Epigenetics : Official Journal of the DNA Methylation Society*, 2(2), 119–25.
  36. Sharma, S., Kelly, T. K., & Jones, P. A. (2010). Epigenetics in cancer. *Carcinogenesis*, 31(1), 27–36.
  37. Shutoh, Y., Takeda, M., Ohtsuka, R., Haishima, A., Yamaguchi, S., Fujie, H., Komatsu, Y., Maita, K., Harada, T. (2009). Low dose effects of dichlorodiphenyltrichloroethane (DDT) on gene transcription and DNA methylation in the hypothalamus of young male rats: implication of hormesis-like effects. *The Journal of Toxicological Sciences*, 34(5), 469–482.
  38. Song, C., Kanthasamy, A., Anantharam, V., Sun, F., & Kanthasamy, A. G. (2010). Environmental Neurotoxic Pesticide Increases Histone Acetylation to Promote Apoptosis in Dopaminergic Neuronal Cells : Relevance to Epigenetic Mechanisms of Neurodegeneration, *Molecular Pharmacology* 77(4), 621–632.
  39. Song, C., Kanthasamy, A., Jin, H., Anantharam, V., & Kanthasamy, A. G. (2011). NeuroToxicology Paraquat induces epigenetic changes by promoting histone acetylation in cell culture models of dopaminergic degeneration. *Neurotoxicology*, 32(5), 586–595.
  40. Stevenson, D. E., Walborg, E. F., North, D. W., Sielken, R. L., Ross, C. E., Wright, A. S., Xu, Y., Kamendulis, L. M., Klaunig, J. E. (1999). Monograph : Reassessment of human cancer risk of aldrin / dieldrin. *Toxicology Letters*, 109, 123–186.
  41. Thienpont, B., Steinbacher, J., Zhao, H., Anna, F. D., Kuchnio, A., Ploumaki, A., Ghesquière, B., Dyck, L. V., Boeckx, B., Schoonjans, L., Hermans, E., Amant, F., Kristensen, V. N., Koh, K. P., Mazzone, M., Coleman, M. L., Carell, T., Carmeliet, P. (2016). Tumour hypoxia causes DNA hyper - methylation by reducing TET activity. *Nature Publishing Group*, 537(7618), 63–68.
  42. Thomson, J. P., Moggs, J. G., Wolf, C. R., & Meehan, R. R. (2013). Epigenetic profiles as defined signatures of xenobiotic exposure. *Mutation Research - Genetic Toxicology and Environmental Mutagenesis*, 764–765, 3–9.
  43. Tsai, H., & Baylin, S. B. (2011). Cancer epigenetics : linking basic biology to clinical medicine. *Cell Research*, 21(3), 502–517.
  44. Velázquez, A., Xamena, N., & Creus, A. (2009). Mutagenic evaluation of the organophosphorus insecticides methyl parathion and triazophos in drosophila melanogaster. *Journal of Toxicology and Environmental Health*, 37–41.
  45. Wang, X., Zhou, S., Ding, X., Zhu, G., & Guo, J. (2010). Effect of triazophos, fipronil and their mixture on miRNA expression in adult zebrafish. *Journal of Environmental Science and Health. Part. B, Pesticides, Food Contaminants, and Agricultural Wastes*, 45(7), 648–57.
  46. Zhang, X., Wallace, A. D., Du, P., Kibbe, W. A., Jafari, N., Lin, S., Baccarelli, A., Soares, M. B., Hou, L. (2012). DNA Methylation alterations in response to pesticide exposure in vitro. *Environ Toxicol Pharmacol*; 34(3): 959–968.
  47. Zhang, Y.-J., Wu, H.-C., Shen, J., Ahsan, H., Tsai, W. Y., Yang, H.-I., Wang, L.-Y., Chen, S.-Y., Chen, -J. C., Santella, R. M. (2007). Predicting hepatocellular carcinoma by detection of aberrant promoter methylation in serum DNA. *Clinical Cancer Research : An Official Journal of the American Association for Cancer Research*, 13(8), 2378–84.



### RESEARCH ARTICLE

#### PREVALENCE OF CHRONIC RHINO SINUSITIS AND IT'S RECURRENT AFTER TREATMENT COMPARE TO ITS RECURRENT AFTER SURGERY AT SAUDI ARABIA , 2016.

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#### Abstract

**Objectives:** To assess the prevalence of Chronic Rhinosinusitis in Saudi Arabia, identify the most affected age group and Gender, assess the most common risk factors for Rhinosinusitis and determine recurrent of Rhinosinsitis after treatment and after surgery and to compare them.

**Methods:** A cross-sectional study which was conducted electronically through a random sampling includes 434 person from Saudi Arabia during 2016. The used questionnaire includes 20 questions and was formulated to include demographic aspects, clinical features, risk, medical and surgical history. The questionnaire items were designed and written to suit the tradition and the Islamic culture.

**Results:** about half had infected with chronic sinusitis. 61.6% were females. 55.6% were between (21- 30) years old. 31.9% of infected respondents still having the inflammation without complications for more than three months. 97.6% of infected respondents are treated using medical drugs. 96.9% of the infected ones have the inflammation many times after having drugs as a way of treatment, while 3.1% of them have the inflammation many times after having surgical treatment but it is very important to clarify that the first case's percentage is much higher than the second; because most of the infected people use the medical drugs as a way of treatment not the surgical treatment. The most of our infected respondents weren't smokers. 61.6% of infected respondents suffer from sensitivity. 82.9% of infected respondents hadn't nasal polyps.

**Conclusion:** High prevalence of Chronic Rhinosinusitis in Saudi Arabia. The prevalence of chronic rhinosinusitis among females was higher than that among males, the most affected age group were between (21- 30) years old. Generally The presence of risk factors which may cause Chronic Rhinosinusitis was moderate

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#### Abbreviations Table.

Abbreviation	Description
CRS	Chronic rhinosinusitis
FESS	functional endoscopic sinus surgery

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NHIS	National Health Interview Survey
CRSwNP	CRS with nasal polyps
CRSSNP	CRS without nasal polyps

### Introduction:-

Chronic rhinosinusitis (CRS) is one of the most common chronic diseases which is defined as inflammation of the nose and paranasal sinuses that persists for 12 weeks or longer with two or more of the following symptoms: nasal congestion or blockade, anterior or posterior nasal discharge, facial pain or pressure, reduction or loss of smell, and complementary endoscopic signs and CT changes. Disturbing the quality of life of the affected people and causing a high financial burden on society. The ostiomeatal complex plays a fundamental role in the pathogenesis of rhinosinusitis (Fokkens, 2012).<sup>(1-2)</sup> In Saudi Arabia, chronic rhinosinusitis is prevalent in the eastern province and affects people from all age groups. In the past few years, there has been an increase in the chronic rhinosinusitis incidences in Saudi Arabia (El-Banna&Jiman-Fatani, (2013)).<sup>(3)</sup>

Chronic rhinosinusitis has several subtypes, such as where it can exist with or without nasal polyps. There is also fungal sinusitis, dental sinusitis, pediatric CRS, biofilms as well as MRSA among others. There is a large incidence of allergies in people suffering from chronic rhinosinusitis, particularly those for dust mites, molds, cockroaches and animal dander. Poorly controlled allergies can cause the deterioration of chronic rhinosinusitis symptoms. According to Dutre, Al Dousary, Zhang and Bachert (2013).<sup>(4)</sup> Exposure to airborne irritants such as formaldehyde or tobacco smoke increases the risk of chronic rhinosinusitis. People with particular problems in their immune systems have increased risk of getting chronic rhinosinusitis. One of the most common problems with regard to chronic sinusitis is hypogammaglobinemia or antibody deficiency.

People with subtle issues with their immune defenses mainly affecting the lungs, noses and sinuses also face a greater risk of acquiring chronic rhinosinusitis. Repeated infections by viruses increase the risk of getting chronic rhinosinusitis like common cold. However, it is unclear whether or not the infections are responsible for the rhinosinusitis. A deviated septum also increases the risk of getting chronic sinusitis (Hamid, Joseph & Al-Qahtani, 2015).<sup>(5)</sup> A deviated septum may be present since birth or develop in later years of life because of a nasal injury. A deviated septum results in nasal blockage causing the blockage of one or both nostrils. People with chronic rhinosinusitis usually need lifelong treatment to keep the symptoms in check. Several treatment options are available for people with chronic rhinosinusitis. Yet there are many challenges to the management of CRS especially in the case of the more severe and refractory forms of the disease. As a consequence a wide range of medical and surgical therapies have been used to treat CRS.<sup>(6-7)</sup> researches evaluating the comparative efficiency of various treatments for chronic rhinosinusitis (CRS) is scanty.

This study aimed to assess the prevalence of Chronic Rhinosinusitis in Saudi Arabia, identify the most affected age group and Gender, and assess the most common risk factors for Rhinosinusitis. Determine Recurrent of Rhinosinusitis After Treatment and After Surgery and to Compare them.

### Objectives:-

1. To assess Prevalence of Chronic Rhinosinusitis in Saudi Arabia.
2. To identify the most affected age group and Gender.
3. Determine Recurrent of Rhinosinusitis After Treatment and After Surgery and to Compare them
4. To assess the most common risk factors.

### Methodology:-

This is a cross-sectional study which was conducted through a random sampling. The population was people lives in Saudi Arabia during 2016. All recruited subjects of this study were from Saudi Arabia. Subjects who are not were excluded from the study analysis.

A pre-designed structured English and Arabic languages questionnaire was used in this cross-sectional survey. The used questionnaire includes 20 questions and was formulated to include demographic aspects, clinical features, risk, medical and surgical history. The questionnaire items were designed and written to suit the tradition and the Islamic culture. The questionnaires were electronically on a large scale to get the effective sampling. The questionnaires with missing data more than 50% were excluded from the study analysis. The final study sample size 434 person.

Approval was taken from the ethics committee at faculty of medicine, Taibah University. Ethical consideration was considered to avoid physical or emotional harm in the study questionnaire. The confidentiality and privacy of the collected data were ensured through the use of anonymous questionnaire and during data entry and analysis. People were provided with information on the study aims and methods.

### Population & Sample of the Study:-

The study population includes all residents in the Kingdom of Saudi Arabia till the research year (2016), a random sample of (438) participants was selected, they answered the questionnaire electronically, (216) persons of them were infected with chronic sinusitis, they are nearly half of the selected sample, while (222) aren't infected with sinusitis, table (1) shows the participants properties according to their personal information:

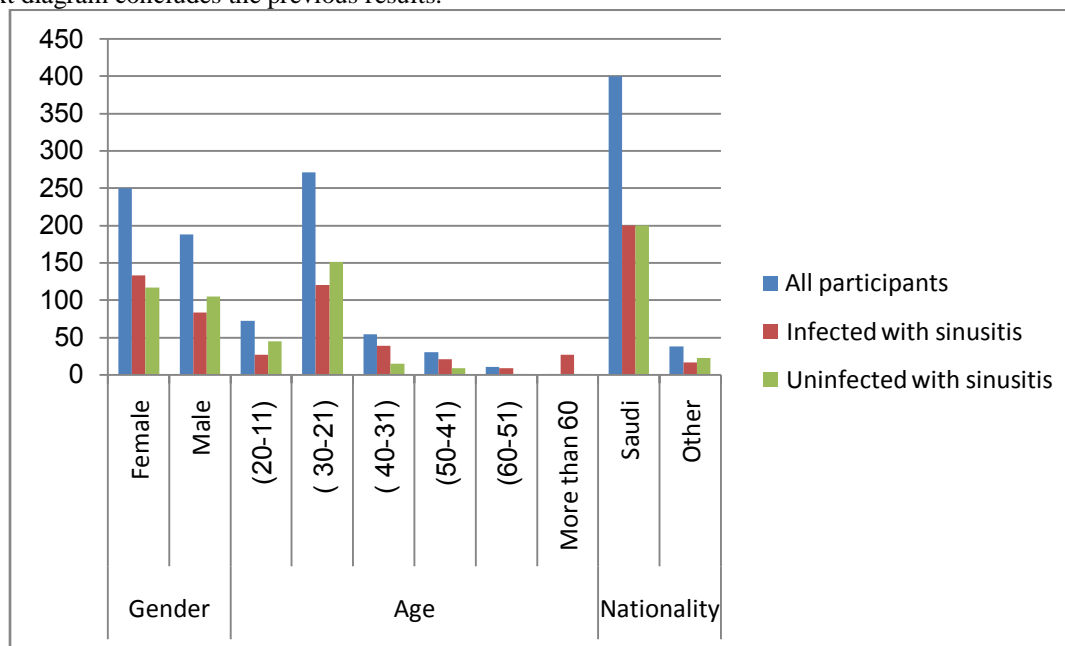
**Table 1:-** The participant's personal data.

		All participants		Infected with sinusitis		Uninfected with sinusitis	
		#	%	#	%	#	%
Gender	Female	250	57.1	133	61.6	117	52.7
	Male	188	42.9	83	38.4	105	47.3
Age	(11-20)	72	16.4	27	12.5	45	20.3
	(21-30 )	271	61.9	120	55.6	151	68.0
	(31-40 )	54	12.3	39	18.1	15	6.8
	(41-50)	30	6.8	21	9.7	9	4.1
	(51-60)	10	2.3	9	4.2	1	.5
	More than 60	1	.2	27	12.5	1	.5
Nationality	Saudi	400	91.3	200	92.6	200	90.1
	Other	38	8.7	16	7.4	22	9.9
Total		438	100.0	216	100.0	222	100.0

From the previous table we notice that 61.6% of the infected people were females, while 38.4% of the infected ones were males.

We also can notice that 55.6% of the ages of those who suffer chronic sinusitis were between (21- 30) years old, while 18.1% of them were between (31- 40) years old, 12.5% of them were between (11- 20) years old, 9.7% of them were between (42- 50) years old, and 4.2% of them were between (51- 60) years old.

The next diagram concludes the previous results.



**Figure 1:-** The participants personal data.

The infected persons' answers descriptive show:-

Through the image Is it possible to determine the exact site of inflammation:-



	Frequency	Percent	Valid Percent
A	55	25.5	26.6
B	84	38.9	40.6
C	68	31.5	32.9
Missing	9	4.2	
Total	216	100.0	

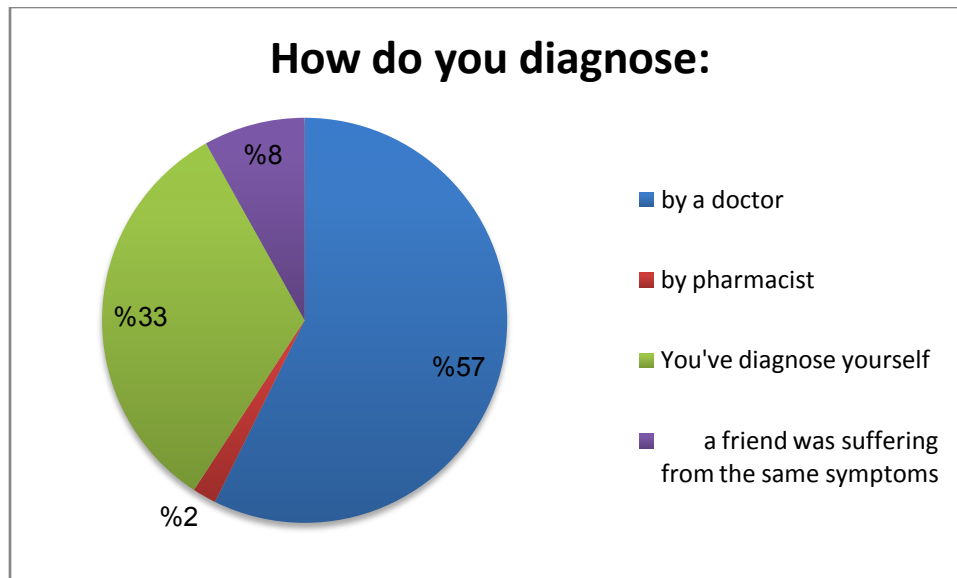
It is clear from the previous table that 40.6% of them suffer from Ethmoid Sinuses (location B), while 32.9% of them suffer from maxillary sinuses (location C), and 26.6% of them suffer from front nasal sinuses (location A).

And according to the side of disease, 87.1% answered that it is in both their face sides, while 6.7% of them told that it is in their left side of their faces, and 6.2% of them suffer from the right side of their faces.



#### How do you diagnose?

And according to the way they have their disease diagnosis, 57% of the infected ones were diagnosed by the doctor, while 33% of them diagnosed themselves, 8% of them were diagnosed by a friend who is suffering from the same symptoms, and 2% of them were diagnosed by a pharmacist.



#### What is the period of inflammation with or without acute exacerbations?

	Frequency	Percent	Valid Percent
Less than 3 months	143	66.2	68.1
More than 3 months	67	31.0	31.9
Missing	6	2.8	
Total	216	100.0	

It is clear from the previous table that 68.1% of the infected ones still have the inflammation for less than three months without having any complications, and 31.9% of them still having the inflammation without complications for more than three months.

#### How many times have you suffered from sinusitis on one year?

	Frequency	Percent	Valid Percent
less than 4 times in year	107	49.5	51.0
more than 4 times in year	103	47.7	49.0
Missing	6	2.8	
Total	216	100.0	

It is clear from the previous table that 51% of the sinusitis infected ones suffer the inflammation less than four times a year, while 49.1% of them suffer from the inflammation for more than four times a year.

#### What is the method of treatment?

	Frequency	Percent	Valid Percent
medication	200	92.6	97.6
surgical treatment	5	2.3	2.4
Missing	11	5.1	
Total	216	100.0	

It is clear from the previous table that 97.6% of the infected ones are treated using medical drugs, while only 2.4% are treated through surgical operations.

#### Have you had any sinus or nasal surgery after sinusitis:

	Frequency	Percent	Valid Percent
No	199	92.1	93.9
Yes	13	6.0	6.1
Missing	4	1.9	
Total	216	100.0	



The previous table shows that 93.9% of the sinusitis infected ones had no surgical operations for sinusitis or for their noses after the infection, while 6.1% of them had surgical operations after the infection.

#### Sinusitis return after which treatment:-

	Frequency	Percent	Valid Percent
medication	190	88.0	96.9
surgical treatment	6	2.8	3.1
Missing	20	9.3	
Total	216	100.0	

It is noticed from the previous table that 96.9% of the infected ones have the inflammation many times after having drugs as a way of treatment, while 3.1% of them have the inflammation many times after having surgical treatment but it is very important to clarify that the first case's percentage is much higher than the second; because most of the infected people use the medical drugs as a way of treatment not the surgical treatment, the researcher think that result to that the sinusitis is a chronic disease and it is not easy to be completely cared.

#### How many times sinusitis return after treatment?

	Frequency	Percent	Valid Percent
Once	48	22.2	24.5
Twice	35	16.2	17.9
three times	24	11.1	12.2
more	89	41.2	45.4
Missing	20	9.3	
Total	216	100.0	

From the previous table we can conclude to that 45.4% of the infected ones have the inflammation for more than three times after having the surgical treatment, while 24.5% have the inflammation just once after the surgical treatment, 17.9% have the inflammation twice after the surgery, and 12.2% of them have the inflammation repeated three times after the surgical treatment.

The question	Yes		No		Missing	
	#	%	#	%	#	%
Have you ever smoked?	43	19.9	169	78.2	4	1.9
Do you suffer sensitivity?	133	61.6	79	36.6	4	1.9
Have you ever been tested for allergies?	49	22.7	157	72.7	10	4.6
Have you ever been on antihistamines?	113	52.3	95	44.0	8	3.7
In the past year do you use nasal steroid sprays or oral steroids?	146	67.6	61	28.2	9	4.2
In the past year do you suffer from nasal polyps?	30	13.9	179	82.9	7	3.2

#### From the previous table we can conclude to that:-

- Most of the infected ones are nonsmokers, as their percentage was 78.2% of the participants.
- 61.6% of the sinusitis infected ones suffer from sensitivity, 36.6% of them don't suffer it.
- 72.7% of sinusitis infected ones have never been tested for allergies, while 22.7% had.
- 52.3% of sinusitis infected ones have used treatment for general sensitivity, while 44% of them haven't.
- 28.2% of sinusitis infected ones didn't use nasal steroid sprays or oral steroids, while 67.6% of them did.
- 82.9% of sinusitis infected ones didn't suffer from nasal polyps, while 13.9% suffered from it.

#### The most important symptoms of sinuses inflammations and it's degrees can be seen in the next table:-

Symptoms	Absent		Mild		Moderate		Severe	
	#	%	#	%	#	%	#	%
Sneezing	43	19.9	76	35.2	40	18.5	37	17.1
Cough	38	17.6	70	32.4	42	19.4	40	18.5
Nasal congestion	50	23.1	68	31.5	50	23.1	23	10.6

Runny Nose	44	20.4	66	30.6	49	22.7	31	14.4
Nasal Obstruction	95	44.0	46	21.3	25	11.6	7	3.2
Loss of Smell or Taste	78	36.1	58	26.9	30	13.9	13	6.0
Thick Nasal Discharge	59	27.3	63	29.2	45	20.8	15	6.9
Post-Nasal Discharge	71	32.9	56	25.9	32	14.8	18	8.3
Ear Fullness or pain	56	25.9	60	27.8	40	18.5	31	14.4
Facial Pain/Pressure	63	29.2	69	31.9	27	12.5	28	13.0
Difficulty Falling Asleep or Wake Up At Night	42	19.4	67	31.0	47	21.8	32	14.8
Fatigue	84	38.9	57	26.4	26	12.0	16	7.4

**From the previous table we can conclude to:-**

- 17.1% of sinusitis infected ones suffer from severe Sneezing, while 35.2% of them suffer mildly from Sneezing.
- 18.5% of sinusitis infected ones suffer from severe Cough, while 32.4% of them suffer mildly from it.
- 10.6% of sinusitis infected ones suffer from severely Nasal congestion, while 31.5% of them suffer mildly from it.
- 14.4% of sinusitis infected ones suffer from severely Runny Nose, while 30.6% of them suffer mildly from it.
- 3.2% of sinusitis infected ones suffer from severely Nasal Obstruction, while 44% of them never suffer from it.
- 6% of sinusitis infected ones suffer from severely Loss of Smell or Taste, while 36.1% of them never suffer from it.
- 6.9% of sinusitis infected ones suffer from severely Post-Nasal Discharge, while 29.2% of them suffer mildly from it.
- 8.3% of sinusitis infected ones suffer from severely Post-Nasal Discharge, while 32.9% of them never suffer from it.
- 14.4% of sinusitis infected ones suffer from severely Ear Fullness or pain, while 27.8% of them suffer mildly from it.
- 13% of sinusitis infected ones suffer from severely Facial Pain/Pressure, while 31.9% of them suffer mildly from it.
- 14.8% of sinusitis infected ones suffer from severely Difficulty Falling Asleep or Wake Up At Night, while 31% of them suffer mildly from it.
- 7.4% of sinusitis infected ones suffer from severely Fatigue, while 38.9% of them never suffer from that.

**Discussion:-**

Chronic rhinosinusitis (CRS), one of the most common chronic diseases, CRS is associated with a substantially impaired quality of life.<sup>(8)</sup> reduced workplace productivity and serious medical treatment costs.<sup>(9,10)</sup>

Identified several risk factors for CRS, including influenza vaccination, septal deviation and allergic rhinitis. Moreover, there were significantly increased prevalence of chronic rhinosinusitis in plant and machinery operators and assemblers, craft and related trade workers and the unemployed.<sup>(11)</sup>

Therefore this study aimed to assess the prevalence of Chronic Rhinosinusitis in Saudi Arabia, identify the most affected age group and Gender, and assess the most common risk factors for Rhinosinusitis.

In the present study about half of the respondents had infected with chronic sinusitis. This considered a very high prevalence. This rate is higher than in many previous studies in different countries, it was 12% in the USA.<sup>(12)</sup> 10.9% in Europe.<sup>(13)</sup> this difference in results may be because CRS is difficult to study as the disease is difficult to define and diagnose. Without neglect the role of weather at this difference, there is some evidence that CRS is more prevalent in the warm than in the colder places.<sup>(14)</sup>

Regarding to demographic data the majority of infected respondents 61.6% were females. confirming earlier data from the US National Health Interview Survey (NHIS),<sup>(13)</sup> and Canada.<sup>(14)</sup> but this finding unlike results of study in china which reported that The prevalence chronic rhinosinusitis among males was higher than that among females in the general population.<sup>(15)</sup> More than half 55.6% of infected respondents were between (21- 30) years old. this finding conform with Kim et al. whose found that A relatively higher prevalence was seen in those aged 15–34.<sup>(16)</sup>

This could be due to this age group are the most vulnerable to risk factors of chronic rhinosinusitis.

The majority of our respondents suffer from Sinuses Safavid, regarding side of disease the most had it in both their face sides. But just about half of the respondents diagnosed their infection by the doctor, this may be one of the reasons of the behind the answer of large number of participants that they were infected with the disease, because not all of them diagnosed their infection by the doctor.

Chronic rhinosinusitis (CRS) is one of the most common chronic diseases which is defined as inflammation of the nose and paranasal sinuses that persists for 12 weeks or longer with two or more of the following symptoms: nasal congestion or blockade, anterior or posterior nasal discharge, facial pain or pressure, reduction or loss of smell, and complementary endoscopic signs and CT changes.<sup>(1-2)</sup> But in our study just 31.9% of infected respondents still having the inflammation without complications for more than three months.

97.6% of infected respondents are treated using medical drugs, while 6.1% of them had surgical operations after the infection. Due to recurrent symptoms, many patients presenting with CRS require repeated medical treatment and even surgical interventions. So in our study 96.9% of the infected respondents have the inflammation many times after having drugs as a way of treatment, and 3.1% of them have the inflammation many times after having surgical treatment.

Previous studies found that smoking and allergies are potent risk factors for CRS.<sup>(14)</sup> Lieu and Feinstein found a significant association between current smoking and rhinosinusitis in women but not men.<sup>(10)</sup> Lotvall J, et al. found revealed a 20 % increased risk of rhinosinusitis in current smokers.<sup>(17)</sup> The most of our infected respondents weren't smokers, but this does not negate the possibility of exposure to secondhand smoke.

In Shi et al., cross-sectional investigation, they reported that having asthma or a nasal allergy significantly increased the risk of CRS.<sup>(15)</sup> which was consistent with some studies discovering positive associations between sinus disease or CRS and asthma.<sup>(18,19)</sup> This conform our finding 61.6% of infected respondents suffer from sensitivity.

CRS is classified into two types based on the presence or absence of nasal polyps: CRS with nasal polyps (CRS<sub>NP</sub>) and CRS without nasal polyps (CRS<sub>NP</sub>).<sup>(20,21)</sup> In this study 82.9% of infected respondents hadn't nasal polyps, while 13.9% suffered from it.

The Canadian Clinical Practice Guidelines for Acute and Chronic Rhinosinusitis recommend the presence of at least two major symptoms (nasal congestion, facial pain or pressure, nasal obstruction, anterior or posterior nasal discharge, and loss of sense of smell).<sup>(22)</sup> our study showed that for symptoms among the majority of infected respondents were absent or mild.

#### **Acknowledgment:-**

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#### **Conclusion:-**

the present study showed high prevalence of Chronic Rhinosinusitis in Saudi Arabia. The prevalence of chronic rhinosinusitis among females was higher than that among males, the most affected age group were between (21- 30) years old. Generally The presence of risk factors which may cause Chronic Rhinosinusitis was moderate.

#### **Recommendation:-**

1. Further studies on the same topic to include the largest number of participants These studies include a medical examination in order to confirm the diagnosis of participants.
2. Community awareness of how to avoid infection of Chronic Rhinosinusitis.
3. The government should do practical procedures to decrease infection risk factors like such as smoking prevention in crowded public places.
4. Be sure to follow safety procedures in the professional business that may increase the chances of disease infection.

**References:-**

1. Kern RC, Conley DB, Walsh W, et al. Perspectives on the etiology of chronic rhinosinusitis: an immune barrier hypothesis. *Am J Rhinol.* 2008;22:549–559.
2. Fokkens WJ, Lund VJ, Mullol J, Bachert C, Alobid I, Baroody F, et al. EPOS: European position paper on rhinosinusitis and nasal polyps 2012. A summary for otorhinolaryngologists. *Rhinology* 2012; 50: 1-12.
3. Dutre, T., Al Dousary, S., Zhang, N., & Bachert, C. (2013). Allergic fungal rhinosinusitis—more than a fungal disease? *Journal of Allergy and Clinical Immunology*, 132(2), 487-489.
4. El-Banna, H., & Jiman-Fatani, A. (2013). Bacteriology of chronic maxillary sinusitis in Jeddah, Saudi Arabia. *African Journal of Microbiology Research*, 7(33), 4276-4283.
5. Hamid, M. E., Joseph, M. R. P., & Al-Qahtani, A. S. (2015). Chronic rhinofacial basidiobolomycosis caused by *Basidiobolus ranarum*: Report of a case from Aseer Region, Kingdom of Saudi Arabia. *Journal de Mycologie Médicale/Journal of Medical Mycology*, 25(4), 306-309.
6. Bachert C1, Pawankar R2, Zhang L , et al. ICON: chronic rhinosinusitis. *World Allergy Organ J.* 2014;7;25.
7. Ragab SM1, Lund VJ, Scadding G. Evaluation of the medical and surgical treatment of chronic rhinosinusitis: a prospective, randomised, controlled trial. *Laryngoscope.* 2004;114(5):923-30.
8. Fu, Qing-Ling, et al. "Influence of self-reported chronic rhinosinusitis on health-related quality of life: a population-based survey." *PloS one* 10.5 (2015): e0126881.
9. Hamilos, Daniel L. "Chronic rhinosinusitis: epidemiology and medical management." *Journal of allergy and clinical immunology* 128.4 (2011): 693-707.
10. Gao, Wen-Xiang, et al. "Occupational and environmental risk factors for chronic rhinosinusitis in China: a multicentre cross-sectional study." *Respiratory research* 17.1 (2016): 1.
11. Thilsing, Trine, et al. "Chronic rhinosinusitis and occupational risk factors among 20-to 75-year-old Danes—A GA2LEN-based study." *American journal of industrial medicine* 55.11 (2012): 1037-1043.
12. Kobayashi, Miwako, et al. "Intervals between PCV13 and PPSV23 vaccines: recommendations of the Advisory Committee on Immunization Practices (ACIP)." *MMWR Morb Mortal Wkly Rep* 64.34 (2015): 944-947.
13. Hastan, D. F. W. J., et al. "Chronic rhinosinusitis in Europe—an underestimated disease. A GA2LEN study." *Allergy* 66.9 (2011): 1216-1223.
14. Chen, Yue, Robert Dales, and Mei Lin. "The epidemiology of chronic rhinosinusitis in Canadians." *The Laryngoscope* 113.7 (2003): 1199-1205.
15. Shi, J. B., et al. "Epidemiology of chronic rhinosinusitis: results from a cross-sectional survey in seven Chinese cities." *Allergy* 70.5 (2015): 533-539.
16. Kim, Yoo Suk, et al. "Prevalence and risk factors of chronic rhinosinusitis in Korea." *American journal of rhinology & allergy* 25.3 (2011): e117-e121.
17. Lötvall, Jan, Linda Ekerljung, and Bo Lundbäck. "Multi-symptom asthma is closely related to nasal blockage, rhinorrhea and symptoms of chronic rhinosinusitis-evidence from the West Sweden Asthma Study." *Respiratory research* 11.1 (2010): 1.
18. Dunlop, Gillian, Glenis K. Scadding, and Valerie J. Lund. "The effect of endoscopic sinus surgery on asthma: management of patients with chronic rhinosinusitis, nasal polyposis, and asthma." *American journal of rhinology* 13.4 (1999): 261-265.
19. Bresciani, Megon, et al. "Rhinosinusitis in severe asthma." *Journal of allergy and clinical immunology* 107.1 (2001): 73-80.
20. Rosenfeld, Richard M., et al. "Clinical practice guideline: adult sinusitis." *Otolaryngology-Head and Neck Surgery* 137.3 (2007): S1-S31.
21. Vives, Michael, Lyle Young, and Sanjeev Sabharwal. "Readability of spine-related patient education materials from subspecialty organization and spine practitioner websites." *Spine* 34.25 (2009): 2826-2831.
22. Desrosiers, Martin, et al. "Canadian clinical practice guidelines for acute and chronic rhinosinusitis." *Allergy, Asthma & Clinical Immunology* 7.1 (2011): 1.

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### RESEARCH ARTICLE

## ARE SOVEREIGN BONDS MORE RISKY THAN SOVEREIGN SUKUK? EVIDENCE FROM MALAYSIAN MARKET.

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sovereign sukuks, sovereign bonds, size effect, value effect, TERM factor, Malaysian market.

### Abstract

The main objective of this paper is to compare sovereign Sukuk performance to classic sovereign bonds issued by the Malaysian government. This comparison focuses on the excess returns variations in reaction to factors as defined by Fama and French (1993). Firstly, sukuks are more sensitive to each of the different factors of the model. Secondly, concerning size effect, small issuances outperform big ones; the opposite is available for bonds. Thirdly, a positive value effect relative to the factor HML is evidenced for Sukuk. However, we highlighted similarities regarding the reaction of both instruments to interest rates and market risk variations.

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### Introduction:-

Sukuks are considered as financial innovations representing a model of ethical finance (see Guéranger (2009)). Among the wide range of Islamic financial products we will be interested in sukuks which represent Islamic certificates of investment. The latter have experienced explosive growth. Global sukuk issuances in 2008 were about 24.264 billion\$ and increased almost twelve times to reach 290.6 billion\$ in 2015. This enabled it to grab significant share of the market for fixed income instruments. This broad expansion is dominated mainly by sovereign and semi-sovereign issuances. Indeed, sovereign sukuk and government related entity issuances account for 70% versus 30% of corporate ones of total global issuances.

Miller, Challoner and Atta (2007), pointed out that the sukuk are Shariah<sup>1</sup> compliant instruments that are very similar to conventional bonds. Despite the respected condition on the assets which must have no relation with illicit activities with the respect of Islam law. Sukuk are similar to traditional bonds in the commitment established between the subscriber and the issuer. Furthermore, the authors added that in practice the two financial instruments generate the same income value for their investors. The only difference is that, for sukuk, the investor receives returns on the underlying asset instead of the interest for conventional bonds.

Wilson (2008) also confirms that the sukuk have no remarkable divergences from conventional bonds, especially from a financial point of view. Certainly, investors feel more protected from risk when holding familiar instrument compared to another new one. In addition, for the sukuk rating, Wilson added that ordinary rating agencies use the

<sup>1</sup> Sharia is Islam law.

same assessment methods as for traditional funding instruments<sup>2</sup>. In the same way, when considering G7 countries Kim and In (2007) have reached the same conclusions. This confirms the evidence on the similarity between Islamic and conventional instruments. Moreover, the shape of co-movement between Islamic assets and conventional bonds showed clearly that they behave in the same way even in terms of frequency and time.

Recently, Ahmad, and Radzi (2011) added that this similarity is clearer for "asset based sukuk<sup>3</sup>". This result was confirmed by Naifar and Mseddi (2013). Although, the two instruments generate predictable returns; they differ in terms of sensitivity to economic and market conditions. They used a sample of issuances spread over a period of 20 years to identify the impact of GDP, the exchange rate, market liquidity on sukuk and bonds from the Malaysian market. The results showed that sukuk are sensitive to economic factors like GDP, Forex and international liquidity (reserves minus gold), while conventional bonds are only sensitive to Forex evolution. These results stipulate that the sukuk take into account the economic circumstances. Moreover, these authors noted that this impact is of minor importance compared to the bonds' one. In the same framework, Godlewski, Turk-Ariss, Weill (2010), pointed out that the sukuk are rather "asset-based" than asset-Backed<sup>4</sup> "instruments, with underlying assets whose nature and area of activity are in accordance with Islamic law. The same research has shown that despite the similarity of sukuk with conventional shares, the sukuk are linked to a specific assets, services or projects during a specific time period unlike ordinary stocks representing a property right that concerns the whole company for an indefinite period.

A comparison of the investors' required returns for the two financial instruments with the same ratings and generating the same profits (coupons for conventional bonds) was performed by Ariff and Safari (2012). In other words, the latter used bonds and sukuk with the same duration, same issuer (sovereign, quasi-sovereign, corporate) rated AAA. Using the classical method for bond valuation the authors showed that required interest rates on the sukuk are different from those on conventional bonds. In addition, they recommended using two different methods for their assessments. Elsewhere,

They found that there was no relationship between the performance of Islamic sukuk and conventional bonds.

For the Malaysian market, Ramasamy et al (2011) compared sukuk to government bonds and corporate ones in terms of sensitivity, as measured by convexity and duration. The results show that sukuk are less risky compared to corporate bonds. In terms of profitability, the sukuk are more profitable. These results have allowed the authors to consider the sukuk as the best investment appropriate for risk adverse investors especially as the debt market is generally preferred by this kind of investors.

Moreover, Godlewski et al. (2010), Alam et al (2013), attributed negative market reaction to Sukuk's issuances against a positive one to conventional bonds to the investor's faculty to distinguish between the two financial instruments despite their structural similarity. Usmani (2007) showed that market participants perceive these instruments differently and their reactions to the issuance of these instruments are specific to one another. This research indicates a lack of a market significant reaction to issuance of conventional bonds against the evidence of a negative one to the Sukuk announcement. In other words Sukuk emissions have a negative effect on the market reflected by the negative value of the Sukuk's average cumulative abnormal returns.

Godlewski et al. (2010) explained this significant difference in market reaction between the issuance of sukuk and that of conventional bonds by adverse selection. According to the authors, only borrowers who predict low returns from their projects are motivated by the issuance of Sukuk because issuers must choose between a mandatory coupon payment without taking into account the conventional return and the principle based on sharing profits and losses. So if an entrepreneur predicts a low profit, he prefers financing based on profit and loss sharing to minimize its possible losses. And if he forecasts large profits, it becomes more interesting to be financed by conventional bonds. So Sukuk issuance presents a negative signal for investors about the company, since bad entrepreneur will

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<sup>2</sup> Several Islamic rating agencies were dedicated to awarding Sukuk ratings, such as "the Islamic Development Bank (IDB)" which has gained a lot of experience in this area, these institution still use the same criteria used by other conventional credit rating institutions.

<sup>3</sup>According to Patel (2013) for the asset-based Sukuk, the principal repayment is guaranteed by the issuer through the buy-back commitment and therefore the coupons are protected.

<sup>4</sup> For asset-backed sukuk, the principal is not guaranteed by the issuer and the coupons are therefore unprotected (the investor has no guaranteed income).

choose this instrument which is badly perceived by investors. In the same context, Kuran (2004) advanced the same argument when he explained the reason that makes several Islamic banks no longer funding by financial instruments based on participatory bases (Moucharaka<sup>5</sup>, Moudharaba<sup>6</sup>). Because, in many countries where Islamic banks coexist with conventional ones when dealing with an adverse selection problem they use the following strategy: proposing conventional bond issuance when the anticipated profits of a project exceed a certain threshold, otherwise they offer sukuk issuance. This last choice is justified by the principle of sharing the losses with the subscribers.

Again, when defending the innovative vision of the Sukuk, Vishwanath and Azmi (2009) consider that the innovative principals of the Sukuk implies a higher exposure to certain financial market risks, especially credit and counterparty ones. Indeed, Sukuk issuers are largely found in emerging markets where counterparties have less sophisticated risk management mechanisms. On the other hand, Fathurahaman and Fitriati (2013) were interested in the Indonesian market. They compared Yield to Maturity (YTM) of both instruments for 10 Sukuk groups and bonds randomly built. The results showed that the YTM of the Sukuks were higher than those of the conventional bonds.

On the other hand, Cakir and Raei (2007) showed that Sukuks present a different financial instrument compared to traditional bonds. They tested the issuance advantage of sovereign Sukuk in terms of risk and thus confirmed that they are alternative financial instruments to conventional bonds. Within a value-at-risk (VaR) framework and for portfolios of equal values, they found that the maximum loss decreases when adding Sukuks to portfolio of Eurobonds. This is explained not only by the fact that these instruments offer a diversification advantage for investors but also because of the different price behaviour of the two instruments. Hassan (2012) carried out the same methodology as Cakir and Raei (2007) they noticed a gain in the portfolios following diversification. However, within a Value at Risk (VaR) framework, the first study concluded that the Sukuk's built portfolio is more risky than the bonds' one. This contradicted the results obtained by Cakir and Raei (2007).

Blake, Elton, Gruber (1993) were interested on bonds and more specifically on bond funds. They agree that compared to stock returns, the latter are generally influenced by fewer factors.

Within market risk valuation framework, researches by Fama and French (1992a), Fama and French (1993) shows that market excess return relative to a risk-free asset is one of the explanatory variables influencing returns' variation of the considered asset. Indeed, an increase in this premium leads investors to require additional returns.

In the same vein we propose to verify the validity of the following assumptions:

**H1: The Sukuk returns vary in the same direction as the market risk premium.**

**H2: Bond returns vary in the same direction as the market risk premium.**

In addition, other risk premiums have been used in the financial literature such as size, value, interest rate variations (TERM). The latter is the difference between the return of long-term government bonds and short-term rates. Fama and French used the "mimicking portfolio" (SMB: small minus big) as a size factor proxy. They made a set of allocations of their sample to calculate this variable which expresses the size premium. Indeed, Bernoth, Hagen, Schuknecht (2012) used the issuance size of sovereign bonds for the European bond market. This variable presents an indirect measure of liquidity. They concluded that the larger the bond size, the higher is required return.

So the next hypotheses could be formulated as follows:

**H3: Sukuks returns vary in the same direction with the size factor (SMB).**

**H4: Bonds returns vary in the same direction with the size factor (SMB).**

Another management style indicator used by Fama and French is the HML (High minus Low) which is the difference between the average of companies with a high book to market ratio and that of companies with the low ratio. Fama and French (1992a) found that firms with low market prospects have a high ratio and a high return, hence a low price of the stock. Conversely, firms with strong prospects have a low ratio and a low return. Hence, the positive relationship with the asset's return.

**H5: The return of the Sukuks varies in the same direction as the value factor (HML).**

<sup>5</sup> Moucharaka (contribution): A participatory contract stipulating the modality of each contribution and the repartition of profits and losses between different participants.

<sup>6</sup> Moudharaba: a partnership engaging two partners one provides capital and the other managing skills.

**H6: Returns on bonds vary in the same direction as the value factor (HML).**

Fama and French (1993) argued that one of the common risk factors associated with bonds is relative to unexpected interest rate variation. Indeed the latter is inversely related to conventional bonds performance. According to Syamni and Husaini (2010) coupon rates are fixed but the present value of receivable cash-flows fluctuates negatively to interest rate variation.

As a result, investors and fund managers will constrain to sell long-term bonds at a reduced price in order to generate cash for redemptions.

Similarly, Bhattacharyay (2013) underlined a negative relationship between bond returns and interest rate variations. This is due to the reluctance of investors to invest in long-term bonds when interest rates fluctuate.

**H7: Bond returns are negatively related to the factor (TERM) representing the interest rate variation.**

Concerning the relationship between Sukuk and interest rate changes, Syamni and Husaini (2010), Said and Grassa (2013) have shown that there is no significant relation between Islamic bonds' returns and interest rate variations as Islamic law prohibits interest. The same result was made by Guyot (2008) through a comparison between the Islamic indices and the conventional ones. The author has found that Treasury Bill rate has less significant impact (even null) on the Islamic indices compared to the conventional ones as the Islamic indices are subject to a "specific filter" linked to the prohibition of the 'Riba<sup>7</sup>'.

Although Islamic law prohibits interest in its undertakings, Elkarim (2012), Xian et al (2015) found that Sukuk returns present a significant and negative reaction to interest rate variations. Indeed, they pointed out a negative relationship between sukuk's revenue and the interest rate. The impact of interest rate variation on sukuk can only be indirect. As a consequence, the authors argued that this variable is a common economic indicator that affects affecting all financial instruments included the sukuk. Thus the following hypothesis:

**H8: Sukuk returns are negatively related to the interest rate (TERM) factor.****Data and Methodology:-**

The recent development of the Sukuk market in Malaysia over the last few years has allowed it to become the world preferred destination for attracting local and foreign investors interested in these innovative financial instruments. Consequently, in 2013 Malaysia accounts for 69% of the world's issuances owing to the development of the necessary skills that have made this country a favourable ground for Islamic financial industries and services. The present paper fits in this framework. We propose to deal with sovereign issues since they are perceived as a benchmark in terms of stability for sovereign bonds. The relative returns variation is considered as an indicator of investor confidence in the government's solvency. Moreover we selected the sukuk and bonds of maturity 10 and 11 years. We chose to deal with daily frequencies spread over the period from 04 September 2013 to 30 April 2015 relative to 17 sukuks issuances and 10 bonds ones.

**Table 1:-** Descriptive statistics of returns for the two financial instruments:

Instrument	ISIN	Mean	Min	Max	ST deviation
Sukuk	MYBZN1200011	4.21216204	3.878	4.539	0.13218201
	MYBGO1300330	4.15286574	3.657	4.434	0.13993381
	MYBGO1200373	4.13396296	3.77	4.419	0.1309147
	MYBGO12037A2	4.07005556	3.638	4.419	0.13422361
	MYBGN1100252	4.0651169	3.705	4.365	0.13555967
	MYBGN11025A9	4.00697454	3.613	4.341	0.12268346
	MYBGN1000213	3.97442477	3.675	4.2265	0.12747342
	MYBGO0900015	3.87223611	3.615	4.103	0.10906711
	MYBZO1200373	4.27471065	3.948	4.641	0.12648042
	MYBZK1300221	4.05468519	3.733	4.3005	0.09701938
	MYBGN1000601	4.00023843	3.6865	4.2885	0.12876654
	MYBGO0900619	3.9468588	3.659	4.179	0.12349964
	MYBGL12098A7	3.91220602	3.594	4.253	0.12911882

<sup>7</sup> Riba is the perception of interest from an investment.



Sovereign bonds	MYBGL12021A9	3.86569444	3.5485	4.143	0.12287644
	MYBGL11001A2	3.7381794	3.4835	4.029	0.10926755
	MYBGN0700086	3.61708565	3.374	3.945	0.09950871
	MYBGN0600195	3.51638773	3.282	3.7775	0.10704237
	MYBMN0700027	3.47070949	3.263	3.7895	0.09290801
	MYBMK1300062	3.83586806	3.4645	4.1415	0.12840149
	MYBMO1200017	3.95365046	3.6115	4.285	0.15378612
	MYBMN1300033	3.95576389	3.5865	4.3015	0.15331458
	MYBMO1500010	3.96196412	3.5865	4.2955	0.14411402
	MYBMO05002S9	3.17552431	2.936	3.58	0.15238437
	MYBMO0600019	3.34306944	3.0665	3.6935	0.11020445
	MYBMK1100058	3.64240046	3.4015	3.9115	0.09650163
	MYBMO0900021	3.7772037	3.481	4.047	0.11717725
	MYBMO1100019	3.91056134	3.601	4.248	0.147146

All bonds mentioned above are domestic issues and provide fixed rate income.

Based on the ratings assigned by the Fitch rating agency, all of the broadcasts in our sample have the same notation as "A".

Price database of domestic Sukuk / domestic bonds were downloaded from Reuters. We used the following calculations to determine the daily performance of the two types of instruments:

Daily returns of the asset  $i$  at time  $t$  ( $R_{i,t}$ ) were calculated using the formula: RETURN.TIME.ECCEANCE (liquidation, maturity, issue, rate, nominal value, base) available on the Excel software where:

**Liquidation** is the liquidation date of the bond.

**Maturity** represents the maturity date of the bond. It is the expiry date.

**Issue** is the issue date of the bond, expressed as a serial number.

**Nominal value** represents the price per unit of nominal value of 100 currency units.

**Base** is the type of the day counting base to use: Base Day Count.

As we have already mentioned, our research is interested in the comparison of the two instruments (Sukuk and Conventional bonds) in terms of return and risk.

In the majority of financial models that are concerned with asset performance measurement, one of the data used is the risk-free rate ( $R_f$ ). Academics and practitioners arbitrarily use either short-term or long-term government bonds as a proxy for risk-free securities.

However, and according to Bruner et al (1998) the majority of practitioners prefer long-term bonds: 70% of companies and financial advisors use T-bonds with a maturity of 10 years or more, while almost 10% use T-bills.

In the present research we will use the US T-bonds as the risk-free rate ( $R_f$ ). We have represented below a descriptive table of the T-bonds:

**Table 2:-** Descriptive statistics of the T-bonds:

ISIN	Maturity benchmark	Amount	Coupon type	Coupon (%)	Rating (Agency)
US912796GH66	1	25 000 390 800	Fixed	N/A	AAA (Fitch)
US912828K668	2	26 095 183 100	Fixed	0,5	AAA (Fitch) Aaa (Moody's)
US912828XA31	3	24 542 959 600	Fixed	1	AAA (Fitch)
US912828K585	5	35 128 097 400	Fixed	1,375	AAA (Fitch) Aaa (Moody's)
US912828WZ90	7	29 106 083 700	Fixed	1,75	AAA (Fitch) Aaa (Moody's)
US912828XB14	10	24 543 188 500	Fixed	2,125	AAA (Fitch)

Hereafter, we will focus on the variables that will be used in our econometric model inspired from Fama and French (1993).

Fama and French (1993) model uses as explained variable the profitability in excess relative to the risk-free investment:  $(R_i - R_f)$ .

On the other hand, the explanatory variables were: market profitability in excess relative to risk-free investment  $(R_m - R_f)$ , Small minus Big (SMB), High minus Low (HML) and a maturity premium (TERM). Based on the literature, the model will be expressed as follows:

$$(R_i - R_f) = f((R_m - R_f), SML, HML, TERM) \quad (1)$$

#### Excess profitability of the bond/sukuk $(R_i - R_f)$ :

Litterman and Scheinkman (1991) when identifying bond performance determinants, they found that, there are "other natural candidates" to play the role of the dependent variable. And the best choice is the excess return of the security relative to the risk-free rate calculated as the difference between the return of the instrument (bonds/Sukuks) and the risk-free rate for a given date.

**Excess return of the market  $(R_m - R_f)$ :** is the difference between the average daily returns of bonds/Sukuk market and the risk-free rate.

The risk-free rate used is the US T-bonds corresponding to the daily term to maturity for each security.

The estimated bond market risk  $(R_m - R_f)$  varies between 0.757% and 3.787% for the whole sample. The intra-individual variance (within) is equal to 0.08, while the inter-individual variance (between) is equal to 0.64 on a total variance of 0.65, and 98% of the total variance. Hence the importance of the individual dimension relative to the temporal dimension of this variable.

**Table 3:-** Descriptive statistics of the variable  $(R_m - R_f)$  for Sukuks and bonds:

Variable bonds		Mean	St deviations	Min	Max	observations
$(R_m - R_f)$	Overall	2,205928	0,8079963	0,75755	3,78745	N=4320
	Between		0,8007581	1,244663	3,493616	n=10
	Within		0,2750132	1,482721	3,354426	T=432
Variable sukkuk		Mean	St deviations	Min	Max	observations
$(R_m - R_f)$	Overall	2,238364	0,6258143	0,8675882	3,697559	N=7344
	Between		0,5586861	1,507482	3,405912	n=17
	Within		0,3127843	1,291665	3,275123	T=432

#### Small minus Big (SMB) & High minus Low (HML) variables:-

These two variables represent the contribution of Fama and French (1992a). They showed that profitability of financial assets is not explained only by the market factor but other factors arising from behavioural finance are candidates.

SMB and HML are, by the way, two portfolios constructed as follows: firstly the bond and sukkuk samples were subdivided into two subsamples (S and B) according to their sizes (S for smallest capitalisations and B For the big capitalisation ones).

A second ranking was made on the basis of the average daily return. There results three groups: L (Low), M (Medium) and H (High) representing respectively 40%, 20% and 40% of the total sample.

There were six portfolios at the junction of the two previous rankings: SL (Small-Low), SM (Small-Medium), SH (Small-High), BL (Big-High). For example, the SL portfolio contains the smallest Sukuk (bonds) and the lowest average returns.

The explanatory variable reflecting the size premium factor (SMB) corresponds to the difference between the average profitability of the three small-cap portfolios (SL, SM, SH) and the average profitability of the three large-capitalization portfolios.

$$SMB = \frac{1}{3}[R_{SL} + R_{SM} + R_{SH}] - \frac{1}{3}[R_{BL} + R_{BM} + R_{BH}] \quad (2)$$

The third explanatory variable reflecting the premium factor (HML) corresponds to the difference between the average profitability of the two portfolios of high average returns (SH, BH) and the average profitability of the two portfolios of low average returns (SL, BL):

$$HML = \frac{1}{2}[R_{BH} + R_{RH}] - \frac{1}{2}[R_{BL} + R_{SL}] \quad (3)$$

**Table 4:-** Descriptive statistics for the SMB portfolio.

Variable		Mean	St deviations	Min	Max	observations
Bonds	Overall	0.2734078	0.0729897	0.11325	0.4461667	N=4320
	Between		0	0.2734078	0.2734078	n=10
	Within		0.0729897	0.11325	0.4461667	T=432
Sukuk	Overall	-0.1810376	0.0415897	-0.2756667	0.51025	N=7344
	Between		0	-0.1810376	-0.1810376	n=17
	Within		0.0415897	-0.2756667	-0.063	T=432

The size premium for bonds varies between 0.11325 and 0.4461667 for the whole sample. Its average value is of the order of 0.2734078. The intra-individual variance (within) is equal to 0.01, whereas the inter-individual variance (between) almost null. As the SMB variable, we note that the total variance of SMB is explained, entirely, by the intra-individual one (within). This proves the importance of the temporal dimension of this variable compared to the individual one.

For the Sukuk population the size premium (SMB) varies between -0.2756667 and 0.51025 for the whole sample. Its mean value is of the order of -0.1810376. The intra-individual variance (within) is equal to 0.002, whereas the inter-individual variance (between) is null. As for bonds, we notice that the total variance is entirely explained by the intra-individual variance (within).

**Table 5:-** Descriptive table of the HML variable for Sukuk Variable

Variable		Mean	St deviations	Min	Max	observations
Bonds	Overall	0,4450804	0,1209728	0,228375	0,731375	N=4320
	Between		5,85E-17	0,4450804	0,4450804	n=10
	Within		0,1209728	0,228375	0,731375	T=432
Sukuk	Overall	0,3505561	0,0527164	0,21825	0,51025	N=7344
	Between		0	0,3505561	0,3505561	n=17
	Within		0,0527164	0,21825	0,51025	T=432

The value premium HML for the Sukuk population has a minimum value of 0.21825 and a maximum of 0.51025 for the whole sample. Its mean value is about 0.3505561. The intra-individual variance (within) is equal to 0.03, while the inter-individual variance (between) is null. We note that the total variance of HML is explained by the intra-variance (Within). This proves the importance of the temporal dimension of the HML variable. This result is available for bonds.

#### Term:-

The unexpected variance of the interest rate presents one of the risk factors for bonds. Our proxy for this factor is the TERM variable which is the difference between the daily performance of Sukuk / bonds and the U.S. Treasury-Bill yield of 3 months. The descriptive analysis of this variable on Stata 11 gave the following tables:

**Table 6:-** Descriptive statistics for the variable TERM:

Variable		Mean	St deviations	Min	Max	observations
Bonds	Overall	3.674705	0.299041	2.8805	4.2635	N=4320
	Between		0.2839073	3.147558	3.933998	n=10
	Within		0.129868	3.289207	4.073147	T=432
Sukuk	Overall	3.937537	0.2305956	3.2555	4.597	N=7344
	Between		0.2012848	3.488421	4.246591	n=17
	Within		0.1226249	3.437638	4.292081	T=432

It's important to note that we applied the Spearman test to ensure that there is no correlation between the different variables.

#### Fama and French (1993) Model:-

In what follows we propose to estimate the Fama and French model (1993). This framework represents a multiple linear regression of the variable to be explained (the excess return) and the explanatory ones such: the market excess return, size premium, the value premium, the interest rate variation proxy.

$$(R_{i,t} - R_{f,t}) = \beta_0 + (R_{m,t} - R_{f,t})\beta_i + SML_t\beta_{s,i} + HML_t\beta_{h,i} + TERM_t\beta_{d,i} + \varepsilon_{i,t} \quad (4)$$

$R_{i,t}$  is the return of the asset i for time t;

$R_{f,t}$  is the risk-free at time t;

$\beta_0$  is a constant;

$R_{m,t}$  is the market return at time t;

$\varepsilon_{i,t}$  is white noise;

SMB: is the risk premium generated by the size factor;

HMB: is the risk premium relative to the value risk factor;

TERM: is the premium relative to the term structure of interest rates.

#### Estimation results and interpretation:-

Considering the model presented above and with the respect of the brief literature review, we could expect the same behaviour of sukuk and bonds toward every explicative variable. However, estimation results presented here after couldn't confirm all of the research hypotheses.

Estimation results are reported in table 7.

In fact and according to table 7, the coefficient  $\beta_i$  relative to excess market returns is positive and close to 1 for both instruments. In other words, a 1% change in market excess returns results in a variation of 0.886% (0.866%) of the return of the Sukuk (bonds).

Therefore, Bonds and sukuk are very sensitive to market return variations.

**Table 7:-** Estimation results.

$(R_{i,t} - R_{f,t}) = \beta_0 + (R_{m,t} - R_{f,t})\beta_i + SML_t\beta_{s,i} + HML_t\beta_{h,i} + TERM_t\beta_{d,i} + \varepsilon_{i,t}$  where  $R_{i,t}$  is the return of the asset i at time t;  $R_{f,t}$  is the risk-free at time;  $\beta_0$  is a constant;  $R_{m,t}$  is the market return at time t;  $\varepsilon_{i,t}$  is white noise; SMB: is the risk premium generated by the size factor; HMB: is the risk premium relative to the value risk factor; TERM: is the premium relative to the term structure of interest rates. And i=Sukuk/Bonds.

Coefficient	Sukuk	Bonds
$\beta_0$	-2.089876 (0.00)	-1.798089 (0.00)
$\beta_i$	0.8866522 (0.00)	0.8661735 (0.00)
$\beta_{s,i}$	0.7242783 (0.00)	-0.106433 (0.00)
$\beta_{h,i}$	0.2082551 (0.00)	-0.151512 (0.00)
$\beta_{d,i}$	-0.610277 (0.00)	-0.595921 (0.00)

Taken together and in absolute value, all model parameters are higher for sukuk than for bonds. This shows the excess of sensitivity of the first instrument to different risk factors.

The excess market return  $(R_{m,t} - R_{f,t})$  is considered as a risk premium representing additional return required by the market for the extra risk taking compared to a risk-free investment.

When a market risk premium increases, investors require additional returns that will allow them to hedge market risk. Hence, the confirmation of hypotheses 1 and 2.

As far as, the slight sensitivity of the Sukuk's excess return to the market risk premium ( $\beta_{Sukuk} > \beta_{Bonds}$ ) reflects the risky nature of this instrument compared to bonds. Indeed, being prohibited by the precepts of "Sharia", any negotiation of the debt is prohibited in the commitments of the Sukuk. This makes sukuk issuers prone to default.

For the SMB variable, the two financial instruments differ widely from one another. Indeed, for Sukuk a 1% change of the SMB variable leads to a variation of 0.72% in Sukuk performance. However, for bonds, the latter is about -0.11%. This difference is also detected when returns are regressed separately on the size indicator variable (SMB). Consequently, we can say that Sukuk returns are more sensitive to liquidity factor as measured by size.

Also positive  $\beta_{s,sukuks}$  coefficient show that sukuk returns vary in the same direction of size factor. In other words, the smaller the size of sukuk is, the higher the perceived return becomes. Small issuance of sukuk sends a positive signal on the presence of counterparts in the Malaysian market.

**Hypotheses 3** supposing a sukuk's return variation of the same meaning with the SMB, is verified.

Surprisingly, the coefficient  $\beta_{s,Bonds}$  is of opposite sign for bonds indicating a negative reaction of excess returns to size factor increase (SMB). This factor is always related to momentum phenomena stipulating that small capitalisation stocks (bond) over perform big ones (see Kent Hirshleifer and Subrahmanyam (1998)). However, when the opposite sign is observed this theory is thwarted. Thus and in the bases on the study of Burmeister, Roll and Ross (2003) we can say that big capitalisations outperform small ones especially in the case of an economic recession. Small issuances are more sensitive to market conditions.

This result clearly rejects hypothesis 4.

As in Fama and French (1993) we consider the book to market (Book value/market value) and the HML factor in the same way as "YTM" as indicators of financial distress. We noticed that Sukuks with downward trending prices have a high "YTM" and positive HML coefficients.

Concerning bonds, the positive impact of the HML portfolio and the explained variable is not supported. Indeed, a 1% increase in HML results in a decrease in excess bond return of 0.1515%. This leads to reject hypothesis 6 of the positive relation between these two variables. This result confirms those of Fama and French (1992b) pointing out that investors are actively hedging against the value risk represented by HML portfolio. We also notice that the latter contributes poorly to bonds' price variation (only 0.1515% of the performance in excess).

Contrariwise, table 7 reports a positive impact of HML portfolio on the excess return of sukuk. In fact, a 1% increase of this factor leads to 0.208% increase of the sukuk excess return. Firstly, the impact in absolute value of HML on returns is twice as high for sukuk as for bonds. Then, this variable contributes more in explaining relative returns. Secondly, the negative value of  $\beta_{h,Sukuk}$  shows that there is some profits opportunity to realise when buying undervaluated sukuk (high B/M) and selling the over valued ones (low B/M).

Thus, we can confirm the positive impact of the HML factor on excess returns for sukuk introduced by the 5<sup>th</sup> hypothesis.

The last variable in our model is TERM proposed by Fama and French (1993) as an extension of Fama and French (1992a). It reflects the market interest rate variation namely the difference between Sukuk (bonds) returns and the 3 months Treasury rate.

The Sukuk-specific model shows a significant effect at the 1% threshold of the Sukuk performance variable. This result urges us to confirm hypothesis 8 which assumes that the Sukuk are negatively influenced by interest rate variations (see Syamni et al (2010) and Said and Grassa (2013)). As in Elkarim (2012) and Xian et al (2015), we can say that Interest rate variation affects indirectly the performance of sukuk as it represents a common economic indicator for financial assets.

In addition, TERM factor highly and negatively contributes to relative sukuk returns variation at about -0.61% for 1% variation. Bonds excess returns have the same meaning with respect to the TERM variation: an increase in the interest rate of about 1% results in a returns' decrease of 0.5959%.

These results could be interpreted in two ways: firstly, sukuk and bonds returns are very sensitive to business condition variations as specified by Fama and French (1993). Secondly, and according to Bhattacharyay (2013) investors are reluctant to invest in long term sukuks/bonds when interest rates increase as they predict a decrease of their purchasing power of long term fixed-rate bonds/Sukuk. Hence, the decline in demand for both instruments. This leads to a decrease in their returns.

Taken together, the last two results, are consistent with the literature review cited above, this leads us to confirm hypotheses 7 and 8.

### Conclusion:-

This paper sheds the light on differences between Sukuks and conventional bonds. Focusing on sovereign ones we have showed that investors perceive differently these two financial instruments.

Firstly, Sukuks are slightly more risky than bonds since relative underlined asset value isn't guaranteed at maturity. On the other side, interest on bonds and principal pay back are fixed beforehand.

Secondly, with respect to SMB factor, sukuks and bonds returns present variations of opposite sign. The first reacts positively leading to better performance of small issuances. And the latter reacts negatively to the size factor increase; hence big bond issuances outperform small ones.

Concerning value premium (HML factor), its contribution in absolute value to sukuk performance is twice that of bonds. However, a negative impact for bonds testifies that investors are actively hedging against the value risk. An effect of a contrary sign is valid for the sukuk showing that there is some profits opportunity to realise when buying undervaluated sukuks (high B/M) and selling the overvaluated ones (low B/M).

Nevertheless, toward interest rate variation, both instruments show negative reactions despite that by construction sukuk returns should be disconnected from. Then we can say that as well as bonds, sukuks are sensitive to changes in market conditions and business environment.

Indeed, the Sukuks show a performance higher than bonds throughout the analysis period. Based on a test of the averages of returns averages and risk premium, we confirmed the difference between the two financial instruments<sup>8</sup>.

### References:-

1. Alam, N., Hassan, M. K., Haque, M. A., 2013, Are Islamic bonds different from conventional bonds? International evidence from capital market tests, *Borsa Istanbul Review*, 13, 3, 22–29.
2. Ahmad W., Radzi R.M., 2011, Sustainability of Sukuk and Conventional Bond during Financial Crisis: Malaysia's Capital Market, *Global Economy and Finance Journal*, pp 33-45.
3. Ariff A. et Safari M. , 2012, Are Sukuk Securities the Same as Conventional Bonds?, *Afro Eurasian Studies*, pp. 101-125
4. Bernoth. K, Hagen. J.V, Schuknecht. L, 2012, Sovereign risk premiums in the European government bond market, *Journal of International Money and Finance*, 31,5, 975-995.
5. Bhattacharyay,B.N. ,2013, Determinants of bond market development in Asia ,*Journal of Asian Economics*, 24, 124–137.
6. Blake C. R., Elton J.E., Gruber M.J.,1993, The Performance of Bond Mutual Funds, *Journal of Business*, 371-403.
7. Bruner, R.F., Eades, K.M., Harris, R., Higgins, R.C., 1998, Best practices in estimating the cost of capital:survey and synthesis. *Financial Practice and Education*, 8, 13-28.
8. Burmeister E., Roll R., and Ross S.A., 2003, Using macroeconomic factors to control portfolio risk, working paper, BIRR, March 2003.
9. Cakir, S., Raei, F., 2007, Sukuk vs. Eurobonds: Is there a difference in value-at-risk?, IMF Working Paper, No. WP/07/237. Washington, DC: International Monetary Fund.

<sup>8</sup> We didn't report the estimate results in order to save the space.

10. Elkarim, B. , 2012, Factors influence Sukuk and conventional bonds in Malaysia, *Global Economy and Finance Journal*, 3-14.
11. Fama E. F. and French K. R. ,1992a, The cross-section of expected stock returns. *Journal of finance*, 427- 465.
12. Fama E. F. and French K. R. ,1992b, The economic fundamentals of size and book-to-market equity , Working paper: Graduate School of Business. University of Chicago.
13. Fama E. F. et French K. R. , 1993, Common risk factors in the returns on stocks and bonds, *Journal of financial economics*, 3-56.
14. Fathurahman H. et Fitriati R. ,2013, Comparative Analysis of Return on Sukuk and Conventional Bonds, *American Journal of Economics*, 159-163.
15. Godlewski, C. J., Turk-Ariss, R., Weill, L., 2010, Are sukuk really special? Evidence from the Malaysian Stock Exchange, *BOFIT Discussion Papers*, 6, 2011, Helsinki: Bank of Finland.
16. Grassa, R., Gazdar, K. ,2012, The determinants of the development of the Sukuk market in GCC countries, *International Conference on Islamic Capital Markets*, Bapepam-LK and IRTI – IDB, Indonesia.
17. Guéranger. F , 2009, *Finance islamique, une illustration de la finance éthique*, Dunod editions, 2009-08-26
18. Guyot A., 2008, Les préceptes de la Shari ‘ah contribuent-ils à l'efficience et à la performance des marchés d'actions? Une étude comparative des indices Dow Jones Islamic, *Colloque international: Ouverture et émergence en Méditerranée*, 17-18 octobre, Rabat, Maroc.
19. Hassan, K. A. ,2012, Comparison between Sukuk and conventional bonds: Value at risk approach, Master thesis, Westminster University, UK. <http://dx.doi.org/10.2139/ssrn.2215194>.
20. Kent.D, Hirshleifer .D and Subrahmanyam. A ,1998, Investor psychology and security market under- and overreactions, *Journal of Finance* 53, 1839-1885.
21. Kim S., et In F. , 2007, On the relationship between changes in stock prices and bond yields in the G7 countries: A wavelet analysis, *Journal of International Financial Markets, Institutions and Money*, 167–179.
22. Kuran T., 2004, “Islam and Mammon”, Princeton University Press.
23. Miller N.D., Challoner J. Atta A., 2007, UK Welcomes the Sukuk, *International Financial Law Review*, 24-25.
24. Naifar N., Mseddi S. , 2013, Sukuk spreads determinants and pricing model methodology, *Afro-Asian Journal. Finance and Accounting*, 3,3, 241-257.
25. Ramasamy, R., Munisamy, S., Helmi, M. H. M. , 2011, Relative risk of Islamic sukuk over government and conventional bonds, *Global Journal of Management and Business Research*, 11, 6, 4–12.
26. Said A, Grassa R, 2013, The Determinants of Sukuk Market Development: Does Macroeconomic Factors Influence the Construction of Certain Structure of Sukuk? *Journal of Applied Finance & Banking*, 3, 5, 2013, 251-267.
27. Syamni, G., Husaini. ,2010, Interest rates and currencies effect on Islamic and conventional bonds, *Economic Journal of Emerging Market*, 2 ,2, 29-140. Usmani M.T, 2007, Sukuk and their contemporary applications, Translated from the original Arabic by Sheikh Yusuf Talal DeLorenzo, AAOIFI Shari’a Council meeting, Saudi Arabia.
28. Vishwanath, S. R., Azmi, S. ,2009, An overview of Islamic sukūk bonds, *The Journal of Structured Finance*, 14,4, 58-67.
29. Wilson R., 2008, Innovation in structuring of sukuk securities, *Humanomics*, 170-181.
30. Xian L.J., Leong R.LLH, Chun W.K., Yee W.S., WeY.J. ,2015, Comparison between performance of sukuk and conventional bond in Malaysia, Faculty of Business and Finance, Department of Finance, April 2015.



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### RESEARCH ARTICLE

#### “AN OBSERVATIONAL STUDY TO COMPARE THE EFFECTS OF DEXMEDETOMIDINE AND ESMOLOL IN ATTENUATING THE HAEMODYNAMICRESPONSETOLARYNGOSCOPY ANDENDOTRACHEALINTUBATION”

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Dexmedetomidine, Esmolol,  
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#### Abstract

**Background:** Laryngoscopy and intubation causes catecholamine release leading to sympathetic overdrive, resulting in hypertension and tachycardia. Different agents have been tried to overcome these responses over the years.

**Aims:** To compare an alpha-2 agonist, Dexmedetomidine, with Esmolol, a beta blocker and to observe which of two is more proficient in suppressing this hemodynamic response.

**Settings & Design:** Randomized, observational and a prospective study.

**Subjects & Methods:** Sixty patients scheduled for general anesthesia were divided into two groups, D (Dexmedetomidine 1 mcg/kg) and E (Esmolol 2 mg/kg), received either drug as an intravenous premedication over 10 minutes before laryngoscopy and endotracheal intubation. Systolic, diastolic, mean arterial pressures and heart rate were measured at various time points. Percentage change of parameters at those time points from the baseline were compared between groups.

**Statistical Analysis Used:** Demographics and hemodynamic parameters were compared for groups by one way (ANOVA) ANALYSIS OF VARIANCE. Paired *t*-test was used for comparison between groups, while for comparison within groups, unpaired *t*-test was used. Probability was said to be significant if *p* value was less than 0.05. Data was represented in mean and SD.

**Results:** Percentage change of hemodynamic parameters from base line were less in Dexmedetomidine group than in Esmolol group. Statistically significant differences were observed between the two groups at time points within 1 minutes after laryngoscopy and endotracheal intubation.

**Conclusions:** Dexmedetomidine was more effective than Esmolol in attenuating the hemodynamic responses to laryngoscopy and tracheal intubation.

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## Introduction:-

Laryngoscopy and endotracheal intubation are one of the two most important integral parts of anaesthetic management and critical care since their description by Rowbotham and Magill in 1921. Laryngoscopy and endotracheal intubation provides control of airway during general anaesthesia. Laryngeal and tracheal stimulation causes circulatory response, was known since 1940 (Reid and Brace).<sup>[1]</sup> The mechanism behind hypertension and tachycardia, is an increased sympathetic action due to increased catecholamine release<sup>[2]</sup> and mechanical stimulus causing reflex responses in cardio-respiratory systems.<sup>[3]</sup> The increase in heart rate (HR) and blood pressure is usually variable, transient and unpredictable which may not be much significance in healthy individuals but can be detrimental in those with hypertension, cardiac dysfunction, coronary vessel disease or cerebro-vascular disease. Laryngoscopic and tracheal intubation responses in such individuals can precipitate coronary insufficiency, arrhythmias, pulmonary edema, left ventricular failure and cerebral hemorrhage.<sup>[4]</sup>

Various non pharmacological and pharmacological methods are in vogue to control this hemodynamic response. Opioids, local Anaesthetics, vasodilating agents and adrenergic blocking agents have been used to attenuate the pressor response.<sup>[5-13]</sup> Alpha2 agonists, recently have gained significance in suppressing the laryngosympathetic responses.<sup>[14]</sup> Dexmedetomidine is an  $\alpha$ -2 adrenergic receptor agonist, with particularly more prominent effects on cardiovascular system. **Srivishnu Vardhan Yallapragada<sup>(15)</sup> et al**, in 2016, concluded that, Dexmedetomidine (0.5 mcg/kg) is superior to esmolol (0.5 mg/kg) in attenuating the hemodynamic response to laryngoscopy and tracheal intubation. Among the  $\beta$  adrenergic receptor antagonist drugs, Esmolol is one of the most effective modality in minimizing the cardiac responses to laryngeal stimuli because of its ultrashort action (9 mins) and it can be administered intravenously. While it is an inhibitor of receptors of myocardium, receptors on smooth muscles of bronchial and vessel walls are also inhibited at higher doses<sup>[16]</sup> **SV Reddy<sup>(17)</sup> et al** in 2014, concluded that Dexmedetomidine 1.0  $\mu$ g/kg provided a more consistent, and effective diminution of haemodynamic response as compared to Esmolol 2.0 mg/kg. Thus, we sought to compare the effects of both these drugs in countering the exaggerated sympathetic responses secondary to laryngoscopy and endotracheal intubation.

## Materials and Methodology:-

60 patients belonging to ASA I & II, of either gender, in age group 18 – 65 yrs posted for elective non- cardiac surgery were included in the study. Exclusion criteria- Patients with cardiovascular system pathologies, drug allergies, H/o bronchial asthma, on beta blocker treatment.

Preanaesthetic preparation- Patients were fasted preoperatively since 10 pm, night before surgery.

On the day of surgery, on the operation table, baseline parameters including Heart Rate (HR), SPO2, Diastolic blood pressure (DBP), Systolic blood pressure (SBP) and Mean arterial pressure (MAP) were recorded using standard ECG, NIBP & SPO2 monitors. IV cannula was secured and all the patients were pre-loaded with Ringer lactate 10 ml/kg. All patients were premedicated using Inj glycopyrolate 0.004 mg/kg, Inj midazolam 0.02 mg/kg and Inj ondansetron 0.08 mg/kg, intravenously on arriving in operation theatre. They were randomly allocated into two groups by chit method. The study groups received either 2 mg/kg of Esmolol iv or 1  $\mu$ g/kg of Dexmedetomidine iv, all made in a 10 ml disposable syringe diluted upto 10 cc with normal saline. The drug were administered as a 10 minutes iv infusion. After injecting the study drug, All study parameters were recorded again after 10 minutes.

## Anaesthesia Technique:-

Patients were pre-oxygenated with 100% oxygen for three minutes. Induction was done with Inj. Thiopentone sodium 6 mg/kg iv and endotracheal intubation was facilitated with Inj succinylcholine 2 mg/kg iv. All parameters were recorded after induction. Laryngoscopy and endotracheal intubation were performed by single investigator by the use of a rigid laryngoscope with standard Macintosh blade & with appropriate sized, disposable, high volume, low pressure, cuffed tracheal tube. Laryngoscopy and intubation was done gently and in a single attempt. All study parameters were recorded for 1, 3, 5, 7, 10, minutes of intubation. Anaesthesia was maintained with O2 (50%) 4 ltr /min, N2O (50%) 4 ltr /min, Isoflurane and inj. Atracurium. All surgical stimuli, analgesics supplements were avoided during the study. IV fluid were calculated and managed. Patients were reversed at the end of surgery, by intravenous inj Neostigmine 0.05 mg/kg and inj. Glycopyrolate 0.01 mg/kg iv.

**Statistical analysis:-**

The data was analyzed using Student's T Test for intergroup comparison and all statistical methods were carried out using the chi-square test. The results were considered statistically significant when the [probability] p value  $<0.05$ .

**Results:-**

All 60 patients who were included were able to complete the study. The demographic data were comparable in terms of age, gender ratio & ASA status for all the patients and there were no statistically significant differences in between the groups ( $P > 0.05$ ). Baseline values of Heart Rate, Systolic Blood Pressure, Diastolic Blood Pressure and Mean Arterial Pressure were comparable in both Group D and Group E. Rise in mean Heart Rate after laryngoscopy and endotracheal intubation was observed in both the groups, although mean rise was minimal 2.39% in Group D (2 beats) as compared to Group E, 8.40% (7 beats), which was highly significant ( $P < 0.05$ ). Mean Heart rate between the two groups was found to be significant throughout the study period immediately after laryngoscopy and intubation. ( $P < 0.05$ ). Furthermore, only in the Group D, there was no statistically significant increase in Heart Rate at any time interval.

Mean rise in systolic blood pressure [SBP] was minimal [1.65%] in the D Group, as compared to the E Group [4.29%], which was statistically significant ( $P < 0.05$ ). Mean Systolic blood pressure between the two groups was found to be significant throughout the study period immediately after laryngoscopy and intubation ( $P < 0.05$ ).

The DBP levels in both, Group D and Group E were comparable at all times after intubation. In both the groups, there was no significant rise in DBP following intubation ( $P > 0.05$ ).

Mean blood pressure decreased after induction, but was not statistically significant in between Group D & Group E. The MAP was raised by, 5.20% (4.8mmHg) in Group D & 5.89% (5.3mmHg) in Group E at the time of intubation. Mean blood pressure was significant at 5, 7 & 10 minutes after intubation in between both groups. ( $P < 0.05$ ).

**Table 1:- BASELINE (R1), HR, SBP, DBP & MAP**

	GROUP D		GROUP E		P Value
HR	80.73333	6.426955	81.3333	7.88442	0.7479
SBP	123.0333	8.083544	124.6667	9.162643	0.4661
DBP	75.36667	5.81605	74.7	5.608799	0.653
MAP	91.3333	4.47470	90.9	4.071346	0.2834

**Table 2:-HEART RATE**

	GROUP D		GROUP E		P VALUE
	MEAN	SD	MEAN	SD	P VALUE
R1(BASELINE)	80.7333	6.4269	81.333	7.8842	0.7479
R2(AFTER STUDY DRUG)	84.9333	6.9328	85.8333	7.6568	0.635
R3(BEFORE INDUCTION)	86.4666	6.9368	89.033	7.2658	0.1671
R4(1MIN)	82.6666	6.1213	88.167	6.9087	0.0018
R5(3MIN)	79.5666	6.4309	85.067	6.6173	0.0018
R6(5MIN)	76.5667	6.2735	82.2	6.3213	0.001
R7(7MIN)	73.9333	6.1134	79.667	5.7615	0.0004
R8(10MIN)	71.4667	6.6214	77.7	5.9257	0.0003

**Table 3:-Systolic Blood Pressure**

	GROUP D		GROUP E		P VALUE
	MEAN	SD	MEAN	SD	
R1(BASELINE)	123.0333	8.0835	124.67	9.1626	0.4661
R2(AFTER STUDY DRUG)	133.0667	7.9564	132.93	6.8528	0.9434
R3(BEFORE INDUCTION)	134.1	6.7688	135.27	5.9939	0.4813
R4(1MIN)	125.0667	7.6425	130.03	5.875	0.0066
R5(3MIN)	118.8333	7.9701	125.33	5.7735	0.0006
R6(5MIN)	112.3333	7.9928	120.97	5.5054	0.0001
R7(7MIN)	106.7666	6.7705	116.77	5.835	0.0001
R8(10MIN)	103.3333	5.9615	113.13	5.9058	0.0001

**Table 4:-Diastolic Blood Pressure.**

	GROUP D		GROUP E		P VALUE
	MEAN	SD	MEAN	SD	
R1(BASELINE)	75.3667	5.81605	74.7	5.6088	0.653
R2(AFTER STUDY DRUG)	77.3333	5.88002	77.933	5.589	0.687
R3(BEFORE INDUCTION)	79.2333	5.99818	79.633	5.3077	0.7856
R4(1MIN)	79.0666	5.58281	79.933	5.699	0.5543
R5(3MIN)	79.1	5.34563	79.833	5.2397	0.5938
R6(5MIN)	77.1333	5.17775	77.433	5.6853	0.8317
R7(7MIN)	74.3	5.29899	74.9	5.5544	0.9644
R8(10MIN)	73.1666	5.11308	73.6	5.8875	0.7619

**Table 5:-Mean Arterial Pressure.**

	GROUP D		GROUP E		P VALUE
	MEAN	SD	MEAN	SD	
R1(BASELINE)	92.16667	4.948586	90.9	4.0713	0.2834
R2(AFTER STUDY DRUG)	94.13333	4.439116	95.993	4.2906	0.1044
R3(BEFORE INDUCTION)	96.76667	4.360349	97.967	4.064	0.2746
R4(1MIN)	96.966667	4.25467964	96.267	4.2583	0.5269
R5(3MIN)	94.066667	4.3702232	94.633	3.7736	0.5932
R6(5MIN)	88.73333	4.3146369	91.5	3.5792	0.009
R7(7MIN)	84.96667	4.3902976	88.667	3.8893	0.001
R8(10MIN)	82.866667	3.9630477	86.6	4.1072	0.0007

## Discussion:-

Laryngoscopy and endotracheal intubation violates the patient's protective airway reflexes and this noxious airway stimuli leads to cardio-vascular responses initiated by proprioceptors responding to the supraglottic and the tracheal tissue irritation.<sup>(18)</sup> These proprioceptors consist of mechanoreceptors which are located in close proximity to the airway mucosa, with the small-diameter myelinated fibers, slowly-adapting stretch receptors with large-diameter myelinated fibers, and nonmyelinated nerve fibers'spolymodal endings.<sup>(19)</sup> These impulses to brainstem are transmitted to the glossopharyngeal and vagal afferent nerves, which in turn, causes the widespread autonomic activation through the sympathetic and parasympathetic nervous systems. Deeper planes of anaesthesia using the inhalational agents; topical lignocaine sprays, calcium channel blockers, vasodilators such as sodium-nitroprusside; nitroglycerine and narcotics etc are used as prophylaxis<sup>[20]</sup> but hypotension, bradycardia, sedation and respiratory depression, are some of their prominent side-effects.

Esmolol, among the  $\beta$ -adrenergic blocking agents, appears to be an appropriate pharmacological agent for minimizing haemodynamic responses to laryngoscopy and endotracheal intubation, as it is more cardio-selective, with a rapid onset and ultra short elimination half-life. Several studies, describing the effects of Esmolol, on both Heart Rate and Blood Pressure during laryngoscopy and endotracheal intubation when compared to control, have been done in the past. **Miller et al**<sup>[21]</sup> reported that Esmolol when given as a single bolus dose of 100 mg, was effective in minimizing the haemodynamic response to laryngoscopy and endotracheal intubation. **Liu et al**<sup>[22]</sup> used

infusion of esmolol and found that rise was 50% lower in patients treated with esmolol when compared to the control group.

Similarly, in our study, we found that, there was a rise in mean heart rate after laryngoscopy and endotracheal intubation in both study groups. Mean rise was less [2.39%] in Group D as compared to Group E [8.40%] which was statistically highly significant ( $P < 0.05$ ). Mean Heart rate between the two groups was found to be significant throughout the study period immediately after laryngoscopy and intubation ( $P < 0.05$ ).

Dexmedetomidine, directly acts on  $\alpha_2$ -adrenoceptor agonists and clinically have significant effects on the requirement of anaesthetic agents and on haemodynamic responses or the sympatho-adrenal responses which occurs during laryngoscopy and anaesthesia induction by Anaesthesia and surgery. **Scheinin et al**<sup>[23]</sup> suggested that Dexmedetomidine when given in a dose of 0.6 mcg/kg, reduces, but not totally abolishes, the pressor responses to laryngoscopy and endotracheal intubation in young & healthy individuals. **Keniya et al**<sup>[24]</sup> concluded from their study that Dexmedetomidine 1.0 mcg/kg when used as pre-medication, minimized, but not totally obtunded the cardio-vascular responses to endotracheal intubation after anaesthesia induction.

In our study, we found that there was increase in mean SBP after laryngoscopy and intubation in both the groups, but the mean increase was minimal 1.65% in Group D when compared with Group E, 4.29%, which was statistically significant ( $P < 0.05$ ).

The Diastolic Blood Pressure levels in both, Group D and Group E were comparable at all times after intubation. In both the groups, there was no significant rise in DBP following intubation ( $P > 0.05$ ).

In our study, we infused Dexmedetomidine at a dose of 1mcg/kg and Esmolol at 2mg/kg, both over a period of 10 min, before induction, when compared to study mentioned above, we found that the mean arterial pressure decreased, but was statistically not significant in between Group D and Group E. The MAP raised by, 5.20% (4.8 mm Hg) in Group D and 5.89% (5.36 mm Hg) in Group E during intubation. MAP was found to be significant at 5, 7 & 10 mins after intubation in between both the groups ( $P < 0.05$ ).

In our study, we did not observe either bradycardia or hypotension in any of the patients in both the study groups.

### Conclusion:-

In constraints of our study, we conclude that, Dexmedetomidine 1 mcg/kg IV as 10 min infusion, more effectively diminishes the pressor stress responses to laryngoscopy and endotracheal intubation compared to Esmolol 2 mg/kg IV without any deleterious effects.

### References:-

1. Reid LC et al. (1940) Irritation of respiratory tract and its reflex effect on heart rate. SurgGynaec Obstet;70:157- 62.
2. Kovac AL.(1996) Controlling the hemodynamic response to laryngoscopy and endotracheal intubation. J Clin Anesth;8:63- 79.
3. Hamaya Y, et al. (2000) Differences in cardiovascular response to airway stimulation at different sites and blockade of the responses by lidocaine. Anesthesiology.;93: 95-103.
4. Dalton B, et al (1972). Myocardial ischemia from tachycardia and hypertension in coronary heart disease- patients undergoing Anaesthesia. Annual Meeting. Boston: American Society of Anesthesiologists;. p. 201- 2.
5. Fassoulaki A, et al (1983) Kaniaris P. Intranasal administration of nitroglycerine attenuates the pressor response to laryngoscopy and intubation of the trachea. Br J Anaesth;5:49-52.
6. Stoelting RK.(1979) Attenuation of blood pressure response to laryngoscopy and tracheal intubation with sodium nitroprusside. Anesth Analg;58:116-9.
7. Mikawa K, et al (1990) The effect of nicardipine on the cardiovascular response to tracheal intubation. Br J Anaesth;64:240-2.
8. Charuluxananan S, et al (2000) Nicardipine versus lidocaine for attenuating the cardiovascular response to endotracheal intubation. J Anesth 2000;14:77-81.

9. Martin DE, et al (1982) Rosenberg H, Aukburg SJ. Low dose fentanyl blunts circulatory responses to tracheal intubation. *Anesth Analg* ;6:680-4.
10. Kosh, et al (1998) Small dose fentanyl: optimal dose of injection for blunting the circulatory responses to tracheal intubation. *Anesth Analg*;86:658-61.
11. Cork RC, et al (1984). Fentanyl preloading for rapid sequence induction of Anaesthesia. *Anesth Analg*;63; 63:60-4.
12. Lev R, et al (1994). Prophylactic lidocaine use preintubation: a review. *J Emerg Med*;12:499-506.
13. Jalonen J, et al (1997). Dexmedetomidine as an anesthetic adjunct in coronary artery bypass grafting. *Anesthesiology*;86:331-45.
14. Jaakola ML, et al (1991). The analgesic action of dexmedetomidine – A novel alpha 2- adrenoceptor agonist – In healthy volunteers. *Pain*;46:281- 5.
15. SrivishnuVardhanYallapragada, et al 2014 et al.: Dexmedetomidine, esmolol, intubation response, laryngoscopic response, *Anesthesia: Essays and Researches*; 8(3);
16. Hussain AM, (2005) Efficacy of fentanyl and esmolol in the prevention of haemodynamic response to laryngoscopy and endotracheal intubation. *J Coll Physicians Surg Pak*;15:454-7.
17. SiddareddigariVelayudha Reddy, et al,(2014)Dexmedetomidine versus esmolol to attenuate the hemodynamic response to laryngoscopy and tracheal intubation: A randomized double-blind clinical study, *IJABMR*; 4(2): 95-100.
18. Miller CD, et al (1990): Intravenous lignocaine fails to attenuate the cardiovascular response to laryngoscopy and tracheal intubation . *Br J Anaesth*65 : 216 – 219 , .
19. Robinson N, et al (2001): In patients with head injury undergoing rapid sequence intubation, does pretreatment with intravenous lignocaine/lidocaine lead to an improved neurological outcome? A review of the literature .*Emerg Med J* 18 : 453 – 457.
20. Ben-Abraham R, et al (2000). Dexmedetomidine: A promising agent for anesthesia and perioperative care. *Isr Med Assoc J.* 2:793–6.
21. Miller DR, et al (1991): Bolus administration of esmolol for controlling the haemodynamic response to tracheal intubation: The Canadian Multicentre Trial . *Can J Anaesth*38 : 849 – 858.
22. Liu PL, et al (1986). Esmolol for control of increases in heart rate and blood pressure during tracheal intubation after thiopentone and succinylcholine. *Can Anaesth Soc J*;33:556–62.
23. Scheinin B, et al (1992). Dexmedetomidine attenuates sympathoadrenal responses to tracheal intubation and reduces the need for thiopentone and perioperative fentanyl. *Br J Anaesth.* 68:126–31.
24. Varshali M Keniya, et al (2011). Dexmedetomidine attenuates sympathoadrenal response to tracheal intubation and reduces perioperative anaesthetic requirement. *Indian J Anaesth.* 55(4): 352–357.

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### RESEARCH ARTICLE

## ALPINIA CALCARATA: A NEW DISTRIBUTIONAL RECORD IN THE ZINGIBERACEAE FLORA OF MANIPUR

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### Abstract

The present paper includes *Alpinia calcarata* Roscoe as a new record in the Zingiberaceae flora of Manipur. The plant is described along with the field photographs.

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### Introduction:-

Zingiberaceae is considered as one of the most important and valuable group of monocots. It is a well-known plant family for its medicinal and economic significance<sup>5</sup>. They are mostly distributed in tropical and sub-tropical region of the globe with maximum distribution in South East Asia.<sup>4,6</sup>

Manipur is situated in the north-east India and is centrally located on the eastern arm of the Himalayas- Purvanchal consisting of a valley embosomed in the mountainous region. The specimen was observed during the field survey in the valley districts in 2016. Detailed studies were undertaken with the various floras and herbaria and is subsequently identified as *Alpinia calcarata* Roscoe. The collection forms a new distributional record in the Zingiberaceae flora of Manipur.

### Taxonomic treatment:-

*Alpinia calcarata* Roscoe- Trans. Linn. Soc. London 8: 347. 1807 (IK)

Pseudostem to 1.3m; leaves sessile; ligule 0.8-1.2 cm, glabrous, apex obtuse bilobed; leaf blade linear, lanceolate, 25-33 x 2.5-3.7 cm, glabrous, green, base attenuate; leaf margins with short bristles; panicle 11.2 cm, rachis velvety; proximal branches 3 flowered; bracteoles membranous, apex obtuse, 1.4 cm long; pedicel 3 mm, pubescent; calyx apex 3-toothed, pubescent, 1.2cm, split on 1 side, white in colour; corolla white, glabrous, obtuse, lobes oblong, 2 shorter, 1.8 cm x 0.5 cm, 1 larger, 2 cm x 0.9 cm; lateral staminodes red, subulate, 3 mm, adnate to the base of labellum; labellum white with cherry red streaks, obovate, apex emarginated, 3.3 cm x 2.4 cm; stamen 2.2 cm; anther dorsifixed, bilobed, 0.7 cm, filament slender slight pinkish at the base, 3.3cm; stigma capitate; presence of 2 oil glands, yellow, 0.2 cm; capsule globose, pubescent; ovary trilobular.

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**Fig.1:-** *Alpinia calcarata* Roscoe in the natural habitat.

**References:-**

1. Baker, J.G. (1892) Zingiber. In: Hooker, J.D. (ed) Flora of British India 6: 243-249. London: L. Reeve and Co.
2. Deb, D.B. (1961) Monocot and Dicot plants of Manipur 3: 119-120.
3. Karthikeyan, S., Jain, S.K., Nayar, M.P. and Sanjappa, M. (1989) Zingiberaceae. In: Florae Indicae Enumeratio- Monocotyledonae. 289-299. Calcutta: Botanical Survey of India.
4. Larsen, K. and Delin, W. (2000) Flora of China 24: 322-377.
5. Rahman, M.A., Islam, M.S. (2015): *Alpinia calcarata* Roscoe: A potential phytopharmacological source of natural medicine. Phcog Rev 9: 55-62
6. Ramesh, K., Singh, S.K., Sharma, S. and Mao, A.A (2013) New and noteworthy records of Gingers from North-east India. Keanean Journal of Science (2): 13-18
7. Roxburgh, W. (1810) Description of several of the monandrous plants of India. Asiat. Res. 11: 318-362.
8. Roxburgh, W. (1820) Flora Indica. Serampore: Mission Press.





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### RESEARCH ARTICLE

## COMPARATIVE STUDY BETWEEN SUCCINYLATED GELATIN (GELOFUSINE) VERSUS RINGER'S ACETATE REGARDING SAFETY AND EFFICACY IN ADULT PATIENTS UNDERGOING CARDIAC SURGERY.

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### Abstract

In this prospective, randomized, double-blinded study 60 adult patients underwent cardiac surgery with CPB were randomly assigned to receive either succinylated gelatin or Ringer's acetate as priming and perioperative maintenance. We found that the dose of the study solution was significantly less in gelofusine group. The pH level, the BE values, coagulation parameters and hematological parameters showed significant changes in the gelatin group. We concluded that: Succinylated gelatin is more effective plasma expander than Ringer's acetate but with worse outcome regarding the acid base balance and coagulation parameters.

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### Introduction:-

Within the human body, fluid homeostasis is a result of complex interactions between different compartments and barriers and the prerequisite of hemodynamic stability. <sup>(1)</sup> Severe intravascular hypovolemia results in a decreased cardiac output, tissue hypoperfusion and organ dysfunction. <sup>(2, 3)</sup> Therefore, perioperative fluid management should avoid these complications via replacing blood and fluid losses as adequately as possible. However, debates regarding the adequate type, amount and composition of fluids are ongoing. <sup>(2, 4, 5)</sup> Colloids are often added to solutions used for volume replacement to keep a colloidal osmotic pressure in the intravascular compartment, <sup>(6)</sup> they are now recommended as an alternative to crystalloids in several resuscitation guidelines <sup>(7)</sup>, but still controversially discussed. <sup>(8)</sup> Colloids can be classified into natural (e.g. albumin) and synthetic colloids (e.g. dextran, hydroxyethyl starch (HES) or succinylated gelatin) <sup>(6)</sup>. Colloids have a smaller volume of distribution than crystalloids; therefore, fewer amounts of fluid are needed to restore intravascular volume, <sup>(9)</sup> they also have been shown to improve oxygen transport, tissue oxygenation, and cardiac output. <sup>(10)</sup> Colloids have been used after cardiac surgery due to their ability to maintain intravascular volume and regional tissue perfusion more efficiently than crystalloids, <sup>(11-12)</sup> however all intravenous fluids produce dilutional coagulopathy and colloids interact with the coagulation System <sup>(13)</sup>. Gelatins can impair coagulation <sup>(14)</sup> and affect platelet aggregation. <sup>(15)</sup> On the other hand, Ringer's solution does not disturb coagulation <sup>(16)</sup> and can be used for fluid therapy in patients with coagulation disorders. No differences in mortality among critically ill patients had been demonstrated after the use of different colloids or crystalloids. <sup>(17)</sup> Cardiopulmonary bypass (CPB) causes a strong activation of the haemostatic system with increasing the risk of postoperative bleeding. <sup>(18)</sup> Previously, Wilkes and colleagues <sup>(19)</sup> showed that the use of HES solutions (HES 450/0.7 and HES 200/0.5) after CPB predisposed patients to increased blood loss. Results of many studies support an evidence-based recommendation for the avoidance or cautious use of HES solutions in patients undergoing surgery with CPB. <sup>(20)</sup> Studies showed that, chloride containing solutions produce hyperchloremia proportional to



their chloride content which persists for at least 6 hours.<sup>(21)</sup> The use of newer preparations of balanced colloids results in less impairment of acid base status and is considered to be a promising strategy to avoid metabolic acidosis associated with colloids suspended in 0.9% saline.<sup>(22)</sup> Hyperchloremia is evident to suppress renin activity in humans.<sup>(21)</sup>

### Patient & Methods:-

After the approval of the institutional review board and the Ethics Committee of Al Fayoum University, written informed consent from 60 patients scheduled for cardiac surgery were obtained.

#### Inclusion criteria:-

Male and female adult patients age from 20 to 55 years old underwent elective cardiac surgery with cardiopulmonary bypass with an expected time of CPB between 30 minutes and 3.5 hours. **Exclusion criteria;** included a history of cardiac surgery, severe congestive heart failure (ejection fraction  $\leq 25\%$ ), hemoglobin concentration  $\leq 10$  g/dL before study, a known allergy to gelatins, renal insufficiency (serum creatinine of  $\geq 2.5$  mg/dL), significant hepatic disease (liver function tests  $\geq 3^{\text{red}}$  upper limit of normal), or a history of coagulation disorders.

This study included two groups: **Group A:** 30 adult patients - age from 20 to 55 years old - who received Ringer's acetate solution. **Group B:** 30 adult patients- age from 20 to 55 years old – who received modified gelatin solution. Preoperative cardiac medications were continued until the morning of surgery, except for angiotensin-converting enzyme inhibitors and angiotensin II antagonists were discontinued at morning of surgery. Acetylsalicylic acid was discontinued 5 days before surgery.

#### Anesthesia:-

All patients were pre-medicated with IV. midazolam (0.1 mg/kg), Anesthesia was induced with propofol (1.0-1.5 mg/kg), fentanyl (3-10  $\mu\text{g/kg}$ ), and pancuronium bromide (0.1 mg/kg), Then Patients were intubated with an oral endotracheal tube and ventilated with a minute volume of 80-100 ml/kg/min. to achieve a target alveolar partial carbon dioxide pressure between 35 and 40 mmHg. Arterial cannula and central venous line were inserted. Heart rate, ECG, invasive arterial blood pressure, central venous pressure and nasopharyngeal temperature were continuously measured. A bladder catheter was inserted to monitor urine output during and after the operation. Anesthesia was maintained with isoflurane 0.5-1.5 MAC till cardiopulmonary bypass, then maintained with propofol (50-100  $\mu\text{g/kg/min}$ ), incremental doses- if needed-of fentanyl & pancuronium during CPB.

#### Anticoagulation and Cardiopulmonary Bypass:-

Anticoagulation was established, while the aortic purse-string sutures are placed before cannulation, with an initial bolus 300-400 IU/kg BW of heparin sodium to get activated clotting time (ACT) higher than 480 sec. Additional heparin - if needed – was administrated to maintain ACT higher than 480 sec during the whole procedure. The cardiopulmonary bypass circuit was prepared as following:

- For group A: 1,500mL of Ringer's acetate + 0.5 g/kg mannitol.
- For group B: 1000mL of gelofusine solution +500 ml Ringer's acetate + 0.5 g/kg mannitol.

After anticoagulation with heparin (300 IU/kg), cardiopulmonary bypass was performed using a non-pulsatile blood flow at 2.5 L/min/m<sup>2</sup>, a non-heparin-coated circuit, and a membrane oxygenator (Quadrox, Maquet, Hirrlingen, Germany; Dideco Compactflow, Mirandola, Italy; or Hilite 7000, Medos, Stollberg, Germany). Mild-to-moderate hypothermia was induced (28°-32°C) and norepinephrine was given to maintain a mean arterial pressure  $\geq 60$  mmHg. St Thomas crystalloid cardioplegic solution (Hamburg) was used for myocardial preservation. Randomization was performed using envelop method. The anesthetist, who collected the data, was blinded with the study solutions. Fluid infusion was adjusted individually for each patient to achieve hemodynamic stability, which is defined as a systolic blood pressure  $>90$  mmHg and avoidance of decrease of systolic blood pressure  $>20\%$  from baseline, a heart rate  $<100$  beats/min and avoidance of an increase in heart rate of 30% from baseline, normal central venous pressure 5-12 mmHg and urine output  $>0.5\text{mL/kg/h}$ , using a maximum study solution dose of 50 ml/kg. If additional volume was needed Ringer acetate solution was given. The use of sodium bicarbonate was only allowed if arterial pH was  $<7.2$ . Regarding concomitant medication, the use of synthetic colloids other than the study solution was forbidden until end of surgery. Transfusion triggers for the transfusion of allogeneic red blood cells were hemoglobin concentrations of  $\leq 7.0$  g/dL (during cardiopulmonary bypass), 7.5 to 8.0 g/dL after weaning from cardiopulmonary bypass, and 8.0 to 8.5 g/dL after the end of surgery. Before weaning from CPB all patients were

rewarmed to 37°C (nasopharyngeal temperature) & heparin was neutralized with 1:1 protamine sulphate to regain normal ACT.

#### Measured parameters:-

The primary variable for assessing therapeutic equivalence was the volume of the study solution in milliliters needed for hemodynamic stabilization until 1 hour after the end of surgery (i.e., the cumulative volume of the study solution in milliliters administered up to this time point). Therapeutic equivalence regarding the primary variable was defined as the treatment difference  $\leq 500\text{mL}$  in the amount of the study solution. Consecutive variables analyzed were arterial pH & base excess at the end of surgery. Arterial pH was measured at each time point from the induction of anesthesia to 1 hour after arrival in the intensive care unit (ICU) (including: room air, after induction, on bypass, before weaning from bypass, after bypass is off, before end of surgery, and after arrival to the ICU samples). In addition, base excess values were measured at the same time points as arterial pH. All blood gas analysis samples were measured at 37°C. Secondary parameters were hemodynamic parameters, fluid balance, and concomitant vasoactive medications. Safety parameters were coagulation variables (platelet count, prothrombin time, prothrombin concentration, and INR), hematology parameters (hemoglobin and hematocrit) clinical chemistry parameters (creatinine, urea, AST and ALT), serum electrolytes (Na & K), and adverse events, safety parameters were measured preoperative as a baseline & one hour after end of surgery.

#### Statistical Analysis:-

Data was collected and coded to facilitate data manipulation and double entered into Microsoft Access and data analysis was performed using SPSS software version 18 under windows 7. Simple descriptive analysis in the form of numbers and percentages for qualitative data, and arithmetic means as central tendency measurement, standard deviations as measure of dispersion for quantitative parametric data, and inferential statistic test: **For quantitative parametric data:** In-dependent **student t-Test** used to compare measures of two independent groups of quantitative data. **Paired t-test** used in comparing two dependent quantitative data. **For quantitative non parametric data:** Non Paired variables; Mann-Whitney test used in comparing two independent groups. Paired variables; Wilcoxon test used in comparing two groups of dependant data. **For qualitative data:** **Chi square** test to compare two of more than two qualitative groups. The level  $P \leq 0.05$  was considered the cut-off value for significance. The sample size was calculated according to Epi Info 2000. Using a special formula based on the lowest reported values of different study outcomes; at a confidence interval of 95%, alpha error 0.05, beta error 0.1 and 90% power of study.

#### Results:-

The demographic data, type of surgery and the operative details showed no significant difference between the two groups (table 1), (table 2) and table (3).

**Table 1:-** Comparisons of age, and weight in different study groups:

Variables	Group A (n=30)		Group B (n=30)		p-value	Sig.
	Mean	SD	Mean	SD		
Age (years)	41.6	9.7	43.3	9.4	0.5	NS
Weight (kg)	76.1	8.6	74.7	9.4	0.5	NS

NS = no statistically significant difference. Group A = Ringer's acetate, Group B = succinylated gelatin

**Table 2:-** Comparisons of gender and type of operation in different study groups:

Variables	Group A (n=30)		Group B (n=30)		p-value	Sig.
	No.	%	No.	%		
Sex						
Male	20	66.7%	15	50%	0.3	NS
Female	10	33.3%	15	50%		
Type of operation						
Valvular	20	66.7%	16	53.3%	0.4	NS
CABAG	10	33.3%	14	46.7%		

**Table 3:-** Comparisons of operation data in different study groups:

Variables	Group A (n=30)		Group B (n=30)		p-value	Sig.
	Mean	SD	Mean	SD		
EF%	68.3	5.3	67.4	5.6	0.6	NS
Duration of surgery (hrs)	5	0.41	5.1	0.47	0.9	NS
Cardiopulmonary bypass time (min)	110.2	22.8	107.4	17.8	0.6	NS
Cross clamp time (min)	74.4	11.7	73.5	13.5	0.8	NS

The dose of the study solution was highly significant between the two groups (in group A -Ringer's acetate-:  $3700 \pm 427.5$  ml in group B -gelofusine group-:  $2365.3 \pm 100.8$  with p value  $<0.001$ ). It is noted that there was no need for additional solution in group B (gelofusine group), on the other hand in group A (Ringer's acetate) almost all cases needed additional solution ( $453.3 \pm 366.9$  ml.). Also the total amount of solution needed was highly significant between the two groups (in group A:  $4153.3 \pm 330.3$ , in group B  $2365.3 \pm 100.8$  with p value  $<0.001$ ) as shown in table (4)

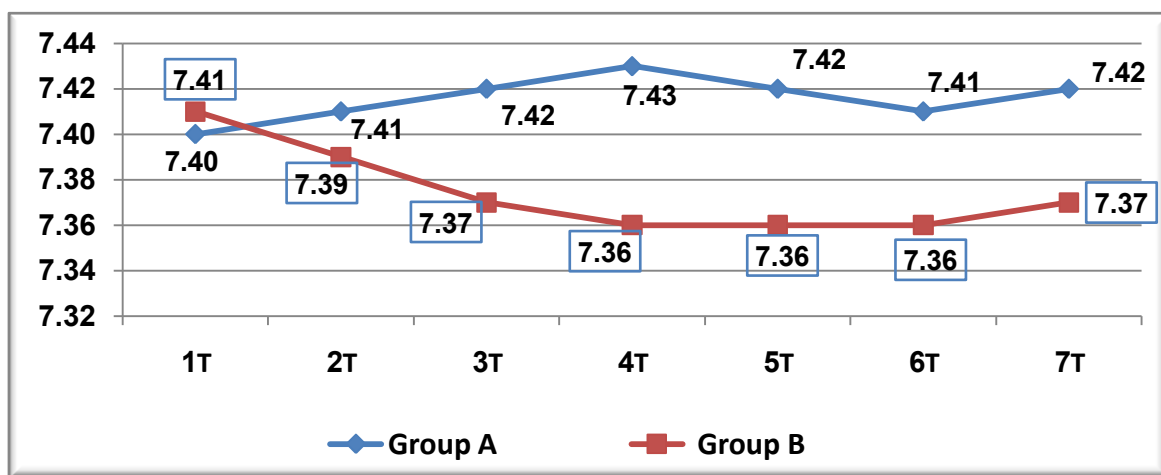
**Table 4:-** Comparisons of volume of study solutions in different study groups:

Variables	Group A (n=30)		Group B (n=30)		p-value	Sig.
	Mean	SD	Mean	SD		
Dose of study solution	3700	427.5	2365.3	100.8	$<0.001$	HS
Additional solution used	453.3	366.9	0	0	$<0.001$	HS
Total amount	4153.3	330.3	2365.3	100.8	$<0.001$	HS

HS = highly significant difference.

Regarding the PH levels, there was no significant difference between the two groups at T1 (Room air; baseline) and T2 (After induction). On the other hand from T3 to the end point of the current study there was an obvious reduction in the PH level of group B (4% succinylated gelatin), which was statistically highly significant in comparison of group A (Ringer's acetate). Figure (1) shows the time line course of the PH in different groups.

The BE also found no significant difference between the two groups at T1 and T2. On the other hand from T3 to the end point of the study, the BE values showed a highly significant difference between the two groups. In group B (4% succinylated gelatin) the BE values decreased and became at the negative side in contrast to the group A (Ringer's acetate). Figure (2) illustrates the time line course of the BE throughout the study in both groups.

**Figure 1:-** time line course of PH in different groups

T1= Room air, T2 (After induction) T3 (on bypass) T4 (before weaning) T5 (after bypass) T6 (end of surgery) T7 (at ICU)

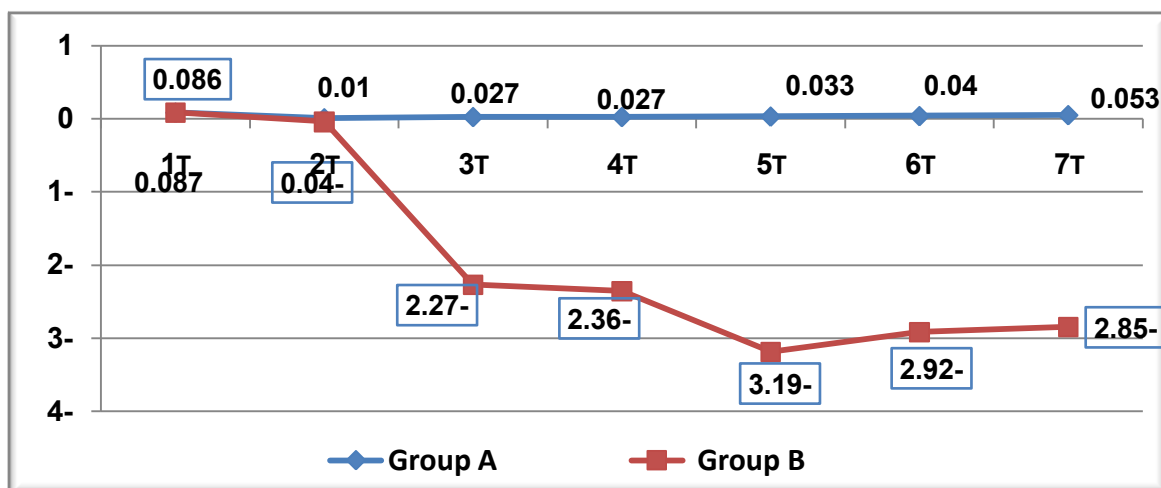


Figure 2:- time line course of BE

Apart from the CVP, the secondary variables showed no significance between the two groups as shown in tables (5) & (6)

Table 5:- Comparisons of secondary variables at end of surgery in different study groups:

Variables	Group A (n=30)		Group B (n=30)		p-value	Sig.
	Median	IQR	Median	IQR		
Hear rate	90	5(85-90)	90	10(80-90)	0.06	NS
CVP	6	1(5-6)	7	3(6-9)	<b>0.001</b>	<b>HS</b>

Table 6:- Comparisons of secondary variables at end of surgery in different study groups:

Variables	Group A (n=30)		Group B (n=30)		p-value	Sig.
	Mean	SD	Mean	SD		
Systolic blood pressure	120.2	7.7	119.3	7.8	0.7	NS
UOP	2.5	0.76	2.4	0.84	0.8	NS
Vasoactive drugs	0.47	0.7	0.37	0.6	0.6	NS

All safety variables including; platelet count, prothrombin time, prothrombin concentration, INR, hemoglobin, hematocrit, kidney function, liver function and serum electrolytes, showed no significant difference between the two groups when compared preoperatively, however, when comparing the safety parameters within the same group, we showed that; in group A (Ringer's acetate) (table 7) platelet count has significantly decreased after operation ( $226.9 \pm 25.8$  to  $171.4 \pm 18.4$  p-value <0.001), the prothrombin time prolonged and concentration decreased, the INR showed a significant increase after operation (with  $1.1 \pm 0.06$  preoperative vs.  $1.2 \pm 0.04$  postoperative p-value 0.02). Also, the hematological parameters; hemoglobin and hematocrit decreased significantly. Apart from the (AST), no statistical significances were recorded regarding the clinical chemistry parameters and postoperative serum potassium level significantly increased.

Table 7:- Comparisons of safety variables before and after operation among group A:

Variables	Before operation		After operation		p-value	Sig.
	Mean	SD	Mean	SD		
Coagulation profile						
Platelet count	226.9	25.8	171.4	18.4	<0.001	HS
Prothrombin time	13	0.42	13.8	0.38	0.002	HS
Prothrombin concentration	91.7	3	87.3	2.4	0.004	HS
INR	1.1	0.06	1.2	0.04	0.02	S
Hematological parameters						
Hemoglobin	12.7	0.94	10.7	0.61	<0.001	HS
HCT	37.9	2.9	32.3	1.8	<0.001	HS

Clinical chemistry parameters						
Creatinine	0.97	0.12	0.99	0.13	0.1	NS
Urea	30.8	7	31	6.9	0.06	NS
AST	17.5	5.3	27.6	5.6	<0.001	HS
ALT	15.4	2.8	15.5	3	0.4	NS
Serum electrolytes						
Na level	139.3	3.5	139.8	3.2	0.2	NS
K level	3.9	0.28	4.1	0.28	<0.001	HS

Also, the safety variables within group B (gelofusine group) showed similar changes as occurred in group A, except that there was no significance regarding the potassium level postoperatively as shown in table (8).

**Table 8:- (continued)** Comparisons of safety variables before and after operation among group B:

Variables	Before operation		After operation		p-value	Sig.
	Mean	SD	Mean	SD		
Coagulation profile						
Platelet count	221.8	23.9	149	15.7	<0.001	HS
Prothrombin time	13.1	0.41	15.2	0.46	<0.001	HS
Prothrombin concentration	91.9	2.9	79.2	2.4	<0.001	HS
INR	1.1	0.04	1.3	0.05	<0.001	HS
Hematological parameters						
Hemoglobin	12.7	0.9	9.5	0.5	<0.001	HS
HCT	38.2	2.9	28.4	1.6	<0.001	HS
Clinical chemistry parameters						
Creatinine	0.99	0.14	0.99	0.13	_____	_____
Urea	32	7.1	32	7.1	_____	_____
AST	17.7	5.2	27.7	5.1	<0.001	HS
ALT	18.1	11.2	18.1	11.2	_____	_____
Serum electrolytes						
Na level	139.9	3.2	139.8	3.1	0.7	NS
K level	3.9	0.26	3.9	0.25	0.9	NS

To find out the differences between the two groups, we compared the postoperative values of both groups (table 9). It was found that, no significant differences between the two groups regarding the clinical chemistry parameters or serum electrolytes. However, there were; significant decrease in postoperative platelet count, significant prolongation in prothrombin time, significant decrease in postoperative prothrombin concentration and significant increase in INR in group B(gelofusine group) when compared to group A (Ringer's acetate). Also, there was a significant decrease in hemoglobin concentration and hematocrit in succinylated gelatin group when compared to Ringer's acetate.

**Table 9:-** Comparisons of safety variables after operation in different study groups:

Variables	Group A (n=30)		Group B (n=30)		p-value	Sig.
	Mean	SD	Mean	SD		
Coagulation profile						
Platelet count	171.4	18.4	149.9	15.7	<0.001	HS
prothrombin time	13.7	0.38	15.2	0.46	<0.001	HS
prothrombin concentration	87.3	2.4	79.2	2.4	<0.001	HS
INR	1.2	0.04	1.3	0.05	<0.001	HS
Hematological parameters						
Hemoglobin	10.7	0.61	9.5	0.52	<0.001	HS
HCT	32.3	1.8	28.4	1.6	<0.001	HS
Clinical chemistry parameters						

Creatinine	0.99	0.14	0.99	0.14	0.9	NS
Urea	31.5	6.9	32	7.1	0.8	NS
AST	27.6	5.6	27.7	5.1	0.9	NS
ALT	18.1	11.1	18	11.2	0.9	NS
<b>Serum electrolytes</b>						
Na level	139.7	3.2	139.8	3.2	0.9	NS
K level	4.1	0.28	3.9	0.25	0.08	NS

### Discussion:-

One of the major findings in our study was the primary variable for assessing the therapeutic equivalence defined as the volume of the study solution in milliliters (including the priming); the current study denoted that gelofusine is superior to Ringer's acetate in maintaining hemodynamic stabilization with much less volume. This is met with several studies which denoted that colloids are more effective regarding their plasma expanding property than crystalloids.<sup>(9, 21)</sup> Regarding 4% succinylated gelatin (the colloid of use in this study), and being a colloid of low average molecular weight, there was a believe that it escapes the capillary pores faster than that of medium and high molecular weight can do, hence, less plasma expanding effect<sup>(23)</sup>, however several studies have described gelatins and starches as equal plasma expanders both in: animal models<sup>(24-26)</sup> and human.<sup>(20, 27)</sup> Moreover, in their study, Dileep et al.<sup>(21)</sup> have described an equal duration of plasma expansion of both 4% succinylated gelatin (gelofusine) and 6% hydroxyethyl starch (Voluven) attributing this to the fact that hydroxyethyl starch is eliminated by the cleavage action of the serum amylase, which increased four times after infusion of hydroxyethyl starch as reported by Wilkes et al.<sup>(28)</sup>

The PaCO<sub>2</sub> levels in this study were maintained by ventilation therefore, base excess (BE) and PH changes reflected any change in the non-respiratory (i.e. metabolic) state. Regarding the pH levels, there was a significant difference between the two groups from T3 to the end point of the current study. Ten cases of group B (4% succinylated gelatin) reached a PH level less than 7.35 to a maximum fall to 7.31 (i.e. metabolic acidosis). This can be attributed to the fact that gelofusine is a saline – based gelatin, it contains: 145 mmol/l sodium ion concentration, 120mmol/l chloride concentration and Succinylated Gelatin 40.0 g/l.

The PH can be calculated by using the Henderson-Hasselbalch equation  $pH = pK + \log \left( \frac{[HCO_3^-]}{(PaCO_2 \times 0.03)} \right)$ , But it does not quantify the abnormalities. Another approach was therefore introduced to eliminate the limitation above which is the Stewart approach.<sup>(29)</sup> According to Stewart, the variables that contribute to the body pH are: the strong ion difference (SID,  $\Sigma$  [strong cations] -  $\Sigma$  [strong anions]), the albumin concentration, and the PCO<sub>2</sub>.<sup>(10)</sup> From this approach we can clear that the SID is the main variable to determine the metabolic influences on the body pH, so if normal saline solution or a saline based solution is infused, an increase in chloride concentration (one of the main anions) will result, leading to a decrease in the SID and hence acidosis (the so called hyperchloremic metabolic acidosis).<sup>(10)</sup> This is met with Dileep et al.<sup>(21)</sup>, who in their Randomized, three-way crossover study, cleared an incidence of hyperchloremia in patients receiving NaCl containing solutions ( including: normal saline, Gelofusine and Voluven) with a direct relationship between the degree of hyperchloremia and the concentration of NaCl in the solutions used. Also in their study Base et al.<sup>(10)</sup> reported a significant hyperchloremia in patients infused with saline-based colloid versus non in who received a colloid in a balanced electrolyte solution. On the other hand Awad et al reported a significant hyperchloremia after 6% hydroxyethyl starch (Voluven) but not 4% succinylated gelatin (Gelofusine).<sup>(27)</sup> Hyperchloremic metabolic acidosis has been considered a benign and self limiting condition over the last few years<sup>(30)</sup> with unclear clinical impact, however recent published data suggest that there is some.<sup>(10)</sup> Noritomi et.al,<sup>(31)</sup> reported a complex metabolic acidosis in patients with severe sepsis or septic shock on ICU admission mainly due to hyperchloremia. Wilkes et al<sup>(32)</sup> in their study reported improved organ perfusion in patients who received balanced solution compared to those who received saline-based one. Also Ondiveeran and Fox-Robichaud<sup>(33)</sup> suggested that solution composition may have an impact on the immune response.

We can attribute the significant difference in the BE to the difference in the electrolyte component of each solution as mentioned above. In their study Boldt et al.<sup>(34)</sup> reported a significant decrease in BE after the use of unbalanced colloid HES in contrast to balanced HES, also Base et al.<sup>(10)</sup> reported the same finding.

The difference in CVP between both groups can be explained by the longer duration of plasma expansion of Gelofusine than Ringer's acetate. On the other hand, the urine output (UOP) and despite the different compartmental distribution of both solutions showed no significant difference between the two groups. This is met with Dileep et al.<sup>(21)</sup> who reported equal volume of UOP in healthy volunteers after loading with 1 liter of different solutions using 0.9% saline, 4% succinylated gelatin (Gelofusine) and 6% hydroxy-ethyl starch (Voluven), they attributed this to the fact that the colloids shifted fluid from the extravascular into the intravascular space.

When comparing the safety parameters within the same group, the current study showed that; in group A (Ringer's acetate) platelet count has significantly decreased after operation ( $226.9 \pm 25.8$  to  $171.4 \pm 18.4$  p-value <0.001). This finding comes in line with Olmos et al.<sup>(35)</sup> and **Tülün Öztürk** et al.<sup>(36)</sup> when assessing the effectiveness of priming the extracorporeal circulation system with albumin - mannitol combined with Ultrafiltration, Olmos et al, used a control group in which the extracorporeal circulation was primed with Ringer's lactate 1500mL, they reported a decrease in platelet count in their control group. Also **Tülün Öztürk** et al in their study about the effect of acute normovolemic hemodilution (ANH) using colloids on the coagulation parameters, they used a control group in which the extracorporeal circulation was primed with Ringer's lactate and mannitol without ANH, they reported a statistically significant decrease in the platelet count within the control group when comparing the baseline reading to that one hour after discontinuation of CPB. Moreover the literatures reported that, thrombocytopenia commonly occurs during cardiac surgery using an extracorporeal circulation due to hemodilution, sequestration and destruction by the non-endothelial surfaces.<sup>(37)</sup>

Regarding the prothrombin time and concentration within group A (Ringer's acetate) there were a significant difference when comparing the preoperative and postoperative values, the prothrombin time prolonged and concentration decreased. This comes in line with **Tülün Öztürk** et al.<sup>(36)</sup> who reported a significant prolongation of prothrombin time in their control group. Also, in the current study, the INR showed a significant increase after operation (with  $1.1 \pm 0.06$  preoperative vs.  $1.2 \pm 0.04$  postoperative p-value 0.02). In their study Olmos et al.<sup>(35)</sup> reported an increase in the INR in the control group but without intra-group analysis.

The hematological parameters within group A (Ringer's acetate) showed that hemoglobin decreased significantly (preoperative  $12.7 \pm 0.94$ , postoperative  $10.7 \pm 0.61$  p-value <0.001) and hematocrit, also decreased significantly (preoperative  $37.9 \pm 2.9$ , postoperative  $32.3 \pm 1.8$  p-value <0.001). In their study Olmos et al.<sup>(35)</sup> reported – within their control group – a decrease in hemoglobin and hematocrit but without intra-group analysis. Also, **Tülün Öztürk** et al.<sup>(36)</sup> reported a significant decrease in hemoglobin within their control group, when comparing the preoperative values to that one hour after discontinuation of CPB.

The significant increase in postoperative serum potassium level among patients of group A can be attributed to the potassium content of the solution used.

The safety variables within group B (gelofusine group) showed the same changes occurred as in group A (Ringer's acetate) except that there was no significance regarding the potassium level postoperatively, and when comparing the postoperative values of both groups, we found that, there were; significant decrease in postoperative platelet count, significant prolongation in prothrombin time, significant decrease in postoperative prothrombin concentration and significant increase in INR in group B (gelofusine group) when compared to group A (Ringer's acetate). Also, there was a significant decrease in hemoglobin concentration and hematocrit in succinylated gelatin group. This is met with Schramko et al.<sup>(38)</sup> and Nielsen VG<sup>(39)</sup> who reported that both gelatin and HES solutions decreased Hb, Hct, and PC more than Ringer's acetate. Also in their study about the effect of intravenous fluids (including; albumin, gelofusine, Haemaccel and saline) on platelet function and hemostasis in elective hip surgery, Evans et al.<sup>(40)</sup> reported that there was a significant decrease of Hb, Hct and platelet count when comparing pre and post and pre and last time points in all fluid groups with less fall in saline group. Despite disturbances of coagulation parameters, these disturbances did not cause detectable clinical changes; this is met with Schramko et al.<sup>(38)</sup> No adverse events were recorded in our study.

## Conclusion:-

In conclusion, the succinylated gelatin is more effective plasma expander and gets more hemodynamic stability than Ringer's acetate. However it has worse outcome regarding the acid base balance and coagulation parameters (Despite no detectable clinical changes). The safety regarding kidney and liver functions and serum electrolytes was comparable between the two groups.

We recommend further studies about balanced Succinylated gelatin (e.g. ISOPLEX 4% W/V SOLUTION FOR INFUSION) produced by Beacon Pharmaceuticals U.K. containing Na 145mmol, K 4mmol, chloride 105mmol, magnesium 0.9mmol and lactate 25mmol, with osmolarity of 284mosm/l and MW 30,000 Daltons.

### References:-

1. De Leeuw PW, Dees A: Fluid homeostasis in chronic obstructive lung disease. *Eur Respir J Suppl* 2003, 46:33s-40s.
2. Chappell D, Jacob M, Hofmann-Kiefer K, et al: A rational approach to perioperative fluid management. *Anesthesiology* 2008, 109:723-740.
3. Holte K, Kehlet H: Fluid therapy and surgical outcomes in elective surgery: a need for reassessment in fast-track surgery. *J Am Coll Surg* 2006, 202:971-989.
4. Brunkhorst FM, Engel C, Bloos F, et al: Intensive insulin therapy and pentastarch resuscitation in severe sepsis. *N Engl J Med* 2008, 358:125-139.
5. Hartog CS, Bauer M, Reinhart K: The efficacy and safety of colloid resuscitation in the critically ill. *Anesth Analg* 2011, 112:156-164.
6. Mitra S, Khandelwal P: Are all colloids same? How to select the right colloid? *Indian J Anaesth* 2009, 53: 592–607.
7. Perel P, Roberts I: Colloids versus crystalloids for fluid resuscitation in critically ill patients. 2012, *Cochrane Database Syst. Rev* 6: CD000567.
8. Levi M, Jonge E: Clinical relevance of the effects of plasma expanders on coagulation. *Semin Thromb Hemost* 2007, 33: 810–815.
9. McIlroy DR, Kharasch ED: Acute intravascular volume expansion with rapidly administered crystalloid or colloid in the setting of moderate hypo-volemia. *Anesth Analg* 2003; 96:1572-1577.
10. Eva M, Base, Thomas Standl, Andrea Lassnigg, et al: Efficacy and Safety of Hydroxyethyl Starch 6% 130/0.4 in a Balanced Electrolyte Solution (Volulyte) During Cardiac Surgery *Journal of Cardiothoracic and Vascular Anesthesia*, Vol. 25, No 3 (June), 2011: pp 407-414.
11. Gallandat Huet RC, Siemons AW, Baus D, et al. A novel hydroxyethyl starch (Voluven) for effective perioperative plasma volume substitution in cardiac surgery. *Can J Anaesth* 2000; 47: 1207–15
12. Verheij J, van Lingen A, Beishuizen A, et al. Cardiac response is greater for colloid than saline fluid loading after cardiac or vascular surgery. *Intensive Care Med* 2006; 32: 1030–8
13. T. Haas, A. Preinreich, E. Oswald, W. Pajk, J. Berger, et al: Effects of albumin 5% and artificial colloids on clot formation in small infants *Anaesthesia*, 2007, 62, pages 1000–1007
14. Schramko AA, Kuitunen AH, Suojäranta-Ylinen RT, Niemi TT. Role of fibrinogen-, factor VIII- and XIII-mediated clot propagation in gelatin haemodilution. An in vitro study using thromboelastometry. *Acta Anaesthesiol Scand* 2009; 53: 731–5
15. Boldt J, Knothe C, Zickmann B, Andres P, et al: Influence of different volume therapies on platelet function in patients undergoing cardiopulmonary bypass. *Anesth Analg* 1993; 76: 1185–90
16. Saxena N, Chauhan S, and Ramesh GS: A comparison of hetastarch, albumin and Ringer lactate for volume replacement in coronary artery bypass surgery. *J Anaesth Clin Pharmacol* 1997; 13:117–20
17. Perel P, Roberts I: Colloids versus crystalloids for fluid resuscitation in critically ill patients. *Cochrane Database Syst. Rev* 2007; 17: CD000567
18. Despotis G, Avidan MS, Hogue CW. Mechanisms and attenuation of hemostatic activation during extracorporeal circulation. *Ann Thorac Surg* 2001; 72: 1821–31
19. Wilkes MM, Navickis RJ, and Sibbald WJ: Albumin versus hydroxyethyl starch in cardiopulmonary bypass surgery: a meta-analysis for postoperative bleeding. *Ann Thorac Surg* 2001; 72: 527–33
20. Roberta J. Navickis, Gary R. Haynes, and Mahlon M. Wilkes: Effect of hydroxyethyl starch on bleeding after cardiopulmonary bypass: A meta-analysis of randomized trials *J Thorac Cardiovasc Surg* 2012;144:223-30
21. Dileep N. Lobo, DM, Zeno Stanga, Mark M. Aloysius, et al: Effect of volume loading with 1 liter intravenous infusions of 0.9% saline, 4% succinylated gelatine (Gelofusine) and 6% hydroxyethyl starch (Voluven) on blood volume and endocrine responses: A randomized, three-way crossover study in healthy volunteers *Crit Care Med* 2010; 38(2): 464-70.
22. Boldt J: The balanced concept of fluid resuscitation. *Br J Anaesth* 2007; 99:312–315
23. Lamke Lo, Liljedahl SO. Plasma volume changes after infusion of various plasma expanders. *Resuscitation* 1976; 5:93-102.
24. Dubniks M, Persson J, Grande PO. Plasma volume expansion of 5% albumin, 4% gelatin, 6% HES 130/0.4, and normal saline under increased microvascular permeability in the rat. *Intensive Care Med* 2007; 33: 293–9



25. Marx G, Cobas Meyer M, Schuerholz T, et al. Hydroxyethyl starch and modified fluid gelatin maintain plasma volume in a porcine model of septic shock with capillary leakage. *Intensive Care Med* 2002; 28: 629–35
26. Persson J, Grande PO. Plasma volume expansion and transcapillary fluid exchange in skeletal muscle of albumin, dextran, gelatin, hydroxyethyl starch, and saline after trauma in the cat. *Crit Care Med* 2006; 34: 2456–62
27. S. Awad, S. Dharmavaram, C. S. Wearn, et al. Effects of an intraoperative infusion of 4% succinylated gelatine (Gelofusine) and 6% hydroxyethyl starch (Voluven) on blood volume. *British Journal of Anaesthesia* 2012; 109(2): 168-76.
28. Wilkes NJ, Woolf RL, Powanda MC, et al: Hydroxyethyl starch in balanced electrolyte solution (Hextend)—Pharmacokinetic and pharmacodynamic profiles in healthy volunteers. *Anesth Analg* 2002; 94:538–544
29. Claude G, Pascale N, Ve´ronique L, et al: Quantitative Analysis of Acid-Base Disorders in Patients with Chronic Respiratory Failure in Stable or Unstable Respiratory Condition. *Respir Care* 2010; 55(11):1453–1463
30. Scheingraber S, Rehm M, Sehmisch C, Finsterer U. Rapid saline infusion produces hyperchloremic acidosis in patients undergoing gynecologic surgery. *Anesthesiology* 1999; 90:1265–70.
31. Noritomi DT, Soriano FG, Kellum JA, et al: Metabolic acidosis in patients with severe sepsis and septic shock: A longitudinal quantitative study. *Crit Care Med* 2009; 37:2733-2739.
32. Wilkes NJ, Woolf R, Mutch M, et al: The effects of balanced versus saline-based hetastarch and crystalloid solutions on acid-base and electrolyte status and gastric mucosal perfusion in elderly surgical patients. *Anesth Analg* 2001; 93:811-816.
33. Ondiveeran HK, Fox-Robichaud AE: Pentastarch in a balanced solution reduces hepatic leukocyte recruitment in early sepsis. *Microcirculation* 2004; 11:679-687.
34. Boldt J, Mayer J, Brosch C, et al: Volume replacement with a balanced hydroxyethyl starch (HES) preparation in cardiac surgery patients. *J Cardiothorac Vasc Anesth* 2010; 24:399-407.
35. Olmos MR, Ballester JA, Arteta MT. et al: Effect of priming solution and Ultrafiltration on post-operative bleeding and blood transfusion in cardiac surgery. *Randomized controlled trial Rev Esp. Anesthesiol Reanim.* 2015; 62(2):81-89.
36. Tln ztrk, İsmet Topu, Barıř Tuncer, et al: Coagulation Effects of Hydroxyethylstarch Versus Modified Fluid Gelatin When Used as Normovolemic Hemodilution Solutions during Cardiac Surgery. *GKDA Derg* 2014, 20(3):141-148.
37. Linda SL, Liza JE, Kaplan JA. Coagulation Monitoring, In: KAPLAN'S CARDIAC ANESTHESIA: THE ECHO ERA, 6<sup>th</sup> ed. Philadelphia: Saunders Elsevier, 2011:496-519.
38. Schramko A, Suojaranta-Ylinen R, Kuitunen A. et al. Hydroxyethylstarch and gelatin solutions impair blood coagulation after cardiac surgery: a prospective randomized trial *Br J Anaesth* 2010; 104(6):691-7
39. Nielsen VG. Hemodilution modulates the time of onset and rate of fibrinolysis in human and rabbit plasma. *J Heart Lung Transplant* 2006; 25: 1344–52
40. Evans PA, Heptinstall S, Crowhurst EC, et al. Prospective double-blind randomized study of the effect of four intravenous fluids on platelet function and hemostasis in elective hip surgery. *J Thromb Haemost* 2003; 1: 2140-8.



### RESEARCH ARTICLE

#### EFFECT OF BACKGROUND PLASMA UPON PLASMA STRUCTURE FIRED FROM A PLASMA GUN

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#### Abstract

Plasma gun is a very effective source to fire plasma structures and has a wide range of applications in optimization of plasma parameters of the plasma structure fired from plasma gun is an important field of research. The effect of background plasma upon plasma structure fired from a plasma gun is reported in this communication. It is observed that in the presence of background plasma both electron density and electron temperature of plasma structure is modified.

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#### Introduction:-

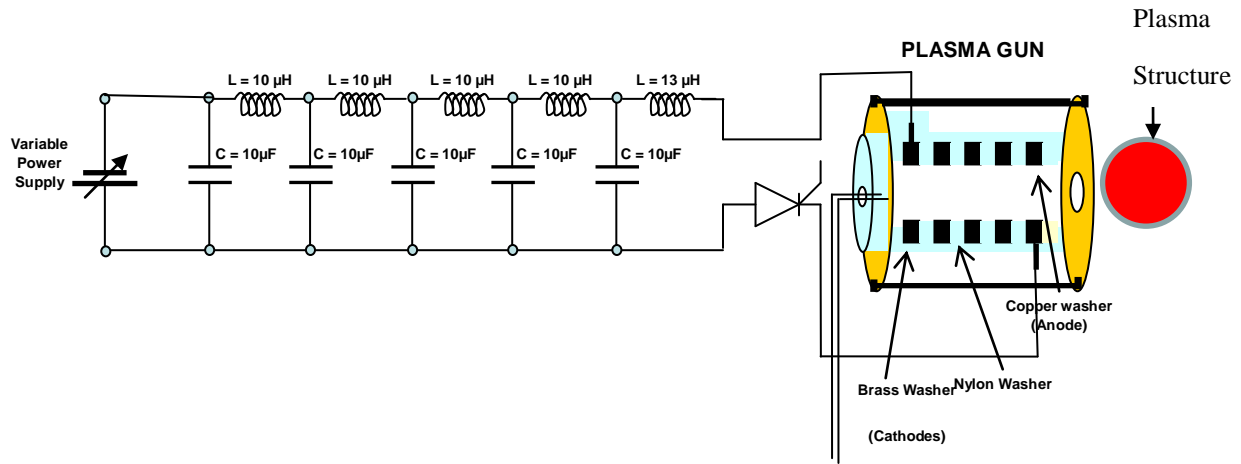
Plasma guns have a wide range of applications in plasma physics and controlled fusion research. They provide high density plasmas for ion extraction [1]. They supply the target plasma in mirror experiments [2] and also help in the initiation of toroidal discharges [3]. They are widely used to accelerate pellets for fuelling fusion devices [4]. A variety of plasma guns have been developed and are in use since last half a century [5-14]. Optimization of plasma parameters in the structure fired from a plasma gun is an interesting field of research even today. Effect of another plasma source to fuel plasma structure fired from a plasma gun in worth discussing.

#### Experimental:-

The plasma gun used in this experiment consists of washer shaped electrodes which are made up of metal/alloys. Copper washer is used as anode and brass washer is used as cathode. In between the electrodes floating brass washers are stacked. The gas feed network injects desired gaseous substance into gun body to make it operational. Argon gas is used in this experiment. The gun is energized by a pulse forming network, which produces square wave pulse of 140  $\mu$ s. The schematic diagram of plasma gun and allied circuit is shown in figure 1. An electromagnetic valve is used to inject gas into the gun from backside (cathode side). A low voltage capacitor bank was fired through a thyatron to generate a magnetic field in the vicinity of the mild steel piece and the resultant magnetization of the mild steel piece lifts the piston to allow the opening of the orifice and entry of the gas into the plasma gun.

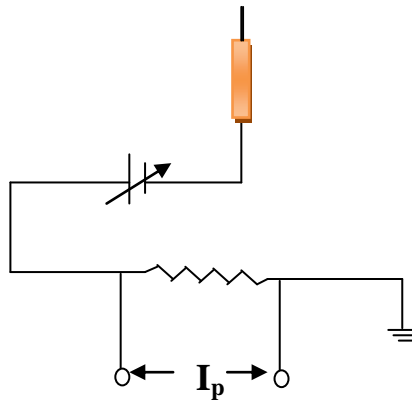
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**Figure 1:-** Schematic diagram of plasma gun and allied circuit.

A background plasma set up is created [15] in the CPS device [16]. The effect of background plasma upon plasma parameters of the plasma structure fired from plasma gun is studied by means of different diagnostic tools. Langmuir probe is simple to fabricate, and is a very effective diagnostic tool to measure plasma parameters [17-18]. The biasing scheme of Langmuir probe is shown in figure 2. A piece of ceramic tube holds the tungsten probe/probes connected with copper wire/wires. Teflon pipe and tapes are used as insulation and holding material. These materials (tungsten, ceramic, teflon etc.) are able to withstand high temperature and are vacuum compatible. Ceramic is also resistant to sputtering and is an insulator.



**Figure 2:-** Langmuir probe biasing scheme

### Results and Discussion:-

Electron density of plasma is measured using Langmuir probe. If  $I_{sat}$  is the electron current flowing through the circuit when probe is maintained at plasma potential and lower than floating potential then,

$$I = I_{sat} \exp(-eV_p/kT) \quad (1)$$

Where  $T$ ,  $V_p$ ,  $k$  are the electron temperature, probe potential and Boltzmann Constant respectively.

$$V_p = V_a - V_s$$

$I_{sat}$  in terms of electron density is given by,

$$I_{sat} = A_p e n_e v = A_p e n_e (kT/2m)^{1/2}$$

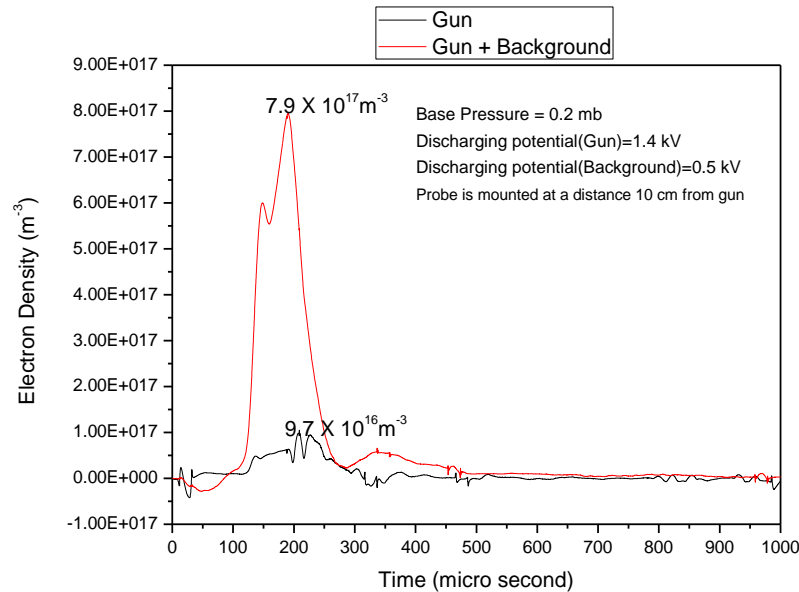
Where  $A_p$ ,  $e$ ,  $n_e$ ,  $v$ , and  $m$  are the area of the probe, charge associated with an electron density, mean thermal velocity and mass of the electron respectively. Electron temperature is measured from the slope of  $I \sim V$  curve.

The electron density is

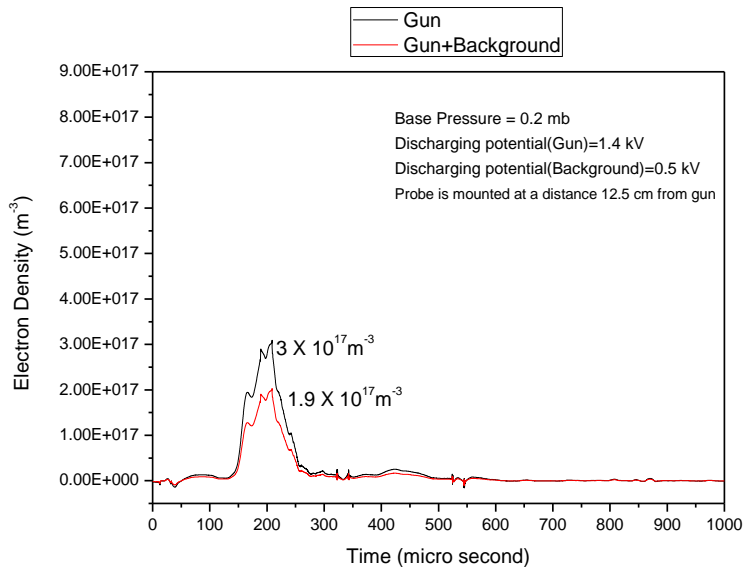
$$n_e = (I_{sat}/A_p)(2\pi m_e/e^3)^{1/2} (e/kT_e)^{1/2} \quad (2)$$

Where,  $A_p = \pi r^2 + 2\pi r l$  = Area of the probe,  $r$  and  $l$  are the radius and exposed length of the probe.

The electron density of plasma fired from the plasma gun is found to be  $9.7 \times 10^{16} \text{ m}^{-3}$  at discharging potential 1.4 kV and ambient pressure 0.2 mb. The electron temperature is  $\sim 1 \text{ eV}$ . The probe is placed at 10 cm and 12.5 cm respectively from the plasma gun. When the background plasma system is turned on and plasma is fired from the gun across the background plasma, the peak electron density becomes  $7.9 \times 10^{17} \text{ m}^{-3}$  at a distance 10 cm from plasma gun, where the background plasma exists. The electron density of back ground plasma is  $10^{13} \text{ m}^{-3}$  for discharging potential 0.5 kV [15]. The background plasma extends from 8 cm from plasma gun to 12 cm, as the parallel plate used in back ground plasma is around 4 cm wide. On the other hand at a distance 12.5 cm from plasma gun where the periphery of background plasma region exists, the electron density of plasma is found to be  $1.9 \times 10^{17} \text{ m}^{-3}$ . The electron density profiles of plasma in the absence and presence of background plasma is shown in figures 4 and 5 respectively.



**Figure 3:-** Electron density profile of argon plasma at a distance 10 cm from plasma gun



**Figure 4:-** Electron density profile of argon plasma at a distance 12.5 cm from plasma gun

Image of plasma structure gives a lot of information [19]. The image of background plasma is shown in figure 5 and the image of plasma fired from plasma gun in the presence of background plasma is shown in figure 6. The plasma structure inside background plasma region becomes more intense, which is evident from the images. The density of plasma structure increases, being fueled by background plasma, ten times as shown in figure 3. So, external plasma near gun mouth will enhance the plasma density and this will be very helpful for the experimenters using plasma guns in fusion devices. Parallel plate type as well as filament plasma can be used as external plasma source for a plasma gun, for its optimization.



**Figure 5:-** Image of background plasma



**Figure 6:-** Image of plasma from plasma gun in the presence of background plasma.

### **Conclusion:-**

Background plasma enhances plasma density of the structure fired from plasma gun. The electron density of plasma structure increases ten times, when fueled by background plasma of density thousand times less than that of plasma produced from plasma gun. The electron temperature is modified in the presence of back ground plasma. External plasma source will enhances the parameters of the plasma structure from plasma gun for fusion devices.

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**References:-**

1. M. Dembinski, P. K. John and A. G. Ponomarenko *Appl. Phys. Lett.* **34**, 553 (1979).
2. F. H. Coensgen *et al. Phys. Rev. Lett.* **37**, 143 (1976).
3. R. Prater, R. Lattaye, S. Wong, S. Ejima, C. Moeller and P. Peterson *EPRI Report ER-215* (1976).
4. T. H. Buller, R. J. Turnbull and K. Kim, *Appl. Phys. Lett.* **34**, 7268 (1979).
5. M. Alidieres, R. Aymar, Ph. Jourdan, F. Koechlin and A. Samain, *Phys. Fluids* Vol. **6**, 407 (1963).
6. J. F. Steinhaus, N. L. Oleson and W. L. Barr, *Phys Fluids* **8**, 1720 (1965).
7. H. Himura, Y. Saito, A. Sanpei, S. Masamune, N. Takeuchi and T. Shiono, *Rev. Sci. Instrum.* **77**, 073506 (2006).
8. A. V. Voronin and K. G. Hellblom, *Plasma Phys. and Controlled Fusion* vol. **41**, 293 (1999).
9. P. F. Little and B. E. Avis, *J. Nucl. Energy, Part C, Plasma Phys* **8**, 11 (1966).
10. Dah. Yu Cheng, *Nucl. Fusion* vol. **10**, 305 (1970).
11. T. Asai, H. Itagaki, H. Numasawa, Y. Terashima, Y. Hirano and A. Hirose, *Rev. Sci. Instrum.* **81**, 10E119: 1 (2010).
12. A. BenAmar Baranga, A. Fisher and D. Tzach, *Rev. Sci. Instrum.* **56**, 1472 (1985).
13. K. K. Jain, P. I. John, A. M. Punithavelu and P. P. Rao, *J. Phys. E: Sci. Instrum.* **13**, 928 (1980).
14. J. E. Osher, *Rev. Sci. Instrum.* **53**, 1685 (1982).
15. S. Samantaray, R. Paikaray, G. Sahoo, P. Das and J. Ghosh, *Res. J. Phys. Sciences*, **3** (6), 10, (2015).
16. G. Sahoo *et al.*, *Applied Mechanics and materials*, **278-280**, 90 (2013).
17. F. F. Chen, "Electrostatic Probes in Plasma Diagnostic Techniques" ed R H . Huddleston and S. L. Leonard (Academic Press), (1965).
18. I. H. Hutchinson, "Principle of Plasma Diagnostics", Cambridge University Press, (1987).
19. G. Sahoo, R. Paikaray and S. Samantaray, *International Journal of Advanced Research*, **2**(11), 438 (2014)



## RESEARCH ARTICLE

### IMMUNOHISTOCHEMICAL EXPRESSION OF GLUT-1 IN EPITHELIAL OVARIAN TUMORS: CORRELATION WITH THE CLINICOPATHOLOGICAL FACTORS AND TUMOR PROLIFERATIVE MARKER PCNA.

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Immunohistochemical, Glut-1, PCNA, ovarian epithelial tumors, clinicopathological factors.

#### Abstract

**Background:** Ovarian carcinomas are frequently diagnosed at advanced-stage due to lack of distinct symptoms and reliable procedure for early detection. The applying of immunohistochemistry has become an important tool improving the prognosis of patients with ovarian carcinomas. **Aim:** To assess the expression of Glut-1 in epithelial ovarian tumors and study its correlation with PCNA to detect their usefulness in the diagnosis and prognosis of such tumors. **Methods:** Glut-1 immunoexpression was analyzed and correlated with PCNA in 45 epithelial ovarian tumors (7 benign, 10 borderline and 28 malignant tumors). **Results:** Glut-1 was expressed in 80% and 92.85% of the studied borderline and invasive carcinomas respectively, but not expressed in any benign tumors. These differences in Glut-1 expression among the benign, borderline and malignant cases, were statistically significant ( $p = 0.000$ ). Analysis of Glut-1 immunoexpression with the clinicopathological criteria of ovarian carcinomas revealed that Glut-1 expression is more significantly expressed in high grade carcinoma and in tumors with an advanced FIGO stage ( $p = 0.043$  and  $p = 0.005$  respectively). Glut-1 was more significantly expressed in lymph node metastases positive group and in those with intraperitoneal implants ( $p = 0.011$  and  $0.016$  respectively). There was a strong positive significant correlation between Glut-1 and PCNA among the studied 45 ovarian tumors (Spearman correlation ( $r$ ) = 0.603,  $p$  value = 0.000). **Conclusion:** Glut-1 can increase the diagnostic accuracy of ovarian tumors by help in differentiating between benign, borderline and malignant tumors. Glut-1 correlated with poor prognostic factors and can be used with PCNA as prognostic markers for epithelial ovarian tumors.

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#### Introduction:-

In Egypt, tumors of the reproductive organs account for 4% of the overall malignancies in females and ovarian malignancies constituted about 1.4% of them [1]. Ovarian carcinomas are frequently diagnosed at advanced-stage due to lack of distinct symptoms and lack of reliable procedure for early detection [2]. Epithelial ovarian tumors

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constitute the majority of ovarian tumors [3] WHO classified ovarian surface epithelial tumors histologically into: serous, mucinous, transitional cell, endometrioid, clear cell, mixed, squamous, and undifferentiated subtypes [4].

Many clinicopathological variables are considered to be of great importance in determining the prognosis of patients with ovarian carcinoma, including tumor staging, histological typing, presence of ascites positive for malignancy, residual tumor mass, and the chemoresponsiveness of the tumor cells [5]. Beside these well-known clinical prognostic factors, the applying and usage of molecular techniques is more accurately related to the intrinsic behavior of the tumors and the pathway of carcinogenesis and may be supportive in improving the prognosis of patients with ovarian carcinomas [6].

There have been significant advances in understanding ovarian carcinoma based on immunohistochemistry and molecular analysis [7]. Immunohistochemistry has become an important tool not only in the diagnosis of ovarian tumors, but also represent markers of prognostic significance[8].Most of the identified tumor markers in ovarian epithelial tumors have not shown satisfactory sensitivity and specificity. Therefore, new candidate markers are needed that can be used to improve the diagnostic accuracy of the screening strategies [9].

The cells of the tumors show a considerable increase in the metabolism of glucose in contrast to the normal tissue. This great increase in the demand of glucose by tumor cells signifying a need for a corresponding enhancement glucose transport through the cellular membrane [10]. The active passage of glucose through the membrane of the cell is controlled via a group of proteins named glucose transporters, they are 14 types (from Glut 1 to Glu-14). They show variable differences in the affinity for glucose, tissue allocation and physiological control [11].

The glucose transporter-1 (Glut-1), is normally expressed and detected by immunohistochemical staining in the membranes of red blood cells (RBCs), endothelium of the capillary of the brain and the perineurium of the peripheral nerves [12]. The Glut-1 is up regulated in situations with decreased oxygen concentrations and hypoxia [13]. Moreover, Glut-1 is accompanied by a rise in the expression of many proteins that have the ability to help the survival of cellular tumor in the adverse microenvironment and enhance the metabolism of glucose [14]. Tumors that overexpress Glut-1 tend to show better and complete response to chemotherapy. So, Glut-1 may be regarded as an independent factor of prognosis that can predict the response of the patient to treatment with chemotherapy, it addition to its early diagnostic role [15]. There has been a great attention to find a link between the expression of Glut-1 in epithelial neoplasms, and the association of Glut-1 expression with the carcinogenesis and patient prognosis in ovarian tumors [16]. However, many researches have detected an association between the expression of Glut-1 and neoplastic progression, development, and the bad outcome of many neoplasms [17, 18].

Detection of proliferating cells by immunohistochemistry is a method to determine the proliferative potential of a tumor[19].Proliferating Cell Nuclear Antigen (PCNA) is a protein cofactor of DNA polymerase that is expressed in the cell cycle during the replication of the DNA and often regarded as an index of cell proliferation.Ki67 is thought to be a more expressive marker of proliferation than PCNA, and as result of that PCNA was less routinely utilized [20]. Interestingly, many researches that have studied the expression of both proliferative markers (Ki67 and PCNA) in the same patient group reported a concordant score with the use of both markers [6, 21, and 22]. This signifies that the usefulness of cellular proliferative markers and the prognosis of cases is more dependent on the selected group of cases rather than the proliferative marker used [20].

The aim of the present work was to assess the immunohistochemical expression of Glut-1in epithelial ovarian tumors and studyits correlation with tumor proliferative marker PCNA and other clinicopathological factors of ovarian carcinomas to detect the usefulness of Glut-1 expression in the diagnosis and prognosis of ovarian epithelial tumors.

## **Material And Methods:-**

### **Patients and clinical data:-**

The present study was performed at the Departments of Pathology, Obstetrics and Gynecology, and Surgery, Zagazig University Hospital, Egypt in the period from May 2015 to November 2016. The study included 7 patients with benign tumors, 10 patients with borderline tumors and 28 patients with malignant tumors. Complete surgical staging that includes total abdominal hysterectomy, bilateral salpingo-oophorectomy, omentectomy, peritoneal washing with cytology and appendectomy for mucinous neoplasms was performed. Conservative surgery that includes either (ophorectomy, unilateral salpingo-oophorectomy or cystectomy) was performed for young aged



patients with apparently benign neoplasm by radiological and clinical data and patients with stage I (with no peritoneal implants) borderline neoplasm who wish to preserve their fertility. For patients with advanced stage disease, cytoreductive surgery was performed.

We collected the clinical and pathological information from the medical records of the patients. All the patients did not receive chemotherapy or radiation prior to the surgical interference. Tumors were staged according to the FIGO (The International Federation of Gynecology and Obstetrics staging system) [23]. Histological typing and grading have followed the World Health Organization classification (WHO) criteria [4]. The ethical committee of Zagazig University approved this study and all patients wrote a consent of agreement prior to their inclusion in this study. All tissue samples were formalin-fixed and paraffin-embedded, the blocks were cut at 4-5 microns and stained with ordinary H&E stain to diagnosis and grade the tumors.

#### **Immunohistochemical staining:-**

The sections (4–5  $\mu$ m) cut from the corresponding tissue sample blocks were deparaffinized with xylene, placed in graded alcohols for rehydration, and deposited in 0.5% hydrogen peroxide in methanol for 10 min to stop endogenous peroxidase activity. Antigen retrieval was achieved by keeping in 0.01 M citrate buffer (pH 6.0) for 5 minutes in a pressure cooker. The primary antibodies were added to the sections at room temperature for 60 min. Then strept avidin-biotin-peroxidase complex technique was applied for Glut-1 (Rabbit Polyclonal Antibody, Dilution 1:200, catalog no. PA1-1063 Thermo Fisher Scientific/Lab Vision Corporation, Rockford, USA.) and PCNA (Mouse monoclonal antibody, clone PC10, Dilution 1:50, catalog no. MA5-11358, Thermo Fisher Scientific/Lab Vision Corporation, Rockford, USA.) by utilizing diaminobenzidine (DAB) as the chromogen. RBCs were used as internal positive control for Glut-1 and breast carcinoma were used as positive control for PCNA. Negative controls for both markers were performed by excluding the primary antibody.

#### **Evaluation of immunohistochemical staining:-**

Glut-1 expression was considered positive only if membrane staining is present. The expression was semi-quantitatively evaluated by analyzing the intensity and the percentage of stained cells. The intensity was scored as 0 (negative), 1+ (weak), 2+ (moderate), and 3+ (strong). A combined score depending on the intensity of staining and the proportion of stained cells was applied as the final score as follow: Low expression was defined as an intensity of 1, 2, or 3 and < 10% stained cells or an intensity of 1 and < 50% stained cells; and high expression was defined as an intensity of 2 or 3 and > 10% stained cells or an intensity of 1, 2, or 3 and > 50% stained cells [24]. Finally for statistical evaluations we have 3 groups, negative, low expression and high expression groups.

PCNA was considered positive if there was any brown nuclear staining present. To assess proliferation, the PCNA labelling index (PCNA LI), was calculated following the previously described method by Ino et al. [6]. The PCNA LI was defined as the number of tumor cells with nuclear PCNA immunostaining divided by the total number of tumor cells, and expressed as a percentage. A total of 1000 nuclei in the selected area were counted under a light microscope at high magnification (X 400 fields) and the mean percentages were recorded as the PCNA LI. For statistical evaluation, tumors with a PCNA LI  $\geq$  50, were considered as high proliferative index group, while cases with a PCNA LI of < 50 were defined as low proliferative index group.

#### **Statistics:-**

The results from the continuous variables analysis were expressed as a means  $\pm$  standard deviation (SD). Categorical data analysis was performed using the  $\chi^2$  or Fisher's exact test, spearman correlation was done to detect and measure the correlation between Glut-1 and PCNA. The statistical analyses were done using SPSS software (version 19.0; SPSS, Chicago, IL) and  $P \leq 0.05$  was regarded as indicator of a statistically significant difference.

#### **Results:-**

##### **Clinicopathological results:-**

The mean age of the studied 45 ovarian tumor patients at initial surgery was  $53.16 \pm 12.01$  years (range 23- 72 years). Among these 45 patients, 7 (15.55%) cases were benign cystadenomas, 10 (22.22%) cases were borderline, and 28 (62.22%) cases were malignant (invasive) carcinoma. Serous type was the predominant histological type (62.22%, 28/45) among all the studied benign, borderline and malignant tumors (Fig. 1). Grading of the studied 28 ovarian carcinomas according to WHO grading system revealed that G1 was the most frequent grade of the studied ovarian carcinoma (53.57%, 15/28), while staging of ovarian carcinomas according to FIGO staging system revealed that the majority of carcinomas (60.7%, 17/28) were diagnosed at advanced stage (Stage III-IV). Lymph node metastases, intraperitoneal implants and ascites were detected in 35.71% (10/28), 57.14% (16/28) and 75%

(21/28) respectively of the studied ovarian carcinomas. All ovarian carcinoma patients' clinicopathological variables are outlined in Table 1.

#### Immunohistochemical expression of Glut-1:-

Glut-1 membranous immunoreactivity was detected in 80% (8/10) and 92.85% (26/28) of the studied borderline and invasive carcinomas respectively and showed progressively more increase in staining intensity in invasive tumors as compared to borderline tumor. Glut-1 immunoreactivity was absent in all the studied benign ovarian tumors (Fig. 2, a, c. Fig. 3, a, c). These differences in Glut-1 expression among the studied benign, borderline and malignant cases, were statistically highly significant ( $p=0.000$ ) (Table 2). Analysis of Glut-1 immunoreactivity with the clinicopathological criteria of the studied 28 ovarian carcinomas revealed that Glut-1 expression is more intensely expressed in high grades carcinoma (G3) and in tumors with advanced FIGO stage (Stage III-IV) with a significant relationship ( $p=0.043$  and  $p=0.005$  respectively). Glut-1 also tend to be expressed with more intensity in lymph node metastases positive group and those with intraperitoneal implants with statistically significant relationship from the negative groups ( $p=0.011$  and  $0.016$  respectively). However, no correlation was found between Glut-1 immunoreactivity and age of the patient, histological types of the tumor or the presence or absence of ascites. ( $p>0.05$ ) (Table 3).

#### PCNA immunoreactivity and the result of correlation analysis between the expression of Glut-1 and the expression of PCNA (PCNA LI) among the studied 45 ovarian epithelial tumors:

PCNA positive immunoreactivity was detected as brown nuclear staining (Fig. 2, b, d. Fig. 3, b, d). Calculation of PCNA labelling index revealed that 37.77% (17/45) of cases had PCNA LI  $\geq 50$ . Based on the correlation analysis between the results of the expression of Glut-1 and the tumor proliferative marker PCNA LI, a significant strong positive correlation was found between the expressions of the two markers among the studied 45 epithelial ovarian tumors (Spearman correlation ( $r$ ) = 0.603,  $p$  value= 0.000) (Table 4).

**Table 1:-**Clinicopathological characteristics of the studied 28 ovarian carcinoma

Variable	N (%)
<b>Age at surgery (y)</b>	
< 55	9 (32.14%)
$\geq 55$	19 (67.85%)
<b>Histological type</b>	
Serous	17 (60.71%)
Mucinous	7 (25%)
Other types (including mixed type)	4 (14.28%)
<b>Histological grade</b>	
G1	15 (53.57%)
G2	7 (25%)
G3	6 (21.4%)
<b>Lymph node metastases</b>	
Negative	18 (64.28%)
Positive	10 (35.71%)
<b>FIGO stage</b>	
I-II	11 (39.2%)
III-IV	17 (60.7%)
<b>Intraperitoneal implants</b>	
No	12 (42.8%)
Yes	16 (57.14%)
<b>Ascites</b>	
No	7 (25%)
Yes	21 (75%)
<b>Total cases</b>	28 (100%)

**Table 2:-**Glut-1 immunohistochemical expression among the tumor type of the studied 45 ovarian tumors.

	<b>Expression</b>	<b>Benign</b> n = (7)	<b>Borderline</b> n = (10)	<b>Invasive</b> n = (28)
<b>Glut-1</b>	Negative	7 (100%)	2 (20%)	2 (7.14%)
	Low	0 (0%)	5 (50%)	11 (39.28%)
	High	0 (0%)	3 (30%)	15 (53.57%)
P value	0.000			

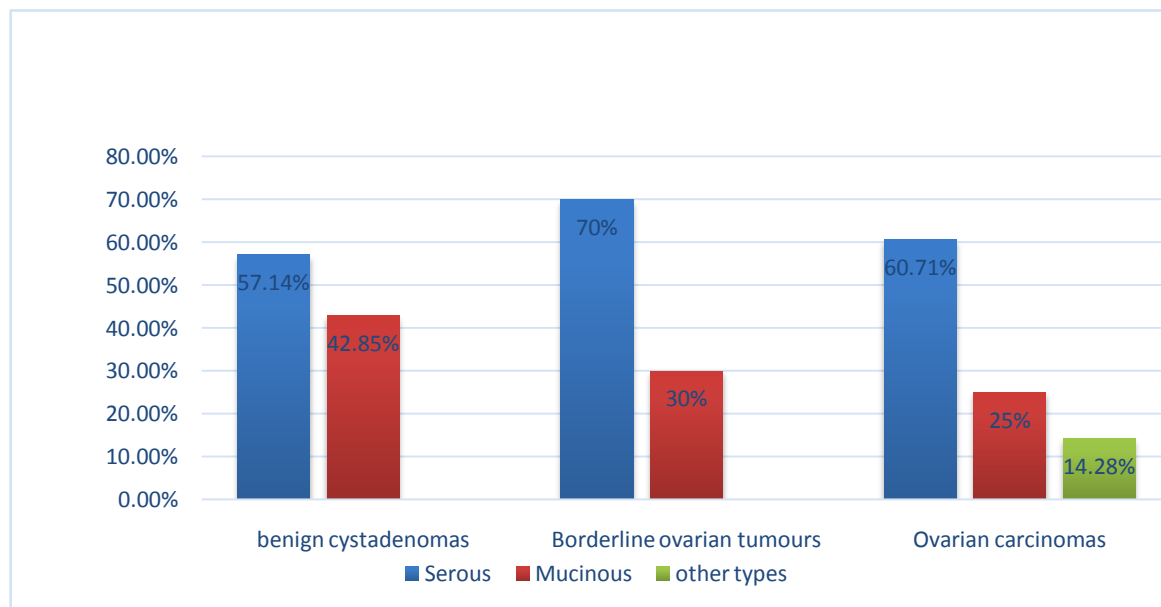
**Table 3:-**Correlation of clinicopathological parameters of the studied 28 ovarian carcinoma with Glut-1 expression.

Variable	Total (n= 28)	<b>Glut-1 expression</b>		
		Absent (2)	Low (11)	High (15)
<b>Age at surgery (y)</b>				
< 55	9 (32.14%)	2 (22.2%)	4 (44.4%)	3 (33.3%)
≥ 55	19 (67.85%)	0 (0.0%)	7 (36.8%)	12 (63.2%)
P value	0.092			
<b>Histological type</b>				
Serous	17 (60.71%)	0 (0.0%)	6 (35.3%)	11 (64.7%)
Mucinous	7 (25%)	1 (14.3%)	3 (42.3%)	3 (42.3%)
Other types (including mixed type)	4 (14.28%)	1 (25%)	2 (50%)	1 (25%)
P value	0.231			
<b>Histological grade</b>				
G1	15 (53.57%)	2 (13.3%)	9 (60%)	4 (26.6%)
G2	7 (25%)	0 (0.0%)	1 (14.3%)	6 (85.7%)
G3	6 (21.4%)	0 (0.0%)	1 (16.7%)	5 (83.3%)
P value	0.043			
<b>Lymph node metastases</b>				
Negative	18 (64.28%)	2 (11.1%)	10 (55.6%)	6 (33.3%)
Positive	10 (35.71%)	0 (0.0%)	1 (10%)	9 (90%)
P value	0.011			
<b>FIGO stage</b>				
I-II	11 (39.2%)	1 (9.1%)	8 (72.7%)	2 (18.2%)
III-IV	17 (60.7%)	1 (5.9%)	3 (17.6%)	13 (67.5%)
P value	0.005			
<b>Intraperitoneal implants</b>				
No	12 (42.8%)	2 (16.7%)	7 (58.3%)	3 (25%)
Yes	16 (57.14%)	0 (0.0%)	4 (25%)	12 (75%)
P value	0.016			
<b>Ascites</b>				
No	7 (25%)	0 (0.0%)	4 (57.1%)	3 (42.9%)
Yes	21 (75%)	2 (9.5%)	7 (33.3%)	12 (57.1%)
P value	0.416			

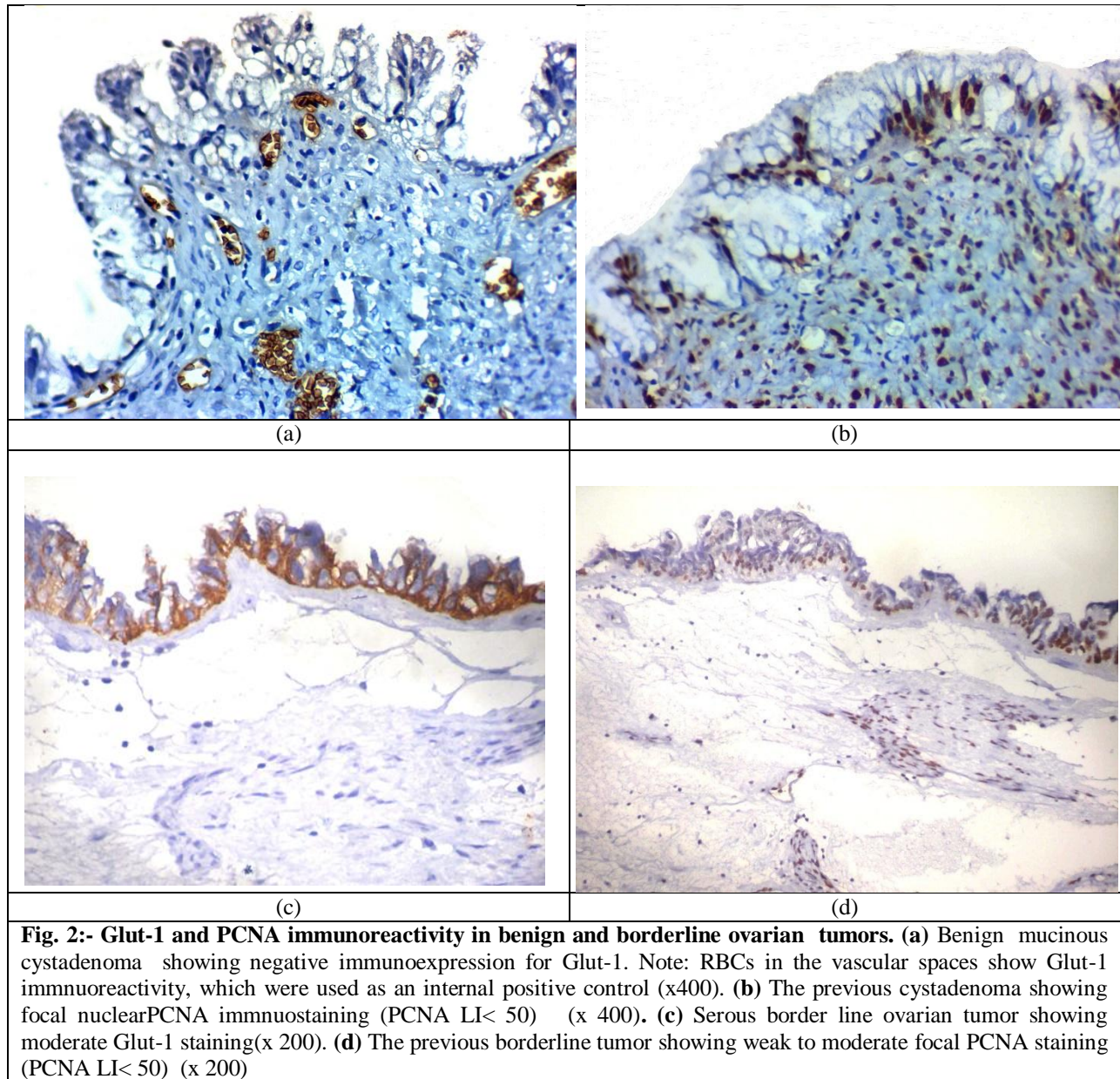
**Table 4:-**Correlation analysis between the expression of Glut-1 and PCNA (PCNA LI) among the studied 45 cases of ovarian tumors.

		PCNA LI		Total
		< 50	≥ 50	
<b>Glut-1</b>	Absent Count (% of total)	11 (24.44%)	0 (0%)	11 (24.44%)
	Low expression Count (% of total)	12 (26.66%)	4 (8.88%)	16 (35.55%)
	High expression Count (% of total)	5 (11.11%)	13 (28.88%)	18 (40%)
Total Count (% of total)		28 (62.22%)	17 (37.77%)	45 (100%)

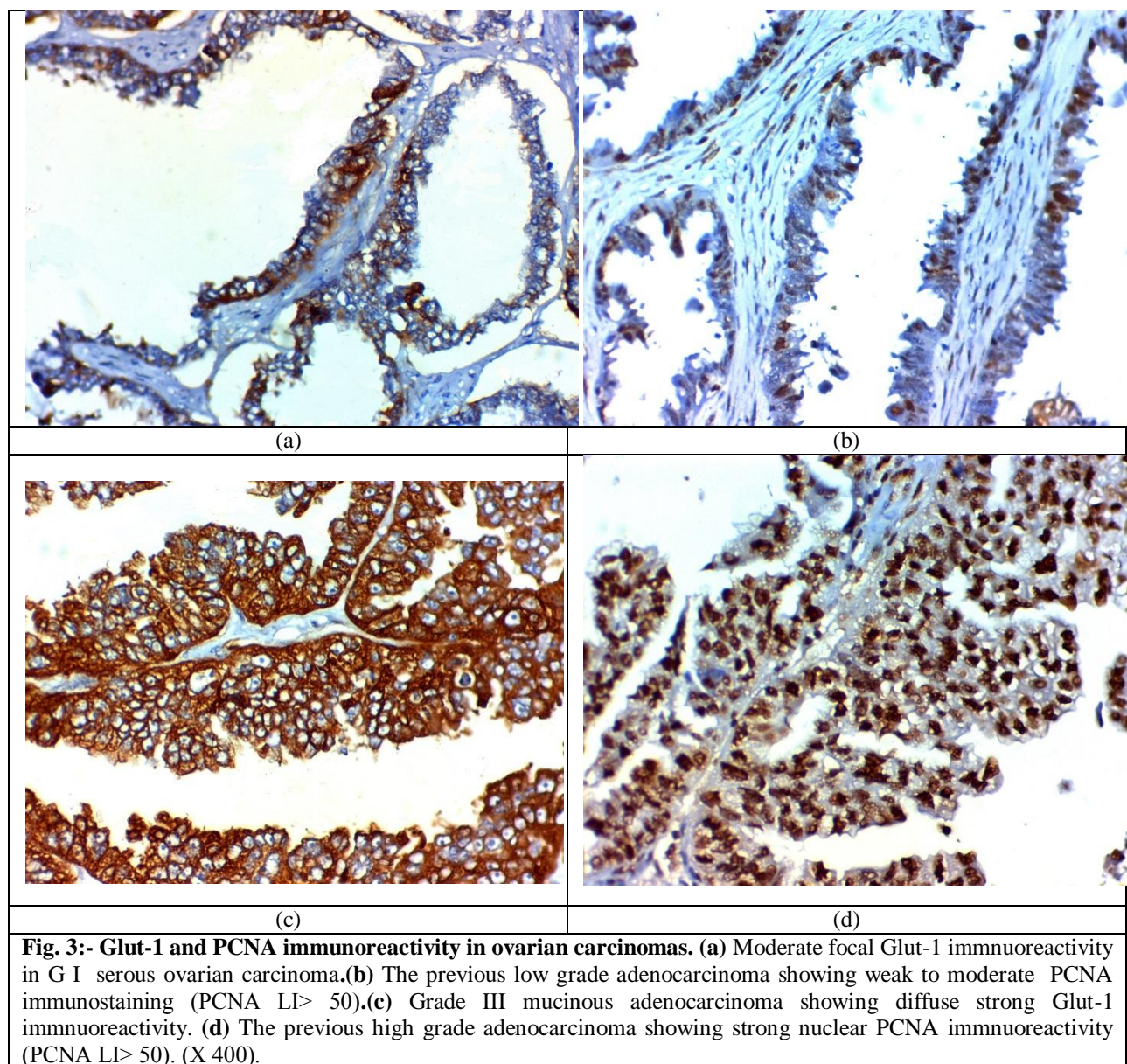
\* Spearman correlation (r) = 0.603 p value= 0.000

**Fig.**

**1:-**A histogram showing histopathological diagnosis and percentage of the studied 45 ovarian tumors. Note: serous type is the predominate type







**Fig. 3:- Glut-1 and PCNA immunoreactivity in ovarian carcinomas. (a)** Moderate focal Glut-1 immunoreactivity in G I serous ovarian carcinoma.(b) The previous low grade adenocarcinoma showing weak to moderate PCNA immunostaining (PCNA LI> 50).(c) Grade III mucinous adenocarcinoma showing diffuse strong Glut-1 immunoreactivity. (d) The previous high grade adenocarcinoma showing strong nuclear PCNA immunoreactivity (PCNA LI> 50). (X 400).

### Discussion:-

Glut-1 is a prototype of the Glut family and is widely distributed in normal tissues including RBCs [25]. Studies on ovarian cancer have suggested that Glut-1 is overexpressed and correlated with tumor aggressiveness and poor prognosis [15, 26]. PCNA is a validated specific cellular proliferative marker. In the cell cycle, it is expressed in the cellular nuclei during the phase of DNA synthesis. It is suitable for estimation of different tumors and benign lesions with proliferative potential [27]

In the present study, we examined the immuoexpression of Glut-1 in 45 ovarian epithelial tumors, including 7 benign cystadenomas, 10 borderline tumors and 28 ovarian carcinomas. We correlated the Glut-1 expression with the expression of tumor proliferative marker PCNA and with other clinicopathological factors of the ovarian carcinoma to detect the usefulness of Glut-1 expression in diagnosis and prognosis of ovarian epithelial tumors.

Our analysis revealed that serous type was the predominant histological type (62.2%, 28/45) among all the studied benign, borderline and malignant ovarian neoplasms. This is closely similar to the study of Choetal. [28], they reported 59.32% (35/59) serous type among their studied ovarian neoplasms.

Grading of the studied 28 ovarian carcinomas, revealed that 53.57% (15/28) of carcinoma were G1. This is in agreement with previous related studies [29, 30], while staging revealed that 60.7% (17/28) of ovarian carcinomas were at stage III - IV. These results revealed that most of ovarian carcinomas are diagnosed at an advanced stage, this is in concordance with many previous related studies [31, 32].

In the present study, analysis of Glut-1 expression among the studied 45 ovarian tumors, revealed that Glut-1 staining was absent in all benign ovarian tumors, and showed progressively more staining in invasive tumors as compared to borderline tumors. These differences in Glut-1 expression among the studied benign, borderline and malignant tumors, were statistically highly significant ( $p=0.000$ ). These findings are in concordance with many previous related studies [15, 16, 26, 28, and 33].

Also, Ma et al [34] reported nearby results on endometrium, where there was a progressive increase in the expression of Glut-1 among normal, hyperplastic and endometrial carcinomas (3.3%, 25.0% and 70.0% respectively). However, in contrast to our finding, Iida et al. [35], reported Glut-1 expression in 68% of benign tumors, 95% of borderline and in all cases of ovarian carcinomas (100%). These differences in the finding may be due to differences in the cohort number (Iida: 102 ovarian tumors, ours: 45), different staining technique, the use of different primary antibody types and the use of different methods of evaluation of marker immunoreactivity.

Based on our finding that Glut-1 immunoreactivity showed a gradual increase in the staining intensity from borderline to frankly malignant ovarian tumors and absence in benign tumors, we could infer that Glut-1 plays an important role in pathogenesis of ovarian carcinomas by supporting their increased need for glucose metabolism. So, Glut-1 increases the diagnostic accuracy of ovarian tumors by help in differentiating between benign, borderline and malignant tumors. This differentiation is of great significance in planning therapeutic strategy.

In the present study, analysis of Glut-1 immunoexpression with clinicopathological criteria of the studied 28 ovarian carcinomas revealed that Glut-1 expression is more intensely expressed in high grade carcinomas with a significant relationship ( $p=0.043$ ). This observation was in concordance with many previous related studies [15, 28, 33, and 36], they reported that poorly differentiated tumors tend to significantly overexpress Glut-1 compared to well and moderately differentiated tumors. Moreover, Centuria et al [15] concluded that tumors with overexpression of Glut-1, had more possibility to get benefit from chemotherapy, so Glut-1 may play a role not only in diagnosis but also it is an independent prognostic factor which determine the response to therapy.

However, in contrast to our finding, Kim et al. [37] did not find any statistical relationship between the grade of ovarian carcinoma and the expression of Glut-1. This difference may be due to the different immunohistochemical clones, different technique used, different cohort number and difference in the selection criteria. This indicates further study on a larger cohort.

Our finding that high grade tumors tend to overexpress Glut-1 than low grade tumors may be due to increase demand for glucose uptake in poorly differentiated tumors. So we could infer that Glut-1 plays a role in tumor differentiation, as well as supplying energy to rapidly proliferating tumor cells. Furthermore, analysis of Glut-1 expression among the studied ovarian carcinomas, detected that Glut-1 tend to be expressed more intensely in tumors with advanced FIGO stage (Stage III-IV) with a statistically significant relationship ( $p=0.005$ ). This is consistent with many previous related studies [24, 28, 33, 36, and 37].

Glut-1 also tends to be expressed with more intensity in lymph node metastases and intraperitoneal implants positive groups with statistically significant relationship from the negative groups ( $p=0.011$  and  $0.016$  respectively). This is consistent with the finding of Cai et al [16], and also consistent with Zhao et al [36] who found that Glut-1 staining was positively correlated with the cancer invasion and lymph node metastasis. The correlation of Glut-1 expression with the grade and stage of studied ovarian carcinomas and with lymph node metastasis and intraperitoneal implants can spotlight on its advantage as prognostic marker in targeted therapy

In the present study, a significant strong positive correlation was detected between the expressions of Glut-1 and the expressions of tumor proliferative marker PCNA among the studied 45 ovarian epithelial tumors (Spearman correlation ( $r$ ) = 0.603,  $p$  value = 0.000). This finding is nearly similar to the finding obtained by Mamede et al. [38] who found a significant positive correlation between the expressions of Glut-1 and the expressions of PCNA

(Spearman correlation ( $r$ ) = 0.58,  $P < 0.01$ ) among the studied pulmonary malignant lesions (41 primary lung cancers and 5 pulmonary metastatic lesions). This finding is also consistent with the finding of Zhao et al. [36] who reported that the score of PCNA was significantly higher in malignant ovarian tumors with strong Glut-1 staining, but this relationship was not significant with moderate and low Glut-1 staining. This difference may be due to the usage of different immunohistochemical clones and technique and different method of interpretation of markers immunoreactivity.

Our finding that there was a strong positive correlation between Glut-1 and tumor proliferative marker PCNA among our studied cases, indicates that tumors with high proliferative activity, need a comparable increase in glucose uptake to have sufficient energy for rapid cellular division.

This supports that both markers play important role in the progression of epithelial ovarian carcinoma and further support their value as a predictive marker of poor prognosis in targeted therapy.

**In conclusion,** Glut-1 increasing the diagnostic accuracy of ovarian tumors by help in differentiating between benign, borderline and malignant tumors. This differentiation is of great significance in planning therapeutic strategy. The correlation of Glut-1 expression with poor prognostic factors such as high grade, advanced stage, lymph node metastasis and intraperitoneal implants can spotlight on its advantage as prognostic marker in targeted therapy together with PCNA which showed high strong correlations with Glut-1 among the studied epithelial ovarian tumors.

## References:-

1. Ibrahim, A., Khaled, H., Mikhail N., Baraka, H., Kamel, H. and Ibrahim, A.S. (2014): Cancer Incidence in Egypt: Results of the National Population-Based Cancer Registry Program. *Journal of Cancer Epidemiology*. 14-18.
2. Daniel, G., Yang, G., Liu, G., Mercado-Urbe, I., Chang, B., Xiao, X., Zheng, J., Xue, F. and Liu, J. (2010): Ovarian cancer: pathology, biology, and disease models. *Frontier in Bioscience*. 14: 2089-2102.
3. Parkin, D., Bray, F., Ferlay J. and Pisani, P. (2005): Global cancer statistics. *CA. Cancer J. Clin.*, 55: 74-108.
4. Meinhold-Heerlein, I., Fotopoulou, C., Harter, P., Kurzeder, C., Mustea, A., Wimberger, P., Hauptmann, S. and Jalid Sehoul, S. (2016): The new WHO classification of ovarian, fallopian tube, and primary peritoneal cancer and its clinical implications. *Arch Gynecol Obstet.*, 293(4):695-700.
5. Chi, D.S., Liao, J.B., Leon, L.F., Venkatraman, E.S., Hensley, M.L., Bhaskaran, D. and Hoskins, W.J. (2001): Identification of prognostic factors in advanced epithelial ovarian carcinoma. *Gynecol Oncol*. 82: 532-537.
6. Ino, K., Shibata, K., H Kajiya, H., E Yamamoto, E., T Nagasaka, T., A Nawa, A., S Nomura, S., and F Kikkawa, F. (2006): Angiotensin II type 1 receptor expression in ovarian cancer and its correlation with tumour angiogenesis and patient survival. *British Journal of Cancer*. 94: 552 – 560.
7. Tomšová, M. and Melichar, B. (2006): Contribution of immunohistochemistry in prognostic assessment of epithelial ovarian carcinoma. *Acta Medica*. 49(3): 161-165.
8. McCluggage, W. (2006): Immunohistochemical and functional biomarkers of value in female genital tract lesions. *International Journal of Gynecological Pathology*. 25(2): 101-120.
9. Coleman, R., Ramirez, P. and Gershenson, D. (2013): *Neoplastic Diseases of the Ovary*, Comprehensive Gynecology (6th ed.). Mosby. ISBN: 978-0-323-06986-1.
10. Medina, R. and Owen, G. (2002): Glucose transporters: expression, regulation and cancer. *BiolRes*. 35(1):9-26.
11. Wei, P., Jin, M., Zhao, H., Li X. and Diao, X.L. (2013): Expression of glucose transporter protein 1 and desmin in reactive mesothelial hyperplasia and epithelioid malignant mesothelioma. *Cancer Cell*, 42(7):451-454.
12. Kim, S., Jung, W. and Koo, J. (2013): The Expression of Glut-1, CAIX, and MCT4 in Mucinous Carcinoma. *J Breast Cancer*. 16 (2):146-151.
13. Airley, R. and Mobasher, A. (2007): Hypoxic regulation of glucose transport, anaerobic metabolism and angiogenesis in cancer: novel pathways and targets for anticancer therapeutics. *Chemotherapy*, 53: 233-56.
14. Carvalho, K., Cunha, W., Rocha, R., Ayala, F., Cajal, M., Begnami, M., Vilela, R., Paiva, G., Andrade, R., and Soares, F. (2011): GLUT1 expression in malignant tumors and its use as an immunodiagnostic marker. *CLINICS*, 66 (6):965-972.
15. Centuaria, G., Magalhaes, A., Penalver, M., Angioli, R., Braunschweiger, P. and Gomez-Marin, O. (2000): Expression of GLUT-1 glucose transporter in borderline and malignant epithelial tumors of the ovary. *Gynecol Oncol*, 79: 33– 37.



16. Cai, Y., Zhai, J., Feng, B., Duan, X., Z. and He, X.J. (2014): Expression of glucose transporter protein 1 and p63 in serous ovarian tumor, *J. Obstet. Gynaecol. Res.* 40 (7): 1925–1930.
17. Younes, M, Lechago, L.V, Somoano, J.R, Mosharaf, M. and Lechago, J. (1996): Wide expression of the human erythrocyte glucose transporter Glut1 in human cancers. *Cancer Res*, 56:1164–7.
18. Airley, R., Loncaster, J., Davidson, S., Bromley, M., Roberts, S., Patterson, A., Hunter, R., Stratford, I. and West, C. (2001): Glucose transporter glut-1 expression correlates with tumor hypoxia and predicts metastasis-free survival in advanced carcinoma of the cervix. *Clin Cancer Res*, 7:928–34.
19. Cattoretti, G., Becker, M., Key, G., Duchrow, M., Schlüter, C., Galle, J. and Gerdes, J. (1992): Monoclonal antibodies against recombinant parts of the Ki67 antigen (MIB 1 and MIB 3) detect proliferating cells in microwave-processed formalin fixed paraffin sections. *J Pathol* : 168: 357-363.
20. Page, C.L., Huntsman, C.L., Provencher, D.G, and Mes-Masson, A.M. (2010): Predictive and Prognostic Protein Biomarkers in Epithelial Ovarian Cancer: Recommendation for Future Studies. *Cancers*. 2: 913-954.
21. Reitmaier, M., Rudlowski, C., Biesterfeld, S., Rath, W. and Schroder, W. (2000): Comparative studies on the biological significance of the marker for proliferation Ki-67-Antigen and PCNA in primary ovarian carcinoma. *Zentralbl. Gynakol*, 122: 361–367.
22. Schonborn, I., Minguillon, C., Mohner, M. and Ebeling, K. (1993): Importance of PCNA proliferating fraction and histomorphologic prognostic factors for survival in breast cancer. *Pathologe*, 14: 307–312.
23. Höhn, A.K., Eienkel, J., Wittekind, C. and Horn, L.C. (2014): New FIGO classification of ovarian, fallopian tube and primary peritoneal cancer. *Pathologe*. 35(4):322-6.
24. Semaan, A., Munkarah, A., Arabi, H., Bandyopadhyay, S., Seward, S., Kumar, S., Qazi, A., Hussein, Y., Morris, R.T. and Ali-Fehmi, R. (2011): Expression of GLUT-1 in epithelial ovarian carcinoma: correlation with tumor cell proliferation, angiogenesis, survival and ability to predict optimal cytoreduction *Gynecol Oncol*:121(1):181–186.
25. Yasuda, M., Miyazawa, M., Fujita, M., Kajiwara, H., Iida, T., Hirasawa, T., Muramatsu, T., Murakami, M., Mikami, M., Saitoh, K., Shimizu, M., Takekoshi, S. and Osamura, R. Y. (2008): Expression of hypoxia inducible factor-1alpha (HIF-1alpha) and glucose transporter-1(GLUT-1) in ovarian adenocarcinomas: difference in hypoxic status depending on histological character. *Oncol Rep*, 19:111–6.
26. Cantuaria G, Fagotti A, Ferrandina G, Magalhaes A, Nadji M, Angioli R., Angioli, R., Penalver, M., Mancuso, S. and Scambia, G. (2001): GLUT-1 expression in ovarian carcinoma: association with survival and response to chemotherapy. *Cancer*, 92:1144–50.
27. Theile, A. and Mueller, K.M. (1996): Proliferation kinetics of brochioloalveolar tumorlets. *Pathologe*, 17(2):163–70.
28. Cho, H., Lee, Y. and Kim J. (2013): Overexpression of Glucose Transporter-1(GLUT-1) Predicts Poor Prognosis in Epithelial Ovarian Cancer, *Cancer Investigation*, 31:607–615.
29. Overexpression of Glucose Transporter-1(GLUT-1) Predicts Poor Prognosis in Epithelial Ovarian Cancer, *Cancer Investigation*, 31:607–615
30. Yokoyama, Y., Jones, C., Licence, A., Yanaiharu, A., Hastings, J.M., Holland, C.M., Emoto, M., Umemoto, M., Sakamoto, T., Sato, S., Mizunuma, H., and Smith, SK., (2003): Vascular endothelial growth factor-D is an independent prognostic factor in epithelial ovarian carcinoma. *British Journal of Cancer*. 88: 237–244.
31. Sundov, D., Caric, A., Mrklic, I., Gugic, D., Capkun, V., Hofman, I.D., Mise B.P., and Tomic, S. (2013): P53, MAPK, topoisomerase II alpha and Ki67 immunohistochemical expression and KRAS/BRAF mutation in ovarian serous carcinomas. *Diagnostic Pathology*, 8:21
32. Wang, L., Li, H., Wen, J., and Peng S. (2014): Expression of CD44v3, erythropoietin and VEGF-C in gastric adenocarcinomas: correlations with clinicopathological features. *Clinica Chimica Acta.*, 100 (3): 321-327.
33. Skirmisdottir I., Seidal T. and Åkerud H. (2016): The relationship of the angiogenesis regulators VEGF-A, VEGF-R1 and VEGF-R2 to p53 status and prognostic factors in epithelial ovarian carcinoma in FIGO-stages I-II. *Int J Oncol.*, 48(3): 998–1006.
34. Kalir, T., Wang, B., Goldfischer, M., Haber, R.S., Reder, I., Demopoulos, R., Cohen, C.J. and Burstein, D.E. (2002): Immunohistochemical staining of GLUT1 in benign, borderline, and malignant ovarian epithelia. *Cancer*. 94: 1078–1082.
35. Ma, X., Hui, Y., Lin, L., Wu, Y., Zhang, X. and Liu, P. (2015): Clinical significance of COX-2, GLUT-1 and VEGF expressions in endometrial cancer tissues. *Pak J Med Sci*, 31(2):280-284.
36. Iida T., Yasuda M., Miyazawa M., Fujita, M., Hirasawa, T., Muramatsu, T., Murakami, M., Saito, K. and Mikami, M. (2008): Hypoxic status in ovarian serous and mucinous tumors, relationship between histological characteristics and HIF-1/GLUT-1 expression. *Arch Gynecol Obstet*, 277:539–546.

37. Zhao, S.J., Liu, J.Y., Ren, F.R. and Feng, Y.J.(2005) Expression of glucose transporter-1 and its correlation with basic fibroblast growth factor and proliferating cell nuclear antigen in epithelial ovarian neoplasm. *Zhonghua Fu Chan Ke Za Zhi*, 40(4):264-8.
38. Kim, K., Park, W., Kim, J., Sol, M.Y., Shin, D, H., Park, D, Y., Lee, C.H., Lee, J.H. and Choi, K.U. (2012): Prognostic Relevance of the Expression of CA IX, GLUT-1, and VEGF in Ovarian Epithelial Cancers. *Korean J Pathol Pathol*, 46(6):532–540.
39. Mamede, M., Higashi, T., Kitaichiy, M., Ishizu, K., Ishimori, T., Nakamoto, Y., Yanagiharaz, K., Li z, M., Tanakaz, F., Wadaz, H., Manabey, T. and Saga, T. (2005): FDG Uptake and PCNA, Glut-1, and Hexokinase-II Expressions in Cancers and Inflammatory Lesions of the Lung. *Neoplasia*, 7:(4) 369 – 379.



### RESEARCH ARTICLE

## BIG FIVE PERSONALITY AND PSYCHOLOGICAL CAPITAL AMONG FINAL YEAR MEDICAL STUDENTS.

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### Abstract

The performance of medical students is influenced by both personality characteristics and positive psychological capital. The aim of the current study was to examine the relationship between Big Five Personality traits and PsyCap among final year medical students and secondly, to determine whether Big Five personality traits hold predictive value for PsyCap of final year medical students. Participants for this study were 200 (90 males and 110 females) final year MBBS students pursuing their course in a Government Medical College of Jaipur City. PCQ-24 (Luthans, Avolio and Avey, 2007) and Big Five Inventory (John & Srivastava, 1999) were used to measure PsyCap and personality traits respectively. Results of bivariate associations showed that overall measure of psychological capital (PsyCap) was significantly related to all of the personality traits, except for conscientiousness. By means of multiple regression analysis, the findings revealed that Extraversion and Agreeableness were significant predictors of PsyCap. Implications of these findings are discussed.

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### Introduction:-

The study of medicine is a long and laborious process of five and a half years. The personality and psychological capital strength of medical students is an important determinant of their successful accomplishment of the course. The prevalence of anxiety, depression and burnout increases during their graduation program. Numerous studies have examined potential risk factors that pose a threat to students' mental health. These potential risk factors are workload, competition, sleep deprivation, lack of social support and the suffering and dying of patients which contribute to medical students' stress and their deteriorating mental health. One of the important steps would be identifying positive human resources such as hope, resilience, self-efficacy, optimism, hardiness, sense of coherence and personality factors such as agreeableness, conscientiousness, openness etc. in medical students to promote good health. The ability to solve problem, critical thinking, strong communication skills and integrity are some of the important factors in medical training followed by residency and professionalism. As a positive psychological resource, PsyCap tends to improve academic performance as well as contributes to personality development in medical students. Big five factors i.e. Extraversion, Openness to experience, Conscientiousness, Neuroticism and Agreeableness, success, adjustment, physical as well as psychological health are important in ensuring their suitability for medical schools since they are future doctors. Therefore, there is an important need to

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assess the personality and psychological capital strength of Indian medical students as there is a dearth of research done on this aspect. Medical students have to balance the pressure of academics and clinical experience.

Hence, the objective of this study is to assess the big five factors and PsyCap in Final Year MBBS students and further explore the relationship between Big Five Personality factors and components of PsyCap.

Psychological Capital (PsyCap) is defined as study and application of positively oriented human resource strength and psychological capacities (Luthans & Youssef, 2004). In terms of positive organizational behaviour, PsyCap acts as interventional model for employees and organization. PsyCap consists of four state-like psychological resource capacities of self-efficacy, hope, optimism and resilience which are measurable and open to development. Self – efficacy is defined as individual's positive belief about one's ability when confronted with difficult tasks. Hope refers to positive motivational state strengthening individual's perseverance in the path of desired goal and success. Resilience is identified as bouncing back in the time of adversity or positive state that goes beyond failure to attain success. Optimism refers to positive aspect regarding self - attribution towards goal achievement (Luthans, Avolio, Avey & Norman, 2007).

The Big Five personality traits are five broad domains or dimensions of personality that are used to describe human personality, the five-factor model. Openness to experience refers to Appreciation for art, emotion, adventure, unusual ideas, curiosity, and variety of experience. Conscientiousness refers to tendency to be organized and dependable, show self-discipline, act dutifully, aim for achievement, and prefer planned rather than spontaneous behaviour. Extraversion refers to Energy, positive emotions, assertiveness, sociability and the tendency to seek stimulation from others. Neuroticism refers to the tendency to experience unpleasant emotions easily, such as anger, anxiety, depression, and vulnerability.

Researchers have shown that performance of both Malaysian medical students and doctors is influenced by certain personality traits such as agreeableness, openness and conscientiousness. There was a positive significant association of agreeableness, openness and conscientiousness with respect to academic achievement in a cross – sectional study of medical students studying in seven universities. Furthermore, significant gender differences were reported in which females scored high in openness, agreeableness and conscientiousness as compared to males (Mustaffa et al., 2012).

Personality traits such as conscientiousness denote learning habits that are considered to be favourable to academic achievements, namely hardworking, responsible, and self-discipline (Chamorro Premuzic & Furnham, 2003a; Chamorro Premuzic & Furnham, 2003b; Gray & Watson, 2002; Laidra et al., 2007; Lieven et al., 2002; Nofle & Robins, 2007). A study by Mirsaleh et al. (2010) showed that there was a positive correlation between openness and conscientiousness in medical students and negative correlation between neuroticism and satisfaction with clinical training. Klasner and Pistole (2003) discovered the influence of personality and social support in adjustment process in medical students. The big five factors except neuroticism significantly associated with mental health, coping and academic stress.

In terms of academic achievement in medical school, Ferguson et al. (2000) and Lievens et al. (2002) found that conscientiousness is a significant predictor of academic success. Studies on success in medical studies and personality have reported that high scores in conscientiousness and low scores in neuroticism are associated with success (Barrick & Mount, 1991; Salgado, 1997). Tanoff (1999) through his research concluded that neuroticism is a primary factor, in determining job satisfaction. Further, Connolly and Viswesvaran (2000) asserted that neuroticism was negatively associated with job performance among employees.

Openness to experience has been found to significantly correlate with academic achievement in medical students. Further, poor personality traits and negative coping styles appear to play a role in the physical and psychological health of medical students (Wang & Miao, 2009).

Multon, Brown and Lent (1991) concluded their meta-analysis and found academic self-efficacy is more predictive than general self-efficacy in educational context. Besides, researchers also conducted academic resilience scales in educational studies (Martin & Marsh, 2006). Therefore, this study re-combined the four components of PsyCap for educational application with academic self-efficacy, optimism, hope, and academic resilience.

A study by Khan et al. (2011) among undergraduate students of different universities of Kuala Lumpur concluded that positive psychological capital and big five personality traits were found to be significantly related to coping mechanisms except neuroticism. High extraversion, openness & conscientiousness individuals engaged in more problem-focused coping. Therefore, personality factors and positive psychological capital has emerged as important constructs for detecting coping mechanisms.

In Indian context, there is a dearth of research on PsyCap in medical students, henceforth, in the light of above concerns, the present study aims to examine big five personality factors and PsyCap in Final Year MBBS students and further investigate the relationship between PsyCap (i.e. Hope, Resilience, Optimism and Efficacy) and big five personality traits (i.e. Extraversion, Openness to experience, Conscientiousness, Neuroticism and Agreeableness) in medical students.

## Methods:-

### Sample:-

This study comprised of 200 (90 males and 110 females) final year MBBS students studying in SMS medical college in Jaipur, Rajasthan in the age range of (20-25 years) and their mean age is 23.19 years.

## Materials:-

### Proforma:-

Information about the demographic details such as age, gender, year of study, etc. were obtained from each student who participated in the survey

**Psychological Capital Questionnaire** (Luthans, Youssef & Avolio, 2007) - PCQ was developed by Luthans, Avey and Avolio in 2007. It measures PsyCap and comprises four subscales, namely, hope, optimism, resilience and self – efficacy. The PCQ is a self - report 24 item questionnaire. Each subscale is comprised of six items and assessed on a six-point Likert scale with the response options: 1 – strongly disagree, 2 – disagree, 3 – somewhat disagree, 4 – somewhat agree, 5 – agree, 6 – strongly agree. The resulting score represents an individual's level of PsyCap.

**Big Five Inventory** (John & Srivastava, 1999) – BFI was developed by John and Srivastava in 1999. It measures big five personality traits namely extraversion, conscientiousness, Neuroticism, Openness and Agreeableness. The BFI is a self - report questionnaire and has 44 items measured on a 5- point Likert scale ranging from 1 (Strongly disagree) to 5 (strongly agree). Alpha reliabilities were reported as follows: .87 for Extraversion, .79 for agreeableness, .81 for Conscientiousness, .82 for Neuroticism and .79 for Openness to Experience.

### Procedure:-

Participants were recruited from MBBS section of Government medical college. PsyCap questionnaire and Big Five Personality Inventory were administered among 200 respondents in their medical college. Demographic information was collected through questionnaires. Instructions were given to the respondents before administration of the scale. For data analysis, SPSS version 21 was used for descriptive analysis (mean, standard deviation) of the data. Pearson Product Moment Correlation was used to investigate the relationship of PsyCap to Big Five Personality factors, furthermore, hierarchical multiple regression analysis was used to identify significant predictors of PsyCap and its components.

## Results:-

Table 1 lists the means and standard deviations of the study variables, as well as the partial correlations between these variables. These bivariate associations show that the overall measure of psychological capital (PsyCap) was significantly related to all of the personality traits, except for conscientiousness. The means regarding PsyCap and its components i.e. hope, resilience, efficacy and optimism of final year medical students were 4.47, 4.61, 4.25, 4.68 and 4.32 respectively. These means indicate higher levels of self – efficacy and hope and average level of overall PsyCap, Resilience and optimism. Table 1 also indicates that among the five personality factors (i.e. Openness to experience, Conscientiousness, Extraversion, Agreeableness and Neuroticism), Overall PsyCap has significant positive association with Agreeableness (.358,  $p < .01$ ) and Extraversion (-.214,  $p < .05$ ). Furthermore, the components of PsyCap were also significantly associated with big five factors of personality. Hope was significantly associated with Agreeableness (.202,  $p < .01$ ) and negatively associated with Neuroticism (-.431,  $p < .05$ ). Efficacy had significant positive relationship with Extraversion (.244,  $p > .01$ ), Agreeableness (.260,  $p < .05$ ) and Neuroticism

(-.432,  $p < .05$ ). Similarly, Resilience had significant positive correlation with Agreeableness (.307,  $p < .05$ ) and Extraversion (.228,  $p < .01$ ). Optimism was significantly associated with Agreeableness (.439,  $p < .05$ ), Conscientiousness (.201,  $p < .01$ ) and openness to experience (.326,  $p < .05$ ).

By means of hierarchical linear regression analysis, significant linear relationships were identified between big five personality factors and overall PsyCap. Table 2 clearly indicates that Extraversion ( $\beta = .382$ ,  $t = 3.858$ ,  $p = .000$ ) and Agreeableness ( $\beta = .449$ ,  $t = 6.390$ ,  $p = .000$ ) were significant predictors of PsyCap,  $F(5, 194) = 13.745$  ( $p < .000$ ).

**Table 1:- Means, Standard Deviations and Partial Correlations of the study variables.**

	Mean	S.D	1	2	3	4	5	6	7	8	9	10
1.PsyCap	4.47	.49	1	.72**	.83**	.77**	.79**	.36**	.11	.21**	-.26**	.17*
2.Hope	4.61	.58		1	.64**	.34**	.30**	.15*	.01	.21**	-.47**	.15*
3.Efficacy	4.68	.63			1	.53**	.57**	.29**	.14*	.27**	-.42**	.00
4.Resilience	4.25	.68				1	.61**	.31**	.05	.25**	.04	.10
5.Optimism	4.32	.58					1	.43**	.16*	-.05	-.00	.28**
6.Agreeableness	3.69	.54						1	.55**	.19**	-.25**	.14
7.Conscientiousness	3.58	.60							1	-.04	-.42**	.16*
8.Extraversion	3.25	.36								1	-.38**	-.07
9.Neuroticism	2.90	.68									1	-.18**
10.Openness	4.32	.58										1

Note - \*  $p < .01$

**Table 2:- The results of Hierarchical Linear Regression Analysis.**

Variables	Step 1( $\beta$ )	Step 2( $\beta$ )	Step 3( $\beta$ )
Step 1			
Age	0.156	.103	.093
Gender	-.138**	-.108**	-.087**
Step 2			
Openness to Experience		.136	.221
Conscientiousness		-.212	-.176
Extraversion		.277	.382**
Agreeableness		.490	.449**
Neuroticism		-.097	-.071
Step 3			
Psychological Capital			.243**
F	13.745**	36.665**	49.657**
$R^2$	.262	.213	.511
$\Delta R^2$	.243	.339	.051

Note - \* $p < .01$

### Discussion:-

The main objective of this study was to explore the relationship between PsyCap and Big Five Factors of Personality among Final year MBBS students. On the basis of relationship between PsyCap and Personality factors, it was observed that the facets of PsyCap namely Hope, Efficacy, Optimism and Resilience are significantly associated with Agreeableness, Neuroticism, Extraversion, Conscientiousness and Openness to Experiences. This demonstrates that medical students high on traits such as Agreeableness and Extraversion tends to have stronger PsyCap levels. People who are high in this trait tend to exhibit positive experiences in social situations and are helpful, cooperative, caring and being affectionate. In comparison to other non – medical streams like engineering, law, mass media and architecture, the personality domains vary from person to person.

With respect to components of PsyCap, this study shows that the medical students have higher levels of Hope and Efficacy which indicates that they are persistent in goal attainment in academics as well as clinical practise. Similar findings were reported in meta-analytic study by Multon(1991) on PsyCap as a predictor of Academic performance in different educational contexts. With respect to the five personality factors, Agreeableness is having significant positive relationship with overall PsyCap and components of PsyCap, i.e. Hope, Efficacy and Optimism

respectively. Agreeableness trait has an interpersonal dimension which means that medical students are empathetic and like to help others (Costa & McCrae, 1992).

Results also showed that Neuroticism has scored lowest in medical students and is having significant relationship with overall PsychCap as well as four facets of PsychCap. In a comparative study by Mustaffa et al. (2012), similar results were observed in which personality traits were examined based on year of the study of MBBS students and Fifth year students scored lowest on neuroticism as compared to first, second, third and fourth year students. In this regard, low scores on Neuroticism implies that fifth year students were more emotionally stable and less impulsive.

In addition, it can be a very good development since medical doctors need to not only deal with patients but also their families and the general public. It is very important for the doctors to always be very careful, patient, and able to control their emotions especially when faced with critical and crisis situations. They also need to be calm and have strong coping abilities.

The limitation of this study is that the data are based on subjective evaluations of final year medical students and due to uneven sample ratio of gender i.e. Male(70%) and Female(30%), gender differences were not investigated with respect to personality traits and PsychCap.

This study indicates the need to investigate predictors with respect to PsychCap and Personality traits in medical students using Regression Analysis and identify positive psychological resources in different groups of Non – Medical streams in view of promoting stress management, mental health promoting programs among students.

### Conclusion:-

The results of this study revealed significant associations of Agreeableness and Extraversion with overall PsychCap in final year medical students. It is concluded by analysing various literatures that, few studies have investigated the relationship between both big five personality factors and PsychCap for training and interventional aspect that would be helpful in medical training and clinical experience as doctors. Especially in medicine sector, the examination of positive psychological capacities with Big Five Personality dimension will lead to better understanding of medical profession and the basic personality profile will help them choose their specialisation and foster their professional life.

### References:-

1. Barrick, M. R., & Mount, M. K. (1991). The big five personality dimensions and job performance: a meta-analysis. *Personnel Psychology*, 44(1), 1-26.
2. Chamorro-Premuzic, T., & Furnham, A. (2003a). Personality traits and academic examination performance. *European Journal of Personality*, 17(3), 237 – 250.
3. Chamorro-Premuzic, T., & Furnham, A. (2003b). Personality predicts academic performance: Evidence from two longitudinal university samples. *Journal of Research in Personality*, 37(4), 319-338.
4. Connolly, J. J., & Viswesvaran, C. (2000). The role of affectivity in job satisfaction: A meta-analysis. *Personality and Individual Differences*, 29(2), 265-281.
5. Costa, P. T., & McCrae, R. R. (1992). Four ways five factors are basic. *Personality and Individual Differences*, 13(6), 653-665.
6. Farsides, T., & Woodfield, R. (2003). Individual differences and undergraduate academic success: The roles of personality, intelligence and application. *Personality and Individual Differences*, 34(7), 1225-1243.
7. Ferguson, E., Sanders, A., O'Hehir, F., & James, D. (2000). Predictive validity of personal statements and the role of the five-factor model of personality in relation to medical training. *Journal of Occupational and Organizational Psychology*, 73(1), 321-344.
8. Ferguson, F., Payne, T., & Anderson, N. (1994). Occupational personality assessment. Theory, structure and psychometrics of the OPQ FMX-5 student. *Personality and Individual Differences*, 17(1), 217-225.
9. Gray, E. K., & Watson, D. (2002). General and specific traits of personality and their relation to sleep and academic performance. *Journal of Personality*, 70(2), 177-206.
10. John, O. P., & Srivastava, S. (1999). The Big Five trait taxonomy: History, measurement, and theoretical perspectives. *Handbook of personality: Theory and research*, 2, 102-138.

11. Khan, A., Siraj, S., & Li, L. P. (2011). Role of positive psychological strengths and big five personality traits in coping mechanism of university students. In *International Conference on Humanities, Society and Culture* (Vol. 20, pp. 210-215).
12. Klasner, L., & Pistole, M. C. (2003). College adjustment in a multiethnic sample: Attachment, separation-individuation, and ethnic identity. *Journal of College Student Development*, 44(1), 92-109.
13. Laidra, K., Pullmann, H., & Allik, J. (2007). Personality and intelligence as predictors of academic achievement: A cross-sectional study from elementary to secondary school. *Personality and Individual Differences*, 42(3), 441-451.
14. Lievens, F., Coetsier, P., De Fruyt, F., & De Maeseneer, J. (2002). Medical students' personality characteristics and academic performance: A five-factor model perspective. *Medical Education*, 36(11), 1050-1056.
15. Luthans, F., Avolio, B. J., Avey, J. B., & Norman, S. M. (2007). Positive psychological capital: Measurement and relationship with performance and satisfaction. *Personnel Psychology*, 60(3), 541-572.
16. Luthans, F., & Youssef, C. M. (2004). Human, social, and now positive psychological capital management: Investing in people for competitive advantage. *Organizational dynamics*, 33(2), 143-160.
17. Martin, A. J., & Marsh, H. W. (2006). Academic resilience and its psychological and educational correlates: A construct validity approach. *Psychology in the Schools*, 43(3), 267-281.
18. Mirsaleh, Y. R., Tabatabaee, A., Rezai, Kivi, S.R., & Ghorbani, R. (2010). The role of religiosity, coping strategies, self-efficacy and personality dimensions in the prediction of Iranian undergraduate rehabilitation interns' satisfaction with their clinical experience. *Clinical Rehabilitation*, 24(12), 1136-1143.
19. Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counseling Psychology*, 38(1), 30.
20. Mustaffa, M. B., Wan Shahrazad, W.S., Khairudin, R., & Syed Salim, S. S. (2012). Parental support, personality, self-efficacy as predictors for depression among medical students. *Pertanika Journal of Social Sciences & Humanities*, 19(4), 9-15.
21. Nofle, E. E., & Robins, R. W. (2007). Personality predictors of academic outcomes: big five correlates of GPA and SAT scores. *Journal of Personality and Social Psychology*, 93(1), 116.
22. Radcliffe, C., & Lester, H. (2003). Perceived stress during undergraduate medical training: A qualitative study. *Medical Education*, 37(1), 32-38.
23. Salgado, J. F. (1997). The five factor model of personality and job performance in the European community. *Journal of Applied Psychology*, 82(1), 30-43.
24. Tanoff, G. F. (1999). *Job satisfaction and personality: The utility of the Five-Factor Model of Personality* (Doctoral dissertation, ProQuest Information & Learning).
25. Wang, W., & Miao, D. (2009). The relationship among coping styles, personality traits and mental health of Chinese medical students. *Social Behaviour and Personality*, 37(2), 163-172.





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### RESEARCH ARTICLE

#### ANTIBACTERIAL ACTIVITY OF MICROORGANISMS ASSOCIATED WITH MARINE INVERTEBRATES FROM THE MOROCCAN ATLANTIC COAST.

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#### Abstract

*In vitro* antibacterial screening of bacterial strains isolated from marine invertebrates, collected from the Moroccan Atlantic coast, against human pathogenic bacteria was conducted in this study. However fourteen marine microorganisms were tested against three Gram-positive bacteria (*Staphylococcus aureus*, *Bacillus sp.* and *Enterococcus faecalis*) and three Gram negative bacteria (*Escherichia coli*, *Pseudomonas fluorescens* and *Pseudomonas sp.*) using the agar disk-diffusion and the agar cylinders methods. The identification of the isolates shows that are belong to the genera *Enterobacter*, *Morganella*, *Aeromonas*, *Pantoea*, *Kluyvera*, *Raoultella*, *Stenotrophomonas*, *Pseudomonas*, *Sphingomonas* and *Staphylococcus* which indicates a diversification in the marine microflora. The evaluation of antibacterial activity of these isolates on human pathogenic bacteria shows that all strains are active against at least one pathogen studied for the two used methods. For the agar cylinders method, six isolates are showing a significant antibacterial activity with inhibition zone diameters greater or equal to 15 mm (*Aeromonas sobria*, *Enterobacter cloacae*, *Stenotrophomonas maltophilia*, *Staphylococcus capitis*, *Pantoea sp3* and *Raoultella ornithinolytica*). For the agar disk-diffusion method, among 28 extracts of the marine isolates, five extracts which are active against two pathogenic bacteria (*Pseudomonas sp* and *Enterococcus faecalis*) with inhibition zone diameters greater or equal to 15 mm (two ethanol extract of *Enterobacter cloacae*, ethanol extract of *Raoultella ornithinolytica*, ethanol extract of *Morganella morganii* and ethanol extract of *Aeromonas sobria*). By comparing the two used methods we can conclude that the agar cylinders method gave better results compared to the agar disk-diffusion method.

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## Introduction:-

Among benthic animals, soft-bodied, sessile animals have concentrated most of the interest in pharmaceutical studies. The toxic chemicals are crucial for invertebrates lacking morphological defence structures such as shells or spines (De Rosa, 2002; Blunt et al., 2008). Indeed, sponges are the most prolific marine producers of novel compounds in terms of new metabolites reported annually (Taylor et al., 2007; Menna, 2009). Furthermore, more sponge-derived compounds are in clinical and preclinical trials (e.g., as anticancer or anti-inflammatory agents) than compounds from any other marine taxa (Taylor et al., 2007; Menna, 2009). A wide variety of novel secondary bioactive metabolites have been isolated from various species of marine sponges world-wide, including powerful antiviral, antimalarial, antitumour and anti-inflammatory, as well as antimicrobial (antibiotic) compounds (Faulkner, 2002). Marine-based microorganisms are also a potential source of new medicines. However, the successes to date are based upon a very limited investigation of these microorganisms in few areas of the world oceans (Pushparaj et al., 1998), suggesting a high potential for continued discovery of new drugs from these microbes (Board, 2002). Accumulated evidence also suggests that microorganisms living in the body of sponges could well be the true source of at least some of these metabolites found in Mediterranean sponges (Thiel et Imhoff, 2003) and in other species from other oceans (Anand et al., 2006; Taylor et al., 2007). Marine sponges often contain diverse and abundant microbial communities, including bacteria, microalgae, and fungi. In some cases, these microbial associates comprise as much as 40% of the sponge volume and can contribute significantly to host metabolism via e.g. photosynthesis or nitrogen fixation (Taylor et al., 2007). Many antimicrobial, antifouling substances have been found among these kinds of bacteria due to the specialized role they play in their respective hosts (Burgess et al., 1999; Holmstrom et al., 2002). It is suggested that the primary role of these antibiotic substances could be related to ecological competition (Zheng et al., 2005). In the present work, we have studied antibacterial activity of isolated marine bacteria associated with same invertebrates belonging to the Moroccan Atlantic coast.

## Material and Methods:-

### Biological materials:-

The marine sponges (*Haliclona viscosa*, *Cliona viridis*, *Ircinia spinulosa* and *Paraleucilla magna*) and the sea cucumber were collected from the littoral Atlantic of El-Jadida (Morocco) at a depth ranging from 3 to 10 m. After sampling, the samples were cleaned, photographed, washed with sea water and immediately transported to the laboratory. The sponges *Haliclona viscosa*, *Cliona viridis* and *Ircinia spinulosa* were identified by Dr. Maria-Jesús Uriz, Research Professor at the Centro de Estudios Avanzados (El Amraoui et al., 2010), while the sponge *Paraleucilla magna* was identified by Dr. Paco Cardenas, Researcher at Evolutionary Biology Centre, Uppsala University, Department of Systematic Biology, Norbyvägen 18D 752 36 UPPSALA, SWEDEN and Dr. Michelle Klatau from Universidade Federal do Rio de Janeiro, Brazil.

### Isolation and identification of microorganisms:-

1 cm<sup>3</sup> of each marine organism was sampled using a sterile scalpel, ground in a sterile mortar in the presence of sterile physiological water, and inoculated on the culture media. After inoculation, the dishes are incubated in an oven at 35 ± 2 °C for 24 hours. Several subcultures were conducted to obtain pure culture.

The identification of marine microorganisms was carried out at the Maghreb laboratory, Rabat (Morocco) to the following protocol: the Gram-positive or Gram-negative bacterial differentiation was carried out by the Gram staining. The Gram-positive bacteria are tested for catalase whereas Gram-negative bacteria undergo the oxidase test, and there-after, according to the results of biochemical tests, a type of gallery is used. Galleries "ID32 STAPH" are used for Gram (+), catalase (+), galleries "ID32 STREP" for Gram (+), catalase (-). Whereas galleries "ID32 GN" for Gram (-), oxidase (+) and galleries "ID32 E" are used for the Gram (-), oxidase (-). Galleries and results are analyzed using an identification device "ATB Expression 2000 SYSTEMS bioMérieux VITEK" linked to the computer.

### Antibacterial activity of isolated microorganisms:-

Antibacterial activity of marine microorganisms was estimated by the agar cylinders and the agar disk diffusion methods against three Gram-positive bacteria (*Staphylococcus aureus* ATCC25923, *Bacillus sp.* CIP104717 and *Enterococcus faecalis* ATCC19433) and three Gram-negative bacteria (*Escherichia coli* CIP54127, *Pseudomonas fluorescens* CAN 228-1 and *Pseudomonas sp.*) using Mueller-Hinton agar medium [bioMérieux® SA]. These

reference strains were obtained from the Collection of Pasteur Institute (CIP), and from the American Type Culture Collection (ATCC). The test pathogens inoculated were prepared by suspending in 10 mL of sterile water the colonies from 18 h culture on Luria Bertani medium. The cell density was determined by a haemocytometer and adjusted to  $10^6$  UFC/mL.

#### **Agar disk diffusion method:-**

The isolated bacteria were cultured in nutrient broth for 7 days then each culture was extracted with ethyl acetate ( $3 \times 100$  ml). The ethyl acetate extracts were combined, dried on anhydrous sodium sulphate ( $\text{Na}_2\text{SO}_4$ ), filtered and concentrated at reduced pressure to give an ethyl acetate extract (extract C). The aqueous phases were lyophilised and twice dissolved in absolute ethanol, then filtered and concentrated at reduced pressure to give an ethanol extract (extract B). The extracts (B and C) were tested for their antibacterial activity using agar disk diffusion methods.

6 mm diameter cellulose discs were saturated with 300  $\mu\text{g}$  of extract (B or C) of isolated bacteria then applied on the test media which were previously inoculated with each pathogen strain. Plates were first kept at  $4^\circ\text{C}$  for at least 2 h to allow the diffusion of chemicals, and then incubated at  $37^\circ\text{C}$ . Inhibition zones were measured after 24 h of incubation. Standard disks of the antibiotic tetracycline (30  $\mu\text{g}$ ) and penicillin (10  $\mu\text{g}$ ) served as the positive antibacterial controls. All tests were performed in triplicate.

#### **Agar cylinders method:-**

Isolates were grown on marine agar plates for four days at  $37^\circ\text{C}$ , and then a calibrated cylinder (6 mm in diameter) was cut out and placed on the surface of the test medium (Muller Hinton) previously inoculated with each test strain. Plates were kept first at  $4^\circ\text{C}$  for at least 2 h to allow the diffusion of active metabolites, and then incubated at  $37^\circ\text{C}$ . Inhibition zones were measured after 24 h of incubation.

#### **Results and Discussion:-**

Six microorganisms were identified from the sponge *Ircinia spinulosa* (Sarcotragus), four microorganisms from the sponge *Paraleucilla magna*, one microorganism from the sponge *Cliona viridis*, one microorganism from the sponge *Haliclona viscosa* and two microorganisms from the sea cucumber. The results of identification of microorganisms are summarized in table 1. Identified isolates belong to the genera Enterobacter, Morganella, Aeromonas, Pantoea, Kluyvera, Raoultella, Stenotrophomonas, Pseudomonas, Sphingomonas and Staphylococcus. This shows a diversification in the marine microflora. Isolates species and their antibacterial activity against six pathogen bacteria were reported in tables 2 and 3.

For the agar cylinders method (Table 2), the results show that all strains (14 isolates) have antibacterial activity against at least one out of six test pathogens studied.

Four microorganisms of the genus Enterobacter are of the same species (*Enterobacter cloacae*). Three of them, Cv, Is<sub>4</sub> and Pm<sub>4</sub>, were isolated from marine sponges (*Cliona viridis*, *Ircinia spinulosa*, *Paraleucilla magna*) while Sc<sub>1</sub> was isolated from Sea cucumber. The four isolates show significant antibacterial activity but only Sc<sub>1</sub> and Pm<sub>4</sub> haven't antibacterial activity against *Pseudomonas fluorescens*. Two microorganisms of the genus Aeromonas are of the same species (*Aeromonas sobria*). One of them, Sc<sub>2</sub>, was isolated from Sea cucumber while Is<sub>1</sub> was isolated from marine sponge *Ircinia spinulosa*. The two isolates show significant antibacterial activity but only Sc<sub>2</sub> haven't antibacterial activity against *Pseudomonas fluorescens*. This strain has a very high potential resistance against the antibacterial action of the majority of microorganisms.

**Table. 1:-** Identification of microorganisms isolated from the marine invertebrates

Marine invertebrate	Reference of isolate bacteria	Identification of isolate
<i>Cliona viridis</i> sp.	Cv	<i>Enterobacter cloacae</i>
<i>Haliclona viscosa</i>	Hv	<i>Morganella morganii</i>
<i>Sea cucumber</i>	Sc <sub>1</sub>	<i>Enterobacter cloacae</i>
	Sc <sub>2</sub>	<i>Aeromonas sobria</i>
<i>Ircinia spinulosa</i> (Sarcotragus)	Is <sub>1</sub>	<i>Aeromonas sobria</i>
	Is <sub>2</sub>	<i>Pantoea sp3</i>
	Is <sub>3</sub>	<i>Kluyvera cryocrescens</i>
	Is <sub>4</sub>	<i>Enterobacter cloacae</i>
	Is <sub>5</sub>	<i>Raoultella ornithinolytica</i>
	Is <sub>6</sub>	<i>Stenotrophomonas maltophilia</i>
<i>Paraleucilla magna</i>	Pm <sub>1</sub>	<i>Pseudomonas putida</i>
	Pm <sub>2</sub>	<i>Sphingomonas paucimobilis</i>
	Pm <sub>3</sub>	<i>Staphylococcus capitis</i>
	Pm <sub>4</sub>	<i>Enterobacter cloacae</i>

**Table. 2:-** Antibacterial activity of marine microorganisms using Agar cylinders method

Isolate microorganisms	Bacterial growth inhibition diameter (mm)					
	Gram-negative bacterium			Gram-positive bacterium		
	<i>E. coli</i> CIP 54127	<i>P. fluorescens</i> CAN 228-1	<i>Pseudo-</i> <i>monas. sp.</i>	<i>Bacillus. sp.</i> CIP104717	<i>S. aureus</i> ATCC25923	<i>E. faecalis</i> ATCC19433
Is <sub>1</sub>	8	7	18	17	9	10
Is <sub>2</sub>	8	-	10	16	8	7
Is <sub>3</sub>	8	-	9	-	8	-
Is <sub>4</sub>	10	15	19	12	14	9
Is <sub>5</sub>	12	11	14	13	15	13
Is <sub>6</sub>	11	-	18	10	8	8
Pm <sub>1</sub>	8	8	8	14	9	7
Pm <sub>2</sub>	-	-	8	10	8	7
Pm <sub>3</sub>	9	10	20	14	15	11
Pm <sub>4</sub>	+	-	12	14	10	7
Sc <sub>1</sub>	8	-	9	12	9	7
Sc <sub>2</sub>	8	-	9	8	9	8
Hv	8	-	10	10	10	10
Cv	8	+	9	22	15	10

- : no activity; +: inhibition diameter &lt;7 mm.

Table. 3: Antibacterial activity of marine microorganisms using Agar disk-diffusion method

Isolate microorganism	Extract	Bacterial growth inhibition diameter (mm)					
		Gram-negative bacterium			Gram-positive bacterium		
		<i>E. coli</i> CIP 54127	<i>Pseudo-monas. sp.</i>	<i>P. fluorescens</i> CAN 228-1	<i>Bacillus. sp.</i> CIP 104717	<i>S. aureus</i> ATCC 25923	<i>E. faecalis</i> ATCC19433
Is <sub>1</sub>	B	8	9	-	-	+	20
	C	9	8	-	+	-	-
Is <sub>2</sub>	B	8	11	-	+	-	11
	C	9	ND	-	+	8	-
Is <sub>3</sub>	B	-	9	-	+	+	-
	C	-	ND	-	ND	-	-
Is <sub>4</sub>	B	+	16	-	+	+	25
	C	+	ND	-	-	7	-
Is <sub>5</sub>	B	11	15	-	+	+	18
	C	+	ND	8	-	-	-
Is <sub>6</sub>	B	12	11	-	8	-	13
	C	-	ND	8	+	-	-
Pm <sub>1</sub>	B	8	8	-	-	-	-
	C	9	ND	-	+	-	+
Pm <sub>2</sub>	B	+	-	-	-	-	-
	C	ND	ND	-	-	-	ND
Pm <sub>3</sub>	B	9	12	-	8	-	11
	C	+	ND	-	-	-	+
Pm <sub>4</sub>	B	8	+	-	-	-	-
	C	+	10	-	-	-	+
Sc <sub>1</sub>	B	+	+	-	-	-	-
	C	+	+	-	-	-	-
Sc <sub>2</sub>	B	8	8	-	-	-	-
	C	+	+	-	-	-	-
Hv	B	9	15	-	-	-	-
	C	-	8	-	-	8	+
Cv	B	10	20	-	-	-	22
	C	ND	ND	-	-	-	+
Tetracycline 30 µg		24	34	22	25	16	32
Penicillin 10 µg		20	17	20	12	-	16

ND: not determined; —: no activity; +: inhibition diameter <8 mm.

Among the marine microorganisms, six isolates which are showing a significant antibacterial activity with inhibition zone diameters greater or equal to 15 mm:

- Four isolates were active against *Pseudomonas sp*, *Aeromonas sobria*, *Enterobacter cloacae*, *Stenotrophomonas maltophilia* and *Staphylococcus capitis*;
- one isolate (*Enterobacter cloacae*) was active against *Pseudomonas fluorescens*;
- three isolates (*Aeromonas sobria*, *Pantoea sp3*, and *Enterobacter cloacae*) were active against *Bacillus sp.* ;
- three isolates (*Raoultella ornithinolytica*, *Staphylococcus capitis* and *Enterobacter cloacae*) were active against *Staphylococcus aureus*.

For the agar disk-diffusion method (Table 3), the results show that all isolate have antibacterial activity against at least one out of six test pathogens studied.

All B extracts (14 extracts) of studied marine microorganisms have displayed some activity against at least one out of six test pathogens studied.

Except two C extracts of isolates (*Kluyvera cryocrescens* and *Sphingomonas paucimobilis*) were not active against any pathogens studied.

Among 28 extracts of the marine microorganisms, five extracts which are showing a significant antibacterial activity with inhibition zone diameters greater or equal to 15 mm:

- four extracts were active against *Pseudomonas sp.*, two B extract of *Enterobacter cloacae* (Is<sub>4</sub> and Cv), B extract of *Raoultella ornithinolytica* (Is<sub>5</sub>) and B extract of *Morganella morganii* (Hv);
- four extracts (B extracts of *Aeromonas sobria* (Is<sub>1</sub>), *Enterobacter cloacae* (Is<sub>4</sub> and Cv) and *Raoultella ornithinolytica* (Is<sub>5</sub>)) were active against *Enterococcus faecalis*.

By comparing the two methods used to determine the antibacterial activity of the studied microorganisms against the six test pathogens studied, we can conclude that the agar cylinders method gave better results compared to the agar disk-diffusion method.

It is evident then that marine macro- and microorganisms, living in an environment where competition and predation are the maximum without physical defence structure, defends themselves by producing chemicals to survive. It is found that the sea surface or cavum of marine organisms such as seaweeds and invertebrates are more nutritious than inanimate material and seawater, and a large number of bacteria could live on it (Sponga et al., 1999). These bacteria species are not generally real symbiotic to the host, but they can instead be regarded as associated bacteria (Ponce et al., 1999), and are forced to develop resistance to antibiotics secreted by its host. In fact, they can produce antibiotics and antifungal to inhibit or limit the development and growth of other competitive microorganisms. Several products have been isolated from marine microorganisms with antimicrobial (Romanenko et al., 2007; Charyulu et al., 2009), antifungal (Barsby et al., 2002), antibacterial (Li et al., 2006; Asha Devi et al., 2011), antiviral (Yasuhara-Bell et al., 2010) and cytotoxic (Maskey et al., 2002; Shaaban et al., 2011) activities.

It is evident then that the antibacterial spectra of the active marine bacteria are different (Zheng et al., 2005). This difference comes from the variation of the ecological conditions of the environment of the microorganisms (El-Wahidi et al., 2011). However, some isolates of the same species show a difference in their antibacterial activity. Moreover, molecular studies of these species could provide the answer.

### Conclusion:-

Preliminary results show that marine microorganisms associated to different marine invertebrates have an antibacterial potential. They can also constitute a potential source of new compounds to be used in the field of health. *Aeromonas sobria* (Is<sub>1</sub>), *Enterobacter cloacae* (Is<sub>4</sub> and Cv), *Stenotrophomonas maltophilia* (Is<sub>6</sub>), *Staphylococcus capitis* (Pm<sub>3</sub>), *Pantoea sp3* (Is<sub>2</sub>) and *Raoultella ornithinolytica* (Is<sub>5</sub>) bacteria that exhibit a significant antibacterial activity should be investigated for isolation and identification of natural antibacterials.

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### References:-

1. Anand, T. P., A. W. Bhat, Y. S. Shouche, U. Roy, J. Siddharth and S. P. Sarma (2006): Antimicrobial activity of marine bacteria associated with sponges from the waters off the coast of South East India. Microbiol Res., 161: 252-262.
2. Asha Devi, N. K., R. Rajendran and S. Karthik Sundaram (2011): Isolation and characterization of bioactive compounds from marine bacteria. Indian J Nat Prod Res., 2: 59-64.
3. Barsby, T., M. T. Kelly and R. J. Andersen (2002): Tupuseleiamides and basiliskamides, new acyldipeptides and antifungal polyketides produced in culture by a *Bacillus laterosporus* isolate obtained from a tropical marine habitat. J Nat Prod., 65: 1447-1451.
4. Blunt, J. W., B. R. Copp, W.-P. Hu, M. H. G. Munro, P. T. Northcote and M. R. Prinsep (2008): Marine natural products. Nat Prod Rep., 25: 35-94.
5. Board, O. S. (2002): Marine biotechnology in the twenty-first century: problems, promise, and products. National Academies Press.
6. Burgess, J. G., E. M. Jordan, M. Bregu, A. Mearns-Spragg and K. G. Boyd (1999): Microbial antagonism: a neglected avenue of natural products research. J. Biotechnol., 70: 27-32.

7. Charyulu, E. M., G. Sekaran, G. S. Rajakumar and A. Gnanamani (2009): Antimicrobial activity of secondary metabolite from marine isolate, *Pseudomonas* sp against Gram positive and negative bacteria including MRSA. *Indian J Exp Biol.*, 47: 964-968.
8. De Rosa, S. (2002): Mediterranean Marine Organisms as Source of New Potential Drugs. *Natural Products in the New Millennium: Prospects and Industrial Application*. A. P. Rauter, F. B. Palma, J. Justino, M. E. Araújo and S. P. dos Santos. Dordrecht. Springer Netherlands., 441-461.
9. El-Wahidi, M., B. El-Amraoui, J. F. Biard, M. J. Uriz, A. Fassouane and T. Bamhaoud (2011): Variation saisonnière et géographique de l'activité antifongique des extraits de deux éponges marines récoltées sur le littoral atlantique d'El Jadida, Maroc. *J Mycol Med.*, 21: 28-32.
10. El Amraoui, B., J. F. Biard, M. J. Uriz, S. Rifai and A. Fassouane (2010): Antifungal and antibacterial activity of Porifera extracts from the Moroccan Atlantic coasts. *J Mycol Med.*, 20: 70-74.
11. Faulkner, D. J. (2002): Marine natural products. *Nat Prod Rep.*, 19: 1-48.
12. Holmstrom, C., S. Egan, A. Franks, S. McCloy and S. Kjelleberg (2002): Antifouling activity expressed by marine surface associated *Pseudoalteromonas* species. *FEMS Microbiol. Ecol.*, 41: 47-58.
13. Li, X., S. K. Kim, K. W. Nam, J. S. Kang, H. D. Choi and B. W. Son (2006): A new antibacterial dioxopiperazine alkaloid related to gliotoxin from a marine isolate of the fungus *Pseudallescheria*. *J Antibiot (Tokyo)*, 59: 248-250.
14. Maskey, R. P., E. Helmke, H. H. Fiebig and H. Laatsch (2002): Parimycin: isolation and structure elucidation of a novel cytotoxic 2,3-dihydroquinizarin analogue of gamma-indomycinone from a marine streptomycete isolate. *J Antibiot (Tokyo)*, 55: 1031-1035.
15. Menna, M. (2009): Antitumor potential of natural products from Mediterranean ascidians. *Phytochem Rev.*, 8: 461-472.
16. Ponce, V., J. P. Berge, C. Debitus, J. L. Nicolas and M. Guyot (1999): Metabolites from the sponge-associated bacterium *Pseudomonas* species. *Mar Biotechnol (NY)*, 1: 384-390.
17. Pushparaj, B., E. Pelosi and F. Jüttner (1998): Toxicological analysis of the marine cyanobacterium *Nodularia harveyana*. *J. Appl. Phycol.*, 10: 527-530.
18. Romanenko, L. A., M. Uchino, G. M. Frolova, N. Tanaka, N. I. Kalinovskaya, N. Latyshev and V. V. Mikhailov (2007): *Sphingomonas molluscorum* sp nov., a novel marine isolate with antimicrobial activity. *Int J Syst Evol Micr.*, 57: 358-363.
19. Shaaban, K. A., E. Helmke, G. Kelter, H. H. Fiebig and H. Laatsch (2011): Glucopiericidin C: a cytotoxic piericidin glucoside antibiotic produced by a marine *Streptomyces* isolate. *J Antibiot (Tokyo)*, 64: 205-209.
20. Sponga, F., i. L. Cavalett, A. Lazzarini, A. Borghi, I. Ciciliato, D. Losi and F. Marinelli (1999): Biodiversity and potentials of marinederived microorganisms. *J Biotechnol.* 70: 65-69.
21. Taylor, M. W., R. Radax, D. Steger and M. Wagner (2007): Sponge-Associated Microorganisms: Evolution, Ecology, and Biotechnological Potential. *Microbiol Mol Biol Rev.*, 71: 295-347.
22. Thiel, V. and J. F. Imhoff (2003): Phylogenetic identification of bacteria with antimicrobial activities isolated from Mediterranean sponges. *Biomol. Eng.*, 20: 421-423.
23. Yasuhara-Bell, J., Y. Yang, R. Barlow, H. Trapido-Rosenthal and Y. Lu (2010): In vitro evaluation of marine-microorganism extracts for anti-viral activity. *Virology*, 7: 182.
24. Zheng, L., X. Han, H. Chen, W. Lin and X. Yan (2005): Marine bacteria associated with marine macroorganisms: the potential antimicrobial resources. *Ann Microbiol (Paris)*, 55: 119-124.

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### RESEARCH ARTICLE

## STRUCTURAL VALIDATION AND HOMOLGY MODELING OF DIFFERENTIALLY EXPRESSED PROTEINS IN *RATTUS NORVERGICUS* INDUCED BY BISPHENOL A AND PROBIOTIC TREATMENT

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Homology Modeling, Bioinformatics, Bisphenol stressed, Bisphenol and probiotic treated proteins.

### Abstract

The aim of the present study was to apply Bio informatics tools to the proteins expressed in alteration with Bisphenol A. The structure-based computational methods are needed to help, identify and characterize protein-protein complexes and their function. Differentially expressed Proteins were Tryptic digested and were analyzed by MALDI-TOF to identify peptide masses afterward used for MS/MS. For individual proteins, the most successful technique is homology modeling. Based on their mass to charge ratio, the expressed proteins sequences were collected from Mascot search data. The sequences were analysed with the help of Phyre-2 server, RasMol version 2.6 software, BLAST, QMEAN servers, SWISS-PROT, QMEAN servers, STRING and Rampage validation tool.

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### Introduction:-

Bioinformatics is the discipline of science in which biology, computer science, and information technology merge to form a single command. A web server for the analysis and comparison of 2D gels using bioinformatics tools has been developed, [1]. Functional analysis and elucidation of large-scale proteomics and gene expression data require effective use of bioinformatics tools and collective information resources coupled with expert-guided examination [2]. Bisphenol-A (BPA), one of many environmental endocrine disrupters, is widely used in polycarbonate plastics, food cans and dental sealants. It is generally believed that consumer exposure to BPA occurs primarily via food in contact with BPA-containing materials, such as polycarbonate baby bottles, table ware and food containers as well as food and beverage cans lined with epoxy resins. Differences in the estrogenic activity of bisphenol A and reference estrogens may be due to differences in recruiting by the liganded receptor of co-regulatory proteins. BPA is thought to bind to plasma proteins in rodents, monkeys and humans [3]. Because pharmacokinetics are altered by protein binding, the potential uptake of BPA into other tissues, including estrogen-target tissues, may be affected. In proteomics ground, combinations of analytical techniques are used to analyse the protein samples. The initial step in all proteomic studies involves the separation of a mixture of proteins. This can be conceded out using 2-D gel electrophoresis technique in which proteins are separated based on their individual molecular weight and charges. Two dimensional gel electrophoresis can retrieve information regarding thousands of different proteins from a crude protein sample. The spots obtained in 2-D gel electrophoresis are separated and subjected to mass spectrometric analysis using MALDI-TOF. MALDI-TOFMS/MS data converted into MGF (Mascot Generic Format). This data can be analysed by using MASCOT server. Mascot is widely used by research facilities around the world. Mascot uses a probabilistic scoring algorithm for protein identification that was adapted from the MOWSE algorithm.

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Mascot is a software search engine that uses mass spectrometry data to identify proteins from peptide sequence databases [4]. This sequence is aligned by using alignment tools, sequence alignment is to identify the functional and structural relationship between the sequences [5]. The first step in comparative modelling is to distinguish all protein structures related to the target sequence, some of which will be used as templates. This step is greatly facilitated by databases of protein sequences and structures and software for scanning those databases. The target sequence can be searched against sequence databases, such as Protein Identification Resource (PIR), GENBANK, SWISS-PROT, or EMBO nucleotide sequences database, and/or structure databases such as the Brookhaven Protein Databank and SCOP. The most popular programs, including FASTA and BLAST to compare the target sequence with each sequence in a database Program MODELLER which implements all the stages in comparative modelling [6], can also automatically search for proteins with known three-dimensional structure that are related to a given sequence. QMEAN is a composite scoring function which is able to derive both entire structure and residue of protein error estimates on the basis of one single model [7,8].

### **Experimental:-**

#### **Tissue collection:-**

The hippocampal regions of the brain were dissected and then stored at -80°C until use. The tissue was homogenized on ice with a cold Tris/EDTA buffer and centrifuged at 10,000 g for 20 min at 4°C. Supernatant was collected and processed for protein analysis. [9] About 0.5g of each liver was homogenized in 4.5 ml of phosphate buffered saline. The crude tissue was centrifuged at 8000 g for 30 min and the supernatant was collected and stored at 4°C [10]

#### **2D gel electrophoresis:-**

The samples were loaded on to the IEF strips 3-10pH Linear, 18cm and kept for Iso-Electric Focusing. After IEF run, the strip was equilibrated in Equilibration Buffer and the second dimension was carried out on a 10% SDS-PAGE. The gels were Silver stained to observe the protein spots and were scanned using Epson Expression 11000XL Scanner

#### **MS Analysis:-**

Mass spectrometry is an important emerging method (Model voyager De-STR, applied Biosystems, Foster, CA, USA) for the characterization of proteins from isolated 2-D gel spots as this method is very sensitive. Spot was treated with acetonitrile for dehydration and trypsin for protein digestion.  $\alpha$ -cyano-4-hydroxycinnamic acid in acetonitrile was used as matrix.

#### **MASCOT Search:-**

After MALDI-TOF MS/MS analysis expressed protein data is converted into MGF (MascotGeneric Format). These data can be analysed by using MASCOT server(<http://www.matrixscience.com>). Mascot has three main search modes: Peptide MassFingerprint, Sequence Query, and MS/MS Ion Search. MS/MS Ion Search is used to analyse data from tandem mass spectrometry experiments. The report was generated depending on specific options used for protein analysis. For each protein match, Mascot calculates an overall Protein Score. This number reflects the combined scores of all observed mass spectra that can be matched to amino acid sequences within that protein. A higher score indicates a more confident match. The number of protein matches at each scoring position is indicated by the height of the red bars, the non-significant area is shaded in green. Complete results are automatically sent to the registered E-mail.

#### **Sequence alignment:-**

The target sequence was searched with BLAST search against Protein Data Bank, which one has a high level of sequence identity with target protein selected as a template protein. Templates were determined by super imposition of the two structures and multiple sequence alignment was performed with CLUSTAL W (1.1) program to identify the set of conserved residues alignment.

#### **Homology modeling:-**

The sequences were analysed with the help of Phyre-2 (protein Homology/analogy Recognition Engine V 2.0) server for obtaining pdb file. The final 3-D structure obtained with the help of RasMol version 2.6 software programme.

**Ramachandran plot analysis:-**

Ramachandran plot displays the phi and psi backbone conformational angles for each residue in a protein. The phi angle is the angle of right-handed rotation around N-C $\alpha$  bond and the psi angle is the angle of right-handed rotation around C $\alpha$ -C bond. Phi and psi angles are also used in the classification of some secondary structure elements such as alpha helix and beta turns. In a Ramachandran plot, the core or allowed regions indicate preferred areas for psi/phi angle pairs for all residues in a protein. If the determination of protein structure is reliable, most pairs will be in the favoured regions of the plot, some pairs will be in the allowed region, and only a few will appear in 'disallowed' regions

**QMEAN analysis for the quality resolution structure:-**

The QMEAN scoring function estimates the global quality of the models on the basis of a linear combination of six structural descriptions, four of them are statistical potentials of mean force. The local geometry is analysed by a torsion angle potential over three consecutive amino acids. The distance –dependent interaction potentials based on C $\beta$  atoms and all atoms, respectively are used to assess long-range interactions. A solvation potential describes the burial status of the residues. The analysis of these Z-scores of the individual terms can help identifying the geometrical features responsible for an observed large negative QMEAN Z-score. Models of low quality are expected to have strongly negative Z-scores for QMEAN but also for most of the contributing terms. Large negative values correspond to red regions in the colour gradient. Good structures are expected to have all sliders in the light red to blue region. The quality of resolution structure of differentially expressed proteins under control, bisphenol and bisphenol with probiotic treated samples represented in the following figures

**Analysis of physico-chemical parameters of a sequence:-**

ProtParam is one among the protein analysis tool available on the ExPasy server. (<http://www.expasy.org/tools/protparam.html>). It is used for calculating various physiochemical parameters of a provided protein. The protein can be either is specified as a UniProtKB/Swiss-Prot accession number or ID or as sequences of amino acids.

**String analysis of differentially expressed proteins:-**

The database STRING is a precomputed global resource for the exploration and analysis of these associations. Since the three types of evidence differ conceptually, and the number of predicted interactions is very large, it is essential to be able to assess and compare the significance of individual predictions. Protein–protein interactions are not limited to direct physical binding. Proteins may also interact indirectly by sharing a substrate in a metabolic pathway, by regulating each other transcriptionally, or by participating in larger multi-protein assemblies. For information on genomes, genes, and encoded proteins, STRING relies on the annotated proteomes maintained by SWISS-PROT.

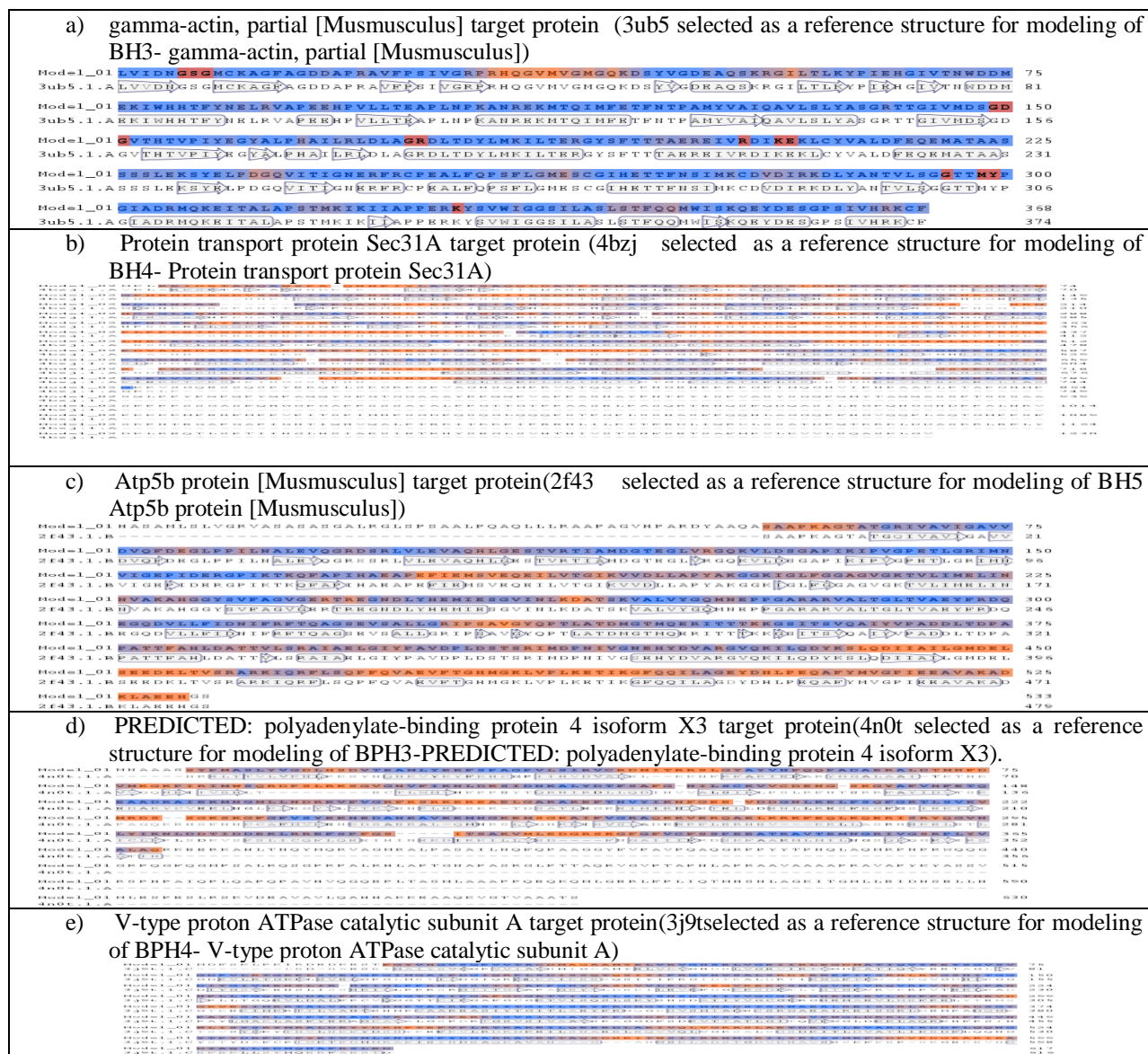
**Results:-**

**Table 1:-** List of differentially expressed proteins of hypothalamus tissue of *Rattus norvegicus* in response to BPA and BPA with probiotic treatment.

Spot no	Protein name	Molecular weight	Calculated pI	Number of amino acids
BH3	gamma-actin, partial [Musmusculus]	41018.9	5.56	268
BH4	Protein transport protein Sec31A	133569.2	6.30	1230
BH5	Atp5b protein [Musmusculus]	56666.8	5.24	533
BPH3	PREDICTED: polyadenylate-binding protein 4 isoform X3	69331.3	9.58	630
BPH4	V-type proton ATPase catalytic subunit A	68326.0	5.41	617

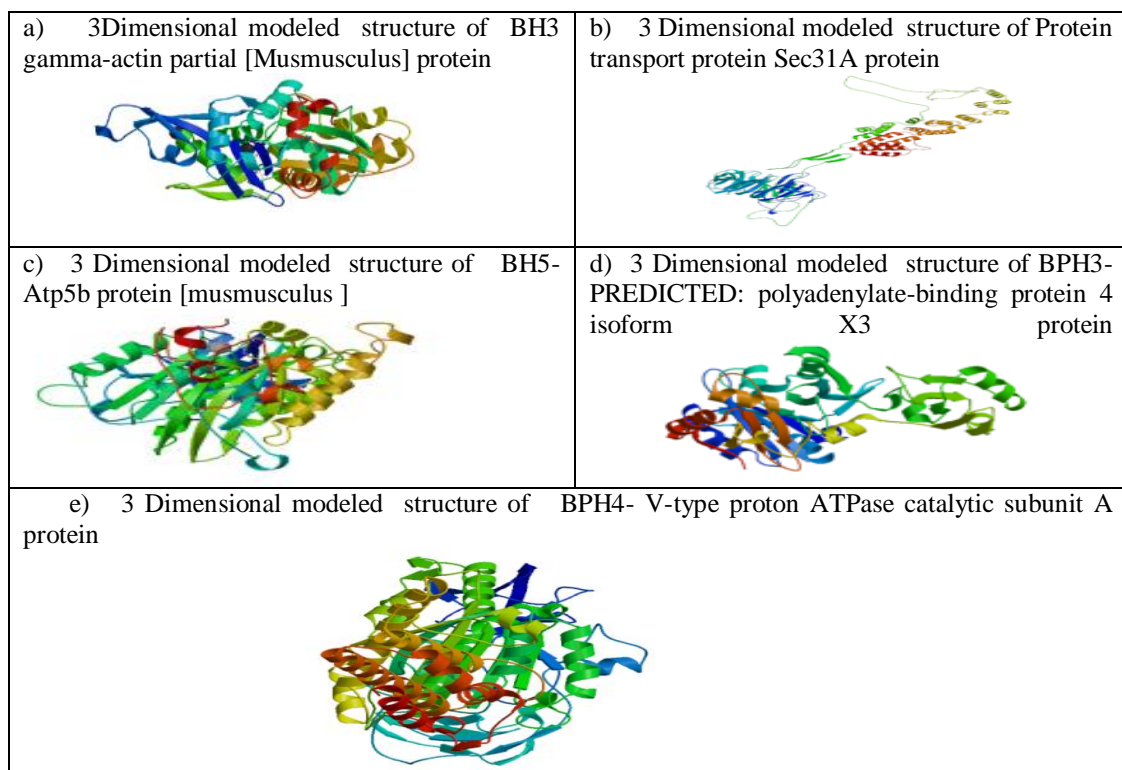
**Table 2:-** List of differentially expressed proteins in liver tissue of *Rattus norvegicus* in response to BPA and BPA with probiotic treatment

Spot no	Protein name	Molecular weight	Calculated pI	Number of Amino acids
BL1384	INSL3_MOUSE, Insulin-like 3	13585.8	9.25	122
BL1500	ATP synthase subunit beta, mitochondrial precursor [Musmusculus]	56300.4	5.19	529
BL1549	Laminin subunit alpha-5 precursor	404053.6	6.28	3718
BPL119	Nucleolar protein 14	98769.4	7.34	860
BPL128	Nuclear protein MDM1	75673.7	9.33	673

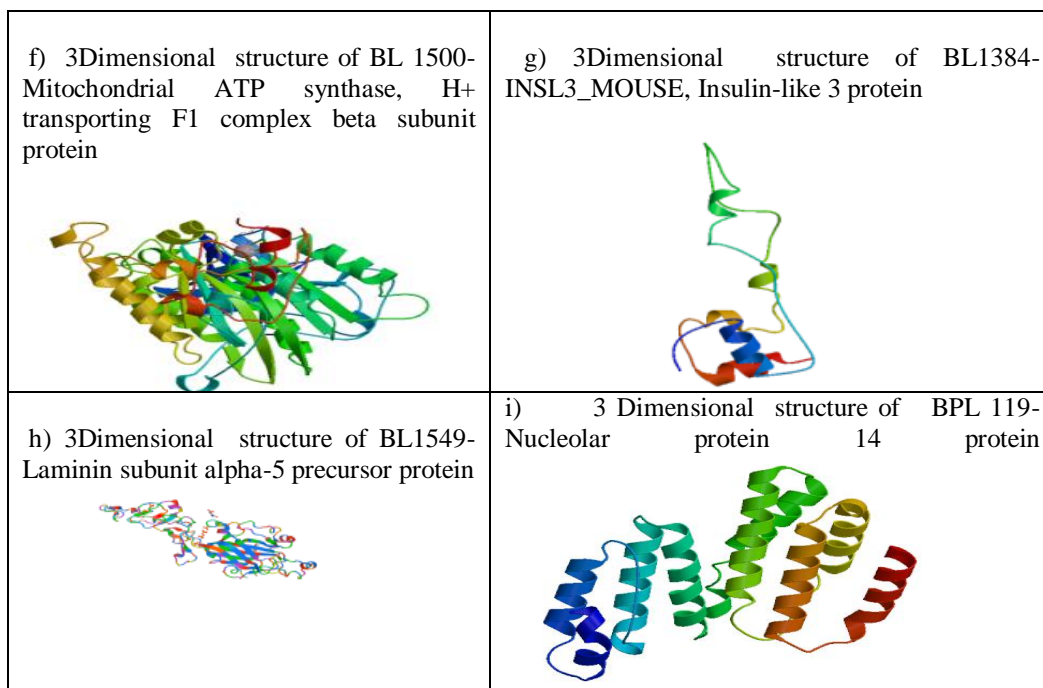
**Fig 1:-** Sequence alignment of differentially expressed proteins In hypothalamus induced by Bisphenol, Bisphenol and probiotic treated proteins.

f)	Mitochondrial ATP synthase, H <sup>+</sup> transporting F1 complex beta subunit target protein(2f43 selected as a reference structure for modeling of BL 1500- Mitochondrial ATP synthase, H <sup>+</sup> transporting F1 complex beta subunit).
	<pre> Model_01 HSLVGEVASASASGALRGLEPSAALPQAQLLLRAAPAGVHPARDYAAQA 75 2f43.1.B -----SAPKAGTATGGIVAVVAVVDVQ 25  Model_01 DEGLFFINALEVQGRDLVLEVAQHLESTVTTAMDGTGLVRGQKVLDGAPIKFVGGFTLGRIMNVIG 150 2f43.1.B DRGLFPFILHLEKVGGRRLVLEVAQHLESTVTTAMDGTGLVRGQKVLDGAPIKFVGGFTLGRIMNVIG 100  Model_01 FIDRGFIRTKQFAPTHARAFEFIEHSEVQELVLTGIRKVVLLAFYAKGGKIGLEGGAGVGGKTVLIMELINNVAK 225 2f43.1.B FIDRRGFIRTKQFAPTHARAFEFIEHSEVQELVLTGIRKVVLLAFYAKGGKIGLEGGAGVGGKTVLIMELINNVAK 175  Model_01 AAGGYVVFAGVGRRTREGNDLYHEMIRSGVINLKDASKVALVYGGHNEFFGARARVALTGLTVARYFRDQGGQ 300 2f43.1.B AAGGYVVFAGVGRRTREGNDLYHEMIRSGVINLKDASKVALVYGGHNEFFGARARVALTGLTVARYFRDQGGQ 250  Model_01 VLLFDHIFRFTQAGREVRALLGRIFSAVYQFTLATDGHGTHGRITTTKGRITTEVGAIVFADDLTDFAPATT 375 2f43.1.B VLLFDHIFRFTQAGREVRALLGRIFSAVYQFTLATDGHGTHGRITTTKGRITTEVGAIVFADDLTDFAPATT 325  Model_01 FAHLDAATVSRATATGLVAVDFLDSERINDENHGHYDVAAGVQKILQDYKELDITATLGHDLRERD 450 2f43.1.B FAHLDAATVSRATATGLVAVDFLDSERINDENHGHYDVAAGVQKILQDYKELDITATLGHDLRERD 400  Model_01 KLTVERARKIQRLQPFQVAVSTGHMGRVFLKRTIKGQQLAGEYDHLRQAFTHVGFIRKAVAKADKLAK 525 2f43.1.B KLTVERARKIQRLQPFQVAVSTGHMGRVFLKRTIKGQQLAGEYDHLRQAFTHVGFIRKAVAKADKLAK 475  Model_01 EHG 529 2f43.1.B EHG 479 </pre>
g)	Laminin subunit alpha-5 precursor target protein(2y38selected as a reference structure for modeling of BL1549- Laminin subunit alpha-5 precursor).
	<pre> Seqres APLAGGDDGFLHPPYFHLAKGKITASATCGRRAPTRRVRKPTRDLYCKLVGGPVAGGDPAQTIQGGYCDICTAA 75 2y38.1.A -----GFLHPPYFHLAKGKITASATCGRRAPTRRVRKPTRDLYCKLVGGPVAGGDPAQTIQGGYCDICTAA 30  Seqres GSHKAPVSHMIDGTERMMQSPFLSRGLRYNVHVTLDLQGVFHVAYVLIKANSRFPDLWVLERSTDFGHTYQP 150 2y38.1.A -----GSHKAPVSHMIDGTERMMQSPFLSRGLRYNVHVTLDLQGVFHVAYVLIKANSRFPDLWVLERSTDFGHTYQP 150  Seqres GQFFASSKRDCLRRFGPRTLRRITQDDDVICTRYSRIVPLRNGRIVVSLVNGRPGALHFSYSPLLRDTKATHI 225 2y38.1.A GQFFASSKRDCLRRFGPRTLRRITQDDDVICTRYSRIVPLRNGRIVVSLVNGRPGALHFSYSPLLRDTKATHI 225  Seqres KLFELTHTLLGHLGKALRQFTVTRKYYSIKDISIGGRCVCHGNADVCDAKDPDLPFRLLQCAQHHTCGGSCD 300 2y38.1.A KLFELTHTLLGHLGKALRQFTVTRKYYSIKDISIGGRCVCHGNADVCDAKDPDLPFRLLQCAQHHTCGGSCD 300  Seqres KCCPGFHQQFHKPATTSANRCQSCCHCHGAYDCYDPRVDRRKASQHQDNVYQGGGVCLDCAQHHTTGINCRKCL 375 2y38.1.A KCCPGFHQQFHKPATTSANRCQSCCHCHGAYDCYDPRVDRRKASQHQDNVYQGGGVCLDCAQHHTTGINCRKCL 375  Seqres PGFFRAPDQFLDSFHYCPAAAHHHHH 403 2y38.1.A PGFFRAPDQFLDSFHYCPAAAHHHHH 399 </pre>
h)	INSL3_MOUSE, Insulin-like 3 target protein(2kqp selected as a reference structure for modeling of BL1384-INSL3_MOUSE, Insulin-like 3).
	<pre> Model_01 MRAPLLLMLLALGSALRSPQPPFARAKLCGHHLVRTLVRVCGGPR--WSPEATQPVETRDRELLQWLEQRHLLHA 73 2kqp.1.A -----VNQHLCSGDLVEALYLVCGERGFFYTKPTRRREAE--LQVGQVBL----- 44  Model_01 LVADVDPALDLPQLPRQASQRQRRSAATNAVHRCLTGTCTQQDLLGLCFH 122 2kqp.1.A ---GGPGAGS-LQPLAL-EGSLQ-KRGIVQCCITSICSLYQLENYCN- 85 </pre>
i)	Nucleolar protein 14 target protein(3zkv selected as a reference structure for modeling of BPL 119- Nucleolar protein 14).
	<pre> Model_01 ----- 75 2kqp.1.A ----- 75  Model_01 ----- 150 2kqp.1.A ----- 150  Model_01 ----- 225 2kqp.1.A ----- 225  Model_01 ----- 300 2kqp.1.A ----- 300  Model_01 ----- 375 2kqp.1.A ----- 375  Model_01 ----- 450 2kqp.1.A ----- 450  Model_01 ----- 525 2kqp.1.A ----- 525  Model_01 ----- 600 2kqp.1.A ----- 600  Model_01 ----- 675 2kqp.1.A ----- 675  Model_01 ----- 750 2kqp.1.A ----- 750  Model_01 ----- 825 2kqp.1.A ----- 825  Model_01 ----- 900 2kqp.1.A ----- 900  Model_01 ----- 975 2kqp.1.A ----- 975  Model_01 ----- 1050 2kqp.1.A ----- 1050  Model_01 ----- 1125 2kqp.1.A ----- 1125  Model_01 ----- 1200 2kqp.1.A ----- 1200  Model_01 ----- 1275 2kqp.1.A ----- 1275  Model_01 ----- 1350 2kqp.1.A ----- 1350  Model_01 ----- 1425 2kqp.1.A ----- 1425  Model_01 ----- 1500 2kqp.1.A ----- 1500 </pre>
j)	Nuclear protein MDM1 target protein (1wpbselected as a reference structure for modeling of BPL 128- Nuclear protein MDM1).
	<pre> Model_01 ----- 75 2kqp.1.A ----- 75  Model_01 ----- 150 2kqp.1.A ----- 150  Model_01 ----- 225 2kqp.1.A ----- 225  Model_01 ----- 300 2kqp.1.A ----- 300  Model_01 ----- 375 2kqp.1.A ----- 375  Model_01 ----- 450 2kqp.1.A ----- 450  Model_01 ----- 525 2kqp.1.A ----- 525  Model_01 ----- 600 2kqp.1.A ----- 600  Model_01 ----- 675 2kqp.1.A ----- 675  Model_01 ----- 750 2kqp.1.A ----- 750  Model_01 ----- 825 2kqp.1.A ----- 825  Model_01 ----- 900 2kqp.1.A ----- 900  Model_01 ----- 975 2kqp.1.A ----- 975  Model_01 ----- 1050 2kqp.1.A ----- 1050  Model_01 ----- 1125 2kqp.1.A ----- 1125  Model_01 ----- 1200 2kqp.1.A ----- 1200  Model_01 ----- 1275 2kqp.1.A ----- 1275  Model_01 ----- 1350 2kqp.1.A ----- 1350  Model_01 ----- 1425 2kqp.1.A ----- 1425  Model_01 ----- 1500 2kqp.1.A ----- 1500 </pre>

**Fig 2:-** Sequence alignment of differentially expressed proteins In liver induced by bisphenol , Bisphenol and probiotic treated proteins

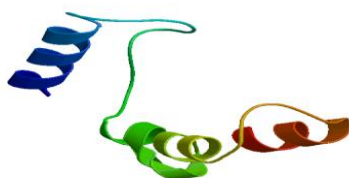


**Fig 3:-** Homology modeling of differentially expressed proteins of Hypothalamus induced by Bisphenol A and treatment with BPA+probiotic bacteria



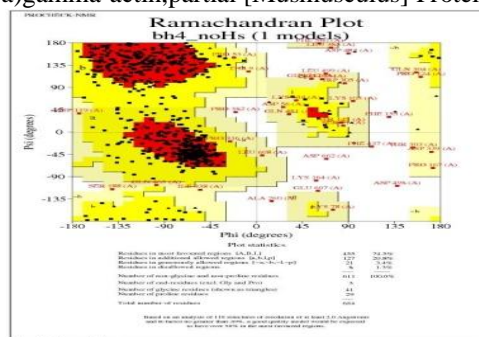


j) 3Dimensional structure of BPL 128-Nuclear protein MDM1 protein

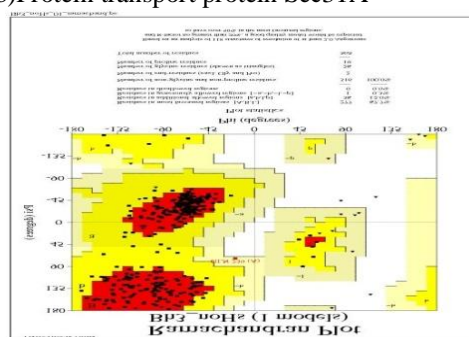
**Fig 4:-** Homology modeling of differentially expressed proteins of Liver induced by BPA and treatment with BPA + probiotic bacteria**Table 3:-** Validation of Hypothalamus tissue protein sample by Ramachandran's plot analysis

S.No	No. of residues in most favoured regions	No. of residues in additional allowed regions	No. of residues in disallowed regions	No. of glycine and proline residues
1.	gamma-actin,partial [Musmusculus]	277(87.7%)	38(12.0%)	28 (Gly),19(pro)
2.	Protein transport protein Sec31A	455(74.5%)	127(20.8%)	41(Gly),29(pro)
3.	Atp5b protein [Musmusculus]	363(91.9%)	30(7.6%)	45 (Gly), 24 (pro)
4.	PREDICTED: polyadenylate-binding protein 4 isoform X3	284(87.1%)	31(9.6%)	28 (Gly), 9( pro)
5.	V-type proton ATPase catalytic subunit A	458(83.4%)	50(9.7%)	50 (Gly), 30(pro)

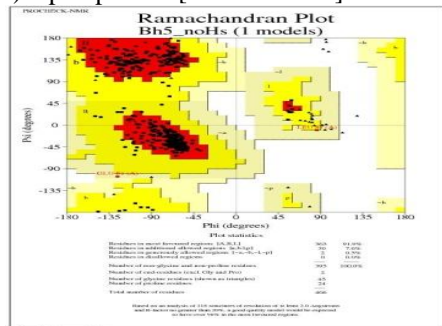
a) gamma-actin,partial [Musmusculus] Protein



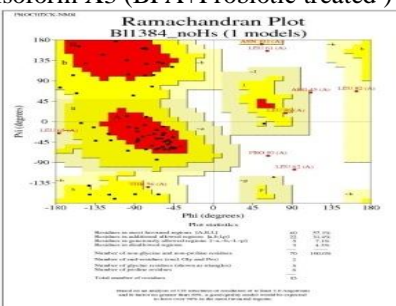
b) Protein transport protein Sec31A



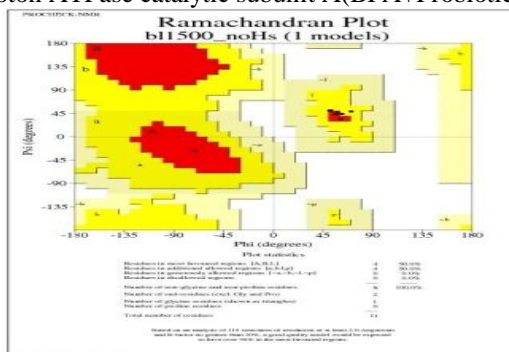
c) Atp5b protein [Musmusculus]



d) PREDICTED: polyadenylate-binding protein 4 isoform X3 (BPA+Probiotic treated )

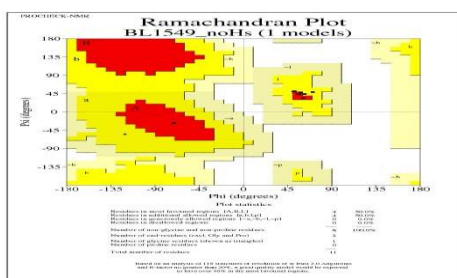
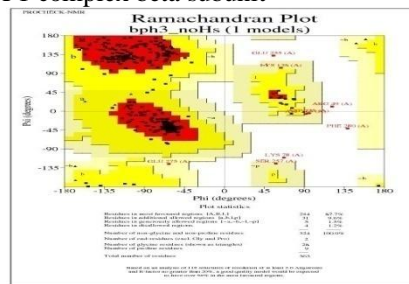


e) V-type proton ATPase catalytic subunit A(BPA+Probiotic treated).

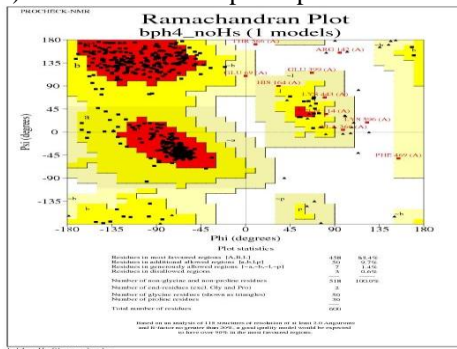
**Fig 5:-** Illustration of Ramachandran's plot analysis of proteins expressed in Hypothalamus response to BPA stress and BPA+Probiotic treatment**Table 4:** Validation of Liver tissue proteins by Ramachandran's plot analysis

S.No	No. of residues in most favoured regions	No. of residues in additional allowed regions	No. of residues in disallowed regions	No. of glycine and proline residues
6.	INSL3_MOUSE, Insulin-like 3	40(57.1%)	22(31.4%)	5 (Gly), 6(pro)
7.	Mitochondrial ATP synthase, H <sup>+</sup> transporting F1 complex beta subunit	4(50.0%)	4(50.0%)	1 (Gly), 0 (pro)
8.	Laminin subunit alpha-5 precursor	44(50.0%)	4(50.0%)	1 (Gly), 0 (pro)
9.	Nucleolar protein 14	103( 89.6%)	11(9.6%)	5 (Gly), 7(pro)
10.	Nuclear protein MDM1	4(50.0%)	4(50.0%)	1(Gly), 0(pro)

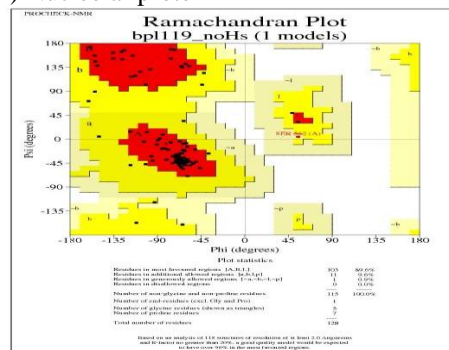
f) INSL3\_MOUSE, Insulin-like 3

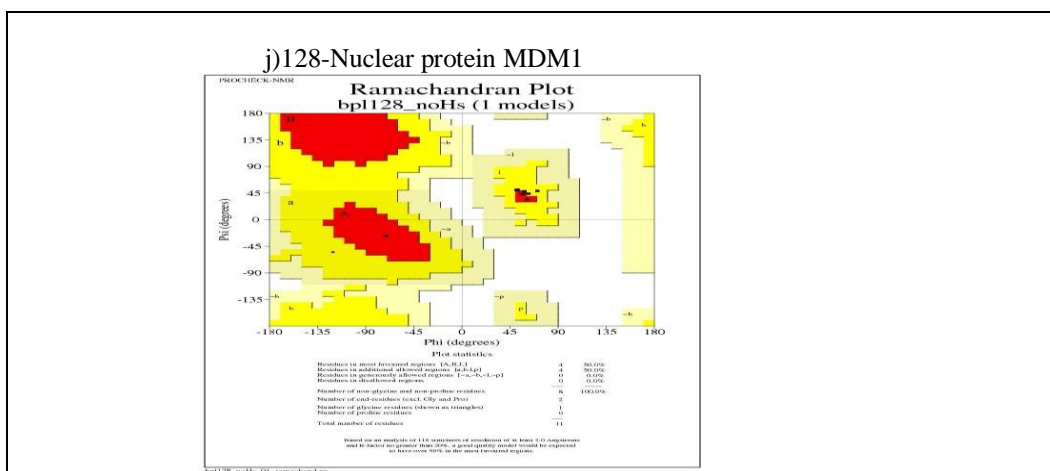
g) Mitochondrial ATP synthase, H<sup>+</sup> transporting F1 complex beta subunit

h) Laminin subunit alpha-5 precursor



i) Nucleolar protein 14

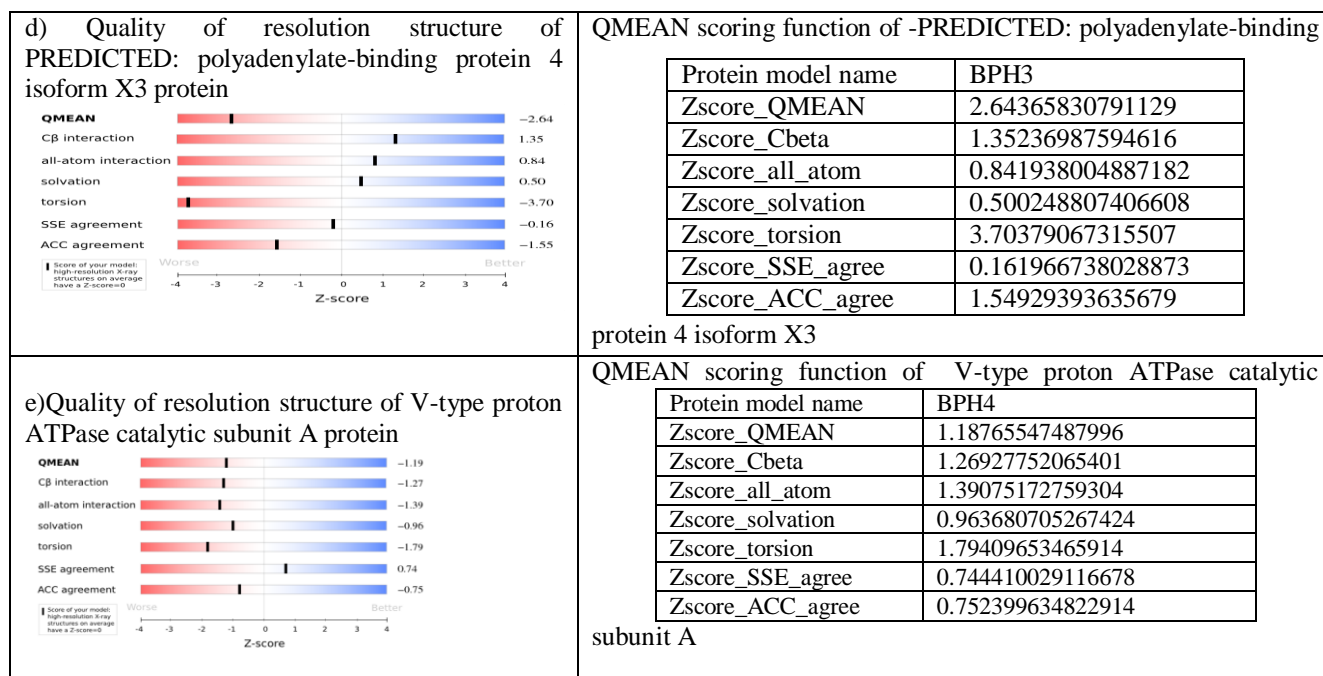




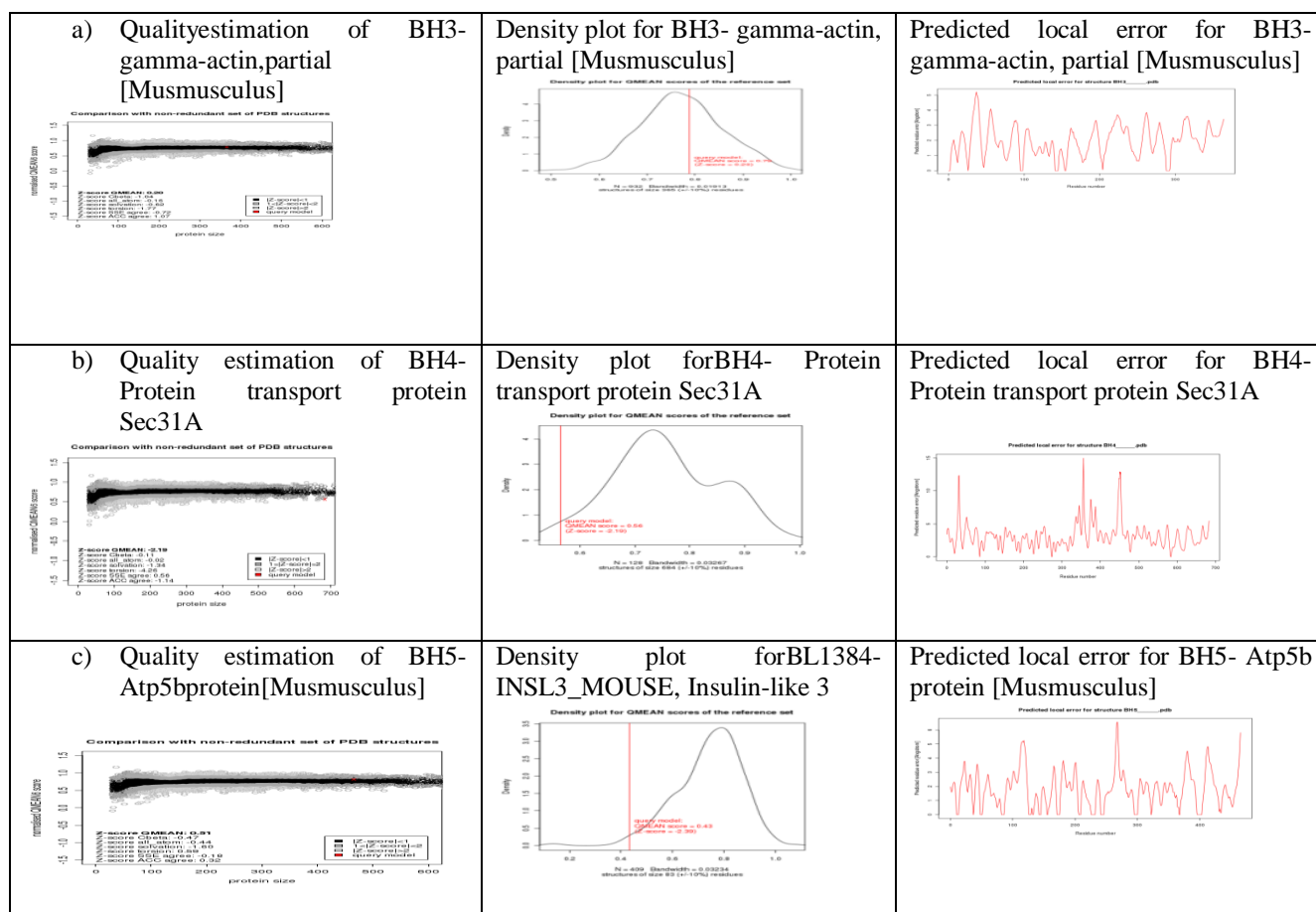
**Fig 6:-** Ramachandran's plot analysis of proteins expressed in Liver response to BPA stress and BPA+Probiotic treatment.

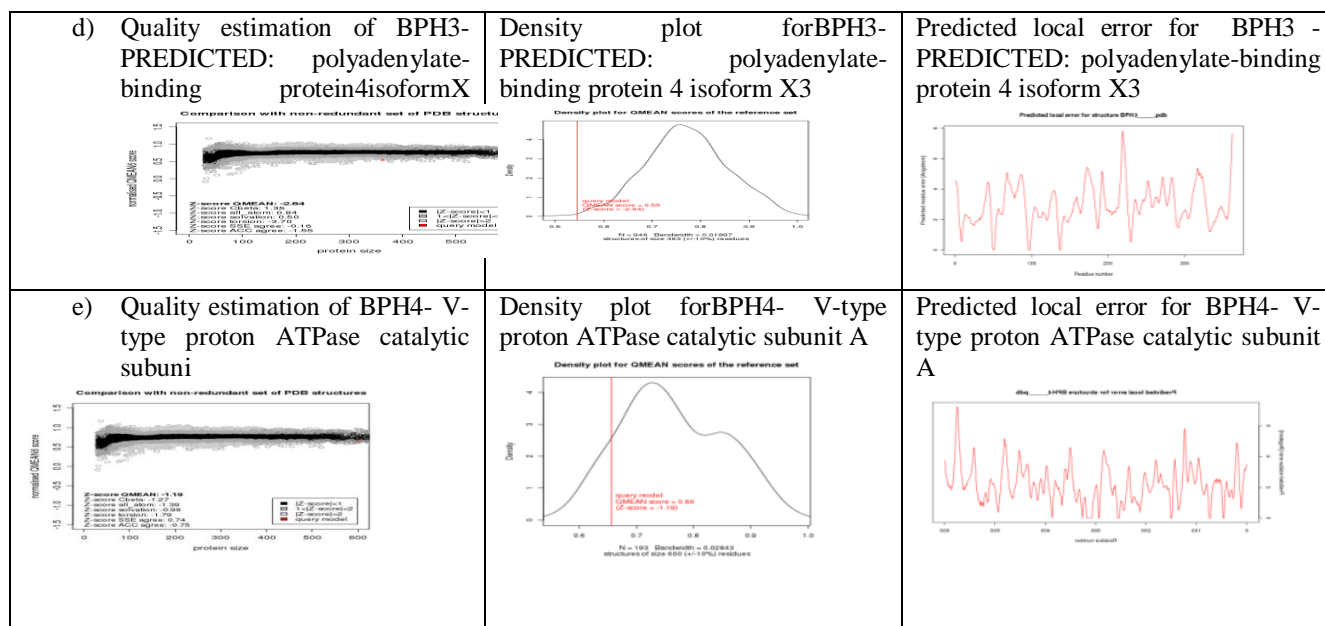
<p>a)Quality of resolution structure of -gamma-actin, partial [Musmusculus] protein</p> <p><b>QMEAN</b></p> <p>Cβ interaction -1.04</p> <p>all-atom interaction -0.16</p> <p>solvation -0.62</p> <p>torsion -1.77</p> <p>SSE agreement -0.72</p> <p>ACC agreement 1.07</p> <p>Score of your model: high-resolution X-ray structures on average have a Z-score=0</p> <p>Worse -4 -3 -2 -1 0 1 2 3 4 Better</p> <p>Z-score</p>	<p>QMEAN scoring function of gamma-actin, partial[Musmusculus]</p> <table border="1"> <tr> <td>Protein model name</td><td>BH3</td></tr> <tr> <td>Zscore_QMEAN</td><td>0.202664453420632</td></tr> <tr> <td>Zscore_Cbeta</td><td>1.03958792614991</td></tr> <tr> <td>Zscore_all_atom</td><td>0.161708866011722</td></tr> <tr> <td>Zscore_solvation</td><td>0.622112948131572</td></tr> <tr> <td>Zscore_torsion</td><td>1.76687838179354</td></tr> <tr> <td>Zscore_SSE_agree</td><td>0.721091515598544</td></tr> <tr> <td>Zscore_ACC_agree</td><td>1.06896443585087</td></tr> </table>	Protein model name	BH3	Zscore_QMEAN	0.202664453420632	Zscore_Cbeta	1.03958792614991	Zscore_all_atom	0.161708866011722	Zscore_solvation	0.622112948131572	Zscore_torsion	1.76687838179354	Zscore_SSE_agree	0.721091515598544	Zscore_ACC_agree	1.06896443585087
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<p>b) Quality of resolution structure of Protein transport protein Sec31 protein</p> <p><b>QMEAN</b></p> <p>Cβ interaction -2.1</p> <p>all-atom interaction -0.1</p> <p>solvation -1.3</p> <p>torsion -4.2</p> <p>SSE agreement 0.56</p> <p>ACC agreement -1.1</p> <p>Score of your model: high-resolution X-ray structures on average have a Z-score=0</p> <p>Worse -4 -3 -2 -1 0 1 2 3 4 Better</p> <p>Z-score</p>	<p>QMEAN scoring function of Protein transport protein Sec31A</p> <table border="1"> <tr> <td>Protein model name</td><td>BH4</td></tr> <tr> <td>Zscore_QMEAN</td><td>2.19243199536967</td></tr> <tr> <td>Zscore_Cbeta</td><td>0.109382670524617</td></tr> <tr> <td>Zscore_all_atom</td><td>0.0201402306006502</td></tr> <tr> <td>Zscore_solvation</td><td>1.34093329731162</td></tr> <tr> <td>Zscore_torsion</td><td>4.25948482492861</td></tr> <tr> <td>Zscore_SSE_agree</td><td>0.560296498026475</td></tr> <tr> <td>Zscore_ACC_agree</td><td>1.14302010241546</td></tr> </table>	Protein model name	BH4	Zscore_QMEAN	2.19243199536967	Zscore_Cbeta	0.109382670524617	Zscore_all_atom	0.0201402306006502	Zscore_solvation	1.34093329731162	Zscore_torsion	4.25948482492861	Zscore_SSE_agree	0.560296498026475	Zscore_ACC_agree	1.14302010241546
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<p>c) Quality of resolution structure of Atp5b protein [Musmusculus] protein</p> <p><b>QMEAN</b></p> <p>Cβ interaction 0.51</p> <p>all-atom interaction -0.47</p> <p>solvation -0.44</p> <p>torsion -1.60</p> <p>SSE agreement 0.59</p> <p>ACC agreement -0.18</p> <p>Score of your model: high-resolution X-ray structures on average have a Z-score=0</p> <p>Worse -4 -3 -2 -1 0 1 2 3 4 Better</p> <p>Z-score</p>	<p>QMEAN scoring function of Atp5b protein [Musmusculus]</p> <table border="1"> <tr> <td>Protein model name</td><td>BH5</td></tr> <tr> <td>Zscore_QMEAN</td><td>0.508027357752407</td></tr> <tr> <td>Zscore_Cbeta</td><td>0.469305344908218</td></tr> <tr> <td>Zscore_all_atom</td><td>0.439180122160005</td></tr> <tr> <td>Zscore_solvation</td><td>1.59520535256758</td></tr> <tr> <td>Zscore_torsion</td><td>0.592791846376968</td></tr> <tr> <td>Zscore_SSE_agree</td><td>0.180361826190693</td></tr> <tr> <td>Zscore_ACC_agree</td><td>0.323508715703452</td></tr> </table>	Protein model name	BH5	Zscore_QMEAN	0.508027357752407	Zscore_Cbeta	0.469305344908218	Zscore_all_atom	0.439180122160005	Zscore_solvation	1.59520535256758	Zscore_torsion	0.592791846376968	Zscore_SSE_agree	0.180361826190693	Zscore_ACC_agree	0.323508715703452
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Zscore_SSE_agree	0.180361826190693																
Zscore_ACC_agree	0.323508715703452																





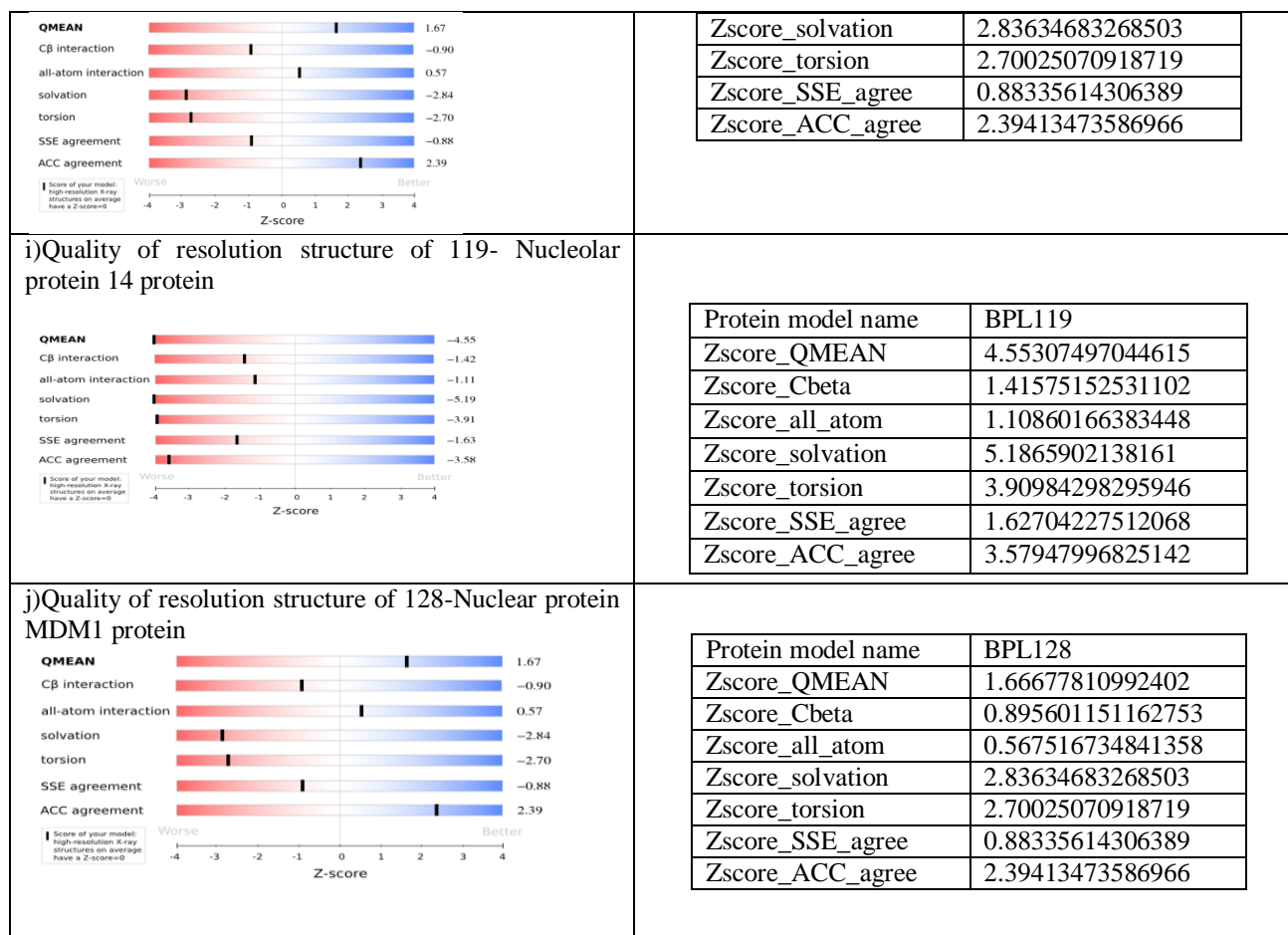
**Fig 7:-** QMEAN analysis for the quality resolution structure of Hypothalamus proteins induced with BPA and BPA+Probiotic treatment.



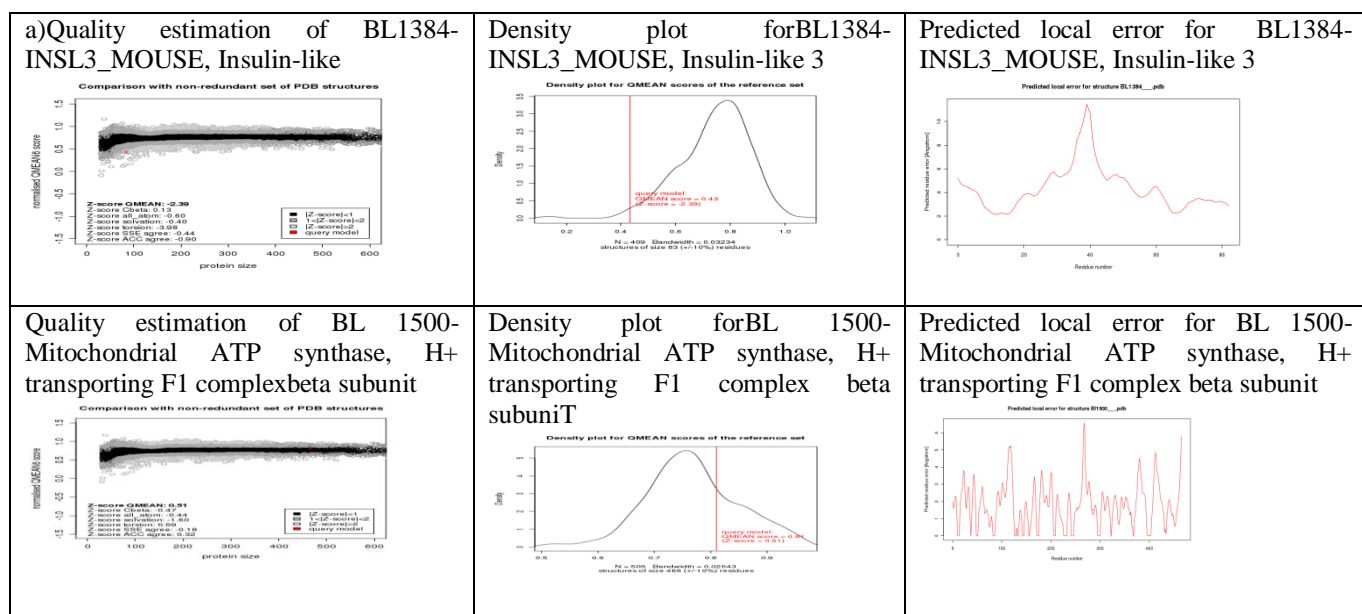


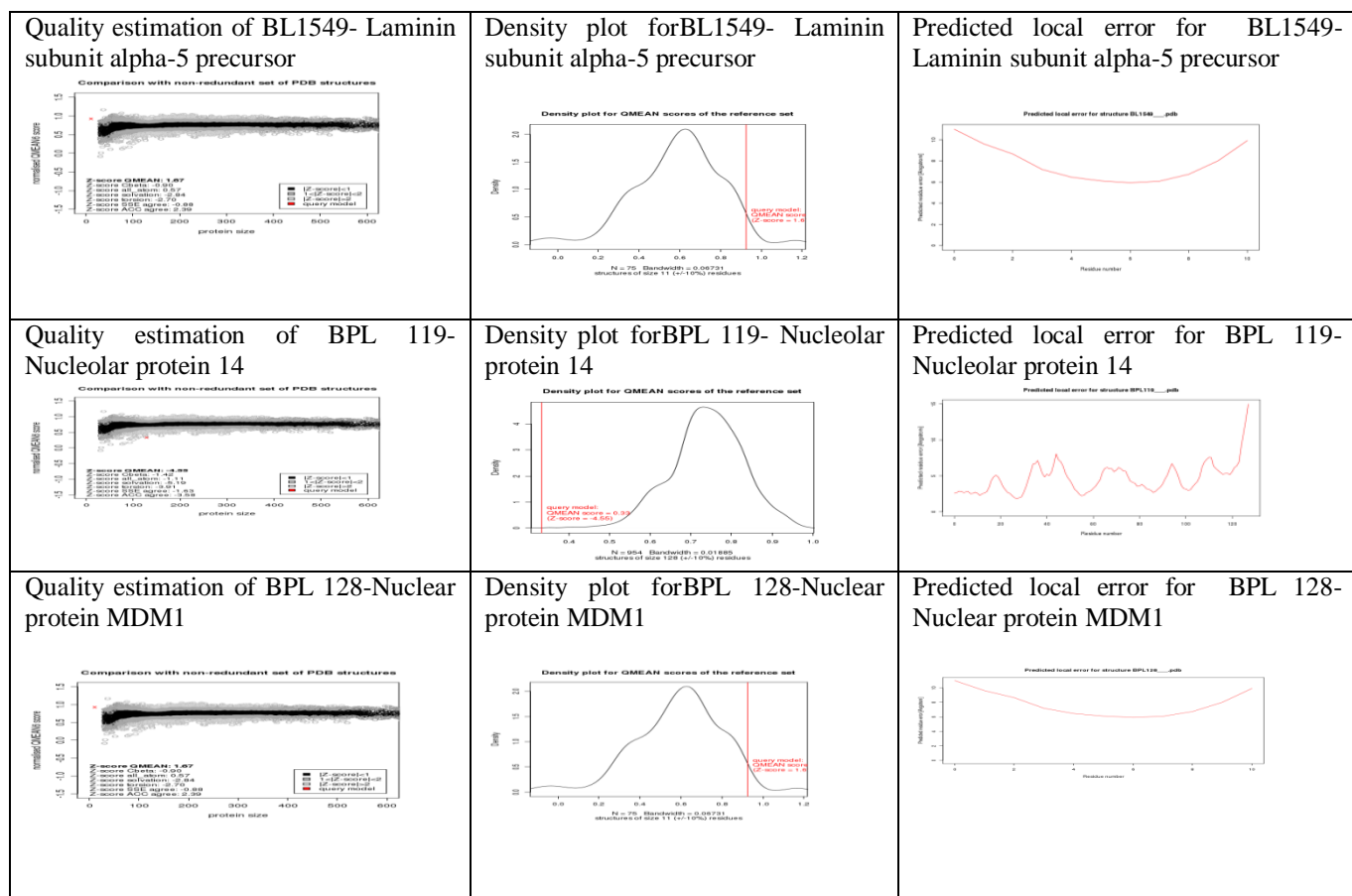
**Fig 8:-** Qmean Analysis,Density Plot Analysis ,Predicted Local Error for estimating the quality of differentially expressed proteins structure of Hypothalamus tissue induced with BPA and BPA+Probiotic treatment

<p><b>f)Quality of resolution structure of 1384- INSL3_MOUSE, Insulin-like 3 protein</b></p> <p><b>QMEAN</b></p> <p>C<math>\beta</math> interaction: 0.13 all-atom interaction: -0.60 solvation: -0.40 torsion: -3.98 SSE agreement: -0.44 ACC agreement: -0.90</p> <p>Score of your model: high-resolution X-ray structures on average have a Z-score=0</p> <p>Worse: -4 -3 -2 -1 0 1 2 3 4 Better</p> <p>Z-score</p>	<table border="1"> <tr><td>Protein model name</td><td>BL1384</td></tr> <tr><td>Zscore_QMEAN</td><td>2.38964453671237</td></tr> <tr><td>Zscore_Cbeta</td><td>0.127878246354725</td></tr> <tr><td>Zscore_all_atom</td><td>0.597864567752103</td></tr> <tr><td>Zscore_solvation</td><td>0.4017765313089</td></tr> <tr><td>Zscore_torsion</td><td>3.97626544639136</td></tr> <tr><td>Zscore_SSE_agree</td><td>0.436430019683796</td></tr> <tr><td>Zscore_ACC_agree</td><td>0.895632370321055</td></tr> </table>	Protein model name	BL1384	Zscore_QMEAN	2.38964453671237	Zscore_Cbeta	0.127878246354725	Zscore_all_atom	0.597864567752103	Zscore_solvation	0.4017765313089	Zscore_torsion	3.97626544639136	Zscore_SSE_agree	0.436430019683796	Zscore_ACC_agree	0.895632370321055
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<p><b>g)Quality of resolution structure of 1500- Mitochondrial ATP synthase, H<sup>+</sup> transporting F1 complex beta subunit protein</b></p> <p><b>QMEAN</b></p> <p>C<math>\beta</math> interaction: -0.47 all-atom interaction: -0.44 solvation: -1.60 torsion: 0.59 SSE agreement: -0.18 ACC agreement: 0.32</p> <p>Score of your model: high-resolution X-ray structures on average have a Z-score=0</p> <p>Worse: -4 -3 -2 -1 0 1 2 3 4 Better</p> <p>Z-score</p>	<table border="1"> <tr><td>Protein model name</td><td>BL1500</td></tr> <tr><td>Zscore_QMEAN</td><td>0.508027357752407</td></tr> <tr><td>Zscore_Cbeta</td><td>0.469305344908218</td></tr> <tr><td>Zscore_all_atom</td><td>0.439180122160005</td></tr> <tr><td>Zscore_solvation</td><td>1.59520535256758</td></tr> <tr><td>Zscore_torsion</td><td>0.592791846376968</td></tr> <tr><td>ZscoreSSEagree</td><td>0.180361826190693</td></tr> <tr><td>ZscoreACCagree</td><td>0.323508715703452</td></tr> </table>	Protein model name	BL1500	Zscore_QMEAN	0.508027357752407	Zscore_Cbeta	0.469305344908218	Zscore_all_atom	0.439180122160005	Zscore_solvation	1.59520535256758	Zscore_torsion	0.592791846376968	ZscoreSSEagree	0.180361826190693	ZscoreACCagree	0.323508715703452
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ZscoreACCagree	0.323508715703452																
<p><b>h)Quality of resolution structure of 1549- Laminin subunit alpha-5 precursor protein</b></p>	<p><b>QMEAN scoring function of BL1549- Laminin subunit alpha-5 precursor</b></p> <table border="1"> <tr><td>Protein model name</td><td>BL1549</td></tr> <tr><td>Zscore_QMEAN</td><td>1.66677810992402</td></tr> <tr><td>Zscore_Cbeta</td><td>0.895601151162753</td></tr> <tr><td>Zscore_all_atom</td><td>0.567516734841358</td></tr> </table>	Protein model name	BL1549	Zscore_QMEAN	1.66677810992402	Zscore_Cbeta	0.895601151162753	Zscore_all_atom	0.567516734841358								
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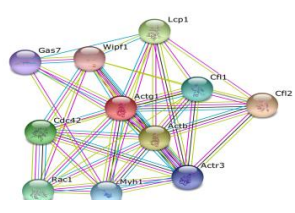
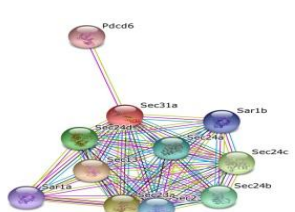


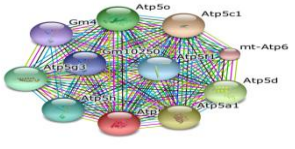
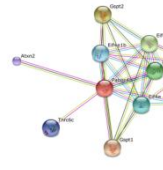
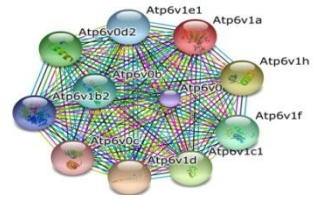
**Fig 9:-** QMEAN analysis for the quality resolution structure of Liver proteins induced with BPA and BPA+Probiotic treatment.



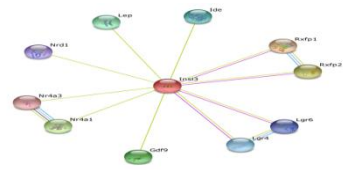


**Fig 10:-** Qmean Analysis, Density Plot Analysis, Predicted Local Error for estimating the quality of differentially expressed proteins structure of Liver tissue induced with BPA and BPA+Probiotic treatment

Prot para analysis of gamma-actin, partial [Musmusculus] protein		String structure of gamma-actin, partial [Musmusculus]	
Formula of the protein	C1822H2860N484O548S22		
Total No. of atoms	5736		
Extinction coefficient	44725		
Molecular weight	41018.9 Daltons		
Estimated half-life	5.5		
Instability index	36.18 ( Stable Protein)		
Aliphatic index	82.17		
GRAVY (Grand average of hydropathicity)	-0.201		
<b>Prot param analysis of Protein transport protein Sec31A</b>		String structure of Protein transport protein Sec31A	
Formula of the protein	C5910H9310N1638O1811S40		
Total No. of atoms	18709		
Extinction coefficient	129355		
Molecular weight	133569.2 Daltons		
Estimated half-life	30 hours		
Instability index	54.48 ( Unstable Protein)		
Aliphatic index	79.21		
GRAVY (Grand average of hydropathicity)	-0.376		

of hydropathicity)		
<b>Prot param analysis of Atp5b protein [Musmusculus]</b>		<b>String structure of Atp5b protein [Musmusculus]</b>
Formula of the protein	C2517H4062N688O768S13	
Total No.of atoms	4062	
Extinction coefficient	19370	
Molecular weight	56666.8 Daltons	
Estimated half-life	3.5 hours	
Instability index	34.99 (Stable Protein)	
Aliphatic index	99.96	
GRAVY(Grand average of hydropathicity)	0.032	
<b>Prot param analysis of PREDICTED: polyadenylate-binding protein 4 isoform X3</b>		<b>String structure of PREDICTED: polyadenylate-binding protein 4 isoform X3</b>
Formula of the protein	C3057H4876N882O905S27	
Total No.of atoms	9747	
Extinction coefficient	38070	
Molecular weight	69331.3 Daltons	
Estimated half-life	30 hours	
Instability index	43.67 (Unstable Protein)	
Aliphatic index	72.40	
GRAVY(Grand average of hydropathicity)	-0.457	
<b>Prot param analysis of V-type proton ATPase catalytic subunit A</b>		<b>String structure of V-type proton ATPase catalytic subunit A</b>
Formula of the protein	C3040H4796N810O921S28	
Total No.of atoms	9595	
Extinction coefficient	70625	
Molecular weight	68326.0 Daltons	
Estimated half-life	30 hours	
Instability index	35.10 (Stable Protein)	
Aliphatic index	85.93	
GRAVY(Grand average of hydropathicity)	-0.196	

**Fig 11:-** Protparam and String analysis of expressed proteins in Hypothalamus tissue response to BPA and BPA+Probiotic treatment.

<b>Protparam analysis of INSL3_MOUSE, Insulin-like 3</b>		<b>String structure of INSL3_MOUSE, Insulin-like 3</b>
Formula of the protein	C587H970N190O165S8	
Total No.of atoms	1920	
Extinction coefficient	11375	
Molecular weight	13585.8 Daltons	
Estimated half-life	30 HOURS	
Instability index	65.67 (Unstable Protein)	
Aliphatic index	97.62	
GRAVY(Grand average of hydropathicity)	-0.282	
<b>Protparam analysis of Mitochondrial ATP synthase, H<sup>+</sup> transporting F1 complex beta subunit</b>		<b>String structure of Mitochondrial ATP synthase, H<sup>+</sup> transporting F1 complex beta subunit</b>
Formula of the protein	C2502H4040N682O763S13	

**Fig 12:-** Prot param and string analysis of expressed proteins in Liver tissue response to BPA and BPA+probiotic treatment

In the present study, we have identified the structures and complete protein information regarding 3D structures, atomic configurations, no. of amino acid residues in Ramachandran plot analysis of BPA stressed liver proteins and BPA and probiotic treated Hypothalamus tissue proteins. We were interested in BPA induced proteins in liver as they were over expressed and this over expression in normal cellular metabolism may lead to the diseases.

This protein is a member of the insulin like hormone or protein super family and was first recognized by cloning projects using testicular tissue, hence its original name of Leydig insulin-like peptide [12,13 ] and also expressed in



ovarian theca and luteal cells in females. Although recognized for some time, its function was unknown until 1999 when two groups investigating mice mutants for INSL3 found bilateral cryptorchidism and developmental abnormalities of the gubernaculum [14,15] in males. It is the Newest hormone or protein demonstrated to be involved in abnormalities like:

#### **Testicular descent or cryptorchidism and Gubernacular swelling:-**

INSL3/Leydig insulin-like peptide acts as a ligand and activates the LGR8 receptor (G-protein coupled receptor) present on testes cells, important in testis descent. This LGR8 receptor activation leads to Signalling process and INSL3 peptide continuous signalling or mutation leads to a condition called cryptorchidism in which testicle that doesn't move into its proper position in the bag of skin hanging below the penis (scrotum). In humans, circulating INSL3 increases through puberty, to reach a maximum in early adulthood, and subsequently appears to decline to significantly lower plasma levels in aging men [16, 17]. Recently, it has been suggested [18] that androgens and phthalates at high concentration may modulate Insl3 gene expression in cultured Leydig cells. Caudal enlargement of the gubernaculum during relative transabdominal movement of the testis is known as the "gubernacular swelling reaction" or "gubernacular outgrowth" and is caused by cell division and an increase in glycosaminoglycans and hyaluronic acid (19). The hydrophilic nature of hyaluronic acid makes the end of the gubernaculum bulky and gelatinous. In females over expression of INSL3 induces ovary descent.

#### **Mitochondrial ATP synthase, H<sup>+</sup> transporting F1 complex beta subunit protein:-**

Mitochondrial ATP5B expression in the liver has been shown to be controlled at the post-transcriptional level (and controlling process was found to be induced by miR-127-5p). MiR-127-5p 3'UTR of  $\beta$ -F1-ATPase which shows much expression in fetal liver targets mRNA ( $\beta$ -mRNA) and miR-127-5p inhibits  $\beta$ -F1-ATPase mRNA translation in humans [20]. MiR-127-5p has an important role in regulating the activity of mitochondrial bioenergetics in oncogenesis[21]. ATP5B was found to be up regulated in breast cancer in tissues in a significant manner. Control of translational efficiency of beta-F1-ATPase mRNA depends on the regulation of a protein that binds the 3' untranslated region of the mRNA. miR-127-5p inhibits  $\beta$ -F1-ATPase mRNA translation in humans.

#### **Counter effect on ATP synthase:-**

The agonist of ATP synthase MAb3D5AB1 recognises catalytic  $\beta$ -subunit of ATP synthase and inhibits the activity of F1 domain. Mab3d5ab1 shows angiostatin-like properties and can be useful in the chemotherapy... This protein can even play an important role as a target protein in the treatment of cancers. Using ATP synthase inhibitor aurovertin B, in breast cancer cells MCF-7, the effect of ATP5B protein in tumor progression was found to be reduced. [22].

#### **Laminin subunit alpha-5 precursor protein:-**

This protein contains five, N-terminus, extracellular immunoglobulin domains, a single transmembrane domain, and a short, C-terminal cytoplasmic tail and may play a role in epithelial cell cancer and in vaso-occlusion of red blood cells in sickle cell disease. More recent data indicate a direct participation of the vascular endothelium, of multiple and complex cellular interactions, and of a global inflammation-mediated cell activation, in the initiation and propagation of the vaso-occlusive process with two consecutive steps. The first step involves adhesion of the stress reticulocytes[23] and activated polymorphonuclear neutrophils, (iii) signalling pathways in the red blood cell (the signalling pathways in the red blood cell, makes the cell susceptible to be modulated by stress, hypoxia, and by the inflammatory response and to influence the activation status of adhesion receptors and of ion transporters implicated in SS-RBC dehydration and finally of a syndrome of complex endothelial dysfunction involving abnormalities of the metabolism of nitric oxide (NO) was brought into light to the endothelium of post-capillary venules, slowing down the blood flow and thereby inducing and propagating sickling of mature SS-RBCs that are maintained for a longer time in a hypoxic environment and activates polymorphonuclear neutrophils second step involves the entrapment of irreversible sickle cells and to the complete occlusion of the micro-vessels[24-31]

#### **Conclusion:-**

In our study, we concluded that BPA stressed proteins in liver tissue are involved in certain metabolic disorders like cryptorchidism, Gubernacular swelling, oncogenesis, epithelial cell cancers and Vaso-occlusive process where BPA and probiotic treatment in liver shown production of Nuclear protein MDM1 protein which is a microtubule-binding protein that negatively regulates centriole duplication which binds and stabilizes microtubules in controlling cell duplication process in testis. This negative regulation seems to be to control the cryptorchidism caused by over expressed proteins by BPA in liver.

**Conflict Of Interest:-**

We declare that we have no conflict of interest.

**Acknowledgement:-**

The authors are thankful to UGC, New Delhi for providing financial assistance (UGC-MRP).

**References:-**

1. Kush,A. and Raghava, GPS.(2008):AC2DGel: Analysis and Comparison of 2D Gels. J Proteomics Bioinform,1: 043-046.
2. Zhang,Z.H., Hongzhan,H., Amrita,C., Mira,J., Anatoly,D.(2008):Integrated Bioinformatics for Radiation-Induced Pathway Analysis from Proteomics anMicroarray Data. J Proteomics Bioinform, 1:047-060.
3. Teeguarden,J.G., Waechter,JM Jr., Clewell,H.J., Covington,T.R., Barton,H.A.(2005): Evaluation of oral and intravenous route pharmacokinetics, plasma binding protein, and uterine tissue dose metrics of bisphenol A: a physiologically based pharmacokinetic approach. Toxicol Sci.,85:823-38.
4. Koenig,T., Menze,B.H., Kirchner,M., Monigatti ,F., Parker,K.C., Patterson,T., Steen,J.J., Hamprecht,F.A., Steen,H.(2008): Robust Prediction of the MASCOT Score for an Improved Quality Assessment in Mass Spectrometric Proteomics. J. Proteome Res, 7:3708–3717.
5. Mount, D.M., Bioinformatics: Sequence and Genome Analysis, 2nd ed., Cold Spring Harbor Laboratory Press: Cold Spring Harbor, NY.
6. Oyediji,K.O., Bolarinwa,A.F., Hamzat,M.A.(2004):Effect of Palm Wine on Reproductive Functions in Male Albino Rats. Res J Bio Sci, 7: 340-344.
7. Benkert,P., Tosatto,S.C.E., Schomburg,D.(2008):QMEAN: A Comprehensive Scoring Functionfor Model Quality Assessment. Prot Stru Fun Bioinform,71: 261-277.
8. Benkert,P., Schwede,T., Tosatto SCE.(2009):QMEANclust: estimation of protein model quality by combining a composite scoring function with structural density information. BMC. Struct Biol,9:1-17.
9. Xu,X-H *et al.*, (2010): Perinatal Exposure to Bisphenol-A Impairs Spatial Memory through Upregulation of Neurexin1 and Neuroligin3 Expression in Male Mouse Brain J Environ. Toxicol. Chem.29, 177.
10. Wessam mohammad Abdel-wahab.(2014): Thymoquinone Attenuates Toxicity And Oxidative Stress Induced By Bisphenol A In Liver Of Male , Pak.biol. sci,7(11);1152-1160.
11. Larkin,M.A. Blackshields, G., Brown,N.P.,Chenna,R., Mc Gettigan,P.A., McWilliam,H., Valentin,F., Wallace,I.M., Wilm,A., Lopez,R., Thompson,J.D., Gibson,T.J., HigginsD.G.(2007):Clustal W and Clustal X version 2.0. Bioinformatics, 23: 2947-2948.
12. Adham,I.M., Burkhardt,E., and Benahmed,M. (1993): Cloning of a cDNA for a novel insulin-like peptide of the testicular Leydig cells. J. Biol. Chem, 268:26668–26672.
13. Burkhardt,E., Adham,I.M.and Brosig,B. (1994)Structural organization of the porcine and human genes coding for a Leydig cell-specific insulinlike peptide (LEY I-L) and chromosomal localization of the human gene (INSL3). Genomics, 20,:13–19.
14. Nef, S. and Parada,L.F.( 1999):Cryptorchidism in mice mutant for Insl3. Nat Genet, 22:295–299.
15. Zimmermann,S., Steding,G., Emmen,J.M., Brinkmann,A.O., Nayernia,K., Holstein,A.F.and Engel,W.(1999): Targeted disruption of the Insl3 gene causes bilateral cryptorchidism. Mol Endocrinol, 13:681–691.
16. Anand-Ivell,R.J.K., Wohlgemuth., Haren,M.T., Hope,J., Hatzinikola, G., Wittert,G., IvellR.(2006) Peripheral INSL3 concentrations decline with age in a large population of Australian men. Int J Androl 29:618–626.
17. Ferlin, A., Garolla, A., Rigon, F., Rasi Caldogno, L., Lenzi, A., Foresta .C.(2006):Changes in serum insulin-like factor 3 during normal male puberty. J Clin Endocrinol Metab 91:3426–3431.
18. Lague,E and Tremblay,J.J.(2008): Antagonistic effects of testosterone and the endocrine disruptor mono-(2-ethylhexyl) phthalate on INSL3 transcription in Leydig cells. Endocrinology, 149:4688–4694
19. Turner, T.T., Ewing,L.L., Jones,C.E., Howards,S.S., Zegeye,B.(1985): Androgens in male rat reproductive tract fluids: hypophysectomy and steroid replacement. Am J Physiol, 248:E274–E280.
20. Willers,I.M., Isidoro,A., Ortega,A.D., Fernandez,P., Cuezva,J.M.(2010): selective inhibition of beta f1-atp ase mrna translation in human tumours, biochem J,426:319-326.
21. Izquierdo, J.M. and Cuezva, J.M.(1997): Control of the translational efficiency of beta-F1-ATPase mRNA depends on the regulation of a protein that binds the 3' untranslated region of the mRNA. Mol Cell Biol, Sep;17(9):5255–5268.



22. Chi,S.L., Wahl,M.L. MoweryY.M., Shan,S., Mukhopadyay,S., Hildebrand,S.C., Kenan,D.J., Lipes, B.D., Johnson,C.E., Maurisch,M.F., Capaldi,R.A., Dewhirst,M.W., Pizzo,S.V.(2007):Cancer Res. May 15;67(10):4716-24.
23. Hemocentro & University of São Paulo. (2011):Ribeirão Preto Medical School, Ribeirão Preto, Brazil Indian J Med Res 134, October , pp 532-537
24. Hebbel,R.P.(1997): Adhesive interactions of sickle erythrocytes with endothelium. J Clin Invest,100 (11 Suppl): S83-6.
25. Platt,O.S.(2000): Sickle cell anemia as an inflammatory disease. J Clin Invest , 106:337-8.
26. Hebbel, R.P., (2008):Adhesion of sickle red cells to endothelium: Myths and future directions. Transfus Clin Biol, 15 :14-8.
27. Chiang,E.Y. and Frenette,P.S.(2005): Sickle cell vaso-occlusion. Hematol Oncol Clin North Am, 9 :771-94.
28. Nemer, W El., Colin,Y., C Le Van Kim,C. (2010) :Role of Lu/BCAM glycoproteins in red cell diseases. Transfus Clin Biol, 17:143-7.
29. Rivera,A., Jarolim,P., Brugnara.C.(2002): Modulation of Gardos channel activity by cytokines in sickle erythrocytes. Blood,99 : 357-603.
30. Merciris,P., Giraud,F.(2001): How do sickle cells become dehydrated? Hematol J,2 :200-5. 31.
31. G.J., Kato, M.T.and Gladwin, M.H.( 2007): Steinberg. Deconstructing sickle cell disease: reappraisal of the role of hemolysis in the development of clinical subphenotypes. Blood Rev , 21 : 37-47



### RESEARCH ARTICLE

#### SURVEILLANCE AMONG ADULTS TO ASSESS KNOWLEDGE AND ATTITUDE TOWARDE ACNE VULGARIS IN SAUDI ARABIA.

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#### Abstract

Participating in school sports is an important means to increase physical activity among adolescents. While participation in schools can play an important role in increasing physical activity levels, school sports participation alone may not be sufficient to meet the current physical activity recommendations for adolescents. Therefore sports participation should not be seen as a replacement for physical education in schools but rather as a supplement to the solid foundation provided by physical education.

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#### Introduction:-

Acne vulgaris is an important health problem among adolescents and young adult. It defined as a polymorphic eruption due to chronic inflammation of the pilosebaceous apparatus characterized by comedones, papules, pustules, cysts and scars that confined to the face, shoulders, upper chest and back.<sup>(1)</sup> The Prevalence of Acne vulgaris varies between 50%<sup>(2, 3)</sup> to 80%<sup>(4, 5)</sup> among different populations in different studies.

Acne vulgaris is also associated with greater physical, psychological and social distresses and the quality of life can be severely affected in sufferers<sup>(6, 7)</sup>. A cross-sectional study conducted in UK among 111 acne patients referred to a dermatologist reported levels of social, psychological and emotional problems were as great as those reported by patients with chronic disabling asthma, epilepsy, diabetes, back pain or arthritis.<sup>(7)</sup>

Despite its high prevalence and the associated negative effects, many people have a lot of wrong beliefs and misunderstandings about their condition.<sup>(2, 8, 9)</sup> Adding to that, a study conducted in Aseer, Saudi Arabia found that there are no major differences in the beliefs, perception and psychological impact of acne patients from a developing society compared to more developed societies.<sup>(10)</sup>

Although Acne represents a common health problem among all age group, however, few studies have been conducted about this important problem among general population in Saudi Arabia.

The objective of the study was to determine awareness and knowledge of acne among adults in Saudi Arabia.

#### Methods:

This is a cross-sectional design included 200 participants. A questionnaire design in

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Arabic language was distributed among Saudi population through social media (as twitter and what's up). The Subjects were asked about the knowledge and perception about the causes of acne and psychosocial impact of acne on the individual.

Demographic data, such as age, gender, educational level, and the economic level was included in the questionnaire. Surveys were administered from September to October 2016. Data entry and descriptive analysis were done using SPSS program.

### Results:-

In our study we take 80.5% female, 19.5% male with average age group (13-18) (4.5%), 60 % (19-25), 19% (26-30), 16.5% ( more than 31) with different educational level 5% illiterate, 1.5% intermediate school, 11% high school, 77% university education with different financial status, 54% average economic situation, 35% excellent economic situation, 11% good economic situation and whether they have acne or not it was 52.5% doesn't have acne, 47.5% with acne.

- ❖ According to type of skin it was 42.5% have combined skin, 27% oily skin, 17.5% normal skin, 13% dry skin and according to what they prefer to use 51% prefer cream, 31.5% using lotion, 17.5% using gel.
- ❖ 85% say that there is a relation between stress and acne, 15% say it is not.
- ❖ 87% say they think there is a relation between acne and hormonal or genetic factors, 13% say there is no relation.
- ❖ According to obesity 44.5% think there is a relation between obesity and acne, 55.5% thinks there is not, 50.5% say there is a relation between poor hygiene and acne, 49.5% say there is no relation.
- ❖ 67.5% say that having acne is affecting their social life, 32.5% say it is not.
- ❖ 73% find that having acne is not affecting their performance at work, 27% it is.
- ❖ 81.5% find there is a relation between their food and acne but 18.5% find it is not.
- ❖ 51% think there is a relation between sun and acne, 49% think it is not
- ❖ 84% think that there is relation between acne and some of the cosmetic products, 16% think it is not.
- ❖ 84% say that acne affect their appearance 15.5% say it is not
- ❖ 84.5% think that acne is infectious disease, 15.5% think it is not
- ❖ 80% say that acne is not affecting their health, 20% they say it is.
- ❖ 67.5% say that they think acne is not affect only the face, 32.5% say it is
- ❖ 75.5% they think that using their medication more frequents will not increase their chance of healing, 24.5% think it is.

### Discussion:-

Acne is a common problem among teenagers. Because of puberty and hormonal changes that is happening. Teens will find ways to counteract this problem since teenage years is the time when an adolescent builds up his self-esteem and acne is a major hindrance to this.

The aim of this research is to clear out the misconceptions about the causes of acne and inform the readers about it. In this research also are the recommendations for preventing and treating acne.

The relationship between acne and aging has several facets it is well known that acne typically starts at certain age around puberty and tend to either resolve or diminished in early to mid twenties. But here in our study we find that average age group 4.5% (13-18) 60.0% (19-25) 19% (26-30) 16.5% ( more than 31) and as it well known that acne more common in women here in our study confirmed by 80.5% female 19.5% male that it is more related to hormones . As there is connection between acne and type of skin usually in our study we find 42.5% have mixed skin 27.0% oily skin 17.5% normal skin 13.0% dry skin according to what they prefer to use 51.0% prefer cream 31.5% lotion 17.5% gel, while it is hard to say that stress is a known cause of acne but it can aggravate acne as we find 85.0% say that there is a relation between stress and acne 15.0% say it is not. A high glycemic diet which can lead to obesity seems to trigger both acne and insulin as we find 44.5% think there is relation between obesity, while 81.4% find there is relation between their food and acne. A lot of people have heard that acne is caused by dirty skin actually we find 50.5% say there is a relation between hygiene and acne in fact washing skin too frequently and too aggressively can make an acne breakout much worse . Acne resulting from sun exposure can be linked to simple sun

sensitivity or may be sign for more serious conditions but here in our study we find 51% think there is a relation between sun and acne 49% think it is not.

Many makeup artist will say that makeup should be used to enhance your best traits not hide your perceived flaws that's easy when you have clear skin but for those who haven't found makeup is the best acne treatment unfortunately makeup can cause acne ,blackheads, whiteheads and inflammations. Here we find 84% think that there is relation between acne and some of the cosmetic products. Finally 84.5% say that acne affect their appearance 15.5% say it is not.

### **Conclusion:-**

The study revealed that there is an actual defect in the general awareness about acne regarding its causes and it is revealed that 47.5% of population (answers) was suffered from acne, which means there is a need to institute society health education programs to enable the adolescents to learn and get the right knowledge and how to handle the acne issues. Education about acne prefers to start at young ages and at students' level which they can understand and recognize their needs, thus should be provided in intermediate and high schools.

As the main target in education about acne is the adolescents, a suitable family education program should be constructed too.

### **References:-**

1. third edition , clinical dermatology John C. Hunter, John Savin, Mark Dahl
2. A. Al Robaee, "Prevalence, knowledge, beliefs and psychosocialImpact of acne in University students in central Saudi Arabia," Saudi Medical Journal, vol. 26, no. 12, pp. 1958–1961, 2005.
3. A. Pearl, B. Arroll, J. Lello, and N. M. Birchall, "The impactof acne: a study of adolescents' attitudes, perception andknowledge," New Zealand Medical Journal, vol. 111, no. 1070, pp.269–271, 1998.
4. T. C. Chu, "Acne and other facial eruptions," Medicine, vol. 25, pp. 30–33, 1997
5. W. J. CunliffeandD. J.Gould, "Prevalence of facial acne vulgaris in late adolescence and in adults," BritishMedical Journal, vol. 1, no. 6171, pp. 1109–1110, 1979.
6. Kellett SC, Gawkrödger DJ. The psychological and emotional impact of acne and the effect of treatment with isotretinoin. Br J Dermatol1999; **140**: 273–282.
7. Mallon E, Newton JN, Klassen A, et al. The quality of life in acne: a comparison with general medical conditions using a generic questionnaire. Br J Dermatol1999; **140**: 672–676.
8. A. Al-Hoqail Knowledge, beliefs and perception of youth toward acne vulgaris Saudi Med. J., 24 (7) (2003), pp. 765–76
9. Al Mashat, S., Al Sharif, N., &Zimmo, S. (2013). Acne awareness and perception among population in Jeddah, Saudi Arabia. Journal of the Saudi Society of Dermatology & Dermatologic Surgery, 17(2), 47-49.
10. Tallab, T. M. (2004). Beliefs, perceptions and psychological impact of acne vulgaris among patients in the Assir region of Saudi Arabia. West African journal of medicine, 23(1), 85-87.



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### RESEARCH ARTICLE

#### EVALUATION OF CD9 & CD56 ANTIGENS EXPRESSION IN ADULT ACUTE MYELOID LEUKAEMIA.

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#### Abstract

**Background:** -Acute myeloid leukaemia (AML) is a malignant clonal disorder resulting from the neoplastic proliferation of a clone of myeloid cells. Flow cytometry is used for confirming diagnosis, identifying prognostic differences, staging of AML and detecting an aberrant immunophenotype that can be used for monitoring of complete remission (CR) achievement.

**Objectives:** - To evaluate the expression of aberrant CD9 and CD56 in newly diagnosed adult AML patients and their association with clinical and haematological parameters and with CR achievement.

**Methods:** -Thirty adult patients (>15 years) who were newly diagnosed de novo AML were selected from the Baghdad Teaching Hospital and Al-Imamein Kadhimein medical city from July 2015 to March 2016. All patients were grouped according to FAB classification and evaluated individually and the diagnosis was based on the morphology, cytochemistry or flow cytometry. Aberrant antigens CD9 and CD56 expressions were investigated by four-colours flow cytometry at the time of diagnosis. The patients were evaluated at day 28 from the start of chemotherapy to assess complete remission achievement. Verbal consent was taken from the patients.

**Results:** -The aberrant expression of CD56, CD9 were observed in 23.3% and 33.3% of AML patients respectively. CD56 was expressed more with monocytic differentiation and CD9 was expressed more with M2 cases. CD56 expression was significantly associated with high total WBC count, high peripheral blood and bone marrow blast cells and the extramedullary manifestations. There was significant association between CD56 and CD9 expression regardless of their intensity of the markers with non-responsiveness to induction therapy.

**Conclusion:** -Aberrant CD9 and CD56 antigens were associated with adverse clinical and hematological parameters at presentation as well as with low cure rate.

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#### Introduction: -

Acute myeloid leukaemia (AML) is a hematopoietic stem cell disorder, characterized by a block in differentiation of haematopoiesis which results in the growth of a clonal population of neoplastic cells or blasts. This malignant alteration in hematopoietic stem cells leads to a loss of normal hematopoietic function. The peak incidence rate

occurs in the first year of life and then decreases steadily up to the age of 4 years and remains relatively constant in childhood and early adulthood; AML is thus a disease of adults. (1)

AML represents approximately 90% of all acute leukemias in adults but accounts for only 13% of leukaemia cases in children younger than 10 years.(2)

Recurring chromosomal aberrations and gene mutations are frequently found in AML and contribute greatly to the pathogenesis of the disease. (2) One of these is the t (8; 21) (q22; q22) translocation which produces RUNX1-RUNX1T1 fusion product that blocks hematopoietic differentiation and enhances self-renewal of hematopoietic stem cells.

The inv (16) (p13q22) or t (16; 16) (p13; q22) produces the leukaemogenic CBF $\beta$ -MYH11 fusion gene which blocks differentiation of hematopoietic stem cells by inhibiting the function of Runt-related transcription factor 1 (RUNX1). APL cells usually have t(15;17)(q22;q11-21) producing PML-RARA fusion products which also behave as a transcriptional repressor.

Accurate diagnosis and classification in AML are essential for treatment decisions and assessment of prognosis. Initial assessment requires a careful history, physical examination, complete blood count (CBC) with peripheral blood (PB) smear review, bone marrow (BM) examination, Flow cytometry (FC), cytogenetic and selected molecular genetic analysis. (3)

#### **Classification of AML: -**

Acute myeloid leukaemia can be classified in many ways: (4, 5)

1. By morphology and cytochemistry supplemented by immunophenotyping, as proposed by the FAB group.
2. The morphologic, immunologic, and cytogenetic (MIC) classification, which was the first to recognize the usefulness of cytogenetic for identifying subgroups of acute leukaemia.
3. The WHO Classification which takes into account morphologic and immunologic features plus well-studied, common non-random chromosomal abnormalities.
4. By immunophenotyping alone, as proposed by the European Group for the immunological classification of leukaemias (EGIL). Laboratory investigation of acute myeloid leukaemia:

#### **CBC and peripheral blood Smear: -**

The leukocyte count is elevated in more than one half of patients but is  $>100,000$  cells/mm<sup>3</sup> in  $<20\%$ . Blasts usually are identified on peripheral smear; Auer rods are considered pathognomonic of AML (which are reddish rod-like filaments of aggregated primary granules). A leukemic leukemia (no blasts in the peripheral smear) is rare. (6)

#### **BM Morphology: -**

A bone marrow aspirate is part of the routine diagnostic work-up of a patient with suspected AML. A marrow trephine biopsy is optional, but it should be performed in patients with a dry tap. For a diagnosis of AML, a marrow or blood blast count of 20% or more is required, except for AML with t (15; 17), t(8; 21), inv (16) or t (16; 16). Myeloblasts, monoblasts, and megakaryoblasts are included in the blast count. In AML with monocytic or myelomonocytic differentiation, monoblasts and promonocytes, but not abnormal monocytes, are counted as blast equivalents. Erythroblasts are not counted as blasts except in the rare instance of pure erythroid leukaemia. (7)

#### **Cytochemistry: -**

Cytochemistry encompasses the techniques used to identify diagnostically useful enzymes or other substances in the cytoplasm of haematopoietic cells

A: Myeloperoxidase: Myeloperoxidase is a lysosomal enzyme present in granulocytic and monocytic cells. The basis of the stain is breakdown of hydrogen peroxide by the enzyme MPO.

B: Sudan Black B (SBB) stain: which is a lipophilic dye that binds irreversibly to an undefined granule component in granulocytes, eosinophils and some monocytes. The intensity of a positive reaction with SBB in general parallels MPO activity; however, SBB is preferable as it is slightly more sensitive in the detection of myeloblasts. (8)

C: Specific esterases: Specific Esterases are a group of enzymes capable of hydrolyzing halogenated naphthol esters. The most commonly used substrate is naphthol AS-D chloroacetate. Chloroacetate esterase (CAE) is most frequently used for the identification of neutrophilic series; it is negative for monocytes, megakaryocytes, erythroblasts and lymphocytes. (8)

D: Nonspecific esterases: are a group of enzymes capable of hydrolyzing various aliphatic and aromatic short chain esters. The substrates used to detect NSEs activity include  $\alpha$ -naphthyl butyrate,  $\alpha$ -naphthyl acetate, naphthol AS-D acetate and naphthol AS acetate. They are most frequently used because they do not stain for granulocytes. Besides monocytes and histiocytes,  $\alpha$ -naphthyl acetate esterase is also positive in megakaryocytes and platelets. (9)

E: Periodic Acid-Schiff (PAS) Reaction: Periodic acid specifically oxidizes 1-2 glycol groups to produce stable aldehydes which give a red reaction product when exposed to Schiff's reagent (leucobasic fuchsin). A positive PAS stain in erythroblasts is a common finding in erythroleukemia where it has a coarsely granular pattern in cells of early stage and a finely granular pattern in cells of later stage. (9)

### Immunophenotyping:-

Leukaemic cells express characteristic nuclear, cytoplasmic and cell surface antigens, this is referred to as the immunophenotype of the cell. Characterization of the immunophenotype is referred to as immunophenotyping is achieved by means of labeled antibodies that recognize specific epitopes of cellular antigens by:

A: immunocytochemistry methods.

B: multiparameter immunophenotypic flow cytometry.

Flow cytometry is the measurement of numerous cell properties as the cells move in single flow in a fluid column and interrupt a beam of laser light. The method allows the quantitative and qualitative analysis of several properties of cell populations from body fluids. In an individual patient, the role of Flow cytometric (FC) immunophenotyping may be: confirming a diagnosis, identifying prognostic differences within a diagnostic category, staging a disease, and detecting an aberrant immunophenotype that can be used for monitoring minimal residual disease, i.e. expression of an antigen inappropriate to a lineage. (10)

Leukaemic myeloblasts express a variety of leucocyte differentiation antigens, which reflect commitment to the myeloid lineage as well as a level of maturation. In the EGIL classification, AMLs are defined immunologically by the expression of 2 or more of the following myeloid markers: MPO, CD13, CD33, CDw65, and CD117. (11) as shown in (Table 1).

**Table 1:-** Expression of cell-surface and cytoplasmic markers for the diagnosis of acute myeloid leukemia. (7)

Myeloid stage	CD markers
Precursor stage	CD34, CD38, CD117, CD133, HLA- DR
Granulocytic markers	CD13, CD15, CD16, CD33, CD65, cytoplasmic myeloperoxidase (cMPO).
Monocytic markers	Nonspecific esterase (NSE), CD11c, CD14, CD64, Lysozyme, CD4, CD11b, CD36, NG2 homologue.
Megakaryocytic markers	CD41 (glycoprotein IIb/IIIa), CD61 (glycoprotein IIIa), CD42 (glycoprotein 1b).
Erythroid marker	CD235a (glycophorin A)

### Aberrant immunophenotyping expression: -

In the majority of cases of AML, leukemia cells have immunophenotype that distinguish them from myeloid progenitor cells found in normal marrow. Comparison of antigen expression on AML cells with that in normal bone marrow reveals: (a) expression of non-myeloid antigens; (b) asynchronous expression of myeloid-associated antigens; (c) over expression of myeloid-associated antigens; and (d) absence of expression of myeloid-associated antigens. (12)

### CD9:-

A transmembrane-4 super family that are characterized as having four transmembrane domains with cytoplasmic N and C termini and the conserved cysteine motif, which act as "molecular facilitators" and linkers for

transmembrane proteins forming tetraspanin web. (13)

#### **CD56:-**

CD56 antigen, a 200–220-kDa cell surface glycoprotein, belongs to the immunoglobulin supergene family and has been identified as an isoform of the neural cell adhesion molecule (NCAM). This antigen mediates cell-to-cell interactions and is possibly involved in cell-mediated cytotoxicity. (14)

#### **Aims of the study:-**

1. To detect the frequency of aberrant CD56 and CD9 expression in de novo newly diagnosed cases of adult AML.
2. To evaluate the correlation of CD56 and CD9 expression with certain clinical and haematological parameters and their initial response to the induction therapy.

#### **Patients, Materials and Methods:-**

This prospective cross-sectional study was conducted on thirty adults newly diagnosed de novo AML patients from July 2015 to March 2016.

The patients were admitted to the Hematology Department of Baghdad Teaching Hospital of the Medical City and Al-Imamein Kadhimein medical city. Diagnosis was based on morphology and cytochemistry of the PB and/or BM samples by an expert haematopathologist in the Teaching Laboratories of the Medical City in Baghdad and Al-Imamein Kadhimein medical city. FC was done by four-color (Partec Cyflow®, Germany).

#### **Flow cytometric Immunophenotyping:-**

After AML cases have been documented in the Teaching Laboratories, the samples were transferred in cool box (6 hours being the maximum time since obtaining the sample) to be investigated for the aberrant expression of surface marker antigens CD56 and CD2 by using four-color (Partec Cyflow® Cube 6, Germany).

Gating of the cells of interest was done depending on FSC/SSC gate. Device software based on Windows™ FC software (CyView™), and the optics of the instrument employing 6 optical parameters: FSC and SSC work in combination with 4 fluorescence channels (FL1-FL4). (15)

#### **Assay Procedure:-**

##### **Includes 3 steps:-**

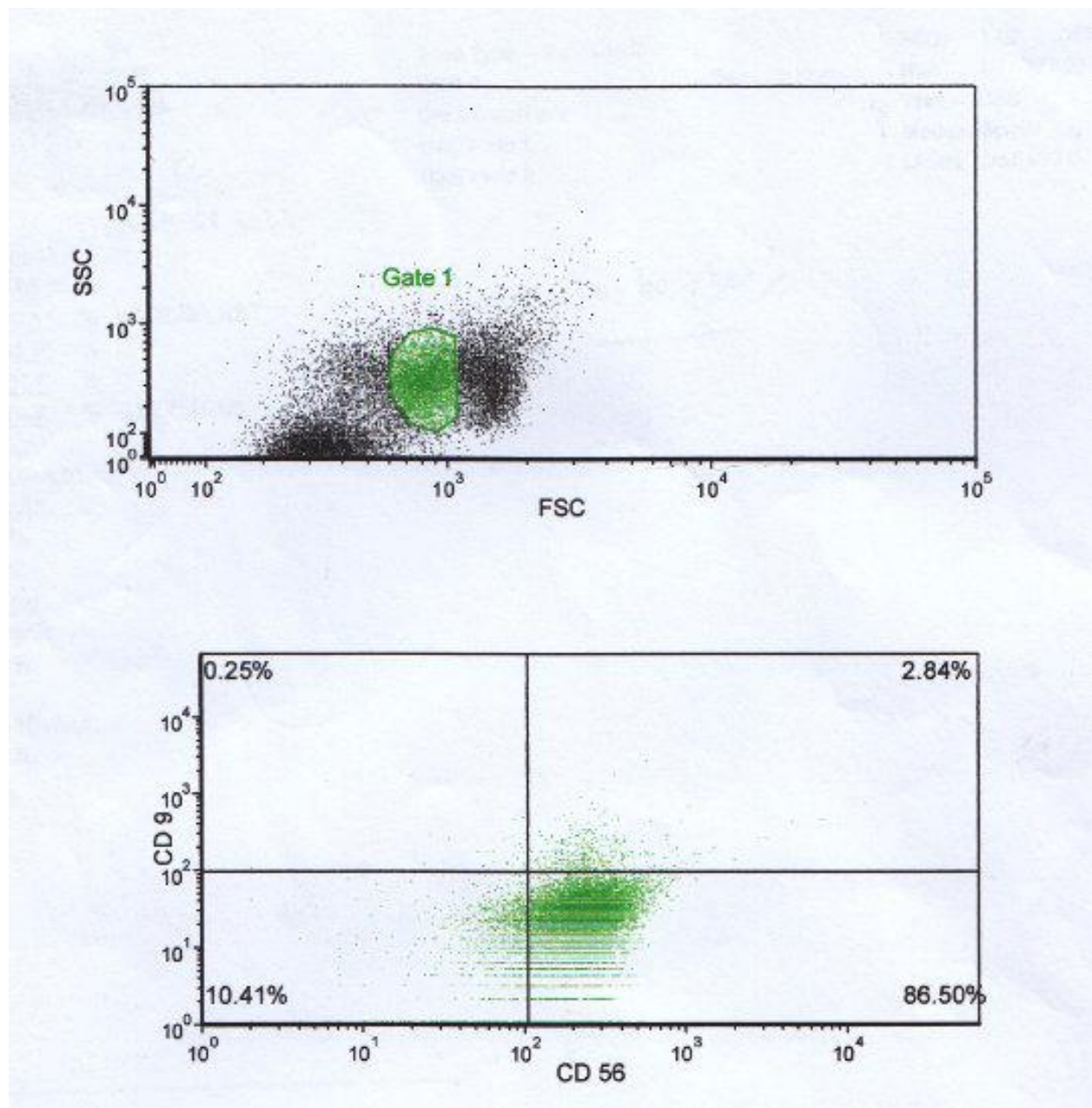
1. Antibody labeling: 100 µl of whole blood was mixed with 10 µl conjugated antibodies in a test tube, and after thoroughly mixing the mixture was incubated for 15 minutes in the dark at room temperature.
2. Leucocyte fixation: 100 µl of reagent A was mixed thoroughly with the mixture obtained in step 1 and was incubated for 10 minutes in the dark at room temperature.
3. Erythrocyte lysis: 2.5 ml of reagent B was added to mixture in step 2 and was shaken gently and incubated for 20 minutes in the dark.

Determination of the aberrant marker Identification of blast cells was performed using FSC versus SSC parameters. Basically, antigen expression is considered to be positive when the percentage of positive blast cells is equal or greater than 20%. Similarly, aberrant phenotypes are defined when at least 20% of the blast cells expressed that particular phenotype. (16) (Figure 1, 2, 3).

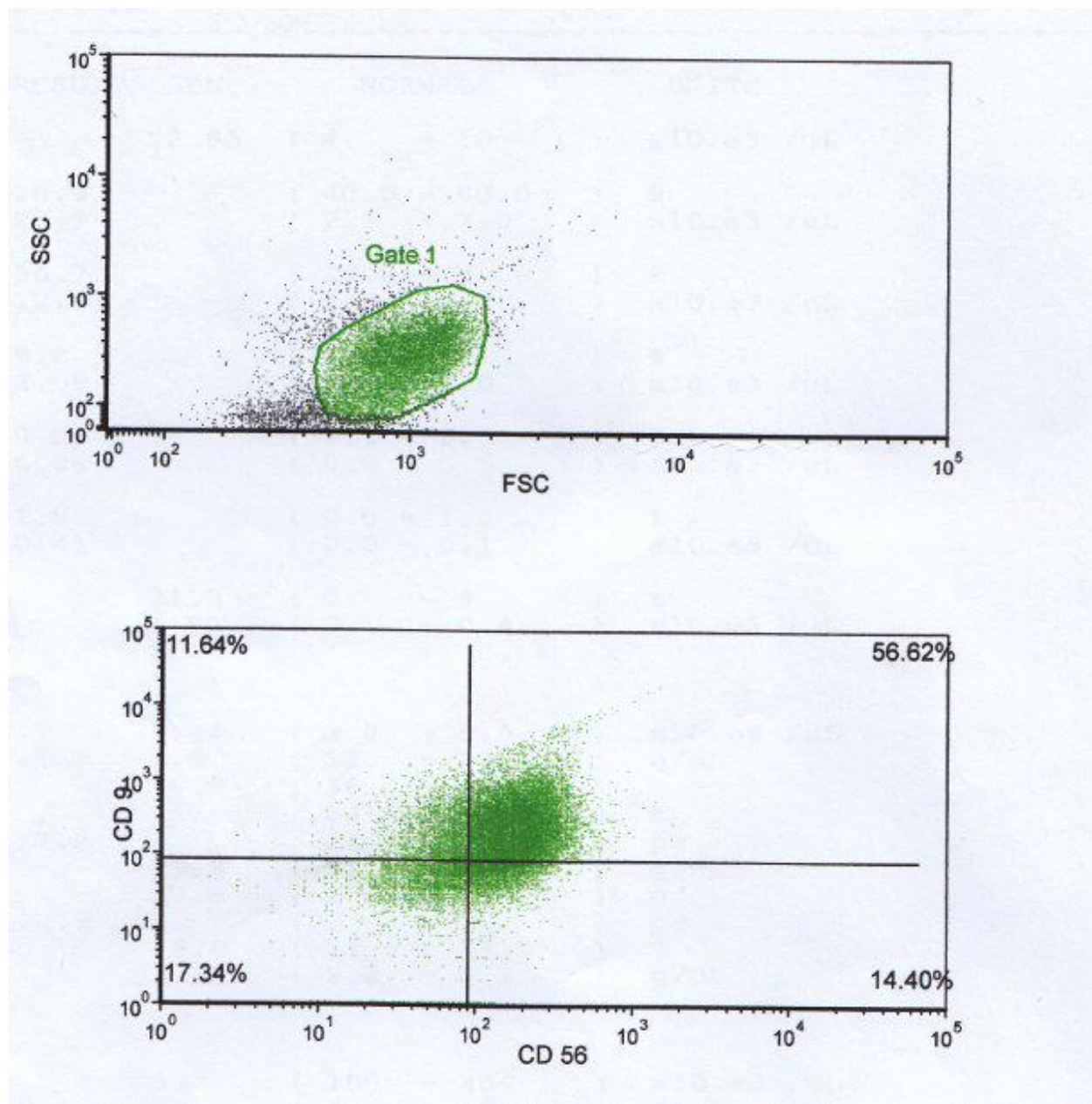
#### **Statistical Analysis:-**

Statistical Package for Social Science (SPSS) version 17 was used to present, describe and analyze data included in the present study. Numeric variables were represented as mean and standard deviation. Nominal variables were expressed as frequency (number) and percentage out of total. Pearson's chi-square and Fisher exact tests were used to evaluate nominal variable frequency difference between groups. Independent sample student t-test was used to compare the mean of numeric variables between groups. The level of ( $\leq 0.05$ ) was considered significant for interpretation of P values.

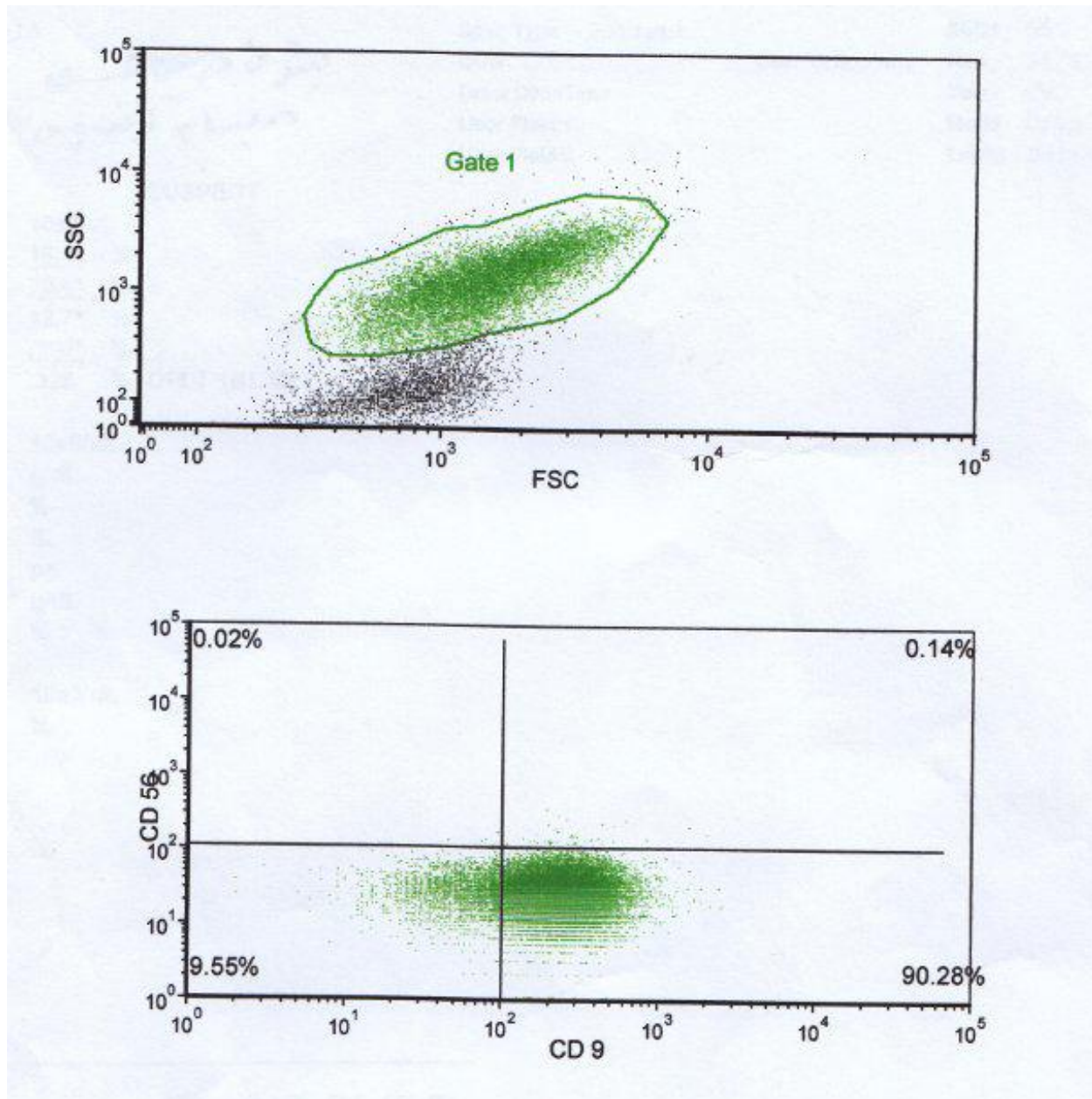




**Figure.1:-** Aberrant expression of CD56 by FC



**Figure 2:-** Aberrant co-expression of CD56 and CD9 by FC

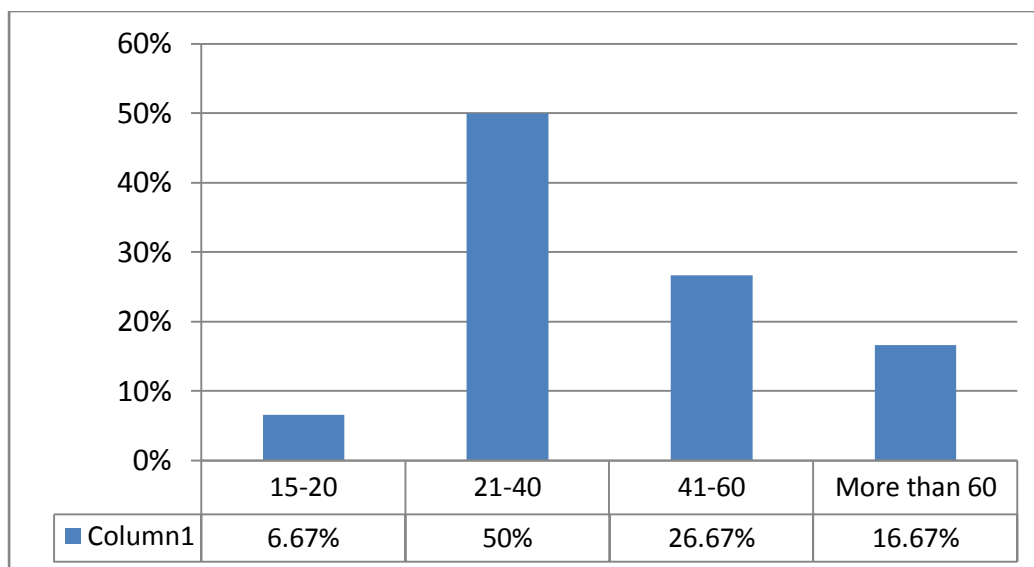


**Figure 3:-** Aberrant expression of CD9 by FC

### Results:-

#### Age Groups:-

The mean age of AML patients included in this study was  $41.33 \pm 16.6$  SD, with a median of 38 years (range of 16-75 years). Half of the cases (50%) being in the age group 21-40 years (Figure 4).



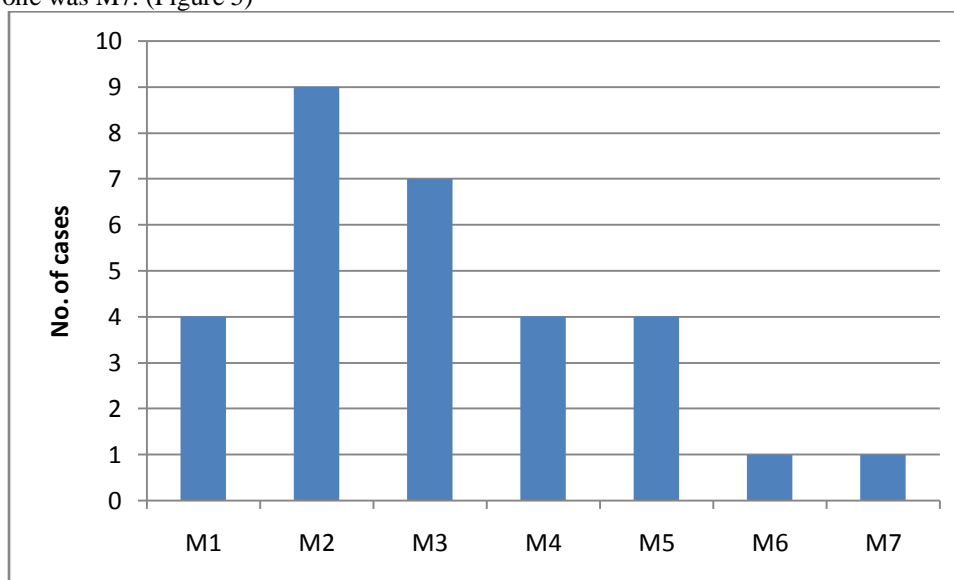
**Figure 4:-** Distribution of the patients according to the age groups.

#### **Gender:-**

Acute myeloid leukaemia were observed more in males (17 males “56.7 %”) than in females (13 females “43.3 %”) with an M: F ratio of 1.3:1.

#### **Distribution of AML cases according to the FAB subtypes:-**

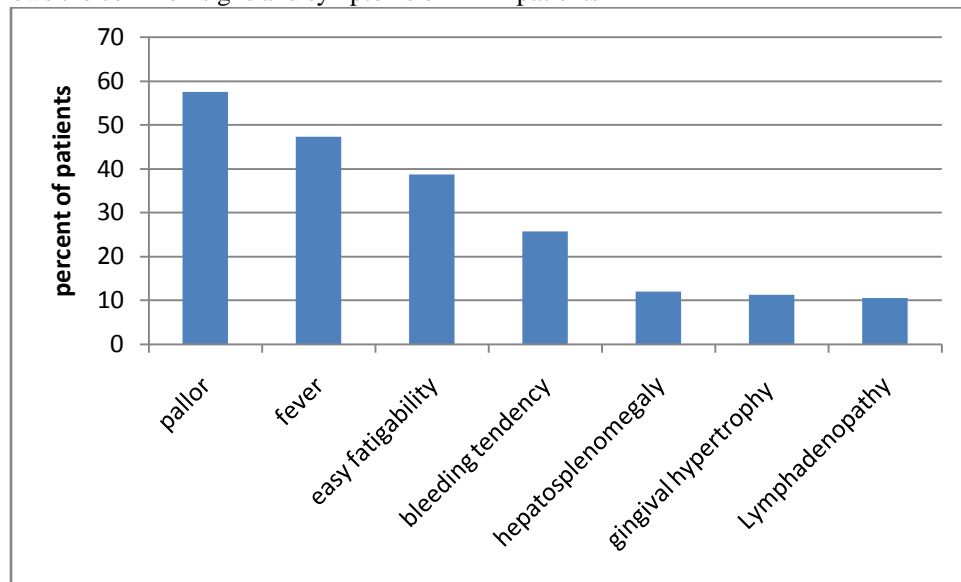
According to FAB subtypes, of the 30 cases studied, 4 were M1, 9 were M2, 7 were M3, 4 were M4, 4 were M5, one was M6 and one was M7. (Figure 5)



**Figure 5:-** Distribution of patients according to FAB subtypes

**Clinical Features:-**

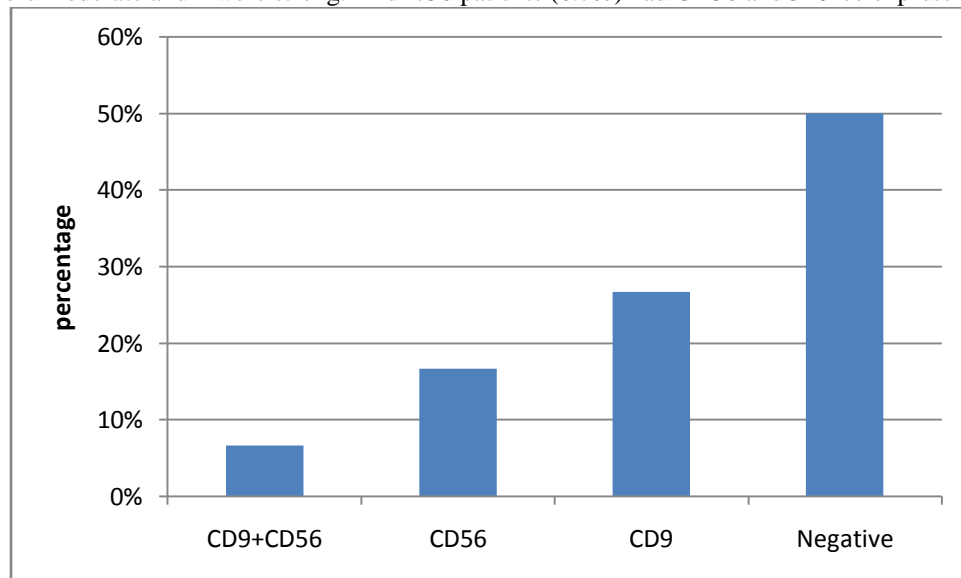
**Figure 6:-** shows the common signs and symptoms of AML patients



**Figure 6:-** Patient's common signs and symptoms.

**Aberrant CD56 and CD9 Expression:-**

CD56 was expressed in 7/30 patients (23.3%), 3 of those were with moderate intensity, 2 were weak and 2 were strong. For CD9 expression, 10/30 patients (33.3%) had positive expressions with 6 of those were with weak intensity, 2 were moderate and 2 were strong. And 2/30 patients (6.7%) had CD56 and CD9 co expression (Figure 6).



**Figure 7:-** Percentage of aberrant expression of CD56 and CD9 in AML patients.

**Correlation between the aberrant CD56 and CD9 expressions with hematological parameters:-**

Table 2 shows that the total WBC count, PB and BM blast cells percentage of AML patients with aberrant CD56 expression were significantly higher than those without aberrant CD56 expression ( $p$  value  $< 0.05$ ), while there was nonsignificant correlation between Hb and platelet count with the aberrant CD56 expression.



**Table 2:-** Correlation between CD56 expression with hematological parameters.

Parameter	CD56 positive (n=7)		CD56 negative (n=23)		P-value
	Mean	SD	Mean	SD	
Total WBC ( $\times 10^9/L$ )	88.9	18.8	16.5	17.7	<0.001
Hb (g/dl)	7.3	1.8	8.8	2.8	0.199
Platelet count ( $\times 10^9/L$ )	82.3	43.1	53.7	35.7	0.088
PB blast cells %	68.2	54.6	30.6	10	<0.001
BM blast cells %	74.6	15.5	45.4	21	0.002

Table 3. showed that there was no significant correlation between the aberrant CD9 expression and any of the hematological parameters.

**Table 3:-** Correlation between CD9 expression with hematological parameters

Parameter	CD9 positive (n=10)		CD9 negative (n=20)		P-value
	Mean	SD	Mean	SD	
Total WBC ( $\times 10^9/L$ )	25.7	34.3	37.2	36.8	0.42
Hb (g/dl)	8.8	2.7	8.3	2.6	0.579
Platelet count ( $\times 10^9/L$ )	64.4	33.2	58.4	42	0.699
PB blast cells %	36.1	19.7	41	18.3	<0.5
BM blast cells %	46.4	24.2	55.2	22.9	0.336

#### The Distribution of aberrant CD56 and CD9 expression in relation to AML FAB Classification:-

CD56 was expressed in 57.1% of the cases of AML FAB subtypes with monocytic differentiation (M5 cases (2/4, 50%) and M4 (2/4, 50%)); it was also expressed in other FAB subtypes 1/4 for M1, 2/9 for M2. CD56 is not expressed on M3, M6 and M7 subtypes.

CD9 was expressed more in M2 subtype (4/9, 44.4%). It is also expressed in all other AML subtypes except M7 subtypes

#### Correlation between the aberrant CD56 and CD9 expression with the extramedullary manifestations:-

The extramedullary manifestations were present in 57.2% of CD56 positive patients with statistically significant correlation (p-value = 0.016).

There is no significant correlation between CD9 aberrant expression and the extramedullary manifestations (p-value = 1).

#### Correlation between the aberrant CD56 and CD9 expression with CR Achievement:-

Complete remission was achieved in 17/30 patients (56.7%) with standard chemotherapy. For patients with aberrant CD56 expression 6 out of 7 did not respond to induction treatment. It appeared that there was a significant correlation between this expression with the non-responsiveness to the induction therapy with p-value = 0.025 (Table 4).

**Table 4:-** Correlation between aberrant CD56 expression with CR achievement

CR achievement	CD56				Total	
	Positive		Negative			
	No.	%	No.	%	No.	%
Yes	1	14.3	16	69.6	17	56.7
No	6	85.7	7	30.4	13	43.3
Total	7	100	23	100	30	100
	P-value =0.025					

For patients with aberrant CD9 expression 9 out of 10 did not respond to induction treatment, and it appeared that there was significant correlation between this expression with the non-responsiveness to induction therapy with p-value <0.001 (Table 5).

**Table 5:-** Correlation between aberrant CD9 expression with CR achievement

CR achievement	CD9				Total	
	Positive		Negative			
	No.	%	No.	%	No.	%
Yes	1	10	16	80	17	56.7
No	9	90	4	20	13	43.3
Total	10	100	20	100	30	100.00
	P-value <0.001					

**Discussion:-**

This study was conducted on 30 newly diagnosed de Novo acute myeloidleukaemia patients. The mean age of all patients was  $41.33 \pm 16.6$  SD, medianof 38 years and ranged between 16-75 years. Those results were comparable toIraqi studies (17-18).

Pallor and fever are the two most frequent signs, while Lymphadenopathyand gingival enlargement are the least frequent. Easy fatigability was the most frequent symptom. Those results were comparable to that published by AlwanAF et al. (19) and Hu R et al. (20)Of the 30 cases studied, M2 was the most frequent AML subtype (30%)followed by M3 (23.3%). This result was comparable to studies done by PoulsRK et al. (21) in Erbil, Alwan AF et al. (19).

The current study revealed that CD56 was expressed in 7 cases out of 30(23.3%) newly diagnosed AML cases, this result was in agreement withRaspadori D et al. (22) E et al. and Dina J et al. (23)

For CD9, it was expressed in 10 cases out of 30 (33.3%) of AML cases. Thisresult is comparable to that obtained by El-Sissy AH et al. (24) who reported CD9expression in 29.4% of AML cases.

Regarding the haematological parameters; the total WBC count of AMLpatients with CD56 expression was significantly higher than those without thisexpression, those findings were comparable with the results obtained by OlteanuH et al. (25). Also the correlations were found betweenPeripheral blood (PB) and bone marrow (BM) blast cells percent of AMLpatients were significantly higher in patients with aberrant CD56 expression. The cause of the higher total WBC count, PB and BM blastcells percent in AML patients with CD56 expression may be explained by thatCD56 expression is associated with an abnormal over expression of the fulllengthp48 RUNX1 isoform in AML cells which block haematopoieticdifferentiation and enhances self-renewal of haematopoietic stem cells andthus we may predict that the CD56 is a poor prognostic marker.

For the distribution of aberrant expression among FAB subtypes, CD56 expression was expressed in half of the cases of AML FAB subtypes withmonocytic differentiation M5 cases (2/4 ; 50%) and M4 (2/4 ; 50%) and thoserresults in agreement with Graf M et al. (26). The increased aberrant CD56 expression in M4 and M5 which areconsidered as unfavorable AML FAB subtypes (14) confirms that CD56 isassociated with a poor prognosis.

About the CD9 expression, it was detected more on M2 subtype (4/9;44.4%). there was a significant correlation between CD56 expression and the extramedullary manifestations and this confirms also that CD56 is a poor prognostic marker as AML patients with increased extramedullary manifestations at presentation generally have a poor outcome. This result was in agreement with Chang H et al. (27)

On the other hand, CD9 expression was no significantly correlated with theextramedullary manifestations.

Regarding the initial response to the induction therapy, CD56 was highlyexpressed with the non-responsiveness to the induction therapy. This correlationmay be explained by observation of more frequent P-glycoprotein (PGP)expression in CD56 positive patients. 106). Those results were consistent with that of Raspadori D et al. (22)Regarding CD9 expression in this study was highly expressed with the non-responsiveness to the induction therapy.

**Conclusion:-**

1. CD56 and CD9 expressions in AML patients were detected in 23.3% and 33.3% respectively.
2. CD56 was expressed more in monocytic AML subtypes.
3. Aberrant CD56 expression was associated with a higher total WBC count, higher PB and BM blast cells, increased extramedullary manifestations at presentation, and a lower response rate to the induction therapy; thus CD56 can be considered as an unfavourable marker.
4. Aberrant CD9 expression was associated with lower response rate to the induction therapy; thus CD9 can be considered as an unfavorable marker.

**Recommendations:-**

1. Studying the correlation of the aberrant expression of CD56 with multidrug related P-glycoprotein (PGP).
2. Studying further aberrant antigens expression in AML as CD10, CD22, and CD4.
3. Further studies for CD9 expression in AML patients.
4. The study should be performed on larger sample size and for longer period of time.

**References:-**

1. Shipley JL and Butera JN. Acute myelogenous leukemia. *Exp Hematol* 2009; 37: 649–58.
2. Deschler B, Lübbert M. Acute myeloid leukemia: epidemiology and etiology. *Cancer* 2006; 107(9): 2099–2107.3.
3. Akagi T, Ogawa S, Dugas M, et al. Frequent genomic abnormalities in acute myeloid leukemia/myelodysplastic syndrome with normal karyotype. *Haematologica* 2009; 94(2): 213–223.
4. Bain BJ. Classification of acute leukaemia: the need to incorporate cytogenetic and molecular genetic information. *J Clin Pathol* 1998; 51: 420–423.
5. Behm FG. Classification of acute leukemias. Available at: [www.springer.com/cda/.../9780896038349-c2.pdf](http://www.springer.com/cda/.../9780896038349-c2.pdf) (accessed on 4 Oct 2015).
6. Zuckerman T, Rowe JM. Acute leukaemia. In: Schmaier AH, Lazarus HM, editors. *Concise Guide to Hematology*. First edition: Wiley Blackwell; 2012; 19: 235–250.
7. Döhner H, Estey EH, Amadori S et al. Diagnosis and management of acute myeloid leukemia in adults: recommendations from an international expert panel, on behalf of the European Leukemia Net. *Blood* 2010; 115(3): 453–474.
8. Bain BJ, Swirsky D. Erythrocyte and leucocyte cytochemistry. In: Bain BJ, Bates I, Laffan MA et al. editors. *Dacie and Lewis practical hematology*. 11<sup>th</sup> ed. Philadelphia: Churchill Livingstone Elsevier 2011; 15: 333–352.
9. Naeim F, Rao PN. Acute myeloid leukemia. In: Naeim F, Rao PN, Grody WW, editors. *Haematopathology: morphology, immunophenotype, cytogenetic, and molecular approaches*. Oxford: Elsevier Inc 2008; 11: 207–251.
10. Orfao A, Ortuno F, Santiago M, et al. Immunophenotyping of acute leukemias and myelodysplastic syndromes. *Cytometry Part A* 2004; 58A: 62–71.
11. Legrand O, Perrot JY, Baudard M, et al. The immunophenotype of 177 adults with acute myeloid leukemia: proposal of a prognostic score. *Blood* 2000; 96(3): 870–877.
12. Immunophenotyping and cytogenetic/molecular genetic analysis in leukemia and related conditions. Barbara J. Bain, *Leukemia diagnosis*. Fourth edition. Hong Kong. Wiley-Blackwell 2010; 64–107.
13. Hemler ME. Tetraspanin proteins mediate cellular penetration, invasion, and fusion events and define a novel type of membrane microdomain. *Annu Rev Cell Dev Biol* 2003; 19: 397–422.
14. Reyes AA, Small SJ, Akeson R. "At least 27 alternatively spliced forms of the neural cell adhesion molecule mRNA are expressed during heart development". *Molecular and Cellular Biology* 2011; (3): 1654–1661.
15. Sysmex. CyFlow® Cube 6. Available at:
16. [http://www.sysmexpartec.com/instrumentation/products.html?&tx\\_cycloproductfinder\\_cyc\\_pf\\_display\[product\]=1024&tx\\_cycloproductfinder\\_cyc\\_pf\\_display\[action\]=show&tx\\_cycloproductfinder\\_cyc\\_pf\\_display\[controller\]=Product](http://www.sysmexpartec.com/instrumentation/products.html?&tx_cycloproductfinder_cyc_pf_display[product]=1024&tx_cycloproductfinder_cyc_pf_display[action]=show&tx_cycloproductfinder_cyc_pf_display[controller]=Product) (accessed 20 Feb 2016).
17. Berdichevski F. Complexes of tetraspanins with integrins: More than meets the eye. *J Cell Sci* 2001; 114: 4143–4151.
18. Dhahir EK. The Significance of FLT3-ITD Mutation and Nucleophosmin Mutation in Acute Leukemia. A thesis Submitted to the College of Medicine – Al Nahrain University in Partial Fulfillment of the Requirement for the Degree of Doctor of Philosophy in Pathology (Hematology) 2012.
19. Gari M., Abuzenadah A., Chaudhary A., et al.: Detection of FLT3 Oncogene Mutations in Acute Myeloid



- Leukemia Using Conformation Sensitive Gel Electrophoresis .Int. J. Mol. Sci 2008; 9: 2194-2204.
21. Alwan AF, Zedan ZJ, Salman OS. Acute myeloid leukemia: clinical features and follow-up of 115 Iraqi patients admitted to Baghdad Teaching Hospital. Tikrit Medical Journal 2009; 15(1): 1-8.
  22. Hussein SH. Survey of Adult de novo Acute Myeloid Leukemia cases reported in the Medical City in Baghdad through the years (2005-2011). A thesis Submitted to the College of Medicine –University of Baghdad in Partial Fulfillment of the Requirement for the Degree of Master of Hematology 2013.
  23. Pouls RK, Shamoon RP, Muhammed NS. Clinical and haematological parameters in adult AML patients: a four year experience at Nanakaly Hospital for blood diseases. Zanco J Med Sci 2012; 16(3): 199-203.
  24. Raspadori D, Damiani D, Lenoci M, et al. CD56 antigen expression in acute myeloid leukemia identifies patients with poor prognosis. Leukemia. 2001; 15: 1161–1164
  25. Dina J, Salaün V, Reman O, et al. Interest of immunophenotyping in acute myeloid leukemia. Haematologica 2002; 87: 14-15.
  26. El-Sissy AH, El-Mashari MA, Bassuni WY et al. Aberrant lymphoid antigen expression in acute myeloid leukemia in Saudi Arabia. Journal of the Egyptian Nat. Cancer Inst 2006; 18(3): 244-249.
  27. Olteanu H, Harrington AM, Kroft SH, et al. The incidence of CD56 expression by flow cytometry in acute promyelocytic leukemia in patients treated with all-trans retinoic acid and anthracycline drug combinations. Available at: <http://pathology.mcw.edu/blog/the-incidence-of-cd56-expression/> (accessed 7 August 2014).
  28. Graf M, Reif S, Hecht K, et al. High expression of costimulatory molecules correlates with low relapse-free survival probability in acute myeloid leukemia (AML). Ann Hematol 2005; 84(5): 287-297.
  29. Chang H, Brandwein J, Qi-Long yi, et al. Extramedullary infiltrates of AML are associated with CD56 expression, 11q23 abnormalities and inferior clinical outcome. Leukemia Research 2004; 28(10): 1007-1011.



### RESEARCH ARTICLE

## EXPRESSION OF CD200 IN CD5 POSITIVE B-CELL LYMPHOPROLIFERATIVE DISORDER (B-CLL AND MCL) AND ITS ROLE IN THE DISCRIMINATION BETWEEN THESE DISORDERS.

Dr. Hind shaker al-mamoori.

### Manuscript Info

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#### Key words:-

CD 200, B-CLL, MCL, CD5 POSITIVE LYMPHOPROLIFRATIVE DIEASES.

### Abstract

Chronic B-cell lymphoproliferative disorders (B-CLPD) are a group of clonal diseases characterized by proliferations of mature B lymphocytes in the bone marrow (BM), peripheral blood, and lymphoid tissues.

Mature B-cell lymphoproliferative disorders is divided by CD5 expression into two groups:

1. CD5 (positive) diseases including B cell chronic lymphocytic leukemia (B-CLL) and mantle cell lymphoma (MCL).
2. CD5 (negative) diseases and including all the other forms of B-CLPD.

Chronic lymphocytic leukemia (B-CLL) and mantle cell lymphoma (MCL) have many features in common and their differential diagnosis may be arduous, particularly when a leukemic phase of lymphoma is the only presentation. Immunophenotypic panels are often useful, with CD23 being the most valid in B-CLL and in MCL suspected cases should be confirmed by immunohistochemically cyclin D1 detection but sometimes indefinite or some time negative repercussion may occur and other immunological markers and advanced cytogenetics or molecular techniques are bona fide but they add extra cost and not widely available. So we study the expression of CD 200 which is a membrane gp of the immunoglobulin superfamily in CD 5 positive mature B-cell lymphoproliferative disorders to help in differentiation.

#### Aim of the study: -

1. To detect the immunohistochemically expression of CD200 in CD5 +ve Mature B-cell lymphoproliferative disorders.
2. Evaluation of the value of CD200 in diagnosis and differentiating between B cell chronic lymphocytic leukemia (B-CLL) and mantle cell lymphoma (MCL).

#### Patients, materials and methods: -

This cross sectional study included 49 adult patients and newly diagnosed by morphology and flow cytometric immunophenotyping as B-CLL for score 4-5 and MCL with score <4 conducted from February 2015 to September 2016 from many centers, Baghdad teaching hospitals and private clinic.

From each patient, left over samples were used.

Bone marrow trephine biopsy sections were stained with hematoxylin and eosin for histopathological assessment. Further detection for the expression of cyclin D1 and CD200 were performed by immunohistochemistry technique.

**Results:** - The patients were 36 males and 13 females newly diagnosed as CD5 positive mature B-cell lymphoproliferative disorder, 39 patients were presented with B-chronic lymphocytic leukemia and 10 were mantle cell lymphoma diagnosed by morphological assessment and flow cytometric immunophenotyping as B-CLL with score 4-5 and MCL with score <4, MCL diagnosis proved by immunohistochemically expression of cyclin D1.

The result showed that CD200 was expressed in 37 (94.9%) out of 39 chronic lymphocytic leukemia patients while mantle cell lymphoma cases were all negative for CD200 expression.

Highly significant association between CD200 expression and B-CLL, p value was <0.001 and negative in 2 cases (5.1%) shown to have an advanced disease.

**Conclusions:** - CD200 is highly expressed in B-CLL and it has a discriminative role in mature CD5 positive B-cell lymphoproliferative disorders (B-CLL and MCL). The only CD 200 negative CLL cases might related to the advanced stage of disease.

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## Introduction: -

Chronic mature B-cell lymphoproliferative disorders (B-CLPD) are a group of clonal diseases characterized by proliferation of mature looking B lymphocytes in the bone marrow, peripheral blood, and lymphoid tissues. B-CLPD diagnosis can be made by morphological, and immunophenotyping that help in differentiation between different types of mature B-cell lymph proliferative disorders (B-CLPD) and this supported by cytogenetic parameters, as is described in the World Health Organization classification (WHO). (1)

Immunohistochemically immunophenotypic analysis is particularly helpful in establishing the diagnosis because there is significant overlap in clinical and morphologic features between these diseases entities and as the B-CLL and mantle cell lymphoma have many features in common and they may give equivocal or negative result for the specific markers used for differentiation so a more advanced cytogenetic or molecular tests are required but they add extra cost and might not be available. (2)

Such difficult cases of B-CLPDs can be further sub classified according to the expression of CD5. Patients with CD5 negative B-CLPD usually present as the leukemic phase of lymphoma such as marginal zone lymphoma (MZL), lymphoplasmacytic lymphoma (LPL), follicular cell lymphoma (FCL), or hairy cell leukemia (HCL); While patients with CD5 positive B-CLPD can be either B-CLL or mantle cell lymphoma in which differentiations between them may be so difficult as they do not have the characteristic immunophenotypic score of CLL or mantle cell lymphoma (MCL) (i.e. CD5+B-CLPD). (3), (4), (5).

CD200 is a membrane gp MRC (OX-2). It is a member of the immunoglobulin superfamily which is encoded by a gene at chromosome 3q12; This transmembrane protein is expressed on different cell types, and it is expressed by endothelial cells and neurons and by B lymphocyte and a subset of T lymphocyte; It plays an important role in the regulation of anti-tumor immunity (5), and overexpression of CD200 has been reported in a number of malignancies, including CLL, because of its differential expression in B-CLL and mantle cell lymphoma (MCL), we evaluate this expression differences on these two disorders.

## Materials and Methods: -

This cross sectional study was conducted on 49 adult patients newly diagnosed mature CD5 positive BCLPD, 39 patients were presented with chronic lymphocytic leukemia diagnosis depend on the WHO classification of mature B-cell Neoplasms with score 4-5 and 10 were mantle cell lymphoma score < 4 (1). The diagnosis of which was

confirmed by the demonstration of cyclin D1 expression by immunohistochemistry, the cases were randomly selected for the age and sex.

**The samples for each patient were subjected to the following procedures: -**

1. Samples were leftover.
2. Bone marrow biopsy was fixed with formalin solution and stained by hematoxylin and eosin for histopathological examination.
3. Immunohistochemistry technique on bone marrow biopsy used to detect CD200 to assess its differential expression on B-CLL and MCL.

**Procedures: -**

**Processing of B.M biopsy and immunohistochemistry: -**

Sections slides were stained with hematoxylin and eosin and sections were fixed on positively charged slides for immunohistochemically tests for CD200 each section was with 4-micron thickness, procedure of immunohistochemistry used in this study was adopted by abcam®. All steps are performed at room temperature.

**Staining protocol: -**

1. Deparaffinize and rehydrate formalin fixed paraffin-embedded tissue section.
2. Add enough drops of hydrogen peroxide block to cover the section. Incubate for 10 minutes. Wash 2 times in buffer.
3. Apply protein block and incubate for 10 minutes at room temperature to block nonspecific background staining. Wash 1 time in buffer.
4. Apply primary antibody and incubate.
5. Wash 3 times in buffer solution.
6. pour complement and incubate for ten minutes at room temperature. Wash 2 times in buffer solution.
7. Pour HRP conjugate and incubate for 15 minutes at RT.
8. Rinse four times in buffer solution. Add 30µl (1 drop) DAB chromogen to 1.5 ml of DAB substrate, mix by swirling and apply to the tissue. Incubate for 10 minutes. Rinse 4 times in buffer.
9. Apply counter stain.
10. Dehydrate and coverslip.

**The slides were examined by light microscope and scanned on low and high powers (10x, 40x).**

**Assessment of immunohistochemically staining: -**

The scoring systems for CD200 were scored positive if 20% or more of the cells within an aggregate showed brown cellular membrane and/or cytoplasmic staining pattern. (6)

**Statistics: -**

A non-parametric two-way contingency table test (Fisher exact test) was employed, using Prism 7 for Mac OS X software, ver. 7.0a (Graph Pad Software, San Diego, California). The validity of CD200 in discrimination of B-CLL than MCL was calculated using sensitivity, specificity, positive and negative predictive values.

**Result: -**

Thirty-nine patients with B-CLL and ten with MCL were enrolled in this study, patients were randomly selected for the age and sex as shown in the table 1. The male to female ratio in B-CLL cases were 2.5:1 and in MCL were 4:1.

**Table 1: -age and sex distribution.**

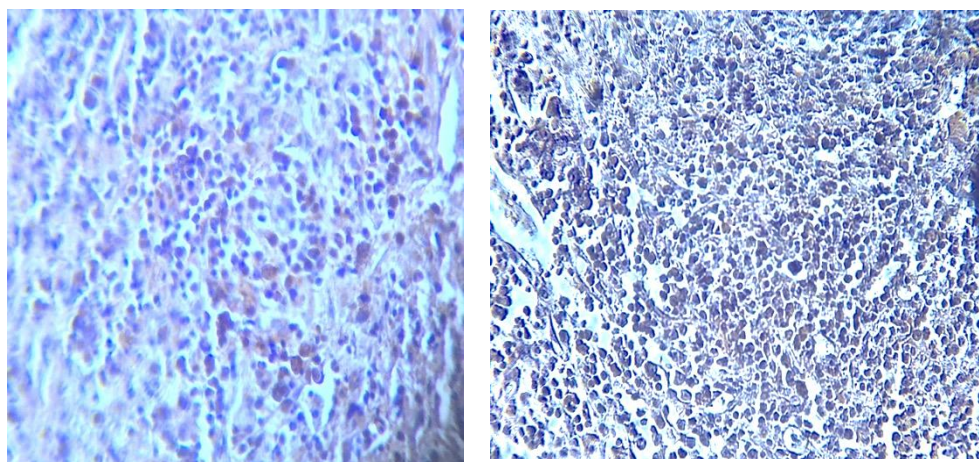
		Study groups		P value
		CLL	MCL	
Age (years) Mean±SD (Minimum-Maximum)		60.08±11.15 (39-80)	57.7±4.3 (50-64)	0.784 <sup>NS</sup>
Sex	Male (%)	28 (71.8)	8 (80)	0.467 <sup>NS</sup>
	Female (%)	11 (28.2)	2 (20)	

Binet stages were available for B-CLL cases and were as shown in table 2

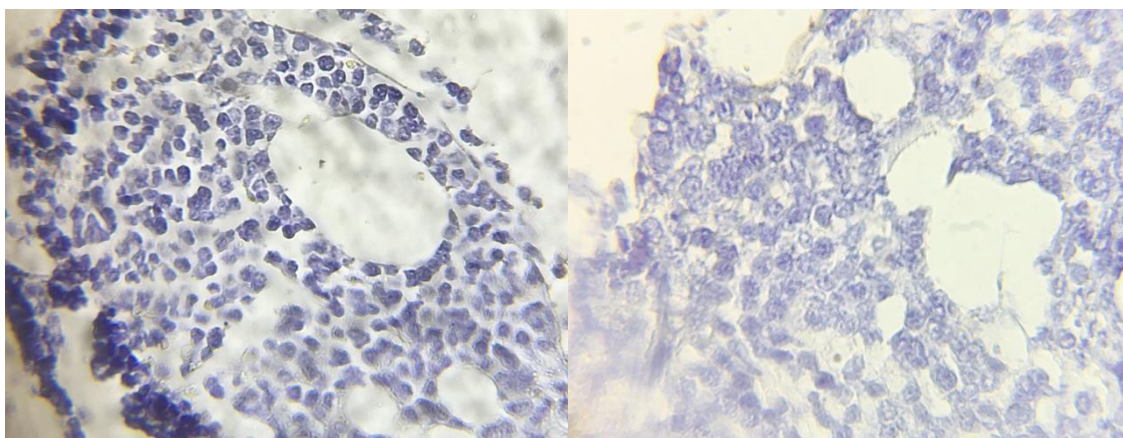
**Table 2:** - Binet staging system for B-CLL

Binet stage		
A	30	76.9%
B	7	17.9%
C	2	5.1%
Peripheral blood lymphocytes ( $10^9$ per liter)	22.1	15-35
Hb (g/100 ml)	13	10.5-13.6
Platelets ( $10^9$ per liter)	145	95-190

CD200 was expressed by 94.9 % of our CLL cases as shown in figure 1 compared with 0% of MCL cases as shown in figure 2. The cut-off value of CD200 percent expression on malignant clone cells in both groups was 20 %, it had 99.37 % sensitivity, 100% specificity, 100% positive predictive value, and 83.33% negative predictive value as shown in the table 3.



**Figure 1:** -Cytoplasmic positivity for CD200 in B-CLL.



**Figure 2:** -cytoplasmic negativity for CD200 in MCL

**Table 3:** -The CD 200 expression on the two studied groups.

	Study groups		P value	Sensitivity (CI)	Specificity (CI)	PPV	NPV	Kappa index
	CLL (4-5)	MCL (<4)						
CD200 positive (%)	37 (94.9)	0 (0%)	<0.001**	94.87 82.68 to 99.37	100 69.15 to 100.00	100	83.33 56.45 to 95.07	0.883
CD200 negative (%)	2 (5.10)	10 (100)						
Total	39	10						

**Discussion: -**

Chronic mature B-cell lymphoproliferative disorders (B-CLPD) are a group of malignant diseases marked by accumulation of mature looking B lymphocytes in the bone marrow, peripheral blood, and lymphoid tissues. B-CLL and MCL both are CD5+ve mature B lymphocyte neoplasms that show differences in the outcomes, modality of treatment and outcomes; B-CLL tends to follow an indolent course, having median survival ranging from 8 to 12 years depending on gene mutational status of immunoglobulin. While in MCL the disease shows a more clinical aggression and treatment-resistant over the time. with a median survival of 3 to 7 years. (7). Thus differentiation of these disorders has vital role prognostically and therapeutically (8). The conjunction of clinical features, morphology and immunological features can lead to an accurate diagnosis in the majority of the cases of B cell chronic lymphoproliferative disorders; but the diagnosis remains uncertain in a small percentage of cases. The characteristic immunophenotypic features of CLL are aberrant expression of CD5, together with CD23 expression and the negativity of CD79b and FMC7 (9).

This is in contrast to MCL, who also express CD5 and lack CD23 expression and strongly express FMC7. The most important helpful markers in their differentiation are CD23 and FMC7. MCL is CD23-ve and FMC7+ve, while CLL usually have the opposite. however aberrant phenotypes may occur as reported by previous studies... whose found that CD23 positivity in CLL ranged from 86.6 to 100% of cases while CD23 expression was found in about half of MCL cases and FMC7 positivity of 0–12% in CLL cases (10, 11) and 90–100% in MCL (10,12) so in these cases flow cytometric discrimination of CLL from MCL can be arduous.

In this study, we scrutinized the expression of CD200 on the clonal cells of patients with B-CLL and MCL. CD200 was expressed in 94.9% CLL cases compared with 0% in MCL cases. And the results showed that there were highly significant differences between these two disorders. CD200 expression in which P was < 0.001, the results also showed that CD200 expression was negative in only two cases of B-CLL who were known to have an advanced diseases shown in table 2 according to Binet staging (stage C). CD200 positivity showed a positive predictive value of 100%, a negative predictive value of 83.33 %, a sensitivity of 94.87 %, and a specificity of 100%.

The results of this study agree with previous studies which confirm the uniform expression CD200 on B-CLL cases and the only negative B-CLL were stage C so there may be a relation between the CD200 expression and the prognosis this need an expanded study. this agree with Alapat et al. (13) and Dahlia A. El-Sewefy et al. (14)

So the inclusion of CD200 in routine panels can be very helpful in distinguishing between these two disease, specially, in patients with inconclusive phenotypes.

**Conclusion: -**

CD200 is highly expressed in B-CLL and it has a discriminative role in mature CD5+ve B-CLPD (B-CLL and MCL). The only CD 200 negative CLL case might related to the advanced stage of disease, so more expanded study required to correlate the CD200 expression and the prognosis of the disease.



**References: -**

1. Swerdlow SH, Campo E, Harris NL, Jaffe ES, Pileri SA, Stein H, et al. WHO classification of tumours of haematopoietic and lymphoid tissues. Lyon: IARC press; 2008.
2. Craig FE, Foon KA. Flow cytometric immunophenotyping for hematologic neoplasms. *Blood* 2008; 111:3941–3967.
3. Barna G, Reiniger L, Tátrai P, Kopper L, Matolcsy A. The cut-off levels of CD23 expression in the differential diagnosis of MCL and CLL. *Hematol Oncol* 2008; 26:167–170.
4. Ho AK, Hill S, Preobrazhensky SN, Miller ME, Chen Z, Bahler DW. Small B-cell neoplasms with typical mantle cell lymphoma immunophenotypes often include chronic lymphocytic leukemias. *Am J Clin Pathol* 2009; 131:27–32.
5. Hanson CA, Morice WG. The clinical and laboratory approach to the CD5/CD10 negative B-cell chronic lymphoproliferative leukemias. *Am J Hematol.* 2008;83(5):347–348.
6. Palumbo GA, Fargione G, Parrinello N, Cardillo K, Chiarenza A, Berretta S, et al. CD200 as a tool for differential diagnosis between B-cell chronic lymphocytic leukemia and mantle cell lymphoma. *Haematologica* 2008; 93:33.
7. Ghielmini M, Zucca E. How I treat mantle cell lymphoma. *Blood* 2009;114:1469–1476.
8. Zhao XF. Pitfalls in diagnostic hematopathology: part I. *Int J Clin Exp Pathol* 2009; 2:11–20.
9. Jaffe ES, Harris NL, Stein H, Vardiman JW, editors. World Health Organization classification of tumours: pathology and genetics of tumours of haematopoietic and lymphoid tissues. Lyon, France: IARC Press; 2001.
10. Ahmad E, Garcia D, Davis BH. Clinical utility of CD23 and FMC7 antigen coexistent expression in B-cell lymphoproliferative disordersubclassification. *Cytometry* 2002; 50:1–7.
11. Monaghan SA, Peterson LC, James C, Marszalek L, Khoong A, Bachta DJ. Pan B-cell markers are not redundant in analysis of chronic lymphocytic leukemia (CLL). *Cytometry B Clin Cytom* 2003; 56:30–42.
12. Garcia DP, Rooney MT, Ahmad E, Davis BH. Diagnostic usefulness of CD23 and FMC-7 antigen expression patterns in B-cell lymphoma classification. *Am J Clin Pathol* 2001; 115:258–265.
13. Alapat D, Coviello-Malle J, Owens R, Qu P, Barlogie B, Shaughnessy JD, et al. Diagnostic usefulness and prognostic impact of CD200 expression in lymphoid malignancies and plasma cell myeloma. *Am J Clin Pathol* 2012; 137:93–100.
14. Dahlia A. El-Sewefy, Dina A. Khattab, Mohamed T.H. Sallam, et al Flow cytometric evaluation of CD200 as a tool for differentiation between chronic lymphocytic leukemia and mantle cell lymphoma. *ehj.eg*2014 39:42–46.



## RESEARCH ARTICLE

### CRACK TOOTH SYNDROME AND ITS MANAGEMENT.

Himani Sharma and K Harish S Shetty

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#### Abstract

Cracks and fractures in teeth are relatively common problems in general and specialist dental practices. The CTS presents both a challenge and an opportunity for the dentist. The possibility of CTS must always be considered when a patient complains of pain or discomfort on chewing or biting. In spite of CTS being a diagnostic challenge, having knowledge and awareness of CTS should enable the dental practitioner to detect the same, thereby preventing further crack propagation and complications associated with crack tooth.

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#### Introduction:-

Cracks and fractures in teeth are relatively common problems in general and specialist dental practices. Tooth fractures include trauma-related crown, crown-root, and root fractures and a broad group of cracked teeth. Bader et al. reported that approximately one in 20 people fracture a tooth each year. Since, these fractures had varying consequences ranging from no treatment being required to extraction of the tooth, it is likely that some of these fractures are crack.

#### Classification of crack tooth syndrome:-

The American Association of Endodontists (AAE)<sup>1</sup> has identified five types of cracks in teeth :

- Craze lines - visible fractures that only involve enamel
- Fractured cusps -originate in the crown of the tooth, extend into dentin, and the fracture terminates in the cervical region
- Cracked tooth -crack extending from the occlusal surface of the tooth apically without separation of the two segments
- Split tooth - extends through both marginal ridges usually in a mesiodistal direction, splitting the tooth completely into two separate segments
- Vertical root fracture - originate in the root, and are generally complete, although they may be incomplete

#### Definition:-

Cameron in 1964 coined the term cracked tooth syndrome<sup>2</sup> which is as “an incomplete fracture of a vital posterior tooth that involves the dentin and occasionally extends to the pulp.”

In recent times, the definition has been modified as follows: “A fracture plane of unknown depth and direction passing through tooth structure that, if not already involving, may progress to communicate with the pulp and or periodontal ligament”.<sup>3</sup>



**Incidence:-**

Crack tooth syndrome occurs primarily in adulthood. Cameron et al<sup>2</sup> reported that 80% of 102 cracked teeth occurred in patients over 40 years of age. Men and women are found to be equally affected.

Most commonly associated with heavily restored mandibular tooth. Mandibular second molars are most commonly affected followed by mandibular first molar and maxillary premolars. While the crack tends to have a mesiodistal orientation in most teeth, it may run buccolingually in mandibular molars. Wedging effect of the prominent mesiopalatal cusp of the maxillary first molar may be a predisposing factor.<sup>4</sup> The transverse ridge of maxillary molars may provide reinforcement and account for lower incidence of fracture in these teeth.<sup>4</sup>

Non-functional cusp may be more susceptible than functional cusp<sup>5</sup> as functional cusps are significantly larger in buccolingual dimension and covered with a thicker layer of enamel.<sup>6</sup> In molars, non functional cusps are found to have a steeper cuspal incline. Cuspal inclines are the guiding planes for lateral excursive movements for group functional occlusal relationships thus non functional cusps may be subjected to greater occlusal forces.

Higher incidence of Crack tooth syndrome in mandibular second molar may be associated with the proximity to the temporomandibular joint, based on the principle of the “LEVER EFFECT”- the mechanical force on an object is increased at closer distances to the fulcrum.<sup>7</sup>

**Etiology:-**

The etiology of crack tooth syndrome is multifactorial. Guersten et al<sup>8</sup> stated that ‘*excessive forces applied to a healthy tooth or physiologic forces applied to a weakened tooth can cause an incomplete fracture of enamel or dentine*’

**Lynch et al<sup>9</sup> subdivided the causes of cracks into four major categories:**

1. Restorative procedures
2. Occlusal
3. Developmental
4. Miscellaneous

Classification	Factors	Examples
1. Restorative procedures	Inadequate design features	<ul style="list-style-type: none"> <li>Over-preparation of cavities</li> <li>Insufficient cuspal protection in inlay/onlay design</li> <li>Deep cusp-fossa relationship</li> </ul>
	Stress concentration	<ul style="list-style-type: none"> <li>Pin placement</li> <li>Hydraulic pressure during seating of tightly fitting cast restorations</li> <li>Physical forces during placement of restoration, e.g., amalgam or soft gold inlays (historical)</li> <li>Non-incremental placement of composite restorations (tensile stress on cavity walls)</li> <li>Torque on abutments of long-span bridges</li> </ul>
2. Occlusal	Masticatory accident	Sudden and excessive biting force on a piece of bone
	Damaging horizontal forces	Eccentric contacts and interferences (especially mandibular second molars)
	Functional forces	Large untreated carious lesions Cyclic forces
	Parafunction	Bruxism
3. Developmental	Incomplete fusion of areas of	Occurrence of cracked tooth syndrome in

	calcification	unrestored teeth
4. Miscellaneous	Thermal cycling	Enamel cracks
	Foreign body	Lingual barbell
	Dental instruments	Cracking and crazing associated with high-speed handpieces

**Signs and symptoms:-**

Two classic patterns<sup>2</sup> of crack formation are present

- ☐ Crack – centrally located- Follow dentinal tubules → extend to pulp
- ☐ Crack – more peripherally directed → may result in cuspal fracture

A suspicion of infraction is raised when symptoms of toothache are not readily connected to evidence of caries, periodontal disease or recent trauma. Many patients with infected teeth may suffer symptoms for long periods of time before a correct diagnosis is made.

Most common symptoms<sup>10,11</sup> associated with symptomatic tooth infractions are-

- Pain on chewing
- Pain on exposure to cold food

Not all teeth with infractions are symptomatic. Symptoms develop when infraction involves the pulp, especially when infractions become populated with bacteria<sup>12,13</sup> and localization may also be possible when infraction reach the periodontal ligament, usually starting in the area of crestal ligament.<sup>14</sup>

These symptoms can be explained by Hydrodynamic theory of pain.<sup>15</sup> Sutton et al<sup>16</sup> suggested that the occasional sharp, momentary lancinating masticatory pain was due to bending and rubbing of dentin along fracture lines.

A unique pain response to chewing experienced by many patients is the pain that occurs when they release the pressure of biting, referred to as “rebound” or “relief” pain.<sup>11,12</sup> Pain that is stimulated by temperature changes, particularly with application of cold stimuli, also a common feature. Often, the pain felt anterior to the tooth responsible for the symptom. Pattern of pain referral noted by Brynjulfsen et al<sup>17</sup> was that pain from mandibular teeth was frequently distributed to maxillary teeth, the neck, ear, muscles of mastication and TMJ. *An important observation was that the longer the duration of pain, the more diffuse it became and often led to headaches*

**Diagnosis:-**

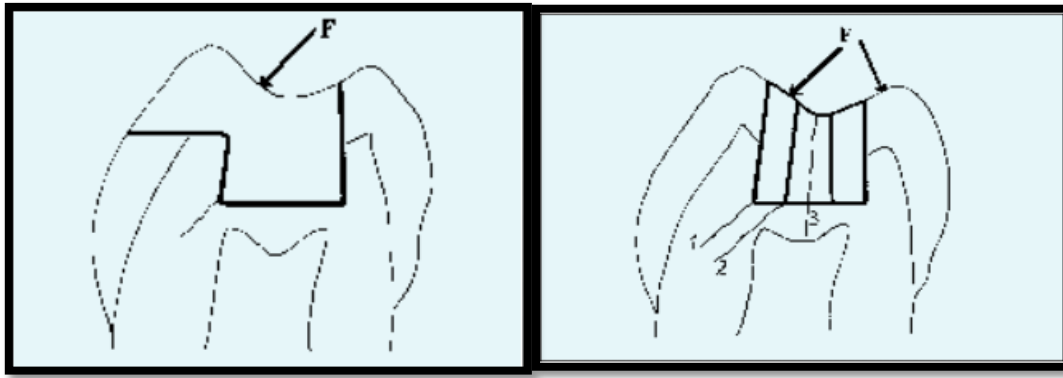
Diagnosis is often problematic and challenging. 20% patients referred to specialist endodontists with diagnostic uncertainties are eventually diagnosed with incomplete tooth fractures

**Dental History:-**

History of a course of extensive dental treatment involving repeated occlusal adjustments or replacement of restorations which fail to eliminate symptoms.

Patient gives a history of pain on biting on a particular tooth, often occurring with foods that have small, discrete, harder particles in them.<sup>18</sup> Patient gives a history of sensitivity to thermal changes, particularly cold.

According to Homewood<sup>18</sup>, fractures tend to occur in a direction parallel to the forces on the cuspal incline; thus with larger restorations, cracks tend to be more superficial and thereby produce fewer symptoms, while with smaller restorations cracks tend to be deeper and closer to the pulp.



If wedging forces are placed on both buccal and lingual cuspal inclines, the resultant crack may occur in the midline of the tooth and propagate towards the pulp, especially in unrestored teeth.

#### **Clinical Examination:-**

Patient may present with facets on the occlusal surfaces of teeth, localized periodontal defects. Use of rubber dam enhances the probability of visualizing these cracks by isolating the tooth, highlighting the crack with a contrasting background.

#### **Visual Examination:-**

Reveal many instances of infractions, especially when aided by the use of transillumination and a dye.

#### **Transillumination:-**

The use of transillumination is dependent on the part of the tooth to be examined. Tooth without restoration will allow the light beam to pass through, when it encounters a fracture line in dentin, the light beam will bend and not pass through the fracture line and opposite tooth structure will be dark.<sup>10</sup> Transillumination along with the use of magnification can help better in visualization of crack.<sup>17</sup>

#### **Methylene blue:-**

Gentian violet or methylene blue stains can be used to highlight fracture lines. Disadvantage of this technique is that it takes at least 2–5 days to be effective and requires placement of a provisional restoration. Placing a provisional restoration undermines the structural integrity of the tooth and further propagates the crack.

#### **Bite Tests:-**

Mimic the symptoms associated with incomplete fractures of posterior teeth.<sup>9</sup> Objects traditionally used for this purpose include: orange wood sticks, cotton wool rolls, rubber abrasive wheels such as a Burlew wheel or the head of a number 10 round bur in a handle of cellophane tape.

The technique for the use of wood sticks<sup>20</sup> has been described. It is advocated that the stick is rested on the suspected tooth and the patient is asked to bite, by the subsequent application of the stick to each individual cusp in turn, to localize the affected cusp.

- Pain which is perceived upon release of pressure is suggested to confirm the diagnosis of crack tooth syndrome.<sup>21</sup>
- Commercially available diagnostic tools to undertake “bite test” include products such as *Fract finder*, *Tooth Slooth II*. Ehrmann et al<sup>20</sup> have advocated the use of this method as one with a higher level of sensitivity than that associated with the use of wood sticks.

Cold stimulus application and electric pulp testing provides information about the status of the pulp and there is evidence that teeth with infraction respond at lower threshold levels to cold and electric pulp testing stimulation compared to non cracked teeth.

Percussion sensitivity is not frequently seen. If infraction is a cuspal infraction and does not directly involve the pulp, percussion may not be as likely to produce a symptomatic response as percussion of teeth with infraction in direct contact with the pulp.

#### **Periodontal probing:-**

- Helps to distinguish between a cracked tooth and a split tooth when the fracture line extends below the gingival, thereby causing a localized periodontal defect.
- For suspected cracks, careful probing must be performed to disclose the presence of an isolated periodontal pocket.
- *However, isolated deep probing often indicates the presence of split tooth, which predicts a poor prognosis.*

#### Radiographs:-

Radiographs are of limited use as fractures tend to propagate in a mesiodistal direction.<sup>9</sup> However, of value in detecting more rarely occurring fractures which may be running in a bucco-lingual direction.<sup>22</sup> Cracks can be detected radiographically in the rare instance in which bacteria in the infraction has stimulated clastic activity in the pulp, resulting in internal resorptive lesions.

#### Microscopic Detection:-

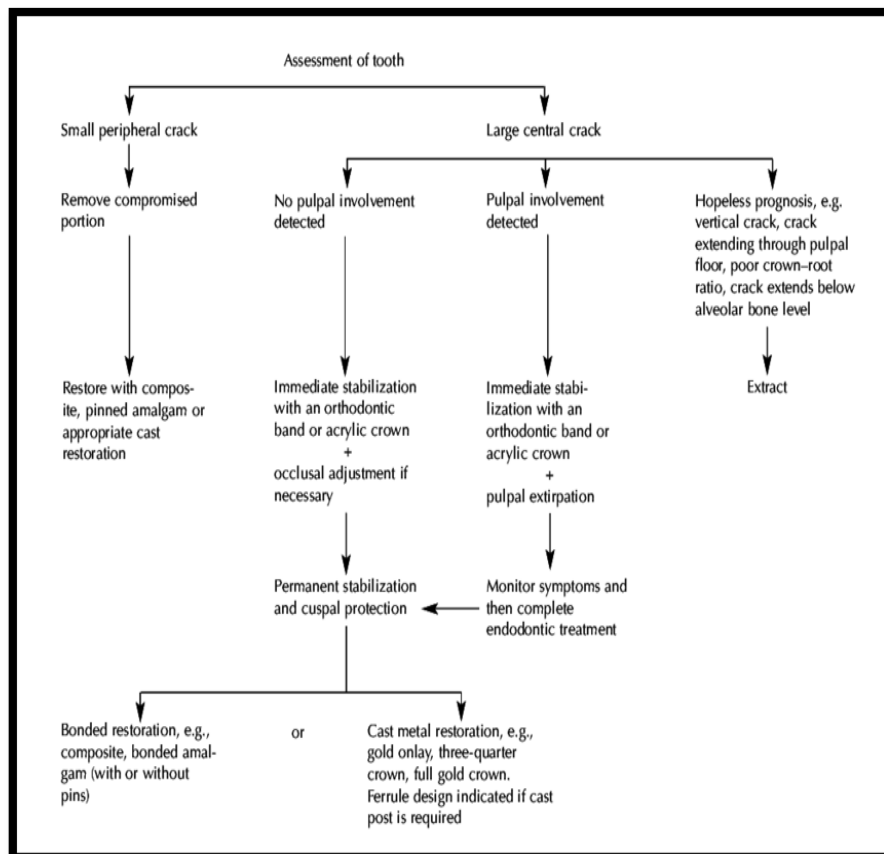
×16 provide an ideal magnification level for the evaluation of enamel cracks.<sup>23</sup> *Use of the clinical microscope makes possible the treatment of asymptomatic but structurally unsound posterior teeth.* It facilitates observation of microscopic crack lines that may show minimal color contrasts against a desiccated tooth surface.

#### Ultrasound:-

Owing to short wavelength in hard tissues and associated high resolution, ultrasound has the potential in clinical dentistry. *It has the ability to penetrate hard structures and detect hard tissue discontinuities, or pathoses, under existing radiopaque restoration.* It is also effective in detecting physical discontinuities. Therefore, ultrasound provide a significant benefit to patients by allowing early detection of dental pathology, especially cracks.<sup>24</sup>

#### Treatment:-

Treatment of CTS will depend on the position and extent of the crack. Management options vary according to clinical need, from replacement of the fractured cusp with a simple restoration to placement of an extracoronal restoration with adequate cuspal protection or root canal treatment.



**Conclusion:-**

The CTS presents both a challenge and an opportunity for the dentist. The possibility of CTS must always be considered when a patient complains of pain or discomfort on chewing or biting. In spite of CTS being a diagnostic challenge, having knowledge and awareness of CTS should enable the dental practitioner to detect the same, thereby preventing further crack propagation and complications associated with crack tooth.

**References:-**

1. American Association of Endodontists. Cracking the cracked tooth code. Endodontics: Colleagues for Excellence. 1997 Fall/Winter;;1–13.
2. Cameron CE. Cracked tooth syndrome. J Am Dent Assoc. 1964;68:405–411.
3. Ellis SG. Incomplete tooth fracture-proposal for a new definition. Br Dent J 2001;190:424-8.
4. Hiatt WH. Incomplete crown-root fracture in pulpal-periodontal disease. J Periodontol 1973;44:369-379.
5. Cavel WT, Kelsey WP, Blankenau RJ. An in vivo study of cuspal fracture. J Prosthet Dent 1985;53:38-41.
6. Khera SC, Carpenter CW, Vetter JD, Staley RN. Anatomy of cusps of posterior teeth and their fracture potential. J Prosthet Dent 1990;64:139-147.
7. K
8. Geurtsen W. The cracked tooth syndrome: Clinical features and case reports. Int J Periodont Restorat Dent 1992;12:395-405.
9. Lynch CD, McConnel RJ. The cracked tooth syndrome. J Can Dent Assoc 2002;68:470-5.
10. Ailor JE. Managing incomplete tooth fractures. J Am Dent Assoc 2000;131:1168–74.
11. Kahler B, Moule A, Stenzel D. Bacterial contamination of cracks in symptomatic vital teeth. Aust Endod J 2000;26:115–18.
12. Wahab MHA, Kennedy JG. Response of cracked teeth to cold and electrical stimulation. Br Dent J 1985;158:250–60.
13. Swepston JH, Miller AW. The incompletely fractured tooth. J Prosthet Dent 1986;55:413–16.
14. Rosen H. Cracked tooth syndrome. J Prosthet Dent 1982;47:36–43.
15. Brännström M. The hydrodynamic theory of dentinal pain: Sensation in preparations, caries, and the dentinal crack syndrome. J Endod 1986;12:453-457.
16. Sutton PRN. Greenstick fracture of the tooth crown. Br Dent J 1962;112:362–6.
17. Brynjulfson A, Fristad I, Grevstad T, Hals-Kvinsland I. Incompletely fractured teeth associated with diffuse longstanding orofacial pain: diagnosis and treatment outcome. Int Endod J 2002;35:461–6.
18. Homewood C I. Cracked tooth syndrome – incidence, clinical findings and treatment. Aust Dent J 1998; 43: 217-222.
19. Liu H H, Sidhu S K. Cracked teeth – treatment rational and case management: case reports. Quintessence Int 1995; 26: 485-492.
20. Ehrmann E H, Tyas M J. Cracked tooth syndrome: diagnosis, treatment and correlation between symptoms and post-extraction findings. Aust Dent J 1990; 35: 105-112.
21. Kruger B F. Cracked tooth syndrome. Letter to the editor. Aust Dent J 1984; 29: 55.
22. Turp C, Gobetti J. The cracked tooth syndrome: an elusive diagnosis. J Am Dent Assoc 1996; 127: 1502-1507.
23. Clark DJ, Sheets CG, Paquette JM. Definitive diagnosis of early enamel and dentin cracks based on microscopic Evaluation. J Esthet Restor Dent. 2003;15:391–401.
24. Culjat MO, Singh RS, Brown ER, Neurgaonkar RR, Yoon DC, White SN. Ultrasound crack detection in a simulated human tooth. Dentomaxillofacial Radiology. 2014 Feb 13.
25. Abbott, P. Endodontics and dental traumatology. An overview of modern endodontics. 1999

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### RESEARCH ARTICLE

#### AMELIORATIVE EFFECT OF THE *AURELIA AURITA* CRUDE VENOM ON THE MURINE EHRLICH ASCITES CARCINOMA-INDUCED HEPATOTOXICITY AND NEPHROTOXICITY.

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#### Abstract

The ability of Jellyfish, *Aurelia aurita* (A.A) crude venom to modify the hepatic and renal dysfunction associated with Ehrlich ascites carcinoma (EAC) stress in experimental mice was assessed. Intraperitoneal injection of A.A. crude venom into EAC-bearing mice at different doses (50, 125, 250, 500, 750 mg/kg B.W), daily, for 7 days was compared with the standard drug, cisplatin, (2mg/kg). Loading the mice with EAC significantly reduced the red blood cells counts and subsequently reduced the hemoglobin (HB). Administration of A.A venom significantly restored red blood count and HB. EAC load had increased the activities of serum AST and ALT but decreased the concentration of albumin and total protein. A.A. crude venom as well as cisplatin improved the hepatic injury by declining the ALT activity and increasing albumin values but no significant changes in the total protein were observed. Moreover, levels of the renal biomarkers, creatinine and urea were highly elevated in EAC-bearing mice. Interestingly unlike cisplatin, levels of those renal biomarkers, creatinine and urea, were significantly decreased by A.A. crude venom administration. Furthermore, histopathological examinations revealed hepatic and renal tissues improvement in EAC-loaded mice after venom administration compared with control group. Taken together, results from this study suggest that A.A crude venom can potentially reduce the hepatic and renal damage induced by EAC load in experimental animals.

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#### Introduction:-

Marine environment has always been considered as rich sources of both biological and chemical diversity. Marine organisms are the main sources of structurally diverse bioactive compounds. The great deal of interest has been expressed regarding marine derived bioactive peptides because of their numerous health related beneficial effects (Kim and Wijesekara, 2010).

**Cnidarians** venoms have roles in drug discovery as the toxic compounds isolated from cnidarian have been viewed to produce several serious implications to human health due to their neurotoxicity, cytotoxicity and tissue damage. Their toxins might offer a tool to study cell physiology (Morabito et al., 2015) and provide promising sources of pharmacological agents for therapy of human diseases.

Biological properties of venom from terrestrial animals have been extensively investigated, while scarce research has been undertaken jellyfish venom. Most of the proteinaceous venoms showing marked curative properties are from highly toxic species (snake, scorpion, etc) and their high toxicity hinders clinical trials. Hence, less toxic species like jellyfish represent a valuable source of pharmacological compounds that may lead compounds for new drugs.

*In vitro* toxic action of the venom from *A.Ahas* received some attention. Lethality and dermonecrosis were observed in mice, with various potencies depending on the origin of the specimen (**Radwan et al., 2001**). The venom is hemolytic to human, sheep, and bovine red blood cells (**Radwan et al., 2001, Segura et al., 2002 and Rastogi et al., 2012**). Protease and phospholipase A activities were recorded to change in response to such venom (**Nevalainen et al., 2004 and Lee et al., 2011**).

Previous studies concluded that SDS-PAGE electrophoresis revealed that the crude venom of *A.A* contains several bands between 200 and 6 kDa (**Rastogi et al., 2012**). The venom was purified by chromatography and the neurotoxic activity of some fractions was characterized. The protein fractions named Aa-1 and Aa-2 were identified and used for further studies. After intramuscular injections with 0.06 mg protein/kg in 0.1 ml/vol of fractions Aa-1 or Aa-2, adult crabs developed tetanic reactions followed by total paralysis and death within three minutes. The molecular weights of Aa-1 and Aa-2 were 66 and 45 kDa, respectively (**Segura et al., 2002 and Ponce et al., 2013**).

Cancer is a group of diseases involving abnormal cell growth with the potential to invade or spread to other parts of the body and associated with different organs disorder. Cisplatin has become one of the most used drugs in the treatment of solid tumors of epithelial origin. Although cisplatin has been a mainstay for testicular cancer therapy (**Einhorn, 1997**), it is also commonly used to treat ovarian, cervical, bladder, and non-small cell lung carcinoma as well as head and neck cancers (**Armstrong, 2006, Helm and States, 2009 and Konstantakou, 2009**). The two limiting factors for a successful application of cisplatin are acquired or intrinsic drug resistance of the tumor and severe side effects in normal tissues, mainly in the kidney, in the inner ear and in the peripheral nerves (**Pabla and Dong, 2008**).

In this regard, the present study aimed to evaluate the potency of *A.A* crude venom to improve the hematological, biochemical and histological injuries induced in the kidney and liver by EAC-loaded in the experimental mice and compare this effect, if there is any with this of cisplatin as one of anticancer drug.

## Material and Methods:-

### *A.A* sampling areas:-

*A.A* was collected during June, 2014 from the Red sea "Wadi el Gemal protected national park" from North head Hnkurab and North head Baghdadi areas.

### Venom preparation:-

*A.A* crude venom was prepared as described by **Torres and Heimer, (2001)** as follows; the oral arms and tentacles of organisms were clipped manually, combined and centrifuged at 1620 g for 10 min at (4°C). The pellet was resuspended in distilled water, lyophilized and stored at (-20°C). The nematocysts rupture was monitored optically in order to obtain their maximal discharge. The best technique for nematocysts discharge was obtained by applying an osmotic shock by resuspending freshly lyophilized samples in deionized water (1mg/10µl), this preparation was stirred for two minutes and centrifuged at 1932 g for 30 min at (4°C). The supernatant was then centrifuged at 11130 g for 20 min at (4°C), and filtered (0.45µm). The venom isolated and resuspended in this form, maintained full activity when stored at (-20°C) for 1 month.

### Experimental animals:-

One hundred twenty *Swiss albino* female mice were purchased from Faculty of Pharmacy Mansoura University. They were housed in plastic cages under standard condition of humidity, temperature, chow and water in the animal lab of Faculty of Science, Port Said University until became of suitable weight. EAC-bearing albino mice (tumor donor animals) were obtained from Tumor National institute, Cairo, Egypt. These mice were kept in the same conditions of normal mice.

1 ml Ehrlich tumor cells were drawn and diluted with saline (0.9% NaCl). Using haemocytometer, the tumor cells were counted and 0.2 ( $1 \times 10^7$ ) ml of freshly drawn diluted ascites fluid were intraperitoneally injected into the normal experimental mice.

### Experimental design:-

#### Animal grouping:-

After 72h of Ehrlich tumor cell injection, Female mice were grouped as follows

**1. Group1. Normal mice (Normal control)**

- a. Normal mice were I.P injected with 0.9% normal saline.

**2. Group2. EAC-bearing mice (Positive control)**

- a. Normal mice were I.P injected with 0.2 ml ( $1 \times 10^7$ ) tumor cells/mouse.

**3. Group3. EAC+ (50 mg/kg BW)**

**4. Group4. EAC+ (125 mg/kg BW)**

**5. Group5. EAC+ (250 mg/kg BW)**

**6. Group6. EAC+ (500 mg/kg BW)**

**7. Group7. EAC+ (750 mg/kg BW)**

A.A crude venom daily for 7 days

**8. Group8. EAC+cisplatin:** Tumor-bearing mice after 72 h of tumor cell injection were I.P injected with the standard drug at dose (2mg/kg) every day for 7 days as standard drug control (El-Nagar, 2011).

#### Collection of samples:-

The blood samples were collected from control group and treated groups after 7 days of daily treatment. Blood samples were collected in EDTA tubes for hematological analysis, another blood sample were left for clotting, centrifuged at 300 rpm for 15 minutes and immediately frozen at (-20°C) till the biochemical assay (ALT, AST, albumin, total protein, urea and creatinine) were carried out. Kidney and liver of the normal, EAC-bearing albino mice and treated animals were fixed in formalin (10%) for histopathological assay.

#### Hematological and Biochemical assays:-

Complete blood count (CBC) includes hemoglobin content, Red blood cells (RBC), white blood cells (WBC), and platelets (PT) counts. It was done by Abbott CELL-DYN1800 automated hematology analyzer, USA, using ready-made kits produced by Abbott laboratories, Abbott Park, IL, 60064, USA. Serum biochemical analysis was determined by colorimetric methods using ready-made kits produced by Linear Chemicals. S.L. Biochemical, BIOMED, SPINERACT diagnostic assays include Aspartate transaminase (AST), Alanine transaminase (ALT), Albumin, Total protein, Urea and Creatinine.

#### Statistical analysis:-

Data was statistically analyzed using MINITAB (Lenth, 1989). Tabulation and graphics of data were done using Microsoft Excel XP. All of the data of control and treated groups were expressed as mean values  $\pm$  standard error. One-way ANOVA and unpaired t-test were carried out to find if there was any significant difference among control and treated groups with A.A crude venom at different doses.

### Results:-

#### Haematological assay:-

The alteration of hematological parameters induced in EAC-bearing albino mice and the protective effect of A.A crude venom are given in **table (1)** comparing to cisplatin post treatment.

As shown in Table (1) EAC-bearing albino mice had a significant decline in Hb, Red blood cells but non-significant change of White blood cell, and platelet counts when compared with control group. Administration of different doses of A.A crude venom after injection with EAC had significantly increased Hb, Red blood cell. While non-significant changes were observed on the Hb levels in the groups administered with doses 125, 250, 500 and 750 mg/kg BW of A.A crude venom. Administration of the standard drug, cisplatin, at dose of 2mg/kg, showed non-significant changes in hemoglobin levels and significant elevation in the RBC count when compared with the EAC control group.



**Table 1:-** Effect of A.Acrude venom and(2mg/Kg BW) Cisplatin on hematological parameters of EAC-bearing *Swiss albino* female mice.

Parameter Groups	Haemoglobin (g/dL)	RBCs count ( $\times 10^6/\mu\text{L}$ )	WBCs count ( $\times 10^3/\mu\text{L}$ )	Platelets count ( $\times 10^3/\mu\text{L}$ )
Normal control	9.58 $\pm$ 0.258	5.212 $\pm$ 0.104	8.02 $\pm$ 0.229	194.4 $\pm$ 17.608
EAC control	7.26 $\pm$ 0.597 <sup>b**</sup>	2.8 $\pm$ 0.10 <sup>b***</sup>	6.5 $\pm$ 0.776	115.8 $\pm$ 1.907
EAC + Cisplatin (2mg/Kg BW)	6.98 $\pm$ 0.427	2.24 $\pm$ 0.051 <sup>a***</sup>	8.06 $\pm$ 0.112	97.2 $\pm$ 2.956 <sup>a***</sup>
EAC+50mg/kg A.A venom	9.18 $\pm$ 0.262 <sup>a*</sup>	5.08 $\pm$ 0.454 <sup>a***</sup>	7.86 $\pm$ 0.384	118 $\pm$ 4.898
EAC+125mg/kg A.A venom	8.5 $\pm$ 0.519	4.854 $\pm$ 0.613 <sup>a**</sup>	9.62 $\pm$ 0.220 <sup>a**</sup>	150.2 $\pm$ 3.942 <sup>a***</sup>
EAC+250mg/kg A.A venom	8.34 $\pm$ 0.627	5.03 $\pm$ 0.638 <sup>a**</sup>	10.04 $\pm$ 0.549 <sup>a**</sup>	170.4 $\pm$ 17.823 <sup>a**</sup>
EAC+500mg/kg A.A venom	9.08 $\pm$ 0.600	5.09 $\pm$ 0.286 <sup>a***</sup>	9.78 $\pm$ 0.950 <sup>a*</sup>	174.2 $\pm$ 20.582 <sup>a*</sup>
EAC+750mg/kg A.A venom	8.58 $\pm$ 0.888	4.97 $\pm$ 0.595 <sup>a**</sup>	8.52 $\pm$ 1.047	194.8 $\pm$ 10.767 <sup>a***</sup>
ANOVA(Pvalue)	—	0.000	0.005	0.000

Results expressed as Mean $\pm$  SE (n=5). ANOVA (P value) represents the difference between all groups. <sup>a</sup>represents significantly different comparing with EAC control group. <sup>b</sup> represents significantly different comparing with normal control group. \* (p<0.05), \*\* (p<0.01), \*\*\* (p<0.001).

## Biochemical Assay:-

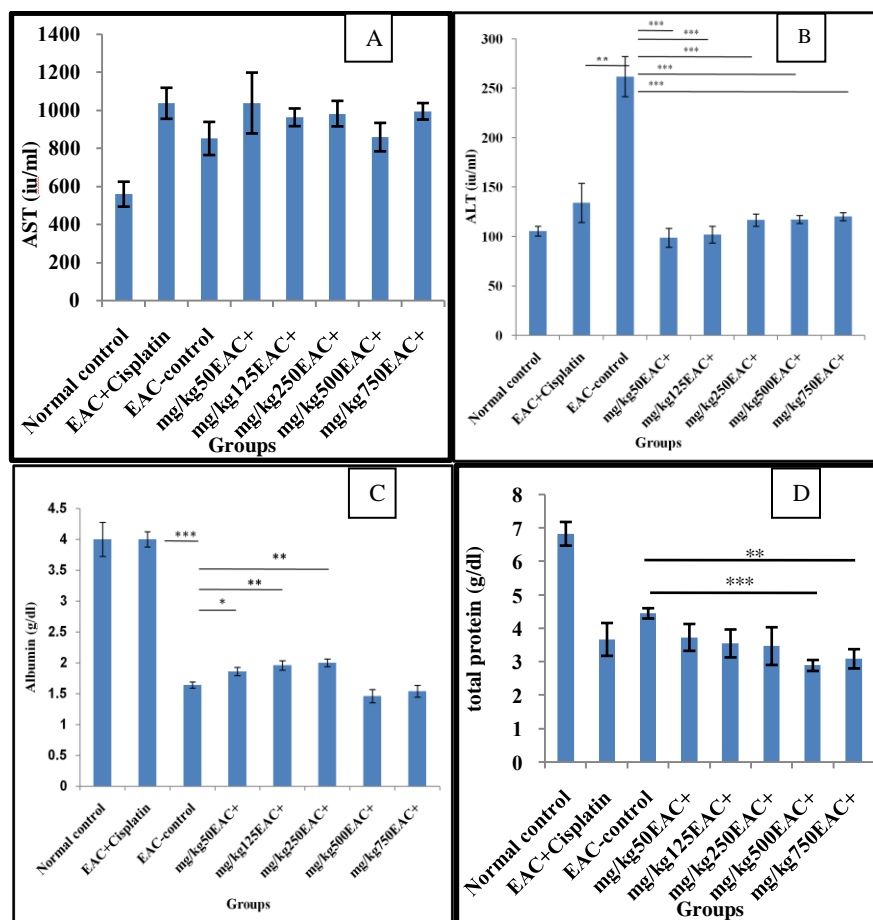
### a-Hepatic biomarkers:-

The changes in the serum liver biomarkers are shown represented in Figure 1(A, B, C, D).

EAC load in albino mice induced hepatotoxicity which is represented as significant increase in liver biomarkers; serum AST and ALT activities ( $P \leq 0.01$  &  $P \leq 0.05$ ) respectively. Both treatments with different doses of A.Acrude venom at all doses 50, 125, 250, 500 and 750 mg/kg BW and the standard drug, cisplatin, non-significantly changed AST activities while different doses of A.Acrude venom at all doses 50, 125, 250, 500 and 750 mg/kg BW and the standard drug, cisplatin, significantly declined ALT activities and ameliorate the hepatotoxicity induced by EAC as noticed in Fig 1-A and B

Moreover, Serum albumin, total protein were highly significant decreased ( $P \leq 0.001$ ) in EAC-bearing *albino* mice. I.P treatment of EACs-bearing mice with A.A crude venom induced significant increase ( $P \leq 0.05$ ) in albumin levels at dose 50, 125 and 250 mg/kg BW and non-significant changes at higher doses 500 and 750 mg/kg. Similarly, the standard drug, cisplatin, induced a very highly significant increase ( $P \leq 0.001$ ; Fig 1C)

I.P treatment of EACs-bearing mice with different doses of A.A crude venom induced non-significant changes in the serum total protein content at low doses 50, 125 and 250 mg/kg BW. Meanwhile, high doses 500 and 750 mg/kg BW of A.A crude venom caused very highly significant decrease ( $P \leq 0.001$  and  $P \leq 0.01$ ). Treating EAC-control mice with the standard drug, cisplatin, induced non-significant changes as shown in **fig1D**.

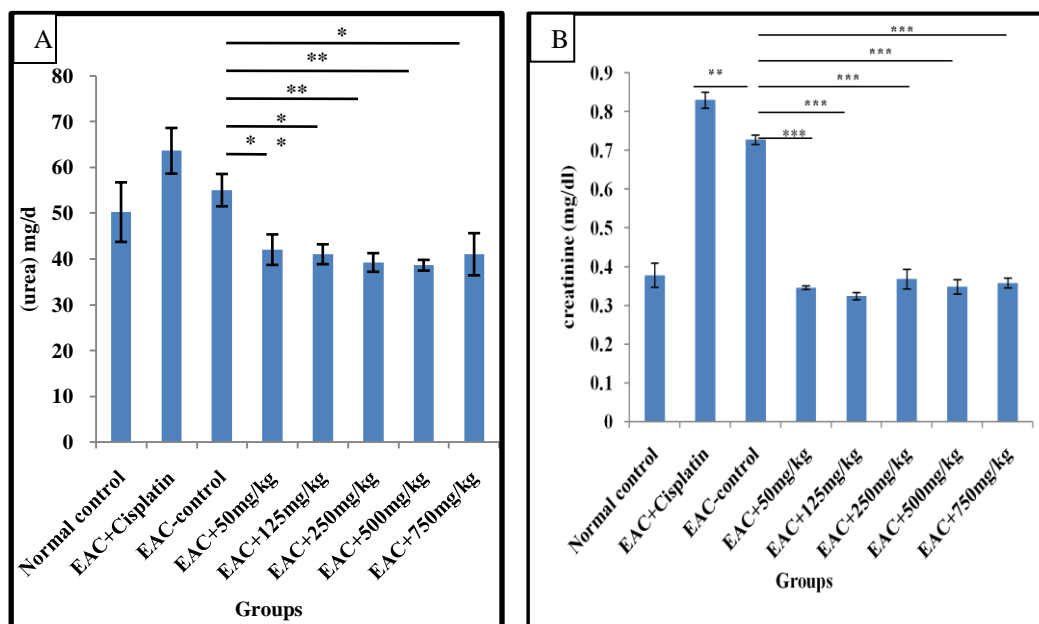


**Figure 1:-** Effect of A.A crude venom on the alteration of biochemical markers induced by EACs-bearing mice, (A) AST, (B) ALT, (C) albumin and (D) total protein levels. \* ( $p < 0.05$ ), \*\* ( $p < 0.01$ ), \*\*\* ( $p < 0.001$ ).

#### **b-Renal biomarkers:-**

EAC-bearing albino mice induced renal damage which is represented as disturbance in renal biomarkers (creatinine and urea). As shown in Fig 2, urea had non-significantly changed ( $P \leq 0.001$ ), while creatinine was significantly increased in EAC-bearing albino compared to those of the normal mice.

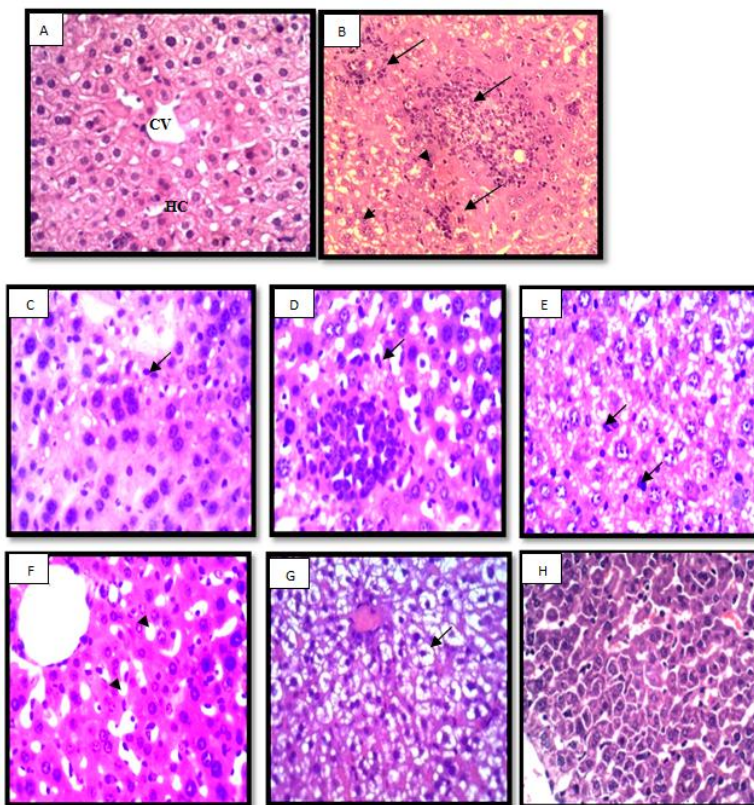
Treatment of EACs-bearing mice with different doses of A.A. crude venom caused a significant decline in serum urea and creatinine at all doses 50, 125, 250, 500 and 750 mg/kg BW respectively. On the other hand, EAC-control mice treatment with cisplatin did not induce any noticeable changes in urea concentration but caused a significant increase ( $P \leq 0.01$ ) in creatinine, as illustrated in **figure 2A,B**.



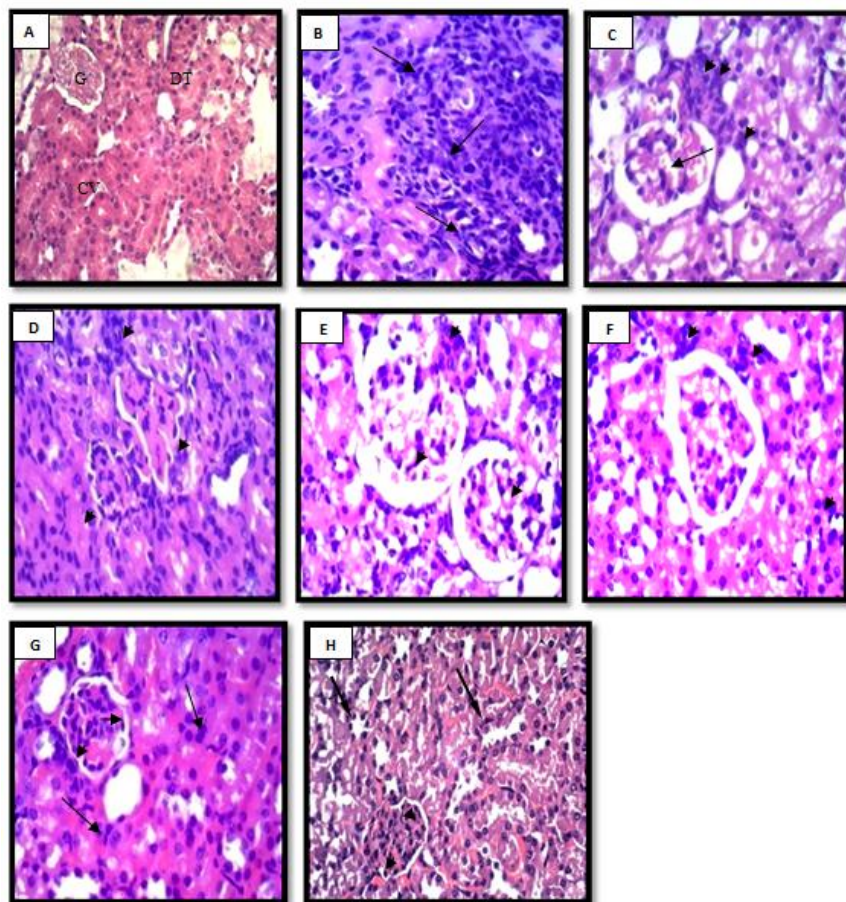
**Figure 2:-** Effect of A.A crude venom on the alteration of biochemical markers induced by EACs-bearing mice. urea (A), creatinine (B), \* ( $p < 0.05$ ), \*\* ( $p < 0.01$ ), \*\*\* ( $p < 0.001$ ).

#### Histopathological Assay:-

Liver and kidney from EAC-loaded mice, A.A crude venom-treated EAC-bearing mice and cisplatin treated EAC-bearing mice were represented in Fig 2 and 4. As shown loading mice by EAC deteriorate lobular architecture where hepatocytes showed enlarged nuclei, hydropic degeneration and sinusoidal infiltration of carcinoma cells mixed with lymphocytes. In addition, marked degenerative changes of renal tubules, stromal congestion and moderate inflammation with mild degeneration of glomeruli, an improvement in hepatic and renal tissues in EAC-loaded mice after A.A crude venom administration was observed at **figures 3 (A-H)**.



**Figure 3:-** Histopathology of liver in normal and EAC-bearing mice groups. **A-** Section of liver of normal control mice showing normal histological appearance of liver including central vein (CV), hepatic cells (HC). **B-** Section of liver of EAC-bearing mice illustrating hydropic degeneration (arrow head) and sinusoidal infiltration of carcinoma cells mixed with lymphocytes (arrows). **C-** Section of liver of **50** mg/kg BW A.A. venom-treated EAC-bearing mice showing shrunken deeply stained nuclei (arrow). **D-** Section of liver of **125** mg/kg BW A. A. venom-treated EAC-bearing mice showing shrunken deeply stained nuclei (arrow) **E-** Section of liver of **250** mg/kg BW A.A. venom-treated EAC-bearing mice showing restored normal lobular architecture, still to notice very few hepatocytes showed shrunken deeply stained nuclei (arrow). **F-** Section of liver of **500** mg/kg BW A.A. venom-treated EAC-bearing mice showing mild improvement with hydropic degenerative changes (arrow head). **G-** Section of liver of **750** mg/kg BW A.A. venom-treated EAC-bearing mice showing: marked improvement with mild degenerative changes (arrow). **H-** Section of liver of 2mg/kg BW **cisplatin**-treated EAC-bearing mice illustrating some hepatocytes hydropic degeneration and ballooning degeneration (arrow head). Slides captured with Power Field of 400x



**Figure 4:-** Histopathology of kidney in normal, EAC-bearing and treated EAC-bearing mice groups. **A-** section of the cortical tissue of the kidney of control normal mice showing glomeruli(G), proximal and distal convoluted tubules (DT) **B-** Section of mice kidney of EAC-control group showing moderate inflammation with mild degeneration of glomeruli, accompany the infiltration of many proliferating groups of neoplastic cells (arrow). **C-** Section of mice kidney of 50 mg/kg BW A.A. venom-treated EAC-bearing mice. **D-** Section of mice kidney of 125 mg/kg BW A.A. venom-treated EAC-bearing mice illustrating degenerative changes of tubules and inflammation with mild degeneration of glomeruli (arrow) Neoplastic cells are fewer than EAC control denoting minimal improvement (arrow head) **E-** Section of mice kidney of 250 mg/kg BW A.A. venom-treated EAC-bearing mice showing cortical tissue few of neoplastic proliferation with minimal glomerular capillary congestion (arrow head). **F-** Section of mice kidney of 500 mg/kg BW A.A. venom-treated EAC-bearing mice showing fewer neoplastic cells are than EAC control denoting minimal improvement (arrow head). **G-** Section of kidney of 750 mg/kg BW A.A. venom-treated EAC-bearing mice showing kidney totally free of neoplastic proliferation with minimal glomerular capillary congestion (arrow head) and mildly degenerated tubules (arrow). **H-** Section of kidney of 2 mg/kg BW cisplatin-treated EAC-bearing mice showing degeneration of tubes and congestion of corpuscles (arrowhead) and mildly degenerated tubules (arrow). Slides captured with high Power Field (HPF) of 400x.

### Discussion:-

Several marine organisms are of considerable interest as a new promising antitumor source. The present investigation showed the ability of A.A crude venom at different doses 50, 125, 250, 500 and 750 mg/kg BW to restore the hematological, biochemical, histopathological disorders developed in experimental mice bearing EAC cells.

The current study revealed that anemia is associated with loading the mice with EAC. It was reported that anemia encountered in tumor bearing mice is mainly due to reduction in RBC and/or hemoglobin percentage and this may occur either due to iron deficiency or due to hemolytic or myelopathic conditions (Fenninger and Mider, 1954 and Sinclair, *et al.*, 1990).



In the current study, hemoglobin content, RBCs count and platelets count showed significant decrease in EAC-bearing control mice. Interestingly, treatment with A.A crude venom with different doses induced appreciated increase in hemoglobin, RBC, WBCs and platelets counts after venom injection. The increase in RBCs, hemoglobin and platelets after treated with A.A crude venom are running in agreement with the data by **Zaki, (2005)** who proved the antitumor effect of sea cucumber, *Holothuria atra*, crude venom on biochemical and hematological parameters on rat, and suggested that this increase in the in RBCs, hemoglobin and platelets may be attributed to activation of the bone marrow by sea cucumber. Similarly, this explanation runs in agreement with **Jakowska et al., (1958)** who reported that the toxin of sea cucumber stimulates hemopoiesis in the bone marrow.

The increase in hemoglobin levels, RBCs, WBCs and platelets counts indicates that A.A crude venom may possess a protective action for the hematopoietic system. On the other hand, the significant increase in WBC's may result from the stress induced by venom injection as reported by **Bawaskar, (2012)** who studied the effect of scorpion sting.

The fact that haemoglobin and RBC content are increased in A.A crude venom-treated groups is consistent with the result by **Meenakshi, et al., (2013)** and this result by **Abd El-Aziz et al., (2014)** who studied the inhibitory effects of Rosemary (*Rosmarinus officinalis L.*) on EAC-bearing mice. Similar effect was observed by **Gupta et al., (2004)** for the extract of *Bauhinia racemosa* stem bark on EAC bearing mice. Moreover the increase in platelets count might be due to platelets activation according to **Konca et al., (2014)** who reported that during his study on the platelet function in children with scorpion envenomation.

In cancer chemotherapy, the major problems are myelo suppression and anemia (**Price and Greenfield, 1954**). In the present study, the treatment of EAC-bearing mice with the standard drug, cisplatin induced significant decrease in RBCs, hemoglobin and platelets levels comparing with EAC-control mice. Based on these results, A.A crude venom may have an advantage to restore the haematological parameters which distorted by cancer in EAC-bearing mice model.

Hepatic enzymes including ALT and AST showed a significant elevation in the EAC control group in comparison with normal control which indicates the hepatocellular damages caused by inoculation with EACs (**El-Dayemet al., 2013**). Moreover, our results revealed that the levels of hepatic enzymes (ALT, AST) were elevated in the EAC-bearing mice. Administration of A.A crude venom to EAC-bearing mice reduced the elevated ALT level indicating a recovery from EAC hepatotoxicity. Reduced level of this hepatic enzyme in serum is one of the indications of the antitumour potential (**Chakraborty et al., 2006** and **Sundaram et al., 2012**).

The current study demonstrated that the treated mice with different doses of A.A crude venom can elevate the plasma level of AST; this might be due to hepatocellular toxicity. Treatment with cisplatin as a standard drug elevated transaminases values indicating a hepatic toxicity too.

In support of this finding, elevation in the plasma levels of AST also agrees with the data by **Liang et al (2011)** who studied the effects of tentacle-only extract from the jellyfish *Cyanea capillata* and the results by **Bruschetta et al., (2014)** who studied the inflammation and oxidative stress by the crude venom extracted from the jellyfish *Pelagia noctiluca* in rats.

**Abu-Amra et al. (2015)** studied the role of bradykinin potentiating factor (BPF7) separated from jellyfish, *Cassiopea andromeda*. It was suggested that the marked increase in this hepatic enzyme by this factor may be due to an enhancement of protein biosynthesis, changes of cellular permeability and release of cyclic AMP. This suggestion was also recommended by **Enjalbert et al., (1980)**, **Etgen and Browning, (1983)**, **Abu-Amra and Abd El-Rehim, (1992)** and **Abu-Amra (2000)**.

On the other hand, the biochemical results of EAC-bearing mice revealed a decrease in the albumin and total protein levels; this may be attributed to increased mitotic division of tumor cells with high body fluid withdrawal and the capillary permeability, which permit the escape of plasma proteins into peritoneal cavity (**Garrison et al., 1987**).

Furthermore, hypoproteinemia and hypoalbuminemia may be due to excessive nephritis and/or massive ascites and also associated with liver disease. This is in parallel to increased AST activity which may be attributed to hepatic damage as a result of cancer cells invasion (**Badret et al., 2011**). Treatment of EAC-bearing

mice with A.A crude venom had significantly increased albumin level in a dose-dependent pattern in lower doses (50, 125 and 250 mg/kg BW) and return to decrease albumin level non-significantly in the higher doses (500 and 750 mg/kg BW), while treatment with cisplatin elevated albumin value to be restored to normal values.

This change of albumin levels recorded in the A.A crude venom-treated animals is in agreement with **Abd El-Aziz et al., (2014)**. The decrease in albumin level in Ehrlich group and its improvement by A.A crude venom may be due to A.A hepatoprotective activity in EAC-bearing-treated mice. In line with these findings, **Natesan et al., (2007)** and **Senthilkumaret al., (2008)** showed that the methanol extract of *Careya arborea* (has antitumor effect) have a hepatoprotective activity in EAC-bearing mice.

In the present study we found a decrease in total protein level after the administration of A.A crude venom. The same effect was observed in the cisplatin-treated EAC-bearing mice. This decrease in total protein level after the administration of A.A crude venom agrees with the study by **Zaki, et al., (2005)**. This decrease may be due to increased catabolism of plasma proteins, or to impaired synthesis of the protein.

It was demonstrated that, the presence of tumors in human body or experimental animals is known to affect many functions of vital organs (**DeWys, 1982**). At the current study, urea and creatinine levels, which are considered as makers of kidney function, were significantly elevated in serum of EAC-control mice indicating renal impairment. These alterations induced by toxic conditions, reflected metabolic cellular dysfunction of these tissues (**Robbins et al., 2001**). An elevation of urea may be attributed to an increase in nitrogen retention or excessive protein breakdown (**Geraciet al., 1990**).

Treatment with A.A crude venom gradually returned the increased levels of urea and creatinine to more or less the normal values, while the treatment of EAC-bearing mice with cisplatin maintained their higher values.

Histopathological assay offered more evidence for improving the EAC-induced cytotoxicity by A.A crude venom. Treatment with different doses of A.A crude venom especially high doses showed regular hepatocytes with abundant cytoplasm with mild hydropic degeneration and mild degenerative changes similar to control.

In addition, treating EAC-bearing mice with the A.A crude venom especially, at the highest doses shows kidney totally free of neoplastic proliferation with minimal glomerular capillary congestion and mildly degenerated tubules with interstitial inflammation. This result is similar to that reported by **Nagarjuna et al., (2013)** when they studied the anti-cancer activity of *Ruellia tuberosa* on EAC induced mammary tumor.

In conclusion, loading mice with EAC-bearing mic- induced haematological, hepatic and renal toxicity. I.P administration of A.A crude venom could restore the hepatic and renal biomarkers which were disturbed by EAC application, moreover, A.A crude venom had improved the histopathological disturbances by EAC load. This biological activities induced by A.A crude venom might be attributed to some bio-active compounds. Further researches are still required to separate and identify the biologically active protein of A.A crude venom individually, then determined the biological mechanism of the effective fraction/s.

## References:-

1. **Abd El-Aziz, M.E.Hefni and Amira M. Shalaby (2014):** Inhibitory effects of Rosemary (*Rosmarinus officinalis* L.) on Ehrlich ascites carcinoma in mice. *Int.J.Curr.Res.Aca.Rev.*2014; 2(9):330-357 .
2. **Abu-Amra S. (2000):** Physiological studies on diabetic male albino mice treated with bradykinin potentiating factor (BPF 7) separated from jellyfish and cobra snake venoms. *J. Egypt Ger. Soc. Zool.*, 31(A): 211-233 .
3. **Abu-Amra S., and Abd El-Rehim S.A (1992):** Effect of factors isolated from venom of Egyptian snakes on plasma cholesterol, creatine kinase and alkaline phosphatase. *J. Egypt. Ger. Soc. Zool.*, 9(A):75-89
4. **Abu-Amra E., Abd-EL-Rehim S.A., Lashein F.M and Seleem A.A (2015):** Influence of Bradykinin potentiating factor on protecting liver and kidney against the toxicity of indomethacin in male mice. *Issue 5* 1.625.
5. **Armstrong D.K (2006):** I.P cisplatin and paclitaxel in ovarian cancer. *NEngl J Med* 354, 34-43.
6. **Badre, S. (2014):** Bioactive toxins from stinging jellyfish, *Toxicon*.09.010.
7. **Bawaskar, H. (2012):** Scorpion Sting: Update. *J Assoc Physicians India* 60,46-53.

8. **Bruschetta G., Impellizzeri D., Morabito R, Marino A., Ahmad A., Spanò N., La Spada G., Cuzzocrea S. and Esposito E. (2014):** *Pelagianoctiluca* (Scyphozoa) Crude Venom Injection Elicits Oxidative Stress and Inflammatory Response in Rats. *Mar Drugs*, 12, 2182-2204.
9. **Chakraborty T, Chatterjee A, Saralaya M.G and Chatterjee M., (2006):** Chemopreventive effect of vanadium in a rodent model of chemical hepatocarcinogenesis: reflections in oxidative DNA damage, energy-dispersive X-ray fluorescence profile and metallothionein expression. *J. Biol. Inorg. Chem.* 11(7): 855-866.
10. **DeWys W.D (1982):** Pathophysiology of cancer cachexia: current understanding and areas for future research. *Cancer Res.* 42(2):721s.
11. **El-Dayem S.M, Fouda F.M, Ali E.H and Motelp B.A (2013):** The antitumor effects of tetrodotoxin and/or doxorubicin on Ehrlich ascites carcinoma bearing female mice. *Toxicol Indus health*, 29, 404-417.
12. **El-Naggar S.A (2011):** Lack of the beneficial effects of Mirazied (*commiphoramolma*) when administered with chemotherapeutic agents on Ehrlich ascetic carcinoma bearing mice. *Adv Biol Res*, 193-199
13. **Einhorn E.H (1997):** Testicular cancer: an oncological success story. *Clin Cancer Res* 3, 2630-2632.
14. **Enjalbert A, Arancibia S, Ruberg M, Priam M, Bluet-Pajot M.T, Rotsztein W.H and Kordon C (1980):** Stimulation of in vitro prolactin release by vasoactive intestinal peptide. *Neuroendocrinology*, 31:200-204.
15. **Etgen A.M and Browning E.T (1983):** Activators of cyclic adenosine 3':5'- monophosphate accumulation in rat hippocampal slices: Action of vasoactive intestinal peptide (VIP). *J. Neurosci.*, 3(12): 2487-2493.
16. **Fenninger L.D and Mider G.B (1954):** Advances in cancer research. Grenstein JP, Haddow A, editors. v2. New York: Academic Press; 1954. p244.
17. **Garrison R.K, Galloway R.H and Heuser L.S (1987):** Mechanism of malignant ascites production. *J Surg Res* 42, 126-132.
18. **Geraci J.P, Jackson K.L, Mariano M.S and Michieli B.M (1990):** Kidney and lung injury in irradiated rats protected from acute death by partial-body shielding. *Rad. Res.*, 112(1), 95.
19. **Gupta M, Mazumder U.K, Kumar R.S and Kumar T.S (2004):** Antitumor activity and antioxidant role of *Bauhinia racemosa* against Ehrlich ascites carcinoma in Swiss albino mice. *Acta Pharmacol Sin* 25:1070-1076.
20. **Helm C.W and States J.C (2009):** Enhancing the efficacy of cisplatin in ovarian cancer treatment could arsenic have a role. *J Ovarian Res* 2, 2.
21. **Jakowska S.R.F, Nigrelli R.F, Murray P.M and Veltri A (1958):** Hemopoietic effects of Holothurin, a steroid saponin from the sea cucumber, *Actinopyga agassizi*, in *Ranapiens*. *Anat. Res.*, 132: 456-466.
22. **Kim SK and Wijesekara I (2010):** Development and biological activities of marine derived bioactive peptides: a review. *J. Functional Foods.*, 2(1): 1-9.
23. **Konca C, Tekin M, Colak P, Uckardes F, Turgut M (2014):** An overview of platelet indices for evaluating platelet function in children with scorpion envenomation. *Exp Clin Sci* 67, 801-808.
24. **Konstantakou E.G (2009):** Human bladder cancer cells undergo cisplatin-induced apoptosis that is associated with p53-dependent and p53-independent responses. *Int J Oncol* 35, 401-416.
25. **Lee H, Jung E, Kang C, Yoon W.D, Kim J.S and Kim E (2011):** Scyphozoan jellyfish venom metalloproteinases and their role in the cytotoxicity. *Toxicon* 58, 277-284.
26. **Lenth R.V (1989):** Quick and Easy Analysis of Unreplicated Factorials. *Technometrics*, Vol 31, p.469.
27. **Liang X., Sihua Liu, Qian He, Qianqian Wang, Xuting Ye, Guoyan Liu, Fei Nie, Jie Zhao, and Liming Zhang (2011):** The Acute Toxicity and Hematological Characterization of the effects of Tentacle-Only Extract from the Jellyfish *Cyanea capillata*. *Mar. Drugs*, 9, 526-534
28. **Meenakshi S., Paripoorana S., Gomathy S. and Chamundeswari (2013):** In vitro and in vivo antitumor and immunomodulatory studies of *Microcosmum exasperatus* against DLA bearing mice. *European Journal of Applied Engineering and Scientific Research*, 2 (3):18-25.
29. **Morabito R, La Spada G, Crupi R, Esposito E and Marino A (2015):** Crude Venom from Nematocysts of the Jellyfish *Pelagianoctiluca* as a Tool to Study Cell Physiology. *Cent. Nerv. Syst. Agents. Med. Chem.*, 15, 6873.
30. **Nagarjuna Reddy, Nagarathna P.K.M and M Divya (2013):** Evaluation of anti-cancer activity of *Ruellia tuberosa* on EAC induced mammary tumor *International Journal of Pharmacology and Toxicology*, 1 (2) 36-42
31. **Natesan S, Badami S, Dongre S.H and Godavarthi A (2007):** Antitumor activity and antioxidant status of the methanol extract of *Careya arborea* bark against Dalton's lymphoma ascites induced ascitic and solid tumor in mice. *J Pharmacol Sci* 103:12-23.
32. **Nevalainen T.J, Peuravuori H.J, Quinn R.J, Llewellyn L.E, Benzie J.A.H, Fenner P.J and Winkel K.D (2004):** Phospholipase A2 in Cnidaria. *Comp. Biochem. Physiol. B Biochem. Mol. Biol.* 139, 731-735



33. **Pabla N. and Dong Z (2008)**: Cisplatin nephrotoxicity: mechanisms and renoprotective strategies. *Kidney Int* 73, 994-1007.
34. **Price V.E and R.E Greenfeld (1954)**: Anemia in cancer. In: *Advanced in Cancer Research*. Greenstein J.P. and A. Haddow (Eds), New York: Academic Press, pp: 244.
35. **Radwan F.F, Burnett J.W, Bloom D.A, Coliano T, Eldefrawi M.E, Erderly H, Aurelian L, Torres M and Heimer-de la Coteria E.P (2001)**: A comparison of the toxinological characteristics of two *Cassiopea* and *Aurelia* species. *Toxicon* 39, 245-257.
36. **Rastogi A, Biswas S, Sarkar A and Chakrabarty D (2012)**: Anticoagulant activity of Moon jellyfish (*Aurelia aurita*) tentacle extract. *Toxicon* 60, 719-723.
37. **Senthilkumar N, Badami S, Dongre S.H and Bhojraj S (2008)**: Antioxidant and hepatoprotective activity of the methanol extract of *Careyaarborea* bark in Ehrlich ascites carcinoma bearing mice. *J. Ethnopharmacol.* 116(1), 1-6.
38. **Sinclair A.J, A.H Barnett and J Luine (1990)**: Free radical and autooxidant system in health and disease. *Br. Hosp. Med.*, 43: 334-344.
39. **Sundaram M, Patra S and Maniarasu G (2012)**: Antitumor activity of ethanol extract of *Gracilariaedulis* (Gmelin) Silva on Ehrlich ascites carcinoma- bearing mice. *Journal of Chinese Integrative Medicine*, 10 (4): 430-435
40. **Ponce D, Lopez-Vera E, Aguilar M.B and Sanchez-Rodríguez J (2013)**: Pre-liminary results of the *in Vivo* and *in Vitro* characterization of a tentacle venom fraction from the jellyfish *Aurelia aurita*. *Toxins* 5, 2420-2433
41. **Segura-Puertas L, Avila-Soria G, Sanchez-Rodríguez J, Ramos Aguilar M.E and Burnett J.W (2002)**: Some toxinological aspects of *Aurelia aurita* (Linne) from the Mexican Caribbean. *J. Venom. Anim.Toxins* 8, 269-282.
42. **Torres M and Heimer E (2001)**: A comparison of the toxinological characteristics of two *Cassiopea* and *Aurelia* species. *Toxicon* 39, 245-257.
43. **Zaki M.A (2005)**: Effects of the crude toxin of sea *CocumbersHolothuriaatra* on some hematological and biochemical parameters in rats. *Egyptian Journal of Natural Toxins*, Vol. 2, 71-86.

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### RESEARCH ARTICLE

## BACTERIAL CONTAMINATION OF HEALTHCARE WORKERS' MOBILE PHONES IN A TERTIARY CARE CENTER IN SAUDI ARABIA

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#### Abstract

**Background:** Mobile phones provide health care workers' (HCWs) with fast communication and quick access to medical information. Their frequent use in the hospital environment may pose a risk of spreading nosocomial infections. In this study, we aimed to determine the bacterial contamination of HCWs' mobile phones.

**Materials/Methods:** Samples were collected from mobiles of HCWs' at King Abdulaziz Medical City, Riyadh. A swab taken from the mobile phone and a questionnaire was answered by each subject. The swabs were sent to the lab for culture, carrying a serial number to indicate the questionnaire.

**Results:** Of the 400 mobile phone samples, 171 (43%) showed bacterial growth. Different variables were examined. The number of male HCWs sampled was 167, 90 of them (54%) showed positive growth, while only 81 (35%) of the 233 samples taken from female participants showed positive growth (p-value = <0.005). In addition, samples taken from phones that are frequently cleaned (226 samples) showed 10% less growth than mobile phones that are not frequently cleaned (p-value = 0.049). The most commonly isolated organism was Coagulase negative Staphylococci, which were isolated from 121 (30%) phones of the mobile phones sampled.

**Discussion:** More than one third of the HCWs' mobile phones were contaminated with bacteria. Our results showed that the degree of bacterial contamination in KAMC-Riyadh is less than studies done in other countries. The most common isolated organism in many of the reviewed studies was methicillin sensitive S.aureus, while in our study it was coagulase negative Staphylococci.

**Conclusion:** More than one third of the HCWs mobile phones were contaminated by bacteria. The results support the claim that HCWs' mobile phones may serve as vectors for transmission of nosocomial infections, and that cleaning mobile phones may reduce this risk.

**Introduction:-**

Mobile phones provide healthcare workers (HCWs) with faster communication and quick access to information, hence, they are usually kept near-at-hand.<sup>7</sup> Some hospitals are even using mobile phones instead of pagers.<sup>9, 10</sup> There are currently no guidelines on mobile phone cleaning and handling in the medical field. Whenever HCWs use their mobile phones, they may transmit organisms from their hands to their mobile phones. As a result, HCWs' mobile phones serve as reservoirs for these microorganisms that could be easily transmitted back to the HCWs' hands. In this way, mobile phones may facilitate the transmission of nosocomial infections.

Many studies have supported this claim: a study done in Turkey has shown that 94% of HCWs' mobile phones and hands in operating rooms and intensive care units demonstrated evidence of bacterial contamination with different types of bacterial organisms. 31.3% of the mobile phones sampled were contaminated with gram negative strains.<sup>11</sup> Another study done in India has shown that as much as 98.5% of HCWs' mobile phones were contaminated by bacteria.<sup>12</sup> Furthermore, a study that sampled 90 HCWs' mobile phones revealed that 70 (89.7%) mobile phones were contaminated by bacteria, 10 of them (11.5%) were contaminated with bacteria known to cause nosocomial infections.<sup>15</sup>

Our study was conducted in King Abdulaziz Medical City (KAMC)-Riyadh. KAMC-Riyadh is a 962 bed tertiary care center located in Riyadh City, Saudi Arabia, which is affiliated with King Saud Bin Abdul-Aziz University for Health Sciences.<sup>16</sup> In this study, we aimed to determine the degree of bacterial contamination of HCWs' mobile phones in KAMC-Riyadh and to identify the microorganisms colonizing these mobile phones. Also, we wanted to estimate the effect of various factors (e.g. gender, position, department of the owner and age of the mobile phone) on bacterial contamination of the mobile phones.

**Methods:-**

A total of 400 samples were collected from HCWs. Non-probability convenience sampling was used. Each morning the principal investigator would assign the data collectors to a different location inside the hospital. Ten samples were collected per day. Before taking samples, written consent was taken from each participant. After that, the participant's mobile phone was sampled using a sterile wet swab. All 400 swab-samples were collected by a single data collector to ensure consistency of the swabbing technique. The back and sides of the mobile phone were swabbed using a sterile wet swab. Simultaneously, the participant was asked to fill a questionnaire. The questionnaire was prepared based on literature review. The questionnaire assessed the following factors: position, department, gender, years of owning the mobile phone, frequency and method of cleaning the phone, frequency of usage of the mobile phone, use of headphones, and use of the phone while dealing with patients. Then, the swabs were taken to the lab conservatively, and assigned lab technicians cultured the samples on blood agar media for 48 hours. Positive cultures were further analyzed using Gram stain, Coagulase, and Catalase reactions.<sup>11,12,14,15</sup>

After obtaining culture results, data from the lab and questionnaire were entered into Microsoft Excel. After data entry was done, data was exported to SPSS version 21 for analysis. Variables were analyzed by Chi square test. P values < 0.05 were considered significant.

**Results:-**

The rate of bacterial contamination of HCWs' mobile phones was 43% (171 phones). Coagulase negative Staphylococci were isolated from 123 (30%) mobile phones, followed by Corynebacterium species, which was isolated from 53 (13%) mobile phones. Details of the number and type of bacteria obtained from mobile phones are depicted in Figure I.

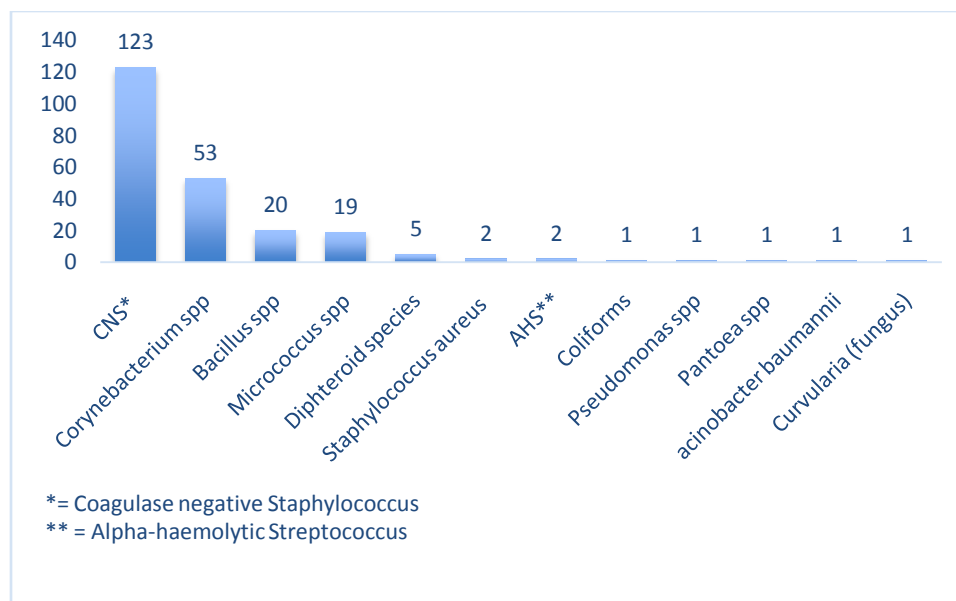


Figure 1-Frequency of isolated organisms from mobile phones

Demographic variables and their effect on phone contamination were obtained from HCWs and are summarized in Table 1. Phone related factors and whether or not they affected the rate of contamination are shown in Table 2. Of the aforementioned variables, only two showed significant difference, which were gender of the owner and cleaning the mobile phone. The number of samples taken from male participants was 167, of which 90 samples (54%) showed positive growth. On the other hand, 81 (35%) of the 233 samples taken from female participants showed positive growth (p-value= <0.005). In addition, samples taken from phones that are cleaned daily (226 samples) showed 10% less growth than mobile phones that are not cleaned daily (p-value= 0.049). In addition to isolating various bacteria, one mobile phone of a female nurse isolated a fungus "Curvularia species."

Table 1:- Participant demographics.

		Positive		Negative		P-value
		N	%	N	%	
Position	Consultant	33	47%	37	53%	0.571
	Resident	44	47%	50	53%	
	Nurse	82	40%	124	60%	
	Other	12	40%	18	60%	
Department	Medicine	60	45%	72	55%	0.239
	Surgery	29	41%	42	59%	
	Pediatrics	21	60%	14	40%	
	ER	7	44%	9	56%	
	ICU	24	38%	40	62%	
	Other	30	37%	52	63%	
Gender	Male	90	54%	77	46%	<0.005
	Female	81	35%	152	65%	

**Table 2:-** Phone related factors.

		Positive		Negative		P-value
		N	%	N	%	
Age of your cell phone	<6months	59	67%	29	33%	0.190
	6-12 months	53	57%	40	43%	
	13-24 months	54	53%	47	47%	
	>24 months	63	53%	55	47%	
How many times do you clean your cell phone per day?	0	90	52%	84	48%	0.396
	1	92	61%	59	39%	
	2	26	62%	16	38%	
	3	12	67%	6	33%	
	4 or more	9	60%	6	40%	
Do you clean your mobile phone?	Yes	139	62%	87	38%	0.04998
	No	90	52%	84	48%	
How many times do you use your cellphone during working hours?	>15	76	60%	50	40%	0.384
	10-15	44	59%	31	41%	
	5-9	52	60%	34	40%	
	<5	57	50%	56	50%	
Do you use headphones?	Yes	85	59%	58	41%	0.509
	No	144	56%	113	44%	
Do you use your cellphone while dealing with the patient?	Yes	62	52%	58	48%	0.139
	No	167	60%	113	40%	

**Discussion:-**

Of the phones sampled in this current study, 43% showed positive bacterial growth which is comparable to a study conducted in the eastern province of Saudi Arabia by Sadat-Ali et al.<sup>17</sup> Most studies show higher contamination rate than our study. Another study done by Ulger et al. reported that 94.5% of 200 health care workers' mobile phones were contaminated with various microorganisms, including nosocomial pathogens.<sup>11</sup> Another study done in India has shown that as much as 98.5% of HCWs' mobile phones were bacterially contaminated.<sup>12</sup> However, a study done in Queen Elizabeth hospital in Barbados, West Indies, had results similar to ours with 45% of mobile phones of 266 medical staff and students were culture positive.<sup>14</sup>

In our study, the most frequently isolated organism was coagulase negative Staphylococcus which was isolated from 30% (121 phones) of the samples. The most common organisms found by Sadat-Ali et al. were Staphylococcus aureus (33%), followed by Staphylococcus epidermidis (22.9%) and Escherichia coli (12.8%).<sup>17</sup> Whereas, a study done in Egypt by Badr et al. had similar results to our study with coagulase negative Staphylococcus being the most common isolated organism (33.3%).<sup>18</sup> Also, 90.5% of the phones sampled by Ulger et al. showed positive growth of coagulase negative Staphylococcus.<sup>11</sup>

The fact that we were able to isolate a fungus "Curvalaria species" indicates another area of thinking about the chance that mobile phones can transmit fungal infections to certain patients.

A limitation to our study is the lack of antibiotic sensitivity testing, which prevented us from accurately comparing our results to other studies. Also, we were not able to assess the risk of some of the isolated bacteria.

Even though the use of cellphones may facilitate patient care, it may pose a risk to patients in the form of transmitting nosocomial infections. Cleaning mobile phones reduces the bacterial contamination of mobile phones which may decrease this risk. We recommend that mobile phone cleaning guidelines are put forth and implemented. Furthermore, the use of mobile phones should be restricted in high-risk situations.

**References:-**

1. Balkhy HH, Cunningham G, Chew F, Francis C, Al Nakhli DJ, Almuneef MA et al. Hospital- and community-acquired infections: a point prevalence and risk factors survey in a tertiary care center in Saudi Arabia. *Int J Infect Dis* 2006; 10(4):326–33.
2. Ortona L, Federico G, Fantoni M, Ardito F, Branca G, Caponera S, et al. A study on the incidence of nosocomial infections in a large university hospital. *Eur J Epidemiol.* 1985; 1(2):94-99.
3. Kleven RM, Edwards JR, Richards CL, Horan Tc, GaynesRp, Pollock Da et al. Estimating Health Care-Associated Infections and Deaths in U.S. Hospitals, 2002. *Public Health Rep* 2007; 122(2):160-6.
4. Alothman AF, Jelani A, Althaqafi A, Rich M, Williams E. Contamination of patient hospital charts by -bacteria. *J Hosp Infect.* 2003; 55(4):304–305.
5. Alothman AF, Bukhari A, Maimony H, Al Johani S, Muhanna A. What is the role of stethoscope in transmitting infection at a tertiary care saudi center? *Int J Infect Dis.* 2008; 12(1):350.
6. Mayhall CG *Hospital epidemiology and infection control*, 4th ed. Philadelphia : Lippincott Williams &Willkins; 2012.
7. Cisco. Hospital increases efficiency of mobile clinicians and staff. [homepage on the Internet]. 2012 [cited 2013 Sep 26]. Available from: [http://www.cisco.com/en/US/prod/collateral/voicesw/evergreen\\_hospital.pdf](http://www.cisco.com/en/US/prod/collateral/voicesw/evergreen_hospital.pdf)
8. Brady RR, Wasson A, Stirling I, Mcallister C, Damani NN. Is your phone bugged? The incidence of bacteria known to cause nosocomial infection on healthcare workers' mobile phones. *J Hosp Infect.* 2006 Jan; 62(1):123-125.
9. Dolan B. 72 percent of US physicians use smartphones. [homepage on the Internet]. May 5, 2010 [cited 2013 Sep 26]. Available from: <http://mobihealthnews.com/7505/72-percent-of-us-physicians-use-smartphones>
10. Bhanoo SN. Doctors and medical students embrace smartphones. [homepage on the Internet]. May 19, 2009 [cited 2013 Sep 26]. Available from: <http://www.washingtonpost.com/wp-dyn/content/article/2009/05/18/AR2009051802234.htm>
11. Ulger F, Esen S, Dilek A, Yanik K, Gunaydin M, Leblebicioglu H. Are we aware how contaminated our mobile phones with nosocomial pathogens? *Ann ClinMicrobiolAntimicrob* 2009 Mar; 8:7 doi:10.1186/1476-0711-8-7.
12. Sham SB, Sundeep HK, Shailaja S. Potential of mobile phones to serve as a reservoir in spread of nosocomial pathogens. *J Hosp Infect.* 2011 Jun; 10(2). Available from: <http://www.ojhas.org/issue38/2011-2-14.htm>
13. Jeske HC, Tiefenthaler W, Hohlrieder M, Hinterberger G, Benzer A. Bacterial contamination of anaesthetists' hands by personal mobile phone and fixed phone use in the operating theatre. *Anaesthesia.* 2007; 62(9):904-906.
14. Ramesh J, Carter AO, Campbell MH, Gibbons N, Powlett C, Moseley H SR, et al. Use of mobile phones by medical staff at Queen Elizabeth Hospital, Barbados: evidence for both benefit and harm. *J Hosp Infect.* 2008 Oct; 70(2):160-165.
15. Brady RR, Fraser SF, Dunlop MG, Paterson-brown S, Gibb A. Bacterial contamination of mobile communication devices in the operative environment. *J Hosp Infect.* 2007 Aug; 66(4):397-398.
16. KAMC. King Abdulaziz Medical City - Riyadh. [homepage on the Internet]. Jun 2013 [cited 2013 Oct 3]. Available from: National Guard Health Affairs, Web site: <http://www.ngha.med.sa/ENGLISH/MEDICALCITIES/AIRiyadh/Pages/default.asp>
17. Sadat-Ali M, Al-Omran AK, Azam Q, Bukari H, Al-Zahrani AJ, Al-Turki RA, Al-Omran AS. Bacterial flora on cell phones of health care providers in a teaching institution. *American journal of infection control.* 2010 Jun 30;38(5):404-5.
18. Badr RI, ibrahimBadr H, Ali NM. Mobile phones and nosocomial infections. *International Journal of Infection Control.* 2012 Mar 26;8(2).

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### RESEARCH ARTICLE

#### CELL SUSPENSION CULTURE - AN IMPROVED SYSTEM FOR PRODUCTION OF COLCHICINE FROM *GLORIOSA SUPERBA* L.

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##### Key words:-

Colchicine, Suspension cultures, HPLC, HPTLC, TLC.

#### Abstract

The present study focused on the identification, isolation and quantification of a major bioactive compound colchicine from the suspension culture of *Gloriosa superba* L. The plant is an ornamental climbing herb with tuberous roots and having numerous medicinal properties. Suspension culture was established in MS medium with different hormonal combinations. Phytochemicals were analysed from callus which later compared to the methanol extract from root tubers of *Gloriosa superba*. The presence of high amount of colchicine in the methanol extract of root tuber and the callus was confirmed through the HPLC. Both the tuber extract and callus indicated the presence of colchicine but the callus has only less amount of colchicine. So production of colchicine was enhanced through elicitation in the suspension cultures. Suspension culture of *Gloriosa superba* was established and production of colchicine was enhanced using various biotic and abiotic elicitors. Colchicine in the suspension culture was identified, quantified and isolated using various chromatographic techniques. The result showed that maximum colchicine production was induced by the biotic elicitor namely chitosan and colchicine was separated and quantified through HPLC, column chromatography, HPTLC, and TLC. The present study thus confirmed that the suspension culture of *Gloriosa superba* possessed high amount of colchicine and which has to be used for further investigation and evaluation of medicinal properties.

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#### Introduction:-

Medicinal plants have played an important role in the development of human culture. Majority of the modern medicines are produced indirectly from medicinal plants and some plants are directly used as medicines. Many commonly used food crops also showed medicinal properties along with their nutritional qualities. Medicinal plants are the major resource for new drugs or drug leads, so the study of these plants helps to understand the pharmacological and therapeutic output and thereby give way for their sustainable utilization. The cultivation and preservation of medicinal plants also helps to protect the biological diversity (Irchhaiya *et al.*, 2014).

The medicinal plant *Gloriosa superba* L. is one of the perennial climbing herb belongs to the family Liliaceae. This plant has numerous medicinal properties and is used for curing major ailments like ulcers, piles, cancer, asthma,

haemorrhoids, inflammation, malaria, leprosy and stomach aches. All parts of *Gloriosa superba* showed medicinal values. The leaf sap is used as a smoothening agent for skin eruptions. The V- shaped tuber is used for the treatment of cancer, haemorrhoids, chronic ulcers and also for inducing labour pains and also reported to have hepatoprotective (Nikhila *et al.*, 2016) as well as anti-inflammatory activities (Nikhila *et al.*, 2015). Root tuber with sesamum oil will reduce the pain in arthritis affected joints. Seeds are used for curing rheumatic pain and also act as muscle relaxant (Ravindra and Mahendra, 2009). The medicinal properties of the plant give evidence to the presence of major secondary metabolites. One of the major compound identified from *Gloriosa superba* is colchicine (Kavina *et al.*, 2011). The cell suspension culture is an important technique for the production of secondary metabolites from the medicinal plants. Thus the main objective of the present study was focused on the isolation and quantification of a major compound colchicine from the suspension culture of *Gloriosa superba* through various chromatographic techniques.

## Materials and Methods:-

### Establishment of Suspension Culture:-

The callus was established using various explants like internode, leaves etc. inoculated with M S medium at different hormonal combinations. Then the six week old callus was transferred into liquid MS media. The cell suspension culture was grown for 25 days in the shaker and this culture was used for the production of secondary metabolites. For the enhancement of secondary metabolite production various types of elicitors were used periodically. The major elicitors used were chitosan, pectin, salicylic acid and calcium chloride at various concentration and incubated for 24, 48 and 72 hours (Gopi and Vatsala, 2006). Major bioactive compounds were identified and quantified using chromatographic techniques.

### Chromatographic Techniques:-

For the identification, isolation and quantification of bioactive compounds various types of chromatographic techniques were used. In case of HPLC the retention time of sample was compared with that of the standard for the identification of colchicine. A C18 column with silica gel and acetonitrile: methanol: water (32:48:20) were used as the stationary phase and the mobile phase respectively.

Column chromatography is a method used to purify individual chemical compounds from mixtures of compounds. The Silica gel was used as the stationary phase and the mobile phase consisted of toluene: ethyl acetate: formic acid: methanol. The fractions obtained were subjected to High Pressure Thin Layer Chromatography. In HPTLC the silica gel used as stationary phase and toluene: ethyl acetate: formic acid: methanol was used as mobile phase. For TLC silica gel and the mixture hexane: chloroform used as stationary and mobile phase respectively (Asha *et al.*, 2013).

## Results and Discussion:-

### Suspension Culture:-

The HPLC profiling showed that the crude methanol extract possessed high amount of colchicine compared to the other standards. Since it is present in high amount, the colchicine is selected as a major compound for further study. For the establishment of suspension culture 96% of the callusing was observed in the hormone combination NAA+ BAP at the concentration of 0.15 + 0.25mg/l. But the callus produces only lesser amount of colchicine [(Fig 1(a) and Fig 1(b))]. So the suspension culture which is ideal for production of colchicine was established and elicitors were used for enhanced production. The six week old callus were used for the elicitation of major compound namely colchicine (Fig: 2).

Suspension culture with the elicitor salicylic acid induced the production of 4.09 mg/g alkaloid within 48 hours at the concentration of 0.25µM. The medium also have 1.86 mg/g alkaloid which exuded into the medium with in the 24 hours at the concentration of 5 µM (Table 1). With the presence of CaCl<sub>2</sub> maximum alkaloid production was observed at 0.5µM concentration within the 48 hours and 1.57mg alkaloid was exuded out into the medium at the concentration of 2.5µM within the 72 hours (Table 2). The Table 3 showed the effect of chitosan on alkaloid production. Maximum alkaloid production (5.96mg/g) was noticed at the concentration of 1mg of chitosan. The medium also have 3.46mg/g alkaloid at the concentration of 1mg of chitosan within the 48 hours. The Table 4 showed that 4.56mg/g of alkaloid was produced at the concentration of 1mg of pectin and the medium also have 2.86mg/g of alkaloid which was exuded out into the medium within the 48 hours. Pandurangan and Philomina, (2010) reported enhancement of colchicine by the addition of sulphate ions whereas in the present study addition of the chitosan enhanced the maximum production of colchicine in cell suspension culture of *Gloriosa superba*.



**HPTLC:** The estimation and quantification of isolated compound from suspension culture was analysed by HPTLC. The result showed that the chitosan induces maximum amount of colchicine production in the suspension culture (Fig: 3)

#### Column Chromatography:-

The column chromatography of suspension culture provide 82 fractions. These fractions are subjected to the alkaloid test. Out of 82 fractions only 12 to 19 fractions showed positive result for the alkaloid test. Isolated fractions with alkaloid were subjected to HPTLC and also subjected to TLC using standard (Fig: 4). The spot with alkaloid was scratched out from the preparative TLC was used for further analysis which clarifies it as colchicine. These results were comparable with the previous work done by Kavina *et al.*, (2011) where identification and quantification of colchicine from seed and tuber through various chromatographic techniques were reported.

#### Conclusion:-

It can be concluded that the suspension cultures of *Gloriosa superba* can suggested as an improved system for *in vitro* production the medicinally active compound colchicine. The present study will be helpful for the maximum utilization of the plant along with the identification and isolation of useful bioactive molecules.

**Table 1:-**Effect of salicylic acid on alkaloid production.

Name of elicitor	Treatment duration	Conc.of elicitor	Alkaloid in mg/g (callus)	Alkaloid in mg/g (medium)
Salicylic acid	24 hr	Control	1.01±0.03	0.59±0.06
		0.25 µM	1.32±0.05	0.98±0.60
		0.5µM	1.23±0.08	0.96±0.53
		2.5µM	1.09±0.12	1.07±0.39
		5µM	1.45±0.09	1.86±0.05
	48 hr	Control	1.39±0.53	0.63±0.88
		0.25 µM	4.09±0.59	1.01±0.55
		0.5µM	3.67±0.07	1.23±0.02
		2.5µM	2.87±0.64	1.34±0.08
		5µM	3.65±0.34	1.29±0.10
	72 hr	Control	1.25±0.81	0.69±0.41
		0.25 µM	2.43±0.45	1.05±0.64
		0.5µM	3.56±0.53	1.25±0.06
		2.5µM	2.33±0.23	1.35±0.62
		5µM	3.02±0.39	1.26±0.07

**Table 2:-**Effect of calcium chloride on alkaloid production.

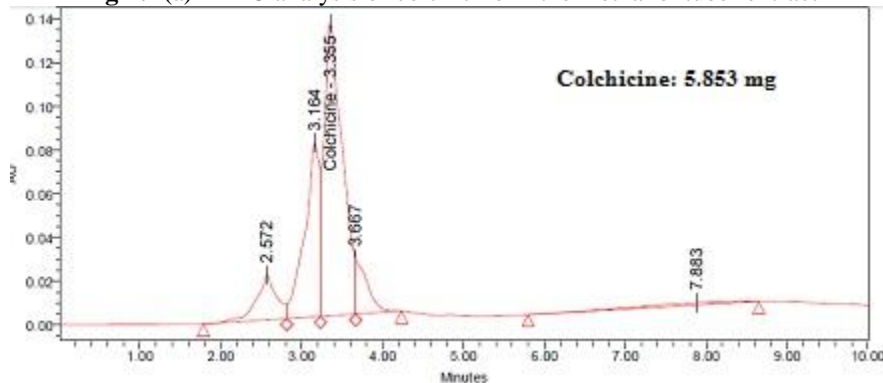
Name of elicitor	Treatment duration	Conc.of elicitor	Alkaloid in mg/g (callus)	Alkaloid in mg/g (medium)
CaCl <sub>2</sub>	24hr	Control	1.54±0.08	0.44±0.05
		0.25 µM	1.43±0.02	0.48±0.08
		0.5µM	1.59±0.12	0.58±0.03
		2.5µM	1.96±0.53	0.76±0.53
		5µM	1.86±0.32	0.89±0.45
	48hr	Control	1.62±0.07	1.02±0.06
		0.25 µM	2.31±0.03	1.21±0.08
		0.5µM	2.86±0.07	1.36±0.86
		2.5µM	2.24±0.23	1.41±0.34
		5µM	2.19±0.58	1.49±0.21
	72hr	Control	1.69±0.97	1.19±0.76
		0.25 µM	2.35±0.02	1.45±0.53
		0.5µM	2.35±0.60	1.48±0.22
		2.5µM	2.27±0.06	1.57±0.42
		5µM	2.29±0.31	1.39±0.11

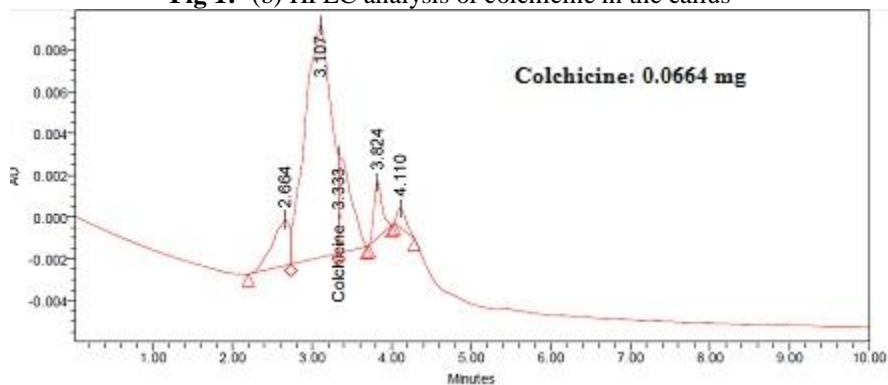
**Table 3:-**Effect of Chitosan on alkaloid production

Name of elicitor	Treatment duration	Conc.of elicitor	Alkaloid in mg/g (callus)	Alkaloid in mg/g (medium)
<b>Chitosan</b>	24 hr	Control	1.52±0.03	1.04±0.21
		0.5mg	2.33±0.08	1.23±0.42
		1 mg	3.09±0.12	1.49±0.15
		1.5mg	2.86±0.32	1.56±0.33
		2mg	2.96±0.09	1.66±0.61
	48 hr	Control	1.64±0.11	1.52±0.44
		0.5mg	3.41±0.02	2.55±0.31
		1 mg	5.96±0.33	3.46±0.08
		1.5mg	4.34±0.51	2.34±0.03
		2mg	3.89±0.37	2.49±0.01
	72 hr	Control	1.79±0.04	1.04±0.01
		0.5mg	3.55±0.01	1.23±0.24
		1 mg	4.45±0.06	1.49±0.05
		1.5mg	3.17±0.08	1.56±0.52
		2mg	3.65±0.04	1.66±0.03

**Table 4:-**Effect of Pectin on alkaloid production

Name of elicitor	Treatment duration	Conc.of elicitor	Alkaloid in mg/g (callus)	Alkaloid in mg/g (medium)
<b>Pectin</b>	24 hr	Control	1.22±0.01	1.12±0.03
		0.5mg	1.43±0.03	0.98±0.21
		1 mg	2.59±0.12	1.09±0.26
		1.5mg	2.46±0.24	1.16±0.07
		2mg	2.66±0.21	1.26±0.01
	48 hr	Control	1.24±0.33	1.26±0.21
		0.5mg	2.11±0.43	0.91±0.32
		1 mg	4.56±0.18	2.86±0.08
		1.5mg	3.04±0.22	2.24±0.02
		2mg	2.83±0.18	2.07±0.04
	72 hr	Control	1.49±0.37	1.24±0.15
		0.5mg	3.01±0.03	2.00±0.28
		1 mg	2.95±0.90	2.35±0.17
		1.5mg	3.07±0.55	2.15±0.32
		2mg	3.25±0.01	2.25±0.39

**Fig 1:-** (a) HPLC analysis of colchicine in the methanol tuber extract

**Fig 1:- (b) HPLC analysis of colchicine in the callus****Fig 2:-Elicitation of Colchicine in Suspension culture**

Four weeks old callus



Elicitation process



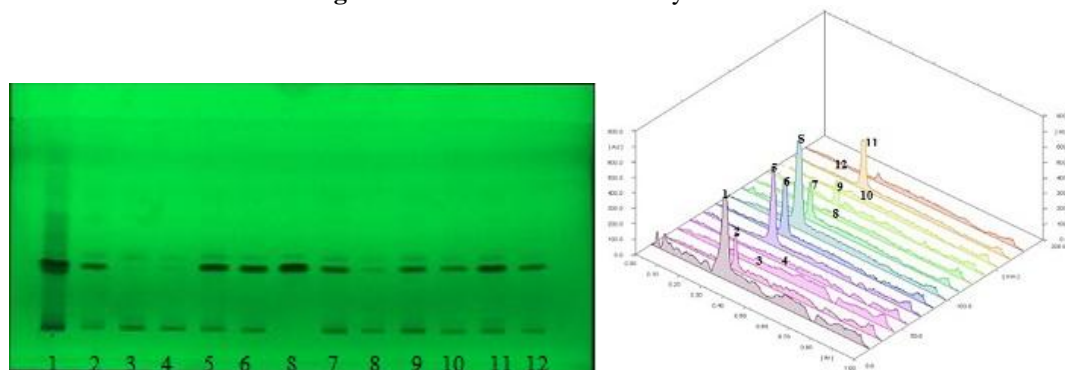
24 hrs culture



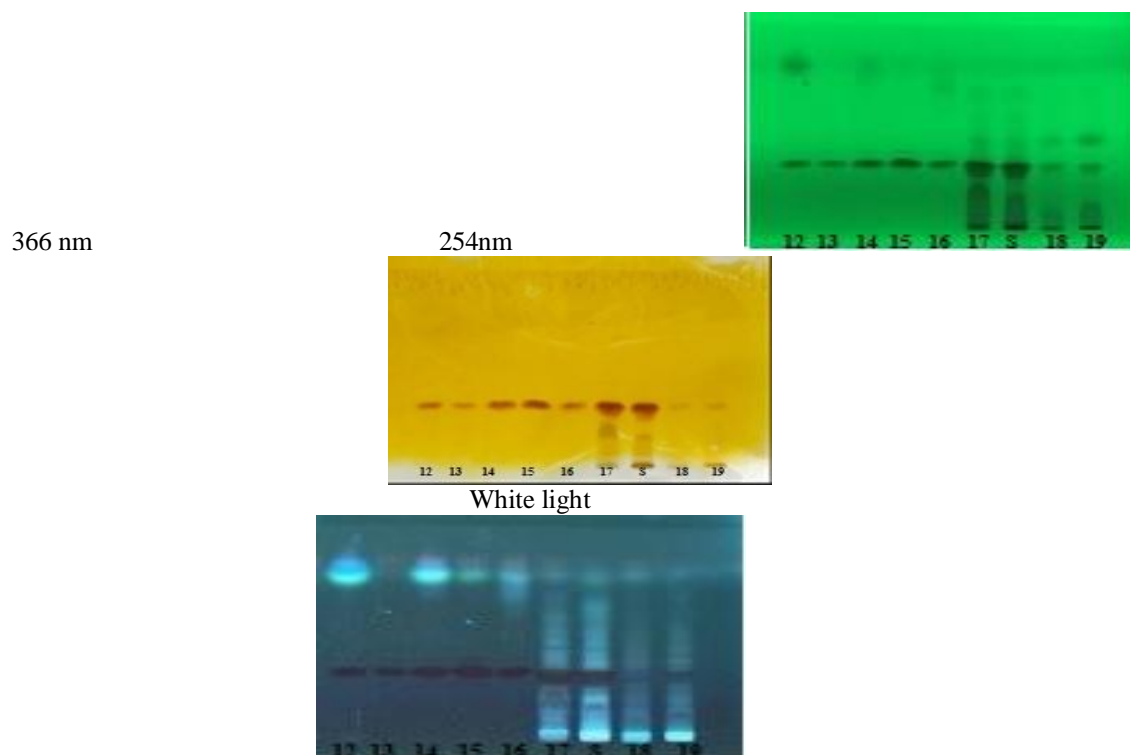
48 hrs culture



72 hrs culture

**Fig 3:-**Estimation of Colchicine by HPTLC

1. Tuber crude methanol, 2. Callus crude methanol, 3. Control callus, 4. Control medium, 5. Chitosan callus, 6. Chitosan medium, S. Standard, 7.SA callus, 8.Salicylic acid medium, 9. CaCl<sub>2</sub> callus, 10. CaCl<sub>2</sub> medium, 11. Pectin callus, 12. Pectin medium

**Fig 4:-**HPTLC of isolated fractions.

**Reference:-**

1. Asha, V., Namrata, S. and Arvind, K. (2013): Phytochemical investigation and thin layer chromatography of *Asparagus racemosus* methanolic leaves extract. *International journal of Advanced Research in Pharmaceuticals and Bioscience.*, 3(1):15-18.
2. Gopi, C. and Vatsala, T.M. (2006): In vitro studies on effects of plant growth regulators on callus and suspension culture biomass yield from *Gymnema sylvestre* R. Br. *Afr. J. Biotechnol.*, 5: 1215-1219.
3. Irchhaiya, R., Anurag, K., yadav, A., Gupta, N., Kumar, S., Gupta, N., Kumar, S., Yadav, V., Prakash, A. and Gurjar, H. (2014): Metabolites in plants and its classification. *World journal of pharmacy and pharmaceutical sciences.*, 4 (1): 287-305.
4. Kavina, J., Gopi, R. and Paneerseivam, R. (2011): Quantification of Colchicine in Seed and Tuber samples of *Gloriosa superba* by High Performance Liquid Chromatography method. *Journal of applied pharmaceutical science.*, 1(7):11-119.
5. Nikhila, G .S, Sangeetha, G. and Swapna T.S. (2015): Anti inflammatory properties of root tubers of *Gloriosa superba* and its conservation through micropropagation, *Journal of Medicinal Plants Research*, Vol 9(1): 1-7
6. Nikhila, G. S., Sangeetha, G., Devi Chinmayee, M. and Swapna, T. S. (2016): An investigation on phytochemical screening and hepatoprotective activity in an important medicinal herb *Gloriosa superba* L., *International Journal of Applied and Pure Science and Agriculture*, Volume 02, Issue 05: 133-137.
7. Pandurangan, B. and Philomina, D. (2010): Effect of nutritional factors and precursors on formation of colchicine in *Gloriosa superba* in vitro. *Research in Biotechnology.*, 1:29-37.
8. Ravindra, A. and Mahendra, K.R. (2009): Review: Current advances in *Gloriosa superba* L. *Biodiversitas.*, 10(4): 210-214.

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### RESEARCH ARTICLE

#### ASSESSMENT OF EXISTING PHYSICAL FEATURES OF RURAL KITCHEN IN KANPUR DEHAT.

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##### Key words:-

Existing physical feature, Rural kitchen.

#### Abstract

Women spent their most of the time in the kitchen. Their work efficiency, cooking quality and the stress on women is more important in the kitchen. All these will be going to affect by physical condition of the kitchen. Compare to bedroom, kitchen rooms, need proper planning of lighting but unfortunately due importance not given to the kitchen. A study was conducted in village area to affect the physical condition of the rural kitchen on the house wives of rural area while carrying out kitchen activities. The study indicated that there is a need to create awareness and educate housewives about the necessity of good physical condition for carrying out cooking activities with ease and comfort and also to impress upon them the unnecessary strain that they under go due to poor physical condition of kitchen. Keeping this fact in view the present study was conceptualized to gain inside into the rural kitchen, its physical features and water facilities. Study was conducted in Kanpur Dehat through direct interview schedule. Rural kitchen were still not in good condition maximum were of kachcha type and constructed in open place.

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#### Introduction:-

Housing is a basic human need and an important constituent for the quality life of the people and an index of the socio-economic progress of a country. It provides the base for increased access to health, education and sanitation, especially for the poor and the vulnerable groups. Housing in India has two major facets: urban and rural. Urban housing received more attention because of the pressure of growing population and the need to meet the requirements of slum and pavement dwellers as well as urban renewal. In the process, rural housing got neglected, though the greater part of population lives in villages. The nature and magnitude of rural housing problem is much more complex. In the rural areas, poor people usually live in *kachcha* sheds which can hardly be called houses in the true sense. It is surprising but true that when living standard of people has been rising day by day, there is not much improvement in the organization and qualities of kitchen especially in rural areas and lower income brackets of urban areas. Mud, brick wall and cow dung smeared floor were the most common being found in almost all the houses while only one had stone wall and two had their flooring of cement in Ludhiana (Kirthi, 1985).

Encyclopedia Britannica has defined kitchen “as a room or place in a house for cooking in which culinary and other activities are kept”. The kitchen is the most valuable and important place in a house because cooking is done here for the physical and mental fitness of the family members. A family’s physical and mental health depends upon the

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food cooked in the kitchen and (Patani, 1979). In other words, kitchen is a very significant part of house. A home maker spends major part of her working hours in food related tasks and the kitchen is the main arena where these tasks are performed. A rural homemaker spends about 6 to 7 hours daily in the kitchen (Sandhu, 1972). It is important that kitchen of a house should meet at least minimal standards, so that the health and safety of a home maker, who spends most of her time in the kitchen can be safe guarded. Hence, careful planning and organization of kitchen are imperative to perform the activities efficiently and reduce the time and energy spent in cooking related activities. Keeping this fact in view the present study was conceptualized to gain inside into the rural kitchen, its physical features, use and storage features available so as to pave the way. Further, it was thought that a study of this nature would also build information on prevalent conditions in rural housing as we entered the new millennium.

### Materials and Methods:-

The study was conducted in Kanpur dehat of Uttar Pradesh during the year 2016. The pre-coded interview schedule was constructed in order to elicit information needed to obtain the objectives of the study. Multistage purposive random sampling technique was followed to select the state, district, blocks, villages and respondents. District Kanpur dehat was purposively selected as a field of study while four blocks namely Akbarpur, Maitha, Amraudha and Rajpur were selected randomly. Two villages from each selected block i.e. Bara and Patari village from **Akbarpur block**, Chhateni and Tikari villages from **Maitha block**, Chaprehta and Fatepur village from **Amraudha block** and from **Rajpur block** Kandhi and Dewanpur village were selected randomly. Twenty respondents from each selected village were randomly selected. Total 160 respondents were randomly selected for final data collection.

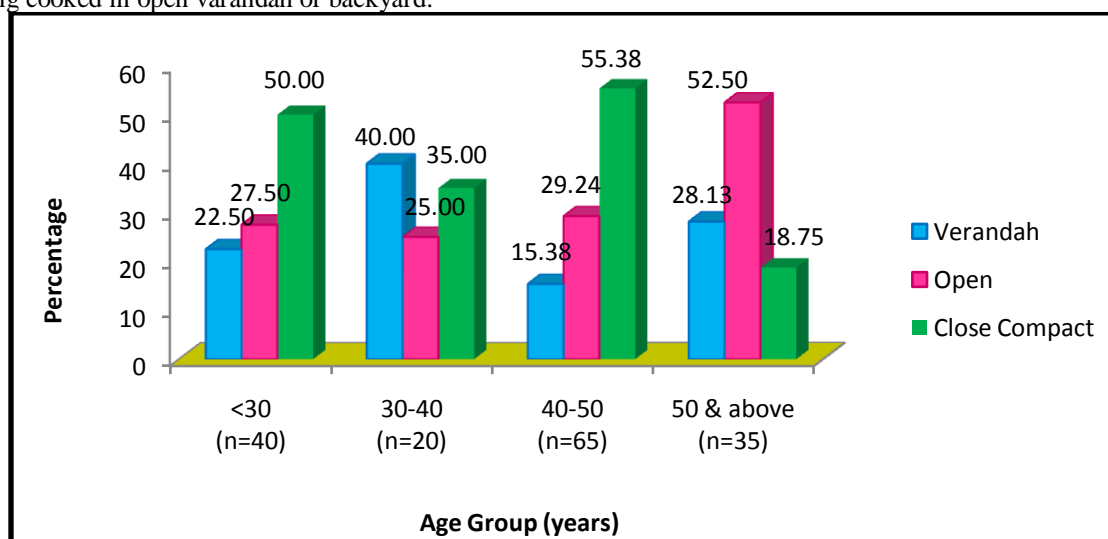
### Results and Discussion:-

The housing as a component of social sector of modern economy was most under developed and under invested. In other words, housing was one such social sector which often exhibited very low yield.

**Table 1:-** Distributions of Households on the Basis of location of Kitchen.

S.No	Location of Kitchen	Frequency	Percentage
1	Verandah	37	23.13
2	Open	90	56.25
3	Close Compact	33	20.62
4	Total	160	100.00

Results of the study in table 1 revealed that Area used for cooking food is mentioned as kitchen in the study. Data pertinent to physical features of rural kitchen presented in table 4.2.1 inferred that majority (56.25 %) households had open kitchen while about twenty four per cent kitchens were located in verandah, followed by 20.63 per cent kitchens were close compact kitchen, whereas data pertinent to location of cooking area as identified by **Awasthi et al. (2002)** revealed that while 50.83 % rural families carried out cooking in a separate/enclosed kitchen the remaining cooked in open verandah or backyard.



**Fig 1.2:-** Location of Kitchen According to the Age of Respondents

Clearly depicts that maximum respondents belonging to less than thirty year of age group were having close compact kitchen but in contrast to this majority of fifty and above age groups respondents were having open kitchen. Majority of respondents having kitchen in verandah were belonging to 30-40 years of age.

**Table 2:-** Distribution of Households on the Basis of Orientation of Kitchen

S.No	Orientation of Kitchen	Frequency	Percentage
1	East	50	31.25
2	West	45	28.13
3	North	25	15.62
4	South	40	25.00
	<b>Total</b>	<b>160</b>	<b>100.00</b>

As per the recommendations given by *R.S. Deshpande (1965)* kitchen should be oriented towards East or Northeast and about thirty one per cent households were having their kitchen towards East side followed by 28.13 per cent who's kitchen had West orientation. One quarter kitchens were oriented towards South, whereas minimum (15.62 %) kitchens were having North orientation.

**Table 3:-** Distribution of Households on the Basis of Style of the Kitchen.

S.No	Style of the Kitchen	Frequency	Percentage
1	Sitting	120	75.00
2	Standing	25	15.62
3	Sitting & standing both	15	9.38
	<b>Total</b>	<b>160</b>	<b>100.00</b>

Out of total 160 households, three fourth i.e. 75.00 per cent households under the study were having sitting style kitchen, while 15.62 per cent households were having standing kitchens. Only nine per cent households were found to have sitting and standing both styles as per the need.

**Table 4: Distribution of Households on the Basis of Type of Kitchen**

S.No	Type of Kitchen	Frequency	Percentage
1	Kachcha	40	25.00
2	Mixed	85	53.13
3	Pucca	35	21.87
	<b>Total</b>	<b>160</b>	<b>100.00</b>

More than fifty per cent households were having mixed type of kitchen followed by twenty five per cent who had kachcha type of kitchen. About twenty two per cent kitchens were pucca kitchens.

**Table 5:-** Distribution of Households on the Basis of Type of Floor

S.No	Type of Floor	Frequency	Percentage
1	Mud	81	50.63
2	Brick	37	23.12
3	Cement plastered	33	20.62
4	Tiled/Mosaic	9	5.63
	<b>Total</b>	<b>160</b>	<b>100.00</b>

More than fifty per cent floors out of total kitchen under the study were made of mud, followed by 23.12 per cent which were made of bricks. About twenty one per cent kitchen floors were cement plastered. Minimum i.e. only about six per cent kitchen floors were made of tiles or mosaic.

**Table 6:-** Distribution of Households on the Basis of Kitchen Enclosures

S.No	Kitchen Enclosures	Frequency	Percentage
1	With roof & dwarf wall	35	21.88
2	Roof with high wall	33	20.62
3	Without roof & dwarf wall	29	18.13
4	With roof & without dwarf wall	63	39.37
	<b>Total</b>	<b>160</b>	<b>100.00</b>



As per the table 6 majority (39.37 %) households having kitchen without roof and dwarf wall, whereas 21.88 per cent kitchens were enclosed with roof and dwarf wall. Further 20.62 per cent kitchens were having roof with high walls while, about eighteen per cent kitchens were enclosed by roof but not having dwarf wall.

**Table 7:-** Distribution of Households on the Basis of Construction Material of Roof

S.No	Construction Material of Roof	Frequency	Percentage
1	Thatch	13	8.13
2	Fired mud tiles	28	17.50
3	Tin shade	15	9.38
4	Brick	18	11.25
5	Cemented plastered	23	14.37
	<b>Total</b>	<b>160</b>	<b>100.00</b>

Roof was found in 97 kitchens and out of those maximum i.e. about eighteen per cent roofs were made of fired mud tiles, while 14.37 per cent households were having cement plastered roofs in their kitchen followed by 11.25 per cent households were having roofs of kitchen made of bricks. About ten per cent households were having tin shade on kitchen. Only 8.13 per cent were having thatched roof. Majority about thirty nine per cent kitchens were not having any roof.

**Table 8:-** Distribution of Households on the Basis of Construction Material of Wall.

S.No	Construction Material of Wall	Frequency	Percentage
1	Mud	43	26.88
2	Brick	29	18.13
3	Plastered	25	15.62
4	No construction of wall	63	39.37
	<b>Total</b>	<b>160</b>	<b>100.00</b>

Out of total 97 households having walls in their kitchen, 26.88 per cent households were having mud walls in their kitchens, while more than eighteen per cent households were having brick walls in the kitchen. About sixteen per cent households were having cement plastered walls in the kitchen. On the other hand 39.37 per cent households were not having any walls in their kitchens.

### Conclusions:-

The outcomes of the study reveals that 20.62% respondents carried out cooking in a separate or closed compact kitchen while 23.13% of them cooked in verandah and majority 56.25% respondents cooked food in open place of the house. 28.13 % kitchens had west oriented face. More interestingly, only 42.5 % rural kitchen had roof and out of those only 14.35% were cement plastered roof. Hence, it can be concluded that the kitchens in rural areas are in poor conditions compare to urban areas. Therefore, rural kitchens and its designing need immediate attention of planners, policy makers' architects and builders apart from households themselves.

### References:-

1. **Awasthi, N. (2002)** Assessment of physical features and quality of rural kitchen unpublished. M.Sc. Thesis, C.S.A. University of Agri. and Tech., Kanpur. 137 p.
2. **Deshpande, R.S. 1965.** Grouping and Synthesis of a Home. Modern Ideal Houses for India pp. 44-47.
3. **Kirthi, 1985,** A study of the Condition of Rural Kitchen *Journal of Research* **20** (2): 131-135.
4. **Patani, M. 1979,** Kitchen Griha Prabhandha Awash Evam Griha Sajja, IInd ed. Published by Star Publication Agra, pp. 99-101.
5. **Sandhu, M.K., 1972** A study of the utilization of the time spent in performing household activities by the home makers in rural area *Kurukshetra Indian journal for village Development* Govt.of India **16**(3). 511-516.



## RESEARCH ARTICLE

### ENHANCEMENT OF ENERGY EFFICIENT ROUTING PROTOCOL BY MINIMIZING ENERGY CONSUMPTION IN WIRELESS SENSOR NETWORKS.

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Sleep scheduling routing protocol, Dead node, Energy enhancement, Sink node, Sensor nodes.

#### Abstract

A wireless sensor network (WSN) consists of number of sensor nodes along with a sink node that keeps track of all information in the network. These sensor nodes get the power from small some batteries in them. The WSN is used for many applications mostly for the regions that are out reach of human beings e.g. hilly area, mountains, rivers and to get readings of these places to get the environmental changes, we have to connect all nodes, connection of these all nodes forms the graph of the network. There is needed to be synchronized and balanced battery life to increase the life of the network. This is the main motive of our project here we have proposed a protocol which will help us in enlarging the life of network and low battery loss in the network for that we will keep only the sensor nodes that are part of path at the time of transmission and those who are not in use will be kept in sleep mode. This will help us to enhance energy of the battery of and also enhances the energy of entire network.

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#### Introduction:-

A Wireless Sensor Network (WSN) consists of large numbers of sensor nodes. These sensors are sensing the number of events in the world. All sensor nodes are keeping communication within the nodes by using wireless network only. They are getting power from battery and we know that battery have limited energy. Each sensor node consumes limited power and memory again due to constraints imposed by the available supply of energy. The major function of WSNs is to observe and record events in the environment and report them to the sink. In the process, the sink node also needs to broadcast messages to each node of the WSN, and sensor nodes may need to communicate with each other as well. Wireless sensor network are typically deployed in extreme conditions such as mountainous region, foreign planets such as Moon, Mars etc.

In order to enhance the network life duration, it is very important to minimize the consumption of energy by individual nodes. This would ensure that the connectivity needed to transmit data from a sensor node to sink can always be maintained. And average energy loss per transmission will be minimized.

Another requirement of WSNs for applications such as flood detection, fire detection etc. is that the delay to transmit data from sensor node to the sink should be as minimum as possible. These requirements need to be complete. Completion of requirements is not too easy. The transceiver is the major unit that consumes lots of energy

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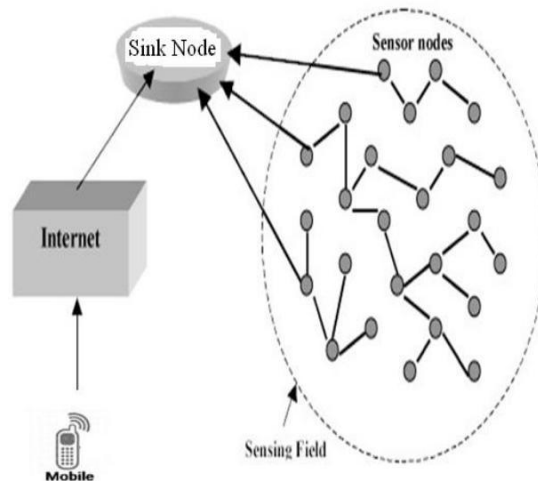
in each sensor node even when it is idle. Therefore, sensor nodes are usually put to sleep if they are not required to transmit data or sense environment i.e. minimization of energy consumption and it is really very difficult to integrate sleep scheduling scheme with routing protocols for WSNs. Thus we can achieve the objective of routing protocols. We assume that the transceiver, processor, and sensing units can be put to sleep (minimization of energy consumption) independently and when we say that the sensor node is put to sleep, we denote that the transceiver and the processor are put to sleep. The sleep scheduling of sense units can be complete separately to ensure sensing coverage. Here, we propose a fresh sleep scheduling scheme using a tree, and an energy aware routing protocol that is appropriately integrated with the above sleep scheduling scheme with a view to meet the objectives for routing protocols as given above.

### Project scope:-

The energy routing protocol in this project is intended for WSNs in which sensor nodes are static. Besides the applications running in the WSN require that the information's gathered by the sensor nodes have to be transmitted quickly to the sink. We are assuming that each node has a unique ID, and the communication between neighboring nodes is symmetric and bidirectional. It is as well unspecified that the clocks of the sensor nodes in the WSN are synchronized so that nodes can be woken up nearly at the same time i.e. synchronization and they can execute the protocol. The objectives of energy routing protocol with sleep scheduling are as follows.

1. Many sensor nodes should be asleep many of the time so that the energy consumption per node is reduced.
2. Consumption of energy by all the sensor nodes of systems remains balanced, i.e., at any time, consumption of energy of each node should be same.
3. Transmission time of data from a sensor node to the sink is as minimum as possible as i.e. energy consumption will be minimum.

### Project Architecture:-



**Fig 1:- Project architecture**

Energy routing protocol with sleep scheduling. The energy routing protocol is intended for WSNs in which sensor nodes are static. Besides the applications running in the WSN require that the information shared by the sensor nodes from the sensing field have to be transmitted urgently to the sink. Next, we have to consider that each node has a unique ID, and the communication between neighboring nodes is symmetric and bidirectional. It is as well unspecified that the clocks of the sensor nodes of all in the WSN are synchronized so that nodes can be woken up nearly at the same time, and they can execute the energy routing protocol.

Also with the special module that will inform the administrator about any attack that has appeared at any of the nodes in our wireless sensor network by sending the details of the attack in the form of a message notification to his mobile phone.

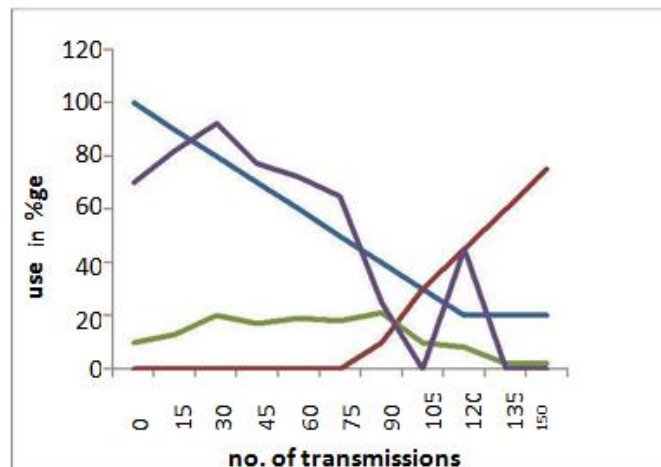
### Overview of energy routing protocol:-

System is divided in two parts 1. Sensor node & 2. Sink node. Sensor node is one of the nodes in the network except the one who receives data sensor node's work is to provide the data to be delivered to the sink node and the information about its neighbors along with their battery lives. Sink node find its the path of data delivery and also one who receives the data from the sensor nodes.

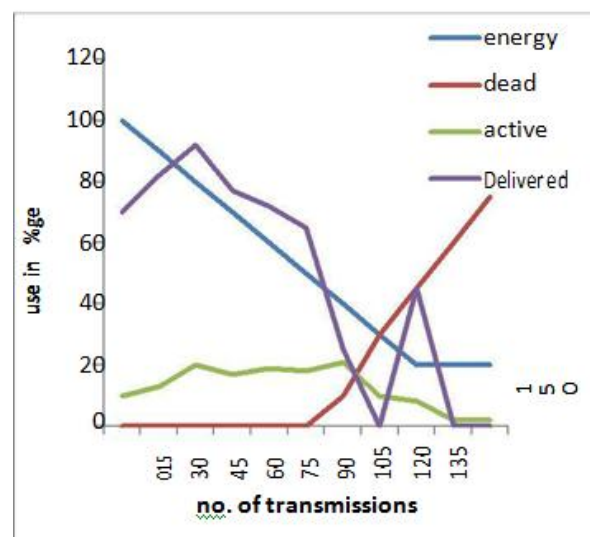
We plot a graph of network that we have to deal with the entire sensor node who is the information sender then. Sink node divides the sensor node in internal nodes and Leaf nodes basically internal nodes are those who have active participation in the data delivery and leaf nodes are those whom we don't need during current data delivery. And according to our protocol we keep the internal nodes awoken and let the leaves sleep till this data transmission is completed. Administrator is informed if any node is under attack .Thus we did the energy consumption by doing the sleeping the nodes whenever not required and wake up the sensors whenever required. Also we made the equal energy consumption of all sensors nodes and proper synchronization.

### Results of energy routing protocol:-

We have obtained few results by comparing our system with few of the previously existing systems. Following are the results by comparison with the GSP [4].



**Fig 2:-** Percentage of active nodes and dead nodes, packets delivered, and average remaining energy in unipath approach.



**Fig 3:-** Percentage of active nodes and dead nodes, packets delivered, and average remaining energy in our approach.

Here the two graphs look same but our protocol is different from the GSP [4]. Because our protocol takes very less time than it, reason behind that is table that consists of the energy value of each node and it is automatically updated after each transmission is complete. While in GSP [4] the table is created each time while we are going to transmit other node or the same node.

Following figure shows the comparison of our protocol with the traditional approaches that were used previously even before the GSP [4]. From the following graph it is easy to predict how energy efficient our protocol is, e.g. if we consider the total battery consumption in the network in 8 transmissions by taking integer value 60 / transmission then if the network is of 8 nodes the battery consumption will exceed integer value 3500, but using our proposed protocol the value is even less than integer value 2000. The result says it all.

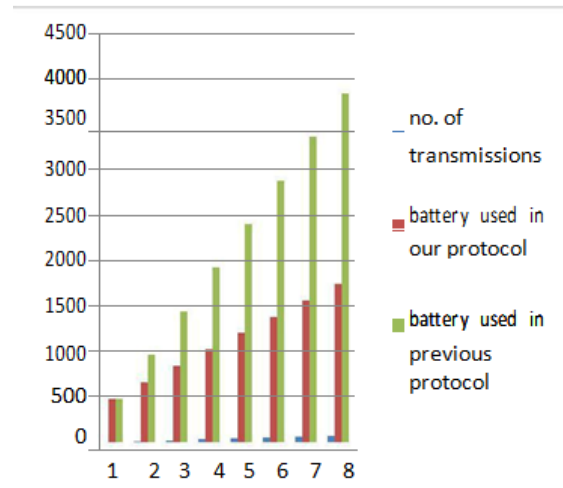


Fig. 4:- Comparison of battery use in our protocol & previous protocol.

### Conclusion:-

We presented an energy aware routing protocol with sleep scheduling for WSNs. The core of the routing protocol is the efficient construction of the broadcast tree with two paths from each node towards the sink, and with higher remaining energy at each internal node of the tree. The tree is reconstructed at the beginning of each period so that none of these nodes dies before other nodes, which means that all nodes will die at around the same time. Consecutive packets are routed through alternative path to reduce traffic in individual paths. Leaf node sleep mechanism is highly energy efficient as more number of nodes is able to sleep, and this helps to prolong the network lifetime.

### References:-

1. R. Mitra and D. Nandy. A survey on clustering techniques for wireless sensor network. Int. J. of Research in Computer Science, 2(4):51{57, 2012.
2. S.S. Kanhere N. Ahmed and S. Jha. The holes problem in wireless sensor networks:a survey. ACM SIGMOBILE Mobile Computing and Communications Review, 9(2):4{18, April 2005. URL doi:10.1145/1072989.1072992.
3. N. Chand V. Katiyar and S. Soni. A survey on clustering algorithms for heterogeneous wireless sensor networks. Int. J. Advanced Networking and Applications, 2(4):745{754, 2011.
4. S. Jabbehdari R. Sheikhpour and A. Khadem-Zadeh. Comparison of energy efficient clustering protocols in heterogeneous wireless sensor networks. InternationalJournal of Advanced Science and Technology, 36:27{40, November 2011
5. K. Akkaya and M. Younis. A survey on routing protocols for wireless sensor networks, ad hoc networks. Ad Hoc Networks, CiteSeerX, 3:325{349, 2005.URLhttp://citeseer.ist.psu.edu/viewdoc/summary?doi=10.1.1.85.3616.
6. An energy Efficient routing protocol with sleep scheduling for wireless sensor networks. By Amulya Ratna Swain, R. C. Hansdah and Vinod Kumar Chouhan Department of Computer Science and Automation Indian Institute of Science Bangalore, India
7. J. L. Hill. System architecture for wireless sensor networks. Ph.D. dissertation,University of California atBerkeley, Spring,2003.

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### RESEARCH ARTICLE

#### EFFECT OF IMPELLER TYPE AND ROTATIONAL SPEED ON FLOW BEHAVIOR IN FULLY BAFFLED MIXING TANK.

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#### Abstract

This paper reports the results of numerical study undertaken to investigate the effect of different impeller types and rotational speed on velocity field in mixing tank. The hydrodynamic of the flow in standard mixing tank generated by two impellers, Chemineer S-4 impeller (radial flow), Pitched Blade impeller (axial flow) is studied. Using ANSYS FLUENT v15.4. is used to solve the continuity and momentum equations incorporating the RNG K- $\epsilon$  turbulence model with the standard wall function available in Fluent. The multiple frames of reference (MFR) model is used for impeller modeling. The results show that the mixing performance of Chemineer impeller is better than the Pitched blade impeller at the same level of rotation speed.

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#### Introduction

Mixing tank is one of the techniques that used and play a significant role in industrial processes to homogenize the mixture of two or more fluids/solids by using rotating impeller. The better understanding of the fluids behavior in mixing vessel may improve the performance of impeller and the mixing process. The main aims of using mixing are to improve the mass and heat transfer and to generate a homogenized mixture to minimize the settling of the particles at the bottom of the tank. A summary of some recent published works in the literature is given below.

**Nienow, and Miles** (1977) investigated the effect of impeller type and mixing tank configuration on fluid-particles mass transfer. **Ducoste and Clark** (1997) study the effect of tank size and impeller type on the turbulence in mixing tank. **Wei, et. al.** (1997) studied the influence of the number and width of baffles in mechanically mixing vessel with and without aeration on the fluid hydrodynamics and mixing tank. **Ducoste and Clark** (1999) employed the Computational Fluid Dynamics (CFD) in the study. The model was a simple geometry consists of the submerged impellers in cubical mixing vessel. The k- $\epsilon$  model was used to simulate the turbulence and the flow pattern induced in the vessel. **Masoud Rahimi** (2005) used CFD simulation to study the impellers number and layout on mixing time. A large storage tank of 19000m<sup>3</sup> contain three types of crude oil with difference density. **Aoyi et. al.** (2008) investigated the hydrodynamics of fluid in mixing stirred vessel agitated by Rushton turbine with low clearance condition. The CFD technique and LDV measurements were performed in order to understand the flow pattern and mixing time. **Angelique Delafosse et. al.** (2008) investigated the hydrodynamics in mixing tank by CFD simulation. Two models were used to determine the dissipation rate and its distribution in mixing vessel. Three dimensional simulations using the commercial CFD code FLENT 6.2.16 based on the Unsteady Reynolds Averaged Navier-Stokes equations (URANS) model and Large Eddy simulation (LES) model was used.

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In this paper, the flow field in stirred tank is studied using ANSYS Fluent (13) to identify the dead zones in the tank where the fluid is not mixing by presenting the velocity vectors at different planes in the tank. Two types of impellers (Pitched Blade and Chemineer S-4 Impellers) are used in this investigation to select the appropriate impeller for flocculation mixing process.

### The CFD Model and Simulation

The CFD modeling of mixing problem, consist of three steps which are pre-processing, equation solving and post-processing. In first part the problem geometry should be built and meshed. In the second step the partial differential equations describing the flow (Continuity and Navier-Stokes) are discretized on the mesh and solved simultaneously. The boundary and initial conditions should be introduced to the CFD. The turbulence model selected which is describing the effect of turbulence on the bulk flow properties of the fluid. Finally, the obtained results should be analyzed.

The CFD involves the numerical solution of conservation equations. In the present study, the simultaneous solution of continuity and Reynolds-averaged Navier –Stokes (RANS) equations together with the RNG of K- $\epsilon$  turbulent model were carried out using the finite control volume with cylindrical coordinates. The following equations were used in the model:

#### Continuity Equation:-

The net flow of mass across the boundary of a control volume is zero in steady state flow:

$$\nabla \cdot \vec{G} = 0 \quad (1)$$

Where:

$\vec{G} = \rho \vec{V}$ , is mass velocity.

Equation (1) can be written relative to cylindrical coordinates as follows:

$$\frac{\partial G_z}{\partial z} + \frac{1}{r} \frac{\partial}{\partial r} (r G_r) + \frac{1}{r} \frac{\partial G_\theta}{\partial \theta} = 0 \quad (2)$$

The subscripts z, r and  $\theta$  are representing to the axial, radial and tangential components respectively. The  $\bar{u}$ ,  $\bar{v}$  and  $\bar{w}$  are the components for the time mean velocity in z, r and  $\theta$  directions respectively, and  $u'$ ,  $v'$  and  $w'$  be the corresponding velocities of fluctuation. The continuity equation can be written as conservation of mass equation with the following form: (Joseph 1997), (Ronald 1984)

$$\frac{\partial}{\partial z} (\bar{u}) + \frac{1}{r} \frac{\partial}{\partial r} (r \bar{v}) + \frac{1}{r} \frac{\partial}{\partial \theta} (\bar{w}) = 0 \quad (3)$$

#### Momentum Equations:-

The general momentum equations in terms of shear stress  $\tau$  governing the fluid motion for three dimensions for cylindrical coordinate are [9]:

In Z-direction

$$\rho \left( \frac{\partial U}{\partial t} + U \frac{\partial U}{\partial z} + V \frac{\partial U}{\partial r} + \frac{W}{r} \frac{\partial U}{\partial \theta} \right) = - \frac{\partial p}{\partial z} + \left[ \frac{1}{r} \frac{\partial}{\partial r} (r \tau_{rz}) + \frac{1}{r} \frac{\partial}{\partial \theta} \tau_{\theta z} + \frac{\partial}{\partial z} \tau_{zz} \right] + \rho F_z \quad (4)$$

In R-direction

$$\rho \left( \frac{\partial V}{\partial t} + U \frac{\partial V}{\partial z} + V \frac{\partial V}{\partial r} + \frac{W}{r} \frac{\partial V}{\partial \theta} - \frac{W^2}{r} \right) = - \frac{\partial p}{\partial r} + \left[ \frac{1}{r} \frac{\partial}{\partial r} (r \tau_{rr}) + \frac{1}{r} \frac{\partial}{\partial \theta} \tau_{\theta r} + \frac{\partial}{\partial z} \tau_{zr} - \frac{\tau_{\theta\theta}}{r} \right] + \rho F_r \quad (5)$$

In- $\theta$ -direction

$$\rho \left( \frac{\partial W}{\partial t} + V \frac{\partial W}{\partial r} + \frac{W}{r} \frac{\partial W}{\partial \theta} + \frac{WV}{r} + U \frac{\partial W}{\partial z} \right) = - \frac{1}{r} \frac{\partial p}{\partial \theta} + \left[ \frac{1}{r^2} \frac{\partial}{\partial r} (r^2 \tau_{r\theta}) + \frac{1}{r} \frac{\partial}{\partial \theta} \tau_{\theta\theta} + \frac{\partial}{\partial z} \tau_{z\theta} + \frac{\tau_{\theta r} - \tau_{r\theta}}{r} \right] + \rho F_\theta \quad (6)$$

The previous equations of mass conservation and momentum can be combined to form of one general form (Versteeg 1995)

$$\frac{\partial \psi_z}{\partial z} + \frac{1}{r} \frac{\partial(r\psi_r)}{\partial r} + \frac{1}{r} \frac{\partial(r\psi_\theta)}{\partial \theta} = S_\Phi \quad (7)$$

For the continuity and momentum the  $\psi_z$ ,  $\psi_r$ , and  $\psi_\theta$  are the total diffusion fluxes defined by:

$$\psi_z = \rho U \phi - \Gamma_\phi \frac{\partial \phi}{\partial z} \quad (8)$$

$$\psi_r = \rho V \phi - \Gamma_\phi \frac{\partial \phi}{\partial r} \quad (9)$$

$$\psi_\theta = \rho W \phi - \Gamma_\phi \frac{\partial \phi}{r \partial \theta} \quad (10)$$

Where  $\Phi$  stands for any of the dependent variables and the corresponding values of  $\Gamma_\phi$  and  $S_\phi$  is indicated in table

(1). For axisymmetric swirling flow  $\left(\frac{\partial \phi}{\partial \theta} = 0\right)$ , equation (7) becomes:

$$\begin{aligned} \frac{\partial \psi_z}{\partial z} + \frac{1}{r} \frac{\partial(r\psi_r)}{\partial r} &= S \\ \rho \frac{\partial}{\partial z} \left( U \phi - \Gamma_\phi \frac{\partial \phi}{\partial z} \right) + \frac{1}{r} \frac{\partial}{\partial r} \left( r V \phi - r \Gamma_\phi \frac{\partial \phi}{\partial r} \right) &= S_\phi \end{aligned} \quad (11)$$

**Table 1:-** variables of equations

Equation	$\Phi$	$\Gamma\Phi$	$S\Phi$
Conservation of mass Eq(2)	1	0	0
Conservation of momentum in z - direction eq. (4)	U	$\mu_{eff}$	$-\frac{\partial \bar{p}}{\partial z} + \frac{\partial}{\partial z} \left( \mu_{eff} \frac{\partial \bar{u}}{\partial z} \right) + \frac{1}{r} \frac{\partial}{\partial r} \left[ r \mu_{eff} \left( \frac{\partial \bar{v}}{\partial z} \right) \right] + \frac{1}{r} \frac{\partial}{\partial \theta} \left[ \mu_{eff} \left( \frac{\partial \bar{w}}{\partial z} \right) \right]$
Conservation of momentum in r - direction eq.(5)	V	$\mu_{eff}$	$-\frac{\partial \bar{p}}{\partial r} + \frac{\partial}{\partial z} \left[ \mu_{eff} \frac{\partial \bar{u}}{\partial r} \right] + \frac{1}{r} \frac{\partial}{\partial r} \left[ r \mu_{eff} \frac{\partial \bar{v}}{\partial r} \right] + \frac{1}{r} \frac{\partial}{\partial \theta} \left[ \mu_{eff} r \frac{\partial}{\partial r} \left( \frac{\bar{w}}{r} \right) \right] + \rho \frac{\bar{w}^2}{r} - \frac{2\mu_{eff}}{r} \left( \frac{1}{r} \frac{\partial \bar{w}}{\partial \theta} + \frac{\bar{v}}{r} \right)$
Conservation of momentum in $\theta$ -direction eq. (6)	W	$\mu_{eff}$	$-\frac{1}{r} \frac{\partial \bar{p}}{\partial \theta} + \frac{\partial}{\partial z} \left[ \mu_{eff} \left( \frac{1}{r} \frac{\partial \bar{u}}{\partial \theta} \right) \right] + \frac{1}{r} \frac{\partial}{\partial r} \left[ \mu_{eff} \left( \frac{\partial \bar{v}}{\partial \theta} - \bar{w} \right) \right] + \left[ \frac{\mu_{eff}}{r} \left( r \frac{\partial}{\partial r} \left( \frac{\bar{w}}{r} \right) + \frac{1}{r} \frac{\partial \bar{v}}{\partial \theta} \right) \right] - \frac{\rho \bar{w} \bar{v}}{r} + \frac{1}{r} \frac{\partial}{\partial \theta} \left[ \mu_{eff} \left( \frac{1}{r} \frac{\partial \bar{w}}{\partial \theta} + \frac{2\bar{v}}{r} \right) \right]$

### The $k$ - $\epsilon$ Turbulence Model:-

Jones and Launder had proposed the following equations for both the turbulence kinetic energy ( $k$ ) and for energy dissipation ( $\epsilon$ ) [10], for turbulence kinetic energy ( $k$ )

$$\rho \bar{u} \frac{\partial k}{\partial z} + \rho \bar{v} \frac{\partial k}{\partial r} + \rho \bar{w} \frac{\partial k}{\partial \theta} = \frac{\partial}{\partial z} \left( \frac{\mu_t}{\sigma_{k,t}} \frac{\partial k}{\partial z} \right) + \frac{1}{r} \frac{\partial}{\partial r} \left( \frac{\mu_t}{\sigma_{k,t}} r \frac{\partial k}{\partial r} \right) + \frac{1}{r} \frac{\partial}{\partial \theta} \left( \frac{\mu_t}{\sigma_{k,t}} \frac{\partial k}{\partial \theta} \right) - \rho \epsilon + \mu_t G \quad (12)$$

For energy dissipation rate ( $\epsilon$ )

$$\rho \bar{u} \frac{\partial \epsilon}{\partial z} + \rho \bar{v} \frac{\partial \epsilon}{\partial r} + \rho \bar{w} \frac{\partial \epsilon}{\partial \theta} = \frac{\partial}{\partial z} \left( \frac{\mu_t}{\sigma_{\epsilon,t}} \frac{\partial \epsilon}{\partial z} \right) + \frac{1}{r} \frac{\partial}{\partial r} \left( \frac{\mu_t}{\sigma_{\epsilon,t}} r \frac{\partial \epsilon}{\partial r} \right) + \frac{1}{r} \frac{\partial}{\partial \theta} \left( \frac{\mu_t}{\sigma_{\epsilon,t}} \frac{\partial \epsilon}{\partial \theta} \right) + C_1 \frac{\epsilon}{k} \mu_t G - C_2 \frac{\epsilon^2}{k} \quad (13)$$



Where G refers to the generation term and is given by [37]:

$$G = 2 \left[ \left( \frac{\partial \bar{u}}{\partial z} \right)^2 + \left( \frac{\partial \bar{v}}{\partial r} \right)^2 + \left( \frac{\bar{v}}{r} \right)^2 \right] + \left[ \left( \frac{\partial \bar{u}}{\partial r} \right) + \left( \frac{\partial \bar{v}}{\partial z} \right) \right]^2 + \left( \frac{\partial \bar{w}}{\partial z} \right)^2 + \left( \frac{\partial \bar{w}}{\partial r} - \frac{\bar{w}}{r} \right)^2 \quad (14)$$

The turbulent kinetic energy (k) and the dissipation rate of the turbulent energy ( $\epsilon$ ) are chosen as the two properties in order to determine the turbulent viscosity  $\mu_t$

$$\mu_t = \frac{C_\mu \rho k^{\frac{1}{2}}}{l^{-1}} \quad (15)$$

Where:  $C_\mu$  is a constant. It is assumed that at a high Reynolds number, ( $\epsilon$ ) value to be Proportional to  $k^{\frac{3}{2}}/l$ , the above equation becomes:-

$$\mu_t = \frac{C_\mu \rho k^2}{\epsilon} \quad (16)$$

The quantities  $\sigma k, t$ ,  $C_1$ ,  $C_2$ ,  $\sigma \epsilon, t$  and  $C_\mu$  that appear in the k- $\epsilon$  model and  $\mu_t$  equations, are the universal k- $\epsilon$  model constants, whose values are reproduced in table (2).

**Table 2:-** shows the variable of k- $\epsilon$  model.

Equation	$\Phi$	$\Gamma \Phi$	$S\Phi$	$C_1$	1.44
Turbulent K.E.eq. (12)	K	$\mu_t/\sigma k, t$	$-\rho \epsilon + \mu_t G$	$C_2$	1.92
Dissipation rate eq.(13)	$\epsilon$	$\mu_t/\sigma \epsilon, t$	$\mu_t G C_1 \frac{\epsilon}{k} - C_2 \frac{\epsilon^2}{k}$	$C_\mu$	0.09
				$\sigma k, t$	1
				$\sigma \epsilon, t$	1.3

#### Mixing time:-

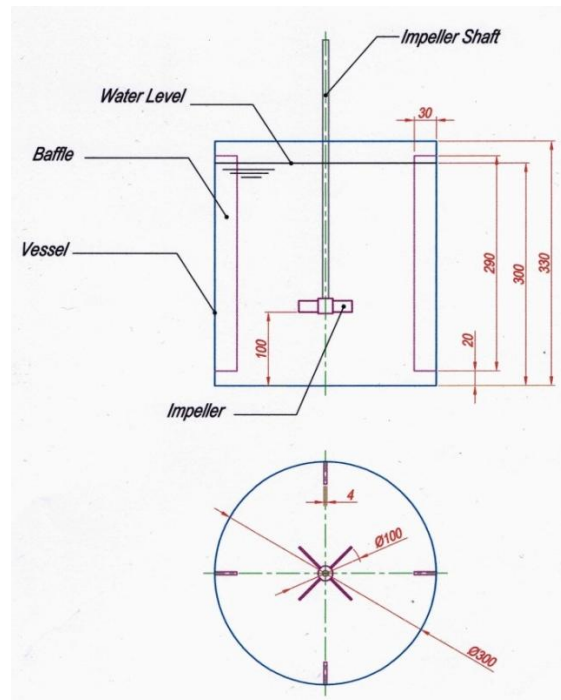
Mixing time can be calculated from experimental relation referring to the concentration of tracer material which reach 99% using calculated tracer concentration in all tank fluid. (Harnby, 2001)

$$t = \frac{4.605}{a/D_i^b / D_i^c} \quad (17)$$

Where a, b and c are constant depending on type pf impeller.

#### Model Stirred Tank Configuration:-

A schematic diagram of the tank and the impeller is shown in Fig. 1. The system consists of a flat bottomed cylindrical vessel, the diameter ( $D_t = 0.3$  m) of which equals the height of the liquid ( $H=D_t$ ). Four baffles having width,  $W=D_t/10$  are spaced equally around the vessel. The shaft of the impeller is concentric with the axis of the vessel. The Impeller diameter,  $D_i$ , equivalent to  $D_t/3$ . The distance between the tank bottom and the impeller position C is set to  $C= D_t/3$ . The rotational speed of the impeller, N, is ranging from 60 rpm to 135 rpm increasing step 15 rpm, leading to a tip speed,  $V_{tip}$ , ranging 0.314 m/s to 1.05 m/s. The working fluid is water with density,  $\rho$ , of 1000 kg/m<sup>3</sup> and viscosity,  $\mu$ , of  $1 \times 10^{-3}$  Pa.s. The mixing tank as showed Fig.1 was design in depends on the standard configuration as follow: [1], (Georgy 1991). The two types of impellers: Chemineer S-4 and pitched blade impeller as shown in Fig.2, the specification of the impellers are show in table (3).



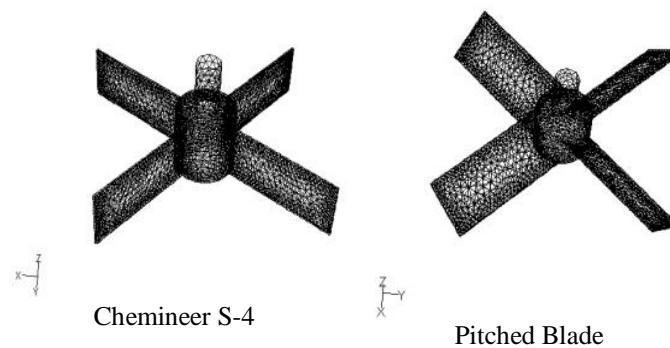
**Fig. 1:-** mixing Tank in Present Study

**Table 3:-** Specification of Impeller.

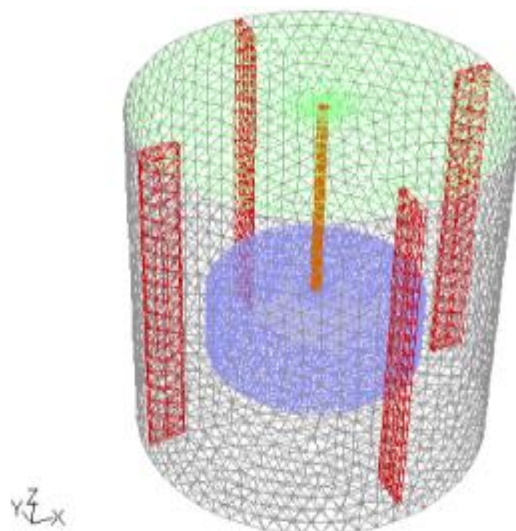
Specification	Impeller type	
	Chemineer S-4	Pitched Blade
No. of blades	4	4
Blade width at tip (m)	0.016	0.02
Blade width at root (m)	0.016	0.02
Blade thickness	0.003	0.003
Hub cord angle (deg.)	90	45
Hub Diameter (m)	0.2	0.2
Hub height (m)	0.2	0.2

### The Numerical Solution Setup

In the present study, mixing in 21.2 liter of water agitated by three types of impellers. The impellers rotation speeds were ranging from 60 to 135 rpm. The mixing tank model was divided in to 58244 nodes as shown in Fig.3. The MFR method was applied for modeling the impeller rotation. Also the continuity and Navier-Stokes equations together with the RNG version of the K- $\epsilon$  were used to describe the equation of motion (13).



**Fig 2:-** Impeller Modeling and Mesh Geometry.



**Fig 3:-** The Mixing Tank Modeling and Mesh Geometry.

### Results and Discussions

The impellers rotation speed has a great effect on fluid motion in mixing processes. Consequently, the efficiency of settling process for the solid material is affected by the changing of impeller rotation speed. Also, the concentration of chemical additives would become more homogeneous when the optimum impeller rotation speed has been correctly selected.

Fig.4 and Fig.5 illustrated the velocity vectors, contour and graph for Z- $\theta$  and Z-R planes for Pitched Blade impeller rotated at 60 rpm. At the Z- $\theta$  plane 0 degree, the impeller pumping the fluid toward the bottom of the tank, and then moved with high velocity toward the upper zone near the baffle surface because the baffles help the circulated fluid to flow upward to the upper zone of the tank instead of circulation. This fluid motion produced a circular mixing zone (eddy) at which the fluid circulated around the specific point located at 0.11m from the center of tank with height of 0.54m from the base surface which is almost half the clearance between the impeller and the bottom of tank.

The average velocity of fluid is in varied with the radius of the tank. Thus, two poor mixing zones are generated at center of the bottom of the vessel also at the free surface of fluid. The same behavior of fluid is repeated in Sec.30°, and Sec60° but the average velocity of fluid decreases when the fluid motion toward the upper zone of the vessel due there are no baffles existed at those sections. At Sec. 90 degree it is easy to note that the fluid motion is identical with the fluid flow at Sec.0 degree.

In Z-R plane as shown in Fig. 5 at height 0.01m from the bottom of the tank the fluid flow generates a low velocity zone at the center of plane, this zone about 0.085m in diameter. At height 0.1m the fluid velocity is highly fluctuated due to the high influence of impeller pumping capacity as well as the effect of circulation fluid which decrease the velocity of pumped fluid which produces the eddy as explained earlier. The low velocity mixing zone is located between the impeller zone and the tank wall having an annulus shape of inner diameter about 0.038m and 0.24m in outer diameter. The fluid velocity is increased near the baffles with impeller rotation direction is clockwise, resulting in part of the fluid flow toward the upper zone of tank and the rest return to impeller zone with high velocity. The fluid flow changes from highly fluctuated to more moderate motion at height of 0.2m which reflects the effect of rotational motion of impeller. The effect of baffles is quite clear by producing poor mixing zones located between them. The velocity increases as height increased until reached 0.3m height at which the eddies length scale become small and circulated toward the shaft of impeller due to the effect of pumping from impeller.

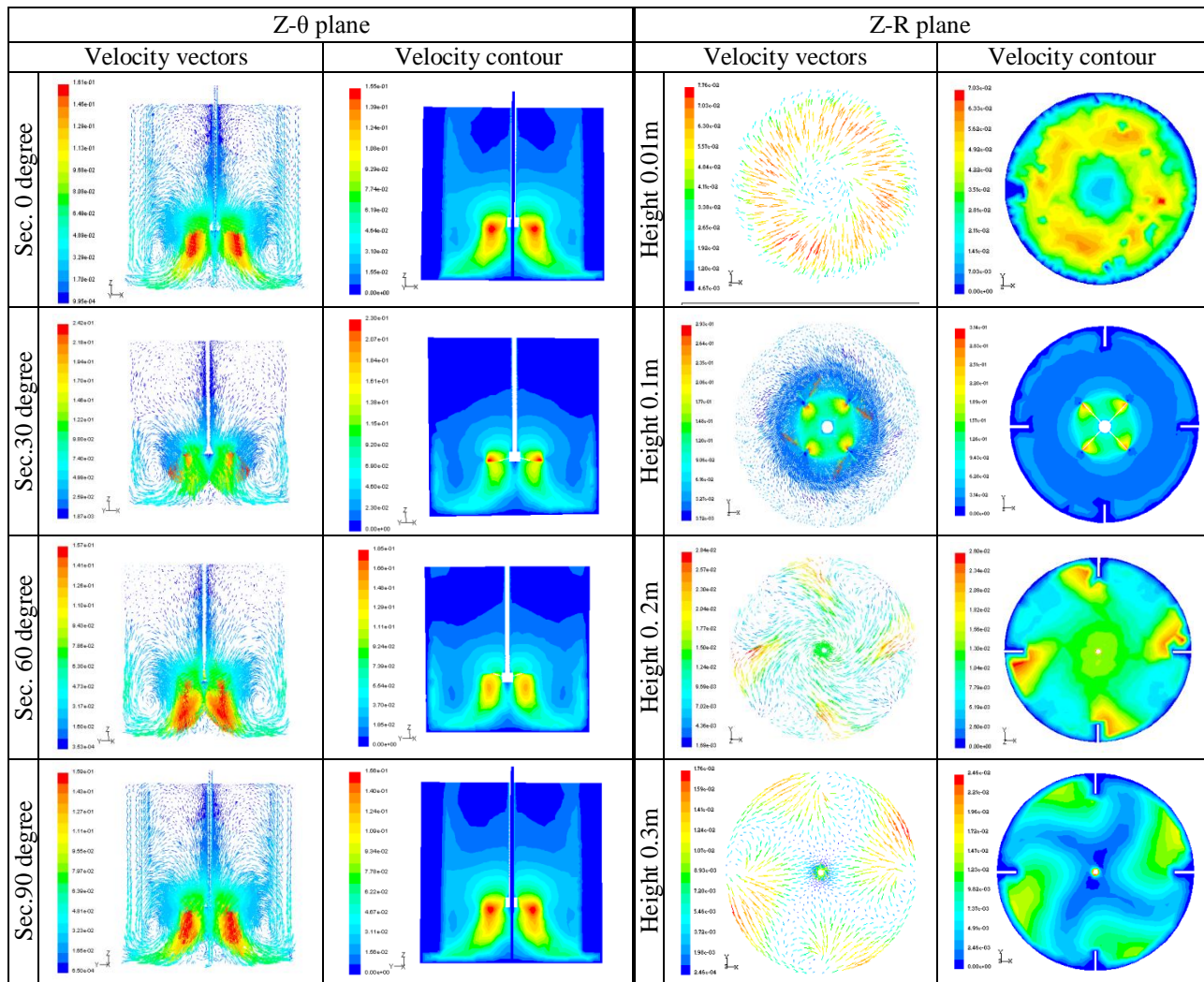


Fig. 4:- Velocity Vectors and Contour for Pitched Blade Impeller Rotation Speed at 60 Rpm.

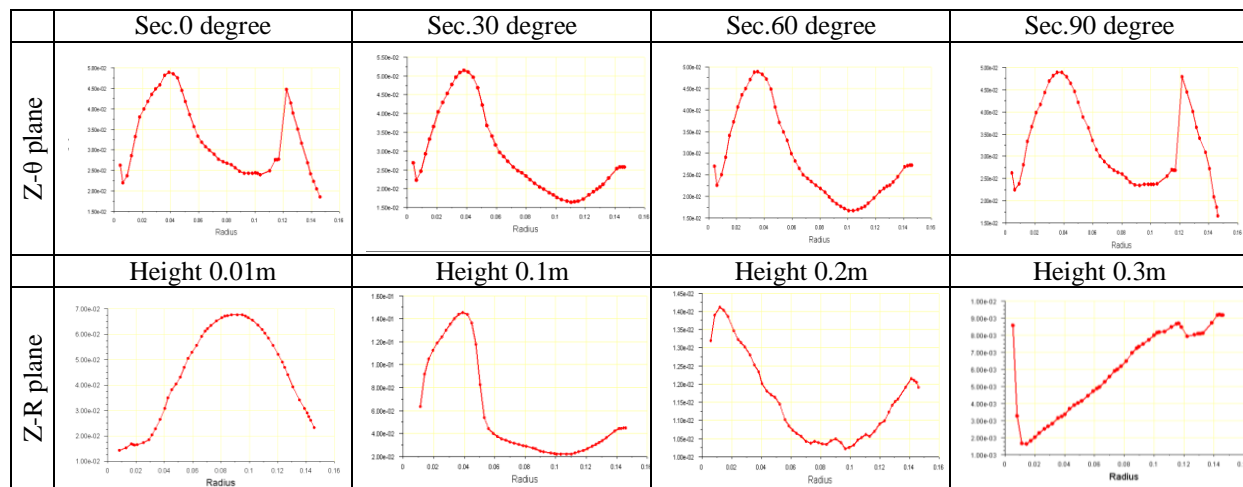


Fig. 5:- Velocity graph for Pitched Blade Impeller Rotation Speed at 60 Rpm in Z- $\theta$  and Z-R planes.

Fig.6 shows the velocity vectors and contours for Chemineer S-4 impeller rotates at 60 rpm. The velocity vectors for 0° plan show that the impeller blades pumped the fluid radially to ward tank wall that cause fluid to split into two



jets. The small jet is circulated downward to the bottom of tank and then returns to the impeller zone so produces an eddy in the zone below the impeller. The center of eddy is located at radius of 0.103 m from the tank center and 0.064m from the bottom of tank. A Poor or weak mixing region is existed at the center of tank below the impeller.

The second jet of the fluid will be circulated in upward direction, so generate an eddy which is located at same radial direction with lower one but with height of 0.134m from the bottom of tank. The flow pattern will be same at 30° and 60° plans except the reduction in the fluid flow velocity at the upper zone especially at 30° plan and velocity of fluid near the wall of tank increases in the upward direction. The fluid flow behavior in 90° plan is similar to that observed at 0° plan.

In Z- $\theta$  direction at height 0.01 m velocity vectors and contour shows the poor mixing zone in the center of tank. The velocity increases toward the wall of tank, then the velocity decreases near the tank wall, this fluctuation of velocity lead to form annular ring zone with high mixing. At height of 0.1m (impeller zone) the velocity linearly increases along the blade of impeller until it reaches to its maximum value at the tip of the blade. Then the velocity is sharply decreases because of fluid circulation as a result of the direction of pumping direction.

At height 0.2 m most of fluid is split into four symmetrical jets and the other flows upward direction reaching the free surface. These symmetrical jets are radially circulated in the mixing plan thus, eddies were generated as the flow become close to the wall of the baffles. The fluid flow far from the wall of baffles still circulate with high velocity in the radial direction toward the center of tank that lead to generate a high mixing zone. At the free surface of fluid the velocity decreases because most of the fluid circulates in the lower zone due to the influences of impeller pumping capacity. The high mixing zone reduces especially at the center of tank but swirling motion continues near the baffles wall.

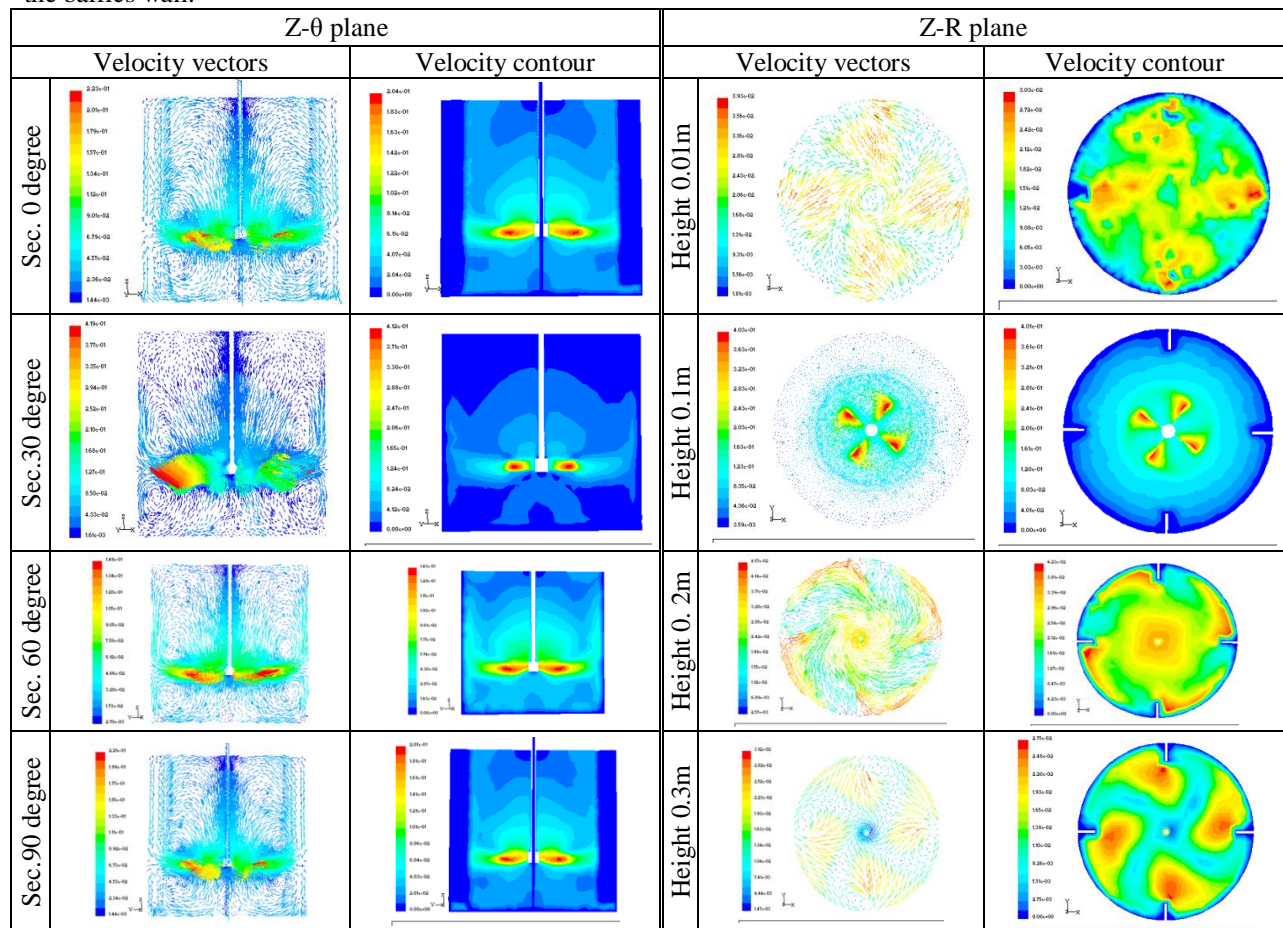
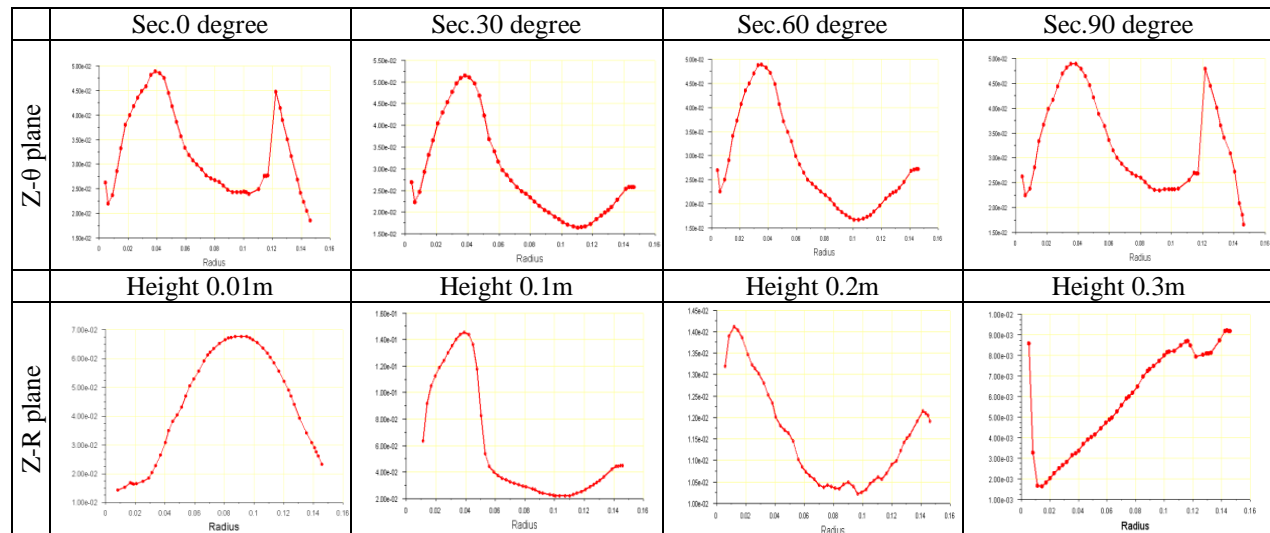


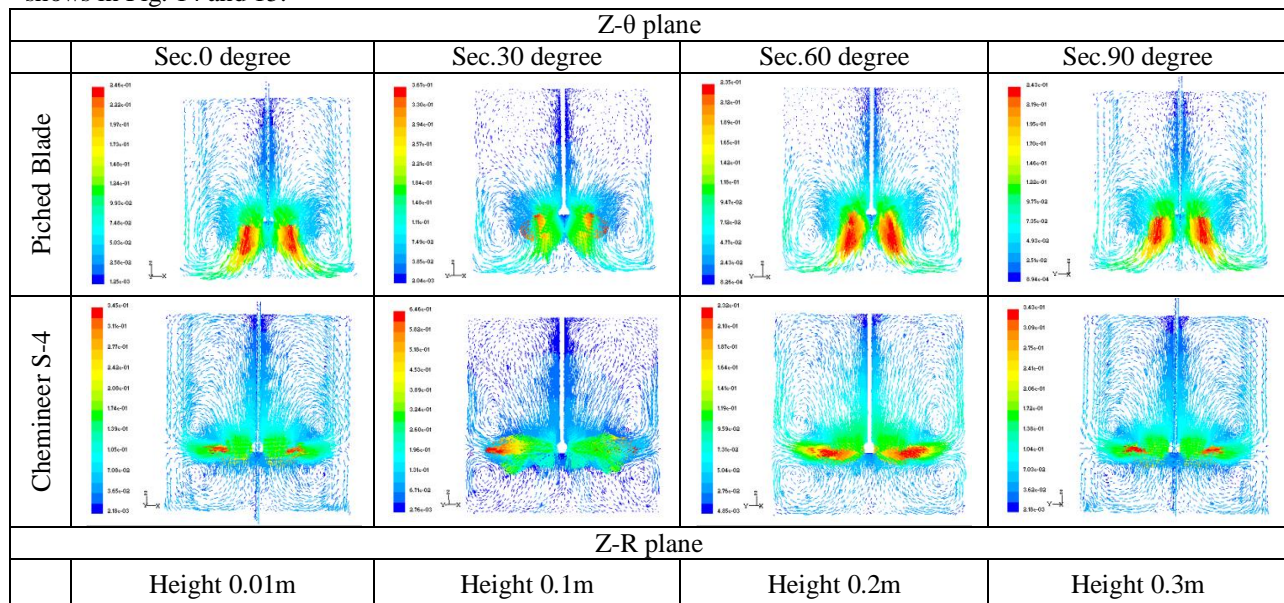
Fig. 6:- Velocity Vectors and Contour for Chemineer S-4 Impeller Rotation Speed at 60 Rpm

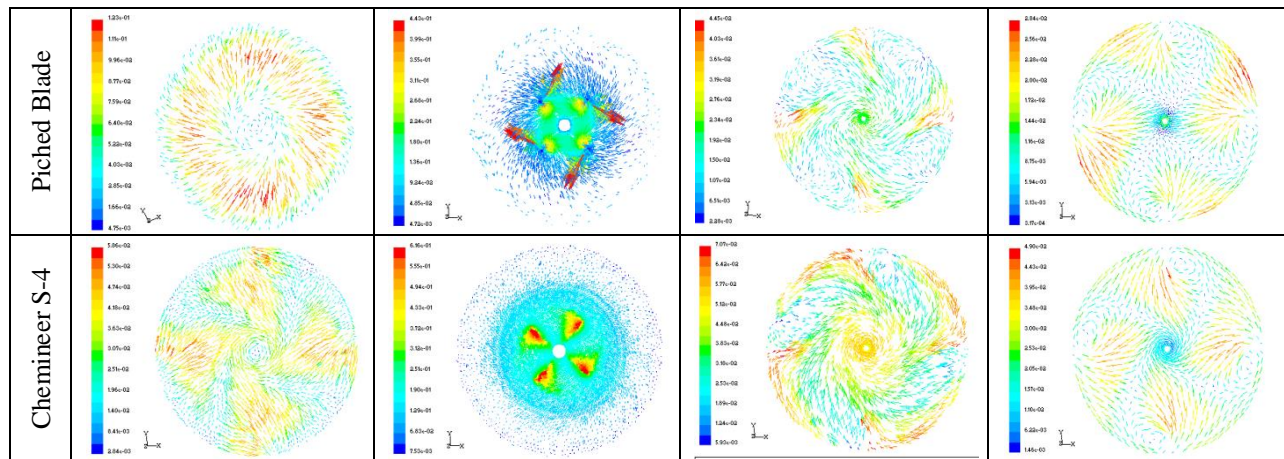


**Fig. 7:-** Velocity graph for Chemineer S-4 Impeller Rotation Speed at 60 Rpm in Z-θ and Z-R planes

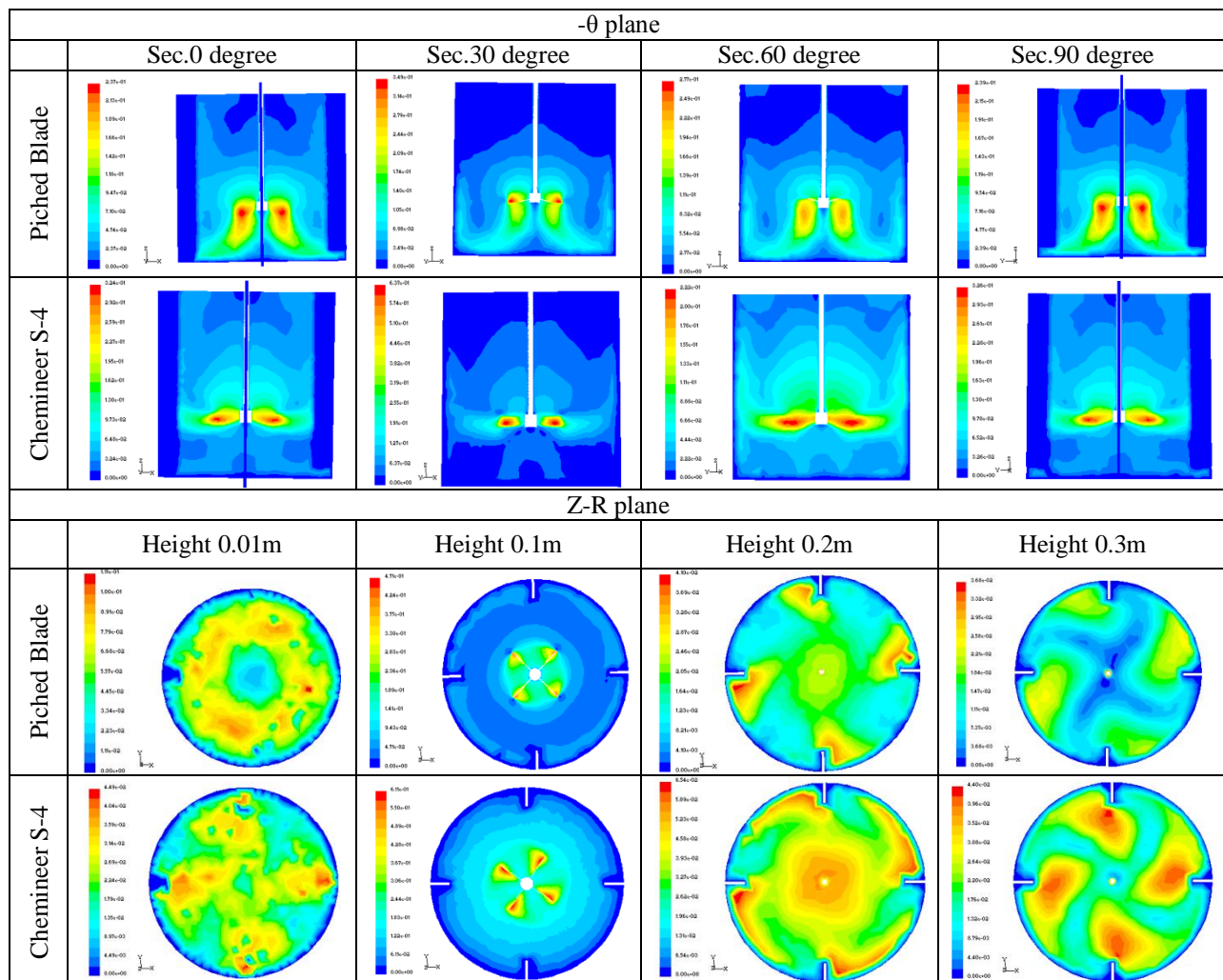
Fig.8 shows the difference between the flow patterns induced by Pitched blade and Chemineer impellers with both rotates at 90 rpm. The difference can be observed in both Z-θ and Z-R planes. The Pitched blade impeller influence the all tank while Chemineer impeller influence the mixing in 2/3 of the tank at same rotation speed. The velocity of fluid flow in mixing tank agitated by Chemineer impeller is higher than that induced by pitched blade impeller as showed in Fig.9 Thus the mixing time with Chemineer impeller is less than that with Pitched blade one.

Fig.10 illustrated the velocity of the fluid in the mixing tank in Z-R plane with height 0.1 m from the bottom of the tank. The Chemineer impeller produces a fluid flow with a high velocity as well as the high velocity fluctuated in comparison with the Pitched Blade impeller. In the height of 0.1 , 0.2 and the free surface of the fluid, it easy to note that the similarity with velocity fluctuated produced by both impellers but still Chemineer impeller produce fluid motion higher than that produces by Pitched Blade impeller as shows in Fig. 11,12 and 13. In the Z-θ plane the velocity of fluid generated by both impellers is similar in the fluctuation and closer in values for all sections as shows in Fig. 14 and 15.



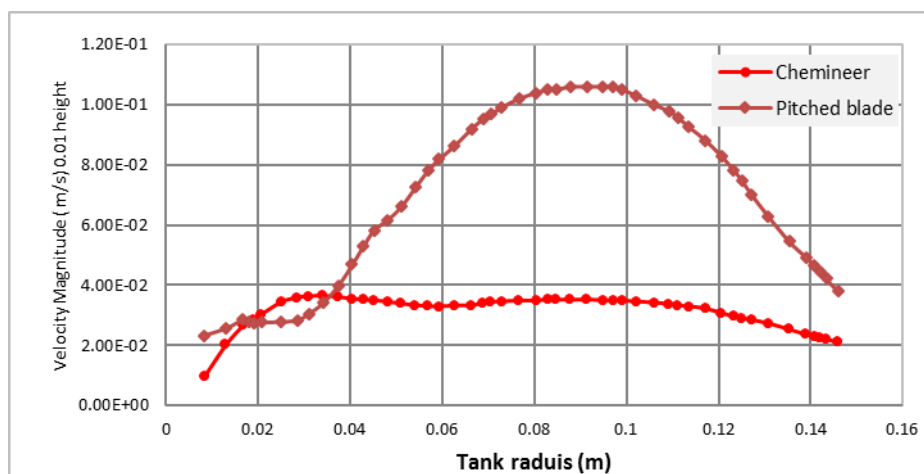


**Fig. 8:-** Velocity Vectors for Pitched Blade and Chemineer S-4 Impellers Rotation Speed at 90 Rpm

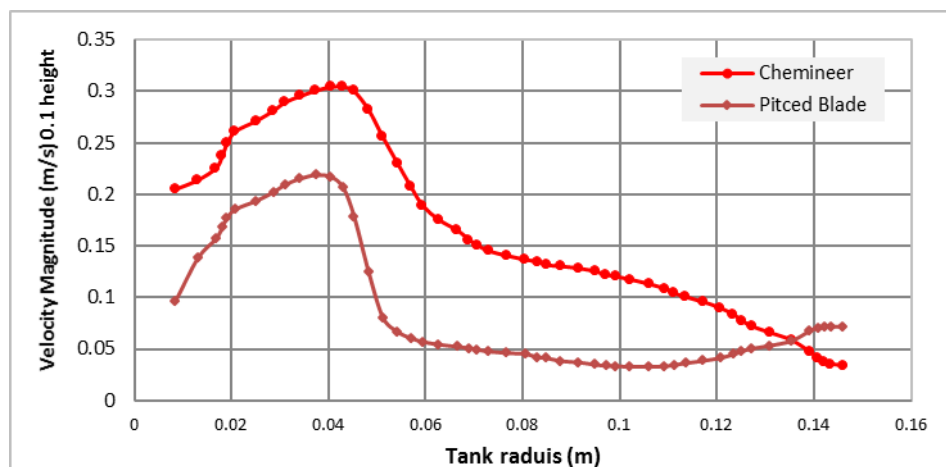


**Fig. 9:-** Velocity Vectors and Contour for Pitched Blade Chemineer S-4 Impeller Rotation Speed at 90 Rpm

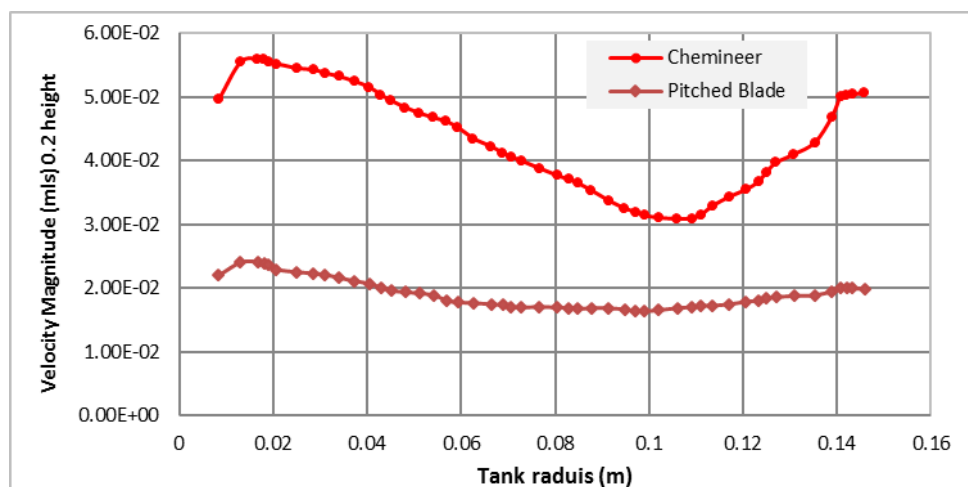




**Fig. 10:-** Velocity graphs for Pitched Blade and Chemineer S-4 Impeller Rotation Speed at 90 Rpm at Z-0 plane Height 0.01m

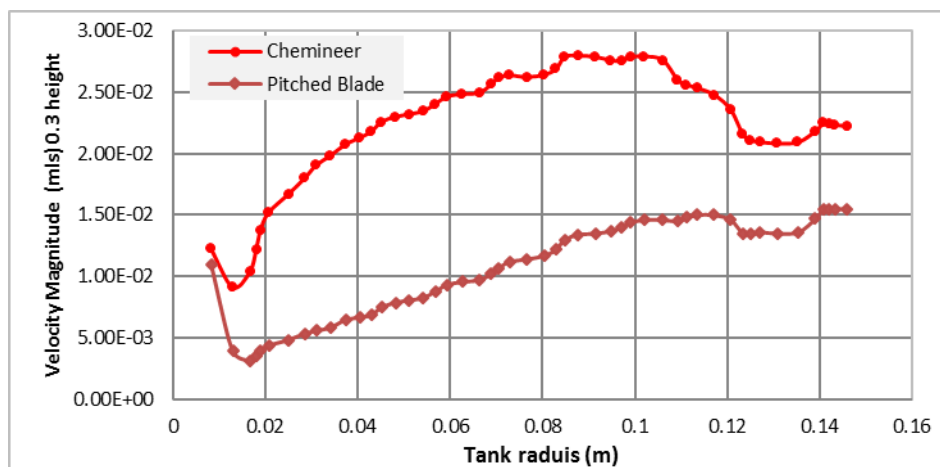


**Fig. 11:-** Velocity graphs for Pitched Blade and Chemineer S-4 Impeller Rotation Speed at 90 Rpm at Z-R plane Height 0.1 m

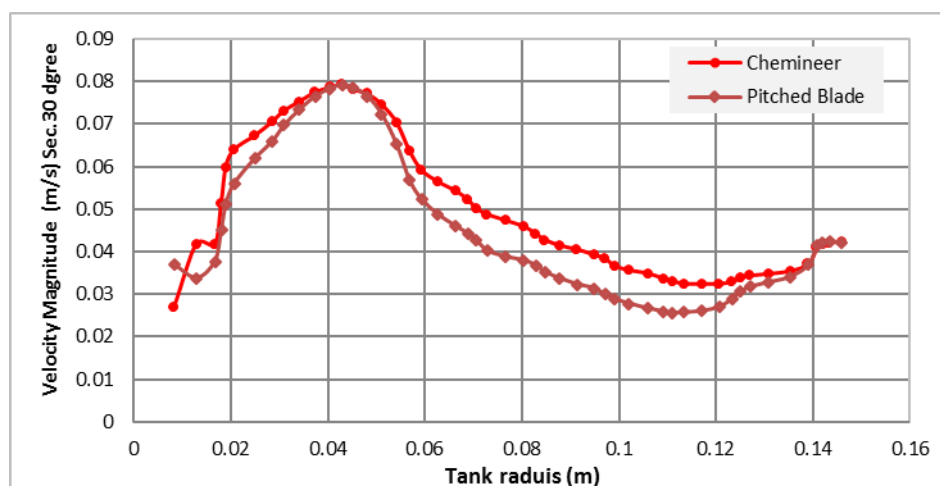


**Fig. 12:-** Velocity graphs for Pitched Blade and Chemineer S-4 Impeller Rotation Speed at 90 Rpm at Z-R plane Height 0.2 m

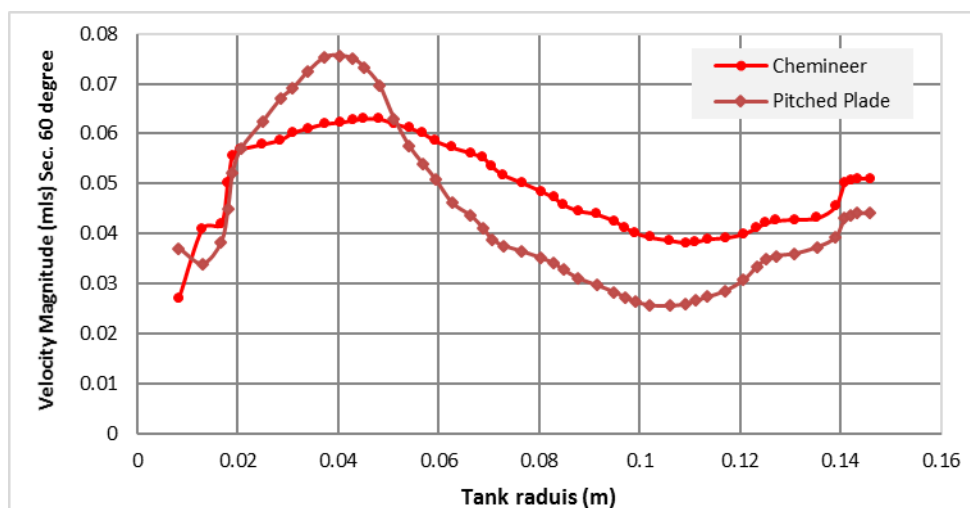




**Fig. 13:-** Velocity graphs for Pitched Blade and Chemineer S-4 Impeller Rotation Speed at 90 Rpm at Z-R plane Height 0.3 m



**Fig. 14:-** Velocity graphs for Pitched Blade and Chemineer S-4 Impeller Rotation Speed at 90 Rpm at Z-R plane Sec. 30 degree.



**Fig. 15:-** Velocity graphs for Pitched Blade and Chemineer S-4 Impeller Rotation Speed at 90 Rpm at Z-θ plane Sec. 60 degree.

The mixing time depend on both the fluid flow pattern and fluid velocity, hence the Chemineer impeller produce fluid flow with high velocity and shorter paths than that generates with Pitched Blade impeller thus the mixing equipped with Chemineer impeller is less in time than with Pitched Blade impeller as Shows in Fig. 16.

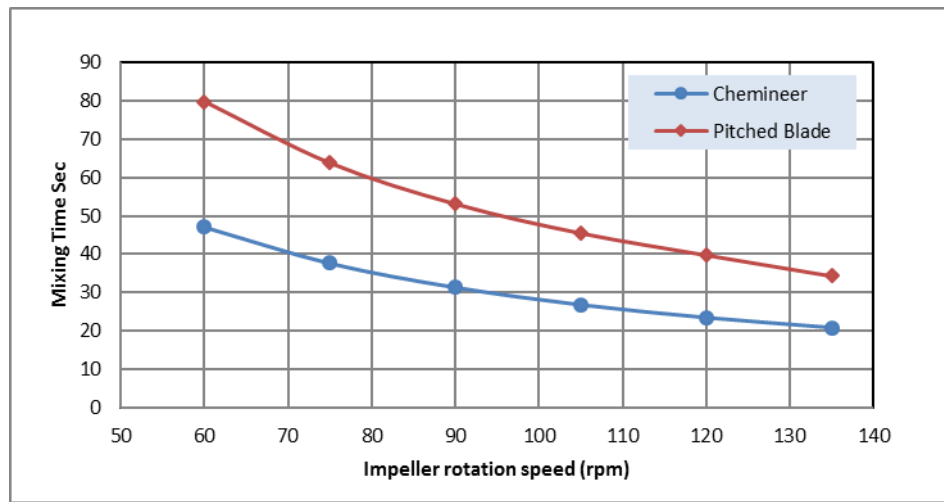


Fig 16:- Mixing Time for Pitched Blade and Chemineer S-4 Impellers.

#### Nomenclature:-

Symbols	Description	SI Unit
a	Acceleration	m/s <sup>2</sup>
C0	Constant	
C1	Constant	
C2	Constant	
C <sub>μ</sub>	Constant	
D <sub>i</sub>	Impeller diameter	m
D <sub>t</sub>	Diameter of mixing tank	m
E <sub>k</sub>	Turbulent kinetic energy in equation	m <sup>2</sup> /s <sup>2</sup>
C	Impeller clearance	m
H	Liquid height in mixing tank	m
N	Impeller rotation speed	rev/min
p	Pressure	N / m <sup>2</sup>
r	Radius of mixing tank	m
S <sub>r</sub>	Source term in r-direction of momentum equation	
S <sub>θ</sub>	Source term in θ-direction of momentum equation	
S <sub>k</sub>	Source term in k-ε model	
S <sub>ε</sub>	Source term in k-ε model	
t	Mixing time	s
U	Velocity vector in z - direction	m / s
u	Velocity in z-direction	m / s
V	Velocity vector in θ - direction	m / s
v	Velocity in r-direction	m / s
W	Velocity vector	m / s
w	Velocity in θ – direction	m / s
ρ	Density	kg / m <sup>3</sup>
ε	Dissipation rate of kinetic turbulence energy	m <sup>2</sup> / s <sup>3</sup>
ε <sub>w</sub>	Dissipation rate of kinetic turbulence energy at wall	m <sup>2</sup> / s <sup>3</sup>
ε <sub>e</sub>	Eddy viscosity	Pa.s
Γ	Arbitrary parameter	

## Conclusions

The FLUENT v.15.4 is used to analysis the Pitched Blade and Chemineer impeller used for mixing purpose in cylindrical mixing tank. The following conclusions and the results of the study:

1. The numerical analysis gives good results of velocity distribution and mixing rate with the tank. Such results can be used for describing the flow behavior and the difference between the two used impellers
2. Velocity vectors show that the poor mixing zone is generated with Pitched Blade impeller is less than that generated with Chemineer impeller.
3. The fluid flow velocity generated with Chemineer impeller is higher than that generated with Pitched Blade.
4. The fluid flow velocity is similar in the distribution behavior for Z- $\theta$  and Z-R planes but noted a difference in the magnitude for the two impellers.

## References

1. W. Nienow, D. Miles "The Effect of Impeller / Tank Configuration on Fluid-Particle Mass Transfer" Elsevier Sequoia, The Chemical Engineering Journal, vol.15, pp.13-24, 1978.
2. Joel J. Ducoste, Mark M. Clark, "Turbulence in Flocculators: Effect of Tank Size and Impeller Type", AIChE. Journal, vol.43, No. 2, pp.328-338, February, 1997.
3. Wei-Ming Lu, Hong-Zhang Wu and Ming-Ying Ju, "Effect of Baffle design on the Liquid Mixing in an Aerated Stirred Tank with Standard Rushton Turbine Impeller", Pergamon, Chemical Engineering Science, vol.52, No.21:22, pp.843-3851, 1997.
4. Joel J. Ducoste, Mark M. Clark, "Turbulence in Flocculators: Comparison of Measurements and CFD Simulations" AIChE. Journal, vol.45, No.45, pp.432-436, February, 1999.
5. Masoud Rahimi, "The Effect of Impellers Layout on Mixing in a Large-Scale Crude Oil Storage Tank" Elsevier, Journal of Petroleum Science & Engineering, vol. 46, pp.161-170, 2005.
6. Aoyi Ochieng, Maurice S. Onyango, Anil Kumar, Kirimi Kiriamiti, Paul Musonge "Mixing in a Tank Stirred by a Rushton turbine at Low Clearance", Elsevier, Chemical Engineering and Processing, vol.47, pp.842-851, 2008.
7. Angelique Delafosse, Alain Line, Jerome Morchain and Pascal Guiraud, "LES and URANS Simulation of Hydrodynamics in Mixing Tank: Comparison to PIV Experiments", [8] Elsevier, Chemical engineering Research and Design, vol.86, pp.1322-1330, 2008.
8. Joseph H. Spurk "Fluid Mechanics ". Translated by Kathrine mayes, Springer-Verlag Berlin Germany, 1997. PP: 147.
9. Ronald I. panton "Incompressible Flow ". A Wiley–interscience publication, John Wily and Sons, 2nd edit., 1984.
10. Versteeg, H.K. and W. Malasekera, "An Introduction to Computational Fluid Dynamics, the Finite Volume Method". Longman scientific and technology, 1995.
11. Georgy T., Franklin, L. Burton "Wastewater Engineering, Treatment, Disposal, and Result ". McGraw-Hill series in water resources and environmental engineering, 3rd edi., 1991. PP: 217.
12. N. Harnby, M. F. Edwards, A. W. Nienow "Mixing in the process industries" Butterworth – Heinemann, second edition, 2001.
13. Ansys Fluent 13: theory guide. U.S.A.: Ansys Inc.; 2011



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### RESEARCH ARTICLE

#### PREVALENCE OF ASTHMA AMONG SAUDI CHILDREN IN MAKKAH, SAUDI ARABIA

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#### Abstract

**Objectives:** The published data on prevalence of asthma among Saudi children and its risk factors is scarce. This study was carried out to determine the prevalence of Asthma and its relationship with risk factors among Saudi children in Makkah, Saudi Arabia.

**Methodology:** A retrospective study was done at Obstetrics and Gynecology Hospital (OGH) in Jarwal, Makkah, Saudi Arabia. Random selection of 150 cases (30 cases each year) admitted to OGH within the period 2002 – 2006. A questionnaire form was used to collect information from patient's medical records, including demographic data discharge diagnosis with other associated diseases. Data were entered and analyzed using SPSS package.

**Results:** Overall, 36 out of 150 cases (24%) are asthmatic. 61.1% of asthmatic children are males and 38.9% are females. Asthmatic cases recorded the least percentage in 2002 (16.6%) and the highest in 2006 (36.6%). 20% of cases recorded in 2003 and also in 2005. In 2004, 26.6% of cases recorded. Out of 36 children with asthma, 9 cases (25%) are with positive family history, 10 cases (27.8%) are with positive relation to change in weather, 16 cases (44.4%) are with positive relation to dust, 8 cases (22.2%) are with positive relation to exercise, 2 cases (5.6%) are with positive relation to passive smoking and 6 cases (16.7%) are with positive relation to pets.

**Conclusion:** The prevalence of asthma among Saudi children in Makkah is higher than those reported from the neighboring cities and other countries. Males are more susceptible to asthma than females. Dust was the most common risk factor triggering asthmatic children in Makkah. Passive smoking was the less common risk factor related to asthmatic children.

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#### Introduction:

Asthma is the most common chronic disease in children [Asher I, Pearce N, 2014]. It is one of the most common chronic illnesses in Saudi Arabia and local reports suggest that the prevalence of asthma is increasing [Al-Ghamdi BR, Mahfouz AA, Abdelmoneim I et al 2008]. An estimated 300 million people worldwide suffer from asthma, with 250,000 annual deaths attributed to the disease WHO, 2007). Asthma is not just a public health problem for high income countries: it occurs in all countries regardless of level of development. Over 80% of asthma deaths occur in low and lower-middle income countries [WHO, 2006]. Asthma deaths will increase by almost 20% by 2020 if urgent action is not taken [WHO, 2006]. Despite the abundance of high-caliber medical services and the availability of international guidelines, recent studies have shown that the burden of asthma might be significantly higher than previously estimated [Rabe KF, Adachi M, Lai CK, Soriano JB et al 2004], [Abudahish A, Bella H. et al 2006]. Asthma is under-diagnosed and undertreated, creating a substantial burden to individuals and families and possibly restricting individuals' activities for a lifetime [WHO, 2006].

In Saudi Arabia, it is estimated that up to 11.5% of children are suffered from bronchial asthma [Al-Frayh AR et al.1992]. For reasons that remain unclear, the prevalence of bronchial asthma is increasing [El-Gamal FM et-

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al.1993]. In Taif city, western city in Saudi Arabia, the asthma prevalence rate among children was 13.1%, whereas smoking and a history of asthma in the family increased this rate [Fayez Hamam, Ahmed Eldalo, Ahmad Albarraq et al 2015]. Other researchers concluded that there was a significant increase in the prevalence of bronchial asthma in the Kingdom of Saudi Arabia every year (during the period 1986-1995) [A R Al Frayh; Z Shakoor; M O Gad El Rab; and S M Hasnain; 2001]. In United States, about 1 in 10 children (10%) had asthma in 2009 [Centers for Disease Control and Prevention, *Vital Signs*, May 2011]. In most parts of the world, asthma prevalence is continuing to increase or remaining stable [C. Anandan, U. Nurmatov, O. C. P. Van Schayck, A. Sheikh; 2009].

Asthma runs strongly in families and is about 50% due to genetic susceptibility and about 50% due to environmental factors [Palmer, L.J., Burton, P.R. et al. 2000]. Boys are consistently reported to have more prevalent wheeze and asthma than girls [Almqvist C, Worm M, Leynaert B; 2007].

Bronchial asthma in children is varying from region to region due to the variability of extrinsic allergens that play a major role in infection of susceptible children that lead to the disease [Al-Frayh AR et al.1992]. In a recent survey, 75 % of people said that cold air can trigger asthma symptoms [www.asthma.org.uk]. Change in weather, fluctuations in humidity and temperature, appear to influence emergency department visits for pediatric asthma [Nana Mireku, Yun Wang et al; 2009]. The exposure to air pollutants exacerbates the risk of asthma in children even at relatively low levels of exposure [Jong-Tae Lee, Ho Kim, Hoyin Song et al 2002]. Other investigators in Riyadh, Capital city in Saudi Arabia, revealed that dust of sand storm had no significant impact on acute asthma exacerbations in children [Abdullah A. Alangari, Muhammad Riaz; 2015]. Exercise-Induced Asthma is associated with impaired quality of life among children with asthma [Namiko Kojima, Yukihiro Ohya, Masaki Futamura et al 2009]. Bronchoconstriction of approximately 12-15% of the population associated with exercise can occur in nearly all individuals with asthma [Mahler DA; Section of Pulmonary and Critical Care Medicine, Dartmouth-Hitchcock Medical Center, 1993]. The exposure to environmental tobacco smoke in asthmatic children was higher than among healthy children, indicating that passive smoking may be a predisposing and/or aggravating factor for childhood asthma [S. Willers, E. Svenonius et al; 1991]. Prevalence rate for asthma in children with pets is twice that of children without pets [Bener A, al-Jawadi TQ, Ozkaragoz F, al-Frayh A, Gomes; 1993]. Pet-ownership was associated with increased respiratory symptoms [Bener A, al-Jawadi TQ, Ozkaragoz F, al-Frayh A, Gomes; 1993]. Children with pets had more frequent transient or intermittent asthma symptoms [M. Kerkhof, A. H. Wijga, B. Brunekreef et al; 2009].

In Saudi Arabia, few studies have been conducted so far to investigate the various aspects of this problem among children [El-Gamal FM et al 1993., Al-Frayh A et al.1992, Al-Frayh AR et al.1992].

This study was taken to assess the prevalence of asthmatic children in period from 2002 to 2006 and to figure out the most related risk factor to asthmatic children in Makkah.

## Methodology:

A retrospective review was done randomly for 150 patients less than 5 years of age admitted to Obstetrics and Gynecology Hospital (OGH) in Jarwal, Makkah, Saudi Arabia with complaints of fever, abdominal pain, vomiting, shortness of breath, cyanosis, anemia, skin infections and high blood sugar during the period from 2002 to 2006. We randomly picked out 30 patient's medical records for each year (2002 – 2006). The data were collected in 3 days from 22 – 24 / 4 / 2007. The study received approval from Institutional Review Board. Informed consent was obtained from the hospital. A questionnaire form was used to collect information from patient's medical records, including demographic data discharge diagnosis with other associated diseases. Patient's medical records were filtered according to inclusive and exclusive criteria. Inclusive criteria are Saudi and under 5 years old patients. Gender, family history, change in weather, dust, exercise, passive smoking and animal indoor were the main risk factors focused on it inside patient's medical record. Data were entered and analyzed using SPSS package (Release 10.01, 1999, Chicago, IL, USA). Descriptive statistics were performed as appropriate, including frequencies for variables, mean  $\pm$  standard deviation and cross tabulations. Statistical significance was set at  $p < 0.05$  throughout the analysis.

## Results:

First, 150 cases (30 each year) were randomly selected. Then of these 150 samples, 36 cases were asthmatic, and hence asthma prevalence rates among Saudi children less than 5 years of age was 24% (table 1.1).

The original distribution of Male: Female in Makkah is 1:1. The total number of Asthmatic cases in our sample is 36. During the period 2002 to 2006, we found that males are more faced to Asthma than females in which 22 out of 36 cases are males and 14 out of 36 are females. It means 61.1% males and 38.9% are females (Table 1.2). That reflects males are more likely to be affected by Asthma than females.

We noticed that the prevalence of asthma among Saudi children in Makkah increases by time (Table 1.3). We randomly picked out 30 patient's medical records for each year (2002 – 2006). At 2002, 5 cases out of 30 cases are asthmatic (16.6%). At 2003, 6 cases out of 30 cases are asthmatic (20%). At 2004, 8 cases out of 30 cases are asthmatic (26.6%). At 2005, 6 cases out of 30 cases are asthmatic (20%). At 2006, 11 cases out of 30 cases are asthmatic (36.6%). So totally, Prevalence of Asthma among Saudi Children increases every year in Makkah.

Within the period of 2002 – 2006, family history factor was positive in 9 cases (25% of cases). (Table 2.1 a). Change in weather factor was positive in 10 cases (27.8% of cases). (Table 2.1b). Dust factor was positive in 16 cases (44.4% of cases) (Table 2.1c). Exercise factor was positive in 8 cases (22.2% of cases) (Table 2.1d). Passive smoking factor was positive in 2 cases (5.6% of cases) (Table 2.1e). Indoor animal (Pets) factor was positive in 6 cases (16.7% of cases) (Table 2.1f).

### 1.1 Prevalence of asthma. 36 out of 150 cases (24%) are asthmatic children.

	Frequency	Percent
Asthma	36	24.0
Other	114	76.0
Total	150	100.0

### 1.2. Male: Female ratio. 61.1% of asthmatic children are males, 38.9% are females.

		Frequency	Percent
Valid	Male	22	61.1
	Female	14	38.9
	Total	36	100.0

### 1.3 Year prevalence. Asthmatic cases recorded the least percentage in 2002 (16.6%) and the highest in 2006 (36.6%). 20% of cases was recorded in 2003 and 2005. In 2004, 26.6% of cases was recorded.

Year		Count	Asthma	Total
	2002	Count	5	30
		% within Disease	16.6%	20%
	2003	Count	6	30
		% within Disease	20%	20%
	2004	Count	8	30
		% within Disease	26.6%	20%
	2005	Count	6	30
		% within Disease	20%	20%
Total	2006	Count	11	30
		% within Disease	36.6%	20%
		Count	36	150
		% within Disease	100.0%	100.0%

### 2.1a Family history. 9 cases (25%) are with positive family history.

		Disease
		asthma
Family history	Yes	Count
		9
	No	% within cases
		25%
	No	Count
		27
		% within cases
		75%

**2.1b Change in weather. 10 cases (27.8%) are with positive relation to change in weather.**

			Disease
			asthma
Change in Weather	Yes	Count	10
		% within cases	27.8%
	No	Count	26
		% within cases	72.2%

**2.1c Dust. 16 (44.4%) cases are with positive relation to dust.**

			Disease
			asthma
Dust	Yes	Count	16
		% within cases	44.4%
	No	Count	20
		% within cases	55.6%

**2.1d Exercise. 8 (22.2%) cases with positive relation to exercise.**

			Disease
			asthma
Exercise	Yes	Count	8
		% within cases	22.2%
	No	Count	28
		% within cases	77.8%

**2.1e Passive smoking. 2 (5.6%) cases are with positive relation to passive smoking.**

			Disease
			asthma
Passive smoking	Yes	Count	2
		% within cases	5.6%
	No	Count	34
		% within cases	94.4%

**2.1f Pets. 6 (16.7%) cases are with positive relation to pets.**

			Disease
			asthma
Pets	Yes	Count	6
		% within cases	16.7%
	No	Count	30
		% within cases	83.3%

**Discussion:**

This retrospective study has clearly shown that there is overall increase in the prevalence of asthmatic children in Makkah. The prevalence of 24% is relatively high compared with AlFrayh's study and Fayeze Hamam's study [Al-Frayh AR et al.1992],[Fayeze Hamam, Ahmed Eldalo, Ahmad Albarraq et al 2015]. This 24% of asthmatic children in Makkah is also more than the prevalence of asthmatic children in United States. The study concurs with the study of A R AlFrayh [A R Al Frayh; Z Shakoor; M O Gad El Rab; and S M Hasnain; 2001] in which the prevalence of asthma among Saudi children is increasing every year. Also, the study concurs with Almqvist's study [Almqvist C, Worm M, Leynaert B; 2007] in which males are more susceptible to have asthma than females. Although 50% of asthmatic children have family history [Palmer, L.J., Burton, P.R. et al. 2000], our study revealed 25% which is less than that in Palmer's study. Despite weather change triggers asthmatic symptoms and influence pediatrics to visit emergency department [www.asthma.org.uk], [Nana Mireku, Yun Wang et al; 2009], our study revealed that only 27.8% of asthmatic children visit emergency department due to change in weather. According to Alangari's study, there is no significant relation between dust and asthma [Abdullah A. Alangari, Muhammad Riaz; 2015]. Otherwise, our study revealed that 44.4% of asthmatic children triggered by dust. Bronchoconstriction associated with exercise

of approximately 22.8% asthmatic children is relatively high compared with Mahler's study [Mahler DA; Section of Pulmonary and Critical Care Medicine, Dartmouth-Hitchcock Medical Center, 1993]. Asthma associated with passive smoking of approximately 5.6% asthmatic children is relatively low compared with S. Willers's study [S. Willers, E. Svenonius et al; 1991]. 10.7% of asthmatic children triggered by pets is relatively low compared with Bener A's study [Bener A, al-Jawadi TQ, Ozkaragoz F, al-Frayh A, Gomes; 1993].

There are a number of limitations that need to be considered, of which the data taken from only one hospital and the sample size was very small. To overcome these limitations, a larger study that excludes all the limitations should follow.

In conclusion, the prevalence of asthma among Saudi children in Makkah is higher than those reported from the neighboring cities and other countries. Males are more susceptible to asthma than females. Dust was the most common risk factor triggering asthmatic children in Makkah. Passive smoking was the less common risk factor related to asthmatic children. Further studies including large sample size and more than one hospital are required.

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### References:

1. El-Gamal FM et al. Epidemiology of bronchial asthma. *Saudi medical journal*, 1993, 14:419-23.
2. WHO website.
3. www.asthma.org.uk website.
4. Al-Frayh A et al. Prevalence of asthma among Saudi children. *Saudi medical journal*, 1992, 13:521-4.
5. Asher I, Pearce N; Global burden of asthma among children; 2014.
6. Lee DA et al. Prevalence and spectrum of asthma in childhood. *British medical journal*, 1983, 286:1256-8.
7. Anderson HR et al. Medical care of asthma and wheezing illness in children: a community survey. *Journal of epidemiology and community health*, 1983, 37:180-6.
8. Al-Frayh AR et al. A comparative study of immediate skin test reacting to inhalant allergens in asthmatic children of two different regions in Saudi Arabia. *Annals of Saudi medicine*, 1992, 12:468-71.
9. Mahler DA; Section of Pulmonary and Critical Care Medicine, Dartmouth-Hitchcock Medical Center, 1993
10. Al-Frayh AR. The pattern of skin test reactivity to aeroallergens in asthmatic children in Riyadh. *Journal of asthma*, 1990, 27:315-9.
11. Bener A et al. Heredity of asthma in Saudi population. *European journal of epidemiology*, 1992, 8:733-6.
12. Al-Frayh AR et al. Parental smoking and the risk of childhood asthma. *Journal of asthma*, 1991, 28:281-6.
13. Al-Frayh AR. Asthma patterns in Saudi Arabian children. *Journal of the Royal Society of Health*, 1990, 110:98-100.
14. Al-Moamary MS, Alhaider SA et al; The Saudi initiative for asthma–2012 update: guidelines for the diagnosis and management of asthma in adults and children. *Ann Thoracic Med*; 2012.
15. Al-Frayh AR et al. Epidemiology of asthma and allergic rhinitis in two coastal regions of Saudi Arabia. *Allergie et immunologie*, 1989, 21:389-93.
16. Al-Frayh AR. IGE-mediated skin reaction among asthmatic children in Riyadh. *Annals of Saudi medicine*, 1991, 11:448-51.
17. Al-Ghamdi BR, Mahfouz AA, Abdelmoneim I, Khan MY, Daffallah AA. Altitude and bronchial asthma in south-western Saudi Arabia. *East Mediterr Health J* 2008;14:17-23.
18. Rabe KF, Adachi M, Lai CK, Soriano JB, Vermeire PA, Weiss KB, et al. Worldwide severity and control of asthma in children and adults: The global asthma insights and reality surveys. *J Allergy Clin Immunol* 2004;114:40-7.
19. Abudahish A, Bella H. Primary care physicians perceptions and practices on asthma care in Aseer region, Saudi Arabia. *Saudi Med J* 2006;27:333-7.
20. Alamoudi O. Prevalence of respiratory diseases in hospitalized patients in Saudi Arabia: A 5 years study 1996-2000. *Ann Thorac Med* 2006;1:76-80.



21. Colver AF. Underdiagnosis and undertreatment of asthma in childhood. *Br Med J (Clin Res Ed)* 1983;286:1511-2.
22. Speight AN, Lee DA, Hey EN. Underdiagnosis and undertreatment of asthma in childhood. *Br Med J (Clin Res Ed)* 1983;286:1253-6.
23. Al-Jahdali HH, Al-Hajjaj MS, Alanezi MO, Zeitoni MO, Al-Tasan TH. Asthma control assessment using asthma control test among patients attending 5 tertiary care hospitals in Saudi Arabia. *Saudi Med J* 2008;29:714-7.
24. Kalyoncu AF et al. Prevalence of childhood asthma and allergic diseases in Ankara, Turkey. *Allergy*, 1994, 49:485-8.
25. Bazhner RL et al. Immunity, allergy and related diseases. In: Behrman RE et al., eds. *Nelson textbook of pediatrics*, 14th ed. Philadelphia, WB Saunders Company, 1992:545-610.
26. Heggie AC et al. Air quality monitoring in the new industrial city of Jubail, Saudi Arabia. In: Brasser LJ, Mulder WC, eds. *Man and ecosystem. Proceedings of the 8th World Clean Air Congress, September 11-15 1989*. The Hague, Netherlands, Johor Bahru, 1989:49-54.
27. Gregg I. Epidemiological research in asthma: the need for a broad perspective. *Clinical allergy*, 1986, 16:17-23.
28. Bennis A et al. Prevalence de l'asthme de l'adolescent à Rabat. Enquete dans les établissements de l'enseignement secondaire. [The prevalence of adolescent asthma in Rabat. A survey conducted in secondary schools.] *Revue des maladies respiratoires*, 1992, 9:163-9.
29. Williams H, McNicol KN. Prevalence, natural history, and relationship of wheezy bronchitis and asthma in children. An epidemiological study. *British medical journal*, 1969, 4:321-5.
30. Dales RE et al. Respiratory health of a population living downwind from natural gas refineries. *American review of respiratory disease*, 1989, 139:595-600.
31. Grodfrey RC. Asthma and IgE levels in rural and urban communities of the Gambia. *Clinical allergy*, 1975, 5:201-7.
32. Holmgren D et al. Childhood asthma in a rural country. *Allergy*, 1989, 44:256-9.
33. Anderson HR. The epidemiological and allergic features of asthma in the New Guinea highlands. *Clinical allergy*, 1974, 4:171-83.
34. Waite DA et al. Asthma prevalence in Tokelauan children in two environments. *Clinical allergy*, 1980, 1:71-5.
35. Fayez Hamam, Ahmed Eldalo, Ahmad Albarraq, Mohammad Khaleel, Yahya Kaabi, Adel Al Ghamdi, Yahya Al Faifi, Saleh Al Qarni, Abdullah Al Harbi, 2015.
36. C. Anandan, U. Nurmatov, O. C. P. Van Schayck, A. Sheikh; 2009.
37. Fagbule D, Ekanem EE. Some environmental risk factors for childhood asthma: a case-control study. *Annals of tropical paediatrics*, 1994, 14:15-9.
38. Stachan DP et al. A national survey of asthma prevalence, severity and treatment in Great Britain. *Archives of disease in childhood*, 1994, 7:174-8.
39. Salome CM et al. Bronchial hyperresponsiveness in two populations of Australian school boys. I. Relation to respiratory symptoms and diagnosed asthma. *Clinical allergy*, 1987, 17:271-81.
40. Liard R et al. Prevalence of asthma among teenagers attending school in Tahiti. *Journal of epidemiology and community health*, 1988, 42:149-51.
41. Clifford RD et al. Prevalence of respiratory symptoms among 7 and 11 year old schoolboys and association with asthma. *Archives of disease in childhood*, 1989, 64:1118-25.

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### RESEARCH ARTICLE

## ARGINASE ENZYME ACTIVITY AND LACTOFERRIN PROTEIN CONCENTRATION IN EGYPTIAN DIABETIC PATIENTS.

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#### Abstract

**Purpose:** This work has been carried out to evaluate the arginase activity and lactoferrin (LF) level as biochemical markers in type 2 diabetic Egyptian.

**Subjects and Methods:** The present study consisted of 84 patients classified into three groups: Uncontrolled diabetic patients [G1], Control diabetic patients [G2], Normal healthy subjects [G3]. Lactoferrin concentration was measured using ELISA technique. Arginase and other biochemical parameters were measured by using Jenway 6105 uv/vis spectrophotometer. Finally, all the results were statistically analyzed and compared with normal subjects [G3].

**Results:** The mean sera value of both arginase and LF was found to be elevated in uncontrolled type 2 diabetic patient group [G1] and controlled type 2 diabetic patient group [G2] compared to normal healthy group [G3].

**Conclusion:** Both arginase and LF are considered as good biomarkers for diagnosis of type 2 diabetes and for detection of the best and most effective method for the treatment.

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#### Introduction:-

Diabetes is defined as a chronic metabolic disorder characterized by a dysfunction in insulin secretion and/or insulin action, also known as hyperglycemia, and is divided into type 1 diabetes mellitus, type 2 diabetes mellitus (T2DM), and gestational diabetes mellitus (GDM) [1]. Diabetes is defined by the WHO that a plasma glucose >200 mg/dl, a fasting plasma glucose of >126 mg/dl [2].

Arginase is the fifth and final step in the urea cycle. It converts L- arginine into ornithine and urea (9). Although the function of the arginase enzyme in the liver is the catalysis of arginine hydrolysis to ornithine and urea, in extrahepatic tissues the function of the enzyme is essentially unknown. Normal blood serum contains only trace of arginase. However, in some pathological conditions, especially in various types of cancer, the elevated activity levels of arginase enzymes in the serum have been reported in many studies [3].

Lactoferrin is an iron-binding diferric glycoprotein present in most of the exocrine secretions. The major role of lactoferrin, which is found abundantly in colostrum, is antimicrobial action for the defense of mammary gland and

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the neonates. Lactoferrin consists of two equal halves, designated as N-lobe and C-lobe, each of which contains one iron-binding site. While the N-lobe of lactoferrin is known for its enhanced antimicrobial effect, the C-lobe of lactoferrin mediates various therapeutic functions which are still being discovered. The potential of the C-lobe in the treatment of diabetes has been indicated [4].

### **Objective:-**

The aim of this project is to clarify the relation between LF and arginase by indicating the effect of LF in diabetic patients which is counter and handling to the effect of arginase. Also, to evaluate the arginase activity and lactoferrin protein concentration levels in diabetic patients and to detect whether these parameters can be used to improve the clinical assessment of diabetes mellitus and considered as biomarkers for monitoring, the progression and recurrence of diabetes mellitus. In addition, the work aims to assess the role of these parameters in monitoring diabetes mellitus therapy and detect the best and most effective method for the treatment.

### **Material and Methods:-**

#### **Patients:-**

The present study consisted of subjects of 84 patients. They were classified into three groups: Untreated Type 2 Diabetes group [G1]: consisting of 32 type 2 diabetic patients, the duration of disease ranged from (15 months-96 months). Treated type 2 diabetes group [G2]: consisting of 32 type 2 diabetic patients treated with tablets (Gliclazide), and duration of disease ranged from (24-120) years. Normal healthy subjects group [G3]: consisting of 20 normal healthy persons. All groups included in this study were matched in age, BMI and gender. They free from heart diseases, muscle disorders and liver diseases.

#### **Biochemical Measurements:-**

All biochemical parameters including serum creatinine, liver enzymes as (ALT) and (AST) and random blood glucose were determined by using Jenway 6105 uv/visspectrophotometer. The method used for the determination of arginase activity was based on the colorimetric determination of urea by condensation with diacetylmonoxime in an acid medium in the presence of ferric chloride (oxidant) and carbazide (accelerator) using Jenway 6105 uv/vis spectrophotometer.

Lactoferrin, LF, level was measured using ELISA technique. This assay employed a quantitative sandwich enzyme immunoassay technique, which measured LF in 5 hours. A monoclonal antibody specific for human LF had been pre-coated onto a microplate. Human LF in standards and samples was sandwiched by the immobilized antibody and biotinylated polyclonal antibody specific for human LF, which was recognized by a streptavidin-peroxidase conjugate. All unbound material was then washed and a peroxidase enzyme substrate was added. The color development was stopped and the intensity of the color was measured.

#### **Statistical Analysis:-**

The data were evaluated with One Way ANOVA used to declare the significant difference between groups at  $p < 0.05$ . Duncan multiple comparisons test at  $p < 0.05$  was used to declare the significant difference between each two groups. Both tests used to compare both serum arginase activity and serum lactoferrin concentration in different studied groups where significant values represented by ( $P < 0.05$ ) while non-significant values represented by ( $P > 0.05$ ).

### **Results:-**

The range of serum arginase activity in uncontrolled diabetic type 2 patients group (G1) was (86.30-141.80 U/L), with a mean  $\pm$  SD  $[114.49 \pm 14.82]$  U/L. The range of serum arginase activity in controlled diabetic type 2 patients group (G2) was (43.50-70.70 U/L), with a mean  $\pm$  SD  $[56.07 \pm 8.71]$  U/L. The range of serum arginase activity in normal healthy subjects (control group) (G3) was (10.90-33.50 U/L), with a mean  $\pm$  SD  $[21.77 \pm 6.51]$  U/L. The range of serum LF concentration in uncontrolled diabetic type 2 patients group (G1) was (40.20-67.50 ng/ml), with a mean  $\pm$  SD  $[52.35 \pm 6.75]$  ng/ml. The range of serum LF concentration in controlled diabetic type 2 patients group (G2) was (29.90-48.50 ng/ml), with a mean  $\pm$  SD  $[39.73 \pm 4.05]$  ng/ml. The range of serum LF concentration in normal healthy subjects (control group) (G3) was (9.70-19.10 ng/ml), with a mean  $\pm$  SD  $[14.01 \pm 3.00]$  ng/ml. Statistical analysis using ANOVA test revealed that significant elevation in the mean levels of both serum arginase activity and lactoferrin concentration in uncontrolled diabetic type 2 patients group (G1) compared to controlled diabetic type 2 patients group (G2) and normal healthy subjects (G3). Significant elevation in mean values of serum

arginase activity was found in controlled diabetic type 2 patients group (G2) compared to normal healthy subjects (control group) (G3) as shown in table (1).

In uncontrolled type 2 diabetic patient group (Group 1), there is correlation between arginase and urea at  $P (<0.01)$  and  $r = (0.909)$ . The correlation of LF and total cholesterol, triglycerides, HDL and LDL –cholesterol in both diabetic groups are shown in table(2) and table(3).

### Discussion:-

The present study may consider a link between the effect of serum arginase activity and serum lactoferrin concentration in one study for diabetes mellitus disease. We showed in this study that there is inverse relation between the effect of both arginase activity and lactoferrin concentration on Egyptian diabetic patients, where elevation of serum arginase activity in type 2 diabetes causing vascular dysfunction may as a result of decreasing insulin level and elevation of ROS at the same time serum lactoferrin concentration start to raise as immune response to counteract the inflammation that result from elevation of arginase and ROS.

This may be explained by hyperglycemia or insulin resistance in that appears to be involved in the widespread induction of arginase observed in diabetes as exposure of vascular cells to high concentrations of glucose triggers a rise in arginase activity. Consequently, Egyptian diabetic patients will have a weakened immune resulting from the hyperglycemia and decreasing insulin signaling which has anti-inflammatory effect, as a result the Egyptian diabetic patients will be exposed to inflammation and cell damage that cause increasing of oxidative stress as increasing ROS that cause vascular dysfunction and inducing the immune system yielding some signals, and some pathways that stimulate increasing serum arginase activity. Also, elevation of serum arginase level in control diabetic patient Egyptian begin to decrease somewhat due to controlling glucose levels by handling with tablets or exogenous insulin by syringe which modulate the immune system through adjusting the insulin level by its action as anti-inflammatory and restoring the elasticity of vascular cells.

**Table 1:-** Biochemical Data in Patient and Control Groups

Groups Biochemical Data	Uncontrolled Diabetic Type 2 Patients (G1)	Control Diabetic Type 2 Patients (G2)	Normal Subjects (G3)
Serum Arginase Activity (U/L)	<b>114.49 ±14.82<sup>c</sup></b>	<b>56.07 ±8.71<sup>b</sup></b>	<b>21.77±6.51<sup>a</sup></b>
Serum Lactoferrin Concentrations (ng/ml)	<b>52.35±6.75<sup>c</sup></b>	<b>39.73±4.05<sup>b</sup></b>	<b>14.01±3.00<sup>a</sup></b>
Serum Urea Concentration (mg/dl)	<b>54.51 ± 6.68<sup>b</sup></b>	<b>53.57 ± 5.29<sup>b</sup></b>	<b>17.70 ± 4.35<sup>a</sup></b>
Serum T.Cholesterol Concentration (mg/dl)	<b>239.52±9.32<sup>c</sup></b>	<b>215.85±4.31<sup>b</sup></b>	<b>114.67±2.95<sup>a</sup></b>
Serum Triglycerides Concentration (mg/dl)	<b>183.15 ± 2.69<sup>c</sup></b>	<b>172.30 ± 1.92<sup>b</sup></b>	<b>75.23 ± 0.87<sup>a</sup></b>
Serum HDL Cholesterol Concentration (mg/dl)	<b>28.29±1.50<sup>a</sup></b>	<b>32.24±1.41<sup>b</sup></b>	<b>42.77±2.39<sup>c</sup></b>
Serum LDL Cholesterol Concentration (mg/dl)	<b>175.16±10.83<sup>c</sup></b>	<b>149.16±5.10<sup>b</sup></b>	<b>56.84±5.15<sup>a</sup></b>

Data are presented by Mean±SD for Arginase activity, Lactoferrin, Urea, Cholesterol, Triglycerides, HDL and LDL Cholesterol concentrations.

\*= There is a significant difference by using One Way ANOVA at  $p < 0.05$ .

The same letter means that there is no significant difference between the two groups by using Duncan multiple comparison test at  $p < 0.05$ .

The different letters mean that there is a significant difference between the two groups by using Duncan multiple comparison test at  $p < 0.05$

**Table 2:-**Correlation of lactoferrin concentration with lipid profile in group (G1).

Lipid profile	r	P- value
Serum T. Cholesterol Concentration (mg/dl)	<b>0.596</b>	<b>P (&lt;0.01)</b>
Serum Triglycerides Concentration (mg/dl)	<b>0.978</b>	
Serum HDL Cholesterol Concentration (mg/dl)	<b>-0.932</b>	
Serum LDL Cholesterol Concentration(mg/dl)	<b>0.630</b>	

**Table 3:-**Correlation of lactoferrin concentration with lipid profile in group (G2).

Lipid profile	r	P- value
Serum T. Cholesterol Concentration (mg/dl)	<b>0.704</b>	<b>P (&lt;0.01)</b>
Serum Triglycerides Concentration (mg/dl)	<b>0.888</b>	
Serum HDL Cholesterol Concentration (mg/dl)	<b>-0.962</b>	
Serum LDL Cholesterol Concentration(mg/dl)	<b>0.978</b>	

While most studies have focused on the coronary circulation and large conduit blood vessels, the role of arginase in mediating diabetic endothelial dysfunction in other vascular beds has not been fully investigated [5].

In this study, there is a correlation between arginase and urea at  $P (<0.01)$ . Diabetes was accompanied by increased food consumption, amino acid metabolism, and ratio of blood glucagon to insulin, all of which would tend to increase urea cycle and arginase activity [6]. Arginase, which is present in two isoforms catalyzes the final step of the urea cycle yielding L-ornithine and urea from L-arginine [7]. It was demonstrated that elevated levels of arginase and lower serum arginine levels are associated with increased urea production by RBCs from DM patients might have a negative impact on the functionality of vascular endothelial cells to impair NO synthesis by endothelial cells [8]. The deamination of amino acids reaction was catalyzed by many enzymes and excreted in the form of urea in diabetes. The increase in activity of liver arginase in diabetes may be a response to this high rate of protein catabolism [9].

Lactoferrin is stored in secondary granules of neutrophils and is released in response to activation of proinflammatory cytokines such as TNF- $\alpha$ , IL-6, and IL-8. The serum level of lactoferrin, which is very low in the physiological state, increases significantly with infection. By studying the results of serum LF concentration in Egyptian diabetic patients with type 2, it was shown that diabetic patients (uncontrolled and control patients) may be accompanied with complications like inflammation as a result of elevation of arginase level and ROS which lead to secretions of LF from neutrophils with higher levels as immune response and that may be explained by deficiency in secretion of insulin from pancreas or low efficiency of insulin effect on the target cells comparing to healthy subjects. As LF has anti-inflammatory effect and its secretion is one of the immune response processes, it was noted that, elevation of LF levels could decrease serum arginase activity by increasing the production of NO at the same time decreasing levels of ROS which cause vascular dysfunction in response to cytokines.

LF elevation may be due to inflammation accompanied to diabetes complication that result from elevation of serum arginase activity and ROS levels. Also, elevation of lipid profile may explain this elevation in lactoferrin concentration. Our results observed that there is correlation between lactoferrin, cholesterol, triglycerides (TG), HDL cholesterol and LDL cholesterol at ( $P < 0.01$ ) in non-control diabetic group (Group 1), control diabetic group (Group 2) and normal healthy subject (Group 3). Also, our study about the diabetic Egyptian patients showed that there was significant difference between each two groups of this experiment represented by  $P (<0.05)$ .

The anti-inflammatory effect of lactoferrin takes place by suppression of  $\text{TNF-}\alpha$  and  $\text{IL-1}\beta$ , which were activated in TNB-Induced colitis. The inhibitory effect of lactoferrin on proinflammatory cytokines suggested that lactoferrin released from secondary granules of activated neutrophils at an inflammatory site may provide an inhibitory feedback mechanism to prevent excessive neutrophil aggregation and activation [10].

Improving insulin action [by the administration of insulin or an insulin-sensitizer as rosiglitazone] could increase lactoferrin production and improve the neutrophil function. Insulin under strict euglycemia was able to prime neutrophil function in adult healthy humans and modulates neutrophil activity not only by gaining a better metabolic control but also through a direct effect of the hormone. Thus, improved insulin action might act as an immunoregulatory agent to turn immune cells to a primed state, which prepared the cell for a greater immune response and increased cytokine secretion. Increased insulin action or sensitivity would allow a more balanced neutrophil response, increasing the efficiency of the immune system [11].

The concentration of circulating lactoferrin was significantly decreased in individuals with an altered glucose tolerance and might contribute to dyslipidemia. In addition, the circulating lactoferrin concentration was linked to the plasma lipid profile where it was demonstrated the effect of lactoferrin as antiatherosclerosis by reducing the plasma and hepatic concentrations of cholesterol and triglycerides in mice and increased plasma concentrations of HDL cholesterol [12]. However, it was observed that concentration of lactoferrin was lower in diabetic patients as compared to control group [13]. On the other hand, it was explored that no difference in lactoferrin was found among the patients with non-insulin-dependent diabetes mellitus (NIDDM) group and healthy controls group [14].

Experimental studies in cells demonstrated that lactoferrin significantly inhibited/decreased intracellular reactive oxygen species (ROS) levels in a dose-dependent manner and protected from oxidative stress. As FFA produce an increase in oxidative stress, the putative decrease of FFA induced by lactoferrin could also contribute. In fact, different protective functions against inflammation have been attributed to lactoferrin, and the preservation of adipose tissue integrity and the associations with lactoferrin with CRP and antioxidant enzymes may be interpreted in this scenario. It was found that lactoferrin led to decreased TG concentration in adipose tissue explants [15].

Our experimental results for elevation of lactoferrin concentration in uncontrolled diabetic patient group (group 1) are in agreement with [16] using ELISA and [17] who found a significant increase in the concentration of lactoferrin in NIDDM in comparison to control group. It was found that significant increases in the concentration of lactoferrin in the diabetic subjects (30%) in comparison with (17%) of healthy subjects suggesting that disease-specific mechanisms might be responsible and these increased concentrations may reflect neutrophil priming caused by hyperglycemia.

Lactoferrin also directly interacted with modified LDL to prevent its interaction with scavenger receptors. A region rich in basic amino acid residues near the lactoferrin N terminus is responsible for the interaction with acetylated or oxidized LDL. This cationic part of lactoferrin strongly binds modified LDLs via electrostatic interaction with positively charged Arg residues at physiological pHs [12].

The mechanism of LF action might involve several processes, such as inhibition of adipogenesis, decrease of dietary triglyceride absorption, elevation of HDL cholesterol possessing anti-atherogenic properties, inhibition of accumulation of oxidized LDL cholesterol forms in macrophages and protection against formation of foam cells. LF also increased the susceptibility of cells to insulin action, including in conditions when the response to insulin was lowered (during inflammation). LF was a promising, completely nontoxic, natural remedy which might be applied in long-term prophylaxis and therapy of metabolic disturbances, such as insulin resistance/type II diabetes [18].

It was shown that circulating lactoferrin concentration was inversely associated with fasting triglyceride concentration ( $r = -0.24$ ;  $P = 0.001$ ), body mass index (BMI) ( $r = -0.20$ ;  $P = 0.007$ ), waist-to-hip ratio ( $r = -0.35$ ;  $P < 0.001$ ), and fasting glucose concentration ( $r = -0.18$ ;  $P = 0.01$ ), and directly correlated with HDL cholesterol concentration ( $r = 0.21$ ;  $P = 0.004$ ) [11] and [12].

The increase of lactoferrin was favorably associated with lipid levels and parameters of oxidative stress and inflammation. Lactoferrin had been described to inhibit selective uptake of HDL-cholesterol esters by 35–50% in human primary adipocytes and SW872 liposarcoma cells. By inhibiting HDL uptake, lactoferrin could lead to preservation of HDL-cholesterol levels after fat overload. This action seemed to be mediated by the interaction of

lactoferrin with low-density lipoprotein-related protein. Low-density lipoprotein-related protein contributes physiologically to HDL-cholesterol selective uptake in adipocytes. Lactoferrin would also inhibit the interaction of lipoprotein lipase with low-density lipoprotein-related protein[15].

So our results can conclude that elevation of serum LF concentration may play an important role in returning the immunity balance to the prime state by its action in recurrence of immunity of diabetic patients especially the vascular dysfunction which represents the main problem of Egyptian diabetic patients that result from elevation of serum arginase. Detection of both arginase activity and lactoferrin concentration may act as new parameters to evaluate the sequel of the diabetes especially concerning the major and minor vasculopathy in Egyptian diabetic patients. Also, in the future research in the pharmacology field, we can use these results for arginase activity and LF concentration as a target for controlling the diabetes complications.

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### Reference:-

1. **You H., Bo P., Sunmin P., Sung-Hoon K. (2011):** A Comparative Study of Eating Habits and Food Intake in Women with Gestational Diabetes according to Early Postpartum Glucose Tolerance Status. *Diabetes Metab. J.*, 35:354-363.
2. **Britney G., Mary S., James T., Lily W., Phil D., Joy J., Pamela F., Priyaanka N., George E., and Thomas A. (2010):** Genome-Wide Analysis of Copy Number Variation in Type 1 Diabetes. *Plos One*, 5(11): 1-8.
3. **Wu G and Morris SM. (1998):** Arginine metabolism: nitric oxide and beyond. *The Biochemical Journal* 336 (Pt1): 1-17.
4. **Sharma S, Sinha M, Kaushik S, Kaur P, Singh TP. (2013):** C-lobe of lactoferrin: the whole story of the half-molecule. *Biochem. Res. Int.*, 2013:271641.
5. **Fruzsina J., Robert J., Kelly P., Ahmad S. and William D. (2013):** Arginase promotes skeletal muscle arteriolar endothelial dysfunction in diabetic rats. *Immunology*, 4(119): 1-7.
6. **Jelodar G, Razmi N, Gholampour V. (2007):** Arginase alteration in the reproductive system of alloxan-diabetic dogs. *J. Reprod. Dev.*, 53(2):317-321.
7. **Jochen S., Daniel N., and Dan B. (2013):** Development of novel arginase inhibitors for therapy of endothelial dysfunction. *Immunology*, 4(278): 1-6.
8. **Serafin R.-Z., Miguel M.-R., Marisela O., Lourdes S.-S., Miguel Q.-Q., Norberto G.-G., Rolando H.-M. (2013):** Increased Erythrocytes By-Products of Arginine Catabolism Are Associated with Hyperglycemia and Could Be Involved in the Pathogenesis of Type 2 Diabetes Mellitus. *PLOS ONE*, 8 (6):e66823.
9. **Salimuddin, Kailash U., and Najma B. (1999):** Effects of Vanadate on Expression of Liver Arginase in Experimental Diabetic Rats. *IUBMB Life*, 48: 237-240.
10. **Jun-Ichi T., Hajime N., Katsuaki T., Masahiko I., Tadashi U., Atsushi N., Makoto N., Shinobu S., Toshifumi S., and Hisahiko S. (2002):** Lactoferrin reduces colitis in rats via modulation of the immune system and correction of cytokine imbalance. *Am. J. Physiol. Gastrointest. Liver Physiol.*, 283: G187-G195.
11. **Moreno-Navarrete J. M., Ortega F.J., Bassols J., Ricart W., and Fernández-Real J. M. (2009):** Decreased Circulating Lactoferrin in Insulin Resistance and Altered Glucose Tolerance as a Possible Marker of Neutrophil Dysfunction in Type 2 Diabetes. *J. Clin. Endocrinol. Metab.*, 94: 4036-4044.
12. **Jose´ M.-N., Francisco O., Judit B., Antoni C., Wifredo R., and Jose´ F.-R. (2008):** Association of Circulating Lactoferrin Concentration and 2 Nonsynonymous LTF Gene Polymorphisms with Dyslipidemia in Men Depends on Glucose-Tolerance Status. *Clinical Chemistry*, 54(2):301-309.
13. **Beata N., Marcin F., Tomasz K., Maja K., Micha Z. (2010):** Lactoferrin inhibits the growth of nasal polyp fibroblasts. *Pharmacological Reports*, 62: 1139-1147.
14. **Ben-Aryeh H., Serouya R. Kanter Y., Szargel R., and Laufer D. (1993):** Oral health and salivary composition in diabetic patients. *J. Diabetes Complications*, 7(1):57-62.
15. **José F., Eduardo G.-F., José M.-N., Mora M.-P., Lourdes G.-S., Wifredo R., and Francisco T. (2010):** Fat Overload Induces Changes in Circulating Lactoferrin That Are Associated with Postprandial Lipemia and Oxidative Stress in Severely Obese Subjects. *Obesity*, 18: 482-488.
16. **Dodds M.W., Yeh C.K., and Johnson D.A. (2000):** Salivary alterations in type 2 (non-insulin dependent) diabetes mellitus and hypertension. *Community Dent. Oral Epidemiol.*, 28(5): 373-381.
17. **Vengen I.T., Dale A.C., Wiseth R., Midthjell K., and Videm V. (2010):** Lactoferrin is a novel predictor of fatal ischemic heart disease in diabetes mellitus type 2: long-term follow-up of the HUNT1 study. *Atherosclerosis*, 212(2): 614-620.
18. **Artym J. (2012):** A remedy against obesity? The role of lactoferrin in the metabolism of glucose and lipids. *Postepy. Hig. Med. Dosw. (Online)*, 66:937-953.



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### RESEARCH ARTICLE

#### DIABETES MELLITUS AMONG ADULT MALE POPULATION OF ARAR CITY, NORTHERN SAUDI ARABIA.

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Arar city; prevalence; Diabetes Mellitus; adult males; risk factors; Saudi Arabia.

#### Abstract

**Background:** There is increase in the prevalence of diabetes in Saudi Arabian population, due to significant changes in cultural factors, in addition to changes in dietary habits and socio-economic factors in addition to the high prevalence of physical inactivity.

**Objective:** The aim of this study is to measure the prevalence of Diabetes Mellitus, and to identify some of the associated risk factors in adult educated and employed males of Arar city, Northern Saudi Arabia.

**Participants and methods:** A cross-sectional study was carried out in Arar city, during the period from January to February 2016. A total of 325 educated and employed male Saudi nationals aged  $\geq 30$  years were included in the study. Data were collected by means of personal interview with the participants using a predesigned questionnaire covering the medical history of diabetes, age, family history of diabetes and physical activity. Anthropometric examination included height and weight measurements and calculation of body mass index (BMI). Blood sample is drawn under complete aseptic conditions to determine random blood glucose level. Person considered diabetic if random blood sugar was  $\geq 200$  mg/dl.

**Results:** The prevalence of Diabetes Mellitus among adult educated and employed males of Arar city was 14.8 %. There is high statistically significant difference between different age groups of the participants as regard diabetes (P value  $< 0.001$ ) but there is no statistically significant difference between obese and non obese (P value  $> 0.05$ ). There is also highly significant relation between the family history of diabetes and diabetes (P value  $< 0.001$ ). Diabetes was found in 17.8% and 9.8% of physically inactive and physically active participants respectively and there is statistically significant relation between diabetes and physical activity (P value  $< 0.05$ ).

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**Conclusion and recommendations:** The prevalence of diabetes is relatively high among the male Arar city, Northern Saudi Arabia population and represents a major clinical and public health problem. Factors such as aging, family history of DM and physical activity are associated with diabetes. A national prevention programs to prevent diabetes and address the modifiable risk factors should be implemented.

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## INTRODUCTION:

A major international study collating and analyzing worldwide data on diabetes found that the number of adults with this disease has doubled since 1980, reaching up to 347 million in 2008 [1].

Another significantly large study, which assessed obesity as a diabetes risk factor across five continents, showed more than 60% of men and 50% of women being overweight or obese, thereby contributing immensely to this global health problem [2].

A prominent example of a country with a sharp increase in its diabetes prevalence rate as a result of rapid economic and cultural change is the Kingdom of Saudi Arabia. Over the last four decades, the data in Saudi Arabia show an ever increasing prevalence of physical inactivity, unhealthy dietary habits and sedentary behavior in its population [3], which in turn resulted in Saudi Arabia being ranked as the third country in the world with the highest prevalence of diabetes [4].

The prevalence of diabetes in Saudi Arabia increased from 4.3% in 1987 to 23.7% in 2004 [5]. This increase has been attributed to significant changes in cultural factors, such as increase in affluence, which unmasks an increase in the genetic or ethnic propensity for diabetes, in addition to changes in dietary habits with the substitution of animal products and refined foods [6], along with the socio-economic factors. This is in addition to the high prevalence of physical inactivity among Saudi Arabian population that reached 96.1% [7] and ranged from 43.3% to 99.5% [8].

## Study objective:

The aim of this study is to measure prevalence of diabetes, and to identify some of the associated risk factors in adult educated and employed male population of Arar city, Northern Saudi Arabia.

## PARTICIPANTS AND METHODS:

A cross-sectional study was carried out in Arar city, the capital of the Northern Province of KSA, during the period from January to February 2016.

## Sampling

A total of 325 educated and employed male Saudi nationals aged  $\geq 30$  years were included in the study. Data were collected by means of personal interview with the participants using a predesigned questionnaire covering the following items:

- Medical history of diabetes, age, family history of diabetes and physical activity.
- **Anthropometric examination included height and weight measurements** with the use of a calibrated balance beam scale and a wall-mounted stadiometer and calculation of body mass index (BMI). Normal weight was defined as  $18 \leq \text{BMI} < 25 \text{ kg/m}^2$ , overweight as  $25 \leq \text{BMI} < 30 \text{ kg/m}^2$  and obesity as  $\text{BMI} \geq 30 \text{ kg/m}^2$  [9].
- Blood sample is drawn under complete aseptic conditions to determine random blood glucose level. Person considered diabetic if random blood sugar was  $\geq 200 \text{ mg/dl}$  [10].

Any participant suspected as diabetic was advised to visit a nearby primary health care center to complete investigations, start management and follow up.

## Ethical considerations

This study was reviewed and approved by the Research Ethics Committee of Faculty of Medicine, Northern Border University. Participants were informed that participation is completely voluntary, and written consent was obtained from each participant before being subjected to the questionnaire and after discussing the objective with the participants. No names were recorded on the questionnaires. Adequate training of data collectors took place to ensure protection of confidentiality, and all questionnaires were kept safe.

### Statistical analysis

Collected data were coded and analyzed using statistical package for the social sciences (SPSS, version 15) [11]. The w2-test was used as a test of significance, and differences were considered significant at P value 0.05 or less.

### Results:-

Table (1) shows the background characteristics of studied Participant. The majority of the Participants in the study were between 40 and 50 years of age, and only 2.8% were between 30 and 40 years of age. More than half of participants have no Family History of DM (52%). About 36 % of the participants are obese (BMI >30). About 37.8% recorded physical activity. Blood samples revealed that 14.8 % of the participants showed measured random blood glucose > 160 ml/dl and considered as diabetic.

Table (2) shows the relationship between DM and age group, family history of DM, presence of obesity and physical activity in studied adult males of Arar population. There is high statistically significant difference between different age group of the participants as regard D.M (P value < 0.001). The percentage of diabetes among obese and non obese was 18.6% and 12.6% respectively. But the difference was not significant between obese and non obese regarding D.M (P value >0.05). 25.6% of participants having positive family history of diabetes were diabetic and there is high statistically significant difference (P value <0.001). Diabetes was found in 17.8% and 9.8% of physically inactive and physically active participants respectively. There is statistically significant relation between physical activity of the participants and D.M (P value <0.05).

There is significant weak positive correlation between age and random blood glucose in the studied population (r = 0.286 and P value < 0.001). (Table 3).

**Table (1): percentage distribution of DM, age groups, family history of DM, presence of obesity and physical activity in studied adult males of Arar population, KSA, 2016**

Variable	No.	%
<b>Diabetes Mellitus</b>		
Yes (random blood glucose $\geq$ 200 ml/dl)	48	14.8
No (random blood glucose $\leq$ 200 ml/dl)	277	85.2
<b>Mean<math>\pm</math>SD</b>	<b>121.6<math>\pm</math>47.0</b>	
<b>Age group</b>		
30-	9	2.8
40-	211	64.9
50-	91	28.0
60+	14	4.3
<b>Mean<math>\pm</math>SD</b>	<b>38.0<math>\pm</math>6.12</b>	
<b>Family History of DM</b>		
Yes	156	48.0
No	169	52.0
<b>Obesity</b>		
Yes	118	36.3
No	207	63.7
<b>Physical activity</b>		
Yes	123	37.8
No	202	62.2

**Table (2): relationship between DM and age group, family history of DM, presence of obesity and physical activity in studied adult males of Arar population, KSA, 2016**

Agegroup		Diabetes Mellitus (n=325)		Total (n=325)	Chi-Square Value	P value
		Yes (n=48)	No (n=277)			
30-	No.	7	3	10	28.36	0.000
	%	70.0%	30.0%	100.0%		
40-	No.	23	188	211		
	%	10.9%	89.1%	100.0%		
50-	No.	17	74	91		
	%	18.7%	81.3%	100.0%		
60+	No.	1	12	13		
	%	7.7%	92.3%	100.0%		
Total	No.	48	277	325		
	%	14.8%	85.2%	100.0%		
Obesity						
Yes	No.	22	96	118	2.21	0.094
	%	18.6%	81.4%	100.0%		
No	No.	26	181	207		
	%	12.6%	87.4%	100.0%		
Family history of DM						
Yes	No.	40	116	156	28.16	0.000
	%	25.6%	74.4%	100.0%		
No	No.	8	161	169		
	%	4.7%	95.3%	100.0%		
Physical activity						
Yes	No.	12	111	123	3.95	0.032
	%	9.8%	90.2%	100.0%		
No	No.	36	166	202		
	%	17.8%	82.2%	100.0%		

**Table (3): Correlation between age and random blood glucose in the studied population**

R	0.286
P value	0.000

## Discussion:

Determining the prevalence of diabetes mellitus is important to allow for rational planning and allocation of resources. Therefore, we designed this study to determine the prevalence of diabetes among adult male Saudi nationals.

This study is a cross-sectional study was carried out in Arar city, the capital of the Northern Province of KSA, during the period from January to February 2016.

A total of 325 male Saudi nationals aged  $\geq 30$  years with Mean age ( $\pm$ SD) was 38.0 ( $\pm 6.1$ ) were selected.

In the present study revealed that the prevalence of Diabetes among adult males of Saudi Arabia was 14.8 % . Our finding is less than that reported by **Khalid et al, (2011)**, the prevalence of diabetes among adult males in KSA was 34.1% [11]. and less than the reported prevalence in Gulf region (25.7%) and Oman (16.1%).[12,13 ]. Our figure is quite lower than the prevalence found in other Arab countries and other regions of KSA, this is mostly attributed to the relatively health awareness of our target group and the strict health measures and health education adopted by local health authorities in Arar city to prevent and control Diabetes Mellitus.

Our data demonstrate that 18.7% of individuals aged 50-60 years have diabetes. Studies from Saudi Arabia have shown different age-specific prevalence rates of diabetes. Our data demonstrate also an positive correlation between

age and random blood sugar level; the fact that diabetes prevalence increases with age is consistent with the findings in previous studies [11,14].

It is well documented that obesity is a strong risk factor for the development of DM as shown by several studies, however, In this study, the data showed that (36.3%) of Arar men population are obese and that (18.6%) of them are diabetics (P value = 0.094). This finding isn't in accordance with findings of Daousi et al., 2006 who reported higher prevalence of obesity in diabetics with 80% to 90% of people diagnosed with type 2 diabetes being obese [15]

Both obesity and diabetes are preventable. Previous studies have demonstrated that changes in lifestyle are effective in preventing both diabetes and obesity in high-risk adults with impaired glucose tolerance [16,17].

The current study reported that, diabetes was found in 17.8% and 9.8% of physically inactive and physically active participants respectively. There is statistically significant relation between physical activity of the participants and D.M (P value <0.05). Increasing physical activity, improving diet and then sustaining these lifestyle changes can reduce both body weight and risk of diabetes. Health professionals must continue to stress the importance of a balanced diet and physical activity for healthy weight loss [9].

Age, physical activity and family history of DM were major contributors significantly associated with DM. This significant relationship has been found consistently in different populations. In United Arab Emirates [18], the significant risk factors for DM were age, family history of DM and obesity and in Greece, age, obesity, family history of DM, hypertension, and elevated triglyceride levels were significantly associated with the presence of DM [19].

In the Saudi society, men and women must overcome many obstacles to make the best choices for optimal health. The provision of clinical preventive services to identify and control hypertension, elevated cholesterol levels, obesity and diabetes remain important medical priorities nationally. Development and implementation of national programs to promote a balanced diet, increased physical activity and weight control must be national priorities as well.

### **Conclusion and recommendations:-**

The prevalence of diabetes is relatively high among the male Arar city, Northern Saudi Arabia population and represents a major clinical and public health problem. Factors such as aging, family history of DM and physical activity are associated with diabetes A national prevention programs to prevent diabetes and address the modifiable risk factors should be implemented.

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### **References:**

- 1- Al-Hazzaa HM. Prevalence of physical inactivity in. Saudi Arabia: A brief review. *East Mediterr Health J.* 2004; 10: 663–70.
- 2- Al-Hazzaa H, Abahussain N, Al-Sobayel H, Qahwaji D, Musaiger A. Physical activity, sedentary behaviors and dietary habits among Saudi adolescents relative to age, gender and region. *International Journal of Behavioral Nutrition and Physical Activity* [Internet]. 2011; 8(1):140. Available from: <http://www.ijbnpa.org/content/8/1/140>.
- 3- Al-Nozha MM, Al-Maatouq MA, Al-Mazrou YY et al. Diabetes mellitus in Saudi Arabia. *Saudi Med J.* 2004; 25: 1603–10.
- 4- Al-Nozha MM, Al-Hazzaa HM, ArafahMR et al. Prevalence of physical activity and inactivity among Saudis aged 30–70 years. A population-based cross-sectional study. *Saudi Med J.* 2007; 28: 559–68.

- 5- Amin TT, Al-Sultan AI, Ali A. Overweight and obesity and their relation to dietary habits and sociodemographic characteristics among male primary school children in Al-Hassa, Kingdom of Saudi Arabia. *Eur J Nutr.* 2008; 47: 310–18.
- 6- Balkau B, Deanfield JE, Després JP et al. International day for the evaluation of abdominal obesity (idea) a study of waist circumference, cardiovascular disease, and diabetes mellitus in 168 000 primary care patients in 63 countries. *Circulation.* 2007; 116: 1942–51.
- 7- Bennett P. New data, fresh perspectives: Diabetes Atlas [Internet]. 3rd ed. Brussels, Belgium: International Diabetes Federation; 2006 [cited 2014 Nov 6]. Available from: [www.idf.org/sites/default/files/attachments/article\\_495\\_en.pdf](http://www.idf.org/sites/default/files/attachments/article_495_en.pdf).
- 8- Danaei G, Finucane MM, Lu Y et al. National, regional, and global trends in fasting plasma glucose and diabetes prevalence since 1980: Systematic analysis of health examination surveys and epidemiological studies with 370 country-years and 2.7 million participants. *Lancet.* 2011; 378: 31–40.
- 9- WHO Expert Consultation. Appropriate body-mass index for Asian population and its implications for policy and intervention strategies. *Lancet.* 2004;363:157–163. [PubMed]
- 10- Somannavar S, Ganesan A, Deepa M, Datta M, and Mohan V. Random Capillary Blood Glucose Cut Points for Diabetes and Pre-Diabetes Derived From Community-Based Opportunistic Screening in India. *Diabetes Care.* 2009 Apr; 32(4): 641–643.
- 11- Khalid A. Alqurashi, Khalid S. Aljabri, and Samia A. Bokhari. Prevalence of diabetes mellitus in a Saudi community. *Ann Saudi Med.* 2011 Jan-Feb; 31(1): 19–23.
- 12- Hamadeh RR. Noncommunicable diseases among the Bahraini population: A review. *East Mediterr Health J.* 2000;6:1091–7. [PubMed]
- 13- Al-Lawati JA, Al Riyami AM, Mohammed AJ, Jousilahti P. Increasing prevalence of diabetes mellitus in Oman. *Diabet Med.* 2002;19:954–7. [PubMed]
- 14- Wild S, Roglic G, Green A, Kng H. Global prevalence of Diabetes. Estimates for the year 2000 and projections for 2030. *Diabetes Care.* 2004;27:1047–53. [PubMed]
- 15- Daousi C, Casson IF, Gill GV, MacFarlane IA, Wilding JP, Pinkney JH. Prevalence of obesity in type 2 diabetes in secondary care: Association with cardiovascular risk factors. *Postgrad Med J.* 2006;82:280–4. [PMC free article][PubMed]
- 16- Tuomilehto J, Lindström J, Eriksson JG, Valle TT, Hämäläinen H, Ilanne-Parikka P, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med.* 2001;344:1343–50. [PubMed]
- 17- Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, et al. Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med.* 2002;346:393–403. [PMC free article][PubMed]
- 18- H. Saadi, S.G. Carruthers, N. Nagelkerke, F. Al-Maskari, B. Afandi, R. Reed, et al., Prevalence of diabetes mellitus and its complications in a population-based sample in Al Ain, UAE, *Diab. Res. Clin. Pract.* 78 (2007) 369–377.
- 19- A. Melidonis, S. Tournis, M.G. Kompoti, I. Lentzas, V. Roussou, S. Iaklianos, et al., Increased prevalence of DM in a rural Greek population, *Int. Electron. J. Rural Remote Health Res. Educ. Pract. Policy* 6 (2006) 534.



### RESEARCH ARTICLE

#### PREVALENCE AND AWARENESS OF OBESITY AMONG SAUDI FEMALE IN RIYADH, SAUDI ARABIA.

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Obesity, Females, Knowledge, prevalence

#### Abstract

**Background:** Despite knowing the seriousness of obesity and its impact on health, its prevalence still growing in Saudi Arabia, which puts a considerable financial burden on governments and individuals resources

**Objective:** to determine the prevalence of obesity among Saudi female in Riyadh city, Find out level of awareness among women regarding obesity and its problems.

**Methods:** A cross-sectional study among Saudi female in Riyadh. Self-administered pretested questionnaire was distributed in six major shopping malls in January, 2011. The administered questionnaire included the demographic data, anthropometric measurements, questions to assess the knowledge of participants about obesity.

**Results:** Total of 174 female participants included in study, mean age was 22 years. 59 % of participants have collage level education, 50% high school education .For marital status , 63% of participant were married . Regarding the participants weight, 33.3% were overweight (BMI 25-30) and 28% were obese (above 30). Most of participants reported High caloric intake (96%) and Lack of physical activity (92%) as the main risk factor for obesity. For health consequences and complication of obesity, Most of participants reported hypertension, stroke, heart disease, and DM as the main health consequence for obesity with percentage of 79%, 70%, 73%, 70% respectively. While 30%, 26 % and 10% reported cancer, sleep apnea and Gynecological problems as health problem related to obesity (respectively).

**Conclusion:** Obesity is a real public health problem among Saudi female that need control strategies through life style modification and medical intervention. Knowledge of the health consequences of obesity among Saudi female were high about cardiovascular risk but poor about cancer, Osteoarthritis, sleep apnea and Gynecological risk.

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## Introduction:-

Obesity is a major health problem that associated with decreases in life expectancy and health-related quality of life (1). In 2014, WHO estimated that more than 1.9 billion of adults around the world were overweight and over 600 million were obese (2). Locally, Prevalence of overweight and obesity in Saudi female above age of 15 years is reported to be 28.8% and 33% 10.6%, respectively (3).

Obesity have strong relationship with many risk factor including hormones, low socioeconomic status, smoking , high media times and high intake of food though the strength of the relationship varies with the condition (4-5).

Furthermore, obesity associated with multiple co-morbidities including cardiovascular, endocrine, pulmonary, sleep apnea, arthritis, gastrointestinal, gall bladder disease, and certain types of cancer (6).

Despite knowing the seriousness of obesity and its impact on health, its prevalence still growing (7). This increase obesity rate put a considerable financial burden on governments and individuals resources (8). Knowing the prevalence rates and level of societies awareness is therefore a major step to the development of useful interventions methods to minimize this health problem.

The objective of this study was to determine the prevalence of obesity among Saudi female, Find out level of awareness among women regarding obesity and its problems.

## Methods:-

A cross-sectional study was conducted among Saudi female in Riyadh. Self-administered pretested questionnaire was distributed in six major shopping malls (Granada mall, Hayat mall, Panorama mall, Sahara mall, Alothaim mall and Riyadh gallery) in January, 2011. The coded questionnaires had unique identification numbers to keep the anonymity of participants. In each of the six malls, 29 questionnaires were distributed over visitor. The purpose of the study were explained to participants and written consent obtained from female, who agreed to participate in the study. The final questionnaire was developed after pilot testing among 30 Saudi female and necessary modifications were done. The Inclusion criteria for study were Saudi females, ages 18 and older, living in Riyadh city and not working in the medical field.

The administered questionnaire included the following sections:

- Demographic data: age, marital status, education level
- Anthropometric Measurements: Body weight was measured using a bathroom scale. Height was measured using a stadiometer then Body mass index was calculated for each subject as the ratio of body weight (in kg) and squared height (in metres). A participant was considered to be obese or not by using the BMI criteria Suggested by Beaton et al. BMI less than  $18.5 \text{ kg/m}^2$  was considered underweight, between 18.5 and  $25 \text{ kg/m}^2$  was considered normal,  $25\text{--}30 \text{ kg/m}^2$  was considered overweight, and  $30 \text{ kg/m}^2$  or above was considered obese.
- Knowledge of participants: was assessed by asking them about different aspects of obesity including risk factor, various medical conditions and cancers associated with obesity, management of obesity.

The ethics committees at a collage approved this study. Each participant received a thorough explanation of the purpose of the study and written consent obtained from each participant .the participants was told that the enrollment is voluntary.

The survey responses were entered into the SPSS software (version 17.0) and checked for any errors or missing information. Demographic characteristics were assessed using means for continuous variables and proportions for categorical variables. Knowledge about disease risk was assessed using proportions. Analysis of variance test used to assess differences in obesity awareness by demographic Variables (marital status, age).

## Results:-

Total of 174 female participants included in study, mean age was 22 years, the age ranged from 18 to 54 years. 59 % of participants have collage level education, 50% high school education and 16% postgraduate level education. For marital status, 63% of participants were married while 36.7% were singles. Regarding the participants weight, 4.5 % were underweight with body mass index below 18.5, 34 % were normal weight (BMI between 18.5-25) , 33.3%

were overweight (BMI 25-30) and 28% were obese (above 30). **Table 1** showed demographic data and BMI of participant.

**Table 1:** Demographic data and BMI.

<b>Age</b>	18 -25	79	45.4 %
	26 -40	56	32 %
	Above 40	39	22.4 %
<b>Education</b>	Illiterate	2	1.%
	Primary & Middle school &	3	1.7%
	high school	50	28.7%
	Collage	103	59.%
	Post graduate	16	9%
<b>BMI</b>	Under weight	8	4.5 %
	Normal weight	59	34 %
	overweight	58	33.3 %
	obese	49	28 %
<b>Marital status</b>	single	64	36.7 %
	Married	110	63 %

Regarding participants knowledge about the risk factors of obesity ,most of participants reported High caloric intake (96%) and Lack of physical activity (92%) as the main risk factor while 56.8% reported Insufficient sleep , 56.8% psychiatric illness 48.8% Genetic susceptibility 52.8% Drugs and 47.7 Age 40 as risk factors. For health consequences and complication of obesity, Most of participants reported hypertension, stroke, heart disease, and DM as the main health consequence for obesity with percentage of 79%, 70%, 73%, 70% respectively. While 30%, 26 % and 10% reported cancer, sleep apnea and Gynecological problems as health problem related to obesity (respectively). Regarding obesity preventative measures, 96% and 93 % of responder reported Healthy diet and regular exercise as main preventative measures (respectively). **Table 2** showed Percentage of Participants having Correct Knowledge about obesity Risk Factors and health consequences.

**Table 2:-** Percentage of Participants having Correct Knowledge about obesity Risk Factors, preventative measure and health consequences

<b>Risk factor</b>	Lack of physical activity	161	92%
	Insufficient sleep	99	56.8%
	psychiatric illness	85	48.8%
	Genetic susceptibility	92	52.8%
	Drugs such as steroids, OCP	83	47.7
	High caloric intake	168	96
	<b>Age</b>	70	40
<b>Health consequences</b>	Hypertension	138	79%
	Stroke	122	70 %
	Heart disease	128	73 %
	Cancer	52	30 %
	DM	121	70 %
	Osteoarthritis	45	26 %
	sleep apnea	78	45 %
<b>Preventative measure</b>	Gynecological problems	19	10%
	Healthy diet	168	96.5%
	Regular exercise	162	93%
	Meditation	87	50%
	Regular health check-ups	90	51.7%
	stress management	50	28.7%

Most of participants (57%) between age of 18 to 25 were non obese. In contrast, 74.3 of the participants above 40 years were obese ( $p < 0.001$ ). Among married female, 29% were non obese, 38% overweight and 36.3 were obese while single female 54.6 % non obese 31% overweight and 14% obese ( $p = 0.001$ ). **Tables 3 and 4 .**



**Table 3:-** Relationship between obesity and age of participant.

Age	Non obese	Overweight	Obese	Total
18 -25	45 (57%)	29 (36.7%)	5 (6%)	79 (100%)
26- 40	19 (34%)	22 (39.2%)	15 (26.7 %)	56 (100%)
Above 40	3 (7.6 %)	7 (18%)	29 (74.3)	39 (100%)
Total	67 (100%)	58 (100%)	49 (100%)	174

P&lt;0.001

**Table 4:-** Relationship between obesity and marital status of participant.

Marital status	Non obese	Overweight	Obese	total
Single	35 (54.6%)	20 (31.2%)	9 (14%)	64
Married	32 (29%)	38 (34%)	40 (36.3 %)	110
Total	67	58	49	174

P=0.001

**Discussion:-**

This study aimed to determine the prevalence of obesity among Saudi female and to assess the level of awareness among Saudi women regarding obesity and its problems. This small scale study is unique in certain ways as the study was conducted at the capital city of Saudi Arabia , in the largest malls of city which is a destination of all society spectrums and made this study as representative of obesity prevalence and level of awareness.

Prevalence of obesity in our study reported to be 28%, this is almost consistent with previously reported among Saudi female (33%) (3). This shows that obesity is major public health problem among Saudi female, that need control strategies and not to be ignored.

BMI increases in direct proportion with age, in which participants above age of 40 have the greatest rate of obesity followed by age of 25 to 40. Similar conclusion reported previously (9). The reason behind this could be due to decline in physical activity with age in addition to menopause that associated with Weight gain and changes in fat distribution (10).

In current study, marital status was associated with higher BMI, several studies reported similar association between marriage and increased prevalence of obesity (11-12). The explanation for this finding could be because married couples tend to eat regularly with their children and they have better eating pattern and high caloric intake. Sobal J etal reported strong association between marital status and obesity only among men, but not among female (13).

In our study between 70 %to 79 % of subjects were aware that obesity increase risk of hypertension, cardiac disease, stroke and diabetes. Eden R Cardozo etal reported similar finding for awareness of cardiovascular disease and DM in obese subject (14). Ginger J. Winston reported slightly higher level of awareness (94%-96%) (15).in our study, we found lower level of awareness among participants about the association of cancer and Gynecological problems to obesity and this finding reported globally (14, 16).

The limitation of study included study design as the cross sectional study may give a different results if another time-frame has been chosen

In summary, Obesity is a real public health problem among Saudi female that need control strategies through life style modification and medical intervention. Our findings indicated that Saudi females were knowledgeable about association between obesity and increased risk of cardiovascular, diabetes .in contrast level of awareness about obesity and risk of cancer, Osteoarthritis, sleep apnea and Gynecological problems were poor.

**References:-**

1. Peeters A. Obesity in Adulthood and Its Consequences for Life Expectancy: A Life-Table Analysis. *Annals of Internal Medicine*. 2003;138(1):24.
2. World Health Organization. Obesity. 2008. Available at: <http://www.who.int/topics/obesity/en/>.
3. Memish ZA, El Bcheraoui C, Tuffaha M, Robinson M, Daoud F, Jaber S, et al. Obesity and associated factors - Kingdom of Saudi Arabia, 2013. *Prev Chronic Dis* 2014;11:E174.
4. Antia FP. *Clinical dietetics and nutrition*. Oxford University Press, London, 1989.
5. Kleiser C, Schaffrath Rosario A, Mensink G, Prinz-Langenohl R, Kurth B. Potential determinants of obesity among children and adolescents in Germany: results from the cross-sectional KiGGS study. *BMC Public Health*. 2009;9(1):46.
6. PI-SUNYER F. Comorbidities of overweight and obesity: current evidence and research issues. *Medicine & Science in Sports & Exercise*. 1999;31(Supplement 1):S602.
7. Williams E, Mesidor M, Winters K, Dubbert P, Wyatt S. Overweight and Obesity: Prevalence, Consequences, and Causes of a Growing Public Health Problem. *Current Obesity Reports*. 2015;4(3):363-370.
8. Withrow D, Alter DA. The economic burden of obesity worldwide: a systematic review of the direct costs of obesity. *Obesity Reviews*. 2011;12(2):131-141.
9. Nyaruhucha C, Achen J, Msuya J, Shayo N, Kulwa K. Prevalence and awareness of obesity among people of different age groups in educational institutions in Morogoro, Tanzania. *East African Medical Journal*. 2004;80(2).
10. Torng P, Su T, Sung F, Chien K, Huang S, Chow S et al. Effects of menopause and obesity on lipid profiles in middle-aged Taiwanese women: the Chin-Shan Community Cardiovascular Cohort Study. *Atherosclerosis*. 2000;153(2):413-421.
11. Fitzgibbons Shafer E. The Effect of Marriage on Weight Gain and Propensity to Become Obese in the African American Community. *Journal of Family Issues*. 2010;31(9):1166-1182.
12. Lipowicz A, Gronkiewicz S, Malina R. Body mass index, overweight and obesity in married and never married men and women in Poland. *American Journal of Human Biology*. 2002;14(4):468-475.
13. Sobal J, Rauschenbach B, Frongillo E. Marital status, fatness and obesity. *Social Science & Medicine*. 1992;35(7):915-923.
14. Cardozo E, Dune T, Neff L, Brocks M, Ekpo G, Barnes R et al. Knowledge of Obesity and Its Impact on Reproductive Health Outcomes Among Urban Women. *Journal of Community Health*. 2012;38(2):261-267.
15. Winston G, Caesar-Phillips E, Peterson J, Wells M, Martinez J, Chen X et al. Knowledge of the health consequences of obesity among overweight/obese Black and Hispanic adults. *Patient Education and Counseling*. 2014;94(1):123-127.
16. Thapa J, Lyford C, McCool B, Pence B, McCool A, Belasco E. Improving Cancer Risk Awareness Including Obesity as a Risk Factor for Cancer in a Small U.S. Community. *J Cancer Educ*. 2016 Jun 11. [Epub ahead of print]



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### RESEARCH ARTICLE

#### A STUDY ON CUSTOMER SATISFACTION OF HONDA BIKES WITH REFERENCE TO CHINNAMANUR TOWN, THENI DISTRICT.

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#### Abstract

Customer satisfaction is important to business from the short term and long term point of view. In short importance we can include worn and repurchase, while in long-term brand image and market share. If a customer is satisfied he will praise product his/her friends, relatives, neighbors or colleagues and he/she may recommend the product to people he/she may intend to buy the same product, or may buy again in near future one satisfied customer may be the best means of advertisement. It can build a brand image in a particular area and gradually shall increase leading to a greater market share. Hence short - term benefits of satisfaction will pave way to long -term benefits empirical evidence regarding extend of negative versus positive word of mouth is some what equivocal. This study has undertaken to know the customer satisfaction regarding Honda bikes in Chinnamanur town, Theni District.

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#### Introduction:-

Honda is the world's largest manufacturer of two Wheelers, Recognized the world over as the symbol of Honda two wheelers, the 'Wings' arrived in India as Honda Motorcycle and Scooter India Pvt. Ltd. (HMSI), a 100% subsidiary of Honda Motor Company Ltd., Japan, in 1999. Since its establishment in 1999 at Manesar, District Gurgaon, Haryana, Honda has lived up to its reputation of offering the highest quality at the most reasonable price. Despite being one of the youngest players in the Indian two-wheelers market, Honda has become the largest two wheeler manufacturer as well as the second largest two-wheelers company in India.

Honda is also the fastest growing company in country today. With a host of facilities under its wings, the first factory of HMSI is spread over 52 acres including a covered area of about 100,000 sq. meters in Manesar, District Gurgaon, Haryana with an annual capacity of 1.65 million units. To meet the ever increasing demands of the

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products, Honda has started operations of its second plant in Tapukara, District Alwar, Rajasthan. Expanding to full operations, Honda production capacity has jumped 30% year on year to 2.8 million per annum in FY 12- 13.

Honda's third plant at Narsapura Industrial Area near Bengaluru, Karnataka is equipped to manufacture 1.2 million units. Utilizing production technologies refined at Manesar & Tapukara plants as starting point, the 3rd plant is employed with state-of-the-art manufacturing, automation and environment friendly technologies to deliver quality products. On February 17 2016, Honda inaugurated the "World's largest only scooter plant" at Vithalapur Gujarat with annual capacity of 1.2 million units. The new plant will employ approximately 3000 people within first 2 years of commercial production.

The history of the Honda brand is nothing more than the history of our challenges and achievements in creating values, invariably ahead of our time. It is also the history of the dreams of each of our associates that have come true and have been shared by people around the world.

**Methodology:-**

Research is defined as a scientific and systematic search for pertinent information's on a specific topic. It also refers to a search for knowledge. Search comprises defining and redefining problems formulating hypothesis suggested solutions, collecting organizing and evaluating data, making deductions and reaching conclusions and testing the conclusion.

**Research design:-**

The descriptive research studies are those studies, which are concerned with describing the characteristics of a particular individual or a group (demographic characteristics). In the study the researcher has used the descriptive methods of research.

**Period of the Study:-**

The study was undertaken during November – December 2016.

**Data Collection:-**

The study depends on primary data and secondary data.

**Primary Data:-**

The primary data is collected through interaction with personnel at all level on HR perspective the researcher has constructed questionnaire.

**Secondary Data:-**

The secondary data were collection from the company profile policy, letter, relevant manual; notification in the office communication (IOC) verified assessment report, statement of account, p/c statement (audit reports) statutory records are offered for study. Relevant supportive/authentic document are offered for verification.

**Sampling Design:-**

Under the simple random sampling each member of the population has a known and equal chance of being selected in the study, the researcher used the simple random sampling methods for the research from the total population.

**Sample Size:-**

The size of the sample was finalized to 110 samples after considering the factors like the extent of error, degree of confidence etc.

**Objectives:-**

- To study the socio demographic factors of customers.
- To identify the factors that influence to purchase of Honda bikes
- To analyse the satisfactory level of customers about the Honda bikes in the study area.
- To offer suitable suggestions based on the findings of the study.

**Research Hypothesis:-**

- There is a significant association between age' and satisfaction of two- wheeler (Bajaj).
- There is a significant association between area of residency and attraction of media.

**Statistical Tools Used:-**

- Percentage analysis
- Chi - square test

**Data Analysis And Interpretation:-****Table 1:-** Disrblution Of Respondents on the basis of gender.

S.no	Gender	No. of Respondents	Percentage
1.	Male	95	86.36
2.	Female	15	13.64
	<b>Total</b>	<b>110</b>	<b>100</b>

Source: Primary data

It is evidenced from table 1, 86.36% of respondents belong to the Male category and 13.64% of respondents belong to the female category. Therefore majority of the respondents belong to the male category.

**Table 2:-** Distribution Of Respondents on the basis of age.

S.no	Age	No. of Respondents	Percentage
1.	Below	5	4.54
2.	21-30	59	53.64
3.	31-40	22	20.00
4.	41-50	15	13.64
5	Above51	9	8.18
	<b>Total</b>	<b>110</b>	<b>100</b>

Source: Primary data

From the above table it is identified that 53.64% of respondents belong to 21-30 years of age, 20% of respondents belong to 31-40 years of age, 13.64%, of respondents belong to above 41-50 years of age, 8.18% of respondents belong to above 51 years of age, 4.54% of respondents belong to below 20 years of age group. Hence majority of the respondents belong to 21-30 years of age group.

**Table 3:-** Distribution Of Respondents on the basis of educational qualification

S.no	Educational Qualification	No of Respondents	Percentage
1.	Uneducated	1	0.91
2.	SSLC	23	20.91
3.	HSC	12	10.91
4.	UG	45	40.91
5.	PG	29	26.36
	<b>Total</b>	<b>110</b>	<b>100</b>

Source: primary data

It is noticed from table 3, 40.91 % of respondents belong to UG. degree, 26.36% of respondents belong to P.G. degree, 20.91% of respondent belong to SSLC, 10.91% of respondents belong to HSC, 0.91 % of respondents belong to uneducated. Therefore, majority of the respondents belong to UG degree only.

**Table 4:-** Distribution of respondents on the basis of occupation.

S.No	Occupation	No. of Respondents	Percentage
1.	Govt. employees	12	10.91
2.	Private employees	54	49.09
3.	Students	14	12.73
4.	House wife	5	4.54
5.	others	25	22.73
	<b>Total</b>	<b>110</b>	<b>100</b>

Source: primary data

Table 4 reveals that 49.09% of respondents are private employees, 22.73% of respondents belong to other occupations, 12.73% of respondents are students, 10.91% of respondents are government employees and 4.54% of respondents are house wife. Therefore majority of the respondents belong to private employees.

**Table 5:-** Distribution Of Respondents On The Basis Of Annual Income.

S.no	Annual income	No of Respondents	Percentage
1.	Rs.50,000	40	36.36
2.	Below Rs 50,000	22	20.00
3.	Rs.1,00,000	24	21.82
4.	Above Rs.1,00,000	16	14.55
5.	Rs.1,50,000 to Rs.2,00,000	8	7.27
	<b>Total</b>	<b>110</b>	<b>100</b>

Source: Primary data

Table 5 shows that 36.36% of respondents belong to the income of Rs. 50,000, 21.82% of respondents belong to the income of Rs. 1,00,000, 20% of respondents belong to the income of below 50,000, 14.55% of respondents belong to the income of above Rs. 1,00,000 and 7.27% of respondents belong to the income of Rs. 1,50,000 to Rs. 2,00,000. Therefore majority of the respondents belong to the Annual income of Rs. 50,000 only.

**Table 6:-** Distribution of respondents on the basis of marital status

S.no	Marital Status	No. of Respondents	Percentage
1.	Married	62	56.36
2.	Unmarried	48	43.64
	<b>Total</b>	<b>110</b>	<b>100</b>

Source: primary data

It is clear from table 6, 56.36% of respondents belong to 'married and 43.64% of respondents belong to unmarried. Therefore majority the respondent belong to married.

**Table 7:-** Distribution of respondents on the basis of cost of bikes

S.no	Cost of two wheeler	No of Respondents	Percentage
1.	Low	13	11.82
2.	Moderate	65	59.09
3.	High	32	29.09
	<b>Total</b>	<b>110</b>	<b>100</b>

Source: Primary data

Table 7 clearly shows that 59.09% of respondents feels the cost of two wheeler is moderate, 29.09% of respondents feels the cost of two wheeler is high and 11.82% of respondents feels the cost of two wheeler is low. Therefore majority of the respondents feels the price of bikes are moderate.

**Table 8:-** Distribution of respondents on the basis of usage of bikes

S.No	Usage of Two wheeler	No. of Respondents	Percentage
1.	0-2 years	46	41.82
2.	3-5 years	34	30.91
3.	6-8 years	12	10.91
4.	Above 9 years	18	16.36
	<b>Total</b>	<b>110</b>	<b>100</b>

Source: Primary data

Table 8 shows that 41.82% of respondents using the bikes 0 to 1 years, 30.91% of respondents using the bikes 3 to 5 years, 16.36% of respondents using the bikes above 9 years and 10.91 % of respondents using the bikes 6 to 8 years. Hence majority of the respondents are using the bikes upto 2 years.

**Table 9:-** Distribution of respondents on the basis of selection of honda bikes

S.No	Selection of two wheeler criteria	No. of Respondents	Percentage
1.	Price	49	44.55
2.	Quality	20	18.18
3.	Comfort and Fuel efficiency	28	25.45
4.	Style and pick up	13	11.82
5.	Others	-	-
	<b>Total</b>	<b>110</b>	<b>100</b>

Source: Primary data

Table 9 shows that 44.55% of respondent prefers for price, 25.45% of respondents prefer for comfort and fuel efficiency, 18.18% of respondents prefer for quality. 11.82% of respondents prefer for style and pickup, hence majority of respondents prefer the bike for its price factor.

**Table 10:-** Distribution of respondents on the basis of attraction of media.

S.No	Attraction of media	No of Respondents	Percentage
1.	Television Advertisement	35	31.82
2.	Magazine	15	13.64
3.	Friends and relatives	44	40.00
4.	Show rooms	12	10.91
5.	Others	4	3.63
	<b>Total</b>	<b>110</b>	<b>100</b>

Source: Primary data

Table 10 reveals that 40% of the respondents purchase decisions were influenced by their friends and relatives, 31.82% of respondents were influenced by television, 13.64% of respondents were influenced by magazine, 10.91% of respondents were influenced by show room displays, 3.63% of respondents were influenced by others factors. Hence, majority of the respondents were influenced by their friends and relatives for the purchase of Honda bikes.

#### Association between age and satisfaction of two wheeler (honda).

Age	Satisfaction of two wheeler			Statistical inference
	Good	average	poor	
Below 20	-	6	-	CV=14.202 TV=15.5 CV<TV Not Significant
21-30 years	20	35	-	
31-40 years	13	11	2	
41-50 years	7	7	-	
Above 51 years	5	4	-	

Degrees of freedom = (r-I) (c-I)

= (5 - 1) (3 - 1)

= 8

8 at 5% level of significance.

#### Inference:-

Above There is no significant association between age and satisfaction of two wheeler.

Hence the null hypothesis has been accepted.

#### Association between area of residency and attraction of media.

Aria of Residency	Attraction of Media					Statistical inference
	Television	Magazine	Friends & relatives	Show rooms	others	
Village	10	3	20	3	-	CV= 6.883 TV= 9.49 CV<TV Not significant
Town	25	12	24	9	4	

Degrees of freedom = (r-I) (c-I)

= (2 - 1) (5 - 1)

= 4

4' at 5% level of significance.

**Inference:-**

There is no significant association between area of residency and attraction of media. Hence the null hypothesis has been accepted.

**Findings suggestions and Conclusions:-****Findings related to socio - demographic factors:-**

- Majority of Respondents are Males (86.36%)
- Majority of Respondents belong to the age group of 21 - 30 years (53.64%)
- Majority of Respondents studied up to their U.G. degree (40.91 %)
- Majority of Respondents using the Honda bikes are private employees (49.09%) Majority of Respondents receiving the income of Rs. 50,000 (36.36%)
- Majority of Respondents are married (56.36%).

**Findings Related To Hypothesis:-****Research Hypothesis:- 1**

There is a significant association between age and satisfaction of Honda Bikes

**Null Hypothesis:-**

There is no significant association between age and satisfaction of Honda Bikes.

**Statistical test used:-**

Chi-square test was used.

**Finding:-**

There is no significant association between age and satisfaction of two Wheeler. Hence null hypothesis is accepted.

**Research Hypothesis:- 2**

There is a significant association between area of residency and attraction of media.

**Null Hypothesis:-**

There is no significant association between the area of residency and attraction of media.

**Statistical test used:-**

Chi - square test was used.

**Finding:-**

There is no significant association between' area of residency and attraction of media.  
Hence null hypothesis is accepted.

**Suggestions:-**

- It is suggest that though Honda Two wheelers are having good quality, it should be improved furthermore.
- More styles and models should be introduced to attract the more customers.
- Lot more facilities may be provided.
- More safety measures may be provided to attract more amounts of customers.
- It is suggest that more advertisements may be given on television and magazine to influence the customer to purchase the Honda two wheelers more.
- It is suggest that to provide installment payment scheme. So that the product can attract the customers easily.
- It is suggest the company should concentrate more on cost of maintenance.
- It is suggest that the company should concentrate more on the mileage of Honda two wheelers, because some of the customers are dissatisfied about mileage.
- It is suggest that the company may open many show rooms in and around chinnamanur town so as to attract rural people surrounding that town.



**Conclusion:-**

The study reveals that almost all the customers are satisfied with the facilities and services provided by the Honda two wheelers in the study area. The company may make necessary research frequently about the product as well as satisfaction level of customers about Honda bikes, company may also get feedback from the customer's part to overcome the problems faced by them. . The company can change the product style and reduce the cost of the product may be attracted by more customers and get full satisfaction. The suggestions given in this study will improve the sale of the product and thus improve their efficiency and production.

**Bibliography:-**

1. **David L. Loudon and Albert, J. Della Bitta**, Consumer behaviour fourth Edition, Tata McGraw - Hill Publishing Company Ltd., New Delhi.
2. **Edwinflippo** "Personnel Management" 6<sup>th</sup> edition, MC Graw hill publication –1984.
3. **H.C. Purohit**. Consumer satisfaction and complaining behaviour first edition - Mittal publication, New Delhi.
4. **Kothari C.R.**, Research Methodology methods and techniques second edition. New age International publishers.
5. **S.P. Gupta**, statistical methods, Twenty ninth revised Edition 2000. Sultan. Chand and Sons, New Delhi.
6. **G.L. Tyagi / Arun Kumar**, Consumer behaviour atlantic publishers and distributors.
7. **Tripathi P.C.** "Personal Management and Industrial relation" Sult and Chand & Sons, New Delhi 1999.
8. [www.honda2wheelersindia.com/](http://www.honda2wheelersindia.com/)

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### RESEARCH ARTICLE

#### OPTIMUM CONDITIONS OF SUPEROXIDE DISMUTASE EXTRACTION FROM TAMARIXAPHYLLAL. (TAMARISK).

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##### Key words:-

Superoxide dismutase (SOD), Extraction,  
Tamarixaphylla.

#### Abstract

The present study was conducted to investigate the optimum conditions of superoxide dismutase (SOD) extract from *Tamarixaphylla* L. (tamarisk) parts included (Leaves, Flowers, Fruits, and Seeds). The results indicated that the highest superoxide dismutase specific activity concentrated in the crude extract of the leaves reaching 24.98 unit / mg protein, and followed by flowers 17.53 unit / mg protein, and fruits 8.99 unit / mg protein, while the seeds have lowest specific activity 5.66 unit / mg protein. using potassium phosphate buffer 0.1 M pH 7.8 containing 1mM EDTA- $\text{Na}_2$  and 2% PVP, and pyrogallol as substrate, Therefore, the leaves was used as source of SOD. The study was aimed to determine the optimum conditions of the enzyme extraction. The result indicated that the optimum concentration of EDTA- $\text{Na}_2$ , PVP, extraction ratio, pH, buffer concentration, and the extraction time were 2mM, 2%, 1:3, 0.1M and 20 min, respectively.

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#### Introduction:-

Superoxide dismutase SOD (EC 1.15.1.1) is a metalloenzymes which is known to accelerate spontaneous dismutation of superoxide radicals to molecular oxygen and hydrogen peroxide [1]. SOD is widely distributed among aerobically living organisms and has been inferred to play active role in controlled superoxide levels in cellular compartments [2,3]. There are three types of SODs in plants, classified according to the metal at the catalytic centre: CuZnSOD, FeSOD and MnSOD [4]. Cu/ZnSOD are chiefly located in chloroplast, also in the cytosol. And also found in the watermelon cotyledons [5]. FeSODs located in the chloroplasts, but also located in the peroxisomes and mitochondria of *Dianthus caryophyllus* L. together with a Mn-isozyme [6]. Also found in Hybrid agave [7]. MnSOD in mitochondria [8]. MnSOD is essential to a biotic life [9,10]. Specific inhibitors used to detect isoenzymes of SOD include  $\text{H}_2\text{O}_2$  and (KCN). Cu/Zn SOD inhibited by both inhibitor, unlike MnSOD, while FeSOD inhibited only by  $\text{H}_2\text{O}_2$  [11,12,13].

All types of superoxide dismutase are abundant in different organisms, including tobacco, pea, *Pisum sativum*, *Ginkgo biloba*, *Nuphar luteum*, *Rauwolfia serpentina* Benth, *Methanobacterium bryantii* and *Escherichia coli* [14-21]. SOD extract from different plant species, *Bambusa oldhamii* [22], leaves and roots of *Deschampsia Antarctica* [23], and *Manihot esculenta* [24].

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**Material and Methods:-****Plant and Chemicals Materials:-**

*Tamarixaphylla* L. plant were harvested from the farmland surrounding the university of Qadisiyah province of Diwaniyah.

The source of chemicals were as follows: Potassium phosphate Pyrogallol, Bovine serum albumin, PVP, EDTA- $\text{Na}_2$ , HCl, (BDH(England)). Coomassie brilliant blue G-250 (Sigma( USA))., Tris-base, , (Fluka (Switzerland)). Tris-HCl(Oxoid(England)).

**SOD Extraction:-**

Superoxide dismutase extracted from *Tamarixaphylla* L. according to [25], with some modification. Fresh plants tissues (5g) was pulverized in a cold mortar and pestle with (15ml) of 0.1M potassium phosphate buffer pH (7.8) containing 1mM EDTA- $\text{Na}_2$  and 2% (w/v) insoluble PVP. The homogenate was strained through four layers of miracloth and centerfuged at 15,000 rpm for 20 min at 0°.

**SOD activity:-**

The activity of superoxide dismutase was determined using a Pyrogallol auto-oxidation . One unit of activity is defined as the amount of SOD required to inhibit the 50% of pyrogallol auto-oxidation [26].

**Protein determination:-**

The total protein concentration was measured by the Bradford method [27], by using bovine serum albumin as the standard.

**Optimum Conditions of SOD:-****Concentration of EDTA- $\text{Na}_2$ :-**

SOD from *Tamarixaphylla* L. leaves extract at different concentration of EDTA- $\text{Na}_2$  (0.1, 0.2, 0.4, 0.6, 0.8, 1 , 2) mM .

**Concentration of PVP:-**

SOD extract at different concentration of PVP (0.1, 0.2, 0.4, 0.6, 0.8, 1, 2, 3, 4, 5) % (w/v).

**Optimum ratio for SOD extract:-**

SOD extract from *Tamarixaphylla* L. extracted at different ratio (1:2, 1:3 , 1:4 , 1:5 , 1:6) (w:v)

**Concentration of buffer solution:-**

SOD extract at different concentration of potassium phosphate buffer range between (0.1-0.7) M pH 7.8 .

**Optimum pH:-**

SOD extract at different pH range between (4.0-9.0)

**Optimum extraction time:-**

SOD extract at different time (5 , 10 , 15 , 20 , 25 , 30 ) min.

**Results and Discussion:-****SOD activity in *Tamarixaphylla* L. parts:-**

High SOD specific activity concentrated in the crude extract of *Tamarixaphylla* L. leaves compare with the other parts of plant, reached 36.55 unit/ mg protein. Therefore, it has been used as a source of SOD in further studies.

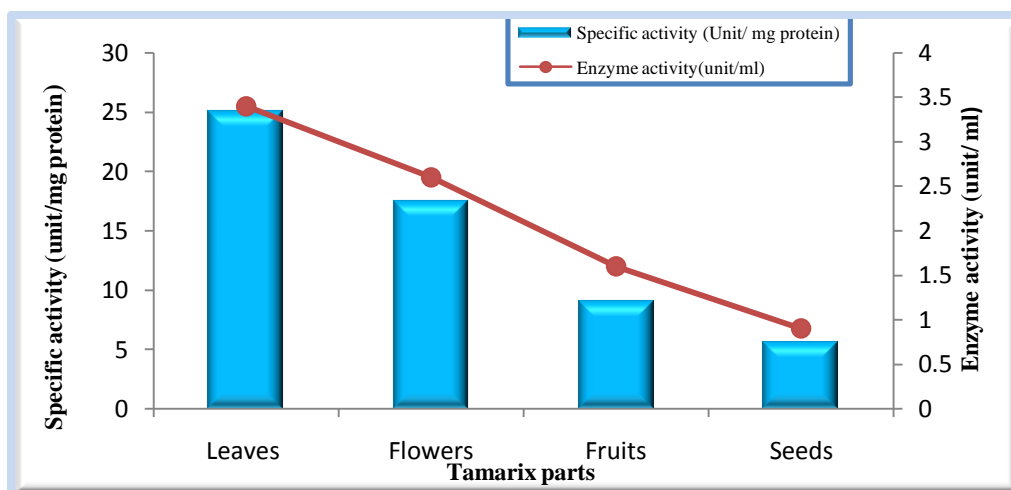


Figure 1:- SOD activity in *T. aphylla* L. parts

#### The optimum conditions of SOD :

**Concentration of EDTA- $\text{Na}_2$ :** The enzyme was found to show maximum activity at concentration 1 mM. SOD extract from the leaves *Eleusinecoracana* L. by added 1mM EDTA- $\text{Na}_2$  [28]. The optimum concentration of EDTA- $\text{Na}_2$  added in the extraction of SOD from roots and leaves of *Medicago truncatula* was 0.1mM [29]. The used of EDTA in the extraction of the enzyme maintained the stability of enzyme being chelating agent prevent overlapping contaminated ions of the buffer during the work of enzyme [30]. So it added in concentration 1 mM in the current study to get rid of the harmful effects of metal ions and to maintain the stability of the enzyme.

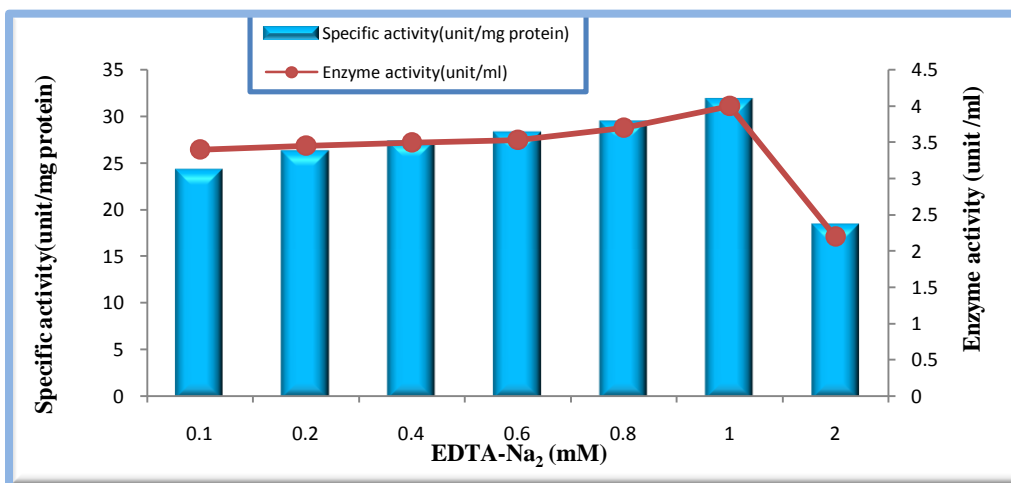
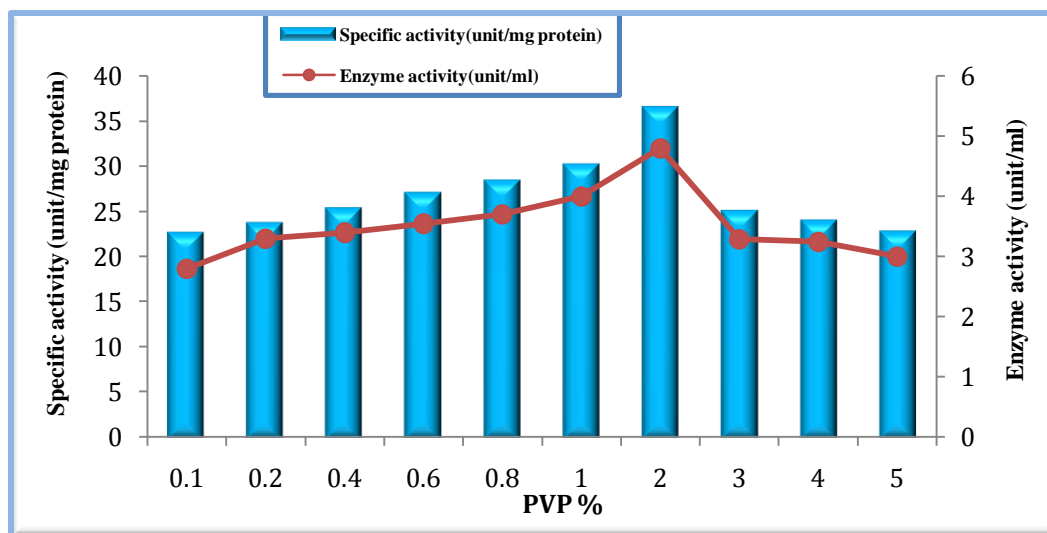


Figure 2:- Effect of EDTA- $\text{Na}_2$  on the specific activity of SOD from *T. aphylla* L.

#### Concentration of PVP:-

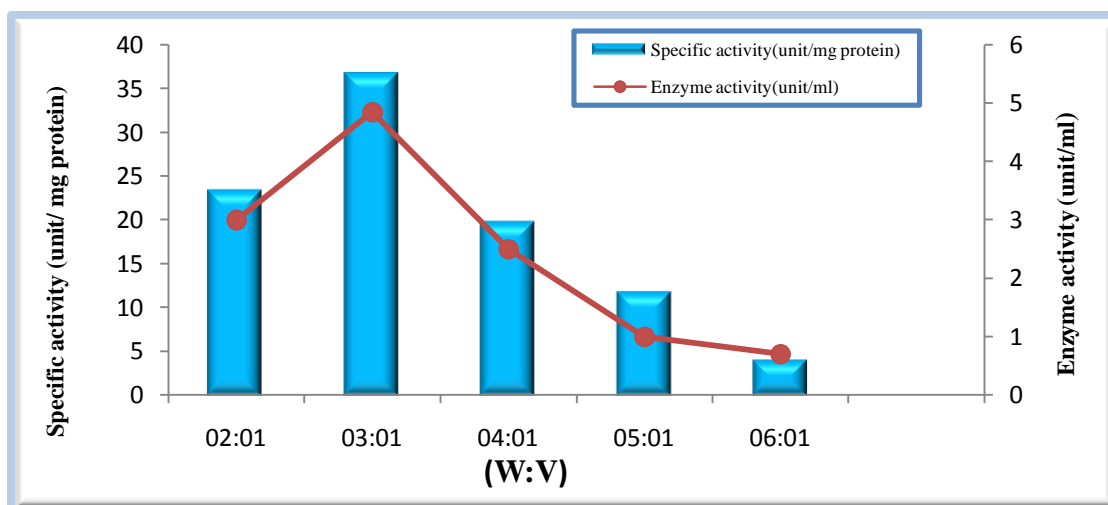
The high SOD activity showed at concentration 2% (w/v) . The PVP added to extract SOD from *Fritillaria meleagris* was 200 mg [31]. While the PVP ratio to extract SOD from roots and leaves of *Kandelia cande* L was 4% [32]. PVP used in the extraction of enzymes from plants tissues to adsorption of phenolic compounds and reduced the impact on the stability of protein and their effectiveness [33].



**Figure3:-**Effect of PVPon the specific activity of SOD from *T. aphylla*L.

#### Extraction ratio:-

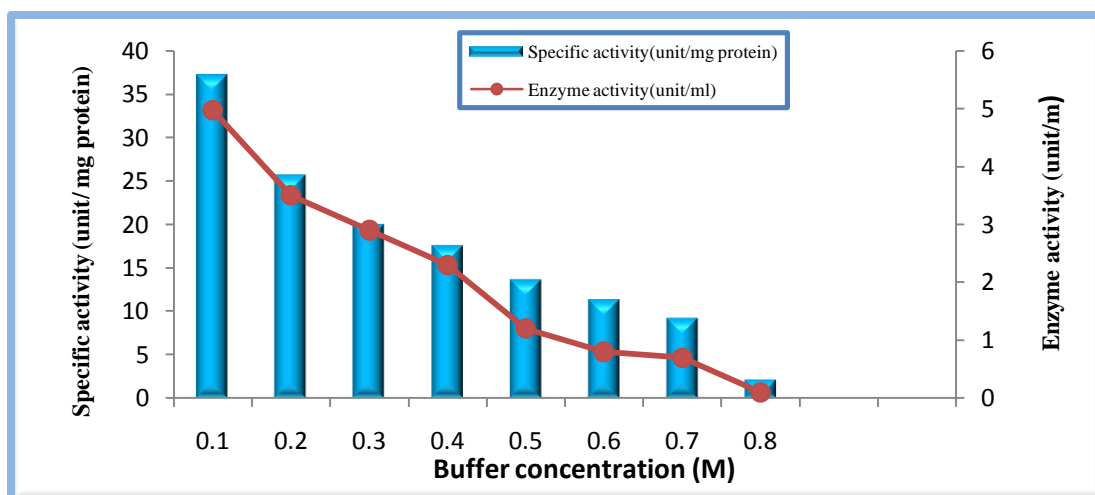
Maximum activity of the enzyme showed at 1:3 (W:V) . SOD extracted from the leaves of *Brassica napus* L. in 1:3 ratio [34]MnSOD extracted from the leaves of *Pisumsativum* L. in 1:5 ratio [8].



**Figure 4:-**Extraction ratio of SOD from *T. aphylla*L. leaves

#### Concentration of buffer solution:-

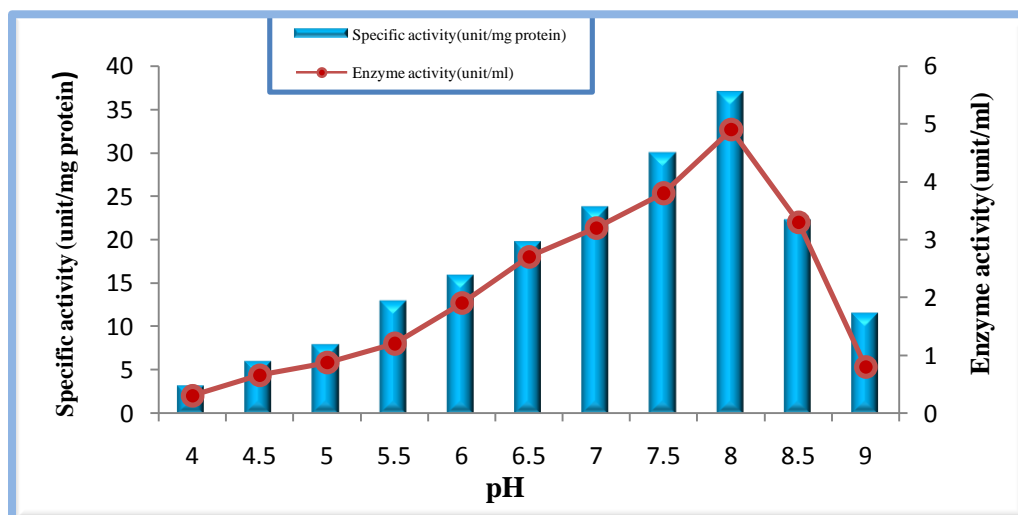
The enzyme show high activity at 0.1 M of potassium phosphate buffer. The ionic strength of 0.1 M of potassium phosphate buffer sufficient to decode the correlation between cellular enzyme and other materials , While the difference in extraction buffer concentrations used in the study included a decrease in the efficiency of extraction increased emphasis this is because the increase of the buffer solution concentration increases the liberation of protein and non-protein , thereby increasing protein concentration and decrease the specific activity. Optimum SOD specific activity of SOD extract from seeds of Chickpea by used potassium phosphate buffer 0.1 M [35].SOD specific activity extract from Spinachby used 50mMpotassium phosphate [36].



**Figure 5:-**Effect of concentration of buffer solution of SOD specific activity

#### pH buffer Solution:-

The highest SOD activity was determined at pH (8.0) by used potassium phosphate buffer 0.1M, therefore it considered the optimum pH. Optimum pH of SOD extract from the seeds of *Brassica napus* L. was 7.8[37]. The optimum activity of SOD extract from the leaves of *Triticumaestivum* L [38].



**Figure 6:-**Effect of pH of SOD from *T. aphylla* L.leaves

#### Extraction Time:-

The high SOD activity determined at 20 min. with specific activity reached 38.11 unit/ mg protein ,then followed by 15, 10, 25,5 and 30 , respectively. 20 min was enough for liberation of the enzyme , Therefore it is considered the optimum period of the extraction.

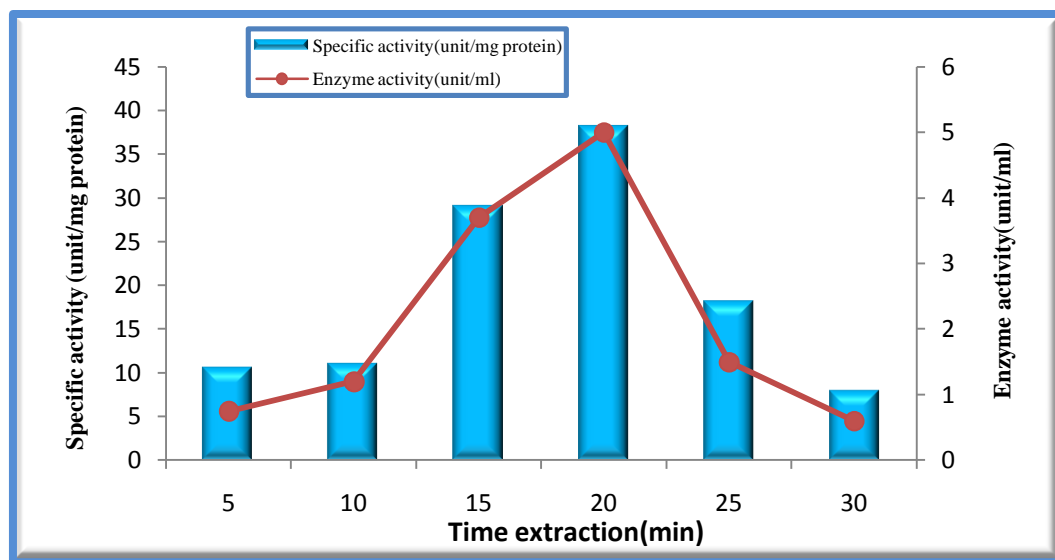


Figure 7:-Effect of extraction time on SOD specific activity

### References:-

1. Beyer, W.; Jmlay, J. and Fridovich, I.(1991). Superoxide dismutase. Prog. Nucl. Acid Res. Mol. Biol. 40: 221-248.
2. McCord, J. M.; Keele, B. B. and Fridovich, I. (1971). Proc. Nat. Acad. Sci. USA 68,1024-1027.
3. Fridovich, I. (1978). Science 201, 875-880.
4. Fridovich, I.(1986). Superoxide dismutases. –In: Advances in Enzymology. Vol. 58 (ed. A. Meister), pp. 61-97. –New York.
5. Bueno, P. and Del Rio, L. A. (1992). Purification and properties of GlyoxysomalCuperzinc Superoxide Dismutase from Watermelon Cotyledons (*Citrullus vulgaris*Schrad). Plant Physiol. 98, 331-336.
6. Droillard, M. Jand Paulin, A. (1990) Isoenzymes of superoxide dismutase in mitochondria and peroxisomes isolated from petals of carnation (*Dianthus caryophyllus*) during senescence. PlantPhysiol 94: 1187-1192.
7. Chen, B.; Chen, L.; Gao, L. G.; Ye, S. Y.; Xiao, R.; Liu, P. L.; Chen, B. L.; Zhang, Y. X. and Yao, J.(2011). Purification and partial properties of superoxide dismutase from Agave Hybrid No. 11648. J. Chem. Soc., 59, No. 1. 1-5.
8. Del Rio, L. A.; Sandalio, L. M.; Altomare, D. A. and Zilinskas, B. A.(2003). Mitochondrial and peroxisomal manganese superoxide dismutase: different expression during leaf senescence . Journal o Expermental Botany . Vol, 154 no.384. PP 932-933.
9. Carlloz, A. and Touati, D.(1986).Isolation of superoxide dismutase mutants in *Escherichia coli*: is superoxide dismutase necessary for aerobic life? EMBO. J 5: 623-630
10. Miller, A. F.(2012).Superoxide dismutase : ancient enzymes and newinsight FEBS Lett. 585-595.
11. Del Rio , L. A.; Sandalio, L. M.; Yanez, J. and Gomes, M.(1985). Induction of a manganese-containing superoxide dismutase in leaves of *Pisumsativum* L. by high nutrient levels of zinc and manganese . Journal of inorganic Biochemistry 24,25-34.
12. Bowler, C.; Montagu, M. V. and Inze, D.(1992) . Superoxide dismutase and stress tolerance. Annu. Rev. Plant. Physiol., 43, 83-116.
13. Murao, K.; Takamiya, M.; Ono, K. and Takio, S. (2004). Copper deficiency induced expression of Fe-superoxide dismutase gene in *Matteucciastrruthiopteris*. Plant Physiology and Biochemistry , 42, 143-148.
14. Bakardjieva, N.; Hristov, K. FrziolRast(1992).FrziolRast18, 23-30.
15. Burke, J. J. and Oliver, M. J.(1992) Plant Physiol100, 1595-1603.
16. Sevilla, F.; Julio, L. G. and Luis, A. D. R.(1982) Plant Physiol. 70, 1321-1326.
17. Duke, M. U. andSalin, M. L.(1985). Arch Biochem. Biophys243, 305-314.
18. Salin, M. L. and Bridges, S.M.(1980).Plant Phsiol69, 161-165.
19. Kirillova, N. V.; Smirnova, M. G. and Komov, V. P.(2001) Appl. Biochem. Microbiol37, 160-163
20. Kithy, T. W.; Lancaster, J. R.; Fridovich, I.(1981).Arch Biochem. Biopgys210, 140-148.
21. Youst, F. J. and Fridovinch, I.(1973). J. Biol. Chem248, 4905-4913.

22. **Wu,T.H.; Liao, MH.; Kuo, WY.; Huany, CH.; Hsieh, HL. and Jinn, TL.(2011).** Characterization of Copper/Zinc and manganese superoxide dismutase in green bamboo (*Bambusaoldhamii*) cloning, expression and regulation. *Plant Physiology and Biotechnology*. Vol. 49(2): 195-200.
23. **Perez-Torres, E.; Garcia, A.; Dinamarca, J.; Alberdi, M.; Gutierrez, A.; Gidelkel, M.; Ivanova, A. G.; Huner, N. P. A.; Corcuera, L. J. and Bravo, L. (2004).** The role of photochemical quenching and antioxidants in photoproduction of *Deschampsia Antarctica*. *Functional Plant Biology*. Vol,31.731-741.
24. **Xu, J.; Yang, J.; Duan, X.; Jiang, Y. and Zhang, P.(2014).** Increased expression of native cytosolic Cu/Zn superoxide dismutase and ascorbate peroxidase improves tolerance to oxidative and chilling stress in cassava (*Manihotesculenta*Crantz). *BMC Plant Biology*. 14: 208.
25. **Wong, C. Y. (1995).** Effect of temperature preconditioning on Catalase, Peroxidase, and superoxide dismutase in chilled zucchini squash. *Postharvest Biology and Technology* ,5,67-76.
26. **Marklund, S. and Marklund, G. (1974).** Involvement of the superoxide anion radical in the autoxidation of pyrogallol and a convenient assay for superoxide dismutase. *European Journal of Biochemistry* 47: 469-474.
27. **Bradford, M. M. (1976).** A rapid and sensitive method for the quantitation of microgram quantities of protein utilizing the principle of protein. Dye binding. *Analytical Biochemistry*. 72: 248-254.
28. **Kotapati, K. V.; Palaka, B. K.; Kandukuri, A.; Pamuru, R. R. and Ampasala, D. R. (2014).**Responseofantioxidative enzymes to drought stress in finger Millet leaves ( *Eleusinecoracana* L.) GAERTN. *International Journal of Plant, and leuviromatal Science*.Vol,4 issue 3: 2231-4490.
29. **Lopez-Millan, A. F.; Ellis, D. R. and Grusak, M. A. (2005).** Effects of Zinc and Manganese supply on the activities of superoxide dismutase and carbonic anhydrase in *Medicagootruncluta* wild type and raz mutant plant. *Plant Science* 168: 1015-1022.
30. **Stoll, V. S. and Blanchard, J. S. (1990).** Buffers: Principles and practice P: stresses, *Plant Cell Environ*.
31. **Jevremovic, S.; Petric, M.; Zivkovic, S.; Trifunovic, M. and Subotic, A. (2010).** Superoxide dismutase activity and enzyme profilesinbulbsof snakes head Fritillary in response to cold treatment. *Arch. Bio. Sci., Belgrad*, 62(3): 553-558.
32. **Rahman, M.M.; Islam, K. S. and Chongling, Y.(2010).** Effect of Chromium stress on antioxidative enzymes and malondialdehyde content activities in leaves and root of Mangrove seedling (Kandeliacande L.) . *Journal of Forest Science*. Vol, 26(3). pp.171-179.
33. **Whitaker, J. K. and Bernard, R. A. (1972).** Experiments for an Introduction to Enzymology. The Wibber Press. Davis, Galif.
34. **Abedi, T. and Pakniyat, H. (2010).** Antioxidant enzyme change in response to drought stress in ten cultivars of oilseed rape (*Brassicanapus* L.). *Czech J. Genet. Plant Breed.*, 46(1): 27-34
35. **Randhawa, N and Kaur, J.(2015).** Antioxidant responses of Chickpea genotypes exposed to moisture stress. *International Journal of Advanced Research*. 3(2): 950-955.
36. **Li, W. X.; Zang, M. and Wang, S. J.(2008).** Effect of three-stage hypobaric storge on membrane lipid peroxidation and activities of defense enzyme in green asparagus . *LWT. Food Science and Technology*. 41: 2175-2181.
37. **Ali, B.; Deng, X.; Hu, X.; Gill, R. A.; Ali, S.; Wang, S. and Zhou, W.(2015).**Deterio active effects of Cadmium stress an antioxidant system and cellular structure in germination seeds of *Brassicanapus* L. . *J. Agric. Sci. Tech*. Vol, 17. 63-74.
38. **Asthir, B.; Koundal, A. and Bains, N. S.(2011).**Kinetics properties of wall bound superoxide dismutase in leaves of wheat (*Triticumaestivum* L.) following stripe rust (*Pucciniastriiformis*) infection. *Journal of Biochemistry and Biophysics*.Vol.48,pp 341-345.





### RESEARCH ARTICLE

#### CONTROL OF ENVIRONMENTAL POLLUTION BY EFFECTIVE UTILIZATION OF FLY-ASH PRODUCED BY THERMAL POWER PLANTS IN CULTIVATED LAND AND BIODEGRADATION OF PLASTIC USING *PSEUDOMONAS SP.* ISOLATED FROM WASTE WATER

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Biodegradation, plastics, *Pseudomonas sp.*, fly-ash, seed germination and plant growth promoting activity.

#### Abstract

Accumulation of plastics in the environment is creating a threat to the mankind. Some plastics are degradable which do not cause threat to the environment, and are being used for several purposes such as making of containers, use for packaging, water pipes etc. In this study, the isolation and characterization of plastic degrading bacteria from paper mill waste water was done. Identification of the isolated strains was performed on the basis of colony morphology, grams nature, and several biochemical tests. Plastic strips are subjected to biodegradation by isolated bacteria using mineral salt medium. The degradation was observed by changes in physical and optical characteristics. The maximum degradation was observed in *Pseudomonas sp.* showed after 21 days of incubation

Utilization of fly-ash, produced by thermal power plants in different fields to control environmental pollution has given due importance for the last many years. In this paper an attempt has been made to present the results of some experiments conducted to utilize fly-ash collected from Kolaghat thermal power plant, properly by extracting its suitable nutrients, by *Pseudomonas sp.* isolated from waste water, useful for plant growth. To conduct this experiment, a single bacterial isolate are isolated from waste water through King's media. After single colonies isolation and thrice time purification, isolate are stored in 40% glycerol solution at isolate are separated for studying their fly-ash and their seed germination as well as plant growth promoting ability on isolate showed good results of seed treatment whether on general soil or fly have been in tabulated form.

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#### Introduction:-

Energy is an essential ingredient for all around development of any country. In India, almost 80% of total electrical power produced, is generated by coal-based thermal power plants. Since, Indian coal consists of high percent of ash, so, when it is burnt by thermal power plants, they produce huge amount of fly-ash causing environmental pollution. With ever-increasing per capita consumption of energy due to exponentially rising population, it is not possible to reduce power generated by coal-based power plants due to environmental pollution but stress may be given to control the same. Several attempts have been made to utilize effectively this huge amount of fly-ash without

dumping into the ash-pond or on the bare lands. For example: the production of in-organic polymer[1,2], production of nano-structure materials[3] and utilization in concrete and cement production is the most effective one for both economic and ecological point of view.

Plastics are the polymers which on heating become mobile and can be cast into moulds. Plastics are non-metallic compounds that can be molded into any desired shapes and sizes. Plastics are used for packaging, making diapers, fishing nets, agricultural films and also used for many more purposes. Plastics and their use has become a part in all sectors of economy. Present demand of plastics is increasing in the areas of agriculture, consumer goods, health and medicine [4]. Plastics can be categorized into some of the basics classes such as: natural plastics, semi synthetic plastics, synthetic plastics, thermoplastics, thermosetting plastics. Amongst these plastics comes the Low density polyethylene (LDPE), Medium density polyethylene (MDPE) and High density polyethylene (HDPE) products. The LDPE, MDPE, and HDPE forms can be classified into polyethylene terephthalate, polyvinyl chloride, polypropylene, polystyrene etc[5]. Various mediums or environment as a whole is used for biodegrading polymers. Due to various physical as well as biological forces depolymerisation can be observed. The physical forces such as temperature, moisture, pressure cause mechanical damage to the polymers[6]. A large number of microorganisms have found to produce enzymes which degrade plastics and many more metallic as well as non metallic compounds.

Today there is a growing interest in the development of biodegradable plastics that would enhance the degradability of other plastic products in landfills and composts under natural conditions [7]. Microbial degradation of plastics is caused by enzymatic activities leading to a chain cleavage of the polymer into oligomers and monomers after which they are further metabolized by the microbial cells. Aerobic metabolism results in carbon dioxide and water[8], whereas anaerobic metabolism results in carbon dioxide, water, and methane as the end products, respectively[9]. One of the major factors in determining the degradability is the melting temperature( $T_m$ ). Melting temperature( $T_m$ ) is inversely proportional to biodegradability [10]. A large number of parameters such as roughing of surface, formation of holes, cracks, defragmentation, change in color, formation of biofilms,  $CO_2$  evolution, oxygen consumption, molar mass, formation of clear zones and weight loss of the compound help in measuring the extent of biodegradability[11,12,13].

This research article evaluates the biodegradability of plastics by *Pseudomonas sp.* isolated by a pure culture shake-flask incubation method. The percent of biodegradation was evaluated by comparing the initial and final dry weights of plastic before and after incubation in their respective culture media. Our hypothesis and purpose of selecting *Pseudomonas sp.* for biodegradation was, this bacteria are predominant in nature and are often found to survive in nutrient deficient ecosystems with their versatile metabolism, hence they would be able to utilize polyethylene amended in the nutrient medium as carbon and energy source when basal nutrients in the medium are exhausted.

It was reported that some bacteria can solubilise many water insoluble minerals like tri-calcium phosphate [14,15,16], manganese dioxide, calcium silicate[17] etc. present in fly-ash[18,19]. Since, Indian fly-ash is full of plant-nutrients, like- Zn, Cu, Ni, Cr, V etc.[20,21], so in this paper, an attempt has been made to present the results of some experiments conducted to extract nutrients from the fly-ash using pseudomonas bacteria isolated from waste water so that fly-ash could be effectively utilized in cultivated land for plant-growth

## **Materials and Methods:-**

### **Sample collection:-**

Waste water samples were collected in sterile containers from garbage dump in paper industry, Balichak, Paschim-medinipur (Latitude-22° 25' 00" to 22° 57' 00" north, longitude- 87° 11' east, altitude 23 meters from mean sea level), West-Bengal, India.

### **Isolation of plastic degrading micro-organisms:-**

99ml of sterile distilled water was taken into a conical flask and One gram of soil sample was added to it and mixed well. Serial dilution of the sample was done. Pour plate method was adopted to isolate the microorganisms, and nutrient agar was used for the culture of bacteria. For each dilution, three replicates were made. For 2-7 days the plates were incubated at 30°C. Sub-culturing of the developed colonies was done to obtain pure colonies and then the colonies were stored at 40°C. The developed colonies were isolated and sub cultured repeatedly to get pure colonies and then preserved in slant at 4°C [22].

**Identification of microorganisms:-**

Gram staining, Colony morphology, Biochemical tests( catalase test, gelatin hydrolysis test, indole test, methyl red and voges proskauer test, starch hydrolysis test, and simmon's citrate test), and motility tests were performed on the isolated strains of micro organism.

**Selection of plastic:-**

Plastic having 50 microns thickness are used for comparative investigation of their biodegradability nature. The plastic are used to made from a combination of virgin plastic vegetable starch (6%), organic minerals, and vegetable extracts.

**Pre-treatment of plastic:-**

The plastic are cut in small strips and transferred to a fresh solution containing 70 ml Tween 80, 10 ml bleach, and 983 ml distilled water and stirring for 30 to 60 minutes [23]. The strips were transferred to a beaker with distilled water and stirred for 1 hour. Further, they were aseptically relocated to ethanol solution 70% v/v for 30 min. Finally, the plastic strips were transferred to a Petri dish and incubated at 45 to 50°C overnight. Ethanol was used to disinfect the plastic and remove any organic matter adhering to its surface.

**Plastic degradation by broth culture method:-**

Pre weighed plastic strips were added to the flask containing 50 ml of mineral salt medium and the medium was inoculated with the isolated micro organism. The control flask was maintained with the mineral salt medium containing plastic strips but free of microorganisms. The test and the control samples were left in a shaker at 30°C for 1 month period. After the incubation period the strips were collected from the medium, washed with distilled water, dried and weighed. The weight loss in the plastic strips was calculated finally.

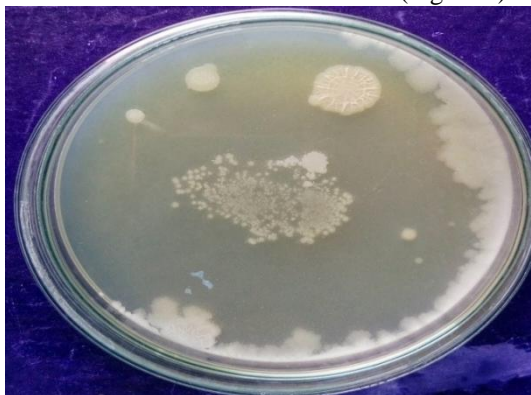
**Seed Bacterization for Growth Promotion:-**

Seed of *Cicer arietinum* were bacterized in twice way. For set 1: Seeds of *Cicer arietinum* were surface-sterilized with 70% ethanol, 1% sodium hypochlorite solution and sterilized double-distilled water repeatedly and sequentially up to 5 min. [24] and dried under a sterile air stream. Then seeds were bacterized separately with the selected isolates. 2ml of bacterial inoculums containing  $3 \times 10^8$  CFU/ml were separately centrifuged at 7000 rpm for 20 min (Cooling Centrifuge, REMI C-24 BL, India) and supernatant were discarded. Bacterial pellets were washed twice with sterile distilled water and finally suspended with carboxymethyl cellulose solution (1mg CMC in 100 ml sterile distilled water) [25]. Surface-sterilized seeds were then dipped separately in different bacterial solution for 3 hrs. For set 2: Sterilization was done but seeds were not bacterized. 2 seeds from every bacterial solution of set 1 were collected and

kept separately on thermal power-plant ash and general soil. Similarly, 2 seeds of set 2 were kept separately on two week treated thermal power plant ash by those different selected bacteria. After 7, 14, 21 and 28 days incubation plant growth-promoting activity was studied.

**Results and Discussions:-**

Bacterial strains were isolated from the contaminated waste water sample using Nutrient agar medium respectively. Among this study white bacterial colonies were noted in  $10^5$  dilution (Figure 1).



**Figure 1:-** Isolation of *Pseudomonas* sp. from waste water of paper mill effluents dump.

The *Pseudomonas sp.* from waste water are isolated and characterized on their morphological and biochemical characteristics (Table 1).

**Table 1:-** Morphological and biochemical characteristics of *Pseudomonous sp.* isolated from waste water of paper mill effluents dump.

Test/Assay Name	P <sub>s</sub> -waste water
Gram Staining	'-ve'
Capsule Staining	'-ve'
Endospore Staining	'-ve'
Form of Colony	Circular
Elevation of Colony	Convex
Surface of Colony	Concentric
Cell-shape	Small bacillus
Motility	'+ve'
Catalase Test	'+ve'
Indole	'-ve'
Methyl red	'-ve'
Voges Proskauer	'-ve'
Citrate	'+ve'

After 4 weeks of incubation in an incubator shaker at 40°C and 150 rpm, the culture flasks were removed and tested for the viability of bacteria and any contamination in the medium. The blanks and the treatments showed good stability of *Pseudomonas* in the medium with no sign of contamination. In addition, there was intense bio film formation by all the *Pseudomonas sp.* which was clearly visible in the broth. From the bellow (Tables 2,3,4,5) and (Figure 2) it can be interpreted that the degradation of plastic strips has taken place. Confirmation of the degradation can be done by observing the weight loss in the plastic strips. By the help of *Pseudomonus sp.* maximum biodegradation i.e, 45% was done after 21 days of incubation.

**Table 2:-**Weight loss determination plastic degradation bacteria after in 7days.

Organism	Initial weight	Final weight	Weight loss	% of weight loss
<i>Pseudomonas sp.</i>	0.50	0.43	0.07	14

**Table 3:-**Weight loss determination plastic degradation bacteria after in 14days.

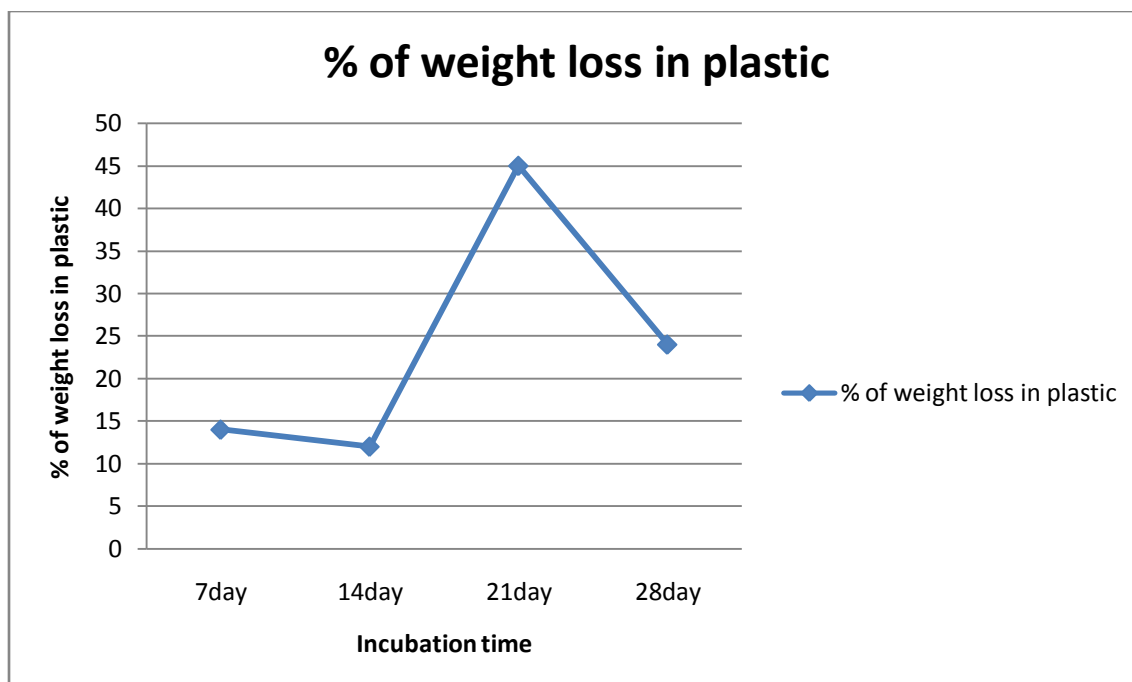
Organism	Initial weight	Final weight	Weight loss	% of weight loss
<i>Pseudomonas sp.</i>	0.43	0.38	0.05	12

**Table 4:-** Weight loss determination plastic degradation bacteria after in21days.

Organism	Initial weight	Final weight	Weight loss	% of weight loss
<i>Pseudomonas sp.</i>	0.38	0.21	0.17	45

**Table 5:-** Weight loss determination plastic degradating bacteria after in28days.

Organism	Initial weight	Final weight	Weight loss	% of weight loss
<i>Pseudomonas sp.</i>	0.21	0.16	0.05	24



**Figure 2:-** Trend of biodegradation of plastic by *Pseudomonas sp.* from waste water.

Plant growth promoting effects and seed germination of plant was carried out on water agar media and fly ash containing soil and the results are shown in the given (Figures 3). After 3<sup>rd</sup> week the maximum plant growth was occurred. More experimental studies are required to verify the same results for other plants like rabi crop or large plants like mango, jackfruit, guava, banana etc. that can grow on fly-ash and produce flowers and fruits. Other types of cattle-dung can also be used for above experiments. So this is one of the best way to utilize fly-ash to solve the environmental problem.



**Figure 3:-** After 3<sup>rd</sup> week bacterial isolates plant growth promoting and seed germination on water agar media and fly ash containing soil.

### Conclusion:-

Biodegradation is a novel procedure to degrade different kinds of artificial substances in a biological manner. This helps to maintain balance in the surrounding. Bacterial strains were successfully isolated from waste water. Isolated bacterial strain are identified as *Pseudomonas sp.* Most of the plastics are degraded naturally in 2 years of decomposition. But LDPE degradation is carried out with microbes to reduce the environmental pollution.

The fly-ash of thermal power plant is a huge source of silica, aluminum, iron and calcium salts, which play as micronutrients for plant growth. Microbes not only play vital role in physical weathering of parental rocks for generation of fertile land or soil but also help in plant nutrition by microbes- plant symbiosis phenomena. Thus, if we apply microbes with fly ash, microbes make ash useful for plants and these plants keep clean the atmosphere. Fly-ash has great potential in agriculture to its efficacy in modification of soil health and crop performance. However, since there is a potential for harming the environment and human health, long term confirmatory research is necessary before planning agriculture as a venue to fly-ash utilization.

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### References:-

1. Chand N, Vashishtha SR, "Development, Structure and Strength Properties of PP/PMMA/FA Blends". *Bull. Mater. Sci.*, (2000) 23(2), 103-107.
2. Steveson M, Sagoe-Crentsil K, "Relationship Between Composition, Structure and Strength of Inorganic Polymers, Part 2: Fly Ash-Derived Inorganic Polymers". *J. Mater. Sci.*, (2005) 40(16), 4247-4259.
3. Paul KT, Satpathy SK, Manna I, Chakroborty KK, Nando GB, "Preparation and Characterization of Nano Structured Materials from Fly Ash: A Waste from Thermal Power Stations, by High Energy Ball Milling". *Nanoscale Res. Lett.*, (2007) 2(8), 397-404.
4. Usha R, Sangeetha T and Palaniswamy M, *Libyan Agric Res Center J Internati* (2011)2(4), 200-204.
5. Shimao M. *Curr. Opin. Biotechnol*, (2001) 12, 242-247.
6. Bellina G, Tosin M, Degli-Innocenti F. *Polym Degrad Stab* (2000) 69, 113-120.
7. Pometto, AL; Lee, B; Johnson, KE, Production of an Extracellular Polyethylene- Degrading Enzyme(s) by *Streptomyces* Species. *Appl. Environ. Microbiol.*, (1992) 58 (2), 731 - 733.
8. Starnecker, A; Menner, M, Assessment of biodegradability of plastics under stimulated composting conditions in a laboratory test system.
9. *Int. Biodeterior. Biodegrad* (1996), 85 - 92.
10. Gu, JD; Ford, TE; Mitton, DB; Mitchell, R (2000). *Microbial corrosion of metals. The Uhlig Corrosion Handbook*. 2nd Edition. Wiley, New York, USA.
11. Wang YZ, Yang KK, Wang XL, Zhou Q, Zheng CY, Chen ZF. *J Poly Environ*, (2004)12, 7-11.
12. Sharma Prabhat, Bhattacharyya S, Verma Vishal, Kalyani RK, Kumar Vijai, Pandey KN and Singh M. *Internat Res J Environ Sciences*, (2013)2(9), 83-85.
13. Premraj R, Dan Mukesh Doble. *Ind J Biotech*, (2005) 4, 186-193.
14. Priyanka N. *Internation J of Biomed Ad Res*, (2011)2(9), 235-238.
15. Khan AA, Jilani G, Akhtar MS, Naqvi SMS, Rasheed M, "Phosphorus Solubilizing Bacteria: Occurrence, Mechanisms and Their Role in Crop Production". *J. Agric. Boil. Sci*, (2009) 1, 48-58.
16. Mahdi SS, Hassan GI, Hussain A, Rasool F (2011). "Phosphorus Availability Issue- Its Fixation and Role of Phosphate Solubilizing Bacteria in Phosphate Solubilization". *Res. J. Agric. Sci*, (2011) 2, 174-179.
17. King EO, Ward MK, Raney DE, "Two Simple Media for the Demonstration of Pyocyanin and Fluorescein". *J. Lab. and Clinical Microbiol.*, (1954) 44, 301-307.
18. Bennett PC, Rogers JR, Choi WJ, "Silicates, Silicate Weathering, and Microbial Ecology". *Geomicrobiology Journal*, (2001) 18, 3-19.
19. Giere R, Carleton LE, Lumpkin GR, "Micro- and Nano-Chemistry of Fly Ash from Coal-Fired Power Plant". *Am. Mineral*, (2003) 88, 1853.
20. Sadasivan S, Negi BS, "Chemical Characteristics of Fly Ash from Coal Fired Thermal Power Plants in India", *Science of the Total Environment*, (1991)103, 151-158.

21. Khandkar UR, Gangwar MS, Srivastava PC, Singh M (1993). "Edaphological Characteristics of Unweathered and Weathered Fly Ashes from Gondwana and Lignite Coal", *Environment Pollution*.
22. Jayaprakashvel M, Muthezhilan R, Srinivasan R, Hussain AJ, Gobalakrishnan S, Bhagat J, Kaarthikeyan C and Muthulakshmi R, "Hydrogen Cyanide Mediated Biocontrol Potential of *Pseudomonas* sp". AMET1055 Isolated from the Rhizosphere of Coastal Sand Dune Vegetation, (2010)10, 39-42.
23. Nishida H, Tokiwa Y. *J Environ Polym Degrad*, (1998)1, 227–233.
24. El-Shafei, HA; El-Nasser, NHA; Kansoh, AL; Ali, AM, Biodegradation of disposable polyethylene by fungi and *Streptomyces* species. *Polym. Degrad. Stab*, (1998) 62, 361 - 365.
25. Abdul Baki A A, Anederson J D , "Vigour Determination in Soybean Seed by Multiple Criteria". *Crop Sci*, (1973) 13 , 630-633.
26. Holt JG, Krieg NR, Sneath PHA, Staley JT, Williams ST (1994). "Bergey's Manual of Determinative Bacteriology", 9th Edition Published by Williams and Wilkins, A. Wavelly Company, Baltimore.





### RESEARCH ARTICLE

#### TOXIC EFFECTS OF $\text{Cu}(\text{SO}_4)$ ON GILL AND LIVER TISSUES OF FRESH WATER CATFISH *CLARIAS BATRACHUS* (LINN.).

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Gill, liver, histopathology, copper and *Clarias batrachus*.

#### Abstract

Heavy metals are a major problem because they are toxic and tend to accumulate in living organisms. This study was carried out with the aims of studying on histopathology of  $\text{Cu}(\text{SO}_4)$  toxicity on gill and liver tissues of catfish *Clarias batrachus* within the period of 96 h. Totally, 140 fishes with mean weight  $60 \pm 10$  g were stocked in 12 aquariums with capacity of 200 L water and divided in to 3 trails including control, 0.3 ppm and 0.5 ppm of Cu with 3 replicates. Tissue samples were fixed by bouin's solution and sectioned in 7  $\mu\text{m}$  based on histological regular method and stained with Hematoxylin and Eosin (H & E) method for microscopic study within the period of 96 h. Results showed some damaged such as hyperplasia, telangiectasis and edema, necrosis of second filaments, jerky movement, aneurism, hyperaemia and fusion of second filaments in gills; and cell atrophy, necrosis, fatty degeneration, hyperaemia and bile stagnation at different treatments in comparison with control. Gill and liver tissue damages were severer with the increase of Cu concentration and days. Therefore, Cu had acute toxicity effects on gill and liver tissues in Catfish at 0.3 and 0.5 ppm concentrations.

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#### Introduction:-

Heavy metals are serious danger for the earth ecosystem. Accumulation of heavy metals in water, air and soil is a major environmental problem. A little amount of copper is produced from destroying of soils and rocks (Kasraiee, 2009). Naturally, heavy metals formed lower than 1% of body weight and their concentration fluctuations lead to environmental impermanent and disaster in animals (Clark, 1986). Industrial development and environment chemical pollution threatens aquatic animal life. Environmental pollutions with heavy metals were increased in the world and it may be bioaccumulated in fish tissues (Mansour and Sidky, 2002). Therefore, heavy metals are the most important pollutant of aquatic ecosystem that is the cause of major problems for human (Karan *et al.*, 2002). Some metals such as copper and ferric are needed in little amount for natural development, but some of them such as Cu, Cd, Pb and Hg are toxicant at lower concentrations. Therefore, discharge of industrial, mineral, agricultural, house sewage and fuel (Swarup *et al.*, 2006; Patra *et al.*, 2005; Woodling *et al.*, 2001), algacides and fungicides used in aquaculture (Onwumere and Oladimeji, 1990) are considered as aquatic ecosystem pollutants so that

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industrial wastewaters are the main source of pollution (Kaviraj and Das, 1995) that include various kinds of toxic pollutants such as suspended solid, minerals, poisons and pesticides (Kumar and Singh, 2010). Therefore, heavy metal pollutions have harmful effects on environmental equivalent and animal diversity (Vinodhini and Narayanan, 2008). Copper is one of these pollutants and also added to ponds as a micronutrient for increasing in production of planktons and fish (Adhikari and Ayyappan, 2004). Catfish is a warm water fish that feed on planktons. Copper may be transferred by plankton to fish and human finally. Higher amount of zinc leads to pathologic disasters in tissues and causes fish death. Some studies were done in Iran that showed the effects of Cu on different tissues of *Cyprinus carpio* (Mohammad Khanlo Ashaieri, 2003; Rostami *et al.*, 2000; Rostami and Soltani, 2009) in rainbow trout (*Oncorhynchus mykiss*) (Farangi and hajimoradloo, 2007) and in fingerlings of *Acipenser persicus* (Moshtaghi *et al.*, 2009; Fathollahi *et al.*, 2010). Therefore, the aim of this study was investigating histopathological effects of Cu acute toxicity on gill and liver tissues in *C. batrachus*.

### Materials and Methods:-

Adult and live fish *C. batrachus* were collected from the fish farm Patra and Bhadbhada Bhopal M.P.) brought to the laboratory, cleaned by using 0.1% KMnO<sub>4</sub> to avoid dermal infection. Fishes were acclimatized in glass aquaria for 15 days and were fed with fish food (earthworms) and water in the aquaria was replaced by freshwater at every 24h.

140 fishes with mean weight  $60 \pm 10$  g in 3 treatments (0.3 and 0.5 ppm) with 3 replicates were stocked in aquarium with capacity of 200 L water. Firstly, the fishes were adapted to clinical conditions and then introduced to detected concentrations. Desired concentrations of Cu were measured by the Germ/volume method and using  $C2V2 = C1V1$  formula. Firstly, the total required Cu was measured and then dissolved in a specific volume of the whole water for providing stock solution. Then, specific volumes of the stock were poured into aquariums. Samples of gill and liver tissues were collected at 24, 48, 72 and 96 h, fixed by Bouin's solution and dehydrated based on standard method, clarified, embedded, sectioned with 7  $\mu$ m diameters by using microtome set (model Letiz 1512, Germany), stained based on Hematoxylin and Eosin (H & E) method (Hallajian, 2010) and were studied by light microscope.

### Results:-

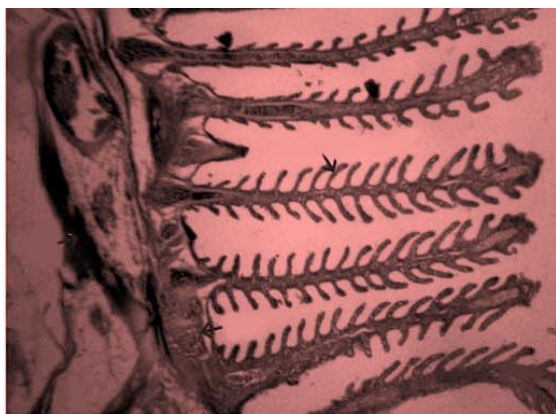
Clinical studies results showed some apparent signs such as fast opening and closing of operculum and mouth, fidgety and air swallowing.

#### (A) Microscopic study of gill:-

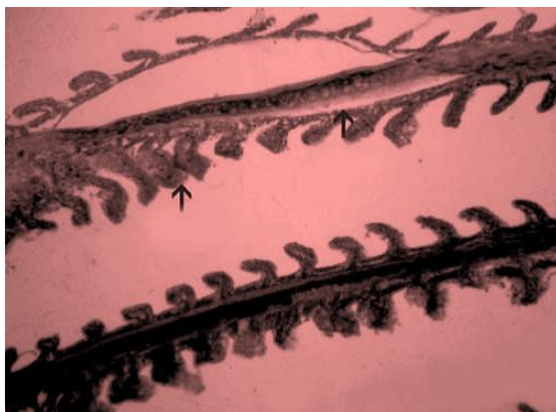
Some damages including hyperplasia, telangiectasis, and edema, necrosis of second filaments, jerky movement, aneurism, hyperemia and fusion of second filaments in gills at 0.3 and 0.5 ppm concentrations than control and severe with increase of concentration and days

#### (B) Microscopic study of liver:-

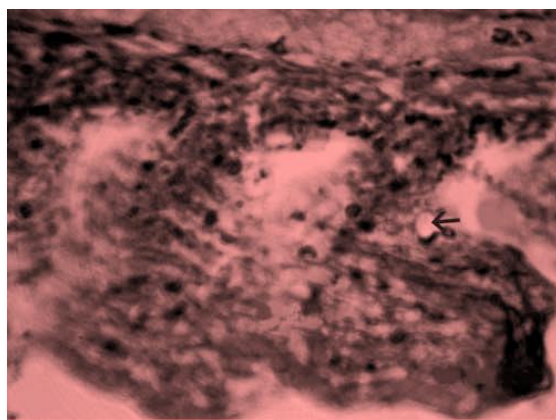
Microscopic studies of liver samples showed some damages such as cell atrophy, cell necrosis, fatty degeneration, hyperemia, bile stagnation and melanomacrophage at 0.3 and 0.5 ppm than control (Figures 4, 5 and 6). Liver damages were lower at 0.3 ppm than 0.5 ppm of Cu. Therefore, with the increase of zinc sulphate concentration and days up to 72 h liver damages were severe but at 72 & 96h.



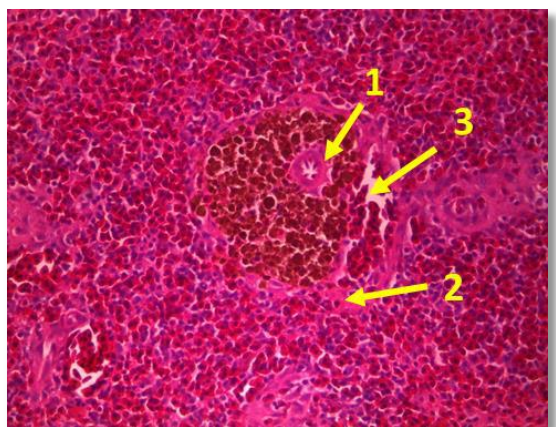
**Figure 1:-** part of control gill showing structural organization. Note the gill lamella, taste bud and gill arch. H/E  
x100



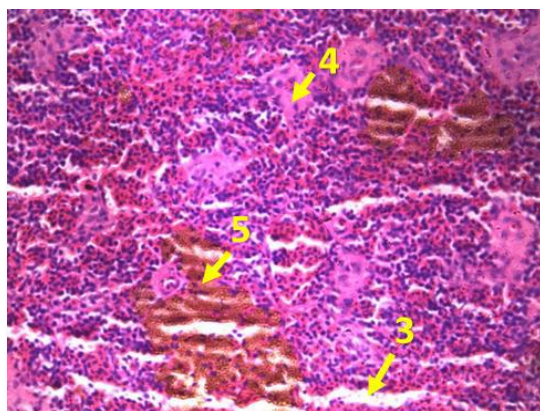
**Figure 2:-** Hyperplasia (H), fusion of gill filaments (F), at 0.3 ppm of Cu after 12 h. (H & E, 245X).



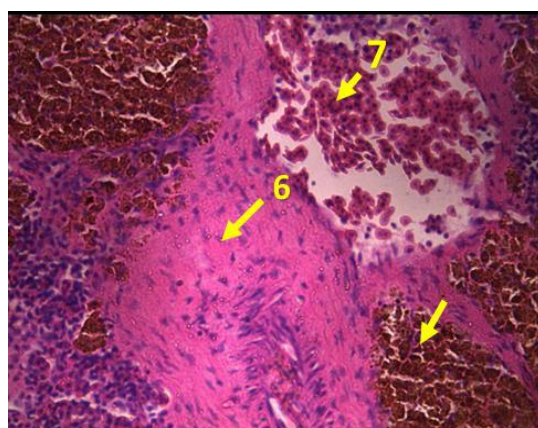
**Figure 3:-** Hyperplasia, haemosiderin (He), fusion of filaments (F) and necrosis of cells (N) at 0.5 ppm at 96 hrs. H  
& E, 245X.



**Figure 4:-** Liver cells at control (H&E, 750X).



**Figure 5:-** Hyperemia (H), bile stagnation (Bs) (H&E, 750X).



**Figure 6:-** Necrosis of cells (N), fatty degeneration at concentration (F) (H&E, 750X).

### Discussion:-

Heavy metals have an important physiological effects and causes of many diseases if decreased or increased. Copper is a mineral ingredient and its toxicity has bad effects on the body of fishes (Donmez *et al.*, 1993). Gill structure in Catfish includes primary and second lamella. Secondary lamellas of this fish are long and free from the end of distal. A normal secondary lamella complex was from two thin layers of epithelial cells, blood vessels and row of cells (Athikesavan *et al.*, 2006). Copper has effects on chloride cells, gill morphology and physiology such as pH reduction in blood vessel, decrease in oxygen absorption and heart beat and delays egg hatch time and increase of larvae survival. Cu is resistant to deposition and lingering in environment for long time. Acute damages caused by Cu on gill include lamella fusion, hyperplasia, hyperemia, cell necrosis and telangiectasis after 12 h. These disasters in fish are kind of responses to environment conditions, so that fusion of secondary filaments is due to mucosa glycoprotein on cells (Chreck and Moyle, 1990) which lead to increase exposure of lamella with air or oxygen for collapse and adhesiveness, hyperemia and hyperplasia that indicated an immune response to chemical matters such as heavy metals (Rostami *et al.*, 2000). Hypertrophy and hyperplasia caused to disaster in gill epithelium cells because of reduction in water flow between gill filaments that decreased respiratory function (Marioara *et al.* 2009). Some similar effects have been reported by Marioara *et al.* (2009) and Athikesavan *et al.* (2006) about Cadmium effects on Silver Carp; Naji *et al.* (2007) about Cu effects on Common Carp; Gorouiee *et al.* (2008), Collins and Brown (1998), and Jeney (1992) about aluminum sulfate effects on *Rutilus frisikuttum*, *Onchorhynchus mykiss* and *Cyprinus carpio*, respectively. Fernandez *et al.* (2008) indicated that long term exposure to heavy metals cause respiration, blood circulation and osmoregulation disasters in fishes. Alvarado *et al.* (2006) observed that high increase in chloride cells of gills led to thickness in epithelial cells, increase in migration of chloride cells into secondary lamella edge, hypertrophy and fusion of secondary lamella of gills. Liver play a main role in detoxication. Histological studies of liver showed cell atrophy, cell necrosis, hyperaemia and bile stagnation after 12 h exposure to Copper sulphate. Rostami *et al.* (2000), and Rostami and Soltani (2009) reported cell necrosis, increase of



*Hemosydrine* in Common Carp exposed to Cu. Kamaraju and Ramasamy (2011) indicated that increase in  $\text{NiCl}_2$  concentration lead to decrease in glycogen level. Yilmaz *et al.*, (2011) showed that with increase of  $\text{CdSO}_4$  concentration in *Leuciscus cephalus*, some disasters in liver such as fatty degeneration, cell necrosis and kopfer cells were severed according to present study results.

### Conclusion:-

Based on obtained results at present study, zinc sulphate induced some histopathological disasters and leads to fish death. Toxicity rate of Cu in fishes was severe with the increase of concentrations and days.

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### References:-

1. Adhikari, S. and Ayyappan, S. 2004. Behavioral role of zinc on primary productivity, plankton and grow of a fresh water teleost *Labeo rohita*. (Hamilton). Aquaculture 231(14):327- 336.
2. Alvarado, N.E. Quesada, I. Hylland, K. Marigomez, I. and Soto, M. 2006. Quantitative changes in metallothionein expression in target cell-types in the gills of turbot (*Scophthalmus maximus*) exposed to Cd, Cu and Zn and after a depuration treatment. Aquat. Toxicol. 77(1):64-77.
3. Athikesavan, S. Vincent, S. Ambrose, T. and Velmurugan, B. 2006. Nickel induced histopathological changes in the different tissues of freshwater fish, *Clarias batrachus* (Valenciennes). J. Environ. Biol. 27(2):391-395.
4. Clark, R. 1986. Marine pollution. Clarendon press, Oxford. pp. 64-82.
5. Colins, S.P. and Brown, J.A. 1998. Lamellar adhesion and impactions for gaseous exchange in brown trout exposed to low levels of aluminum. Department of Biological Sciences Hatchery Laboratory, University of Exeter, Devon, EX4 4PS, UK, pp. 51-55.
6. Donmez, H. Dursun, N. Ozkul, Y. and Demiratas, H. 1993. Increased sister chromatin exchange in workers exposed to occupational lead and copper. Biol. Trace Elem. Res. 61(1):105-109.
7. Farangi, M. and Hajimoradloo, M. 2007. Clinical and histopathological acute toxicity signs of Ammonia in Rainbow trout (*Oncorhynchus mykiss*). J. Azadshahr Azad Univ. 4:72-79.
8. Fathollahi, R. Khara, H. Pajand, Z. Shenavar, A. Hallajian, A. and Moshtaghi. 2010. Lethal concentration detection (LC50 – 96 h) of NaCl and its effects on gills of Persian sturgeon (*Acipenser persicus*). J. Biol. Sci. Azad Univ. Lahijan 3:52-65.
9. Fernandez, C. Fernandes, A.F. Ferreira, M. and Salgado, M.A. 2008. Oxidative stress response in gill and liver of (*Liza saliens*), from the Esmoriz-Paramos Coastal Lagoon, Portugal. Arch. Environ. Contam. Toxicol. 55:2.
10. Gorouiee, H. Jamili, S.H. and Rostami, M. 2008. Acute toxicity of Aluminum sulphate on gill tissues of *Rutilus rutilus*. J. Educ. Res. Aquat. Anim. 79:193-196.
11. Hallajian, A. 2010. Histological methods. Int. Sturgeon Res. Inst. p. 212.
12. Jeney, Z.S. 1992. Acute effect of sub lethal ammonia concentrations on common carp. Effect of ammonia on adrenalin and noradrenalin levels in different organs. Aquaculture 104:139-148.
13. Kamaraju S, Ramasamy K 2011. Effect of cadmium chloride on glycogen content in gill, liver and kidney of edible exotic fish *Clarias batrachus*. Int. J. Curr. Res. 33(5):53-57.
14. Mohammad KA 2003. Detection of LC50 and study on acute effects of Zinc on muscle tissues of gonads and liver in Common Carp (*Cyprinus carpio*). MSc Thesis. North Branch of Tehran University. p. 98.
15. Karan V, Victoric S, Tutundic V, Poleksic V 2002. Functional Enzymes Activity and Histology of Carp after Copper Sulfate Exposure and Recovery. Ecotoxicol. Environ. Saf. 40:49-55.
16. Kasraiee P 2009. Heavy metals in environment. J. Ecol. <http://www.drkasraie.blogfa.com/post8.aspx>.
17. Kaviraj A, Das S 1995. Influence of Chelating Agent EDTA, Absorbent Activated Charcoal and Inorganic Fertilizer (single super phosphate) on the Histopathological Changes of Common carp Exposed to Copper sulphate. Proc. Nata-Sci. India.B. Biol. Sci. 65:305-308.
18. Kumar P, Singh A 2010. Cadmium toxicity in fish: An overview. GERF Bull. Biosci. 1(1):41-47.
19. Mansour SA, Sidky MM 2002. Ecotoxicological studies. 3: Heavy metals contaminating water and fish from Fayoum Governorate, Egypt. Food Chem. 78:15-22.

20. Marioara N, Gabi D, Liliana PC, Motmaria BD, Tapalaga I, Lunca M, Liliana B 2009. Pathological tissue lesions Induced by Chronic Cadmium intoxication in Catfish *Carassius auratus gibelio*. Zootehnie Biotechnol. 42(2):84-90.
21. Moshtaghi B, Nezami SH, Kara H, Pajand Z, Shenavar A, Hallajian A, Fathollahi R 2009. Lethal concentration detection of  $\text{KMnO}_4$  and  $(\text{CuSO}_4 \cdot 5\text{H}_2\text{O})$  in *Acipenser persicus* fingerlings. J. Biol. Sci. Azad Univ. Lahijan 11:67-78.
22. Naji T, Safaeian SH, Rostami M, Sabrjoo M 2007. Investigation of Zinc Sulphate on gill of Common Carp (*Cyprinus carpio*) fry. J. Environ. Technol. Sci. 2:29-36.
23. Onwumere BG, Oladimeji AA 1990. Accumulation of metals and histopathology in *Oreochromis niloticus* exposed to treated NNPC Kaduna (Nigeria) Petroleum Refinery effluent. Ecotoxicol. Environ. Saf. 19:123-134.
24. Patra RC, Swarup D, Naresh R, Puneet K, Shekhar P 2005. Cadmium level in blood and milk from animals reared around different polluting sources in India. Bull. Environ. Contam. Toxicol. 76(4):1092-1097.
25. Rostami M, Soltani M 2009. Study on chronic effects of copper sulphate on some organs in *Cyprinus carpio*. J. Vet. Tehran Univ. 64:193-198.
26. Rostami M, Soltani M, Sasani F 2000. Study on histopathological effects of some heavy metals ( $\text{CuSO}_4$ ,  $\text{ZnSO}_4$ ,  $\text{HgSO}_4$  and  $\text{CdSO}_4$ ) on tissues of *Cyprinus carpio*. J. Vet. Tehran Univ. 55:1-3.
27. Schreck CB, Moyle PB 1990. Methods for fish biology. Am. Fisher. Soc. pp. 491-525.
28. Swarup D, Patra RC, Naresh Ram, Puneet K, Pallav S, Balagangatharathilagar M 2006. Deficiency of copper and cobalt in goats reared around lead zinc smelter. Small Rumin. Res. 63(3):309-313.
29. Vinodhini R, Narayanan M 2008. Bioaccumulation of heavy metals in organs of fresh water fish *Cyprinus carpio* (Common carp). Int. J. Environ. Sci. Technol. 5(2):179-182.
30. Woodling JD, Brinkman SF, Horn BJ 2001. Non uniform accumulation of cadmium and copper in kidney's of wild brown trout *Salmo trutta* populations. Arch. Environ. Contam. Toxicol. 40:381-385.
31. Yilmaz M, Ersan Y, Koc E, Ozen H, Karaman M 2011. Toxic Effects of Cadmium Sulphate on Tissue Histopathology and Serum Protein Expression in European Chub, *Leuciscus cephalus*. Kafkas Univ. Vet. Fak Derg 17(Suppl A):131-135.



### RESEARCH ARTICLE

## ASSESSMENT OF GLAUCOMA AWARENESS AND KNOWLEDGE AMONG DIABETIC PATIENTS IN HAIL, SAUDI ARABIA

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### Abstract

Green banking is a new concept of banking were in all other activities of banking remains the same, but extra protection is given on sustainability environmental protection through paper less banking. It is that part of banking which aim at reduction of operational cost, improving efficiency and total productivity. This paper makes an attempt to find out the awareness and adoptability of concept of green banking. We know that India is a developing nation were nearly 40% of population are youths. It makes an investigation into the various modes of e – banking services available to the customers and extent they use the services.

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### Introduction:-

Glaucoma is the second leading cause of blindness in the world and the estimated prevalence of Glaucoma around the world is estimated 60 million people with glaucomatous optic neuropathy and an estimated 8.4 million people who are blind as the result of glaucoma. The prevalence in Saudi Arabia has not been determined however, These numbers are set to increase to 80 million and 11.2 million by 2020.

People with diabetes are vulnerable to develop glaucoma as are non-diabetics. Lack of knowledge about the disease may cause patients to present late and miss the opportunity to reap the benefits of early intervention.

### Objectives:-

To evaluate the awareness and knowledge on Glaucoma among diabetic patients in Hail city and yearly screening measure.

### Materials & Methods:-

a community based cross sectional study was conducted in Hail city Among diabetic patients. the questionnaire was designed to be three parts:

first part related to personal information (age, gender, education level) and diabetic duration. Second part focused on the awareness and knowledge through 8 questions (four questions evaluating their awareness and four assessing their knowledge). The third part had two questions dealing with the source of information about glaucoma and any screening done regularly. Diagnosed cases of glaucoma were excluded from participating. The questionnaire began with the entry level question "have you heard about glaucoma"

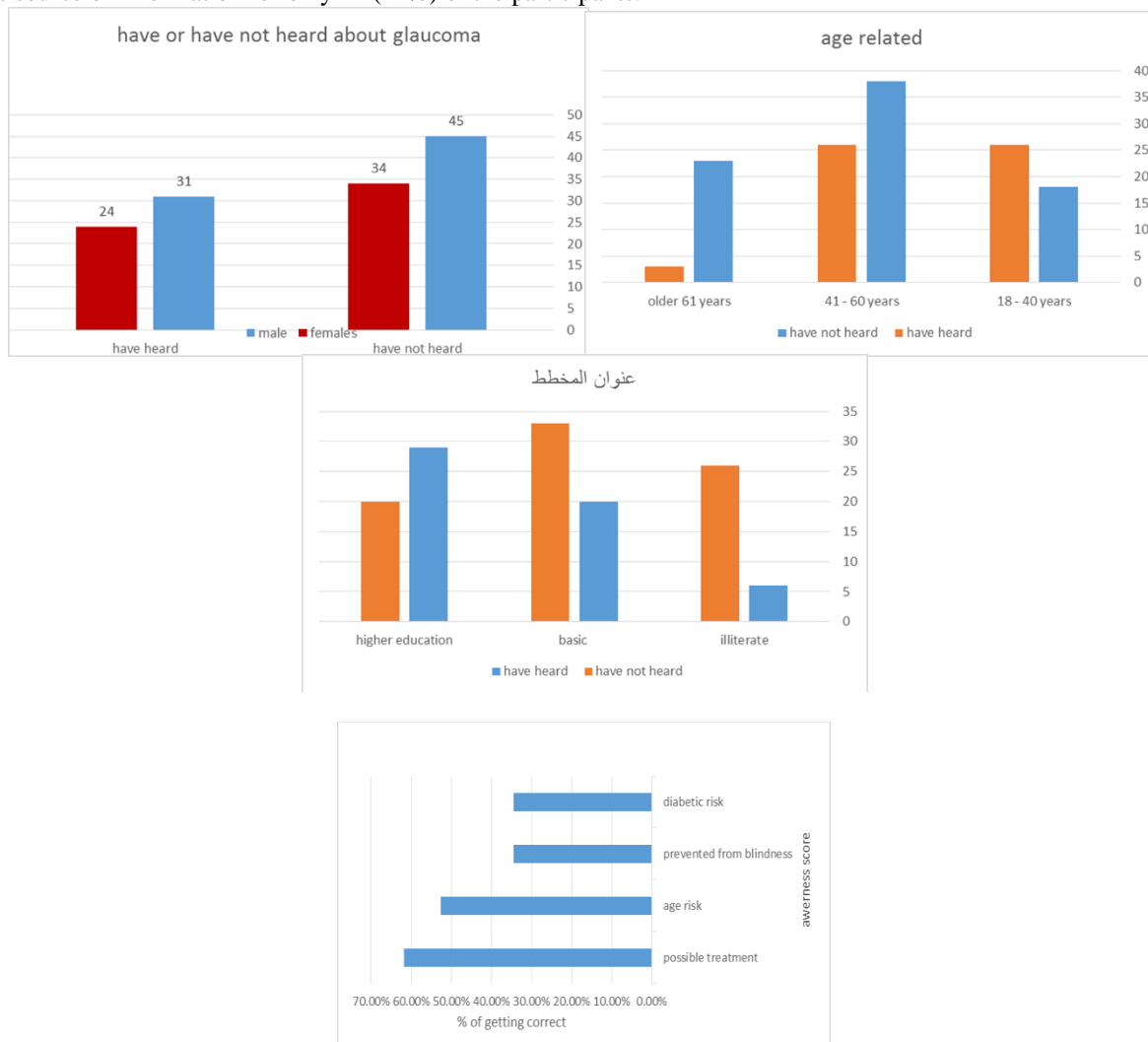
However, not having heard the term itself meant lack of awareness

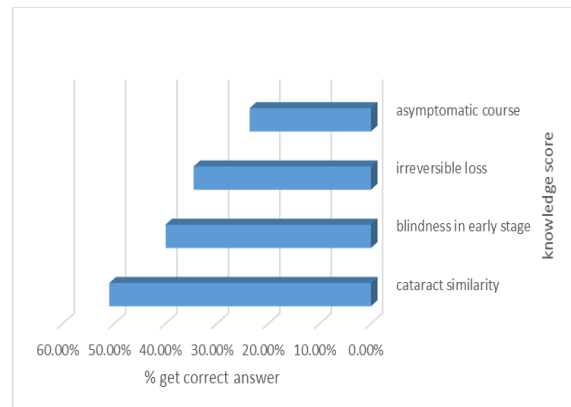
### Results:-

A total of 134 diabetic patients were collected, Age range 18 - 70 The mean age was 53 years. Males were about 76 participants (56.7%) and female 58 (43.3%), Among the 32 (23%) illiterate participants 22 were male and 10 were female 102 (77%) participants were educated at different level, 82 (61.2 %) have more than 10 years duration with diabetes, A total of 55 (41%) participants had heard about glaucoma, And the remaining who have not heard are consider as not aware, (26.2 %) were aware, and (21.2 %) had some knowledge about glaucoma. Awareness of glaucoma in terms of age and gender no difference.

Literate participants were more likely to be aware and likely to be knowledgeable than illiterate participants .The level of education had a significant association with both awareness and knowledge.

Source of information about glaucoma among the respondents was also assessed during the survey. Source of information for 28 (50.9) participants was from family or friends. Another 15 (27%) participants had received information from visiting hospitals, medical personnel, eye camps or other healthcare recourses. TV and other media was source of information for only 12 (21%) of the participants.





### Discussion:-

This study assesses the awareness and knowledge about glaucoma among diabetic patients. The goal of this study to evaluate the understanding of glaucoma, that is, a silent clinical course, irreversible loss, and the importance of screening. Some of participants had heard the term glaucoma (جلوكما) even though, they were a few actually aware, we attributed that as the term may confuse as there is a similar term in Arabic ماء ازرق and cataract ماء أبيض. We did not find any relationship between age or gender and glaucoma awareness, like many other studies. In this study, awareness and knowledge was better among individuals with higher education. As expected, small percentage knew that glaucoma has asymptomatic course and this must raise alert. Lack of awareness could often lead to under-diagnosis and late presentation, as noted in several previous studies and therefore, adversely affected the eye care-seeking behavior. Satisfied percentage knew could be vision loss irreversible, friends and family as the most common source of glaucoma information. Studies from the UK have reported the successful role of media in increasing the awareness about glaucoma. \*

### Conclusions:-

glaucoma awareness and knowledge is suboptimal in Hail among diabetic patients and their knowledge about yearly screening benefits is nearly poor. We recommend the use of public awareness campaigns through various media.

### Reference:-

1. Kinsky ophthalmology – glaucoma chapter “introduction“
2. Prevalence of blindness WHO. [http://www.who.int/blindness/Vision2020\\_report](http://www.who.int/blindness/Vision2020_report)
3. Indian J Ophthalmology .
4. Awareness, knowledge, and practice: A survey of glaucoma in north Indian rural residents, Parveen Rewri
5. Baker H, Murdoch IE. Can a public health intervention improve awareness and health-seeking behavior for glaucoma? Br J Ophthalmol. 2008;92:1671–5.





### RESEARCH ARTICLE

#### METASTATIC OVARIAN TUMOR DISCOVERED ACCIDENTALLY DURING CESAREAN SECTION IN A 34-YEAR-OLD WOMAN: A CASE REPORT.

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##### Key words:-

Primary ovarian tumors, krukentburg tumor, CK7, CK20, CDX-2, luteoma of pregnancy.

#### Abstract

Krukentburg tumor is a rare metastatic ovarian carcinoma usually occur in female between 30-40-year-old and rarely seen after menopause. Stomach is the most common primary site.

Histopathological features of krukentburg tumors appears as diffuse stromal proliferation, mucus-production, and numerous signet-cells and these tumors spread mostly by lymphatic route. Treatment and prognostic factors are not well established.

This study describes a 34-year-old female with a unilateral ovarian mass discovered accidentally during cesarean section delivery and it was misdiagnosed as luteoma of pregnancy, but histopathological examination showed a diffuse infiltration of the ovary and omentum by malignant cells, some of which have signet ring morphology. These findings were not correlated with luteoma of pregnancy or any other types of primary ovarian tumors like primary surface epithelial tumor, sex cord stromal tumor or germ cell tumor. A panel of immunohistochemical markers were ordered and the results were as follow: (negative CK7, AFP, and alpha inhibin, and positive EMA, CK20 and CDX-2). these findings were diagnostic for metastatic adenocarcinoma either from the stomach or pancreas (krukentburg tumor). Two weeks later, the patient was evaluated and a large gastric tumor was found in her stomach and she underwent gastrectomy.

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### Introduction: -

Ovarian cancer is the second most common cancer among all gynecological malignancies and it's one of the leading causes of cancer death among women. Malignant ovarian lesions include primary lesions that develop from the ovarian tissue itself or secondary lesions due to ovarian metastasis from primary lesion elsewhere.<sup>[1]</sup>

Primary ovarian tumors include surface epithelial stromal tumors, sex-cord stromal tumors, germ cell tumors and other more rare types. **Ovarian epithelial tumors** account for the majority of all ovarian tumors. And they are classified according to histological cell type into serous, mucinous (formed by cells of the endocervical epithelium or those of the intestinal epithelium), endometrioid (formed by cells of the internal lining of the endometrium) clear and transitional tumors. These tumors usually range from being benign to borderline or malignant tumor.<sup>[1]</sup>

Krukenberg tumors are rare secondary ovarian cancer due to metastatic adenocarcinoma of the gastrointestinal tract, mainly originate from the stomach. It is bilateral in most of the cases. They are rarely discovered during pregnancy, thus, possess diagnostic challenges to the physicians since its usual symptoms can be attributed to pregnancy. Local extension of the tumor produces gastrointestinal symptoms which could be confused with the effect of pregnancy hormones on the gastrointestinal tract or misdiagnosed with hyperemesis gravidarum. Abdominal distention can also be masked by the gravid uterus. Furthermore, new onset ovarian masses discovered during pregnancy or delivery can be mistaken with pregnancy luteoma, which is, benign ovarian neoplasm that is usually asymptomatic and discovered incidentally during surgeries or imaging.<sup>[2]</sup>

These metastatic tumors usually occur in age group between 30-40 years and rarely seen after menopause. Diagnosis of krukenberg tumors made histologically by the presence of diffuse stromal proliferation, mucus-production and neoplastic signet ring cells.<sup>[3]</sup>

The prognosis of patients with this type of tumor are extremely poor, median survival of 7–14 months. Treatment guidelines has not been established well because of rarity of the disease. And still there is no optimal therapy for this tumor.<sup>[4]</sup>

### Case presentation: -

A 34-year-old pregnant woman on her usual state of health came to the hospital for cesarean delivery. During C/S, her surgeon accidentally discovered a unilateral ovarian mass. Thereafter, oophorectomy and partial omentectomy were performed. The specimen was sent for further evaluation.

The patient did not report any complaint before, and her family history was noncontributory.

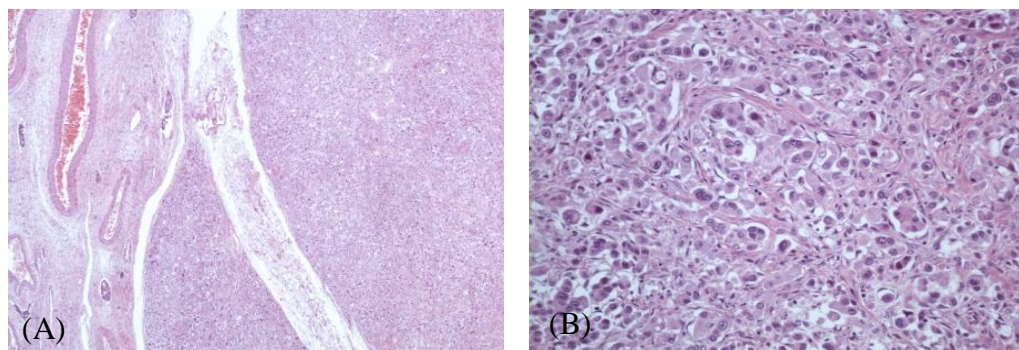
### Pathological findings: -

Gross examination revealed a 12X7 cm tumor with smooth external surface and there were no nodules. The cut section showed fleshy whitish tissue with central areas of necrosis and hemorrhage. The microscopic examination showed a diffuse infiltration of the ovary and omentum by signet ring cells, which contain mucin that pushed the nucleus against cell membrane. (Fig.1,2). These findings were not correlated with luteoma of pregnancy or any primary ovarian tumors like surface epithelial tumor, sex cord stromal cell tumor or germ cell tumor but these findings were suspicious for metastatic krukenberg and adenocarcinoma.

Therefore, we ordered a panel of immunohistochemical markers to reach the definitive diagnosis.

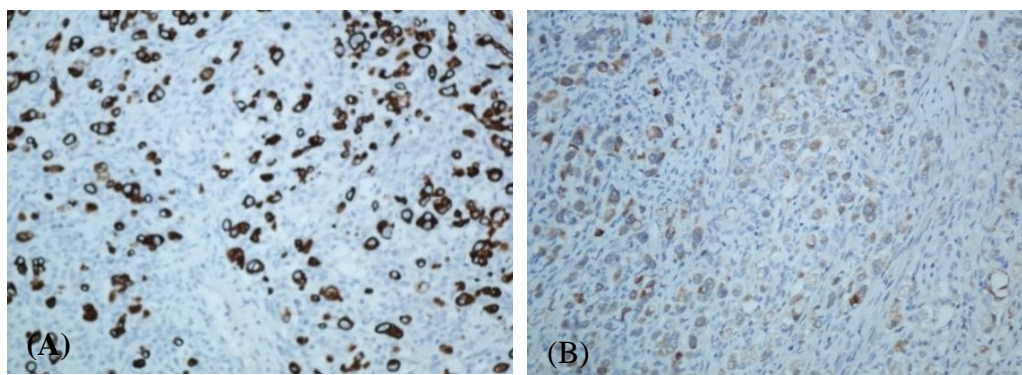
The results of immunohistochemical staining for tumor cells were as follow: positive for CK7, CK20 Fig.3(A), CDX-2 and CD99 (Diffuse immunoreactivity). EMA was also positive Fig.3(B). At the same time, tumor cells staining negative for AFP, S-100, HMB-45 and NSE. Inhibin was completely negative.

Further investigations were done to identify the primary site of the tumor and after two weeks of extensive work up for this patient; the primary tumor was found in stomach and it was a gastric adenocarcinoma.

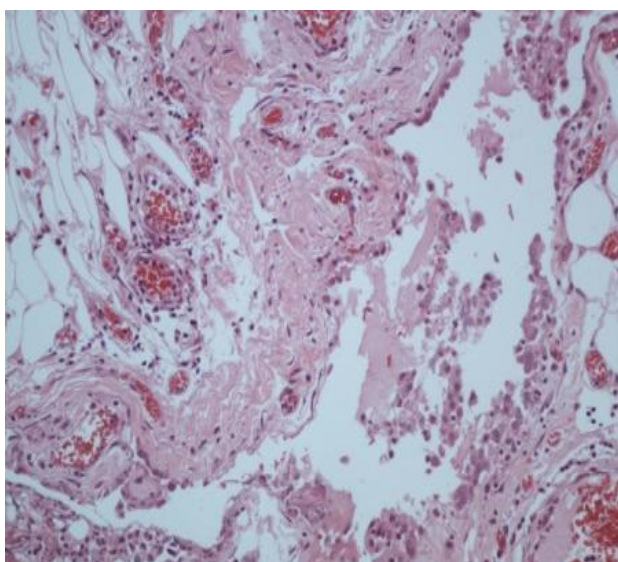


**Fig.1:-** Diffuse infiltration of ovarian stroma by malignant cells arranged singly and in small aggregates, some of these cells have vacuolated cytoplasm (signet ring appearance)

Finally, our patient underwent gastrectomy.



**Fig.3:-** (A) positive CK20. (B) positive EMA.



**Fig.2:-**The omentum showed diffuse multiple signet ring cells.

**Discussion: -**

Metastases of mucin-secreting signet ring cell cancer (SRCC) to ovarian tissues are known as Krukenberg tumor, which is uncommon metastatic ovarian cancer originate from gastrointestinal tract. Stomach is the most common primary site, followed by colon, appendix, and breast cancer. Usually occur in age group between 30-40 year old.<sup>[5]</sup> as in this case, she is a 34-year old.

Krukenberg tumor rarely occurs during pregnancy, diagnosis sometimes is difficult as the presenting symptoms are usually attributed to the pregnancy and there is a maternal and fetal risk for invasive workup.

In most of cases, primary tumor and its metastasis to ovary are diagnosed at the same time, but in 20–30% of cases, ovarian metastasis diagnosed after primary tumor resection.<sup>[6]</sup>

It has been reported that 80% of metastatic ovarian carcinomas are bilateral<sup>[7]</sup> and most ovarian carcinomas that have been metastasized from primary tumors of the large intestine shows solid and cystic components.<sup>[8]</sup>

Our case is parallel to this experience, since the patient had a unilateral metastatic ovarian tumor and the diagnosis of primary gastric adenocarcinoma was established after 2 week of accidental discovery of metastatic krukenburg tumor.

At the beginning, the ovarian mass in our case was misdiagnosed as luteoma of pregnancy which is a non-neoplastic hormonal dependent lesion of the ovary arises from pre-existing luteinized stromal cells, usually discovered incidentally during C/S or postpartum tubal ligation, regress spontaneously postpartum unless there's indication of surgery and it needs accurate diagnosis as it may be misdiagnosed as malignant ovarian tumor which results in unnecessary surgery.<sup>[2]</sup>

In our case, the histopathological findings were not consistent with the diagnosis of pregnancy luteoma as it shows diffuse infiltration of the ovary and omentum by malignant cells that produce excessive mucin intracellularly. The mucin forms large vacuole within the cells and pushes the nucleus from the center to the periphery against the cell membrane leading to the characteristic feature called “signet ring appearance”.

Several mechanisms of metastasis have been reported, lymphatic is the most common route of metastasis, followed by hematogenous spread, direct invasion and peritoneal seeding.<sup>[6]</sup>

There are only 50 cases of Krukenberg tumors occurring during pregnancy have been reported in the literature and there was no significant impact on fetal survival as most (97%) of the reported cases have led to the delivery of healthy baby.<sup>[9]</sup>

Symptomatic patients usually present with abdominal pain, distention, vomiting and weight loss. Virilization and hirsutism may occur due to an effect of estrogen and androgen hormones, other gynecological symptoms such as amenorrhea, menstrual irregularity, and vaginal bleeding are much less frequent in the literature cases.<sup>[6]</sup> The pseudo-Meigs syndrome is a rarely associated condition, which is malignant ovarian tumor with benign hydrothorax and ascites.<sup>[4]</sup>

Here, we present an unusual case of Krukenberg tumor which discovered accidentally during C/S delivery, not preceded by any significant symptoms.

Sometime it is difficult to differentiate morphologically between primary signet ring cell carcinoma of the ovaries and Krukenberg tumors, because usually they are resembling to each other.

Immunohistochemistry is a valuable diagnostic tool in differentiating between them. primary ovarian surface epithelial tumors are mostly positive to CK7 and negative to CK20 and CDX-2. By contrast, metastatic adenocarcinoma is less frequently to be positive for CK7 but is positive for CK20 and CDX-2 in most cases.

Park et al<sup>[23]</sup> found that 71% (207 of 289) of the gastric carcinomas stained positively for CK7, whereas only 9% (21 of 225) of the colorectal carcinomas proved to be CK7 positive, and 41% (117 of 289) of the gastric carcinomas and 73% (165 of 225) of the colorectal carcinomas were CK20 positive.<sup>[4]</sup>

Our patient's tumor stained positively for both CK7 and CK20, indicative of gastric origin.

The treatment strategy is controversial in Krukenberg tumor. surgical resection and aggressive chemotherapy can possibly improve the outcome.<sup>[5]</sup> In advanced disease, palliative treatment (Chemotherapy and Radiotherapy) is considered.<sup>[6]</sup>

The prognosis is poor, the median overall survival time is 2 years. The prognostic factors still not well established. One study reported that, regardless of cancer stage patients who underwent metastectomy and chemotherapy had better prognosis than those who are received chemotherapy alone.<sup>[10]</sup>

Survival of patients who underwent both metastasectomy and gastrectomy was longer than the patients who underwent metastasectomy only. Gastrectomy and absence of ascites are considered as risk factors associated with good survival rate. Inability of resection for the primary tumor is indicate a poor survival rate.<sup>[10]</sup>

Rarely, metastatic ovarian tumors are discovered before primary site, If the primary tumor is identified after the discovery of secondary tumor the prognosis is poor.<sup>[5]</sup> As in our case.

CA 125 level normally elevated during pregnancy and immediately after delivery. However, markedly elevation is commonly seen during cancer.<sup>[11]</sup> CA 125 levels are considered as a useful prognostic marker in evaluating patient's outcome after tumor resection.<sup>[5]</sup> Patient's age and size of ovarian tumor has no role in prognosis.<sup>[4]</sup>

### Conclusion:-

Krukenbuerg tumors are uncommon metastatic gastrointestinal cancer to the ovary mostly from the stomach, presenting with vague symptoms, radiological imaging, histological findings and immunohistochemical evaluation aid in diagnosis and identification of the primary malignancy.

Unfortunately, there are limited treatment options and no optimal treatment has been established. It has a poor prognosis and short median survival time. However, better outcome depends on early diagnosis. As in our case synchronous diagnosis and treatment of the primary cancer and its metastatic tumor along with regular follow-up can prolong the survival time.

Leuteoma of pregnancy should be considered as a differential diagnosis for any ovarian mass diagnosed during pregnancy to avoid unnecessary surgery, the former lesion regress spontaneously in postpartum period.

We report this case because of the relatively rarity of accidentally discovered metastatic ovarian tumor from gastric adenocarcinoma during CS delivery which was preceded by a normal full-term pregnancy.

### References:-

1. Chen V.W., Ruiz B., Killeen J.L., et al., Pathology and classification of ovarian tumors. CNCR Cancer, 2003. **97**(S10): p. 2631-2642.
2. Nanda, A., U.A. Gokhale, and G.R. Pillai, Bilateral pregnancy luteoma: A case report. Oman Med. J. Oman Medical Journal, 2014. **29**(5): p. 37.372-1
3. Fang WU, Xiaoazhao, Baibing MI et al., Clinical characteristics and prognostic analysis of Krukenberg tumor. mol clin onc Molecular and Clinical Oncology, 2015.
4. Rawasia W.F., Chaddha U., El-Kersh K., et al., Dyspnoea and the ovaries: a rare presentation of Krukenberg tumour. BMJ case reports, 2013. **2013**.
5. Umakanthan, S., M.M. Bukelo, and K. Hardik, A 36-year-old female with Krukenberg tumor from a colonic carcinoma. Journal of cancer research and therapeutics, 2015. **11**(4)
6. Sahin S., Karatas F., Hacıoglu B., et al., Krukenberg tumor presenting with amenorrhea as the sole initial symptom: Case report and review of the literature. Journal of cancer research and therapeutics, 2015. **11**(4)
7. AL-AGHA OM, & NICASTRI AD. (2006). An in-depth look at Krukenberg tumor: an overview. Archives of Pathology & Laboratory Medicine. 130, 1725-30.

8. Shiono S., Saito T., Fujii H., et al., A case of Krukenberg carcinoma metastasized from colon cancer resembling mucinous cystadenocarcinoma of the ovary. 2013, e-Century Publishing Corporation.
9. Goyal S, Bhankar H, Tyagi N., et al., Incidentally diagnosed Krukenberg tumor in pregnancy: A rare presentation with dismal outcome. Clinical Cancer Investigation Journal, 2016;5(2):196.
10. Kumar M., Kumar A., Maroules M., et al., Postmenopausal vaginal bleeding as initial presentation of gastric cancer: a case report with literature review of prognostic factors and treatment of krukenberg tumor. Annals of translational medicine, 2016. **4**.(4)
11. Co P.V., Gupta A., Attar B.M., et al. Gastric cancer presenting as a krukenberg tumor at 22 weeks gestation. J. Gastric Cancer Journal of Gastric Cancer, 2014. **14**(4): p. 275-278.



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### RESEARCH ARTICLE

#### THE EFFECT OF DIABETES ON ACETOACETATE METABOLISM IN HEART.

**Abdurazzaq M. N. Sultan, Daniya M. Alturkistani, Camellia A. Sultan, Nada A. Sagar, Heba A. Bargawi, Khulud K. Natto, Rabeea F. Farhan, Sultan A. Sultan, Abdulrahman A. Alghamdi, Qusai A. Sultan, Moayad. Filimban and Bayan H. Alghamdi.**

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##### Key words:-

Acetoacetate, Diabetes, Insulin, L-carnitine, Propionate, Dinitrophenol, Heart metabolism

#### Abstract

**Background Aims:** In this study, the effects of perfusion pressure, insulin, L-carnitine, propionate and 2,4-dinitrophenol on the utilization and oxidation of acetoacetate were investigated in the isolated non-working perfused heart from normal and diabetic rats.

**Materials and Method:** Hearts from Male Wistar albino rats were used. In the diabetic subgroup, Diabetes was induced by an intravenous injection of alloxan. The hearts were perfused at a perfusion pressure of 40 or 80 mmHg for 1 h with Krebs-Henseleit Medium, with the concentrations of calcium and magnesium halved, and oxygenated by equilibration with 5% carbon dioxide and 95% oxygen. Determination of acetoacetate and D-3-hydroxybutyrate levels were made by the method of Mellanby and Williamson and Williamson and Mellanby respectively, and comparison between groups was done using the two-tailed Student's t-test for independent samples.

##### Results

- Increasing Perfusion Pressure: No effect in both normal or diabetic hearts.
- Insulin: No effect on acetoacetate utilization.
- Diabetes: A decrease in the utilization and oxidation of acetoacetate and the production of D-3-hydroxybutyrate.
- L- carnitine:
  - Normal hearts: no effect on acetoacetate utilization.
  - Diabetic hearts: acetoacetate utilization was enhanced
- Propionate:
  - Normal hearts: Inhibited utilization of acetoacetate without affecting the rate of oxidation. The rate of D-3-hydroxybutyrate production was inhibited.
  - Diabetic hearts: Enhanced the utilization and oxidation of acetoacetate while reducing the production of D-3-Hydroxybutyrate
- Dinitrophenol:
  - Normal hearts: Enhanced the utilization and oxidation of acetoacetate and decreased the production of D-3-

hydroxybutyrate

- Diabetic hearts: utilization and oxidation of acetoacetate were enhanced without effect on production of D-3-hydroxybutyrate.

**Conclusion:** Diabetes inhibits and insulin has no significant effect on myocardial acetoacetate utilization and oxidation. Insulin, L-carnitine, or propionate are not suitable to ameliorate the utilization of acetoacetate in hearts from normal or diabetic animals, whereas Dinitrophenol enhances the catabolism of acetoacetate.

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## Introduction:-

It has long been known that the isolated non-working perfused heart utilizes acetoacetate as a preferred substrate of oxidation, even in the presence of glucose and insulin<sup>1, 2</sup>, whereas acetoacetate and/or D-3-hydroxybutyrate (D-3-HB) as sole substrate(s) do not maintain cardiac function in the isolated working heart<sup>3</sup>. Ketone bodies oxidation is preserved in advanced heart failure to maintain adequate myocardial function<sup>4</sup>. Insulin inhibits the utilization and oxidation of acetoacetate in hearts from normal rats<sup>1, 3</sup>, and in contrast, insulin stimulates the utilization and oxidation of D-3-HB in hearts from normal and diabetic rats<sup>5, 6</sup>. Propionate has been shown to enhance the utilization and oxidation of acetoacetate in the non-working heart<sup>7</sup> and improves heart contractile function in the working heart<sup>8</sup>, whereas propionate inhibits the utilization, but not the oxidation of D-3-HB<sup>9</sup>. Carnitine enhances the removal of acetoacetate in vivo and in vitro studies<sup>10, 11, 12, 13</sup>, but has no effect on the removal of D-3-HB<sup>12, 13</sup>. Ischemia-reperfusion stimulates myocardial D-3-HB utilization<sup>14</sup>. The deletion of succinyl-CoA:3-oxoacid-CoA transferase (SCOT) in mouse hearts promotes accelerated pathological remodeling<sup>15</sup> (the rate-limiting enzyme for myocardial oxidation of  $\beta$ -hydroxybutyrate and acetoacetate) and in advanced human heart failure the myocardial utilization of D-3-HB is increased and there is a significant increase in the expression of the gene encoding succinyl-CoA:3-oxoacid-CoA transferase<sup>16</sup>. In mouse models, cardiac hypertrophy and failure causes increased expression of  $\beta$ -hydroxybutyrate dehydrogenase 1 (BDH1) and the heart is shifted to ketone bodies as a significant source of energy<sup>17</sup>. The data support the importance of ketone bodies as a source of energy and their significant regulatory role in heart metabolism<sup>18</sup>. The utilization and oxidation of D-3-HB were inhibited in hearts from diabetic rats<sup>5, 6</sup>. No data were found in the literature on the effect of diabetes on the metabolism of acetoacetate in heart, and very limited data is available on acetoacetate as a sole substrate in the heart<sup>19</sup>. Although the first step of D-3-HB oxidation is its conversion to acetoacetate there is a difference in the reported effects of insulin, propionate, and L-Carnitine on the metabolism of acetoacetate and D-3-HB, this encouraged us to carry out this investigation. An attempt was also made to improve the utilization and oxidation of acetoacetate in the heart.

## Materials and Methods:-

### Animals:-

Male Wistar albino rats weighing 200-350 g were housed at a constant temperature of 22°C  $\pm$  and a 12 h light/ 12 h dark cycle. The animals were given continuous access to tap water and a rat pellet diet containing 13% protein and 3% fat<sup>20</sup>.

### Induction of Diabetes:-

The rats were made diabetic by a single intravenous injection of alloxan (40 mg/kg). Rats were used 4 weeks after alloxan administration. There was about 30% reduction the body weight of diabetic rats. The concentration of blood glucose was about 16.6 mM<sup>5</sup>.

### Chemicals:-

All chemicals, of the highest available grade were obtained from Sigma London Chemical Corp. Ltd., U. K.

### Analytical Methods:-

The determination of acetoacetate and D-3-HB were made by the method of Mellanby and Williamson<sup>21</sup> and Williamson and Mellanby<sup>22</sup> respectively.



**Media:-**

Hearts from normal or diabetic rats were perfused at a perfusion pressure of 40 mmHg or 80 mmHg for 1 h with Krebs-Henseleit Medium<sup>23</sup>, modified in that the concentration of calcium and magnesium were halved (MKHM), and oxygenated by equilibration with 5% carbon dioxide and 95% oxygen. The initial concentrations of acetoacetate (Li-salt), propionate, L-carnitine, DNP, insulin as shown in the results.

**Perfusion Method:-**

Hearts were perfused as described previously<sup>20</sup>. Hearts were perfused at a perfusion pressure of 40 mmHg or 80 mmHg; the perfusate temperature was 37°C. The technique involves the continuous infusion of fresh perfusate into a volume of recirculating perfusate that is kept constant by balanced withdrawal. Perfusate was introduced at  $32.6 \pm 0.1$  (80) ml.h<sup>-1</sup>. Fractions were collected for 5 minutes, alternate functions were analysed to determine acetoacetate and D-3-HB concentrations. The mechanical performance (rate, vigour and rhythm) of the heart were noted periodically<sup>24</sup>. These parameters along with the metabolic stability were used as criteria of a successful preparation. Coronary flow was measured at the end of each experiment,  $48 \pm 1$  (6) and  $109 \pm 7$  (9) ml.g.dry wt<sup>-1</sup>.min<sup>-1</sup>. at 40 and 80 mmHg respectively.

**Calculation and statistical analysis:-**

Calculation as described before<sup>20</sup>. Comparisons between groups were assessed using the two-tailed Student's t-test for independent samples.

**Results:-****Effect of Perfusion Pressure:-**

Increasing the perfusion pressure from 40 mmHg to 80 mmHg in hearts from normal (Groups 1 and 2) or diabetic animals (Groups 7 and 8), had no significant effect on the utilization and oxidation of acetoacetate and D-3-HB production.

**Effect of Diabetes:-**

At a perfusion pressure of 80 mmHg, the rates of acetoacetate utilization and oxidation and D-3-HB production were inhibited by 38%, 30% and 36% ( $P < 0.003$ ,  $P < 5.8 \times 10^{-5}$ ,  $P < 0.001$ ) respectively, in hearts from diabetic animals (Group 8), whereas at 40 mmHg the rates of acetoacetate utilization and oxidation, and D-3-HB production were inhibited by 42%, 46%, 36% ( $P < 2.26 \times 10^{-4}$ ,  $P < 0.003$ ,  $P < 4.05 \times 10^{-4}$ ) respectively (Group 7).

**Effect of Insulin:-**

Insulin had no significant effect on the utilization of acetoacetate in hearts from normal or diabetic animals (Groups 3 and 9).

**Effect of L-Carnitine:-**

L-Carnitine had no effect on acetoacetate utilization in hearts from normal animals (Group 4), whereas in hearts from diabetic animals (Group 10) the rate of acetoacetate utilization is enhanced by 16% ( $P < 0.02$ ) without effecting the rate of acetoacetate oxidation, but the production of D-3-HB was increased by 44% ( $P < 0.05$ ).

**Effect of Propionate:-**

In hearts from normal animals (Group 5) propionate inhibited the utilization of acetoacetate by 20% ( $P < 0.02$ ) without affecting the rate of oxidation, but the rate of D-3-HB production is inhibited by 72% ( $P < 6.1 \times 10^{-8}$ ). On the other hand, in hearts from diabetic animals (Group 11) propionate enhanced the utilization and oxidation of acetoacetate by 46% and 78% ( $P < 0.003$ ,  $P < 0.002$ ) respectively and the production of D-3-HB was reduced by 38% ( $P < 0.1$ ).

**Effect of 2,4-Dinitrophenol:-**

Dinitrophenol enhanced the utilization and oxidation of acetoacetate by 35% and 56% ( $P < 7.27 \times 10^{-5}$ ,  $P < 7.82 \times 10^{-6}$ ) respectively and decreased the production of D-3-HB by 18% ( $P < 0.003$ ) in hearts from normal rats, whereas in hearts from diabetic rats utilization and oxidation of acetoacetate were enhanced by 60% and 80% ( $P < 0.003$ ,  $P < 0.004$ ) respectively, without affecting the production of D-3-HB.

**Discussion:-**

Although the rate of coronary flow was increased (from 48 to 109 ml.g.dry wt<sup>-1</sup> min.<sup>-1</sup>) on increasing the perfusion pressure from 40 to 80 mmHg, the rates of acetoacetate utilization and oxidation were not affected nor was the rate of D-3-HB production. On the other hand, increasing the perfusion pressure 3-fold (25 to 75 mmHg) increases the oxidation of acetoacetate about 34% without affecting the acetoacetate utilization, but decreases the production of D-3-HB by 45%<sup>7</sup>. Comparing the rates of acetoacetate oxidation of non-working rat heart<sup>1</sup> and working heart<sup>3</sup> indicates that there is no effect of work-load on the oxidation of acetoacetate. Whereas, the utilization and oxidation of D-3-HB was enhanced by 30% and 44% respectively<sup>9</sup> on doubling the perfusion pressure (40 to 80 mmHg).

Chronic diabetes (4-weeks) inhibited the utilization and oxidation of acetoacetate and D-3-HB production, this finding is compatible with the decrease in the activity of 3- hydroxybutyrate dehydrogenase [EC 1.1.1.30] (51%) in heart mitochondria<sup>25</sup>. Since the oxidation of acetoacetate is inhibited, it is most likely that the activity of 3-oxoacid CoA-transferase [EC 2.8.3.5] is decreased. Grinblat et al.<sup>25</sup> reported 50% decrease in heart mitochondria three months after onset of diabetes, whereas the acetoacetyl CoA - thiolase [EC 2.3.1.9] was not affected. Sultan<sup>6</sup> reported that diabetes (4 weeks) inhibits the utilization and oxidation of D-3-HB. Therefore, the rise of the blood level of ketone bodies during diabetes is due to over production and the decrease in the utilization and oxidation of ketone bodies.

Since insulin has no effect on acetoacetate utilization and oxidation, and enhances the utilization and oxidation of D-3-HB<sup>5,6</sup>, introducing insulin therapy in ketosis, if it does not improve the overall utilization of ketone bodies, will not deteriorate the case. The reduction in the rate of acetoacetate utilization and oxidation in diabetes is unlikely due to the lack of insulin. It seems that the defect in the catabolism of acetoacetate in diabetes can be corrected by introducing anaplerotic substance such as propionate which could enrich citric acid cycle with succinyl CoA (an essential metabolite for acetoacetate oxidation), but the inhibitory effect of propionate on D-3-HB utilization<sup>9</sup> preclude the use of propionate to ameliorate ketone bodies catabolism. It has been found that Propionate caused a drastic reduction of free CoA and L-carnitine in the heart, F.Di Lisa etd (1994)<sup>30</sup>.

L-carnitine had no effect on acetoacetate utilization in heart from normal rats, whereas, the 16 % increase of acetoacetate utilization in diabetic state is compensated by the increase in the rate of D-3-HB production, since the rate limiting step of acetoacetate and D-3-HB oxidation, 3-oxoacid CoA-transferase [EC 2.8.3.5], is inhibited in diabetes. Although, it has been reported that carnitine enhances the removal of acetoacetate in diabetes<sup>12, 13</sup>, L-carnitine is not suitable to ameliorate the oxidation of acetoacetate in normal or diabetic states, moreover L-carnitine has no effect on D-3-HB utilization or oxidation in the perfused rat heart (unpublished observation), and does not stimulate D-3-HB utilization in heart mitochondria<sup>26</sup>. L-carnitine is reported to increase the concentration of tissue CoA<sup>11</sup>, according to Russell and Taegtmyere<sup>8</sup> such a change could improve the oxidation of acetoacetate, but the presented data did not support that CoA alone could be a limiting factor for acetoacetate oxidation. Propionate and L-carnitine addition alone to acetoacetate had negligible effects on contractile function Russell etd (1995)<sup>31</sup>.

Dinitrophenol (DNP) is an un-coupler (uncouples oxidative phosphorylation), its stimulatory effect on the utilization and oxidation of acetoacetate is likely mediated through its capability to alter the NADH/NAD<sup>+</sup> ratio in the mitochondria. The decrease in D-3-HB production in the normal state and the increase in the percent oxidation of acetoacetate in the diabetic state support such a suggestion, moreover, DNP enhances the utilization and oxidation of D-3-HB in isolated perfused heart in a concentration-dependent manner<sup>14</sup>, by decreasing myocyte NADH<sup>27</sup>, raising Ca<sup>2+</sup> cytosolic concentration, and AMP/ATP ratio<sup>28, 29</sup> through stimulating AMPK/p38 MAPK<sup>32</sup>. The regeneration of NAD<sup>+</sup> could enhance  $\alpha$ -ketoglutarate dehydrogenase ( $\alpha$ -KGDH) which is reported to be inhibited by acetoacetate<sup>10</sup>, and thereby the oxidation of ketone bodies is enhanced by providing succinyl CoA.

In conclusion, increasing perfusion pressure, and giving insulin, failed to improve the catabolism of acetoacetate in hearts from normal or diabetic animals. Acetoacetate utilization and oxidation are inhibited in hearts of diabetic animals. L-Carnitine and propionate are not good candidates to ameliorate the catabolism of acetoacetate. 2,4-Dinitrophenol enhanced the utilization and oxidation of acetoacetate in hearts from normal or diabetic animals suggesting that NADH/NAD<sup>+</sup> ratio plays an important role in the regulation of ketone bodies' metabolism. It is possible that dinitrophenol stimulated acetoacetate oxidation act through AMPK/ p38 MAPK signaling pathway as suggested for D-3-HB<sup>14</sup>.

**Table 1:-**

Hearts from normal (Groups 1 to 6) and diabetic (Groups 7 to 12) rats were perfused with MKHM containing acetoacetate (Ac) as indicated in the table for 60 minutes. The addition of other substances are shown in the table, and their initial concentrations are insulin (2mU.ml<sup>-1</sup>), L-carnitine (5 mM), propionate (4 mM), DNP (0.05 mM). The perfusate concentration of Ac and D-3-HB and the rates of utilization, oxidation and production were given for the last 30 minutes of perfusion period. The perfusion pressure is 80 mmHg except for groups 1 and 7, it is 40 mmHg and indicated by \*. Values are means  $\pm$  SEM for the numbers of observations in parentheses.

Group	Addition	Initial conc. Ac (mM)	Perfusate con. Ac (mM)	Perfusate con. D-3- HB(mM)	Utilization of Ac	Oxidation of Ac	Production of D-3-HB
1*	----	5.39 $\pm$ 0.07(6)	3.33 $\pm$ 0.13	0.69 $\pm$ 0.03	398 $\pm$ 16	263 $\pm$ 18	135 $\pm$ 5
2	----	5.25 $\pm$ 0.09(9)	3.19 $\pm$ 0.08	0.56 $\pm$ 0.02	406 $\pm$ 18	295 $\pm$ 16	111 $\pm$ 4
3	Insulin	5.26 $\pm$ 0.06(9)	3.25 $\pm$ 0.11	0.54 $\pm$ 0.03	416 $\pm$ 12	318 $\pm$ 21	111 $\pm$ 6
4	L- Carnitine	5.28 $\pm$ 0.07 (6)	3.31 $\pm$ 0.08	0.46 $\pm$ 0.07	416 $\pm$ 22	320 $\pm$ 28	96 $\pm$ 12
5	Propionate	5.04 $\pm$ 0.1(6)	3.48 $\pm$ 0.3	0.15 $\pm$ 0.04	319 $\pm$ 27	288 $\pm$ 22	31 $\pm$ 7
6	DNP	5.30 $\pm$ 0.06(6)	2.68 $\pm$ 0.16	0.43 $\pm$ 0.03	551 $\pm$ 15	460 $\pm$ 14	91 $\pm$ 4
7*	----	5.38 $\pm$ 0.03(6)	4.33 $\pm$ 0.04	0.40 $\pm$ 0.01	230 $\pm$ 11	143 $\pm$ 9	87 $\pm$ 3
8	----	5.20 $\pm$ 0.03(6)	4.16 $\pm$ 0.1	0.20 $\pm$ 0.05	251 $\pm$ 18	181 $\pm$ 23	71 $\pm$ 13
9	Insulin	5.08 $\pm$ 0.06(9)	3.84 $\pm$ 0.1	0.30 $\pm$ 0.03	272 $\pm$ 17	205 $\pm$ 20	67 $\pm$ 8
10	L- carnitine	5.32 $\pm$ 0.05(6)	4.02 $\pm$ 0.2	0.45 $\pm$ 0.04	290 $\pm$ 23	188 $\pm$ 21	102 $\pm$ 5
11	Propionate	5.19 $\pm$ 0.08(6)	3.68 $\pm$ 0.1	0.19 $\pm$ 0.04	366 $\pm$ 23	322 $\pm$ 25	44 $\pm$ 7
12	DNP	5.14 $\pm$ 0.08(5)	3.44 $\pm$ 0.16	0.33 $\pm$ 0.03	401 $\pm$ 34	325 $\pm$ 31	76 $\pm$ 4

**References:-**

- Williamson, J. A. and Krebs, H. A., 1961, Acetoacetate as fuel of respiration in the perfused rat heart, *Biochem. J.*, 80, 540-547.
- Hall, L. M., 1961, Preferential oxidation of acetoacetate by the perfused heart, *Biochem. Biophys. Res. Commun.*, 6, 177-179.
- Taegtmeyer, H., Hems, R., and Krebs, H. A., 1980, Utilization of energy-providing substrates in the isolated working rat heart, *Biochem. J.*, 186, 701-711.
- Janardhan, A., Chen, J., and Crawford, P. A., 2011, Altered systemic ketone body metabolism in advanced heart failure, *Tex. Heart Inst. J.*, 38 (5), 533-538.
- Sultan, A. M. N., 1992, Effects of diabetes and insulin on ketone bodies metabolism in heart, *Mol. Cell. Biochem.*, 110, 17-23.
- Sultan, A. M. N., 1994, The effects of chronic diabetes and physiological insulin concentration on ketone bodies metabolism in the heart, *Diabetes Research (Clinical and Experimental)*, 27, 47-60.
- Revsin-Lanier, B., Lebowitz, J., and Morrow, III G., 1980, Propionate enhancement of acetoacetate oxidation in perfused rat hearts, *Clinical Sciences*. 59, 289-292.
- Russell, R. R., and Taegtmeyer, H., 1991, Changes in citric acid cycle flux and anaplerosis antedate the functional decline in isolated rat hearts utilizing acetoacetate, *J. Clin. Invest.*, 87, 384-390.
- Sultan, A. M. N., 1997, The effects of anaplerotic substrates on D-3-hydroxybutyrate metabolism in the heart, *Mol. Cell. Biochem.* 171, 59-64.
- Hulsmann, W. C., Siliprandi, D., Ciman, M., and Siliprandi, N., 1964, Effect of carnitine on the oxidation of  $\alpha$ -oxoglutarate to succinate in the presence of acetoacetate or pyruvate, *Biochem. Biophys. Acta.*, 93, 166-168.
- Bieber, L., Emaus, R., Valkner, K., and Farrell, S., 1982, Possible functions of short-chain and medium-chain carnitine acetyltransferase, *Fed. Proc.*, 41, 2858-2862.
- Nosadini, R., Avogaro, A., Cobelli, C., Toffolo, G., Marescotti, C., Mollo, F., Benetton, M., Tiengo, A., and Enzi, G., 1984, The kinetics of ketone bodies in obese and insulin dependent diabetic subjects., In *Recent Advances in Obesity and Diabetes Research*. Melchionda, N. et al. Eds. Raven Press, New York, pp 293-307.

13. Nosadini, R., Avogaro, A., Mollol, F., Marescotti, C., Tiengo, A., Siliprardi, N., Cobelli, C., and Toffolo, G. L., 1982, Carnitine improves acetoacetate disposal in insulin-dependent diabetic. In proceedings of the 11th IDF Meeting, 10-17 Nov. 1982, Nairobi, Kenya. Alberti KGMM et al. Eds. Excerpta Medica, Amsterdam, pp 123.
14. Sultan, A. M. N., 2014, Utilization of D-3-hydroxybutyrate by the isolated perfused heart under global no-flow ischemia and stress conditions, UQU Med. J. 5 (1), 1-17.
15. Schugar, R. C., Moll, A. R., d'Avignon D. A., Weinheimer, C. J., Kovacs, A., and Crawford, P. A., 2014, Cardiomyocyte-specific deficiency of ketone body metabolism promotes accelerated pathological remodeling, Molecular Metabolism, 3, 754-769.
16. Bedi Jr, K. C., Snyder N. W., Brandimarto, J., Aziz Moez, Mesaros, C., Worth, A. J., Wang, L. L., Javaheri, Ali, Blair, J. A., Marglies, K. B., and Rame, J. E., 2016, Evidence for intramyocardial disruption of lipid metabolism and increased myocardial ketone utilization in advanced human heart failure. Circulation, 133, 706-716.
17. Aubert, G., Martin, O. J., Horton, J. L., Lai, L., Vega, R. B., Leone, T. C., Koves, T., Gardell, S. J., Kruger, M., Hoppel, C. L., Lewandowski, E. D., Crawford, P. A., Muoio, D. M., and Kelly, D. P., 2016, The failing heart relies on ketone bodies as a fuel. Circulation, 133, 698-705.
18. Kolwicz, Jr, S. C., Airhart, S., and Tian, R., 2016, Ketones step to the plate: A game changer for metabolic remodeling in heart failure. Circulation, 133, 689-691.
19. Dedkova, E. N., and Blatter L. A., 2014, Role of  $\beta$ -hydroxybutyrate, its polymer poly-  $\beta$ -hydroxybutyrate and inorganic polyphosphate in mammalian health and disease, Frontiers in physiology, 5, 260, doi:10.3389.
20. Sultan, A. M. N., 1988, D-3-Hydroxybutyrate metabolism in the perfused rat heart, Mol. Cell. Biochem., 79, 113-118.
21. Mellanby, J. and Williamson, D. H. Acetoacetate. In Methods of Enzymatic Analysis. Hans Ulrich Bergmeyer Ed. Academic Press, Vol.4, 1841-1843, 1974.
22. Williamson, D. H. and Mellanby, J. D-(-)-3-Hydroxybutyrate. In Methods of Enzymatic Analysis. Hans Ulrich Bergmeyer Ed. Academic Press, Vol.4, 1836-1839, 1974.
23. Krebs, H. A. and Henseleit, K., 1932, Untersuchungen uber die Harnstoffbildung im Tierkorper, Hoppe Seylers Z. Physiol. Chem., 210, 33-66.
24. Sultan, A. M. N., 1990, The effect of fasting on D-3-hydroxybutyrate metabolism in the perfused rat heart, Mol. Cell. Biochem, 93, 107-118.
25. Grinblat, L., Pacheco-Bolanos, L. F. and Stoppani, A. O. M., 1986, Decrease rate of ketone body oxidation and decreased activity of D-3-hydroxybutyrate dehydrogenase and succinyl-CoA : 3- oxoacid CoA - transferase in heart mitochondria of diabetic rats, Biochem. J., 240, 49-56.
26. Yu-Yan Y., 1981, Antiketonic and antiketogenic actions of carnitine in vivo and in vitro in rats, J. Nutr., 111, 831-840.
27. Rodrigo, G. C., Lawrence, C. L., and Standen, N. B., 2002, Dinitrophenol pretreatment of rat ventricular myocytes protects against damage by metabolic inhibition and reperfusion, J. Mol. Cell. Cardiol., 34, 555-569.
28. Hudman, D., Rainbow, R. D., Lawrence, C. L., and Standen, N. B., 2002, The origin of calcium overload in rat cardiac myocytes following metabolic inhibition with 2,4-dinitrophenol, J. Mol. Cell. Cardiol., 34, 859-871.
29. Kang, S., Kim, N., Joo, H., Youm, J. B., Park W. S., Warda, M., Kim, H., Cuong, D. V., Kim, T., Kim, E., and Han, J., 2005, Changes of cytosolic  $\text{Ca}^{+2}$  under metabolic inhibition in isolated rat ventricular myocytes, Korean J. Physiol. Pharmacol., 9, 291-298.
30. Propionate caused a drastic reduction of free CoA and L-carnitine in heart, F. Di Lisa et al (1994). [31] Propionate on L-carnitine addition alone to acetoacetate had negligible effects on contractile function Russell et al (1995).
31. Pelletier, A., Joly, E., Prentki, M., and Coderre, L., 2005, Adenosine 5'-monophosphate-activated protein kinase and p38 mitogen-activated protein kinase participate in the stimulation of glucose uptake by dinitrophenol in adult cardiomyocytes, Endocrinology, 146, 2285-2294.



### RESEARCH ARTICLE

#### PREVALENCE OF PARENTAL SELF MEDICATION AND ITS POSSIBLE EFFECT TO THEIR CHILDREN IN AL-MADINAH , KINGDOM OF SAUDI ARABIA.

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#### Abstract

**Background :** Self medication refers to the treatment of common health problems with medicines approved as safe and effective for use without consulting a physician and without any medical supervision.

**Objective :** The aim of the present study were to determine the prevalence of parental self-medication among children in Almadinah, Saudi Arabia , and parental knowledge and attitude about common medicine use practices in children ,in addition to the factors influencing self-medication.

**Methods:** A cross-sectional study was conducted. convenient random sampling method was used to select the participants. Data were collected using an online questionnaire tool.

**Results :** A total of 170 participants from Almadinah were involved in the study 50% of the them were fathers, and 50% were mothers .Most of them didn't have health insurance, while only 23% of them had. 63% of the sample use medicines without medical prescription for their children. We notice that 83% of the participants' children haven't been suffering any chronic disease. High temperature is the most popular case in which the parents use medicines without medical prescription for their children, then colds. The most used medication was Antipyretic. It can be noted that the majority of parents were giving their children drugs without a prescription, although they are convinced of the seriousness of the use of medications without a prescription. Parents depend on old medical prescription and pharmacist as major sources of information at self-medication.

**Conclusion :** The study revealed the fact that parental self-medication among public in Almadimah is a routine practice. we suggested that Parents' should be awareness about the riskiness of self-medication, especially in children to ensure that they will receive best medical Care.

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## Introduction:-

Self medication refers to the treatment of common health problems with medicines approved as safe and effective for use without consulting a physician and without any medical supervision. This practice is widespread around the world <sup>(1)</sup>. The practice of self-medication among children consider really important since they constitute a large percentage of the population in developing countries and are prone to many illnesses <sup>(2)</sup>. Unjustified and inappropriate self-medication results in wastage of healthcare resources and increases resistance of pathogens, drug-drug interactions, and adverse drug reactions leading to hospital admissions <sup>(3-6)</sup>. Younger children are often given medications by their parents because the first response by most families to many illnesses in their children has been found to be the use of non-prescribed drugs. Paediatric OTC drugs cover a wide range of medications including cough and cold medicines (CCMs), antipyretic analgesics (e.g. paracetamol and ibuprofen), vitamin supplements and dermatological products, antibiotics, antispasmodic agents etc. <sup>(7)</sup> The conditions for which the drugs were used included fever, diarrhea, vomiting, cough and upper respiratory tract infections <sup>(8)</sup>. Most drugs in children are used to be administered outside hospitals, both as prescribed and non-prescribed ones <sup>(9)</sup>. Various studies have evaluated self-medication in children and reported higher rates of self-medication which was often inappropriate and parents were reported to have inadequate knowledge about self-medication <sup>(10,11)</sup>. To our knowledge, no information is available regarding the self-medication prevalence in the community in Saudi Arabia. Therefore, it is important to have data on self-medication in this area so that future interventions can be planned. Hence, the aim of the present survey carried out in the general population in Almadinah, were To determine the prevalence of parental self-medication use among children in KSA, to investigate the effect of these medication to child's health and to know the factors influencing self-medication.

## Material and Methods:-

A descriptive cross sectional study was undertaken among the population of Al- madinah, Kingdom of Saudi Arabia. A sample of (170) persons was selected randomly and answered the questionnaire randomly. The questionnaire was the study tool prepared by the research team with the help of experts and specialists in this field of study, the questionnaire contained four main sections; the first section represented the social and demographic data, which includes sex, age, job, living place, monthly income, health insurance availability, educational level, and the number of children, while the second section contained (5) questions to measure the spread of dispensing medicines without a medical prescription, the third section contained (7) questions in order to measure the awareness and behavior of the parents toward the dispensing without a prescription, and the fourth section aimed to know the factors affecting the dispensing without a prescription.

## Statistical Analysis:-

The statistical analysis program (SPSS v.22) was been used in the study in data entry and analysis, with the use of necessary statistical methods to achieve the objectives of the study. The following statistical methods were used:

- Frequencies.
- Percentages.
- Graphs.
- Chi-square test.

## Results:-

**participants' distribution according to their personal and demographic data:**

**Table 1:-** Personal data for the participants (N = 170)

Variable		#	%
Gender	Male (father)	85	50%
	Female (Mather)	85	50%
Age (years)	Less than 30 years	65	38%
	More than 30 years	105	62%
Occupation	employee in the health field	11	6%
	employee in unhealthy field	99	58%
	unemployed	60	35%
Living	City	164	96%
	Village	6	4%
Monthly income	Less than 5,000 r.s	41	24%
	5000-10000 r.s	53	31%

	More than 10,000 r.s	76	45%
Do you have health insurance	Yes	39	23%
	No	131	77%
Education level	Secondary or less	29	17%
	Collectors or more	141	83%
Number of children	1-3	106	62%
	4-6	44	26%
	More than 6	20	12%

It is clear from the previous table that 50% of the participants were fathers, and 50% were mothers, 62% of their ages were more than 30 years old, while 28% of them were less than 30 years old.

And their distribution according to their jobs; 58% of them were employee in the health field, only 6% were working in the health field, and the rest of them were unemployed. And the participants' distribution according to their living place, most of them were living in cities.

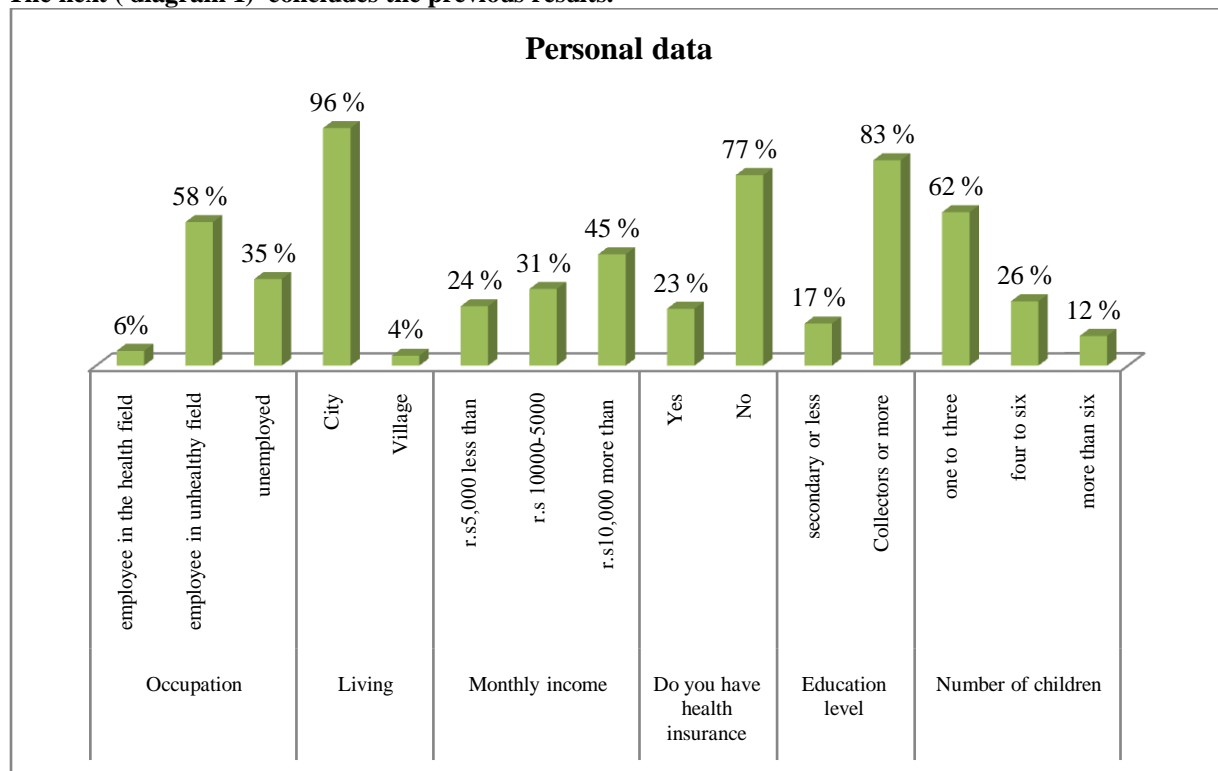
We found that 45% of the participants' monthly incomes were more than (10000) Riyal, 31% of their incomes were between (5000-10000) Riyal, and 24% of their incomes were less than (5000) Riyal.

While their distribution in terms of having health insurance; most of them didn't have health insurance, while only 23% of them had.

83% of the participants had university degrees, and the rest had secondary certificates or less.

Finally their distribution according to the number of their children; 62% of them had from (1- 3) children, 26% of them had (4- 6) children, and 12% of them had more than 6 children.

**The next ( diagram 1) concludes the previous results.**



**Measuring of the spread of dispensing medicines without a medical prescription:**

The next( table 2) shows the participants' distribution according to using medicines for their children without medical prescription:

Answer	#	(%)
Yes	107	62.9
No	63	37.1
Total	170	100.0

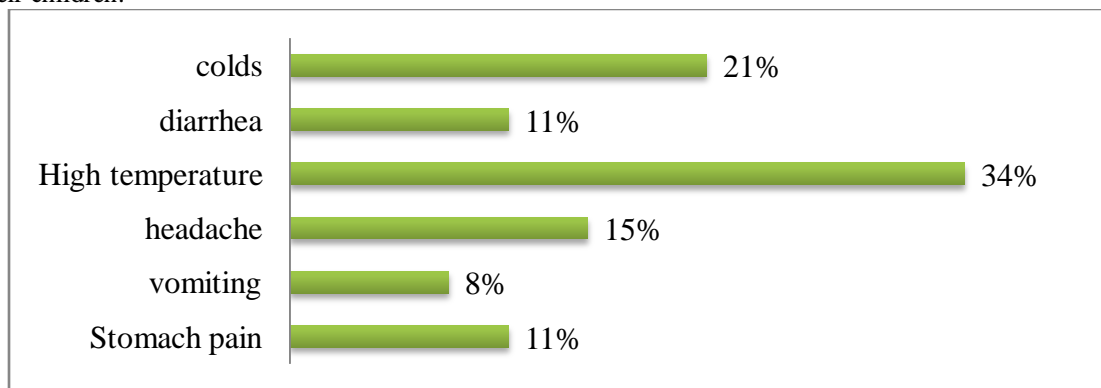
We notice from the previous table that 63% of the sample members (mothers and fathers) use medicines without medical prescription for their children.

Then next (table 3) shows the participant's distribution whether their children have been suffering chronic diseases or not:

Answer	#	(%)
Yes	29	17.1
No	141	82.9
Total	170	100.0

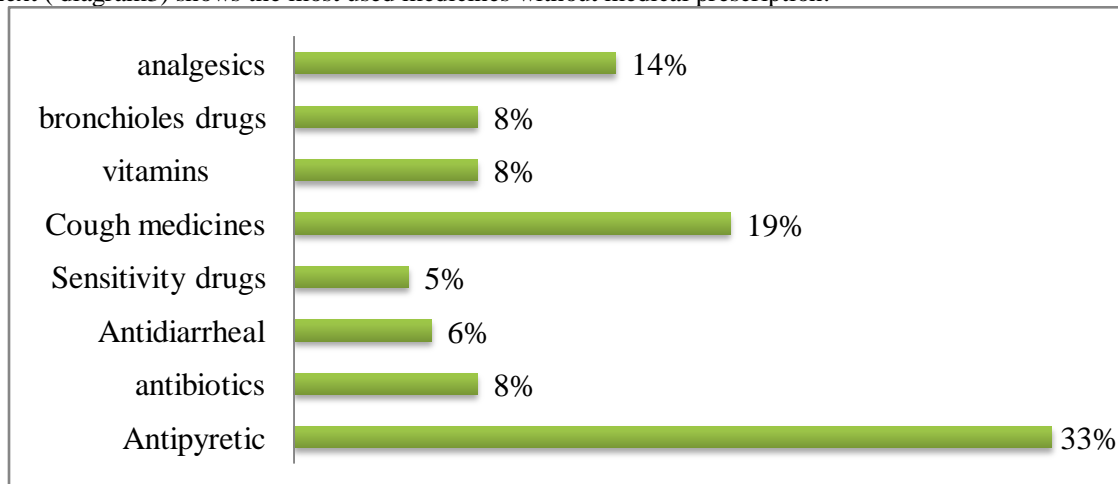
We notice that 83% of the participants' children haven't been suffering any chronic disease, while 17% of their children have been suffering chronic diseases; as diabetes and asthma.

The next ( diagram 2) shows the most popular cases in which the parents use medicines without medical prescription for their children:



We notice from the table that (high temperature) is the most popular case in which the parents use medicines without medical prescription for their children, then colds, after that headache, diarrhea, stomach pain and vomiting ordered from the most to the least cases they may use medicines without medical prescription for their children.

The next ( diagram3) shows the most used medicines without medical prescription:





It is noticed that the most used ones was as the following order:

Antipyretic, Cough medicines, bronchioles drugs, analgesics, antibiotics, vitamins, Antidiarrheal and sensitivity drugs.

**Measuring the awareness and behavior of the parents toward the dispensing without a prescription ( table 4 )**

	Agree	Disagree	I don't know			
	# (%)	# (%)	# (%)	P-valu	Relative weight	Ranking
when the child's temperature is high, he should be given antipyretic	161 (94.7)	6 (3.5)	3 (1.8)	0.00**	97%	1
when the child's temperature is high, he should be given antibiotic	17 (10.0)	135 (79.4)	18 (10.6)	0.00**	44%	7
No side effects will result cause of using medicines without medical prescription	20 (11.8)	115 (67.6)	35 (20.6)	0.00**	48%	6
Use of medications without a good recipe leads to hide the symptoms of the disease and the difficulty of diagnosis	78 (45.9)	25 (14.7)	67 (39.4)	0.00**	77%	5
I think many parents are using drugs without a prescription	117 (68.8)	20 (11.8)	33 (19.4)	0.00**	86%	4
parents should be told about the danger of using drugs without a prescription	148 (87.1)	12 (7.1)	10 (5.9)	0.00**	93%	3
The physician should diagnose the disease and make the necessary tests before treatment description	156 (91.8)	10 (5.9)	4 (2.4)	0.00**	95%	2

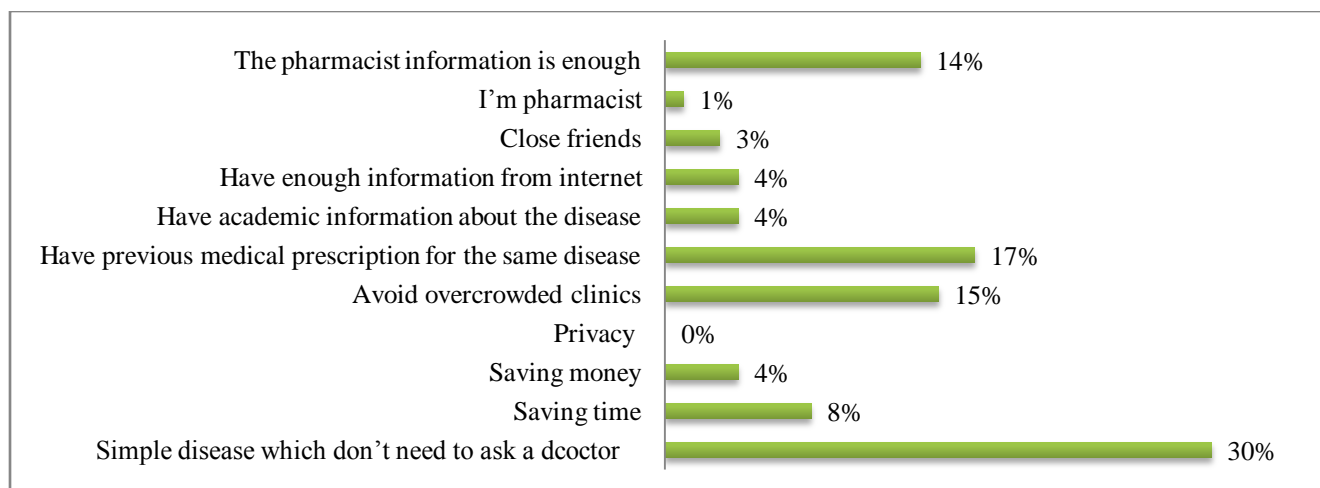
\*\*Chi Square test - Significant at the 0.01 level.

It is noted from the (table 4) that most paragraphs won the highest approval rate by the participants: the paragraph which states that "when the high temperature of the child should be given antipyretic," came the first order of relative weight of 97%, followed by a paragraph which states "must The doctor diagnosed the disease and the work of the necessary tests before treatment Exchange, "a relative weight of 95%.

It can be noted that the majority of parents were giving their children drugs without a prescription, although they are convinced of the seriousness of the use of medications without a prescription.

**The factors affecting the dispensing without a prescription:-**

The next (diagram 4) shows the most important reasons lead the parents to use medicines without a prescription for their children.



It is clear from the previous diagram that the most important reasons made the parents use medicines without a prescription for their children, were ordered as follows (Simple disease which don't need to ask a doctor, have previous medical prescription for the same disease, avoid overcrowded clinics, the pharmacist information is enough and saving time).

### Discussion:-

Self-medication is still an important public health problem throughout the world, since it is a fairly common practice. Unjustified and inappropriate self-medication results in wastage of healthcare resources and increases resistance of pathogens, drug-drug interactions, and adverse drug reactions leading to hospital admissions [12,13,14,15]. Most of the studies on self-medication in children have investigated the use of medicines by children themselves [16,17]. Few studies have evaluated parental attitude and practice towards self-medicating their children [18,19,20]. Therefore this study has highlighted the prevalence of parental self-medication use among children, and parental knowledge and attitude about common medicine use practices in children in KSA, in addition to the factors influencing self-medication.

At the current study participants were divided into males and females equally, this showed that both parents involved in dealing with health problems of their children. However study in India showed that most of respondents were female [21] which indicates that mothers are more involved in dealing with health problems of their children. While in Baghdad city fathers purchasing self-medicated were relatively more than mothers [22], the possible explanation of this slight difference is that some women considered that the father is more appropriate for this mission or they could not leave their homes without companionship of a male relative from the first degree [23].

Despite the lack of evidence for the effectiveness of many over-the-counter (OTC) medications [24,25], and the possible risks associated with their improper use among young children, [26,27], they remain widely used [28]. The results of our study showed high prevalence of parental self-medication use among children 62.9%. These results are consistent with another study in Saudi Arabia reported that 53.8% of the parents practiced self-medication in their children [29]. This proportions consistent with the global variation of prevalence of self-medication which has been reported by various studies to range between 30-70% [30]. The reasons for such huge global variation many be numerous including different methods used for collecting information, availability of free medical care for children in the public sector hospitals in some countries [31]. Also cultural, social and educational factors have been shown to affect self-medication [29].

The common ailments of children including headache, fever, flu, diarrhoea and sore throat can be treated at home [32]. This study revealed that the most frequent symptoms which motivated the parents to practice self-medication for their children were fever followed by colds, headache, diarrhea, stomach pain and vomiting respectively. This is consistent with most of the other studies on parental self-medication in children which reported that fever, cough and cold as the common symptoms for using medicines without consulting a doctor [19,20,21,29]. Also our study revealed that the most common used drug were Antipyretic, Cough medicines, and bronchioles drugs respectively.

According to our results parents showed good awareness and behavior toward the dispensing without a prescription, there is contradict between this results and previous study in KSA which reported that most participants had poor knowledge positive attitude toward self-medications[33].The reason for the different in results, the is time difference between the two studies, and the difference in regions that were targeted by these two studies in the KSA.

In the present study 11.8% of parents believed that no side effects will result cause of using medicines without medical prescription. While most of parents believed that side effects will result cause of using medicines without medical prescription. These results differed with study from UK found that parents were generally unaware of potential side effects of OTC medicines because they believed that “over-the-counter medicines are not strong and were unlikely to harm their child,” [34]. And study from Japan reported little awareness about adverse effects of non-prescription medicines among participants[35].This difference is due to different at sociodemographic indicators in different countries.

At this study the reasons of Self-medication are Varied, the most common reason was that the disease is simple which don't need to ask a doctor. Actually some minor ailments can be relieved with SM medications such as Paracetamol or other traditional remedies, without seeking for consultation from general practitioners or pediatricians [32].

Parents knowledge and information of the children's ailments may be obtained from doctors, pediatrics, pharmacists, friends, books, magazines, newspaper or the internet [36].The commonest source of information about self-medicated drugs at our study , and at many other studies was old medical prescription [22,37]. Because parents considered that the prescription will be the same if they visited the physician and also considered that they had good experience and became familiar with the appropriate medication for managing this current condition [38].

Also pharmacist information represent another other important source of information for parents at children's ailments and it the reason for 14% for self-medication. this is consistent with the results of other studies Saudi Arabia [23], in Iraq [22], and Indonesia [39], that's considered pharmacist information as one of the major sources of information for parents at children's ailments. Which highlight the important roles of community pharmacies in wide pervasion of SM in the community[40].

Although regulations do not allow pharmacists to prescribe drugs, this may be explained by the fact they are more easily accessible and the service is faster.

### **Conclusion:-**

There is high prevalence of parental self-medication use among children in KSA. However parents showed good awareness and behavior toward the dispensing without a prescription. The major reason for self-medication the simplicity of disease or symptoms so it don't need a doctor. The most frequent symptoms which motivated the parents to practice self-medication for their children are fever followed by colds, headache, diarrhea, stomach pain and vomiting respectively. And the most common used drug are Antipyretic, Cough medicines, and bronchioles drugs respectively. Parents depend on old medical prescription and pharmacist as major sources of information at self-medication.

### **Recommendation:-**

- Parents' should be awareness about the riskiness of self-medication, especially in children.
- Distributing brochures to parents about the riskiness of self-medication in centers of vaccinate children to ensure they arrive for most parents.
- Exploit the various media effectively to raise awareness among parents about the riskiness of self-medication.
- Pharmacists should committed to regulations which do not allow pharmacists to prescribe drugs.
- Pharmacists can play crucial roles in enhancing the proper practicing of self-medication because they are reliable sources of information for many parents.

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**References:-**

1. Chewning B, Sleath B. Medication decision-making and management: A client-centered model. *SocSci Med.*, 1996; 42: 389-98.
2. Lee D, Balasubramaniam K, Ali H. Drug utilization studies: Their transferability between industrialized and developing countries. In: Dukes MNG, editor. *Drug Utilization Studies. Methods and uses*. Copenhagen, World Health Organization Regional office Europe, 1993 (WHO Regional Publications, European Series, No. 45).
3. P. Olivier, L. Bertrand, M. Tubery, D. Lauque, J.-L. Montastruc, and M. Lapeyre-Mestre, "Hospitalizations because of adverse drug reactions in elderly patients admitted through the emergency department: a prospective survey," *Drugs & Aging*, vol. 26, no. 6, pp. 475–482, 2009. View at Publisher ·
4. D. Lewinski, S. Wind, C. Belgardt, V. Plate, C. Behles, and H. G. Schweim, "Prevalence and safety-relevance of drug-related problems in German community pharmacies," *Pharmacoepidemiology and Drug Safety*, vol. 19, no. 2, pp. 141–149, 2010. View at Publisher ·
5. C. Eickhoff, A. Hämmerlein, N. GRIESE, and M. Schulz, "Nature and frequency of drug-related problems in self-medication (over-the-counter drugs) in daily community pharmacy practice in Germany," *Pharmacoepidemiology and Drug Safety*, vol. 21, no. 3, pp. 254–260, 2012.
6. N. Asseray, F. Ballereau, B. Trombert-Paviot et al., "Frequency and severity of adverse drug reactions due to self-medication: a cross-sectional multicentre survey in emergency departments," *Drug Safety*, vol. 36, no. 12, pp. 1159–1168, 2013.
7. Zaki A, Abdel-Fattah M, Bassili A, Arafa M, Bedwani R. The use of medication in infants in Alexandria, Egypt. *Eastern Mediter Health J* 1999;5:320-7.
8. Sharma R, Verma U, Sharma CL, Kapoor B. Selfmedication among urban population of Jammu city. *Indian J Pharmacol* 2005;37:37-45.
9. Fosarelli P, Wilson M, De Angelis C. Prescription medications in infancy and early childhood. *Am J Dis Child* 1987;141:772-5.
10. Eldalo AS. Saudi parent's attitude and practice about self-medicating their children. *Arch PharmaPract*, 2013; 4: 57-62.
11. Eldalo AS, El-Hadiyah TM, Yousif M A. Sudanese parents' knowledge, attitudes and practice about self-medication to their children: Qualitative study. *Saudi J Health Sci.*, 2013; 2: 103-7.
12. Olivier, Pascale, et al. "Hospitalizations because of adverse drug reactions in elderly patients admitted through the emergency department." *Drugs & aging* 26.6 (2009): 475-482.
13. Lewinski, Daniel, et al. "Prevalence and safety-relevance of drug-related problems in German community pharmacies." *Pharmacoepidemiology and drug safety* 19.2 (2010): 141-149.
14. Eickhoff, Christiane, et al. "Nature and frequency of drug-related problems in self-medication (over-the-counter drugs) in daily community pharmacy practice in Germany." *Pharmacoepidemiology and drug safety* 21.3 (2012): 254-260.
15. Asseray, Nathalie, et al. "Frequency and severity of adverse drug reactions due to self-medication: a cross-sectional multicentre survey in emergency departments." *Drug safety* 36.12 (2013): 1159-1168.
16. Du, Yong, and Hildtraud Knopf. "Self-medication among children and adolescents in Germany: results of the National Health Survey for Children and Adolescents (KiGGS)." *British journal of clinical pharmacology* 68.4 (2009): 599-608.
17. Buck, Marcia L. "Self-medication by adolescents." *Pediatr Pharm* 13.5 (2007): 1-4.
18. Eldalo, Ahmed S. "Saudi parent's attitude and practice about self-medicating their children." *Archives of Pharmacy Practice* 4.2 (2013): 57.
19. Eldalo, Ahmed S., Tarig MH El-Hadiyah, and M. A. Yousif. "Sudanese parents' knowledge, attitudes and practice about self-medication to their children: Qualitative study." *Saudi Journal for Health Sciences* 2.2 (2013): 103.
20. Tibdewal, Sunita, and Madhur Gupta. "Mother's use of medication in their children of preschool age." *Indian journal of public health* 49.1 (2005): 27.
21. Sontakke, Smita, et al. "EVALUATION OF PARENTAL PERCEPTION ABOUT SELF-MEDICATION AND OTHER MEDICINE USE PRACTICES IN CHILDREN."
22. Jasim, Ali Lateef. "PARENTAL SELF MEDICATION OF ANTIBIOTICS FOR CHILDREN IN BAGHDAD CITY." *International Journal of Pharmacy and Pharmaceutical Sciences* 6.10 (2014): 485-489.
23. Alghanim, S. A. "Self-medication practice among patients in a public health care system/Pratique de l'automédication chez les patients bénéficiant d'un système de soins de santé public." *Eastern Mediterranean health journal* 17.5 (2011): 409.

24. Schroeder, Knut, and Tom Fahey. "Systematic review of randomised controlled trials of over the counter cough medicines for acute cough in adults." *Bmj* 324.7333 (2002): 329.
25. Smith, Michael BH, and William Feldman. "Over-the-counter cold medications: a critical review of clinical trials between 1950 and 1991." *Jama* 269.17 (1993): 2258-2263.
26. Gadowski, Anne. "Rational use of over-the-counter medications in young children." *JAMA* 272.13 (1994): 1063-1064.
27. Gunn, Veronica L., et al. "Toxicity of over-the-counter cough and cold medications." *Pediatrics* 108.3 (2001): e52-e52.
28. Allotey, Pascale, Daniel Diamond Reidpath, and Danielle Elisha. "'Social medication' and the control of children: a qualitative study of over-the-counter medication among Australian children." *Pediatrics* 114.3 (2004): e378-e383.
29. Eldalo, Ahmed S. "Saudi parent's attitude and practice about self-medicating their children." *Archives of Pharmacy Practice* 4.2 (2013): 57.
30. Alele, Peter Micheal. *Self-medication practices by caretakers for children under five years in Tororo District*. Diss. Makerere University, 2013.
31. Aoyama, Ikuko, Shinichi Koyama, and Haruo Hibino. "Self-medication behaviors among Japanese consumers: sex, age, and SES differences and caregivers' attitudes toward their children's health management." *Asia Pacific family medicine* 11.1 (2012): 1.
32. Dawood, Omar T., Mohamed IM Ibrahim, and Subish Palaian. "Parent's knowledge and management of their children's ailments in Malaysia." *Pharm Pract (Internet)* 8.2 (2010): 96-102.
33. Aljadhey, Hisham, et al. "Self-medication in Central Saudi Arabia: Community pharmacy consumers' perspectives." *Saudi medical journal* 36.3 (2015): 328.
34. Birchley, Nicola. "Parental management of over-the-counter medicines." *Nursing Children and Young People* 14.9 (2002): 24.
35. Aoyama, Ikuko, Shinichi Koyama, and Haruo Hibino. "Self-medication behaviors among Japanese consumers: sex, age, and SES differences and caregivers' attitudes toward their children's health management." *Asia Pacific family medicine* 11.1 (2012): 1.
36. Pandolfini, Chiara, Piero Impicciatore, and Maurizio Bonati. "Parents on the web: risks for quality management of cough in children." *Pediatrics* 105.1 (2000): e1-e1.
37. Kariyawasam, S. H., et al. "A descriptive cross sectional study on mothers self-medicating children." (2005).
38. Awad, Abdelmoneim, et al. "Self-medication with antibiotics and antimalarials in the community of Khartoum State, Sudan." *J Pharm PharmSci* 8.2 (2005): 326-331.
39. Widayati, Aris, et al. "Self medication with antibiotics in Yogyakarta City Indonesia: a cross sectional population-based survey." *BMC research notes* 4.1 (2011): 1.
40. James, H., et al. "Influence of medical training on self-medication by students." *International journal of clinical pharmacology and therapeutics* 46.1(2008):23-29



## RESEARCH ARTICLE

### EFFECT OF POMEGRANATE JUICE AND PEEL ON ANTIOXIDANT ENZYMES AND LIPID PROFILE IN CARBON TETRACHLORIDE-INDUCED HYPERLIPIDEMIC RATS.

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#### Abstract

Lipid peroxidation is a crucial step in the pathogenesis of free radical-related disease states, including glomerulonephritis, rheumatoid arthritis, gastrointestinal and cardiovascular diseases. Antioxidants play a significant role in protecting living organism from the toxic effect of various chemicals by preventing free radical formation. Pomegranate is a good source of polyphenols and other antioxidants. The purpose of the present study is to evaluate the effect of pomegranates juice and peel administration on antioxidant enzymes activities and lipid profile in carbon tetrachloride-induced hyperlipidemic rats. Hyperlipidemic rats were treated with pomegranates juice and peel for 8 weeks. Results showed that all hyperlipidemic rats administrated juice and peel had significant decrease in TBARS concentration and increase in GSH, GPx, GST, CAT and SOD in plasma compared to CCl<sub>4</sub> group. Lipid profile parameters (except HDL-C) decreased significantly with juice and peel administration compared to CCl<sub>4</sub> group. In conclusion, consumption of pomegranate juice and peel showed significant improvement of lipid parameters and antioxidant enzyme activities in hyperlipidemic rates suggesting therapeutic potential of using pomegranate as a medicinal plant for managing hyperlipidemia and modifying the risk of CVD.

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#### Introduction: -

Human are continuously exposed to different kindsof chemicals such as food additives, industrialchemicals, pesticides and other undesirablecontaminants in the air, food and soil(Stavric, 1994).These substancesmostly induce a freeradical-mediated lipid peroxidation leading todisruption of biomembranes and cellular dysfunction. Lipid peroxidation is thought to play an important role in the pathogenesis of free radical-related disease states, including glomerulonephritis, rheumatoid arthritis, gastrointestinal and cardiovascular diseases(Cho et al., 2003). Oxidative stress has been linked to an altered lipid profile and endothelial damage which is a crucial event in the most common pathological processes underlying cardiovascular diseases (CVD)(Halperin et al., 2006). Additionally, the well-known side effects of the current synthetic lipid-lowering drugs have increased the need to move toward alternative treatment for the prevention of hyperlipidemia including medicinal plants and natural antioxidants(Pahan, 2006).

Antioxidants play a significant role in protecting living organism from the toxic effect of various chemicals by preventing free radical formation(Sheweita et al., 2001). Studies have demonstrated that there are approximately 5000 known plant phenolics and many of them have antioxidant activity(Pace et al., 2006). During last years, the

interest in the antioxidant properties of the phenolic compounds in vegetables and fruits among agricultural and food scientists, nutritionists, food industry professionals and consumers had increased, derived from their strong activity and low toxicity compared with those of synthetic phenolic antioxidants, such as butylated hydroxytoluene (Dolatabadi et al., 2010).

*Punica granatum* L., commonly called pomegranate has an ancient history; sculptured representations of the fruit are found on the ancient monuments of Egypt and the Assyrian ruins. The tree is native to the region of Persia and the Himalayan ranges of India and has been cultivated in Iran, Afghanistan, Pakistan, North India, Armenia, Azerbaijan, Georgia, and the Mediterranean region for several millennia (Jurenka et al., 2008). Pomegranate has been used in various regions and folk or traditional medicine because of its enormous compounds with lots of activities and without toxicity (Lansky et al., 2007). Pomegranate juice is an affluent source of polyphenols with high antioxidative potential. Moreover, its antihypertensive, and anti-inflammatory effects have been shown in limited studies in human and murine models. Pomegranate juice showed an antioxidant activity three times higher than red wine and a green tea infusion (Gil et al., 2000). Pomegranate juice also displayed potent antiatherogenic action in atherosclerotic mice and humans (Aviram et al., 2000).

Carbon tetrachloride ( $\text{CCl}_4$ ), a well-known model agent for producing chemical hepatic injury, requires biotransformation by hepatic microsomal cytochrome P450 to produce toxic metabolites, namely trichloromethyl free radicals ( $\text{CCl}_3\cdot$ ) and subsequent derivative ( $\text{Cl}_3\text{COO}\cdot$ ) (Brautbar et al., 2002). These radicals may interact with membrane lipids leading to peroxidation (Aamir et al., 2011).  $\text{CCl}_4$  causes an imbalance between the synthesis and degradation of lipids (Boll et al., 2001). In view of this, this study was carried out to evaluate the effect of pomegranate juice and peel administration on antioxidant enzymes activities and lipid profile in carbon tetrachloride-induced hyperlipidemic rats.

### Materials and Methods:-

The component used in the preparation of products and standard diet were purchased from local markets in Alexandria, Egypt.  $\text{CCL}_4$  was purchased from Merck; Darmstadt. The dose of  $\text{CCL}_4$  used was 1 ml/kg BW twice a week (Zuinen et al., 2007). Commercial kits were obtained from Biosystems S.A. (Spain), Diamond (Germany) and Randox (United Kingdom). Methanol, Folin-Ciocalteu (Prolabo) reagent, Sodium Carbonate, Gallic Acid, Rutin,  $\text{AlCl}_3$ , DPPH reagent were obtained from Central laboratory unit for advanced environmental and biological analyses, High institute of public health, Alexandria University. The study was approved by the ethical committee of the High Institute of Public Health, Alexandria University.

### Preparation of Pomegranate juice:-

Pomegranate was purchased from local markets in Alexandria, Egypt. The fresh pomegranate fruits, free of blemishes or obvious defects were washed and cut into pieces, the rind was removed, and seeds were separated. Juice was obtained using a commercial blender (Braun blender, Germany), filtrated with a Buchner funnel and immediately diluted with distal water to volume of 1:3 and stored at  $20^\circ\text{C}$ . The chosen dose of Pomegranate juice for the experiment was 5 ml/Kg BW (Osman et al., 2011).

### Preparation of pomegranate peel powder:-

The pomegranate peel was collected, washed, cut into small pieces and dried in air then in an oven at  $50^\circ\text{C}$  till complete dryness. The dried peel was grounded to fine powder in a mechanical blender and stored at  $3 - 4^\circ\text{C}$  until used. For the experimental protocol, 5% of pomegranate peel powder were added to the standard diet (Abdou et al., 2012).

### Experimental animals and protocol:-

Fifty male rats about 130-150 gm were obtained from the Medical Research Institute, Alexandria University, Alexandria, Egypt. The animals were housed in cages under standard condition of illumination with a 12-h light-dark cycle at  $25 \pm 1^\circ\text{C}$  (Childs et al., 2002). Animals were housed 5 per cage and fed on standard rodent pellet diet (Gold Mohar, Lipton - India, Ltd), and tap water ad libitum for two weeks before the beginning of the experiment for rehabilitation. Diets were presented to rats in special non-scattering feeding cups to avoid loss of food and contamination. Every day the animals were observed for the external appearance, shape, color, distribution of hair and physical activity. The animals were then divided randomly into the following five groups:

**Group (1):** Ten rats served as control group given the standard diet for 8 weeks.

**Group (2):** Ten rats were given the standard diet and treated with CCL<sub>4</sub> alone (1 ml/Kg BW) twice a week for 8 weeks.

**Group(3):** Ten rats were given the standard diet and treated with combination of CCL<sub>4</sub>(1ml/kg BW) and pomegranate juice(5 ml/Kg BW) for 8 weeks.

**Group (4):** Ten rats were treated with combination of CCL<sub>4</sub>(1 ml/Kg BW) and pomegranate peel alone added to standard diet by 5% for 8 weeks.

**Group (5):** Ten rats were treated with combination of CCL<sub>4</sub> (1 ml/KgBW), pomegranate juice (5 ml/Kg BW) and pomegranate peel by 5% for 8 weeks.

#### Measured parameters and techniques:

At the end of the experiment, rats were fasted overnight and anesthetized with chloroform. The blood samples were collected in tubes with heparin (anti-coagulant). The heparinated blood samples were placed immediately in ice. Plasma samples were obtained by centrifugation at 860xg for 20min, and were stored at -20°C until analyses. Liver was immediately removed at the end of the experiment; weighed and washed using chilled saline solution. Tissues were minced and homogenized (10% w/v) in ice-cold sodium potassium phosphate buffer (0.01 M, pH 7.4) containing 1.15% KCl in a Potter–Elvehjem type homogenizer. The homogenate was centrifuged at 10,000 ×g for 20 min at 4°C. The resultant supernatant of the organs was used for the measurement of different enzyme activities.

#### Estimation of antioxidant enzymes in plasma and liver:-

The activity of Glutathione S-transferase (GST; EC 2.5.1.18), Glutathione reductase (GSH) Glutathione peroxidase (GPx; EC. 1.1.1.9) was determined by the methods of **Habig et al.,(1974)**, **Beutler et al., (1963)**, and **Chiu et al., (1976)** respectively. Catalase (CAT; EC 1.11.1.6) activity was assayed using the Luck method involving the decomposition of hydrogen peroxide (**Luck, 1971**). Superoxide dismutase (SOD; EC 1.15.1.1) activity was measured according to **Misra and Fridovich (1972)**. Plasma thiobarbituric acid-reactive substances (TBARS) were measured by the method of **Tappel and Zalkin (1959)**.

#### Lipid profile:-

Plasma concentrations of total lipids, total cholesterol (TC) and triglycerides (TG) were determined per the methods of **Frings et al., (1972)**, **Watson (1960)**, and **Fossati et al., (1982)**, respectively. High-density lipoprotein (HDL-C) was measured according to the methods of **Warnicket al., (1983)**. Low-density lipoprotein (LDL-C) was determined by the calculation (cholesterol-(TG/5+HDL-C). Very low-density lipoprotein (VLDL-C) was calculated by dividing the values of TG by factor of 5.

#### Statistical analysis:-

Data were analyzed using SPSS software package version 20 (SPSS, Chicago, IL, USA). P value (< 0.05) was considered significant. The data were assessed for normality using Kolmogorov-Smirnov test. The data were normally distributed and presented as mean ± standard deviation. One way ANOVA test was used to compare the mean for different measures among the different experimental groups, followed by post-hoc pairwise comparison with adjustment of P value using Bonferroni correction.

#### Results and Discussion:-

Data in Table 1 shows the effects of pomegranate juice and peel on antioxidant enzymes activities in CCl<sub>4</sub>-induced hyperlipidemic rats. CCl<sub>4</sub> significantly (p<0.05) increased TBARS and decreased GSH levels as well as GPx, GST, CAT and SOD activities in plasma of the rat group treated only with CCl<sub>4</sub> as compared to control group. In other words, CCl<sub>4</sub> induced oxidative stress in plasma as manifested by the alterations observed in antioxidant defense systems both enzymatic and non-enzymatic. Lipid peroxidation is one of the principal causes of CCl<sub>4</sub> toxic effect and is mediated by the free radicals' derivatives of CCl<sub>4</sub>. Our results are in consistence with the results of **Shih et al. (2005)** who confirmed that the hepatic activity of superoxide dismutase was markedly decreased by CCl<sub>4</sub> treatment. Also, **Comporti (1985)** indicated a substantial increase in ROS, MDA levels and depletion of GSH levels in CCl<sub>4</sub> intoxicated rats.

On the other hand, our study demonstrated that treatment of hyperlipidemic rats with combination of CCL<sub>4</sub>, pomegranate juice and peel caused significant (p<0.05) decrease in TBARS concentration and increase in GSH, GPx, GST, CAT and SOD activities. In other words, pomegranate juice and peel reduced the toxic effects of CCl<sub>4</sub> (Table1). The significant elevation in GSH, GST, SOD, GPx and catalase of plasma indicates the protection offered



by juice and peel against CCl<sub>4</sub> induced toxicity. It is known that some flavonoids are able to reduce xenobiotic - induced toxicity in animals and counteract the damaging effects of oxidative stress, cooperating with natural systems like glutathione and other endogenous protective enzymes (Kadarian et al., 2002). These results are in agreement with Mohieldin et al. (2011) who revealed that treating rats with carbon tetrachloride and pomegranate peel ethanolic extract had significantly decrease the GST, catalase and SOD activity, and significantly increase the GST, catalase and SOD activity when compared with CCl<sub>4</sub>-treated group during the hepatoprotective and curative periods. Our findings are also confirmed by the findings of Aviram et al., (2004) who reported that total antioxidant status in serum of patients with carotid artery stenosis was substantially increased, by 130% after 12 months of juice consumption. The effect of juice may be related to its potent tannins and anthocyanins which scavenge wide spectrum of free radicals. (Gil et al., 2000), (Aviram et al., 2000).

Pomegranate peel administration showed insignificant higher levels of plasma GSH, GPx, GST, CAT, and SOD when compared to juice, which is may be due to the slightly higher content of polyphenols in peel than in juice. Aviram et al., (2000) found that the inner and outer peels contain 20–30 fold more polyphenols than do the aqueous fractions of the seeds and Juice (566 and 739 µmol polyphenols/mg compared with 22 and 25 µmol polyphenols/mg, respectively).

The decrease of TBARS in plasma of the hyperlipidemic rat groups treated with juice and peel (Table 1) agrees with the results of Naveena et al., (2008) who reported that the free radical scavenging activity of pomegranate peel phenolics involves electron donation to free radicals that converts them to relatively more stable compounds. Several studies have confirmed the antioxidant and free radical scavenging activity of phenolic compounds derived from pomegranates, the antioxidant activity of plants extracts depends on the concentration of phenolic compounds, and the antioxidant power of pomegranate peel extract has been found to linearly increase with the concentration of peel phenolics up to the level of 400 µg/g (Sönmez et al., 2005), (Rosenblat et al., 2006).

Data listed in Table 2 shows the effect of pomegranate juice and peel on lipid profile of CCl<sub>4</sub>-induced hyperlipidemic rats. Treatment of rats with CCl<sub>4</sub> caused a significant increase ( $p < 0.05$ ) in plasma TG, TC, LDL-C and VLDL-C, while HDL-C was significantly decreased ( $p < 0.05$ ) compared to control group. These findings are in agreement with Uličná et al. (2003) who reported that the long-term intraperitoneally administration of CCl<sub>4</sub> to experimental animals induced, as expected, pathological changes in the liver. CCl<sub>4</sub> treatment of rats also caused a severe increase of hepatic triacylglycerol, total cholesterol and Malondialdehyde. The highly reactive free radical (trichloromethyl, CCl<sub>3</sub><sup>•</sup>) in the presence of oxygen leads to auto-oxidation of fatty acids and causes functional and morphological changes in the cell membrane. Scavenging of free radicals is one of the major anti-oxidation mechanisms to inhibit the chain reaction of lipid peroxidation. ROS are highly reactive and can react with many intracellular molecules, mainly unsaturated fatty acids (phospholipids, glycolipids, glycerides and sterols) and transmembrane proteins with oxidizable amino acids. The oxidation of these molecules causes the increase in the cellular membrane permeability. ROS can attack the unsaturated bonds of the membrane lipids in an autocatalytic process, with the genesis of peroxides, alcohol and lipidic aldehydes as by-products of the reaction. Thus, the increase of free radicals in cells can induce the lipid peroxidation by oxidative breakdown of polyunsaturated fatty acids in membranes of cells (Henke et al., 2005).

Meanwhile, our study reported that treatment of hyperlipidemic rats with pomegranate juice caused a significant decrease ( $p < 0.05$ ) in plasma lipids except HDL-C, which was significantly increased ( $p < 0.05$ ) compared to control group. These results are in agreement with Esmailzadeh et al., (2006) who found that pomegranate juice significantly reduced TC, LDL-C, the ratio of LDL-C/HDL-C, and the ratio of TC to HDL-C. Another study on mice fed pomegranate juice, plasma lipid peroxidation was markedly lower, and this effect was dependent on concentration (Aviram et al., 2000). Furthermore, Aviram et al., (2004) showed that pomegranate juice consumption for 3 years on patients with carotid artery stenosis reduces common carotid intima-media thickness, blood pressure and LDL-C oxidation. Khoo et al., (1990) reported that LDL-C aggregation was inhibited in vitro by pomegranate juice; this inhibition may be related to hydrophobic interactions between constituents of pomegranate juice and the lipoprotein. Pomegranate juice was indeed shown to possess impressive antioxidative properties due to its polyphenolics, tannins and anthocyanins (Gil et al., 2000). Additionally, phenolic compounds derived from pomegranate, vitamins C and E, melatonin and lycopene have been used as antioxidant agents to prevent various lipid-peroxidation-induced damages in different organs (Sönmez et al., 2005), (Rosenblat et al., 2006), (Sönmez et al., 2007), (Türk et al., 2007). Polyphenolic flavonoids not only affect cellular oxygenases but also cause

conformational changes in plasma membrane constituents, such as cellular receptors for lipoproteins(Aviram et al., 2000).

The decrease in plasma lipid profile of hyperlipidemic rats treated with peel which is showed in the present study is in agreement with Hossin(2009)who evaluated the pomegranate peel powder as a dietary fiber source for the treatment of hypercholesterolemia and atherosclerosis and found that dietary supplementation with peel powder at a concentration of 5, 10 and 15 g/100 g for a period of four weeks significantly reduced serum TC, TG, LDL-C, VLDL-C and lipid peroxidation levels in Hypercholesterolemic rats. Results of the present study confirm these findings(Table2).He also reported that all Hypercholesterolemic groups administered with different level of pomegranate peel extract (1, 2 and 3%) had significant decrease in serum TC, LDL-C-, VLDL-C, lipid peroxidation and atherogenic index and triglycerides comparing with control positive. Additionally, Ibrahim (2010)noticed that feeding the rats on standard diet containing 400 or 800 mg/Kg BW pomegranate peel extract for 4 weeks obviously decreased ( $P<0.05$ ) levels of TC, TG and TL.Pomegranate peel polyphenolic extract is effective in lowering serum and hepatic lipids(Cheng et al., 2005).

In the current study pomegranate peel was shown to be more influential in lowering level of lipid profile than juice, which is consistent with the findings of Aviram et al., (2000) who compared between the juice and the peel in terms of total polyphenol content. The researchers analyzed the antioxidant properties of pomegranate constituents other than the juice; they prepared aqueous solutions of the inner and outer peels and the crushed seeds and found that the aqueous extracts of the inner and outer peels were more powerful antioxidants than the juice, suggesting that the inner and outer peels may contain more potent antioxidant polyphenols. The aqueous extract obtained from the crushed seeds was found to be a weak antioxidant against LDL-Coxidation.

Based on the previous results, the authors concluded that the consumption of pomegranate juice and peel caused significant improvement of lipid parameters and antioxidant enzyme activities in hyperlipidemic rats suggesting therapeutic potential of using pomegranate as a medicinal plant for managing hyperlipidemia and modifying the risk of CVD.

**Table 1:-** Effect of pomegranate juice and peel on antioxidant enzymes activities in CCl<sub>4</sub>-induced hyperlipidemic rats.

Parameter	Experimental groups				
	Control	CCl <sub>4</sub>	CCl <sub>4</sub> +J*	CCl <sub>4</sub> +P*	CCl <sub>4</sub> +J*+P*
<b>TBARS (nmol/ml)</b>	0.54±0.01 <sup>d</sup>	0.97±0.03 <sup>a</sup>	0.71±0.01 <sup>b</sup>	0.67±0.02 <sup>b</sup>	0.63±0.01 <sup>c</sup>
<b>GSH (U/ml)</b>	0.549±0.05 <sup>b</sup>	0.250±0.02 <sup>e</sup>	0.406±0.03 <sup>d</sup>	0.457±0.03 <sup>cd</sup>	0.498±0.03 <sup>cb</sup>
<b>GPx (U/ml)</b>	16.63±1.09 <sup>b</sup>	7.39±0.60 <sup>d</sup>	12.16±0.65 <sup>c</sup>	13.92±1.17 <sup>bc</sup>	14.98±1.18 <sup>bc</sup>
<b>GST (μmol /hr./ml)</b>	1.03±0.02 <sup>b</sup>	0.49±0.03 <sup>e</sup>	0.82±0.02 <sup>d</sup>	0.86±0.02 <sup>cd</sup>	0.92±0.02 <sup>c</sup>
<b>CAT (u/min/ml)</b>	51.83±3.90 <sup>b</sup>	22.71±0.99 <sup>d</sup>	40.58±3.63 <sup>c</sup>	43.75±4.02 <sup>bc</sup>	45.63±3.66 <sup>bc</sup>
<b>SOD (U/ml)</b>	2.73±0.02 <sup>b</sup>	1.40±0.10 <sup>d</sup>	2.08±0.03 <sup>c</sup>	2.39±0.03 <sup>bc</sup>	2.55±0.10 <sup>b</sup>

\*J: Pomegranate juice, \*P: Pomegranate peel.

Values are expressed as means ± SE; n = 10 for each treatment group. Mean values within a row not sharing a common superscript letter (a, b, c, d, e, f) were significantly different,  $p<0.05$ .

**Table 2:-**Effect of pomegranate juice and peel on lipid profile in CCl<sub>4</sub>-induced hyperlipidemic rats.

Parameter	Experimental groups				
	Control	CCl <sub>4</sub>	CCl <sub>4</sub> +J*	CCl <sub>4</sub> +P*	CCl <sub>4</sub> +J+P
<b>TL(mg/dl)</b>	508.75±11.31 <sup>c</sup>	677.88±10.00 <sup>a</sup>	574.98±11.91 <sup>b</sup>	557.94 ±6.32 <sup>b</sup>	555.13±24.43 <sup>b</sup>
<b>TC(mg/dl)</b>	147.72±5.45 <sup>d</sup>	198.76±4.40 <sup>a</sup>	181.93±7.86 <sup>ab</sup>	168.67±6.47 <sup>bc</sup>	160.35±6.31 <sup>cd</sup>
<b>TG(mg/dl)</b>	123.00±5.43 <sup>b</sup>	159.30±4.24 <sup>a</sup>	149.13±10.79 <sup>a</sup>	146.15±12.27 <sup>a</sup>	138.87±8.11 <sup>ab</sup>

<b>HDL-C(mg/dl)</b>	54.48±2.63 <sup>b</sup>	36.21±2.87 <sup>e</sup>	40.31±1.62 <sup>ed</sup>	45.87±2.57 <sup>cd</sup>	48.06±2.98 <sup>bc</sup>
<b>LDL-C(mg/dl)</b>	68.64±1.73 <sup>c</sup>	130.69±0.68 <sup>a</sup>	111.79±4.08 <sup>b</sup>	93.57±1.45 <sup>b</sup>	84.42±1.71 <sup>b</sup>
<b>VLDL-C(mg/dl)</b>	24.6±1.09 <sup>d</sup>	31.86±0.85 <sup>a</sup>	29.83±2.16 <sup>ab</sup>	29.23±2.45 <sup>ab</sup>	27.87±1.62 <sup>cd</sup>

\*J: Pomegranate juice, \*P: Pomegranate peel.

Values are expressed as means ± SE; n = 10 for each treatment group. Mean values within a row not sharing a common superscript letter (a, b, c, d, e, f) were significantly different, p<0.05.

## References:-

1. **Aamir, S., Thippeswamy, B.S., KulKarani, V.H. and Karunakar, H. (2011):** Hepatoprotective effect of *Euphorbia thymifolia* whole plant extract on CCl<sub>4</sub> induced hepatic damage in rats. *Int J Res Ayurveda Pharm.*, 2(22):681–6.
2. **Abdou, H.S., Salah, S.H., Boolesand, F.H. and Abdel, Rahim E.A. (2012):** Effect of pomegranate pretreatment on genotoxicity and hepatotoxicity induced by carbon tetrachloride (CCl<sub>4</sub>) in male rats. *J. Medicinal Plants Research*. 6(17):3370- 3380.
3. **Aviram, M., Dornfeld, L., Rosenblat, M., Volkova, N., Kaplan, M., Coleman, R., Hayek, T., Presser, D. and Fuhrman, B. (2000):** Pomegranate juice consumption reduces oxidative stress, atherogenic modifications to LDL and platelet aggregation: studies in humans and in atherosclerotic apolipoprotein E-deficient mice. *Am. J. Clin. Nutr.*, 71(5):1062-76.
4. **Aviram, M., Rosenblat, M., Gaitini, D., Nitecki, S., Hoffman, A., Dornfeld, L., Volkova, N., Presser, D., Attias, J., Liker, H. and Hayek, T. (2004):** Pomegranate juice consumption for 3 years by patients with carotid artery stenosis reduces common carotid intima-media thickness, blood pressure and LDL oxidation. *Clin Nutr.*, 23(3):423–33.
5. **Beutler, E., Duron, O. and Kelly, B.M. (1963).** An improved method for the detection of blood glutathione. *J. Lab. Clin. Med.*, 61:882-88.
6. **Boll, M., Weber, L.W., Becker, E. and Stampfl, A. (2001):** Pathogenesis of carbon tetrachloride-induced hepatocyte injury bioactivation of CCl<sub>4</sub> by cytochrome P450 and effects on lipid homeostasis. *Z Naturforsch C.*, 56(1–2):111–21.
7. **Brautbar, N., and Williams, J. (2002):** Industrial solvents and liver toxicity: Risk assessment, risk factors and mechanisms. *Int J Hyg Environ Heal.*, 205(6):479–91.
8. **Cheng, S., Guo, C.J., Yang, J., Wel, J.Y., Li, Y.F. and Xu, J. (2005):** Experimental study on hypolipidemic effect of polyphenolic extract from pomegranate peel. *J Prev Med Chinese People's Lib Army*.
9. **Childs, A.C., Phaneuf, S.L., Dirks, A.J., Phillips, T. and Leeuwenburgh, C. (2002):** Doxorubicin treatment in vivo causes cytochrome C release and cardiomyocyte apoptosis, as well as increased mitochondrial efficiency, superoxide dismutase activity, and Bcl-2:Bax ratio. *Cancer Res.*, 62(16):4592–8.
10. **Chiu, D.T., Stults, F.H. and Tappel, A. (1976):** Purification and properties of rat lung soluble glutathione peroxidase. *Biochim Biophys Acta.*, 445(3):558–66.
11. **Cho, E.J., Yokozawa, T., Rhyu, D.Y., Kim, H.Y., Shibahara, N. and Park, J.C. (2003):** The inhibitory effects of 12 medicinal plants and their component compounds on lipid peroxidation. *Am J Chin Med.*, 31(6):907–17.
12. **Comporti, M., (1985):** Lipid peroxidation and cellular damage in toxic liver injury. *Lab Invest.*, 53(6):599–623.
13. **Dolatabadi, J.E. and Kashanian, S. (2010):** A review on DNA interaction with synthetic phenolic food additives. *Food Research International*, 43:1223–30.
14. **Esmailzadeh, A., Tahbaz, F., Gaieni, I., Alavi-Majd, H. and Azadbakht, L. (2006):** Cholesterol-Lowering Effect of Concentrated Pomegranate Juice Consumption in Type II Diabetic Patients with Hyperlipidemia. *Int J Vitam Nutr Res.*, 76(3):147–51.
15. **Fossati, P. and Prencipe, L. (1982):** Serum triglycerides determined colorimetrically with an enzyme that produces hydrogen peroxide. *Clin Chem.*, 28(10):2077–80.
16. **Frings, C.S., Frendley, T.W., Dunn, R.T. and Queen, C.A. (1972):** Improved determination of total serum lipids by the sulfo-phospho-vanillin reaction. *Clin Chem.*, 18(7):673–4.
17. **Gil, M.I., Tomas-Barberan, F.A., Hess-Pierce, B., Holcroft, D.M. and Kader, A.A. (2000):** Antioxidant activity of pomegranate juice and its relationship with phenolic composition and processing. *J Agric Food Chem.*, 48(10):4581–9.
18. **Habig, W.H., Pabst, M.J. and Jakoby, W.B. (1974):** Glutathione S-transferases. The first enzymatic step in

- mercapturic acid formation. *J Biol Chem.*, 25;249(22):7130–9.
19. **Halperin, R.O., Sesso, H.D., Ma, J., Buring, J.E., Stampfer, M.J. and Gaziano, J.M. (2006):** Dyslipidemia and the risk of incident hypertension in men. *Hypertension.* 47(1):45–50.
  20. **Henkel, R. (2005):** The impact of oxidants on sperm function. *Andrologia.* 37(6):205–6.
  21. **Hossin, F.L. (2009):** Effect of pomegranate (*Punica granatum*) peels and its extract on obese hypercholesterolemic rats. *Pakistan J Nutr.*, 1;8(8):1251–7.
  22. **Ibrahim, M.I. (2010):** Efficiency of pomegranate peel extract as antimicrobial, antioxidant and protective agents. *World J Agric Sci.*, 6(4):338–44.
  23. **Jurenka, J.S. (2008):** Therapeutic applications of pomegranate (*Punica granatum* L.): A review. *Altern Med Rev.*, 13(2):128–44.
  24. **Kadarian, C., Broussalis, A.M., MinoLopez, J., Gor-zalczany, P., Ferraro, S. and Acevedo, G. (2002):** Hepatoprotective activity of *Achyrocline satureioides* (Lam.) D.C. *Pharmacol Res.*, 45(1):57–61.
  25. **Lansky, E.P. and Newman, R.A. (2007):** *Punica granatum* (pomegranate) and its potential for prevention and treatment of inflammation and cancer. *J. Ethnopharmacol.*, 109:177–206.
  26. **Luck, H. (1971):** “Catalase,” In: *Methods of Enzymatic Analysis*, H. U. Bergmeyer, Ed., pp. 885–893, Academic Press, New York, NY, USA.
  27. **Misra, H.P. and Fridovich, I. (1972):** The role of superoxide anion in the autoxidation of epinephrine and a simple assay for superoxide dismutase. *J Biol Chem.*, 247(10):3170–5.
  28. **Naveena, B.M., Sen, A.R., Kingsly, R.P., Singh, D.B. and Kondaiah, N. (2008a):** Antioxidant activity of pomegranate rind powder extract in cooked chicken patties. *Int. J. Food Sci. Technol.*, 43:1807–12.
  29. **Osman, M., Ahmed, M., Mahfouz, M.U. and Elaby, S. (2011):** Biochemical Studies on The Hepatoprotective Effects of Pomegranate and Guava Ethanol Extracts. *New York Sci J.*, 44(33):27–39.
  30. **Pace, G., Lima, P., Vianello, F., Corrêa, C.R., Arnoux, R. and Campos, D.S. (2014):** Polyphenols in Fruits and Vegetables and Its Effect on Human Health. *Food Nutr Sci.*, 5(5):1065–82.
  31. **Pahan, K. (2006):** Lipid-lowering drugs. *Cell Mol Life Sci.*, 63(10):1165–78.
  32. **Rosenblat, M., Hayek, T. and Aviram, M. (2006):** Anti-oxidative effects of pomegranate juice (PJ) consumption by diabetic patients on serum and on macrophages. *Atherosclerosis.* 187(2):363–71.
  33. **Sheweita, S.A., Abd El-Gabar, M. and Bastawy, M. (2001):** Carbon tetrachloride-induced changes in the activity of phase II drug-metabolizing enzyme in the liver of male rats: Role of antioxidants. *Toxicology.* 165(2–3):217–24.
  34. **Shih, C.C., Wu, Y.W. and Lin, W.C. (2005):** Aqueous extract of *Anoectochilus formosanus* attenuate hepatic fibrosis induced by carbon tetrachloride in rats. *Phytomedicine.* 12(6–7):453–60.
  35. **Sonmez, M., Turk, G. and Yuce, A. (2005):** The effect of ascorbic acid supplementation on sperm quality, lipid peroxidation and testosterone levels of male Wistar rats. *Theriogenology.* 63(7):2063–72.
  36. **Sonmez, M., Yuce, A. and Turk, G. (2007):** The protective effects of melatonin and Vitamin E on antioxidant enzyme activities and epididymal sperm characteristics of homocysteine treated male rats. *Reprod Toxicol.*, 23(2):226–31.
  37. **Stavric, B. (1994):** Role of chemopreventers in human diet. *Clin Biochem.*, 27(5):319–32.
  38. **Tappel, A.L. and Zalkin, H. (1959):** Inhibition of lipid peroxidation in mitochondria by vitamin E. *Arch Biochem Biophys.*, 80(2):333–6.
  39. **Türk, G., Ateşşahin, A., Sönmez, M., Yüce, A., Çeribaşı, A.O. (2007):** Lycopene protects against cyclosporine A-induced testicular toxicity in rats. *Theriogenology.* 67(4):778–85.
  40. **Ulicná, O., Greksák, M., Vancová, O., Zlatos, L., Galbavý, S. and Bozek P. (2003):** Hepatoprotective effect of rooibos tea (*Aspalathus linearis*) on CCl<sub>4</sub>-induced liver damage in rats. *Physiol Res.*, 52(4):461–6.
  41. **Warnick, G.R., Benderson, V. and Albers, N. (1983):** Selected Methods. *Clin. Chem.* 10:91–9.
  42. **Watson, D. (1960):** A simple method for the determination of serum cholesterol. *Clin Chim Acta.*, 5(5):637–43.
  43. **Zuinen, R., Yamaji, K., Aoki, M., Chikuma, T. and Hojo, H. (2007):** Early induced, high-level interleukin-6 expression in the rat peritoneal cavity into which a hepatotoxicant carbon tetrachloride was administered. *Toxicol Lett.*, 170(1):42–8.



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### RESEARCH ARTICLE

#### A STUDY OF CONSUMER PERCEPTIONS AND PURCHASE BEHAVIOUR TRENDS TOWARDS DIGITAL ONLINE BUYING BEHAVIOUR OF CUSTOMERS FROM DIFFERENT AGE-GROUPS.

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#### Abstract

The research aims to find out what factors help in strengthening the trust in the process of shopping through digital online mediums. From the population, a sample of girl students studying management courses were taken along with Baby Boomers, Gen-X and Gen-Y respondents. They were then assessed by asking them to find out the factors because of which, they have developed some level of 'trust' based on the e-commerce sites. A total of twenty online shopping websites were given to them to analyze the factors that led to building of trust in the purchase process and transactions made by them. The aim of this research is to provide insight into fundamental processes that are related to digital buying. The survey by twenty seven girl students had been instrumental in identifying intentions and perceptions in the cases of online buying. The study also tries to understand the different challenges faced in the buying process. The research concluded that there are many factors that are responsible for building trust for online purchase from a particular website. A sample of two hundred and forty respondents was collected and a self-administered questionnaire was prepared. Factor Analysis, T test, one way Anova test was conducted to know the significance of apparent trust, credibility and perceived worthiness.

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#### Introduction:-

The research study aims to find out the factors and reasons as to what leads to dis-trust while consumer are online and wanting to purchase the branded or non-branded products and services digitally online and what intentions and perceptions make them avoid taking risk that they think can be true. (Jacob &Kaplan, 1999; Yate Stone, 1999), have divided the risk perceived by customers into various types and categories, and defined what types of risks are majorly involved that act as a barrier towards digital online buying behaviour. These types of risks depend upon the category of the goods, products or services. For example, if the product or service is a debit card or credit card transaction, it is "financial risk", that customer's financial safety is at stake. Similarly, while these girls from the sample are wanting to purchase shoes or clothes or mobiles, etc, they not only come across the 'financial risk' but also 'functionality risk', related to the product of interest. The other types of risks perceived by these respondents are the 'physical safety risk', 'psychological risk' and 'social risk.' Joycee (2012) with Levitt (1993), talk about how the 'World Wide Web' is going to come up as the most progressive and liked channel for manufacturers, wholesalers-retailers, sellers and buyers as in market-space instead of market place, and in near future unlimited use

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of online digital shopping of products and brands will be the trend for communicating for reaching consumer directly, with a shorter sales cycle. These online customer generations can be taken out of their perceptual risk of purchasing the branded products. If the e-commerce transactions are consistently fair and reliable and credible, trust starts building up. 'Trust is defined as a person's expectation of the other's cooperative behavior in situations where it is possible to suffer some damage if the other behaves selfishly (Yamagishi, 1998).' (Wong, 2008) throws light on the virtual web spaces' advantages and convenience over a traditional marketing and selling system. The virtual reality is more economical and carries capability in offering a vast array of products with multi-fold alternatives available in order to cater to the needs of more segments of online buyers and provide them with customer delight. It can be obviously witnessed that in today's e-business scenario, the growth is mammoth, not only in buying of the railway tickets, airlines, booking of hotels, movies, re-creation, but also moving towards purchase of products and services from diverse sectors like beauty, healthcare, clothes and apparels, make-up, wallets, shoes, belts and other accessories. The factors that have been analyzed for this sea-change have been very critical towards the success of the websites' credibility. It is noteworthy that higher the brand value of a product, higher is the 'perceived risk' associated with it.

The emphasis on building up and sustaining trust has been supported by varied researchers and scientists. Goritzz (2008) describes 'trustworthiness as promotor of both intention to buy and combat perceived risks'. This research tries to throw light on the need for "factors that guarantee trust" for shopping online. In the e-commerce scenario, customers can't see, touch, smell, or taste the goods and they may not place a query, if in doubt. One of the most important factor by which the e-commerce or m-commerce can be made trustworthy is, by providing and involving the customer in more information about the product of interest. Consumer once recognizes the need for the product, and goes online for finding primary and secondary information about the available brands in that category, they are actually engaging themselves in the information search about possible brands and their variants available. Once this customer has an awareness set of chosen brands, and does alternative evaluations, he comes to the decision of purchase online. This is the beginning of development of trust and may lead to online loyalty for the shopping website.

There has been whole sole emphasis on the innovation and creation of 'interfaces' through which the e-commerce website can communicate the trust factors effectively. The internet also allows consumers to access an unlimited range of products and services from companies around the world, and it has reduced the time and effort consumers spend on shopping (Ko et al., 2004 and Lim, Yap and Lau, 2010). Hernandez, Jimenez and Martin (2011) carried out a research to analyse whether individuals' socioeconomic characteristics, namely, age, gender and income influence online shopping behaviour. Their results indicated that these factors do not condition the behaviour of the experienced e-shopping. In their study, they also claimed that the effects of some variable thought to be crucial from findings from previous studies may have changed and this could be a result of the rapid evolution of e-commerce in recent years. The research by Sorce, Perotti and Widrick (2005) conducted among 300 samples also identified that age was negatively correlated with online pre-purchase search but was positively correlated with online purchasing when pre-purchase search behaviour was taken into consideration. The research conducted by Sorce, Perotti and Widrick (2005) revealed two interesting findings which must given voice here.

### **Contextual Study:-**

Firstly, it was found that there was not significant differences in terms of the act of shopping online but when asked if they had searched for or purchased specific products or services online, younger shoppers reported searching for more products than the older group. Secondly, when the search for the product was taken into consideration, older consumers were more likely to purchase once they had searched for the item online. Despite the numerous researches on purchasing behavior in relation to different generation, there is a gap in the research related to perceptions of the challenges of online purchasing among the three generations which this research aims to fill. This paper is divided into the following sections. The first section reviews the literature of online purchasing. The method section furnishes details on data collection, framework of study and analysis. Then, in the findings section, the analysis of the responses obtained from the survey are discussed. The conclusion section highlights the key findings and provides recommendation for future research. The internet has entered the mainstream consciousness of society over the past decade and Jhe (2014) attributes this to the web's graphical interface as well as the change in the controlling body, where it has moved from the government to the private sector. They went on to add that companies have started using the internet with the aim of cutting marketing costs, thereby reducing the price of the products and services in order to stay ahead in the highly competitive market. According to Changchit (2006), an increasing number of people are gravitating towards more intensive use of the internet as the accessibility of technology, the

availability of information, and the ability to interact through the internet increase and evolve. Internet based services offer many advantages to providers and to users. Principal advantages are convenience, speed, accessibility, timeliness and cost effectiveness. However, the drawbacks are that many computer applications were originally designed to deliver these advantages rather than provide high levels of security (Johnson and Krone, 2007).

Apart from the issue of systems' security, an internet user may also be vulnerable to exploitation or attack in terms of the security applied in conducting any online transaction (Johnson and Krone, 2007). Fraud and internet crime are recognised as important issues for governments and private businesses worldwide. An area of growing concern is the impact of criminal activity on householders who use the internet (Johnson and Krone, 2007). In addition, according to Browne, Durrett and Wethebe (2004), other internet business problems include the need to structure internal and external business processes to serve customers appropriately, the need to provide adequate technological and physical infrastructures, and the need to understand customer consumption processes in 'virtual' and physical environments. According to Hernandez, Julio and Martin (2011), in the last few decades, extensive research has been conducted into information technology (IT) adoption, testing a series of factors considered to be essential for improved diffusion and these researches can be divided into three groups where some studies analyse IT characteristics such as usefulness, ease of use and/or security (Davis, 1989; Yu et al., 2005), others focus on the emotions and experiences of users (Agarwal and Prasad, 2000 and Fiore and Kim, 2007) and a third group attempts to determine the importance of socioeconomic user characteristics, such as age, gender, educational level, place of residence and income.

### **Online Purchasing and The Generations:-**

Generation is a strong determinant of online purchasing behavior. This has been proven in past researches where generally it has been found that Generation Y contributes to the highest percentage of online purchasing, followed by Generation X and Baby Boomers. According to Lachman and Brett (2013), Generation Y takes shopping seriously and spends a lot of online time researching, fantasizing, considering flash-sale promotions, checking out what celebrities are wearing and then imagining how they would look in similar outfits, using pinterest.com to share items with family members, and keeping up with food and fashion blogs. This is supported by the findings of Consumer Behavior Report (2008) which stated Generation Y is more immersed in online and mobile activities including social networks (86%), podcasts (57%), blogs (50%) and text messaging (96%) than any other generation. However, the National Australia Bank's Online Retail Sales Index shows that online spending is dominated by Generation X (cited in Bainbridge, 2013). Although studies have indicated differences in their researches with regards to online purchasing and generation, it can generally be summed that the highest percentage of online shopping is done either by Generation X or Y with Baby Boomers being the lowest. As a result of the contradictions in the findings of research on age and online purchasing with some indicating that younger generation tend to shop more online (Dholakia and Uusitalo, 2002 and Joines et al., 2003) while others have found that older consumers were more likely to shop online (Donthu and Garcia, 1999 and Korgaonkar and Wolin, 1999), Sorce, Perotti and Widrick (2005) have concluded that demographic factors versus shopping motivations and attitudes in predicting online shopping remains an open question.

### **Perceptions of Online Purchasing:-**

Consumers' perceptions towards online shopping has been broadly researched by various researchers and scholars with a wide range of methods to compare consumer behavior in online shopping to that of traditional offline shopping behavior (Gupta, 2013). According to Li and Zhang (2002), there are in-depth studies on online shopping attitudes and behavior in recent years where most of them have attempted to identify factors influencing or contributing to online shopping attitudes and behavior. Internet knowledge, income and education level were found to be powerful predictors of internet purchases among university students according to an online survey of 425 U.S. undergraduate and MBA students (Case, Burns, and Dick, 2001). Ho and Wu (1999) discovered that there are positive relationships between online shopping behavior and five categories of factors which include e-stores logistical support, product characteristics, websites technological characteristics, information characteristics and homepage presentation. Schubert and Selz (1999) examined the quality factors of electronic commerce sites in terms of information, agreement and settlement phases. Researchers have also carried out various researches using different methods and have revealed findings that are similar as well as different with regards to consumers' perceptions of online shopping. Changchit (2006) carried out a survey in South Western United States University (US) to identify the differences between consumers who prefer online shopping and those who prefer offline shopping. The responses from 107 individuals indicated differences in the perception of the consumers as to the factors of past experience, benefits, convenience and levels of uncertainty between those who preferred online shopping and those

who did not. One significant finding was that positive past experience had a positive relationship with desire to shop online. Parment (2013) asserted that Baby Boomers in Sweden showed a higher degree of involvement for grocery product and paid more attention to optimizing purchase decision especially on clothes for example by avoiding poor quality of clothing and by making sure different elements of the wardrobe fit together as compared to Generation Y. On the other hand, Generation Y is more interested on online purchasing based on emotional involvement.

There has been quite intensive in-depth studies on finding out the factors influencing online buying. (Chang et al., 2004; Limayem et al., 2000; Sim and Koi, 2002; Ahn, Ryu and Han, 2004; Liu and Wei, 2003 as well as O'Cass and Fenech, 2003 cited in Thananuraksakul, 2007). Apart from lot of emphasis on providing product information, there are many other variables that enhance and boost the e-commerce transactions, which include economy, comfort and convenience, variety of brands, travel time and information search saving, user-friendly, and holding a win-win situation for both the parties. Mann (2012) suggested other variables, '(Lohse and Spiller, 1998 and Park and Kim, 2003), geography and store accessibility (Farag et al., 2006), perceived risk and online shopping benefits (Pires, Stanton, Eckford 2004), typology of online stores (Moe, 2003), pleasure and web trust (Ha and Stoel, 2009), attitudes to online shopping (Dittmar et al., 2004 and Ahn et al., 2007)' and the impact of consumers' socio-economic conditions (Farag et al., 2006). (KuestasAbdulghader et. al., 2012). Talks about increasing concern on other factors challenging for online purchase 'insecurity, lack of customers' protection and trust which are vital elements for a successful online transaction between countries, organizations' as well as individuals.

#### Research Objectives:-

- To explore the variables that impact the digital marketing transactions.
- To understand the state and level of affiliation between these factors.
- To find out the challenges that e-commerce faces vis-à-vis traditional commerce.
- To know marketing plans used for online marketing for Baby Boomers, Gen X and Gen Y.

'Kotler et.al (2005) and Mc Carthy (1978) designed a basic prototype as shown in Figure- 1.'

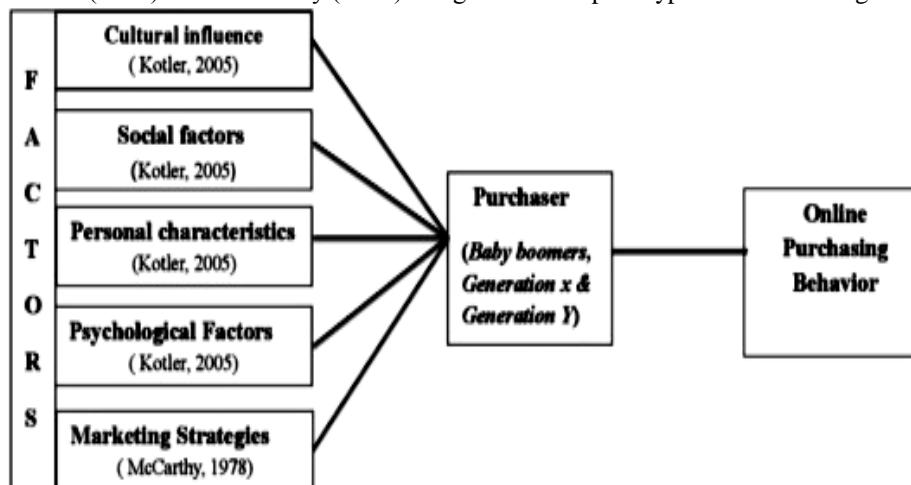


Fig.1:-

#### Research Framework:-

A total of 240 questionnaires were distributed among the three generations comprising of both males and females. The demographics of these samples are shown in Table 1.

**Table 1:-** Gender Distribution of Samples.

	Frequency	Percent
Male	132	55
Female	108	45
Total	240	100

The findings indicate that a total of 55% (132) of this samples were males and 45% (108) were females. Since past literature indicates that educational background and income plays a significant role in determining the consumers' intention to purchase online, the researchers sought to identify this background information through the questionnaire.



**Table 2:-** Educational Background of the Sample.

Educational Background	Teenagers	Males	Females
Secondary School	18.8	13.8	1.2
Diploma	18.8	26.2	9
Bachelor's Degree	25	35	81.2
Master's Degree	22.5	15	6.2
PhD	10	6.2	1.2
Other Professional Qualification	3.8	3.8	1.2
Incomplete	1.2	0	0
Total	100	100	100

**Table 3:-** Income Bracket of Samples.

Income Brackets	Teenagers	Males	Females
RM 2000 and below	10	6.2	31.2
RM 2000 - RM 4000	8.8	33.8	15
RM 4001 - RM 6000	21.2	28.8	15
RM 6001 - RM 8000	20	10	10
RM 8001 and above	36.2	18.8	20
Incomplete	3.8	2.5	8.8

As shown in Table 2, 25% of Teenagers are degree holders, 23% are Masters holders and 10% are PhD holders. With regards to Males, 61% are degree holders, 15% are Masters Holders and 6 are PhD holders. A large percentage, 81% of the Females, are pursuing a Bachelor's degree or have completed their first degrees, 6% are master holders and 1% are PhD holders. Table 3 indicates that the largest percentage (36%) of the Teenagers are earning an income of Rs. 8000 and above while the majority of Males (34%) fell under the income group of Rs 2000 to RM 4000. On the other hand, a large percentage (31%) of Females are earning an income ranging between Rs 2000 and below. The samples' employment status and number of years employed were also identified as past literature has indicated that there is a significant relationship between these with the intention to purchase online. Table 4 and Table 5 indicate the findings.

**Table 4:-** Employment Status of Samples.

		Frequency	Percent	Valid Percent	Cumulative Percent
	0	3	1.2	1.2	1.2
	Full Time	141	58.5	58.8	60
	Part Time	15	6.2	6.2	66.2
Valid	Contract	5	2.1	2.1	68.3
	Freelance	18	7.5	7.5	75.8
	Unemployed	58	24.1	24.2	100
	Total	240	99.6	100	
Missing	System	1	0.4		
Total		241	100		

**Table 5:-** Number of Years Employed.

		Frequency	Percent	Valid Percent	Cumulative Percent
	0	12	5	5	5
	Less than 1 year	55	22.8	22.9	27.9
	1-5 years	30	12.4	12.5	40.4
Valid	6-10 years	29	12	12.1	52.5
	11-15 years	25	10.4	10.4	62.9
	16 years and above	89	36.9	37.1	100
	Total	240	99.6	100	
Missing	System	1	0.4		
Total		241	100		

Table 4 shows that a large percentage of the samples are employed fulltime (59%). 24% of the samples are unemployed. These samples are representatives of Generation Y and they are still studying. A small percentage of samples are freelance workers (8%), part time workers (6%) and contract workers (2%). Table 5 shows the years of experience of the samples. In terms of years of experience, a large percentage have been working for more than 16 years (37%). On the other hand, 10% of the samples have been working between 11 to 15 years, 12% between 6 to 10 years, 12% between 1 to 5 years and 23% less than a year.

#### Online Purchasing Experience According to Gender and Generations:-

From the questionnaire collected, the researchers did a frequency count as to the number of samples according to gender and generation who have done online shopping. Table 7 and Table 8 show the findings. The findings in Table 6 indicate that both males and females have experience shopping online. 80% of males and 78% of females from the sample size have previously done online shopping. Thus, it shows that there is not much difference according to gender with regards to purchasing online. This findings contradicts past researchers (Alreck and Settle, 2002, Brown et al., 2003, Donthu and Garcia, 1999, Korgaonkar and Wolin, 1999 and Levy, 1999; Li et. al., 1999; Rodgers and Harris 2003; Slyke et al., 2002 and Stafford et al., 2004 cited in Zhou, 2007) who found that male consumers make more online purchases and spend more money online than females; they are equally or more likely to shop online in the future, and are equally or more favorable of online shopping. Literature review has also revealed that most of the internet shoppers are men, earning high incomes and owning a university education (Dholakia and Uusitalo, 2002 and Li et al., 1999; Vrechopoulos et al., 2001 cited in Nayyar and Gupta 2010).

**Table 6:-** Online Purchasing Experience According to Gender.

			Have you done any online shopping?			Total
			Yes	No	Missing	
Gender	Male	Count	105	27	0	132
		% within Gender	79.5%	20.5%	0%	100%
	Female	Count	84	23	1	108
		% within Gender	77.8%	21.3%	0.9%	100%
Total		Count	189	50	1	240
		% within Gender	78.8%	20.8%	0.4%	100%

The findings indicate that all three generations do some form of purchasing online. However, both Generation X and Y do it more than Baby Boomers. 83% of Generation X and 81% of Generation Y have purchased products/ services online. In the case of Baby Boomers, only 73% have done online shopping. The higher percentage of Generation X and Y purchasing online is linked to the fact that these generations were born during the time when technology had already advanced. The findings of this research is supported by Parment's (2013) study on Generation Y which indicated that the constant and overwhelming flow of information has become the rule for them as they are multi-taskers who use their mobile phones for just about anything. Parment's findings can also apply to Generation X. According to Hernandez, Jimenez and Martin (2011), a review of literature shows that computer skills are more easily learned by younger individuals (Czara et. al., 1989) and older people perceive greater risks (Morris and Venkatesh 2000). Further they cited Trocchia and Jada, (2008) who also showed similar findings where they listed three obstacles which make older consumers reluctant to do online shopping which comprise lack of IT experience, resistance to change and their insistence on trying out the product before purchase. These findings are proven true in the current study which shows the Generation X and Y do online purchasing to a larger degree compared to Baby Boomers.

**Table 7:-** Online Purchasing Experience According to Generations.

			Have you done any online shopping?			Total
			YES	NO	Missing	
	Generation Y	Count	65	15	0	80
		% within Generation	81.2%	18.8%	.0%	100.0%
Generation	Generation X	Count	66	14	0	80
		% within Generation	82.5%	17.5%	.0%	100.0%
	Baby Boomers	Count	58	21	1	80
		% within Generation	72.5%	26.2%	1.2%	100.0%
Total		Count	189	50	1	240
		% within Generation	78.8%	20.8%	.4%	100.0%

Factors Affecting Online Purchasing Prior to analyzing the factors that affects the online purchasing among the three generations, the researchers sought to identify the most common products purchased by the three generations and also the preferred method of purchasing these products. A list of commonly purchased products was given to the samples who were then asked to identify their preferred method of purchase; over the internet or at the retail store. The selection of products was made based on a pilot study that was carried out to identify the most commonly purchased products at a regular basis. Table 8 shows the findings.

**Table 8:-** Commonly Purchased Product (%).

Variables	Baby Boomers		Generation X		Generation Y	
	Online	Retail	Online	Retail	Online	Retail
Groceries	1	99	6	94	4	96
Cosmetics	10	90	15	85	6	94
Books/ CDs	26	74	30	70	25	75
Clothes	9	91	16	84	24	76
Furniture	5	95	14	86	9	91
Electronic gadgets	21	79	30	70	25	75
Computers/Mobiles	19	81	30	70	14	86
Airline/Railway tickets	51	49	59	41	74	26
Cinema tickets	65	35	72	28	74	26
Holiday packages	49	51	58	42	59	41

Out of the ten products/services given in the list, the findings indicated that the three generations' preferred method of purchasing was similar for three specific products: cinema tickets (Baby Boomers, 65%, Generation X, 72% and Generation Y, 74%), airlines/ railway tickets (Baby Boomers, 51%, Generation X, 59% and Generation Y, 74%), and holiday packages (Baby Boomers, 49%, Generation X, 58% and Generation Y, 59%) where they all opted buying over the internet as their preferred method. One significant observation is that in the case of holiday packages, the difference in percentage of Baby Boomers' preference between purchasing at retail store and online is not very significant (2%). The rest of the seven products inclusive of groceries (Baby Boomers, 99%, Generation X, 94% and Generation Y, 96%), cosmetics, (Baby Boomers, 90%, Generation X, 85% and Generation Y 94%), books/CDs (Baby Boomers, 74%, Generation X, 70% and Generation Y, 75%), clothes (Baby Boomers, 91%, Generation X, 84% and Generation Y, 76%), furniture (Baby Boomers, 95%, Generation X, 86% and Generation Y, 91%), electronic gadgets (Baby Boomers, 79%, Generation X, 70% and Generation Y, 75%), and computer products/mobiles (Baby Boomers, 81%, Generation X, 70% and Generation Y, 86%) showed a tendency among the samples from the three generations to purchase at retail stores. The findings here contradicts the findings of Monsuwé et al. (2004 cited in Haslingger, Hodzic, Opazo, 2007) who compared the traditional way of shopping and online shopping and concluded that online shopping is a more convenient way compared to the traditional ones. His conclusion was based on the fact that the internet allows for more information to be gathered with a minimal amount of effort, inconvenience, and invested time by the consumer. Monsuwe's findings is applicable to the current findings where the samples from the three generations preferred purchasing cinema tickets, airline/ railway tickets and holiday packages online. This is probably because the above activities are time consuming.

**Table 9:-** Relationship between the Factors Affecting Online Purchasing and Generation of Online Purchasers.

		Gen der	Genera tion	Educ ation	Employ ment	Sala ry	Personal charact eristics	Psycholo gical factors	Cultur al influe nce	Soci al fact ors	Market Mix strategi es
Gender	Pearson Correla tion	1	0.041	-0.101	0.088	-0.131 <sup>*</sup>	-0.095	0.016	0.019	-0.01	-0.099
	Sig.(2- tailed)		0.527	0.118	0.173	0.042	0.142	0.811	0.765	0.88	0.128
	N		240	240	240	240	238	237	239	237	238
Generatio n	Pearson Correla tion		1	-0.027	-0.397 <sup>**</sup>	0.28 <sup>**</sup>	0.099	0.057	0.008	.178 <sup>**</sup>	0.99

	Sig.(2-tailed)			0.679	0.000	0.000	0.129	0.382	0.904	0.006	0.129
	N			240	240	240	238	237	239	237	238
Education	Pearson Correlation			1	-0.091	0.309**	0.057	0.006	0.048	-0.04	-0.053
	Sig.(2-tailed)				0.161	0.000	0.385	0.921	0.462	0.543	0.416
	N				240	240	238	237	239	237	238
Employment	Pearson Correlation				1	-0.245**	0.014	-0.032	0.072	-0.075	0.004
	Sig.(2-tailed)					0.000	0.830	0.624	0.269	0.249	0.956
	N					240	238	237	239	237	238
Salary	Pearson Correlation					1	0.141*	0.084	0.09	0.166*	0.052
	Sig.(2-tailed)						0.029	0.197	0.163	0.011	0.427
	N						238	237	239	237	238
Personal Characteristics	Pearson Correlation						1	.458**	.289**	.467**	.524**
	Sig.(2-tailed)							0.000	0.000	0.000	0.000
	N							236	238	236	237
Psychological factors	Pearson Correlation							1	.362**	.372**	.419**
	Sig.(2-tailed)								0.000	0.000	0.000
	N								237	236	237
Cultural Influence	Pearson Correlation								1	.327**	.240**
	Sig.(2-tailed)									0.000	0.000
	N									237	238
Social factors	Pearson Correlation									1	.368**
	Sig.(2-tailed)										0.000
	N										237
Marketing mix strategies	Pearson Correlation										1
	Sig.(2-tailed)										
	N										

\*p&gt;0.001

\*\*p&gt;0.005

Past researchers have identified numerous factors that influence online purchasing behavior. Based on these findings, four main categories of factors were identified: personal characteristics psychological factors, factors related to cultural influence and social factors. The respondents were asked to indicate their agreement on whether

these factors affect their intention to purchase online. A correlation analysis was done to determine the relationship between the variables. The analysis was done to determine whether the demographic factors such as gender, generation, education, employment and salary influences the consumers' online purchasing behavior. The result proved that there is a positive correlation between generation and social factors with ( $r = 0.178$ , sig. level = 0.006). The social factors indicated in the questionnaire comprise the following statements; products are also used by family and friends, products are endorsed by celebrities, suppliers are engaged in corporate social responsibility and there is online feedback of products. The findings indicate that these factors are significant in influencing the consumers' decision to do online purchasing. Meanwhile the findings indicated that personal characteristics, psychological factors, factors related to cultural influence and marketing mix strategies did not significantly influence the generations in their online purchasing behavior. Besides that, the income of consumers also has a significant positive relationship with personal characteristics ( $r = 0.141$ , sig. level 0.029) and social factors ( $r = 0.166$ , sig. level 0.11). The personal characteristics include lifestyle, the liking for the products, current position whether they are students, office workers or professionals as well as trends of the generations. This proved that consumers who have high incomes do more online shopping. Baby Boomers, who earned higher also, preferred to buy products of current trends to upgrade their lifestyle. This finding is consistent with previous researchers where it was found that income is positively related to the tendency to shop online (Bagchi and Mahmood 2004; Donthu and Garcia, 1999, Korgaonkar and Wolin, 1999 and Li et al., 1999; Susskind 2004 cited in Zhou 2013; Cunningham and Cunningham, 1973 cited in Nayyar and Gupta 2010). The findings also indicated that psychological factors, factors related to cultural influence and marketing mix strategies have negative relationship with salary. In the studies of Hernandez, Jimenez and Martin (2011), higher income causes internet users to perceive lower implicit risks in online purchasing and thus increase their demand for such activity while on the other hand, low income is a deterrent to online transactions as they do not have the ability to withstand possible financial losses.

The findings in this study is consistent with past literature. However, caution must be taken in coming to a conclusion as the study of Hernandez, Jimenez and Martin (2011) has also proven that the user's income only has effect on the first e-commerce activity which changes once users have acquired experience in the activity. Their view is supported by the study of Al-Somali et. al. (2009). This research, however, did not study the difference in relationship between age and first instance of online purchasing and subsequent online purchasing. At this point, it is also important to take note of the implication from Sorce, Peratti and Widrick's study (2005) where it is stated that different marketing approaches are necessary for the different consumer age segments. Older consumers may need to be induced to get online in the first place, while younger consumers will require enticement to translate their shopping and browsing into actual purchasing.

**Table 11:- Marketing Strategies.**

		Product		Price		Place		Promotion	
		1	2	1	2	1	2	1	2
Baby Boomers	Count	65	15	55	25	59	21	49	31
	Expected Count	57.2	22.8	54.9	25.1	58.5	21.5	47.9	32.1
	% with Generation	81.2%	18.8%	68.8%	31.2%	73.8%	26.2%	61.2%	38.8%
Generation X	Count	55	25	58	22	60	20	56	24
	Expected Count	57.5	22.5	54.2	24.8	57	21	48.3	31.7
	% with Generation	68.8%	31.2%	72.5%	27.5%	75%	25%	70%	30%
Generation Y	Count	52	58	52	28	57	23	39	41
	Expected Count	57.2	22.8	54.9	25.1	58.5	21.5	47.9	32.1
	% with Generation	65%	35%	65%	35%	71.2%	28.8%	48.8%	51.2%

The researchers asked the respondents to identify which marketing strategies affects their online purchasing behavior and the results indicated that for the Baby Boomers, the product strategy was the most significant (81.2%) followed by place (73.8%), price (68.8%) and lastly promotion (61.2%). In the case of Generation X, the findings indicated a difference where place was indicated as the most significant (75%), followed by price (72.5%), promotion (70%) and lastly product (68.8%). The perceptions as to the strategy which had a significant impact on the decision to purchase online for the Generation Y was similar to Generation X where they identified place as the most significant variable (71.2%), followed by both product and price (65%) and promotion (48.8%). In this study, the researchers did not expand the term 'promotion' with that of trust as done by some researchers (Bhattacharjee, 2002, Gefen, 2003 and Mc Knight et al., 2002 and Yoon, 2002). According to Chang et. al, all these researchers

found a significant positive effect of trust on intention to purchase where trust is conceptualized as a construct where the truster (online purchaser) is willing to be vulnerable to the action of the trustee (marketer or producer).

### Conclusion & Discussion:-

This research was carried out among samples from the three generations to identify the perceptions and challenges of online shopping in Malaysia. The purpose was to identify whether there were any differences between the perceptions of the three generations. The findings indicated that the percentage of both females and males shopping online is almost similar. With regards to generations, the findings are consistent with past literature where it is shown that generation X and Y do online shopping more than Baby Boomers. In terms of products that are most purchased online by the three generations include cinema tickets, airline/railway tickets and holiday packages. The findings on the factors affecting online purchasing indicated that personal characteristics, psychological factors, cultural influence and marketing mix strategies do not significantly influence the generations in their online purchasing behavior. The only factor that was found to be significant in influencing the consumers' decision to do online purchasing is social factors which comprised of products used by family and friends, products endorsed by celebrity, suppliers engaged in corporate social responsibility and there is online feedback of product. In terms of challenges of online purchasing, all three generations indicated risk of credit card transaction as the most significant. The limitations in this study include the sample size which is relatively small for generalizations. A larger sample would give more valid results. The research also did not take into consideration the difference in perception of a new user with that of an experienced user to online shopping. Another limitation is that the characteristics of Malaysia's unique population which is rich in cultural diversity with its unique practices and taboos was not taken into consideration in the analysis of the sample's perceptions and challenges of online shopping. Thus, it is recommended that research in this area can be further extended to analyze the differences in perceptions between the three predominant races in Malaysia as well as differences between the genders. It is also recommended that online marketers take into consideration the challenges that are perceived by online purchasers in order to cultivate a good impression on online shopping among the three generations.

### References:-

1. Ahmad Nabot VG. Consumer attitudes toward online shopping: An exploratory study from Jordan. Article in international Journal of social ecology and sustainable development. 2014, 25-32.
2. Anyasree PA. Factors influencing online buying behaviour in tiruchirappalli district. Research journal's Journal of Marketing. 2014, 2348-0947.
3. Badlani KM. (N.D.). A Customer Perception towards Online Shopping An Exploratory Study. Altius Shodh Journal of Management & Commerce.
4. Balachandran W. An adaptive decision support system for last mile logistics in e-commerce- A study on online grocery shopping in Jordan. International Journal of decision support system technology, 2013, pp. 40-65.
5. Buttner, O. B. & Goritz, A. S. (2008). Perceived trustworthiness of online shops. Journal of Consumer Behaviour, 7(1), 35-50.
6. Jacoby, J. & Kaplan, L. B. (1972). The components of perceived risk. In M. Venkatesan (Ed.), Proceedings of Association for Consumer Research 3rd Annual Conference (pp. 382-393).
7. Organization Science, 3(4), 475-500. (Richa, VOL.3(1) 2012; Ruchi Nayyar, 2011) (Javidani, 4 October, 2010 ; anyasree, june 2014; Chen, 2005; Badlani; Ahmad Nabot, JULY 2014 ; Vijayasathy, 2003; Dholakia, 2003; Powers, 2013; CheNawi Noorshella1, 2015; Jyoti1, 2015)
8. CheNawi Noorshella1 AM. Examining the Key Factors Affecting e-Service Quality of Small Online Apparel Businesses in Malaysia. Sage open. 2015, 1-10.
9. Gurvinder S Shergill, ZC. Web based shopping consumer's attitude towards online shopping in New Zealand. Journal of electronic commerce, 2005, pp. 79-94.
10. Kushboo Makkwana KD. (n.d.). A customer perception towards online shopping. Atlusshodh journal of management and commerce, pp. 2348-8891.
11. Javidani SA. Measuring e-shopping intention: An Iranian perspective. African Journal of Business Management. 2010; 4(13):2668-2675, 2668-2676.
12. Fernandez, a. a. (2013). Consumer Perception of privacy and security Risk for online shopping. In a. a. Fernandez, Consumer Perception of privacy and security Risk for online shopping (pp. 27-44).
13. Gotland, H. p. (2014). E marketing. karp, g. (2009). The morning Call. Allentown. marketography. (2014, 03 01). Retrieved 03 01, 2014, from www.marketography.com

14. Parasuraman A, Grewal D. The impact of technology on the quality-value-loyalty chain: A research agenda. J. of the Acad. Mark. Sci. 2000; 28:168.
15. Rice, R. E. (1992). Task analyzability, use of new medium and effectiveness: A multi-site exploration of media richness.
16. Yamagishi, T. (1998). The structure of trust: The evolutionary games of mind. Tokyo: University of Tokyo Press.
17. Ziqui Liao Ml. Internet based e shopping and consumer attitudes: An empirical study. Article in information and management, 2001, pp. 299-306.

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### RESEARCH ARTICLE

## EFFECT OF INDEPENDENCE VARIABLES ON EMPOWERMENT OF SHG MEMBERS THROUGH ENTREPRENEURIAL ACTIVITIES AND LOAN PRACTICES ADOPTED

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### Abstract

Empowerment is a process, which generates changes in ideas and perceptions and creates awareness about one's rights and opportunities for self-development in all important spheres of life. It enables individuals and groups to change the balance of power by way of knowledge, know-how and experience to strengthen one's capacity and self-reliance. Many factors affect empowerment level of women such as caste, family's socio-economic status, custom, culture, age and education of family members as well as women's herself etc. Thus the study was conducted to know the role of SHGs participation in women empowerment. Random Sampling techniques were used and total 240 women respondents were selected to three blocks of Kanpur District. The study revealed that as age increases with correlation coefficient of 0.2436, 0.2447, 0.2478 and 0.3280. Occupation was observed significantly positively correlated with economic, socio-cultural and politico-legal empowerment. **Sharma and Sharma (2010)** stated that for Indian rural womenfolk, micro-finance is all about self-sufficiency, employment creation, income generation, social safety as well as sustainable livelihood of the of the poor women's group. Micro-finance intertwines two major pillars of India viz., democracy and micro-entrepreneurship at the grass root level.

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### Introduction:-

Now-a-days economic development is one of the factors that have changed the entire scenario of social and cultural environment within the country especially for the women. Women empowerment has been recognized as the central issue in determining the status of women and it has been considered as one of the strategies to tackle the socio-economic poverty. Women have taken up self-help movement through savings as a mass movement. Development agenda of the country in the last few years placing the people, especially women, in the forefront has enabled formation of a large number of SHGs throughout the country. The ultimate objective of all these efforts is to make women economically independent and self-reliant- Many factors affect empowerment level of women such as caste, family's socio-economic status, custom, culture, age and education of family members as well as women's herself etc. Economic empowerment is one of the approaches which have been widely used with women empowerment. One can be empowered either externally by capacity building or internally by developing self-expression, both are interdependent/ Control and management of resources develops the ability for self-expression in various ways as self- confidence, ability of decision making, skill overcome external barriers for accessing resources

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etc. women must go through intrinsic transformations regarding knowledge, skill and understanding which can be enhanced by group method which also involves empowerment of an individual. Many factors affected their choice of work as interest and educational background, family, social status, income level, technical knowledge, entrepreneurial background etc. Some activities like hand-made papers, bee-keeping, making of soap, jiggery, pulse processing, fruit processing and preservation, bamboo and cane work, weaving of doormats, manufacturing of candles etc. considered and identified as the convenient entrepreneurial activities for housewives. The SHG bank linkage programme is unique but faces several challenges regarding sustainability of the programme. The first and foremost challenge is how to maintain the quality of SHGs when there is mushroom increase in their number. The poor quality is seen in the book keeping, audit of groups in the country, which are accumulating regular savings, undertakes credit functions by means of intrinsic resources and credit from banks successfully. **Nagayya and Rao (2009)** reviewed the SHGs-Bank linkage programme at national and state level with special reference to Andhra Pradesh in detail and certain aspects of other three southern states-Tamil Nadu, Karnataka and Kerala. Banks have an important role to play and stake in inclusive banking in stepping up the success rate in the functioning of SHGs and support organizations of various categories. Self-help promotional Institutions and banks should pursue the task of spreading healthy management practices among SHGs, uniformly in developed and less developed regions. **Dutta and Panda (2009)**, indicated that Impact Assessment is the structured study, which measures the impact on employment, income generation, nutrition, education, health, consumption, business development (micro entrepreneurship) and gender equity on MFI's clients. Impact assessment refers to the assessment of how financial products and services affected the lives of the poor. Impact assessment is the measurement of the income growth, assets growth and vulnerability reduction of the poor by the microfinance programme. The indicators for impact assessment are not limited to economic development but extended to developmental growth like health, education, empowerment, gender, etc. **Estable and Torreguitart (2010)** studied about the effects of micro-finance in developed countries, and specifically the start-up of micro-business by women entrepreneurs with limited access to credit, having benefit from a micro-credit programme to developed their self-employment projects. as a part of general project to try to understand the impact of the existing micro-finance institutions (MFIs). The present research aims to study the social impact of the micro-business started up by women entrepreneurs granted with micro-loans, by means of a qualitative approach, the study proposed involves a total of ten women, clients of three different MFIs based in Catalonia. Semi-structured interviews have been used to conduct the research. The results have been analysed with the help of a frame. Work in which parameters related to the women micro-entrepreneurs, to their entrepreneurship experiences, and to the MFIs granting their loans are regarded as indicators of the personal and family impacts, of their professional lives and of the social impacts of micro-finance. The observed impacts are mostly related to personal and family issues, on account of the limited capacity of the micro-credit instrument to better the women's standard of living. Social impacts, although expected to be marginal, are also revealed by the study.

### Research Methodology:-

Present study on "Effect of independence variables on empowerment of SHG members through entrepreneurial activities and loan Practices adopted" was conducted in rural areas of Kanpur District. Three blocks namely Chaubepur, Shivrajpur and Kalyanpur were purposively selected from the study areas. 8 villages were than purposively selected from each blocks to get a total of 24 villages. One SHG from each village and 10 respondents from each SHG was randomly selected to get a total of 240 respondents.

### Results & Discussion:-

The present study were based on two main objectives such as Socio-Personal the respondents and empowerment of rural women through Self Help Group. Majority, about forty- three per cent respondents were belonging to 35 to 45 years of age followed by 28.75 per cent were of 25 to 35 years. About twenty- five per cent respondents were educated up to high school whereas, 16.66 per cent respondents were educated up to middle school. Majority, (47.08%) respondents were belonging to OBC caste followed by 31.66 per cent respondents were of SC/ST category. Majority (63.75%) respondents were belonging to joint family and about forty-nine per cent respondents were having 5 to 8 members in their family. More than forty per cent respondents were having the pucca house and 34.16 percent heads of family were labour.

**Part I:-** Personal and socio-economic characteristics N = 240

S.No	Personal Profile	Frequency	Percent
<b>Age</b>			
1	<25	37	15.41
2	25 – 35	69	28.75
3	35 – 45	103	42.91
4	>45	31	12.91
	<b>Total</b>	<b>240</b>	<b>100.0</b>
<b>Educational Level</b>			
1	Illiterate	29	12.08
2	Read and write only	36	15.00
3	Primary	36	15.00
4	Middle school	40	16.66
5	High school	67	27.91
6	Intermediate and above	32	13.33
	<b>Total</b>	<b>240</b>	<b>100.0</b>
<b>Caste</b>			
1	General	51	21.25
2	OBC	113	47.08
3	SC/ST	76	31.66
	<b>Total</b>	<b>240</b>	<b>100.0</b>
<b>Type of Family</b>			
1	Joint	153	63.75
2	Nuclear	87	36.25
	<b>Total</b>	<b>240</b>	<b>100.0</b>
<b>Size of Family</b>			
1	Up to 4 members	69	28.75
2	5 to 8 members	117	48.75
3	Above 8 members	54	22.50
	<b>Total</b>	<b>240</b>	<b>100.0</b>
<b>Type of House</b>			
1	Kaccha	49	20.41
2	Pucca	102	42.50
3	Mixed	89	37.08
	<b>Total</b>	<b>240</b>	<b>100.0</b>
<b>Occupation of head of family</b>			
1	Labour	82	34.16
2	Caste occupation	39	16.25
3	Farmers	24	10.00
4	Business	51	21.25
5	Service	44	18.33
	<b>Total</b>	<b>240</b>	<b>100.0</b>

**Table 2:-** Distribution of Respondent on the Basis of Loan Practices Adopted N = 240

S.No.	Loan Practices	Frequency	Per cent
<b>Number of loan taken by SHGs members</b>			
1	One	101	42.08
2	2-4	55	22.91
3	4-6	56	23.33
4	More than 6	28	11.66
	Total	240	100.00
<b>Size of the latest loan</b>			
1	Less than 5000	136	56.66
2	5000 to 10000	68	28.33
3	10000 to 15000	30	12.50
4	15000 and more	6	2.50
	Total	240	100.00
<b>Amount of loan borrowed from banks</b>			
1	Up to 5000	74	30.83
2	5000 to 10,000	55	22.91
3	15,000 to 25,000	52	21.66
4	25,000 to 40,000	38	15.83
5	40,000 and more than	21	8.75
	Total	240	100.00
<b>Loan amount Repaid by SHG members</b>			
1	Up to 30%	76	31.66
2	30 – 50%	62	25.83
3	50 70 %	54	22.50
4	Above 70%	48	20.00
	Total	240	100.00
<b>Sources of SHGs loan</b>			
1	Revolving fund	83	34.58
2	Subsidy loan	52	21.67
3	SGSY	105	43.75
	Total	240	100.00
<b>Rate of interest on loan from bank</b>			
1	7.50 per cent	181	75.42
2	8.50 per cent	59	24.58
	Total	240	100.00

**Loan Practices Adopted:-****Loan Practices Adopted:-**

Majority about forty two per cent respondents borrowed loan only once whereas, about thirty one per cent borrowed up to 5000 from bank and maximum (31.66%) respondents repaid loan up to 30%. Maximum about forty four per cent respondents borrowed loan from SGSY and majority i.e. 75.42 per cent respondents borrowed Rs. Up to 25,000 and paid 7.5 per cent per annum interest to the bank.

**Table 3:-** Distribution of Respondents on the Basis of Entrepreneurial Activities N = 240.

S.No	Entrepreneurial activities	Regularly	Occasionally	Never
<b>A</b>	<b>Agricultural activities</b>			
1	Vegetable & seed production	65 (27.10)	70 (29.17)	105 (43.75)
2	Honey bee keeping	16 (6.67)	8 (3.33)	216 (90.00)
3	Dairy farming	112 (46.67)	50 (20.83)	178 (74.17)
4	Goatary/ Poultry farming	85 (35.42)	60 (25.00)	95 (39.58)
5	Vegetable vending	107 (44.58)	33 (13.75)	100 (41.66)
6	Vermi compost & NADEP	32 (13.33)	59 (24.58)	149 (62.08)
<b>B.</b>	<b>Non-Agricultural activities</b>			

1	Food processing	83 (34.58)	29 (12.10)	128 (53.33)
2	Agarbatti making	8 (3.33)	94 (39.17)	138 (57.50)
3	Candle making	13 (5.42)	128 (53.33)	99 (41.25)
4	Tailoring	70 (29.17)	53 (22.10)	137 (57.10)
5	Flour milling	3 (1.25)	2 (0.83)	235 (97.92)
6	Shop at local level	133 (55.42)	00 (0.00)	107 (44.58)
7	Basket making/ mat making	29 (12.10)	41 (17.10)	170 (70.83)

(Figure in parenthesis indicates percentage)

#### Entrepreneurial Activities:-

About forty seven per cent respondents were 'regularly' engaged in "dairy farming" followed by 44.58 per cent respondents 'regularly' engaged in "vegetable vending". More than thirty five per cent respondents 'regularly' engaged in "goatary". Among non-agricultural activities, about fifty five per cent respondents were found 'regularly' engaged in "local level shop" followed by about thirty five per cent 'regularly' engaged in "food processing".

**Table 4:-** Relationship Between Empowerment of SHGs Members and Selected Independent variables. N = 240

Variables	Empowerment of SHGs Member			
	Economic empowerment	Socio-cultural empowerment	Politico-legal Empowerment	Self - Esteem
Age	0.2436*	0.2447*	0.2478*	-0.3280*
Education	-0.0692	-0.0729	0.0744	0.2126*
Caste	0.1120	0.0836	0.1054	-0.1354
Family Size	-0.0191	0.0119	-0.065	0.0410
Family type	0.3586*	-0.3008	-0.3691	0.2501*
Type of house	0.3384*	0.3323*	0.4115*	0.3288*
Occupation	0.4490*	0.4238*	0.4433*	0.3595*

(\* Significant at 5.0% level of significance)

To assess the relationship between empowerment of SHG members and selected independent variables correlation coefficient was assessed. The computed 'r' value showed that age is significantly positively correlated with all types of empowerment indicating as age increases economic empowerment, socio-cultural empowerment, politico-legal empowerment and self-esteem empowerment of respondent's also increase. Education is negatively correlated with economic empowered, socio-cultural empowerment, politico-legal empowerment but significant positive correlation was found between education and self -esteem empowerment. As education increases self-esteem empowerment of respondents also increases, as her level of education increase she understand her better and feel her own problems and find out solutions for them also.

No significant correlation was found between caste and economic, socio – cultural and politico-legal empowerment while negative correlation was found between self-esteem empowerment and caste. Family size was also negatively correlated with economic and politico-legal empowerment but positively correlated with socio cultural and self – esteem empowerment. On the other hand family type was significantly positively correlated with self-esteem empowerment, respondents belonging to nuclear family were found more self-esteem empowered but family type was negatively correlated with economic, socio cultural and politico legal empowerment. Positive significant correlation was observed between type of house and economic empowerment, socio-cultural empowerment and politico-legal empowerment but negative correlation was found between type of house and self-esteem empowerment. Occupation was observed significantly positively correlated with economic empowerment, socio-cultural empowerment and politico-legal empowerment as level of occupation increases economic, socio-cultural and politico-legal empowerment also increases but negative correlation was found between occupation and self – esteem empowerment. Thus, null hypothesis is partially rejected on the basis of the above findings.

#### Conclusion:-

It is concluded from the present study that SHGs today play a major role in poverty alleviation in rural India. A growing number of poor people (mostly women) in various parts of India are the member of SHG and actively engage in saving and credit, as well as in other activities. Empowerment by way of participation in SHG brings

enviable changes and enhances the living conditions of women in poor and developing countries like India. About ninety-six per cent respondents were strongly agreed upon “SHGs helped women to stop migration” and a majority of respondents were ‘strongly agree’ on SHGs “have little effect in changing an attitude of men towards women”. Several factors and strategies have been provided by the SHGs that have made a positive contribution to the economic empowerment of women such as saving, credit and income generation thereby ensuring economic independence. When a woman becomes members of SHG, her sense of public participation enlarged, a horizon of social activities, high self- esteem, self-respect and fulfilments in life, expended and enhances the quality of status of women as a participant. Nearly ninety-two per cent respondents want to be Pradhan as they feel more confident since they come out from home and understand what is running in society so they also want to contribute their part for its betterment. SHGs are the major sources of inspiration for women’s welfare. Women are an integral part of our country and economy. All round development and harmonious growth of nation would be possible only where women are considered as equal partners and SHG provides women a floor where she expresses herself and share responsibilities and thus, her self-confidence develop to its maximum and she reaches the top of her self-esteem.

**Reference:-**

1. **Estape, G. and Torreguitart, C. 2010.** Micro-credit and women empowerment: An empirical case study based on Catalonia. ISTR International Conference, Istanbul.
2. **Nagayya, D. and Rao D.K. 2009.** Micro-finance and support organization in the southern States of India. *Small Enterprise Development, Management and Extension Journal*, **36** : 1-24.
3. **Panda D.K. 2009.** “Understanding Microfinance”, Wiley India, New Delhi.
4. **Sharma, A.K. and Sharma, A. 2010.** Micro Financing Rural Women for Empowerment—Quo Vadis Micro-finance and Women Empowerment.



## RESEARCH ARTICLE

### ACCELERATION OF DISTANCE COMPUTATION FOR MULTIPLE SEQUENCE ALIGNMENT ON MULTI-CORE ARCHITECTURES

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#### Abstract

Although high quality multiple sequence alignment is an essential task in bioinformatics, it becomes a big dilemma nowadays due to the gigantic explosion in the amount of molecular data. The most consuming time and space phase is the distance matrix computation. This paper addresses this issue by proposing a vectorized parallel method that accomplishes the huge number of similarity comparisons faster in linear space.

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#### Introduction:-

Multiple sequence alignment of several nucleotides or amino acids is an important tool in bioinformatics. It can identify patterns or motifs to characterize protein families, and is therefore utilized to detect homology between sequences as well as to perform phylogenetic analysis [1].

It is playing an increasingly important role in diverse areas, such as elucidation of the tree of life [2], studies of epidemiology and virulence [3], drug design [4], and human genetics [5]. Most popular MSA tools, ClustalW[6], T-Coffee[7], MAFFT[8], and DIALIGN[9], utilize the progressive method that was at first introduced in [10].

It typically consists of three stages. Stage 1 computes a Distance Matrix (DM) comprised of the distance value between each pair of input sequences. Stage 2 computes an evolutionary tree from the DM using some phylogeny reconstruction methods like Neighbor-Joining (NJ) [11] which guides the final multiple alignment process. In stage 3, first closely related sequence or group of sequences is aligned then the most divergent sequences are aligned to get the final MSA.

However, there are some obstacles that must be handled carefully when using the progressive method. First, complexity is of increasing relevance due to the rapid growth of sequence databases, which now contains enough representatives of larger protein families to exceed the capacity of most current programs.

For example, aligning two sequences with one megabyte length each requires several terabytes of memory, which cannot be provided by most of the commodity computational resources. Second, computational load of multiple alignment calculations is of great increasing.

For example, computations of modern homologous sequence data sets could take days. In fact, the best methods sometimes fail to deal with these complexities efficiently and obtain biologically accurate alignments at the same time. The present study overcomes these obstacles by using two main approaches.

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The first is the vectorization, where all matrices are compensated by vectors, which in turn reduces the memory requirement and speedup execution without affecting the accuracy.

The second approach is parallelism, the widespread programming method nowadays that allows multiple independent processes which share the same resources, to be executed concurrently at less time. Thus, this work proposes an optimized method for the progressive MSA distance matrix computation using vectorization and parallelism.

It aims at producing a superlative MSA tool over existing ones in space and execution time. Implementation tests uses MATLAB@2012 compiler and explicit parallel programming with the fork-join model of parallel execution on core i7.

MATLAB was the most appropriate programming language for our work because it is an interpreted language of a high-level scripting and interactive sessions. It tends to be easier to code and debug. Its package comes with sophisticated libraries for matrix and vector operations, general numeric methods and plotting of data. It supports parallelism and MEX-files including C++ codes that accelerate execution and offer full control over parallelization [12]. The multi-core was the candidate platform for implementation due to its availability, but it is intended to extend our work for clusters; grids; or clouds. A multi-core processor uses the shared memory storage mechanism. The relationship between its cores is tightly coupled, and they are often interconnected by shared-cache, therefore, there is almost no communication overhead between cores [13].

### **Related Work:-**

This section surveys the most popular parallel tools developed for MSA using multi-cores. It highlights their parallel techniques and their performance enhancement. ClustalW presented a fully multithreading optimized version called MT-ClustalW [14]. It utilized the machine resources and achieves higher throughput. It was 2 times faster than the sequential ClustalW using 8 threads. While on Cell BE [15], it makes extensive use of vectorization and schedules the application across all cores which speed up the pairwise alignment phase. In addition, it applies loop unrolling and loop skewing optimizations that speedup the progressive alignment phase. It achieves an overall speedup of 9.1. Also on a QS21 Cell Blade, it demonstrates a speedup of 24.4 times when using 16 synergistic processor units compared to single-thread execution on the power processing unit, and 3.8 times faster than a 3-thread version running on an Intel Core2 Duo[16]. Cloud-Coffee [17] is the parallel implementation of T-Coffee that is based on shared-memory architectures, like multi-core. It was benchmarked on the Amazon Elastic Cloud (EC2) and runs 3.7 times faster. In [18], all stages of MAFFT have been parallelized using the POSIX Threads library with the best-first and simple hill-climbing parallelization strategies. It achieved a speedup of 10 times with different random numbers on a 16 core PC. DIALIGN-TX-MPI [19] is the parallel version of DIALIGN-TX that was implemented using both OpenMP and MPI on a heterogeneous multi-core cluster. It used an iterative heuristic method for MSA that is based on dynamic programming and generates alignments by concatenating ungapped regions with high similarity. It obtains a speedup of 3.13. MSAProbs [20] combines a pair-HMM and a partition function to calculate posterior probabilities. It investigates weighted probabilistic consistency transformation and weighted profile-profile alignment, to achieve high alignment accuracy. In addition, it is optimized for modern multi-core CPUs by employing a multi-threaded design in order to reduce execution time. It statistically demonstrates dramatic accuracy improvements over previous tools. MSACompro [21] incorporates predicted secondary structure, relative solvent accessibility, and residue-residue contact information into the currently most accurate posterior probability-based MSA methods. It uses a multiple-threading implementation on a 32 CPU cores machine. Benchmarks clearly show improvements in accuracy over MSAProbs and all leading tools. We concluded from the study of the above tools that MSACompro and MSAProbs are the most accurate but at expense of speed. Sample-Align-D is the fastest but not available. Clustal and MAFFT are fast, available, portable and can align huge number of sequences but less accurate. MUSCLE and T-coffee provide a good compromise between time spent and quality of the resulting alignment. And most of them exhaust large storage space due to the usage of matrices. Thus this research aims at addressing the problems concerning space and time.

### Proposed Approach:-

Some attempts have been made to accelerate DM computations using GPU's [22], and CUDA [23]. This section explains our proposed algorithm. It depends mainly on the espoused idea in this work of switching from matrices to vectors. Its main goal is to speedup computations and reduces storage. The baseline equation used to compute the elements of the distance matrix  $DM(N \times N)$  for aligning  $N$  sequences  $\{S_1, S_2, \dots, S_N\}$  is:

$$DM(i, j) = 1 - \text{nid}(S_i, S_j) / \min(L_i, L_j) \quad \forall 1 \leq i, j \leq N \quad (1)$$

where  $\text{nid}(S_i, S_j)$  is the similarity score between  $S_i$  and  $S_j$ . It is computed by using the most popular optimal local alignment known as the Smith-Waterman algorithm (SM) [24]. It compares two sequences by computing a distance that represents the minimal cost of transforming one segment into another, with respect to the given scoring system. It identifies common subsequences between any two sequences  $S_1$  and  $S_2$  of length  $L_1$  and  $L_2$ , by computing the similarity  $H(i, j)$  of two sequences ending at position  $i$  and  $j$ , using the following recurrence:

$$H(x, y) = \max \begin{cases} 0, \\ H(x-1, y-1) + \text{sbt}(S_i(x), S_j(y)), \\ H(x-1, y) + g, \\ H(x, y-1) + g, \end{cases} \quad \forall 1 \leq i, j \leq N \quad (2)$$

where  $\text{sbt}$  is a nucleotides or amino acid substitution matrix, and  $g$  is a gap penalty.

The proposed algorithm vectorizes all above matrices. First, it benefits from the fact that computing any anti-diagonal in the matrix  $H$  is based only on the values of the previous two anti-diagonals. Based on Equation (2), each cell  $H(i, j)$  depends only on its Northern  $H(i, j-1)$ , Western  $H(i-1, j)$  and North-Western  $H(i-1, j-1)$  previously computed. Thus, just one vector  $V$  for current anti-diagonal, with two buffers  $V1$  and  $V2$  for two previously computed anti-diagonals, are enough to compute the similarity score.

This is done by computing all cells along anti-diagonal  $V$  in parallel. The value of each cell is evaluated in terms of its diagonal neighbour stored at  $V1$ , with its left and upper neighbours stored at  $V2$ , and the maximum value is selected indicating the highest score, using the following equation repeatedly along all  $2L-1$  anti-diagonals, where it is assumed that all sequences have the same length  $L$ , for simplicity.

$$\begin{aligned} V^i(k) &= \{H(k+1, i-k+1)\}_{k=2}^i \\ &= \left\{ \begin{array}{l} \max(0, H(k, i-k) + \text{sbt}(S_1(k), S_2(i-k+1)), \\ H(k, i-k+1) + g, H(k+1, i-k) + g) \end{array} \right\}_{k=2}^i \\ &= \left\{ \begin{array}{l} \max(0, V^{i-2}(k-1) + \text{sbt}(S_1(k-1), S_2(i-k)), \\ V^{i-1}(k-1) + g, V^{i-1}(k) + g) \end{array} \right\}_{k=2}^i \\ V^i(k) &= \max \left\{ \begin{array}{l} 0, \\ V^i1(k-1) + \text{sbt}(S_1(k-1), S_2(i-k)), \\ V^i2(k-1) + g, \\ V^i2(k) + g \end{array} \right\} \quad (3) \end{aligned}$$

**Fig. 1** illustrates the main idea when aligning the two sequences  $S1=\{\text{ACCGTCG}\}$  and  $S2=\{\text{TCCGTCA}\}$  of length 7. It shows the computation of the similarity matrix  $H$ , with the linear gap cost (-8) and a substitution cost of (5) if the characters are identical and (-4) otherwise, and how it is replaced by  $V$ , using  $V1$  and  $V2$ .



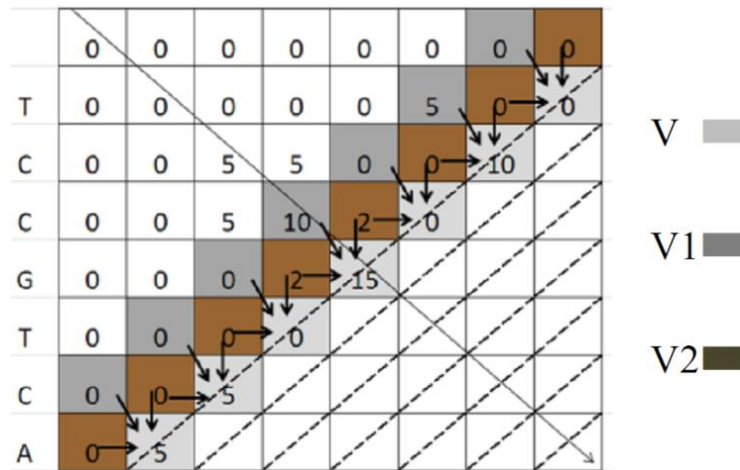


Fig. 1:- Relation between H, V, V1, V2.

Second, the proposed algorithm also replaces the distance matrix DM by a distance vector DV. It exploited the fact that DM is symmetric, and stores only its minor diagonal with its upper triangle, dispensing repeated values. It computed the values of DV by the following equation:

$$DV(k) = 1 - (dv_k) / \min(L) \quad (4)$$

Where  $(dv_k)$  is the number of similarity score in the optimal local alignment of  $S_i$  and  $S_j$ . Fig. 2 shows the correspondence between DV and DM cells when  $N=5$ .

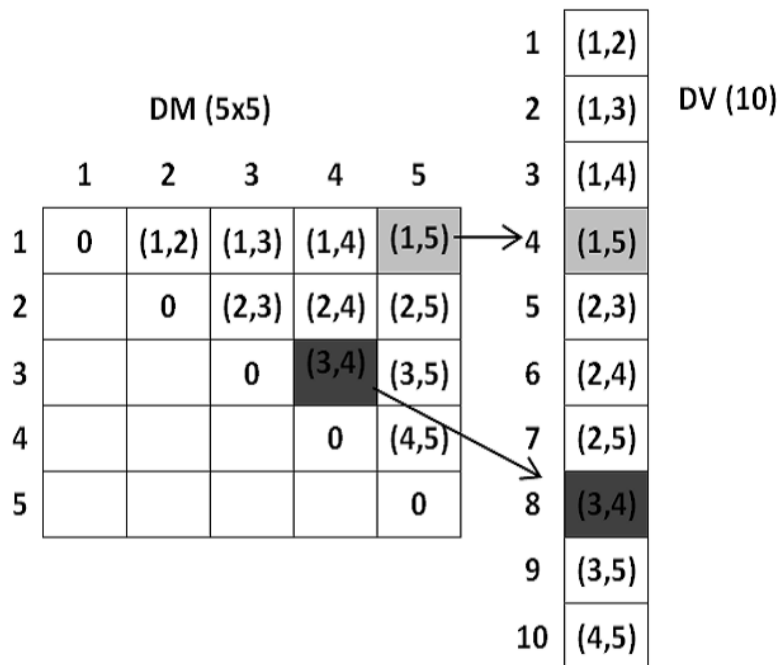


Fig. 2:- The relation between DM, DV.

### Results and Discussion:-

This section presents results obtained when measuring the performance of the above proposed parallel method implemented using MATLAB® R2012a on a core-i7 processor with 8 cores of 3.4GHz and 8GB RAM running on Windows7. Evaluations were concerning two attributes of MSA tools that are of great importance to users. They are time and space.

**Runtime:-**

The most important criterion of measuring the quality of our tool is the consumed time during its execution. A set of performance evaluation experiments has been conducted using ten protein sequence datasets, consisting of sequences with different combinations of sequences' number (N) and length (L), selected from the Human Immunodeficiency Virus (HIV) dataset downloaded from NCBI. Table (1) presents the execution time and speedup of the proposed parallel algorithm for computing the distance vector DV, and the original algorithm computing the distance matrix DM. It shows that the greater the length of sequences, the more acceleration of DV due to the high computation speedup of the optimal exact matches.

**Table 1:-** Performance Comparison between DM, DV Computations

N	L	DM(sec.)	DV (sec.)	Speedup
400	856	760.812	141.245	5.386
400	408	213.575	48.063	4.444
600	462	595.460	142.750	4.171
800	454	1087.349	230.806	4.711
1000	858	4895.379	900.068	5.439
1000	446	1640.334	385.649	4.253
2000	266	2624.920	570.873	4.598
4000	247	22720.202	5579.069	4.072
4000	83	4989.181	1462.492	3.411
8000	73	16972.691	4733.101	3.586

Our work has achieved higher performance due to four reasons: (1) the superiority of MATLAB on other languages at dealing with vectors, (2) the optimal use of Multi-core machine when parallelizing the computation of DV independent elements, (3) the perfect use of C++ mix-file when dealing with memory, (4) the use of RAM only for storing the V's and H's.

**Usage Space:-**

Storage space is the second parameter of measuring the quality of the MSA tool because of the huge growth of sequence databases that exceed current programs' capacity. It is measured by the space needed to store data. Experiment results of used storage during computations of both DM and DV were recorded as given in Table (2), with respect to the size of the N input sequences. It is clear that the proposed algorithm has reduced the overall space almost to the half. This is because the space required for the matrix DM whose size is  $N \times N$  has been reduced to DV of size  $N \times (N-1)/2$ .

**Table 2:-** Storage Comparisons between DM, DV

N	L	DM(Mbyte)	DV(Mbyte)
400	408	0.64	0.31
400	856	0.64	0.31
600	462	1.44	0.70
800	454	2.56	1.25
1000	446	4	1.95
1000	858	4	1.95
2000	266	16	7.80
4000	247	64	31.19
4000	83	64	31.19
8000	73	256	124.78

In addition, Table (3) shows the RAM storage exhausted when storing H's in comparison to that of V's. This remarkable achievement comes from the fact that SW algorithm consumes  $(L+1)^2$  word to find similarity between two sequences of length L, while DV uses only  $3(L+1)$  word.

**Table 3:-** Storage Comparisons between H's, V's

<b>L</b>	<b>H's(Kbyte)</b>	<b>V's(Kbyte)</b>
408	334.56	2.45
856	1468.90	5.14
462	428.74	2.78
454	414.05	2.73
446	399.62	2.68
858	1475.76	3.54
266	142.58	1.60
247	123.01	1.49
83	14.11	0.51
73	10.95	0.44

### Conclusion and Future Work:-

The contribution of this work contain optimizations for SW algorithm, and DM computation for addressing the problem of building a parallel tool for multi-cores that produces the best alignment of multiple sequences in short time without using much storage space. Results prove that the proposed approach for DM and SW has good ability to aligning large number of sequences through powerful improved storage handling capabilities with efficient improvement of the overall processing time.

For future, it is planned to apply the same mechanism on NJ stage, and combine all algorithms to produce the aligner. Then the aligner will be extended to operate on different parallel platforms. Challenges expected to be tackled when merging optimization techniques for improving accuracy may affect performance improvements.

### References:-

1. Albert Y. Zomaya, Parallel computing for bioinformatics and computational biology: models, enabling technologies, and case studies, John Wiley & Sons Inc., 2006.
2. CW. Dunn, A. Hejnol, DQ. Matus, K. Pang, WE. Browne, et al., Broad phylogenomic sampling improves resolution of the animal tree of life, Nature, vol. 452, , 2008 pp. 745–749.
3. Y. Bao, P. Bolotov, D. Dernovoy, B. Kiryutin, L. Zaslavsky, et al., The influenza virus resource at the National Center for Biotechnology Information, J. Virol., vol. 82, 2008, pp. 596–601.
4. RK. Kuipers, HJ. Joosten, WJ. van Berkel, NG. Leferink, E. Rooijen, et al., 3DM: systematic analysis of heterogeneous superfamily data to discover protein functionalities, Proteins, vol. 78, 2010, pp. 2101–2113.
5. S. Singh, R. Tokhunts, V. Baubet, JA. Goetz, ZJ. Huang, et al., Sonic hedgehog mutations identified in holoprosencephaly patients can act in a dominant negative manner, Hum. Genet., vol. 125, 2009, pp. 95–103.
6. J.D. Thompson, D.G. Higgins, and T.J. Gibson, CLUSTAL W: improving the sensitivity of progressive multiple sequence alignment through sequence weighting, positions-specific gap penalties and weight matrix choice, Nucleic Acids Res., vol. 22, No. 22, 1994, pp. 4673–4680.
7. C. Notredame, D.G. Higgins, J. Heringa, T- Coffee: a novel method for fast and accurate multiple sequence alignment, J. Mol. Biol., vol. 302, No. 1, 2000, pp. 205–17.
8. K. Katoh, K. Misawa, K. Kuma, and T. Miyata, MAFFT: a novel method for rapid multiple sequence alignment based on fast Fourier transform, Nucleic Acids Res., vol. 30, No. 14, 2002, pp. 3059-3066.
9. B. Morgenstern, K. Frech, A. Dress and T. Werner, DIALIGN: Finding Local Similarities by Multiple Sequence Alignment, Bioinformatics, vol. 14, 1998, pp. 290-294.
10. D. Feng, R. Doolittle, Progressive sequence alignment as a prerequisite to correct phylogenetic trees, J. Mol. Evol., vol. 25, 1987, pp. 351–360.
11. Saitou N, Nei M, The neighbor-joining method: a new method for reconstructing phylogenetic trees, Mol. Biol. Evol., vol. 4, pp. 406-425, 1987.
12. Jan Urban., Interfacing C++ libraries to Matlab, MSc. Thesis, Universitas Masarykiana, 2012.
13. Xiaozhong Geng, A Task Scheduling Algorithm for Multi-Core Cluster Systems, JCP, Vol. 7, No. 11, 2012, pp. 2797-2804.
14. Kridsakorn Chaichoompu and Surin Kittitornkun, Multithreaded ClustalW with improved optimization for Intel multi-core processor, ISCIT '06, 2006, pp. 590-594.
15. Hans Vandierendonck, Sean Rul, Michiel Questier et al., Experiences with parallelizing a bio-informatics program on the cell BE, HiPEAC'08, vol. 4917, 2008, pp. 161–175.

16. Hans Vandierendonck, Sean Rul, and Koen De Bosschere, Accelerating multiple sequence alignment with the Cell BE processor, *Comput. J.*, vol. 53, No. 6, 2010, pp. 814–826.
17. P. Di Tommaso, M. Orobitch, F. Guirado, F. Cores, T. Espinosa, C. Notredame, Cloud-Coffee: implementation of a parallel consistency-based multiple alignment algorithm in the T-Coffee package and its benchmarking on the Amazon Elastic-Cloud, *Bioinformatics*, vol. 26, No. 15, 2010, pp. 1903-1904.
18. K. Katoh, and H. Toh, Parallelization of the MAFFT multiple sequence alignment program, *Bioinformatics*, vol. 26, No. 15, 2010, pp. 1899- 1900.
19. E. de Araujo Macedo, A.C. Magalhaes Alves de Melo, G.H. Pfitscher, A. Boukerche, Hybrid MPI/OpenMP Strategy for Biological Multiple Sequence Alignment with DIALIGN-TX in Heterogeneous Multicore Clusters, *IPDPSW'11*, IEEE Xplore Press, 2011, pp. 418- 425.
20. Yongchao Liu, Bertil Schmidt, Douglas L. Maskell, MSAProbs: multiple sequence alignment based on pair hidden Markov models and partition function posterior probabilities, *Bioinformatics*, vol. 26, No. 16, 2010, pp. 1958 -196.
21. X. Deng and J. Cheng, MSACompro: Protein Multiple Sequence Alignment Using Predicted Secondary Structure, Solvent Accessibility, and Residue-Residue Contacts, *BMC Bioinformatics*, vol. 12, 2011, pp. 472-488.
22. Zhi Ying, Xinhua Lin, Simon Chong-Wee and Minglu Li, GPU-Accelerated DNA Distance Matrix Computation, *ChinaGrid'11*, 2011, pp. 42-47.
23. Balaji Venkatachalam, Parallelizing the Smith-Waterman Local Alignment Algorithm using CUDA, 2012, <http://www.zl50.com/2012061030871115.html>.
24. T.F. Smith, M.S. Waterman, Identification of common molecular subsequences, *J. Mol. Biol.*, vol. 147, 1981, pp. 195-197.

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### RESEARCH ARTICLE

#### DETERMINANT FACTORS THAT INFLUENCE SUPPLIER SELECTION FOR ONLINE BUSINESS SELLERS IN MALAYSIA.

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#### Abstract

In the current economic climate, online businesses are developing fast, with increasing responses from customers further encouraging online business. The use of IT enables wider opportunities for business expansion as well as presenting fresh challenges for businesses, which has led to many people deciding to venture into online business. When it comes to business success, the supplier plays an important role, and in choosing the right supplier, the overall performance of business operation can be immensely improved. Therefore, this paper aims to determine the factors that influence supplier selection for online sellers in Malaysia. In previous studies, the main focus proved to be research on supplier selection and the impacts of this on customer organisation and sales figures in physical stores, whereas this study will attempt to focus on online sellers; making the purpose of this study to identify and determine the factors that affect online business sellers in Malaysia in the selection of suppliers. Furthermore, this study attempts to use a combination of TPB and supplier selection criteria models to examine these factors. The increase of market globalisation and competition enabled by Internet-based technologies has contributed to significant changes in the order of stages in supplier selection factors, as well as introducing new criteria to the supplier selection process. As described above, gaps exist in previous research in this area, and there is an overall lack of research on this topic in Asian countries. Due to the lack of existing studies, this study contributes research by investigating the effects of quantity, quality, relationship, reliability, flexibility, delivery and cost on intention and their impacts on the behaviour of online sellers in Malaysia. It is hoped that this research will assist online sellers in selecting the correct supplier for their business, whilst reducing the overall cost and enhancing business competency and client services.

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**Introduction:-**

Nowadays, the advance of Information Technology (IT) supports a large volume of user-generated content. IT provides more opportunities and challenges for business transformation. Many entrepreneurs have changed or expanded their business from a physical store to electronic business, which has also been accepted by users at the present time.

As proven by the exponential growth of existing online businesses, most consumers prefer to shop online. There are many e-commerce web stores that offer online purchase; such as ZALORA, Lazada, Groupon, 11street and Amazon. Some of the online sellers also sell through Facebook, Twitter and Instagram, which demonstrates that it is not only large organisations that can run business via online, but smaller companies such as enterprises, can also set up online stores and offer online purchase to their customers.

Supplier plays an important role in the success of enterprises. Choosing the right supplier determines the overall performance of business operation. When the chosen supplier provides the best quality of products with multiple options provided and at the best price, the sellers receive a lot of benefits, showing these enterprises have more chances to offer their customers the best selling. Therefore, it is important to understand and determine the factors that influence supplier selection because it could result in a significant impact on customer impression. Thus, the researcher aims to identify and understand determinant factors that influence supplier selection for online business sellers in Malaysia.

**Significance of the Study:-**

In previous research, there are a lot of literatures about quantity, relationship, reliability, flexibility, quality, delivery, cost, intention and behaviour in various areas (Camen et al., 2012; Teng & Jaramillo, 2010). Even though there are a lot of literatures in these variables, there are very limited scholars who focused on determinant factors that influence supplier selection for online business sellers in Malaysia. In Malaysia, there are many online sellers involved in this area. However not all business sellers could survive in the competitive market since they did not know how to choose the right supplier to supply the product. This situation affects their business performance and as a consequence, many sellers are no longer interested in continuing their online business.

The following are some of the practical benefits from this study which can improve knowledge and performance of online business sellers in Malaysia:

- The study on the factors that influence supplier selection for online business sellers in Malaysia provides the important know-how regarding the significance of the supplier selection, enabling them to gain greater profitability whilst achieving higher productivity in supply chain, higher level performance for their business and further enhancement its competitiveness in the marketplace.
- The results of the study can also be applied by online business sellers in Malaysia to determine their objectives and future direction. Therefore, better strategy planning can be achieved when making a decision, leading to better company reputation on a global scale.
- This study highlights the determinant factors that influence supplier selection for online business sellers in Malaysia. Thus, this provides a guideline to online business sellers in Malaysia in selecting the best suppliers and therefore encouraging them to invest in these initiatives using the right methodologies, without affecting business reputation.
- This study provides useful insights for online business in Malaysia regarding the roles that influence supplier selection. This is important to enable online business sellers identify the important factors that can help them improve their performance in business and lead to increased productivity.

In terms of research contribution, this study attempts to enrich the current published literature by providing empirical support on the determinant factors that make effective supplier selection for online business sellers in Malaysia. This study will also extend the theory and model and enhance the literature on determinant factors that influence supplier selection for online business sellers in Malaysia. Therefore, it is hoped that this research will be of benefit to the scholarly practitioner, researchers, and in particular online sellers in Malaysia, thus contributing to improving Malaysia's economic scale.

**Objective of the Study:-**

Generally, long term cooperation relationships give positive impacts to online sellers. Therefore, selecting the right supplier is very important to achieve the objective and goals. Thus, the objectives of this study are:

- To investigate the factors that influence supplier selection for online business sellers in Malaysia.
- Examine factors that give an impact on online seller performance.
- Identify the relationship between intention and behaviour for supplier selection.
- Investigate intention and behaviour that influence supplier selection.

**Literature Review:-****Problem Statement and Issues:-**

According to Alstete (2002), many entrepreneurs faced obstacles when starting and running their businesses. Among those barriers, one that is crucial is supplier selection. It is necessary for each company and seller to have supplier evaluation processes, suggesting that selecting the supplier is a fundamental early step in running a business. Measuring supplier performance is important to ensure a well-functioning supply chain and company competitiveness. The goal is to improve performance, especially of the key suppliers. Understanding supplier performance may help sellers to prevent risk and improve cooperation. Evaluation is necessary to know that the supplier is doing well in each area of action. Therefore, careful selection of supplier's evaluation criteria is important.

With the use of internet as a new platform in business, entrepreneurs will have more opportunities to structure and restructure their businesses, utilising all those possible mediums to market their goods and services as well as finding the best possible sources and suppliers which can offer them fruitful, favourable returns. Also, globalisation offers everyone the same chances to use the internet, making it an essential requirement for business sellers nowadays. Thus, most business sellers are now taking steps to use the internet as a platform for their business activities. Therefore, businesses are now able to run 24 hours, 7 days a week without the constraints of time and place. Although online businesses in Malaysia are increasing, there are several factors that may directly or indirectly influence their effectiveness; such as the products offered, reliability, suppliers, cost, etc.

Every business wants quality products. This is because product quality would ensure customers' satisfaction and thus will benefit the traders. Online businesses should always make sure the goods or services to be sold to the end user have high quality with a low cost. Thus, selecting a supplier is a tough decision. Online sellers are faced with myriads of possible risks if they chose the wrong supplier. The risks are usually related to their company profit and money. Therefore, online businesses should be careful in selecting suppliers, because wrong selection will affect their profitability.

Security is also a crucial factor in looking for suppliers. When trust exists it means that online sellers will feel secure and be assured of their relationship with the supplier. Security includes various aspects, for instance, product details and information, warranty, supplier identity confirmation as well as reviews of the products or services. There are many cases of identity theft using the information provided online by the individual who seeks to steal money from the personal account of someone who does internet banking. There are also many issues that need to be considered in addressing the issue of security for the future stability of the online world. Because personal and financial information can be intercepted and used for fraudulent purposes, an online investment involves a greater safety concern than conventional trade. Users need to feel safe when conducting financial transactions, and it is still one of the main obstacles to the growth of e-commerce (Lee and Turban, 2002).

In addition, who to buy from and how much to buy are some simple, basic questions yet critical during supplier selection processes. Suppliers who possess the criteria that can help reducing sellers' costs and have effective control of resources should be chosen first as they offer enormous potential to online sellers. Many researchers stated that the most important function in the purchasing department is selecting the sources of supply. Performance of the company will be affected if they make an unsuitable selection. Thus, online sellers should keep updated with the demand from a new supplier. They should carefully select those criteria that can fulfill supplier's demands as well as their demands during the decision making process.

One thing to be emphasised, is that the quality of the production and services mainly depends on the performance of suppliers. This is why effective purchasing is very important, because it can bring competitive advantages to online business accomplishment. However, the big issue that is always highlighted by the entrepreneurs is suppliers cannot provide the highest quality of the products they supplied but they offer the lowest cost of the product in the market. In other words, quality and cost tend to be two conflicting factors.

Practically speaking, product quality and cost are difficult things to determine (Baxter et al., 1989; Manoochehri, 1984). Sellers should refer to the overall quality performance which helps supply chain managers to select the right sources of supplies with the consideration of time, delivery and price. In this study, the researcher will demonstrate that quality and costs play an important role and they are interrelated.

Our daily life is greatly simplified with advanced technology, including buying and selling online. Online business is not something new but a transition from conventional methods in store to a cyberspace platform. Nowadays, technology advances in social media such as Facebook, Instagram and Twitter can be seen as an opportunity for sellers to generate income using different mediums. It lets many business sellers out there try their luck with online business. However, do they realise that they need to register as a merchant business with Company Commission of Malaysia (SSM)? The main concern of registering with SSM is the safety of consumers when buying and selling online. Besides the need to register with the SSM under the Registration of Businesses Act 1956, the business must also comply with Regulation Consumer (Electronic Transactions, 2012) enforced by Ministry of Domestic Trade, Co-operatives and Consumerism (KPDNKK).

Malaysia is moving from Sales and Services Tax (SST) to Goods and Services Tax (GST) and it was first introduced in Malaysia on 1st April 2015. In this respect, Malaysia Internet Entrepreneur Association (PUIM) expected that small online businesses would be affected by the implementation of the GST. According to the President PUIM MohdAzrulMohdNor, more than 85% of online sellers in the database PUIM consist of those who conduct business on a small scale. This means that they do business whether as an employee or assisted individuals only. Many businesses are still new in this field and the implementation of GST gives them surprising news because there are new members registered with SSM. Businesses that have a transaction worth more than RM500,000 per year are expected to receive the most significant effect. If GST is implemented, then the online sellers have to increase the price of their goods, which is a disadvantage to both the consumers and sellers.

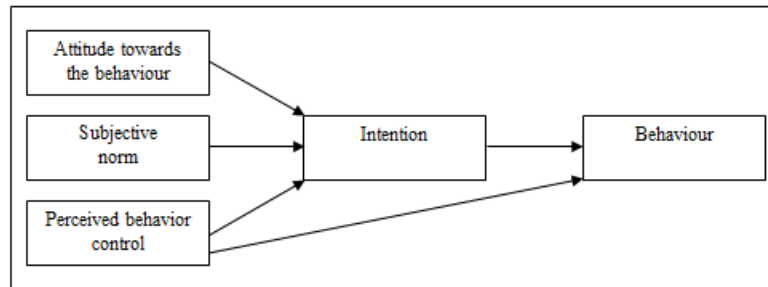
Apart from that, effective supplier relationship can be developed if the supplier selection is appropriately done in the early stages. Supplier selection is a very important aspect in a business. Whether it is a small or large business; or if it is an offline or online business, it is the matter of choosing the right supplier that needs to be prioritised. The right selection of suppliers will also show the way and objective of the company. Previous empirical research also showed that the knowledge in selecting supplier is useful for managing various activities in supply chain. For example, the factors like quality, delivery and price have to be considered for supplier selection and the scientific way of selecting the supplier will enhance the function of overall supply chain.

Increased competition and globalisation of markets facilitated by Internet-based technologies have contributed to dramatic changes in the ranking of supplier selection factors as well as introducing new criteria to the supplier selection process. Due to the lack of research in Asian countries and existing gaps in previous studies as described above, this study investigates the effects of quantity, relationship, reliability, flexibility, quality, delivery and cost on intention and their impacts on behaviour of online sellers in Malaysia.

#### **Research Gap:-**

Previous studies indicated that most of the focus study in supplier selection was on customer organisation and sales in physical stores (Park & Chang, 2010; Ordoobadi, 2009; Teng et al., 2005). There is only few research of supplier selection targeted in the Malaysia context (Muhammad et al., 2006) and there are no studies which examine the satisfaction of the online seller when choosing the supplier. This study aims to explore and view the scope of supplier selection that affects business online sellers in Malaysia. This will be done by examining thoroughly all the factors listed in the previous section.

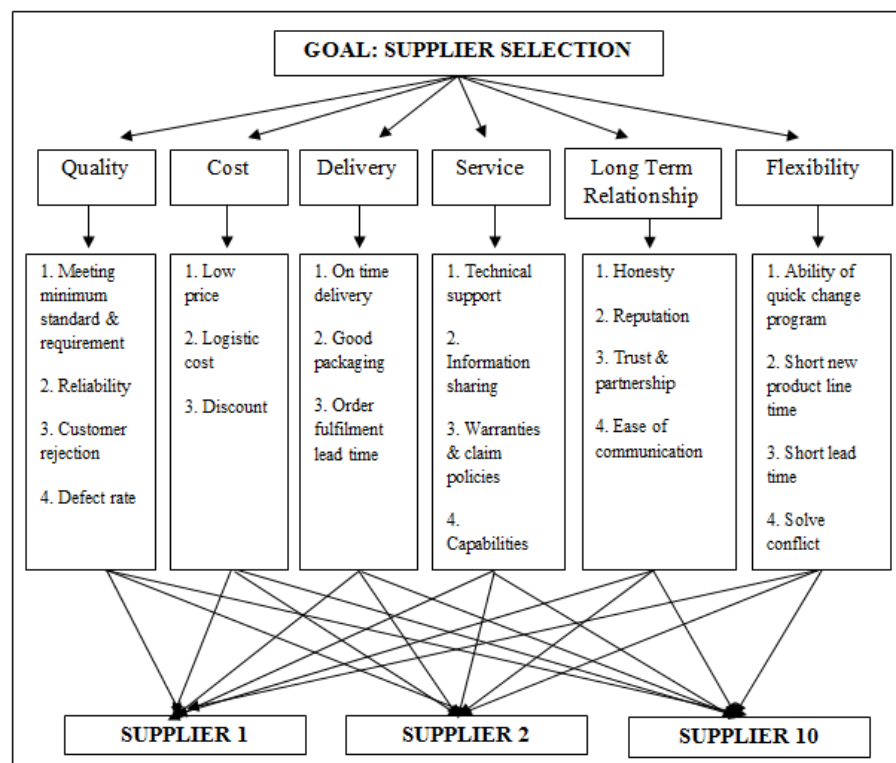


**Theory Used:-****The Theory of Planned Behaviour:-****Figure 1:-** The theory of Planned Behaviour

Theory of Planned Behaviour (TPB) is a theory to explain the intent of the individual to do a particular behaviour (Ajzen 1991). TPB is a theory that has been recognised in the field of psychology, which aims to predict and explain human behaviour. TPB is a continuation of the theory of Reasoned Action (TRA).

Any behaviour must be accompanied by intention. Intention can be seen as a factor that motivates and influences the behaviour of an individual. According to these scholars, attitude, subjective norm and perceived behavioural control reflect intention and influence individual behaviour. Intention will affect behaviour when the individual has a personal positive attitude towards particular behaviours. Normally, the behaviour that is taken by an individual is because of the belief that the action taken was liked by others.

This study uses TPB to investigate the factors that influence the intention of online sellers that will influence their supplier selection. TPB has been used in many different studies in information systems (Mathieson, 1991). TRA and TPB have also been the basis for several studies of internet purchasing behaviour (Limayem et al., 2000; Jarvenpaa and Todd, 1997 b).



Source: Adoption from Yadav&Sharma (2016)

Selection of suppliers has a big impact because it will affect the operation after the selection (Yadav& Sharma, 2016). Supplier selection processes will usually be influenced by the criteria needed to solve the problem (Lui et al., 2005). Therefore, selecting the supplier is complicated because there are a lot of criteria to consider. Online sellers should be careful in choosing suppliers and examine the factors that can help them with later sales operations.

There are two aspects that are emphasised upon when choosing the supplier; the assessment of suppliers and procedures and methods when selecting the supplier. Online sellers need to understand that each supplier has a different background and organisation (Yadav& Sharma, 2016). They have a different concept for the management of their operations. Therefore, it is a question of how to choose the appropriate one when the seller selects suppliers. Online sellers should evaluate several factors such as quality, cost, delivery, services, relationships, flexibility and others. Business success often depends on the construction of a network built with the supplier and thus making informed decisions in choosing the supplier is very important (Yadav& Sharma, 2016; Matook et al., 2009).

In this study, researchers have combined TPB and supplier selection criteria in building a theoretical model of the new framework, with the aim of determining factors that influence supplier selection for online business sellers in Malaysia. It is hoped that the results of the study will help sellers in Malaysia to carefully consider the factors affecting their business and make the right decision in choosing the supplier.

#### Theoretical Framework:-

Figure 2 below shows a model that focuses on aspects of quantity, relationship, reliability, flexibility, quality, delivery, cost, intention and behaviour.

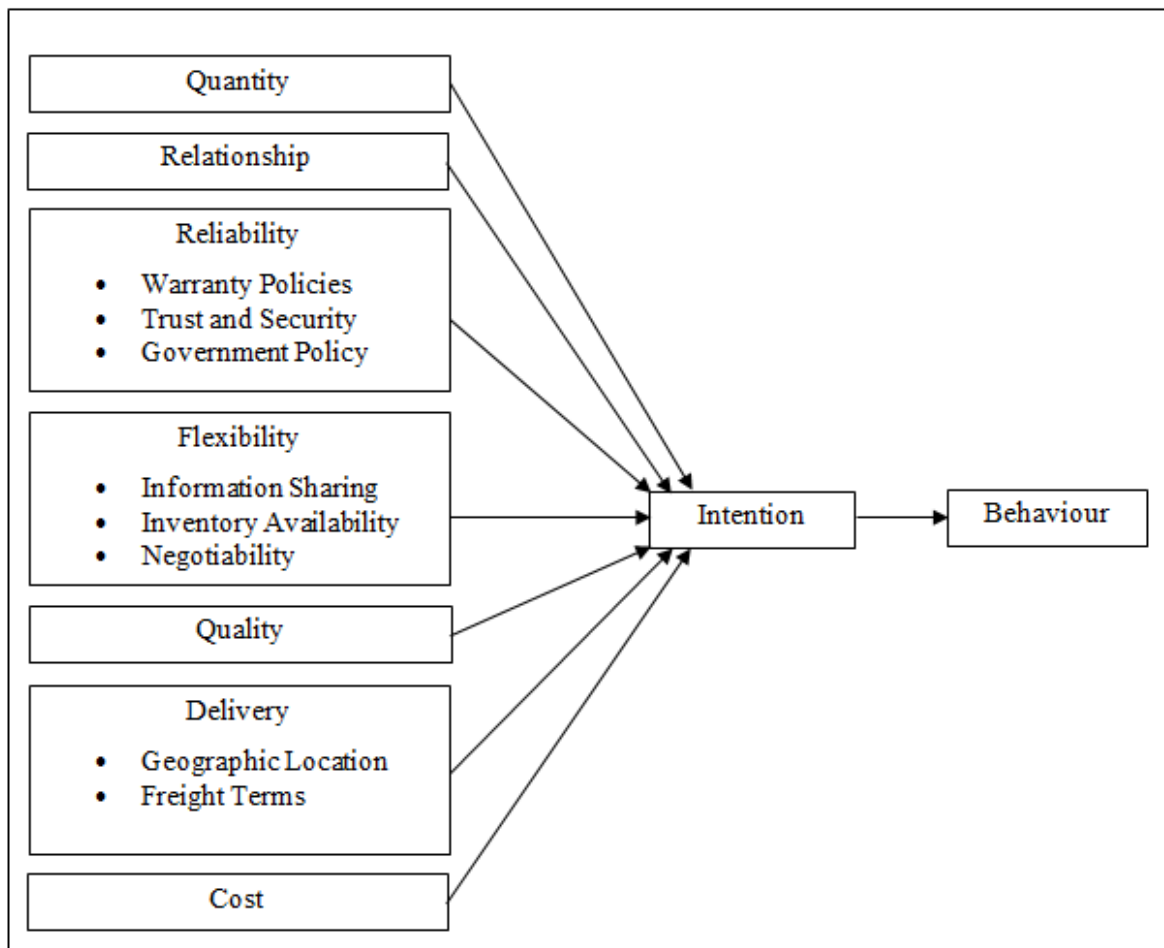


Figure 2:- Conceptual Research Framework

The purpose of this study is to determine factors that influence supplier selection for online business sellers in Malaysia. The hypotheses concern the following nine variables; quantity, relationship, reliability, flexibility, quality, delivery, cost, intention and behaviour.

**Quantity:-**

Quantity is an important element to consider when choosing a supplier. Providing a minimum order quantity (MOQ) is among the characteristics of suppliers preferred by online sellers. However, quantity discount changes following the orders placed. Quantity discount contract is an important element and is influenced by several factors; inventory is one of these factors. The use of quantity discounts is a way to streamline the buyer and seller and it is commonplace in the supply chain. Normally, the more quantity the online seller buys, the cheaper price per unit of goods to be purchased. However, it is difficult for online sellers when buying in large quantities because they need to keep the goods as ready stock.

In addition, online sellers also take the risk because the purchased goods will not necessarily get demand from their customers, thus there is no guarantee that all the stock can be sold in a certain period of time. It is important for a company to reduce their inventory costs and find a balance between the number of orders per year and annual holding costs. Minimising the quantity of orders can indirectly provide an opportunity to explore new opportunities in market. Therefore, in this study, the researcher will examine the relationship between quantity and intention. Thus, the following hypothesis is proposed:

**Hypothesis 1:-** Quantity has a positive impact on intention.

**Relationship:-**

Establishing good rapport is often the element that will contribute to a positive relationship between two parties. In business, online sellers can build relationships with suppliers through various transactions. Normally, this relationship occurs if the online seller gets satisfied with what they want. However, online seller acceptance is different according to their motivation and vision. Relationship on the length of time not only depends on the intent provider only, but should be in line with the online seller's intention to continue to conduct transactions with suppliers (Deb, 2014). Thus, among the issues in developing online seller-supplier relationship is not just the demand from supplier, but also lies with the online seller. Some online sellers will not feel the need for a relationship and this usually causes this relationship not to apply.

Relationships between suppliers and retailers, especially online sellers has not been studied very much before. Therefore in this study, the researchers wanted to know whether the relationship is very important in the selection of suppliers' online seller and thus this hypothesis is proposed:

**Hypothesis 2:-** Relationship has significant impact on intention.

**Reliability:-**

In this study, researchers wanted to investigate the aspect of reliability related to warranty policies, trust and security.

**Warranty Policy:-**

Warranty is also known as an important contract between producers and buyers. Warranty refers to a contract that requires manufacturers and vendors to fit problems or failures in the promised time frame. Warranty can be seen as a form of guarantee of manufacturing to customers for the reliability of its product to consumers. If the product fails to function properly, it is the responsibility of the manufacturer to provide services such as new product replacement, repair or refund payment. Warranty attracts the eyes of customers to purchase goods and services, as they know that they have the rights to complain, refund and replace what they have purchased.

Online sellers need to take a high risk if the goods are sold to the end user have damage and how they as a seller handle this problem. If there is any damage, online sellers need to answer and respond to it. But if the damage is born by the manufacturer, it is a good thing that can promote their business. Therefore, to determine whether the warranty had a positive impact on intention, the following hypothesis is proposed:

**Hypothesis 3a:-** Warranty policies have a positive impact on intention.

**Trust and Security:-**

Trust in online transactions is one of the main elements of success in online selling businesses. The result of trust is very significant on influencing buyers' intention and behaviour. Lack of trust leads to lack of customer acceptance on online purchasing. The purpose of establishing trust is to develop a continuous interaction and acceptance which has a high probability of leading to long-term commitment of business relationship.

Normally, online sellers will use the internet as a medium to find suppliers. So, it is an important issue if the website or online store owned by the suppliers does not provide trustable sources or information, which is less likely to lead to a purchase action. Suppliers need to understand the basic things that can help in building confidence in the online seller. If the trust exists in the supplier, it will improve the online sellers' intention to have a relationship in business.

Apart from trust, security is another reason of selecting a supplier. If the online businesses develop trust in a supplier, it also means that they are assured on the security of the deal. In other words, they have been assured of the goods' safety and quality as well as supplier identity. Being assured of these whole aspects is important because there are cases of goods defects and identity theft which results in a big loss to the company. In the case of identity theft, this issue is quite common nowadays since there are people who can hack the internet banking sites to steal money and personal information. This issue is a big threat in online business and needs to be considered for the future stability of e-commerce (Lee and Turban, 2002).

Therefore, there must be trust and security in online trading companies and the security features should be taken into account so that they can encourage online sellers' behaviour in online payment transactions. In this study, the researcher will also examine this aspect of trust and security with intention toward behaviour. Thus, the following hypothesis is proposed:

**Hypothesis 3b:-** Trust and security has a positive impact on intention.

**Government Policy:-**

Government policies play an important role in promoting innovation and drive the country towards high technology. In this study, researchers wanted to see whether the government's policy is helping online sellers, or whether regulations became a burden. Internet is a new medium that is used by the warm user everywhere. It is a communication tool that can connect one person to another regardless of frontiers. With the advent of new media in Malaysia, the Malaysian government is faced with various challenges. These challenges can be used for development of the country or can pose a risk.

New medium known as Information and Communications Technology (ICT) can help in the economic development, but in reality it is difficult to be controlled and monitored. If viewed from the perspective of online businesses, the Malaysian government has implemented several new policies that should be followed. Among the things that have been emphasised upon by the government of Malaysia is the registration of companies in the Companies Commission of Malaysia (SSM). The SSM's vision is "to be a world class corporate and regulatory authority that meets business needs through effective registration, information, regulation and advice"

There is a question on the necessity to check the SSM, because many users now prefer shopping online. Therefore, registering a company with SSM can increase confidence and trust of internet users with business status, and thus indirectly boosts the credibility of the online company for the long term. If the online business faces any problem, especially with regards to the authorities, it is easy to solve because the company is already legally registered.

Canada started GST on January 1st, 1991; Singapore on 1st April, 1994; Australia also introduced GST in July 2000; while Malaysia started on April 1st, 2015. Looking at other countries and their implementation, Malaysia looks delayed in the implementation of the GST. Malaysia has changed from sales and services tax (SST) to the Goods and Services Tax (GST). GST is a tax on domestic consumption. It must be paid when the money is spent on goods or services, including the purchase of imports. Since GST is a tax on the transaction, it is subjected to every level of business processes and ultimately can be born by consumers. Therefore, the following hypothesis is proposed:

**Hypothesis 3c:-** Government policy has significant impact on intention.

**Flexibility:-**

Flexibility is another factor that should be considered. This study would like to evaluate flexibility based on three factors; inventory availability, information sharing and negotiability.

**Inventory Availability:-**

Managing inventory is an important thing and it requires the power of suppliers and buyers forecasting sales (Ballou, 2000). Almost all of the literatures on inventory management state the important criteria in the inventory management are to minimise costs and maximise profit (Koumanakos, 2008). This is explained in the habit whereby suppliers aim to reduce a lot of the cost when it comes to production and at the same time seeking to maximise profits and meet customer demand.

Online sellers prefer to choose suppliers who can maintain a certain quantity of stock. Normally, suppliers will also ask the buyer to forecast the required amount in advance. This is to make sure that insufficient supply does not occur. In this study, factors of available inventory are measured in terms of quantity, whether the online sellers wants to buy in quantities less than expected or better than expected, and also whether the provider can give it to them. Therefore, the following hypothesis is proposed:

**Hypothesis4a:-** Inventory availability has a significant impact on intention.

**Information Sharing:-**

The second factor that needs to be regarded in flexibility is information sharing. Examples can be seen as the online seller updates necessary information related to inventory, production planning, order status, and many others. The supplier is also required to forecast quantities of stock to be purchased by the online seller to arrange the company's plans. In this situation, both sides need to have compatibility in information sharing (Teng and Jaramilli, 2005). Thus, the following hypothesis is proposed:

**Hypothesis 4b:-** Information sharing has a significant impact on intention.

**Negotiability:-**

Negotiability is the third factor for flexibility. Almost all companies use contract buyers and suppliers (Teng and Jaramilli, 2005). There are conditions required to be met by online sellers and suppliers, especially related to inventory. Negotiability can be associated with mutual trust, which has existed in the supply chain for a long time (Min, 1994). Therefore, this study tries to assess whether the online seller is able to comply with the purchase agreement in accordance to the agreed quantity, and also whether this negotiable factor exists within the provider. Thus the following hypothesis is proposed:

**Hypothesis 4c:-** Negotiability has positive significant impact on intention.

**Quality:-**

Quality is one of the things which should be prioritised in the selection of suppliers. The word quality is rather difficult to understand and interpret. Everyone has their own interpretation of the word quality. Normally, quality is defined as the characteristics contained in a product and whether those features can give satisfaction to customers. Efficient quality management can help in achieving the success of a business. Thus, it could provide a competitive advantage in a market.

Quality can be divided into several aspects including user-based, manufacturing-based, value-based, product-based and transcendent. From these viewpoints, online businesses need to make sure that an item to be retrieved from the supplier should have the features as discussed. In this study, the main and most important point to note is user-based. It is very important for online businesses to sell what customers want. High demand for a product usually will promise fruitful opportunity to succeed in internet business. Therefore, the following hypothesis is proposed:

**Hypothesis 5:-** Quality has a positive impact on intention

**Delivery:-**

Delivery is one factor that should be a concern when selection of a supplier is made. Delivery factors can be viewed in detail in two parts: geographical location and freight terms.

**Geographical Location:-**

Geographical location is more representative of the customer and is a determinant factor when selecting suppliers (Teng and Jaramillo, 2005). Not all suppliers can deliver the goods when the online seller's location is not included in the courier service company. For example, PosLaju has 5 zone coverage areas. Not all of them send directly to the customer, there are areas that require a customer to get stuff on their own in Pos Mini or outlets nearby. It usually occurs if the customer is considerably deepened. Therefore, in this study, the researchers want to examine in detail the factor of geographic location in the selection of suppliers for online sellers and thus this hypothesis is proposed:

**Hypothesis 6a:-** Geographic location has a positive impact on intention

**Freight Terms:-**

Freight delivery term of each company is different. Usually, a company will follow the conditions set by the rules of a nation (Teng and Jaramillo, 2005). Besides rules, each courier company has different price and freight term. In Malaysia, the courier services such as GDex, PosLaju, Skynet, Ta-Q-Bin, and City-Link have their own freight term and offer different prices as they strategies to attract people. Here, bureaucracy occurs since each company targeted as many customers as possible in order to fulfill their company's objective. Therefore, online businesses should consider which courier suits their needs and offers the best deal. Choosing the right courier can save cost and guarantees the safety of the goods delivered. Thus, the following hypothesis is proposed:

**Hypothesis 6b:-** Freight term has a positive impact on intention.

**Cost:-**

Low prices for goods and services can attract customers to buy it. In this case, it shows customers will definitely prefer to buy quality goods at a low price. Thus, indirect sales revenues will continue to increase and may lead to increased profits. While offering low price goods, online sellers need to find suppliers that provide low prices to them. Low cost delivered by the supplier does not necessarily give satisfaction to customers. Evaluation and selection of suppliers of traditional methods are more focused on price and ignore the direct costs and indirect costs that are related to the delivery, use, spare parts, and other qualities. When all costs are taken into account, it will provide a greater effect than the actual cost price of the goods. This is because lowest offer may not represent the overall cost, quality and delivery to suppliers. Therefore, the following hypothesis is proposed:

**Hypothesis 7:-** Cost has a positive impact on intention.

**Intention and behavior:-**

Online business has been growing rapidly due to the increasing consumer demand. In the context of e-commerce, intention of shopping online is caused by the main consequence of pre-purchase satisfaction. Through intention, one can predict the behaviour of online sellers. Rationally speaking, the reaction can only occur if the intention was present and that intention is to grow or be obstructed depending on the outcome.

According to Muhmin (2010), the evaluation criteria for the user, information search and evaluation has been carried out in advance. Thus, it is clear before making any purchase, online sellers will do research in advance and if the study of something is good, then it will encourage the intention to purchase. Intention reflects the desire of the user. Intention is described as the desire to do the behaviour.

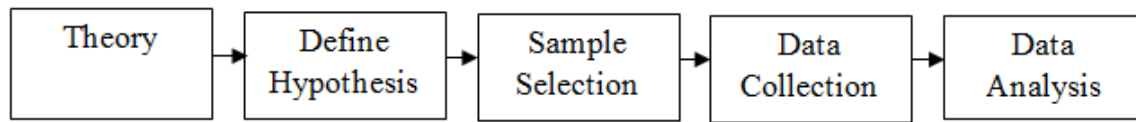
Behaviour control directly or indirectly all depends on the intention. Individuals usually have the resources and opportunities necessary to perform the behaviour (Azjen, 1991). Thus, online sellers need to find detailed information when selecting suppliers. The presence of intention can persuade the behaviour to accept or reject the supplier. Intention that is present will affect the behaviour whether to accept or reject a decision made during the selection occurs. Thus, the following hypothesis is proposed:

**Hypothesis 8:-** Intention has a positive impact on behaviour.

**Methodology:-**

This study will discuss in detail the research methods that have been applied. The researcher attempts to determine the relationship between variables based on data obtained from a sample of a population. The researcher uses

quantitative methods to collect data from the respondents. Figure 3 below shows the overview of the quantitative research process.



**Figure 3:-** Overview of quantitative research process

The population is the entire group of objects in the form of people, events or incidents or other objects to be studied (Sekaran, 2000). In this study, the target population comprises of individuals who currently run businesses online in Malaysia. This is in line with the objective of the study which is to determine the factors that influence supplier selection for online business sellers in Malaysia.

Sampling is a process of selecting a sufficient number of elements of the population in order to understand the nature or characteristics of the population. A proper sample thus allows for generalising the nature or characteristic elements of the population (Sekaran, 2000.) The target respondents of this study consist of online sellers who are currently running businesses via Online Social Networking (OSN) such as Facebook, Instagram, Twitter, You Tube, and others. In this study, convenience sampling was applied during data collection to achieve the objectives of this study.

The research was constructed using convenience sampling. As the name implies, convenience sampling is a specific type of non-probability sampling method that relies on data collection from population numbers who are conveniently available to participate in the study. Researchers used sample cases that are accessible, such as certain organisations or certain members on social networking sites as their participants (Rowley, 2014). The advantages of convenience sampling are the simplicity of producing the sampling and ease of research, data collection can be facilitated in a short duration of time and with cost effectiveness.

### **Discussion and Conclusion:-**

The research conducted here inspects the elements that influence supplier selection for online business sellers in Malaysia, which will allow online sellers to learn about the factors that influence the selection of the supplier, as well as supporting them to make the most effective decision when attempting to choose the best type of supplier. Although online businesses may already have their own supplier selection ideas, this research hopefully could offer them some useful suggestion as an improvement in their strategy and direction in supplier selection. Following this research, it is expected that online sellers can be assisted in reducing the overall costs and improving their competency as well as client services, and other important aspects.

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**References:-**

1. Muhmin, A. G. (2010), "Repeat purchase intentions in online shopping: the role of satisfaction, attitude, and online retailers' performance", *Journal of International Consumer Marketing*, 23 (1), 5-20.
2. Ajzen, I. (1991), "The theory of planned behaviour", *Organizational Behavior and Human Decision Processes*, 50. 179-211.
3. Alstete, J. W. (2002) "On becoming an entrepreneur: an evolving typology", *International Journal of Entrepreneurial Behavior & Research*, 8(4), 222 – 234.
4. Ballou, R. H (2000) "Evaluating inventory management performance using a turnover curve", *International Journal of Physical Distribution & Logistics Management*, 30(1), 72 – 85.
5. Baxtor, L. F., Ferguson, N., Macbeth, D. K. and Neil, G. C. (1989), "Getting the message across? Supplier quality improvement programmes: some issues in practice." *International Journal of Operations and Production Management*, 9, 69–76.
6. Camen, C., Gottfridsson, P. and Rundh, B. (2012), "Contracts as cornerstones in relationship building", *International Journal of Quality and Service Sciences*, 4 (3), 208 – 223.
7. Deb, M. (2014) "A study on the factors governing retailer–customer long-term relationship", *International Journal of Commerce and Management*, 24(3), 257 – 272.
8. Jarvenpaa, S.L. and Todd, P.A. (1997b), "Consumer reactions to electronic shopping on the World Wide Web", *International Journal of Electronic Commerce*, 1 (2), 59-88.
9. Koumanakos, D. P (2008) "The effect of inventory management on firm performance", *International Journal of Productivity and Performance Management*, 57(5), 355 – 369
10. Lee, M. K. O. and Turban, E. (2002), "A trust model for consumer internet shopping", *International Journal of Electronic Commerce*, 6 (1), 75-91.
11. Limayem, M., Khalifa, M. and Frini, A. (2000), "What makes consumers buy from Internet? A longitudinal study of online shopping", *IEEE Transactions on Systems, Man, and Cybernetics – Part A: Systems and Humans*, 30 ( 4), 421-32.
12. Liu, J., Ding, F. Y. and Lall, Y. (2005), "Using Data Envelopment Analysis to Compare Suppliers For Supplier Selection And Performance Improvement," *International Journal of Supply Chain Management*, 3, 143-150.
13. Manoochegri G.H. (1984), "Suppliers and Just-In-Time Concepts", *Journal of Purch. and Mgt.*, Winter, 16-21.
14. Mathieson, K. (1991), "Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior", *Information Systems Research*, 2(3), 173-91.
15. Matook, S., Lasch, R. and Tamaschke, R. (2009), "Supplier development with benchmarking as part of a comprehensive supplier risk management framework", *International Journal of Operations & Production Management*, 29(3), 241-267.
16. Min, H. (1994), "International supplier selection: a multi-attribute utility approach", *International Journal of Physical Distribution & Logistics Management*, 24(5), 24-33.
17. Muhammad, J., Ndubisi, N. O. and Hing, L. H. (2006), "Supplier Selection Strategy and Manufacturing Flexibility: Impact of Quality and Technology Roadmaps" *Asian Academy of Management Journal*, 11(1), 19–47.
18. Ordoobadi, S. M. (2009), "Development of a supplier selection model using fuzzy logic", *Supply Chain Management: An International Journal*, 14 (4), 314 – 327.
19. Park, J. S. and Chang, D. S. (2010), "A study on the difference of supply chain performance from the fitness between competitive priorities and supplier selection criteria", *Asian Journal on Quality*, 11 (2), 183 – 189.
20. Rowley, J. (2014). Designing and using research questionnaires. *Management Research Review*, 37(3), 308-330.
21. Sekaran, U. (2000). *Research methods for business: A skill building approach* (3rd ed.). Hoboken, NJ: John Wiley & Sons, Inc.
22. Teng, S. J. and Jaramillo, H. (2005), "A model for evaluation and selection of suppliers in global textile and apparel supply chains", *International Journal of Physical Distribution & Logistics Management*, 35 (7), 503 – 523.
23. Yadav, V. and Sharma, M. K. (2016) "Multi-criteria supplier selection model using the analytic hierarchy process approach", *Journal of Modelling in Management*, 11(1), 326 – 354.





## RESEARCH ARTICLE

### ONLY EDUCATION IS NOT ENOUGH: A NECESSITY OF ALL-INCLUSIVE SERVICES FOR TECHNICAL EDUCATION.

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#### Abstract

**Purpose:** In addition to create challenging and congruent learning opportunities, it is important for Technical Education providers to create a supportive learning environment to help learners acclimate, connect with others and as well as access well-matched student support services to help them complete their studies and make them employable. Skill building is very crucial to ensure employability of academia to understand and make sure good jobs. Unfortunately, most of the Technical Education institutes in India have not identified the importance of such services, resulting huge unemployment and dissatisfied students. The purpose of this paper is to highlight supporting and extension services in connection to operating services in Technical Education and students' perception on them.

**Design methodology:** A qualitative research by a survey (through a structured questionnaire) of students who are studying or have studied Technical Education affiliated to the North Maharashtra University, Jalgaon on their perception regarding operating, supporting and extension services offered by TE institutes.

**Findings:** The research revealed that TE institutes, no doubt, are offering good operating services however lags in supporting and extension services. It is also found that students' satisfaction of selecting TE institute is highly associated to supporting and extension service than operating services offered by the institute.

**Research limitations:** The survey is delimited to the Technical Education belonging to North Maharashtra University, Jalgaon and located in Khandesh region of India.

**Practical implications:** India, compared to other nations, lacks formally trained manpower. In Korea, for example, the skilled workforce is 96 per cent, in Japan 80 per cent, in Germany 76 per cent and in Britain 70 per cent but in India it is only 10 per cent. Technical Education Institutes of India, can gain competitive edge in the future, by effective and creative ways to attract, retain and foster stronger relationships with students by interaction and mechanism of the market and industry. This is only possible by lubricating; operating, supporting and extension services, all services combined.

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## ..... **Introduction:-**

The World Economic Forum's Global Talent Risk report (WEF, 2011) had cautioned that India would face huge skill deficits due to low employability [1]. In India, only about 14 percent of the labor force is employed in Formal jobs [2]. Other than initiatives like Smart City development, Skill India, Digital India, Start-up India, FDI enhancement, National Investment & Manufacturing zone, creation of Industrial Corridor will not only make India a global manufacturing hub but it will also generate a huge number of employment opportunities with growing Industrial demand [3]. According to NASSCOM (National Association of Software Companies), every year, over 3 million graduates and post-graduates are added to the Indian work force but only 25 per cent of technical graduates and 10-15 per cent of other graduates are considered employable by the industry. Education is a process of skill formation and in this aspect, it is treated at par with the process of capital formation. Education not only increases the productive skills of the individual but also his earning power. It gives learners a sense of wellbeing as well as capacity to absorb new ideas, increases his social interaction, gives access to improved health and provides several more intangible benefits [4].

In the past decade, there has been a sharp increase in the number of private institutes as well as universities in India; higher education is continuing to expand, mostly in an unplanned manner, without even minimum levels of checks and balances [5]. In India, as per the report of All India Survey on Higher Education (AISHE) 2014-2015, enrollment in Technical Education (approximately 30%) is the second largest among all higher education programs [40]. The Government of India encouraged the spread of Technical Education in last decade. Today it is reasonable to contend that the conceptualization and organization of academic work and the academic career structure no longer meet the educational and operational demands of the current environment and create many barriers to success [6]. The wide heterogeneity in quality of universities explains why only 25% of Indian engineering graduates are considered suitable for employment [7]. This is why the Indian National Assessment boards of Higher and Technical Education like NAAC and NBA have given weightages to the supporting and extension activities which are related to employability skills, for assessment of institutes with the academic and curriculum activities. As per National Assessment and Accreditation Council (2013), learning activities should have a visible element for developing sensitivities towards community issues, gender disparities, social inequity etc. and in inculcating values and commitment to society. Extension services also is the aspect of education, which emphasizes community services. These are often integrated with curricula as extended opportunities, intended to help, serve, reflect and learn. The curriculum-extension interface has an educational value, especially in rural India [8].

## **Effective Quality Services:-**

There is desperate need in India that 'Higher Education should be guided through Service Quality concepts to achieve excellence' [9]. There is consensus in the research literature in higher education that students exhibit several different approaches to learning. Qualitative and quantitative studies have confirmed a broad distinction between deep and surface approaches to learning [10].

Bonnema and van der Wald grouped factors of a student market in higher education with the following labels: university, college, employability aspects, course content, student experience, sporting aspects, financial aspects, direct sources, media sources and social sources [11]. Reference [12] define Quality in education from TQM perspective. They believe educational institution as an open system i.e. management system, a technical system and social system. It includes within it the quality of input in the form of students, faculty, supporting staff and infrastructure, the quality of processes in the form of the learning and teaching activity and the quality of outputs include examination results, employment, earning and satisfaction. Reference [13] have briefly examined the various factors which affect the effectiveness of Technical Education and they have categorized them into seven major heads; Administration, Infrastructure, Teaching Effectiveness, Students, Interaction with Industry and Society, Extra-Curricular Activities, Research and Development. Reference [14] explained five factor model of Service Quality in higher education. Among five factors, Administration, Student Safety, Faculty Communication, Facilities and Interpersonal Behavior of Faculty, they found faculty members' communication was most important factor and has significant contribution for the overall satisfaction of the students. Service includes all the activities required to keep the product or service working effectively for the buyer after it is sold and delivered. Value based services should be delivered through; operating services, supporting services and extended activities based on Student Mentoring, Support Student Progression and Student Participation and Activities to enhance skills and ability

development. Educational services are personal and characterized by intensive, intellectual, emotional and/or physical participation of students in a service process. Services are often realized in a number of steps, which, basically, constitute the very service process. Production and consumption of educational services take place simultaneously and students' participation in it is rather important. They evaluate service quality, hence the shaping of the service process—detailed planning on how to provide a service—is vital to maintain (improve) educational service quality. The process is so important that some authors describe it as a real essence of service [15].

### **Operating Services:-**

Operating services are those activities which are required for delivering a service to the acceptance of service. Reference [16] evidence in literature indicates that Continuing Professional Development of teachers is essential in creating effective colleges. Most scholars agree that the relationships between students and faculty are vital to student success in college [17]. Furthermore, Kuh et al. contend that faculty approachability and interaction can consist of many facets, including working with a faculty member on a research project, working with a faculty member on activities other than coursework (committees, program activities, etc.), discussing assignments and grades, and receiving prompt academic feedback on performance. In addition to that the adoption of Total Quality Management enhances credibility to meet the requirements of the faculty performance which leads to improve its competitive position among other similar academic institutions [18]. Audio-Visual aids are now common in conducting the education services [19]. Reference [20] supports an interactive session focuses on participating in shifting the paradigm toward learner-centered curriculum delivery. Teaching and learning in TE is a shared process, with responsibilities on both student and teacher to contribute to their success. Quality teaching and learning has broad horizons, taking place in a research-rich environment, where the subject matter is driven by the latest knowledge and research, delivered in a way which encourages students to develop academic literacy and both subject specific and generic skills which they can apply immediately in the real world. The application of educational technology enhances skills and cognitive characteristics with the explosion of learning and receiving new information, especially on mobile devices. The evolution and development of Information and Communication Technology (ICT) has resulted in a paradigm shift in the educational system. ICTs are changing the way people learn, offering new alternatives to the traditional classroom. ICTs have the capability of providing “personalized, just-in-time, up-to-date, and user-centered education activities” [21]. ICTs have encouraged new research and development in teaching and learning techniques. ICTs have the potential to drive innovative and effective ways of teaching-learning and research. The inclusion of learning tools, easier use of multimedia or simulation tools, easy and almost instant access to data and information in a digital form which allows for computations and data processing generates possibilities which were otherwise not feasible.

### **Supporting Services:-**

An assistance required for successful execution of program or process or service is known as Supporting service. Reference [22] found that students who feel at home, who are well connected to fellow-students and teachers and who take part in extra-curricular activities are more likely to graduate. The current education system lacks its focus on training young people in soft skills that can provide them with employment opportunities. As such, training in soft and employability skills is all the more relevant not least because the education system does not delve into personality development [1]. Another factor that impacts persistence is what is known as business procedures or bureaucratic factors. It can best be defined as the interaction that occurs between the student and the service providers at the institution [23]. For instance, common patterns of exchanges occur between the student and various offices such as the business office, residence life, financial aid, departmental offices that define major requirements, social/athletic events, parking management, etc. A number of colleges and universities offer students a wide variety of services and resources intended to promote persistence by providing academic assistance [24]. Most of the academic support services are tutoring centers which offer academic assistance in a variety of areas, such as speaking, writing, and mathematics. Reference [25] reported that academic resources such as these supporting services produced statistically significant positive impacts on student persistence. According to reference [26], college students must be actively involved and engaged in their surroundings if they are expected to learn and grow while attending college. While it is important for students to be academically involved and engaged, reference [27] contends that it is also important for students to become involved and engaged in other areas of college life, such as campus organizations, activities, athletic events, etc. Reference [28] suggested constant collaborative activities between professors and student support services, such as the incorporation of support services or other supportive resources into class curriculum, class visits to support centers, or simply encouragement to take advantage of support services, promoted student involvement and subsequent connectivity. Reference [29] explains that as universities

provided programs and delivered benefits exceed the charged fees, students would have a high sense of satisfaction. Reference [30] discusses the evolution of web services and describes how services such as fee payment, parking renewal, registration, career services, and personal counseling, as supporting services.

#### Extension Services:-

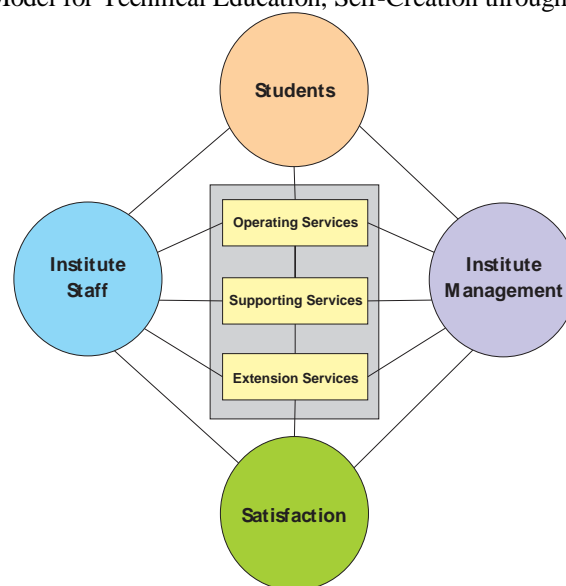
Motivation and students' approaches to learning are dynamically related to each other [31]. One important factor which affects students' persistence is that of being socially integrated and connected with others, especially other students. Education or an Institute, for most students, is not only a time of academic pursuits but also an opportunity to explore or enhance themselves as social beings. In fact, while some students desire to finish college, they do not consider themselves to be ultra-academic beings and instead want to partake in endeavors that develop them socially [32]. Reference [33] detected academic and social integration to be influential on study performance. They also distinguish four concepts in academic integration: academic-, social-, personal- & emotional adjustment and attachment. Greatest importance needs to be attached to extension work, as a learning and development instrument, for the benefit of community through students and teachers [34].

#### Students satisfaction:-

Reference [35] define satisfaction as a state felt by a person who has experienced performance or an outcome that fulfill his or her expectation. Satisfaction is a function of relative level of expectations and it perceives performance. Satisfaction is also perceived as the intentional performance which results in one's contentment [36]. Consumers, such as students, usually make a purchase decision based on their own valuation of the marketing efforts. However, their satisfaction is based on their evaluation of the products or services utilized and whether or not their expectations or needs were met [37]. Educational institutions use certain methodologies to determine the level of their students' satisfaction regarding the services and programs they offer to better fulfill student needs and satisfy student aspirations [38]. If the higher education sector knows about the factors that improve students' perception of satisfaction, it will can provide better services as well as improving existing ones. To gain competitive advantage, reference [39] recommend universities to highlight the strategic importance of social values gained by students when joining them. Moreover, they argued that universities must demonstrate how they provide support to their students' objectives achievement. Basically, this would affect the students' perception of satisfaction hence the university's competitiveness. Several factors influence students' level of satisfaction as well as their achievement and absorption capacity. To deliver knowledge with quality effectively, teaching methods by instructors, as well as the related supporting services, are two critical elements [39]. Determining and assessing students' satisfaction with their educational experiences is not so easy, but can be very helpful for the institutes to build strong relationship with their existing and potential students.

#### Conceptual Framework From Literature Review:-

(Fig 1: All-inclusive Service Model for Technical Education, Self-Creation through Literature Review)



Operating Services	Supportive Services	Extension Services
<ul style="list-style-type: none"> <li>• Curricular planning, implementation, enrichment</li> <li>• Internal &amp; Final Examination</li> <li>• Teaching-learning Process</li> <li>• Students Performance &amp; Learning outcomes</li> <li>• Research Promotion &amp; Research Publication</li> <li>• Computational facilities &amp; Internet</li> <li>• Library access</li> <li>• Laboratory access</li> <li>• Use of Technology</li> </ul>	<ul style="list-style-type: none"> <li>• Industry -Interaction</li> <li>• Publications</li> <li>• Technical Workshops/Symposium</li> <li>• Students guardian/mentor system</li> <li>• Feedback &amp; Assessment System</li> <li>• Employability development</li> <li>• Financial Aid</li> <li>• R &amp; D Cell</li> <li>• Guest Lectures &amp; Expert Talks</li> <li>• Education/Industrial Tours</li> <li>• Training &amp; Employability Development programs</li> <li>• Entrepreneurship Cell</li> <li>• Placements &amp; Higher Education assistance</li> <li>• Co-curricular and Extra-Curricular Activities</li> <li>• Transportation facilities</li> <li>• Residential Facilities</li> <li>• Administrative support</li> <li>• Banking &amp; Post facilities</li> <li>• Safety &amp; Security services</li> <li>• Medical facilities &amp; insurance</li> <li>• Awards &amp; Rewards</li> <li>• Learn and Earn</li> </ul>	<ul style="list-style-type: none"> <li>• Social Activities &amp; holistic development</li> <li>• Community development</li> <li>• Social Clubs</li> <li>• Involvement in National Agencies / NGO</li> <li>• Rural development activities</li> </ul>

### Research Methodology:-

The objective of this research was to find out students' perceptions and experience on services offered by the TE institutes and to find out relation between satisfaction and the services experienced. A qualitative research through a survey was made. It comprised of a structured questionnaire sent through e-mail to the current-students enrolled and passed-out students (alumni) belonging to the technical institutes affiliated to North Maharashtra University. Sample size (n) was calculated at 95% Confidence Level for which Standard Normal Variate (Z) is 1.96 & at Standard Error (e) of 0.03 by  $n = Z^2 (p)(1-p)/e^2$ ; where n = Sample Size to be used for this study, N = unknown population, p = Estimated Portion of Population N. For p = 90%, 'n' comes out to be 553. However, sample size of 664 was selected by quota sampling from technical institutes offering different programs in engineering, pharmacy and management & different students (Current as well Post-students/Alumni) based on their location of native place, gender. The questionnaire comprised structured and closed ended questions measuring different services offered by TE Institute and its' relation with the satisfaction of decision of selection of TE institute were sent through E-mail. Responses were obtained through a google form on a scale ranging from 0 to 5, where value zero is low weightage and value five is high weightage. The characteristics of the sample is described as below;

*By Gender:* Male: 454; Female: 210

*By Native Place:* District: 162; Taluka: 283; Village: 219

*By Technical Educational Program:* Engineering: 492; Pharmacy: 113; Management: 59

**Data Interpretation And Findings:-**

	Individual Mean	Association with 'Satisfaction' of selection of institute		
		p-value	F-value	Pearson' Linear Correlation(PLC)
<b>OPERATING SERVICES</b>				
Infrastructure & Technology	<b>3.60</b>	0.000	14.00	0.215
Faculty & Teaching Learning Methods	<b>3.63</b>	0.000	10.40	0.199
Library & Computational Facilities	3.47	0.000	<b>18.74</b>	<b>0.277</b>
Research Activities	2.90	0.000	<b>18.56</b>	<b>0.277</b>
<b>SUPPORTING SERVICES</b>				
Students Amenities & Recreation	3.27	0.000	14.89	0.240
Campus Placements	3.31	0.000	<b>23.36</b>	<b>0.309</b>
Industry Interactions & Tie-Ups	3.10	0.000	<b>19.03</b>	<b>0.279</b>
Co & Extra-Curricular Activities	3.11	0.000	<b>18.98</b>	<b>0.281</b>
Safety, Security & Medical Facilities	3.07	0.000	15.35	0.255
Gradation, Accreditation & Recognition	3.21	0.000	15.94	0.256
Alumni Interaction	3.11	0.000	16.27	0.257
Soft Skills & Technical Skills	3.52	0.000	11.47	0.210
Sports & Cultural Activities	2.86	0.000	11.55	0.219
Finance & Scholarships	3.07	0.000	12.76	0.222
<b>EXTENSION SERVICES</b>				
Campus & Social Life	3.50	0.000	<b>18.18</b>	<b>0.267</b>
		<b>MANOVA- General Linear Model; <math>p=0.000</math>; <math>Aprro. F=3.310</math> by Wilk's</b>		

It is revealed that students' satisfaction is associated with the services offered by the Institutes with  $p=0.000$  which is significant at  $p<0.05$  and approximate F-value=3.310, conducted by statistical software, Minitab 17, calculated by MANOVA – General Linear Model with Wilk's method. The students responded that they experience best services of Infrastructure and Technology (Mean=3.6), Faculty and Teaching Learning Methods (Mean=3.63) of the institutes wherein they are enrolled. However, their satisfaction for selection of TE Institute is highly associated with Campus Placements (F-value= 23.36, PLC= 0.309), Co & Extra-Curricular Activities (F-value= 18.98, PLC= 0.281), Industry Interactions and Tie-ups (F-value= 19.03, PLC= 0.279), and Campus and Social Life (F-value= 18.18, PLC= 0.267) of Institute wherein they are enrolled.

It is observed that Institutes are concentrating on operating services more than the supporting services and extension services. However, students' satisfaction is more associated with the supporting activities and extension activities than operating activities.

**Conclusion:-**

According to former Prime Minister of India, Dr. Manmohan Singh - 'The time has come to create a second wave of institution building and of excellence in the fields of education, research and capability building'. We need an educational system that is modern, liberal and can adapt to the changing needs of a changing society, a changing economy and a changing world. Infosys, an IT giant, last year sorted through 1.3 million applicants only to find that around two percent were qualified for jobs. Employability services can play a big role to help both institutes and their students to understand and evaluate their job readiness and work constructively to fix the lean points. Industry and Academia connect is necessary to ensure curriculum and skills development of students are in line with requirements. (knowledge + global professional skills = good jobs). We live in a world that requires the combination of different skills and knowledge sets for increasing success and competitiveness, TE leaders must work with all constituent services to forge the best possible strategic services to recruit, develop, retain, to produce employable

graduate students and to assist them for placements and further career path. Educational services can be driven on Five Pillars; make it easy, make it relevant, make it fresh, manage it, measure it. Such services should impart social, moral, integrity, character, spirituality and many more as it builds the qualities of humility, strength and honesty in a student. These sets of services should lead to purity of hearts and sincerity too. Education services must extend relationship with the world. In the next few decades, India will probably have the world's largest set of young people. Even as other countries begin to age, India will remain a country of young people. If the proportion of working population to total population increases by delivering employable services and skill development services, India will find productive job opportunities for such a working population and that would give India a big opportunity to leapfrog in the race for social and economic development and as a result growth rates would go up. No doubt!

### Reference:-

1. Janat, Jaydev (2016). Opinion: Skill development - way ahead for India. *Stateman*. <http://www.asianews.network/content/opinion-skill-development-way-ahead-india-19296>
2. Green, R. A. (December 15, 2014). CAN "MAKE IN INDIA" MAKE JOBS? THE CHALLENGES OF MANUFACTURING GROWTH. INSTITUTE FOR PUBLIC POLICY OF RICE UNIVERSITY, *International Economics*.
3. Sharma, S. D., Kaul, M., Goel, E., & Narang, V. (2015). Exploring prospects for Make in India and Made in India, A study. PHD Chamber of Commerce. *GUJRAT: VIBRANT GUJRAT SUMMIT, 2015*.
4. Kozma, R. (2005), 'National Policies That Connect ICT-Based Education Reform To Economic And Social Development', *Human Technology* Volume 1 (2), October 2005, 117-156.
5. Umashankar Venkatesh, Kirti Dutta (2007), "Balanced scorecards in managing higher education institutions: an Indian perspective", *International Journal of Educational Management*, Vol.21, No. 1, pp. 54-67.
6. Enders, J., & de Weert, E. (Eds.). (2009). The changing face of academic life; analytical and comparative perspectives. *Basingstoke: Palgrave MacMillan*
7. D. Farrell, M. Laboissière, R. Pascal, J. Rosenfeld, C. de Segundo, S. Stürze, and F. Umezawa, *The Emerging Global Labor Market*, McKinsey Global Institute, June 2005.
8. NAAC Manual 2013. Institutional Accreditation. *NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL*, An Autonomous Institution of the University Grants Commission
9. Kanji, G.K. and Tambi, A.M.B.A. (1999), "Total Quality management in UK higher education institutions", *Total Quality Management*, Vol.10 No.1, pp.129-53
10. Entwistle, N., & McCune, V. (2004). The conceptual bases of study strategy inventories. *Educational Psychology Review*, 16, 325–346.
11. Bonnema, J., Van der Wal, D.I.R. (2008). Information and Source Preferences of a Student Market in Higher Education. *International Journal of Educational Management*, 22(4), 214–227. <http://dx.doi.org/10.1108/09513541211201960>
12. Sangeeta Sahney et al., 2004, "A SERVQUAL and QFD approach to total quality education A student perspective", *International Journal of Productivity and Performance Management*, Emerald Group Publishing Limited Vol. 53 No. 2, pp. 143-166
13. Sahu, Anil, Shrivastava R. (2008). Key Factors Affecting the Effectiveness of Technical Education— An Indian Perspective. *Proceedings of the World Congress on Engineering 2008 Vol II*, WCE 2008, July 2 - 4, 2008, London, U.K.
14. John, Franklin and Senith, S (2008). Service Quality in Indian technical Education. *Canadian Journal on Scientific and Industrial Research* Vol. 3 No. 3, March 2012
15. Senić, R., Senić, V. (2008) Menadžment marketing usluga. Kragujevac: Faculty of Economy, *University of Kragujevac*. (in Serbian)
16. Raj Mestry, Ilona Hendricks & Tom Bisschoff 2009. Perceptions of teachers on the benefits of teacher development programmes in one province of South Africa. *South African Journal of Education*, 29:475-490.
17. Kuh, G. D., Kinzie, J., Schuh, J. H., Whitt, E. J., & Associates. (2005). Student success in college: *Creating conditions that matter*. San Francisco: Jossey-Bass.
18. Cornesky R 1994. Using Deming to improve Quality at Colleges and Universities. Man Publications, New York.
19. Bhattacharya, I. & Sharma, K. (2007), 'India in the knowledge economy – an electronic paradigm', *International Journal of Educational Management* Vol. 21 No. 6, pp. 543-568.
20. Lauridsen, B (2011), 'Shifting the Paradigm: Value-Chain Analysis Applied to Online Learning', *TCC Proceedings*, pp. 100-112.

21. Haddad, W. D. & Draxler, A. (2002). The Dynamics of Technologies for Education. In W. D. Haddad & A. Draxler (Eds.), *Technologies For Education Potentials, Parameters, and Prospects*, 1. (pp. 2–17). Prepared for UNESCO and AED by Knowledge Enterprise Inc.
22. Severiens, S., & Wolff, R. (2008). A comparison of ethnic minority and majority students: Social and academic integration, and quality of learning. *Studies in Higher Education*, 33, 253–266.
23. Bean, J. P. (2005). Nine themes of college student retention. In A. Seidman (Ed.), *College student retention* (pp. 215–243). Westport: Praeger Publishers.
24. Pascarella, E.T., & Terenzini, P.T. (2005). How college affects students: Vol. 2 *A decade of research*. San Francisco: John Wiley & Sons, Inc.
25. Adelman, C. (1999). Answers in the toolbox: Academic intensity, attendance patterns, and bachelor's degree attainment. Document No. PLLI 1999-8021. Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement.
26. Evans, N.J., Forney, D.S., & Guido-DiBrito, F. (1998). *Student development in college: Theory, research, and practice*. San Francisco: John Wiley & Sons, Inc.
27. Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition* (2nd ed.). Chicago: University of Chicago Press.
28. Jones, C. (2001). The relationship between writing centers and improvement in writing ability: An assessment of the literature. *Education*, 122(1), 3–20.
29. Fredrickson, J.E. (2012). Linking Student Effort to Satisfaction: the Importance of Faculty Support in Creating a Gain-Loss Frame. *Academy of Educational Leadership Journal*, Vol. 16, Special Issue, 111–125
30. Kleemann, G. L. (2005). Weaving silos—a leadership challenge: A cross-functional team approach to supporting web-based student services. *New Directions For Student Services*, (112), 89–101.
31. Cano, F., & Berben, A. B. G. (2009). University students' achievement goals and approaches to learning in mathematics. *British Journal of Educational Psychology*, 79, 131–153.
32. Moxley, D., Najor-Durack, A., & Dumbigue, C. (2001). *Keeping students in higher education: Successful practices and strategies for retention*. London: Kogan Page Limited.
33. Baker, R. W., & Siryk, B. (1999). *SACQ student adaptation to college questionnaire* (2nd ed.). Los Angeles: Western Psychological Services.
34. Goel, Aruna & Goel, S (2010). Encyclopedia in Higher Education in the 21st Century. *Extension Education Services in Higher Education*, Volume 3. Deep and Deep Publication pvt. Ltd., New Delhi
35. Kotler, P. & Clarke, R.N. (1987). "Marketing For Health Care Organizations," Englewood Cliffs, NJ: Prentice-Hall.
36. Usman, A. (2010). "The Impact of Service Quality on Students' Satisfaction in Higher Education Institutes of Punjab," *Journal of Management Research*, 2 (2).
37. Athanassopoulos, A., Gounaris, S., & Stathakopoulos, V. (2001). Behavioral Responses to Customer Satisfaction: an empirical study. *European Journal of Marketing*, 35(5-6), 687–707
38. Qureshi, Tahir, Shaikat, Muhammad and Hijazi, Syed (2011). Service Quality SERVQUAL model in Higher Educational Institutions, What Factors Are to be Considered. *Interdisciplinary Journal of Contemporary Research in Business*. Vol. 2, No. 5. pp: 281–290.
39. Petruzzellis, L., & Romanazzi, S. (2010). Educational value: how students choose university. *International Journal of Educational Management*. University of Bari Bari, Italy, 24(2), 139–158
40. Key Results of All India Survey on Higher Education 2014–2015. Ministry of Human Resource Development, Department of Higher Education, New Delhi. 2016





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### RESEARCH ARTICLE

#### SEVERE AND RECALCITRANT CHRONIC URTICARIA RESOLVED AFTER FILLER REMOVAL.

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#### Abstract

Chronic idiopathic urticaria is a common skin disease without a clear etiology in the vast majority of cases. The main therapeutic options are directed towards histamine receptors. When antihistamines failed, other therapeutic options maybe added such as systemic steroids, mast cell stabilizer and more recently Omalizumab. Herein we report a rare case of severe and recalcitrant urticaria that was resistant to many treatments modalities including the above-mentioned drugs. Extensive patient history led to two possible triggers, which are lip fillers and tooth filling. Removal of both fillings cured her disease completely. Dermatologists should be aware of any new procedures and materials administered to patients prior to development of urticaria.

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#### Introduction:-

Urticaria for more than six weeks is considered chronic and in majority of cases more (80%) no exogenous causes can be determined. The term chronic idiopathic urticaria (CIU) [1,2,3] is commonly used. Antihistamines, systemic corticosteroids, mast cell stabilizers and biological therapy (omalizumab) are being used. Dermatologists often exposed to unresponsive cases to several treatment modalities. In this paper we are reporting a patient with severe and recalcitrant chronic urticaria for more than 7 months that is only completely resolved after removal of lip filler and tooth filling.

#### Case Report:-

46 years old female, medically free, presented to our clinic with history of severe urticarial for 7 months. The rash started to appear in the face with mild facial angioedema that progressed as generalized urticaria all over the body. The patient started by herself on Cetirizine 10 mg for two weeks, without benefit. Later on she was prescribed Hydroxyzine 25 mg and loratidine 10 mg. Minimal response was noted and after two weeks she was started on Prednisolone 40 mg in addition to the antihistamines. Up to 50% of the rash has improved over the body but angioedema over the face continued to appear. Montelukast 10 mg and doubling the dosage antihistamines brought only little benefit. Omalizumab injection was initiated every week at 300 mg that brought good benefit along with corticosteroid. Corticosteroid was tapered down till 10 mg but patient stopped it completely because of weight gain. Urticaria flared up very significantly with Angioedema of the face (while she still on Omalizumab). Prednisolone 40 mg was taken by the patient irregularly for social occasions to suppress the hives. At this stage, she sought medical advice with other dermatologist. Detailed history revealed that patient has both tooth filling and lip filler (JUVEDERM VOLIFT, Allergan, Inc. Irvine, California, USA) have been administered for her 2 and 1 months

prior to urticaria onset respectively. Patient was advised to remove lip filler first and in one month the tooth filling. Hyaluronidase was injected twice (three days apart) to dissolve the lip filler. However, within few days patient chose to remove the tooth filling by her dentist against our advice and not to wait for a month. In less than one week she noticed significant decrease in number of hives that completely disappeared in a month. She is off all treatments without any recurrence for more than six months.

### Discussion: -

None of the theories of pathogenesis of chronic urticaria (CU) has been fully established<sup>4</sup>. The best-developed hypotheses include the autoimmune theory, theories involving histamine-releasing factors, and the cellular defects theories<sup>5</sup>. IgE-mediated, cell-mediated and complement-mediated were established as main pathogenesis<sup>1</sup>. Dermatologists commonly failed to find out exogenous causes only in 20 to 30% they could be determined. In the literatures, unusual triggers had been reported such as hidden infection including *Helicobacter pylori*<sup>6</sup>, Hepatitis A<sup>7</sup> and Hepatitis C<sup>8</sup>, eye drops and tooth filling have been reported.<sup>9,10</sup> Local skin reaction to Hyaluronic acid at site of injection is well known with all types of fillers that can be confusing as angioedema. In two reports, angioedema affecting lips post fillers has been described, however in the first case<sup>11</sup> it seems to be an overt reaction to local filler rather than a classic immune-mediated angioedema. It occurs within minutes at the site of injection only and disappeared in few days. In the second one<sup>12</sup> Herpes Simplex Virus has been associated with the swelling. In both papers filler hasn't been dissolved and no recurrence has been reported. We expected in those patients that urticaria should continue to flare as long as fillers still in the body.

In contrast to our patient, generalized urticaria has happened within a three to four weeks of injection and only cleared after dissolving lip filler and removal of tooth filling. Another case of urticarial vasculitis (approved by skin biopsy) has been reported<sup>13</sup>. Three weeks after filler and resolved within six weeks later. However in this case filler hasn't been dissolved with hyaluronidase, which might doubt for the possible relationship to cause urticarial vasculitis. Another report of angioedema that related to hyaluronidase rather than lip filler<sup>14</sup>. The possibility that the angioedema in this patient was related to the dissolved filler rather than only hyaluronidase cannot be ruled out. The antigen exposure to the immune system following degradation by hyaluronidase is a possible pathogenesis.

In our patient, both lip filler and tooth filling were administered 1 and 2 months respectively prior to her symptoms. No clue to us which of them is the true culprit. Although we advised her to remove them one month apart, she decided removing them simultaneously, which creates uncertainty, which is the main culprit. Complete remission of urticaria within few weeks of removal of both fillings creates strong evidence for the cause-relationship. Nevertheless, the message from this patient is the importance of detailed and extensive history in finding the possible causes and relieving the frustration and safe huge cost.

### References:-

1. Kaplan AP. Chronic urticaria: pathogenesis and treatment. *J Allergy Clin Immunol* 2004; 114:465.
2. Sheikh J. Autoantibodies to the high-affinity IgE receptor in chronic urticaria: how important are they? *Curr Opin Allergy Clin Immunol* 2005; 5:403.
3. Kulthanan K, Jiamton S, Thumpimukvatana N, Pinkaew S. Chronic idiopathic urticaria: prevalence and clinical course. *J Dermatol* 2007; 34:294.
4. Vonakis BM, Saini SS. New concepts in chronic urticaria. *Curr Opin Immunol* 2008; 20:709.
5. Sarbjit Saini (2015). Chronic urticaria: Clinical manifestations, diagnosis, pathogenesis, and natural history. In Bruce S Bochner, Jeffrey Callen (Ed.), *uptodate*.
6. Liutu M, Kalimo K, Uksila J, Kalimo H. Etiologic aspects of chronic urticaria. *Int J Dermatol* 1998; 37:515.
7. Wedi B, Raap U, Kapp A. Chronic urticaria and infections. *Curr Opin Allergy Clin Immunol* 2004; 4:387.
8. Daoud MS, Gibson LE, Daoud S, el-Azhary RA. Chronic hepatitis C and skin diseases: a review. *Mayo Clin Proc* 1995; 70:559.
9. Carbonella E. Urticaria-angioedema due to carboxymethylcellulose eye drops. - PubMed - NCBI. *Ncbi.nlm.nih.gov*. 2016. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/22812199>. Accessed November 28, 2016.
10. Kal B, Evcin O, Dundar N, Tezel H, Unal I. An unusual case of immediate hypersensitivity reaction associated with an amalgam restoration. *BDJ*. 2008;205(10):547-550. doi:10.1038/sj.bdj.2008.981.

11. Leonhardt J, Lawrence N, Narins R. Angioedema Acute Hypersensitivity Reaction to Injectable Hyaluronic Acid. *Dermatologic Surgery*. 2006;31(5):577-579. doi:10.1111/j.1524-4725.2005.31166.
12. Dougherty A, Rashid R, Bangert C. Angioedema-type swelling and herpes simplex virus reactivation following hyaluronic acid injection for lip augmentation. *Journal of the American Academy of Dermatology*. 2011;65(1):e21-e22. doi:10.1016/j.jaad.2010.11.043.
13. Alijotas-Reig J. Recurrent Urticarial Vasculitis Related to Nonanimal Hyaluronic Acid Skin Filler Injection. *Dermatologic Surgery*. 2009;35(Sup 1):395-398. doi:10.1111/j.1524-4725.2008.01049.x.
14. Andre PFléchet M. Angioedema after ovine hyaluronidase injection for treating hyaluronic acid overcorrection. *Journal of Cosmetic Dermatology*. 2008;7(2):136-138. doi:10.1111/j.1473-2165.2008.00377.x.



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## RESEARCH ARTICLE

### VITAMIN D3 IMPROVES LIVER FUNCTIONS IN EXPERIMENTALLY INDUCED TYPE II DIABETES MELLITUS IN WISTAR RATS

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Diabetes Mellitus, Liver, Mitochondrial  
 NAD<sup>+</sup>, Stearoyl-CoA desaturase1,  
 Vitamin D3

#### Abstract

**Background and Aim:** Vitamin D3 could ameliorate the effects of type 2 diabetes mellitus; however, liver changes in diabetes needs more studies and to highlight changes in liver cell mitochondrial NAD<sup>+</sup> and Stearoyl-CoA desaturase 1 (SCD1).

**Materials and Methods:** Forty adult Wistar rats, of both sexes, were randomly allocated into equal groups of control, vitamin D3 non-diabetic, diabetic, type 2 diabetic and vitamin D3 treated diabetic groups. At the end of the study, all rats were anaesthetized by i.p. Pentobarbitone (40 mg/kg B.W). Fasting blood glucose level was measured by rat tail, then after aortic cannulation, the separated plasma was used for determination of lipid profile, liver functions and insulin level. HOMA-IR and atherogenic indices were calculated. Liver specimens were used for detection of SCD1 gene expression by Real time PCR and mitochondrial NAD<sup>+</sup>.

**Results:** Glycemic parameters and plasma liver enzymes, liver mitochondrial NAD<sup>+</sup> were significantly elevated in the diabetic group compared to the control group, and were significantly lowered in vitamin D3 treated diabetic group compared to the diabetic group. The diabetic group had dyslipidemia compared to the control group, while lipid profile was improved in vitamin D3 treated diabetic group compared to the diabetic group. SCD1 gene expression in liver cells was downregulated in both diabetic groups (untreated and treated) compared to the control group.

**Conclusion:** Vitamin D3 reversed the damaging diabetic effects on liver functions efficiently, probably by ameliorating oxidative stress, however, it altered SCD1 gene expression and regulated its effect on diabetes to lesser extent.

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#### Introduction:-

Diabetes mellitus is a worldwide problem, and increases in incidence and prevalence (Danaei et al., 2011). The relation between vitamin D and type 1 diabetes mellitus has been extensively studied in humans and animals, and it could be due to the immunomodulatory actions of vitamin D (Stene et al., 2000; Gregori et al., 2002; Mathieu et al., 2005; Luong et al., 2005).

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For type 2 diabetes mellitus to develop, impaired pancreatic  $\beta$  cell function and insulin resistance are often present. The prevalence of type 2 diabetes rises in obesity, which is often associated with hypovitaminosis D (**Palomer et al., 2008**). Vitamin D is efficiently deposited in body fat stores decreasing its bioavailability, thereby many obese persons could be chronically vitamin D deficient (**Holick, 2004**). **Zeitz et al. (2003)** reported that vitamin D receptor could be expressed in  $\beta$  cells. Thus, vitamin D deficiency could decrease insulin secretion in rats and humans, and its replenishment could improve  $\beta$ -cell function and glucose tolerance (**Boucher et al., 1995**). Also, it was suggested that vitamin D insufficiency could cause insulin resistance probably by elevated TNF- $\alpha$  level which is a cytokine inversely related to 25(OH) vitamin D (**Hotamisligil and Spiegelman, 1994**). In addition, **Ortlepp et al. (2003)** reported that alteration in vitamin D receptor and vitamin D-binding protein could affect glucose tolerance and insulin secretion. **Ogunkolade et al. (2002)** mentioned that vitamin D could affect type 2 diabetes mellitus through either controlling plasma calcium level, which regulates insulin synthesis and secretion, or directly on pancreatic  $\beta$ -cell function.

In addition, **DeLuca and Cantorna (2001)** mentioned that liver cells had cytosolic or nuclear and/or membrane-bound vitamin D receptors. However, few researchers studied the impact of vitamin D supplementation on altered liver functions in type 2 diabetes mellitus (**Yang et al., 2016**).

Fat metabolism changes in type 2 diabetes mellitus were proved to be present (**Shulman, 2000**). Stearoyl-CoA desaturase (SCD) is the rate limiting enzyme catalyzing the biosynthesis of monounsaturated fatty acids, the substrates for triglycerides synthesis and formation of cholesterol esters and phospholipids. SCD1 is the main SCD isoform expressed in liver (**Dobrzyn and Dobrzyn, 2006**). Abnormal monounsaturated fatty acid production could cause many diseases such as obesity, diabetes and cancer. Therefore, it is of value to study SCD1 expression in normal and disease states (**Miyazaki et al., 2003**). Although many studies are present regarding the effect of type 2 diabetes mellitus on SCD, little is known about the effect of vitamin D on the SCD gene expression in type 2 diabetes mellitus.

On the other hand, oxidative stress could be present in type 2 diabetes mellitus resulting in the development of diabetic complications in many organs (**Giacco and Brownlee, 2010**). However, changes in mitochondrial NAD<sup>+</sup> in liver cells in type 2 diabetes were not extensively studied. Therefore, it is valuable to study the drawbacks of diabetes mellitus (type 2) on liver functions and to elucidate the changes in SCD1 gene expression and mitochondrial NAD<sup>+</sup> in the liver tissues; in addition to study the possible effects of vitamin D3 in type 2 diabetes mellitus.

#### **Aim of the work:-**

This study was performed to demonstrate the effects of vitamin D3 treatment on liver functions in type 2 diabetic rats and to highlight the changes in SCD1 gene expression and mitochondrial NAD<sup>+</sup> in liver cells.

#### **Materials and Methods:-**

##### **Experimental Protocol:**

##### **Animals:**

This study was carried out on 40 adult Wistar rats, of both sexes, initially weighing 160-200 gm, purchased from animal farm from Helwan, Cairo, Egypt. Animals were kept in the Medical Research Center Animal House, Faculty of Medicine, Ain Shams University under standard conditions of boarding and feeding, with free access to water, ad libitum, throughout the whole period of the study. Rats were left for 7 days as a period of acclimatization, during which regular normal diets were introduced daily at 8 a.m., in the form of milk, bread and vegetables.

##### **Experimental Protocol:-**

##### **Rats were randomly allocated into the following groups:-**

**Group I:** Control group (n= 10): received a single i.p. injection of saline in equivalent dose of Streptozotocin and also equivalent dose of 1, 25(OH)<sub>2</sub>D<sub>3</sub> each 2 days for 8 weeks.

**Group II:** Vitamin D3 Supplemented Non-Diabetic group (n=10): which received i.p. injection of 5  $\mu$ g/kg 1, 25(OH)<sub>2</sub> D<sub>3</sub>, each 2 days for 8 weeks, only without induction of diabetes mellitus (**Yin et al., 2012**).

**Group III:** Type 2 Diabetic group (n =10): which were fed high fat diet for 2 weeks followed by single i.p. injection of Streptozotocin (Sigma Co.) in a dose of 35 mg/kg B.W. dissolved in 2 ml of 0.05 M citrate buffer (**Srinivasan et al., 2005**).

**Group IV:** Vitamin D3 Treated Diabetic group (n= 10): which were rendered diabetic by the same method as the diabetic group, and then they were treated with i.p. injection of 5 µg/kg 1, 25(OH)<sub>2</sub>D<sub>3</sub>, each 2 days for 8 weeks (**Yin et al., 2012**).

#### **Induction of Diabetes Mellitus Type 2:-**

High fat diet, introduced to diabetic groups, was prepared by adding butter, to increase its fat content to 16 -17%. Analytical composition of butter used in the present study was in accordance with **Holland and Welch (1992)**. After Streptozotocin injection into overnight fasted rats, they had free access of food and water, and were given 5% glucose solution after 6 hours of Streptozotocin injection to drink overnight to counter hypoglycemic shock. The diabetic state was assessed by measuring the non-fasting blood glucose levels from rat tail 72hrs after Streptozotocin injection. The rats with blood glucose level above 250 mg/dl were selected for the experiment and considered as diabetics (**Zhang et al., 2006**).

On the day of sacrifice, overnight fasted rats were weighed and anaesthetized by i.p. injection of pentobarbitone, in a dose of 40 mg/kg B.W. Fasting blood glucose (FBG) was measured in a blood drop from the rat tail by GlucoDr™ SuperSensor Test Meter, AGM- 2200, Korea. A midline abdominal incision was made and the abdominal aorta was cannulated to collect aortic blood in 2 tubes; EDTA containing tube for subsequent determination of HbA1c in whole blood sample and a heparinized tube, which were centrifuged and the separated plasma was stored at - 80 °C for later determination of insulin level to calculate homeostasis model assessment of insulin resistance (HOMA-IR), γ-GT activity and levels of AST, ALT in addition to lipid profile. Liver specimens were also stored at -80°C for later determination of mitochondrial NAD<sup>+</sup> and SCD1 gene expression.

#### **Determination of Plasma Insulin Level:-**

was performed according to **Flier et al. (1979)**, using enzyme linked immunosorbent assay (ELISA) technique kits supplied by Insulin ELISA kit supplied by DRG .

Homeostasis Model Assessment- Insulin Resistance (HOMA-IR) = [fasting plasma insulin (µU/mL) x fasting plasma glucose (mmol/L) /22.5] (**Salgado et al., 2010**). HbA1c were quantified by HPLC(**Jeppsson et al.; 2002**).

**Liver enzymes levels [Aspartate Aminotransferase (AST), Alanine Aminotransferase (ALT)] and Gamma Glutamyl Transferase (γ-GT) activity** were determined colorimetric assay according to **Reitman and Frankel (1957)** and **Tietz(1986)** using commercial kits from Biolabo (France).

**Determination of plasma levels of triglycerides, total cholesterol, LDL-cholesterol and HDL-cholesterol:** were performed according to the method described by **Vassault et al. (1986)**, **Rifai et al. (1999)** and **Fruchart(1982)** using kits supplied by Greiner Diagnostic, Germany.

**Atherogenic index** was calculated according to **Grundy et al. (1987)** as follows: Atherogenic index = Total cholesterol / HDL-C.

#### **Evaluation of Mitochondrial NAD<sup>+</sup> in Hepatic tissue:-**

Mitochondrial isolation from hepatic tissues which were stored frozen at -80°C till the day of NAD<sup>+</sup> determination, was performed according to **Saleh and Saleh (2010)**. Hydrolysis of mitochondrial nicotinamide adenine dinucleotide (NAD<sup>+</sup>) directly reflects mitochondrial pores opening. The NAD<sup>+</sup> was measured after perchloric acid extraction. In the case of isolated mitochondria, 0.1 ml of 21% (v/v) perchloric acid was added to 1 mg of protein/ml suspensions. The concentration of NAD<sup>+</sup> in the perchloric acid extract of the hepatic mitochondria was measured using an alcohol dehydrogenase reaction. The reaction mixture contained 1000 µl of buffer-substance (0.1 M Tris acetate [pH 8.8] and 0.5 M ethanol), 100 µl of the tissue extract neutralized and 20 µl of alcohol dehydrogenase. The reaction was initiated by enzyme addition and change of absorbance at 340 nm recorded by a spectrophotometer (Behring Werke AG, Marburg, and West-Germany).

**RNA preparation and real-time qPCR analysis:-**

Total mRNA was extracted from liver tissues using RNeasy kits with spin-column DNase digestion (Qiagen). Purity and concentration were determined with a Nanodrop 1000 spectrophotometer (Thermo Scientific). One  $\mu\text{g}$  of RNA was used to synthesize cDNA with a QuantiTect Rev. Transcription Kit (Qiagen) and diluted to 10  $\text{ng}/\mu\text{L}$ . Expression of mRNA was determined using RT<sup>2</sup> qPCR Primer Assay for rat stearyl-Coenzyme-A desaturase 1 (SCD1) catalogue no: 330001 (Qiagen) and SYBR green RT<sup>2</sup> SYBR Green ROX<sup>TM</sup> qPCR Mastermix on an Applied Biosystems Step One Plus RT-PCR system. PCR mix for one reaction Component Volume RT<sup>2</sup> SYBR Green Mastermix was prepared as follows (12.5  $\mu\text{L}$  cDNA synthesis reaction 1  $\mu\text{L}$  RT<sup>2</sup> qPCR Primer Assay (10  $\mu\text{M}$  stock) 1  $\mu\text{L}$  RNase-free water 10.5  $\mu\text{L}$  Total volume 25  $\mu\text{L}$ . The PCR Cycling conditions were adjusted following the manufacture instruction. Cycling program: Initial activation step for 10 min at 95°C to activate HotStarTaq DNA Polymerase, cycling: (Denaturation for 15 seconds at 94°C, annealing for 30 seconds at 60°C, then extension for 30 seconds at 70°C) X40 cycles. PCR products were quantified fluorometrically using SYBR Green, and normalized to the housekeeping gene rat glyceraldehyde-3-phosphate dehydrogenase (GAPDH) and relative to the control according to the following formula:

$$\text{Target amount} = 2^{-\Delta\Delta\text{Ct}}$$

Where  $\Delta\Delta\text{Ct} = \{[\text{Ct}(\text{target gene}) - \text{Ct}(\text{GAPDH})] - [\text{Ct}(\text{control}) - \text{Ct}(\text{GAPDH control})]\}$ .

Fold difference for gene expression was calculated as  $2^{-\Delta\Delta\text{CT}}$  using the endogenous control genes (liver). The identity and purity of the amplified product were assessed by melting curve analysis at the end of amplification.

**Statistical Analysis:-**

All results in the present study were expressed as mean  $\pm$  SE of the mean. Statistical Package for the Social Sciences (SPSS, Inc., Chicago, IL, USA) program, version 20.0 was used. Differences were considered significant when  $P \leq 0.05$ .

**Ethics Committee:-**

This study was approved by the Ethics Committee of Faculty of Medicine, Ain Shams University.

**Results:-**

The diabetic and vitamin D3 treated diabetic groups had significant rises in fasting blood glucose, fasting insulin, HbA1c levels and HOMA-IR compared to the control group, denoting the occurrence of type 2 diabetes mellitus. However, these glycemic parameters were significantly reduced in vitamin D3 treated diabetic group compared to the diabetic group. Vitamin D3 supplemented group (Positive control group) had insignificant changes in fasting blood glucose, fasting insulin, HbA1c levels and HOMA-IR compared to the control group (negative control), as shown in table (1).

**Table 1:-** Changes in fasting blood glucose (mg%), fasting insulin level ( $\mu\text{IU}/\text{ml}$ ), HOMA-IR and HbA1c level (gm%) in the different studied groups.

Group	Fasting blood glucose (mg%)	Fasting insulin level ( $\mu\text{IU}/\text{ml}$ )	HOMA-IR	HbA1c (gm%)
<b>Control group (10)</b>	95.7 $\pm 3.03$	3.56 $\pm 0.18$	0.86 $\pm 0.038$	3.19 $\pm 0.11$
<b>Vitamin D3 supplemented group (10)</b> <b>P</b>	89.8 $\pm 2.89$ NS	3.6 $\pm 0.21$ NS	0.8 $\pm 0.053$ NS	3.27 $\pm 0.13$ NS
<b>Diabetic group (10)</b> <b>P</b>	189.2 $\pm 5.02$ <0.001	4.82 $\pm 0.19$ <0.001	2.26 $\pm 0.115$ <0.001	4.33 $\pm 0.13$ <0.001
<b>Vitamin D3 treated diabetic group (10)</b> <b>P</b> <b>P*</b>	110.1 $\pm 2.43$ <0.01 <0.001	4.17 $\pm 0.14$ <0.05 <0.02	1.14 $\pm 0.051$ <0.01 <0.001	3.93 $\pm 0.16$ <0.001 <0.05

In parenthesis is the number of rats studied in each group.

Values are expressed as means  $\pm$  SEM. NS: Not significant.

P: Significance by LSD at  $P < 0.05$  from the control group.

P\*: Significance by LSD at  $P < 0.05$  from the diabetic group.

Regarding liver functions, plasma AST and ALT levels and  $\gamma$ -GT activity in plasma were significantly increased in both diabetic (untreated and treated) groups compared to the control group, while they were significantly reduced in vitamin D3 treated diabetic group compared to the diabetic group. On the other hand, no-statistical significance was detected in these parameters in vitamin D3 supplemented group compared to control group, as shown in table (2).

**Table 2:-** Changes in AST (IU/mL) and ALT (IU/mL) levels and  $\gamma$ -GT activity (IU/L) in the different studied groups.

Group	AST (IU/mL)	ALT (IU/mL)	$\gamma$ -GT activity (IU/L)
<b>Control group (10)</b>	18.14 $\pm 1.78$	8.85 $\pm 1.19$	5.04 $\pm 0.59$
<b>Vitamin D3 supplemented group (10)</b> P	21.64 $\pm 1.55$ NS	10.11 $\pm 0.56$ NS	6.39 $\pm 0.49$ NS
<b>Diabetic group (10)</b> P	36.49 $\pm 3.01$ $< 0.001$	36.79 $\pm 5.04$ $< 0.001$	23.67 $\pm 1.91$ $< 0.001$
<b>Vitamin D3 treated diabetic group (10)</b> P P*	27.4 $\pm 2.91$ $< 0.02$ $< 0.02$	27.1 $\pm 2.93$ $< 0.001$ $< 0.05$	11.55 $\pm 1.38$ $< 0.002$ $< 0.001$

In parenthesis is the number of rats studied in each group.

Values are expressed as means  $\pm$  SEM.

P: Significance by LSD at  $P < 0.05$  from the control group.

P\*: Significance by LSD at  $P < 0.05$  from the diabetic group.

NS: Not significant.

The diabetic group showed significantly elevated plasma levels of triglycerides, total cholesterol and LDL-Cholesterol, accompanied by significantly reduced plasma HDL-Cholesterol compared to the control group, whereas vitamin D3 treated diabetic group had significantly increased only plasma total cholesterol and LDL-Cholesterol levels compared to the control group. However, vitamin D3 treated diabetic group showed significantly decreased plasma levels of triglycerides, total cholesterol and LDL-Cholesterol accompanied by a significant rise of plasma HDL-Cholesterol compared to the diabetic group. Although atherogenic index was significantly elevated in untreated and treated diabetic groups compared to the control group, it was significantly decreased in vitamin D3 treated diabetic group compared to the diabetic group. Non-significant changes in lipid profile were present in vitamin D3 supplemented group compared to the control group, as shown in table (3) and fig.(1).

**Table 3:-** Lipid profile changes in the different studied groups.

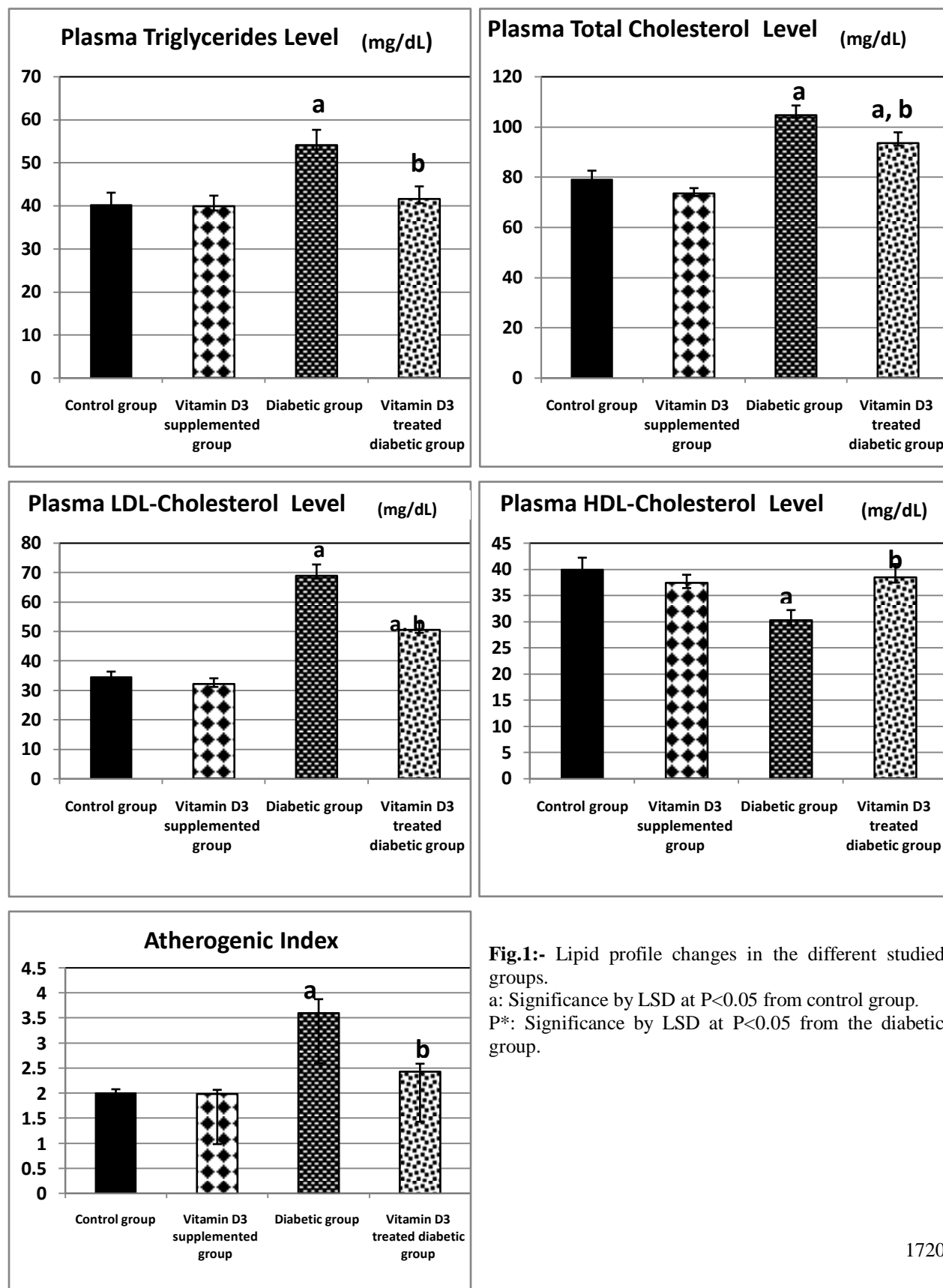
Group	Triglycerides (mg/dl)	Total Cholesterol (mg/dl)	LDL- Cholesterol (mg/dl)	HDL- Cholesterol (mg/dl)	Atherogenic index
<b>Control group (10)</b>	40.18 $\pm 2.82$	79.06 $\pm 3.42$	34.53 $\pm 1.78$	39.96 $\pm 2.24$	2.002 $\pm 0.079$
<b>Vitamin D3 supplemented group (10)</b> P	39.86 $\pm 2.45$ NS	73.41 $\pm 2.12$ NS	32.11 $\pm 1.93$ NS	37.39 $\pm 1.55$ NS	1.987 $\pm 0.083$ NS
<b>Diabetic group (10)</b> P	54.05 $\pm 3.55$ $< 0.005$	104.56 $\pm 3.87$ $< 0.001$	68.86 $\pm 3.84$ $< 0.001$	30.24 $\pm 1.94$ $< 0.005$	3.6 $\pm 0.278$ $< 0.001$
<b>Vitamin D3 treated diabetic group (10)</b> P P*	41.54 $\pm 2.92$ NS $< 0.01$	93.46 $\pm 4.28$ $< 0.01$ $< 0.05$	50.49 $\pm 2.47$ $< 0.001$ $< 0.001$	38.44 $\pm 2.55$ NS $< 0.02$	2.432 $\pm 0.159$ NS $< 0.001$



In parenthesis is the number of rats studied in each group.

Values are expressed as means  $\pm$  SEM. NS: Not significant.

P: Significance by LSD at  $P < 0.05$  from control group. P\*: Significance by LSD at  $P < 0.05$  from the diabetic group.



**Fig.1:-** Lipid profile changes in the different studied groups.

a: Significance by LSD at  $P < 0.05$  from control group.

P\*: Significance by LSD at  $P < 0.05$  from the diabetic group.

Similar levels of SCD1 gene expression was detected in Vitamin D3 supplemented group and control group with insignificant differences. However, the diabetic group showed downregulated SCD1 mRNA by 10 folds less than control group denoting that SCD1 mRNA levels and the enzyme activity in liver were strongly downregulated in both diabetic groups (treated and untreated). In addition, in vitamin D3 treated diabetic group, SCD1 mRNA level was significantly decreased compared to control group; however, it was significantly elevated compared to the diabetic group, as shown in table (4).

**Table 4:-** Changes of liver cell mitochondrial NAD<sup>+</sup> (nmol/mg tissue protein) and liver cell SCD1 gene expression [(fold)/ul] in the different studied groups.

Group	Mitochondrial NAD <sup>+</sup> (nmol/mg tissue protein)	SCD1 Gene expression (fold)/ul
<b>Control group (10)</b>	7.52 ±0.97	0.768 ±0.067
<b>Vitamin D3 supplemented group (10) P</b>	8.18 ±1.14 NS	0.865 ±0.031 NS
<b>Diabetic group (10) P</b>	15.97 ±1.16 <0.001	0.065 ±0.017 <0.002
<b>Vitamin D3 treated diabetic group (10) P P*</b>	10.48 ±1.14 NS <0.002	0.412 ±0.051 <0.001 <0.005

In parenthesis is the number of rats studied in each group.

Values are expressed as means ±SEM.

P: Significance by LSD at P<0.05 from control group.

P\*: Significance by LSD at P<0.05 from the diabetic group.

NS: Not significant.

Liver cell mitochondrial NAD<sup>+</sup> was significantly elevated in the diabetic group compared to the control group, and was insignificantly changed in vitamin D3 treated diabetic and vitamin D3 supplemented groups compared to the control group. On the other hand, there was significant decline in liver cell mitochondrial NAD<sup>+</sup> in vitamin D3 treated diabetic group compared to the diabetic group, as shown in table (4).

## Discussion:-

Induction of type 2 diabetes mellitus in rats was confirmed by assessment of biochemical indicators which includes; hyperglycemia, hyperinsulinemia and poor glycemic control. Poor glycemic control was evaluated by HbA1c, and elevated HOMA-IR as indicator for insulin resistance (Ahmad et al., 2016).

Vitamin D3 treated diabetic group showed reduction in hyperglycemia, hyperinsulinemia and insulin resistance compared to the diabetic group. These findings agree with the study of Talaei et al. (2013), who found that vitamin D3 supplementation could reduce insulin resistance in Type 2 diabetic patients. Obese persons, who might be diabetics, could have lowered circulating 25(OH) D levels (Bell et al. 1985; Wortsman et al. 2000), which could be due to the storage of vitamin D3 and 25 (OH) vitamin D3 in adipose tissue (Wortsman et al. 2000). Thus, Borissova et al. (2003) suggested that vitamin D3 supplementation could treat type 2 diabetes mellitus during the winter.

However, Vitamin D injection (Heshmat et al., 2011) and vitamin D intake did not change the glycemic control in the diabetics (Behradmanesh et al., 2011). Also, Boucher et al. (1995) found that vitamin D caused elevated blood glucose level in diabetic patients compared to the pre-treatment value 8-12 weeks after a single vitamin D injection in a dose of 2500 mg, they attributed the failure to correct diabetes by vitamin D in their study to the moderate increase of 25(OH) plasma vitamin D levels to be only 25 nmol/L.

These protective vitamin D3 effects in diabetes mellitus could be due to its anti-inflammatory properties, or it might affect calcium and phosphorus metabolism facilitating insulin secretion and synthesis via  $\beta$ -cell calcium-dependent

endopeptidases (Chiu et al., 2004). Calcium, also, is essential for  $\beta$ -cell glycolysis, which plays a role in signaling circulating glucose concentration (Boucher, 1998). Moreover, vitamin D could upregulate the insulin receptor gene (Maestro et al., 2002). These mechanisms could be supported by presence of vitamin D receptors on pancreatic  $\beta$  cells (Zittermann, 2006), and in skeletal muscle (Simpson et al., 1985), expression of  $1\alpha$  hydroxylase in pancreatic  $\beta$  cells (Bland et al., 2004) and presence of vitamin D response element insulin receptor genes transcription (Maestro et al., 2002).

In the current study, the diabetic group was dyslipidemic evidenced by elevated plasma levels of triglycerides, total cholesterol, LDL-Cholesterol and atherogenic index accompanied by reduced plasma HDL-Cholesterol compared to the control group. Similar findings were reported in Ahmad et al. (2016). Also, Kudchodkar et al. (1988) reported that elevated plasma triglycerides levels might be commonly present in diabetes mellitus, and could be due to deficient lipoprotein lipase activity (Bruan and Severson, 1992). Thus, Lopes-Virella et al. (1983) found that insulin treatment in diabetics lowered plasma triglycerides levels by normalizing lipoprotein lipase levels.

Treatment of type 2 diabetes mellitus by vitamin D, in this study, ameliorated the diabetes mellitus induced dyslipidemia, manifested by lowered plasma levels of triglycerides, total cholesterol, LDL-Cholesterol and atherogenic index together with higher plasma HDL-Cholesterol compared to the diabetic group. When comparing vitamin D3 treated diabetic group and the control group, only total cholesterol and LDL-Cholesterol were reduced. These findings were similar to the study of Al-Daghri et al. (2012), who found that vitamin D3 administration daily for 18 months caused lowered levels of total cholesterol and LDL cholesterol, without changes in levels of triglycerides and HDL cholesterol. Similarly, Shehab et al. (2012) found significant correlations with total cholesterol, LDL-cholesterol with vitamin D. This lipolytic actions of vitamin D3 could be due to upregulation of lipolytic enzymes hormone sensitive and lipoprotein lipases induced by  $1, 25(\text{OH})_2\text{D}$  (Huang et al., 2013).

However, the lipid lowering effect of vitamin D3 in the diabetic group, in the present study, disagree with the study of Breslavsky et al. (2013), who found no changes in levels of total cholesterol, LDL cholesterol, HDL cholesterol and triglycerides in type 2 diabetics despite vitamin D administration for 12 months. The discrepancy of vitamin D effects on lipid profile in type 2 diabetes mellitus was attributed to the requirement of  $25(\text{OH})\text{D}$  levels to be higher than 28-32 ng/ml in the type 2 diabetic persons to induce such possible extra-skeletal benefits of vitamin D (Hossein-nezhad and Holick, 2013).

The diabetic group had liver cell injury, evidenced by elevated plasma levels of AST, ALT and plasma  $\gamma$ -GT activity, which were in accordance to Hamadi et al. (2012). This damage could be due to the oxidative stress present in the diabetic group (Kakkar et al., 1998). Tangvarasittichai (2015) reported that increased glucose, free fatty acids (FFA) and insulin levels caused reactive oxygen species overproduction, increased oxidative stress and activate stress transduction factor pathways resulting to inhibited insulin activity and secretion causing the onset of type 2 diabetes mellitus.

Vitamin D3 treated diabetic group had lowered AST, ALT and  $\gamma$ -GT activity compared to the diabetic group, denoting hepato-protective effects of vitamin D3 which were similar to the study of George et al. (2012). They reported that the restoring effect of vitamin D3 could be mediated through vitamin D receptor modulation, thereby improving signal transduction and controlling free radicals in the liver of diabetic rats, suggesting a potential role for vitamin D3 in the treatment of diabetes-associated hepatic complications. In addition, the active vitamin D's roles of improving the hepatic steatosis and hepatic insulin resistance could be mediated through its receptor-activated peroxisome proliferator-activated receptors- $\alpha$  (PPAR- $\alpha$ ) signaling pathway (Yin et al., 2012; Zhao et al., 2013).

The protective vitamin D3 effect against liver cell injury observed in the current study may be attributed to its lipid lowering effect. Similar explanation was reported by Yin et al. (2012), who found that vitamin D3 preventing effect against hepatic steatosis was due to inhibited lipogenesis and the elevated FFA oxidation in rat liver.

Liver cell mitochondrial  $\text{NAD}^+$ , as an indicator of oxidative stress, was significantly elevated in the diabetic group compared to the control group. This new finding in type 2 diabetes mellitus could explain the oxidative stress present in diabetes mellitus, which was found in the study of Kakkar et al. (1998). They, also, suggested that oxidative stress could be the cause of development and progression of diabetes mellitus. The elevated  $\text{NAD}^+$  in liver cells of diabetic group could be due to transient upregulated mitochondrial oxidative capacity in the liver, similar to

the study on obese insulin-resistant persons with or without fatty liver resulting to oxidative stress (**Koliaki and Roden, 2016**).

The vitamin D3 treatment had decreased mitochondrial  $\text{NAD}^+$  in treated diabetic group in the present study. This is in accordance to the study of **Chang and Kim (2016)**, who found that 1,25(OH) $_2$ D treatment elevated NAD-to-NADH ratio, and suggested that vitamin D could cause fat mobilization and reducing intracellular fat accumulation and increase lipolysis.

The elevated mitochondrial  $\text{NAD}^+$  could be linked to higher plasma levels of liver enzymes present in the diabetic group. **Maxwell et al. (1997)** reported that diabetes mellitus could cause oxidative damage resulted from antioxidant protection defects, thereby many diabetic complications could be developed. Also, **Alam et al. (2014)** found that the antioxidant treatment of diabetic rats, which was quercetin, had lowered liver enzymes and oxidative stress markers. Thus, the hepato-protective effects of vitamin D3 in diabetes mellitus, observed in this study, assure the antioxidant and lipolytic effects of vitamin D3.

In addition, both diabetic and vitamin D3 treated diabetic groups showed downregulation of SCD1 m-RNA levels in liver cells. SCD1 enzyme has an important role in lipid metabolism and energy expenditure in mammals (**Wang et al., 2008**). SCD genes are regulated at the transcriptional level by the diet, hormones such as insulin and temperature (**Wang et al., 2005**). This could explain the changes present in SCD1 m-RNA levels in liver cells in both diabetic groups (treated and untreated). Moreover, **Popeijus et al. (2008)** reported that raised, rather than reduced, SCD1 mRNA levels could be negatively associated with insulin resistance.

**Droge(2002)** mentioned that SCD-1 could cause fat storage when its activity is elevated, and towards oxidation, when become less active. Hence elevated fatty acid oxidation could raise toxic free radicals levels, the presence of SCD1 downregulation and higher mitochondrial  $\text{NAD}^+$  in liver cells, in this study, could be linked together.

It was reported by **Ntambi et al.(2002)** that diabetic dyslipidemia could be attributed to downregulated SCD1 m-RNA levels in liver cells. Mice with whole-body SCD1 deficiency were lean, and developed severe hypercholesterolaemia and a marked decrease in HDL cholesterol levels when they were fed a low-fat, high-carbohydrate diet (**Flowers et al., 2006**). Also, the downregulated SCD1 in liver cells could be linked to the insulin resistance in the diabetic group. **Roden(2006)** reported that the hepatic SCD1 activity index was correlated with insulin sensitivity. **Stefan et al. (2008)** mentioned that SCD1 could affect insulin sensitivity via regulation of fat accumulation in the liver. High liver fat could cause hepatic and skeletal muscle insulin resistance (**Stefan et al., 2006**), thus hepatic SCD1 activity could regulate skeletal muscle insulin sensitivity(**Stefan et al., 2008**).

In this study, the novel finding of upregulated SCD1 m-RNA levels in liver cells in vitamin D3 treated diabetic group compared to the diabetic group, could explain the decreased insulin resistance. This suggestion could be supported by high SCD1 activity protected both from obesity and from palmitate-induced insulin resistance and lipotoxicity(**Busch et al., 2005**). Moreover,**Foster (2004)** reported that a marked stimulation of the transcription factor carbohydrate-responsive element binding protein were present in the fed state activating the genes of fatty acid and triglyceride synthesis. Thus, SCD-1 is lipogenic via more than one pathway. In the fasting state, SCD-1 levels decreased due to insulin decrease and glucagon increase. This, also, could explain the presence of downregulated SCD1 in liver cell in the vitamin D3 treated diabetic group compared to the control group.

Therefore, the vitamin D3 ameliorated liver damage, dyslipidemia, downregulation of liver cell SCD1 and controlled elevated liver cell mitochondrial  $\text{NAD}^+$  in type 2 diabetes mellitus.

### Conclusion:-

Diabetes mellitus resulted in deteriorated liver functions in diabetic rats and downregulation of SCD1 m-RNA levels in liver cells. Such changes could be caused by oxidative stress and were alleviated by vitamin D3 treatment.

### Conflict of Interest:-

The authors declared no conflict of interest in this study.

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**References:-**

1. Ahmad H, Ahmed Z, Khan R. Effect of Chromium Picolinate Supplementation on Diabetic Profile and Nutritional Status of the Type-2 Diabetic Adult Population – A Randomized Controlled Trial. *J. Food and Nutrition Research*. 4(8): 535-542, 2016
2. Alam MM, Meerza D, Naseem I. Protective effect of quercetin on hyperglycemia, oxidative stress and DNA damage in alloxan induced type 2 diabetic mice. *Life Sci* 109(1):8-14, 2014
3. Al-Daghri N, Alkharfy K, Al-Othman A, El-Kholie E, Moharram O, Alokail M, Al-Saleh Y, Sabico S, Kumar S, Chrousos G. Vitamin D supplementation as an adjuvant therapy for patients with T2DM: an 18-month prospective interventional study. *CardiovascDiabetol* 11: 85, 2012.
4. Behradmanesh S, Roudini K, Baradaran A. Effect of Supplementary Vitamin D on Improvement of Glycemic Parameters in Patients with Type 2 Diabetic. *J Isfahan Med Sch* 29(151):1098–1105, 2011.
5. Bell NH, Epstein S, Greene A, Shary J, Oexmann MJ, Shaw S. Evidence for alteration of the vitamin D-endocrine system in obese subjects. *J ClinInves* 76: 370–373, 1985.
6. Bland R, Markovic D, Hills CE, Hughes SV, Chan SL, Squires PE, Hewison M. Expression of 25-hydroxyvitamin D3-1 $\alpha$ -hydroxylase in pancreatic islets. *J Steroid BiochemMolBiol* 89–90(1–5):121–125, 2004.
7. BorissovaAM ,Tankova T , Kirilov G , Dakovska L , Kovacheva R. The effect of vitamin D3 on insulin secretion and peripheral insulin sensitivity in type 2 diabetic patients. *Int. J. Clin. Pra.* 57(4):258-261, 2003.
8. Boucher BJ. Inadequate vitamin D status. Does it contribute to the disorders comprising syndrome “X”. *Br J Nutr* 79: 315–327, 1998.
9. Boucher BJ, Mannan N, Noonan K, Hales CN, Evans SJ. Glucose intolerance and impairment of insulin secretion in relation to vitamin D deficiency in East London Asians. *Diabetologia* 38: 1239-1245, 1995.
10. Breslavsky A, Frand J, Matas Z, Boaz M, Barnea, Z, Shargorodsky M. Effect of high doses of vitamin D on arterial properties, adiponectin, leptin and glucose homeostasis in type 2 diabetic patients. *ClinNutr* 32: 970-975, 2013.
11. BruanJEA and Severson DL. Lipoprotein lipase released from myocytes is increased by decavandate but not insulin. *Am. J. of Physiol* 262(E): 663-E670, 1992.
12. Busch AK, Gurisik E, Cordery DV, Michelle Sudlow, Gareth S, Denyer D, Labutt R, Hughes WE, Biden TJ. Increased fatty acid desaturation and enhanced expression of stearoyl coenzyme A desaturase protects pancreatic beta-cells from lipoapoptosis. *Diabetes* 54:2917–2924, 2005.
13. Chang E and Kim Y. Vitamin D decreases adipocyte lipid storage and increases NAD-SIRT1 pathway in 3T3-L1 adipocytes. *Nutrition* 32: 702–708, 2016.
14. Chiu KC, Chu A, Go VLW, Saad MF. Hypovitaminosis D is associated with insulin resistance and  $\beta$  cell dysfunction. *Am J ClinNutr* 79: 820–825, 2004.
15. Danaei G, Finucane MM, Lu Y, Singh GM, Cowan MJ, Paciorek CJ, Lin JK, Farzadfar F, Khang YH, Stevens GA, Rao M, Ali MK, Riley LM, Robinson CA, Ezzati M. National, regional, and global trends in fasting plasma glucose and diabetes prevalence since 1980: systematic analysis of health examination surveys and epidemiological studies with 370 country-years and 2.7 million participants. *Lancet* 378:3-40, 2011.
16. DeLuca HF and Cantorna MT. Vitamin D: its role and uses in immunology. *FASEB J* 15:2579-2585, 2001.
17. Dobrzyn P and Dobrzyn A. Stearoyl-CoA desaturase: a new therapeutic target of liver steatosis. *Drug Development Research* 67(8): 643-650, 2006.
18. Droge W. Free radicals in the physiological control of cell function. *Physiol. Rev.* 82: 47-95, 2002.
19. Flier JS, Khan CR, Roth J. Receptor, anti-receptor antibodies and mechanisms of insulin resistance. *New Engl. J Med.* 300: 413-419, 1979.
20. Flowers MT, Groen AK, Oler AT, Keller M, Choi Y, Schueler KL, Richards OC, Lan H, Miyazaki CM, KuipersF, Kendziorzski CM, Ntambi JM, Attie AD. Cholestasis and hypercholesterolemia in SCD1-deficient mice fed a low-fat, high carbohydrate diet. *J Lipid Res* 47:2668–2680, 2006.
21. Foster DW. The Role of the Carnitine System in Human Metabolism *Annals of the New York Academy of Sciences* 1033:1-16, 2004.
22. Fruchart JC. Separation of low density lipoproteins and determination of cholesterol and phospholipids bound to this fraction. *Rev. Fr. Des laboratoires* 103: 7-17, 1982.
23. George N, Kumar TP, Antony S, Jayanarayanan S. Effect of vitamin D3 in reducing metabolic and oxidative stress in the liver of streptozotocin-induced diabetic rats. *British journal of Nutrition* 108(8): 1410-1418, 2012.
24. Giacco F and Brownlee M. Oxidative stress and diabetic complications *Circ Res.* 107(9): 1058-1070, 2010.
25. Gregori S, Giarratana N, Smioldo S, Uskokovic M, Adorini L. A 1 $\alpha$ , 25-dihydroxyvitamin D(3) analog enhances regulatory T-cells and arrests autoimmune diabetes in NOD mice. *Diabetes* 51: 1367-1374, 2002.

26. Grundy SM, Greenland P, Herd A, Huebsch JA, Jones RJ, Mitchell JH, Schlant RC. Cardiovascular and risk factor evaluation of healthy American adults. A statement for physicians by an Ad Hoc Committee appointed by the Steering Committee, American Heart Association. *Circulation* 75: 1340A-1362A, 1987.
27. Hamadi N, Mansour A, Hassan MH, Khalifi-Touhami F, Badary O. Ameliorative effects of resveratrol on liver injury in streptozotocin-induced diabetic rats. *J Biochem Mol Toxicol* 26(10):384-92, 2012.
28. Heshmat R, Tabatabaee O, Moradzade K, Abasszade S. The effect of parenteral vitamin D supplementation on insulin resistance and anthropometric factors in patients with diabetes type 2. *Iran J Diabetes Lipid Disord* 10(5):492-501, 2011.
29. Holick MF. Vitamin D: importance in the prevention of cancers, type 1 diabetes, heart disease, and osteoporosis. *Am J Clin Nutr*; 79: 362-371, 2004.
30. Holland B and Welch A. Hormone in insulin resistance of abdominal obesity: cause or effect? The composition of food 5:115, 1992.
31. Hossein-nezhad A and Holick M. Vitamin D for health: a global perspective. *Mayo Clin Proc* 88: 720-755, 2013.
32. Huang Y, Li X, Wang M, Ning H, Lima A, Li Y, Sun C. Lipoprotein lipase links vitamin D, insulin resistance, and type 2 diabetes: a cross-sectional epidemiological study. *Cardiovasc Diabetol* 12:17, 2013.
33. Jeppsson JO, Kobold U, Barr J, Finke A, Hoelzel W, Hoshino T, Miedema K, Mosca A, Mauri P, Paroni R, Thienpont L, Umemoto M, Weykamp C. Approved IFCC Reference Method for the Measurement of HbA1c in Human Bl. *Cl. Chem and Lab Med.* 40(1):78-89, 2002.
34. Kakkar R, Mantha SV, Radhi J, Prasad K, Kalra J. Increased oxidative stress in rat liver and pancreas during progression of streptozotocin-induced diabetes. *Clin Sci* 94:623-632, 1998.
35. Koliaki C and Roden M. Alterations of mitochondrial function and insulin sensitivity in human obesity and diabetes mellitus. *Annual Review of Nutrition* 36: 337-367, 2016.
36. Kudchodkar BJ, Lee JC, Lee SM, DiMarco NM, Lacko AG. Effect of cholesterol homeostasis in diabetic rats. *Journal of Lipid Research* 29: 1272-1287, 1988.
37. Lopes-Virella MF, Stone P, Ellis S, Clowell JA. Cholesterol determination in high-density lipoproteins separated by three different methods. *Clin. Chem.* 23: 882, 1977.
38. Luong K, Nguyen LTH, Nguyen DNP. The role of vitamin D in protecting type 1 diabetes mellitus. *Diabetes Metab Res Rev* 21: 338-346, 2005.
39. Maestro B, Davila N, Carranza MC, Calle C: Identification of a Vitamin D response element in the human insulin receptor gene promoter. *J Steroid Biochem Mol Biol* 2003, 84(2-3):223-230.
40. Maestro B, Molero S, Bajo S. Transcriptional activation of the human insulin receptor gene by 1, 25-dihydroxyvitamin D(3). *Cell bio-chem funct* 20:227-232, 2002.
41. Mathieu C, Gysemans C, Guilletti A, Bouillon R. Vitamin D and diabetes. *Diabetologia* 48: 1247-1257, 2005.
42. Maxwell SRJ, Thomason H, Sandler D, Leguen C, Baxter MA, Thorpe GHG, Jones AF, Barnett AH. Antioxidant status in patients with uncomplicated insulin-dependent and non-insulin-dependent diabetes mellitus. *European J of Clin Invest* 27(6):484-490, 1997.
43. Miyazaki M and Ntambi JM. Role of stearoyl-coenzyme A desaturase in lipid metabolism. *Prostaglandins, Leukotrienes and Essential Fatty Acids* 68(2) 113-121, 2003.
44. Ntambi JM, Miyazaki M, Stoehr JP, Lan H, Kendziora CM, Yandell BS, Song Y, Cohen P, Friedman JM, Attie AD. Loss of stearoyl-CoA desaturase-1 function protects mice against adiposity. *Proc Natl Acad Sci USA* 99(17):11482-11486, 2002.
45. Ogunkolade BW, Boucher BJ, Prah J, Bustin SA, Burrin JM, Noonan K, North BV, Mannan N, McDermott MF, Deluca HF, Hitman GA. Vitamin D receptor (VDR) mRNA and VDR protein levels in relation to vitamin D status, insulin secretory capacity, and VDR genotype in Bangladeshi Asians. *Diabetes*; 51: 2294-2300, 2002.
46. Ortlepp JR, Metrikat J, Albrecht M, Von Korff A, Hanrath P, Hoffmann R. The vitamin D receptor gene variant and physical activity predicts fasting glucose levels in healthy young men. *Diabet Med* 20: 451-454, 2003.
47. Palomer X, González-Clemente JM, Blanco-Vaca F, Mauricio D. Role of vitamin D in the pathogenesis of type 2 diabetes mellitus. *Diabetes, Obesity and Metabolism* 10(3):185-197, 2008.
48. Popeijus HE, Saris WHM, Mensink RP. Role of stearoyl-CoA desaturases in obesity and the metabolic syndrome. *Int. J. of Obesity* 32:1076-1082, 2008.
49. Reitman S. and Frankel S. A colorimetric method for determining serum glutamic oxaloacetic and glutamic pyruvic transaminases. *Am. J. Clin. Pathol.* 28: 56-63, 1957.
50. Rifai N, Bachorik PS, and Albers JJ. Lipids, lipoproteins and apolipoproteins. In: Burtis CA, Ashwood ER, Tietz (3rd edn). W.B Saunders, Philadelphia, 809-861, 1999.

51. Roden M. Mechanisms of disease: hepatic steatosis in type 2 diabetes pathogenesis and clinical relevance. *Nat ClinPractEndocrinolMetab* 2:335–348, 2006.
52. Saleh NK, Saleh HA. Protective effects of vitamin E against myocardial ischemia/reperfusion injury in rats. *Saudi Med J* 31(2): 142-147, 2010.
53. Salgado ALF, de Carvalho L, Oliveira AC, Nascimento VN, Vieira JG, Parise ER. Insulin resistance index (HOMA-IR) in the differentiation of patients with non-alcoholic fatty liver disease and healthy individuals, *Arq. Gastroenterol.* 47 (2):165-169, 2010.
54. Shehab D, Al-Jarallah K, Mojiminiyi OA, Al Mohamedy H, Abdella NA. Does Vitamin D deficiency play a role in peripheral neuropathy in Type 2 diabetes? *Diabet. Med.* 29: 43-49, 2012.
55. Shulman GI. Cellular mechanisms of insulin resistance. *J. Clin. Invest.* 106: 171-176, 2000.
56. Simpson RU, Thomas GA, Arnold AJ. Identification of 1, 25-dihydroxyvitamin D3 receptors and activities in muscle. *J Biological Chemistry* 260(15):8882–8891, 1985.
57. Srinivasan K., Viswanad B., Asrat L., Kaul C.L., and Ramarao P. (2005): Combination of high-fat diet-fed and low-dose streptozotocin-treated rat: a model for type 2 diabetes and pharmacological screening, *Pharmacol Res.* 52(4):313-320.
58. Stefan N, Hennige AM, Staiger H, Machann J, Schick F, Krober SM, Machicao F, Fritsche A, Haring H. Alpha2-Heremans-Schmid glycoprotein/fetuin-A is associated with insulin resistance and fat accumulation in the liver in humans. *Diabetes Care* 29:853-857, 2006.
59. Stefan N, Peter A, Cegan A, Staiger H, Machann J, Schick F, Claussen CD, Fritsche A, Häring HU and Schleicher E. Low hepatic stearoyl-CoA desaturase 1 activity is associated with fatty liver and insulin resistance in obese humans. *Diabetologia* 51:648–656, 2008.
60. Stene LC, Ulriksen J, Magnus P, Joner G. Use of cod liver oil during pregnancy is associated with lower risk of type 1 diabetes in the offspring. *Diabetologia* 43: 1093-1098, 2000.
61. Talaei A, Mohamadi M, Adgi Z. The effect of vitamin D on insulin resistance in patients with type 2 diabetes. *Diabetology & Metabolic Syndrome* 5:8, 2013.
62. Tangvarasittichai S. Oxidative stress, insulin resistance, dyslipidemia and type 2 diabetes mellitus. *World J Diabetes* 6(3): 456-480, 2015.
63. Tietz NW. Textbook of clinical chemistry, W.B. Saunders co London, 1986.
64. Vassault A, Grafmeyer D, Naudin C, Dumont GR, Bailly M. Protocole de validation de techniques. *Ann Bio Clin* 44: 679-685, 1986.
65. Wang J, Yu L, Schmidt RE, Su C, Huang X, Gould K, Cao G. Characterization of HSCD5, a novel human stearoyl-CoA desaturase unique to primates. *BiochemBiophys Res Commun* 332: 735, 2005.
66. Wang J, Yu L, Wang H, Gao Y, Schrementi JP, Porter RK, Yurek DA, Kuo M, Suen C, Cao G, Bean JS, Kauffman RF, Qian Y. Identification and characterization of Hamster Stearoyl-Co a desaturase isoforms. *Lipids* 43: 197, 2008.
67. Wortsman J, Matsuo LY, Chen TC, Lu Z, Holick MF. Decreased bioavailability of vitamin D in obesity. *Am J Clin Nut* 72: 690-693, 2000.
68. Yang Y, Liu B, Gao L, Wang D, Chen Q, Wang Q, Song M. Effect of 1, 25-Dihydroxyvitamin D3 on triglyceride content and expressions of protein tyrosine phosphatase-1B in liver of type 2 diabetes mellitus rat. *Int J ClinExp Med* 9(6):9425-9430, 2016.
69. Yin Y, Yu Z, Xia M, Luo X, Lu X, Ling W. Vitamin D attenuates high fat diet-induced hepatic steatosis in rats by modulating lipid metabolism. *Eur J Clin Invest* 42: 1189-1196, 2012.
70. Zeitz U, Weber K, Soegiarto DW, Wolf E, Balling R, Erben RG. Impaired insulin secretory capacity in mice lacking a functional vitamin D receptor. *FASEB J* 17:509-511, 2003.
71. Zhang J, Huang Y, Hou T, Wang Y. Hypoglycemic effect of *Artemisia sphaerocephala* Krasch seed polysaccharide in alloxan-induced diabetic rats. *SWISS. MED. WKLY.*, 136: 529-532, 2006.
72. Zhao XQ, Quan L, Du GL, Xiao S, Lü WK, Zhu J. Protective effects and mechanisms of 1, 25(OH)2D3 on diabetes-induced liver injury in a streptozotocin-diabetic rat model. *Zho-nghuaGanZang Bing ZaZhi* 21: 778-780, 2013.
73. Zittermann A. Vitamin D and disease prevention with special reference to cardiovascular disease. *ProgBiophysMolBiol* 92:39-48, 2006.



### RESEARCH ARTICLE

#### MINERAL TRIOXIDE AGGREGATE (MTA) FOR APICAL BARRIER FOR IMMATURE NECROTIC PERMANENT TEETH - FOUR CASE REPORTS

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Four cases of Apexification, MTA

#### Abstract

Open apex is a common occurrence and conservative approach should be applied because the affected teeth are immature in nature. This article describes the management of open apices with periapical radiolucencies in maxillary incisors. Mineral trioxide aggregate (MTA) was used to form an apical barrier and rest of the canal was obturated with different technique. The case series intends to testify the efficacy of MTA as an agent for Apexification and its effect on periapical healing.

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#### Introduction:-

A major problem in performing endodontic immature teeth with necrotic pulp and wide open apices is obtaining an optimal seal of root canal system. The complete formation of root and closure of the apical foramen occurs up to 3 years after the eruption. Traumatic dental injuries to young permanent teeth during this period may cause pulpal inflammation or necrosis and subsequent incomplete development of the dentinal walls and root apices [1]. These teeth present wide dentinal tubules that allow the penetration of bacteria and their irritants. The management of a non-vital tooth with open apex consists of the induction of a natural or artificial apical barrier which can act as a stop for the obturating material. **Apexification** is defined as 'a method to induce a calcified barrier in a root with an open apex or the continued apical development of an incomplete root in teeth with necrotic pulp' [2].

Various techniques were used to induce the apexification process. The most common traditionally used medicament is Calcium Hydroxide. It was first introduced by Kaiser and Frank in 1960's. The approximate time for induction of calcified apical barrier varies between 6 months and 24 months. Although technique is efficient with predictable outcomes, it has several disadvantages like prolonged treatment time, chances of re-infection and risk of cervical fracture [3].

Among the various materials, **Mineral Trioxide Aggregate (MTA)** is considered as one of the most promising materials because of its superior biocompatibility and less cytotoxicity due to its alkaline pH and presence of calcium and phosphate ions resulting in capacity to attract blastic cells and promote favourable conditions for cementum deposition. However MTA has certain disadvantages like high solubility, prolonged setting time of

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In this article, 4 cases are described in which MTA was used to the successful closure of root apex in pulpless permanent maxillary teeth with wide open apex. These cases illustrate the potential benefits of MTA and its relative ease of use for management of open apex and apexification at easily accessed sites.

### **Case Reports:-**

Four cases of open apices reported at different time in the Department of Conservative Dentistry and Endodontics, Guru Nanak Institute of Dental Science and Research, Kolkata- 700114 with the **chief complaint** of discolouration in upper front teeth region of mouth. The age of the patients were in a range between 21 to 25 years. The medical and dental histories were non-contributory. All of the four cases were presented with similar features as follows :-

**History-** Trauma 12-13 years back.

### **Clinical presentation:-**

1. Discolouration
2. Offending tooth shows negative response in electric pulp test (EPT)
3. Non mobile and non tender

### **Radiographic presentation:-**

Circumferential periapical radiolucency with wide open apex along with thin root dentin. The bony support of the tooth was completely intact.

### **Treatment procedure:-**

The treatment protocol was performed as follows :-access cavity was prepared using no.2 round bur (Dentmark) and refined with endo Z bur (Dentsply) with rubber dam (Coltene) isolation. Working length was established by radiograph. Biomechanical preparation and circumferential filling was done with 80 K file. Irrigation was performed with 3% sodium hypochlorite and normal saline alternatively. Calcium hydroxide as an intracanal medicament was placed in the canal for 1 week and the access cavity was sealed with zinc oxide eugenol.

On recall visit, the tooth was found to be asymptomatic clinically and radiographically. Intracanal medicament was removed by irrigating with alternating solutions of 3% Sodium hypochlorite and saline. The canal was completely dried with size 80 absorbent paper point and the absorbable gelatin base foam (AbGel) placed apically as a barrier.

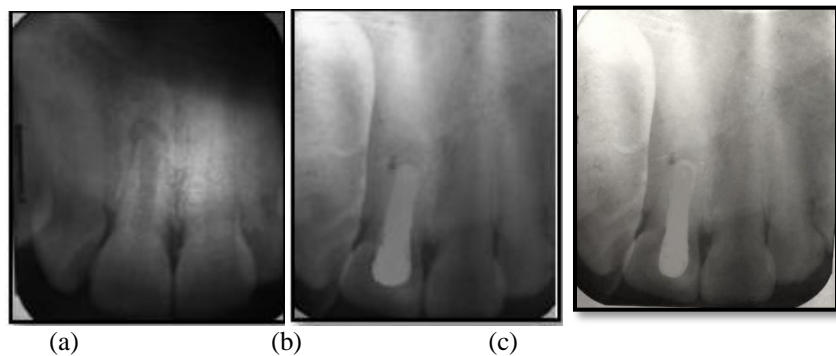
### **For the first two cases:-**

MTA was mixed with manufacturer's supplied liquid to a consistency of wet sand and placed in increments in the apical region of the canal and gently adapted using endodontic pluggers until entire canal was filled with MTA and correct placement of MTA apical plug was assessed radiographically. Access cavity was temporized with zinc oxide eugenol.

### **For rest of the two cases:-**

MTA was mixed with manufacturer's supplied liquid to a consistency of wet sand and placed in increments in the apical region of the canal and gently adapted to the apical portion using endodontic pluggers until an apical plug of 4-5 mm was reached. Correct placement of MTA apical plug was assessed radiographically. Following the placement of MTA over the barrier, butt-end of a paper point was used to clean out any excess material from the walls. Wet sterile cotton was placed in the canal above MTA and access cavity was temporized with zinc oxide eugenol.

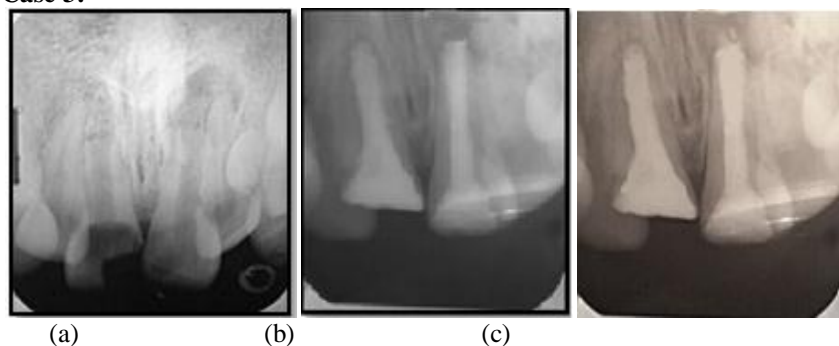
On recall visit, the patient was asymptomatic and rest of the canal space was obturated with gutta flow and post obturation access cavity restoration was done with light cure composite resin (Filtek Z 250 XT, 3M ESPE) on the same day. The patients were recalled at every 1 month interval for a period of 6 months for clinical and radiographic assessment during this period.

**Case 1:-**

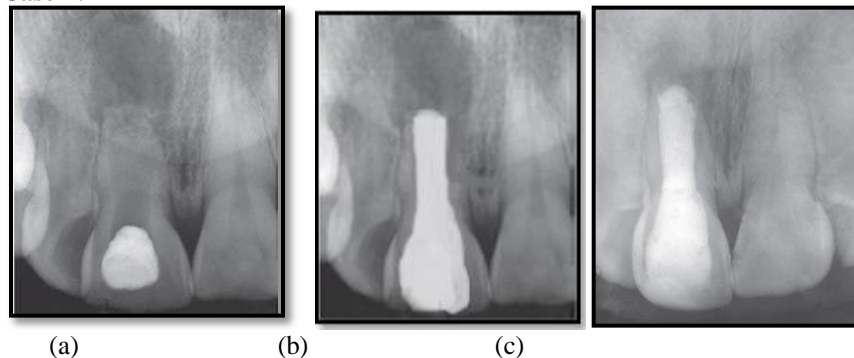
- (a)- Pre operative radiograph (21)  
(b)- Post operative radiograph  
(c)- 6 months follow up radiograph

**Case 2:**

- (a)- Pre operative radiograph (11)  
(b)- Post operative radiograph  
(c)- 6 months follow up radiograph

**Case 3:**

- (a)- Pre operative radiograph (11, 21)  
(b)- Post operative radiograph  
(c)- 6 months follow up radiograph

**Case 4:**

- (a)- Pre operative radiograph (21)  
(b)- Post operative radiograph  
(c)- 6 months follow up radiograph

**Discussion:-**

The completion of root development and closure of the apex occurs up to 3 years following eruption of the tooth (Nolla 1960). After crown formation, the inner and outer enamel epithelium develop as a two-layered epithelial wall to form Hertwig's epithelial root sheath (HERS), which plays a key role in the differentiation of odontoblasts. When the first layer of dentine has been laid down, HERS begins to disintegrate and only the cell rests of Malassez persist in the periodontal ligament. At the same time, HERS progresses in an apical direction until complete formation of the root. When teeth with incomplete root formation suffer pulp necrosis, the root development ceases and apical closure cannot be achieved. Calcium hydroxide pastes have been considered as the material of choice to induce the formation of a hard tissue apical barrier. In 1966, Coviello and Brilliant [5] in 1979 and Schumacher and Rutledge [6] in 1993 suggested calcium hydroxide as a permanent apical barrier. Its efficiency has been demonstrated by many authors, even in the presence of an apical lesion (Chosack et al. 1997, Felipe et al. 2006). However, calcium hydroxide for apexification requires long treatment period. The intracanal dressing needs to be change at regular intervals. Further, the alkaline pH causes collagen degradation and denaturation of dentinal organic proteins causing weakening of dentinal walls [7].

With the discovery of MTA by Torabinejad et al [8] it has become the material of choice for apexification. Single visit apexification is now a viable treatment option for the immature apex. The main constituents are Calcium silicate, bismuth oxide, calcium carbonate ( $\text{CaCO}_3$ ), calcium sulfate, calcium aluminate. It contains a hydrophilic powder that reacts with water and produces calcium hydroxide and  $\text{CaSiO}_4$  hydrated gel. MTA has a range of advantages such as biocompatibility [8] hard tissue formation, sealing ability, antibacterial property.

Interradicular biofilms are usually present in cases with long- standing periapical lesions. Complete obturation with bioactive materials such as MTA in such cases not only have an advantage of cementum formation, but materials like MTA possess antibacterial properties.[ In addition, GP sealer interface can harbor a tenacious gram- positive bacteria and fungi. Such organisms have an ability to survive between GP/sealer and dentin [9]. Further, it is important to seal the canal and prevent bacterial penetration. For this, it is required that the material should adapt and adhere to dentin wall. Various studies have shown MTA forms complete seal due to the interaction of calcium and phosphate ions that facilitates the formation of apatite crystals at material dentin interface hence prevents bacterial leakage [10].

Torabinejad et al. compared the antibacterial property of MTA, amalgam, super EBA (zinc oxide eugenol modified with ethoxybenzoic acid), zinc oxide eugenol (ZOE), and found that MTA has an antibacterial effect on five of nine facultative bacteria but no effect on any of the strict anaerobes. MTA is not affected by the presence of blood. Holland et al. theorized that the tricalcium oxide in MTA reacts with tissue fluids to form calcium hydroxide, resulting in an apical barrier [10].

The patient was kept on 6 months follow- up and radiographic assessment was done during this period. Periapical healing was seen on radiographic observance. This may due to the fact that MTA has superior marginal adaptation. Periapical radiolucency was almost completely healed after 6 months follow- up. In these cases, the circumferential diameter of radiolucency was decreased [11].

**Conclusion:-**

On the basis of radiographic follow-ups we can conclude that the MTA can be successfully used as an apical plug for apexification and subsequent reduction of periapical radiolucency.

**References:-**

1. Bhasker SN. Orban's oral histology and embryology. 11th ed. St. Louis: Mosby-Year Book; 1991. p. 382.
2. American Association of Endodontists: Glossary of endodontic terms. [Updated 2013 Nov 6].
3. Samir S, Bhavesh M, Khushboo D, et al. Hemisection – A conservative approach for a periodontally compromised tooth - A Case Report. *Journal of Advanced Oral Research* 2012; 3: 63-65.
4. M. Najeeb S, Cert P, Jorge M, et al. Hemisection as an Alternative Treatment for Decayed Multirrooted Terminal Abutment: A Case Report. *Journal of the Canadian Dental Association* 2009; 5:75-77.
5. Coviello J, Brilliant JD. A preliminary clinical study on the use of tricalcium phosphate as an apical barrier. *J Endod* 1979; 5:6- 13.
6. Schumacher JW, Rutledge RE. An alternative to apexification. *J Endod* 1993; 19:529- 31.
7. Andreasen JO, Farik B, Munksgaard EC. Long- term calcium hydroxide as a root canal dressing may increase risk of root fracture. *Dent Traumatol* 2002; 18:134- 7.
8. Torabinejad M, Watson TF, Pitt Ford TR. Sealing ability of a mineral trioxide aggregate when used as a root end filling material. *J Endod* 1993; 19:591- 5.
9. Siqueira JF Jr. Aetiology of root canal treatment failure: Why well- treated teeth can fail. *Int Endod J* 2001; 34:1- 10.
10. Sarkar NK, Caicedo R, Ritwik P, Moiseyeva R, Kawashima I. Physicochemical basis of the biologic properties of mineral trioxide aggregate. *J Endod* 2005; 31:97- 100.
11. Soundappan S, Sundaramurthy JL, Raghu S, Natanasabapathy V. Biodentine versus mineral trioxide aggregate versus intermediate restorative material for retrograde root end filling: An in vitro study. *J Dent (Tehran)* 2014; 11:143- 9.

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## RESEARCH ARTICLE

### CELIAC DISEASE AWARENESS AMONG PHYSICIANS IN SAUDI ARABIA: AN EPIDEMIOLOGICAL STUDY.

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Celiac disease, Awareness, and  
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#### Abstract

**Background:** Although Celiac disease (CD) prevalence has progressively increased in the last 20 years worldwide, affecting as high as 2.5% of population in Saudi Arabia, the level of physician's knowledge of this disease has not been reported.

**Objective:** The aim of this study is to assess the knowledge of CD among Saudi physicians who face this common health problem in their clinics.

**Methodology:** We conducted this cross-sectional survey of 286 consultant physicians within 6 medical subspecialties and were based in 6 different medical centers in Riyadh, Saudi Arabia in the period from October 2013 to February 2014. A special questionnaire to test physician's knowledge of celiac disease was designed based on the relevant literature, and it was validated through a pilot study prior to data collection.

**Results:** In the physician survey only 131 (46%) physicians returned the questionnaires. The majority of our respondents had more than 10 years of practice (49.62%). There were several significant findings from the participants' response to the questionnaire. For example, Celiac disease is common in the west as in Saudi Arabia but only 23 (17.56%) out of 131 were not aware of this fact. Furthermore, 29 (22.14%) out of the 131 physicians did not know that intestinal biopsy is a mandatory test to confirm celiac disease.

**Conclusion:** There is a significant percentage of physicians who did not have enough knowledge about CD. This might affect the early detection of the disease and the patients' quality of life negatively.

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#### Introduction:-

Celiac disease (CD) is a chronic systemic immune-mediated disease induced by dietary gluten proteins present in wheat, rye and barley. CD is an inflammatory disorder of the upper small intestine, most probably caused by an abnormal immune reaction to wheat gliadin<sup>(1)</sup>. The Celiac disease (CD) prevalence has progressively increased in the last 20 years and, recently, it was proposed that it might affect 0.6 to 1.0% of population worldwide, and as high as

2.5% in Saudi Arabia<sup>(2-7)</sup>. However, the lack of physician's awareness of celiac disease clinical features, associations, diagnosis treatment and complications may negatively affects their care. The high prevalence of celiac disease makes the early diagnosis of the disease of high importance. The association between the knowledge of the physicians about certain information in celiac disease and the delay of diagnosis and treatment is becoming more evident. The aim of this study is to detect the awareness of the CD disease among primary care physicians, internists, hematologists, endocrinologists, pediatricians and gastroenterologists at Riyadh, which might give us an idea about the delay in diagnosis and treatment plans of celiac disease in Saudi Arabia.

The rationale of this study was that the lack of knowledge of this common disease might delay the diagnosis and cause many serious complications, which could easily be prevented. We believe the information obtained would help to design and conduct educational and training program for involved physician about the celiac disease in the future.

### Materials and Methods:-

This is a cross-sectional survey of 286 physicians which was conducted Riyadh, Saudi Arabia from October 2013 to February 2014 among 6 medical subspecialties who face this CD commonly on their outpatient clinics. This group of physicians included: primary care physicians, gastroenterologists, internists, endocrinologists, hematologists and pediatricians who were based in 6 different medical centers in Riyadh. A special questionnaire to test physician's knowledge of celiac disease was designed based on previous studies and it was validated among 10 physicians prior to starting the study. Hard copies of this questionnaire were handed to a total of 286 physicians, where only 131 physicians have responded. This questionnaire composed of 16 self-administered English questions. The questionnaires asked physicians to choose the correct answer in each of the following topics: etiology, age at onset of symptoms, clinical features, associated diseases, complications of celiac disease, and the diagnosis and management of the celiac disease. There were 3 to 7 options in each of these categories, including some incorrect options and the choice of "I don't know".

We estimate the expected frequency will be 11% that we took from a previous research done in 2005 in USA under the title (physician awareness of celiac disease). Our confidence limits will be 5% with a worst expected percent about 6%, Our confidence level will be 99%. We added 10% non-responsive estimation to our sample size. The Data was entered on Microsoft Excel and checked by two members of the team. Then the data was sent to a statistician, for analyses using The Statistics and Data Analysis Program (Stata) 12.1 version. The Data collected from the questionnaires was divided according to the variables associated to the physicians' awareness about celiac disease (Gender, age, specialty, hospital were the physician works, years of practice).

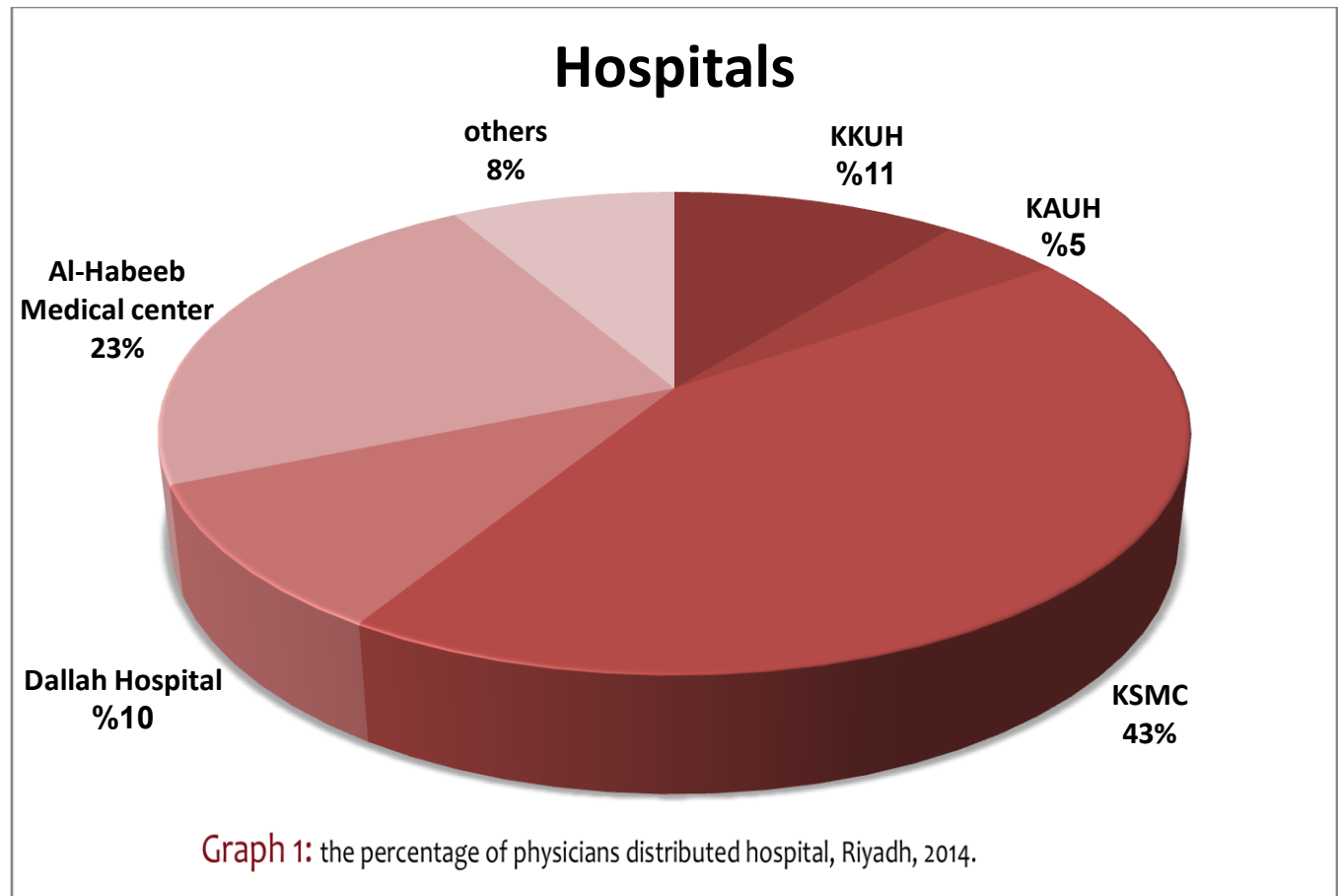
### Results:-

In the physician survey only 131 (46%) physicians (110 (83.97%) male and 21 females (16.03%)) returned the questionnaires. 46 (35.11%) of our target physicians were between the age group of 30-40 years old. From the years of practice, the majority of our respondents had more than 10 years of practice 65 (49.62%), followed by 35 (26.72%) who had 1-5 years of practice <sup>[Table 1]</sup>. but only 66 (50.38%) had ever diagnosed a patient with celiac disease.

**Table 1:-**years of practice of the physicians that were included in the study, Riyadh, 2014.

Years Of practice:	Number	Percentage
<1 year	5	3.82
1-5	35	26.72
6-10	26	19.85
>10 years	65	49.62
Total	131	100%

The 16 questions which assessed the awareness of physicians attending at: King Khalid University Hospital (KKUH), king Saud Medical City (KSMC), King Abdulaziz University Hospital (KAUH), Dallah hospital, Al-Habeeb medical centers and some other medical centers. The highest respondents we got was 57 (43.51%) from King Saud Medical City (KSMC), followed by 30 (22.90%) from Al-Habeeb Medical Centers <sup>[graph 1]</sup>.



The specialties of our target physicians were: Primary Care Physician Gastroenterologist, Hematologist, Internal Medicine, Endocrinologist and Pediatrician. The highest respondents we got were 43 (32.82%) pediatricians, followed by 31 (23.66%) physicians from internal medicine <sup>[table 2]</sup>.

**Table 2:-** the number and percentage of physicians' specialties that were included in the study, Riyadh, 2014.

Specialty	Number	Percentage
Pediatrician	43	32.82%
Internal Medicine	31	23.66%
Primary Care Physician	24	18.32%
Gastroenterologist	19	14.50%
Endocrinologist	13	9.92%
Hematologist	1	0.76%
Total	131	100%

The results of physician questionnaires are summarized in <sup>[Table 3]</sup>.

**Table 3:-** the questions and correct answers of the questionnaire with the number and percentage of the physicians who answered them correctly, Riyadh, 2014.

Survey questions	Physician Awareness (%)
Wheat products Celiac disease is an intolerance to	118 (90.08%)
Celiac disease is affecting patients at any age	84 (64.12%)
Celiac disease is not common in the west compared to Saudi Arabia	23 (17.56%)
Bleeding of rectum is not one of the most common symptoms of Celiac disease	117 (89.31%)
Cough is not related to Celiac disease	60 (45.80%)
Asthma is not related to celiac disease	43 (32.82%)

Celiac disease is highly associated with diabetes type1 more than type2	94 (71.76%)
Colon cancer is not a complication of Celiac disease	24 (18.32%)
Intestinal biopsy is a mandatory test to confirm celiac disease	102 (77.86%)
Anti-tissue transglutaminase antibody (anti-tTG) is the most specific celiac antibody test	69 (52.67%)
blood tests for gluten autoantibodies are accurate only while on a gluten containing diet	60 (45.80%)
There is no need to do a genetic testing for the family members of a person diagnosed with celiac disease	53 (40.46%)
Gluten-free diet is a first step in the management of the celiac disease patient	128 (97.91%)
The damage of small intestine will be repaired again after the diet	111 (84.73%)
The gluten-free diet should be a lifelong diet	122 (93.13%)

### Discussion:-

In this study we investigated the awareness of Celiac disease among physicians, and the study showed that there is inadequate knowledge of Celiac disease among physicians.

Celiac disease (CD) is a chronic systemic immune-mediated disease induced by dietary gluten proteins present in wheat products. CD is an inflammatory disorder of the upper small intestine, most probably caused by an abnormal immune reaction to wheat gliadin.<sup>(1)</sup> In the survey 13 physicians (9.92%) out of the 131 physicians didn't know that Celiac disease is intolerance to wheat products.

The diagnosis of celiac disease requires a intestinal biopsy that shows the characteristic findings of intraepithelial lymphocytosis, intestinal villous atrophy and crypt hyperplasia affecting the lining of the upper small intestine.<sup>(8,9)</sup> In our survey 29(22.14%) physician out of the 131 physicians didn't know that intestinal biopsy is a mandatory test to confirm celiac disease.

The Identification of celiac disease is facilitated by widely available serologic tests, the most sensitive antibody tests for the diagnosis of celiac disease are of the IgA class particularly anti-endomysial antibodies, antigliadin antibodies and anti-tissue transglutaminase antibodies<sup>(9,10)</sup>.

The antigliadin antibodies are only sensitive in children younger than 18 months of age, Anti-tissue transglutaminase antibody (anti- tTG) is the most specific celiac antibody test.<sup>(10,11)</sup> In the survey 62 (47.33%) physician out of the 131 physicians didn't know that Anti-tissue transglutaminase antibody (anti- tTG) is the most specific celiac antibody test.

A range of symptoms, signs and complications may be associated with CD, depending on the degree of intestinal involvement. In the survey we tried to ask our physicians in different ways to test the knowledge of Celiac disease symptoms and signs. The physicians generally knew that bleeding per rectum is not one of the most common symptoms of Celiac disease. Approximately most of our physicians didn't know that cough, asthma and colon cancer are no related to celiac disease.

Although the prevalence of CD has been considered very low in Saudi Arabia, a recent study has shown a serology prevalence rate of 2.2% (1 in 45) among healthy students, which might be one of the highest rates of celiac disease in the world.<sup>(7)</sup> The prevalence of celiac disease among risk groups in Saudi Arabia is 9.5% in short stature children<sup>(13)</sup> and 10%<sup>(14)</sup> or 8.1%<sup>(15)</sup> in Type 1 diabetes children. In our survey more than 80% of our physicians didn't know that Celiac disease is very common in Saudi Arabia compared to the west. Although most of our physicians knew that Celiac disease is highly associated with diabetes type1 more than type2.

Treatment and follow up of Celiac disease involves a gluten-free diet, which means the elimination of all types of food containing gluten which means the elimination of wheat, barley and rye from their diet<sup>(16)</sup> Most of patients respond very well to the gluten-free diet and their clinical features decline in days or weeks, though the histology of intestine needs months to recover.<sup>(17)</sup> Generally 85% and above of our physicians knew that Gluten-free diet is a first step in the management of the celiac disease patient and should be a lifelong diet and the damage of small intestine will be repaired again after the diet.



The high prevalence of celiac disease makes the early diagnosis of the disease of high importance. The association between the knowledge of the physicians about certain information in celiac disease and the delay of diagnosis and treatment is becoming more evident. From the previous studies and our study we noticed a lack of physician's awareness of celiac disease clinical features, associations, diagnosis treatment and complications that may negatively affects patients care. These new studies have shown the importance of CD for our health care system. Although, this disease is widely spread, its yet often undiagnosed, mainly because of the lacks of awareness among physicians.<sup>(18,19)</sup> Most of the recent studies are showing a huge need for increasing awareness of the clinical manifestations of CD, as well as increasing awareness of dietary management plans.<sup>(20,21,22)</sup>

#### **Study Limitations:-**

Short time to conduct the research.

#### **Recommendation:-**

We need to increase the sample size, so it can more representation of Riyadh region physicians in addition once we have more data, we need to compare the awareness of the gastroenterologist to the awareness of the other physician groups.

#### **Conclusion:-**

We found that there is significant percentage of physicians did not have enough knowledge about Celiac disease that may affect the early detection of the disease and the patients' quality of life negatively and may lead to complications and delay their treatment.

#### **Acknowledgements:-**

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#### **References:-**

1. Green PH, Jabri B, Coeliac disease. Lancet 2003;362:383-91.
2. West J, Logan RF, Hill PG, et al. Seroprevalence, correlates, and characteristics of undetected coeliac disease in England. Gut 2003;52:960-5.
3. Mäki M, Mustalahti K, Kokkonen J, et al. Prevalence of celiac disease among children in Finland. N Engl J Med 2003;348: 2517-24.
4. Tatar G, Elsurer R, Simsek H, et al. Screening of tissue transglutaminase antibody in healthy blood donors for celiac disease screening in the Turkish population. Dig Dis Sci 2004;49:1479-84.
5. Fasano A, Berti I, Gerarduzzi T, et al. Prevalence of celiac disease in at-risk and not-at-risk groups in the United States: a large multicenter study. Arch Intern Med 2003;163:286-92.
6. Bingley PJ, Williams AJ, Norcross AJ, et al. Undiagnosed coeliac disease at age seven: population based prospective birth cohort study. BMJ 2004;328:322-3.
7. Aljebreen AM, Almadi MA, Alhammad A, Al Faleh FZ. Seroprevalence of celiac among healthy adolescents in Saudi Arabia. World J Gastroenterol 2013; 19: 2374-8.
8. Riordan FA, Davidson DC. Revised criteria for diagnosis of coeliac disease and medical audit.
9. Arch Dis Child 1991; 66: 561.
10. Rostom A, Murray JA, Kagnoff MF. American Gastroenterological Association (AGA) Institute technical review on the diagnosis and management of celiac disease. Gastroenterology 2006; 131: 1981-2002.
11. 10 - Frost AR, Band MM, Conway GS. Serological screening for coeliac disease in adults with Turner's syndrome: prevalence and clinical significance of endomysium antibody positivity. Eur J Endocrinol 2009;160:675-9.
12. Sugai E, Vázquez H, Nachman F, et al. Accuracy of testing for antibodies to synthetic gliadin-related peptides in celiac disease. Clin Gastroenterol Hepatol 2006;4: 1112-7.
13. Rostom A, Dube C, Cranney A, et al. The diagnostic accuracy of serologic tests for celiac disease: a systematic

- review. *Gastroenterology* 2005;128:Suppl 1:S38-S46.
14. Saadah OI, Al Agha AE, Albokhari SM Al Mughales JA. Screening of Saudi children with short stature for celiac disease. 2nd World Congress of Paediatric Gastroenterology Hepatology and Nutrition. Paris, 2004: Abstract P0405.
  15. Saadah OI, Agha AE, Albokhari SM, Al Mughales JA. Prevalence of celiac disease in Saudi children with type 1 diabetes mellitus. 2nd World Congress of paediatric Gastroenterology Hepatology and Nutrition. Paris, July 2004. Abstract P0408.
  16. Al-Ashwal AA, Shabib SM, Sakati NA, Attia NA. Prevalence and characteristics of celiac disease in type I diabetes mellitus in Saudi Arabia. *Saudi Med J* 2003; 24: 1113-1115.
  17. Peräaho M, Kaukinen K, Mustalahti K, et al. Effect of an oats-containing gluten-free diet on symptoms and quality of life in coeliac disease: a randomized study. *Scand J Gastroenterol* 2004;39:27- 31.
  18. Lee SK, Lo W, Memeo L, Rotterdam H, Green PH. Duodenal histology in patients with celiac disease after treatment with a gluten-free diet. *Gastrointest Endosc* 2003; 57:187-91.
  19. Michael M, Recognizing and managing celiac disease in primary care. *J Am Acad Nurse Pract* 2003; 15: 108-14.
  20. Dickey W, McMillan SA, Hughes DF. Identification of coeliac disease in primary care. *Scand J Gastroenterol* 1998; 33: 491-3.
  21. Lanzarotto F, Crimi F, Amato M, Villanacci V, Pillan NM, Lanzini A. Is under diagnosis of celiac disease compounded by mismanagement in the primary care setting?. A survey in the Italian Province of Brescia. *Minerva Gastroenterol Dietol* 2004; 50: 283-8.
  22. Ress K, Harro M, Maaroos HI, Harro J, Uibo R , Uibo O. High prevalence of coeliac disease: need for increasing awareness among physicians. *Dig Liver Dis* 2007; 39: 136-9.
  23. Zipser RD, Farid M, Baisch D, Patel B, Patel D. Physician awareness of celiac disease: A need for further education. *J Gen Intern Med.* 2005; 20: 644–6.

**Appendices:-**  
**Questionnaire:-**

The purpose of this survey is to determine the knowledge and the awareness of the physician about celiac disease. The questionnaire is voluntary and the data collected is strictly confidential.

---

**Name (optional):** \_\_\_\_\_

**Gender:** ☐ Male. ☐ Female.

**Age:** ☐ 25-30 ☐ 30-40 ☐ 40-50 ☐ >50

**Specialty:**

☐ Primary Care Physician ☐ Internal Medicine

☐ Gastroenterologist ☐ Endocrinologist

☐ Hematologist. ☐ Pediatrician

**Which of the following is the hospital that you work in?**

☐ King Khalid University Hospital (KKUH).

☐ King Abdulaziz university Hospital (KAUH).

☐ King Saud Medical City (al-shemaisi).

☐ Dallah Hospital.

☐ Al-Habeeb Medical centers.

☐ Other: \_\_\_\_\_

**Years of practice:** ☐ <1 year ☐ 1-5 ☐ 6-10 ☐ > 10 years

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All the questions have one answer, so please pick the one you think is the correct.

1. How many celiac disease patients did you diagnosed in the past 1 year?

☐ <1 ☐ 1-5 ☐ 5-10 ☐ 10-15 ☐ >15

2. Celiac disease is an intolerance to

☐ milk products ☐ wheat products ☐ milk, wheat and oats products ☐ cow milk  
☐ I don't know.

3. Celiac disease affect patients at this age

☐ Children ☐ Adults ☐ Elderly ☐ at any age ☐ I don't know.

## RB approval:-

4. Celiac disease is common in the west compared to Saudi Arabia?  
☐Yes. ☐No. ☐I don't know.
5. Bleeding per rectum is one of the most common symptoms of celiac disease  
☐Yes. ☐No. ☐I don't know.
6. Which one of the symptoms is not related to celiac disease?  
☐Shortness of breath ☐Depression ☐palpitations ☐weight loss ☐fatigue ☐cough  
☐I don't know.
7. Which one of the following is not related to celiac disease  
☐ulcerative colitis ☐liver disease ☐asthma ☐Downs syndrome ☐diabetes mellitus  
☐hypothyroidism ☐I don't know.
8. Celiac disease is believed to be highly associated with diabetes type2 more than type1.  
☐Yes. ☐No. ☐I don't know.
9. Which of the following is not a complication of celiac disease?  
☐seizure ☐osteoporosis ☐intestinal lymphoma ☐infertility ☐small bowel cancer  
☐colon cancer ☐I don't know.
10. Intestinal biopsy is a mandatory test to confirm celiac disease.  
☐Yes. ☐No. ☐I don't know.
11. The most specific celiac antibody test is:  
☐Anti-gliadin Antibody (AGA) ☐Anti-endomysial Antibody (EMA) ☐Anti-tissue  
transglutaminase Antibody (anti-tTG)
12. The blood tests for gluten autoantibodies are accurate only while on a gluten containing diet.  
☐Yes. ☐No. ☐I don't know.
13. There is no need to do a genetic testing for the family members of a person diagnosed with celiac disease.  
☐Yes. ☐No. ☐I don't know.
14. The first step in the management of the celiac disease patient is  
☐gluten free diet ☐immunosuppression ☐antibiotics ☐lactose free diet ☐I don't know
15. The damage of small intestine will not be repaired again after the diet  
☐Yes. ☐No. ☐I don't know.
16. The gluten-free diet should be a lifelong diet.  
☐Yes. ☐No. ☐I don't know.



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### RESEARCH ARTICLE

#### INDONESIAN NATIONAL ARMY IN NATURAL DISASTER MANAGEMENT: A CASE STUDY OF THE 2004 KELUD MOUNTAIN ERUPTION.

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#### Abstract

Indonesia has been hit by several natural disasters, and Kelud mountain eruption which occurred on February 13<sup>th</sup> 2004 was one of the heaviest natural disaster occurred in Indonesia. The result shows that anticipation, preparedness, responses and recovery are provided by the Indonesian army Kodim (The Military District Command) 0818/ Malang district and Batu in cope with managing the natural disaster from Kelud mountain. Anticipation and preparedness include planting, fixing the drain/gutter, guiding and doing the natural disaster simulation. Meanwhile responses after Kelud mountain eruption include evacuation of victims, inventory loss, building the Aid Post, and distributing the logistics. Rehabilitation and reconstruction of facilities and infrastructures of the public interests and the people's properties are provided by Indonesian army as recovery action. However, the limited fund, unclear duties, limited education and training, also limited equipment become great obstacles for the successfulness of natural disaster managing. Thus, strategies in cope with solving those obstacle factors such as education and training, providing self-funding, and proposing the new regulations are discussed.

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#### Introduction:

The constitution of Indonesian republic 1945 states: "... Indonesian Government protects all Indonesian people and Indonesian lands and develops the public welfares, educates the people's lives and joins to do the worlds' orders (diciplines) based on the independence and eternal peace and social justice,..." (the introduction of Indonesian constitution, 4<sup>th</sup> paragraph), it means that Indonesian government was created to protect all Indonesian people and Indonesian lands, develops the Indonesian society's welfare, joins the worlds' order (diciplines) based on the similarities in the freedom, eternal peaces and social justice that are accepted by the societies and the world's nations. As one of the nation's components, the Indonesian National Army (TNI) has the obligation to help managing the disasters happened to the whole Indonesian areas. The aid duties to handle the natural disaster done by the Indonesian National Army (TNI) is one of the military operations other than in cope with the war (OMSP) which

is mandated in the Indonesian Constitution No. 3 2002 which is about national Defense (the gazettes of Indonesian Republic the year of 2002 no.03, furthermore, the gazettes of Indonesian republic no. 4169), and then it is called UU PN, article 10 point (3) c namely; ‘ The Indonesian National Army has duty to do the Policy of the National Defense to do the Military Operation out of War’. According to Syamsul Maarif, (Syamsul Maarif, 2012: 141) : the role of Military in managing the disaster is also managed internationally. It is stated in the General Assembly Resolution of the United Nation Organization N. 46/182, human aids must be given on the bases of humanity, neutrality and without taking any sides. Besides, it is also stated that Guiding of the Military Asset Use and The civil defense in the Disaster aids. (Oslo Guidelines, 1994 – updates November 2006, revision 1.1 November 2007). The cooperation between the Indonesian National Army and the National Board for Disaster Management (BNPB) is very strategic especially in giving the responses that is very perceptive on the disaster. Today BNPB and the Indonesian National Army (TNI) have made the Memorandum of Understanding (MOU) between the Defense Ministry, the Indonesian National Army Commander and BNPB with MOU number: MOU / 01 / M / 2011; Kerma / 1 / I / 2011; MOU. 1 / BNPB / I / 2011. The scope of the cooperation involves the management of the disaster that covers the operational and administration activities. In the MOU it is stated that the Defense Ministry has duties: (1) helping the BNPB in the PRB, (2) doing the coordination and facilitating the aids from the other foreign countries which want to give the aids/helps involving the military in PB, (3) The Education of Magister Disaster Management for National Security (Syamsul Maarif, 2012; 139). The aid duty of the natural disaster management done by the Indonesian National Army (TNI) is one of parts of OMSP, which has become the main duties of the Indonesian National Army. As a lesson that happened to Nanggroe Aceh Darussalam, in 2004 there was tsunami, the headquarter of the Indonesian National Army had made a quick reaction force for disaster management (PRCPB) in accordance with the decision of the Indonesian National Army commander no. Perpang / 35 / XI / 2007 dated November 21 2007 about PRCPB of the Indonesian National Army (TNI). The Headquarter of the Indonesian National Army has arranged in detail about the training, the supply fulfillment and the preparation of the operation procedures involving the Indonesian national Army. The Military District Command (Kodim) 0818/Malang district area and Batu has involved in the management disaster of the volcano many times especially in the disaster of the volcano eruption like Semeru, Bromo and Kelud mountains. It causes the Military District Command (Kodim) 0818/Malang district area and Batu has readiness in facing the eruption disaster of the volcanoes. A squad like the Military District Command (Kodim) is the Task Force (Satgas) PRCPB of the Indonesian National Army in the level of the district/city that has duty to help the government district/city in managing the disaster (Book of Natural Disaster Management Guides on the land, 2009;19). The aim of this research is to review and analyze the Capacity of the Infantry of the Indonesian National Army in doing the duty of Kelud mountain natural disaster management; to review and analyze the factors that hinder in doing the duties from the Infantry of the Indonesian national Army in managing the Kelud mountain disaster. An event can be considered into a disaster if there are fatalities even though there is only one victim. It is caused by the new point of view about the safety theory in which human is used as the Center of Gravity. This point of view has developed since the end of the cold war in 1990. Definition of Human Security according to UNDP (1994) is: “Safety from constant threat of hunger, disease, crime and depression. It is also mean of protection from sudden and hurtful disruption in the pattern of our daily lives—whether in our homes, in our jobs, in our communities or in our environment.” In the development implementation, Human security must become the main attention in the nation policy. The government must guarantee that the societies’ interests become the main priority in every nation policy.

There are 2 (two) main categories in the Human Security namely Freedom From Fear and Freedom From Want. The threat that can disturb the continuity and the existence from the Human Security has big number. The United Nations Organization (PBB) categorizes the threat towards Human Security into 7 categories (UNDP, 1994); namely:

1. Economic security;
2. Food security;
3. Health security;
4. Environmental security;
5. Personal security;
6. Community security;
7. Political security.

There are 2 main categories in the Human Security namely Freedom From Fear And Freedom From Want. The threat that can disturb the continuity and the existence of the Human Security has big amount. The first four threats (economic security, food security, health security and environmental security) are grouped as **Freedom From Want** and the next three threats (personal security, community security and political security) are grouped into

**Freedom From Fear.** The natural disaster can be categorized as the threat of nontraditional that one day it can appear suddenly and can disturb the existence of the human being due to its effects. If it is related to the 7 threats mentioned above, the natural disaster can be categorized as a factual threat for the **environmental security** due to the effects that can take human's lives, can cause the destruction to the environment, can cause the wealth disappearance and etc. Capacity can be defined as a human's ability or organization's or a part of the organization to perform some functions effectively, efficiently, and sustainably to reach the organization's goals optimally. ([http://www.access-indo.or.id/documents/OCA\\_Manual.pdf](http://www.access-indo.or.id/documents/OCA_Manual.pdf)). According to Hilder brandand Grindle (1994:10) quoted by Monica Blage schudan John Young in Capacity Development for Policy Advocacy : Current thinking and approach hesamongencies supporting Civil Society Organisations (2006), it is explained that capacity is The ability to perform appropriatetasks effectively, efficiently and sustainably.

Elements that exists in the capacity according to Loubser (1993: 23) like quoted by Blage schudan Young (2006) consists of:

1. Specified objectives ;
2. Efforts ;
3. Capabilities;
4. Resources ;
5. Work organization

Millen (2006 ; 12) stated that capacity is "the individual, organizational or system' ability or to run their functions as they should be efficiently, effectively, and sustainably". Morgan in Millen (2006; 10) defined capacity as "the ability, skills, attitude understanding, values, relationship, behavior, motivation, sources, and conditions that make every individual, organization, networking/sectors and wider system possible to do their functions and reach the development goals which have been set from time to time". Managing disaster according to Cop pola in his book entitled Introduction to International Disaster Management, is divided into: Mitigation, Preparedness, Response, andRecovery. Phasing the disaster management is in the book entitled Integratingenviron mental safe guards into Disaster Management : afieldmanual. Sriyanie Mitht hapala, (2008; 75) explains that phasing the disaster management is divided into activities before the disaster happens, and activities after the disaster happens.

#### **Activities before the disaster happens are divided into:-**

##### **a. Prevention**

Prevention covers the protection done by building the structures and the infra structures to stop the disaster effects. It includes the policy and the legalization that influence the development plans.

##### **b. Mitigation**

Mitigation is an effort to reduce the impacts caused by the natural disaster. The activities done are by giving the counseling and suggestions about the disaster potential that happens.

##### **c. Preparedness**

Preparedness aims to reduce the loss of human lives as minimum as possible, building destruction and the infrastructures through fast and efficient actions towards rehabilitation responses. With the readiness, the society and the other stakeholders have possibility to give responses quickly, and precisely to the disaster and organized them well including the early warning, evacuation routes which have been planned and etc.

#### **Activities after the disaster happens:-**

##### **a. Response/Relief**

Response/Relief is collective actions done as soon as the disaster happens with purposes to save the victims, to lighten their sufferings and to reduce the economic loss due to the disaster. the actions done are by giving helps which include evacuating the victims to the safe locations, providing food, clothes, and etc.

##### **b. Recovery**

Recovery is activities done to return the humans psychologically and the infrastructures to the normal levels after the disaster happens. The activities done are by building the temporary houses and providing basic household facilities.

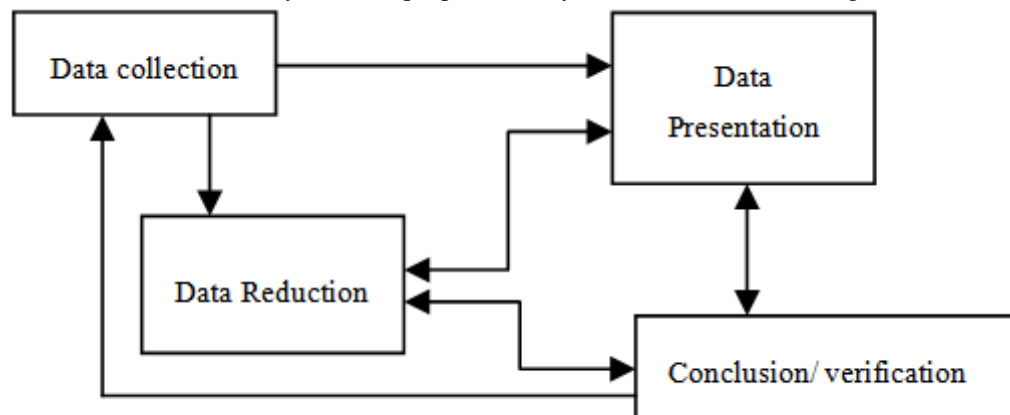
### Rebuilding

Rebuilding is a long period response done after the disaster happens. In this phase, the permanent infrastructures are rebuilt, the ecosystems are recovered and the livelihoods that are broken due to the destruction of the disaster are rehabilitated.

As the explanation (implementation) from the duties of Military Operation out of War (OMSP), it is mandated on the Indonesian Republic Laws No. 3 2002 about the Defense; the Indonesian Republic Laws No. 34 2004 about the Indonesian National Army; the Indonesian Republic Laws No. 24 2007 about the Disaster Management and the Doctrine of the Indonesian National Army Tridek 2007 and the Interim (temporary) Manuscript Doctrine of Kartika Eka Paksi 2007, The Headquarter of the Indonesian National Infantry Army formulated 11 guiding books PMSP from 14 duties of OMSP which become the main duties of the Indonesian National Infantry Army. Those guiding books are used as the basic rules and involvement rules in doing the duties of OMSP for the Indonesian National Infantry Army Force. Those guiding books also states that, in helping the central government or the local government to handle the natural disaster, the rapid reaction task force of the disaster management (Satgas PRCPB) from the Infantry Army are posted in all city levels and the operations are done in all Indonesian territories ( the headquarter of the Indonesian National Infantry Army, 2009, page 16). It is also done at the Military District Command (Kodim) 0818/Malang District and Batu in managing the eruption disaster of Kelud mountain.

### Materials and Methods:-

This research is qualitative research, it is a research based on the concept of “going exploring” which involves in- depth and case- oriented study upon some cases or single case (Finlay, 2006). This research aims to describe, elaborate and analyze the problems which appear in involving the Force of the Indonesian National Infantry Army of the Military District Command 0818/Malang District and Batu in managing the natural disaster of Kelud mountain eruption reviewed from the point of view of the personnel readiness. Therefore, the data source, the informants, or the interviewees, which will be extracted to get the information, are the soldiers of the Indonesian National Infantry Army who are involved, the leaders or the commanders of the forces, the field commanders of the Indonesian National Infantry Army personnel in the Military District Command 0818/Malang District and Batu in managing the natural disaster of Kelud mountain eruption, through the snowball interviews and observation at the sites. The data analysis are done with qualitative descriptive, through the stages of the data presentation, data grouping and conclusion taking as described in the model of data analysis technique presented by Miles and Huberman (Sugiono, 2006; 227),



**Figure 3.1:-** the components in data analysis by Miles and Huberman.

### Result And Discussion:-

On February 13<sup>th</sup> 2014, Kelud mountain in East Java erupted heavily, the mountain which is located 1,731 kilometers above the sea level was explosively erupted. 150 cubic meters of volcanic materials including ashes, sand, and stones from the mountain were erupted and the red hot lava blurted as high as 17 kilometers. The outburst height is correlated with the reach (scope) of the falling ashes; therefore, the spread came to almost all Java island areas. At that time around 180,000 people were at the Kelud mountain evacuated to the safe areas. They were from three regencies including Kediri, Blitar, and Malang. The evacuation took two hours from 21.15 p.m. until 22.55 p.m, and it was conducted by the Disaster Management Board of the city, and Indonesian National Infantry Army, as from



government. Evacuation also involved volunteers, and other social elements spreading in all regencies. The process ran smoothly and did not take any victims.

The Military District Command (Kodim) 0818/ Malang district and Batu is the the Indonesian National Infantry Army Corps under the Military Resort Command (Korem) 083/BDJ Military Command V/Brawijaya. This Corp is the Territory Corp that has duties and responsibilities to develop the defense potential in the area of Malang district and Batu. The Military District Command (Kodim) 0818/ Malang district and Batu has the main duties as the implementer of Kotama Pembina (City Coach), the Implementer of Operation Kotama (Pelaksana Kotama Operasi) and the implementer of Function Duties (Pelaksana Tugas Fungsi) (PTF) Kemhan (Defense Ministry) (The Military District Command Corp Report (Kodim) 0818/ Malang district and Batu, 2011, page 1). The organization structure of the Military District Command (Kodim) 0818/ Malang district and Batu that consists of leader echelons, service echelons, and implementer echelons (see appendix 4)

The Millitary District Command (Kodim) 0818/Malang district and Batu, has already made a fixed procedures (Protap) on The Disaster Management and Refugee Managing (PBP) due to the Kelud mountain eruption in Malang district and Batu as a guidance for the Military District Command (Kodim) in doing the duty to handle the disaster of the Kelud mountain eruption which happened in those cities. Regarding the aid service, the status of Military District Command (Kodim) 0818/Malang district and Batu is under the operation control (BKO) the Malang district government as the implementer corps (Satlak) PBP in Malang district areas. Indonesian govermenthas arranged the disaster management organization in cope with disaster management, including Kelud mountain eruption and refugee management which occurred in Malang district. The organization involves all stake holders in Malang district including government officials in Malang district, the Indonesian National Infantry Army, the Indonesian National police, the Non-Governmental Organizations (LSM), and civil. Arranging the organization is expected to create the relationship and synergistic cooperation among all related institution in managing disaster that occurs in Malang (the structure organization please refers to appendix 3).

The Regent of Malang as the chief of Implementer Unit (Satlak) PBP Malang district forms several Institution (boards) in cope with managing the disaster of the volcano eruption in Malang district,as follows:

**First. Fast Response Team (TRC).** This team has duty to record and make a prediction of the emergency needs fast if there is disaster in its area. This Fast Response Team consists of Trantib (the team who handles the neatness and diciplines), the Indonesian National Infantry Army, the Public Work (PU), Social **Sudin** and other needed elements.

**Second. The Task Force of Disaster and Refugee Management(Satgas PBP)** consists of the government staff (officials) (Functional Unit) and the society in that area that can integrate to do the further activities to save and to rehabilitate. For the integrated steps in managing the disaster and refugee management, the government establishes some Task Forces as follows:

**Rescue Task Force.** The task force has duty to do the activities to search and help the victims in the disaster areas and also evacuate them to the safe areas to get further aids (help);

**Health Task Force.** This task force does the medical evacuation, emergency treatment (medication) and if it is necessary this task force gives further aids(help);

**Public Work Task Force (PU).** This task force does the emergency improvement on the economy medium, communication, clean water supplies, sanitation, and the live medium for the societies of the disaster victims;

**Social Task Force.** This task force prepares the emergency tens (camps) and its equipment, organizing the soup kitchen, preparing the clothes and blankets for the victims who need;

**Cross-Community (Linmas) Task Force.** This task force has activities as follows: 1)arranging the Cross-Community potency that consists of the employees and societies of the vital object; 2) doing the disaster management and managing the refugees in its areas; 3) doing the consultation and coordination with the Tramtib Sudin ( the discipline force) and the Cross-Community (Linmas) in Malang district.

Based on the interview's result, observation and literature study, it can be concluded that the Capacity of the Indonesian National Infantry Army of the Military District command 0818/Malang district and Batu in doing the duties to handle the natural disaster of Kelud mountain by doing some activities, namely: arranging an organization to handle the disaster. the organization involves all stake holders in Malang District like: Government Officials in Malang district, the Indonesian National Army (TNI), Police (POLRI), non-governmental organization (LSM) and the societies. The purposes of arranging those organizations are creating the relationship and synergistic cooperation between all related institution in managing the disaster that happened to Malang district. (the organization structures can be seen in the appendix 3) In the phase of the implementation in managing the volcano eruption disaster and managing the refugees, it is divided into three phases, including activities before, during and after volcano disaster occurred. Those activities are conducted by socializing the Guiding Book in Managing the natural Disaster on the Land, published by the Headquarters of the Indonesian national Infantry Army in 2009 and the Fixed Procedures in Managing the eruption disaster of the volcano eruption and Managing the Refugees which is owned by the Military District Command (Kodim) 0818. Socializing the emergency response and the evacuation routes as preparation for the Kelud mountain eruption occurs anytime, and the implementation of the society evacuation, (moving) wealth and animals/pets during the Kelud mountain eruption which happened on February 13<sup>th</sup> 2014 to safe places that have been prepared before, and the rehabilitation of the household and the public structures and the infrastructure for the people's interest and free medical treatment for the societies. Similar with previous research, Gautam in his opinion regarding the role of Indian army, also demonstrated that other than defend national borders, army has another primary task that is acting as respondent on domestic front, including natural disaster.

However, implementation of the Indonesian national Infantry Army's duty in managing the natural disaster of Kelud mountain face some obstacles. Based on the interview's result and the observation, those obstacles are including:

**Limited Budgets.** The budgets provided by the Military District Command (Kodim) 0818/Malang district and Batu in implementing the devotion work (karyabhakti) or the United Army to build the village (Tentara manunggal Membangun Desa) (TMMD) is very limited. It really influences the effort of the Military District Command (Kodim) to help the local government Malang and Batu to handle the natural disaster in the phase of the pre disaster (before the disaster happens) and after the disaster happens. The elements and operations involved in emergency logistics and services to victims during natural disaster need pretty much big budget allocation.

**The unclear task priority in implementing the task to handle the natural disaster.** The Military District Command (Kodim) is the task Force (Satgas PRCPB) of the Indonesian National Infantry Army in the city levels that has the duty to help the local government to handle the disaster from the level of pre disaster, emergency response and the post disaster. In the implementation, the Military District Command (Kodim) also has the task priority in managing the disaster that can cause the Military District Command not optimal in doing the aid duty to the city government;

If we observe seriously the laws about the disaster management (managing disaster), from the laws of the Indonesian Republic No. 24 2007 about the Disaster management (managing disaster) and also the President Regulation No. 8 3008 (Perpres No 8/2008) about the National Board of the Disaster Management, it does not explain the duty of the Indonesian National Army in detail on every level in managing the disaster (Ditjen Strahan, 2010, page 5). The president regulation (Perpres) No. 8/2008 explains that the representation of the Indonesian National Army only occupies one of the positions as the member of BNPB (article 11, verse 2, letter J), also the Indonesian National Army involvement in managing the disaster covers the mobilization of the personnel and the logistics (alatista/the main equipment of weapon system) done by using the command systems (article 48 verse 1). It is not explained specifically about the limitation of the amount of the personnel mobilization, the mechanism of the alatista/ the main equipment of weapon system and its relation with the need of the nation defense and the command mechanism that is meant to (Ditjen Strahan, 2010, page 6). Moreover, the actor network in the emergency situation must act in a cooperative and mutually supportive way to be effective (Boin et al., 2010). There is also a requirement for flexibility and adaptive mechanisms that can respond to events as they happen. These essential challenges to emergency logistics management are increasingly getting attention from both practitioners and academic circles (Boin et al., 2010), and this may relate to the increasing scale and frequency of these events. Besides the Legal Protection, the obstacles faced by the Indonesian National Army generally in managing the natural disaster is that there is no clear procedure from the government related to the duty specification and the function of the Indonesian national Army especially the Infantry at the field, both at the headquarter levels and the local levels (Ditjen Strahan, 2010, page 6). The budget support also becomes an important issue that becomes the obstacle for the Indonesian

National Army in doing the duty to handle the disaster. the Indonesian National Infantry Army specifically and the Indonesian National Army in general does not have special prepared budgets to handle the disaster (Ditjen Strahan, 2010, page 85)

**Training and Education.** Training on the disaster management in the level of the Military District Command (Kodim) is still a training of rehearsal post directed to train the commander officials and the staff in giving the aids to the local government. Right now there is no Training and education directed to the ability development from the Military District Command (Kodim) personnel in managing the disaster. Organizationally, the Force in the level of the Military District Command (Kodim) is prepared as the task force quick reaction to handle the disaster (PRCPB) of the Indonesian National Infantry Army that involves directly to handle the disaster in the level of district/city, however, in the reality until now there is no training and equipment prepared specially to handle the disaster based on the disaster characteristics. The Military District Command (Kodim) 0818/Malang district and Batu is the same as the other territorial force. All forces under the Military Command (Kodam) IV/Brawijaya has duty to implement the Waskita Defense (PamWaskita). The duty is one of the OMSP duties related to the safety of the president, vice president, and the other state guests. The Military District Command Force (Kodim) 0818/Malang district and Batu often involve in those activities, it is caused due to the activities of the president and his vice president in doing their official travels either domestic or international ones through Aburrahman Saleh airport. The location of the Abdurrahman Shaleh airport has become the responsibility of the Military District command (Kodim) 0818/Malang district and Batu.

**Appliance Supplies.** Appliance supplies that can be used to help the local government in managing the natural disaster are very limited. If they are faced with the disaster that happened to some districts. Malang – Batu have not been able to help the local government optimally. The Indonesian National Army especially the Infantry involvement out of the war (OMSP) show that the Indonesian National Army takes the responsibility to face the threat towards nation which has nontraditional characteristic. At a glance, the duty of OMSP done by the Indonesian National Army can be described like the aid help given by the Indonesian national Army to the institution that needed (Ditjen Strahan, 2010, 136). However, basically those duties have already consorted the Indonesian National Army as the Main component of National defense. Problem that might appear when the Indonesian National Army does the duty of OMSP is that there is no Rules Of Engagement that is clean and transparent to manage the task duty. There is no authority order that influences the Indonesian National Army (TNI) preparation and the Indonesian national Army work performance in implementing those duties. Infrastructures and its maintenance are limited thus it influences the performance of TNI in disaster management duties. Previous research also demonstrated that appliances supplies, emergency-supporting infrastructures including ongoing maintenances are very much necessary things to be provided since disaster might occur anytime and have potentially break infrastructures in many ways (Clarke, 1999). In order to minimize the obstacles face on natural disaster management, the Military District Command (Kodim) 0818/Malang district – Batu did the training program suitable with the program that was in line with the program from the upper command. The training which was programmed to apply the duty of the OMSP especially training in managing the natural disaster for the Indonesian National Infantry Army Force, until now the training is still post rehearsal training. The Military District Command (Kodim) 0818/ Malang district – Batu.

Human resource development in an organization needs training, assessment and development achievement. Those three things must be done to improve the competitiveness of an organization and to evaluate the tasks implemented by each personnel. An organization has a standard for each work force on duty whose has to master their duty and responsibilities tasks. Every organization tries hard to give briefing and training for its personnel therefore, they master their own task and can increase their work performance from each individual. The human resource development has a very important role in an organization. The development is implemented in the education and training with purpose that the main duty carried can be done effectively and efficiently.

To handle the budget obstacle, based on the interview result with the informants who became the doer in managing the disaster, the strategies that need to be done by the Military District Command (Kodim) 0818/Malang district and Batu, are collecting the budget from the donor both from the donation proposal given to the wealthy societies, to companies located in the areas of Malang district and to the district government of Malang and the government of Batu, through the post of the disaster aid budget, grants or unexpected funds. Therefore, with the helps from the societies, entrepreneurs or the district and city government, limited budget and structures and infrastructures that support the disaster management can be solved. Similar with other countries such as Japan, Netherlands,

Switzerland and the UK, the defense ministry budget in cope with natural disaster management partly comes from humanitarian aid budget, other than from defense ministry budget itself (SIPRI, 2008).

Furthermore, the strategies to handle the obstacle of the unclear task that are supposed to be done, the Military District Command (Kodim) 0818/Malang district and Batu through the resort command (Korem) 083/Baladika Jaya Malang proposed a petition to the Commander of the Infantry Strategy Command to publish the implementation rules from the Indonesian National Army (TNI) Laws about the implementation of the Military Operation out of War especially in the natural disaster management help. Cooperation with the National Disaster Management Board (Institution) (BPNB) as an institution that has the authority to do the disaster management according to law in Indonesian Republic Constitution No. 24 2007 about Management (Managing) Disaster and the President Regulation of Indonesian Republic No. 8 2008 dated on January 26<sup>th</sup> 2008 about National Disaster Management Board (BNPB). Previous research also demonstrated that a well cooperation among well-trained public organizations, military and civil may become an effective way to manage natural disaster (Boin et al., 2010) The regulations from the Strategic Commander are intended that there will be specific roles from the Military District Command (Kodim) whose area gets the disaster and is under its responsibility, starting from the command systems, the personnel number and the equipment needed and also supported budget since the area is part of the military operation command out of war. The regulations from the Chief Commander are intended to make the previous regulations more perfect, namely the Chief Commander regulation No. Perkasad /96/XI/2009 dated on November 30<sup>th</sup> 2009 about the Guiding Book about Natural Disaster on Land Management. The decision from the Chief Commander of Indonesian National Infantry Army No. Kep/23/IV/2007 dated on April 24<sup>th</sup> 2007 about the task implementation of the OMP duty and OMSP for the Indonesian National Infantry Army. And the decision of the Chief Commander of the Indonesian National Infantry Army no. Perpang/35/XI/2007 dated on November 21<sup>st</sup> 2007 about PRCPB TNI.

### **Conclusion:-**

The capacity of the Indonesian National Infantry Army of the Military District Command (Kodim) 0818/ Malang district and Batu in implementing the duty of managing the natural disaster of Kelud mountain, was done since before the eruption happened, including implementing the greening on the barren forest, repairing the drainage, counseling to the societies through Babinsa about the areas which are prone from the natural disaster, procedural explanation in cope with natural disaster by commander of the military district and Babinsa, and simulation in dealing with natural disaster. During the mount eruption disaster, evacuating the victims to the refugee camps, keeping the safety of the victims who still could be saved and keeping the location safety, doing the inventory of lives loss, wealth gradually, building the aid posts and distributing the logistics to the refugees were conducted. Activities after the eruption also conducted including rehabilitation such as rebuilding the structures and the infrastructures of the public interests service and people's belonging in the disaster areas until it reaches the adequate levels in the post disaster areas with the main targets to normalize the implementation of the government and the society's lives; reconstruction including rebuilding the structures and the infrastructures of the government institution and society's organization in the disaster areas with the main target to grow and improve the economy activities, social and cultural activities, upholding the laws and disciplines and the rising all aspects of social lives. However, hindrance always occurred in the process of implementation of the Indonesian National Infantry Army in managing the natural disaster of Kelud mountain, including limited budgets, the unclear tasks, limited education and training, as well as limited appliance supplies. In order to solve those obstacles, some strategies are conducted, including education and training sustainably and with stages to improve the soldier human resource of the Indonesian National Infantry Army and the professionalism, seeking the own budget through the aid proposal to the wealthy societies, entrepreneurs, and the Local Government of Malang District and Batu, proposing the new regulations to make the previous regulation more perfect to the Strategic Commander of the Infantry Army (Pangkostra, there is a specific regulation about the authority of the Military District Command that supervises the area of the disaster, both the commands, the personnel and the equipment needed and the budget post that is used as well.

### **References:-**

1. Finlay, L. 2006, "Going Exploring": The Nature of Qualitative Research", Qualitative Research for Allied Health Professionals: Challenging Choices. Edited by Linda Finlay and Claire Ballinger. New York: John Wiley & Sons Lt Griffin, R. Business, 8th Edition. NJ: Prentice Hall.
2. Idrus, Muhammad. 2009, Metode Penelitian Ilmu Sosial : Pendekatan Kualitatif dan Kuantitatif (Edisi ke-2).

- Erlangga , Jakarta .
3. JohnStorey(1995) : Human resource manajement.
  4. Maarif, Syamsul, 2012, PIKIRAN dan GAGASAN Penanggulangan Bencana di Indonesia, Badan Nasional Penanggulangan Bencana, Jakarta.
  5. Mitht hapala, Sriyanie, 2008. Pentahapan penanggulangan bencana kegiatan sebelum bencana terjadi dan kegiatan sesudah terjadi bencana.
  6. Milen A. (2006), Capacity Building : Meningkatkan Kinerja Sektor Publik.Sugiyono, 2009. Metode Penelitian Kuantitatif dan Kualitatif dan R&D .
  7. Miththapala, S. (2008), Integrating Environ mental Safe guards into Disaster Management : Afield Manual. Colombo : International Union for Conservation of Natureand Natural Resources. Pembaruan. Jogjakarta .
  8. Sugiyono. (2011), Metode Penelitian Kuantitatif Kualitatif Dan R &D, Alfabeta Bandung.
  9. UNDP.(1994),TheHumanDevelopmentReport.Oxford:OxfordUniversityPress.
  10. Creswell, John W, 2012, Research Design, Pendekatan Kualitatif, Kuantitaif, dan Mixed (terjemahan), Pustaka Pelajar, Yogyakarta.
  11. Ditjen Strahan, 2010,Peran TNI dalam Penanggulangan Bencana Alam di Indonesia.
  12. Ditjen Strahan Dephan,2010, Potensi bencana erupsi gunung berapi.
  13. Turnip, 2011. tentang Standar dan program latihan yang disiapkan secara khusus untuk satuan PRCPB TNI.
  14. Kodim 0818/Kab Malang & Kota Batu. (2011), Protap Penanggulangan Bencana erupsi gunung berapi dan Penanganan Pengungsi, Kab Malang dan Kota Batu.
  15. Kodim 0818/Kab Malang & Kota Batu. (2011), Laporan Satuan Kodim 0818/Kab Malang & Kota Batu,Jakarta.
  16. Undang-Undang Republik Indonesia Nomor 3 tahun 2002 tentang Pertahanan Negara.
  17. Undang-Undang Republik Indonesia Nomor 34 tahun 2004 tentang Tentara Nasional Indonesia.
  18. Undang Undang Republik Indonesia Nomor 24 tahun 2007 tentang Penanggulangan Bencana .
  19. Peraturan Presiden Republik Indonesia Nomor 8 Tahun 2008 tanggal 26 Januari 2008 tentang Badan Nasional Penanggulangan Bencana (BNPB) .
  20. Peraturan Pemerintah Republik Indonesia Nomor 21 Tahun 2008 tanggal 28 Pebruari 2008 tentang Penyelenggaraan Penanggulangan Bencana.
  21. Peraturan Panglima TNI Nomor Perpang/14/III/2008 tanggal 27 Maret 2008 tentang Buku Petunjuk Induk Operasi Militer Selain Perang.
  22. Peraturan Kasad Nomor Perkasad /96/XI/2009 tanggal 30 November 2009 tentang Buku Pedoman Penanggulangan Bencana Alam Di Darat .
  23. Keputusan Panglima TNI. Nomor Kep/23/IV/2007 tanggal 24 April 2007 tentang pelaksanaan tugas OMP dan OMSP bagi TNIAD.
  24. Keputusan Panglima TNI nomor Perpang/35/XI/2007tanggal 21 Nopember 2007 tentang PRCPB TNI
  25. Clarke, L. B. (1999) Mission Improbable: Using Fantasy Documents to Tame Disaster (Chicago: The University of Chicago Press).
  26. Boin, A., Kelle, P. and Whybark, D. C. (2010) Resilient supply chains for extreme situations: outlining a new field of study, International Journal of Production Economics, 126(1), pp. 1–6.
  27. SIPRI Stockholm International Peace Research Institute (2008). The Effectiveness of Foreign Military Assets in Natural Disaster Response.

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### RESEARCH ARTICLE

#### AWARENESS OF COLORECTAL CANCER AMONG INFLAMMATORY BOWEL DISEASE PATIENTS IN A TERTIARY CARE HOSPITAL: AN EPIDEMIOLOGICAL STUDY.

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#### Abstract

**Background:** Colorectal cancer (CRC) is documented to be the third most common cancer worldwide in terms of incidence and mortality. Inflammatory bowel disease (IBD) patients are at higher risk for developing CRC as compared to the general population, as CRC is the most common cancer in the IBD population. This study aims to assess the awareness of CRC among IBD patients in Saudi Arabia.

**Methods:** A quantitative, observational, retrospective cohort study was conducted at King Khalid University Hospital (KKUH), in Riyadh, Saudi Arabia between November 2013 and February 2014. Directed-interview questionnaires were administered over the telephone to the 384 purposively-selected IBD-established patients.

**Results:** Prompted awareness of CRC symptoms and risk factors was much higher than unprompted awareness. When asked about risk factors, nearly 48% of patients could not recall any risk factors unaided. Overall, the most commonly identified risk factor for CRC unaided was IBD (27.1%), followed by diet (20.5%). However, 14.5% could not identify or did not know whether their own disease (IBD) is a risk factor for CRC.

**Conclusion:** Results from this study showed that the overall awareness of CRC symptoms and risk factors among Saudi IBD patients was poor. However, the knowledge towards CRC symptoms was observed higher than knowledge of risk factors, insinuating a possible gap in patient education. Customization of health-promotion programs for IBD patients is urgently needed to combat the rising incidence of CRC amongst them.

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#### Introduction:-

Colorectal cancer is a common cancer and is ranked as the third in males and the second in females worldwide.<sup>1</sup> In Saudi Arabia, CRC frequency is documented as second to breast cancer. This rate is alarmingly increasing and is estimated to leap up to a fourfold increase by the year 2030<sup>2</sup>. Furthermore, it is also reported to be the third leading cause of cancer death in the United States.<sup>3</sup>

Several risk factors were proven to be associated with the development of CRC. Modifiable factors include obesity, sedentary lifestyle, cigarette smoking, alcohol intake, red meat ingestion, and decreased vegetable and fruit

consumption. On the other hand, non-modifiable factors constitute the following: Family history of CRC, older age and inflammatory bowel disease (IBD), which falls under the scope of this study.<sup>4</sup>

Previous studies assessing the awareness of CRC in several aspects, including epidemiology, symptoms/signs, and risk factors have revealed a poverty in the knowledge of the public, which is disconcerting given the fact that CRC still remains largely a topic of confusion in the general population. This has contributed significantly to the deleterious consequences on time of presentation and, therefore, on overall survival.<sup>5-11</sup> These findings were also consistent with the data of another study, which showed that the level of CRC knowledge among the Saudi general public was low, thus signifying the necessity of continuing public education and screening programs.<sup>12</sup> Furthermore, the lack of awareness was not only reported among the general public, but even more among patients following up in the gastroenterology clinics and the peripheral colorectal surgical unit.<sup>13,14</sup>

This issue needs to be taken seriously since it has been demonstrated that blurred recognition of CRC susceptibility among high-risk groups does exist. One study investigated the awareness of the potential risk for developing CRC in 195 overweight patients where only a third out of them could identify their weight as a risk factor.<sup>15</sup>

This, subsequently, provoked the interest to assess the awareness of CRC in a subset of the general population, IBD patients. This is due to the fact that these patients are at higher risk for developing CRC as compared to the general population and that CRC is found to be the most common cancer among them.<sup>16</sup>

Despite this, we are not aware of any studies addressing this issue locally or internationally. This adds to the uniqueness and indispensability of our study. Since we believe that assessing CRC awareness among IBD patients will help estimating the real magnitude of this issue which will draw the attention of decision-makers and health-care professionals to increase the efforts made for educating the patients and subsequently, lead to earlier presentation and improved survival rates.

## **Methods:-**

A quantitative, observational, retrospective cohort study was carried out to assess the awareness of CRC among IBD patients in King Khalid University Hospital (KKUH) in the periods between November 2013 and February 2014. Patients who were below the age of 12 or have had a history of CRC and/or colonic polyps were excluded from the study. 800 patients were present in the local IBD database compiled between the periods of 2009 and 2013, of which 580 (72.5%) were eligible to be enrolled into the study according to the exclusion criteria. Directed-interview questionnaires were administered to those eligible over the telephone to gather current data pertaining to their awareness. Of those, 317 (54.7%) responded to this study. The questionnaires were compiled and modified based on a pilot study conducted on 12 patients, and consisted in its final form of 16 questions that covered several variables, including demographics, family history of CRC, and overall knowledge of the disease (risk factors, signs/symptoms).

## **Data analysis:-**

Collected data was entered to Excel version 14.00 and categorical variables were expressed as frequencies. Data was analyzed using SPSS version 21. (SPSS Inc., Chicago, IL, USA) and all statistical tests were declared significant at level of 0.05 or less. Chi-square tests were used to examine differences in CRC awareness in relation to socio-demographic factors including gender, age, diagnosis, marital status, occupation, education level, income and having a diagnosed relative or friend of CRC.

## **Ethical considerations:**

Confidentiality with regards to patients' information was maintained and participants' consent was obtained verbally over the telephone. All patients were informed about the purpose of the research, the reason why they were chosen and their right to discontinue from participation at any time without being obligated by the investigators. Neither rewards nor incentives were given to the patients. No conflict of interest was present.

## **Results:-**

### **Socio-Demographic Characteristics:-**

Of the 580 IBD patients who were eligible to enroll, 317 (54.7%) responded to the study. A total of 317 IBD patients were interviewed over the telephone (Table 1). 55.2% had Crohn's disease (CD) while 44.6% were diagnosed with ulcerative colitis (UC) based on endoscopic criteria. 55.5% were male while 44.5% were female,

with a mean age of (Add mean/SD of age here) Patients less than thirty years of age formed a proportion of 55.3% while older patients ( $\geq 30$  years) formed the remaining group. 96.5% were Saudis, where those who reside in Riyadh formed the largest proportion of the respondents. 79.5% of the IBD patients have attained either a high school or university degree while 20.5% were from other educational levels (illiterate, reads & write, primary school, middle school and higher studies). 60.6% were either governmental employees or students. 52.4% of the patients were married. The monthly income of 80% of the patients was ranging from 1,333 or less to 5,333 USD. The vast majority had no first or second-degree relatives nor did they have any friends diagnosed with CRC (90.5% and 80.1%, respectively).

#### **Knowledge of CRC Risk Factors, Signs and Symptoms:-**

Responses to knowledge assessments including recognition of risk factors and signs and symptoms were variable (See tables 2 & 3). Out of the 317 patients, 35.3% have never heard of CRC and 62.1% of the patients either don't think or don't know whether CRC is common or not. When asked about sources of information, the internet was the most popular method used by IBD patients to learn more about CRC while doctors' education was the second most commonly chosen source of information (Chart 1).

#### **Knowledge of Risk Factors:-**

In questions relating to patients' knowledge of CRC risk factors, 59% of IBD patients answered "no" to the question "do you know any risk factors of colorectal cancer?"

Nearly 48% of patients could not recall any risk factors without aided while 45.5% of them still didn't manage to recall and answered "no" or "I don't know" after being prompted.

Overall, the most commonly identified risk factor for CRC unaided was IBD (27.1%) and it was followed by diet (20.5%). Out of all patients, 14.5% couldn't recognize or didn't know whether their own disease (IBD) is a risk factor for CRC. On the other hand, aid was needed by more than half of the patients (58.4%) to identify IBD as a risk factor. The least well-recognized risk factors for CRC, however, were by far diabetes mellitus (57.1%) and hypertension (53.9%). Similarly, Age and gender were not recognized by around half of the patients (50.8, 54.3%, respectively).

Most risk factors were correctly chosen by patients after aided, these include alcohol (66.6%), smoking (63.7%), family history (57.7%) and obesity (47.3%).

However, a proportion of 54.6% of the IBD patients incorrectly chose hemorrhoids as a risk factor for CRC after aided.

#### **Knowledge of Symptoms:-**

Around 50% of IBD patients believed they don't know any symptoms while approximately a similar proportion of them answered "yes" to the question "do you know any symptoms of colorectal cancer?". Abdominal pain was the most frequent symptom of CRC that was correctly believed by 28.7% of the patients without being prompted while 7.6% managed to name "weight loss" as a symptom of CRC. Other symptoms of CRC were answered correctly by the patients only after being aided, these include bleeding per rectum (53.9%) and change in bowel habits (59%). Difficulty of swallowing was correctly judged by 54.9% of IBD patients not to be a symptom of CRC. However, black stools (17%) and fatigue (14.5%) were the most frequent wrongly identified as not being symptoms of CRC after being prompted.

Around 50% of IBD patients correctly answered "yes" to the question "do you think that colorectal cancer can present without symptoms?" while about 39% of patients believed the opposite.

#### **Factors Associated With Knowledge of CRC Signs, Symptoms and Risk Factors:-**

A confidence interval of 95% was used and results showed that men demonstrated higher unprompted knowledge of risk factors than women, they were more likely to recognize IBD ( $p=0.056$ ) and smoking ( $p=0.015$ ) as risk factors for CRC. Older patients were also better at identifying symptoms of CRC compared to the younger age group. For example, those aged 30 or older correctly named that bleeding per rectum and fatigue are symptoms of CRC ( $p=0.038$ ,  $p=0.026$  respectively). Moreover, they could also identify obesity as a possible risk factor for CRC without being aided ( $p=0.016$ ). On the other hand, most patients who are less than 30 years of age wrongly believed



that CRC is not common compared to older patients ( $p = 0.001$ ). Patients who had university or higher study education showed higher recognition of symptoms and risk factors without being aided, they correctly identified bleeding per rectum as a symptom ( $p = 0.008$ ) and IBD ( $p = 0.006$ ), family history ( $p = 0.017$ ) as risk factors for CRC. The different knowledge levels between CD and UC patients were statistically insignificant.

### Discussion:-

Determining the IBD patients' awareness regarding CRC may offer significant information to incorporate the policy decision for screening promotion, early diagnosis and reduction of morbidity and mortality of CRC. Until now, and according to the available literature, this is the first study to assess the awareness of CRC among a cohort of IBD patients. This study showed that a large proportion of patients had poor awareness regarding symptoms and risk factors of CRC. Prompted awareness of CRC symptoms and risk factors was much higher than unprompted awareness which was also reported in an earlier study that was conducted among the general public of the United Kingdom.<sup>5</sup> Our study also shows that Saudi IBD patients were more aware of CRC symptoms than risk factors, this could be justified by the resemblance of presenting symptoms between CRC and IBD which might have confused and aided them in reaching a more rightful prediction.

When comparing the proportion of Saudi IBD patients who could recognize their own disease (IBD) as a risk factor for CRC after being aided to the general British population<sup>5</sup>, it is striking to say that the Saudi IBD patients' awareness to IBD as a risk factor is not that different from the general public but in fact less (58.4% and 61.9%, respectively) despite that they were expected to be better informed than average about CRC. This is worrisome since it implies that Saudi IBD patients are either experiencing poor public health educational programs or in denial to the fact that their risk is higher compared to the general population.

It is worth mentioning that IBD was the only common recognized risk factor among both the Saudi general public and within the Saudi IBD population possessing higher levels of education, which may guide the focus of the educational efforts to the other less identified risk factors.<sup>12</sup>

The most recalled symptom of CRC without prompt by Saudi patients was abdominal pain. Likewise, a Malaysian study among rural population reported that abdominal pain was the most frequent symptom identified unaided and the second most agreed symptom of CRC from prompted question.<sup>10</sup> Weight loss, however, was the least recognized symptom of CRC unaided among the Saudi IBD patients in this study, perhaps due to the fact that this symptom is non-specific to CRC and is not anatomically confined to the abdomen (as in the case of abdominal pain). This might compromise the professional help-seeking behaviors. Similarly, the same Malaysian study demonstrated that only less than 5% could relate weight loss to CRC without aided.<sup>10</sup>

Men knew more CRC risk factors than women, particularly smoking and IBD. This could be because men are aware that CRC is more pronounced among them or perhaps implies men's preference to think that cancer risk is modifiable in regards to smoking. Our results were in disagreement with a couple of studies including a local study among the general public that revealed a better awareness of CRC symptoms among women.<sup>5,12</sup> The fact that Saudi men in our study showed higher awareness is encouraging especially that previous studies have also shown that CRC is more common among Saudi males.<sup>17,18</sup>

Older patients showed higher knowledge of symptoms than younger patients especially in bleeding per rectum and fatigue, they have also shown better knowledge in some risk factors like obesity which is reassuring because they are at higher risk and in need to correctly recognize these symptoms and risk factors. Moreover, local studies have reported increased prevalence of CRC among older age groups.<sup>18</sup> However, interestingly, younger age group (<30 years) were more aware of the link between CRC and alcohol than older patients. This is consistent with findings from the same British study which reported that younger age groups had a higher awareness of alcohol as a risk factor for CRC.<sup>5</sup>

Diet was a well-recognized risk factor by the patients after aid and this provides a positive implication due to the predominance of unhealthy lifestyle habits among the Saudi population, for example being overweight<sup>19</sup>, poor fruit and vegetable, high meat and fat consumption.

Knowing someone with CRC or having a family history of CRC was present in very few patients in this study which hindered the process of finding any statistical significance.

Certain limitations of this study should be noted. The method of data collection used in this study was designed to offer a straightforward evaluation of knowledge levels, it hadn't been previously validated and therefore cannot be used for international comparison of CRC awareness. Moreover, due to the fact that our study is a single-center study and that most of our patients were Riyadh citizens receiving good level of education, findings may not necessarily be applicable to rural hospitals in Saudi Arabia.

### Conclusion:-

Saudi IBD patients' awareness of CRC symptoms and risk factors is alarmingly low, emphasizing the significance of the health-care professionals to continue educating them about their own risk of CRC and the need of more solid screening programs which will lead to the reduction of CRC incidence and mortality. Moreover, customization of health-promotion programs for IBD patients is noteworthy in order to increase their CRC awareness. Furthermore, since internet was the most frequented source of information, the need of establishing a well-structured website is indispensable. Lastly, further research should be conducted with validated questionnaires to permit comparison of awareness level of CRC among IBD patients worldwide.

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### References:-

1. Jemal A, Bray F, Center M, Ferlay J, Ward E, Forman D. Global cancer statistics. *CA Cancer J Clin.* 2011;61(2):69-90.
2. Ibrahim EM, Zeeneldin AA, El-Khodary TR, Al-Gahmi AM, Bin Sadiq BM. Past, present and future of colorectal cancer in the Kingdom of Saudi Arabia. *Saudi J Gastroenterol.* 2008 Oct;14(4):178-82.
3. Siegel R, Naishadham D, Jemal A. Cancer statistics, 2013. *CA Cancer J Clin.* 2013 Jan;63(1):11-30.
4. Johnson CM, Wei C, Ensor JE, Smolenski DJ, Amos CI, Levin B, Berry DA. Meta-analyses of colorectal cancer risk factors. *Cancer Causes Control.* 2013 Jun;24(6):1207-22.
5. Power E, Simon A, Juszczak D, Hiom S, Wardle J. Assessing awareness of colorectal cancer symptoms: measure development and results from a population survey in the UK. *BMC Cancer.* 2011 Aug;23(11):366.
6. Manning AT, Waldron R, Barry K. Poor awareness of colorectal cancer symptoms; a preventable cause of emergency and late stage presentation. *Ir J Med Sci.* 2006 Oct-Dec;175(4):55-7.
7. Breslow R, Sorkin J, Frey C, Kessler L. Americans' knowledge of cancer risk and survival. *Prev Med.* 1997;26(2):170-177.
8. Gimeno-García AZ, Quintero E, Nicolás-Pérez D, Jiménez-Sosa A. Public awareness of colorectal cancer and screening in a Spanish population. *Public Health.* 2011 Sep;125(9):609-15.
9. Keighley MR, O'Morain C, Giacosa A, Ashorn M, Burroughs A, Crespi M, et al; United European Gastroenterology Federation Public Affairs Committee. Public awareness of risk factors and screening for colorectal cancer in Europe. *Eur J Cancer Prev.* 2004 Aug;13(4):257-62.
10. Su T, Goh J, Tan J, Muhaimah A, Pigeneswaren Y, Khairun N, et al. Level of colorectal cancer awareness: a cross sectional exploratory study among multi-ethnic rural population in Malaysia. *BMC Cancer.* 2013 Aug 7;(13):376.
11. Christou A, Thompson SC. Colorectal cancer screening knowledge, attitudes and behavioural intention among Indigenous Western Australians. *BMC Public Health.* 2012 Jul 18;(12):528.
12. Zubaidi AM, AlSubaie NM, AlHumaid AA, Shaik SA, AlKhayal KA, AlObeed OA. Public awareness of colorectal cancer in Saudi Arabia: A survey of 1070 participants in Riyadh. *Saudi J Gastroenterol.* 2015 Mar-Apr;21(2):78-83.
13. Harewood GC, Murray F, Patchett S, Garcia L, Leong WL, Lim YT, et al. Assessment of colorectal cancer knowledge and patient attitudes towards screening: is Ireland ready to embrace colon cancer screening? *Ir J Med Sci.* 2009 Mar;178(1):7-12.
14. McVeigh TP, Lowery AJ, Waldron RM, Mahmood A, Barry K. Assessing awareness of colorectal cancer symptoms and screening in a peripheral colorectal surgical unit: a survey based study. *BMC Surg.* 2013 Jun 22;13(1):20.

15. Leite-Pereira F, Medeiros R, Dinis-Ribeiro M. Overweight and obese patients do not seem to adequately recognize their own risk for colorectal cancer. *J Cancer Educ.* 2011 Dec;26(4):767-73.
16. Forbes GM. Colorectal cancer screening tests: pros and cons, and for whom? *Expert Rev GastroenterolHepatol.* 2008 Apr;2(2):197-205.
17. Al-Ahwal MS, Shafik YH, Al-Ahwal HM. First national survival data for colorectal cancer among Saudis between 1994 and 2004: what's next? *BMC Public Health.* 2013 Jan 25;13:73.
18. Mosli MH, Al-Ahwal MS. Does the increasing trend of colorectal cancer incidence in jeddah reflect a rise in the Kingdom of Saudi Arabia? *Asian Pac J Cancer Prev.* 2012;13(12):6285-8.
19. Ng SW, Zaghoul S, Ali HI, Harrison G, Popkin BM. The prevalence and trends of overweight, obesity and nutrition-related non-communicable diseases in the Arabian Gulf States. *Obes Rev.* 2011 Jan;12(1):1-13.



## RESEARCH ARTICLE

### NARRATING *THINGS FALL APART* THROUGH THE PRISM OF LANGUAGE

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#### Abstract

The present article studies Chinua Achebe's style of language used in his literary works that have helped shape the outcome of his native Igbo language as well as that of the English language. Since, Achebe has chosen the written word over the spoken as medium of linguistic and social reform, the analysis rest on the close reading of his magnum opus novel *Things Fall Apart* (1958) rather than perusal of his oral statements. Whereas his writings have catapulted him into a transcendental position in both the Western and African literary canons, his use of English language as his medium of expression has earned him much criticism from his fellow writers and critics alike. The paper has shown how well his narrative style is appreciated by both European and African readers.

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**"Until the lions produce their own historians, the story of the hunt will glorify only the hunter."**

#### Chinua Achebe, Home and Exile:-

Born on the 15<sup>th</sup> of November in Ogidi in Eastern Nigeria, Chinua Achebe became one of the foremost authors of Africa of the twenty-first century. The author himself wrote of the time and place in which he was born and raised as "a strongly multiethnic, multilingual, multi-religious, somewhat chaotic colonial situation". (Achebe 39) In fact, Eastern Nigeria consists of many provinces that make up Igboland, dominated by the Igbo tribes of which Achebe's native town is one. Traditional Igbo societies are relatively autonomous and free from interference from other societies. The Igbo's pride themselves in their self governance and freedom from outside interference, which is their ideal aim in both the pre and post colonization period. Critics of the Igbo tribe have often claimed that they are a stateless or acephalous nation and their administrators have called them argumentative. The relationship of the Igbos with their British administrators has been tumultuous and complicated to say the least.

The infinity of possibilities that language exhibits enables it to capture the adaptability of man and prove that language is essentially an intricate form of expression that is in a constant state of metamorphosis. Cultures around the world change with the change of individual choices; language, being a part of culture, too changes with the change of culture.

The potency of a language is determined by its speakers. The evolution of a language is traced by the study of its native speakers and how they communicate within their communities. Linguist Steven Pinker argues that

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communication is “rooted in our development as individuals, but also in the history of our language community.” (24) The present article is a study of one such speaker, Chinua Achebe, whose decisions about his language have helped shape the outcome of his native Igbo language as well as that of the English language. Since, Achebe has chosen the written word over the spoken as medium of linguistic and social reform, the analysis will rest on the close reading of one of his written text rather than perusal of his oral statements.

Achebe displays a sense of fearlessness in the statement of his purpose and an intention to deliberately engage his culture and international audience alike. It was with this determination that he wrote his first novel, *Things Fall Apart* (1958), with an aim to subvert and disrupt the prevailing notions of African servitude. He stated in reference to *A Man of the People*,

I wanted the novel to be a denunciation of the kind of independence we were experiencing in postcolonial Nigeria and many other countries in the 1960s, and I intended it to scare my countrymen into good behavior with a frightening cautionary tale. (Achebe 43)

The purpose of his writings is to shake up his audiences and countrymen with his voice before he allows them to sink into general apathy or stupidity.

The overwhelming success of *Things Fall Apart* has earned Achebe both acclaim and criticism. Whereas his writings have catapulted him into a transcendental position in both the Western and African literary canons, his use of English language as his medium of expression has earned him much criticism from his fellow writers and critics alike. As far as the novel is concerned, critics have invariably agreed that the novel describes “the effect of British missionaries and administrators on a typical village tribal society; the dislocation that change, religious and educational, brings to historic certainties” (Povey 254), and that it does so with a “tragic objectivity”. (Ravenscroft 9) The novel is greatly admired by its readers for its realistic depiction of Igboland, its rich symbolism, metaphor, imagery and the lessons it teaches about community and the convergence of cultures. Despite of using the usurping British tongue, Achebe successfully betrays a wholly African perspective on the English novels retains a leitmotif of African tribalism and betrays his multilingual abilities through an extensive use of the Igbo vocabulary.

Achebe’s decision use the hegemonic British tongue to espouse the native narrative has led to questions over his allegiance to his homeland and his beliefs about colonialism. Ngugi Wa Thiong’O’s disappointment with the African acceptance of English is discernible when he writes that “it is the final triumph of a system of domination when the dominated start singing its virtues.” (20) For Ngugi, Achebe’s choice of language was a loss of the African identity and culture. But, it would go without saying that Achebe’s *Things Fall Apart* proves Ngugi’s concerns as unfounded and that an African writer can retain his culture and belief while still writing in English for practical purposes.

In *Home and Exile*, Achebe makes a powerful statement, “until the lions produce their own historians, the story of the hunt will glorify only the hunter.” (73) The statement is an embodiment of Achebe’s life and works and the force that drives his conscious and subconscious language attitudes. Achebe is a historian, albeit self-elected. He is the narrator of the Igbos in particular and the Africans in general, narrating the story of the lion in the language of the hunter. It is quite sure that Achebe knew the risks of writing in the English language but despite this, he wrote *Things Fall Apart* with an intention to allow the western reader to be a partaker as well as a reveler in the African language and lifestyle. What follows is Achebe’s use of language to achieve his aim.

Chinua Achebe succeeds in using the narrator as the most potent tool to express African identity and reality in *Things Fall Apart*. In fact, Achebe’s concern as an African writer was the proper representation of Africa and its people. Achebe was very critical of Joseph Conrad and his depiction of the African nation and its people, so much so that he even called Conrad “a bloody racist”. (Achebe 328) Achebe accused Conrad of choosing “the role of purveyor of comforting myths”. (325) According to him, Joseph Conrad had rather enforced the European stereotypes that existed in the early twentieth century rather than representing Africa and its people in an appropriate manner. *Things Fall Apart* is the result of Achebe’s will to counter Joseph Conrad’s *Heart of Darkness* and to write a story that appropriately reflects his country, tribe and his people. The omniscient narrator is responsible for bringing the novel to life in *Things Fall Apart*, and by doing so in an objective manner. He encourages the readers of the novel to come to their own opinions about the African story.

The narrator is the chronicler of the disintegrating Igbo society and as such he is an insider of the Igbo community, omniscient but objective. Achebe allows the narrator to reveal his own personal observations about the Igbo way of life and their traditions and customs. The status of the narrator as an insider is revealed right from the outset of the novel as he captures the rise to fame of Okwonko as well as the physical changes that he has undergone in a span of twenty years, “that was many years ago, twenty years or more, and during this time Okwonko’s fame had grown like a bushfire in harmattan. He was tall and huge, and his bushy eyebrows and wide nose gave him a very severe look.” (Achebe 3) Such an intimate observation can only be given by an insider who is familiar with the characters involved. The narrator of the novel is established as a reliable spokesperson for Okwonko and his tribesman by virtue of his familiarity with the tribe and its people [characters].

The distinctly African style of narrative that the narrator used to detail the food and religion of the Igbo community and its tradition further confirms his native stature. The details of about yam foo foo as being the chief food in celebrations allow the readers to envisage a realistic African ritual:

yam foo foo and vegetable soup was the chief food in the celebration. So much of it was cooked that, no matter how heavily the family ate or how many friends and relations they invited from neighboring villages, there was always a huge quantity of food left over at the end of the day. The story was always told of a wealthy man who set before his guests a mound of foo-foo so high that those who sat on one side could not see what was happening on the other, and it was not until late in the evening that one of them saw for the first time his in-law who had arrived during the course of the meal and had fallen to on the opposite side. (Achebe 23)

The African’s appreciation for words, metaphor and figurative language is reflected in this passage. Oral traditions are distinctive tribal characteristics through which the history of the tribe is passed down the generations. In this passage, Achebe captures the importance of the oral tradition in the Igbo society. The narrator is the mouthpiece of the author who speaks as a wise sage would speak to his young pupils and teaching them of the significance of food and relationships within the community.

The discussion of the narrator’s power is not complete without giving him credit for the use of gender-specific language. The feminine language in the novel enters with Okonkwo’s wives and Ezinma, his daughter. The narrator addresses the heavy handed treatment of his wives by Okonkwo at first, but his voice become softer when he describes Okonkwo’s favorite wife Ekwefi or her daughter Ezinma. The readers are taken by surprise when Okonkwo displays an unusual sympathy and follows his wife and daughter to the oracle’s cave. This episode is only one of a few verbal repartees between Okonkwo and his wife and the narrator captures it as:

Tears of gratitude filled her eyes. She knew her daughter was safe. “Go home and sleep,” said Okonkwo. “I shall wait here.”

“I shall wait too. It is almost dawn. The first cock has crowed.”

As they stood there together, Ekwefi’s mind went back to the days when they were young. She had married Anene because Okonkwo was too poor then to marry. Two years after her marriage to Anene she could bear it no longer and she ran away to Okonkwo. (65)

In the passage above, the voice of the narrator captures an intimate display of vulnerability and the African humanity that twentieth century Europeans have never seen before. The passage above reveals the trust that Ekwefi has for her husband as well as the passionate bond that they share. Two years earlier, Ekwefi had trusted Okonkwo with her life and sexuality, now, she trusts him with the life of her daughter. This dialogue between the two is the only time in the novel that captures the soft side of Okwonko. The rough Okwonko is never harsh to Ekwefi, the wife he loves and never tries to prove his strength or show off his warrior like attitude. To Ekwefi, Okwonko is simply a man, a loving husband, a caring father who wishes to protect his daughter. He not only pursues his wife and tries to persuade her to return home to safety, but also allows her to defy him and stay by his side, a similar act of defiance that once brought a beating to Ojiugo but now encourages respect for Ekwefi.

Okonkwo’s intimacy to Ezinma is further extended in the later part of the novel when they begin to interact more at home. The narrator not only captures Okonkwo’s concern for his daughter but also shows the value that he places on her daughter as an individual. Okonkwo has a soft spot for his daughter. The narrator states that Ezinma matures in beauty and character during Okonkwo’s seven years of exile. She begins to receive the attention of men in Mbanta and this makes Okonkwo sad because “he never stopped regretting that Ezinma was a girl. Of all his children she

alone understood his every mood. A bond of sympathy had grown between them as the years had passed.” (98) This vulnerability of Okonkwo lets us readers take a deeper look into the softer side of the protagonist, a side that only the narrator is privy to. The humanity of the African culture is vividly captured by the narrator and successfully establishes the African citizens as a people with a voice.

The duality of the voices and the role of the narrator is a perplexing conundrum for many scholars. In the postmodern world, the role of the writer is doubted and questioned resulting in many critics rejecting this ethnographic narrator with ties to the author. A postmodernist would reject Achebe's reflection in his work and contend that the narrative devices are established accidentally or a result of unintentional language use. It will take Cary Synder, the literary critic to counter this dilemma, arguing that the shifting narrator “from the most credulous believer to the skeptic or cultural outsider... replicates the dynamic positioning of the native anthropologist – at once part of Igbo culture and apart from it”(168). The language of Achebe should not be equated with the author by the readers of *Things Fall Apart* and should give room for the acceptance of authorial intention on the grounds of an anthropological agenda. It must be accepted that Achebe is an insider and can depict the life and culture of Igboland with authority; it should also be accepted that Achebe, as an author, skillfully crafts the Nigerian world with objectivity and grace through his particular narrative devices.

The narrator plays a prominent role in understanding *Things Fall Apart* and the African image that the novel portrays. The absence of the narrator will probably lead to two undesirable positions, either Achebe would have to write from a more personal point of view and risk being esoteric and alienate his European audience, or, the novel could have taken a more objectified and critical perspective which Achebe desperately wants to Conrad, the criticalness of his contemporary Conrad. The purpose of the novel is to portray the African as a relatable and human entity. The narrator provides Achebe with the tool that he needs to construct an artistic, objective and delicate style of writing. The narrator's familiarity of the Igbo society and his ability to look into the thoughts and actions of the characters makes him the author's tool of choice.

‘Achebe's intention to create a new African image is manifested in his use of narrative devices. The objectivity of the narrator's language enables him to capture the events of the plot and the hidden observation of the characters. Achebe's skill of using an objective narrator is praised by Hilary Dannenberg as:

It is Achebe's ability to endow his narrative with a post-binary and thus a truly postcolonial complexity which lies at the heart of the groundbreaking nature of *Things Fall Apart*. Achebe's narrator is so nimble and mercurial that he subverts all binaries. This narratorial and ideological mercuriality is achieved through the inclusion of many layers of voice, perspective and culture in the text. (176)

The most important term in this quote is “postcolonial complexity.” Achebe does not intend to solve the problems in his linguistic spectrum. He offers no solutions; he only depicts the torrid state of affairs with simplicity and realism. It is this focused and detailed description that allows European and African readers to appreciate his narrative style.

## References:-

1. Achebe, Chinua. (2009). *A Man of People*. London: Heinemann. Print.
2. ---. (2000) *Home and Exile*. New York: Oxford Up. Print.
3. ---. (2009). *The Education of a British-Protected Child*. New York: Random House. Print.
4. ---. (2009). *Things Fall Apart*. Ed. Abiola Irele. New York: Norton. Print.
5. Conrad, Joseph. (2004). *Heart of Darkness*. New Delhi: Worldview Publication. Print.
6. Dannenberg, Hilary. (2009). “The Many Voices of *Things Fall Apart*.” In *Interventions: International Journal of Postcolonial Studies* 11.2: 176-79. JSTOR. Web. 15 May 2015
7. Pinker, Steven. (2007). *The Stuff of Thought: Language as a Window into Human Nature*. London: Viking Penguin Group. Print.
8. Povey, John. (1966). “Contemporary West African Writing in English.” In *Books Abroad* 40.3: 253-260. JSTOR. Web. 15 May 2015.
9. Ravenscroft, Arthur. (1969). *Chinua Achebe*. London: F. Mildner and Sons. Print.
10. Snyder, Carey. (2008). “The Possibilities and Pitfalls of Ethnographic Readings: Narrative Complexity in *Things Fall Apart*.” In *College Literature* 35.2: 154-74. Web. Academic Search Complete. 15 May 2015.
11. Wa Thiong'o, Ngugi. (1986). *Decolonising the Mind*. New Hampshire: Reed Publishing Inc. Print.



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### RESEARCH ARTICLE

#### METABOLIC SYNDROME AND ELEVATED OSTEOPONTIN: THEIR ASSOCIATED COMORBIDITIES IN PATIENTS WITH PSORIASIS.

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#### Abstract

**Background:** Psoriasis is a systemic, chronic, and hyper-proliferative immune mediated skin disorder. Osteopontin influences cell mediated immunity and plays an important role during both acute and chronic inflammation.

**We aimed** to assess metabolic syndrome and osteopontin and their associated systemic comorbidities in patients with psoriasis.

**Subjects and methods:** The study included 48 subjects: 24 patients of psoriasis of any age, both sexes with different grades of disease severity. Severity was assessed by psoriasis area and severity index (PASI) score. Their mean age was (33.25±12.9), 13 of them were females (54.2%) and 11 were males (45.8%). In addition to 24 healthy control group, 15 females (62.5%) and 9 males (37.5%). Their mean age was (31.63 ± 16.52). Clinical, demographic evaluation and dermatological examination of the psoriatic lesions (site of the lesion, morphology and progression of the disease and severity) was performed in addition to serological testing of serum OPN level, total cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, triglyceride, and fasting blood glucose (FBG).

**Results:** psoriatic cases showed elevated body mass index, FBG, serum osteopontin, cholesterol, triglycerides and low density lipoprotein cholesterol and decreased levels of high density lipoprotein cholesterol than normal control. Metabolic syndrome and hypertension representing 25% and 41.6% respectively of psoriatic cases. In psoriatic cases, psoriasis area and severity index (PASI) score, had significant positive correlation with obesity, blood pressure, FBG, dyslipidemia, but no correlation with age, disease duration. Serum OPN had positive correlation with age, blood pressure but no correlation with BMI, disease duration, FBG or dyslipidemia.

**Conclusions** Psoriatic patients have a high prevalence of metabolic syndrome. High level of OPN can be used as an early detector of cardiovascular problems in psoriatic patients and this inflammatory cytokine can be used as a new target in the treatment of psoriasis.

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## Introduction:-

Psoriasis (PS) is a systemic, chronic, relapsing and hyper-proliferative immune mediated skin disorder. It affects 1-3 % of the world population and its prevalence is highly variable, depending on ethnicity and climate. It is characterized by inflammatory skin and joint manifestations [1].

Psoriasis results from interaction between genetic predisposition and large spectrum of environmental factors that triggers the development of skin lesion. T-helper (Th) 1 and Th17 mediated inflammation have been proposed to be pathologically essential in psoriasis [2].

Metabolic syndrome (Met.S) is a clinical entity comprising risk factors such as hypertension, glucose intolerance, hyperlipidemia, abdominal obesity and increased inflammatory state. Psoriasis patients may similarly predispose for those inflammatory disorders. Experimental and epidemiological studies have linked certain interleukins, cytokines and hormones with cardiovascular disease (CVD). Metabolic syndrome (Met.S), obesity and DM, making psoriasis at risk in developing systemic comorbidities [3].

Osteopontin (OPN) is phosphorylated sialic acid –rich non-collagenous bone matrix protein. OPN is found in several biological fluids including human plasma, serum, breast milk and urine. It was named for its function as a bridge between cells and minerals. OPN has been implicated as an important factor in bone remodeling and expressed in immune cells, including macrophages, neutrophils, dendritic cells with varying kinetics [4]. Osteopontin influences cell mediated immunity and has Th 1 cytokine functions and is overexpressed in cancers of lung, breast, colorectal, stomach and ovary and found in atheromatous plaques within arteries. OPN plays an important role during both acute and chronic inflammation and is upregulated in tissues during several pathological processes including atherosclerosis, valve stenosis, myocardial infarction and rheumatic arthritis [5].

Psoriasis is associated with cardiovascular comorbidities, possibly due to overall systemic inflammation. There is increased risk for atrial fibrillation, atherosclerosis, coronary artery calcification, type 2 diabetes, dyslipidemia, hypertension, obesity, peripheral vascular disease, myocardial infarction, stroke, and cardiac death. Also systemic treatments for psoriasis include cyclosporine, methotrexate, retinoids, and biological drugs have adverse cardiovascular (CV) effects. Inflammation may be a prime factor in linking psoriasis to atherosclerosis. The two conditions share many similarities, both psoriasis and atherosclerosis are mainly mediated by T-helper (Th) 1 cells and characterized by a systemic overexpression of adhesion molecules, inflammatory markers, and neo-angiogenesis factors [6].

Osteopontin promoting the migration and activation of human DC and enhanced proliferation of vascular smooth muscle cells. Osteopontin expression increases under a variety of conditions of heart diseases and is associated with increased myocytic apoptosis and myocardial dysfunction [7].

Plasma OPN levels are higher in patients with coronary artery disease and have been correlated with its severity. Furthermore, plasma OPN has been reported to be a potential clinical marker for the prediction of atherosclerosis and further adverse cardiac events in patients with essential hypertension and patients with chronic stable angina. Osteopontin has also been implicated in the process of pathological vascular calcification. Increased osteopontin expression has been demonstrated in calcified human atherosclerotic plaques [8].

We aimed to assess metabolic syndrome and osteopontin and their associated systemic comorbidities in patients with psoriasis

## Patients and Methods:-

This study was carried out at the outpatient clinics of Dermatology, Venerology and Andrology and Internal Medicine Departments, Faculty of medicine of Zagazig University, in the period from March 2015 till March 2016. The study had the approval of The Institutional Review Board (IRB) at Zagazig University, Egypt.

## Subjects:-

The study included 48 subjects: 24 patients of newly diagnosed psoriasis of any age, both sexes with different grades of disease severity, different clinical presentations. Severity was assessed by Psoriasis area and severity index (PASI) score, 13 of them were females (54.2%) and 11 were males (45.8%). Their ages ranged 10-60 year with a mean

(33.25±12.9) . In addition to 24 control group, 15 females (62.5%) and 9 males (37.5%). Their ages ranged 10-70 with mean (31.63 ± 16.52).

#### **Exclusion criteria:-**

Patients receiving any systemic treatment for psoriasis for at least 2 months before inclusion in the study. Also we excluded alcohol consumers, smokers, patients on lipid lowering medications, corticosteroids or immunosuppressive drugs, respiratory, hepatic or renal diseases and also patients with thyroid dysfunction.

#### **Methods:-**

They consented to be included in the study. In addition to full history, physical examination was performed with stress on weight, height and body mass index (BMI) which was calculated by dividing weight (kg) by height in squared meters (m<sup>2</sup>). Dermatological examination of the psoriatic lesions (site of the lesion, morphology and progression of the disease and severity).

Assessment of disease severity: According to **Matteo and Michela, (2013) [9]**: Psoriasis area and severity index (PASI) score is a three point disease activity score that has been used to grade the disease severity. The score assesses four body regions: the head (H), the upper extremities (U), the trunk (T) and the lower extremities (L) corresponding to 10%, 20%, 30% and 40% of the total body surface area respectively. According to the extent of the lesion, each area of psoriasis involvement is given a numerical value (0 - 6) corresponding to the following scale. The PASI result is a score for psoriasis severity ranges from 0 (no disease) to 72 (maximal disease) according to **Langley and Ellis, 2004 [10]**.

#### **Procedure:-**

##### **Serological evaluation:-**

Venous blood samples (5ml) were collected under sterile conditions from all subjects to estimate serum OPN level by enzyme linked immunosorbent assay (ELISA) technique using a kit based on the principle of double-antibody sandwich technique and also to estimate lipid profile and FBS.

##### **Sample Collection and Storage:-**

Using a serum separator tube (SST), five ml of the blood sample was left to clot for 20 minutes at room temperature then subjected to centrifugation for 20 minutes at approximately 2000-3000 rpm to separate the serum. The serum samples were removed using a sterile pipette and stored at -70°C until assayed.

##### **Test principle:-**

The kit used a double-antibody sandwich enzyme-linked immunosorbent assay (ELISA) to assay the level of human osteopontin (OPN) in samples. We add osteopontin (OPN) to monoclonal antibody enzyme which is precoated with human (OPN) monoclonal antibody, incubation, then we add (OPN) antibodies labeled with biotin and combined with streptavidin-HRP to form immune complex, then carry out incubation and washing again to remove the uncombined enzyme. Then we add chromogen solution A, B, the colour of the liquid changes into the blue and at the effect of acid, the color finally becomes yellow. The chroma of the color and the concentration of the human substance (OPN) of sample were positively correlated.

The specific kit reagents used in the test were supplied from PELOBIOTECH GmbH – Am Klopferspitz 19 – 82152 Planegg - Germany.

##### **Statistical analysis:-**

The data were tabulated and statistically analyzed using Microsoft Office Excel 2010, and Statistical Package for Social Sciences version 20 (SPSS: An IBM Company). Data were represented as Mean ± SD, and were analyzed statistically by using analysis of variance (ANOVA), Chi-squared test (X<sup>2</sup>), paired T test and correlation coefficient (r). Values were considered significant if p < 0.05.

#### **Results:-**

Demographic and laboratory characteristics of patients and control groups are described in **Table (1)**: We found no statistical difference in age and sex distribution between groups. But there was significantly elevated body mass index (BMI) in psoriatic cases. Mean duration of disease was 7.92 ± 8.06, mean psoriasis area and severity index

(PASI) score was  $16.31 \pm 12.09$ . Metabolic syndrome was present in 25% of psoriatic cases compared to 12.5% of control group, hypertension was present in 41.6% of psoriatic cases compared to 20.8% of control group but the difference was insignificant.

**Table (2):** The level of FBG in cases was higher than that of control, but without statistically significant difference. There were significantly elevated levels of osteopontin, cholesterol, TG and LDL and significantly decreased levels of HDL in patients with psoriasis than control.

**Table (3), Fig. 1:** In the psoriasis group, PASI score had no significant correlation with age or disease duration, but PASI score had significant +ve correlation with obesity (BMI), systolic & diastolic blood pressure, FBG, dyslipidemia, (elevated cholesterol & TG & LDL) and significant -ve correlation between PASI score and HDL. In **Table (3), Fig. 2:** in the psoriasis group, serum OPN had significant +ve correlation with age, systolic and diastolic blood pressure. Serum OPN had no significant correlation with BMI, disease duration, FBG, cholesterol, TG, LDL and HDL.

**Table 1:-** Demographic and clinical data of the studied subjects

Variable	Cases (n=24)	Control (n=24)	Test	P
Sex: n (%) Female Male	13(54.2%) 11(45.8%)	15(62.5%) 9(37.5%)	$X^2=0.34$	0.56
Age (year)	$33.25 \pm 12.9$ 10 – 60	$31.63 \pm 16.52$ (10 – 70)	T=0.6	0.55
Duration of disease: (year)	$7.92 \pm 8.06$ (0.17 – 33)	-	-	-
Psoriasis area and severity index (PASI) score	$16.31 \pm 12.09$ (1.8 – 41.5)	-	-	-
BMI kg/m <sup>2</sup>	$43.31 \pm 12.07$ 18 – 60	$33.05 \pm 9.43$ 21.4 – 48	T=3.28	0.002*
Metabolic syndrome n/%	6 /24(25%)	3/24 (12.5%)	$X^2=1.23$	0.27
Hypertension n/%	10/24(41.6%)	5/24(20.8%)	$X^2=2.43$	0.12

**Table 2:-** Mean  $\pm$ SD(range) of the laboratory data of the studied subjects

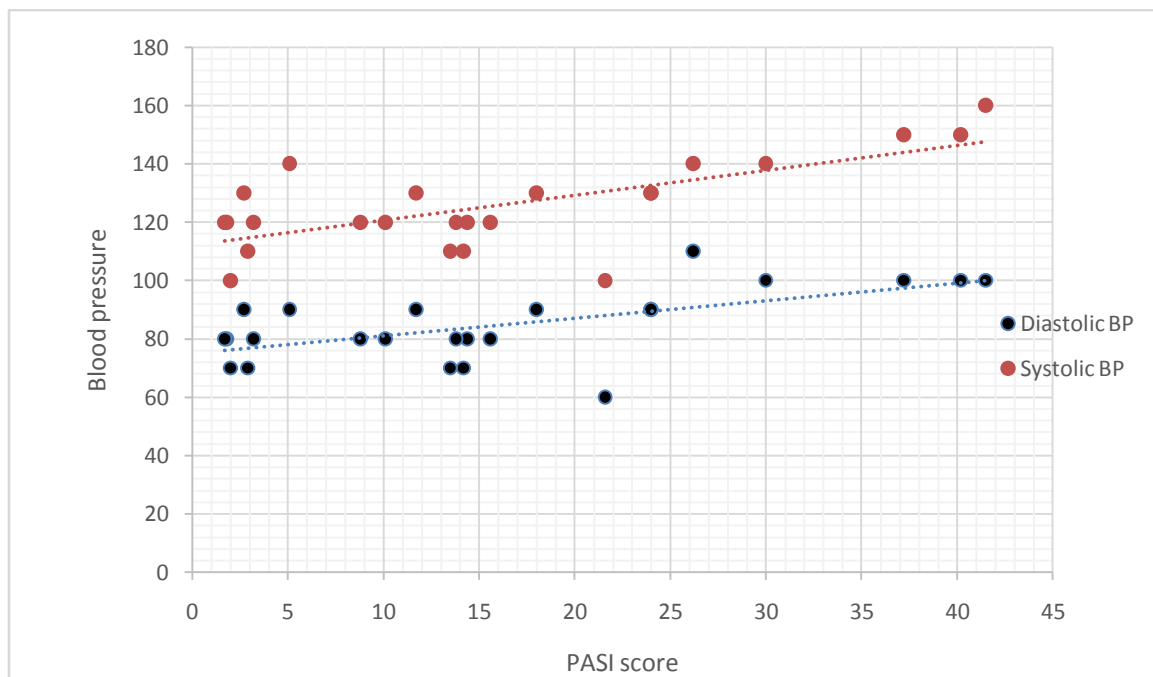
Variable	Cases (n=24)	Control (n=24)	Test	P
Osteopontin	$187.08 \pm 141.1$ (95 – 600)	$107.42 \pm 35.8$ (960 – 180)	2.93	0.003*
FBG (mg/dl)	$111.11 \pm 47.4$ (75 – 274.5)	$89.24 \pm 6.39$ (77.4 – 99)	1.32	0.19
Cholesterol(mg/dl)	$248.88 \pm 62.89$ 150 – 400	$174.42 \pm 34.87$ (111.2 – 239.8)	5.07	<0.001*
TG (mg/dl)	$230.75 \pm 64.6$ 45.8 – 229	$102.74 \pm 50.76$ (32.9 – 233.7)	5.18	<0.001*
LDL-C(mg/dl)	$116.79 \pm 30.35$ (58.5 – 169.8)	$99.4 \pm 33.39$ (33.4 – 174.6)	2.03	0.04*
HDL-C (mg/dl)	$41.51 \pm 15.17$ (30 – 88.3)	$51.77 \pm 13.46$ (28 – 73.7)	3.1	0.002*

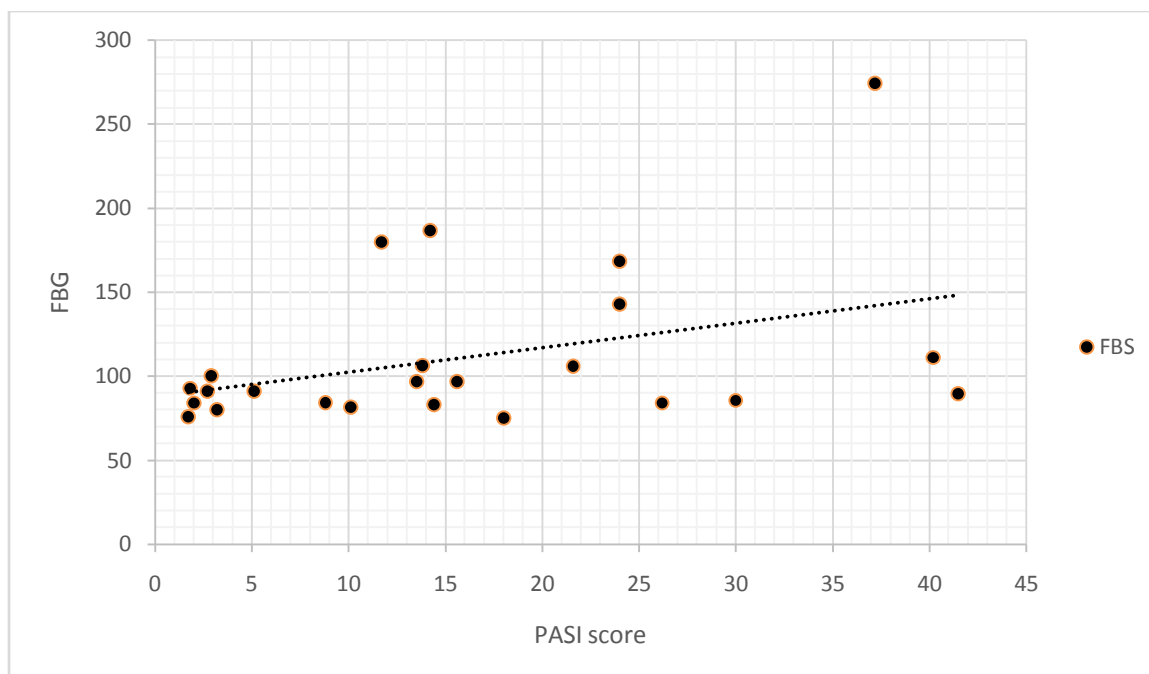
HDL-C; high-density lipoprotein-cholesterol, TG ; triglycerides, LDL-C; low-density lipoprotein-cholesterol, , FBG; fasting blood glucose, \* P < 0.05 .

**Table 3:-** Correlation between serum osteopontin level&PASI score and patients data

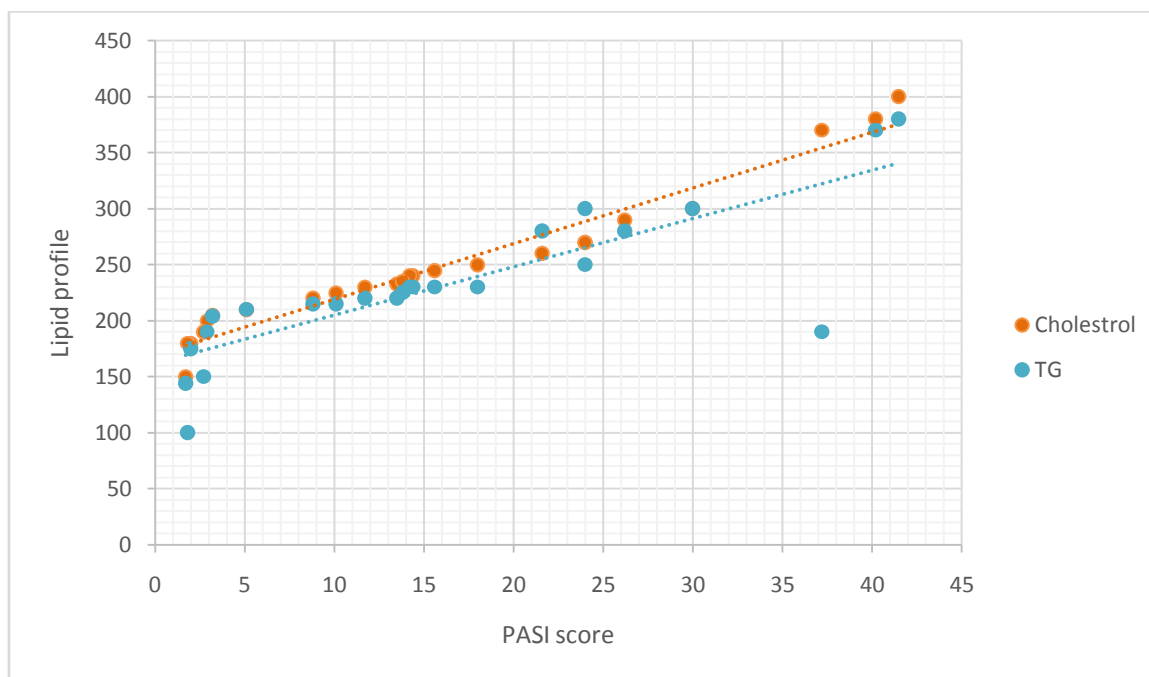
Variable	Osteopontin		PASI	
	r	P	r	P
Age	0.36	<b>0.03*</b>	0.03	0.90
BMI	-0.3	0.16	0.26	<b>0.04*</b>
Duration of disease	-0.18	0.4	0.13	0.37
PASI score	0.33	0.12	-	-
Systolic blood pressure	0.39	<b>0.02*</b>	0.28	<b>0.04*</b>
Diastolic blood pressure	0.41	<b>0.01*</b>	0.32	<b>0.03*</b>
FBG	-0.29	0.18	0.39	<b>0.02*</b>
Cholesterol	0.08	0.7	0.42	<b>0.006*</b>
TG	0.09	0.68	0.40	<b>0.01*</b>
LDL-C	-0.04	0.87	0.25	<b>0.04*</b>
HDL-C	-0.1	0.63	-0.29	<b>0.03*</b>

HDL-C; high-density lipoprotein-cholesterol, TG ; triglycerides, LDL-C; low-density lipoprotein-cholesterol, FBG; fasting blood glucose.\* P <0.05 .

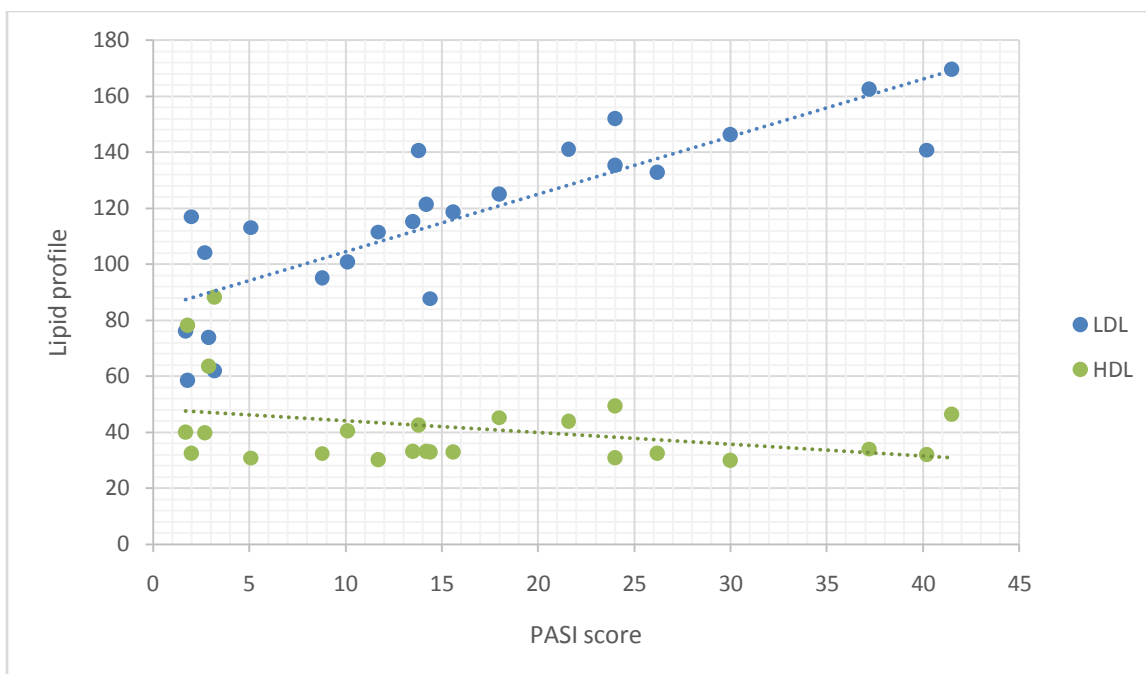
**Fig.1a:-**correlation between PASI score and blood pressure.



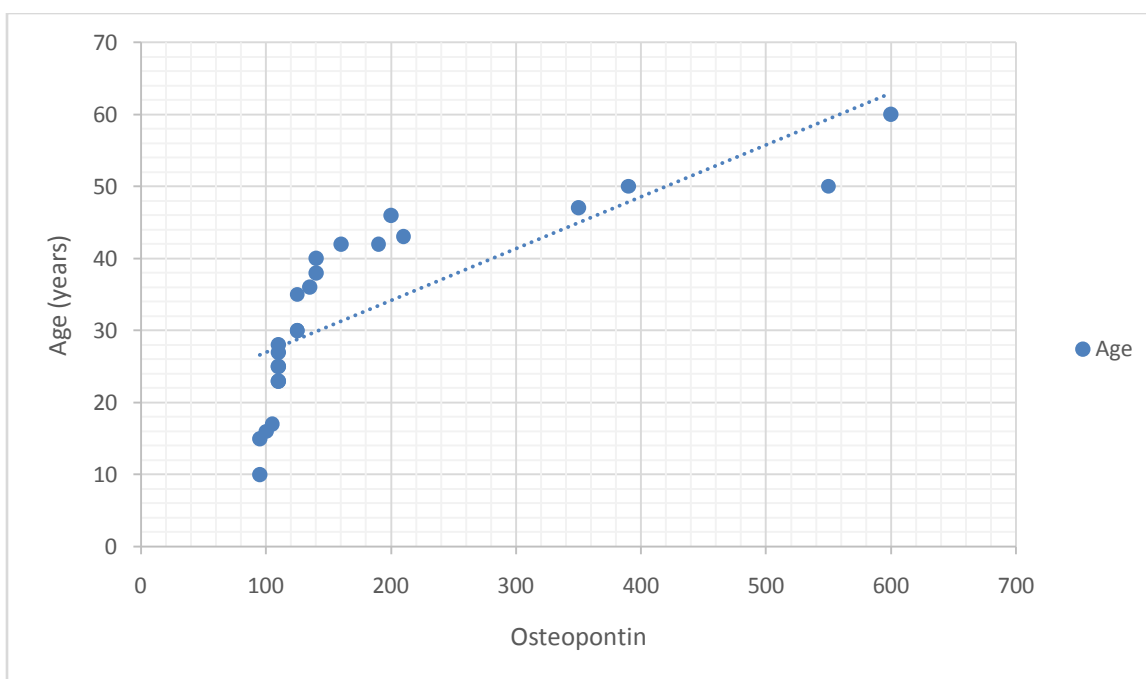
**Fig1b:-** correlation between PASI score and FBS .



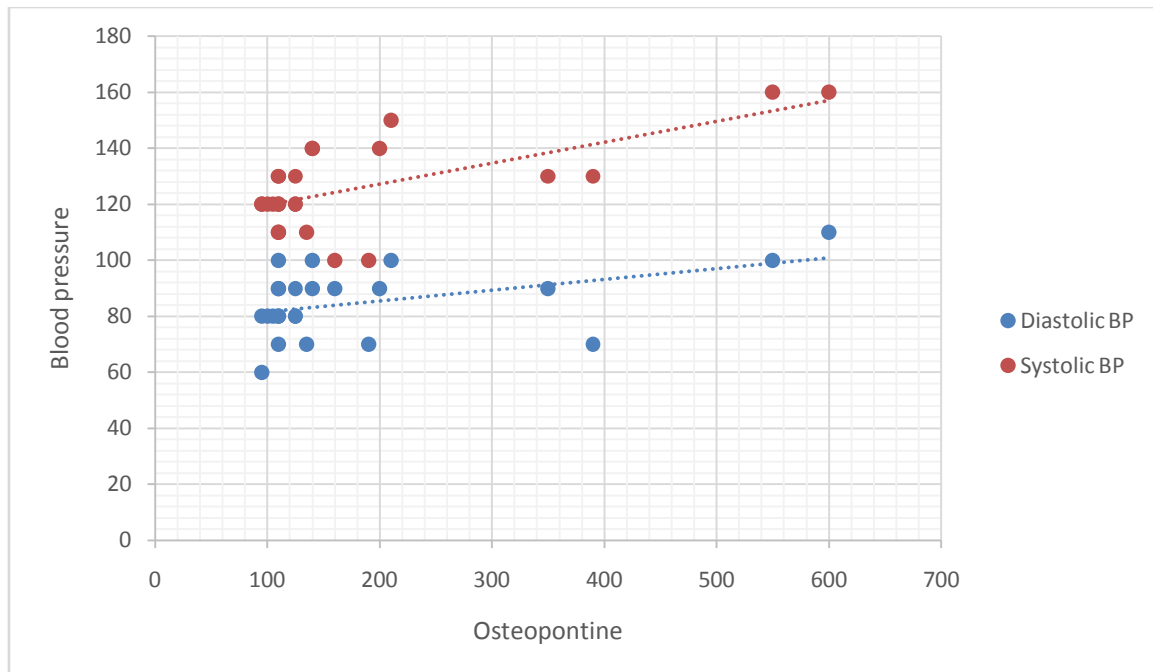
**Fig 1c:-** correlation between PASI score and lipid profile(cholesterol&TG).



**Fig.1d:-** correlation between PASI score and lipid profile (LDL&HDL).



**Fig 2a:-** correlation between OPN level and age in cases group.



**Fig 2b:-** correlation between serum OPN level and blood pressure.

### Discussion:-

Psoriasis is a chronic inflammatory immune-mediated disease affecting approximately 1-3% of the general population. Psoriasis is not just a disease of skin and joints, but also is a systemic disease that is connected with a range of comorbidities especially metabolic syndrome and cardiovascular diseases (CVDs) [11].

This dermatosis is considered to be a T-cell mediated disease with active hyperproliferation of keratinocytes and abnormal vascular expansion within the superficial dermis. This expansion is mediated by angiogenesis, an active vaso-proliferative process which appears to be a key inflammatory response early in the pathogenesis of psoriasis [12]. There is a number of Th lymphocyte subsets that have been detected in psoriatic lesions. Earlier reports indicated that activated Th1 cells in psoriatic lesions that produce  $IFN\gamma$ ,  $TNF\alpha$  and IL-2 were mainly involved in the pathogenesis of psoriasis [13].

Osteopontin is a phosphorylated acidic glycoprotein of pleiotropic properties and has been recently recognized as a potential inflammatory cytokine having a role in many diseases. OPN is produced by different cell lines and binds to several integrin receptors and is known to induce cell adhesion, migration, and survival of immune cells including neutrophils, macrophages, T cells, mast cells, and osteoclasts [14]. Secreted OPN appears to have a role in the development of psoriasis through inhibiting keratinocyte apoptosis, thereby supporting enhanced epidermal proliferation. OPN promotes vessel formation subsequently supporting the influx of inflammatory cells. OPN has a pro-angiogenic effect on microvascular endothelial cells, and has been involved in the onset of angiogenesis through a mechanism mediated by IL-1 [15]. Moreover, there are reports suggest that OPN and MMP-9 may be regulated by  $TNF\alpha$ , indicating that they may have a role in the pathogenesis of psoriasis [16].

Metabolic syndrome (Met.S) is a clinical entity comprising risk factors such as hypertension, glucose intolerance, hyperlipidemia, abdominal obesity and increased inflammatory state [17]. According to NCEP-ATP III (National Cholesterol Education Program Adult Treatment Panel III) metabolic syndrome involves 3 or more of the factors: Fasting plasma glucose  $\geq 110$ , Blood pressure: systolic  $\geq 130$  & diastolic  $\geq 85$ , Triglycerides (mg/dl)  $\geq 150$ , HDL-c (mg/dl): male  $< 40$  & female  $< 50$ , Central obesity (waist circumference): male  $> 102$  cm & female  $> 88$  cm.

We aimed to assess metabolic syndrome and osteopontin and their associated systemic comorbidities in patients with psoriasis.

In our study, FBS level was found to be non-significantly more in psoriatic cases rather than control. Cholesterol, LDL-c, TG levels were significantly elevated, and HDL-c levels were lower in psoriatic cases than control. Also

obesity was found to be statistically higher in psoriasis than control. Severity of psoriasis had significant positive correlation with obesity, FBS, dyslipidemia and hypertension.

According to the results of our study, psoriasis is positively associated with metabolic syndrome, and patients with more severe psoriasis were exposed to have metabolic syndrome than those with milder psoriasis. This result is consistent with **Armstrong et al., 2013 [18]** as they found that metabolic syndrome and its components was found to be more among subjects with psoriasis, and that patients with advanced psoriasis have greater odds of metabolic syndrome than those with milder psoriasis.

Psoriatic patients have a high prevalence of the Met.S. Psoriasis as a chronic inflammatory skin disorder is characterized by a variety of immunologic and inflammatory changes and may similarly predispose for those inflammatory disorders. This could likely be due to the effects of chronic inflammatory changes, in particular, the secretion of proinflammatory cytokines [19].

Chronic systemic inflammation induces endothelial dysfunction, altered glucose metabolism, and insulin resistance that play a significant role in the development of obesity, diabetes mellitus, dyslipidemia, and cardiovascular disease such as atherosclerosis and myocardial infarction or stroke [20]. On assessing the components of Met.S, psoriasis continues to stand as an independent risk factor with respect to altering levels of glucose tolerance and dyslipidemia. Subjects with psoriasis have a higher percentage of known DM. Patients with psoriasis have also an increased insulin resistance and probably worse impaired glucose tolerance, therefore a higher risk of diabetes [21].

Cytokines such as tumor necrosis factor (TNF)-alpha and interleukin-6 (IL-6) seem to play a central role. TNF- $\alpha$  plays a critical role in activation of innate and acquired immune responses leading to chronic inflammation, tissue damage and keratinocyte proliferation. TNF- $\alpha$  levels are markedly increased in skin lesions, synovium and serum of patients with psoriasis and these correlate with the severity of the disease. Decreased levels of TNF- $\alpha$  are associated with clinical resolution [22].

TNF- $\alpha$  may lead to insulin resistance by inhibiting insulin mediated tyrosine phosphorylation of the insulin receptor, as well as insulin receptor substrate-1. TNF- $\alpha$  has also been shown to be a potent activator of C-Jun amino-terminal kinase, which stimulates activator protein-1, a major regulator of pro-inflammatory activity and is connected with obesity [23]. Mouse models show that c-Jun amino-terminal kinase activity is abnormally elevated in obesity, while its absence is associated with decreased adiposity, improved insulin sensitivity and enhanced insulin receptor signaling [24].

We found that there was significant dyslipidemia in psoriatic cases than normal control. It was reported that macrophages activated by engulfing low density lipoprotein (LDL) immune complexes release large quantities of TNF- $\alpha$ . Treatment with TNF-inhibitors affect the increase of HDL levels, decreased LDL and triglyceride levels and strongly recommended the use of anti-TNF- $\alpha$  modalities, adalimumab and infliximab, for the treatment of obese psoriatics and suggested that anti-TNF- $\alpha$  treatment might prevent cardiovascular diseases in psoriasis [25].

Furthermore, interleukin-6, IL-8, Interferon - $\gamma$ , IL1, and IL-17 are also implicated in the generation of pro-atheromatous abnormalities like dyslipidemia, insulin resistance, endothelial dysfunction, clotting system activation, and pro-oxidative stress. TNF- $\alpha$  may affect endothelium dysfunction by decreasing the levels of nitric oxide synthase and cyclooxygenase-1 [26].

C-reactive proteins [27] and cellular oxidative stress [28] may also be responsible for altered lipid metabolism. Anti-psoriatic drugs such as oral retinoids and cyclosporine, can be also responsible for lipid profile disturbances in psoriatic patients because of their action on the circulating lipids. Including hypercholesterolemia, hypertriglyceridemia and low HDL-cholesterol [29].

Hypertriglyceridemia secondary to VLDL elevation is associated with both procoagulant and prothrombotic factors in the blood and affects the adhesiveness of platelets. Resting platelets circulate freely, adhering neither to each other nor to other cells. However, activated platelets adhere to all lipoproteins, especially VLDL. VLDL mediated platelet adhesion may play an important role in the progression of atherosclerosis. Furthermore, VLDL remnants are susceptible to retention within the arterial intima and thereby promoting atherosclerotic plaque growth [30, 31].



Regarding OPN, our study found significantly elevated serum OPN in psoriatic patients than in healthy controls. Also **Robati et al., 2016** [31] found higher levels of serum osteopontin in psoriatic patients than in healthy controls. That elevated serum levels of osteopontin in our study were positively correlated with increasing age. **Cheng et al., 2008** [6] noticed that, the level of OPN increased with increase of age. In our study plasma osteopontin values were not associated with sex, severity of psoriasis, duration of the disease or dyslipidemia. **Cheng et al., 2008** [6] reported the same result that, plasma OPN levels were not associated with sex, duration of the disease, disease severity or dyslipidemia.

**Tossi et al., 2015**, [32] measured serum levels of selenium, prolactin and osteopontin in both psoriasis and healthy control groups, there was no significant difference in selenium and prolactin levels between the two groups, but OPN was significantly high in psoriasis group. Lesional skin of psoriatic patients showed significant elevated OPN levels in comparison to controls [33, 34]. In psoriasis, OPN secreted by keratinocytes inhibits keratinocyte apoptosis, thereby supporting enhanced epidermal proliferation, OPN acts as a pro-inflammatory agent that participates in the up-regulation of Th cell lineages, among which are the Th1 and Th17 cells. OPN secreted by keratinocytes, possibly stimulated through IFN  $\gamma$  from T-cells and OPN from effector T cells attract additional inflammatory cells [15].

The relationship between the inflammatory cells present in psoriasis and OPN expression might be one of the responsible factors, where the environment is rich in inflammatory cells, such as macrophages, natural killer cells and T lymphocytes, which are known to be among the cells responsible for the expression of OPN [35].

Osteopontin is involved in the onset of angiogenesis which is considered as a corner stone in the psoriatic story. OPN expressed in inflammatory cells and endothelial cells of psoriatic patients. Its pro-angiogenic effect on microvascular endothelial cell is through promoting vessel formation subsequently supporting the influx of inflammatory cells [36].

The matrix metalloproteinase (MMP)-9 induced by OPN and TNF $\alpha$  acts as an angiogenesis promoting factor [37]. One study had demonstrated that OPN expression seems to be related to the CD34 expression, angiogenesis marker, expressed in the endothelial cell of psoriatic lesions skin [33].

In our study, elevated plasma OPN levels were found to be significantly associated with hypertension, but not significantly associated with fasting blood glucose. In agreement with us, **Cheng et al., 2008** [6] found that elevated OPN levels were significantly associated with hypertension but not significantly positively correlated with DM in psoriatic patients. Another study **Robati et al., 2016** [31] found higher levels of plasma OPN and mean intima-media wall thickness of the common carotid artery in psoriatic patients than healthy control and this supports increased cardiovascular risk in psoriatic patients and the possible role of OPN.

OPN was found to be expressed in smooth muscle cells in the atherosclerotic lesion in angiogenic endothelial cell and macrophages. OPN modulates proliferation, migration and accumulation of smooth muscle cells and endothelial cell involved in repair and remodeling processes of the vasculature. Osteopontin expression increases under a variety of conditions of the heart diseases and is associated with increased myocyte apoptosis and myocardial dysfunction [7]. Plasma OPN levels are higher in patients with coronary artery disease and have been correlated with its severity. Furthermore, plasma OPN has been reported to be a potential clinical marker for the prediction of atherosclerosis and further adverse cardiac events in patients with essential hypertension and patients with chronic stable angina [38].

In our results, we found non significant positive correlations between plasma OPN and severity of psoriasis. On the contrary, **El-Eishi et al., 2012** [35] found positive correlation between plasma OPN and psoriasis severity and found that plasma OPN was associated with the presence of metabolic syndrome components.

### Conclusion:-

Psoriatic patients have a high prevalence of the metabolic syndrome. OPN involvement in psoriasis enlarges the list of cytokines able to stimulate the inflammatory response in this disease. OPN is involved in the pathophysiology of psoriasis, in the onset and worsening of psoriasis and lastly a possible association with disease severity. High level of OPN is correlated also with cardiovascular risks in psoriatic patients. The possibility of using this inflammatory cytokine as a new target in the treatment of psoriasis, anti-OPN antibodies, may eventually become a useful therapeutic

approach in psoriasis. OPN may be used as early detector of cardiovascular problems in psoriatic patients and as a new target in decreasing cardiovascular risks in those patients.

### References:-

1. Mahajan R and Handa S (2013) : Pathophysiology of psoriasis. Indian. J Dermatol Venereol Leprol ; 79:1-9.
2. Abdelnoor AM and Al-Akl N (2013): Factors Involved in the Pathogenesis of psoriasis. Adv S Med Scien ;1(2): 75-94.
3. VM Voiculescu, M Lupu, L Papagheorghe, C Giurcaneanu, and E Micu (2014): Psoriasis and Metabolic Syndrome – scientific evidence and therapeutic implications. J Med Life. 2014 Oct-Dec; 7(4): 468–471.
4. Bassyouni IH, Bassyouni RH, Ibrahim NH, et al (2012) : Elevated Serum Osteopontin Levels in Chronic Hepatitis C Virus Infection: Association with Autoimmune Rheumatologic Manifestations. J Clin Immunol ; 32:1262–1269.
5. Sase S P, Nagane N., Ganu J V. Osteopontin: A Novel Protein Molecule. Indian Medical Gazette. 2012 Feb ; 145 (2): 62-66.
6. Cheng X, Yu X, Ding YJ, et al (2008) : The Th17/Treg imbalance in patients with acute coronary syndrome. Clin Immunol 2008 ; 127: 89–97.
7. Mazzone A, Parri MS, Giannessi D, et al (2011): Osteopontin plasma levels and accelerated atherosclerosis in patients with CAD undergoing PCI: a prospective clinical study. J Coron Artery Dis ; 22(3):179-187.
8. Alain-P G., Hervé C., Danièle D., Mark K et al (2001): Time Course of Osteopontin, Osteocalcin, and Osteonectin Accumulation and Calcification After Acute Vessel Wall Injury, J Histochem Cytochem January 2001 vol. 49 no. 1 79-86
9. Mattei PL1, Corey KC, Kimball AB. (2013): Psoriasis Area Severity Index (PASI) and the Dermatology Life Quality Index (DLQI): the correlation between disease severity and psychological burden in patients treated with biological therapies. J Eur Acad Dermatol Venereol. 2014 Mar; 28(3):333-7. . Epub 2013 Feb 21.
10. Langley RG and Ellis CN (2004) : Evaluating psoriasis with Psoriasis area and Severity Index, Psoriasis Global Assessment and Lattice System Physician Global Assessment. J Am Acad Dermatol ; 51:563-569.
11. Kılıç A and Cakmak S (2013) : Psoriasis and comorbidities. EMJ Dermatol ; 1:78-85.
12. Lima H, Dogan S, Atakan N, et al (2013) : Psoriasis, types, causes and medications. InTech ; 51(1):978-953.
13. Lowes MA, Suárez-Fariñas M and Krueger JG (2014) : Immunology of Psoriasis. J Annu Rev Immunol; 32:227-255.
14. Kahles F, Findeisen H M and Bruemme D (2014): Osteopontin: A novel regulator at the cross roads of inflammation, obesity and diabetes . J Mol Metab ; 3(6):384-393.
15. Buback F, Renkl AC, Schulz G, et al (2009): Osteopontin and the skin: multiple emerging roles in cutaneous biology and pathology. J Exp Dermatol ; 18:750–759.
16. Buommino E, Filippis A, Gaudiello F, et al (2012): Modification of osteopontin and MMP-9 levels in patients with psoriasis on anti-TNF $\alpha$  therapy. Arch Dermatol Res; 304(6):481-5.
17. Balta I, Balta S, Demirkol S, et al (2013): Other inflammatory markers and related factors should be kept in mind in metabolic syndrome with psoriasis patients. Arch Dermatol Res ; 305:459–460 .
18. Armstrong AW, Harskamp CT, Armstrong EJ (2013): Psoriasis and metabolic syndrome: a systematic review and meta-analysis of observational studies. J Am Acad Dermatol ; 68:654–662.
19. Nakajima H, Nakajima K, Tarutani M, Sano S (2012) The role of pigment epithelium-derived factor as an adipokine in psoriasis. Arch Dermatol Res 304(1):81–84
20. Boehncke W., Boehncke S., Tobin A., Kirby B. (2011) The ‘psoriatic march’: a concept of how severe psoriasis may drive cardiovascular comorbidity. Exp Dermatol 20: 303–307
21. Albareda M, Ravella A, Castelló M et al (2014): Metabolic syndrome and its components in patients with psoriasis. Springer plus; 3:612.
22. Joshi R. (2004): Immunopathogenesis of psoriasis. Indian J Dermatol Venereol Leprol; 70:10-2.
23. Farshichian M, Zamanian A, Farshichian M, et al (2007) : Serum lipid levels in Iranian patients with psoriasis. J Eur Assoc Dermatol Venereol; 21: 802–805.
24. Jacob D., Dahlia W., Bayta D., Jonathan S., et al (2008): Psoriasis and Dyslipidaemia: A Population – based study, Acta Derm Venereol 2008; 88:561-565
25. Strober BE, Poulin Y, Kerdel FA, et al (2011): Switching to adalimumab for psoriasis patients with a suboptimal response to etanercept, methotrexate, or phototherapy: efficacy and safety results from an open-label study. J Am Acad Dermatol; 66:671.
26. Karadag AS, Yavuz B, Ertugrul DT, et al (2010): Is psoriasis a preatherosclerotic disease? Increased insulin resistance and impaired endothelial function in patients with psoriasis. Int J Dermatol; 48(6):642–646.
27. Escarcega RO, Garcia-Carrasco M, Fuentes-Alexandro S, et al (2006): Insulin resistance, chronic inflammatory state and the link with systemic lupus erythematosus-related coronary disease. Autoimmune Rev; 6:48-53.

28. Rocha-Preira P, Santos-Silva A, Rebelo I, et al (2001): Dyslipidemia and oxidative stress in mild and in severe psoriasis as a risk for cardiovascular disease. *Clin Chim Acta*; 303:33-90.
29. Wakkee M, Thio HB, Prens EP, et al (2007): Unfavorable cardiovascular risk profiles in untreated and treated psoriasis patients. *Atherosclerosis*; 190: 1–9.
30. Lotuș Măllbris, MD, PhD, Fredrik Granath, Anders Hamsten, ET AL (2006): Psoriasis is associated with lipid abnormalities at the onset of skin disease, *JAAD*, April 2006 Volume 54, Issue 4, Pages 614–621
31. Robati RM1, Partovi-Kia M1, Sadat-Amini H1, Haghighatkhah HR2, et al (2016): Serum osteopontin level and common carotid artery intima-media wall thickness in psoriasis. *Int J Dermatol*. 2016 May;55(5):e262-7. Epub 2016 Jan 15.
32. Toossi P1, Sadat Amini SH1, Sadat Amini MS2, Partovi Kia M1, et al (2015): Assessment of serum levels of osteopontin, selenium and prolactin in patients with psoriasis compared with healthy controls, and their association with psoriasis severity. *Clin Exp Dermatol*. 2015 Oct;40(7):741-6. doi: 10.1111/ced.12657. Epub 2015 May 19.
33. Amin MM and Azim ZA (2012): Immunohistochemical study of osteopontin, Ki-67 and CD34 of psoriasis in Mansoura, Egypt. *Indian J Pathol Microbiol* ; 55(1):56–60.
34. El-Eishi NH, Kadry D, Hegazy RA, Rashed L (2012) : Estimation of tissue osteopontin levels before and after different traditional therapeutic modalities in psoriatic patients. *J Eur Acad Dermatol Venereol*; 27(3):351-5.
35. Gaspari AA (2006): Innate and adaptive immunity and the pathophysiology of psoriasis. *J Am Acad Dermatol* ; 54(suppl2):67-80.
36. Giachelli CM and Steitz (2000) : S. Osteopontin: A Versatile regulator of inflammation and biomineralization. *J Matrix Biol* ; 19(7):615-622.
37. Nissinen L and Kähäri VM (2014): Matrix metalloproteinases in inflammation. *J Biochim Biophys Acta*; 1840(8):2571-2580.
38. Abdel-Azeez HA and Al-Zaky M (2010): Plasma osteopontin as a predictor of coronary artery disease: association with echocardiographic characteristics of atherosclerosis. *J Clin Lab Anal* ; 24(3):201-206.

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### RESEARCH ARTICLE

## PROTECTIVE POTENTIAL OF CYNODON DACTYLON EXTRACT ON LAMOTRIGINE INDUCED BRAIN TOXICITY IN MICE FETUSES.

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### Abstract

Lamotrigine (LTG), an antiepileptic drug believed to be safe in pregnancy whereas *Cynodon dactylon* (CD) is a herb having antioxidant potential, used for the treatment of various diseases including epilepsy in alternative system of medicine. The study was planned to observe the effect of LTG alone and with *Cynodon dactylon* on growing brain of mice. Lamotrigine was given orally at a dose of 60mg/kg body weight on 7<sup>th</sup>- 9<sup>th</sup> gestational day, to the pregnant mice of treated group I (T I) whereas both Lamotrigine (60mg/kg, 7<sup>th</sup>- 9<sup>th</sup> day) and *Cynodon dactylon* juice (0.3 ml, 6<sup>th</sup>-17<sup>th</sup> day of gestation) were given to treated group II (T II). Control group (C) received the same volume of distilled water during 6<sup>th</sup>-17<sup>th</sup> day of gestation. On 18<sup>th</sup> day of gestation fetuses from all groups were collected and kept in 10 % formalin for fixation. After three days of fixation the brains were removed from the cranial cavity and observed macro and microscopically. Brain of T I group showed insignificant decrease in weight. The haemorrhagic patches and the prominent blood vessels on various surfaces of brain have been observed in T I group. The macroscopic findings in T II group brain were similar to the control group. The microscopic features of T I brain revealed destruction and oedematous appearance of parenchyma of hippocampus, loss of normal architecture of cortical and subcortical zone, dilated ventricles with disruption of ependymal lining, degeneration and clumping of choroid plexus as compared to control group. Treated group II showed reduction in pathological findings which were appeared in treated group I. Therefore there may be possibility that *Cynodon dactylon* (CD) fresh juice neutralised the effect of lamotrigine neurotoxicity in growing brain upto certain extent. This may happened due to antioxidant property of CD.

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### Introduction:-

Lamotrigine (LTG) [3,5-diamino-6(2,3dichlorophenyl)1,2,4triazine], is an anticonvulsant drug used in the treatment of epilepsy and bipolar disorder in the United States as an adjunctive treatment since 1994 and as monotherapy since 1998 (Goel P et al, 2012). Lamotrigine is used frequently in pregnancy as many workers claimed its malformation rate same as in normal population (Vajda et al, 2006; Richens A., 1994) but others found LTG to produce intra uterine growth retardation and other congenital malformations (Padmanabhan et al, 2003; Morrow et

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al, 2006) and a few studies reported that LTG possess teratogenic action on fetal brain (Marchi et al, 2001; Manent et al, 2008; Mohanty et al, 2011). *Cynodon dactylon* (CD) is a herb having antioxidant property, used in treatment of various diseases including epilepsy in ayurvedic system of medicine. The present experimental study was conducted to observe the effect of *Cynodon dactylon* fresh juice on the teratogenic changes in foetal brain, induced by lamotrigine.

### Materials and Methods:-

**Experimental animal:** Pregnant Swiss albino mice were used as experimental animal for the present study, each weighing 20-25 g. Mice were caged in air conditioned animal house of Department of Anatomy, Institute of Medical sciences, Banaras Hindu University, Varanasi, India.

### Methods:-

Female mice were transferred to cage containing adult males of proven fertility overnight for mating and were inspected next morning for the presence of vaginal plug. The day of vaginal plug positive was considered as gestational day (GD) 0. Pregnant mice were divided into two groups (6 mice in each group), i.e. Control and treated. The treated group further subdivided into two i.e. treated group I (T I) and treated group II (T II). T I group was given Lamotrigine, orally through gavage tube at a dose of 60mg/kg body weight from GD 7 to 9. T II group were treated with 0.3 ml of *Cynodon dactylon* extract (fresh juice) from day 6 to 17, as well as lamotrigine from 7 to 9 day of gestation. *Cynodon dactylon* extract is freshly prepared everyday by dissolving calculated amount of lyophilized juice in distilled water. Control group was given distilled water for same duration through same route. On the 18<sup>th</sup> day of gestation the mice were sacrificed by cervical dislocation. The foetuses were collected by laparotomy and fixed in 10 % formalin for 2 to 3 days. After fixation, the brain were removed from the cranial cavity and examined for gross abnormalities, if any, then weight was measured and finally the organ was processed for microscopic study. The study protocol was approved by animal ethical committee, BHU. All procedures were in accordance with the guidelines of the Animal Welfare Act. Statistical analysis was done by using one way ANOVA to compare the mean weight of control and treated brains of different groups.

### Results:-

As compared to control group, the brain of both T I and T II showed reduction in weight, that was statistically insignificant. The mean weight of the control group was 0.0614 g (SD .0127), whereas in T I group 0.0599 g (SD = 0.0062) & in T II group .0604 (SD =.0045). On macroscopic examination the outer surface of the growing brain of T I group revealed prominent dilated blood vessels and haemorrhagic patches, whereas T II group showed the normal appearance of the brain as shown in control group (Fig 1). There was no significant difference in the length and breadth of any group of brain. On microscopic examination hippocampus and cortical zones showed the normal layering pattern in control group whereas T I group revealed destruction of hippocampal region and cortical zone along with oedematous appearance. T II group showed the less destruction of the normal pattern of the layering and disappearance of the oedematous spaces (Fig. 2, Fig.3). In higher magnification the cells of the cortical zone of T I showed the proliferation of the immature growing cells whereas in T II there was no any indication of proliferation of cortical cells but degenerative changes has been observed (Fig. 4). The ventricle of T I group revealed dilatation, destructed choroid plexus and thickening of proliferated immature growing cells in the periventricular area whereas the T II group showed the appearance of ventricle and periventricular area as in control group (Fig.5). In higher magnification the T I group showed the destructed ependymal lining of the ventricle along with the disintegration of choroid plexus whereas T II group showed the of lining ependymal layer of the ventricle at few places as compared to control group.

### Discussion:-

The present study was mainly focussed on the effect of *Cynodon dactylon* on teratogenic action induced by LTG in growing brain. The mean weight of brain was found decreased in T I group as compared to control, although it was not statistically significant. Haemorrhagic patches on the surfaces of brain and prominent dilated blood vessels, especially on basal surface were also seen in the present study. Mohanty et al, (2011) observed that the brain weight of growing foetuses exposed to LTG was found increased but, not significant statistically. They also reported that some of the LTG exposed foetus had well defined dark brown swellings over parieto-occipital region of head (exencephaly) and hemorrhages of various sizes over the body (C. Mohanty et al, 2011). The mice brain was used for the present study whereas rat brain was used for the previous study. Marchi et al, (2001) mentioned that fetuses of the LTG treated group had reduced body weight at birth, increased volume and diameter of the cerebral structure

(Marchi et al, 2001). Another study also reported no significant difference in mean brain weight and mean brain volume in control and experimental rat fetuses (Sah N et al, 2013). Further it was observed in the same report that one of the lamotrigine exposed rat fetus had exencephaly whereas no any such case was found in the present study. Microscopic study in present work showed derangement of architecture and interruptions in the continuity of the cortical layers, oedematous appearance in subcortical and periventricular zone, dilatation of ventricles and disruption of ependymal lining along with destruction and clumping of choroid plexus have been observed in the brain of treated group I fetuses. A similar finding was reported by Marchi et al (2001), who revealed that the use of lamotrigine during the organogenesis period was associated with histological alterations. They analyzed cortex, subcortex, ependyma and lateral ventricles in their study on rat brain, after giving LTG on 9-11 day of pregnancy. Their results revealed the subcortical density enhancement, and ventricle dilatation (Marchi et al, 2001). In another study it was observed that the LTG treated growing brain showed dilated ventricle with less differentiated cortical layers (C. Mohanty et al, 2011). Treatment of pregnant wistar rats with a high dose of LTG (20 mg/kg/day) resulted in clear morphological alterations in the parietal cortex and in CA1 and CA3 hippocampal field (Manent et al, 2008). Histological study of the cerebral cortex revealed ill defined plexiform layer and dilated lateral ventricle (Sah N et al, 2013). Excess oxidative stress may be one of the mechanisms that contribute to teratogenicity. The nervous system is particularly vulnerable to the deleterious effects of reactive oxygen species (Puchchakayala G, 2012). *Cynodon dactylon* has been proved for its neuroprotective activity against aluminium induced toxicity (Sumathi T et al, 2011). The methanolic extract of *Cynodon dactylon*, given orally was found to significantly increase the levels of superoxide dismutase, catalase and NADH dehydrogenase in comparison with the control group (Manju Bhaskar et al, 2015). *C. dactylon* has been proved to inhibit lipid peroxidation in CNS (Auddy B et al, 2003; Rai PK, 2010). Correlating our findings with the previous works we can interpret that free radical scavenging activity of *Cynodon dactylon* may be the responsible for the prevention of oxidative stress induced teratogenicity. Goodman et al, 1996 showed that pre-treatment with either estrogen or progestins could prevent excitotoxic and oxidative stress injury and enhance cell survival in cultures of embryonic hippocampal neurons. Roof, R.L. et al. 1992 have been showed that the high endogenous levels of progesterone in female rats dramatically reduced cerebral oedema. So the alternative hypothesis responsible for the neuroprotective effect of CD in LTG induced abnormalities growing brain might be presence of steroids in it.

### Conclusion:-

Lamotrigine treatment followed by supplementation of *Cynodon dactylon* resulted in reduction in macro and microscopic neuropathological findings. It is therefore possible that the antioxidant activity of *Cynodon dactylon* neutralised the effect of lamotrigine induced changes in various parts of growing brain and helps to prevent the teratological changes in brain cell and tissue.

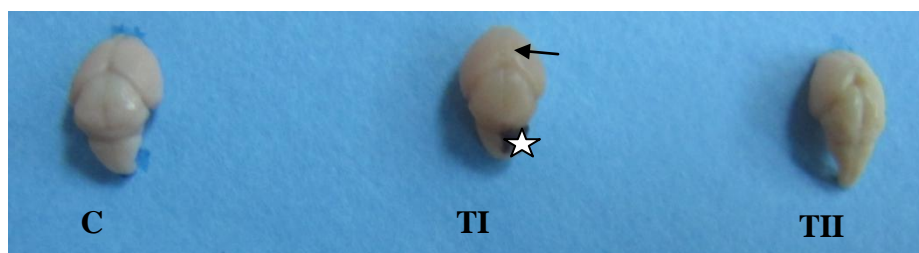


Figure 1:-



Figure 2:-



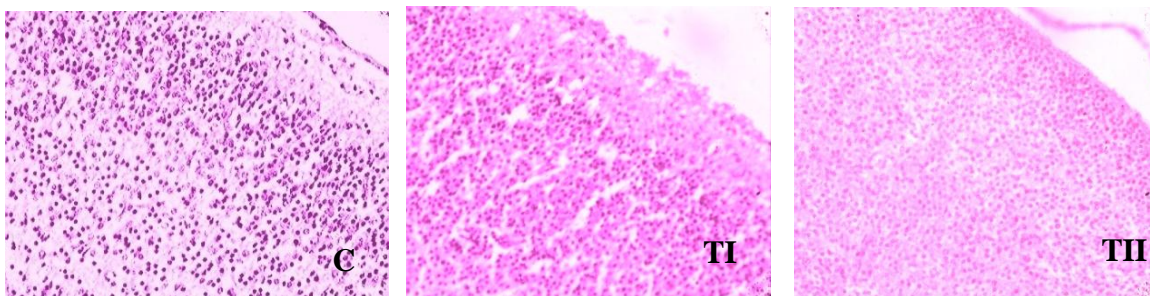


Figure 3:-

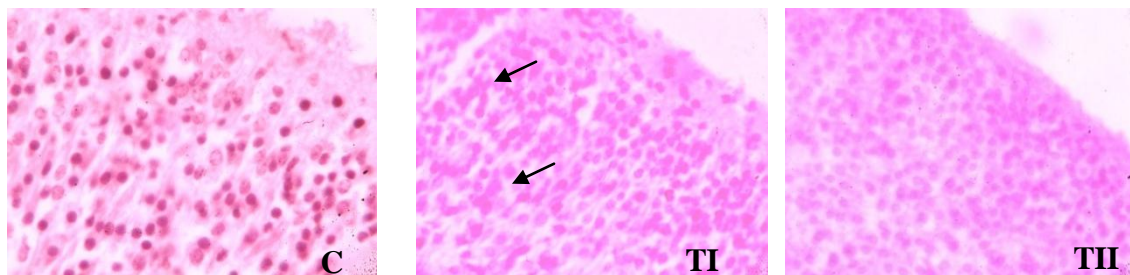


Figure 4:-

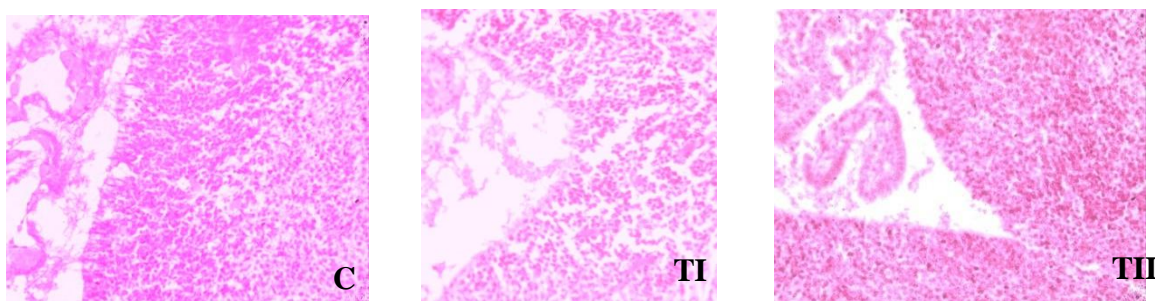


Figure 5:-

### Legends of Figure:-

**Figure 1:** Photograph showing dorsal surface of fetal brain of control (C) and treated groups (TI & TII). T I group showing haemorrhagic patch (☆) and prominent vessels (▲), whereas T II group showing normal appearance of dorsal surface of the brain as seen in control group.

**Figure 2:** In low magnification (H&E, 100X), photomicrograph of brain showing features of hippocampus. T I group showing destruction and oedematous appearance of parenchyma of hippocampus, whereas T II showing the normal features of hippocampus as seen in control group.

**Figure 3:** In high magnification (H&E, 400X), photomicrograph of brain showing layers of cortex. The control brain (C) reveals normal pattern of the various layers of cortex T I group showing destruction of the various cortical layers and oedematous spaces, whereas the T II group showing only the mild destruction of cortical layers as compared to control group.

**Figure 4:** In oil immersion magnification (H&E, 1000X), photomicrograph of brain showing cortical layers of control (C) and treated groups (TI & TII). T I group showing the degenerated growing cells of various layers of the cortical zone along with the oedematous appearance and clumping of degenerated cells at places (▲), whereas T II group showing the normal appearance of the cells as seen in control group.

**Figure 5:** In high magnification (H&E, 400X), photomicrograph of brain showing ependymal lining and choroid plexus, of control (C) and treated groups (TI & TII). T I group showing the destruction of ependymal lining and

clumping of degenerated choroid plexus and T II group reveals the normal appearance of region as seen in control group.

### References:-

1. Bhaskar, M, Chinmaykinkar and Grewal H. (2015): Neuroprotective effect of *Cynodon dactylon* and *Phyllanthus amarus* on the antioxidant defense system in Alzheimer's disease. Indo American Journal of Pharmaceutical Research, 5(1): 338-343
2. Goel,P., Isher,H, Saha,P.K., Tendon R., Devi L., Dhama,G.P. (2012): Lamotrigine Induced Hypersensitivity Syndrome in Pregnancy. Nep J of Obs and Gynae, 7 (1), 13: 68-70
3. Goodman, Y.,Bruce A.J., Cheng, B.,Mattson M.P. (1996) Estrogens attenuate and corticosterone exacerbates excitotoxicity,oxidative injury, and amyloid beta-peptide toxicity in hippocampal neurons. J. Neurochem, 66: 1836–1844
4. Manent,J.B., Jorquera,I, Franco,V, Ben-Ari Y., Perucca, E., Represa, A.(2008): Antiepileptic drugs and brain maturation: Fetal exposure to lamotrigine generates cortical malformations in rats. Epilepsy Research, 78(2-3):131-139
5. Marchi,N.S.A. de, Azoubel, R., Tognola W. A.( 2001): Teratogenic Effects of Lamotrigine on Rat Fetal Brain A morphometric study. Arq Neuropsiquiatr, 59 (2B): 362-364.
6. Mohanty, C., Shah, N., Dhungel, S., Das B.K. (2011): Effect of Lamotrigine on Fetal Rat Brain. People's Journal of Scientific Research, 4(2): 5-7
7. Morrow, J., Russell, A., Guthrie, E., Parsons, L., Robertson, I., Waddell, R., Irwin, B., Mc Givern, R.C., Morrison, P.J., Craig, J.( 2006): Malformation risks of antiepileptic drugs in pregnancy: a prospective study from the UK epilepsy and pregnancy register. Journal of Neurology, Neurosurgery and Psychiatry, 77(2): 193-198.
8. Padmanabhan, R., Abdulrazzaq, Y.M., Bastaki, S.M., Shafiulla M., Chandranath, S.I. (2003) Experimental studies on reproductive toxicologic effects of lamotrigine in mice. Birth Defects Research Part B, Developmental and Reproductive Toxicology, 68(5): 428-438.
9. Puchchakayala G, Akina S, and Thati M. (2012): Neuroprotective Effects of Meloxicam and Selegiline in Scopolamine-Induced Cognitive Impairment and Oxidative Stress. International Journal of Alzheimer's Disease, 2012: 1-8.
10. Rai, P.K., Jaiswal, D., Rai, D.K., Sharma, B., Watal, G, (2010): Antioxidant potential of oral feeding of *Cynodon dactylon* extract on diabetes-induced oxidative stress. J Food Biochem, 34: 78-92
11. Richens A. (1994): Safety of lamotrigine. Epilepsia, 35(5): 37-40.
12. Roof, R.L., Stein D.G.(1992): Progesterone treatment attenuates brain edema following contusion injury in male and female rats. Restor. Neurol. Neurosci., 4: 425–427
13. Sah,N., Pandit ,R.K., Dhungel S. (2013) : Effect of Lamotrigine on fetal rat brain morphology. Janaki Medical College Journal of Medical Sciences, 1(1): 26-29
14. Sumathi, T., Shobana C., Kumari, B.R., Nandhini, D.N. (2011): Protective role of *Cynodon dactylon* in ameliorating the aluminium-induced neurotoxicity in rat brain regions. Biol Trace Elem Res., 144: 843–853
15. Vajda F.J., Hitchcock A., Graham J, Solinas,C., O'Brien,T.J., Lander C. M. , Eadie M.J . (2006): Foetal malformations and seizure control: 52 months data of the Australian Pregnancy Registry. Eur J Neurol, 13: 645-54.



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### RESEARCH ARTICLE

#### PRIMARY PULMONARY HYPERTENSION DURING PREGNANCY: A CASE REPORT.

**Bushra mukhtar alhajjaji, Ahmed Salim Mohmoud Elshigagi, Rania Sami Iraqi, Abdulrahman Tarek khizindar, Dina Mohamed Hossameldin Ahmed, Ahmad Layth mimish, Salwa Ahmed Yahi Almalki, Gofran Tawfiq Mohammed Abduljabbar, Alaa Omer Bafageeh, Mawadah Ismaeel Nooh and Aseel Hassan Ali ALmagrabi.**

#### Manuscript Info

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##### Key words:-

Primary pulmonary hypertension;  
Pregnancy;  
General anaesthesia;  
Pulmonary vasodilators

#### Abstract

We describe a case of a 25-year-old pregnant woman who presented with severe primary pulmonary hypertension (PPH). Her echocardiogram showed severe right ventricular hypertrophy with dilatation and Moderate right ventricular systolic dysfunction. Right ventricle systolic pressure (RVSP) was estimated to be 125 mmHg. She had an elective caesarean section under general anaesthesia at 32 weeks of gestation. Pulmonary artery pressures measured by a pulmonary artery catheter before anaesthesia were 102 mmHg and pulmonary vascular resistance was 429. Intraoperative nitric oxide was used to reduce pulmonary artery systolic pressure (PASP). After the delivery of a healthy infant, PASP was controlled with nebulized iloprost and silandafil. Five days later she was transferred from intensive care unit after she was started on silandafil 50 mg three times daily and a small dose of warfarin.

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#### Introduction:-

The mortality rate of primary pulmonary hypertension (PPH) complicating pregnancy is very high [1] and [2]. The only long-term 'cure' is a heart-lung transplant. Increased pulmonary vascular resistance combined with the normal physiological changes of pregnancy and delivery is difficult to manage. A successful outcome has been described following general anaesthesia for caesarean section in a woman with PPH and coarctation of the aorta [4]. We describe in this report the management of a pregnant lady with severe PPH delivered successfully with elective caesarean section under general anaesthesia.

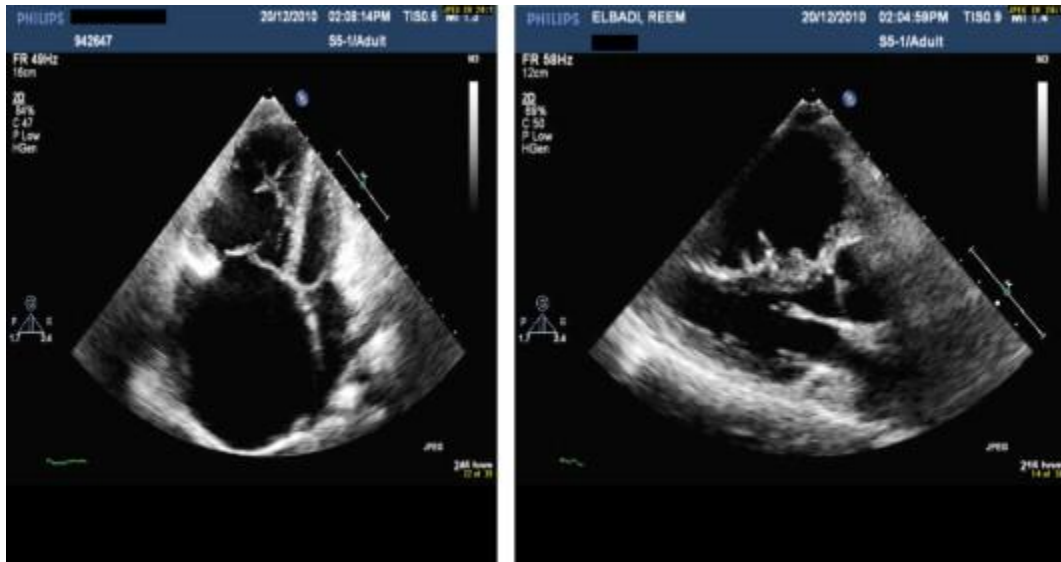
#### Case report:-

A 25-year-old primigravida presented at 32 weeks of gestation with one month history of progressive dyspnea associated with central localised chest pain, palpitation and mild intermittent cough. There was no significant past medical history.

On examination she was tachypneic and tachycardic. Arterial pressure was 100/60 mmHg. She had signs of right ventricular overload including elevated jugular venous pressure (14 cm above sternal angle), lower limb edema and right parasternal heave. On auscultation she had an accentuated pulmonary component of the second heart sound and a pan systolic murmur of tricuspid regurgitation.

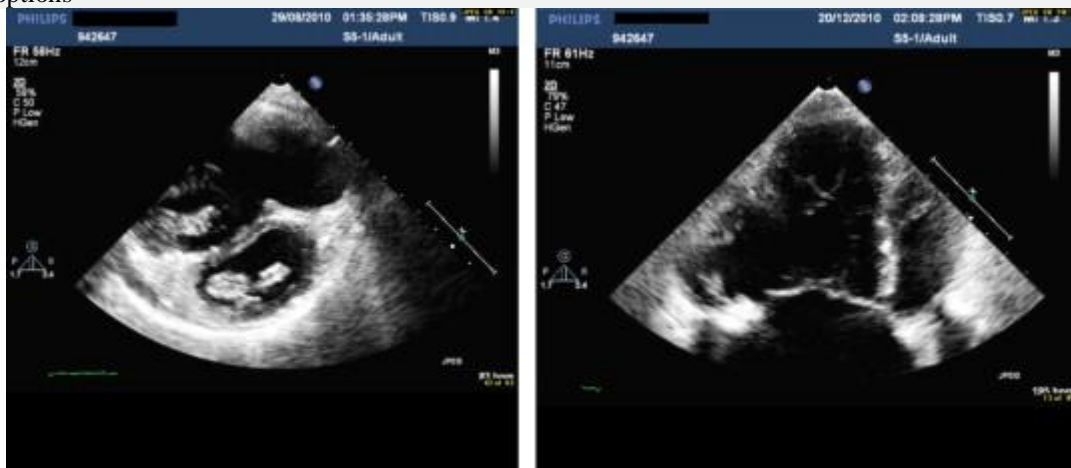
ECG showed right heart strain pattern, and chest radiograph showed a prominent right heart silhouette with prominent pulmonary arteries.

An echocardiogram showed severe right ventricle (RV) dilatation and hypertrophy (RVH) with moderate RV systolic dysfunction in addition to a huge right atrium (RA), Figure 1 and Figure 2, and severe tricuspid regurgitation (TR). Right ventricle systolic pressure (RVSP) was 125 mmHg (Fig. 3) with no evidence of left to right shunt with negative contrast injection. Left side of the heart was normal.



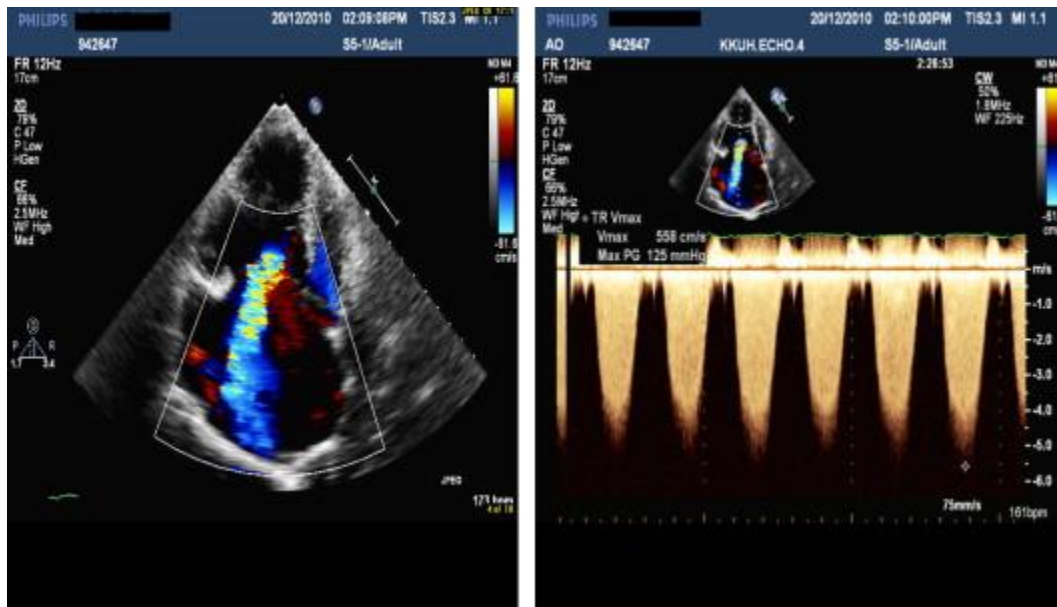
**Figure 1:-**Severe right ventricle and right atrium dilatation.

Figure options



**Figure 2:-**Severe right ventricular dilatation with right ventricular hypertrophy. Flattening of interventricular septum in systole indicating significant right sided pressure overload.

Figure options



**Figure 3:-** Severe Tricuspid regurgitation with peak TR velocity of (5.5 m/s) with high right ventricular systolic pressure (RVSP) of 125 mmHg.

#### Figure options

A ventilation/perfusion scan and duplex ultrasound (US) of the lower limbs excluded pulmonary embolic disease. Blood work for vasculitis screen did not reveal any evidence of vasculitis or connective tissue disease.

A clinical diagnosis of PPH was made and she was transferred to the intensive care unit and assessed by cardiology and pulmonary teams. She was started on diuretics and her dyspnea and lower limbs edema improved. Additionally she was given dexamethazone, silandafil 50 mg PO three times daily and intravenous infusion of heparin for two days prior to delivery.

An elective caesarean section and tubal ligation under general anaesthetic was planned after two days of admission. She was prepared for the procedure and anaesthetised by cardiac anaesthesia team. In the operating room she received midazolam 1.5 mg i.v. after which an arterial cannula and pulmonary artery catheter were inserted. Systolic pulmonary artery pressure (PAP) was 102 mmHg. After pre-oxygenation, anaesthesia was induced with propofol 40 mg, fentanyl 1 mg. She was intubated and the ventilated with oxygen and isoflurane. Vecuronium was used for muscle relaxation.

Nitric oxide 1.5 ppm was given after induction of anaesthesia and continued during the rest of the procedure. A live, healthy baby girl was delivered 10 min after induction of anaesthesia. The baby appeared heavily narcotized but promptly responded to naloxone. Augmentin 1.2 g i.v. was given after delivery and syntocinon 10 units i.v. as an infusion over 20 min to contract the uterus, which caused a slight increase in pulmonary artery pressures to 120 mmHg. Nitric oxide was continued after delivery and was well tolerated. The dose was gradually increased to 12 ppm. PAP decreased progressively to 90 mmHg by the end of the procedure. She was subsequently transferred to intensive care unit. The patient was extubated same day, 9 h after surgery with no complications.

Postoperative echocardiography was unchanged. Pulmonary artery systolic pressure (PASP) was equal to 102 mmHg. Intravenous heparin was recommenced four hours post-surgery to maintain an activated partial thromboplastin time of 2–2.5 the normal. Two hourly nebulized iloprost was introduced. This enabled the nitric oxide and pressure support ventilation to be weaned without any rebound increase in PAP. PAP remained at or slightly below systemic. Cardiac output remained fairly stable (8.1–9.2).

Post operative clinical course was uneventful in the intensive care unit and patient hemodynamics showed increased pulmonary vascular resistance (PVR) up to 800 and PAP up to 96. She was advised to continue on iloprost nebulizer 20mcg Q 6 h and silandafil 50 mg three times a day as well as home O<sub>2</sub>. She was also started on warfarin and was

discharged from intensive care unit on day five post operatively and from the hospital in day 11 days postoperatively in a stable clinical condition.

She was given the appropriate outpatient clinic appointments to be followed and assessed for heart and lung transplantation.

### **Discussion:-**

PPH is defined as a sustained elevation of PASP (mean greater than 25 mmHg at rest) in the absence of a demonstrable cause. Pulmonary vasoconstriction, medial hypertrophy, thrombosis in situ and dysfunctional pulmonary vascular endothelium are believed to be the underlying contributing mechanisms [4].

Pulmonary hypertension is poorly tolerated during pregnancy. Deterioration typically occurs in the second trimester with symptoms of fatigue, dyspnoea, syncope and chest pain. This corresponds to the physiological increase in cardiac output and blood volume of 40%. During labour, uterine contractions effectively add 500 ml of blood to the circulation. The labour pain increase right atrial pressure, blood pressure and cardiac output [5]. Women with PPH is advised against pregnancy. In early pregnancy a termination is considered. Where PPH is not diagnosed until late pregnancy an elective delivery with caesarean section is preferred. This facilitates cooperation between specialities, permits monitoring to be started in advance, the pain and haemodynamic consequences of labour to be minimized and an intensive care bed to be arranged. Premature spontaneous labour is common [2] therefore delivery is usually planned for 32–34 weeks gestation. In our patient the cardiovascular physiological changes of pregnancy had already occurred by the time of presentation. Identification of these hemodynamic changes has led to the use of anticoagulants, oxygen, and vasodilators, which have been shown in several reports to lead to an improvement in hemodynamics and outcome in nonpregnant patients with PPH [6].

An opioid-based general anaesthetic was considered appropriate for a failing right ventricle. It facilitated the control of PAP and the use of nitric oxide. Nitric oxide can be administered by facemask but is poorly tolerated, difficult to monitor and cannot be scavenged. A narcotic-based technique minimizes increased pulmonary pressures during laryngoscopy and avoids the excessive negative inotropic effect of inhalational agents. Care was taken to avoid reducing venous return during positive pressure ventilation. Narcotic-related neonatal depression is usually easily managed. O'Hare et al. [3] reported a successful outcome following an emergency caesarean section under general anaesthetic for a woman with PPH and coarctation of the aorta. They gave intravenous and aerosolized prostacyclin postoperatively.

Vasoconstriction is a prominent feature, leading to the rationale for using pulmonary vasodilators such as oxygen, nitric oxide, epoprostenol and iloprost in the short term and calcium antagonists in the long term. Nitric oxide has been used in the pre and post-delivery management of PPH in pregnancy, with clear reductions in PAP as evidenced by cardiac catheterization data, [8] but not during caesarean section.

Epoprostenol is a naturally occurring prostaglandin and potent vasodilator. It affects vascular remodelling and inhibits platelet aggregation. Iloprost is a synthetic analogue of epoprostenol with improved metabolic and chemical stability, which decreases PAP and PVR, increases cardiac output, and has minimal effect on systemic arterial pressure [9]. The pulmonary vasodilator effect lasts 60–120 min. In comparison, intravenous prostacyclin (epoprostenol) reduces PVR with similar efficacy but reduces systemic arterial pressure to a greater degree [10] with no clinically significant reduction in PAP. Neither iloprost nor prostacyclin is recommended in pregnancy because of concerns over the effect on uterine blood flow.

Patients with PPH are at risk of thrombosis and thromboembolism. The Mayo Clinic group has reported that anticoagulation may improve the outcome in severe pulmonary hypertension [11].

Pulmonary artery catheterization provides early warning of rising PAP, deteriorations in right ventricular function and the effects of therapeutic interventions. Its use has not been associated with improved survival [7], and there is an increased risk of pulmonary artery rupture and thrombosis in these conditions [12].

PPH complicating pregnancy remains a fatal condition with deaths reported to occur between two and nine days post-delivery [1] usually from right heart failure. Iloprost and nitric oxide therapies may have a role in controlling PAP in this condition but there is no evidence of improved survival.

An important component in the successful management of these patients involves a multidisciplinary team approach with an obstetrician, pulmonary or cardiology specialist, anesthesiologist, and experienced nursing staff [12].

#### Summary:-

PPH is likely to worsen during labour and delivery, resulting in a high maternal mortality rate. Early recognition and treatment with vasodilator and anticoagulation therapy may reduce the likelihood of complications. Elective caesarean section may be performed with intraoperative vasodilator administration. A multidisciplinary approach to the management of patients with PPH during pregnancy is of great importance for a successful maternal-foetal outcome.

#### Acknowledgement:-

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#### References:-

[1]

N.V. Roberts, P.J. Keast

#### **Pulmonary hypertension and pregnancy – a lethal combination**

Anaesth Intensive Care, 18 (1990), pp. 366–374

[View Record in Scopus](#)

|

[Citing articles \(71\)](#)

[2]

U. Elkayam

#### **Pregnancy and cardiovascular disease**

Braunwald (Ed.), Hert disease – a textbook of cardiovascular medicine (4th ed.), Saunders (1992), pp. 1790–1809

[3]

R. O'Hare, C. McLoughlin, K. Milligan, D. McNamee, H. Sidhu

#### **Anaesthesia for caesarean section in the presence of severe primary pulmonary hypertension**

Br J Anaesth, 81 (1998), pp. 790–792

[CrossRef](#)

|

[View Record in Scopus](#)

|

[Citing articles \(54\)](#)

[4]

J. Lewis, M.D. Rubin

#### **Primary pulmonary hypertension**

N Engl J Med, 336 (1997), pp. 111–117

[5]

T.G. Cheek, B.B. Gutsche

#### **Maternal physiological alterations during pregnancy**

S.M. Shnider, G. Levinson (Eds.), Anaesthesia for obstetrics (2nd ed.), Williams & Wilkins, Baltimore (1987), pp. 3–13

[6]

V.V. McLaughlin, D.E. Genthner, M.M. Panella, *et al.*

#### **Reduction in pulmonary vascular resistance with long term epoprostenol (prostacyclin) therapy in primary pulmonary hypertension**

N Engl J Med, 338 (1998), pp. 273–277

[CrossRef](#)

|

[View Record in Scopus](#)

|

[Citing articles \(563\)](#)

[7]

A.P. Lange

**Prostaglandins as abortifacients in Denmark** Acta Obstet Gynecol Scand, 113 (Suppl.) (1983), pp. 117–124

CrossRef

View Record in Scopus

Citing articles (5)

[8]

J.N. Robinson, R. Banerjee, M.J. Landzberg, M. Thiet

**Inhaled nitric oxide therapy in pregnancy complicated by pulmonary hypertension**

Am J Obstet Gynecol, 180 (1999), pp. 1045–1046

Article

PDF (96 K)

View Record in Scopus

Citing articles (37)

[9]

A. Haraldsson, N. Kieler-Jenson, U. Nathorst-Westfelt, *et al.*

**Comparison of inhaled nitric oxide and inhaled aerosolised prostacyclin in the evaluation of heart transplant candidates with elevated pulmonary vascular resistance**

Chest, 114 (1998), pp. 780–786

Article

PDF (3275 K)

CrossRef

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Citing articles (119)

[10]

T. Scherer, P. Radermacher

**Prostacyclin (PGI<sub>2</sub>): new aspects of an old substance in the treatment of critically ill patients**

Intensive Care Med, 23 (1997), pp. 146–158

[11]

V. Fuster, P.M. Steele, W.D. Edwards, *et al.*

**Primary pulmonary hypertension: natural history and the importance of thrombosis**

Circulation, 70 (1984), p. 580

CrossRef

View Record in Scopus

Citing articles (736)

[12]

P.G. Barash, D. Nardi, G. Hammond, *et al.*

**Catheter-induced pulmonary artery perforation**

J Thorac Cardiovasc Surg, 82 (1981), pp. 5–12

View Record in Scopus

Citing articles (120)



## RESEARCH ARTICLE

### ACUTE PANCREATITIS RELATED TO THERAPEUTIC DOSING WITH COLCHICINE: A CASE REPORT.

Kaled Waleed Abduljawad, Ahmed Salim Mohmoud Elshigagi, Ibrahim Hamad Alwashmi, Mohammed Abdulaziz Alowaidhi, Racan Talat Izzuldeen, Abdalelah Salih Minkabu, Shaikh Mohammad Alkaff, Abrar Essam Mounshi, Osama Hassan Alsubhi, Alaa Ibrahim Alasiri, Ghassan Abdulrauf Niaz, Ahlh Adnan Bilal, Ahmad Atiq Alharbi and Haitham Rasheed Alhaiti.

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#### Abstract

**Background:-** Colchicine is used in the treatment and prophylaxis of gout. It possesses a narrow therapeutic window, frequently resulting in dose-limiting gastrointestinal side-effects such as diarrhoea and emesis. As colchicine is a cellular anti-mitotic agent, the most serious effects include myelosuppression, myoneuropathy and multiple organ failure. This occurs with intentional overdose or with therapeutic dosing in patients with reduced clearance of colchicine due to pre-existing renal or hepatic impairment. Acute pancreatitis has rarely been reported, and only in association with severe colchicine overdose accompanied by multi-organ failure.

**Case presentation:-** We report a case of acute pancreatitis without other organ toxicity related to recent commencement of colchicine for acute gout, occurring in an elderly male with pre-existing renal impairment.

**Conclusion:-** 1) Colchicine should be used with care in elderly patients or patients with impaired renal function.  
2) Aside from myelosuppression, myoneuropathy and multiple organ failure, colchicine may now be associated with acute pancreatitis even with therapeutic dosing; this has not previously being reported.

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#### Introduction:-

**Background:-** Colchicine is frequently used to treat and prevent recurrence of acute gout [1] but has a narrow therapeutic window, with dose-limiting gastrointestinal side-effects such as diarrhoea and vomiting [2]. Colchicine toxicity relates to its cellular anti-mitotic action and preferentially affects tissues that have a rapid turnover [3], leading to early gastrointestinal failure, myelosuppression and ultimately multi-organ failure [1, 2]. Colchicine in intentional overdose is difficult to treat and frequently lethal [4]. Acute pancreatitis related to colchicine has rarely been reported, and only in the context of severe toxicity [5, 6, 7].

**Case presentation:-** A 79 year old man presented to the Emergency Department with severe epigastric pain, nausea, vomiting without hematemesis, diarrhoea and anorexia. He has a history of red cell and platelet transfusion dependent myelofibrosis, iron overload due to multiple red cell transfusion, chronic renal failure, ischemic heart disease, left ventricular systolic dysfunction, cerebrovascular disease, peripheral vascular disease, hypertension, and hyperlipidemia. His regular medications include diltiazem, valacyclovir, nicorandil, bisoprolol, deferasirox,



frusemide and glyceryl trinitrate patches. Aside from the recent addition of colchicine, his medications are unchanged. The patient denied using herbal or over the counter products. He was independent with activities of daily living, was a life-long non-alcohol drinker and stopped smoking decades ago. There was no history of abdominal trauma.

The patient was alert and orientated with blood pressure 100/48 mm Hg, pulse 66/min regular, respiratory rate 20/min, SaO<sub>2</sub> is 97% on room air and temperature 36.8°C. There was marked epigastric tenderness without abdominal distension. Normal bowel sounds are present. No free subdiaphragmatic gas was visible on erect chest X-ray.

Several blood investigations were performed; serum lipase is elevated at 859 (reference range, RR 25–300 U/L). Serum urate is 0.92 (RR 0.15–0.5 mmol/L), albumin-corrected calcium 2.38 (RR 2.15–2.6 mmol/L), sodium 136 (RR 135–145 mmol/L) and potassium 5.0 (RR 3.2–4.5 mmol/L). There was a mild deterioration of serum creatinine to 332 (RR 70–120 µmol/L) and urea 38.9 (RR 3.0–8.0 mmol/L). Venous blood gases showed pH of 7.24 (RR 7.35–7.45), bicarbonate 18 (RR 22–27 mmol/L), base deficit -8.9 (RR -3.0 to +3.0 mmol/L) and lactate 1.0 (RR 0.2–2.0 mmol/L). Serum triglyceride level was 2.0 (RR 0.5–2.0 mmol/L). Liver function tests were deranged: aspartate transaminase 206 (RR 10–45 U/L), alanine transaminase 269 (RR 5–45 U/L), gamma glutamyl transaminase 145 (RR 10–70 U/L), alkaline phosphatase 209 (RR 40–110 U/L) and total bilirubin 9 (RR <20 micromoles/L). Prothrombin time was 16.1 (RR 11–16 seconds), INR 1.3 and APTT 33.4 (RR 22–35 seconds). Haematology parameters were unchanged from previous results, with haemoglobin 118 (RR 130–180 g/L), haematocrit 0.352 (RR 0.40–0.54), white cell count 7.8 (RR 4.5–11.0 × 10<sup>9</sup>/L) and platelets 34 (RR 150–400 × 10<sup>9</sup>/L).

The patient recovered over 48 hours with clear oral fluids and supportive medical treatment including intravenous fluids and analgesia as required. This coincided with declining lipase levels. Myelosuppression ascribable to colchicine did not occur.

An abdominal ultrasound demonstrated normal liver texture, oedematous pancreas, and multiple small incidental calculi within a normal walled gallbladder, no hepatobiliary ductal dilatation or pericholecystic fluid, normal pancreatic duct, enlarged spleen and multiple bilateral renal cysts without hydronephrosis.

### Discussion and conclusion:-

The incidence of acute pancreatitis varies in different countries and depends on cause, with the estimated incidence in England being 5.4/100 000 per year; in the United States it is 79.8/100 000 per year [14]. Precipitants of acute pancreatitis are extensive and wide ranging [10]; the most frequent causes are gallstones (30–60%) and alcohol (15–30%) [8, 14]. In 20% of cases, the cause remains unidentified [8]. Drugs are implicated in only 2–5% of cases, either by a hypersensitivity reaction or the generation of a toxic metabolite [14], although it is frequently difficult to prove causality [9].

Identifying the underlying cause of acute pancreatitis allows avoidance or treatment of the precipitant and improves chances of recovery [10]. This patient sustained mild and self-limited acute pancreatitis associated with recent commencement of colchicine for gout, which has not previously been reported. However, comorbidities implicated in acute pancreatitis make a trigger or co-factor role for colchicine more likely [9], rather than colchicine being the sole aetiological agent. In this case, microlithiasis [8], chronic renal failure [10, 11, 14] and frusemide [10] may have set the scene for acute pancreatitis precipitated by colchicine. With a normal bilirubin level, however, the patient had liver function tests which were more consistent with a hepatic rather than an obstructive enzymosis. Furthermore, he did not have hypercalcaemia or hypertriglyceridaemia, metabolic factors well known to contribute to pancreatic inflammation [8, 14].

There was no evidence of acute seroconversion to hepatitis A, B, C viruses; Epstein-Barr virus, Cytomegalovirus and herpes simplex 1 and 2 viruses. As such, acute viral hepatitis or pancreatitis was unlikely. Non-drug aetiologies for pancreatitis in this patient (renal failure, microlithiasis, ongoing use of frusemide) remained; despite this, rapid clinical recovery occurred with withdrawal of colchicine. This renders colchicine the most eminent association to pancreatitis in this case.

Sole attribution for acute pancreatitis to a single drug remains difficult due to high rates of concurrent contributory diseases in acute pancreatitis [9]. Aside from frusemide, of which there had been no recent dose escalation, none of



this patient's other prescribed medications have been reported to increase risk of acute pancreatitis [10, 14]. Nitrates have been known to reduce pancreatitis pain and relapse [13], with diltiazem improving survival in rat models of acute pancreatitis [12]

There have been several reports of acute pancreatitis related to colchicine; including accidental ingestion of a plant (*Colchicum autumnale*) thought to be wild garlic [3], intraurethral administration of colchicine for condyloma acuminata [5], and after intentional oral overdoses of colchicine [6, 7]. These patients had severe colchicine toxicity associated with multi-organ failure and death in one case [7].

Patients with renal impairment have reduced colchicine clearance, may be more susceptible to colchicine toxicity and require cautious dosing [1, 2]. In this case report, acute pancreatitis occurred in an elderly man with pre-existing renal impairment after two days of oral colchicine 1 mg daily for gout in the big toe. Unlike with colchicine overdose-related pancreatitis [5, 6, 7], this patient did not experience severe colchicine toxicity, myelosuppression or deteriorating multi-organ dysfunction. Clinicians need to be cautious when prescribing colchicine in patients with renal impairment [1, 2] as isolated acute pancreatitis (or potentially even more severe toxicity) may occur in these patients even with therapeutic doses of colchicine.

Declarations

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#### **Competing interests:-**

The author(s) declare that they have no competing interests.

#### **Authors' contributions**

JYST was fully involved in writing, reviewing and approving the manuscript.

#### **References:-**

1. Terkeltaub RA: Clinical practice. Gout. N Engl J Med. 2003, 349: 1647-1655. 10.1056/NEJMcp030733.**View ArticlePubMedGoogle Scholar**
2. Teng GG, Nair R, Saag KG: Pathophysiology, clinical presentation and treatment of gout. Drugs. 2006, 66: 1547-1563. 10.2165/00003495-200666120-00002.**View ArticlePubMedGoogle Scholar**
3. Brvar M, Kozelj G, Mozina M, Bunc M: Acute poisoning with autumn crocus (*Colchicum autumnale* L.). Wien Klin Wochenschr. 2004, 116: 205-208.**View ArticlePubMedGoogle Scholar**
4. Folpini A, Furfuri P: Colchicine toxicity-clinical features and treatment. Massive overdose case report. J Toxicol Clin Toxicol. 1995, 33: 71-77.**View ArticlePubMedGoogle Scholar**
5. Naidus RM, Rodvien R, Mielke H: Colchicine toxicity: A multisystem disease. Arch Intern Med. 1977, 137: 394-396. 10.1001/archinte.137.3.394.**View ArticlePubMedGoogle Scholar**
6. Freeman JS, Panebianco PS: Colchicine overdosage: Report of a case. J Am Osteopath Assoc. 1982, 82: 252-254.**PubMedGoogle Scholar**
7. Clevenger CV, August TF, Shaw LM: Colchicine poisoning: report of a fatal case with body fluid analysis by GC/MS and histopathologic examination of postmortem tissues. J Anal Toxicol. 1991, 15: 151-154.**View ArticlePubMedGoogle Scholar**
8. Whitcomb DC: Acute pancreatitis. New Engl J Med. 2006, 354: 2142-2150. 10.1056/NEJMcp054958.**View ArticlePubMedGoogle Scholar**
9. Wilmink T, Frick TW: Drug-induced pancreatitis. Drug Saf. 1996, 14: 406-423.**View ArticlePubMedGoogle Scholar**
10. Draganov P, Forsmark CE: "Idiopathic" pancreatitis. Gastroenterology. 2005, 128: 756-763. 10.1053/j.gastro.2005.01.037.**View ArticlePubMedGoogle Scholar**
11. Robinson DO, Alp MH, Grant AK, Lawrence JR: Pancreatitis and renal disease. Scand J Gastroenterol. 1977, 12: 17-20.**PubMedGoogle Scholar**
12. Hughes CB, el-Din AB, Kotb M, Gaber LW, Gaber AO: Calcium channel blockade inhibits release of TNF alpha and improves survival in a rat model of acute pancreatitis. Pancreas. 1996, 13: 22-28. 10.1097/00006676-199607000-00003.**View ArticlePubMedGoogle Scholar**

13. Berger Z, Pap A: The role of nitroglycerin preparations in the treatment of post-acute and chronic pancreatitis. *Ther Hung.* 1993, 41: 72-77.**PubMedGoogle Scholar**
14. Greenberger NJ, Toskes PP: Acute and chronic pancreatitis. *Harrison's Principles of Internal Medicine*. Edited by: Kasper DL, Braunwald E, Fauci AS, Hauser SL, Longo DL, Jameson L, Isselbacher KJ. 2005, New York: McGraw-Hill, Chapter 294: 16**Google Scholar**.



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## RESEARCH ARTICLE

### Public Knowledge, Attitudes and Behavior Towards Zika Virus in Saudi Arabia

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#### Abstract

**Aim:** To assess Public knowledge, attitudes and behavior towards Zika virus in Saudi Arabia.

**Methods:** A prospective cross-sectional survey conducted for a period of 2 months from June-2016 to July-2016. Knowledge scoring was given based on the percentage of correct responses. Data were collected using a self-prepared questionnaire and analyzed using descriptive statistics. Association of respondent's knowledge score with sex, age group, and educational level, was analyzed by Chi-square test.

**Results:** The total sample size of the present study was 284 members, of which 187 were males and 97 were females. There was no statistical difference regarding Zika virus infection in the knowledge between both genders. There was no statistical difference regarding Zika virus infection in the knowledge between age groups. The majority of respondents were found by completing secondary schooling with 66 (36.7%), followed by no education with 50 (27.8%), primary schooling in 45 (25%), and finally completing graduate with 19 (10.5%). There was significant difference in knowledge between education level groups ( $p < 0.0001$ ). 35.6% of them didn't hear about Zika virus, while 30.6% hear about the virus in the previous few months and 26% knew about it in the last year. About 46 % don't know if there is a treatment of Zika virus infection while about 11 % they said yes there is a treatment. The majority of them 57 % don't take any measure to protect themselves from the virus, 39.4% who said no they don't know how to protect themselves. 44% don't know if there is a national or global organization to protect them or their family from the virus and 45.4 % they don't know while 10.6 % they said yes. When they asked how to protect themselves from mosquito's bite or decrease the mosquito's exposure 64.1% said all of above (keep the environment clean, clean the body and hands and sterilization of water, don't keep collect water) while 20.1% don't know the exact protection way.

**Conclusion:** There is lack of public knowledge about Zika infection transmission, symptoms, treatment and prevention, thus needs more education by health facilities and social media.

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#### Introduction

Zika virus infection is a rapidly evolving disease currently spreading in the continental United States and in US territories, the Caribbean, North America, Central America, and South America. The current outbreak has been in the news regularly since the Pan American Health Organization identified the first case in May 2015 [1].

The US Centers for Disease Control and Prevention (CDC) predicted that the high volume of travel to Brazil for the Olympics would increase Zika distribution worldwide, with the potential to increase the regions of spread in the current outbreak by 19 countries [2].

In 1947 in the Zika forest of Uganda, the first samples of the virus were isolated from a captive rhesus monkey. The next year, scientists recovered the virus from an *Aedes africanus* mosquito in the same forest [3]. Four years later, the first cases of the Zika virus were found in humans, both in

Uganda and the United Republic of Tanzania [4]. In 2007, the first largest outbreak of Zika was found on the Pacific Island of Yap with 185 suspected cases. Prior to this, only 14 cases of Zika had ever been documented, hence the concern; although other cases were likely to have occurred and were not reported. Outbreaks of Zika have been reported in tropical Africa, Southeast Asia, and the Pacific Islands [5]. Because the symptoms of Zika are similar to those of many other diseases, many cases may not have been recognized and thus measures of prevention are not being held out. As of February 2016, Brazilian national authorities estimate 500,000 to 1.5 million cases of the Zika virus and a total of 39 countries reporting local circulation of the disease [6].

The Zika virus does not cause severe disease in a healthy individual, affected individuals may not even show symptoms [7]. In pregnant women, it can cause their baby to be born with microcephaly thus the reason for large concern [8]. Additionally, there has been an increase in the incidence of Guillain-Barre Syndrome in regions of Zika virus affection [9]. Saudi Arabia has not reported of any cases of the presence of Zika virus, and to continue to prevent Zika virus in Saudi Arabia residents it is important to assess the knowledge of the residents regarding the spread of the virus, concern and its prevention [10].

In Africa, Zika virus exists in a sylvatic transmission cycle involving nonhuman primates and forest-dwelling species of aedes mosquitoes. In Asia, a sylvatic transmission cycle has not yet been identified. Several mosquito species, primarily belonging to the *stegomyia* and *diceromyia* subgenera of aedes, including *A. africanus*, *A. luteocephalus*, *A. furcifer*, and *A. taylori*, are likely enzootic vectors in Africa and Asia [3,11].

The incubation period for Zika virus is unknown, but if it is similar to that of other mosquito-borne flaviviruses, it is expected to be generally less than 1 week. In one volunteer, a febrile illness of 4 days' duration developed 82 hours after subcutaneous inoculation of Zika virus [12].

Common symptoms were macular or papular rash (90% of patients), fever (65%), arthritis or arthralgia (65%), nonpurulent conjunctivitis (55%), myalgia (48%), headache (45%), retro-orbital pain (39%), edema (19%), and vomiting (10%). No patient was hospitalized during the outbreak in Yap. These common symptoms occurred at frequencies similar to those in the Yap outbreak in a cohort of pregnant women with Zika virus infection in Brazil.<sup>69</sup> The rash is generally maculopapular and pruritic,<sup>69</sup> and fever, when present, is generally short-term and low-grade [13, 14].

Microcephaly is a clinical finding of a small head size for gestational age and sex and is indicative of an underlying problem with the growth of the brain. The findings of Zika virus RNA in the amniotic fluid of fetuses with microcephaly and in the brain tissue of fetuses and infants with microcephaly, as well as the high rates of microcephaly among infants born to mothers with proven antecedent acute Zika virus infection,<sup>69</sup> provide strong evidence linking microcephaly to maternal Zika virus infection [15, 16].

The mainstays of the routine diagnosis of Zika virus infection are the detection of viral nucleic acid by RT-PCR and the detection of IgM antibodies by IgM-capture enzyme-linked immunosorbent assay (MAC-ELISA). The detection of viral nucleic acid in serum provides a definitive diagnosis; however, in most instances viremia is transient, and diagnosis by RT-PCR has been most successful within 1 week after the onset of clinical illness [17,18,19].

As with the other mosquito-borne flaviviruses, treatment for uncomplicated Zika virus infection focuses on symptoms. No Zika virus vaccine exists; thus, prevention and control measures center on avoiding mosquito bites, reducing sexual transmission, and controlling the mosquito vector. Potentially effective methods of prevention that are focused on reducing infections among pregnant women include avoiding unnecessary travel to areas of ongoing Zika virus transmission, avoiding unprotected sexual contact with partners who are at risk for Zika virus infection,<sup>103</sup> and using mosquito repellent, permethrin treatment for clothing, bed nets, window screens, and air conditioning. The most effective *A. aegypti* vector control relies on an integrated approach that involves elimination of *A. aegypti* mosquito breeding sites, application of larvicides, and application of insecticides to kill adult mosquitoes [20,21,22].

The underlying reasons for the emergence of Zika virus in the past decade are unknown. Recent global increases in the incidence and spread of dengue, chikungunya, and now Zika virus — all with *A. aegypti* as the primary vector — suggest common underlying mechanisms for their emergence, such as globalization and urbanization [23].

## Problem Statement

After the outbreak of the Zika virus, there was a sharp rise in the incidence of the number of cases of microcephaly in the areas affected by the virus thus, indicating a link between the two. Microcephaly is a congenital malformation, which is associated with serious complications such as cerebral damage, thereby causing a concern about the Zika virus and stressing upon its prevention.

The current study aimed to assess the knowledge and attitude of the Saudi residents in regards to the Zika virus epidemic.

## Methods

### Study design and population

The present study was conducted Jeddah, from June 2016 to July 2016. The study was initiated after getting approval from the Institutional Ethical Committee, Ministry of Health, KSA. The method of study is a cross-sectional survey using a validated Google Forms (Online Survey) Tool [24] and the Population included in this study were selected in purposeful random method.

### Statistical analysis

All the data of the study populations was entered into Microsoft excel spreadsheet and descriptive statistics were used for demographic characteristics. Association of respondent's knowledge score with sex, age group, educational level and income was analyzed by Chi-square test using Graph pad prism.  $p \leq 0.05$  were considered significant.

## Results

The total sample size of the present study was 284 members, of which 187 were males and 97 were females. There was no statistical difference regarding Zika virus infection in the knowledge between both genders. Poor knowledge was observed in 61% of male and 71.21% of female out of the total respondents as shown in Fig. 1.

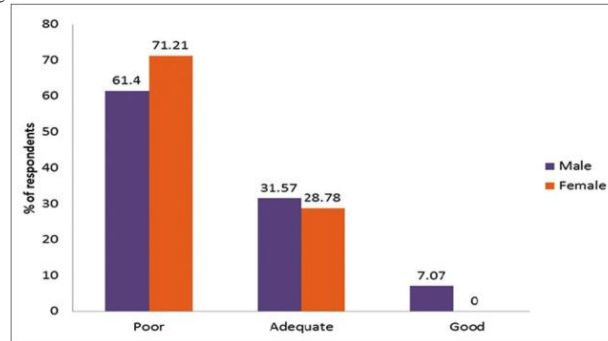


Fig. 1: Knowledge based on gender distribution

Out of total respondents, 64 (35.55%) were between the age group 26-35 years, followed by 53 (29.44%) in between the age group 36-45 years, 34 (18.89%) in between the age group >45 years then finally 29 (16.11%) in between the age group 18-25 years. There was no statistical difference regarding Zika virus infection in the knowledge between age groups. The results were presented in Fig. 2.

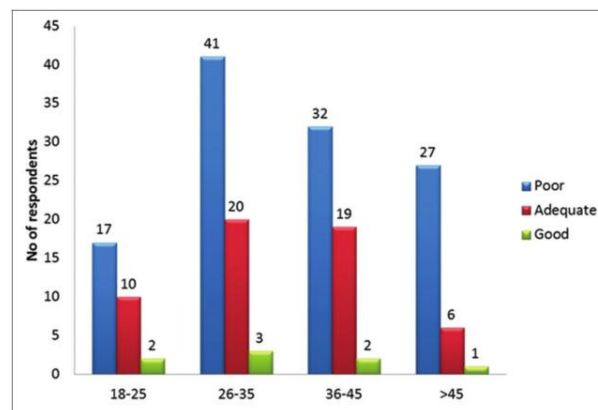


Fig. 2: Knowledge based on age group distribution

Total distribution of respondents with respect to education level shows that majority of respondents were found by completing secondary schooling with 66 (36.7%), followed by no education with 50 (27.8%), primary schooling in 45 (25%), and finally completing graduate with 19 (10.5%). There was significant difference in knowledge between education level groups ( $p < 0.0001$ ). The percentage of respondents with good knowledge was low in primary and secondary education level and high in graduates with 36.8% as represented in Fig. 3.

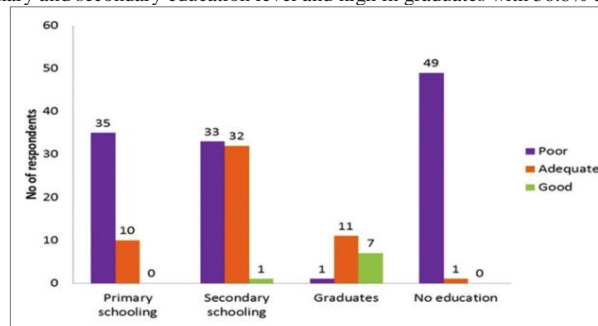


Fig. 3: Knowledge based on education level

35.6% of them didn't hear about Zika virus, while 30.6% heard about the virus in the previous few months and 26% knew about it in the last year. Among those who heard about the virus, only very little knew about it years ago. The majority of them didn't know someone who has been infected with Zika virus. Most of them said they don't know the cause of fever if someone of their family had it. 46% said they don't know the route of transmission of Zika virus, while 32% said that the cause are mosquitoes. The remaining 22% had different answers distributed between (sexually transmitted, pollution, and dirty environment). More than half of them didn't know the symptoms of Zika virus infection. 9.5% said that the symptoms are fever and headache. 33% said that fever and headache, joints pain, rash, fatigue and red eyes all are symptoms of the virus.

39% said yes there is a prevention way to protect against the virus, while 30% said maybe, 30% didn't know, and very few said no. 41% of respondents who knew a prevention way against the virus didn't know the exact way, while 47% said the mosquito's protection way.

About 46 % don't know if there is a treatment of Zika virus infection while about 11 % they said yes there is a treatment (Fig 4). Most of them don't know the word (microcephaly) means. When asked about if the pregnant women infected with the virus what is the side effect, about 150 responses (52.8%) said don't know, while 20.8 % said all of above (abortion, infected with virus, microcephaly of baby, difficulty of labor, malformation of baby, affected next baby). 55.6% didn't take any pregnancy prevention measure to protect from the virus while only 5.3 % take a prevention way (Fig. 5). The majority of them 57 % don't take any measure to protect themselves from the virus, 39.4% who said no they don't know how to protect themselves. 44% don't know if there is a national or global organization to protect them or their family from the virus and 45.4 % they don't know while 10.6 % they said yes. When they asked how to protect themselves from mosquito's bite or decrease the mosquito's exposure 64.1% said all of above (keep the environment clean, clean the body and hands and sterilization of water, don't keep collect water) while 20.1% don't know the exact protection way.

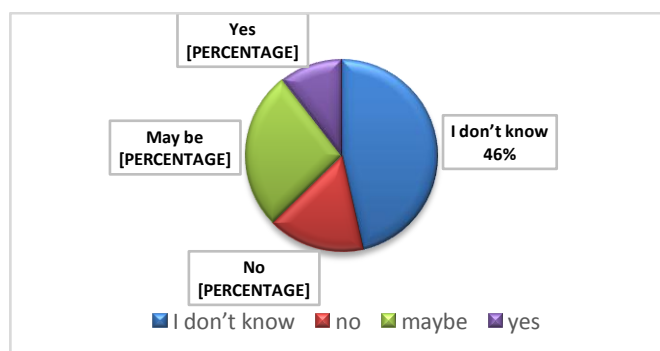


Fig. 4: Knowledge based on Zika virus Treatment

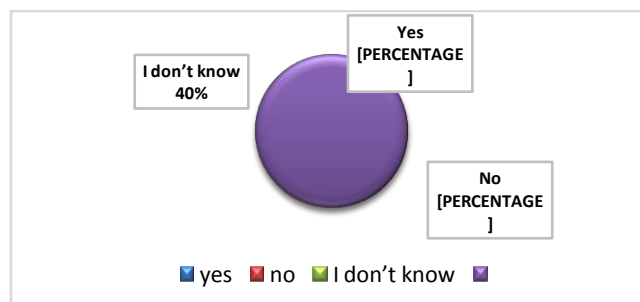


Fig. 5: Knowledge based on Zika virus Prevention during Pregnancy

## Discussion

The Zika could a potentially devastating disease affecting the lives of many. As an emerging threat, it is important to recognize how much the public understands about the Zika virus and whether they are familiar with the preventative measures and applying their knowledge to help prevent disease.

A total of 284 participants answered a questionnaire created to evaluate the knowledge about the virus and the results were variable, but the common theme from the results was that raising awareness about all aspects of the disease and its prevention is essential. According to whether the public knew about the Zika virus or not, the majority of people who answered the questionnaire were aware about the Zika virus. A similar result was received by the Harvard Opinion Research Program, which conducted a poll regarding the public's response regarding the Zika virus. Their survey also conveyed that the majority of their participants knew about the Zika virus [25]. A study regarding public knowledge done by the Harris Poll also showed that 'that three out of four Americans are very or somewhat familiar with the Zika virus' [26]. The consistent results through the three studies show that whether in Jeddah or the United States, the public is aware of the emerging of the Zika virus.

Even though our questionnaire indicated that the majority of the participants did know of the Zika virus, but majority of them did not know what symptoms a person of the Zika virus would present with neither did they show understanding that a person infected with the virus would most likely now show any symptoms. 9.5% of the participants said the symptoms were fever and headache and 33% answered fever, headache, joint pain, rash, fatigue and red eyes were symptoms of the virus and 56% which is the majority of the participants, did not know what the symptoms are. Likewise, in the Harvard survey referred to previously, 71% of the participants said that people with Zika would most likely show symptoms [26], which is not true as people affected by the Zika virus usually do not show any symptoms. This was also indicated in the article published in *Journal of American Medical Association* (JAMA) that mentioned that 80% of the Zika infections are usually asymptomatic, and due to that "individuals make not take precautions to avoid transmission" [28].

Regarding understanding about whether the Zika virus would affect pregnant ladies adversely, 52.8% of the participants denied that they knew about the effects of the virus on pregnancy. Additionally, a survey done by the Harris Polls in the United States found that not a lot of people

understood that a fetus can contract Zika from an infected mother and that Zika can adversely affect the brains fetus inside the womb [27,28]. However, inconsistent results were gathered by a poll done by The Associated Press-NORC Center for Public Affairs Research. This poll showed that two thirds of the participants knew about the birth defects associated with the Zika virus [29]. The discrepancy between this study and our study might be due to the fact that there were 312 confirmed Zika virus cases in the United States and this could have led to increasing awareness among Americans. Meanwhile, there have been no confirmed cases in Saudi Arabia leading a limited amount of knowledge of the virus. The difference between the two American studies might be due to the amount of participants that participated in the studies. The study done by the Harris Polls included 2,026, while the study done by The Associated Press included 1,004 adults [26].

In respect to the treatment of the Zika virus, about 40% of the participants said they did not know of any treatment for the virus, about 9% said there was a treatment, 36.3% said there might be a treatment and 14.1% said there is no treatment. This indicates that there is clearly a lack of knowledge regarding the treatment availability of the Zika virus. It is important for the public to realize that there is no treatment currently available for Zika and therefore, all measures should be done to prevent getting affected by the virus and consequently. Likewise, the poll done by The Associated Press-NORC Center for Public Affairs Research, Americans are unclear about the unavailability of any sort of treatment of the virus [29]. Additionally, our survey indicates that the majority of the population has very little knowledge of how the measures of prevention that one needs to take in order to prevent mosquito bites. For example, 64.1% of the participants mentioned that keeping the environment clean, sterilization of water, cleaning the body and hands, and removing collected water are all a part of preventing mosquito bites. 20.1% of the participants did not know how to prevent the virus. This indicates that there is gap in the public knowledge of prevention and the public isn't aware of other measures such as using mosquito nets and insect replants to prevent mosquito bites neither are they aware that the virus could be sexually transmitted and the use of condoms is a method of prevention of the spread of the virus. Likewise, the Harris Poll also established through their survey that 'there's a significant lack of understanding regarding the other ways Zika can be transmitted' and thus prevented [29], therefore indicating that awareness about prevention and transmission of the Zika virus needs to be introduced to a further extent, including awareness about other methods of prevention as indicated by the article published in the *Infectious Disease of Poverty Journal* "The Global Spread of Zika" which says "Aedes mosquitoes are active and bite during the day, so use of an effective repellent is highly recommended. The fitting of house door and window screens, use of air-conditioning, removal of yard and household debris and containers (e.g. disposed tyres, broken bowls and cups, flower vases) that provide breeding sites for mosquitoes, are all measures that contribute to control of the vector within a local community" [30].

The above analysis of the results is indicative of the fact that the public is aware of the presence of Zika virus to a certain extent most probably due to social media and television news channels; however, there is a limited amount of knowledge that people have regarding this issue for example the treatment, the symptoms, and the link to birth defects. Raising awareness about this issue is imperative to prevent the virus from spreading and eventually eradicating it.

The findings in this report are subject to a couple of limitations. First, our research includes the responses of 284 participants. The number of responses may not be enough to gather enough information regarding the knowledge of the Zika virus. Despite having 284 responses, the majority of the respondents were of ages between 20-30 while only 12% were below the age of 20 and 12% were above the age of 20. This is another limitation that was faced in this research. In order to gain a complete idea of the knowledge of the public, a wider scope of participants with a more variety of ages including more participants above and below the age of 20 and 30 is needed. Lastly, this research only represents the information in Jeddah and no other city in Saudi Arabia.

## Conclusion

In conclusion, our research demonstrates that awareness about the Zika virus and its prevention and other factors related to the virus is needed. Despite the public being aware of the presence of the virus, there is lack of knowledge about the symptoms, treatment and prevention and thus more education should be provided by health facilities.

## References

1. Brasil, Patrícia, et al. "Zika virus infection in pregnant women in Rio de Janeiro." *New England Journal of Medicine* 375.24 (2016): 2321-2334.
2. Attaran, Amir. "Zika virus and the 2016 Olympic Games." *The Lancet Infectious Diseases* 16.9 (2016): 1001.
3. Dick, G. W. A. "Paper: Epidemiological notes on some viruses isolated in Uganda (Yellow fever, Rift Valley fever, Bwamba fever, West Nile, Mengo, Semliki forest, Bunyamwera, Ntaya, Uganda S and Zika viruses)." *Transactions of the Royal Society of Tropical Medicine and Hygiene* 47.1 (1953): 13-48.
4. Kindhauser, Mary Kay, et al. "Zika: the origin and spread of a mosquito-borne virus." *Bull World Health Organ* 94.9 (2016): 675-686C.
5. Musso, D., et al. "Potential for Zika virus transmission through blood transfusion demonstrated during an outbreak in French Polynesia, November 2013 to February 2014." *Euro Surveill* 19.14 (2014): 20761.
6. Brustolin, Marco, Núria Busquets i Martí, and Natàlia Majó i Masferrer. "Autochthonous and invasive mosquitoes of Catalonia as vectors of zoonotic arboviruses." (2016).
7. Gould, E. A., and T. Solomon. "Pathogenic flaviviruses." *The Lancet* 371.9611 (2008): 500-509.
8. Hubbard, Ruth. "Abortion and disability: Who should and who should not inhabit the world." *The disability studies reader* (1997): 93-104.
9. Cao-Lormeau, Van-Mai, et al. "Guillain-Barré Syndrome outbreak associated with Zika virus infection in French Polynesia: a case-control study." *The Lancet* 387.10027 (2016): 1531-1539.
10. Gould, Ernest A., and Stephen Higgs. "Impact of climate change and other factors on emerging arbovirus diseases." *Transactions of the Royal Society of Tropical Medicine and Hygiene* 103.2 (2009): 109-121.
11. Powers, Ann M., A. Margaret, and Phil Honein. "Zika Virus." (2016).
12. Saiz, Juan-Carlos, et al. "Zika virus: the latest newcomer." *Frontiers in microbiology* 7 (2016).
13. Petersen, Lyle R., et al. "Zika virus." *New England Journal of Medicine* 374.16 (2016): 1552-1563.
14. Duffy, Mark R., et al. "Zika virus outbreak on Yap Island, federated states of Micronesia." *N Engl J Med* 2009.360 (2009): 2536-2543.
15. França, Giovanni VA, et al. "Congenital Zika virus syndrome in Brazil: a case series of the first 1501 livebirths with complete investigation." *The Lancet* 388.10047 (2016): 891-897.

16. Cauchemez, Simon, et al. "Association between Zika virus and microcephaly in French Polynesia, 2013–15: a retrospective study." *The Lancet* 387.10033 (2016): 2125-2132.
17. Hayes, Edward B. "Zika Virus Outside Africa-Volume 15, Number 9—September 2009-Emerging Infectious Disease journal-CDC." (2009).
18. Barzon, Luisa, et al. "Isolation of infectious Zika virus from saliva and prolonged viral RNA shedding in a traveller returning from the Dominican Republic to Italy, January 2016." *Eurosurveillance* 21.10 (2016).
19. Faye, Oumar, et al. "One-step RT-PCR for detection of Zika virus." *Journal of Clinical Virology* 43.1 (2008): 96-101.
20. Miner, Jonathan J., et al. "Zika virus infection during pregnancy in mice causes placental damage and fetal demise." *Cell* 165.5 (2016): 1081-1091.
21. Plourde, Anna R., and Evan M. Bloch. "A literature review of Zika virus." *Emerging infectious diseases* 22.7 (2016): 1185.
22. Sampathkumar, Priya, and Joyce L. Sanchez. "Zika virus in the Americas: a review for clinicians." *Mayo Clinic Proceedings*. Vol. 91. No. 4. Elsevier, 2016.
23. Sikka, Veronica, et al. "The emergence of Zika virus as a global health security threat: a review and a consensus statement of the INDUSEM Joint Working Group (JWG)." *Journal of global infectious diseases* 8.1 (2016): 3.
24. Google Forms (Online Survey) Tool. 2017. Available at: <https://www.google.com/forms/>
25. ZIKA VIRUS AND THE ELECTION SEASON. 2016. Available at: <https://cdn1.sph.harvard.edu/wp-content/uploads/sites/94/2016/08/STAT-Harvard-Poll-August-2016-Zika.pdf>.
26. Most Americans Aware of Zika Threat, But Gaps in Knowledge Remain. 2016. Available at: <http://www.theharrispoll.com/health-and-life/Americans-Aware-of-Zika-But-Knowledge-Gaps-Remain.html>
27. Cross, John W. "Summary of Emergent Infectious Disease: Zika Focus." (2016).
28. Lucey, Daniel R., and Lawrence O. Gostin. "The emerging Zika pandemic: enhancing preparedness." *Jama* 315.9 (2016): 865-866.
29. Poll: Some key gaps in Americans' knowledge about Zika virus. 2016. Available at: <http://apnorc.org/news-media/Pages/News+Media/Poll-Some-key-gaps-in-Americans%27-knowledge-about-Zika-virus.aspx>.
30. Gyawali, Narayan, Richard S. Bradbury, and Andrew W. Taylor-Robinson. "The global spread of Zika virus: is public and media concern justified in regions currently unaffected?" *Infectious diseases of poverty* 5.1 (2016): 37.



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### RESEARCH ARTICLE

#### CLINICO ETIOLOGICAL PROFILE OF HYPONATREMIA IN IMCU OF KANNIYAKUMARI GOVERNMENT MEDICAL COLLEGE

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#### Key words:-

Hyponatremia, Seizure, SIADH, Sodium.

#### Abstract

**Background :** Sodium is the dominant extracellular cation and its homeostasis is vital to the normal physiologic function of cells. Hyponatremia is defined as a serum level of <135 mmol/L. This study is to evaluate aetiological factors, clinical features of patients with hyponatremia in IMCU (Intensive Medical Care Unit).

**Methods:** An observational study was conducted in 100 patients admitted in Kanniyakumari Govt. Medical College from Jan 2016 to Dec 2016 who had serum Sodium <130mmol/L. History, examination and relevant details were taken.

**Results:** In the present study, the mean age was 68 years. 37% were asymptomatic. The major clinical presentation among those symptomatic was altered sensorium accounting for 45%. The commonest cause was SIADH (Syndrome of Inappropriate AntiDiuretic Hormone secretion) followed by extra-renal causes. The mortality was 5%.

**Conclusions:** Hyponatremia is one of the common causes of altered consciousness and seizures especially in elderly patients. It is very important to classify the hyponatremia and find out the correct etiology. Treatment of hyponatremia is highly rewarding and it should be done in a more scientific way. The common causes and the management protocol should be available in every IMCU.

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#### Introduction:-

Sodium is the dominant extracellular cation and its homeostasis is vital to the normal physiologic function of cells. Normal serum sodium level is 135-145 mmol/L.

Hyponatremia is defined as a serum level of <135 mmol/L. It is estimated that nearly 7% of healthy elderly persons have serum sodium concentrations of 135 mmol/L<sup>1,2</sup> or less. Hyponatremia is a common electrolyte abnormality in hospitalized patients<sup>3,4</sup>

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Hyponatremia can be classified on the basis of serum osmolality into hyperosmolar, normoosmolar & hypoosmolar states. Hypoosmolar hyponatremia is further classified into hypervolemic, euvolemic and hypovolemic hyponatremia based upon the volume status.

### Materials and Methods:-

100 consecutive cases who had serum Sodium levels of  $<130$  mmol/L were identified and studied during a period of 12 months from Jan 2016 to Dec 2016. The patients of age 15 years or more and who were hyponatremic on admission were included in the study. Patients who developed hyponatremia during hospital stay were excluded. Detailed history including onset, duration, and progression of symptoms, history of illnesses such as congestive cardiac failure, chronic kidney disease, chronic liver disease, hypothyroidism, hypopituitarism, pneumonia, malignancies were recorded. History of drugs causing hyponatremia like diuretics, antidepressants, anticonvulsants, chemotherapeutic agents, and NSAIDs were taken and detailed general and physical examinations of the patients were done.

In sera, measurements of sodium, potassium, urea, creatinine, uric acid, albumin and glucose concentration were taken. Serum osmolality was measured using the formula<sup>5</sup>  
 $[2 \times (\text{Na} + \text{K})] + (\text{BUN}/2.8) + (\text{glucose}/18)$

### Na-Sodium; K-Potassium; BUN- Blood urea nitrogen

Other tests included urine sodium, osmolality, serum cortisol, ACTH level, thyroid function test, liver function test.

After establishing the diagnosis of hyponatremia, the patients were categorized based on the level of hyponatremia into mild, moderate and severe hyponatremia.<sup>6-8</sup>

126-130 mmol/l	-	Mild
121-125 mmol/l	-	Moderate
$\leq 120$ mmol/l	-	Severe

They were then further evaluated to find out the etiology. Serum and urine osmolality was calculated. Normal serum osmolality is 275-295 mosm/kg  $\text{H}_2\text{O}$ <sup>(13)</sup>. They were then assessed clinically to find out the volume status clinically if they had low serum osmolality.

Hypervolemia - Presence of bilateral basal crepitation, raised jugular venous pressure, bilateral pitting pedal edema, hepatomegaly.

Hypovolemia-Presence of tachycardia, postural hypotension, dry tongue, nature of skin turgor, urine output.

Those patients who had no signs mentioned above was considered to be euvolemic.

Student's t-test and analysis of variance (ANOVA) were statistical methods used to analyse continuous variables. Chi square test and Fisher's exact test were used to analyse categorical variables. The study protocol was approved by the ethical committee.

### Results:-

In the present study of 100 patients 48 were males and 52 were females.

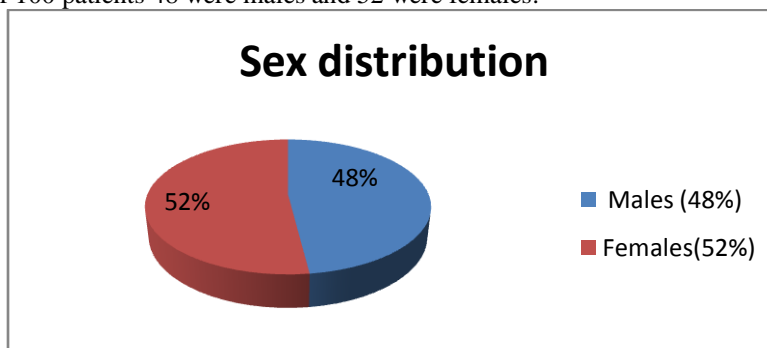


Figure 1:Sex distribution

The patients were between 15- 85 years of age, predominantly between 65-85 years.

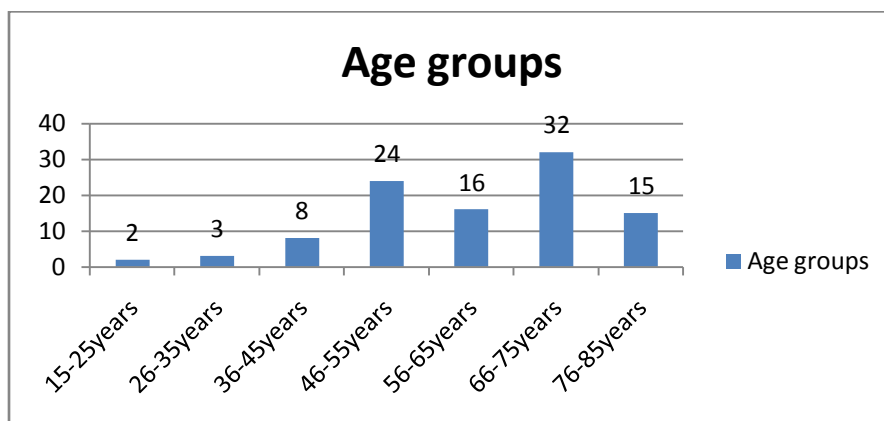


Figure 2: Age distribution

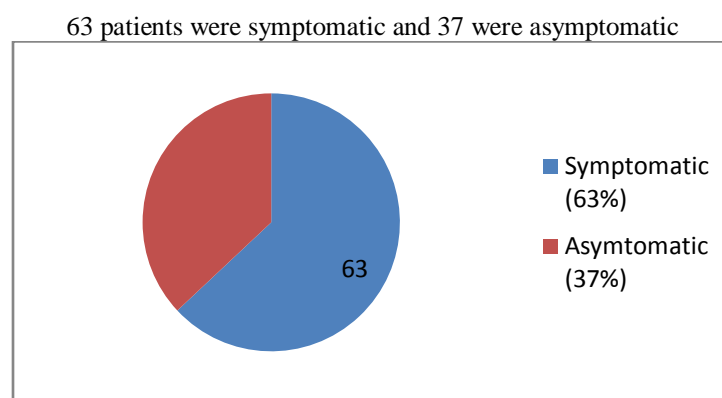


Figure 3: Symptomatic vs Asymptomatic

Serum sodium levels  
126-130 mmol/L – 13  
121-125 mmol/L – 32  
<120 mmol/L – 55

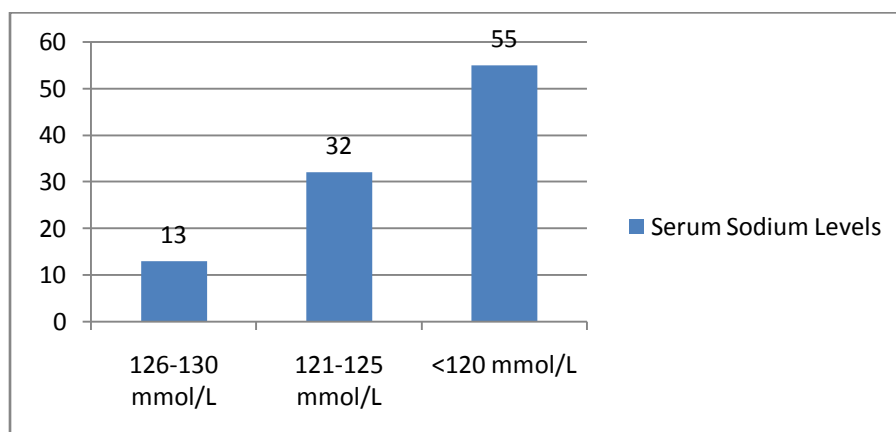


Figure 4: Serum Sodium levels

**Causes of hypoosmolar hypovolemic hyponatremia:-**

Extra renal loss – 17  
Diuretic induced – 10

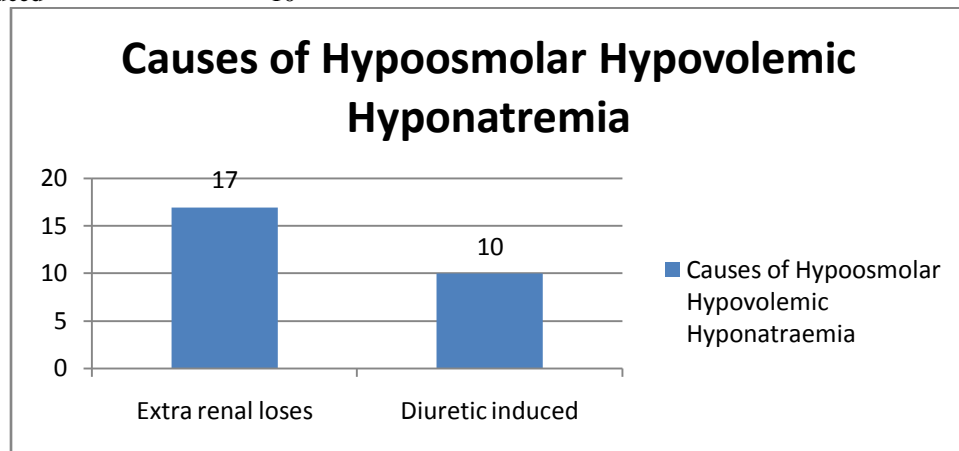


Figure 5: Causes of Hypoosmolar Hypovolemic Hyponatremia

**Causes of hypoosmolar Euvolemic Hyponatremia:-**

SIADH – 39  
Hypothyroidism – 6  
Central hypopituitarism – 2

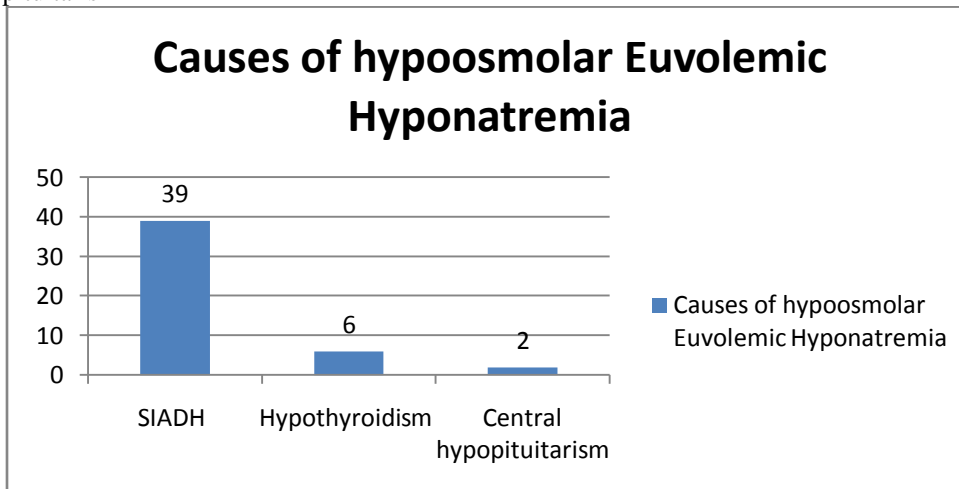


Figure 6: Causes of hypoosmolar Euvolemic Hyponatremia

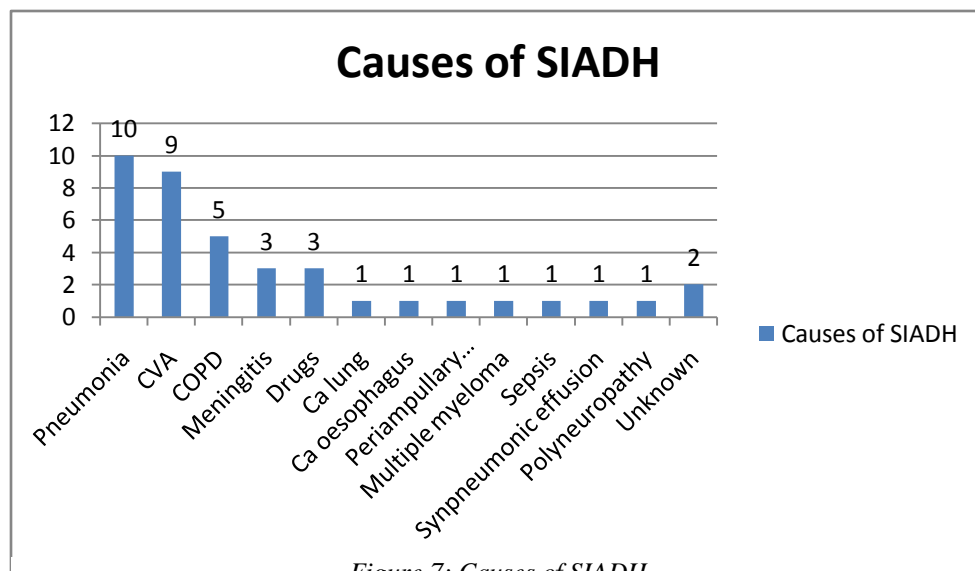
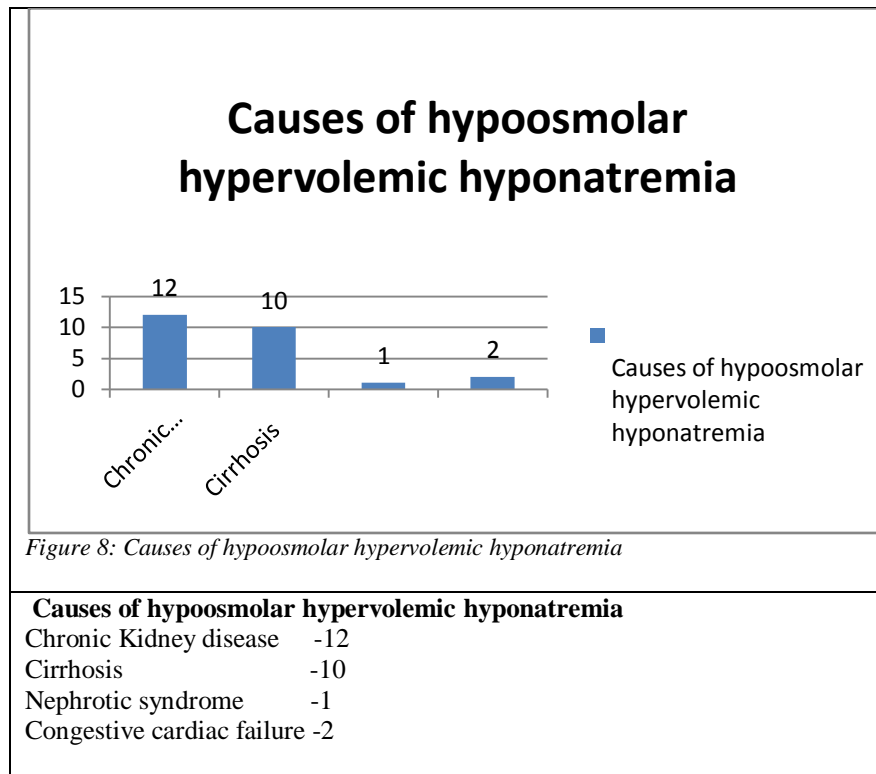


Figure 7: Causes of SIADH

**Causes of SIADH:-**

Pneumonia	-10
Cerebrovascular accidents(CVA)	-9
COPD	-5
Meningitis	-3
Drugs	-3
Ca lung	-1
Ca oesophagus	-1
Periapillary Carcinoma	-1
Multiple myeloma	-1
Sepsis	-1
Synpneumonic Effusion	-1
Polyneuropathy	-1



### Discussion:-

Hyponatremia is a common clinical problem which is being increasingly recognized in all departments. The management is highly rewarding as the patient comes back to a near normal state of health. At the same time, over treatment is also dangerous as it can lead to permanent neurological damage. As hyponatremia is becoming an increasingly common clinical state, a proper systematic study of the causes, management and outcome of hyponatremia is timely. Our study throws light to all the aspects.

Of the 100 patients studied, 48% were male 52% were female. The female preponderance in our study correlates well with most of the other studies. Mean age group is 68.34 years. It is well known that older group patients are more liable for metabolic abnormalities and a small tilt in metabolic stability will make them more symptomatic.

The prevalence of severe hyponatremia (<120 mmol/L), formed the major group which is in contrast to other studies by Thomas et al<sup>9</sup>, Gross et al<sup>10</sup> and Hochman et al<sup>11</sup> who had mild to moderate cases as the predominant group. This stresses the fact that hyponatremia is recognized and diagnosed quite late in our country. Lowest serum sodium was 100 mmol/L. Mean serum sodium at the time of presentation was 118mmol/L.

The causes of hyponatremia in decreasing order of frequency are as follows:

Causes	No. of patients
SIADH	39
Extrarenal loss	17
Chronic kidney disease	12
Cirrhosis	10
Diuretic induced	10
Hypothyroidism	6
Congestive cardiac failure	2
Central hypopituitarism	2
Nephrotic Syndrome	1
Hyperglycemia	1

In our study SIADH was the commonest cause of hyponatremia. Respiratory diseases like pneumonia (25.64%) followed by CVA (23.07%) was the commonest etiological factor for SIADH. This is comparable with other studies by Thomas et al<sup>9</sup>, Gross et al<sup>10</sup>, and Hochman et al<sup>11</sup>.

Cardiac failure was one of the important causes in other studies. In our study it was only 2%, which is in contrast to 18%, 13% and 25% by Thomas et al<sup>9</sup>, Hochman et al<sup>10</sup> and Gross et al<sup>11</sup> respectively. Other possible explanation being, patients with mild congestive heart failure are increasingly being treated in outpatient clinics. But our study is comparable with the study by Minneke. J. Coenradl et al<sup>12</sup>.

Majority of patients (62.9%) with hypoosmolar hypovolemic hyponatremia is due to extra renal loss which is comparable with other studies.

Many drugs produce SIADH. In our study anti depressants were the commonest cause which is comparable with other studies. Six patients who had hypoosmolar euvoletic hyponatremia were due to hypothyroidism which is comparable with other studies.

It is not difficult to diagnose hyponatremia who present with acute symptoms. It is important to recognize those patients without much symptoms, some of them having chronic hyponatremia and it is important to correct them at a slower pace.

63% of our patients were symptomatic and the rest 37% were asymptomatic. The major clinical presentation among those symptomatic was altered sensorium accounting for 45%.

23% had chronic hyponatremia which included patients with serum sodium <125 mmol/L and mild or no symptoms. The major causes include chronic renal failure and cirrhosis. Hence it is evident that it is very important to study serum electrolytes in patients who are having chronic illness.

We followed up the patient till the discharge or death of the patient with twice daily measurement of serum sodium and serial monitoring of other parameters. No complications of treatment was noted in our study.

The mean hospital stay of our patients was 11.6 days. The mortality in our study group was 5%. The cause of mortality include squamous cell carcinoma of lung, sepsis, hepatic failure, meningitis and periampullary carcinoma. It is well observed that death is due to underlying primary conditions and not due to hyponatremia itself.

### Summary and Conclusions:-

1. Total of 100 cases of hyponatremia admitted in IMCU during a period of 12 months were studied.
2. Of them 48% were male and 52% were female.
3. The mean age was 68.34 years. The commonest age group being 65-85 years and the least affected group was < 50 years.
4. Among the 100 cases 63% were symptomatic, who had seizures, altered sensorium or GI symptoms.
5. Their mean serum sodium level at the time of presentation was 118 mmol/L. Lowest serum sodium recorded was 100 mmol/L.
6. 65% of patients had severe hyponatremia  $\leq 120$  mmol/L
7. The commonest cause of hyponatremia was SIADH followed by extra renal losses due to vomiting and diarrhea and chronic renal failure.
8. The treatment was based on the basic principles but modified to suit the clinical situation.
9. The mean hospital stay was 11.6 days.
10. The mortality in our study group was 5%.

### Conclusion:-

Hyponatremia is one of the common causes of altered consciousness and seizures especially in elderly patients. It is very important to classify the hyponatremia and find out the correct etiology. According to this study the common causes of hyponatremia are SIADH followed by extra renal loss due to vomiting and diarrhea and chronic renal failure.

Our study shows that many people had serum sodium of <120mmol/L which we considered as severe hyponatremia. Such severe hyponatremia was not observed in many foreign studies. Treatment of hyponatremia is highly rewarding.

The mortality in our study group is 5% and most of them were due to the underlying primary disease and not due to hyponatremia itself.

It is necessary to recognize such an increasing electrolyte abnormality and to correct them. The common causes and the management protocol should be available in every IMCU.

### References:-

1. De Vita MV, Gardenswartz MH, Konecky A, Zabetakis PM. Incidence and etiology of hyponatremia in an intensive care unit. Clin. Nephrology 1990;34:163-166
2. Kleinfeld M, Casimir M, Borra S. Hyponatremia as observed in a chronic disease facility. J Am Geriatr Soc 1979;27:156-161
3. Upadhyay A, Jaber BL, Madias NE. Incidence and prevalence of Hyponatremia. Am J Med. 2006;119:S30-5.
4. Reddy P, Mooradian AD. Diagnosis and management of Hyponatremia in hospitalized patients. Int J Clin Pract 2009;63:494-508
5. Scott MG, LeGrys VA, Klutts JS. Electrolytes and blood gases. In: clinical chemistry and molecular diagnostics Tietz S, 3<sup>rd</sup> Ed. Saunders WB, Philadelphia. 2007;468-483
6. Saeed BO, Beaumont D, Handley G H, Weaver J U. Severe hyponatremia: investigation and management in a district general hospital. J Clin Pathol. 2002;55:893-896
7. Heinrich S, Wagner A, Gross P. Hyponatremia. Med Klin Intensiv Med Notfmed. 2013;108(1);53-58
8. Shannon G. Severe hyponatremia – recognition and management. Australian prescriber 2011;34(2)
9. Thomas Abraham Vargese, Sunil Bahl Radhakrishnan et al. Frequency and aetiology of Hyponatremia in adult hospitalized patients in medical wards of a General Hospital in Kuwait. Kuwait medical journal 2006;38(3):211-213
10. P. Gross, M. Kettler, C. Hausmann et al. Role of diuretics, hormonal derangements and clinical setting of Hyponatremia in medical patients. Klin Wochenschr 66 (1988), P:662-669
11. I Hochman, S. Cabili and GPear, Hyponatremia in internal medicine ward patients: causes, treatment and prognosis. 1<sup>st</sup> J. Med Sci 25 1989; P73-76
12. Conrath MJ, Meinders AE. Causes of Hyponatremia in department of internal medicine and neurosurgery. Eur J Internal Med 2003;14:302-309
13. Harrison's Principles of Internal Medicine : 19<sup>th</sup> edition: P 2762



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### RESEARCH ARTICLE

#### Smart Control of Water Flow and Depth Within Rice Field for Improving Irrigation Management and Mitigating Methane Emission.

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*Oryza sativa*, growth, yield, water management, methane mitigation, GHGs.

#### Abstract

A two-year field experiments were carried out at the Experimental Farm of the Central Laboratory for Agricultural Climate, Agriculture Research Center, Egypt during 2015 and 2016 successive rice seasons. such investigation aimed to study the productivity and CH<sub>4</sub> emission capacity of two Egyptian rice varieties (Sakha101 and Sakha106) under different irrigation water depths (4, 8 and 12 cm) from the soil surface. Innovated siphon container were connected to a water valve to maintain the continually of the water head at the desired depths. The water depth treatments were laid out in a randomized complete block design with four replications for each variety in both seasons. A combined analysis was used between the two varieties in each season to interpret the data. Plant height cm, root length cm and chlorophyll SPAD at 30 and 55 days after transplanting, panicle length cm, number of tillers m<sup>-2</sup>, number of grains panicle<sup>-1</sup>, number of unfilled grains panicle<sup>-1</sup>, 1000-grain weight, grain yield t ha<sup>-1</sup>, straw yield t ha<sup>-1</sup> and harvest index were recorded. Methane fluxes were measured by using closed chamber method. Water depth affected significantly all studied characteristics. The maximum values of most of the studied characteristics were recorded at 8 cm water depth. On the other hand, the lowest values were observed at 12 cm water depth. CH<sub>4</sub> emission was dramatically reduced by decrease the water depth. There was significant correlation coefficient between methane emission and all studied agronomic characteristics except 1000-grain weight and harvest index. The methane emission from rice fields decreased significantly with the increase of plant growth and yield. Irrigation water depth at 8 cm seem to be the recommendable treatment to achieve the promising rice yield and methane mitigation value.

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#### Introduction:-

Egypt is facing limited water resources, according to fast increase of population growth and its corresponding economic activities which caused a reduction in the per capita share of the limited fresh water resources. Rice crop is one of the major cereal crops feeding the Egyptian population. All of the rice areas in Egypt are under lowland

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irrigated rice. These rice areas require a large amount of irrigation water. Most of the rice farmers think that increasing water depth in their rice fields up to maximum level will reflect directly on rice grain yield irrespective to these hazardous side effect on environmental system. Talpur *et al.* (2013) reported that the maximum plant survival and tallest average plant height were recorded in 5 cm water depth compared to 10, 15 and 20 cm from cultivation till to mid stage of growth. The maximum water depth of 20 cm produced the shortest root, while 5 cm produced the longest root. The weight of 1000 grains has more affected by a deeper water depth as compared to shallower water depth but the total yield was opposite of these. It was observed that the number of grains loss due to excessive water depth has an adverse impact as compared to deficient water depths.

Kima *et al.* (2014) indicated that water reductions at the vegetative stage delayed plant growth and affected grain filling rate and 1000-grain weight, but the recovery process induced by effective rainfall contribution was such that grain yield was not affected. In water scarcity context, applying 180% of soil saturation water seems suitable for increasing both rice production and irrigation water productivity in tropical climate conditions. They argue that, rather than the daily application of the small amount of water, saturated soil culture practice can be adopted in the specific agro-climatic zone by adjusting the irrigation water depth according to the irrigation intervals. Weekly application of a 3 cm water depth above soil surface can be recommended to farmers as an alternative to save irrigation water, time, energy, and increase outputs.

Methane is the second most important culprit of GHGs. Its emissions rose by about 40% from 1970, with an 85% increase from the combustion and use of fossil fuels. Agriculture, however, is the largest source of CH<sub>4</sub> emissions (Aulakh *et al.*, 2001). Agricultural lands (used for agricultural production, managed grassland and permanent crops including agro-forestry and bio-energy crops) occupy about 40-50% of the Earth's land surface and release a significant amount of CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O in atmosphere (Cole *et al.*, 1997; IPCC, 2001 and Paustian *et al.*, 2004). Agriculture accounts for 10-12% of total global anthropogenic emissions of GHGs. This sector contributes about 47% and 58% of total anthropogenic emissions of CH<sub>4</sub> and N<sub>2</sub>O, respectively, with a wide range of uncertainty in the estimates of both the agricultural contribution and the anthropogenic total. Globally, agricultural CH<sub>4</sub> emission increased by 17% from 1990 to 2005, an average annual emission increase of 58 Mt CO<sub>2</sub>-eq yr<sup>-1</sup>. Methane is produced when organic materials are decomposed anaerobically. Water management practices have a strong influence on the processes involved in CH<sub>4</sub> emission from rice paddy fields. The presence of surface standing water is essential for the development of the anaerobic conditions in paddy soil by limiting the transport of atmospheric oxygen into the soil. In the Japanese rice cultivation; short-term floodwater drainage is commonly performed to aerate the paddy soil during the flooding period to prevent some negative effects of soil reduction on the growth of rice plant. Yagi and Minami (1990) detected a decrease in CH<sub>4</sub> emission rates during the period of midsummer drainage in Japanese rice paddy fields. Sass *et al.* (1992) demonstrated that CH<sub>4</sub> emission rates varied markedly with water regime, showing the lowest emission with multiple intermittent draining practices.

Zheng Bing-song, *et al.* (2006) reported that water deficiency is one of the primary yield-limiting factors in rice. Different rice genotypes showed different relative root parameters and relative nutrition content and water use efficiency under different water supply conditions (0 cm (submerged), 40 cm and 80 cm groundwater levels below the soil surface). The length and number of adventitious root are more important than seminal root length in water and nutrition uptake, and maintaining the grain yield and increasing dry matter, but the adventitious root number could not be served as an index for screening drought-resistant genotypes.

the main target of this work was to throw light on the role of irrigation water depth in rice field in mitigating methane emission in relation to growth, yield and yield components of rice crop.

### Materials and Methods:-

Two years field experiment were carried out at the Experimental Farm of the Central Laboratory for Agricultural Climate, Agriculture Research Center, Egypt during 2015 and 2016 successive rice seasons. such experiments were conducted to study the performance of two rice varieties (Sakha101 and Sakha106) under different irrigation water depths (4, 8 and 12 cm) from the soil surface. Irrigation water depths were kept using a smart control flow system (Fig. 1). Innovated siphon container were connected to a water valve and flow meter to maintain the continually of the water head at the desired depths under low pressure. The depths of water were controlled in each replicate through a perpendicular wires installed over the container of the siphon that poise by water balance. The water depth treatments were laid out in a randomized complete block design with four replications for each variety in both

seasons. A combined analysis was used between the two varieties in each season to interpret the data. Correlation analysis was done by Pearson correlation coefficient method using the PC software SPSS Ver. 14.

Seeds of the two varieties were soaked in water for 24 hours before sowing the nursery, then drained and incubated for 48 hours to hasten the germination. Pre-germinated seeds were uniformly broadcasted in the nurseries on 1<sup>st</sup> and 3<sup>rd</sup> of May in the two seasons, respectively. The permanent field was well prepared. Seedlings were carefully pulled from nursery after 25 days from sowing and transferred to the permanent field. Seedlings were handily transplanted in hills at the rate of 2-3 seedlings hill<sup>-1</sup> and at the spacing of 20x20 cm between hills and rows. The plot size was 12 m<sup>2</sup> (2x6m). The all recommended cultural practices were applied for each variety.

The studied growth characteristics were plant height (cm), root length (cm) and chlorophyll SPAD at 30 and 55 days after transplanting. Chlorophyll meter (model SPAD-502, MINOLTA, Japan) was used to determine the leaves chlorophyll content. The studied yield attributes traits were panicle length (cm), number of tillers m<sup>-2</sup>, number of grains panicle<sup>-1</sup>, number of unfilled grain panicle<sup>-1</sup>, 1000-grain (g) weight, grain yield (t ha<sup>-1</sup>), straw yield (t ha<sup>-1</sup>) and harvest index.

Methane fluxes were measured by using closed chamber method. This measurement system was a modified version of the system originally described by Schutz *et al.*, 1990. For the measurements, an air-tight acrylic glass chamber (15 cm in diameter and 1 m high) was carefully placed on the wooden frame. One day before the recording of CH<sub>4</sub>, this wooden frame was placed at a randomly selected measuring site inside each plot. In each replicate, two chambers were inserted into the soil after flooding. The closure period was 1 h, during which two gas samples from inside the chambers were taken at 30 min intervals. Methane emission was measured at 8.00–10.00 am and at 15.00–17.00 pm, and the average value was used as the flux value for the day. Methane emission rates were recorded after 65 days of transplanting. Average air temperature (32°C) was recorded just before measuring the CH<sub>4</sub> emissions. Methane concentration in the sampled air was measured using a FID-GC (Shimadzu GC-14APF). Statistical analysis: The analysis of variance by means of “MSTATC” computer software package was carried out as combined analysis for the two varieties in each season according to Gomez and Gomez (1984).

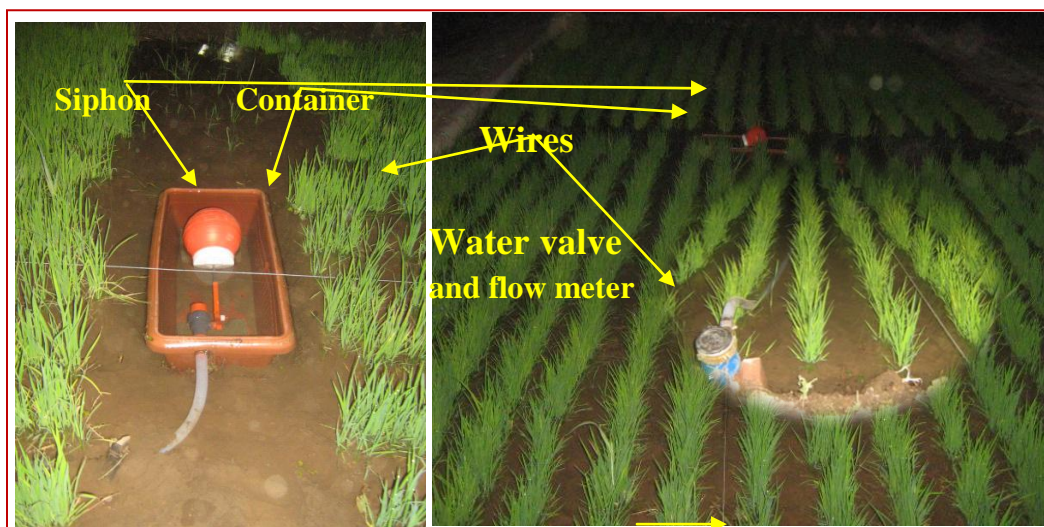


Fig 1. Smart control of irrigation water flows to experimental plots.

### Results and Discussion:-

Plant height at 30 and 55 DAT was varied significantly among different treatments combinations (Tables 1 and 2). At 30 DAT, the highest values of plant height were recorded when irrigation water was kept at 4 cm in depth for the two varieties. On the other hand, 8 cm water depth recorded the tallest plants at 55 DAT. These results were true in both the experimental seasons of 2015 and 2016 are in harmony with those of Talpur *et al.* (2013) and Kima *et al.* (2014).

**Table 1. Plant height (cm), root length (cm) and leaf chlorophyll content (SPAD) of the two rice varieties at 30 DAT as affected by water depth treatments.**

Treatments		Plant height cm		Root length cm		Chlorophyll SPAD	
Variety	Water depth cm	2015	2016	2015	2016	2015	2016
Sakha 101	4	51.50a	49.44b	12.36ab	12.36ab	33.99ab	32.96a
	8	49.44b	45.32d	8.24c	8.24c	32.96b	30.90b
	12	43.26d	45.45d	8.19c	8.79c	29.77c	30.88b
Sakha 106	4	51.50a	51.50a	13.39a	12.36ab	35.02a	33.99a
	8	47.38c	47.38c	10.30bc	10.30bc	33.99ab	30.90b
	12	48.41c	48.41bc	9.79c	8.76c	30.90c	29.87b

Means of each column designated by the same letter are not significantly different at 5% level using Duncan's multiple range test.

**Table 2. Plant height (cm), root length (cm) and leaf chlorophyll content (SPAD) of the two rice varieties at 55 DAT as affected by water depth treatments.**

Treatments		Plant height cm		Root length cm		Chlorophyll SPAD	
Variety	Water depth cm	2015	2016	2015	2016	2015	2016
Sakha 101	4	76.22cd	71.07c	17.51c	18.54b	42.23b	41.20bc
	8	83.43ab	78.28b	19.67b	19.57ab	44.21ab	43.26ab
	12	71.07e	67.68d	12.36e	13.39c	38.11c	38.11d
Sakha 106	4	80.34bc	78.28b	19.57b	18.54b	43.26ab	41.20bc
	8	86.52a	82.40a	21.66a	20.59a	44.99a	44.77a
	12	74.16de	73.13c	14.49d	14.42c	39.14c	39.14cd

Means of each column designated by the same letter are not significantly different at 5% level using Duncan's multiple range test.

In both seasons the length of rice roots showed significant differences with the water depths for both varieties (Tables 1 and 2). The longest length of root was measured in 4 cm water depth at 30 DAT and in 8 cm water depth at 55 DAT. Increasing water depth to 12 cm decreased root length significantly. Obvious reduction in either plant height or root length of rice plant grown in depth (12cm) at 30 and 55 DAT could be attributed to the deleterious impact of poor aeration on plant -water-soil relation and their address effects on growth criterion of rice plant. These results are in harmony with Zheng Bing-song *et al.* (2006), Talpur *et al.* (2013) and Kima *et al.* (2014). De Datta (1981) emphasized that extremely deep water resulted in poor growth and yield. Roots were deeper in Sakha106 compared to Sakha101. Ascha *et al.* (2005) reported that plant becomes adapted to water deficiency through the possession of pronounced root system, which maximizes water capture and allows access to water at depth.

Application of various water depths in rice varieties showed a significant impact on leave chlorophyll content at 30 and 55 DAT as shown in Tables 1 and 2. Chlorophyll content at 30 DAT decreased gradually by increasing water depth from 5 up to 12 cm while, at 55 DAT the highest values were recorded at 8 cm water depth for both varieties. Chlorophyll content in Sakha 106 was slightly higher than those in Sakha101. Kima *et al.* (2014) found a similar trend and reported that under shallow water depth, plants reduced evapotranspiration that led photosynthesis decrease which in turn induced chlorophyll decrease.

In both seasons panicle length was affected significantly by different treatments (Table 3). The longest panicles were observed when 4 cm water depth was applied either to Sakha101 or to Sakha106. Number of tillers per meter square was affected significantly by different water depth. Application of 8 cm irrigation water depth to Sakha101 recorded the highest number of tillers followed by the same water depth to Sakha106. Data in Table 3 showed also that water depth treatments affected significantly number of grain per panicle. Sakha101 at 8 cm water depth produced the highest number of grains per panicle followed by Sakha106 at the same depth. All above mention results were fact in either 2015 or 2016 experimental seasons. Similar trend was found by Talpur *et al.* (2013) and Kima *et al.* (2014).

**Table 3. Panicle length (cm), number of tillers m<sup>-2</sup>, number of grains/panicle and number of unfilled grains of the two rice varieties as affected by water depth treatments.**

Treatments		Panicle length cm		No of tillers m <sup>-2</sup>		No of grains panicle <sup>-1</sup>		No of unfilled grains panicle <sup>-1</sup>	
Variety	Water depth cm	2015	2016	2015	2016	2015	2016	2015	2016
Sakha 101	4	22.66a	21.63a	249.5b	241.3c	121.11b	114.82c	12.27c	18.76b
	8	21.63a	19.57b	272.2a	253.7a	148.30a	144.87a	20.81b	21.58ab
	12	16.48c	15.45c	224.5c	206.3e	106.79c	96.46d	27.07a	22.02a
Sakha 106	4	21.01a	18.54b	240.0b	226.6d	105.06c	112.96c	4.90f	2.61e
	8	19.02b	16.48c	259.6b	243.1bc	118.45bc	123.60b	8.51e	9.69d
	12	14.42d	12.36d	216.3c	203.9e	93.42d	88.58d	13.66d	19.23c

Means of each column designated by the same letter are not significantly different at 5% level using Duncan's multiple range test.

Number of unfilled grains per panicle varied significantly according to water depth treatments (Table 3). Unfilled grains per panicle increased significantly with the increase in water depth for both varieties. The highest number of unfilled grains per panicle was measured at 12 cm water depth by Sakha101 rice variety followed by 8 and 4 cm by Sakha101. Meanwhile 1000-grain weight was affected significantly by water depth treatments (Table 4). Shallow water depth recorded highest values of 1000-grain weight. these results are fairly true in both the two seasons.

Water depth affected significantly grain yield as presented in Table 4. The maximum values of grain yield were recorded by Sakha106 at 8 cm water depth. On the other hand, the lowest values of grain yield were observed by Sakha101 at 12 cm water depth. This is agreed with results obtained by Talpur *et al.* (2013) and Kima *et al.* (2014). Reduction in rice grain yield under 12cm depth treatment in both cultivars and in both seasons could be attributed to the reduction in number of tiller/m<sup>2</sup>, number of grains/ panicle and the increase in number of unfilled grains/panicle (Table 3) as well as the decrease in 1000-grain weight (Table 4). It can be assumed that the increase in water depth up to 12cm caused a bad aeration conditions around root and shoots of rice plant. Adequate oxygen supplies are necessary to respiration and other essential physiological processes of plant and consequently rice yield and its components of deep water level plots was decreased. Sakha106 produced higher grain yield than Sakha101. This might be due to the substantial yield losses by the large percentage of unfilled grains in Sakha101.

**Table 4. Thousand-grain weight (g), grain yield( t ha<sup>-1</sup>), straw yield ( t ha<sup>-1</sup>) and harvest index of the two rice varieties as affected by water depth treatments.**

Treatments		1000-grain weight		Grain yield t ha <sup>-1</sup>		Straw yield t ha <sup>-1</sup>		HI	
Variety	Water depth cm	2015	2016	2015	2016	2015	2016	2015	2016
Sakha 101	4	27.78ab	27.10bc	8.63d	8.46d	12.10cd	11.91b	0.416b	0.415c
	8	29.23a	28.93a	9.19bc	9.11bc	12.45c	12.25b	0.425a	0.426a
	12	26.63b	26.63c	7.63e	7.35e	11.44d	10.57c	0.400d	0.410d
Sakha 106	4	27.15b	27.60bc	9.58b	8.63cd	13.66a	12.08b	0.412c	0.417bc
	8	28.08ab	27.99ab	10.46a	10.26a	14.19a	13.73a	0.424a	0.428a
	12	26.80b	26.55c	8.88cd	8.17d	12.44c	11.38c	0.417b	0.418b

Means of each column designated by the same letter are not significantly different at 5% level using Duncan's multiple range test.

Straw yield was affected significantly by water depth treatments (Table 4). Sakha106 at 8 cm water depth produced the highest value of straw yield. Harvest index showed significant difference with the water depths used in this study. The maximum values of harvest index were measured at 8 cm water depth whatever the variety.

Methane emission values obtained under the three water depths in the two experimental seasons are presented in table 5. Methane flux ranged from 0.288-0.597 and 0.278-0.566 mg m<sup>-2</sup>hr<sup>-1</sup> in both seasons respectively. There was a significant differences in CH<sub>4</sub> emission values among water depths. Available results in Table 5 clear that methane emission values were increased as irrigation water depth increased. increasing water depth from 4cm to 8cm and 12cm level increase CH<sub>4</sub> emission from Sakha 101 plots by 28.6 and 107.1 % respectively in 1st season and by 9.4 and 89.6% in the second one. Analogous values for Sakha 106 cultivars plots were 17.9 and 89.37 % in 2015 and 14.9 and 92.6 % in 2016 season, respectively. There for, management of irrigation water level in rice fields can be used as a smart tool for mitigating CH<sub>4</sub> emission in irrigated paddy field. Variation in CH<sub>4</sub> emission rate was also

detected between the two investigated cultivars. Sakha 101 plots emitted more CH<sub>4</sub> ( 2.448 mg/m<sup>2</sup>/ha) as a total of the two seasons comparing with 2.307 mg/m<sup>2</sup>/ha for Sakha 106. Our data showed, CH<sub>4</sub> emission was dramatically reduced by decrease the water depth wherein, suitable water management practice can be established by assessing appropriate controlling the irrigation and flow rate to reduce CH<sub>4</sub> emission with any adverse effects on yield and soil fertility. These results confirm the phenomena that the aeration under 3 cm water depth in paddy soil led to decrease methane emission. However, under 12 cm of water depth, reduction condition was prevailing which provide a good condition to emit more methane than under oxidized zone. Genotypic differences in the emission of methane from rice paddies are reported also by Nirmali Gogoi *et al.* (2008).

**Table 5. Methane emission as affected by rice varieties and water depth treatments.**

Treatments		Methane mg m <sup>-2</sup> hr <sup>-1</sup>	
Variety	Water depth cm	2015	2016
Sakha 101	4	0.2884d	0.2987c
	8	0.3708b	0.3269b
	12	0.5974a	0.5665a
Sakha 106	4	0.2884d	0.2781d
	8	0.3399c	0.3196b
	12	0.5459a	0.5356a

Means of each column designated by the same letter are not significantly different at 5% level using Duncan's multiple range test.

Regarding the correlation coefficient between methane emission and the studied agronomic characteristics, data in Table 6 revealed that there was significant correlation coefficient between methane emission and all studied agronomic characteristics except 1000-grain weight and harvest index. The correlation coefficient was highly significant and positive between methane emission and number of unfilled grain per panicle. On other hand, it was highly significant and negative between methane emission and each of chlorophyll content SPAD at 30 DAT, root length at 55 DAT, chlorophyll content SPAD at 55 DAT, panicle length, number of tillers per m<sup>2</sup> and straw yield. The correlation coefficient was significant and negative between methane emission and each of plant height at 30 and 55 DAT, root length at 30 DAT, number of grains per panicle and grain yield. These results demonstrated that methane emission from rice fields decreased significantly with the increase in the rice plant growth and yield. Denier *et al.* (2002) and Ali *et al.* (2009) reported similar trend.

**Table 6. Correlation coefficient between methane emission and agronomic characters.**

Characters	Methane
Plant height at 30 DAT	-0.650*
Root length at 30 DAT	-0.681*
Chlorophyll SPAD at 30 DAT	-0.782**
Plant height at 55 DAT	-0.619*
Root length at 55 DAT	-0.883**
Chlorophyll SPAD at 55 DAT	-0.817**
Panicle length	-0.779**
Number of tillers m <sup>-2</sup>	-0.741**
Number of grains panicle <sup>-1</sup>	-0.626*
Number of unfilled grains panicle <sup>-1</sup>	0.855**
1000-grain weight	-0.522
Grain yield	-0.595*
Straw yield	-0.726**
HI	0.172

\*Correlation is significant at the 0.05 level (2- tailed).

\*\* Correlation is significant at the 0.01 level (2- tailed).

### Conclusion:-

Rice yield and CH<sub>4</sub> emission were positively affected significantly by irrigation water depth. Methane emission was dramatically reduced by decrease the water depth. Irrigation water depth at 8cm seem to be recommendable treatment to obtain the promising rice yield and CH<sub>4</sub> mitigation value. There was significant correlation coefficient

between methane emission and all studied agronomic characteristics except 1000-grain weight and harvest index. The methane emission from rice field decreased significantly with the increase of rice plant growth and yield.

### References:-

1. Ali, M.A; C.H. Lee; Y.B. Lee and P.J. Kim. 2009. Silicate fertilization in no-tillage rice farming for mitigation of methane emission and increasing rice productivity. *Agric., Ecosys. Environ.*, 132:16–22.
2. Ascha, F; M. Dingkuhn; A. Sow and A. Audebert. 2005. Drought-induced changes in rooting patterns and assimilate partitioning between root and shoot in upland rice. *Field Crop. Res.*, 93: 223–236.
3. Aulakh, M.S; R. Wassmann; C. Bueno and H. Rennenberg. 2001. Impact of root exudates of different cultivars and plant development stages of rice (*Oryza sativa L.*) on methane production in a paddy soil. *Plant and Soil*, 230:77-86.
4. Cole, C; J. Duxbury; J. Freney; O. Heinemeyer; K. Minami; A. Mosier; K. Paustian; N. Rosenberg; N. Sampson; D. Sauerbeck and Q. Zhao, 1997. Global estimates of potential mitigation of greenhouse gas emissions by agriculture. *Nutrient Cycling in Agroecosystems*, 49 : 221-228.
5. De Datta S.K. 1981. Principles and practices of rice production, New York (USA): John Wiley. de Laulanié H. 1993. Le système de riziculture intensive malgache, *Tropicultura (Brussels)* 11:110-114.
6. De Datta, S.K; H. K. Krupp; EI Alvarez and S.C. Modgal. 1973. Water management practices in flooded tropical rice, in *Water Management in Philippine Irrigation Systems: Research and Operations*, pp. 1-18, Int. Rice Res. Inst., Los Barios, Philippines.
7. Denier, van Der Gon HAC., M.J. Kropff; N. van Breemen; R. Wassmann, R.S. Lantin; E. Aduna and TM Corton. 2002. Optimizing grain yields reduces CH<sub>4</sub> emissions from rice paddy fields. *Proc. Natl. Acad. Sci. U.S.A.* 99, 12021–12024.
8. Gomez, K. and A. Gomez. 1984. *Statistical Procedures of Agricultural Research*. John Wiley and Sons. Inc., New York, U.S.A.
9. IPCC 2001. Climate Change 2001. The Scientific Basis. In Houghton, J.T, Ding, Y, Griggs, D.J, Nogue; M. van der Linden; P.J. Dai; X. K. Maskell and C.A. Johnson, (eds). Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, 881
10. Kima, A.S; W.G. Chung and Y.M. Wang. 2014. Improving Irrigated Lowland Rice Water Use Efficiency under Saturated Soil Culture for Adoption in Tropical Climate Conditions. *Water*, 6: 2830-2846.
11. Nirmali Gogoi, K.K Baruah and Prabhat K Gupta. 2008. Selection of rice genotypes for lower methane emission. *Agronomy for Sustainable Development*, Springer Verlag/EDP Sciences/INRA, 28 (2): 181-186.
12. Paustian, K; B.A .Babcock; J. Hatfield; R. Lal; B.A. McCarl; S. McLaughlin; A. Mosier; C. Rice, G.P. Robertson; N.J. Rosenberg; C. Rosenzweig; W.H. Schlesinger and D. Zilberman. 2004. *Agricultural Mitigation of Greenhouse Gases: Science and Policy Options*. CAST (Council on Agricultural Science and Technology) Report, R141 2004, 120.
13. Sass, R. L; F.M. Fisher; Y.B. Wang; F.T. Turner and M.F. Jund. 1992. Methane emission from rice fields: the effect of flood water management, *Global Biogeochem. Cycles*, 6, 249-262.
14. Schütz, H., W. Seiler, and R. Conrad (1990) Influence of soil temperature on methane emission from rice paddy fields. *Biogeochemistry*, 11:77-95, 1990.
15. Talpur, M.A; J.i. Changying; S.A. Junejo; A.A. Tagar and B.K. Ram. 2013. Effect of different water depths on growth and yield of rice crop. *Afr. J. Agric. Res.* 8(37). 4654-4659.
16. Wickham, T.H and C.N. Sen. 1978. Water management for lowland rice: Water requirements and yield response, in *Soil and Rice*, 649- 669, Int. Rice Res. Inst., Los Barios, Philippines.
17. Yagi, K and K Minami. 1990. Effect of organic matter application on methane emission from some Japanese paddy fields, *Soil Sci. Plant Nutr.*, 36: 599-610.
18. Zheng Bing-song; JIANG De-an; WU Ping; WENG Xiao-yan; LU Qing and WANG Ni-yan. 2006. Relation of root growth of rice seedling with nutrition and water use efficiency under different water supply conditions. *Rice Sci.*, 13(4): 291-298.



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### RESEARCH ARTICLE

#### LASER 805NM EFFECTS ON BACTERIAL GENETIC AND SENSITIVITY TOWARD ANTIBIOTICS.

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Bacterial genetic, Laser 805nm, Plasmid.

#### Abstract

Low-intensity laser is proposed in clinical protocols based on biostimulative effects, yet dosimetry is inaccurate and their effects on DNA at therapeutic doses are controversial. The aim of this work was to evaluate the effects of low-intensity laser 805nm wavelength on *Escherichia coli* (*E. coli*) and *Staphylococcus aureus* (*S. aureus*) plasmids. Our findings in this study indicate that the 805nm laser has effect on *gram positive and gram negative bacterial* genetic profile. Studies about laser effects and safety strategies are necessary for professionals and patients exposed to low-intensity lasers at therapeutic doses.

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#### Introduction:-

Since resistance to antibiotics is becoming an increasing problem, another possibility to battle bacterial infections are needed (Finger, *et.al.* 2013). Safety concerns about food, drinking water, health surveillance, and clinical diagnosis related to microbial pathogens have attracted increasing attention worldwide (Raj, *et.al.* 2015). Gram negative bacteria *Escherichia coli* (*E. coli*) are the leading cause of urinary tract infection, food borne illness, inflammation, bloody diarrhoea (Nataro and Kaper 1998). These are due to their ability to produce toxins and enzymes which help bacteria to avoid body immune response as well as resist antibiotic treatment (Lim, *et.al.* 2010). On the other hand, *Staphylococcus aureus* (*S. aureus*) is a Gram-positive spherical bacterium and it is equipped with a great variety of virulence factors, which include both structural and secreted products participating in pathogenesis of infection. In addition, it is one of the main causes of hospital and community-acquired infections which can result in serious consequences (Campanile, *et.al.* 2015).

Today, it is generally accepted that an exponential growth in the use of lasers has been observed in almost every area of pure and applied sciences. A wide variety of the laser propelled the invention of a several new ways research. Most of the electronic industry giants and many research laboratories are now competing to manufacture novel ranges of lasers (Nasim and Jamil, 2014). Furthermore, scientists have been agreed that the susceptibility of bacterial plasmid to laser light is varied from one Genus to another. Laser treatment has been applied for the development of an effective and safe technology for the inactivation of bacterial pathogens (Liang, *et.al.* 2013). It is well documented that the exposure of laser radiation was genotoxic in prokaryotic organisms also indicated that the presence of laser light selectively enhances damage on the guanine bases in DNA of pathogenic microorganism



(Geng, *et al.* 2008). However, gene expression and the corresponding protein production resulting from exposure to laser radiation have not been investigated well (Raul and David, 2013).

Low-level lasers have been used among scientists to cure many diseases based on its biostimulative effect. However, the photo-biological basis for its mechanism of action and adverse effects are not well understood. The aim of this study was using experimental model to evaluate the effects of 805nm laser on genetic bacterial pathogens.

## Materials and Methods:-

### Bacterial isolates:-

Two different bacteria (*E.coli* and *S. aureus*) were obtained from Teaching hospital (Erbil/Iraq). They were re-cultured on nutrient agar for 48 hours. Then they were cultured in nutrient broth and put them in shaking incubator for 24 hours. Identification and diagnosis for both bacteria had done by using api 20E system.

### Plasmid extraction:-

Once the bacterial culture in nutrient broth had been prepared, we harvested the bacterial culture by centrifugation at 8000 rpm in a micro centrifuge for 2 minutes at room temperature. Then we decant the supernatant and remove all remaining medium.

Plasmid extraction was performed by using GeneJET Plasmid Miniprep Kit for both bacteria. This methodology is based upon protocols described by manufacturer (Thermo Scientific). All extraction steps carried out at room temperature. Also all centrifugations carried out in a micro centrifuge at 12 000 rpm.

### Gel electrophoresis:-

Gel prepared at 0.5gms of powdered agarose, were mixed into 100ml of 1X TBE buffer. The mixture was then heated in microwave until it becomes clear. 1 $\mu$ L of Web Green was then added into the solution. The gel solution was poured into a gel tray; a comb was placed into the gel to create the wells for plasmid DNA samples. The gel was then allowed to cool and set for 30 minutes. After the mini agarose gel electrophoresis prepared, we added 10 $\mu$ L of the extracted plasmid DNA, with 1 $\mu$ L of loading dye and placed in the pores. The tray was then put in a tank containing TBE buffer. A voltage of 80 v/cm<sup>2</sup> was allowed to pass through the gel for 45 minutes till the trapping dye nearly reached the edge of the gel, then examined and photographed under UV light source.

### Laser Device and Irradiation Setup:-

The 805nm Diode laser was used in this study with spot size diameter of 5mm. The exposure time was adjusted for 5,10 and 15 minutes. The setup of chopped diode laser is illustrated in Figure (1).



**Figure 1:-** laser sensitivity test shows the setup of irradiation method by Diode laser (805nm).

### Samples Preparation and laser Irradiation:-

After both bacterial plasmids isolated, we added 50 $\mu$ L of distilled water for each of them (tubes). Then we transferred 10 $\mu$ L of the mixture (plasmid and distilled water) into Eppendorf tubes. The laser beam then used with the 805nm wavelength, the exposure time was adjusted for three different times for both isolated plasmids which are 5,10 and 15 minutes. At the end we utilized mini agarose gel electrophoresis to study laser effect on both plasmids at different times.

**Result:-**

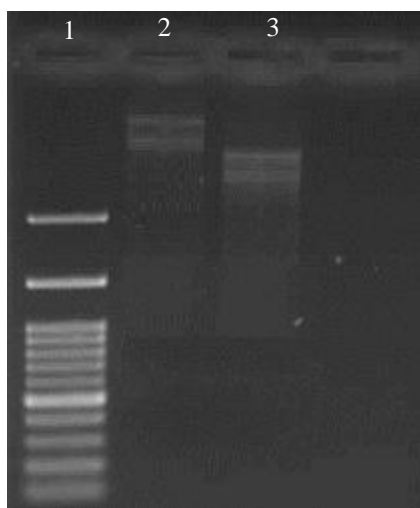
Two different bacteria *E.coli* and *S. aureus* were selected in this study to detect the irradiation effects on their plasmid content. The irradiated DNA samples were immediately re-dissolved in 50 µl of distilled water. Agarose gel electrophoresis was used to separate different forms of plasmid DNAs (irradiated and non-irradiated plasmid). The agarose gel was prepared with 0.5gms agarose and 1µL of Web Green; the samples were then run in the agarose gel at 80 volts for 45 minutes. The table 1 displays the loading samples into the gel. The results of the gel run are given in Figure 2, which shows the plasmid profile for both microorganisms before laser irradiation. It can be seen well number 1 represents the ladder with the size of 1kb. Further down in the gel, lane number 2 and 3 show the *E.coli* and *S. aureus* genetic profile prior to diode laser respectively. Both plasmids before irradiation in the range of above 1kb in size which appears as double bands. However, the size of the *E.coli* plasmid(s) is bigger than *S. aureus* plasmid(s).

On the other hand, table 2 demonstrates the loading samples into the gel after irradiation. The consequences of the diode laser 805nm on both bacterial genetic profiles as shown in figure 3 and 4. It can be seen from the third figure that well number 1, 2 and 3 contain the extracted *E.coli* plasmid that irradiated with 805 diode laser for 5, 10 and 15 minutes respectively. Furthermore, figure 4 demonstrates that pore number 1, 2 and 3 contain the result of irradiated *S. aureus* genetic profile in three different times 5, 10 and 15 minutes respectively. The same result for *E.coli* and *S. aureus* were obtained as shown in both figures (3 and 4). Thus, there is no evidence of irradiation product band for both irradiated plasmids. This is referred to the impairment of irradiation on its plasmid profile.

The molecular weights of the unknown bands were determined using a calibration curve based on the known molecular weights of the constituents of the ladder and corresponding relative distances travelled.

**Table 1:-** Displays well content before laser irradiation and product band sizes (bp).

Well number	Sample type	Band size (bp)
1	ladder	1000<
2	<i>E.coli</i>	1000<
3	<i>S. aureus</i>	1000<



**Figure 2:-** Gel electrophoresis image shows well content and migration of plasmid DNA extracts before irradiation with diode laser.

**Table 2:-** displays well content after laser irradiation, product band sizes (bp) and time.

Well number	Sample type	Band size (bp)	Time/Minutes
1	<i>E.coli</i>	None	5
2	<i>E.coli</i>	None	10
3	<i>E.coli</i>	None	15



**Figure 3:-** Gel electrophoresis image illustrates extracted *E.coli* genetic profile migration after 5, 10 and 15 minutes of irradiation with 805nm diode laser.

**Table 3:-** Displays well content after laser irradiation, product band sizes (bp) and time.

Well number	Sample type	Band size (bp)	Time/Minutes
1	<i>S. aureus</i>	None	5
2	<i>S. aureus</i>	None	10
3	<i>S. aureus</i>	None	15



**Figure 4:-** Gel electrophoresis image shows isolated *S. aureus* plasmid migration after 5, 10 and 15 minutes of irradiation with diode laser.

### Discussion:-

The problems of antibiotic resistance and pathogens in the environment are of unremitting concern for society. Traditional methods to remove and inactivate pathogens have included chlorine, UV, antibiotics, and a variety of physical and chemical processes (Capita and Alonso-Calleja, 2013, Bech, *et.al.* 2014). However, we are witnessing the emergence of pathogens that are resistant to these traditional methods. For example, emerging environmental pathogens such as *Mycobacterium avium* have been identified, which are resistant to traditional chlorine based treatments (Worley-Morse, and Gunsch 2015). Furthermore, antibiotics are no longer as effective due to the emergence of multiple types of antibiotic resistance, and there is concern of entering a post-antibiotic era. Clearly, there is a need to investigate alternative disinfection strategies for controlling pathogens in the environment and in engineered waste streams.

One novel approach to controlling environmental pathogens is the use of laser, which has received much attention in the medical field as a way to specifically damage plasmid DNA by disabling the antibiotic resistant gene.

We have investigated laser-induced DNA strand breaks in plasmids. The supercoiled plasmid was irradiated at 805nm wavelength. The plasmid may exist in supercoiled, relaxed-circular or linear conformation. Only one single strand break (SSB) is sufficient to relax DNA in supercoiled form to relaxed-circular form. One double strand break (DSB) will produce linear molecules (Adjei, *et.al.* 2016).

Generally, this study shows that the laser 805nm irradiation had a major effect on *E.coli* and *S. aureus* plasmids. The idea of inducing DNA cut photo chemically has attracted attention, the strand breaks of plasmid DNA might be due to singlet oxygen that is generated through the irradiation process which causes bacterial genetic profile to be cleaved due to the interaction with nitrogen base of DNA especially guanine bases which might be act as sinks for electrons holes within DNA owing to their propensity to be oxidized. The electron holes induced by laser irradiation may be propagated via stacking interactions in the DNA helix until it encounters guanine cluster, where it may persist longer than at other sites (Sies, *et.al.*1996, Adjei, *et.al.* 2016)

### Conclusions:-

In conclusion, we have demonstrated the possibility and advantages of using 805nm laser. Bacterial plasmid(s) could be impaired by laser irradiation for instance *E.coli* and *S. aureus* plasmids. This means that many antibiotics could be replaced by diode laser 805nm wavelength for curing infectious microorganisms. Overall, it is believed that the diode laser 805nm wavelength can meet the scientist's challenges from laboratories to industries.

### Reference:-

1. Finger, S., Wiegand, C., Buschmann, H., Hippler, U. (2013) Antibacterial properties of cyclodextrin–antiseptics-complexes determined by micro plate laser nephelometry and ATP bioluminescence assay. *International Journal of Pharmaceutics*. 452. pp188– 193.
2. Raj, V., Vijayan, A. N., Joseph, K. (2015) Cysteine capped gold nanoparticles for naked eye detection of *E. coli* bacteria in UTI patients. *Sensing and Bio-Sensing Research*. **5**. pp33–36.
3. Nataro, J. P., and Kaper, J. B. (1998) Diarrheagenic *Escherichia coli*. *Clin Microbiol Rev*. 11(1): pp142–201.
4. Lim, J. Y., Yoon, J. W., and Hovde, C. J. (2010) A Brief Overview of *Escherichia coli* O157:H7 and Its Plasmid O157. *J Microbiol Biotechnol*. 20(1). pp5–14.
5. Campanile, F., Bongiorno, D., Perez, M., Mongelli, G., Sessa, L., Benvenuto, S., Gona, F., Varaldo, P. E., Stefani, S. (2015) Epidemiology of *Staphylococcus aureus* in Italy: First nationwide survey, 2012. *Journal of Global Antimicrobial Resistance*. 3. pp247–254.
6. Geng, J., Yu, S., Wan, X., Wang, X., Shen, P., Zhou, P., Chen, X. (2008) Protective action of bacterial melanin against DNA damage in full UV spectrums by a sensitive plasmid-based noncellular system. *J. Biochem. Biophys*. 70. pp 1151–1155.
7. Bech, T. B., Rosenbom, A. E., Kjaer, J., Mostafa Amin, M. G., Olsen, P., Jacobsen, C. S. (2014) Factors influencing the survival and leaching of tetracycline-resistant bacteria and *Escherichia coli* through structured agricultural fields. *Agriculture, Ecosystems and Environment*. 195. pp10–17.
8. Capita, R., Alonso-Calleja, C., (2013) Antibiotic-resistant bacteria: a challenge for the food industry. *Crit Rev Food Sci Nutr*. 53 (1). pp11–48.
9. Cueroa, R., and McKay, D. S. (2013) Induction and construct UV protective yeast plasmid. *Journal of Biotechnology*. 166. pp76–83.
10. Liang, J., Yuann, J. P., Cheng, C., Jian, H., Lin, C., Chen, L. (2013) Blue light induced free radicals from riboflavin on *E. coli* DNA damage. *Journal of Photochemistry and Photobiology B: Biology*. 119. pp60–64.
11. Nasim, H., and Jamil, Y. (2014) Diode lasers: From laboratory to industry. *Optics & Laser Technology*. **56**. pp211–222.
12. Worley-Morse, T. O., and Gunsch, C. K. (2015) A computational analysis of antisense off-targets in prokaryotic organisms. *Genomics*. 105. pp123–130.
13. Adjei, D., Wiechec, A., Wachulak, P., Ayele, M. G., Lekki, J., Kwiatek, W. M., Bartnik, A., Davidková, M., Vyšín, L., Juha, L., Pina, L., and Fiedorowicz, H. (2016) DNA strand breaks induced by soft X-ray pulses from a compact laser plasma source. *Radiation Physics and Chemistry*. 120. pp17–25.
14. Sies, H., Schulz, W. A., and Steenzen, S. (1996) Adjacent guanines as preferred sites for strand breaks in plasmid DNA irradiated with 193 nm and 248 nm UV laser light. *Journal of Photochemistry and Photobiology*. 32. pp 97-102.

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### RESEARCH ARTICLE

#### Optimization of allele specific PCR (AS-PCR) for the early detection of FLT3 (D835Y) mutation in Acute Myeloid Leukemia patients at Tabuk, Saudi Arabia.

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#### Abstract

Activating mutations in FLT3 occur in ~30% of adult AML, primarily consisting of internal tandem duplication (ITD) mutations (~25%) and point mutations in the tyrosine kinase domain (~7%), at the activation loop (residue D835). The early detection of FLT3- D835Y in AML patients is clinically important for AML patients in this small region of Saudi Arabia especially for determining drug responses, prognosis, and selection of therapy. The present study was conducted on 47 specimens among which 37 were from leukemia patients (5 were newly diagnosed AML, 7 ALL and 25 MPD) and 10 healthy controls. Genomic DNA from blood was isolated using DNA QIAamp DNA Blood Mini Kit from Qiagen and stored at -20°C until PCR. The Allele Specific-PCR based assay for FLT3 (D835Y) mutation was optimized in the Lab. The mutation was detected in 2/5 cases of AML, 0/25 of MPD and 0/5 of ALL. It was observed that patients with AML possessed significantly higher frequency of FLT3 D835 mutation (2/5) than other leukemia cases and healthy controls. The D835Y Flt3-TKD mutation was not detected in any of the healthy controls (0/10). It was concluded that allele specific PCR technique permits the direct detection of FLT3 c.2503G>T (D835Y) point mutation in AML patients and acts as useful genetic technique that is very valuable for molecular diagnosis, prognosis, drug response, and predisposition to AML patients. In addition, the test was simple, fast, and inexpensive procedure that does not require any special equipment other than a thermo cycler.

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#### Introduction:-

**Acute myeloid leukemia** is a clinically and biologically heterogeneous disease and the most common cause of leukemia-related mortality in the United States, with an estimated 19,950 new cases and 10,430 deaths anticipated in 2016 (ACS 2016). Acute myeloid leukemia (AML) is also common among the Saudi Arabian population with a median age at diagnosis of 25 years (range, 0-99 years) among males and 28 years (range, 0-88 years) among females (1).

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However, patients with a high risk of relapse, as determined on the basis of cytogenetics, Cell counts on presentation and the presence of FLT3 mutation, are considered for allogeneic bone marrow transplantation. Extramedullary relapse (EMR) occurs in approximately 2% to 8% of all AML cases (2). The occurrence of FLT3 mutations of AML was associated with poor prognosis and significantly change treatment towards FLT3inhibitor (3-4). The FLT3 gene is a member of class III receptor tyrosine kinase family, including c-kit, c-fms, and the platelet-derived growth factor receptors (5). FLT3 length mutations (FLT3-LM or FLT3-ITD for “internal tandem duplication”) represent one of the most frequent genetic alterations in AML. They show a frequency of 20% to 27% in AML in adults (6) and of 10% to 16% in childhood cases (7).

FLT3 (FMS-like tyrosine kinase 3, CD135) is a type 3 receptor tyrosine kinase that plays important roles in cell survival, proliferation, and differentiation during normal hematopoiesis. Activating mutations of FLT3 are now recognized as the most common molecular abnormality in acute myeloid leukemia and may play a role in other hematologic malignancies as well (8). FLT3-LM mostly are represented by internal tandem duplications and/or insertion-deletion mutations in exons 11 and 12 of the human FLT3 gene on chromosome 13q12, which codes for the juxtamembrane domain of the FLT3 protein. The mutations are heterogeneous and consist of internal tandem duplications of 6 to 30 amino acids, resulting in an elongated FLT3 protein with constitutive PTK activity. In addition to the juxtamembrane domain mutations, mutations in the tyrosine kinase domain (FLT3-TKD) have also been described in AML (9).

FLT3-TKD mutations are small mutations in the activation loop of FLT3, mostly representing point mutations in codon D835 or deletions of codon I836. These mutations alter the configuration of the constitutive activation, resulting in increased access of substrates and ATP that leads to autophosphorylation and subsequently triggers various intracellular signaling pathways (10). They induce constitutive tyrosine phosphorylation leading to activation of the receptor tyrosine kinase and are supposed to represent gain-of-function mutations (11). Corresponding activation loop mutations have been reported at position D816 of KIT (CD117 or proto-oncogene c-Kit) and also in other receptor tyrosine kinases. Most often, these result in replacement of aspartate at the 835<sup>th</sup> position by another amino acid (e.g. tyrosine, histidine, valine, or glutamate) (12). PCR-RFLP (restriction fragment length polymorphism) using EcoRV is one of the methods of detection for FLT3-TKD. It is important to note that digestion by EcoRV could not detect all FLT3-TKD mutations (13), however, sequence analysis showed that 50 – 68% of FLT3-TKD mutations were substitutions of the first nucleotide of codon D835, most commonly from G to T (14). Traditionally, FLT3-ITD, FLT3-TKD, and NPM1 mutations are detected by PCR followed by electrophoresis or Taqman RQ-PCR (15).

The traditional PCR technique is convenient and less expensive. High-resolution melting (HRM) curve analysis is a homogenous, closed-tube, post-PCR technique for rapidly and efficiently discovering genetic variations in DNA fragments (16), based on the sequence dependent dissociation behavior of DNA when exposed to increasing temperature. A Simplified method for the early detection of *FLT3*-D835Y in AML patients is clinically important in this region of Saudi Arabia especially for determining drug responses, prognosis, and selection of molecular-targeted therapy. *FLT3*-D835Y mutation may provide good predictive criteria of an unfavorable course in AML and could be used to identify patients at a high risk of relapse. This simplified strategy for detection of *FLT3*-D835Y mutations was feasible, reproducible, cheaper and simpler when compared with other methods. Our study aims to establish a conventional cost-effective detection method for *FLT3*-D835Y mutations in patients with acute myeloid leukemia (AML) in Tabuk population.

## Material and methods:-

### Ethical approval:-

The study was ethically approved by the Ethics committee, University of Tabuk.

### Selection of Cases:-

The subjects were recruited from the hematology OPD of King Khaled hospital, Tabuk

### Inclusion Criteria:-

Cytopathologically confirmed AML patients (M0-M2 and M4-M7FAB classification, or with refractory anemia with excess of blasts (RAEB) or refractory anemia with excess of blasts in transformation (RAEB-t) with an IPSS score of  $\geq 1.5$  Patients with therapy-related AML/RAEB/RAEB.

### Sample collection:-

4ml-5ml of venous blood was collected in EDTA vials from AML patients and healthy controls.

### Experimental Design:-

**Genomic DNA extraction:**

DNA extraction was done by using DNeasy Blood Kit (250) cat 69506 from Qiagen as per the manufactures instructions. The QIAamp DNA Blood Mini Kit provides silica-membrane-based DNA purification. The QIAamp DNA Blood Mini Kit was designed for processing up to 200µl fresh or frozen human whole blood. QIAamp Mini spin columns can be easily processed in a centrifuge or on vacuum manifolds. The DNA extract was dissolved in nuclease-free water, and stored at 4°C until use. The DNA quality and yield was assessed using Nanodrop spectrophotometer and agarose gel electrophoresis.

**Allele-specific PCR for FLT3 (D835Y) point mutation:-**

Allele-specific PCR was performed in a final volume of 25µL containing 5 µL of PCR-master mix purchased from Epigentek (USA), 0.25 µL of 25 pmol/µL of each primer as shown in table 1, 17.50µL of Nuclease free water. Finally 2µL of 50ng genomic DNA. The primers were designing using Primer3 software.

**Table: 1 Primers designed for FLT3-TKD c.2503C>A (D835Y)**

Primer		Sequence	Annealing Temp	PCR product
Forward wt	FLT3835CF1	5'-CATAGTTGGAATCACTCATGATATC-3	52.9	193bp
Reverse	FLT3835R	5'-TACTGAAGTTGAGTCTAGAAGAAAGA-3		
Forward mut	FLT3835AF2	5'-CATAGTTGGAATCACTCATGATATA-3	53.3	193bp
Reverse	FLT3835R	5'-TACTGAAGTTGAGTCTAGAAGAAAGA-3		

**Preparation of PCR mix**

The Methylamp Taq PCR Mix was premixed ready-to-use solution containing all reagents required for PCR (except template, primers and water). Methylamp Taq DNA polymerase ,5x Reaction Buffer: 1 0.4 M Tris-HCl, 0.1 M (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>, 0.1% w/v Tween-20 ,12.5 mM MgCl<sub>2</sub>: 1x PCR solution – 2.5mM MgCl<sub>2</sub> ,1mM dNTPs of each and remaining nuclease free ddH<sub>2</sub>O as depicted in Table 2. Finally the 2µL of DNA was added from each patient and control separately.

**Table 2 : Preparation of PCR mix**

PCR for normal allele of FLT3-TKD c.2503C>A (D835Y)		
Reagent	1x	5 x
PCR master mix	5ul	25ul
FLT3835CF1	0.25 ul	1.25 ul
LT3835R	0.25 ul	1.25 ul
Nuclease free water	17.50 ul	87.50 ul
Total volume	23ul	125ul
PCR for mutant allele of FLT3-TKD c.2503C>A (D835Y)		
Reagent	1x	5 x
PCR master mix	5ul	25ul
FLT3835AF2	0.25 ul	1.25 ul
FLT3835R	0.25 ul	1.25 ul
Nuclease free water	17.50 ul	87.50 ul
Total volume	23ul	125ul

**Thermo cycling conditions**

The thermo cycling conditions for the PCR amplification of Allele-specific primers for FLT3 c.2503G>T (D835Y) point mutation were initial denaturation at 95°C for 10 minutes followed by 40 cycles 95 °C for 45 sec, 57.9°C for 45 sec, and 72°C for 45 sec followed by the final extension at 72°C for 10 minutes. The amplification products were separated by electrophoresis through 2% agarose gel stained with ethidium bromide. The PCR amplification for normal as well as mutant allele of FLT3-TKD c.2503C>A (D835Y) yielded 193bp bands sizes.

**Results:-**

The purity of DNA extracted was checked by using Nanodrop1000 Spectrophotometer from Thermo scientific, USA. All DNA samples were screened for purity by measuring optical density (OD) at 260nm (OD<sub>260</sub>) and 280 nm (OD<sub>280</sub>). DNA concentration (ug/ml) was calculated based on the OD<sub>260</sub> reading. A ratio of ~1.8 was generally accepted as “pure” for DNA .The optimal rang of ratio obtained were 1.7-2 .The DNA 260/230: 1.7-2; Pure DNA



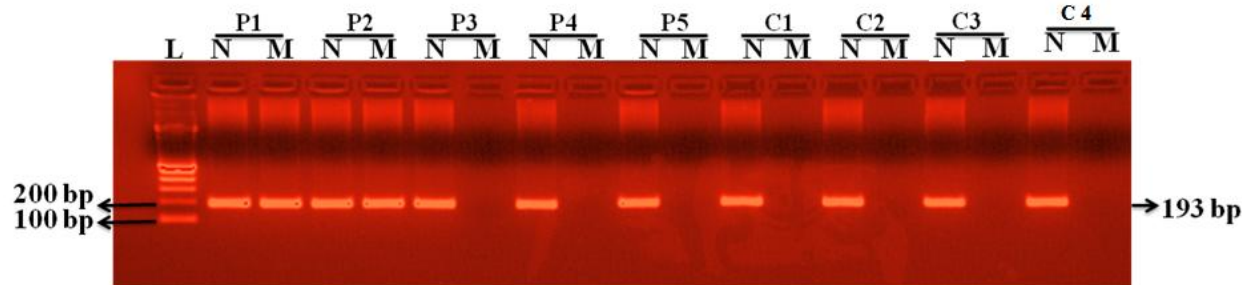
must have a 260/280 ratio between 1.8 and 2. The quality of DNA was checked by running in 1% gel electrophoresis as shown in Figure 1.



#### Allele-specific PCR for FLT3 (D835Y) point mutation:-

The variations in the human DNA sequence between individuals can be an indication of predisposition to disease, affect the response to drug treatment, or more directly be the fingerprint of an inheritable trait or defect. Significant efforts at improving the speed, accuracy and sensitivity of detecting such polymorphisms have led to the development of a number of powerful approaches. Sequence-specific base pairing between the strands of DNA, according to the Watson-Crick model, forms the basis of many detection systems.

Allele-specific PCR presented here allows efficient discrimination of point mutation by allele-specific PCR in a single reaction with standard PCR conditions. A common reverse primer and two forward allele-specific primers with different tails amplify two allele-specific PCR products, which are further separated by agarose gel electrophoresis. PCR specificity is improved by the introduction of a destabilizing mismatch within the 3' end of the allele-specific primers. This is a simple and inexpensive method for SNP detection that does not require intensive PCR optimization. In the present study, two primers were designed one was meant for the amplification of wild allele (C) whereas the other primer was designed to amplify the mutant allele (A) of FLT-TKD gene. But both primers generated a common band of 193bp for normal and mutant genotype as depicted in figure 2.



**Figure 2. FLT3 835 mutation in AML patients and healthy controls:**

L= 100bp Ladder, N= Normal, M=Mutant,

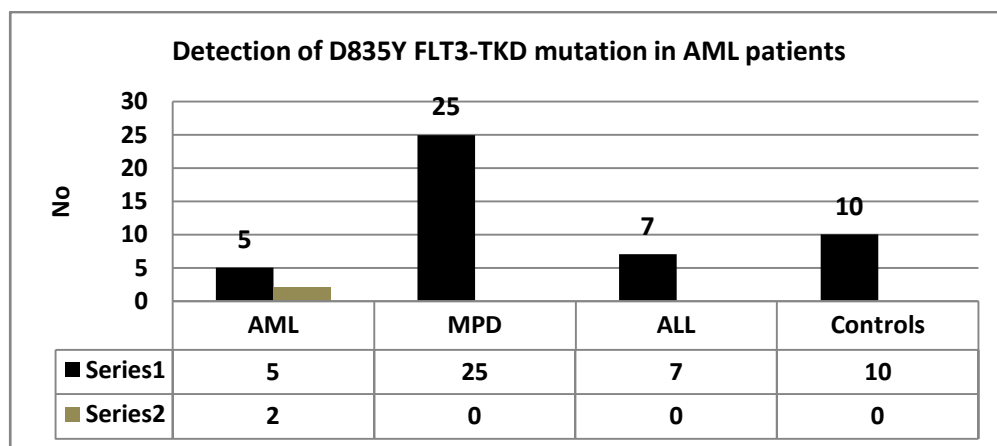
P1 and P2 = Positive for FLT3-TKD mutation

P3,P4,P5= Negative for FLT3-TKD mutation

C1,C2,C3 and C4 Controls samples = Negative for FLT3-TKD mutation

The Allele Specific-PCR based assay for FLT3 (D835Y) mutation was optimized in the Lab . This is the most common KD mutation at codon 835, converting aspartic acid to tyrosine (D835Y). The mutation was detected in 2/5 cases of AML, 0/25 of MPD and 0/5 of ALL cases as depicted in figure 3. It was observed that patients with AML possessed significantly higher frequency of FLT3 D835 mutation (2/5) than other leukemia cases and healthy controls. Interestingly, all the controls were found to be negative for the D835Y FLT3-TKD mutation. FMS-like tyrosine kinase 3 (FLT3) is mutated in approximately a third of acute myeloid leukemia cases, predominantly in the forms of FLT3/internal tandem duplication mutations in the juxtamembrane domain or point mutations in the kinase domain.





**Figure 3. D835Y FLT3-TKD mutation in different subjects**

For routine diagnosis, this characteristic of AS-PCR means that it is a very time-efficient method. It is concluded that allele specific PCR that permits the direct detection of FLT3 c.2503G>T (D835Y) point mutation in AML patients and acts as useful genetic markers for molecular diagnosis, prognosis, drug response, and predisposition to AML patients. The test is therefore a simple, fast, and inexpensive procedure that does not entail any special equipment other than a thermo cycler. Other mutations have also been seen like D835V, D835E, and D835H, converting aspartic acid to valine, glutamic acid, and histidine at residue 835, respectively, mutations converting glycine to glutamic acid at residue 831 (G831E) and arginine to glutamine at residue 834 (R834Q), as well as the deletion of isoleucine at residue 836. They induce constitutive tyrosine phosphorylation leading to activation of the receptor tyrosine kinase and are supposed to represent gain-of-function mutations.(19) Corresponding activation loop mutations have been reported at position D816 of KIT and also in other receptor tyrosine kinases, eg, RET. (20). On dimerization by FL stimulation, wild-type FLT3 activates a series of downstream signaling targets, including the p85 subunit of phosphoinositide 3-kinase (PI3K), growth factor receptor-bound protein 2 (GRB2), proto-oncogene tyrosine-protein kinase SRC, and SH2-containing inositol phosphatase (SHIP), suggesting its involvement in the PI3K and mitogen-activated protein kinases (RAS-MAPK) pathway.

### Discussion:-

The studies on the frequencies of the FLT3-TKD mutations in AML were performed by Abu-Duhier *et al* (n = 97), (21) Yamamoto *et al* (n = 429),(22) Thiede *et al* (n = 979),(23) Moreno *et al* (n = 208),(24) and Fröhling *et al* (n = 224),(25) with AML showing a normal karyotype. According to these studies the FLT3 (D835Y) mutation has an incidence of 5.8% to 7.7% in AML patients and thus are less frequent than the FLT3-length mutation (FLT3-LM) also referred to as FLT3-ITD (internal tandem duplication)(26). Functionally, FLT3/D835Y bone marrow (BM) showed an equivalent or slightly higher engraftment ability compared with wild-type mice, and both are higher than that of the FLT3/ITD mice. These results suggest that the more quiescent HSC pool is not affected by signaling through the FLT3/D835Y mutations and that the FLT3/D835Y mutation does not mobilize the functional HSCs capable of long-term engraftment into cell cycle. According to these studies, FLT3-TKD show an incidence of 5.8% to 7.7% in AML and thus are less frequent than FLT3-length mutation (FLT3-LM) (26). Given the prevalence and propensity for poor outcome in AML patients harboring FLT3 mutations, a sustained effort has been underway to develop targeted inhibitors of the receptor-tyrosine kinase (FLT3-RTK). A variety of compounds have entered clinical trials and some have met with success.

Several FLT3 tyrosine kinase inhibitors have demonstrated in vitro and in vivo activity (28). The signaling properties of both mutation subtypes were suggested by Choudhary *et al* (29) who showed that FLT3-length mutation (FLT3-LM) gain a function over ligand-activated FLT3-wild-type, which is not gained by FLT3-TKD mutations. Gene-expression profiling with microarray analysis showed different gene-expression patterns for FLT3-LM and for FLT3-TKD positive AML. (30)

FLT3-length mutation (FLT3-LM) and FLT3-TKD mutations should be regarded as two biologically and prognostically different mutations within a single gene. The identification of new markers of leukemia and the use of increasingly sophisticated technologies for detection of important mutations should further facilitate routine monitoring of prognosis, MRD and elucidate the features of drug-resistant leukemic cells. The previous studies confirm that FLT3 activating mutations also occur in a significant percentage of AML patients. Early detection of

FLT3 mutations and an intensification of induction therapy might be useful for this group of patients to overcome the poor prognosis. Simplified methodologies for the early detection of FLT3- D835Y mutation in AML patients was clinically important for AML patients in a small region of Saudi Arabia especially for determining drug responses, prognosis, and selection of molecular-targeted therapy.

### Conclusion:-

The allele specific PCR optimization can be potentially useful for the detection of FLT3-TKI (D835Y) gene mutation in AML patients. The test is a simple, fast, and inexpensive procedure that does not entail any special equipment other than a thermocycler and therefore, can be easily optimized in any laboratory for routine use.

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### Reference:-

1. Cancer Registry Report, 2006, Ministry of Health, Riyadh, Saudi Arabia.
2. Koc Y, Miller KB, Schenkein DP. Extramedullary tumors of myeloid blasts in adults as a pattern of relapse following allogeneic bone marrow transplantation. *Cancer* 1999;85:8-15.
3. Chandra KC (2011) Genetic abnormalities and challenges in the treatment of acute myeloid leukemia. *Genes and Cancer* 2(2):95-107
4. Whitman S.P et al. (2001) Absence of the wild-type allele predicts poor prognosis in adult de novo acute myeloid leukemia with normal cytogenetics and the internal tandem duplication of FLT3: a cancer and leukemia group B study. *Cancer Research* 61(19):7233-7239.
5. Levis M, Small D. Novel FLT3 tyrosine kinase inhibitors. *Expert Opin Investig Drugs* 2003;12:1951-1962.
6. Yamamoto Y, Kiyoi H, Nakano Y, et al. Activating mutation of D835 within the activation loop of FLT3 in human hematologic malignancies. *Blood* 2001;97:2434-2439.
7. Thiede C, Steudel C, Mohr B, et al. Analysis of FLT3-activating mutations in 979 patients with acute myelogenous leukemia: association with FAB subtypes and identification of subgroups with poor prognosis. *Blood* 2002;99:4326-4335.
8. Armstrong SA, Mabon ME, Silverman LB, Li A, Gribben JG, Fox EA, Sallan SE, Korsmeyer SJ. FLT3 mutations in childhood acute lymphoblastic leukemia. *Blood*. 2004 May 1;103(9):3544-6.
9. Abu-Duhier FM, Goodeve AC, Wilson GA, et al. Identification of novel FLT-3 Asp835 mutations in adult acute myeloid leukaemia. *Br J Haematol* 2001;113:983-988.
10. Moreno I, Martin G, Bolufer P, et al. Incidence and prognostic value of FLT3 internal tandem duplication and D835 mutations in acute myeloid leukemia. *Haematologica* 2003;88:19-24.
11. Lee BH et al. (2007) FLT3 mutations confer enhanced proliferation and survival properties to multipotent progenitors in a murine model of chronic myelomonocytic leukemia. *Cancer Cell*, 12 (4), 367-380
12. Abu-Duhier FM, et al. (2001) Identification of novel FLT-3 Asp835 mutations in adult acute myeloid leukaemia. *British Journal of Haematology* 113:983-988.
13. Yanada M, Matsuo K, Suzuki T, Kiyoi H, & Naoe T (2005) Prognostic significance of FLT3 internal tandem duplication and tyrosine kinase domain mutations for acute myeloid leukemia: a meta-analysis. *Leukemia* 19:1345-1349
14. Jiang J, et al. (2004) Identifying and characterizing a novel activating mutation of the FLT3 tyrosine kinase in AML. *Blood* 104(6):1855-1858
15. Cordell JL, Pulford KA, Bigerna B, Roncador G, Banham A, Colombo E, Pelicci PG, Mason DY, Falini B. Detection of normal and chimeric nucleophosmin in human cells. *Blood*. 1999 Jan 15; 93(2):632-42.
16. Erali M, Voelkerding KV, Wittwer CT. High resolution melting applications for clinical laboratory medicine. *Exp Mol Pathol*. 2008 Aug; 85(1):50-8.
17. Abu-Duhier FM, Goodeve AC, Wilson GA, et al . Identification of novel FLT-3 Asp835 mutations in adult acute myeloid leukaemia. *Br J Haematol* 2001;113:983-988
18. Zheng R, Small D . Mutant FLT3 signaling contributes to a block in myeloid differentiation. *Leuk Lymphoma* 2005;46:1679-1687.

19. Bagrintseva K, Schwab R, Kohl TM, et al. Mutations in the tyrosine kinase domain of FLT3 define a new molecular mechanism of acquired drug resistance to PTK inhibitors in FLT3-ITD-transformed hematopoietic cells. *Blood* 2004;103:2266-2275
20. Gilliland DG . Hematologic malignancies. *Curr Opin Hematol* 2001;8:189-191.
21. Abu-Duhier FM, Goodeve AC, Wilson GA, et al. Identification of novel FLT-3 Asp835 mutations in adult acute myeloid leukaemia. *Br J Haematol* 2001;113:983-988
22. Rosnet O, Buhning HJ, Marchetto S, et al. Human FLT3/FLK2 receptor tyrosine kinase is expressed at the surface of normal and malignant hematopoietic cells. *Leukemia* 1996;10:238-248.
23. Thiede C, Steudel C, Mohr B, et al. Analysis of FLT3-activating mutations in 979 patients with acute myelogenous leukemia: association with FAB subtypes and identification of subgroups with poor prognosis. *Blood* 2002;99:4326-4335
24. Moreno I, Martin G, Bolufer P, et al. Incidence and prognostic value of FLT3 internal tandem duplication and D835 mutations in acute myeloid leukemia. *Haematologica* 2003;88:19-24.
25. Fröhling S, Schlenk RF, Breitnick J, et al. Prognostic significance of activating FLT3 mutations in younger adults (16 to 60 years) with acute myeloid leukemia and normal cytogenetics: a study of the AML Study Group Ulm. *Blood* 2002;100:4372-4380
26. Auewarakul CU, Sritana N, Limwongse C, Thongnoppakhun W, Yenchitsomanus PT. Mutations of the FLT3 gene in adult acute myeloid leukemia: determination of incidence and identification of a novel mutation in a Thai population. *Cancer Genet Cytogenet* 2005;162:127-134
27. Meshinchi S, Woods WG, Stirewalt DL, et al. Prevalence and prognostic significance of Flt3 internal tandem duplication in pediatric acute myeloid leukemia. *Blood* 2001;97:89-94.
28. Bali P, George P, Cohen P, et al. Superior activity of the combination of histone deacetylase inhibitor LAQ824 and the FLT-3 kinase inhibitor PKC412 against human acute myelogenous leukemia cells with mutant FLT-3. *Clin Cancer Res* 2004;10:4991-4997
29. Choudhary C, Schwable J, Brandts C, et al. AML-associated Flt3 kinase domain mutations show signal transduction differences compared with Flt3 ITD mutations. *Blood* 2005;106:265-273.
30. Neben K, Schnittger S, Brors B, et al. Distinct gene expression patterns associated with. *Oncogene* 2005;24:1580-1588.



### RESEARCH ARTICLE

## A NOVEL APPROACH FOR THE SOLUTION OF A CLASS OF URYSOHN INTEGRAL EQUATIONS USING BERNSTEIN POLYNOMIALS.

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### Abstract

In this paper a novel technique implementing Bernstein polynomials is introduced for the numerical solution of a class of Urysohn integral equations. These polynomials are utilized to reduce the solution of the given problem to the solution of a system of non-linear algebraic equations. The remaining set of nonlinear equations is solved numerically by using the approach to yield truncated Bernstein series coefficients of the solution function. Several illustrative examples with numerical simulations are provided to support the theoretical claims.

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### Introduction:-

The topics of integral equations have been an increasing interest in the past years, because these kinds of equations appear in various fields of applied science and engineering. So, getting solutions with a high level of accuracy for the integral equations is a very important task. Considering that many real-world mathematical problems, especially in the area of applied mathematics are too complicated to be solved in exact terms, the using of numerical methods has been swiftly developed recently. There are many numerical methods for approximating solutions of the linear and non-linear Fredholm integral equations in one and two-dimensional spaces. In the literature cited below, among the numerous works that have been suggested, some famous approaches are listed as well. Eskandarughlu et al. in [1], presented a numerical method based on using spline piece-wise functions and Picard's method for solving the Urysohn -type integral equations. The Adomian decomposition method (ADM) for obtaining approximate series solution of Urysohn integral equations was presented in [2]. The numerical approximation solution of the Urysohn integral equation with two methods has been worked out in [3].

The numerical approximation of this kind of equation has been studied by means of the sinc approximation with the double exponential transformations in [4]. This numerical method combined the sinc Nyström method with the Newton iterative process that involves solving a nonlinear system of equations. Saberi-Nadjafi and Heidari in [4], offered a combination of the Newton-Kantorovich method and quadrature methods for solving nonlinear integral equations. The method solved the nonlinear integral equations of the Urysohn form in a systematic procedure. Also in [5, 6], two iterative schemes based on the homotopy analysis method have been used to the numerical solution of differential equations [7, 8, 9]. On the other hand, the artificial neural networks (ANNs) approach is one of the more applicable methods that have been used for approximating solutions of different kinds of integral equations. For further information on ANNs in this respect see [10, 11]. The ANNs is applied to solve both ordinary and partial differential equations with initial and boundary value problems [12]. In many problems in science and engineering, we have some unknown functions which are too complicated to be determined. The Bernstein polynomials method is one of the earliest analytic-numeric algorithms for approximating the unknown in different kinds of mathematical

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problems. This is an extremely useful way of expressing a complicated function in terms of simple polynomials. The only requirement is that the given function should be smooth. In other words, at a point of interest it must be possible to differentiate the function as often as we please.

### Bernstein Polynomials:-

The general form of the Bernstein polynomials [13-16] of  $n$ th degree over the interval  $[a, b]$  is defined by

$$B_{i,n}(x) = \binom{n}{i} \frac{(x-a)^i (b-x)^{n-i}}{(b-a)^n}, \quad a \leq x \leq b, \quad i = 0, 1, 2, \dots, n \quad (1)$$

Note that each of these  $n + 1$  polynomials having degree  $n$  satisfies the following properties:

1.  $B_{i,n}(x) = 0$  if  $i < 0$  or  $i > n$
2.  $\sum_{i=0}^n B_{i,n}(x) = 1$
3.  $B_{i,n}(a) = B_{i,n}(b) = 0$ ,  $1 \leq i \leq n-1$

Using MATHEMATICA code, the first 11 Bernstein polynomials of degree ten over the interval  $[a, b]$ , are given below:

$$\begin{aligned} B_{0,10}(x) &= (b-x)^{10}/(b-a)^{10} & B_{6,10}(x) &= 210(b-x)^4(x-a)^6/(b-a)^{10} \\ B_{1,10}(x) &= 10(b-x)^9(x-a)/(b-a)^{10} & B_{7,10}(x) &= 120(b-x)^3(x-a)^7/(b-a)^{10} \\ B_{2,10}(x) &= 45(b-x)^8(x-a)^2/(b-a)^{10} & B_{8,10}(x) &= 45(b-x)^2(x-a)^8/(b-a)^{10} \\ B_{3,10}(x) &= 120(b-x)^7(x-a)^3/(b-a)^{10} & B_{9,10}(x) &= 10(b-x)(x-a)^9/(b-a)^{10} \\ B_{4,10}(x) &= 210(b-x)^6(x-a)^4/(b-a)^{10} & B_{10,10}(x) &= (x-a)^{10}/(b-a)^{10} \\ B_{5,10}(x) &= 252(b-x)^5(x-a)^5/(b-a)^{10} \end{aligned}$$

Now the first six polynomials over  $[0, 1]$  are shown in Fig. 1(a), and the remaining five polynomials are shown in Fig. 1(b)

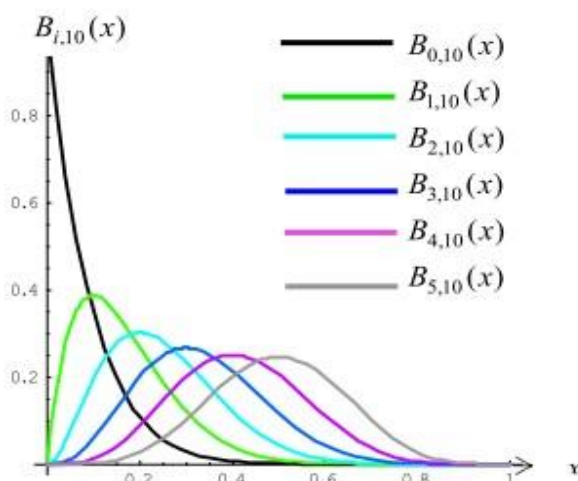


Fig. 1(a): Graph of first 6 Bernstein polynomials over  $[0, 1]$

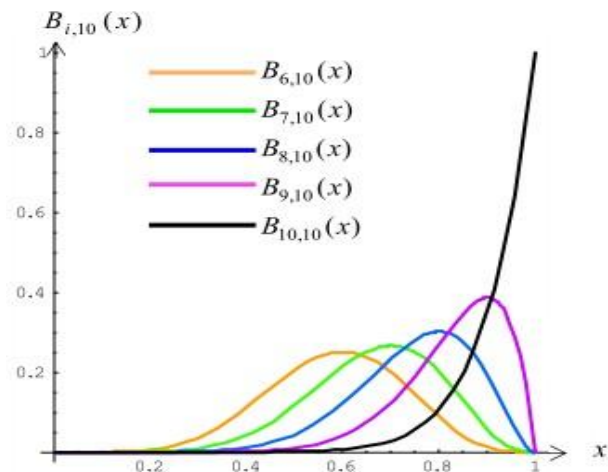


Fig. 1(b): Graph of last 5 Bernstein polynomials over  $[0, 1]$

### Formulation of Integral Equation in Matrix Form:-

In many applications a matrix formulation for the Bernstein polynomials is useful. These are straight forward to develop if only looking at a linear combination in terms of dot products. Given a polynomial written as a linear combination of the Bernstein basis function [17]:

$$B(t) = C_0 B_{0,n}(t) + C_1 B_{1,n}(t) + \dots + C_n B_{n,n}(t)$$

It is easy to write this as a dot product of two vectors:-

$$[B_{0,n}(t) B_{1,n}(t) \dots B_{n,n}(t)] \begin{bmatrix} C_0 \\ C_1 \\ \vdots \\ C_n \end{bmatrix}$$

Which can be converted to the following form:

$$B(t) = [1 \quad t \quad t^2 \dots t^n] \begin{bmatrix} b_{00} & 0 & 0 & \dots & 0 \\ b_{01} & b_{11} & 0 & \dots & 0 \\ \vdots & \vdots & \vdots & \dots & \vdots \\ b_{0n} & b_{1n} & b_{2n} & \dots & b_{nn} \end{bmatrix}$$

Where  $b_{nn}$  are the coefficients of the power basis that are used to determine the respective Bernstein polynomials. We note that the matrix in this case is lower triangular. In the quadratic case (i.e.  $n=2$ )

The matrix Representation is:-

$$B(t) = [1 \quad t \quad t^2] \begin{bmatrix} 1 & 0 & 0 \\ -2 & 2 & 0 \\ 1 & -2 & 1 \end{bmatrix} \begin{bmatrix} C_0 \\ C_1 \\ C_2 \end{bmatrix}$$

The cubic case = 3 , the matrix Representation is:-

$$B(t) = [1 \quad t \quad t^2 t^3] \begin{bmatrix} 1 & 0 & 0 & 0 \\ -3 & 3 & 0 & 0 \\ 3 & 6 & 3 & 0 \\ -1 & 3 & -3 & 1 \end{bmatrix} \begin{bmatrix} C_0 \\ C_1 \\ C_2 \\ C_3 \end{bmatrix}$$

**Solution of a class of Urysohn integral equations:-**

In this section, first we consider the Urysohn integral equation (UIE) of the second kind given by

$$x(t) = f(t) + \int_0^1 K(t, s, x(s)) ds \quad (2)$$

Where  $x(t)$  is the unknown functions to be determined,  $k(t, s, x(s))$ , the kernel is a continuous function,  $f(t)$  being the known function. To determine an approximate solution of (2),  $x(t)$  is approximated in the Bernstein polynomial basis on  $[0, 1]$  as:

$$x(t) = \sum_{i=0}^n a_i B_{i,n}(t) \quad (3)$$

Where  $a_i$ ,  $i = 0, 1, \dots, n$  are unknown constants to be determined using Newton-Raphson method. Substituting (3) in (2), we obtain:

$$\sum_{i=0}^n a_i B_{i,n}(t) = f(t) + \int_0^1 K\left(t, s, \sum_{i=0}^n a_i B_{i,n}(t)\right) ds \quad (4)$$

Now we put  $t = t_j$ ,  $j = 0, 1, \dots, n$  in (4),  $t_j$ 's being chosen as suitable distinct points in  $[0, 1]$ , such that  $t_0 = 0$ ,  $t_n = 1$ , and  $t_j = t_0 + jh$ , where  $h = (1 - 0)/n$ . Putting  $t = t_j$ , we obtain the nonlinear system:

$$\sum_{i=0}^n a_i B_{i,n}(t_j) = f(t_j) + \int_0^1 K\left(t_j, s, \sum_{i=0}^n a_i B_{i,n}(t_j)\right) ds \quad (5)$$

The nonlinear system (5) can be solved by standard methods for the unknown constant  $a_i$ 's. These  $a_i$ ,  $i = 0, 1, \dots, n$  are then used in (3) to obtain the unknown function  $x(t)$  approximately.

The following algorithm summarizes the steps for finding the approximate solution for the second kind of nonlinear Urysohn integral equation.

**Algorithm (BPNUIE):****Step (1):**

Assume  $t_0 = 0$ ,  $t_n = 1$ , and  $t_j = t_0 + jh$ , where  $h = (1 - 0)/n$ .

**Step (2):**

Putting  $t = t_j$  in (4) to obtain nonlinear System (5).

**Step (3):**

Solved the nonlinear system (5) to calculate the unknown  $a_i$ ,  $i = 1, \dots, n$ .

**Step (4):**

Used  $a_i$  in (3) to obtain the function  $x(t)$  approximately.

**Numerical Examples:-**

In this section, the method presented in this paper is used to find numerical solution of two illustrative examples. The solution of the equations obtained here. All calculations in the following tables are performed using Matlab.

**Example1.** [4] Let us solve the Urysohn integral equation:

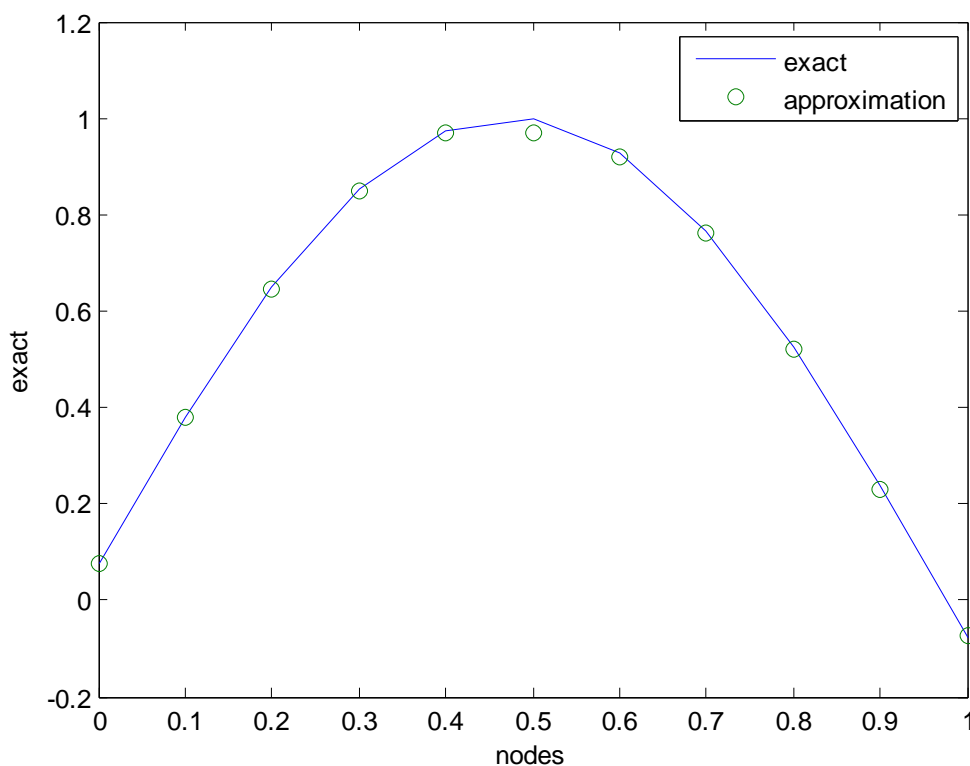
$$\int_0^1 \cos(\pi x) \sin(\pi t) y^3(t) dt = 5(y(x) - \sin(\pi x)), \quad 1 \leq x \leq 1,$$

By the explained Bernstein series method. The exact solution corresponding to this equation is  $y(x) = \sin(\pi x) + 1/3(20 - \sqrt{391})\cos(\pi x)$ .

For  $n = 4$ , the original integral equation is reduced to a fundamental non-linear system. The iterative process yields the results which have been gathered in Table 1. Figure 2 shows the exact solution and the approximate solution.

**Table 1:-** Numerical results for Example 1.

si = 0.1i	Exact solution	Approximatesolution	Error
i = 0	0.0754266889049	0.0748255	6.01E-04
i = 1	0.3807520383605	0.3810056	2.54E-04
i = 2	0.6488067254460	0.6435965	5.21E-03
i = 3	0.8533516897425	0.8498055	3.55E-03
i = 4	0.9743646449962	0.9702287	4.14E-03
i = 5	1	0.9702355	2.98E-02
i = 6	0.9277483875941	0.9188357	8.91E-03
i = 7	0.7646822990073	0.7632754	1.41E-03
i = 8	0.5267637791389	0.5205584	6.21E-03
i = 9	0.2372819503893	0.2314202	5.86E-03
i = 10	-0.0754266889049	-0.0732011	2.23E-03



**Fig. 2:-** Comparison of the exact and approximate solutions for Example 1.

**Example2.** [5] Consider the Urysohn integral equation:

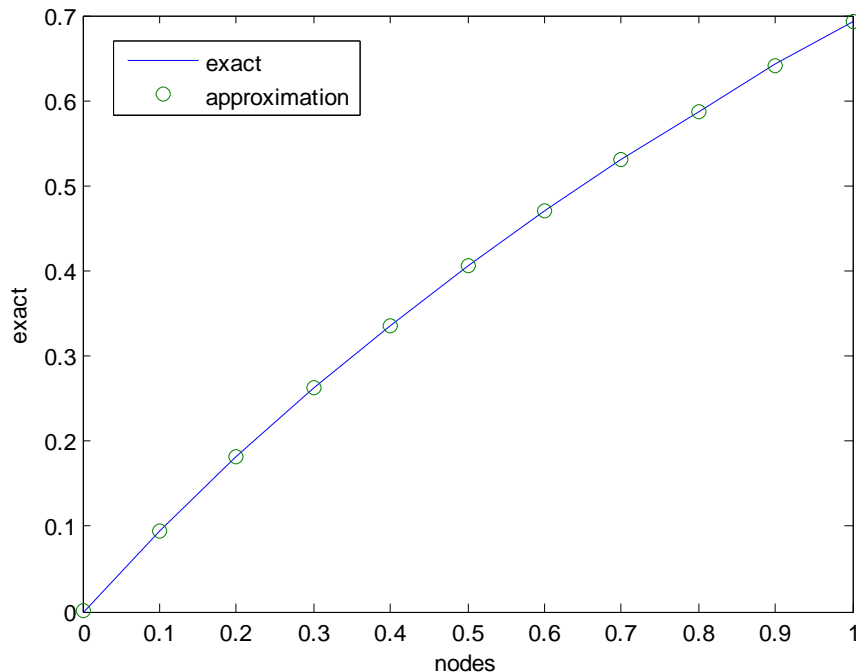
$$\int_0^1 (x-t)y^2(t)dt = y(t) - \ln(4(x+1)(1-x\ln 2 + x)^2) + 2x + \frac{5}{4}$$

With the exact solution  $y(x) = \ln(x+1)$  and use the present method for finding its approximate solution. The iterative process yields the results which have been gathered in Table 2. Figure 3 shows the exact solution and the approximate solution.

**Table 2:-**Numerical results for Example 2.

si = 0.1i	Exact solution	Approximatesolution	Error
i = 0	0	0.0010088	1.01E-03
i = 1	0.095310179804	0.0953524	4.22E-05
i = 2	0.182321556793	0.1822203	1.01E-04
i = 3	0.262364264467	0.2621755	1.89E-04
i = 4	0.336472236621	0.3363668	1.05E-04
i = 5	0.405465108108	0.4055742	1.09E-04
i = 6	0.470003629245	0.4713763	1.37E-03
i = 7	0.530628251062	0.5310079	3.80E-04
i = 8	0.587786664902	0.5871986	5.88E-04
i = 9	0.641853886172	0.6413895	4.64E-04
i = 10	0.693147180559	0.6929504	1.97E-04





**Fig. 3:-** Comparison of the exact and approximate solutions for Example 2.

It follows from the results of these examples that  $y_n(x)$  converge as  $n \rightarrow \infty$  to the exact solution  $y(x)$  of the integral equation. A successful choice of the "zeroth" approximation can result in a rapid convergence of the procedure.

### Conclusion:-

In this paper, we presented a useful numerical method that originated mainly from the Bernstein polynomials for solving Urysohn type integral equation. As we explained above, this method converts the present problem to a system of non-linear algebraic equations which may not be solvable easily. Having determined the unknown Bernstein coefficients of the solution function, the series solution is produced for numerical purposes immediately. It is important to be noted that, the more terms must be evaluated to the higher accuracy level. The obtained numerical results from analyzed examples illustrated that in applications involving computations with polynomials, the Bernstein form offers an efficient algorithm for many basic functions.

### References:-

1. M. Eskandarughlu, H.E. Derili Gherjalar, H. Mohammadikia, A. Arzhang, *Austra. J. Basic Appl. Sci.* 7 (1), 286–294 (2013).
2. R. Singh, G. Nelakanti, J. Kumar, *the Sci. World J.* 2014, Article ID 150483 (2014).
3. K. Maleknejad, K. Nedaiaasl, *J. Int. Equ. Appl.* 25(3), 321–454 (2013); K. Maleknejad, K. Nedaiaasl, B. Moradi, *Proceedings of the World Congress on Engineering*, 2013, Vol I.
4. J. Saberi-Nadjafi, M. Heidari, *Comput. Math. Applications* 60, 2058–2065 (2010).
5. A. Jafarian, Z. Esmailzadeh, L. Khoshbakhti, *Appl. Math. Sci.* 7(28), 1375–1385 (2013).
6. F. Awawdeh, A. Adawi, *Int. Math. Forum* 17, 805–817 (2009).
7. A.K. Golmankhaneh, N.A. Porghoveh, D. Baleanu, *Rom. Rep. Phys.* 65, 350–361 (2013);
8. D. Rostamy, M. Alipour, H. Jafari, D. Baleanu, *Rom. Rep. Phys.* 65, 334–349 (2013);
9. A.K. Golmankhaneh, Ali K. Golmankhaneh, D. Baleanu, *Rom. Rep. Phys.* 63, 609–623 (2011);
10. A.K. Golmankhaneh, Ali K. Golmankhaneh, D. Baleanu, *Sig. Proce.* 91(3), 446–451 (2011).
11. A. Kadem, D. Baleanu, *Rom. J. Phys.* 56, 332–338 (2011);
12. X.J. Yang, D. Baleanu, W.P. Zhong, *Proc. Romanian Acad. A* 14, 127–133 (2013).
13. A.M.O. Anwar, F. Jarad, D. Baleanu, F. Ayaz, *Rom. J. Phys.* 58, 15–22 (2013); Jafarian et al., *Rom. J. Phys.* 58, 694–702 (2013);
14. J.J. Rosales Garcia, M.G. Calderon, J.M. Ortiz, D. Baleanu, *Proc. Romanian Acad. A* 14, 42–47 (2013).

16. A. Jafarian, S. Measoomy Nia, J. Hyperstruct. 2(1), 53–71 (2013); Jafarian, S. Measoomy Nia, Appl. Math. Model. 37(7), 5027–5038 (2013); Jafarian, S. Measoomy Nia, Int. J. Math. Mod. Numer. Opt. n 4(3), 225–237 (2013);
17. Jafarian, S. Measoomy Nia, A.K. Golmankhaneh, D. Baleanu, Adv. Diff. Equ. DOI:10.1186/1687-1847-2013-123.
18. S. Effati, R. Buzhabadi, Neural Comput. Appl., DOI:10.1007/s00521-010-0489-y.
19. I.E. Lagaris, A. Likas, D.I. Fotiadis, IEEE Transac. Neur. Netw. 9(5), 987–1000 (1998).
20. J. Reinken Hof, Int. J. Numer. Methods Engrg. 11, 1627 (1986).
21. E. Kreyszig, Int. J. Numer. Methods Engrg. 14, 292 (1979).
22. B. N. Mandal and S. Bhattacharya, Appl. Math. Comput. 190, 1707 (2007).
23. M.I. Bhatti and P. Bracken, J. Comput. Appl. Math. 205, 272 (2007).
24. Muna M. Mustafa & Khawla A .AL-Zubaidy. Use of Bernstein Polynomial in Numerical Solution of Nonlinear Fredholm Integral Equation. Eng. & Tech. Journal, Vol. 29, No. 1, 2011



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### RESEARCH ARTICLE

#### PREVALENCE AND CAUSALITY ASSESSMENT OF CUTANEOUS ADVERSE DRUG REACTIONS

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Cutaneous Adverse drug reactions,  
 WHO Scale, Naranjo's Scale

#### Abstract

**Background:** Cutaneous Adverse drug reactions (CADRs) are among the most frequent Adverse Drug Events (ADEs). Considering their impact on patient's lives and relatively high incidence, identifying the risks and monitoring of CADRs is of great clinical significance to prevent patient from unwanted exposure to drug toxicity.

**Objective:** To determine the prevalence of different types of CADR's and there causal relationship with the offending drug.

**Material & methods:** A prospective, observational and non-invasive study was carried out in Department of Dermatology at a Tertiary care hospital for duration of 6 months. Patients with 18 years or higher with visible skin lesions suspected to be drug related were included. Assessment was carried out by WHO, Naranjo's and Hartwig and Siegel's classification graded on a 3-point scale. Descriptive statistics were used to examine the normality of data and describe the analysis.

**Results:** A total of 95 cases of suspected Cutaneous ADRs were recorded from a total population of 10,000 patients, among which 90 cases were analyzed showing 34 cases (37.8%) males and 56 (62.2%) females. Maximum patients belonged to the age group of 21-30 years (34.4%). The total Prevalence was found to be 0.9%, in which the highest Prevalence was seen in females (0.56%). The most common CADR observed was Steroid induced acne (38.6%) and most common group of offending drugs were Topical corticosteroids (38.8%). According to WHO and Naranjo's scale most of the observed cases were classified as Probable (97.8%) and as per the Hartwig and Siegel's classification, 56 cases (62.2%) were Moderate in severity. One case (1.1%) was fatal.

**Conclusions:** A wide range of clinical spectrum of CADRs was observed. Out of which Steroid induced acne was the most common Cutaneous ADRs seen. Topical corticosteroids were the most common offending agent with highest Prevalence in females. Most of the cases were of Probable and Moderate in severity. Fatal case was observed with Toxic epidermal necrolysis. Further identification and reporting

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of CADR is essential in promoting drug safety and better patient care, among health care professionals and patients.

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### Introduction:-

Adverse drug events (ADEs) are among the major challenges in modern medicine. Adverse drug reaction (ADR) has been defined in many ways. WHO defines ADR as any response to a drug which is noxious and unintended, and which occurs at doses normally used in man for prophylaxis, diagnosis, therapy of disease, or for the modification of physiological function.<sup>1</sup> A Cutaneous Adverse reaction caused by a drug is any undesirable change in the structure or function of the skin, its appendages or mucous membranes, and it encompasses all adverse events related to drug eruption, regardless of the etiology.<sup>2</sup>

In India epidemiological studies estimated that ADRs are fourth to sixth leading cause of death.<sup>3</sup> ADRs are one of the leading causes of morbidity and mortality, adding to overall healthcare cost. It is estimated that approximately 2.9–5.6% of all hospital admissions are caused by ADRs and as many as 35% of hospitalized patients experience an ADR during their hospital stay.<sup>4</sup>

Almost any medicine can induce skin reactions, and certain drug classes, such as non-steroidal anti-inflammatory drugs (NSAIDs), antibiotics and antiepileptic drugs, have drug eruption rates approaching 1–5%.<sup>5</sup> Most of the Cutaneous drug reactions are not serious but some are severe and potentially life-threatening. Serious reactions include Angioedema, Erythroderma, Stevens–Johnson syndrome (SJS) and Toxic epidermal necrolysis (TEN). Drug eruptions can also occur as a result of multi-organ involvement, as in Drug-induced Systemic lupus erythematosus. Drug reactions can be classified into immunologic and non-immunologic etiologies. The majority about 75–80% of adverse drug reactions are predictable & non-immunological in origin, the remaining 20–25% of adverse drug events are immune-mediated or unpredictable reactions. Skin reactions as a result of non-immunological causes are more common and include cumulative toxicity, overdose, photosensitivity, drug interactions, and metabolic alterations.<sup>6</sup>

Adverse drug reactions (ADRs) are a major cause of morbidity, hospital admission, and even death. Hence it is essential to recognize ADRs and to establish a causal relationship between the drug and the adverse event. It is desirable that ADRs should be objectively assessed and presented. Majority of CADR is diagnosed clinically. These reactions may differ with different classes of drugs. Generating data is essential to understand the pattern of CADR of different classes and generating information regarding offending drugs.<sup>3</sup> Recognition of the offending drug enables early withdrawal and improved outcomes. This will help the doctors to ensure safe drug usage and be aware of offending drugs thereby reducing morbidity and mortality. Observational studies are tools to know the pattern of reactions and causative drugs.

### Objectives:-

The objective of this study was to observe the types of Cutaneous Adverse drug reactions (CADRs) in the patients attending the Dermatology Department, Prevalence of Cutaneous Adverse drug reaction at Tertiary Care Hospital, to determine causal relationship with final outcome of CADR and to recognize the offending drug, to determine the severity index of the adverse reactions, prevent CADR and minimize hospitalization, to achieve a better treatment outcome and improve productivity and health.

### Materials and Methods:-

It was a prospective, observational, non-invasive study carried out at Out Patient and Inpatient Department of Dermatology at Osmania General Hospital, Hyderabad over a period of six months (January 2015–June 2015).

### Inclusion criteria:-

- Patients of either sex as inpatients and outpatients attending Dermatology Department.
- Patients more than 18 years of age.
- All patients attending Dermatology department, presented with visible skin lesions suspected to be drug related included in the study.

**Exclusion Criteria:-**

- Patients less than 18 years of age.
- Patients without visible skin lesions.
- Patients who could not recall the name of the suspect medicines consumed.
- If lesions turned out to be disease related (e.g., viral exanthemas, rash of rickettsial infections, and collagen vascular disease,) on closer examination.
- Patients who reported to have consumed indigenous (ayurvedic and homeopathic) medicines were also excluded.
- Patients unable to respond to verbal questions.

Demographic data like patient name, age, sex, brief description of the suspected ADR, Information about the suspected drug were recorded in the case collection form. Each case was assessed for its causality using the WHO-UMC assessment scale<sup>7</sup> and Naranjo's scale<sup>8</sup> of which Unlikely, Conditional or Unassessable cases were excluded. The final diagnosis of CADR was based on history of drug exposure, clinical findings and under supervision of consultant Dermatologist. Severity of ADRs was evaluated by Hartwig and Siegel's classification graded on a 3-point scale.<sup>9</sup>

**Results:-**

During the study period, a total of 95 cases of suspected Cutaneous ADRs were recorded from a total population of 10,000 patients attended the Dermatology Department from January 2015 to June 2015, out of which 5 cases were excluded because the offending drug was not identified or the data was insufficient to make any analysis. The remaining 90 cases were analyzed, among which one case was fatal. Maximum patients belonged to the age group of 21-30(34.4%), followed by 18-20 age group (22.2%), 31-40 age group (20%), 41-50(13.3%), >50 age group(10%). The total prevalence was found to be 0.9 (90%), in which the highest prevalence was seen in females (P=0.56/56%) and the prevalence of males was found to be 0.34 (34%). Table 1 shows the description about the age distribution, gender distribution and prevalence of CADR. Figure 1(a) shows details of age distribution pattern of CADR encountered during the study. 34 cases (37.8%) were males and 56 cases (62.2%) were females showing Female predominance. Figure 1(b) shows sex distribution patterns seen during the study. Figure 1(c) shows the Prevalence rate of the CADR.

The most common pattern of Cutaneous ADR observed was Steroid induced acne (38.6%). The second common CADR seen was Fixed drug eruption (FDE) (13.3%) followed by Erythematous rash (11.1%), Toxic Epidermal Necrolysis (TEN) and Urticaria recording (7.5%). Among which one was fatal experienced from TEN. Steven Johnson Syndrome recorded (4.4%). About (3.3%) of Vasculitis and Erythema was observed. About (2.2%) were seen with Erythroderma, Photosensitivity reaction and Drug rash eosinophilic systemic syndrome (DRESS). Alopecia, Exfoliative Dermatitis, Infectious eczema dermatitis, and Acanthosis like-nigricans were identified in only about (1.1%). Table 2 and Figure 2 show details of the Clinical patterns of CADR encountered during our study.

The most common group of offending drugs responsible for Cutaneous ADRs were Topical corticosteroids (38.8%), among which Betamethasone recorded the highest incidence of CADR followed by Antibiotics (24.8%), among which Ciprofloxacin was the common offending drug seen followed by Metronidazole, Tetracycline, Amoxicillin, 1 case was seen with each of Cotrimoxazole, Ceftriaxone and Dapsone. Use of tetracycline in one patient was fatal. Use of Anti-epileptic drugs was seen in (15.4%), where Phenytoin recorded the highest number of ADRs. NSAIDs were seen in (10%), (3.3%) with Anti-tubercular drugs, Oral and Parental corticosteroids with (3.3%). Rare cases about (1.1%) were seen with Antifungal (Fluconazole), Opioid Analgesic (Tramadol), Angiotensin converting enzyme inhibitors (ACEI) (Captopril), and Non-nucleoside reverse transcriptase inhibitor (NNRTI) (Efavirenz). Table 3 and Figure 3 shows detail results of therapeutic drugs classes implicated in CADR encountered in this study.

**Causality Assessment:-**

90 cases of CADR were assessed as per WHO and Naranjo's Scale. According to Naranjo's Scale, most of the cases were Probable (97.8%) and (2.2%) showed a Definite score. According to WHO Scale (2.2%) scored Certain, remaining all (97.8%) were of Probable. Unlikely, conditional, unclassifiable were excluded from the study Table 4 and Figure 4 show details of Causality Assessment of CADR based on Naranjo's and WHO scale.

**Severity Index:-**

Severity of CADR was assessed as per the Hartwig and Siegel's classification graded on a 3-point scale. The results of assessment of the severity index revealed that most of the cases were Moderate in severity accounting for (62.2%), followed by Mild with (26.7%) and (10%) were identified as Severe. One case (1.1%) was fatal. Table 5 and Figure 5 show the details of Severity Assessment of CADR encountered during the study period.

**TABLE 1:- AGE, SEX AND PREVALENCE OF CADR**

Age group	Males	Total no. of ADRs = 90	Total population 10,000	Females	Total no. of ADRs = 90	Total population 10,000	Total	Total no. of ADRs = 90	Total population 10,000
		% in Males	Prevalence (P)		% in Females	Prevalence (P)		% in Total	Prevalence (P)
18-20	6	17.64%	0.06	14	25%	0.14	20	22.2%	0.20
21-30	9	26.48%	0.09	22	39.28%	0.22	31	34.4%	0.31
31-40	9	26.48%	0.09	9	16.07%	0.09	18	20%	0.18
41-50	5	14.7%	0.05	7	12.5%	0.07	12	13.3%	0.12
>50	5	14.7%	0.05	4	7.15%	0.04	9	10%	0.09
Total	34	38%	P = 0.34 or 34%	56	62%	P = 0.56 or 56%	90	100%	P= 0.9 or 90%

**TABLE 2:- CLINICAL PATTERNS OF CADR**

Clinical type	Frequency	Percentage
Steroid induced acne	34	38.6%
Fixed Drug Eruption (FDE)	12	13.3%
Erythematous rash	10	11.1%
Toxic Epidermal Necrolysis(TEN)	7	7.5%
Urticaria	7	7.5%
Steven Johnson syndrome(SJS)	4	4.4%
Vasculitis	3	3.3%
Erythema multiforme(EMF)	3	3.3%
Erythroderma	2	2.2%
Drug Rash Eosinophilic Systemic Syndrome(DRESS)	2	2.2%
Photosensitivity reaction	2	2.2%
Eczema dermatitis	1	1.1%
Exfoliative dermatitis	1	1.1%
Alopecia	1	1.1%
Acanthosis like nigricans	1	1.1%

**TABLE 3:- DRUGS RESPONSIBLE FOR CADRs**

Drug name	Individual group	No. of cases	Total no. of cases	Percentages
Topical corticosteroids	Betamethasone	24	35	38.3%
	Mometasone	10		
	Clobetasol	1		
Antibiotics	Ciprofloxacin	7	22	24.8%
	Metronidazole	6		
	Tetracycline	4		
	Amoxicillin	2		
	Cotrimoxazole	1		
	Ceftriaxone	1		
	Dapsone	1		
Antiepileptic	Carbamazepine	2	14	15.4%
	Phenytoin	12		
NSAIDS	Diclofenac sodium	4	9	10%
	Naproxen	2		
	Aspirin	2		
	Ibuprofen	1		
Antitubercular	Isoniazid	1	3	3.3%
	Rifampicin	2		
Oral corticosteroids	Prednisolone (oral )	2	3	3.3%
	Hydrocortisone (IV)	1		
Opioid Analgesic	Tramadol	1	1	1.1%
Antifungal drugs	Fluconazole	1	1	1.1%
Angiotensin converting enzyme inhibitor (ACEI)	Captopril	1	1	1.1%
Non nucleoside reverse transcriptase inhibitor (NNRI)	Efavirenz	1	1	1.1%

**TABLE 4:- CAUSALITY ASSESSMENT OF CADRs (WHO AND NARANJO'S SCALE)**

Type of reaction	WHO SCALE		NARANJO SCALE			
	No. of cases	Percentage	No. of cases	Score		%
Definite	2	2.2%	2	+10		2.2%
Probable	88	97.8%	88	No of cases	Score	97.8%
				40	+6	
				44	+7	
				4	+8	
Possible	0	0%	0	0		0%

**TABLE 5:- SEVERITY INDEX OF CADRs (HARTWIG AND SIEGEL'S SEVERITY ASSESSMENT SCALE)**

Severity index	No. of cases	Percentage
Mild	24	26.7%
Moderate	56	62.2%
Severe	9	10%
Fatal	1	1.1%

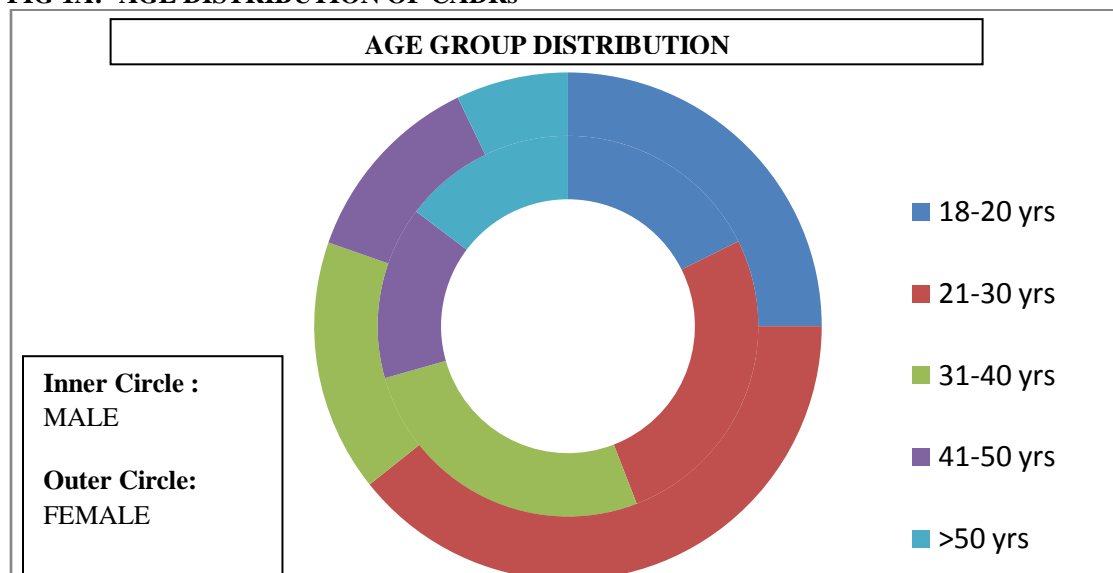
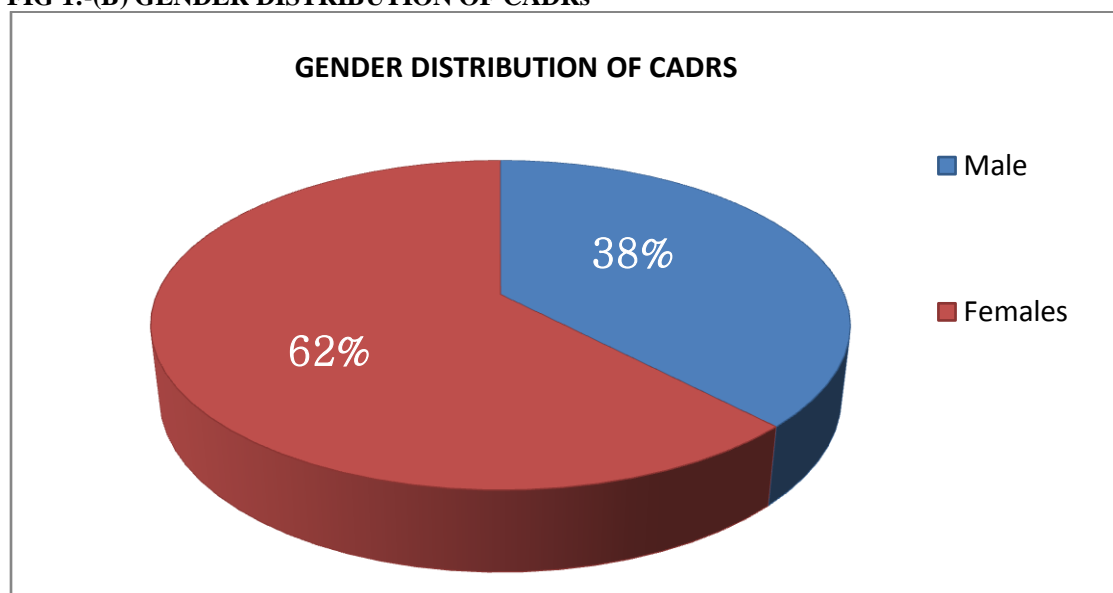
**FIG 1A:- AGE DISTRIBUTION OF CADRs****FIG 1:-(B) GENDER DISTRIBUTION OF CADRs**



FIG 1(C):- PREVALENCE RATE OF CADRs

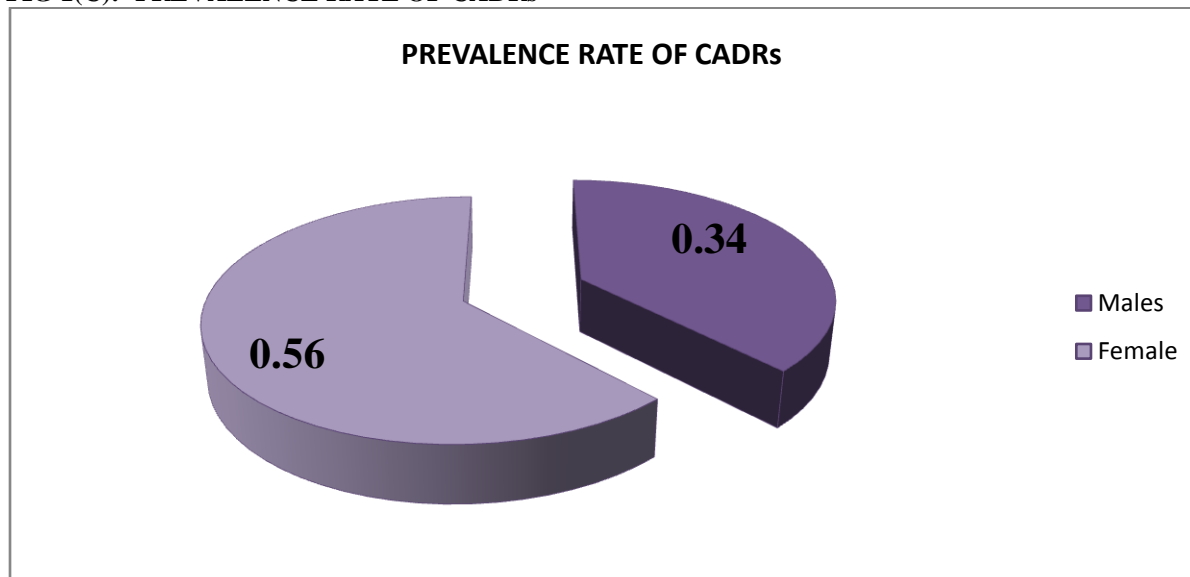
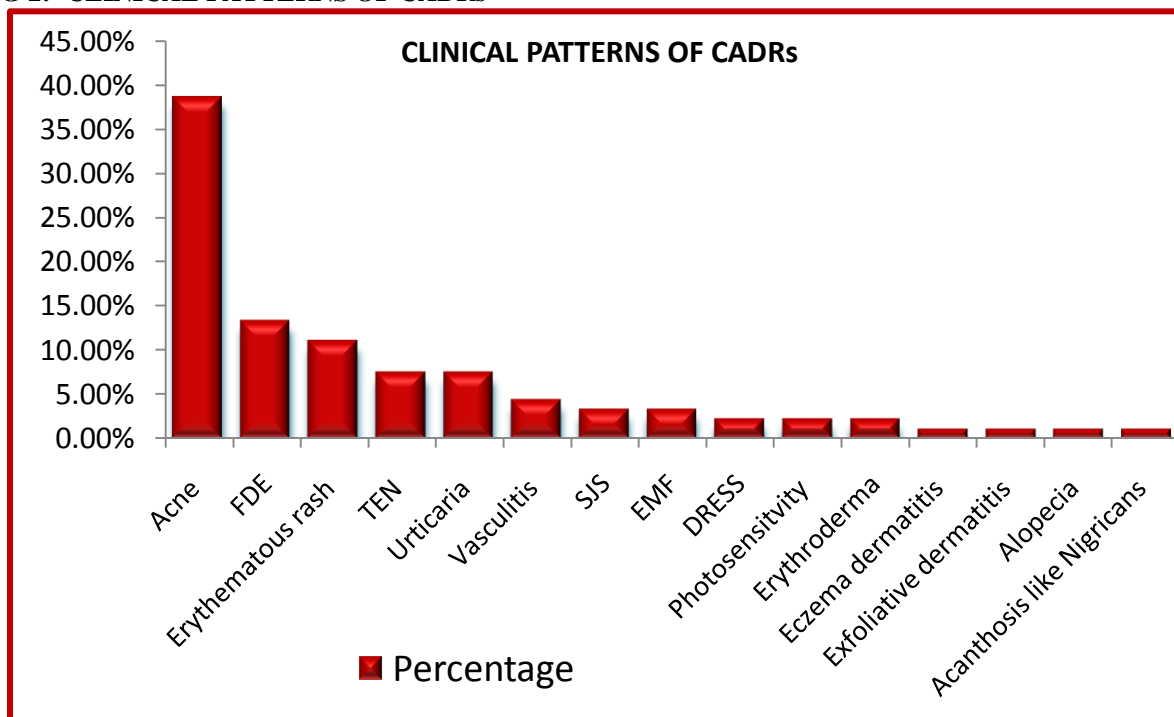
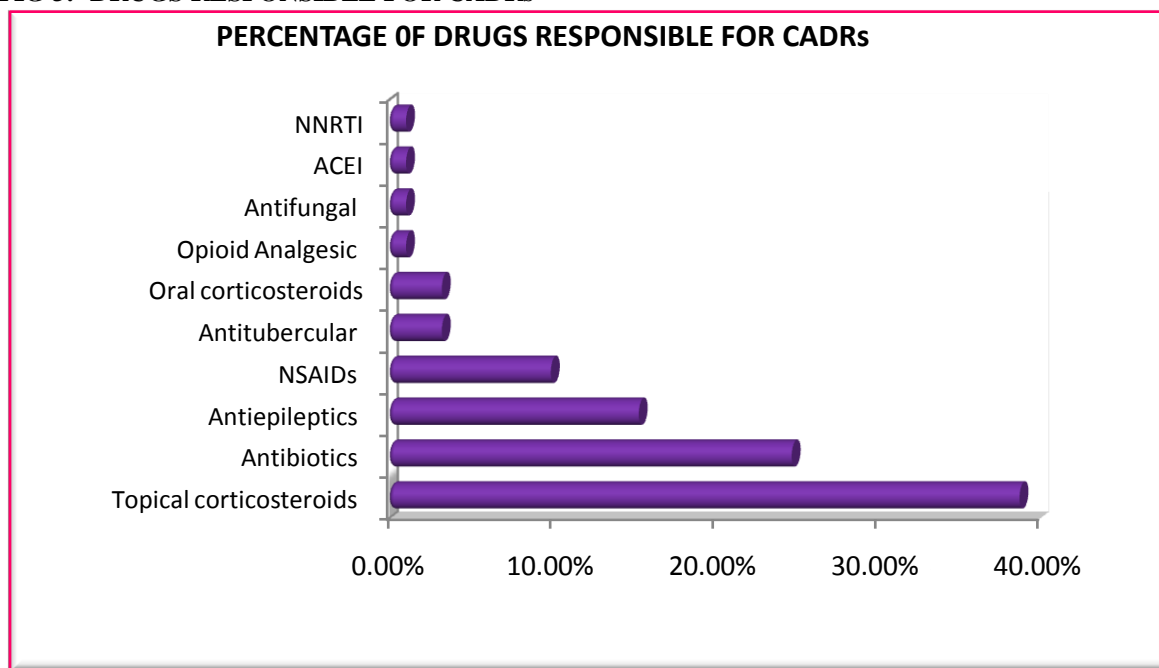
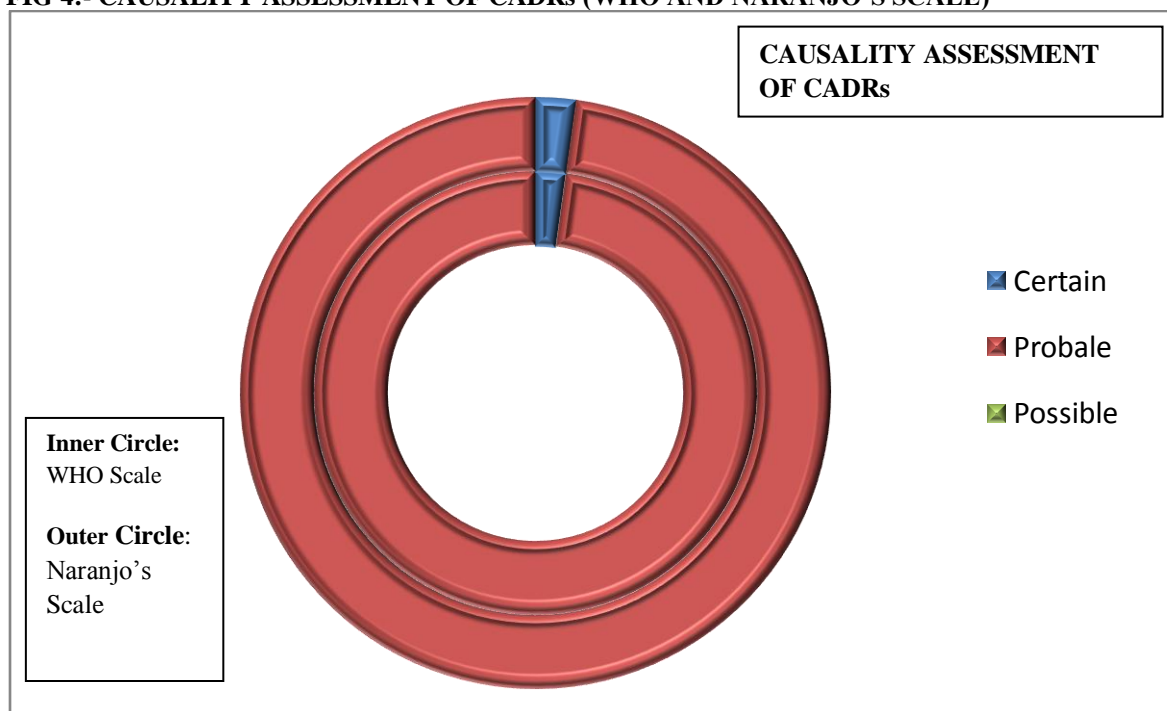
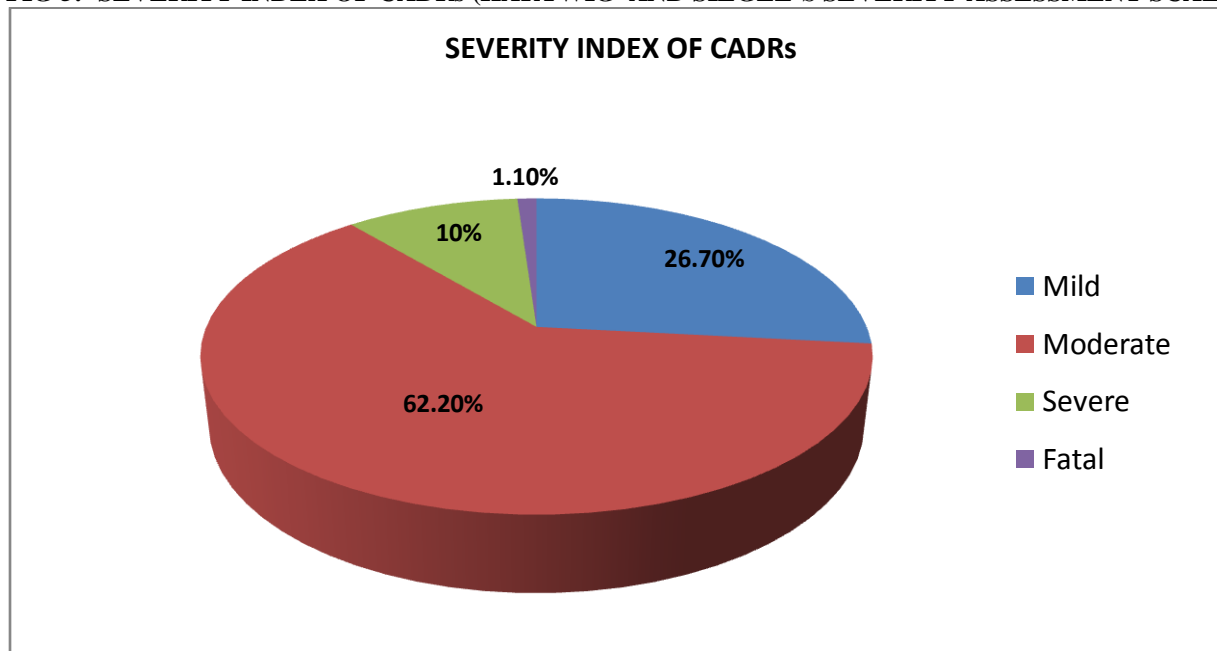


FIG 2:- CLINICAL PATTERNS OF CADRs



**FIG 3:- DRUGS RESPONSIBLE FOR CADRs****FIG 4:- CAUSALITY ASSESSMENT OF CADRs (WHO AND NARANJO'S SCALE)**

**FIG 5:- SEVERITY INDEX OF CADRs (HARTWIG AND SIEGEL'S SEVERITY ASSESSMENT SCALE)**

### Discussion:-

A Prospective, Observational and non-invasive study was carried out for a period of 6 months recording 95 cases, from a total population of 10, 000 patients attended the Dermatology Department, out of which 5 cases were excluded because the offending drug was not identified or the data was insufficient to make any analysis. The remaining 90 cases were analyzed, among which one case was fatal. Of the 90 cases, 34(37.8%) were males and 56 (62.2%) were females contributing to female preponderance, which was similar to that of studies reported in the literature by **Ruchika Nandha, et al (2011)<sup>10</sup>**, **V Sudershan et al (2011)<sup>11</sup>**, **Saraswoti neupane and Surya Raj Sharma (2012)<sup>12</sup>**, **Akram Ahmed et al (2012)<sup>13</sup>**, **Mahmood Farshchian et al (2015).<sup>14</sup>** Unlike in study of **Shalini Chawla et al (2011)<sup>15</sup>** and **Tejas K Patel, Sejal H Thakkar, DC Sharma- Review (2015)<sup>16</sup>** which showed male preponderance.

In our study, highest percentage of CADR was recorded in the age group of 21- 30 showing (34.4%) which is in accordance with studies reported by **Shalini Chawla et al (2011)<sup>15</sup>** where the mean age of patients who experienced CADR was 32, and **V Sudershan et al (2011)<sup>17</sup>** reported higher incidence in adult age group of 21-30 years. Adverse drug reactions reported in our study showed maximum incidence with the application of Topical corticosteroids (38.8%), followed by Antibiotics (24.8%), among which Ciprofloxacin was the common offending drug. (15.4%) were seen in patients who administered Anti-epileptic drugs where Phenytoin recorded the highest number of ADRs. NSAID was about (10%). Antitubercular, Oral and Parenteral corticosteroids were the offending agent recording (3.3%). Rare cases (1.1%) were seen in patients taken Antifungal agents, Opioid Analgesic, Angiotensin converting enzyme inhibitors (ACEI), and Non-nucleoside reverse transcriptase inhibitor (NNRTI). Studies carried out by **Bharani Kalpana R, et al (2014)<sup>18</sup>** have reported that oral Antimicrobials, Injectable Antimicrobials, NSAID's and Topical Steroids (Betnovate) were the leading cause of ADRs .All the other literature articles showed the highest offending drug to be Antimicrobials accounting for nearly 50% of the cases, followed by NSAIDs, Antiepileptic.

The common clinical pattern of Cutaneous ADR observed in our study was Steroid induced acne recording about (38.6%). The second common CADR was seen is Fixed drug eruption (FDE) with about (13.3%) followed by Erythematous rash that showed (11.1%), Toxic Epidermal Necrolysis (TEN) and Urticaria recording (7.5%).in which 1 was fatal with TEN wherein similar mortality with TEN was seen in the study of **Saraswoti neupane and Surya Raj Sharma (2012)<sup>12</sup>** Steven Johnson Syndrome (SJS) were identified in (4.4%). About (3.3%) of Vasculitis and Erythema was observed, (2.2%) were seen with Erythroderma, Photosensitivity reaction and Drug rash

eosinophilic systemic syndrome (DRESS). Rare cases about (1.1%) was seen in Alopecia, Exfoliative Dermatitis, Infectious eczema dermatitis, and Acanthosis like nigricans. Unlike in other studies Fixed drug eruption was the highest recorded clinical pattern of ADR by **Saraswoti neupane and Surya Raj Sharma (2012)**<sup>12</sup>. Some studies have observed urticaria and exanthematous rash as offending agents by **Karamsad Suthar J.V1 and Desai S.V (2011)**<sup>19</sup> recording both about 31.42%, whereas studies by **Balpande K.G., et.al (2013)**<sup>20</sup> recorded (32.75%) and (26.72%) respectively. Acute urticaria was the most common clinical presentation (59.2%) in the study by **Mahmood Farshchian et al (2015)**<sup>14</sup>

According to Causality assessment as per the Naranjo's scale, (2.2%) scored Definite, Remaining all about (97.8%) scored Probable and as per the WHO scale (2.2%) scored Certain, rest all (97.8%) were of Probable. Unlikely, conditional, unclassifiable were excluded from the study. Most of the studies showed the same assessment data giving high incidence of Probable cases about (55.89%) reported by **Mena Shrivastava et al (2011)**<sup>21</sup>, and about (90.62%) as reported by **Palanisamy S, Arul Kumaran KSG, Rajasekaran A (2009)**<sup>22</sup> and about (78.26%) reported by **Himangshu Mahato et al (2014)**<sup>23</sup>

The results of assessment of the severity index revealed most cases with Moderate about (62.2%), followed by Mild about (26.6%). (10%) were identified as Severe. One case (1.1%) was fatal which was similarly seen in the study by **Saraswoti neupane and Surya Raj Sharma (2012)**<sup>12</sup> In our study all the cases were Type B (Bizarre type) which was similarly seen in the study by **Karamsad Suthar J. and Desai S.V (2011)**<sup>19</sup> where 100% ACDRs were Type B (Bizarre immunological allergic drug reaction).

### **Conclusion:-**

Clinical patterns and the drugs causing ADR are remarkably similar to those observed in other studies except for minor variations. A wide clinical spectrum of Cutaneous ADRs ranging from Steroid induced acne to Fixed Drug Eruption (FDE), Erythematous rashes, serious Toxic Epidermal Necrolysis (TEN), Urticaria, Steven Johnson Syndrome (SJS) and Drug Rash Eosinophilic Systemic Syndrome (DRESS) was observed. Out of which Steroid induced acne was the most common Cutaneous ADRs seen. Topical corticosteroids were the most common and among which Betamethasone was offending agent causing Cutaneous ADRs. The study demonstrated the causal relationship that was established using WHO and Naranjo's algorithm. It was evaluated that majority of the cases assessed were "probable", with few cases of "certain". Analysis revealed the severity of Cutaneous ADR that showed majority of the cases as moderate followed by mild and severe. Fatal case was seen with TEN. These variations may be explained by the differences in drug usage patterns and short duration of the study. The aim of the study was achieved by assessing the prevalence, causality and severity assessment, offending drugs involved in CADR and clinical patterns recorded during the course of study. This helps in prevention and early detection of CADR and can be used as a guide to healthcare professionals to communicate more effectively regarding the management of such conditions.

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### **Conflict of Interest:-**

I and the other co authors have no conflict of interest to declare.

**References:-**

1. <http://www.adr-database.com>. World Health Organization. Collaborating Centre for International Drug Monitoring. Geneva: World Health Organization. 1984, WHO publication DEM/NC/8
2. Nayak S, Acharjya B. Adverse cutaneous drug reaction. Indian J Dermatol 2008; 53:2-8. 1. Breathnach SM, Hintner H. Adverse Drug Reactions and the Skin. Oxford:Blackwell Scientific, 1992
3. Srinivasan R and Ramya G PES College of Pharmacy, Department of Pharmacy Practice, 50 Ft. Road, Hanumanth Nager, Bangalore, Karnataka, India. Adverse Drug Reaction-Causality Assessment, International Journal of Research in Pharmacy and Chemistry. 2781-ISSN: 2231. 2011, 1(3)
4. Murphy BM, Frigo LC. Development, Implementation, and Results of a Successful Multidisciplinary ADR Reporting Program in a University Teaching Hospital. Hospital Pharmacy 1993; 28: 1199-1204.
5. Bigby M. Rates of cutaneous reactions to drugs. Arch Dermatol 2001; 137:765-770.
6. McKenna JK, Leiferman KM. Dermatologic drug reactions. Immunol Allergy Clin North Am 2004; 24: 399-423
7. WHO-UMC.org/Graphics/24734.pdf
8. <https://livertox.nih.gov/Narajo.html>
9. Hartwig SC, Siegel J and Schneider PJ. Preventability and Severity Assessment in Reporting Adverse Drug reactions. American Journal of Hospital Pharmacy. 1992; 49:2229-31 37. Information About Adverse Drug.
10. Ruchika Nandha, et al, Department of Pharmacology, Government Medical College, Patiala, Punjab Cutaneous adverse drug reactions in a tertiary care teaching hospital: A North Indian perspective. India. International Journal of Applied and Basic Medical Research, Jan-Jun 2011, 1 (1): 50-53.
11. V Sudershan et al ,Department of Pharmacology, Gandhi Medical College, Hyderabad, Cutaneous adverse drug reactions in a tertiary care hospital, Scholars Research Library Pharmacy Letter, 2011, 3 (6):210-217.
12. Saraswoti neupane and Surya raj Sharma, Cutaneous Adverse reactions: A 6- Month Teaching Hospital Based Study from Mid-Western Nepal, Journal of clinical and diagnostic research. 2012 May (supply-I); 6(3):445-448.
13. Akram Ahmed et al, department of pharmacy practice, Annamalai University, Tamilnadu, Incidence of Adverse drug reactions with commonly prescribed drugs in tertiary care teaching hospital, Research article.. ISSN:0975-7538, January (2012) Int. J. Res. Pharm. Sci; 3(1): 79-83.
14. Mahmood Farshchian et al. Clinical, Cosmetic and Investigational Dermatology, Drug-induced skin reactions: a 2 year study. 2015 Feb; 8:53-56.
15. Shalini Chawla et al Department of Pharmacology, Maulana Azad Medical College, BahadurShah Zafar Marg, Delhi, Adverse drug reaction monitoring in a tertiary care teaching hospital, India, RESEARCH LETTER. July 2011; 2(3): 196-198.
16. Tejas K Patel, Sejal H Thakkar, DC Sharma. Cutaneous adverse drug reactions in Indian population: A systematic review. Indian Dermatology Online Journal. July 2014; 5( 6 ) :76-86.
17. V Sudershan et al ,Department of Pharmacology, Gandhi Medical College, Hyderabad, Cutaneous adverse drug reactions in a tertiary care hospital, Scholars Research Library Pharmacy Letter, 2011, 3 (6):210-217.
18. Bharani Kalpana R,et.al, Dermatological Manifestations of Adverse Drug Reactions: An Observational Study from Tertiary Care Center of Central India.J Pharm Biomed Sci September 2014; 04(03):208-214.
19. Karamsad Suthar J.V1 and Desai S.V, A study of Adverse Cutaneous Drug Reactions in Outdoor Patients attending to Skin & V.D. Department of Shree Krishna Hospital, Gujarat International Journal of Research in Pharmaceutical and Biomedical Sciences ISSN: 2229-3701 , Jan – Mar 2011; 2(1):274-279.
20. Balpande K.G., et.al, Department of Pharmacology, NKP Salve Institute of Medical Sciences, Nagpur (MS), Study of Clinical Pattern in Patients with Cutaneous Adverse Drug Reactions: Research paper, India. Int J Med Pharm Sci, May 2013; 03 (09): 34-39.
21. Mena Shrivastava et al, Adverse Drug Reactions Reported in Indira Gandhi Government Medical College and Hospital, Nagpur, Journal of the Association of Physicians of India ,May 2011;59(3) 238-242.
22. Palanisamy S, et al , Department of Pharmacy Practice, KMCH College of Pharmacy, Coimbatore-48, A Study on Assessment, Monitoring, Documentation and Reporting Of Adverse Drug Reactions at a Multi-Specialty Tertiary Care Teaching Hospital in South India, International Journal of PharmTech Research, Vol.1, No.4, pg. 1519-1522, Oct-Dec 2009; ISSN : 0974-4304.
23. Himangshu Mahato et al , Adverse Cutaneous Drug Reaction— Burden in a Rural Teaching Hospital in Eastern India-Research Article ,World Journal of Pharmacy and Pharmaceutical sciences, 29 May 2014 Volume 3, Issue 6 , 1966- 1973. ISSN: 2278-4357.



### RESEARCH ARTICLE

## HISTOPATHOLOGY OF GALLBLADDER IN IRON DEFICIENCY ANEMIA PATIENTS UNDERGOING CHOLECYSTECTOMY: A PROSPECTIVE STUDY

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### Abstract

Gall stones may be said to be contributing to varied pathology affecting gall bladder ranging from chronic cholecystitis to carcinoma. Cholelithiasis produces diverse histopathological changes in gall bladder mucosa namely acute inflammation, chronic inflammation, cholestasis, hyperplasia and carcinoma. The study was performed on a group of 118 patients who were admitted in department of surgery for cholecystectomy (laparoscopic) during period of 1 year and 16 days. Patients were divided in two groups based on S.Ferritin levels and histopathological examination of these patients was done. In both the groups, majority of subjects were diagnosed as chronic cholecystitis on histopathology. There is one interesting finding that acute cholecystitis is more prevalent in iron deficient cases. A finding suggesting higher prevalence of acute cholecystitis in iron deficient case might indicate if acute cholecystitis may be prevented using iron supplements. To establish this correlation a study with large sample size may be done.

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### Introduction:-

A gallstone is a stone formed within the gallbladder out of bile components. Most people with gallstones (about 80%) never have symptoms. Complications of gallstones include inflammation of the gallbladder, inflammation of the pancreas, and liver inflammation. In those who are having gallbladder attacks surgery to remove the gallbladder is typically recommended. This can be either done through several small incisions or through a single larger incision. Surgery is typically done under general anesthesia. Among gastroenterological diseases, Gallstone disease is one of the world's most expensive medical conditions<sup>1</sup>. In the United States, there are more than 500 000 cholecystectomies, the total cost of which exceeds 5 billion dollars<sup>2</sup>.

Women are three times more likely to develop gallstones than men, and first-degree relatives of patients with gallstones have a twofold greater prevalence.<sup>3</sup>

Many conditions affecting gall bladder are characterized by finding of associated gallstones. Gall stones may be said to be contributing to varied pathology affecting gall bladder ranging from chronic cholecystitis to carcinoma. Cholelithiasis produces diverse histopathological changes in gall bladder mucosa namely acute inflammation, chronic inflammation, cholesterosis, hyperplasia and carcinoma. The prevalence of gallstone disease varies with age, sex and ethnic group. In India, gallstone disease is 7 times more common in the north as compared to the south. It is mainly due to dietic influence. <sup>4</sup>The histopathological diagnosis in most of the cholecystectomy specimens is chronic cholecystitis. However, other diverse, but benign histopathological changes of gallbladder mucosa are also seen namely acute inflammation, cholesterosis, metaplasia and hyperplasia. Very rarely cholecystectomy specimen may reveal an unexpected gallbladder carcinoma. Similarly, surgery is performed in clinically suspected (often supported by radiological and other investigational corroborative findings) cases of Gall bladder malignancy. Still in many cases cholecystectomy performed with provisional diagnosis of benign diseases based on clinical, ultrasonological and computerized tomographic scanning misses a significant number of early malignant lesions of gallbladder. <sup>5</sup>

### Material and Methods:-

This prospective study was conducted in the Department of Surgery in collaboration with Department of Pathology at tertiary care hospital, Lucknow, India. The ethical committee of the institute approved the study protocol.

The study was performed on a group of 118 patients who were admitted in department of surgery for cholecystectomy (laproscopic) during period of 1 year and 16 days

Patients suffering from cholelithiasis confirmed by Ultrasonography and admitted in the surgical ward for cholecystectomy were included in the study irrespective of their age, sex and parity. Both laparoscopic and open cholecystectomies were the procedures advocated for treatment. Patients suffering from empyema and mucocele of the gall bladder were excluded from this study.

Serum iron was estimated by time end point method with ferroZine reagent<sup>125</sup>. The normal reference values were supplied with the kit, for males (60-158 µg/dl) and for females (35-145 µg/dl).

All the gallbladder specimens collected during laproscopic cholecystectomy were submitted for histopathological examination in department of pathology. These specimens were analysed for histopathological changes in relation to gall stone disease.

### Observation:-

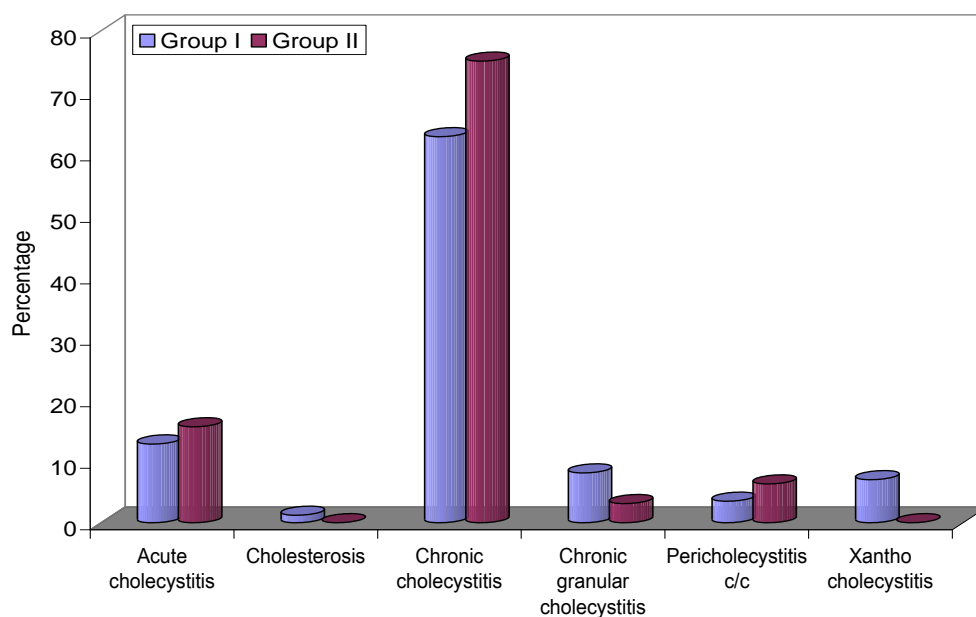
A total of 86 (72.9%) patients comprised Group I which comprised of patients having Serum ferritin levels within normal range (>60 µg/dl for males and >35 µg/dl for females). Remaining 32 (27.1%) subjects were anemic subjects with serum ferritin levels below normal range (<60 µg/dl for males and <35 µg/dl for females). Thus the ratio of iron deficient to non iron deficient patients in present study was 0.37:1

### Distribution of subjects according to Histopathological findings.

S.No.	HPE Findings	Total		Group I (n=86)		Group II (n=32)	
		No.	%	No.	%	No.	%
1.	Cholesterosis	1	1.2	1	1.2	0	0
2.	Acute Cholecystitis	16	13.5	11	12.8	5	15.6
3.	Chronic Cholecystitis	82	69.4	58	62.8	24	75.1
4.	Chronic cholecystitis with Pericholecystitis	5	4.2	3	3.5	2	6.3
5.	Chronic granulomatous cholecystitis	8	6.7	7	8.1	1	3.1
6.	Xanthocholecystitis	6	7.0	6	7.0	0	0

$$\chi^2=4.219(df=5); p=0.518$$





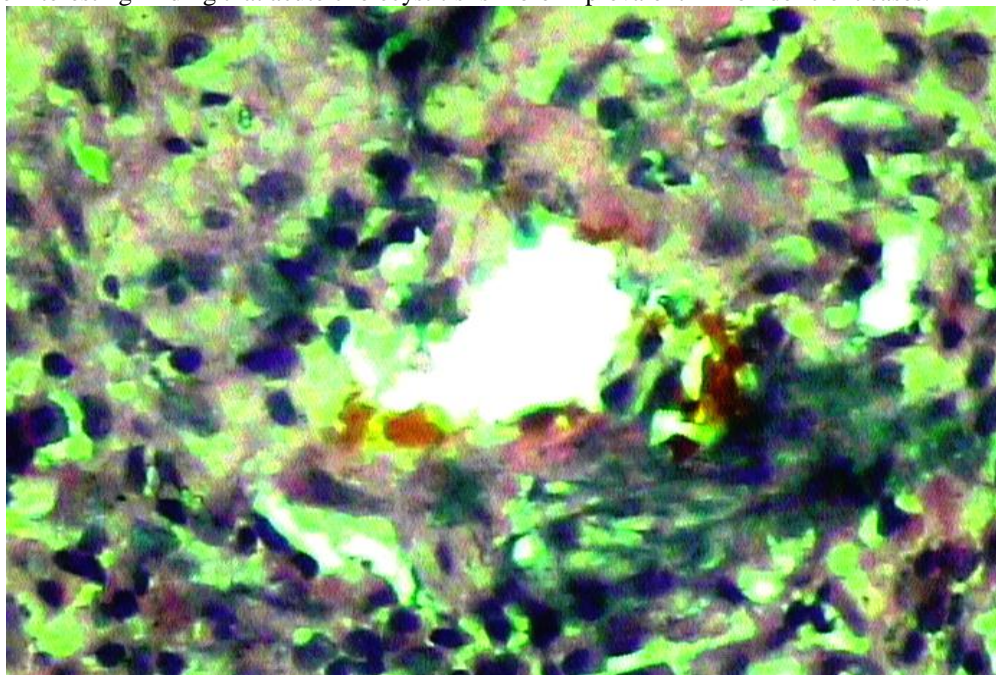
**Fig.1. Distribution of subjects according to Histopathological findings.**

Histopathological findings in 118 cases were studied. Of these 86 cases belong to group I and 32 belong to group II.

Acute cholecystitis was found in 16 cases, chronic cholecystitis in 86 cases, chronic cholecystitis with pericholecystitis in 5 cases, chronic granumatoscholecystitis in 8 cases and xanthocholecystitis in 6 cases.

In both the groups, majority of subjects were diagnosed as chronic cholecystitis on histopathology. Statistically, the difference between two groups was not significant ( $p=0.636$ ).

There is one interesting finding that acute cholecystitis is more prevalent in iron deficient cases.



**Image 1:- Cholesterosis with biliary sludge.**

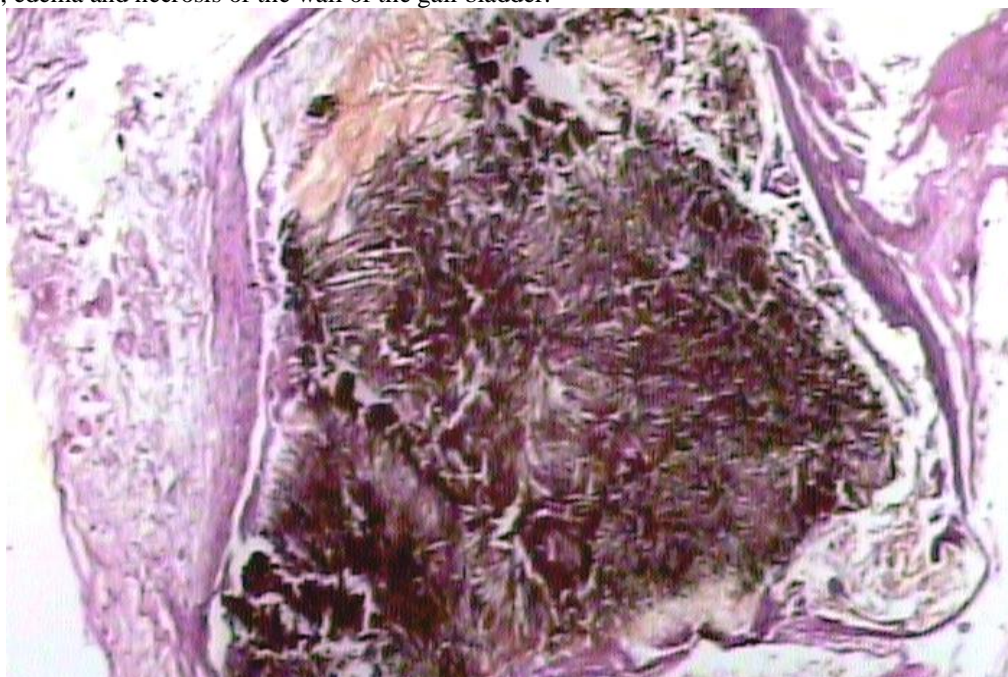


Cholesterosis was seen in 1 case only (image.1). There was no inflammatory reaction in the wall of gallbladder. Foamy macrophages seen in lamina propria and epithelium, mucosal hyperplasia.



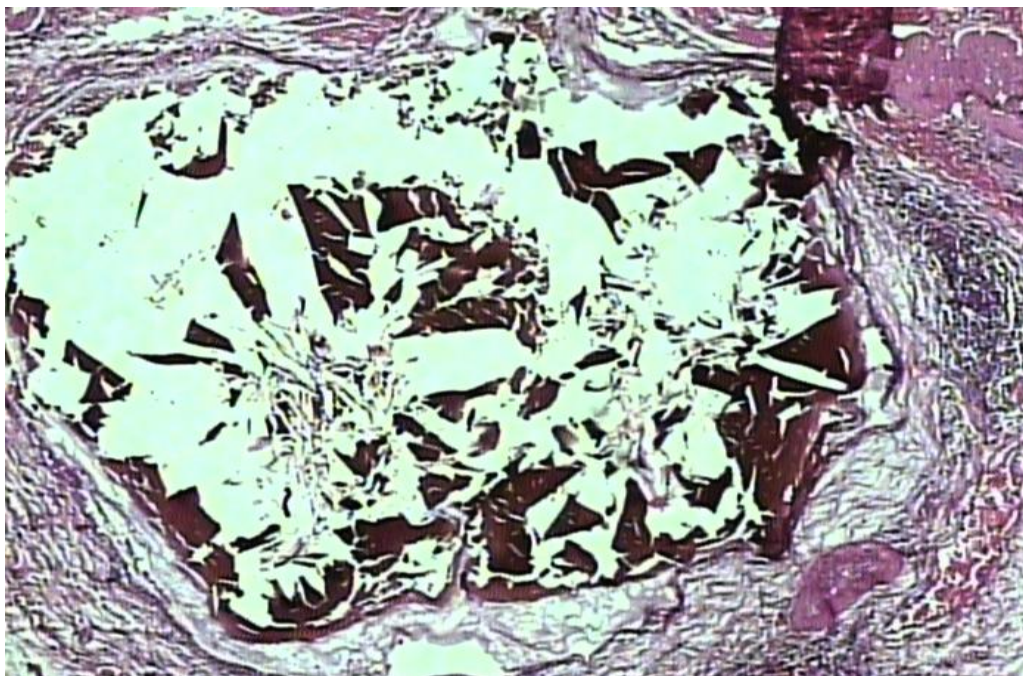
**Image 2:-** Acute cholecystitis

Acute cholecystitis was found in 16 cases (image.2). There are signs of inflammation present in gallbladder wall. The microscopic features are classical for acute inflammation and include hyperemia, polymorphonuclear leukocyte infiltration, edema and necrosis of the wall of the gall bladder.



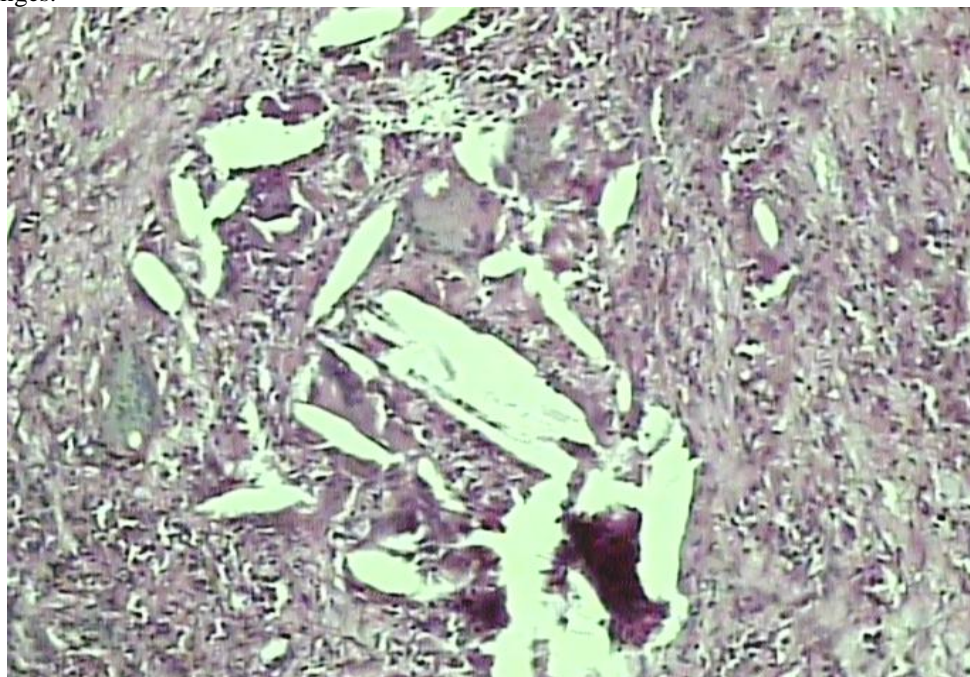
**Image 3:-** Chronic cholecystitis with impacted stone.



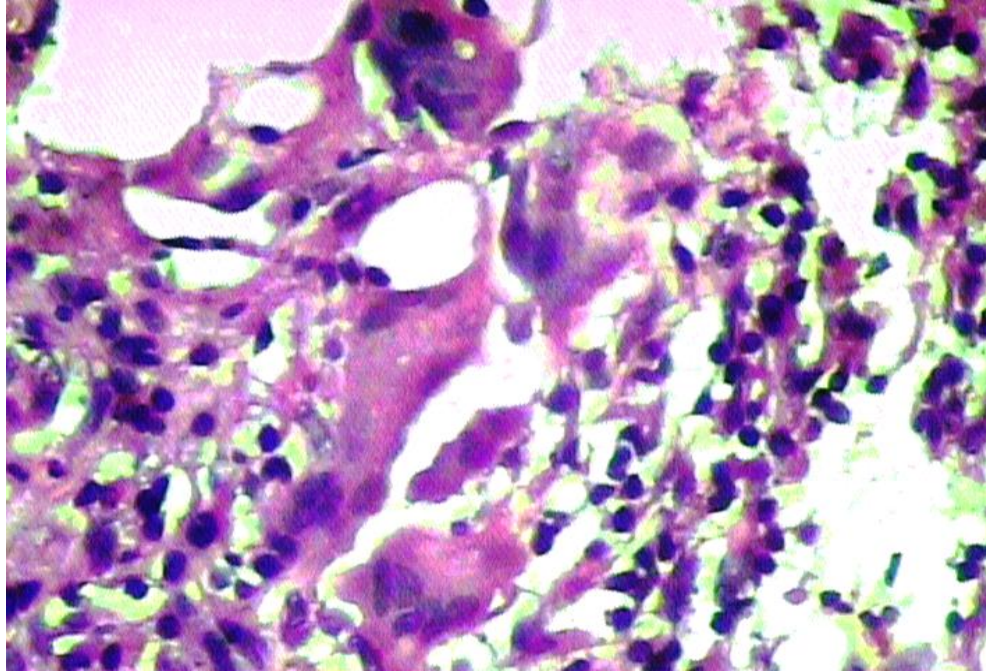


**Image 4:-** Chronic cholecystitis with impacted cholesterol stone

Chronic cholecystitis was found in 86 cases (image.3, image.4). The gallbladder wall has mild chronic inflammation with rokitansky-Aschoff sinuses, smooth muscle hypertrophy, hyalinized collagen, lymphoid aggregates, variable mucosal changes.



**Image 5:-** Chronic granulomatous cholecystitis (cholesterol granuloma)



**Image 6:-** Chronic cholecystitis with foreign body granuloma

Chronic granumatoscholecystitis in 8 cases (image.7, image.8). Gallbladder wall is has multinucleated cells with granulomatous changes. There is rupture of Rokitansky-Aschoff sinuses with extravasation of bile, foamy macrophages with bile or iron, cholesterol clefts and multinucleated giant cell.

### **Discussion:-**

Over ninety one per cent patients presented with pain upper abdomen, a number significantly lower than that reported by Laghari et al where all patients had upper abdominal pain.<sup>6</sup> None of the patients in our study had any evidence of malignancy either clinically or on ultrasound examination.

The present study was carried out on 118 cholecystectomy specimens to determine the histopathological spectrum of gallbladder diseases. Histopathology not only establishes a tissue diagnosis in gallstone disease, but also contributes towards understanding its etiopathogenesis and can help in planning future treatment modality.

The most common histopathological finding in our study was chronic cholecystitis; 82 specimens were reported as chronic inflammation with mucosal ulceration, denudation, metaplasia to dysplasia and wall infiltration by chronic inflammatory cells like neutrophils, macrophages, plasma cells and varying degrees of fibrosis. A similar study by Memon<sup>7</sup> also reports chronic cholecystitis as major histopathological finding, identified in 64.8% cases. In both the groups, majority of subjects were diagnosed as chronic cholecystitis on histopathology. Statistically, the difference between two groups was not significant ( $p=0.181$ ) which suggests that there is no role of iron levels in histopathology of gall bladder.

Gallbladder polyps have an incidence ranging from 4.6 to 6.9 per cent<sup>8</sup>. In our study, no case of gallbladder polyp was identified. This low incidence can be attributed to small number of cases in our series. The prevalence of this pathology is much higher amongst males<sup>9</sup>.

Although there are myriad of premalignant conditions, carcinoma gallbladder has a strong association with gallstones<sup>10</sup>. The strong association between the two warrants attention paid to histopathology of specimen in all cases undergoing cholecystectomy for cholelithiasis, irrespective of presence or otherwise of any gross abnormalities. It is widely reported that long standing mucosal irritation by the stones cause atypical cellular changes and increased cellular proliferation. It has been hypothesized that in long standing cases, these areas of hyperplasia progress to metaplasia and carcinoma-in- situ<sup>11</sup>. Studies confirm presence of such changes in the vicinity of gallbladder carcinoma<sup>12</sup>.



There is one interesting finding in our study that acute cholecystitis was more prevalent in iron deficient cases which can be studied with large sample size.

### Conclusion:-

The histopathological spectrum of gallbladder disease after cholecystectomy was found to be quite diverse. The most common histopathological diagnosis in gallstone disease was chronic cholecystitis, which was associated with a variety of mucosal alterations and lesions like cholesterosis, metaplasia, empyema and adenomyoma. A finding suggesting higher prevalence of acute cholecystitis in iron deficient case might indicate if acute cholecystitis may be prevented using iron supplements. To establish this correlation a study with large sample size may be done.

### Bibliography:-

1. Bagaudinov KG, Saidov SS, Garilevich BA, Zubkov AD, Abdulaev RA, Ovakimian GS. Improvement of extracorporeal shockwave cholelithotripsy in the comprehensive treatment of cholelithiasis. *Klin Med (Mosk)* 2007; 85: 56-59.
2. Doggrell SA. New targets in and potential treatments for cholesterol gallstone disease. *Curr Opin Investig Drugs* 2006; 7: 344-348.
3. Novacek G. Gender and gallstone disease. *Wien Med Wochenschr* 2006; 156: 527-533.
4. Epidemiological study of cholelithiasis : Indian context : BY Dr. S. R. Mhamunkar, Dr R. D. Bapat, Ms. S. P. Mahadik, Dr. B.A. Abhyankar : [www.indian-doctor.com/papers/nutri/gallston.htm](http://www.indian-doctor.com/papers/nutri/gallston.htm)
5. Samad A: Gall bladder carcinoma in patients undergoing cholecystectomy for cholelithiasis. *J Pak Med Assoc* 2005, 55:497-499.
6. Laghari AA, Talpur KAH, Malik AM, Khan SA, Memon AI: Laparoscopic Cholecystectomy in complicated gallstone disease. *J Liaquat Uni Med Health Sci.* 2008, 7 (1): 18-24.
7. Memon W, Khanzada TW, Samad A, Kumar B: Histopathology spectrum of gallbladder specimens after cholecystectomy. *Pak J Med Sci.* 2011, 27 (3): 533-536.
8. Matos AS, Baptista HN, Pinheiro C, Martinho F: [Gallbladder polyps: how should they be treated and when?]. *Rev Assoc Med Bras.* 2010, 56 (3): 318-321. 10.1590/S0104-42302010000300017.
9. Sun XJ, Shi JS, Han Y, Wang JS, Ren H: Diagnosis and treatment of polypoid lesions of the gallbladder: report of 194 cases. *Hepatobiliary Pancreat Dis Int.* 2004, 3 (4): 591-594.
10. Ayyaz M, Waris M, Fahim F: Presentation and etiological factors of cancer gall bladder in patients undergoing cholecystectomies at Mayo Hospital, Lahore. *Ann King Edward Med Coll.* 2001, 7: 138-140.
11. Duarte I, Llanos O, Domke H, Harz C, Valdivieso V: Metaplasia and precursor lesions of gallbladder carcinoma. Frequency, distribution, and probability of detection in routine histologic samples. *Cancer.* 1993, 72 (6): 1878-1884.
12. Sarma NH, Ramesh K, Gahukamble LD, Fituri OM, Mangal DK: Gall bladder cancer in north eastern Libya. *East Afr Med J.* 1998, 75 (7): 417-421.



## RESEARCH ARTICLE

### HELICOBACTER PYLORI ERADICATION EFFECT ON LIVER FAT CONTENT IN PATIENT WITH NON-ALCOHOLIC FATTY LIVER DISEASE.

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Helicobacter pylori, Non-alcoholic Fatty Liver Disease, Insulin Resistance, Alanine aminotransferase, aspartate aminotransferase.

#### Abstract

**Background:** Helicobacter pylori (HP) infection role in nonalcoholic fatty liver disease (NAFLD) pathogenesis is controversial.

**Aims:** This study aimed to evaluate the effect of HP eradication on liver fat content (LFC), liver function tests (LFT), lipid profile, and homeostasis model assessment-IR (HOMA-IR) index in NAFLD.

**Patients and Methods:** Patient with dyspepsia and increased serum levels of aminotransferases enrolled in the study. Exclusion criteria were factors affecting aminotransferases levels or HP treatment regimen. Patients with elevated aminotransferases levels and ultrasound findings of fatty liver disease were supposed for NAFLD. NAFLD liver fat score used to classify NAFLD, those with score greater than -0.64 and positive results for urea breath test (UBT), were included. Patients underwent lifestyle modifications and HP eradication. Alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), triglyceride (TG), cholesterol (CHOL), high and low-density lipoprotein (HDL, LDL), fasting serum glucose (FSG), LFC, and HOMA-IR were checked at baseline, after eight weeks and twenty four weeks.

**Results :** One hundred twenty patients (58 males) with the mean age of 45.39 ( $\pm 9.24$ ) were included with repeated ANOVA measurement showed a significant reduction in anthropometric measurements, laboratory parameters (except for HDL) and LFC in both groups during the study; however, no significant difference was observed between the groups.

**Conclusions:** HP eradication per se might not affect LFT, lipid profile, LFC, and insulin resistance in dyspeptic NAFLD patients

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#### Introduction:-

Recently the relation between the gut microbes and the development and progression of liver cell damage has come to interest, regarding to this, helicobacter pylori (HP) deoxy-ribonucleic acid (DNA) was detected in patients with different causes of chronic liver disease (CLD) including non-alcoholic fatty liver disease (NAFLD) (1-4). Regardless of HP DNA existence in liver samples, no bacteria could be cultured (5).

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Different theories for the mechanisms of the NAFLD development in patients with HP infection were issued, one proposed that HP species would produce liver specific toxin causes liver cell damage (6), another one suggested that HP invasion to intestinal mucosa might increase gut permeability and allow the bacterial endotoxin to pass via the portal vein to the liver (7). Because HP eradication is not such difficult in most cases, discovering its role in diseases apart from the stomach could be of great importance for public health, currently the way in which HP eradication would affect clinical state of patients with NAFLD is not well cleared (8-11).

### **Aim of the study:-**

The aim of this study was to determine the short term effect of HP eradication on liver fat content, LFTs, and metabolic profile (biochemical parameters and anthropometric measurements) in a sample of dyspeptic NAFLD patients.

### **Patients and Methods:-**

This study was done as a randomized clinical trial, each of the patients was assigned to treatment or control group, Participants signed a written consent prior to enrollment.

Adult patients referred to the gastroenterology clinic of a general hospital due to increased serum aminotransferase levels were selected. Serum alanine aminotransferase (ALT) and aspartate aminotransferase (AST) levels  $\geq 40$  units per liter (U/L) considered elevated (12). Patients with dyspepsia, positive results for anti HP antibody and ultrasonographic evidence of fatty liver were enrolled; the exclusion criteria were factors affecting serum aminotransferase or HP treatment strategy (13). All patients with elevated serum aminotransferase levels in the first blood sampling were rechecked after two months, and persistently elevated serum aminotransferase levels with ultrasonographic criteria for fatty liver supposed to have NAFLD (13). Considering the liver biopsy limitations, 'NAFLD liver fat score' used in enrolled patients to define NAFLD (14), those with NAFLD liver fat score greater than -0.64, and positive results for urea breath test (UBT) were included in the study.

Lifestyle modifications was provided to all participants and it consisted of providing calorie-restricted diets and programmed physical activity to achieve ideal body weight based on the guidelines for the diagnosis and management of NAFLD : update 2010 (15) with avoiding of rapid weight loss as it could worsen NAFLD (16), A dietitian checked the patients and controlled their calorie intake.

The patients in treatment group received quadruple treatment with omeprazole (20 mg twice daily), amoxicillin (1 g twice daily), bismuth subcitrate (240 mg twice daily), and clarithromycin (500 mg twice daily) for two weeks (17), the patients requested to bring used packages at the follow up visits weekly, evaluated for compliance and any potential side effects.

The percent of the liver fat content calculated based on the validated formula (14), A radiologist did the liver ultrasonography, the echogenicity of the right lobe of the liver compared to the right kidney with a 3.5 megahertz probe to identify fatty liver (18).

HP antibody (IgG) measured using a quantitative enzyme-linked immunosorbent assay technique, UBT performed by Helioprobe test kit to detect HP infection and eradication. Eradication investigated six weeks after the end of treatment (19). Waist circumference (WC) measured at midpoint between the lower border of rib cage and the top of iliac crest at the end of expiration (20). After a twelve-hour overnight fast, sera of the patients were tested for fasting serum glucose (FSG), ALT, AST, alkaline phosphatase (ALP), triglyceride (TG), cholesterol (CHOL), low-density lipoprotein (LDL) by enzymatic methods (13). Serum insulin concentrations measured based on an enzyme immunoassay. Quantitative measurement of insulin resistance (IR) was done by homeostasis model assessment-IR (HOMA-IR =fasting serum insulin  $\times$  fasting serum glucose/22.5) (21). Diabetes mellitus (DM) was diagnosed either previous diagnosis of DM or if FBS equal or greater than 126 mg/dl after double check.

Primary outcome measure was change from baseline fat content at 6 months. Secondary outcome measures were changes from baseline LFT, metabolic parameters, and anthropometric measurements at 6 months.

A statistical power analysis used to calculate the sample size. Considering the two-sided level ( $\alpha$ ) of 0.05 and the power of 90% ( $\beta = 0.1$ ), a total sample size of 46 patients was determined to detect one percent inter-group difference in liver fat content. 60 patients were enrolled in each treatment group of the study.

Data was summarized as means  $\pm$  SD for continuous and number (percentage) for qualitative variables. T test and Chi-square used to compare the mean values of continuous and categorical variable between the treatment groups. Repeated measure analysis of variance (ANOVA) was applied for comparing treatment groups regarding the changes of variables during the study. All statistical analyses were performed using SPSS version 17 (SPSS, Chicago, IL, The USA). The probability of the difference between the dependent and the independent variables were considered significant if a two-tailed P value was less than 0.05.

## Results:-

One hundred and forty five patients of suspected NAFLD were evaluated from April 2013 to April 2014. One hundred and twenty patients, with the mean age of  $45.35 \pm 9.24$  years, were included in the study. Table 1 represents patient characteristics. Reasons for leaving out were patient unwillingness to participate in the study ( $n = 10$ ), normalization of ALT during the lead-in phase ( $n = 14$ ), and pregnancy or lactation ( $n = 1$ ).

**Table 1:-** The baseline characteristics of participants

	Lifestyle Modification plus Helicobacter pylori eradication	Lifestyle Modification	P value
<b>Age, mean <math>\pm</math> SD, y</b>	$45.6 \pm 7.3$	$45.2 \pm 7.1$	0.7
<b>Gender</b>			0.5
Male	26	32	
Female	32	28	
<b>Diabetes mellitus</b>			0.5
Present	26	25	
Absent	32	35	

There were no medications side effects occurred requiring dose reduction or discontinuation of the treatment during the study. Good adherence to the therapy was followed by pill counting during the follow up visits. Based on UBT results, the eradication rate was 96 %.

All the continuous variables were normally distributed at the baseline measurement. Table 2 shows the comparisons of LFC, anthropometric measurements, and laboratory levels according to the treatment groups during the study. There was no significant difference between the treatment groups at baseline, eight weeks, and twenty four weeks.

**Table 2:-** The comparison of liver fat content, anthropometric measurements, and laboratory levels between the treatment groups during the study

	Lifestyle Modification plus Helicobacter pylori eradication	Lifestyle Modification	P value
<b>Liver fat content, mean <math>\pm</math> SD</b>			
Baseline	$11.9 \pm 6.3$	$11.6 \pm 5.8$	0.7
Eight weeks	$10.5 \pm 5.9$	$10.1 \pm 5.7$	0.8
Twenty four weeks	$9.1 \pm 6.3$	$8.7 \pm 5.1$	0.6
<b>Waist circumference, mean <math>\pm</math> SD, cm</b>			
Baseline	$103.2 \pm 1.9$	$102.1 \pm 2.1$	0.4
Eight weeks	$102.8 \pm 2.1$	$101.9 \pm 2.5$	0.3
Twenty four weeks	$99.3 \pm 2.7$	100.1	0.7
<b>Weight, kg</b>			
Baseline	$88.3 \pm 9.1$	$89.2 \pm 7.6$	
Eight weeks	$87.5 \pm 10.7$	$88.1 \pm 6.3$	0.6
Twenty four weeks	$80.7 \pm 8.4$	$80.9 \pm 8.3$	0.7
<b>Body mass index, kg/m<sup>2</sup></b>			
Baseline	$32.4 \pm 3.2$	$31.3 \pm 3.5$	0.3
Eight weeks	$31.8 \pm 4.2$	$30.9 \pm 4.1$	0.2

Twenty four weeks	29.2 ± 3.1	28.4 ± 3.3	0.2
<b>Aspartate aminotransferase, U/L</b>			
Baseline	45.9 ± 18.6	45.7 ± 18.4	0.8
Eight weeks	37.8 ± 15.2	38.3 ± 17.9	0.7
Twenty four weeks	32.3 ± 13.1	33.1 ± 15.4	0.6
<b>Alanine aminotransferase, U/L</b>			
Baseline	67.8 ± 25.4	72.4 ± 26.4	0.5
Eight weeks	53.5 ± 31.1	53.1 ± 32.5	0.8
Twenty four weeks	42.2 ± 23.3	41.7 ± 24.9	0.8
<b>Alkaline phosphatase, U/L</b>			
Baseline	181.4 ± 57.3	189.7 ± 49.8	0.3
Eight weeks	171.7 ± 50.9	186.3 ± 47.6	0.2
Twenty four weeks	161.5 ± 42.1	175.4 ± 41.6	0.1
<b>Triglycerides, mg/dl</b>			
Baseline	175.6 ± 99.7	156.7 ± 87.9	0.3
Eight weeks	139.4 ± 75.3	128.5 ± 54.9	0.2
Twenty four weeks	121.5 ± 47.3	118.3 ± 42.1	0.5
<b>Cholesterol, mg/dl</b>			
Baseline	181.7 ± 30.6	183.4 ± 39.5	0.6
Eight weeks	172.8 ± 28.6	174.2 ± 32.4	0.7
Twenty four weeks	168.4 ± 22.7	169.3 ± 24.2	0.8
<b>Low density lipoprotein, mg/dl</b>			
Baseline	102.5 ± 24.5	109.2 ± 34.2	0.2
Eight weeks	98.1 ± 24.1	103.7 ± 28.5	0.3
Twenty four weeks	92.4 ± 18.7	95.8 ± 22.1	0.5
<b>High density lipoprotein, mg/dl</b>			
Baseline	44.6 ± 6.1	43.2 ± 6.0	0.2
Eight weeks	46.1 ± 5.9	45.8 ± 5.9	0.5
Twenty four weeks	51.6 ± 6.8	49.8 ± 7.9	0.6
<b>Fasting plasma glucose, mmol/L</b>			
Baseline	5.9 ± 0.7	5.8 ± 0.6	0.5
Eight weeks	5.5 ± 0.4	5.5 ± 0.5	0.6
Twenty four weeks	5.2 ± 0.6	5.3 ± 0.5	0.5
<b>HOMA-IR<sup>a</sup></b>			
Baseline	5.2 ± 1.9	5.0 ± 2.2	0.6
Eight weeks	4.2 ± 1.3	4.2 ± 1.8	0.5
Twenty four weeks	3.6 ± 1.2	3.5 ± 1.3	0.6

<sup>a</sup> HOMA-IR : homeostasis model assessment – insulin resistance

Table 3 shows the results of repeated measure ANOVA with Greenhouse-Geisser correction that determined that the mean studied parameters differed statistically significantly between the time points. Post hoc tests using the Bonferroni correction revealed that all treatment groups showed statistically significant reduction in LFC, anthropometric measurements, and laboratory values (except for HDL) from baseline to the end of the study.

**Table 3:-** The Comparison of Liver Fat Content, Anthropometric Measurements and Laboratory Parameters Change regarding the treatment Groups during the Study<sup>a</sup>

Pair Wise Comparison Between Baseline and the End of treatment		
	Mean ± SD	P value
Liver fat content, %	3.4 ± 0.2	< 0.01
Waist circumference, cm	2.6 ± 0.3	< 0.01
Weight, kg	8.1 ± 0.2	< 0.01
Body mass index, kg/m <sup>2</sup>	2.8 ± 0.2	< 0.01
Aspartate aminotransferase, U/L	12.9 ± 1.2	< 0.01



Alanine aminotransferase, U/L	28.3 ± 2.0	< 0.01
Alkaline phosphatase, U/L	16.8 ± 2.5	< 0.01
Triglycerides, mg/dl	46.3 ± 5.9	< 0.01
Cholesterol, mg/dl	14.6 ± 2.3	< 0.01
Low density lipoprotein, mg/dl	12.6 ± 1.7	< 0.01
High density lipoprotein, mg/dl	-7.2 ± 0.5	< 0.01
Fasting plasma glucose, mmol/L	0.7 ± 0.1	< 0.01
Fasting serum insulin, mU/L	3.7 ± 0.4	< 0.01
HOMA-IR <sup>b</sup>	1.5 ± 0.1	< 0.01

<sup>a</sup> Negative values represent the increase of the parameter at that interval

<sup>b</sup> Abbreviation : HOMA-IR, Homeostasis model assessment-insulin resistance

No statistically significant difference in the changes of mean LFC, laboratory values, and anthropometric measurements between the treatment groups at the study intervals (All P values > 0.05 in between-subject effects model).

### Discussion:-

This study was designed to evaluate the effect of HP eradication on LFC, LFT, and metabolic parameters in NAFLD patients. In this study the result of HP eradication per se might not affect LFC, LFT, lipid profile, insulin resistance, and anthropometric parameters. As liver ultrasonography is to some extent limited for diagnosis and grading the NAFLD severity (18), however its availability and cost effectiveness makes it an appropriate tool for fatty liver screening and it was used to evaluate fatty liver in patients with persistently elevated liver enzymes level. It was done by a single radiologist to avoid inter-observer variability. Considering the possible complications and poor patient acceptance, “NAFLD liver fat score” was used instead of liver biopsy for NAFLD diagnosis. Sensitivity and specificity of the values greater than -0.64 are 86% and 71% respectively, to predict NAFLD (14).

To increase the feasibility and reproducibility of the study, a valid formula was applied to measure liver fat content. A previous study showed the validity of this equation to predict liver fat content considering proton magnetic resonance spectroscopy (PMRS) as the gold standard (14). There was a significant high correlation between liver fat content identified by PMRS and liver fat content calculated by the above formula (14) ( $r = 0.7$ ,  $P < 0.0001$ ).

The role of HP in extragastric diseases has come to interest. There is large body evidence showing the association of HP and CLD (22-26). The prevalence of HP like DNA in the liver tissue samples of patients with CLD was significantly higher than the patients with metastatic adenocarcinoma (2). In the study of Ponzetto et al. the prevalence of HP antibody (IgG) was higher in males with HCV associated cirrhosis compared to age-matched male blood donors (23). The genomic sequences corresponding to HP were determined in the liver tissues of patients with HCC and cirrhosis. It was proposed that HP might be implicated in the progression of cirrhosis in patients with HCV infection (24).

Specific studies regarding HP and NAFLD are increasing. The presence of HP DNA in one sample of liver tissue from a NAFLD patient was a novel finding in 2008 (3). Aller et al. showed that probiotics might decrease markers of lipid peroxidation and improve liver function tests (LFT) in NAFLD (27). Solga et al. reported that probiotics protect gut epithelial cells from the adhesion and invasion of HP (28). Therefore, it can be concluded that probiotics induce their therapeutic effects in NAFLD via avoidance of intestinal mucosa destruction by HP. It was suggested that HP infection was one of the risk factors for the development of NAFLD (25). The study by Polyzos et al. compared biopsy proven NAFLD patients with matched healthy controls (26). The anti HP antibody (IgG) was higher in NAFLD than controls. This study recommended that HP infection eradication might have therapeutic perspectives in NAFLD treatment.

Lifestyle modifications to control daily calorie intake is considered as the gold standard care in NAFLD patients. This strategy was applied to all participants. Obtaining the ideal body weight resulted in sustained improvement of biochemical (serum liver enzymes and insulin level) and histological findings in NAFLD (29). This is in agreement with the results of our study that showed the significant reduction of LFC, LFT, and metabolic indices (FSG, lipid profile, HOMA-IR, and anthropometric measurements) in both treatment groups during the study. In our study, changes in LFC and LFT were not significantly different in HP eradicated group from controls who did not receive

eradication treatment. This finding is somehow in accordance with the result of Stalke et al. (1). They reported no correlation between LFT and identification of HP DNA in the liver biopsy samples of CLD patients.

In our study, HP eradication had no additional effect on the metabolic indices changes. It was suggested that gut microbiota might regulate IR (30). Currently, there are controversial results about the effect of HP on insulin resistance. The positive correlation of HP with the metabolic syndrome and the inverse correlation with morbid obesity were reported (8-11). Gunji et al. studied a large sample of Japanese general population (8). HP seropositivity was higher in those with metabolic syndrome than the controls. They suggested that HP infection could be associated with metabolic syndrome. On the other hand, there are reports showing the enhanced risk of obesity following HP cure (10, 11). These studies proposed that increased Ghrelin following HP treatment improves the appetite and leads to weight gain. The controversial results of the above studies could be due to the difference in the duration of HP infection, and the type of gastritis in the studied populations.

The limitations of the study and Recommendations, as there is not enough evidence to show the benefit of HP eradication in all infected patients, only dyspeptic NAFLD patients were included in this study. Therefore, the results cannot be generalized to all NAFLD patients. Another limitation of the study was the lack of performing liver biopsy to define the histologic response. Comparing the effect of HP eradication on biochemical and histological changes in NAFLD patients (including non-dyspeptic) with longer follow up duration is recommended.

### Summary:-

This randomized clinical trial was performed on one hundred and twenty dyspeptic NAFLD patients who were randomly assigned to lifestyle modification alone or lifestyle modification plus HP eradication treatment. A dietitian checked the daily calorie intake. HP eradication treatment was performed by standard quadruple therapy for 2 weeks. HP eradication rate was 96 % in this sample of NAFLD patients. A comparison was performed between successful eradication group, and those who did not receive HP eradication. Repeated measure ANOVA showed a significant reduction in LFC, anthropometric measurements, and laboratory parameters (except for HDL) in both groups during the study; however, no significant difference was observed between the two groups.

Within the limitations of this study, it can be concluded that HP eradication in dyspeptic NAFLD patients did not provide any additional improvement in LFC, LFT, FSG, lipid profile, IR, and anthropometric measurements compared to lifestyle modification alone.

### References:-

1. Stalke P, Al-Soud WA, Bielawski KP, Bakowska A, Trocha H, Stepinski J, et al. Detection of *Helicobacter* species in liver and stomach tissues of patients with chronic liver diseases using polymerase chain reaction-denaturing gradient gel electrophoresis and immunohistochemistry. *Scand J Gastroenterol.* 2005; 40(9):1032–41.
2. Pirouz T, Zounubi L, Keivani H, Rakhshani N, Hormazdi M. Detection of *Helicobacter pylori* in paraffin-embedded specimens from patients with chronic liver diseases, using the amplification method. *Dig Dis Sci.* 2009; 54(7):1456–9.
3. Cindoruk M, Cirak MY, Unal S, Karakan T, Erkan G, Engin D, et al. Identification of *Helicobacter* species by 16S rDNA PCR and sequence analysis in human liver samples from patients with various etiologies of benign liver diseases. *Eur J Gastroenterol Hepatol.* 2008; 20(1):33–6.
4. Huang Y, Fan XG, Wang ZM, Zhou JH, Tian XF, Li N. Identification of *Helicobacter* species in human liver samples from patients with primary hepatocellular carcinoma. *J Clin Pathol.* 2004; 57(12):1273–7.
5. Pellicano R, Menard A, Rizzetto M, Megraud F. *Helicobacter* species and liver diseases: association or causation? *Lancet Infect Dis.* 2008; 8(4):254–60.
6. Taylor NS, Fox JG, Yan L. In-vitro hepatotoxic factor in *Helicobacter hepaticus*, *H. pylori* and other *Helicobacter* species. *J Med Microbiol.* 1995; 42(1):48–52.
7. Fukuda Y, Bamba H, Okui M, Tamura K, Tanida N, Satomi M, et al. *Helicobacter pylori* infection increases mucosal permeability of the stomach and intestine. *Digestion.* 2001; 63 Suppl 1:93–6.
8. Gunji T, Matsuhashi N, Sato H, Fujibayashi K, Okumura M, Sasabe N, et al. *Helicobacter pylori* infection is significantly associated with metabolic syndrome in the Japanese population. *Am J Gastroenterol.* 2008; 103(12):3005–10.

9. Gunji T, Matsubashi N, Sato H, Fujibayashi K, Okumura M, Sasabe N, et al. Helicobacter pylori infection significantly increases insulin resistance in the asymptomatic Japanese population. *Helicobacter*. 2009; 14(5):144–50.
10. Nwokolo CU, Freshwater DA, O'Hare P, Randeva HS. Plasma ghrelin following cure of Helicobacter pylori. *Gut*. 2003; 52(5):637–40.
11. Wu MS, Lee WJ, Wang HH, Huang SP, Lin JT. A case-control study of association of Helicobacter pylori infection with morbid obesity in Taiwan. *Arch Intern Med*. 2005; 165(13):1552–5.
12. Pratt DS, Kaplan MM. Evaluation of abnormal liver-enzyme results in asymptomatic patients. *N Engl J Med*. 2000; 342(17):1266–1271.
13. Krier M, Ahmed A. The asymptomatic outpatient with abnormal liver function tests. *Clin Liver Dis*. 2009; 13(2):167–177.
14. Kotronen A, Peltonen M, Hakkarainen A, Sevastianova K, Bergholm R, Johansson LM, et al. Prediction of non-alcoholic fatty liver disease and liver fat using metabolic and genetic factors. *Gastroenterology*. 2009; 137(3):865–72.
15. Fan JG, Jia JD, Li YM, Wang BY, Lu LG, Shi JP, et al. Guidelines for the diagnosis and management of nonalcoholic fatty liver disease: update 2010: (published in Chinese on Chinese Journal of Hepatology 2010; 18:163-166). *J Dig Dis*. 2011; 12(1):38–44.
16. Suzuki A, Binks M, Sha R, Wachholtz A, Eisenson H, Diehl AM. Serum aminotransferase changes with significant weight loss: sex and age effects. *Metabolism*. 2010; 59(2):177–85.
17. Fakheri H, Malekzadeh R, Merat S, Khatibian M, Fazel A, Alizadeh BZ, et al. Clarithromycin vs. furazolidone in quadruple therapy regimens for the treatment of Helicobacter pylori in a population with a high metronidazole resistance rate. *Aliment Pharmacol Ther*. 2001; 15(3):411–6.
18. Razavizade M, Jamali R, Arj A, Talari H. Serum parameters predict the severity of ultrasonographic findings in non-alcoholic fatty liver disease. *Hepatobiliary Pancreat Dis Int*. 2012; 11(5):513–20.
19. Jonaitis LV, Kiudelis G, Kupcinskas L. Evaluation of a novel <sup>14</sup>C-urea breath test "Heliprobe" in diagnosis of Helicobacter pylori infection. *Medicina (Kaunas)*. 2007; 43(1):32–5.
20. Romero-Corral A, Somers VK, Sierra-Johnson J, Thomas RJ, Collazo-Clavell ML, Korinek J, et al. Accuracy of body mass index in diagnosing obesity in the adult general population. *Int J Obes (Lond)* 2008; 32:959–66.
21. Wallace TM, Levy JC, Matthews DR. Use and abuse of HOMA modeling. *Diabetes Care*. 2004; 27(6):1487–95.
22. Dogan Z, Filik L, Ergul B, Sarikaya M, Akbal E. Association between Helicobacter pylori and liver-to-spleen ratio: a randomized-controlled single-blind study. *Eur J Gastroenterol Hepatol*. 2013; 25(1):107–10.
23. Ponzetto A, Pellicano R, Leone N, Cutufia MA, Turrini F, Grigioni WF, et al. Helicobacter infection and cirrhosis in hepatitis C virus carriage: is it an innocent bystander or a troublemaker? *Med Hypotheses*. 2000; 54(2):275–7.
24. Leone N, Pellicano R, Brunello F, Cutufia MA, Berrutti M, Fagoonee S, et al. Helicobacter pylori seroprevalence in patients with cirrhosis of the liver and hepatocellular carcinoma. *Cancer Detect Prev*. 2003; 27(6):494–7.
25. Takuma Y. [Helicobacter pylori infection and liver diseases]. *Gan to Kagaku Ryoho*. 2011; 38(3):362–4.
26. Polyzos SA, Kountouras J, Papatheodorou A, Patsiaoura K, Katsiki E, Zafeiriadou E, et al. Helicobacter pylori infection in patients with nonalcoholic fatty liver disease. *Metabolism*. 2013; 62(1):121–6.
27. Aller R, De Luis DA, Izaola O, Conde R, Gonzalez Sagrado M, Primo D, et al. Effect of a probiotic on liver aminotransferases in nonalcoholic fatty liver disease patients: a double blind randomized clinical trial. *Eur Rev Med Pharmacol Sci*. 2011; 15(9):1090–5.
28. Solga SF, Diehl AM. Non-alcoholic fatty liver disease: lumen-liver interactions and possible role for probiotics. *J Hepatol*. 2003; 38(5):681–7.
29. Promrat K, Kleiner DE, Niemeier HM, Jackvony E, Kearns M, Wands JR, et al. Randomized controlled trial testing the effects of weight loss on nonalcoholic steatohepatitis. *Hepatology*. 2010; 51(1):121–9.
30. Dumas ME, Barton RH, Toye A, Cloarec O, Blancher C, Rothwell A, et al. Metabolic profiling reveals a contribution of gut microbiota to fatty liver phenotype in insulin-resistant mice. *Proc Natl Acad Sci U S A*. 2006; 103(33):12511–6.



### RESEARCH ARTICLE

#### INFECTION CONTROL KNOWLEDGE AND PRACTICES AMONG MEDICAL AND DENTAL INTERNS AT TAIBAH UNIVERSITY, SAUDI ARABIA, 2016

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#### Abstract

**Background:** Healthcare workers such as medical interns are at high risk of infection. Strict compliance is considered as an efficient way to reduce and control hospital acquired infections. Also, it minimizes infection transmission between patients as well as healthcare workers.

**Objectives:** To assess the knowledge and practices of medical and dental interns about the standard precautions of infection control.

**Methodology:** A cross sectional study was carried out among medical and dental interns from Taibah University, Saudi Arabia. A simple random sample of 102 interns participated in the study; 83 of them were medical interns and 19 were dental interns. A valid and reliable data collection tool was used through an electronic self-administered questionnaire. Afterwards, the data analysis was done using SPSS program version 22. Ethical approval was issued by the Taibah University IRB committee.

**Results:** In this study, we had a (63%) response rate. Most of the interns (50%) had a satisfactory level of knowledge about the standard methods of infection control. However, (93%) of the interns displayed insufficient knowledge regarding the necessity in wearing surgical gloves while providing medical care to patients with AIDS. Our findings also showed that the greatest source of knowledge was from senior doctors (61%). In the practice scale, (73%) of the interns had competent practice even though (54%) of them reported that they recapped needles after using them.

**Conclusion:** The majority of medical and dental interns had satisfactory knowledge and competent practice about infection control, and they mainly learned and acquired from their doctors.

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#### Introduction:-

Standard precautions are designed to minimize the risk of acquiring occupational infections in clinical centers. These infections could be gained from both expected and unexpected sources (1). As a result, healthcare workers such as medical interns are at a high risk of infections. Another reason why they need to be cautious is that they are the first responder to undiagnosed infectious cases (2).

Strict compliance of healthcare workers to infection control standard precautions prevent and control infections acquired in hospitals. Also it prevents the transfer of any infection between patients and healthcare workers (3)(4). Standard precautions also aim to prevent the transmission of infections from known and unknown sources and assist maintaining basic levels of patient safety and health care providers.

Previous studies on health science students and medical students found that the general knowledge and compliance of standard precaution were insufficient, especially in hand hygiene, sharp management, and individual protective equipment (5)(6).

A cross-sectional study carried out in Kuwait University found the prevalence of weak knowledge of standard infection control was 38.2% and that of poor practice was 27.7% (5)(7). The cause of the poor knowledge and compliance of interns to simple essential behaviors is inadequate guidelines and recommendations of standard precautions (6). Another cross-sectional study was also conducted in King Faisal University, Saudi Arabia. The research found that 80% of medical interns need to improve their expertise on infection control (6).

The aim of our study is to assess the knowledge and practices of medical and dental interns at Taibah University, Saudi Arabia about standard precautions of infection control.

**Objectives:-**

1. To assess the knowledge and sources of information of infection control precautions among medical students.
2. To evaluate the practice of infection control precautions among medical and dental intern.

**Methodology:-****Setting and Design:-**

A cross-sectional study design at Taibah University, Saudi Arabia. The duration of data collection was from July/2016 to September/2016.

**Subjects:-**

The data of all medical and dental interns, both of which were males and females, at Taibah University were collected. Interns or students from other fields such as nursing, pharmacy, and other applied medical sciences colleges were not included in our study.

**Data Collection:-**

A valid and reliable data collection tool was used through an electronic English version of a self-administered questionnaire. We also utilized a scale to assess the knowledge and practice of infection control. The knowledge scale was categorized into excellent, satisfactory, and poor. Those who gained from 15 to 18 considered as excellent, those who gained from 10 to 15 considered as satisfactory and those who gained below 10 considered as poor. The practice scale was classified into competent, weak, and unsafe. Interns who got from 65 to 90 have competent practice, while who got 49 to 64 have weak practice, lastly having a score from 16 to 48 considered as unsafe practice. The categorization was done to elicit the interpretation of data and ease the comparison between varieties of groups (8).

**Questionnaire Administration:-**

The questionnaire was given to each intern who had an informed consent of the right of not participating in the survey and the confidentiality of the process to take part in the study.

**Data Analysis:-**

The collected data were analyzed using Statistical Package for Social Sciences (SPSS) version 22. Any result with a p-value of <0.05 was considered statistically significant for the purpose of this study.

**Ethical Approval:-**

Ethical approval was issued by the Taibah University IRB committee, with acceptance number; 143799859, 31/5/2016.

### Results:-

Some of the medical interns, who had a background about standard precautions, were gleaned either by doctors at the hospital or by the hospital itself through providing a bedside liable and from the media as well. When the interns were students, their syllabus had no course devoted to teaching or training of infection-control management and standard precautions.

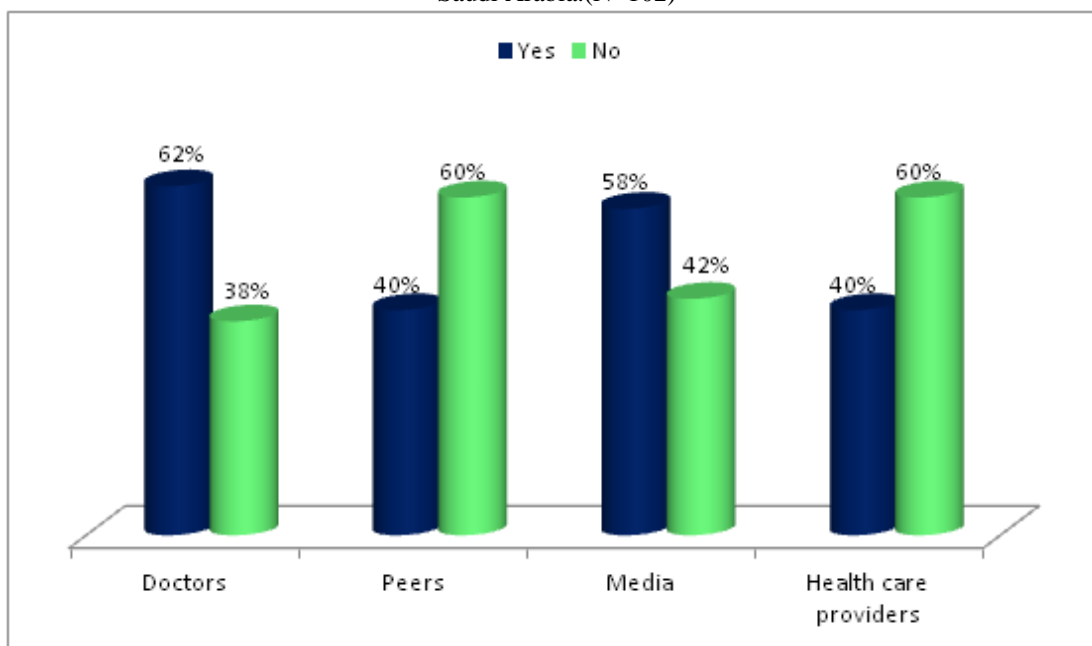
The total number of the interns (both genders) who participated in this survey, were 122 medical interns and 40 dental interns and the response rate was (63%). Among the respondents, (81%) of the participants were medical interns and (19%) were dental interns. Overall, the majority of interns (75%) studied infection-control practices in the university, while a few of them (26%) took part in previous extra courses on infection-control practice. (**Table.1**)

**Table.1:-** Distribution of socio-demographic characteristics of participants among medical and dental interns at Taibah University, Saudi Arabia.

(N=102)	N (%)
<b>Age</b> mean±SD	24±0.667
<b>Gender</b> Female Male	50 (49%) 52 (51%)
<b>Profession</b> Medical interns Dental interns	83 (81%) 19 (19%)
<b>When did you have hepatitis B virus vaccine?</b> Before your undergraduate clinical training years During your undergraduate clinical training years Just before your internship training Never had it	29 (28%) 21 (21%) 12 (12%) 40 (39%)
<b>Did you study infection- control practices during your undergraduate university studies?</b> Yes No	76 (75%) 26 (25%)
<b>Does your hospital/training centers provide formal bedside training about infection control (proper hand hygiene, using PPE, etc.)?</b> Yes No Yes but not sufficient	46 (45%) 26 (26%) 30 (29%)
<b>Did you have any previous extra courses about infection - control practices?</b> Yes No	26 (26%) 76 (74%)

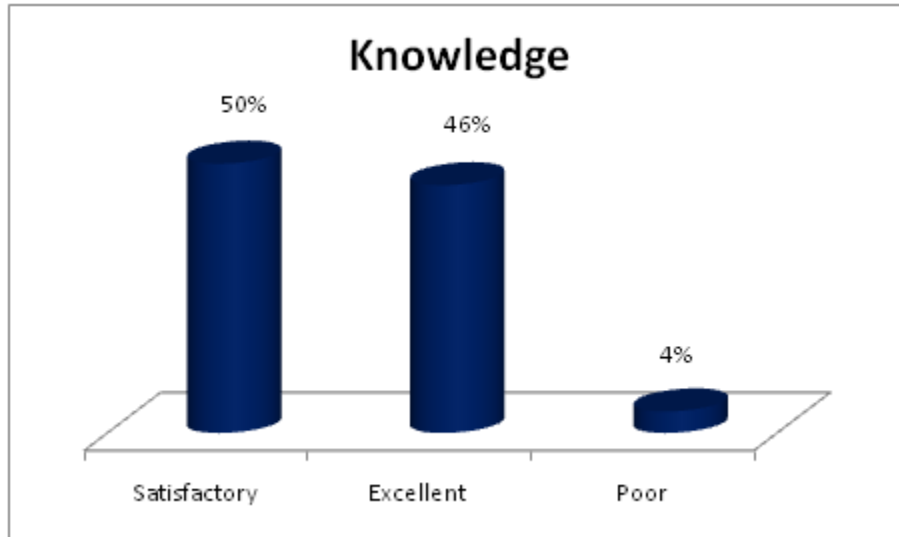
Regarding the source of learning infection-control practices, the highest reference (62%) was from doctors. Also, (58%) of the participants claimed that they obtained this knowledge from the media (YouTube, TV, books, etc.), and (60%) think that they did not learn about infection control from their peers nor from healthcare providers (**Fig. 1**).

**Figure 1:-** Source of learning practice of infection control among medical and dental interns at Taibah University, Saudi Arabia.(N=102)

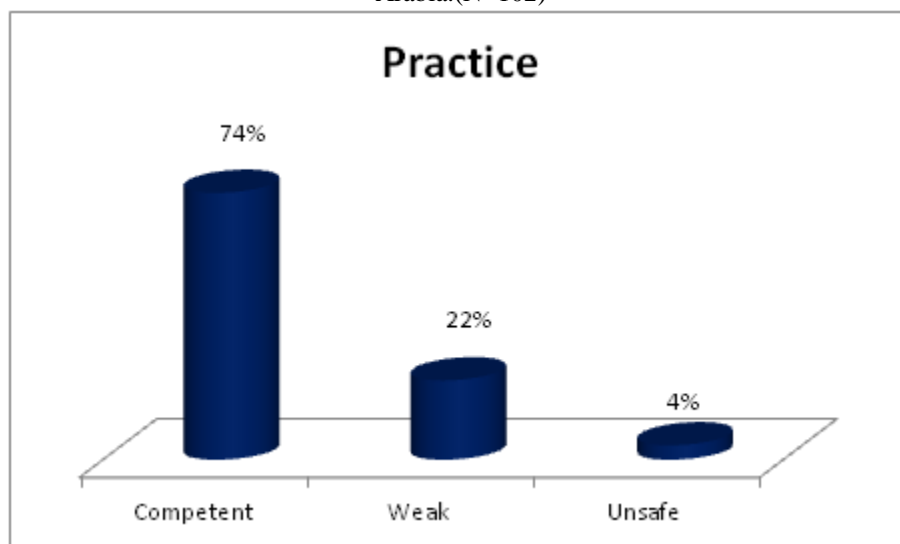


In the knowledge scale, we found that most of interns had satisfactory knowledge and that a few had excellent and poor knowledge. (**Fig. 2**).

**Figure 2:-** Assessment of knowledge scale among medical and dental interns at Taibah University, Saudi Arabia.(N=102)



In the practice scale, we found that vast majority of participants had competent practice and that a few of them had weak and unsafe practice. (**Fig. 3**)

**Figure 3:-** Assessment of practice scale among medical and dental interns at Taibah University, Saudi Arabia.(N=102)

For more details about knowledge of interns about infection-control practice, (93%) of them thought that there was no need to wear surgical gloves in all caring procedures provided to patients suffering from AIDS. As sweat and tears are non-infectious, we thought that we did not need standard precautions against them in this research. However, in our study, most of the interns mentioned that health care providers should take standard precaution against sweat (77%) and tears (73%). (**Table 2**)

**Table 2:-** Infection-control knowledge among medical and dental interns at Taibah University, Saudi Arabia.

(N=102)	Right answers N ( % )	Wrong answers N ( % )
Needles used for medication preparation or injecting patients should be discarded in the sharp box.	99 (97%)	3 (3%)
Spots of blood spilled from the patient must be cleaned using sterilizing agent dedicated for this purpose.	86 (84%)	16 (16%)
Facial mask and eye protection is not necessary if the necessary procedure for the patient may cause volatility or spill a patient's blood or body fluids.	94 (92%)	8 (8%)
Standard precautions should be applied to all patients regardless of the presence or absence of the source of the infection.	94 (92%)	8 (8%)
Wearing surgical gloves is necessary in all caring procedures provided to patients suffering from AIDS.	7 (7%)	95 (93%)
Standard Precautions are applied only to patients suffering from AIDS or hepatitis.	83 (81%)	19 (19%)
Standard precautions should be applied in cases in which there is a contact with the patient's sweat.	24 (23%)	78 (77%)
Standard precautions should be applied in cases in which there is a contact with the patient's tears.	28 (27%)	74 (73%)
Standard precautions should be applied in cases in which there is a contact with the patient's saliva or mouth secretions.	88 (86%)	14 (14%)
Standard precautions should be applied in cases in which there is a contact with the patient's vaginal secretions.	99 (97%)	3 (3%)
Standard precautions should be applied in cases in which there is a contact with the patient's urine or stool.	92 (90%)	10 (10%)
It is a must to use/wear the face mask when entering rooms for patients with chickenpox and measles.	84 (82%)	18 (18%)
Patients with illnesses spread by droplets or spray must wear the facemask throughout	94 (92%)	8 (8%)



the process of transferring them transferred from one ward to another.		
It is necessary to use isolation gown when entering rooms of patients who need contact precautions.	98 (96%)	4 (4%)
Patients with diseases spread by droplets or spray should not be isolated in private rooms.	84 (82%)	18 (18%)
Patients who are in need of using contact precautions should be isolated in private rooms.	77 (75%)	25 (25%)
Tools of patients who need contact precautions should not be used or shared with other patients.	96 (94%)	6 (6%)
Double surgical gloving is necessary when performing procedures or nursing care for patients with diseases spread by blood contact such as AIDS or hepatitis-B.	84 (82%)	18 (18%)

As for the assessment of infection control-practices, we found that (54%) of the interns recapped the needle after using it, a practice that can cause it to prick. (**Table 3**).

**Table 3:-** Assessment of infection-control practices among medical and dental interns at Taibah University, Saudi Arabia.

(N=102)	Always N (%)	Most of the times N (%)	Sometimes N (%)	Rare N (%)	Never N (%)
I put the used needles and surgical blades in the pot allocated for this purpose.	66(65%)	21(20%)	8(8%)	0(0%)	7(7%)
I wash my hands before providing nursing care to patients.	57(56%)	2(21%)	17(17%)	4(4%)	2(2%)
I wash my hands before doing nursing care even if they were not direct contact with the patient's blood or body fluids (for example, preparing medications).	35(34%)	25(24%)	20(20%)	14(14%)	8(8%)
I wear sterile surgical gloves when touching blood or body fluids or internal mucosa or in cases of wounds in the skin.	63(62%)	19(18%)	9(9%)	4(4%)	7(7%)
I wear non-surgical gloves when performing nursing care that may result in direct contact with the patient's blood or body fluids.	61(60%)	21(20%)	11(11%)	2(2%)	7(7%)
I cover my wounds with a cover that is impermeable to water before providing care to patients.	51(50%)	17(17%)	22(21%)	7(7%)	5(5%)
I wash my hands immediately after removing medical gloves.	57(56%)	24 (23%)	14(14%)	3(3%)	4(4%)
I change the on-surgical medical gloves when I move from one patient to another.	84(82%)	13(13%)	3(3%)	1(1%)	1(1%)
I wash my hands after providing nursing care to a patient.	70(69%)	24(23%)	4(4%)	3(3%)	1(1%)
I remove tools and objects contaminated with blood in a medical waste bag, regardless of the presence of the source of the infection.	76(74%)	14(14%)	8(8%)	3(3%)	1(1%)
I clean tools that have stains of blood on them, with disinfectants.	65(55%)	13(12%)	12(12%)	6(6%)	15(15%)
I clean surfaces and tools used for patient care after the completion of the care.	44(44%)	18(18%)	16(16%)	7(7%)	15(15%)
I wear facemask when there is a possibility of a leakage or spillage of any body fluids from the patient.	70(69%)	21(20%)	7(7%)	2(2%)	2(2%)
I wear protective apron when there is a likelihood of exposure to the patient's blood or body fluids.	58(57%)	22(21%)	15(15%)	4(4%)	3(3%)
I perform needle recapping after giving the patient injection or using the needle.	55(54%)	22(21%)	9(9%)	4(4%)	12(12%)
I wear eye protective tool when there is a possibility of	42(41%)	22(21%)	12(12%)	13(13%)	13(13%)

a leakage or spillage of any body fluids from the patient.					
I empty the sharp container when it becomes completely full.	33(32%)	24(24%)	11(11%)	3(3%)	31(30%)

In our study, interns who learn from their senior doctors had excellent to satisfactory knowledge (59%) more than interns who didn't learn from them (37%) but the difference were non-significance ( $p=.681$ ). (**Table 4**).

In the other hand, interns who did not learn from their peers had excellent to satisfactory knowledge (57%) more than interns who learn from them (39%) but the difference were non-significance ( $p=.137$ ). (**Table 4**).

**Table 4:-** Impact of source of knowledge on medical and dental interns background regarding infection-control at Taibah University, Saudi Arabia.

(N=102)		Excellent N (%)	Satisfactory N (%)	Poor N (%)	p-value**
learn infection control practices from your doctors	YES	31 (30%)	30 (29%)	2 (2%)	.681
	NO	16 (16%)	21 (21%)	2 (2%)	
learn infection control practices from your peers	YES	14 (14%)	25 (25%)	2 (2%)	.137
	NO	33 (32%)	26 (25%)	2 (2%)	
learn infection control practices from media	YES	26 (25%)	31 (30%)	2 (2%)	.817
	NO	21 (21%)	20 (20%)	2 (2%)	
learn infection control practices from Health care providers	YES	17 (17%)	23 (22%)	1 (1%)	.540
	NO	30 (29%)	28 (28%)	3 (3%)	

\*\* Likelihood Ratio \* Level of significance at  $<0.05$  (chi-square test was used)

In our study, interns who learn from their senior doctors had competent practices (48%) more than interns who didn't learn from them (25%) but the difference were non-significance ( $p=.234$ ). (**Table 5**)

In the other hand, interns who did not learn from their peers had weak to unsafe practices (21%) more than interns who learn from them (6%) but the difference were non-significance ( $p=.073$ ). (**Table 5**).

**Table 5:-** Impact of source of knowledge on medical and dental interns practices regarding infection-control at Taibah University, Saudi Arabia.

(N=102)		competent N (%)	weak N (%)	Unsafe practice N (%)	P value **
learn infection control practices from your doctors	YES	49 (48%)	13 (13%)	1 (1%)	.234
	NO	26 (25%)	10 (10%)	3 (3%)	
learn infection control practices from your peers	YES	35 (34%)	5 (5%)	1 (1%)	.073
	NO	40 (39%)	18 (18%)	3 (3%)	
learn infection control practices from media	YES	45 (44%)	11 (11%)	3 (3%)	.452
	NO	30 (29%)	12 (12%)	1 (1%)	
learn infection control practices from Health care providers	YES	32 (31%)	8 (8%)	1 (1%)	.643
	NO	43 (42%)	15 (15%)	3 (3%)	

\*\* Likelihood Ratio \* Level of significance at  $<0.05$  (chi-square test was used)

## Discussion:-

The purpose of this study was to assess the knowledge and practice of infection control among medical and dental interns depending on many variables. We found in this study that the knowledge of infection control was satisfactory by (50%) unlike a study conducted in the king Faisal University in which (80%) of the participants needed to improve their knowledge of infection control (6).

In this study, (92%) of the interns recognized the importance of applying standard precautions to all patients regardless of the presence or absence of the source of the infection. This performance was higher than that in the King Faisal University in which only (41.8%) recognized that all patients were sources of infections (6).

About the knowledge of applying standard precautions to all body fluid as a source of infections, there were some variations between (23%) of the interns recognized to apply standard precautions to patient's sweat and (27%) to patient's tears. This appears to be the difference compared to the previous study in which (31.9%) of them recognized that all body fluids except sweat were sources of infections (6).

Many previous studies reported that students' attitudes toward infection-control practice were influenced by their senior doctors (9) (10). This finding corresponded with our results, which showed that the major source of learning infection-control practices was from the doctor's (62%) In other words, there was an increase in the responsibility of the doctors about practicing infection-control precaution at bedside.

The present study showed that (58%) of the interns learned about infection control from the media (YouTube, TV, book, etc.). This result is quite similar to that of a previous study in which self-learning and informal bedside clinical practices were the main sources of knowledge of infection control, especially about dealing with sharp injuries (11).

Overall in this study, we found that (74%) of the interns are competent in their practices, (22%) have weak practice, which is a similar outcome to a study done in the Kuwait university where they had a (27.7%) prevalence of poor practice (7).

Washing hands before and after patient contact is important. Still in our study only (56%) of the interns, wash their hands before patient contact, while (69%) wash afterwards. While in other studies, the overall frequency of hand washing before patient contact was (6.7%), and (23.7%) after (12). Another study in India reported that hand hygiene compliance by Healthcare Workers was less than (50%) (13).

When touching blood, body fluids, internal mucosa or in cases of wounds in the skin we found that (62%) of our interns wear sterile surgical gloves, while (60%) wear non-surgical gloves. This is found to be less than other studies, that had (75.5%) of respondents that reported to adhere to wearing gloves while performing procedures (11). A study in Uganda had (83.25%) of the respondents who always use gloves when drawing blood or placing cannulas (14). On the other hand, a study done on Healthcare workers had lesser results than ours, where only (43%) have always used gloves when drawing blood (15).

According to WHO, washing hands after removing medical gloves is required for glove usage and hand hygiene (16). In concern to this practice we found that respondents in our study have, lower rate (56%) compared to another study in Nigeria that had (77%) of doctors wash their hands before and after using gloves (17). Another study also had higher results in which (61%) of their respondents reported to always wash their hands after gloves usage (15).

In this study, (69%) of intern's wear face mask when there is a possibility of spitting out or spillage of any body fluids from the patient. This is a higher result in comparison to a previous study that had (50%) of doctors that wears cap and mask before invasive procedures (16).

Needle recapping after usage and giving injections is a behavior that increasing the risk of needle stick injury and infected by blood borne diseases. We found (54%) of the interns in our study a higher result in comparison to other studies, where in Nigeria only (31.3%) of the doctors perform it (16), and (44%) in a study at Uganda.

### **Conclusion:-**

The present study showed that the majority of medical and dental interns had satisfactory knowledge about infection control. Moreover, most of them learned infection-control practice from their senior doctors.

### **Limitation of the Study:-**

We used in this study a self-administered questionnaire to measure the practice. This method is not the best method, as it does not provide clear picture about it. Another limitation was low response rate (63%) especially among the dental interns (47%).

### **Recommendation:-**

We recommend that stakeholders in the medical profession should update their medical curricula by focusing and brainstorming on topics that would minimize the high risk of infections to which interns and patients are susceptible.

They should also use educational seminars, workshops, pamphlet and posters in universities and hospitals to educate doctors, nurses, and other medical professionals about infection control.

### Reference:-

1. Siegel JD, Rhinehart E, Jackson M, Chiarello L. 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Health Care Settings. *Am J Infect Control* [Internet]. 2007 Dec [cited 2015 Jan 11];35(10 Suppl 2):S65-164.
2. Askarian M, Honarvar B, Tabatabaee HR, Assadian O. Knowledge, practice and attitude towards standard isolation precautions in Iranian medical students. *J Hosp Infect*. 2004;58(4):292–6.
3. Phillips G, Ker J. Champion students! Experience with a standardized infection control training package in medical students. *J Hosp Infect* [Internet]. 2006 Apr [cited 2016 Jun 1];62(4):518–9.
4. Ayub A, Goyal A, Kotwal A, Kulkarni A, Kotwal A, Mahen A. Infection control practices in health care: Teaching and learning requirements of medical undergraduates. *Med journal, Armed Forces India* [Internet]. 2013 Apr [cited 2016 Jun 1];69(2):107–12.
5. Ojulong J, Mitonga KH, Iipinge SN. Knowledge and attitudes of infection prevention and control among health sciences students at University of Namibia. *Afr Health Sci* [Internet]. 2013 Dec [cited 2016 Apr 21];13(4):1071–8.
6. Amin TT, Al Noaim KI, Bu Saad MA, Al Malhm TA, Al Mulhim AA, Al Awas MA. Standard precautions and infection control, medical students' knowledge and behavior at a Saudi university: the need for change. *Glob J Health Sci* [Internet]. 2013 Jul [cited 2016 May 29];5(4):114–25.
7. Karim J, Al-Saraji M, Al-Mousawi F, Al-Haddad Z, Al-Sharaf D, Marwan Y, et al. Knowledge and self-reported practice of universal precautions among Kuwait University medical students in their clinical years. *Med Princ Pract* [Internet]. Karger Publishers; 2012 Jan 13 [cited 2016 May 29];21(4):328–33.
8. AL-Rawajfah OM, Tubaishat A. Nursing students' knowledge and practices of standard precautions: A Jordanian web-based survey. *Nurse Educ Today* [Internet]. Elsevier B.V.; 2015;35(12):1175–80.
9. Mann CM, Wood A. How much do medical students know about infection control? *J Hosp Infect* [Internet]. 2006 Dec [cited 2017 Jan 2];64(4):366–70.
10. Koenig S, Chu J. Senior medical students' knowledge of universal precautions. *Acad Med* [Internet]. 1993 May [cited 2017 Jan 2];68(5):372–4.
11. Amin TT, Al Noaim KI, Bu Saad MA, Al Malhm TA, Al Mulhim AA, Al Awas MA. Standard precautions and infection control, medical students' knowledge and behavior at a Saudi university: the need for change. *Glob J Health Sci* [Internet]. Canadian Center of Science and Education; 2013 Jul 1 [cited 2016 May 29];5(4):114–25. Available from: /pmc/articles/PMC4776810/?report=abstract
12. Basurrah M, Madani T. Handwashing and gloving practice among health care workers in medical and surgical wards in a tertiary care centre in Riyadh, Saudi Arabia. *Scand J Infect Dis* [Internet]. 2006 Aug 1 [cited 2017 Jan 1];38(8):620–4.
13. Nair SS, Hanumantappa R, Hiremath SG, Siraj MA, Raghunath P. Knowledge, Attitude, and Practice of Hand Hygiene among Medical and Nursing Students at a Tertiary Health Care Centre in Raichur, India. *ISRN Prev Med* [Internet]. Hindawi Publishing Corporation; 2014 [cited 2017 Jan 1];2014:608927.
14. Kamulegeya A, Kizito AN, Balidawa H. Ugandan medical and health sciences interns' infection control knowledge and practices. *J Infect Dev Ctries* [Internet]. 2013 Oct 15 [cited 2017 Jan 1];7(10):726–33.
15. Hersey JC, Martin LS. Use of infection control guidelines by workers in healthcare facilities to prevent occupational transmission of HBV and HIV: results from a national survey. *Infect Control Hosp Epidemiol* [Internet]. 1994 Apr [cited 2017 Jan 1];15(4 Pt 1):243–52.
16. Organization, W. H. (2009). Glove Use Information Leaflet. *Patient Safety*, 1(August), 1–4.
17. Iliyasu G, Dayyab FM, Habib ZG, Tihamiyu AB, Abubakar S, Mijinyawa MS, et al. Knowledge and practices of infection control among healthcare workers in a Tertiary Referral Center in North-Western Nigeria. *Ann Afr Med* [Internet]. Medknow Publications and Media Pvt. Ltd.; 2016 [cited 2017 Jan 1];15(1):34–40.

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### RESEARCH ARTICLE

#### AWARENESS OF ANTENATAL CARE IMPORTANCE AMONG SAUDI PREGNANT WOMEN IN MADINA.

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#### Abstract

**Introduction:** Antenatal Care is care before birth and includes education, screening, counseling, treatment, monitoring and promoting the well-being of the mother and fetus. Its importance cannot be overstated for both.

**Objective:** To assess the awareness of antenatal care importance among pregnant women attending antenatal care clinics in Madina, Saudi Arabia.

**Methodology:** A cross-sectional study carried on (1617) women who attended Maternity and Children's Hospital and National Guard Hospital in Madina during the period from August to September 2016. The data were collected through face to face interview and use of questionnaire format.

**Results:** A total of 1617 women were selected in the study, 74.7% of the participant's ages were between 20-34 years old. Most of them had a university degree with percentage of 40%. 80.9% started following up at first or second trimester and 80.1% were following up their pregnancies consistently and regularly. 89.7% believed in the importance of antenatal care visits. 89% believed that the use complementary supplements during pregnancy can prevent some problems.

**Conclusion:** The education has been a great role in the interest of mothers in Antenatal care. Most of women have no diseases, and they believe that the use of complementary grain during pregnancy reduces the incidence of some of the problems related to pregnancy. More than half of women have a good awareness about knowledge of the importance of the first visit and the importance of continued follow-up in the same place.

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**Objectives: -****General objectives: -**

To assess the awareness of antenatal care importance among Saudi pregnant women attending ANC in Madina, Saudi Arabia

**Specific objectives: -**

1. To determine the role of mothers' education in antenatal care awareness.
2. To evaluate the knowledge about the importance of following up the whole period of pregnancy.
3. To assess the awareness of booking and its role in increasing the quality of care.
4. To inspect the effect of socioeconomic status on adherence to antenatal care.
5. To assess the awareness of taking specific supplements during pregnancy. e.g. folic acid.

**Introduction: -**

Antenatal Care (ANC) is “care before birth” and includes education, screening, counseling, treatment, monitoring and promoting the well-being of the mother and fetus.<sup>1</sup> ANC is based on providing women and their families appropriate advices and information which may help them to be in a good health during pregnancy, delivery, and postnatal recovery.<sup>2</sup> Also, providing mothers with appropriate supplements such as folic acid and vitamins that needed during pregnancy.<sup>3</sup> In addition, providing care of newborn, promotion of early, exclusive breastfeeding, and assistance with family planning in order to improve pregnancy outcomes. To achieve the full life-saving potential that ANC promises for women and babies, four visits providing essential evidence based interventions a package often called focused antenatal care are required. Good caring during pregnancy is so important for the health of the mother and the development of the unborn baby, it links the woman and her family with a formal health system which will increase the chance of using a skilled attendant particularly at birth and contributes to well health through the life cycle.<sup>2</sup> At any health care delivery system, Antenatal care is considered as a back bone of obstetrical services, it is substantial for health of pregnant women and it is the way in which maternal and fetal complications are determined and managed.<sup>3</sup> Roughly, a thousand mothers all around the world die daily due to pregnancy and delivery related causes,<sup>4</sup> which resemble 25% of maternal deaths according to World Health Organization. Although, maternal mortality rates in the past 25 years has decreased by about 44%, it is still considered by WHO to be intolerably immense. The vast majority of these fatalities take place in low-resource settings, and hence preventable in a great measure. This matter of concern, therefore, was a first priority in The Millenium Development Goals (MDGs) acknowledged by the international community in 2000 which obligate the medical community globally to promote maternal health as one of their recommendations.<sup>5</sup> Beside family planning, essential obstetric care, and safe delivery, antenatal care as one of the pillars of Safe Motherhood Initiative was encouraged by health providers as studies have proven that it can effectively curtail maternal morbidity and mortality.<sup>6,7</sup> Pregnant women in developed countries appreciate the role of antenatal care and they consider it full-fledged and accredited. On the other hand, its role in the perspectives of pregnant women in developing countries is debatable, thus, poor attendance is noted.<sup>3</sup> Shalash& Mohammed, 2012 stated that the vulnerability to diseases and death during pregnancy are decidedly higher among women who do not follow up in antenatal care clinics in contrast to women who do so.<sup>7</sup> Furthermore, continuity of antenatal care in reachable and high quality clinics prevent problems and lessen deaths during pregnancy.<sup>2</sup> Unsurprisingly, this would justify that developing countries have the largest share of maternal mortality which is 99%.<sup>8</sup> In our region, resolving the causes of lacking adherence to antenatal care has become an urgent demand since average number of ANC visits has dropped to the lower limit.<sup>9</sup> The reason of poor antenatal care attendance is undoubtedly multifactorial, with factors having important roles linked to health providers, pregnant women themselves, and other elements. A study was conducted to assess the ANC performance of physicians in Madina, Saudi Arabia revealed that overall performance was fair to low, which is definitely unfavorable and does not live up to WHO expectations. Faulty application of antenatal care programs, prolonged waiting time, number of facilities, dissatisfaction of women toward doctors’ attitude or their feedback, and other caregivers related dilemmas facing pregnant women indicate that antenatal care have rarely been subjected to assessment.<sup>10</sup> Regarding pregnant women, they have many variables can influence attendance including educational level, socioeconomic status, and most importantly level of awareness of antenatal care importance which considered as a key factor to determine commitment to ANC visits.<sup>11</sup> Women also can encounter various obstacles along the lines of transportation issues or that permission by the husband is not gained, a companion is not available to attend with her to the clinic, and other external troubles as might be cultural or traditional conflicts that she may face.<sup>12</sup> Al Otaiby et al., 2013 established a study that was one of the few of its kind in Riyadh, Saudi Arabia regarding awareness and recognition of antenatal care and they reported that antenatal knowledge scores were below average

with no difference regarding age or literacy level among this population.<sup>13</sup> Due to the scarcity of researches about the awareness of ANC in Saudi Arabia, we need more studies in different cities to assess the level of knowledge and awareness among pregnant women in our population in order to know to what extent should health authority raise public awareness of this issue. Our study aims to assess the awareness of antenatal care importance among Saudi pregnant women in Madina, Saudi Arabia and Find out the relationship between pregnant woman's knowledge with certain variables; age, educational level, socioeconomic status, gravidity, parity and number of prenatal care visits.

## **Methodology: -**

### **Study design: -**

This is a cross-sectional study which was conducted through a random sampling. The population was pregnant women mainly from Madina region in Saudi Arabia during August and September 2016. The aim of this study is to assess the awareness of antenatal care importance among Saudi pregnant women attending Antenatal clinics of several hospitals including MMCH and MNGH, and to explore the factors that influence antenatal care attendance. All recruited subjects of this study were actively involved in attending ANC clinics. Subjects who were too sick to participate and non-Saudi women have been excluded from the study analysis. A pre-designed structured Arabic and English languages questionnaires were used in this cross-sectional survey through face to face interview. The used questionnaires were formulated to include demographic aspects, clinical features, nutritional, medical, obstetric and psycho-social history. The questionnaires include 39 questions, discussing various aspects in the subject's socioeconomic, educational, medical and psychological life. The questionnaires' items were designed and written to suit the tradition and the Islamic culture of the Holy Madina City. The questionnaires with missing data more than 50% were excluded from the study analysis. The final study sample size was 1617 pregnant women. Approval was taken from the ethics committee at Maternity and Children Hospital in Madina, Saudi Arabia. Ethical consideration was considered to avoid physical or emotional harm in the study questionnaire. The confidentiality and privacy of the collected data were ensured through the use of anonymous questionnaire and during data entry and analysis. People were provided with information on the study aims and methods and each one of them has signed an informed consent to participate in this study.

### **Statistical analysis: -**

The collected data were analyzed using statistical analysis system (SAS). Data from the questionnaire has been entered as numerical or categorical, as appropriate. Two types of statistics have been done:

1. Descriptive statistics; where quantitative data was shown as mean  $\pm$  S.D for women in each group, and qualitative data was expressed as frequency and percent which plays the proportion of participants who are represented within each category.
2. Analytical statistics: where Chi- square test between qualitative variables. Also, unpaired women's t-test was used as a test of significance for comparison between two arithmetic means of two different groups. The level of statistical significance was defined as  $P \leq 0.05$ .

## **Results: -**

This section of the study gives descriptive analysis through the repeat tables and the diagrams for the participants' answers on all the questionnaire questions, and then it analyzes and clarifies the most important statistical analysis obtained to achieve the study objectives.

### **Population & Sample of the Study: -**

The population was all pregnant women mainly from Madina region in Saudi Arabia during August and September 2016, a random sample of (1617) woman was selected, and table (1) shows their properties according to their personal information:

**Table 1:-** The participants' personal data (n=1617).

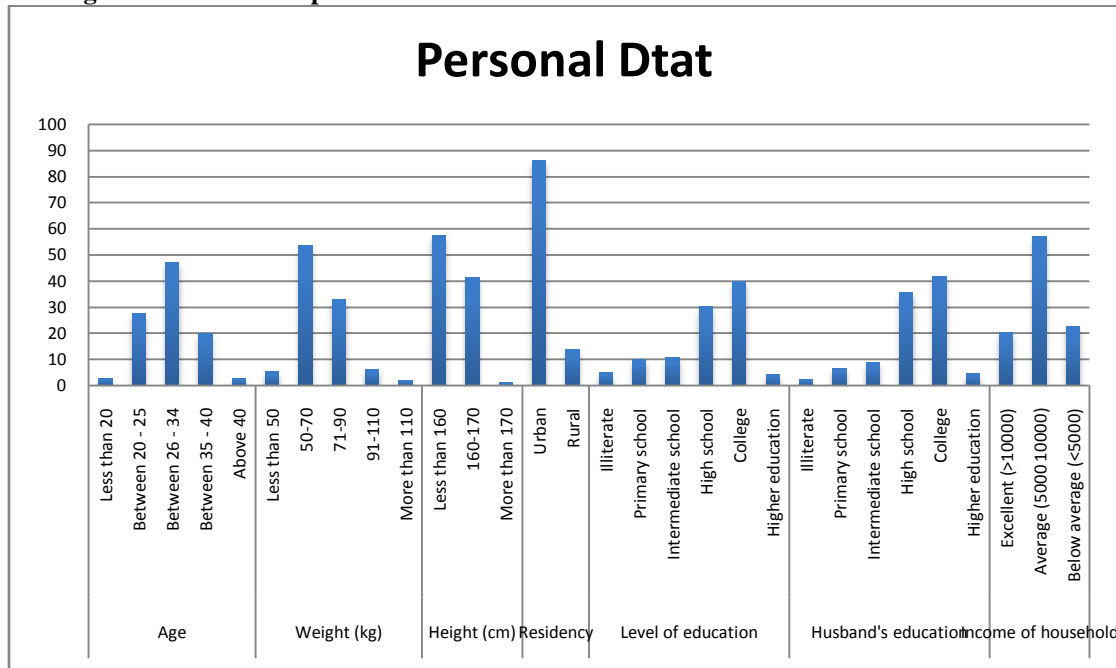
<i>Personal Data</i>		#	%	<i>P-value</i>
<i>Age</i>	Less than 20	44	2.7	0.00**
	Between 20 - 25	445	27.5	
	Between 26 - 34	764	47.2	
	Between 35 - 40	320	19.8	
	Above 40	44	2.7	
<i>Weight (kg)</i>	Less than 50	85	5.3	0.00**
	50-70	865	53.5	
	71-90	536	33.1	
	91-110	99	6.1	
	More than 110	32	2.0	
<i>Height (cm)</i>	Less than 160	926	57.3	0.00**
	160-170	671	41.5	
	More than 170	20	1.2	
<i>Residency</i>	Urban	1391	86.0	0.00**
	Rural	226	14.0	
<i>Level of education</i>	Illiterate	83	5.1	0.00**
	Primary school	160	9.9	
	Intermediate school	171	10.6	
	High school	486	30.1	
	College	647	40.0	
	Higher education	70	4.3	
<i>Husband's education</i>	Illiterate	40	2.5	0.00**
	Primary school	107	6.6	
	Intermediate school	141	8.7	
	High school	578	35.7	
	College	678	41.9	
	Higher education	73	4.5	
<i>Income of household</i>	Excellent (>10000)	331	20.5	0.00**
	Average (5000 10000)	921	57.0	
	Below average (<5000)	365	22.6	

Chi-squared test: \*Significant at 0.05 \*\*Significant at 0.01

It is clear from the previous table that 47.2% of the participants' ages were between (26-34) years old, while 27.5% of them were between (20 -25) years old, 19.8% of them were between (35 -40) years old, 2.7% of them were less than (20) years old, and the same percentage for those who were more than (40) years old. And their distribution according to their weight, 53.5% of the sample members had their weights between (50 -70) kg, while 33.1% of them had their weights between (71-90) kg. And according to their lengths the distribution was as follows, 57.3% of them were less than (160) cm long, while 41.5% were between (160- 170) cm long, and 1.2% of them were more than (170) cm long. And when the participants were asked about their residence place, 86% said that they were living in Madina, while 14% of them were living in villages. When the participants were asked about their educational level; 40% of them had university degree, while 30.1% of them high school certificates. And the distribution according to their husbands' educational levels; 41.9% of them had university degree, while 35.7% of them had secondary school certificates. And finally, their distribution according to their monthly income; 20.5% of them had their income more than (10000) riyal, while 57% of them had their income between (5000- 10000) riyal, and 22.6% of them had a monthly income less than (5000) riyal.



The next diagram concludes the previous results: -



### Analysis of Results: -

#### First: Obstetric History:-

The following table shows the participants' distribution according to their Gestational age; 36.2% of them were in the third trimester, while 8.7% of them were in the first trimester, 7.7% of them were in the second trimester, 43.4% of them had given birth to their babies, and only 4% of them weren't pregnant.

Gestational age	Frequency	Percent
First trimester (1-12)	141	8.7
Second trimester (13-26)	124	7.7
Third trimester (27-end of pregnancy)	585	36.2
Delivered	702	43.4
Not pregnant	65	4.0
Total	1617	100.0

The next table shows the participants' distribution according to the number of pregnancies; number of deliveries, and number of miscarriages; 47.8% of them have already been pregnant for (2-4) times, while 22.9% of them got already pregnant just once, 15.6% of them have already been pregnant for (5- 6) times, and 13.7% of them have already been pregnant for more than (6) times. And according to the number of deliveries; 32.9% of them delivered from 2 to 3 babies, while 23.3% of them delivered just one baby, and 16.6% of them have never delivered any baby. The participants' distribution according to the number of miscarriages; 67.4% have never miscarriage their babies, while 28.1% of them had (1- 2) miscarriages, 4.1% of them had (4- 5) miscarriages, and 0.4% of them had more than (5) miscarriages.

Variable		#	%	P-value
Gravidity	1	370	22.9	0.00**
	2- 4	773	47.8	
	5- 6	252	15.6	
	More than 6	222	13.7	
Parity	Nulliparous	269	16.6	0.00**
	Primiparous	377	23.3	
	2- 3	532	32.9	
	4- 5	265	16.4	

	More than 5	174	10.8	
Abortion	None	1090	67.4	0.00**
	1-2	454	28.1	
	3-5	67	4.1	
	More than 5	6	0.4	

Chi-squared test: \*Significant at 0.05 \*\*Significant at 0.01

The next table shows the women participants' distribution according to whether they ever had abnormal pregnancies as ectopic or cluster pregnancy; according to the ectopic pregnancy; 97.1% of them have never had this type of abnormal pregnancy, while 2.7% of them have had ectopic pregnancy once or twice, 0.2% of them had it from (3-5) times. And according to the cluster pregnancy; 99.4% of them have never had this type of abnormal pregnancy, while 0.4% % of them have had ectopic pregnancy once or twice, 0.2% of them had it from (3-5) times.

Ectopic	1570 (97.1)	43 (2.7)	4 (.2)	0.00**
Molar	1607 (99.4)	7 (.4)	3 (.2)	0.00**

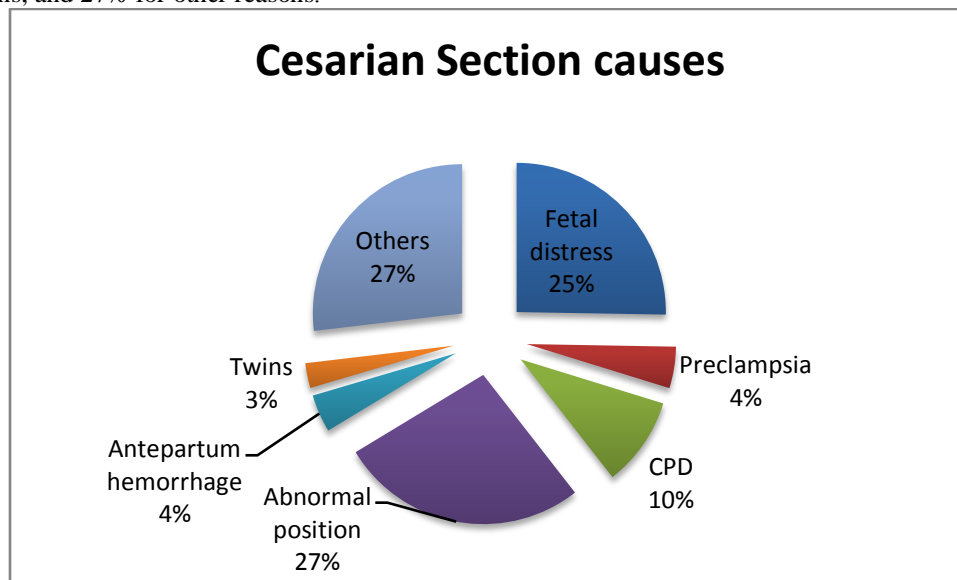
Chi-squared test: \*Significant at 0.05 \*\*Significant at 0.01

The following table shows the distribution of participants in terms of the number of times each birth is natural, assisted or cesarean. For natural childbirth 37.8% of the participants never had a natural birth while 17.2% had it once before and 23.7% had two or three natural births and a 21.2% had more than 3. The participants' distribution according to Assisted delivery it's found that 96% of the participants never used this method before while 2.7% used it once before and a 0.9% tried it two or three times and only 0.4% used it more than three times. The distribution regarding cesarean delivery, 65.5% from the participants never had a cesarean delivery while 20.3% tried it once, 11.8% tried it two or three times and 2.5% tried it more than three times.

Normal spontaneous delivery	612 (37.8)	278 (17.2)	384 (23.7)	343 (21.2)	0.00**
Assisted delivery	1552 (96.0)	44(2.7)	15(.9)	6(.4)	0.00**
Cesarean Section	1059 (65.5)	328 (20.3)	190 (11.8)	40(2.5)	0.00**

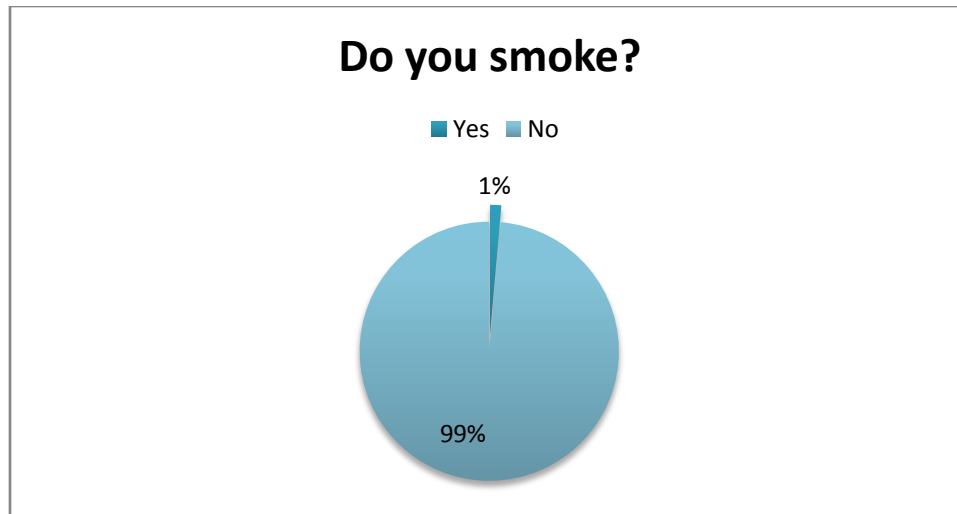
Chi-squared test: \*Significant at 0.05 \*\*Significant at 0.01

The following diagram illustrates the reasons for caesarean section for those who gave birth this way, where it's found that 27% of those who have it suffered from abnormal fetal position, and 25% the reason was fetal distress, and 10% due to CPD, and 4% due Antepartum hemorrhage, and 4% also due to Preeclampsia, and 3% due to carrying twins, and 27% for other reasons.



Second: Maternal health

The following diagram shows the distribution of the sample in terms of smoking; where we note that 99% of women were non-smokers, while only 1% smokers.



The following table shows a group of diseases of the participants.

Diabetes	108 (6.7)	1509 (93.3)	0.00**
Asthma	63 (3.9)	1554 (96.1)	0.00**
Hypertension	50 (3.1)	1567 (96.9)	0.00**
Epilepsy	3 (.2)	1614 (99.8)	0.00**
Sickle cell anemia	5 (.3)	1612 (99.7)	0.00**
Iron deficiency anemia	399 (24.7)	1218 (75.3)	0.00**
Urinary tract infection	441 (27.3)	1176 (72.7)	0.00**
Cardiac diseases	16 (1.0)	1601 (99.0)	0.00**
Systemic Lupus Erythematosus (SLE)	6 (.4)	1611 (99.6)	0.00**
Scleroderma (Systemic Sclerosis)	2 (.1)	1615 (99.9)	0.00**

Chi-squared test: \*Significant at 0.05 \*\*Significant at 0.01

It is noted from the above table that 6.7% of participants have diabetes, while 93.3% doesn't have diabetes, and 3.9% asthmatics, while the 96.1% non-asthmatics, 3.1% for patients with high blood pressure, while 96.9% were free of blood pressure, and 0.2% patients with epilepsy, while 99.8% is living without epilepsy, and 0.3% sickle-cell anemia, while 99.7% are not affected, and 24.7% of participants has iron deficiency anemia, while 75.3% of them are not diseased with it, and 27.3% people has rheumatoid urinary tract, while 72.7% is not diseased with it, and 1% of the participants diagnosed with heart disease, while 99% were free of heart disease, and 0.4% of the participants diagnosed with Systemic Lupus Erythematosus (SLE), while 99.6% are not affected, and finally, 0.1% of them are living with scleroderma, while 99.9% are not diseased by it.

### Third: Booking:-

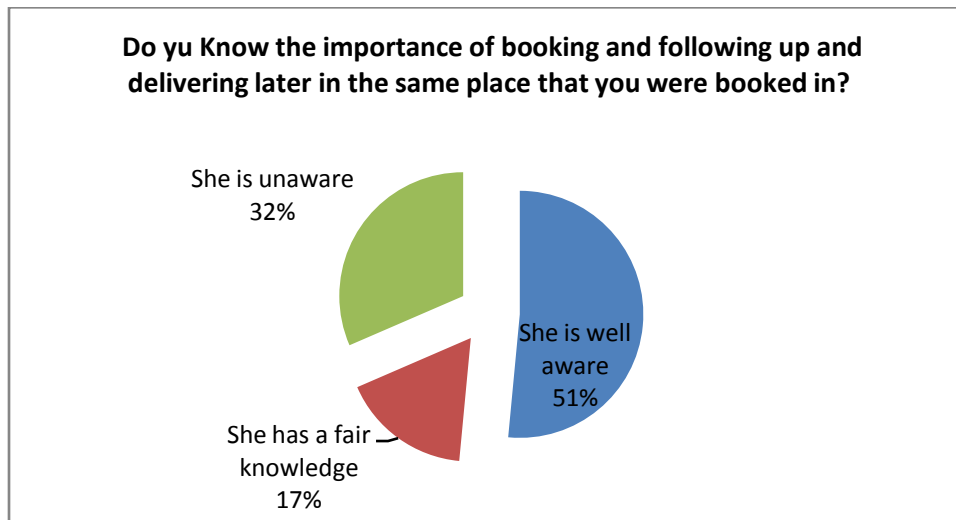
The following table shows the distribution of participants according to the month that the pregnant woman started her pregnancy follow-up with the doctor. It's noted that 80.9% of participants started their follow-up at the first or second month of pregnancy, while 13.9% they began to pursue their pregnancy follow up with the doctor in the third month to the fifth of pregnancy, and 1.1% started at the sixth or seventh month and 0.4% of them began to get there to follow up in the eighth or ninth month.

1 - 2 months	1309	80.9
3 - 5 months	225	13.9
6 - 7 months	18	1.1
8 - 9 months	7	.4
I have not had a booking appointment	58	3.6
Total	1617	100.0

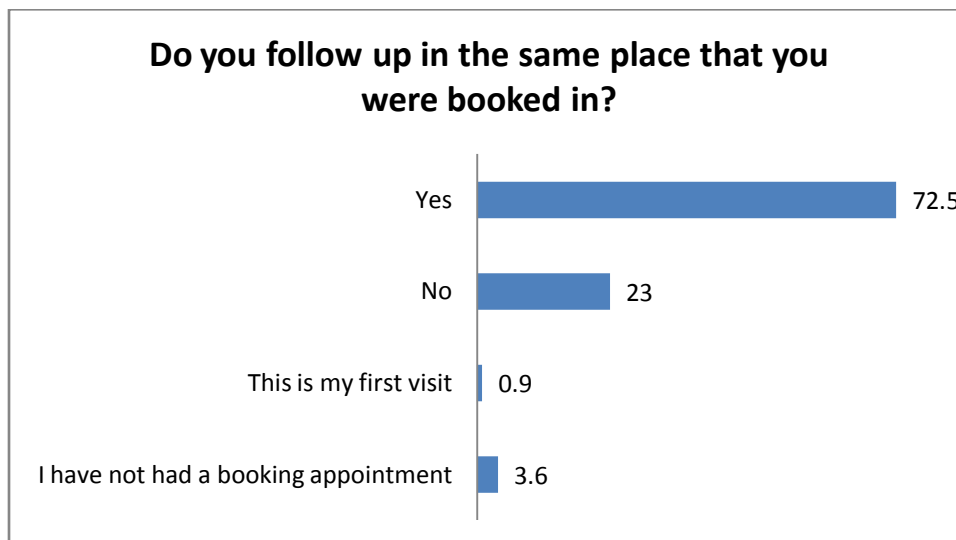
The following table shows the place of the follow-up of pregnant women; where we find that 45.9% of women go to private hospitals, while 23.6% of them to primary care centers and 16.1% of them do their follow-up in women and children's hospital, and 10.8 in other government hospitals.

MCH	260	16.1
Private hospitals	742	45.9
Other government hospitals	175	10.8
Primary health care	382	23.6
I don't follow up	58	3.6
Total	1617	100.0

The following diagram shows the ladies knowledge of the importance of the first visit and the importance of continued follow-up in the same place, It's noted in the figure that 51% of women have a good awareness of this, while 17% do not have as much awareness as needed, and 32% have no awareness at all.

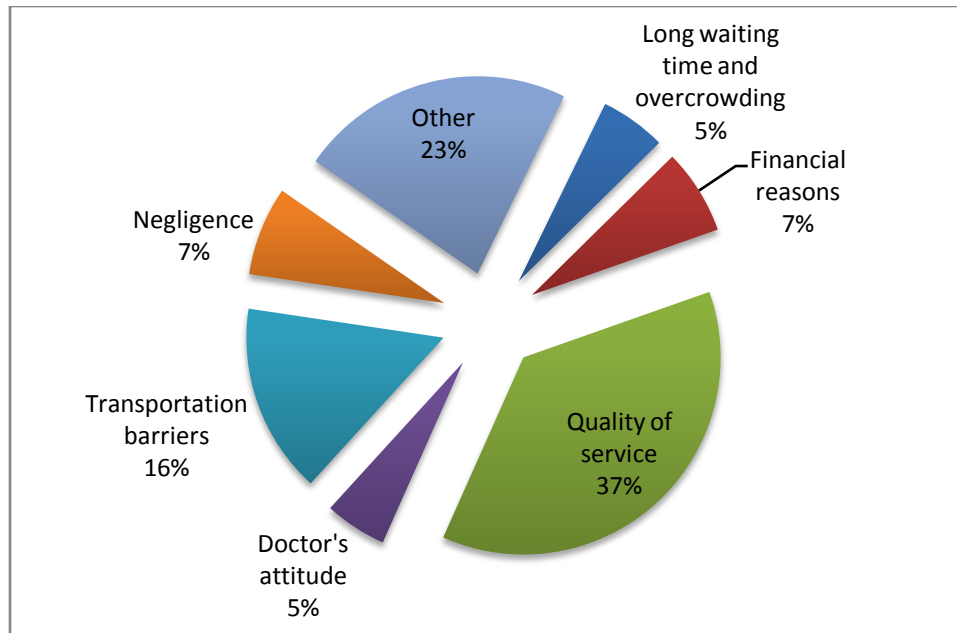


From the diagram, it concludes that 72.5% of women follow-up their pregnancy at the same place they visited at the first time, while 23% continued their follow-up elsewhere.



And when asked about the reason that some of the woman changed the first place of their pregnancy follow-ups they answered as follow, 37% of them changed the place because of the quality of services provided, and 16% changed it because of lack of transportation, and 7% for financial reasons and 7% due to negligence, and 5% because of the

long wait times and congestion, and 5% due to the attitude of the physician, and 35% change the place up for other reasons.

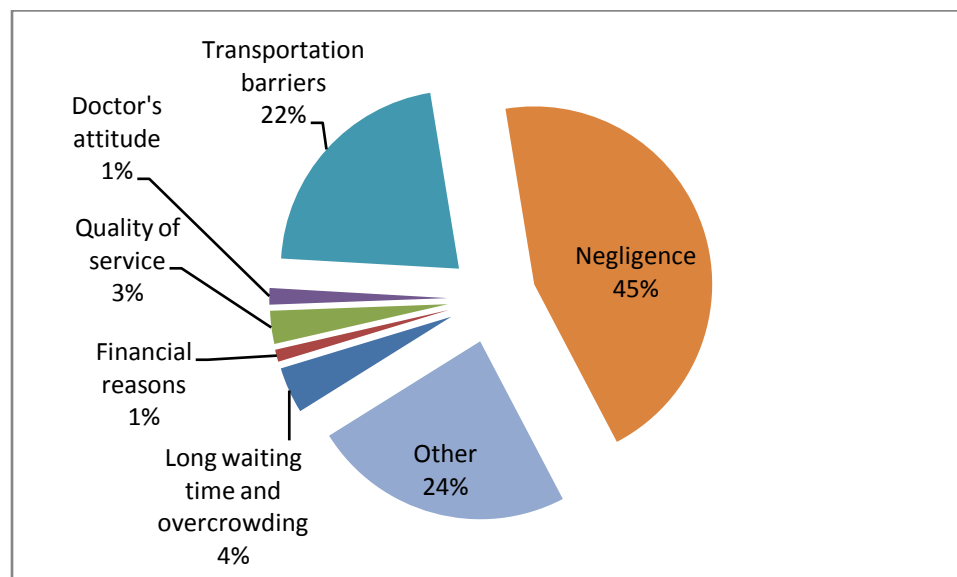


#### Fourth: ANC related questions: -

The following table shows the distribution of participants in terms of whether they are following up their pregnancies consistently and regularly, and it's noted that 80.1% are getting them consistently and regularly, while 16.4% are not.

Yes	1294	80.1
No	265	16.4
I don't follow up at all	58	3.6
Total	1617	100.0

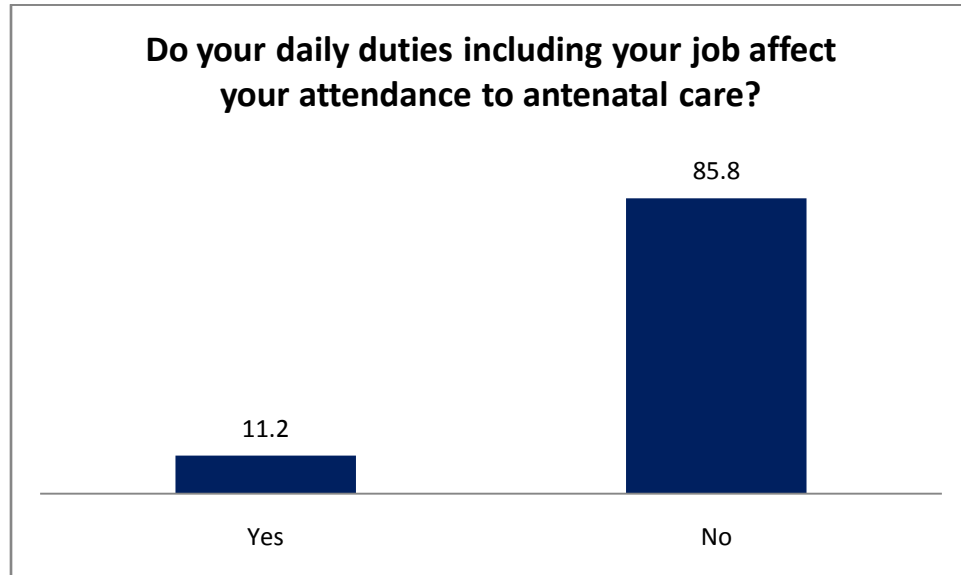
Women who don't follow their pregnancy consistently and regularly were asked about the reason and 45% of them said it was neglect, while 22% was the lack of transportation, and 4% because of the long wait times, and 3% due to the quality of services, and 22% for other reasons.



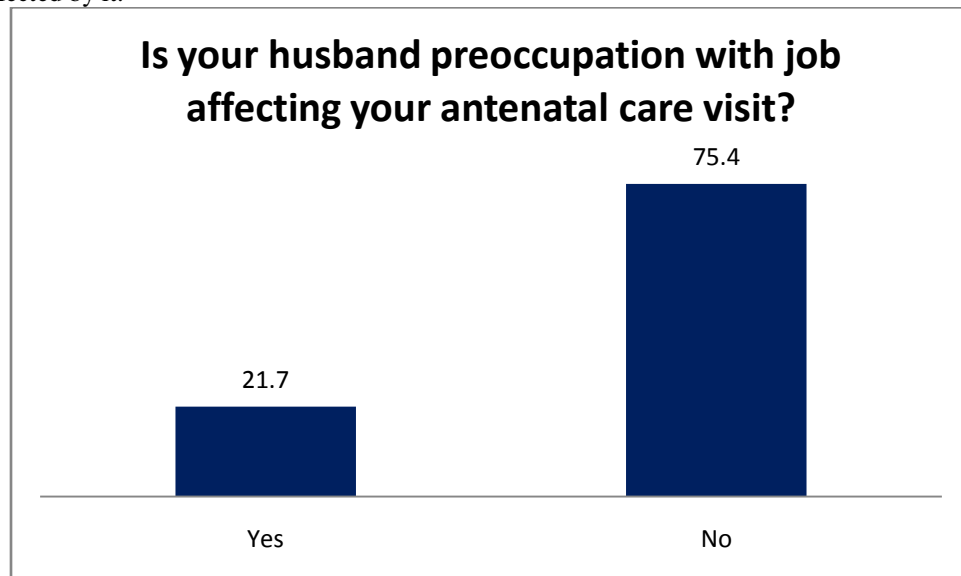
The following table shows the distribution of the sample in terms of how they believe the importance of the follow-up of pregnancy during the whole pregnancy; it's noted that that 89.7% believe in the importance of the follow-up, while 10.3% do not.

Yes	1450	89.7
No	167	10.3
Total	1617	100.0

The following figure shows the distribution of participants according to whether daily work duties affect their presence to the pregnancy follow-ups, and answered 85.8% said that work duties do not have an impact on the visits, while 11.2% of women answered that daily duties and work have an impact on their attendance to pregnancy follow-up.



The following figure shows the distribution of participants by whether the busyness of their husbands affect one way or another their attendance to prenatal care, and answered 75.4% of women are not affected by it, while 21.7% of women is affected by it.



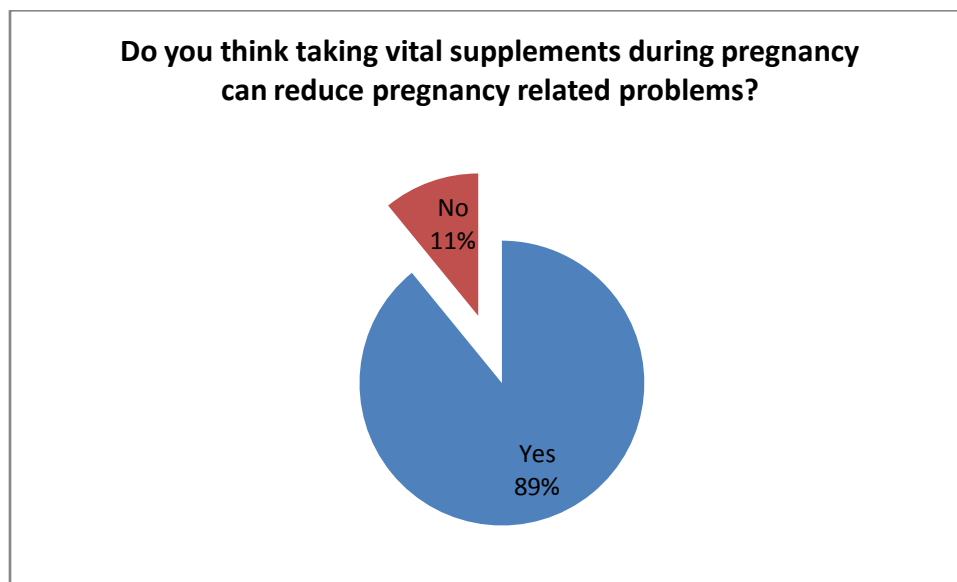
**Fifth: Supplements: -**

The following table shows some of the supplements that pregnant women uses during pregnancy, and the proportions of each of them. For folic acid, we note that 92.1% of women take it during pregnancy, and for vitamin D, we find that 38.5% of women take it, while for iron, we find that 82% of women have it during pregnancy, and for calcium, we find that 75.6% of women have it during pregnancy.

Folic acid	1490 (92.1)	127 (7.9)	0.00**
Vitamin D	622 (38.5)	995 (61.5)	0.00**
Iron supplements	1326 (82.0)	291 (18.0)	0.00**
Calcium	1223 (75.6)	394 (24.4)	0.00**

Chi-squared test: \*Significant at 0.05 \*\*Significant at 0.01

The following diagram shows the distribution of the sample in terms of the extent of their belief that the use of complementary grain during pregnancy reduces the incidence of some of the problems related to pregnancy, where we note that 89% of the participants believe so, and only 11 % of them do not believe so.

**Sixth: Satisfaction: -**

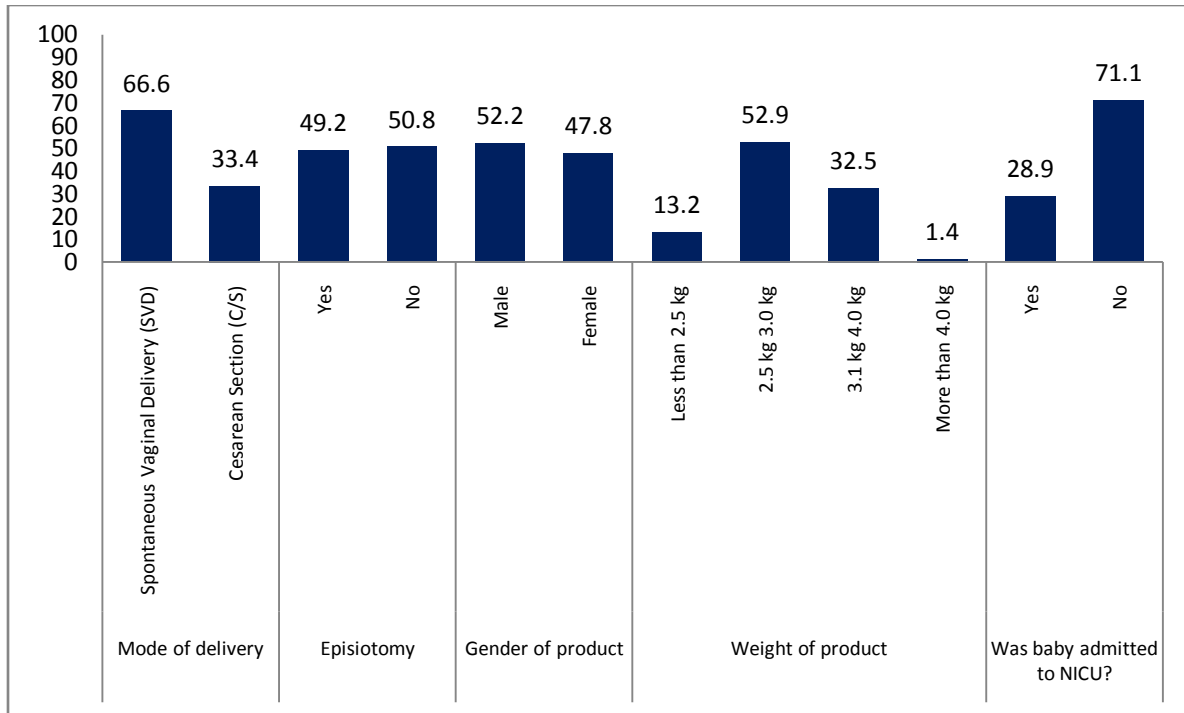
The following table shows some of the things that women may not be satisfied with during the follow-up of pregnancy, 86.4% of women are not happy about the number of visits, and for the time between visits found that 83.4% of women are unhappy with it, but for the time being spend with your physician there were 89.1% of women are not satisfied, and for the waiting times it was found that 67.4% of women are not satisfied.

Number of visits	1397 (86.4)	220 (13.6)	0.00**
Spacing between visits	1348 (83.4)	269 (16.6)	0.00**
Time spent with provider	1441 (89.1)	176 (10.9)	0.00**
Waiting time	1090 (67.4)	527 (32.6)	0.00**

Chi-squared test: \*Significant at 0.05 \*\*Significant at 0.01

**Seventh: Outcome: -**

The following chart explains a variety of pregnancy related subjects, For the type of birth, found that 66.6% of women have natural childbirth, while 33.4% had Caesarean birth. As for the gender, there were 52.2% of male births, while 47.8% of female births. The percentage of babies born weighing less than 2.5 kg is 13.2%, while the percentage of babies born weighing (2.5-3 kg) is 52.9%, and those born weighing somewhere between (3.1-4 kg) is 32.5%, and percentage of babies born weighing more than 4 kg were is 1.4%. It found that 28.9 percent of births were transferred to the intensive care unit for newborns, while 71.1% of births have not been transferred to the unit care center for newborns.



#### Eighth: Relationships and correlations: -

The first hypothesis states that there is a relation between get booking appointment and each of (Age, Residency, Level of education, Income of household, and Gravidity).

Using the Chi-Square test was tested the NULL hypothesis which states that there is no relation between get booking appointment and each of (Age, Residency, Level of education, Income of household, and Gravidity), versus the alternative hypothesis which states that there is a relation between get booking appointment and each of (Age, Residency, Level of education, Income of household, and Gravidity), the next table shows the test results.

		When					Chi-	P-va
		1 - 2 months	3 - 5 months	6 - 7 months	8 - 9 months	I have not had a booking appointment		
Age	Less than 20	37	6	0	0	1	45.039	.000*
	20 25	384	47	4	0	10		
	26 34	626	103	9	5	21		
	35 40	240	60	5	2	13		
	Above 40	28	9	0	0	7		
Residency	Urban	1149	183	16	4	39	16.353	.003*
	Rural	166	42	2	3	13		
Level of education	Illiterate	60	13	1	1	8	65.786	.000*
	Primary school	113	29	6	2	10		
	Intermediate school	129	29	3	2	8		
	High school	386	83	4	1	12		
	College	568	63	4	1	11		
	Higher education	59	8	0	0	3		
Income	Excellent (>10000)	273	47	3	1	7	11.977	.152



	Average (5000 10000)	761	122	7	4	27		
	Below average (<5000)	281	56	8	2	18		
Gravidity	1	334	28	1	0	7	72.166	.000*
	2- 4	636	110	9	2	16		
	5- 6	199	38	3	3	9		
	More than 6	146	49	5	2	20		

\*Significant at the 0.05 level

**We conclude from the above table that: -**

1. There is **a relation** between get booking appointment and Age, where the P-value was less than 0.05 level.
2. There is **a relation** between get booking appointment and Residency, where the P-value was less than 0.05 level.
3. There is **a relation** between get booking appointment and Level of education where the P-value was less than 0.05 level.
4. There is **a relation** between get booking appointment and Gravidity where the P-value was less than 0.05 level.
5. There is no relation between get booking appointment and Income of household where the P-value was more than 0.05 level.

**The second hypothesis states that there is a relation between the knowledge of the importance of booking and following up and delivering later in the same place, and each of (Age, Residency, Level of education, Income of household, and Gravidity).**

Using the Chi-Square test was tested the NULL hypothesis which states that there is no relation between the knowledge of the importance of booking and following up and delivering later in the same place, and each of (Age, Residency, Level of education, Income of household, and Gravidity), versus the alternative hypothesis which states that there is a relation between the knowledge of the importance of booking and following up and delivering later in the same place, and each of (Age, Residency, Level of education, Income of household, and Gravidity), the next table shows the test results.

		She is well aware	She has a fair knowledge	She is unaware		
Age	Less than 20	11	10	23	16.062	.042*
	20 25	224	71	150		
	26 34	400	132	232		
	35 40	174	55	91		
	Above 40	24	7	13		
Residency	Urban	738	240	413	15.038	.001*
	Rural	95	35	96		
Level of education	Illiterate	32	19	32	42.807	.000*
	Primary school	63	29	68		
	Intermediate school	73	28	70		
	High school	245	91	150		
	College	373	97	177		
Income of household	Higher education	47	11	12	15.472	.004*
	Excellent (>10000)	200	44	87		
	Average (5000 10000)	464	165	292		
Gravidity	Below average (<5000)	169	66	130	3.052	.802
	1	196	66	108		
	2- 4	391	135	247		
	5- 6	133	35	84		
	More than 6	113	39	70		

\*Significant at the 0.05 level

**We conclude from the above table that:-**

1. There is **a relation** between the knowledge of the importance of booking and following up and delivering later in the same place, and Age, where the P-value was less than 0.05 level.
2. There is **a relation** between the knowledge of the importance of booking and following up and delivering later in the same place, and Residency, where the P-value was less than 0.05 level.
3. There is **a relation** between the knowledge of the importance of booking and following up and delivering later in the same place, and Level of education, where the P-value was less than 0.05 level.
4. There is **a relation** between the knowledge of the importance of booking and following up and delivering later in the same place, and Income of household, where the P-value was less than 0.05 level.
5. There is no relation between the knowledge of the importance of booking and following up and delivering later in the same place, and Gravidity, where the P-value was more than 0.05 level.

**The third hypothesis states that there is a relation between the regularly attendance to ANC, and each of (Age, Residency, Level of education, Income of household, and Gravidity).**

Using the Chi-Square test was tested the NULL hypothesis which states that there is no relation between the regularly attendance to ANC, and each of (Age, Residency, Level of education, Income of household, and Gravidity), versus the alternative hypothesis which states that there is a relation between the regularly attendance to ANC, and each of (Age, Residency, Level of education, Income of household, and Gravidity), the next table shows the test results.

		Yes	No	I don't followup		
Age	Less than 20	34	6	4	10.694	0.220
	20 25	350	71	24		
	26 34	607	128	29		
	35 40	258	52	10		
	Above 40	31	8	5		
Residency	Urban	1106	225	60	.865	0.649
	Rural	174	40	12		
Level of education	Illiterate	64	17	2	5.117	0.883
	Primary school	121	32	7		
	Intermediate school	136	25	10		
	High school	390	77	19		
	College	514	102	31		
	Higher education	55	12	3		
Income of household	Excellent (>10000)	263	51	17	2.754	0.600
	Average (5000 10000)	731	147	43		
	Below average (<5000)	286	67	12		
Gravidity	1	287	63	20	7.369	0.288
	2- 4	621	120	32		
	5- 6	208	36	8		
	More than 6	164	46	12		

**\*Significant at the 0.05 level**

**We conclude from the above table that:-**

1. There is no relation between the regularly attendance to ANC, and Age, where the P-value was more than 0.05 level.
2. There is no relation between the regularly attendance to ANC, and Residency, where the P-value was more than 0.05 level.
3. There is no relation between the regularly attendance to ANC, and Level of education, where the P-value was more than 0.05 level.
4. There is no relation between the regularly attendance to ANC, and Income of household, where the P-value was more than 0.05 level.

5. There is no relation between the regularly attendance to ANC, and Gravidity, where the P-value was more than 0.05 level.

**The fourth hypothesis states that there is a relation between follow-up the regular antenatal care visits throughout the whole period of pregnancy, and each of (Age, Residency, Level of education, Income of household, and Gravidity).**

Using the Chi-Square test was tested the NULL hypothesis which states that there is no relation between follow-up the regular antenatal care visits throughout the whole period of pregnancy, and each of (Age, Residency, Level of education, Income of household, and Gravidity), versus the alternative hypothesis which states that there is a relation between follow-up the regular antenatal care visits throughout the whole period of pregnancy, and each of (Age, Residency, Level of education, Income of household, and Gravidity), the next table shows the test results.

		Yes	No		
Age	Less than 20	40	4	.756	.944
	20 25	397	48		
	26 34	689	75		
	35 40	284	36		
	Above 40	40	4		
Residency	Urban	1253	138	1.779	.182
	Rural	197	29		
Level of education	Illiterate	68	15	14.152	.015*
	Primary school	137	23		
	Intermediate school	147	24		
	High school	445	41		
	College	589	58		
Income of household	Higher education	64	6	3.340	.188
	Excellent (>10000)	303	28		
	Average (5000 10000)	828	93		
	Below average (<5000)	319	46		
Gravidity	1	342	28	4.677	.197
	2- 4	687	86		
	5- 6	221	31		
	More than 6	200	22		

**\*Significant at the 0.05 level**

**We conclude from the above table that:**

1. There is no relation between follow-up the regular antenatal care visits throughout the whole period of pregnancy, and Age, where the P-value was more than 0.05 level.
2. There is no relation between follow-up the regular antenatal care visits throughout the whole period of pregnancy, and Residency, where the P-value was more than 0.05 level.
3. There is **a relation** between follow-up the regular antenatal care visits throughout the whole period of pregnancy, and Level of education, where the P-value was less than 0.05 level.
4. There is no relation between follow-up the regular antenatal care visits throughout the whole period of pregnancy, and Income of household, where the P-value was more than 0.05 level.
5. There is no relation between follow-up the regular antenatal care visits throughout the whole period of pregnancy, and Gravidity, where the P-value was more than 0.05 level.

### **Discussion: -**

World health organization (WHO) estimated that annually 529,000 women die globally as a result of pregnancy and childbirth.<sup>28</sup> Antenatal care (ANC) is an effective tool to reduce both infant and maternal mortality rates.<sup>1</sup> Al Otaiby et al., 2013 reported that antenatal knowledge scores were below average in Saudi Arabia.<sup>13</sup> This study aimed to assess the awareness of antenatal care importance among pregnant women in Madina, Saudi Arabia and its relationship with certain variables such as age, educational level, socioeconomic status, gravidity, parity and number prenatal care visits. This study includes 1617 women, their Demographics shows that the majority of them between

26-34 years old. About half of them had collage education and higher, while 35.7% had High school, this show the high education for many of them. Only 2.5% of them had Illiterate husband. This education has been a great role in the interest of mothers in ANC. Several other studies also found a strong positive impact of mothers' education on the utilization of health services,<sup>15,16</sup> because knowledge and education can improve the awareness of people about their rights and health.<sup>23</sup> The study results showed good obstetric history, most of women have never miscarriage their babies, while 0.4% of them had more than (5) miscarriages. 37.8% of the participants never had a natural birth, and 96% of the women never used assisted delivery before 34.5% had Cesarean Section for one time at least, The most common reason for 27% of those who have it suffered from abnormal embryonic situation. Vast majority nonsmokers, but at study in Lebanon almost one quarter (23%) of participants reported smoking during pregnancy.<sup>17</sup>

It may be the reason for differing proportion between the two countries is different customs, traditions and the nature of society. Results of the study have shown that vast majority of mothers had healthy pregnancy, 99.4% of women have never had abnormal pregnancy. Generally, most of women have no diseases; the most common diseases were Urinary tract infection 27.3%, followed by Iron deficiency anemia 24.7%. In recent study Prevalence of anemia (Hb<11gm/dl) on pregnant women in Pakistan was found to be 96%.<sup>18</sup> Iron, folate and vitamin supplements are routinely given to women attending antenatal care facilities along with advice for appropriate dietary practices to reduce anemia. 89% of the women believe that the use of complementary grain during pregnancy reduces the incidence of some of the problems related to pregnancy. Most of women take supplements that pregnant women use during pregnancy, such as; Folic acid, Vitamin D, Iron supplements, Calcium. In study in Pakistan, 64% of the women had never used any haematinics.<sup>18</sup> This may be due to differences in economic level between Saudi Arabia and Pakistan, so many women in Pakistan haven't get hematinics. All the mothers had registered antenatal, this same to Javali et al. study.<sup>19</sup> And Roy et al. study.<sup>20</sup> But Gupta et al. found that 89.6% of women had registered themselves.<sup>21</sup> This may be due to the low level of education and economic level in many areas in India. 80.9% of women started their follow-up at the first or second month of pregnancy. Gupta et al. found that 74.4% started their follow-up at the first or second month of pregnancy.<sup>21</sup> Javali et al., reported that 56.5% and 42.9% women under ANC registration in the 1st trimester and the 2nd trimester, respectively. <sup>19</sup> Berhe et al., reported that 48%, 42.4% women made their first visit in the 1st trimester, 2nd trimester.<sup>22</sup> More than half of women have a good awareness about knowledge of the importance of the first visit and the importance of continued follow-up in the same place. 72.5% of women follow-up their pregnancy at the same place they visited at the first time. 89.7% believe in the importance of the follow-up pregnancy during the whole pregnancy, while 80.1% are getting their pregnancies consistently and regularly, the most common reason for don't follow their pregnancy consistently and regularly was neglect. According to our results there was a relation between get booking appointment and age, residency, level of education, gravidity where the P-value was less than 0.05 level. But there was no relation between get booking appointment and income of household where the P-value was more than 0.05 level. Also in our study, there is a relation between the knowledge of the importance of booking and following up and delivering later in the same place, and age, residency, level of education, income of household where the P-value was less than 0.05 level. But there was no relation between the knowledge of the importance of booking and following up and delivering later in the same place, and gravidity, where the P-value was more than 0.05 level. According to our results there was no relation between regularly attendance to ANC, or follow-up the regular antenatal care visits throughout the whole period of pregnancy, and age. This finding conforms a study in India found that maternal age was not statistically associated with ANC.<sup>24</sup> But conflict with many other studies which found that maternal age is one of the important predictors for ANC, it was found that the young women were more likely to seek antenatal care than older one.<sup>25,26</sup> The reason of difference in the results is the difference in economic and cultural levels between the target groups in the two studies. Also in our study, there was no relation between regularly attendance to ANC, or follow-up the regular antenatal care visits throughout the whole period of pregnancy, and income of household, where the P-value was more than 0.05 level. Because most of the services of ANC in KSA rely on health insurance and therefore does not pose a financial burden on the family. There was a relation between follow-up the regular antenatal care visits throughout the whole period of pregnancy, and level of education where the P-value was less than 0.05 level. This conform previous studies found a strong positive impact of mothers' education on the utilization of health services.<sup>15,16</sup> This is considered normal because whenever greater the parent level of education and culture, it increased awareness of their rights and the importance of the ANC. There was no relation between regularly attendance to ANC, or follow-up the regular antenatal care visits throughout the whole period of pregnancy, and gravidity where the P-value was more than 0.05 level. While study in Nepal revealed that there was statistically significant association between numbers of childbirth and the ANC visits ( $p < 0.05$ ).<sup>27</sup> The results of our study differ from the results of the study in Nepal because the level of education in Nepal is less than it in Saudi Arabia, as well

as economic level, so in Nepal mothers experience of pregnancy and delivery made them believe their maternal health knowledge was adequate.

**Limitations: -**

The generalizability of these results is subject to certain limitations. For instance, limited time allocated for study, since data has been collected in less than one month. The study was conducted only in 2 major hospitals, and inclusion of a greater number of centers or comparisons of urban and rural centers was not feasible. Lack of sufficient cooperation from the health institutions to provide information pertaining to patients. A worth mentioning limitation in this study is the unavailability of experts' opinion on the recommended content and delivery methods for antenatal education from the providers of this service. Knowing the providers' point of view and combining it with the responses of the target population will add to the validity of this study and will help in the development of effective antenatal education programs. More in-depth study of the sociodemographic aspects and job satisfaction of the health care providers would also be useful to give a more accurate measure of overall performance. Also, the rarity of study's topic in Saudi Arabia made us face many obstacles especially in the literature review. Furthermore, the scope of this study was limited in terms of its external validity. The methodology that was implemented in data collection yielded qualitative data that only can be interpreted relative to participants' populations.

**Conclusions: -**

In summary, all the mothers had registered antenatal Care, the education has been a great role in the interest of mothers in ANC. Most of women have no diseases, and they believe that the use of complementary grain during pregnancy reduces the incidence of some of the problems related to pregnancy. More than half of women have a good awareness about knowledge of the importance of the first visit and the importance of continued follow-up in the same place. There was no relation between the regularly attendance to ANC, and age, gravidity, residency, level of education, income of household. Also, there was no relation between follow-up the regular antenatal care visits throughout the whole period of pregnancy, and age, gravidity, residency, income of household. But there was a relation between follow-up the regular antenatal care visits throughout the whole period of pregnancy, and level of education

**Recommendations: -**

Based on the findings of the present study, the following recommendations are suggested:

1. Enhance strategies to increase awareness of importance of follow up and delivery later at the same place of booking
2. Government should increase number of health care centers and improve the quality of services provided at these centers. Also, should recruit large numbers of qualified health care providers to decrease work load on the staff and to give each patient her full time of examination and consultation.
3. The patient's medical files should be linked by system in all hospitals of the kingdom so when patient change her hospital the other hospitals and health care centers can easily reach to her information.
4. Patient satisfaction surveys should be carried out routinely to improve the quality of services.
5. Different health education methods should be available to increase awareness of the women about the importance and components of antenatal care and how that help in decreasing the complication of pregnancy.
6. enhance the role of family physician to let the population trust them and follow up at health care centers.
7. Mass media including social media should play a consequential role in presenting the benefits of prenatal care like early diagnosis and treatment of some possible complications during pregnancy.
8. It would be more advantageous to attempt to re-conduct the study with a much larger sample size, and to carry out the study across many other cultural backgrounds and demographical aspects.
9. Further studies should be conducted to incorporate the views and responses of health care providers, as the study only depended on the responses of Saudi women.
10. Further research is recommended on the evaluation of the content of antenatal education and its cultural relevance.

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**References: -**

- 1- Nursing, G., Nursing, G., Said, P., & Mukarramah, M. A.-. (2012). No Title, 9(4), 4291–4299.
- 2- Lincetto, O., Mothebesoane-anoh, S., Gomez, P., & Munjanja, S. (n.d.). Antenatal Care, 51–62.
- 3-Shafqat, T., Fayaz, S., Rahim, R., & Saima, S. (2015). KNOWLEDGE AND AWARENESS REGARDING ANTENATAL CARE AND DELIVERY AMONG PREGNANT WOMEN, 23(2), 88–91.
- 4-Best, T., Lives, S., & Progress, A. (n.d.). CALL TO ACTION : CONTINUED Frontline Health Workers : No Health Workers , No Health.
- 5-Bank, T. W. (2013). Trends in Maternal Mortality : 1990 to 2013.  
FACTORS INFLUENCING ATTENDANCE TO ANTENATAL CARE SERVICES IN. (2015).
- 6-Onoh R, Umeora O, Agwu U, Ezegwui H, Ezeonu P, Onyebuchi A. Pattern and Determinants of Antenatal Booking at Abakaliki Southeast Nigeria. *Annals of Medical and Health Sciences Research*. 2012;2(2):169-175. doi:10.4103/2141-9248.105666.
- 7-Issue, S. (2012). Assessment of pregnant women's knowledge and practices concerning prenatal care who attend primary health care centers in Baghdad City, 25, 1–10.
- 8-Sheet, F., & Facts, Q. (2015). FACT SHEET GOAL 5 : Improve maternal health, (September 2008), 2005–2006.
- 9-Nigenda, G., Langer, A., Kuchaisit, C., Romero, M., Rojas, G., Al-osimy, M., ... Al-, Y. (2003). Women's opinions on antenatal care in developing countries : results of a study in Cuba , Thailand , Saudi Arabia and Argentina, 12, 1–12.
- 10-Habib, F., & Hanafi, M. I. (2011). Antenatal care in primary health care centres in Medina , Saudi Arabia , 2009 : a cross-sectional study, 17(3), 196–202.
- 11-Sadiq, N., Waheed, Q., Hussain, M., Rana, A. T., Yousaf, Z., Chaudry, Z., ... Iqbal, S. (n.d.). Students ' Corner Short Communication Factors affecting the utilization of antenatal care among women of reproductive age in Nurpur Shahan, 616–618.
- 12-Anjum F, Noor N, Bano S.To Assess the Knowledge of Women in Regards to Antenatal Care.*Med Forum* 2015;26(2): 23-26.
- 13-Otaiby, T. Al, Jradi, H., & Bawazir, A. (2013). Women ' s Health Care Antenatal Education : An Assessment of Pregnant Women Knowledge and Preferences in Saudi Arabia, 2(4), 2–6. <http://doi.org/10.4172/2167-0420.1000139>
14. AbouZahr, Carla. "Safe motherhood: a brief history of the global movement 1947–2002." *British Medical Bulletin* 67.1 (2003): 13-25.
15. Fosu, Gabriel B. "Childhood morbidity and health services utilization: cross-national comparisons of user-related factors from DHS data." *Social science & medicine* 38.9 (1994): 1209-1220.
16. Costello, Michael A., Lauro C. Lleno, and Eric R. Jensen. Determinants of two major early-childhood diseases and their treatment in the Philippines: Findings from the 1993 National Demographic Survey. East-West Center, Program on Population, 1996.
17. Chaaya, M., et al. "Knowledge, attitudes, and practices of argileh (water pipe or hubble-bubble) and cigarette smoking among pregnant women in Lebanon." *Addictive behaviors* 29.9 (2004): 1821-1831.
18. Awan, Mahe Munir, Muhammad Aftab Akbar, and Misbahul Islam Khan. "A study of anemia in pregnant women of railway colony, Multan." *Pak J Med Res* 43.1 (2004): 11-4.
19. Javali, Rudramma, Appasaheb Wantamutte, and M. D. Mallapur. "Socio-demographic factors influencing utilization of Antenatal Health Care Services in a rural area-A cross sectional study." (2014).
20. Roy, Manas P., et al. "Determinants of utilization of antenatal care services in rural Lucknow, India." *Journal of family medicine and primary care* 2.1 (2013): 55.

21. Gupta, Rajiv Kumar, et al. "Knowledge regarding antenatal care services, its utilization, and delivery practices in mothers (aged 15-49 years) in a rural area of North India." *Tropical Journal of Medical Research* 18.2 (2015): 89.
22. Berhe, Kalayou K., et al. "Assessment of antenatal care utilization and its associated factors among 15 to 49 years of age women in Ayder Kebelle, Mekelle City 2012/2013; a cross sectional study." *American Journal of Advanced Drug Delivery* 2.1 (2014): 62-75.
23. Mastaneh, Zahra, and Lotfollah Mouseli. "Patients awareness of their rights: insight from a developing country." *International journal of health policy and management* 1 (2013).
24. Laishram, Jalina, et al. "Knowledge and practice of ante-natal care in an urban area." (2013).
25. Niroula, B. "Use of Health Service in Hill Village in Central Nepal." *Health Transition Review* 4.2 (1994): 151-66.
26. Rahman, M., et al. "Determinants of antenatal care seeking behaviors in Bangladesh. ICDDR, B: Center for Health and Population Research." *Reproductive Health in Rural Bangladesh* 1 (1997): 86-104.
27. Sanjel, S., R. H. Ghimire, and K. Pun. "Antenatal care practices in Tamang community of hilly area in central Nepal." *Kathmandu University Medical Journal* 9.2 (2012): 57-61.



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### RESEARCH ARTICLE

#### FUNCTIONAL HYPOPARATHYROIDISM AMONG TYPE 2 DIABETIC PATIENTS ON HEMODIALYSIS: IMPACT OF GLYCEMIC CONTROL.

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iPTH; 25-hydroxyvitamin D; hemodialysis; poor  
 glycemic control; good glycemic  
 control; osteodystrophy

#### Abstract

**Background:**End-stage renal disease has become a public health concern worldwide. Type 2 diabetes is associated with significantly accelerated rates of diabetic nephropathy. There are controversies about the role of intact parathyroid hormone (iPTH) in the pathogenesis of osteodystrophy among diabetic patients on regular hemodialysis.

**We aimed to** estimate serum levels of iPTH, 25-hydroxyvitamin D and to clarify the possible relationships between iPTH and HbA1c ;which reflect the glycemic control as well as other clinical and biochemical parameters in end-stage renal disease patients on regular hemodialysis.

**Subjects and methods:** A case-control study of 84end-stage renal disease patients on maintenance hemodialysis thrice weekly. Patients were stratified into three groups;group1:28 diabetic patients with good glycemic control(HbA1c < 7), group 2:28 diabetic patients with poor glycemic control(HbA1c >7), and group3:28non diabetic patients, In all studied participants,blood urea, serum creatinine , calcium, phosphorus, albumin, alkaline phosphatase, lipid profile, HbA1c, fasting blood glucose (FBG),post prandial blood glucose (PPBG) and25-hydroxyvitamin Dwere measured.Also, we estimate serum iPTHlevels by ADVIA CENTAUR instrument using Chemiluminescence principle.

**Results:**Non diabetic patienton chronic hemodialysis had significantly higher values of serum 25-hydroxyvitamin D,serum iPTHmore than diabetic group, moreover diabetic patients with poor glycemic control had significantly lower values of serum 25-hydroxyvitamin D and serum iPTH, compared to good glycemic control.In diabetic patients with poor glycemic control,iPTHlevel was negatively correlated with Alkaline phosphatase,post prandial blood glucose, fasting blood glucose, as well as HbA1c. In patients with good glycemic control serum iPTHlevel was positively correlated with25-hydroxyvitamin D., there were significant negative correlations betweeniPTH level and creatinine, alkaline phosphatase, phosphorous, albumin, post prandial blood glucose, fasting blood glucose, as well as HbA1c.Stepwise linear regression analysis showed that, serum iPTH levels were independently correlated with 25-hydroxyvitamin D with diastolic blood pressure,

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serum phosphorus, albumin, alkaline phosphatase, FBG, PPBG and HbA1c.

**Conclusion:** Non diabetic patient on chronic hemodialysis had significantly higher values of serum 25-hydroxyvitamin D and iPTH more than diabetic group. Moreover, in diabetic patients with poor glycemic control, serum iPTH level and 25-hydroxyvitamin D were significantly lower than good glycemic control patients.

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## Introduction:-

End-stage renal disease (ESRD) has become a public health concern worldwide. According to the United States Renal Data System annual report (USRDS); it is high in Taiwan patients, Japan and USA and low in Philippines, Bangladesh and Russia [1]. Anand et al. [2] predicted an annual incidence of 239 pmp in people with diabetes and hypertension who live in sub-Saharan Africa, where renal replacement therapy (RRT) use correlated with regional income, with most patients unable to access RRT. Liyanage et al. [3] estimated that at least 432 000 people in Africa require RRT but are not receiving it. Regarding developing countries such as Egypt, the prevalence of ESRD have gone up and increased from 225 pmp in 1996 to 483 pmp in 2004. The main cause of ESRD in Egypt is hypertension, followed by diabetes, and still unknown causes represent about 15% of the cases [4].

Diabetes is a chronic metabolic disease, 415 million people have diabetes in the world and more than 35.4 million people in the MENA Region (the Middle East and North Africa region), by 2040 this will rise to 72.1 million. In Egypt, the prevalence of diabetes in adults are 14.9% and 7.8 million cases of diabetes were estimated in Egypt in 2015 according to International Diabetes Federation (2015). Type 2 diabetes (T2D) is associated with accelerated rates of micro and macro vascular complications [5].

There was great evidence that, the higher incidence of osteodystrophy among the diabetic patients on regular hemodialysis was attributed to high intact parathyroid hormone (iPTH) level (150-300 pg/ml), osteodystrophy due to high iPTH level is called High Turnover Bone Disease (HTBD) [6].

Interestingly, recent studies suggested that, there were another type of osteodystrophy in type 2 diabetic patients with ESRD on regular hemodialysis, due to low iPTH level and called Low Turnover Bone Disease (LTBD) [6].

Thus, diabetic patients on maintenance hemodialysis (MHD) are affected with alteration of iPTH level in opposite direction. Consequently, renal osteodystrophy can be of two types. High Turnover Bone Disease (HTBD) due to high iPTH level and Low Turnover Bone Disease (LTBD) due to comparatively low iPTH level [7]. It has been revealed in some studies that, usually diabetic ESRD patients on MHD have lower iPTH level than non-diabetic ESRD patients on MHD [8-10]. Increasing evidence suggests that, in both diabetic and non-diabetic haemodialyzed patients, impaired iPTH secretion appears to be the main determinant responsible for decreased bone turnover and 'adynamic bone disease' [11].

There are controversies about the mechanisms of renal-related bone disease, and the actual role of iPTH serum levels variation in the pathogenesis of renal osteodystrophy. Therefore, the purpose of current study was to estimate serum levels of iPTH and to clarify the possible relationships between iPTH and HbA1c; which reflect glycemic control as well as other clinical and biochemical parameters in ESRD patients on regular hemodialysis.

iPTH level was decreased in poor glycemic control diabetic patients on hemodialysis, moreover it was negatively correlated to measures of blood glucose, as well as biochemical parameters of end stage renal disease. Considering the controversy about the level of iPTH in diabetic patients on hemodialysis and its correlation with HbA1c and other biochemical parameters; our findings revealed the favorable effect of good control of blood glucose on iPTH. Furthermore, tight metabolic control of the diabetic patients is mandatory to avoid hypoparathyroidism. Ca and Vit D supplementations in ESRD may be fruitful in keeping iPTH level within target range.

### Subjects and Methods:-

This study included 84 patients of end-stage renal disease on maintenance hemodialysis thrice weekly; 4 hours each session for more than 3 months. Patients recruited from Hemodialysis and Endocrinology units of Internal Medicine Department of Zagazig University Hospitals, Egypt. Patients were matched as regard age, gender, and ethnic origin. Patients were stratified into three groups; group 1 (n=28); diabetic patients with good glycemic control with HbA1c <7, group 2; diabetic patients with poor glycemic control with HbA1c > 7 (n=28) and group 3 (n=28) non diabetic patients. All patients were subjected to thorough medical history and full clinical assessment. Patients suffering from any acute infection, acute renal failure, liver disease, cardiac disease, acute illness, parathyroidectomy, any endocrine disorder except diabetes mellitus, those who were taking hormone replacement therapy, bisphosphonates, aluminium hydroxide and steroids were excluded from the study. The ethical committee of Faculty of Medicine, Zagazig University approved our study protocol, and all participants assigned written informed consent.

### Blood sampling:-

Blood samples were drawn from all subjects after an overnight fasting and divided into 3 portions: and HbA1c; 1 ml of whole blood was collected into evacuated tubes containing fluoride for fasting blood glucose. Serum was separated immediately from remaining part of the sample and stored at -20 °C until analysis.

### Biochemical measurements :-

We determined fasting blood glucose using the glucose oxidase method (Spinreact, Girona, Spain). Total cholesterol and triglycerides were measured by routine enzymatic methods (Spinreact, Girona, Spain). HDL cholesterol was determined after precipitation of the apoB-containing lipoproteins. LDL cholesterol was calculated using the Friedewald formula (12). Biochemical parameters including serum levels of blood urea nitrogen (BUN), calcium, phosphorous, alkaline phosphatase, uric acid, creatinine, and albumin were measured with standard techniques by an automatic analyzer. Serum 25(OH) D levels tested by a high-performance liquid chromatography (HPLC). Serum iPTH was measured by ADVIA CENTAUR instrument using Chemiluminescence principle. The serum samples were immediately frozen at -70 °C until analysis.

### Statistical analysis:-

Statistical analyses were performed using the Statistical Package for the Social Sciences for Windows (version 22.0; SPSS Inc., Chicago, IL, USA). Data were expressed using descriptive statistic (mean  $\pm$  standard deviation) and were analyzed statistically by Chi-squared test ( $\chi^2$ ), paired T test. Pearson correlation coefficient was used to assess the association between iPTH, clinical, biochemical tests and other studied metabolic parameters in patients with hemodialysis. A linear regression analysis was performed to detect the main predictors of iPTH levels in hemodialysis patients. P-values were considered significant if <0.05.

### Results:-

Among patients on chronic hemodialysis, in the diabetic group, 69.6 % were male and 30.4% were female, their mean age was  $47.73 \pm 12.02$  year. In the non-diabetic group, 64.3% were male and 35.7% were female, their mean age was  $45.25 \pm 14.45$  year. Diabetic and nondiabetic patients were matched for age and gender.

Patients with poor glycemic control (PGC), 67.8 % were male and 32.2% female, their mean age was  $49.04 \pm 11.28$  year. In patients with good glycemic control (GGC), 71.4% were male and 28.6% were female, their mean age was  $46.43 \pm 12.79$  year. Both diabetic groups were matched for age and gender.

**Clinical and biochemical characteristics of the studied groups are summarized in Table 1:** Diabetic patient on chronic hemodialysis had significantly higher values of PPBG, FBG, HbA1c, LDL, TG, TC, PO4, albumin and Alkaline phosphatase than non diabetic group ( $p < 0.05$ ), and there was non-significant difference regarding other parameters, ( $p > 0.05$ ).

**Table 1:-** clinical and biochemical characteristics of the studied groups .

Variable	Diabetic (n=56)	Non-diabetic (n=28)	T	p
Systolic blood pressure (mmHg)	$136.5 \pm 15.43$	$131.25 \pm 18.14$	1.39	NS
Diastolic blood pressure (mmHg)	$74.20 \pm 9.90$	$70.71 \pm 9.10$	1.56	NS
Pulse (beat/min)	$80.75 \pm 2.99$	$81.1 \pm 3.86$	0.47	NS
FBG (mg/dL)	$113.5 \pm 19.4$	$76.18 \pm 3.08$	10.09	<0.001*

PPBG(mg/dL)	213.8 ± 67.9	119.6 ± 5.17	7.30	<0.001*
HbA1c (gm%)	8.22 ± 1.59	5.43 ± 0.35	9.19	<0.001*
LDL (mg/dl)	89.9 ± 15.5	76.32 ± 6.18	4.93	<0.001*
HDL (mg/dl)	41 ± 4.20	40.64 ± 3.19	0.40	NS
TG (mg/dl)	196.8 ± 68.6	163.14 ± 3.5	3.27	<0.01*
Cholesterol (mg/dl)	166.9 ± 34.8	142.00 ± 10.6	3.68	<0.001*
Ca (mg/dl)	9.20 ± 0.97	9.00 ± 0.39	1.09	NS
PO4 (mg/dl)	5.17 ± 1.46	4.29 ± 0.83	2.98	<0.01*
Albumin (g/dl)	3.72 ± 0.10	3.89 ± 0.15	6.129	<0.001*
Alkaline phosphatase (IU/L)	159.2 ± 50.04	105.6 ± 17.3	5.49	<0.001*
Creatinine (mg/dl)	9.14 ± 1.00	9.00 ± 0.84	0.67	NS
Urea (mg/dl)	135.9 ± 14.6	132.2 ± 10.7	1.18	NS
25-Hydroxyvitamin D (ng/ml)	17.1 ± 7.7	19.7 ± 7.3	2.4	NS

HDL-C; high-density lipoprotein-cholesterol, TG ;triglycerides, LDL-C; low-density lipoprotein-cholesterol, PPBG; postprandial blood glucose, FBG; fasting blood glucose, HbA1c; hemoglobin A1c.\* P <0.05 .

**Clinical and biochemical characteristics of diabetic groups (Table 2):** Poor glycemic control group had significantly higher values of systolic & diastolic blood pressure, PPBG, FBG, HbA1c ,urea,alkaline phosphatase, TG, and cholesterol than good glycemic control group (p < 0.05). On the other hand, there were significant lower levels of 25-Hydroxyvitamin D in poor glycemic group compared to good glycemic control group . There was no significant difference regarding other parameters (p > 0.05).

**Table 2:-**clinical and biochemical characteristics of both diabetic groups .

Variable	Poor Glycemic Control (n=28)	Good Glycemic Control (n=28)	T	p
Systolic blood pressure (mmHg)	140.71 ± 16.2	132.32 ± 13.57	2.10	<0.05*
Diastolic blood pressure (mmHg)	77.32 ± 10.41	70.07 ± 8.43	2.47	<0.05*
Pulse (beat/min)	80.96 ± 2.95	80.54 ± 3.09	0.53	NS
FBG(mg/dL)	129 ± 14.83	98.00 ± 6.93	10.02	<0.001*
PPBG(mg/dL)	273.2 ± 41.40	154.40 ± 18.95	13.81	<0.001*
HbA1c (gm%)	9.66 ± 0.9	6.79 ± 0.23	16.16	<0.001*
LDL (mg/dl)	92.90 ± 17.33	88.11 ± 10.95	1.24	NS
HDL (mg/dl)	41.11 ± 5.17	40.89 ± 3.05	0.19	NS
TG (mg/dl)	221.1 ± 82.40	183.21 ± 19.14	2.37	<0.05*
Cholesterol (mg/dl)	177.9 ± 41.81	155.75 ± 21.57	2.50	<0.05*
Ca (mg/dl)	9.43 ± 1.09	8.98 ± 0.79	1.78	NS
PO4 (mg/dl)	5.38 ± 1.41	4.97 ± 1.51	1.05	NS
Albumin (g/dl)	3.70 ± 0.1	3.75 ± 0.12	1.94	NS
Alkaline phosphatase (IU/L)	196.25 ± 42.1	122.11 ± 21.94	8.27	<0.001*
Creatinine (mg/dl)	9.10 ± 0.95	9.18 ± 1.07	0.30	NS
Urea (mg/dl)	140.1 ± 16.45	131.57 ± 11.18	2.28	<0.05*
25-Hydroxyvitamin D (ng/ml)	13.9 ± 5.5	20.1 ± 8.4	6.27	<0.01*

HDL-C; high-density lipoprotein-cholesterol, TG ;triglycerides, LDL-C; low-density lipoprotein-cholesterol, PPBG; postprandial blood glucose, FBG; fasting blood glucose, HbA1c; hemoglobin A1c.\* P <0.05 .

**Pearson correlations between serum iPTH (pg/ml), clinical and biochemical characters among both diabetic groups on hemodialysis ( Table3):** In diabetic patients with poor glycemic control, serum iPTH level was positively correlated with 25-Hydroxyvitamin D, on the other hand, serum iPTH level was negatively correlated with alkaline phosphatase. In diabetic patients with good glycemic control, serum iPTH level was positively correlated with 25-Hydroxyvitamin D, on the other hand there were significant negative correlations between serum iPTH level and creatinine, alkaline phosphatase, phosphorous and albumin, there were non-significant correlation between iPTH and other clinical and biochemical characters in both groups.

**Table 3:-**correlation between iPTH (pg/ml), clinical and biochemical characters among both diabetic groups on hemodialysis.

Variable	Poor Glycemic Control (n=28)		Good Glycemic Control (n=28)	
	r	P	r	p
Sex (gender)	0.147	0.454	0.111	0.573
Age (year)	0.031	0.875	0.128	0.517
Diastolic blood pressure	-0.176	0.370	-0.068	0.733
Systolic Blood Pressure	-0.260	0.182	-0.087	0.658
Ca	-0.257	0.187	-0.236	0.227
PO4	-0.243	0.213	-0.465	<0.01*
Albumin	-0.110	0.578	-0.530	<0.001*
Alkaline phosphatase	-0.574	<0.001*	-0.599	<0.001*
Creatinine	-0.099	0.615	-0.442	<0.05
Urea	-0.301	0.119	-0.088	0.654
25-Hydroxyvitamin D	0.787	<0.001**	0.940	<0.001**
LDL	0.106	0.590	-.304-	0.116
HDL	0.152	0.440	0.042	0.831
Cholesterol	-0.514-	.005*	-0.288-	0.138
Triglyceride	-0.528-	.004*	-0.233-	0.233

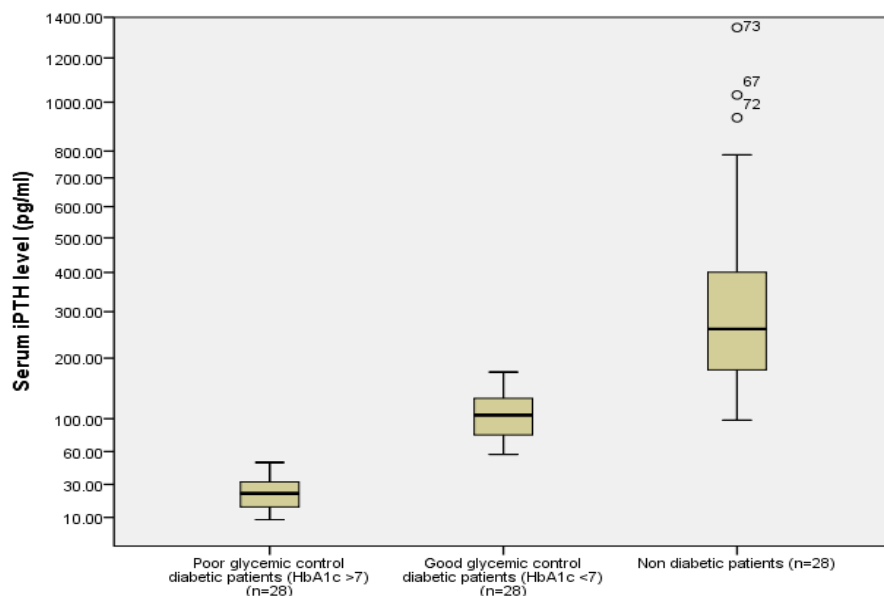
**Linear regression analyses in diabetic patients on hemodialysis (n=56) :** stepwise linear regression analysis was done to assess the main independent parameters associated with serum iPTH. Our results showed that, serum iPTH levels were independently correlated with 25-Hydroxyvitamin D , diastolic blood pressure, serum phosphorus ,albumin,alkaline phosphatase,post prandial blood glucose, fasting blood glucose, hemoglobin A1c. (p< 0.001) (Table 4).

**Table 4:-**Linear regression analyses in diabetic patients on hemodialysis to test the influence of the main independent variables against serum iPTH (pg/ml) levels (dependent variable).

Model		Unstandardized Coefficients		Standardized Coefficients	T	P	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	229.952	173.140		1.328	0.195	585.205	125.301
	Diastolic blood pressure	1.148	.401	.884	2.865	<0.001*	.326	1.970
	Systolic blood pressure	.321	.183	.477	1.756	0.090	.696	.054
	Albumin	250.53	311.300	.149	.805	<0.001*	885.439	384.363
	Urea	11.828	8.863	.505	1.335	0.192	6.248	29.904
	25-Hydroxyvitamin D	2.444	.327	.393	7.475	.000	1.788	3.101
	Serum calcium	27.909	60.620	.068	.460	0.648	95.726	151.543
	Serum phosphorus	80.760	34.748	.399	2.324	<0.001*	9.892	151.629
	Creatinine	52.277	41.303	.197	1.266	0.215	136.515	31.962
	LDL	5.087	4.033	.213	1.261	0.217	3.138	13.312
	HDL	9.631	8.919	.117	1.080	0.289	8.559	27.821
	TG	.291	2.200	.022	.132	0.896	4.777	4.196
	TC	1.814	2.520	.130	.720	0.050	6.953	3.326
	Pulse	2.597	15.549	.036	.167	0.868	34.310	29.117
	Alkaline phosphatase	2.069	2.822	.173	.733	<0.001*	7.824	3.686
	PPBG	4.025	4.013	.353	1.003	<0.001*	12.210	4.160
	FBG	13.929	6.470	.671	2.153	<0.001*	27.124	.735
	HbA1c	136.764	108.640	.404	1.259	<0.001*	84.808	358.337

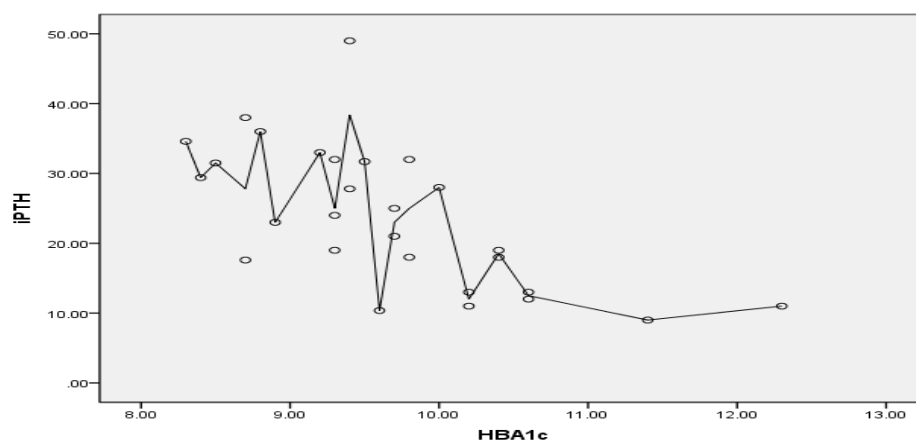
HDL-C; high-density lipoprotein-cholesterol, LDL-C; low-density lipoprotein-cholesterol, PPBG; post prandial blood glucose, FBG; fasting blood glucose, HbA1c; hemoglobin A1c. \* P < 0.05

**Comparison of serum iPTH(pg/ml) levels among the studied groups (Fig.1):** Non diabetic patient on chronic hemodialysis had significantly higher values of serum iPTH (pg/ml) ( $371.39 \pm 306.45$ ) compared to diabetic group ( $65.25 \pm 47.76$ ). There was high significant elevated serum iPTH in good glycemic control group compared to poor glycemic control group ( $106.67 \pm 31.37$ ), ( $23.82 \pm 10.13$ ) respectively.

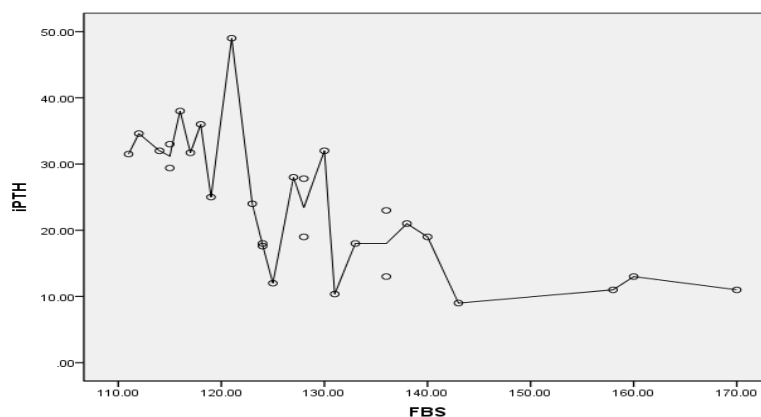


**Fig .1:-** Comparison of serum iPTH(pg/ml) levels among the studied groups

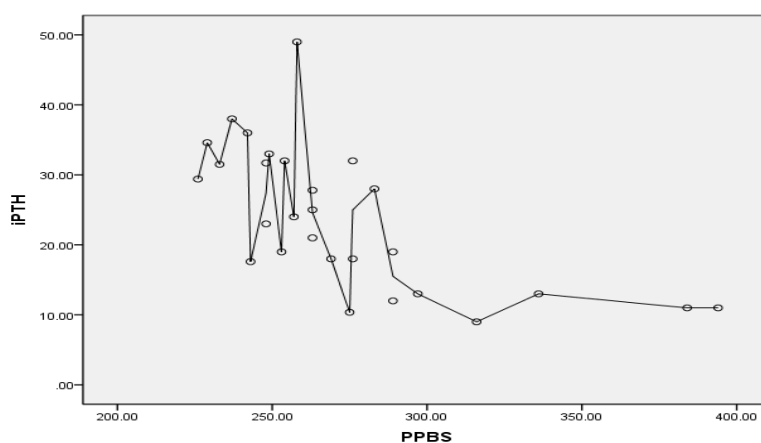
**Correlations between iPTH(pg/ml),glycemic parameters among poor glycemic control group on hemodialysis(Fig.2 a,b and c):** In diabetic patients with poor glycemic control, serum iPTH level was negatively correlated with HbA1C ( $r=-0.650, p<0.001$ ), FBG ( $r=-0.696, p<0.001$ ) as well as PPBG ( $r=-0.652, p<0.001$ ).



**Fig. 2a:-**Correlation between iPTH and HbA1c in diabetic patients (poor glycemic control group)

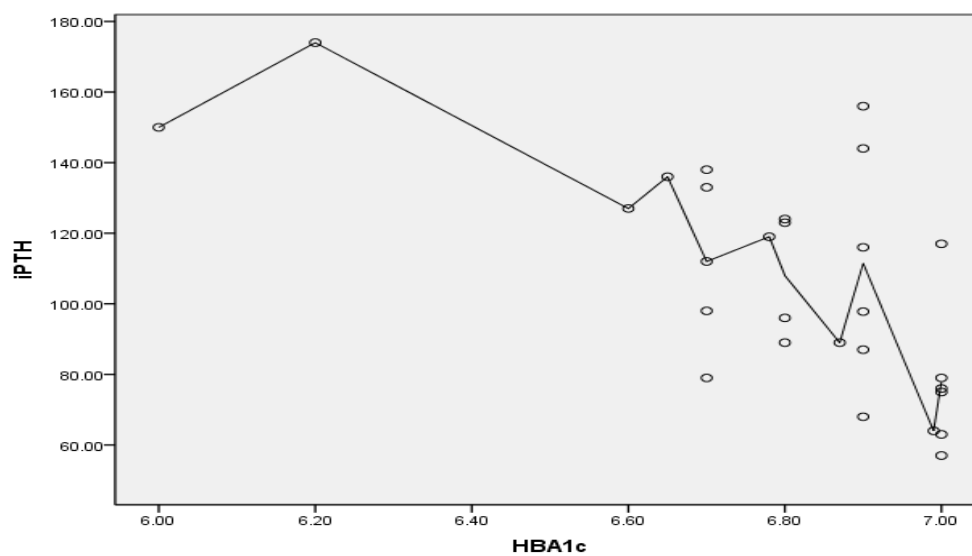


**Fig. 2b:-** Correlation between iPTH and FBG in diabetic patients (poor glycemic control group)

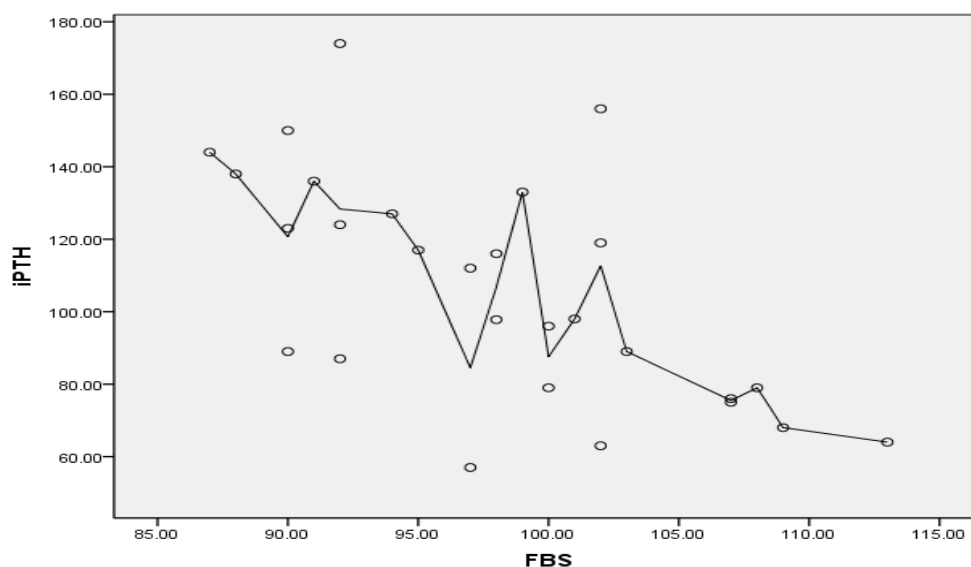


**Fig. 2c:-** correlation between iPTH and PPBG in diabetic patients (poor glycemic control group)

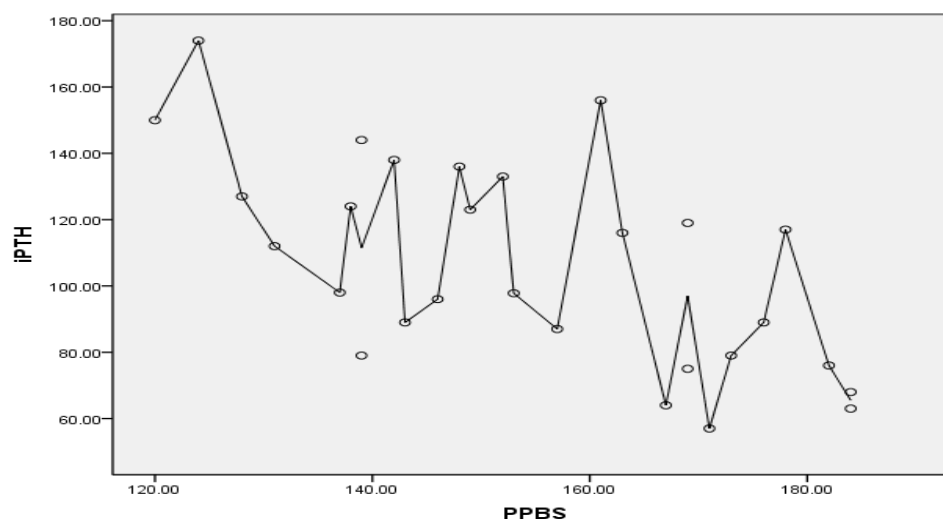
**Correlations between iPTH(pg/ml),glycemic parameters among good glycemic control group on hemodialysis (Fig.3 a,b and c):** In diabetic patients with good glycemic control, serum iPTH level was negatively correlated with HbA1C( $r=-0.649, p<0.001$ ), FBG ( $r=-0.634, p<0.001$ ), as well as PPBG( $r=-0.631, p<0.001$ ).



**Fig. 3a:-** Correlation between iPTH and HbA1C in diabetic patients (good glycemic control group)



**Fig. 3b:-** Correlation between iPTH and FBG in diabetic patients (good glycemic control group)



**Fig. 3c:-** correlation between iPTH and PPBG in diabetic patients (good glycemic control group)

### Discussion:-

Worldwide, the incidence of individuals with end-stage renal disease (ESRD) has increased markedly over the past decades and imposes a major social and economic burden for healthcare systems [12].

Diabetes Mellitus (DM) is the main cause of chronic kidney disease (CKD). Given the prevalence of DM is estimated to increase from 366 million patients in 2011 to 552 million patients in the year 2030. Furthermore, it is well established that diabetic nephropathy particularly from type 2 diabetes and hypertensive nephrosclerosis are the leading causes of ESRD in developed and developing countries possibly because of increasing prevalence of obesity, diabetes and hypertension [13].

Numerous reports have described renal osteodystrophy as "the silent crippler"; affected patients may be completely asymptomatic. Nonetheless, if symptoms developed it is observed in the late stages of the disease, these symptoms including bone and joint pain as well as bone deformity and fractures. Adynamic bone disease is a severe state of renal osteodystrophy characterized by low levels of PTH, lack of bone cell activity and a low bone turnover [14]. The excessive suppression of PTH can lead to adynamic bone disease (currently the most common osteodystrophy), mainly because of low bone turnover [15].

Previous studies have shown advanced glycation end products (AGEs) which produced in diabetic state play an important role in the pathogenesis of both impaired secretion of iPTH and decreased bone formation. Furthermore, (AGEs) inhibit hypersecretion of PTH in response to low serum calcium [16]. Data on the association between T2DM and osteoporotic fractures is controversial. Martinez-Laguna D [17] reported 20% increased risk of hip fracture in the first years following T2DM disease onset compared to matched non-diabetic patients.

Nonetheless, numerous reports have linked the higher incidence of osteodystrophy among the diabetic patients on regular hemodialysis to high intact parathyroid hormone (iPTH) level, thus, the objective of the present study was to estimate the serum levels of iPTH and to clarify the possible relationships between iPTH serum levels and HbA1c which reflect the glycemic control as well as other clinical and biochemical parameters in ESRD patients on regular hemodialysis. Our study revealed clear evidence that, diabetic patient on chronic hemodialysis had significantly higher values of PPBG, FBG, HbA1c, LDL, TG, TC, PO<sub>4</sub>, albumin and Alkaline phosphatase, compared to non-diabetic patients on hemodialysis.

This was in agreement with the findings detected by **Paulo et al.**, [18], who reported a statistical significant difference regarding fasting blood sugar, phosphorus and glycated hemoglobin in diabetic group compared to non-diabetic group. Likewise, **Takeshi et al.**, [19], reported a high statistical significant difference between all groups regarding glycated hemoglobin. These results were in agreement with the study of **Ahmed R. et al.**, [20], they reported a statistical significant difference between all diabetic and non-diabetic patients regarding HbA1c, fasting blood sugar, serum albumin and phosphate.

Regarding the influence of hyperglycemia on clinical and biochemical parameters, our results revealed that in poor glycemic control group, systolic & diastolic blood pressure, FBG, PPBG, HbA1c, urea, alkaline phosphatase, TG, and cholesterol were significantly higher than in patients with good glycemic control. Similar results had been detected by other authors **Ahmed R. et al.**, [20] they reported a statistical significant difference between controlled diabetic and uncontrolled diabetic patients regarding fasting blood sugar and glycated hemoglobin.

The main finding of our study, non-diabetic patient on chronic hemodialysis had significantly higher values of serum iPTH more than diabetic group, moreover, patients with good glycemic control had significantly higher levels of serum iPTH and 25-Hydroxyvitamin D compared to poor glycemic control group.

These findings are in a close agreement with results reported by **Ahmed R. et al.**, [20], who have also determined that serum iPTH levels in diabetic patients on hemodialysis were lower when compared with those in non-diabetic patients, also poor glycemic control further reduced levels of serum iPTH, also good glycemic control was associated with higher levels of serum iPTH, while no statistical difference of serum levels of iPTH between controlled diabetic patients and non-diabetic patients, suggesting that proper glycemic control could eliminate the effects of diabetic state on serum iPTH level.

Previous studies also have shown that, despite the fact that serum iPTH levels are considered important for the understanding of the mechanisms leading to renal related bone disease, changes in iPTH biological action play a significant role in the pathogenesis of renal osteodystrophy [21]. Both high and low circulating iPTH levels have been linked respectively to high and low bone turnover osteodystrophy or adynamic bone disease in patients on hemodialysis [14, 22]. Pilz S et al; 2011 [23] showed low 25(OH)D concentrations in patients with CKD. Molina P et al 2014 [24] have reported that cholecalciferol decreases albuminuria and improves iPTH levels.

Our study demonstrated that, in diabetic patients with poor glycemic control, serum iPTH level was positively correlated with 25-Hydroxyvitamin D, on the other hand, serum iPTH level was negatively correlated with Alkaline phosphatase. In good glycemic control, serum iPTH level was positively correlated with 25-Hydroxyvitamin D, but there were significant negative correlations between serum iPTH level and creatinine, alkaline phosphatase, phosphorous and albumin, there were non-significant correlation between iPTH and other clinical and biochemical characters in both groups. Regarding correlation between serum iPTH and parameters of glycemic control. In diabetic patients with poor glycemic control, serum iPTH level was negatively correlated with post prandial blood glucose, fasting blood glucose, as well as HbA1C.

These results were in agreement with the studies of **Wasan et al.**, [25] and **Dan S et al.**, [26], they observed that in diabetic poor glycemic control group, there was a significant inverse correlation between serum iPTH and serum



alkaline phosphatase, cholesterol, triglycerides, fasting blood sugar, postprandial blood sugar and glycated hemoglobin.

Also our results revealed that diabetic patients with good glycemic control, serum iPTH level was negatively correlated with post prandial blood glucose, fasting blood glucose, as well as HbA1C. Similarly the study of **Dan S et al.**, [26] observed that, in the diabetic good glycemic control group there was a significant positive correlation between serum iPTH and serum albumin and creatinine, while there is a significant inverse correlation between serum iPTH and serum phosphate, alkaline phosphatase, fasting blood sugar, postprandial blood sugar and glycated hemoglobin.

These results were supported previously by **Murakami et al.**, [10], who reported that there was an inverse correlation between serum iPTH levels and glycemic control. Specifically, diabetic patients with poor glycemic control were characterized by low circulating iPTH, which is conversely found at higher levels in diabetic patients with good glycemic control. **Atmaca et al** [27] reported that, impaired blood glucose regulation in subjects with type II DM leads to functional hypoparathyroidism and advised further investigation for the effect on bone loss and fragility. Also **Polymeris et al** [28] revealed reduction in parathyroid hormone which was inversely correlated with elevated blood glucose during oral glucose tolerance test in non diabetic postmenopausal women.

Our study explored that, In diabetic patients on hemodialysis, stepwise linear regression analysis showed that, serum iPTH levels were independently correlated with 25-Hydroxyvitamin D, diastolic blood pressure, serum phosphorus, albumin, alkaline phosphatase FBG, PPBG and HbA1c.

Also, **Paula et al.**, [18], found that serum HbA1c levels were independent correlated with the serum iPTH levels in diabetic group. The inverse correlation noted between blood glucose and parathyroid hormone suggest that hyperglycemia may have an inhibitory action on the synthesis and secretion of parathyroid hormone and it is attractive to speculate that hyperglycemia together with an insulin deficit may lead to a hypoparathyroid state and a downregulation of PTH receptors [25].

**Paula et al.**, [18] detected the inhibitory effects of insulin on both the secretion and the action of iPTH in both primary and secondary hyperparathyroidism. however, it is still unclear as **Procopio M and Borretta G** [29] studies suggest that poor metabolic control per se, could inhibit low calcium-mediated iPTH secretion. **Guh et al.**, [30] detected the protective effect of diabetic process on the development of hyperparathyroidism and development of an adynamic bone lesion. In contrast, the uncontrolled hyperglycemia is parallel with increased risk of vascular calcification and increased cardiovascular mortality.

Also, **Gnudi et al.**, [31] reported that low bone turnover osteodystrophy represents a risk factor for accelerated peripheral vascular disease in patients on hemodialysis. While low blood levels of intact PTH strongly suggest the presence of adynamic bone, a high PTH level does not exclude this possibility. Histological studies have found adynamic bone in patients on hemodialysis despite PTH values above 44.0 pmol/L. This may be related to limitations of the PTH assay due to accumulation of inhibitory PTH fragments [32]. Despite the fact that K-DOQI [33] guidelines recommend keeping glycated hemoglobin below 7% in diabetic patients undergoing dialysis, this recommendation is not based on clinical trials for the population undergoing renal replacement therapy (RRT), and the target range might be challenged due to the lack of nationwide studies related to this issue, making way for an individualized approach for these patients [34].

### Conclusion:-

Non diabetic patient on chronic hemodialysis had significantly higher values of serum 25-hydroxyvitamin D and intact parathyroid hormone (iPTH) more than diabetic group. Moreover, in diabetic patients with poor glycemic control, serum iPTH level and 25-hydroxyvitamin D were significantly lower than diabetic patients with good glycemic. Thus, tight metabolic control of the diabetic process is very important to avoid hypoparathyroidism and low bone turnover in these patients. Alongside, individual titration of Ca and Vit D supplementations in ESRD patients on hemodialysis may be fruitful in keeping iPTH level within target range. Further studies should be done to investigate whether targeting iPTH and other determinants involved in renal bone disease in dialysis patients may prevent or delay the development of vascular calcifications.

**References:-**

1. US renal data system, USRDS 2005 Annual data report: Atlas of end-stage renal disease in the United States, national institute of health, national institute of diabetes and digestive and kidney disease, Bethesda, MD, 2005. *Am J Kidney Dis* 2006;47:S1.
2. Anand S, Bitton A, Gaziano T. The gap between estimated incidence of end-stage renal disease and use of therapy. *PLoS One* 2013; 8: e72860.
3. Liyanage T, Ninomiya T, Jha V, et al. Worldwide access to treatment for end-stage kidney disease: a systematic review. *Lancet* 2015; 385: 1975–1982
4. A Afifi, et al. Annual reports of the Egyptian renal registry; 1996-2008
5. Brownlee M. The pathobiology of diabetic complications: a unifying mechanism. *Diabetes*.2005;54(6):1615–1625.
6. Gal-Moscovici A, Popovtzer MM. New worldwide trends in presentation of renal osteodystrophy and its relationship to parathyroid hormone levels. *Clin Nephrol*. 2005;63: 284-89.
7. Coen G. Adynamic bone disease: an update and overview. *J Nephrol*.2005;18: 117-22.
8. Vincenti F, Hattner R, Amend WJ Jr et al. Decreased secondary hyperparathyroidism in diabetic patients receiving hemodialysis. *JAMA* 1981; 245: 930-933.
9. Inaba M OS, Nagasue K, et al. Impaired secretion of parathyroid hormone is coherent to diabetic hemodialyzed patients. *Am J Kidney Dis*. 2001; 38:139-42.
10. Murakami R, Murakami S, Tsushima R, Ueda C, Mikami K, Ebina T, et al. Glycaemic control and serum intact parathyroid hormone levels in diabetic patients on haemodialysis therapy. *Nephrol Dial Transplant*.2008; 23:315-20.
11. Inaba M, Nagasue K, Okuno S et al. Impaired secretion of parathyroid hormone, but not refractoriness of osteoblast, is a major mechanism of low bone turnover in hemodialyzed patients with diabetes mellitus. *Am J Kidney Dis* 2002; 39: 1261–1269.
12. Beladi Mousavi SS, Alemzadeh Ansari MJ, Cheraghian B (2011): Outcome of Patients on Hemodialysis in Khuzestan, Iran. *NDT Plus*: 4:143-4.
13. Beladi Mousavi SS, Alemzadeh Ansari MJ, Alemzadeh Ansari MH, Beladi Mousavi M (2012): Long-term survival of patients with end-stage renal disease on maintenance hemodialysis a multicenter study in Iran. *IJKD*.;6: 452-6.
14. Coen G, Ballanti P, Bonucci E et al. (1998): Bone markers in the diagnosis of low turnover osteodystrophy in hemodialysis patients. *Nephrol Dial Transplant*; 13: 2294–2302
15. Andress DL (2008): Adynamic bone in patients with chronic kidney disease. *Kidney Int*; 73: 1345–54.
16. Yamamoto T, Ozono K, Miyauchi A (2001): Role of advanced glycation end products in adynamic bone disease in patients with diabetic nephropathy. *Am J Kidney Dis*.; 38:S161–S64
17. Martinez-Laguna DI, Tebe C, Javadi MK, Nogues X, Arden NK, et al. Incident type 2 diabetes and hip fracture risk: a population-based matched cohort study. *Osteoporos Int*. 2015 Feb;26(2):827-33
18. Paula FJ, Lanna CM, Shuhama T, Foss MC (2001): Effect of metabolic control on parathyroid hormone secretion in diabetic patients. *Braz J Med Biol Res*; 34:1139-45.
19. Takeshi O, Masanori E, Tsutomu T, Tomoaki M, Yoshihiro T, Hideki T, Tetsuo S, Yoshiki N (2006): Impact of Glycemic Control on Survival of Diabetic Patients on Chronic Regular Hemodialysis. *Diabetes Care* 29:1496–1500
20. Ahmed Ramadan Ali, Ahmed Alsayed Emam, Heba S. Assal, Alaa B. Abbas (2010): Intact Parathyroid Hormone in Egyptian Type 2 Diabetics with Chronic Hemodialysis: Impact of Glycemic Control. *Kidney*; 19:17–22.
21. Luigi Gnudi (2008): Serum intact parathyroid hormone in diabetic patients on hemodialysis: what is the treatment goal? *Nephrol Dial Transplant*; 23: 24–26.
22. Gal-Moscovici A & Popovtzer MM (2005): New worldwide trends in presentation of renal osteodystrophy and its relationship to parathyroid hormone levels. *Clin Nephrol*; 63: 284-89.
23. Pilz S, Iodice S, Zittermann A, Grant WB, Gandini S. Vitamin D status and mortality risk in CKD: a meta-analysis of prospective studies. *Am J Kidney Dis*. 2011;58:374–382.
24. Molina P, Górriz JL, Molina MD, Peris A, Beltrán S, Kanter J, Escudero V, Romero R, Pallardó LM. The effect of cholecalciferol for lowering albuminuria in chronic kidney disease: a prospective controlled study. *Nephrol Dial Transplant*. 2014;29:97–109.
25. Wasan Abdulkareem Abbas, Mohammed A. Al-Zubaidi, Sundus Kh. Al-Khazraji (2012): Estimation of serum calcium and parathyroid hormone (PTH) levels in diabetic patients in correlation with age and duration of disease. *Iraqi J. Comm. Med.*, Apr. (2).

26. Dan S, Aditya P, Samanta M, Jothimalar R, Soundarajan P (2014): Effect of Glycemic Control on Intact Parathyroid Hormone Level in End Stage Renal Disease Patients on Maintenance Hemodialysis. *Diabetes Research and Clinical Practice*, S0168-8227(14)00180-6.
27. Murat Atmaca, Ismail Acar, Engin Gonultas, Ismet Seven et al (2014). Type 2 diabetes mellitus and functional hypoparathyroidism. *Turk Jem*; 18:116-120.
28. Polymeris AD, Doumouchtsis KK, Giagourta I, Karga H. (2011). Effect of oral glucose load on PTH, 25OHD3, calcium and phosphorous homeostasis in postmenopausal women. *Endocr Res*; 36:45-52.
29. Procopio M, Borretta G (2003): Derangement of glucose metabolism in hyperparathyroidism. *J Endocrinol Invest.*; 26:1136-42.
30. Guh JY, Chen HC, Chuang HY, Huang SC, Chien LC, Lai YH (2002): Risk factors and risk for mortality of mild hypoparathyroidism in hemodialysis patients. *Am J Kidney Dis.*; 39:1245-54.
31. Gnudi L (2008): Serum intact parathyroid hormone in diabetic patients on hemodialysis: what is the treatment goal? *Nephrol Dial Transplant*; 23:24-6.
32. National Kidney Foundation (2003): *Am J Kidney Dis.* 2003; 42:S1-202.
33. KDOQI (2003): Clinical Practice Guidelines for bone metabolism and disease in chronic kidney disease. *Am J Kidney Dis*; 42 Suppl 3:S2.
34. Kovesdy CP, Sharma K, Kalantar-Zadeh K (2008): Glycemic control in diabetic CKD patients: where do we stand? *Am J Kidney Dis*; 52(4):766-77.

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### RESEARCH ARTICLE

## KNOWLEDGE & ATTITUDES TOWARD ELECTROCONVULSIVE THERAPY (ECT) AMONG A SAMPLE OF HEALTH FIELD STUDENT AND THE GENERAL PUBLIC IN SAUDI ARABIA AT "QASSIM"

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Albshri , Bdoor saad alrasheedi and Farida khalaf alharbi.

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### Abstract

**Background :** Electroconvulsive therapy (ECT) it is one of many methods used for treatment in hospital and ECT more we find them in the psychiatric clinic. However, the Electroconvulsive therapy has been demonstrated effective and safe treatment for a psychiatric disorder like depression, schizophrenia, and neuroleptic malignant syndrome, it has electrical polar which pass electrical through the brain when the patient under general anesthesia.

There are many stigmas is attached to the use of ECT, which undermines the acceptance of this treatment by the general public. In contrast to the negative view about ECT among the general public, studies, which have evaluated the knowledge and attitude of mentally ill patients who have received ECT and their relatives, suggest that they are mostly satisfied with the experience of ECT.

However, this is the first study focusing on awareness about ECT since there are no data on Qassim region about attitude or awareness of general public toward ECT.

**Objective:**

to explore the state of knowledge & attitudes toward electroconvulsive therapy (ECT) among a sample of health field and the general public in Saudi Arabia at "Qassim".

**Methods:** By use the Cross- sectional study ... Extensive electronic was administered to health field student and the general public in Saudi Arabia at "Qassim" (n=200) to investigate the source of ideas about ECT, the extent of knowledge and attitude toward ECT.

**Result:** It is good to know that most of the health field student are well informed about ECT the score was about 64% compared to the general public about 36% , the most age have the knowledge score is the age between 31-40 .however the source of knowledge more from the internet 34% in compare to other sources . The health field student and the general public have a good attitude towards ECT (is an inhuman treatment) 61% of the sample disagreed with this statement. The health field student and the general public attitude towards ECT (is a painful treatment) 73.5% of the sample agreed with this statement. While attitude towards ECT (is that Need anesthesia) from the health field student and the general public 57.5% of the sample disagreed with this statement. In the view of the most cases improved by treatment. From

the sample for the safety of ECT during pregnancy, show the health field student (29%) and the general public (14%) agreed to it implying that majority of the people did not consider ECT safe in pregnancy.

Keywords: Electro-convulsive therapy (ECT)

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## **Introduction:-**

Electroconvulsive therapy (ECT) involves the induction of a grand mal seizure through the passage of an electrical current to the patient's brain with the aim of improving the patient's mental status under anesthesia and muscle relaxant. There is no solid based clarification for the mechanism of action and how the ECT works but the most credibility goes to the biochemical theory. ECT is widely prescribed worldwide and first indicated in the emergency treatment of severe depression with suicide or psychosis, medication-resistant schizophrenia. ECT is also commonly used as an effective alternative to medication for patients who have a comorbid medical condition.

Modified and non-modified ECT are the two forms of the treatment, modification comes in the form of using anesthesia together with the muscle relaxant to limit the intensity of convulsion and reduce its side effects as bone and teeth fractures. Most of the internationally established guidelines recommended the modified ECT in the last decade as the standard routine treatment. Unilateral treatment is prescribed for some patients instead of bilateral to overcome the most frequently occurring side effects as temporary memory loss, mental confusion, and headache.

Despite controversies surrounding its use still remains one of the most efficacious treatment for the much severe mental disorder.

However, a lot of stigmas is attached to the use of ECT, which undermines the acceptance of this treatment by the general public. In contrast to the negative view about ECT among the general public, studies which have evaluated the knowledge and attitude of mentally ill patients who have received ECT and their relatives, suggest that they are mostly satisfied with the experience of ECT.

Studies which have evaluated the attitude of patients before and after ECT also show the attitudes become more positive after an experience of the treatment.

However, this is the first study focusing on awareness about ECT since there are no data on Qassim region about attitude or awareness of general public toward ECT.

Aim In this study, to examine the knowledge and attitude of the general public toward ECT.

## **Objective:-**

to explore the state of knowledge & attitudes toward electroconvulsive therapy (ECT) among a sample of health field student and the general public in Saudi Arabia at "Qassim".

## **Methods:-**

Study Design: Cross- sectional descriptive study.

Study setting: this research done in Saudi Arabia at "Qassim".

Study Population: population less than 20, 20-30, 31-40 and more than 40.

## **Data collection Technique:-**

### **Type of questionnaire:-**

See the appendix

### **sample size:-**

200(100 for health field in Saudi Arabia at "Qassim" and 100 for general population)

### **Sample method:-**

A random sample will be collected from health field in Saudi Arabia at "Qassim" and the general public.

**The plane for data collection:-**

The sample is divided into two groups, one for health field in Saudi Arabia at "Qassim" and another group for general public through electronic Questionnaires.

**Table 1:-** knowledge score in relation to study TYPE.

College		Knowledge		Total
		yes	no	
health field student.	Count	64	36	100
	%	64%	36%	100%
General public	Count	31	69	100
	%	31%	69%	100%
Total	Count	95	105	200
	%	47.5	52.2%	100%

The table show that significantly less knowledge more among general public: 36% compared to 64% of health field student.

**Table 2:-** Description the relation between the age and the knowledge.

			knowledge score		Total
			Yes	no	
Age	Less than 20	Count	7	13	20
		%	35%	65%	100.0%
	20-30	Count	41	55	96
		%	42.70%	57.29%	100.0%
	31-40	Count	35	22	57
		%	61.14%	38.5%	100.0%
	>41	Count	12	15	27
		%	44.4%	55.5%	100.0%
Total		Count	95	105	200
		%	47.5	52.2%	100.0%

**Table 3:-** Illustrates the knowledge score related to sex.

		knowledge score		Total
		yes	no	
Sex	Male	54 48.2%	58 51.7%	112
	Female	41 46.5%	47 53.4%	88
Total		95	105	200

**Table 4:-** The table shows the source of knowledge

			Sources				Total
			book	T.V	Internet	Relative or friend experience	
Gender	male	Count	7	24	17	12	60
		%	11%	40%	28%	20%	100.0%
	female	Count	11	11	24	12	60
		%	18%	18%	40%	20%	100.0%
Total		Count	18	35	41	24	120
		%	15%	29%	34%	20%	100.0%

The table shows that they get the knowledge from internet 34% in compare to T.V: 29%, relative\friend experience: 20% and book: 15%

**Table 5:-** This table show the medical and non-medical attitude towards ECT (ECT is an inhuman TREATMENT).

			inhuman treatment		Total
			yes	no	
	Medical	Count	29	71	100
		%	29%	71%	100.0%
	Non medical	Count	49	51	
		%	49%	51%	100.0%
Total		Count	78	122	100
		%	39%	61%	100.0%

This table shows the medical and non-medical good attitude towards ECT 61% of the sample disagreed with this statement.

**Table 6:-** This table show the medical and non-medical attitude towards ECT.

			Painful treatment		Total
			Yes	No	
medical		Count	79	21	100
		%	79%	21%	100%
Non medical		Count	68	32	100
		%	68%	32%	100%
Total		Count	147	53	200
		%	73.5%	26.5%	100.0%

This table show the medical and non-medical attitude towards ECT 73.5% of the sample agreed with this statement

**Table 7:-** This table show the medical and non-medical attitude towards ECT

			Need anesthesia		Total
			yes	no	
	Medical	Count	46	54	100
		%	46%	54%	100.0%
	Non medical	Count	39	61	100
		%	39%	61%	100.0%
Total		Count	85	115	200
		%	42.5%	57.5%	100.0%

This table show the medical and non-medical attitude towards ECT 57.5% of the sample disagreed with this statement.

**Table 8:-** This table show the knowledge of the duration OF ECT.

			Duration		Total
			medical	Non medical	
	One	Count	26	21	47
		%	55%	44%	100.0%
	2-3 times	Count	25	15	40
		%	62%	37%	100.0%
	Depend on the disorder	Count	49	65	114
		%	42%	57%	100.0%
Total	Count		100	100	200
	%		100%	100%	100.0%

**Table 9:-** This table show side effect.

			Persistent Side effect		Total
			yes	No	
result	Medical	Count	57	43	100
		%	57%	43%	100.0%
	Non medical	Count	69	41	100
		%	69%	41%	100.0%

Total	Count	126	74	200
	%	55.6%	44.4%	100.0%

The table show most cases improved by treatment.

**Table 10:-** Comparison between efficacy of ECT VS medical treatment.

			efficacy		Total
			yes	no	
reading	Medical	Count	48	52	100
		%	48%	52%	100.0%
	Non medical	Count	40	60	100
		%	40%	60%	100.0%
Total		Count	88	112	200
		%	44%	56%	100.0%

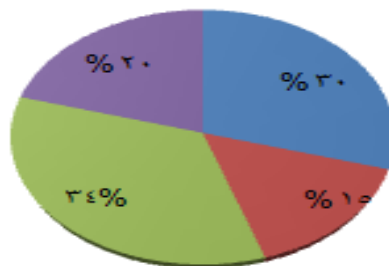
**Table 11:-** this table show the medical and non-medical attitude towards ECT

			Safe In pregnancy		Total
			yes	no	
	Medical	Count	29	71	10
		%	29%	71%	100.0%
	Non medical	Count	14	86	100
		%	14%	86%	100.0%
Total		Count	43	157	200
		%	21%	78%	100.0%

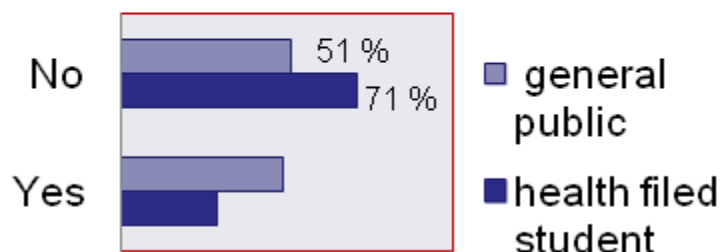
The table show only a few of the medical (29%) and non-medical(14%) agreed to it implying that majority of the people did not consider ECT safe in pregnancy.

## THE SOURCE OF KNOWLEDGE

■ T.V ■ BOOK ■ INTERNET ■ RELATIVE \FRINED EXPERIENCE



### The score of health filed student and the general public attitude towards ECT ( ECT is an inhuman treatment ).





**Conclusion:-**

IT IS GOOD to know that most of the health field student are well informed about ECT , the score was about 64% compared to the general public about 31% , the most age have the knowledge score is the age between 31-40 .however the source of knowledge more from internet 34% the in compare to other sources . The health field student have a good attitude towards ECT (is an inhuman treatment) 71% of the sample disagreed with this statement. The health field student and the general public attitude towards ECT (is a painful treatment) 73.5% of the sample agreed with this statement. While attitude towards ECT (is that Need anesthesia) from the health field student and the general public 57.5% of the sample disagreed with this statement. In the view of the most cases improved by treatment. From the sample for the safety of ECT during pregnancy, show the health field student (29%) and the general public (14%) agreed to it implying that majority of the people did not consider ECT safe in pregnancy.

**Recommendation:-**

we consider that there are many options in the treatment that it has a benefit as well as side effects, but should the person know both, so he can choose what is he would prefer to the treatment. And we LIKE TO clear about the ECT treatment that it gives us a positive result, not causes any pain under general anesthesia and safe for pregnant and this is what approved in the previous researchers.

**The Appendix:- ....**

1) AGE...	2) GENDER...	3) EDUCATIONAL LEVEL
Below 20	Male	- Academic medical specialization
20-30	Female	- Academic non-medical specialization
31-40		- Non- academic
Above 40		

4) do you have information about electroconvulsive therapy sessions?

Yes / no

5) if yes, what are the sources of your information?

Book

Internet

Television

A relative or friend dealing with electroconvulsive therapy

6) do you think that the electrical therapy sessions method of treatment is inhumane?

Yes / no

7) do you think that electroconvulsive therapy sessions painful?

Yes / no

8) do you think that the fear and anxiety that accompanies attending the proceedings is the reason why many patients refused to use this type of treatment?

Yes / no

9) do you think that the electricity therapy sessions require anesthesia?

Yes / no

10) how many sessions needed by the patient to give the desired results?

One session

Two to three on average

Vary depending on the disease

11) do you think that therapy sessions lead to get used to it?

Yes / no

12) do you know someone who has this kind of treatment?

Yes / no

13) if yes, did he/she responded to treatment?

Yes / no

14) it does result in symptoms of long-term side effect?

Yes / no

15) do you think electroconvulsive therapy sessions safe for pregnant women?

Yes / no

**16) do you think the use of electroconvulsive therapy sessions more effective than drug?**

**Yes / no**

**17) do you think the electroconvulsive therapy session given to only hopeless cases?**

**Yes / no**

**18) do you think that modern scientific research proving effectiveness electroconvulsive therapy?**

**Yes / no**

**References:-**

1. <http://www.ncbi.nlm.nih.gov/pubmed/18648319>
2. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2913640/#!po=34.1667>
3. <http://www.sciedu.ca/journal/index.php/jnep/article/viewFile/2049/1442>



## RESEARCH ARTICLE

### PATCH-WISE IMAGE DE-NOISING TECHNIQUE FOR IMPROVED PMRI USING ITERATIVE BILATERAL FILTER, LRMD AND SVM OF MEDICAL IMAGES.

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#### Key words:-

Image denoising, Rican noise, PSNR, MSE, SSIM, Bilateral Filter, Low Rank Matrix Decomposition (LRMD) and Support Vector Machine (SVM), .

#### Abstract

The most challenging research area in image processing is image denoising. This technique not only some self-possessed technical difficulties, but also may result in the demolition of the image (i.e. making it blur). There are various important component of large number of applications such as in medical diagnosis. In medical research there are different medical images like X- Ray, MRI, PET and CT gave minute to minute information about brain and whole body. The image denoising techniques includes parallel magnetic resonance imaging (pMRI) technique which can speed up MRI scan through a multi-channel coil array receiving signal simultaneously. Nevertheless, noise amplification and aliasing artifacts are serious in pMRI reconstructed images at high accelerations. An image enhancement method is proposed by using low rank matrix decomposition, LRMD and support vector machine, SVM. Low rank matrix decomposition is applied on image to remove the noises and enhancing the quality of an image. It describes the problem of finding and exploiting low-dimensional structures in high- dimensional data. The aim of Low Rank Matrix approximation based image enhancement is that it removes the various types of noises in the adulterate images simultaneously. The noise and aliasing artifacts are removed from the structured Matrix by applying sparse and low rank matrix decomposition method. The support vector machine exhibits video which is converted into different sizes of frames so that it can be enhanced easily. Then noisy image and enhanced image are compared to obtain higher signal to noise ratio and other parameters like Peak Signal to Noise Ratio PSNR, Structural Similarity Index Matrix SSIM and Mean Square Error MSE for qualitative assessment to the enhancement result. This method can effectively remove both noise and residual aliasing artifact from pMRI reconstructed noisy images, and produce higher peak signal noise rate (PSNR) and structural similarity index matrix (SSIM) than other state-of-the-art De-noising methods. Here we propose image de-noising using low rank matrix decomposition (LMRD) and Support vector machine (SVM). The proposed method gives more clear image with higher PSNR and improved SSIM value than the previous methods.

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### Introduction:-

The digital signal processing having image which has an input and output (or a set of characteristics or parameters of image) image. In image processing we work in two domains i.e., spatial domain and frequency domain. The Spatial domain refers to the image plane itself, and image processing method in this category are based on direct manipulation of the pixels in an image and coming to frequency domain it is the analysis of mathematical functions or signals with respect to frequency rather than time.



**Fig 1:-** Medical original, noisy and denoised image

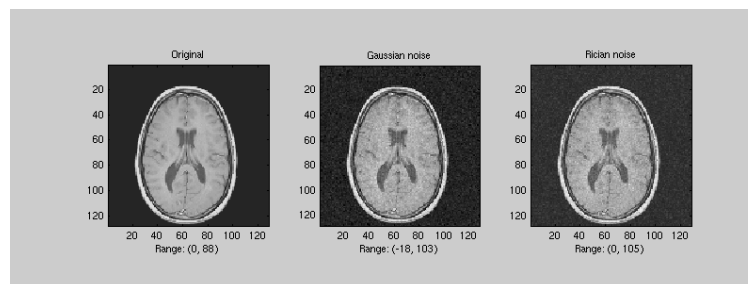
The sources of noise in digital images arise during image acquisition and transmission. The Noise degrades the image quality for which there is a need to denoise the image to restore the quality of image.

### NOISE Types:-

There are various types of noise have their own characteristics and are inherent in images in different ways.

#### Gaussian Noise:-

Gaussian noise is evenly distributed over the signal. This means that each pixel in the noisy image is the sum of the true pixel value and a random Gaussian distributed noise value.

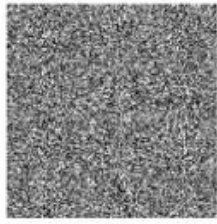


**Fig 1.1:-** Gaussian noise and Rician noise image

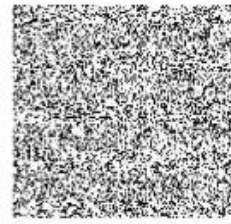
As the name indicates, this type of noise has a Gaussian distribution, which has a bell shaped probability distribution function given by

$$F(g) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(g-m)^2}{2\sigma^2}}$$

Where  $g$  represents the gray level,  $m$  is the mean or average of the function and  $\sigma$  is the standard deviation of the noise. The Gaussian noise represent in Image 1.2 illustrates the Gaussian noise with mean (variance) as 1.5 (10) over a base image with a constant pixel value of 100.



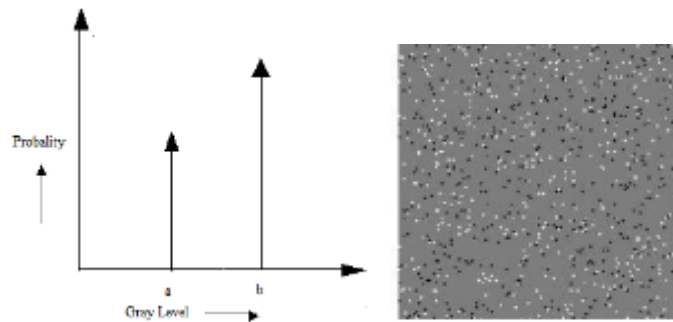
**Fig 1.2:-** Gaussian noise  
(mean = 0, variance = 0.05)



**Fig 1.2:-** Gaussian noise  
(mean = 1.5, variance = 10)

### Salt and Pepper Noise:-

Salt and Pepper is an impulse type of noise and is also referred to as intensity spikes. It is generally caused due to errors in transmission. This is caused generally due to errors in data transmission. It has only two possible values, a and b. The probability of each is typically less than 0.1. The corrupted pixels are set alternatively to the minimum or to the maximum value, giving the image a “salt and pepper” like appearance. Unaffected pixels remain unchanged. For an 8-bit image, the typical value for pepper noise is 0 and for salt noise 255. The salt and pepper noise is generally caused by malfunctioning of pixel elements in the camera sensors, faulty memory locations, or timing errors in the digitization process. The probability density function for this type of noise is shown in Figure 1.3.



**Fig 1.3:-** salt and pepper noise

**Fig 1.3:-** salt and pepper noise

### Medical Image denoising:-

Image denoising is an important image processing task, both as a process itself, and as a component in other processes. Very many ways to denoise an image or a set of data exists. The main properties of a good image denoising model is that it will remove noise while preserving edges. Traditionally, linear models have been used. One common approach is to use a Gaussian filter, or equivalently solving the heat-equation with the noisy image as input-data, i.e. a linear, 2nd order PDE-model. For some purposes this kind of denoising is adequate. One big advantage of linear noise removal models is the speed. But a back draw of the linear models is that they are not able to preserve edges in a good manner: edges, which are recognized as discontinuities in the image, are smeared out.

The different digital medical imaging technologies Such as positron emission tomography (PET), magnetic resonance imaging (MRI), computerized tomography (CT) and ultrasound Imaging has revolutionized modern medicine. Today, many patients no longer need to go through invasive and often dangerous procedures to diagnose a wide variety of illnesses. Here the widespread use of digital imaging in medicine today, the quality of digital medical images becomes an important issue through worldwide. In medical line to achieve the best possible diagnosis it is important that medical images be sharp, clear, and free of noise and artifacts. The major challenges in the study of medical imaging because they could mask and blur important features in the images and many proposed de-noising techniques have their own problems. Image de-noising still remains a challenge for researchers because noise removal introduces artifacts and causes blurring of the images. The factors which affect noise modeling in medical imaging are capturing instruments, information transmission media, image quantization and separate sources of radiation. There are a number of shortcomings and these includes: acquisition noise from the equipment, ambient noise from the environment, the presence of background issue, other organs and

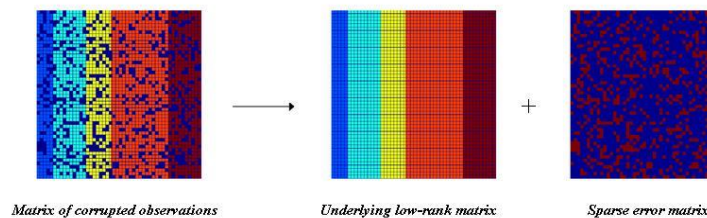
anatomical influences such as body fat, and breathing motion. Therefore, noise reduction is very important, as various types of noise generated limits the effectiveness of medical image diagnosis.

### Techniques Used:-

There are various main techniques are used to enhance the results of this thesis. These techniques are discussed below:

#### Low-Rank Matrix Decomposition:-

LRMR is derived from compressed sensing theory which has been successfully applied various matrix completion issues for example image compression video denoising and dynamic MRI Compared with classical denoising methods. Denoising techniques based on low rank completion enforce fewer external assumptions on noise distribution. These methods rely on the self-similarity of three dimensions (3-D) images across different slices or frames to construct a low rank matrix. The significantly varying contents between different slices or frames may lead an exception to the assumption of low-rank 3-D images and discount the effectiveness of these methods.



**Fig 2.1:-** Image represents Low-rank matrix decomposition

Low-Rank Matrix Decomposition It is derived from compressed sensing theory has been successfully applied various matrix completion problems, e.g., image compression video denoising and dynamic MRI Compared with classical denoising methods. Denoising methods based on low rank completion enforce fewer external assumptions on noise distribution. These methods rely on the self-similarity of three dimensions (3-D) images across different slices or frames to construct a low rank matrix. Nonetheless, significantly varying contents between different slices or frames may lead an exception to the assumption of low-rank 3-D images, and discount the effectiveness of these methods. In this paper, we propose to remove both noise and aliasing artifacts in pMRI image by using a sparse and low rank decomposition method.

#### Support Vector Machine (SVM):-

It is primarily a classifier in which width of the margin between the classes is the optimization criterion, i.e. empty area around the decision boundary defined by the distance to the nearest training patterns. These are called support vectors. The concept of (SVM) Support Vector Machine was introduced by Vapnik. The SVM classifier is widely used in bioinformatics (and other disciplines) due to its highly accurate, able to calculate and process the high-dimensional data such as gene expression and exibility in modeling diverse sources of data .SVMs belong to the general category of kernel methods. A kernel method is an algorithm that depends on the data only through dot-products. When this is the case, the dot product can be replaced by a kernel function which computes a dot product in some possibly high dimensional feature space. This has two advantages: First, the ability to generate non-linear decision boundaries using methods designed for linear classifiers. Second, the use of kernel functions allows the user to apply a classifier to data that have no obvious fixed-dimensional vector space representation.

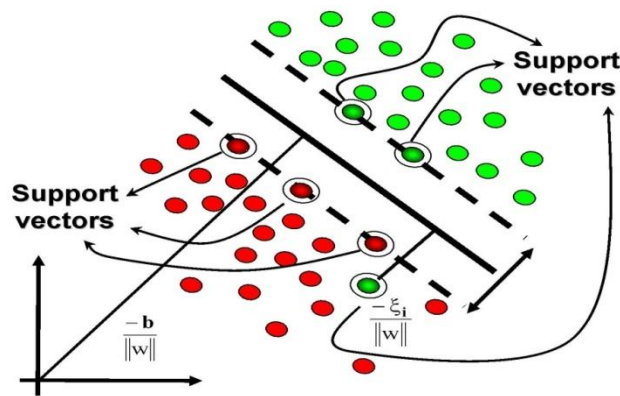


Fig 2.2:- Image represents data mapping of support vectors in SVM

The support vector machines have proved to achieve good generalization performance with no prior knowledge of the data. The principle of an SVM is to map the input data onto a higher dimensional feature space nonlinearly related to the input space and determine a separating hyper plane with maximum margin between the two classes in the feature space. The SVM is a maximal margin hyper plane in feature space built by using a kernel function. This results in a nonlinear boundary in the data space.

#### Filters:-

In image processing filters are mainly used to suppress either the high frequencies in the image that is smoothing the image, or the lower frequencies that is enhancing or detecting edges in the image. The image can be filtered in frequency domain or in the spatial domain. In spatial domain there are two types of filters namely linear filters and non linear filters. The bilateral filter is a non-linear filter and edge-preserving noise-reducing smoothing filter for medical images. In this the weight can be based on a Gaussian distribution. Weights depend not only on Euclidean distance of pixels, but also on the radiometric differences (e.g. range differences, such as color intensity, depth distance, etc.). The intensity value at each pixel in an image is replaced by a weighted average of intensity values from nearby pixels. The bilateral filter can blur an image while respecting strong edges. The ability of bilateral filter to decompose an image into different scales without causing haloes after modification has made it ubiquitous in computational photography applications such as tone mapping, style transfer, relighting, and denoising of medical images. This text provides a graphical, intuitive introduction to bilateral filtering, a practical guide for efficient implementation and an overview of its numerous applications, as well as mathematical analysis. The formulation of it is simple and each pixel is replaced by a weighted average of its neighbors. This aspect is important because it makes it easy to acquire intuition about its behavior, to adapt it to application-specific requirements, and to implement it.

#### Parameters used:-

Following are the two main parameters that are used to calculate the results of the proposed work in this thesis. These parameters are:

#### Peak Signal-to-Noise Ratio (PSNR):-

Peak signal-to-noise ratio is an engineering term for the ratio between the maximum possible power of a signal and the power of corrupting noise that affects the fidelity of its representation. Because many signals have a wide dynamic range and PSNR is usually expressed in terms of the logarithmic decibel scale. Peak signal-to-noise ratio is the maximum gray scale value of the pixels in the fused image. Higher the value of the PSNR is better the performance of the fusion algorithm.

#### Mean Square Error (MSE):-

The mean square error (MSE) of a procedure for estimating an unobserved quantity measures the average of the squares of the errors that is, the difference between estimator and what is estimated. It would have the same effect of making all the values positive as the absolute value. There are two basic techniques used to compare the various image are the mean square error (MSE) and the peak signal-to-noise ratio (PSNR). A commonly utilized reference based assessment metric is the Mean Square Error (MSE). The MSE between a reference image and a fused image is given by the reference and fused images respectively and image dimensions. The MSE is the



cumulative squared error between the compressed and the original image, whereas PSNR is a measure of the peak error. Smaller the value of the MSE is better the performance of the fusion algorithm.

### Structure Similarity Index Matrix (SSIM):-

Structure similarity index matrix is a method for measuring the similarity between two images and it is a full reference matrix. In other words the measuring of image quality based on an initial uncompressed or distortion free image. This parameter is employed for measure the similarity between two images. SSIM enforced to recover on ancient ways like peak signal-to-noise ratio and mean square error. The distinction with reference to different parameters like MSE or PSNR is that it estimates perceived

### Conclusions:-

The formalism presented in this paper demonstrates that the LRMD and SVM techniques are combined to propose a new technique to further reduce the noise in medical images. In this paper, we propose different techniques like LRMD, MSE, Bilateral filter and SVM as a tool for image de-noising and enhancement. Low rank matrix decomposition and SVM will be used. The evaluation will be based on the PSNR and mean SSIM with their improved values as compare to the previous research. The parameter introduced is mean square error(MSE), it is proposed approach i.e. improved technique for medical image de-noising using these techniques and SVM will exhibit outcomes of noise reduction and image quality improvements with different noise levels which will qualify it to be suitable for image processing and denoising. The proposed approach drastically improves the quality of Parallel MRI scanning in particular medical images. Future work may be further applied new formulas or algorithm for the enhancement of denoised images. The proposed algorithm has been implemented on MATLAB tool. This approach can also be an effective technique to denoise the images used for digital image processing.

### References:-

1. Abuzoum Mohamed Saleh "Efficient analysis of medical image de-noising for MRI and Ultrasound Images", (2012).
2. Akutagawa Mastake, ChanYongjia, Katayama Masato, Yohsuke Kinouchi, Qinyu Zhang, "Additive and multiplicative noise reduction by back propagation neural network", Proceedings of the 29th Annual International Conference of the IEEE EMBS Internationale, Lyon, France August 23-26, 2007 IEEE(2007).
3. Al-Sobou Yazeed A. (2012) "Artificial neural networks as an image de-noising tool" World Appl. Sci. J., 17 (2): 218-227, 2012
4. Dr. T.Santhanam, S.Radhika, "Applications of neural networks for noise and filter classification to enhance the image quality", IJCSI International Journal of Computer Science Issues, Vol. 8, Issue 5, No 2, September 2011 (IJCAI 2011).
5. E.Salari, S. Zhang, "Image de-noising using neural network based non-linear filter in wavelet domain", 0-7803-8874-7/05/IEEE(2005)
6. F.Marvasti, N.sadati, S.M.E Sahraeia, "Wavelet image De-noising based on neural network and cycle spinning" 1424407281/07/IEEE(2007).
7. Gupta Manoj, KumarPapendra, KumarSuresh (IJCA-2010) "Performance comparison of median and the weiner filter in image de-noising."
8. KaurJappreet, KaurManpreet, KaurManpreet, KaurPoonamdeep "Comparative analysis of image de-noising techniques." (IJETA2012)
9. Leavline E.Jebamalar Sutha S, Singh D.Asir Anton Gnana (IJCA-2011) "Wavelet domain shrinkage methods for noise removal in mages."
10. Mr. S. Hyder Ali, Dr.(Mrs.) R. Sukanesh, Ms. K. Padma Priya "Medical image de-noising using neural networks".
11. Rehman Amjad, Sulong Ghazali, Saba Tanzila "An intelligent approach to image denoising", (JATIT 2005-2010).
12. Sontakke Trimbak R, Rai RajeshKumar, "Implementation of image de-noising using thresholding techniques", IJCTEE.
13. Toshihiro Nishimura, Masakuni Oshiro, "US Image Improvement Using Fuzzy NeuralNetwork with Epanechnikov Kernel", 978-1-4244-4649-0/09/ ©2009 IEEE
14. Zhengya Xu Hong Ren Wu Xinghuo Yu · Bin Qiu, "Adaptive progressive filter to remove impulse noise in highly corrupted color images", Springer-Verlag London Limited 2011.



15. Xiao-Ping Zhang, Member, IEEE, "Thresholding Neural Network for Adaptive Noise reduction", IEEE transactions on neural networks, vol. 12, no. 3, may 2001.
16. Dr. T.Santhanam, S.Radhika, "Applications of neural networks for noise and filter classification to enhance the image quality", IJCSI International Journal of Computer Science Issues, Vol. 8, Issue 5, No 2, September 2011 (IJCAI 2011).
17. S.Karthik , Hemanth V K , K.P. Soman , V.Balaji , Sachin Kumar S , M. Sabarimalai Manikandan , "Directional Total Variation Filtering Based Image Denoising Method", IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 2, No 1, March 2012 ISSN (Online): 1694-0814.
18. S.V.N. Vishwanathan, M. Narasimha Murty, "SSVM : A Simple SVM Algorithm".
19. Akutagawa Mastake, Chan Yongjia, Katayama Masato, Yohsuke Kinouchi, Qinyu Zhang, "Additive and multiplicative noise reduction by back propagation neural network", Proceedings of the 29<sup>th</sup> Annual International Conference of the IEEE EMBS Internationale, Lyon, France August 23-26, 2007 IEEE(2007).
20. Manjon, J.V., Carbonell-Caballero, J., Lull, J.J., García-Martí, G., Martí-Bonmatí, L., Robles, M.: MRI denoising using non- local means. Medical Image Analysis 12, 514–523 (2008).
21. Jing Peng, Yan Ma, "Integer Wavelet Image Denoising Method Based on Principle Component Analysis", Journal of Software, vol. 7, no. 5, May 2012.
22. Alexei N. Skourikhine, Lakshman Prasad, Bernd R. Schlei, "Neural Network for Image Segmentation", the Conference Applications and Science of Neural Networks, Fuzzy Systems and Evolutionary Computation, part of 45th SPIE's International Symposium on Optical Science and Technology, San Diego, Calif., July 31–August 4, 2000. Proc. SPIE, Vol. 4120, 28-35, 2000.
23. Qiyu Jin · Ion Grama · Quansheng Liu, "A New Poisson Noise Filter Based on Weights Optimization", Springer Science+Business Media New York 2013.
24. F.Marvasti, N.sadati, S.M.E Sahraeia, " Wavelet image De-noising based on neural network and cycle spinning" 1424407281/07/IEEE(2007).
25. Gupta Manoj, Kumar Papendra, Kumar Suresh (IJCA-2010) "Performance comparison of median and the weiner filter in image de- noising."
26. Kaur Jappreet, Kaur Manpreet, Kaur Manpreet, Kaur Poonamdeep "Comparative analysis of image de-noising techniques." (IJETA 2012)
27. Leavline E. Jebamalar Sutha S, Singh D. Asir Anton Gnana (IJCA-2011) "Wavelet domain shrinkage methods for noise removal in images."
28. Mr. S. Hyder Ali, Dr.(Mrs.) R. Sukanesh, Ms.K. Padma Priya " Medical image de-noising
29. using neural networks".
30. Rehman Amjad, Sulong Ghazali, Saba Tanzila "An intelligent approach to image denoising", (JATIT
31. Sontakke Trimbak R, Rai Rajesh Kumar, "Implementation of image de-noising using thresholding techniques", IJCTEE.

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### RESEARCH ARTICLE

## COMPUTATIONAL ANALYSIS OF FLAME BEHAVIOR EJECTED FROM UP TO DOWN INSIDE A VERTICAL COMBUSTION CHAMBER OF A BOILER USING IRAQI NATURAL GAS AS A FUEL.

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### Abstract

Combustion study of Iraqi natural gas used in diffused shape flame is necessary to improve energy conversion in power plants and other usage of thermal systems. Oxidization of fuel to get energy is not a function of chemical reaction speed which happened very fast. This response occurs when there is a mixture contains an amount of air with any selected fuel. This study concentrated on the effect of bouency on flame length since the mixture ejected up to down. Till now, most studies focused on burning fuel in horizontal flame where bouency force effect on its length assumed to be negligible. The result from this study leads to the conclusion that the short flame length that has no effect on the combustion chamber erosion.

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### Introduction:-

Flame geometry (length and width) can give an indication about radiative heat transfer and fire spread inside a combustion chamber [1]. It is also an important parameter used in burner design as the optimum purpose of a perfect design to extract the maximum amount of energy from the burnt fuel. The shape of flame can clarify the burning process.

Many researchers studied the flame geometry used different approaches [1,2, 3, 4]. Forman [1] and Spalding [2] introduced a mathematical model of the flame. Becker et al [3] presented a correlation about flame dimension while Hamodat et al [4] used high speed camera to formulate the short exposures and put a correlation comparable with that found by Becker.

In the present work, a consistent computer program [5] was used to study the flame length and its behavior inside of a boiler using Iraqi Liquefied petroleum Gas LPG.

### Theory:-

The flame generated as a result of burning fuel flowing outside an orifice hole, nozzle in still air is called free diffusion flame. Two factors strongly affecting the vertical flame behavior: the buoyancy force due to density difference during boiler height and the momentum forces due to fuel and air velocities coming out of the orifice or nozzle and direction guides.

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Most of the researches and results obtained in the last twenty years were for horizontal flames, where the buoyancy forces can be neglected. Hawthorne et al [6] derived the following formula to predict the horizontal flame length ratio. They concluded that it depends on fuel specification and the aero-dynamic properties within the turbulent layers during combustion process.

$$\frac{l_f}{d_o} = 3.1 \left[ \frac{\lambda_b + 1}{1.31} (2Sc + 1) - 1 \right] \sqrt{\frac{\rho_f}{\rho_m}} \quad (1)$$

Where;  $l_f$ : flame length,  $d_o$ : nozzle or effective orifice diameter,  $\lambda_b$ : air-fuel ratio,  $Sc$ : Schmidt number ( $Sc \approx 0.8-0.85$ ),  $\rho_f$ : fuel density at injector outlet,  $\rho_m$ : average density of flame layers.

Injector diameter  $d_o$  at constant volumetric flow rate of fuel plays a big role on flame length controlling, where injection speed  $u_o$  will decrease as the diameter of nozzle increase [6].

Becker [3] proposed a dimensionless parameter to govern these forces. Richardson number (1/ Fraud number) which is defined as: buoyancy / input momentum.

$$Ri_o = g d_o / u_o^2 \quad (2)$$

Where;  $g$ : acceleration due to gravity,  $d_o$ : effective orifice diameter,  $u_o$ : mean fuel velocity at the orifice outlet.

$$d_o = d_i (\rho_f / \rho_a)^{0.5} \quad (3)$$

Where;  $d_i$ : orifice diameter,  $\rho_f$ : fuel density at orifice outlet,  $\rho_a$ : air density.

For  $Ri_o > 1$ , the flame will be buoyancy controlled, but if  $Ri_o < 1$ , the momentum will control the flame. For pure propane fuel, Becker [3] proposed the following formula:

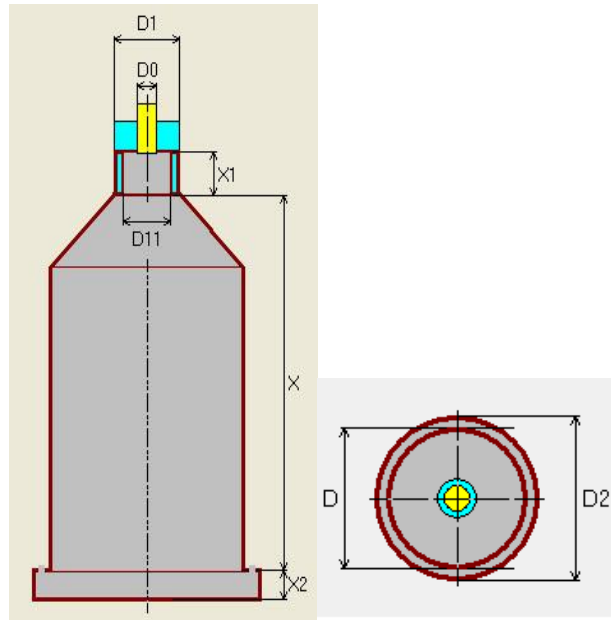
$$l_f / d_o = 63.4 Ri_o^{-0.13} \quad (4)$$

For  $10^{-5} < Ri_o < 0.005$ .

A mathematical simulation of all processes inside the combustion chamber had been introduced in the current work. The simulation included the gas movement, heat transfer, chemical reactions and burning products. The physical process had been translated into mathematical differential equations which, in turn, had been solved using a consistent computer program [5]. The velocity components, temperature and pressure had been calculated at each node of the proposed mesh.

#### Combustion chamber description:-

The combustion chamber under investigation is a cylinder with inner diameter of (510 mm) with a conical entrance. The burner is fixed at the beginning of the cone. It contains two channels, the first one is of (140mm) in diameter which allows the primary air to enter the combustion chamber (10% of the total air volume). The second channel is an annular with adjustable directional gates which allows the secondary air to enter the system with an annular movement. Figure (1) shows the dimensions of talk about.

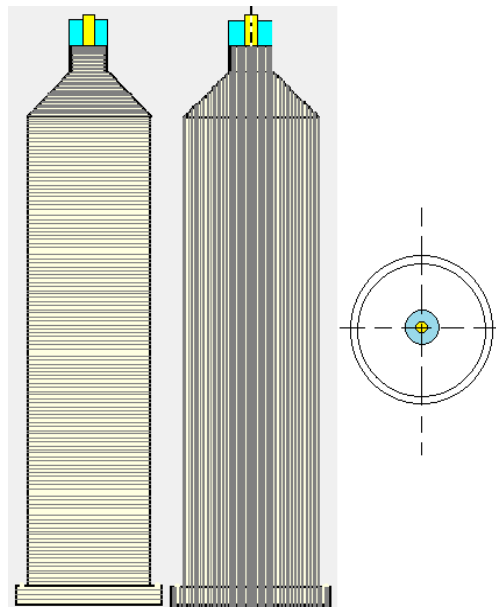


**Figure 1:-** dimensions of combustion chamber where; D1: diameter of burner(160mm), D0: diameter of jet(variable), D11: diameter of primary air entrance (140mm), X1: air channel length(100mm), X: combustion chamber length(2200mm), X2: turning cup length(80mm), D: diameter of combustion chamber(510mm), D2: diameter of turning cup (600mm).

The fuel (natural gas) is ejected through a nozzle of a diameter (5-26mm) which is located at the center of the burner. The velocity of the injected gas (fuel) is (340 to 12.6 m/sec) depending on the nozzle diameter and a different ejected fuel volume.

#### Grid generation description:-

In order to get an accurate result with the minimum computing time, the combustion chamber had been divided into longitudinal, radial and latitudinal grids. The longitudinal direction is divided into 176 elements while the radial direction is divided into 57 cylindrical elements. Another division is a latitudinal one. It contains 4 portions.



**Figure 2:-** longitudinal, radial and latitudinal grids.

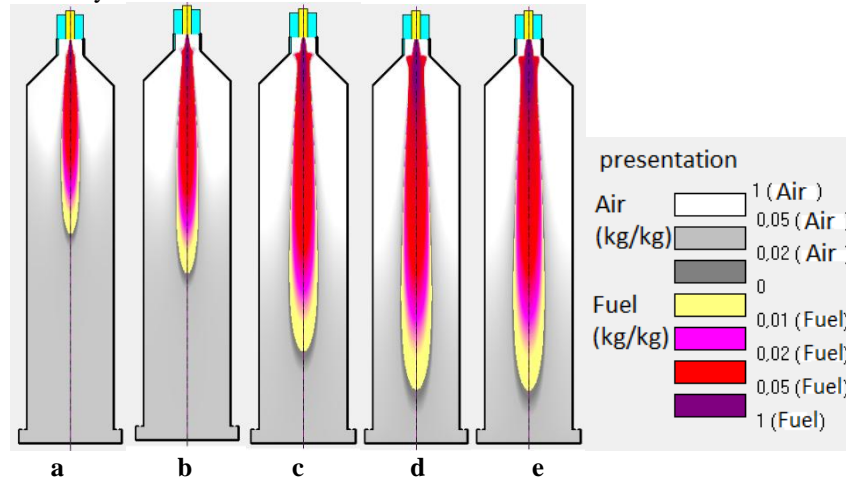
According to the combustion nature and in order to reduce the computing time, the elements are not equal in size. Figure (2) shows the combustion chamber grid division.

#### Iraqi natural gas specification.

CH <sub>4</sub>	C <sub>2</sub> H <sub>6</sub>	C <sub>3</sub> H <sub>8</sub>	H <sub>2</sub> S	N <sub>2</sub>
87.5%	3%	2%	2.5%	5%

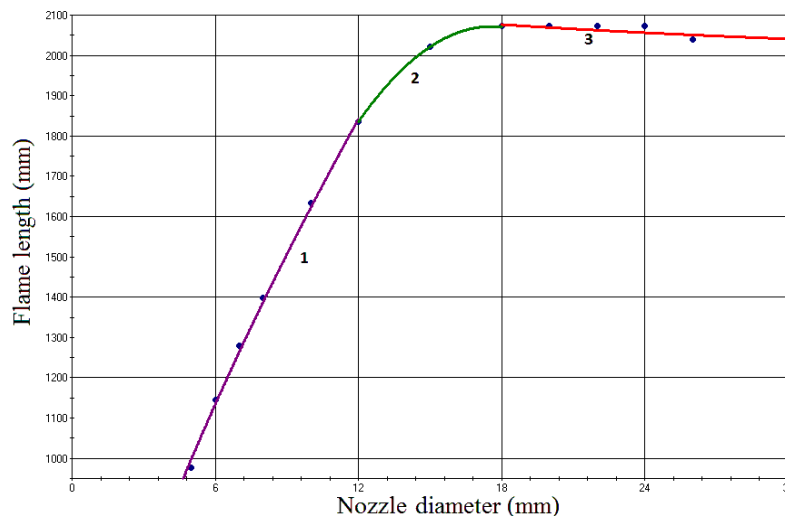
#### Results:-

The best way that shows the effect of nozzle diameter changing on flame length is by comparing between different cases through the results of program which gives a graphical shape of flame inside of combustion chamber. All dimensions of flame clearly shown below:



**Figure 3:-** flame shape inside of combustion chamber, Fuel injector diameter in (a) situation is 6mm, 8mm in (b), 12mm in (c), 18mm in (d) and 22mm in (e).

The relationship between flame length and throttle diameter is directly until injection speed of 26.2 m/s (curve number 1 and 2) then still constant. But when fuel speed drop to 12.56 m/s, flame length will decrease (curve number 3). The following curves show flame behavior during variable fuel speed caused by nozzle diameter changing.



**Figure 4:-** effect of nozzle diameter changing on flame length

Fraud number content fuel injection speed as one of its parameters. It is an important factor to build dimensionless relationship of flame length divided by throttle diameter in one side and that number in the other side. Fraud number

can be said is the guide of combustion process that control flame length both in horizontal and vertical case [7]. As shown in figure, the down curve is divided into two parts. The first (basic) is to low injection speed of fuel. The limitation of this case is ( $Fr < 10000$ ). It may be represented by the following equation:

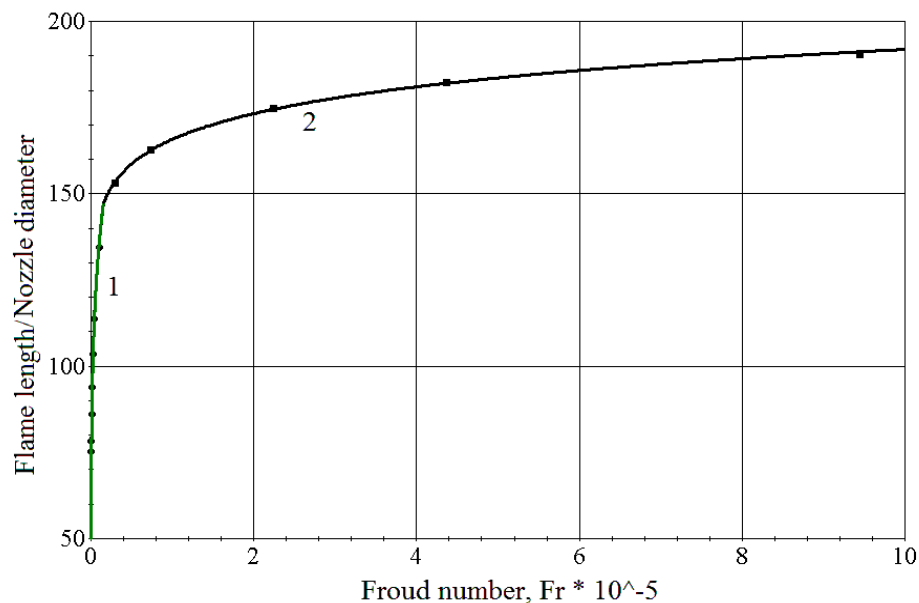
$$l_f/d_o = 21,9 Fr^{0,198} \quad (5)$$

Where:  $l_f$  - is flame length,  $d_o$  – nozzle diameter. The resultant equation is near to that given in [5] and [8]. The power of Fraud number in [8] is got from experimental work which is equal to 0.2. That mean, the present work gives identification of flame behavior as in real process.

The second (transition) part represented by curve 2. It is for high range of Fraud number ( $Fr > 30000$ ). In its equation, Fraud number has smallest power as shown below:

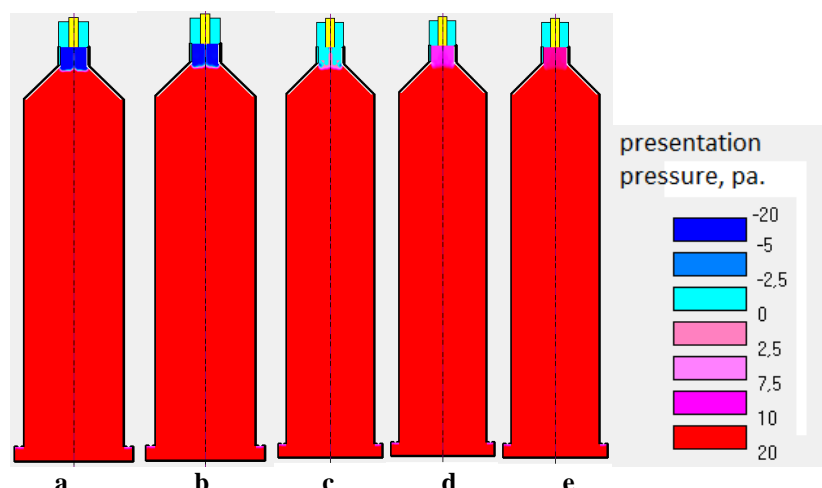
$$l_f/d_o = 79,8 Fr^{0,0635} \quad (6)$$

Here creation of entrance from first part in which strong effect of Fraud number to second part where lifting force acting on flame represented by bouency.



**Figure 5:-** Dimensionless graph shows effect of Fraud number on flame length divided by diameter of fuel injector.

The effect of pressure in the beginning of combustion chamber on flame also can be studied. In the figure below the difference in color shows the difference in pressure. Blue color mean low pressure (negative) at that location while purple is for positive pressure. Negative pressure resulted from high speed of fuel because the relation between pressure and flowing speed inversely. Pressure in primary air entrance plays big role in burning process because when its magnitude is negative will induce combustion process starting early inside of that canal. All that happened because of sucking force affect on air – fuel mixture in near space. So that; flame length in using of small diameter will be shorter than that in case of large diameter until fuel injection speed decrease to about 26 m/s, at that time buoyancy force resist flame elongation.



**Figure 8:-** pressure changing through combustion process. Fuel injector diameter in (a) situation is 6mm, 8mm in (b), 12mm in (c), 18mm in (d) and 22mm in (e).

### Conclusions:-

1. Flame length: Three equations can govern the flame length depending on nozzle diameter ( $d_o$ ) as shown in figure (4).
2. for small nozzle hole diameters ( 5-12 mm):  $l_f = 323.6 (d_o)^{0.7}$
3. for medium nozzle diameters ( 12-18 mm):  $l_f = -7.56 (d_o)^2 + 266 (d_o) - 268$
4. for large nozzle diameters ( 18-26 mm):  $l_f = 2291 / (d_o)^{0.034}$

### Discussion:-

The photos shown in figure (3) show the flame length for different diameters at constant volumetric flow rate (24 m<sup>3</sup>/hr) and for fixed combustion chamber length of (220 cm).

It can be noted that for small hole diameters, the combustion will start at the same moment of fuel impinging as shown in fig.(3-a). The fuel enters the combustion chamber with high activity. In the large diameter hole, there will be a delay in combustion which will increase the flame length, fig. (3-c,d). The reason behind this is the turbulence inside the combustion chamber due to fuel impinging velocity.

Figure (5) shows the relationship between Fraud number (Fr) with ( $l_f / d_o$ ). It can be noted that as the fuel injector diameter increase, (Fr) becomes more asymptotic to the vertical axis, while for small diameters; (Fr) increases and become constant steeping along the x-axis. As the injector diameter decreases, it is noted that (Fr) slightly changed.

### References:-

1. Forman, A. Williams, (1995), "Combustion Theory", Benjamin/ Cummings.
2. Spalding, D. Brian, (1979), " Combustion and Mass Transfer", Pergamon Press.
3. Becker, H.A. and Yamazaki, S., (1978), " Momentum Flux and Temperature in Vertical Free Turbulent Diffusion Flames", Combustion and Flames, 33 ,PP 123-194.
4. Hamodat, A. H., Ahmad, B. I., Al-Saffar, A. S., (1992), "Free Diffusion Flame Height", The Third Scientific Conference of Technical Education.
5. Альмохаммед О.А., Кузнецов В.А. Численное исследование закономерностей горения природного газа в вертикальной топке // Вестник БГТУ им. В.Г. Шухова. 2013. № 2. – С. 163 – 167.
6. Hawthorne, W. R., Weddel, D. S., Hottell, H. C.,(1949), " Mixing and Combustion in Turbulent Gas Jet", Third Symposium on Combustion and Flames and Explosion Phenomena, PP 266-288.
7. Трубаев П.А., Кузнецов В.А., Беседин П.В. Методы компьютерного моделирования горения и теплообмена во вращающихся печах. – Белгород, Изд-во БГТУ: БИЭИ, 2008. – 230 с.
8. Семикин И.Д., Аверин С.И., Радченко И.И. Топливо и топливное хозяйство металлургических заводов. – М.: Металлургия, 1965. – 392 с.



## RESEARCH ARTICLE

### SCRAMBLING FACE IMAGES FOR PRIVACY PROTECTION USING ARNOLD TRANSFORM

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Scrambling face images, Arnold transform and kernel representation.

#### Abstract

Secure image communication is becoming increasingly important due to theft and manipulation of its content. Law enforcement agents may find it increasingly difficult to stay afloat above the ill intentions of hackers. To deal with this problem, facial image scrambling technique appears as a solution for privacy related applications. This project proposes scrambling face images for the purpose of privacy protection using Arnold transform. In the proposed method, the facial features are extracted using Kernel Principle Component Analysis and the feature selection method is used to select important features for classification. This paper presents a system that uses Arnold transform to scramble an image. The number of times the transform is applied depends on a secret message expressed in a higher base. Then kernel representation based classifier is used for classifying the facial images. This kernel classifier transforms the scrambled image data into a three dimensions space through the mapping. The experiments show that the proposed face verification system identifies ID Code of the authorized person and solves the challenging tests in the scrambled domain.

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#### Introduction:-

In the digital world, the internet is used for faster transmission of large volume of important and valuable data. Various confidential data such as Government, Military and Banking and in other secured data, space and geographical images taken from satellite and commercial important document are transmitted over the Internet. Since internet has many points of attack; it is vulnerable to many kinds of attack, so this information needs to be protected from unauthorized access. To protect data from unauthorized access many data protection techniques are implemented. Digital image scrambling technology is an important way of securing digital image information. With the use of transformation techniques, it can change the original image into a disordered one. Making it hard to recognize; for those who get the image in unauthorized manner to extract information of the original image from the scrambled images.

The techniques in digital images protection technique consist of two categories. One is watermarking and the other is encryption. The watermark-based techniques embed an invisible signal into the image to form a watermarked version. At the receiver's end, the integrity of image contents can be verified by authenticating the embedded signal. For encryption algorithms, produces an unintelligible or disorder image from the original image. Image encryption method is also called image scrambling. The image encryption algorithms are classified into two kinds. One is

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spatial-based method; the other is frequency-based method. The spatial-based methods are usually achieved by swapping the pixel positions or altering pixel values. Arnold transform is widely applied to image encryption. The frequency based methods are exploited discrete prolate spheroidal sequences to design an image scrambling scheme without bandwidth expansion. However, the decrypted image is only equivalent to the original image.

### **Related works:-**

Now-a-days privacy is the important thing in the case of human facial images. Number of studies has been proposed for protecting the face images.

R. Jiang et al. [7], proposes Face recognition in the Scrambled Domain via Saliency-Aware Ensembles of Many Kernels. Here, a saliency-aware face recognition scheme was used to work with chaotic patterns in the scrambled domain. In the scrambled domain, semantic facial components simply become chaotic patterns. In this context, it becomes difficult to exploit landmarks or 3D models for better accuracy. Template-based face description has been considered to emphasize the importance of semantic facial components. Given a training dataset, faces are forwarded to the training procedure. The offline procedure then learns its semantic saliency map. In the human perception system, concept-level semantic features are more meaningful than pixel level details. Scrambled facial recognition could generate a new problem in which many manifolds need to be discovered for discriminating these chaotic signals.

T. Honda et al. [5], proposes the hierarchical image-scrambling method has three special features: restoration of the original image from only the scrambled image and its key, controlling of the scramble-level by using parameters for the length of random number and opening the image with a general image viewer. The image format structure is retained; therefore, it can be opened with a general image viewer. It can be used to protect privacy by scrambling images and the information of scramble area and parameter sets is included in the image. The images cannot view private information that they do not have permission to access. Experimental results suggest that scramble level can be controlled linearly by using parameters. The image format structure is retained. Therefore, it can be opened with a general image viewer. A scrambled image can be opened without a specific image viewer and retains the image format structure. The transforming process of an image is non-restorable; therefore the transformed information cannot be used as original information. It also increases the processing time.

A. Melle et al. [10], proposes a reversible scrambling technique which acts in pixel domain. The encoding parameters are encrypted using a secret key and then stored separately or alternatively embedded in the image itself by watermarking. The Region of Interest is decoded by parameters decryption with full or partial knowledge of the secret key, thus leading to different levels of scrambling alteration. This approach forms an objective quality perspective, showing that the visual quality decreases with increasing strength of scrambling. It obtains significant drop in recognition score and limiting the resolution of the encoding parameters. The encoded data is encrypted with a secret key. Partial knowledge of encryption key gives a protected version of the original image at variable levels of scrambling.

P. Perakis et al. [11], proposes a 3D landmark detection method for 3D facial scans. It based on Facial Landmark detector Model. The procedure involves landmark detection, labeling and selection. The detected and classified geometric candidate landmarks, from the shape index and the spin image maps are used as the candidate landmarks. These points create combinations of five landmarks, one from each class. The two types of landmark position constraints are used to reduce the search space (pruning) by removing obvious outliers and thus speed up the search algorithm. It offers high tolerance to large expression variations. It achieved by the state-of-the-art accuracy significantly out performing. The detection of a landmark with absolute distance error will work under certain threshold only. 3D landmark detection methods claim pose invariance, they fail to address large pose variations.

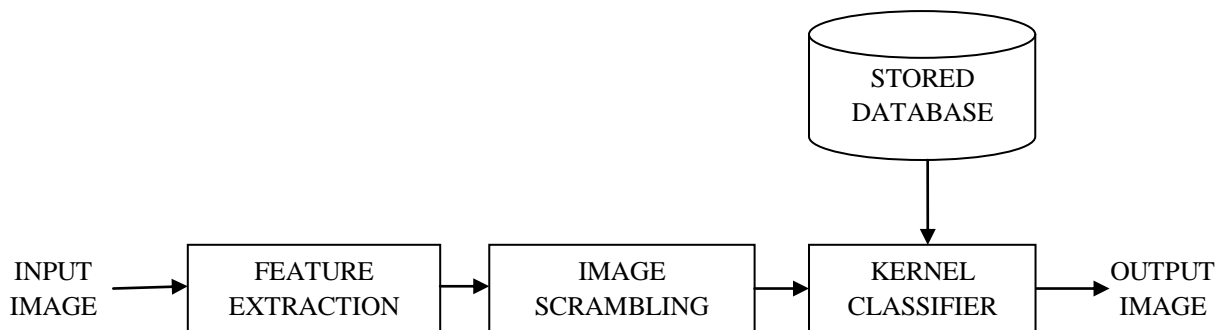
S. Taheri et al. [14], proposes Component-based recognition of faces and facial expressions using a dictionary-based component separation algorithm. For this purpose, first generate two data-driven dictionaries, one for neutral components and the other one for the expression components. Knowing that the neutral component of the test face has sparse representation in the neutral dictionary and the expression part can be sparsely represented using the expression dictionary, then decompose the test face into these morphological components. The elements of the test face along with the dictionaries are then used for face and expression recognition. The algorithm finds a face model and facial expression that maximizes the likelihood of a given test image. The method for recognition of faces and expressions consider either the expression-invariant face recognition problem.

### Methodology:-

Digital images are increasingly sent over networks as documents, commercial items or law enforcement material. Due to the heightened activities of hackers all over the world, these images can easily end up in the hands of unscrupulous third parties who might profit/extort or modify them without the knowledge of the legitimate receiver. To safeguard the image information, research has been carried out in mathematics, cryptology and in information theory over the years. Previously, image watermarking, visual cryptology, information sharing and image scrambling has been proposed to counter image theft.

The objective of image scrambling is to generate a non-intelligible image which prevents human visual system or computer vision system from understanding the true content. It is very difficult for an authorized user to descramble the image using information regarding scrambling method and the variables are used in order to decipher the image.

This paper presents a system that uses Arnold transform to encrypt an image. The number of times the transform is applied depends on a secret message expressed in a higher base. Arnold transform is an ergodic theory; it is also called cat mapping and then it is applied to digital image. Arnold scrambling algorithm has the feature of simplicity and periodicity. According to the periodicity of Arnold scrambling, the original image can be restored after several cycles. Digital images are scrambled and restored with the use of random upper (lower) triangular matrix and this method is of great application value due to its easy operation in encryption and decryption.



**Figure.1:-** Block diagram of facial image scrambling method

### Description:-

The design three random strategies are used for scrambling the input image. These strategies improve the security and extend applications of Arnold transform.

They are as follows:-

- The first strategy is random division.
- The second is random iterative numbers.
- The third is random encryption order.

The proposed scheme is composed of three steps:-

- Face detection and feature selection.
- Image scrambling based on Arnold transform.
- Kernel mapping to extract the original image.

### Input image:-

The input image is taken as the behavioral sample. The images are collected from the Yale database. This database contains fifteen persons and each person's has eleven sample faces. For the face verification this experiment uses the small dataset by splitting it into training and test dataset.



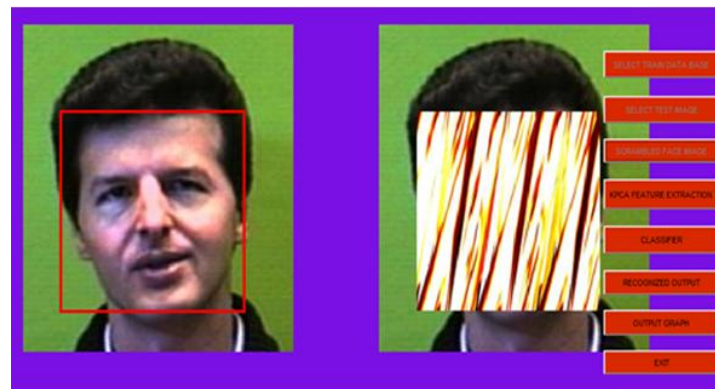
**Figure 2:-** Input image

#### Face detection:-

The main function of this step is to determine whether the human face appear in the given image and check where the face is located. The human face has been selected from the input image and displays the patch in the input face image. This patch indicates that the face has been detected.

#### Image Scrambling:-

Scrambling is the preprocessing step. It is like a non-password security algorithm and it hides the information of the image. Digital image scrambling can convert images into irregular and meaningless pattern. After scrambling the images will become irregular pattern like structure, as a result the visual information is hidden from the public eye and privacy is protected even if the visual contents are distributed or browsed over different public network. This work uses Arnold transform based scrambling technique due to its periodicity and simplicity.



**Figure 3:-** Scrambled face image

#### Arnold transform:-

In the research of ergodic theory V.I Arnold proposed a method called Arnold transform. It has been called popular image scrambling method due to its simplicity and ease of use. This method is used to provide security to the images. In Arnold transform pixel position at  $(x, y)$  is transformed to another point  $(x', y')$  as follows:

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{bmatrix} 1 & 1 \\ 1 & 2 \end{bmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \pmod{N} \quad \text{Equation (1)}$$

Where  $(x, y)$  and  $(x', y')$  are the pixel coordinates of the original image and the encrypted image, respectively.

Let  $A$  denote the left matrix in the right part of Equation (1),  $I(x, y)$  and  $I(x', y')^{(n)}$  represent pixels in the original image and the encrypted image obtained by performing Arnold transform  $n$  times, respectively.

Thus, image encryption using  $n$  times Arnold transforms can be written as:

$$I(x', y')^{(k)} = AI(x, y)^{(k-1)} \pmod{N} \quad \text{Equation (2)}$$

Where  $k = 1, 2, \dots, n$ , and  $I(x', y')^{(0)} = I(x, y)$ .

**Facial Feature Selection:-**

The main facial regions are selected for the purpose of scrambling. The possible regions are detected by testing all the valley regions. Then all the possible face regions such as human eye, nostril and mouth corners are selected and perform scrambling. It is a widely used feature extraction technique which helps matching between same object of different views.

**Kernel Principle Component Analysis (KPCA):-**

KPCA is a development of the PCA (Eigen faces) method. PCA method is used in the feature extraction step of a face recognition system. Face image data has a very high dimensionality. To reduce the dimensionality data would contain only important features that we need in order to perform classification. PCA Performs very well in reducing the dimensionality of the data. However, the performance of PCA method (or other linear methods) is not completely satisfactory for problems with high nonlinearity, such as face recognition. Basically, the KPCA is used to tackle the nonlinearity of face recognition problem. By using a nonlinear kernel function, a dimensional reduction is performed.

**Region Arnold Transform:-**

**Scrambling:** Apply Arnold transform with the use of random upper (lower) triangular reversible matrix, and this method is of great application value due to its easy operation in encryption by N iterations. Then replace those original pixels with the scrambled pixels. Repeat the computation from  $i = 1$  to  $i = K$ . The final result is the encrypted image. Therefore, digital images scrambled in this way become disordered in both pixel position

The security of our encryption scheme mainly depends on the random strategies. Since there are many possibilities of random division, attacker is very difficult to guess the division pattern. The used iterative number of Arnold transform when it is applied to the  $i$ -th regions. To improve security, this method produces a random order for processing these pixel regions.

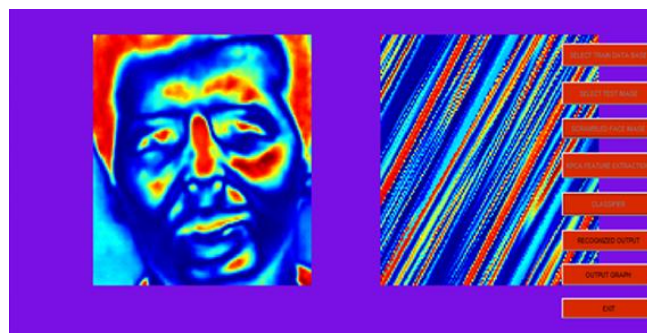
After transformation Arnold transform produce new image and the image is difficult to identify by human eye or hackers. But after transformation the facial information is retained entirely in the image due to the properties of being cyclic and irreversible. Unlike encryption, scrambling process does not really hiding information from the access. It only prevents unwanted exposure of human faces.

**Classifier:-**

The extracted features from the scrambled images, then select important features for classification. This project uses a t-test for feature selection. After features are selected, classifications are performed using classifier. After scrambling process, the features are randomly scattered in the feature space. So, kernel classifier is suitable for randomly scattered distribution, it correctly classifies the randomly distributed features.

**Kernel Mapping:-**

A kernel is a similarity function. Instead of defining a slew of features, a single kernel functions is used to compute similarity between images. The special characteristics of kernel classifier are it transforms the scrambled image data into a 3D space through the mapping. This embedding on a higher dimension is called the kernel trick or kernel mapping. The deciphering is performed by kernel mapping. After the N iteration steps of kernel mapping the original image retrieved. Thus, the kernel mapping obtains the original image from the scrambled image.



**Figure 4:-** Kernel map

**Output Image:-**

The two general applications of this face recognition method, the first is the identification and the second is the verification. Face identification helps to identify the face image by deciphering the scrambled image. The face verification is used to check whether the identified image is sent by the authorized person and also identifies ID Code of the authorized person based on the trained database. Thus, the proposed method provides high secure and reliable.

```

Command Window
New to MATLAB? Watch this Video, see Examples, or read Getting Started.
>> main
The ID Number is :1.jpg
fx >> |

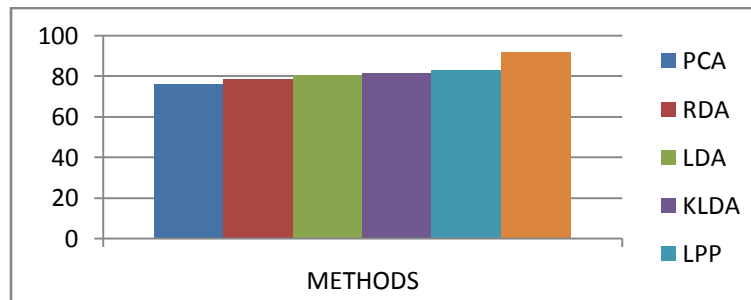
```

**Figure 5:-** Authorized person ID Code output**Figure 6:-** Output image**Experimental Results:-**

This section presents results obtained from the proposed system. In the experiment all code was implemented in MATLAB 2013 a, and ran on a PC with 2.40 GHz Intel-core CPU. The Yale dataset contains 15 subjects and each subject has 11 sample images. This dataset shows that the proposed system attains high rate of accuracy and reduce time consumption.

**Table 1:-** Accuracy of various methods

METHOD	PCA	RDA	LDA	KLDA	LPP	KPCA
ACCURACY	76.0	76.0	80.0	81.5	83.1	91.5

**Figure 7:-** Accuracy graph**Conclusion:-**

A privacy protected facial verification system using kernel method in the scrambled domain is proposed. In this method, the features are extracted from the scrambled face using Kernel Principle Component Analysis feature extraction method and based feature selection method is used to select important features for classification. Through

the Arnold transform, decomposition and recombination of pixels, the algorithm scrambles pixel positions and changes pixel values. Then kernel mapping based classifier is used for classifying the face images. During recombination, inflow of pixel values is avoided by conversion of number systems. Apart from disordering pixel positions and changing pixel values, this algorithm is able to diffuse errors.

Experiments shows that proposed face verification system attains high rate of accuracy and reduce time consumption. This method provides high security of images in the transmission process. The security of our scheme depends on the random strategies. Since there are many possibilities of random division, iterative numbers, and encryption order, attacker is difficult to correctly guess all random strategies at the same time. Thus, the security is guaranteed. Furthermore, our evaluation indicated that our method can flexibly control of scrambling with parameter sets regardless of contents in an image, There is little increase in processing time compared to non-scrambling when scrambling a face in an image; therefore, it can be applied to embedded systems such as those equipped with surveillance cameras.

## References:-

1. Cootes T. F., Edwards G. J., and Taylor C. J., (2001), "Active appearance models," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 23, no. 6, pp. 681–685.
2. Draper B. A., Baek K., Bartlett M., and Beveridge J., (2003), "Recognizing faces with PCA and ICA," *Comput. Vis. Image Und.*, vol. 91, nos. 1–2, pp. 115–137.
3. Erdélyi A., Barát. T., Valet P., Winkler T., and Rinner B., (2014), "Adaptive Cartooning for Privacy Protection in Camera Networks," in *Proc. 11th IEEE Int. Conf. Adv. Video Signal Based Surveill.*, pp. 44–49.
4. He X., Yan S., Hu Y., Niyogi P., and Zhang H. J., (2005), "Face recognition using Laplacianfaces," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 27, no. 3, pp. 328–340
5. Honda T., Murakami Y., Yanagihara Y., Kumaki T., and Fujino. T.,(2013), "Hierarchical image-scrambling method with scramble-level controllability for privacy protection," in *Proc. IEEE 56th Int. Midwest Symp. Circuits Syst. (MWSCAS)*, pp. 1371–1374.
6. Jiang R. and Crookes D., (2014), "Deep salience: Visual salience modeling via deep belief propagation," in *Proc. AAAI, Quebec City, QC, Canada*, pp. 2773–2779.
7. Jiang R., Maadeed S. A., Bouridane A., Crookes D., and Celebi M. E., (2016), "Face recognition in the Scrambled Domain via Saliency-Aware Ensembles of Many Kernels," *IEEE Trans. on Inform. Forensics and Security*, vol. 11, no. 8, , pp. 1807-1817.
8. Lin Y. Y., Liu T. L., and Fuh C. S., (2011), "Multiple kernel learning for dimensionality reduction," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 33, no. 6, pp. 1147–1160.
9. McDuff D., Kaliouby R. E., and Picard R. W., (2012), "Crowdsourcing facial responses to online videos," *IEEE Trans. Affective Comput.*, vol. 3, no. 4, pp. 456–468.
10. Melle A. and Dugelay J. L., (2014), "Scrambling faces for privacy protection using background self-similarities," in *Proc. IEEE Int. Conf. Image Process. (ICIP)*, pp. 6046–6050.
11. Perakis .P, Passalis G., Theoharis T., and Kakadiaris I. A., (2013), "3D facial landmark detection under large yaw and expression variations," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 35, no. 7, pp. 1552–1564.
12. Rahulamathavan Y., Phan R. C. W., Chambers J. A., and Parish D. J., (2013), "Facial expression recognition in the encrypted domain based on local Fisher discriminant analysis," *IEEE Trans. Affective Comput.*, vol. 4, no. 1, pp. 83–92.
13. Sim T., Baker S., and Bsat M., (2002), "The CMU pose, illumination, and expression (PIE) database," in *Proc. IEEE Int. Conf. Autom. Face Gesture Recognit.*, pp. 46–51.
14. Taheri S., Patel V. M., and Chellappa R., (2013), "Component-based recognition of faces and facial expressions," *IEEE Trans. Affective Comput.*, vol. 4, no. 4, pp. 360–371.
15. Timotius I.K., Setyawan I., and Febrianto A., (2010), "Face Recognition between Two Person using Kernel Principal Component Analysis and Support Vector Machines", *International Journal on Electrical Engineering and Informatics*, Vol. 2, no. 1,pp-53-61.
16. Wang D., Chang C., Liu Y, Song G., and Liu Y., (2015), "Digital Image Scrambling Algorithm Based on Chaotic Sequence and Decomposition and Recombination of Pixel Values" *International Journal of Network Security*, Vol.17, No.3, PP.322-327.
17. Wright J., Yang A. Y., Ganesh A., Sastry S. S, and Ma Y., (2009), "Robust face recognition via sparse representation," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 31, no. 2, pp. 210–227.
18. Yale database [Online]. Available: <http://cvc.yale.edu>.



### RESEARCH ARTICLE

#### PRICE VOLATILITY IN THE INDIAN GOLD SPOT MARKET: AN ECONOMETRIC ANALYSIS

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Gold, Spot Market, GARCH Models,  
Volatility, Risk Management.

#### Abstract

The present paper is an effort to examine the price volatility in the gold spot market. A host of Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models are used to analyze and gain a better understanding of the volatility of gold prices. The result of the GARCH (1, 1) model depicts that around 85% of the information associated with gold price volatility is derived from the previous days forecast. While the EGARCH model describes downward movement in gold daily return volatility is followed by higher volatility, the TGARCH (1, 1) model signifies that both positive and negative shocks have the same effect on future gold price volatility. This study has implications for both practitioners and academic researchers interested in price volatility in the gold spot market.

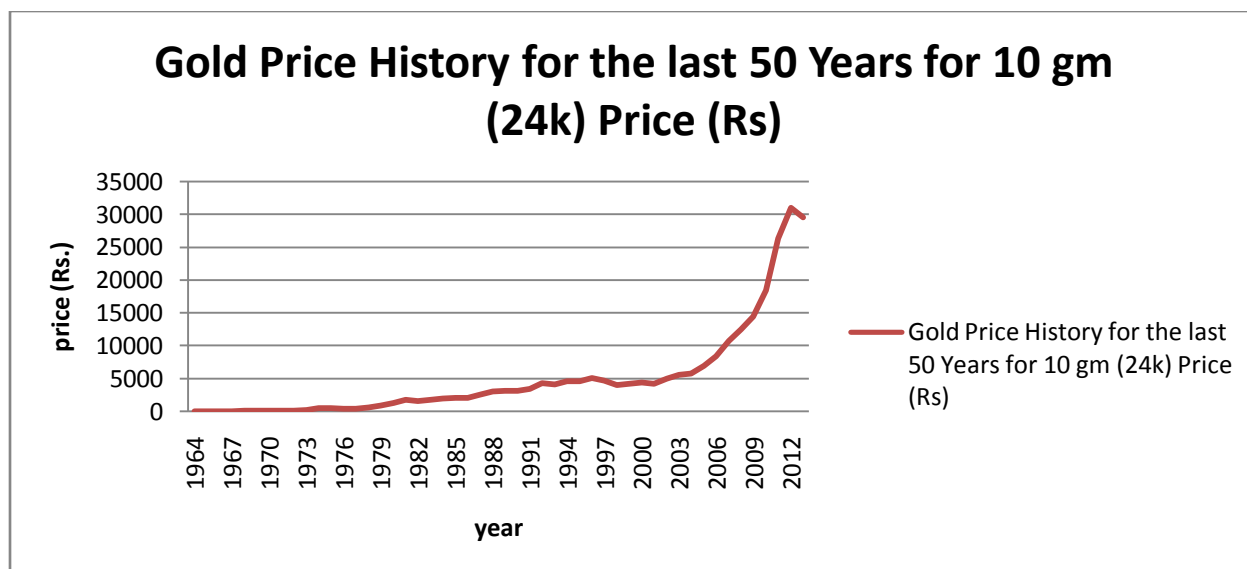
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#### Introduction:-

Gold is a precious metal with which mankind has a long and very intimate relation. Gold is considered as a symbol of purity and good fortune. Most of the gold that the entire world holds lies in India. There are many investment areas such as stock markets, mutual funds, fixed deposits and government bonds amongst others, but people still prefer to invest in gold. It is also used in various other ways like to make ornamental objects and jewelry, in electronics, in laptop computers, in aerospace, in glass making etc. Due to its appeal, gold has been historically priced above other commodities most of the time. The gold price history of the last 50 years is depicted in **figure no. 1** below.

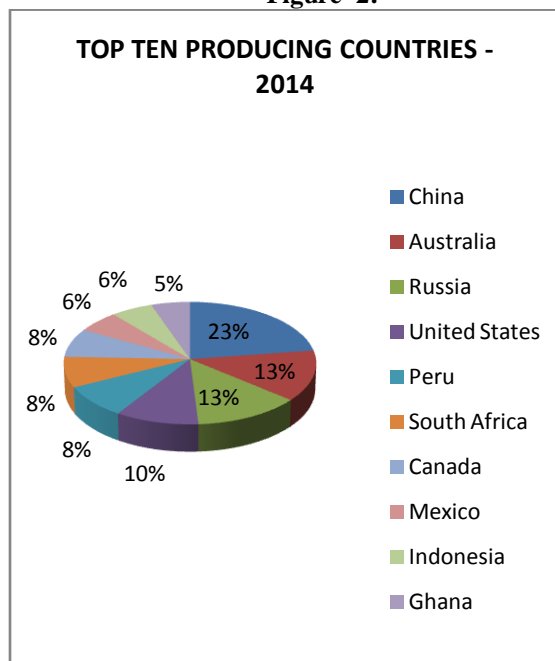
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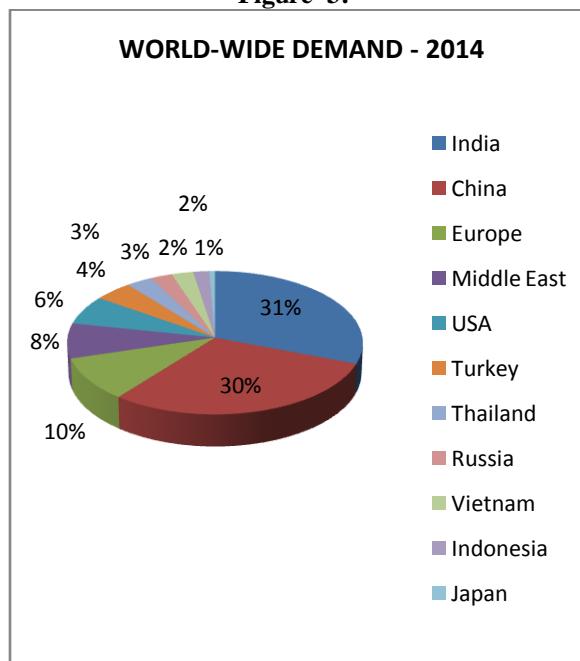
From the above graph it is clearly understood that the price of 10 gm of gold in the year 1964 was Rs.63.25 whereas in the year 2012 it was Rs.31, 050. The gold price of 10 gm in December 2013 was Rs. 29,600. Initially the increase in gold price was less from year to year but there is a drastic increase in the recent years. In the past decade, the increase in gold prices has been notable. However, a sudden jump in the price from Rs.18, 500 in 2010 to Rs. 26,400 in 2011 is an unpredictable increase. Various factors such as rise in investor demand, robust jewelry off take, geo-political concerns, US dollar movement against other currencies, Indian rupee movement against the US dollar, central banks diversifying into bullion, fall in supply, gold mine production etc influence gold prices in any country. In India, demand of gold and inflation are the two major factors which are responsible for gold price changes. The gold price variation can also be better understood by analyzing the demand and supply scenario of it in the country. The following figures i.e. figure no. 2 and figure no. 3 depict about the state of world wide supply and demand situation of gold by 2014 respectively.

Figure 2:-



Source: LBMA, Thomson Reuters GFMS

Figure 3:-



Source: World Gold Council



From the above figure it can be clearly understood that there is a mismatched scenario for supply and demand of gold in India. Though India stood first so far as demand for gold in the world is concerned with 31%, but does not stand even with in 10 highest gold producing countries of the world. Thus, it can be easily expected that the price of gold in the country mostly depends on the international market condition.

Having understood the importance of gold and its fluctuating price trend in the country, this paper is developed to analyze and gain a better understanding of the time varying dynamics of price volatility in the gold spot market. The present paper used three models from the ARCH family such as GARCH (1, 1), EGARCH (1, 1), and TGARCH (1, 1) model which are applied to the spot price of gold for a period of 5 and ½ years. When referring to the (1, 1) in each model, the first (1) represents the first order auto regression GARCH term and the second (1) represents the first order moving average ARCH term. In other words, the models suggest that future conditional variance is based on the past variance.

The outline of the paper is as follows. The next section briefly reviews the related literatures and discusses the contribution of this study. Section III and IV describes about the objectives and hypothesis of the study. Section V and VI explain about the data collection procedure and application of statistical tools. While section VII represents the empirical results of the applied tools, the final section summarizes the main findings of the study in form of conclusion.

### Review of Literature:-

This section provides brief review of earlier studies on price volatility in commodity markets. There are numerous studies that analyses the price volatility in the developed countries. However, such studies are not enough in number in developing countries like India. There are few researches in which the researchers have examined commodity price volatility from different perspectives. This study will add to existing literature by understanding the price volatility allied with gold spot market.

**Charles, Darne, and Kim (2014)** tested the weak form market efficiency for gold, platinum and silver. They used daily spot data repossessed from Thomas Financial Data Stream for a period of 37 years i.e. from 1977 to 2013 and employed the automatic portmanteau and automatic variance ratio test. They suggested that the gold and silver markets displayed a downward trend of predictability representing that gold and silver markets have become more efficient over time.

**Nawaz and Moomal (2012)** conducted a study on the volatility in gold price returns. The data for the study collected on daily basis for a tenure of 3 years starting from 1<sup>st</sup> January, 2009 to 31<sup>st</sup> September, 2011. The results investigated volatility by using models such as standard deviation and GARCH and found an unequal spread of residuals referred as heteroskedasticity. Furthermore, a fast mean reversion has been observed showing that the alpha and beta are far from 1. Based on results it was concluded that there has been volatility in gold prices.

**Coudert, Virginie and Raymond, Helene, (2011)** examined the role of gold as a harmless haven. They extended the existing writings in 2 means. First, they studied crunch 7 stages consecutively distinct by recessions and bear markets. Second, ARMA-GARCH-X model had been used to evaluate conditional co-variances between gold and stocks returns. The regressions were run on monthly data for gold and numerous stock market indices. The study indicated that gold succeeded as being a safe haven against all the stock indexes. The outcome demonstrated that it holds for crunches named as recessions or bear markets, as the covariance between gold and stocks returns is observed as negative or null in all circumstances.

**Marzo, Massimiliano and Paolo Zagaglia, (2010)** examined how the connection of gold prices and the U.S. Dollar had been impacted by the current anarchy in financial markets. They have used spot prices of gold and spot bilateral exchange rates against the Euro and the British Pound to analyze the pattern of instability spillovers. They have also used the GARCH models to judge the causal links of instability fluctuates in the two assets. They recognized the capability of gold to produce constant co-movements with the Dollar exchange rate which have continued the latest levels of market disruption. Their results even disclosed that exogenous rise in market insecurity have inclined to generate reactions of gold prices that are extra steady than those of the U.S. Dollar.

**Elder and Serletis (2008)** used daily data from the New York Mercantile Exchange on spot-month futures prices for crude oil, gasoline, heating oil, natural gas, and propane. The time frame for the study was from 3<sup>rd</sup> January,

1984 to 30<sup>th</sup> June, 2005. They found that the energy prices displayed long memories and anti-persistence, as well as the variance of each commodity series being dominated by high frequency components. This indicates that the time series for sample commodities propose weak form inefficiency.

**Kat and Oomen (2007)** examined the return properties of 142 commodity futures from January 1965 to February 2005 using a multivariate analysis framework. The study suggested that the volatility of commodity futures is comparable to that of US large cap stocks. It is also found that a consistently positive risk premium is lacking in commodity futures with an exception of energy. They also recommended that futures returns and volatility can vary considerably over different phases of the business cycle for many commodities under different monetary conditions. Furthermore, in almost all commodities they found significant degrees of autocorrelation, which affects the properties of longer horizon returns.

**Adrangi et al. (2006)** investigated price discovery on nearby future prices of various commodities listed on Chicago Board of Trade (CBT). Using the daily closing prices of contracts from 1969 to 1999 obtained from CBT, the researchers found that there is an existence of strong bidirectional causality in futures prices.

From the above literature review, it is observed that there are enormous amount of literature on the concerned subject considering the world-wide commodity market. However, it is comparatively less in case of price volatility in Indian commodity markets. In such circumstances, this study carries a significant importance to re-look on the price volatility in gold spot market in India. Therefore, the broad objectives of this study are mentioned below.

#### Objective of the study:-

The principal objective of this study is to evaluate the price volatility in the Indian gold spot market. To accomplish this basic objective, following sub-objectives are set:

1. To analyze the gold spot price trend during last 5 decades.
2. To analyze the presence of volatility clustering in the gold spot price trend during 2011–16.
3. To analyze the time varying volatility in the gold spot prices during 2011-16.

#### Hypothesis:-

(H<sub>0</sub>): Future conditional variance in gold spot price is not based on the past variances.

(H<sub>1</sub>): Future conditional variance in gold spot price is based on the past variances.

#### Data and Methodology:-

The present study is based on the secondary data of daily cash (spot) prices of gold collected from [www.mcxindia.com](http://www.mcxindia.com) for the periods January 1, 2011 to June 30, 2016. The data includes 1484 observations and various statistical tools like ARCH, GARCH, EGARCH and TARCH are employed to analyze the time varying volatility in the gold spot price. Further, the application of three GARCH models requires the data to be stationary. In order to test the stationarity of the data, the Augmented Dickey-Fuller test (1981) is performed. If the results indicate that the data are non-stationary, then the data will be transformed by taking the first difference of the daily spot price. The daily return series is used in all three GARCH models and calculated as  $R_t = \ln(P_t/P_{t-1})$ . All these tests are conducted using E-views software (version-8). A brief description about all these statistical tools is given below.

#### Augmented Dickey-Fuller Test (ADF):-

Augmented Dickey Fuller test (ADF) is used for detecting the presence of stationarity in the series. The early and pioneering work on testing for a unit root in time series was done by Dickey and Fuller (1979 and 1981). If the variables in the regression model are not stationary, then it can be shown that the standard assumptions for asymptotic analysis will not be valid. For a return series  $R_t$ , the ADF test consists of a regression of the first difference of the series against the series lagged  $k$  times as follows:

$$\Delta r_t = \alpha + \delta r_{t-1} + \sum_{i=1}^k \beta_i \Delta r_{t-i} + \varepsilon_t$$

$$\Delta r_t = r_t - r_{t-1}; r_t = \ln(R_t)$$

The null hypothesis is  $H_0: \delta = 0$  and  $H_1: \delta < 1$ . The acceptance of null hypothesis implies nonstationarity. The nonstationary time series can be transformed to stationary time series either by differencing or by detrending.

#### Arch and garch model:-

ARCH and GARCH models assume conditional heteroscedasticity with homoscedastic unconditional error variance. It means the changes in variance are a function of the realizations of preceding errors and these changes represent temporary and random departure from a constant unconditional variance. The advantage of GARCH model is that it captures the tendency in financial data for volatility clustering. Therefore, it enables to make the connection between information and volatility explicit since any change in the rate of information arrival to the market will change the volatility in the market. In empirical applications, it is often difficult to estimate models with large number of parameters such as ARCH (q). To outwit this problem, Bollerslev (1986) proposed GARCH (p, q) models. The conditional variance of the GARCH (p, q) process is specified as

$$h_t = \alpha_0 + \sum_{j=1}^q \alpha_j \varepsilon_{t-j}^2 + \sum_{i=1}^p \beta_i h_{t-i}$$

with  $\alpha_0 > 0$ ,  $\alpha_1, \alpha_2, \dots, \alpha_q \geq 0$  and  $\beta_1, \beta_2, \dots, \beta_p \geq 0$  to ensure that conditional variance is positive. In GARCH process, unexpected returns of the same magnitude produce same amount of volatility. The large GARCH lag coefficients indicate that shocks to conditional variance takes a long time to die out, thus volatility is 'persistent. If  $(\alpha + \beta)$  is close to unity, then a shock at time t will persist for many future periods. A high value of it implies a 'long memory.'

#### Exponential GARCH (EGARCH) Model:-

GARCH models successfully capture thick tailed returns and volatility clustering, but they are not well suited to capture the "leverage effect" since the conditional variance is a function only of the magnitudes of the lagged residuals and not their signs. In the EGARCH model of Nelson (1991)  $\sigma_t^2$  depends upon the size and the sign of lagged residuals. The specification for the conditional variance is:

$$\log(\sigma_t^2) = \alpha_0 + \sum_{j=1}^q \beta_j \log(\sigma_{t-j}^2) + \sum_{i=1}^p \alpha_i \frac{|\varepsilon_{t-i}|}{\sigma_{t-i}} + \sum_{h=1}^r \gamma_h \frac{\varepsilon_{t-h}}{\sigma_{t-h}}$$

Note that the left-hand side is the log of the conditional variance. This implies that the leverage effect is exponential, rather than quadratic and that forecasts of the conditional variance are guaranteed to be nonnegative thus eliminating the need for parameter restrictions to impose non-negativity as in the case of ARCH and GARCH models. The presence of leverage effects can be tested by the hypothesis that  $\gamma_h < 0$ . The impact is asymmetric if  $\gamma_h \neq 0$ .

#### Threshold GARCH (TARCH) Model:-

In ARCH / GARCH models both positive and negative shocks of same magnitude will have exactly same effect in the volatility of the series. T-GARCH model helps in overcoming this restriction. TARCH model was introduced by Zakoin (1994) and Glosten, Jaganathan and Runkle (1993). The generalized specification for the conditional variance is given by:

$$\sigma_t^2 = \alpha + \sum_{j=1}^q \beta_j \sigma_{t-j}^2 + \sum_{i=1}^p \alpha_i \varepsilon_{t-i}^2 + \sum_{h=1}^r \gamma_h \varepsilon_{t-h}^2 d_{t-h}$$

Where,  $d_t = 1$  if  $\varepsilon_t < 0$  and zero otherwise. In this model, good news,  $\varepsilon_{t-1} > 0$  and bad news  $\varepsilon_{t-1} < 0$ , have differential effect on the conditional variance; good news has an impact of  $\alpha_i$ , while bad news has an impact of  $\alpha_i + \gamma_i$ . If  $\gamma_i > 0$ , it indicates bad news increases volatility, and it can be said that there is a leverage effect for the i-th order. If  $\gamma_i = 0$ , then the news impact is asymmetric. The main target of this model is to capture asymmetries in terms of positive and negative shocks.

#### Forecasting Evaluation:-

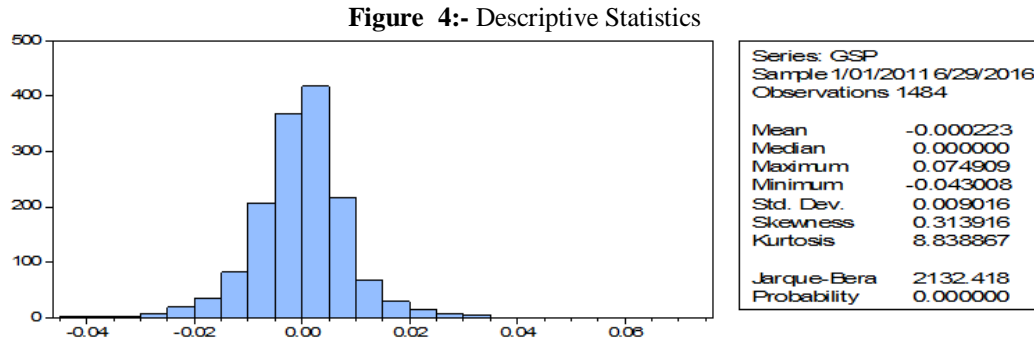
Serial correlation test, ARCH effect test and Normality test are employed to measure the accuracy of the forecasting models.

### Analysis and Description:-

To examine the time varying volatility in the gold spot market, the various models of ARCH family like GARCH (1, 1), EGARCH (1, 1) and TARCH (1, 1) are analyzed. The present section begins with a preliminary statistical analysis of the data followed by an empirical analysis of each model. Finally, robustness checks are conducted to ensure that all GARCH models are correctly specified.

### Descriptive Statistics:-

Figure 4 below displays a summary of descriptive statistics along with histogram for gold spot price returns from January 2011 to June 2016.



From the above figure it is clearly understood that the mean gold return is -0.000223. The standard deviation is .009016. It can be seen that the gold price return varies from -0.043008 to 0.074909 stating that there is wide fluctuation in the daily return on gold price. The histogram displays the positive value for skewness at 0.313916 indicating the series distribution is skewed to the right. So far as kurtosis is concerned, gold price returns have a high peak and thicker tails than a normal distribution. Further, the Jarque-Bera test rejects normality at 5% level which indicates that the gold price returns are not normally distributed.

### ADF Test:-

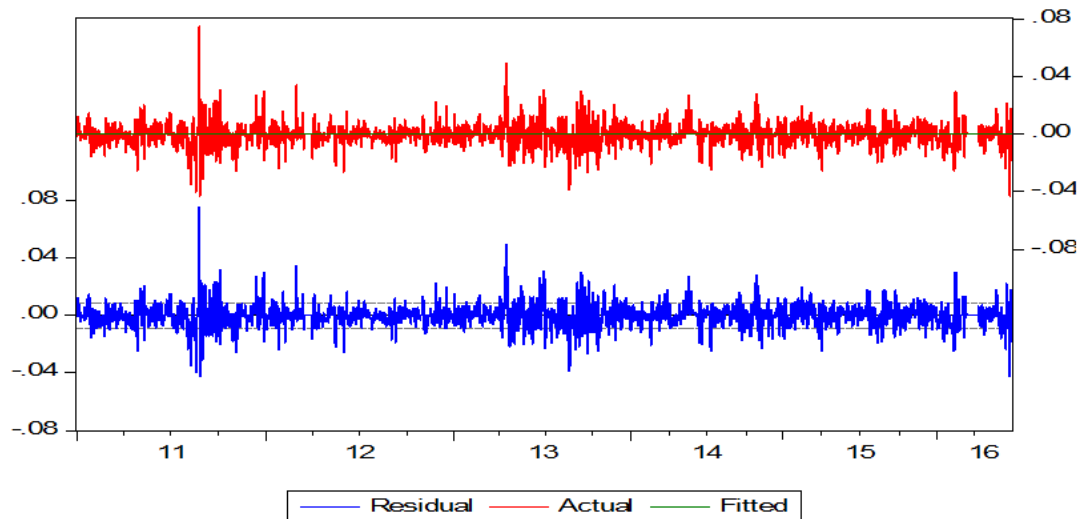
To examine the time varying volatility in the gold spot market, application of ARCH family models are required. But, for the estimation of ARCH and GARCH models, the variable is required to be stationary. The Augmented-Dickey Fuller (ADF) test is a statistical procedure which examines for the presence of unit roots in time series data. The daily gold return data used in the study are found to be stationary as referenced in table 1 below (Annexure 1).

**Table 1:- ADF Unit Root Test**

Particulars	t- statistics	Probability
At level	-38.92274	0.00

Before employing ARCH family model, it is also necessary to examine the 5 and ½ year time series of conditional variance estimates from January, 2011 to June, 2016. Figure 5 below depicts the periods of high and low volatility in the daily gold returns during the sample period.

**Figure 5:- Conditional Variance of Gold returns**



It can be clearly noticed from the above graph that there are several periods of low volatility followed by periods of high volatility for a prolonged period and periods of high volatility followed by periods of high volatility for a prolonged period. During the year 2011, it can be seen that for number of times period of low volatility followed by another period of low volatility and it continues till the first quarter of 2012. From mid of 1 quarter of 2012 to last quarter of the year, number of high volatility periods followed by high volatility periods. During this period, the volatility is extreme and peaks near .08 and then reverts to .01. Further, the periods of low volatility continues from 1<sup>st</sup> quarter of 2013 to 3<sup>rd</sup> quarter of 2013. Thereafter, the period of high volatility starts again. Thus, it can be concluded that figure 5 indicates about the time varying nature of the time series. This kind of volatility pattern for residuals gives sufficient justification to run ARCH family models like GARCH, EGARCH and TGARCH. Further, the whole thing can be double checked by appointing ARCH test to examine the application of ARCH family model to the time series under study. The result of ARCH test presented in Annexure -2 depicts that the observed R square is 105.17 and corresponding P value is 0.00 meaning that the null hypothesis of no ARCH effect can be rejected at 1% confidence level and alternative hypothesis of presence of ARCH effect can be accepted. It implies clustering of volatility where large changes tend to be followed by large changes, of either sign and small changes tend to be followed by small changes.

#### The GARCH Models:-

GARCH (Generalized Autoregressive Conditional Heteroskedasticity) models help to forecast volatility when volatility changes over time. This concept is known as heteroskedasticity. It is a common finding in almost all financial time series data that they do not exhibit homoscedasticity and is therefore, changing over time. In the present study the daily gold return data also follow the same pattern and changing over time. Therefore, the employment of GARCH, EGARCH and TARCH models to evaluate time varying volatility in daily gold return series as well as various factors influencing such volatility is legitimate.

The GARCH (1, 1) is the most popular model used when modeling daily returns (Taylor, 2005). Table 2 below displays the results of the GARCH (1, 1) model. (Annexure 3)

**Table 2:-** GARCH (1, 1) Model.

Dependent Variable: Spot returns in Gold				
Method: ML - ARCH (Marquardt) - Normal distribution				
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)				
Mean Equation				
	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.000104	0.0002	-0.51733	0.6049
Variance Equation				
C	3.67E-06	7.13E-07	5.143865	0.0000
Residual Term	0.106173	0.01227	8.651586	0.0000
GARCH Term	0.850975	0.01793	47.46546	0.0000

The results indicate that both ARCH term and GARCH term at 0.106 and 0.851 respectively are significant at the 99% level of confidence. These two parameters when combined equate to 0.957 which is close to unity. It implies that a shock at time  $t$  will persist for many future periods or it has a 'long memory.' Thus, it can be interpreted that gold price changes affect the future forecasts of gold price volatility for a longer period of time. The model also depicts that around 85% of the information associated with gold price volatility is derived from the previous days forecast.

The EGARCH (1, 1) model evaluates the existence of asymmetry in the volatility of spot gold returns by analyzing the effect of positive and negative shocks on gold price volatility by assuming the conditional variance is exponential. Table 3 below displays the results of the EGARCH (1, 1) model. (Annexure 4)

**Table 3:- EGARCH (1, 1) Model**

<b>Dependent Variable: Spot returns in Gold</b>				
<b>Method: ML - ARCH (Marquardt) - Normal distribution</b>				
<b>LOG(GARCH) = C(2) + C(3)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(4) *RESID(-1)/@SQRT(GARCH(-1)) + C(5)*LOG(GARCH(-1))</b>				
<b>Mean Equation</b>				
	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.000201	0.000179	-1.117164	0.2639
<b>Variance Equation</b>				
C(2)	-0.627749	0.098042	-6.402888	0.0000
C(3)	0.211709	0.018422	11.49228	0.0000
C(4)	-0.013012	0.011847	-1.098377	0.2720
C(5)	0.950414	0.009279	102.4274	0.0000

From the results of the above table it is understood that there is no leverage effect in the EGARCH model since the coefficient of the EGARCH model i.e. C (4) is negative at -0.013012 and insignificant meaning that there is no negative correlation between the past returns and future volatility of gold returns. It depicts that downward movement in gold daily return volatility is followed by higher volatility than an upward movement of the same magnitude.

The TARCH (1, 1) model also known as Threshold ARCH determines whether downward prices are treated separately from upward prices (Seiler, 2004). Table 4 below depicts the results of TARCH model. (Annexure 5)

**Table 4:- TARCH (1, 1) Model**

<b>Dependent Variable: Spot returns in Gold</b>				
<b>Method: ML - ARCH (Marquardt) - Normal distribution</b>				
<b>GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*RESID(-1)^2*(RESID(-1)&lt;0) + C(5)*GARCH(-1)</b>				
<b>Mean Equation</b>				
	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.000147	0.000208	-0.706625	0.4798
<b>Variance Equation</b>				
C	3.63E-06	7.83E-07	4.630197	0.0000
RESID(-1)^2	0.091081	0.012273	7.421131	0.0000
RESID(-1)^2*(RESID(-1)<0)	0.026033	0.016965	1.534558	0.1249
GARCH(-1)	0.853066	0.019140	44.56987	0.0000

From the above table it is clearly observed that the coefficient of TARCH term is positive (0.026033) and insignificant meaning that there is no leverage effect of TARCH model. This indicates that both positive and negative shocks have the same effect on future gold price volatility.

#### **Robustness Checks:-**

Finally, in order to verify the models are specified correctly, the diagnostic checking of all the models is being conducted. There are three conditions to be fulfilled by each of the models to be considered good or bad from the

statistical point of view. They are (a) presence of no serial correlation, (b) presence of no ARCH effect and (c) normal distribution of residuals. Results of all the three tests for each of the models are being depicted in the following table. (Annexure 6 - 8).

**Table 5:-** Diagnostic Checking

Models	Serial Correlation test	ARCH effect test		Normality test	
GARCH	Q stats > 0.05	Obs*R-squared	0.850233	Jarque-Bera	415.8612
		Prob.Chi-Square(1)	0.3565	Probability	0.000000
EGARCH	Q stats > 0.05	Obs*R-squared	4.042965	Jarque-Bera	531.4110
		Prob.Chi-Square(1)	0.0444	Probability	0.000000
TARCH	Q stats > 0.05	Obs*R-squared	1.526884	Jarque-Bera	390.7251
		Prob.Chi-Square(1)	0.2166	Probability	0.000000

Table 5 above indicates that the probability value of the Q (36) statistic is not significant since the reported value is above .05 in case of all the three models. Thus, the null hypothesis of presence of no serial correlation in the residuals is accepted in GARCH, EGARCH and TARCH models. This indicates that the first condition of diagnostic checking is desirable. Secondly, the probability value of Chi-square is more than 5% in case of GARCH and TARCH model while in case of EGARCH model the same value is more than 1%. Thus the null hypothesis of presence of no ARCH effect in the residuals can not be rejected at 5% confidence level in case of GARCH and TARCH model and at 1% level of confidence in case of EGARCH model. Therefore, the second condition of diagnostic checking of presence of no ARCH effect is accepted which is desirable. Thirdly, the probability values of Jarque-Bera statistics of all the three models are found to be less than 1%. Thus, the null hypothesis of residuals are normally distributed is rejected at 1% confidence level for all the three models which is not desirable. However, many economists say that although the residuals are not normally distributed, the model can be accepted. Therefore, it can be concluded that all the ARCH family models are specified correctly in the study.

### Conclusion:-

The present paper empirically analyzes time varying effects of price volatility using a family of ARCH models. Based on the theoretical and empirical literature that is reviewed in this study, the conditional variance hypothesis in the context of an emerging commodity market namely MCX has been investigated. The study examined the volatility in the gold spot price using daily data of closing price from MCX home page for a period of 5 and 1/2 years. It has examined the hypothesis by using different descriptive statistical tools namely mean, standard deviation, Jarque-Bera test etc and econometric tools like ARCH family models such as GARCH(1,1), EGARCH(1,1) and TARCH (1,1).

The results provide evidence that gold price changes affect the future forecasts of gold price volatility for a longer period of time. It means the volatility in the gold spot market exhibits the persistence of volatility. GARCH (1, 1) model also depicts that around 85% of the information associated with gold price volatility is derived from the previous days forecast. Further, the EGARCH model describes that there is no leverage effect meaning that there is no negative correlation between the past returns and future volatility of gold returns during the study period. Finally, the TARCH (1, 1) model indicates that both positive and negative shocks have the same effect on future gold price volatility. Various diagnostic checking tests like serial correlation test, ARCH effect test and normality test are also applied to verify the correctness of the used models. The outcomes indicate that all the ARCH family models are specified correctly in the study. Thus, the alternative hypothesis can be accepted that the future conditional variance in gold spot price is based on the past variances.

The present study subjects to certain inherent limitations. It is based on a limited period of 5 and ½ years i.e. from January, 2011 to June, 2016. Further, the study is meant for only gold and the spot price of it is collected from one commodity exchange i.e. MCX. The volatility in the gold spot market could impact the futures market. Therefore, the various players those who trade in gold should observe the futures markets in order to determine whether hedging gold price volatility is an appropriate risk management tool. Several other factors such as demand for gold and inflation would also be expected to have an impact on the spot price of gold in the country. These factors can be considered for further study in this area.

**References:-**

1. Acworth, W. 2012. "Annual Volume Survey: Volume Climbs 11.4% to 25 Billion Contracts Worldwide", Futures Industry, March 2012, pp. 24-33.
2. Aggarwal, R. and Sundararaghavan, P.S, (1987), "Efficiency of the silver futures market: An empirical analysis study using daily data", Journal of Banking and Finance, vol. 11, no. 1, pp. 49-64.
3. Allayannis, G. and Weston, J. P, (2001), "The Use of Foreign Currency Derivatives and Firm Market Value", The Review of Financial Studies, vol. 14, no. 1, pp. 243-276.
4. Alptekin, Volkan, Burcu, Guvenek and Melek, Acar, Boyacioglu, (2010), "Modeling volatility of the gold prices by using generalized autoregressive conditional heteroscedasticity method: The case of Turkey", Journal of Academic Research in Economics, vol. 2, no. 2, pp. 197-212.
5. Baillie, R. T, and Myers, R.J, (1991), "Bivariate GARCH Estimation of the Optimal Commodity Futures Hedge", Journal of Applied Econometrics, vol. 6, pp. 109-124.
6. Baur, Dirk, G, (2011), "Explanatory mining for gold: Contrasting evidence from simple and multiple regressions", Elsevier journal, September 2011, Page 265-275.
7. Bera, A. K, Garcia, P and Roh, J.S, (1997), "Estimation of Time-Varying Hedge Ratios for Corn and Soybeans: BGARCH and Random Coefficient Approaches". OFOR paper number 97-06.
8. Berkman, H, and Bradbury, M, (1996), "Empirical Evidence on the Corporate Use of Derivatives". Financial Management, vol. 26, pp. 69-73.
9. Bhanot, Karan, Martinez, Valeria, ZiNing and Yiuman, Tse, (2006), "Competition for Order Flow and Market Quality in the Gold and Silver Futures Markets", Paper provided by College of Business, University of Texas at San Antonio in its series Working Paper, December 2006, with number 0036.
10. Bollerslev, T, (1986), "Generalized Autoregressive Conditional Heteroskedasticity", Journal of Econometrics, vol. 31, no. 3, pp. 307- 327.
11. Bollerslev, T. 1990. "Modelling the Coherence in the Short-Run Nominal Exchange Rates: A Multivariate Generalized ARCH Model". The Review of Economics and Statistics, vol. 72, no. 3, pp. 498-505.
12. Bordo, D. Michael, Dittmar, D. Robert, Gavin T. William, (2007), "Gold, Fiat Money, and Price Stability", Berkeley Journal, January 2007, Page 26.
13. Charles, Amelie, Darne, Olivier and Kim, Jae, (2014), "Stock Return Predictability: Evaluation based on Prediction Intervals", MPRA paper 70143, University Library of Munich, Germany.
14. Chang, C.L, McAleer, M, and Tansuchat, R, (2011), "Crude Oil Hedging Strategies Using Dynamic Multivariate GARCH". Energy Economics, vol.33, pp. 912-923.
15. Chernyshoff, Natalia, David, S, Jacks, and Alan, M, Taylor, (2007), "Stuck on Gold: Real Exchange Rate Volatility and the Rise and Fall of the Gold Standard", NBER Working Papers, No 11795.
16. Ciner, C, (2001), "The relationship between gold and silver prices: A note", Global Finance Journal, vol.12, pp.299-303.
17. Coudert, Virginie and Raymond, Helene, (2011), "Gold and financial assets: Are there any safe havens in bear markets?", Access Econ Journal, February 2011, pp.1613-1622.
18. Crowder, W. J, and Hamed, A, (1993), "A Cointegration test for oil Futures Market Efficiency", The Journal of Futures Markets, vol 13, no. 8, pp. 933-941.
19. Demidova, Menzel, Nadeshda, and Heidorn, Thomas, (2007), "Gold in the investment portfolio", Paper provided by Frankfurt School of Finance and Management, Working Paper Series number 87.
20. Desquilbet, Baptiste Jean and Nenovsky, Nikolay, (2004), "Credibility and adjustment: gold standards versus currency boards", William Davidson Institute, Working Papers, May 2004, Page 692.
21. Elam, E, and Dixon, B, L, (1988), "Examining the Validity of a Test of Futures Market Efficiency". Journal of Futures Market, vol. 8, no. 3, pp. 251-276.
22. Engle, R, (2001), "GARCH 101: The Use of ARCH/GARCH Models in Applied Econometrics". Journal of economic Perspectives, vol. 15, no. 4, pp. 157-168.
23. Engle, R, F, (1982), "Autoregressive conditional heteroskedasticity with estimates of the variance of United Kingdom inflation". Econometrica, vol. 50, no. 4, pp. 987-1007.
24. Elder, J, and Serletis, A, (2012), "Oil Price Uncertainty", Working paper, North Dakota State University.
25. Erb, C, and Harvey, C, (2006), "The strategic and tactical value of commodity futures", Financial Analysts Journal, Vol.62. no.2, pp. 69-97.
26. Glosten, L, Jaganathan, R, and Runkle, D, (1993), "Relationship between the expected value and volatility of the nominal excess returns on stocks", Journal of Finance, Vol. 48, pp.1779-1802.
27. Kat, H, M, and Oomen, R, C, (2007), "What every investor should know about commodities", Journal of Investment Management, Vol.5, pp. 1-25.



28. Kearney, Adrienne, A, and Lombra, Raymond, E, (2009), "Gold and platinum: Toward solving the price puzzle", Elsevier journal, August 2009, pp.884-892.
  29. Kearney, Adrienne, A, and Lombra, Raymond, E, (2008), "Non-neutral short-run effects of derivatives on gold prices", Applied Financial Economics, vol. 18, no.12, pp.985-994.
  30. Lucey, Brian M. and Tully, Edel, (2006), "The evolving relationship between gold and silver during 1978-2002: evidence from a dynamic cointegration analysis: a note", Applied Financial Economics, Vol. 2, no.1, pp. 47 – 53.
  31. Marzo, Massimiliano and Paolo, Zagaglia, (2010), "Gold and the U.S. Dollar: Tales from the Turmoil", Working Paper Series from Rimini Centre for Economic Analysis.
  32. Nawaz, Ahmad and Moomal, Sara, (2012), "Volatility in Gold Price Returns: An Investigation from International Market", Journal of Futures Market, vol. 38, no. 3, pp. 236-261.
  33. Nelson, D, B, (1991), "Conditional heteroskedasticity in asset returns: A new approach", Econometrica, vol.59, 347-370.
  34. Park, S, Y, and Jei, S, Y, (2010), "Estimation and Hedging effectiveness of time varying hedge Ratio: Flexible Bivariate GARCH Approaches". The Journal of Futures Markets, vol. 30, no. 1, pp. 71-99.
  35. Peter, J, W, N, Bird, (1985), "The weak form efficiency of the London Metal Exchange", Applied Economics, Vol. 17, no. 4, pp. 571-587.
  36. Rajgopal, S, and Shevlin, T, (2002), "Empirical evidence on the relation between stock option compensation and risk taking". Journal of Accounting and Economics, vol. 33, no. 2, pp. 146-171.
  37. Rogers, D, (2002), "Does Executive Portfolio Structure Affect Risk Management?: CEO risk-taking Incentives and Corporate Derivatives Usage". Journal of Banking and Finance, vol. 26, pp. 271-295.
  38. Samal, Prava, Gouri and Swain, Kumar, Anil, (2014), "Wheather Castor seed futures market is efficient in price discovery? An econometric analysis", The Utkal Business Review, The Journal of Business Studies,, Vol. XXVIII, no.2, pp. 77-98.
  39. Samal, Prava, Gouri and Swain, Kumar, Anil, (2015), "Market efficiency of agricultural commodity futures in India: A case of selected commodity derivatives traded on NCDEX during 2013", International Journal of Business and Management Invention, Vol. 4, no.1, pp. 32-49.
  40. Smith, C, and Stulz, R, (1985), "The determinants of firms' hedging policies". Journal of Financial and Quantitative Analysis, vol. 20, no. 4, pp 391- 405.
  41. Solt, M,E, and Swanson, P,J, (1981), "On the efficiency of the markets for gold and silver", Journal of Business, vol.54, no. 3, pp. 453-478.
  42. Switzer, L, N, and El-Khoury, M, (2007), "Extreme Volatility, Speculative Efficiency and The Hedging Effectiveness of the Futures Markets", Journal of Futures Markets, vol. 27, no. 1, pp. 61-84.
  43. Tse, Y, K, and Tsui, A, K, C, (2002), "A Multivariate Generalized Autoregressive Conditional Heteroscedasticity Model With Time Varying Correlations", Journal of Business & Economic Statistics, vol. 20, no. 3, pp. 351-362.
  44. Yang, J, Bessler, D, A, and Leatham, D, J, (2001), "Asset Storability and Price Discovery in Commodity Futures Markets: A New Look", The Journal of Futures Markets, vol. 21, no. 3, pp. 279-300.
  45. Yang, W, and Allen, D, E, (2005), "Multivariate GARCH hedge Ratios and Hedging effectiveness in Australian Futures Markets", Journal of Accounting and Finance, vol. 45, no. 2, pp. 301-321.
- [www.investopedia.com](http://www.investopedia.com)  
[www.academic.edu](http://www.academic.edu)  
[www.scribd.com](http://www.scribd.com)  
[www.tradingeconomics.com](http://www.tradingeconomics.com)  
[www.commodityonline.com](http://www.commodityonline.com) .

#### Annexure-1:-

##### Augmented Dickey- Fuller Test:-

Null Hypothesis: GSP has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=23)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-38.92274	0.0000
Test critical values:	1% level		-3.434552	
	5% level		-2.863283	

	10% level		-2.567746	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(GSP)				
Method: Least Squares				
Date: 07/26/16 Time: 12:30				
Sample (adjusted): 1/03/2011 6/29/2016				
Included observations: 1483 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
GSP(-1)	-1.011356	0.025984	-38.92274	0.0000
C	-0.000225	0.000234	-0.959921	0.3373
R-squared	0.505671	Mean dependent var		2.10E-06
Adjusted R-squared	0.505337	S.D. dependent var		0.012828
S.E. of regression	0.009022	Akaike info criterion		-6.576980
Sum squared resid	0.120545	Schwarz criterion		-6.569830
Log likelihood	4878.831	Hannan-Quinn criter.		-6.574315
F-statistic	1514.980	Durbin-Watson stat		1.999088
Prob(F-statistic)	0.000000			

**Annexure 2:-****ARCH Model**

Heteroskedasticity Test: ARCH				
F-statistic	113.0508	Prob. F(1,1481)		0.0000
Obs*R-squared	105.1751	Prob. Chi-Square(1)		0.0000
Test Equation:				
Dependent Variable: RESID^2				
Method: Least Squares				
Date: 07/26/16 Time: 12:36				
Sample (adjusted): 1/03/2011 6/29/2016				
Included observations: 1483 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.96E-05	6.05E-06	9.856340	0.0000
RESID^2(-1)	0.266308	0.025047	10.63254	0.0000
R-squared	0.070920	Mean dependent var		8.13E-05
Adjusted R-squared	0.070293	S.D. dependent var		0.000228
S.E. of regression	0.000219	Akaike info criterion		-14.00949
Sum squared resid	7.13E-05	Schwarz criterion		-14.00234
Log likelihood	10390.03	Hannan-Quinn criter.		-14.00682
F-statistic	113.0508	Durbin-Watson stat		2.052522
Prob(F-statistic)	0.000000			

**Annexure-3:-****GARCH Model**

Dependent Variable: GSP				
Method: ML - ARCH (Marquardt) - Normal distribution				
Date: 07/26/16 Time: 12:39				
Sample: 1/01/2011 6/29/2016				
Included observations: 1484				
Convergence achieved after 14 iterations				
Presample variance: backcast (parameter = 0.7)				
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.

C	-0.000104	0.000202	-0.517331	0.6049
	Variance Equation			
C	3.67E-06	7.13E-07	5.143865	0.0000
RESID(-1)^2	0.106173	0.012272	8.651586	0.0000
GARCH(-1)	0.850975	0.017928	47.46546	0.0000
R-squared	-0.000173	Mean dependent var		-0.000223
Adjusted R-squared	-0.000173	S.D. dependent var		0.009016
S.E. of regression	0.009017	Akaike info criterion		-6.744651
Sum squared resid	0.120582	Schwarz criterion		-6.730358
Log likelihood	5008.531	Hannan-Quinn criter.		-6.739324
Durbin-Watson stat	2.022317			

**Annexure-4:-****EGARCH Model**

Dependent Variable: GSP				
Method: ML - ARCH (Marquardt) - Normal distribution				
Date: 07/26/16 Time: 12:41				
Sample: 1/01/2011 6/29/2016				
Included observations: 1484				
Convergence achieved after 21 iterations				
Presample variance: backcast (parameter = 0.7)				
LOG(GARCH) = C(2) + C(3)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(4)				
*RESID(-1)/@SQRT(GARCH(-1)) + C(5)*LOG(GARCH(-1))				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.000201	0.000179	-1.117164	0.2639
	Variance Equation			
C(2)	-0.627749	0.098042	-6.402888	0.0000
C(3)	0.211709	0.018422	11.49228	0.0000
C(4)	-0.013012	0.011847	-1.098377	0.2720
C(5)	0.950414	0.009279	102.4274	0.0000
R-squared	-0.000006	Mean dependent var		-0.000223
Adjusted R-squared	-0.000006	S.D. dependent var		0.009016
S.E. of regression	0.009016	Akaike info criterion		-6.738849
Sum squared resid	0.120562	Schwarz criterion		-6.720983
Log likelihood	5005.226	Hannan-Quinn criter.		-6.732189
Durbin-Watson stat	2.022654			

**Annexure-5:-****TARCH Model**

Dependent Variable: GSP				
Method: ML - ARCH (Marquardt) - Normal distribution				
Date: 07/26/16 Time: 12:44				
Sample: 1/01/2011 6/29/2016				
Included observations: 1484				
Convergence achieved after 15 iterations				
Presample variance: backcast (parameter = 0.7)				
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*RESID(-1)^2*(RESID(-1)<0) +				
C(5)*GARCH(-1)				

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.000147	0.000208	-0.706625	0.4798
Variance Equation				
C	3.63E-06	7.83E-07	4.630197	0.0000
RESID(-1)^2	0.091081	0.012273	7.421131	0.0000
RESID(-1)^2*(RESID(-1)<0)	0.026033	0.016965	1.534558	0.1249
GARCH(-1)	0.853066	0.019140	44.56987	0.0000
R-squared	-0.000071	Mean dependent var		-0.000223
Adjusted R-squared	-0.000071	S.D. dependent var		0.009016
S.E. of regression	0.009017	Akaike info criterion		-6.744255
Sum squared resid	0.120570	Schwarz criterion		-6.726389
Log likelihood	5009.237	Hannan-Quinn criter.		-6.737596
Durbin-Watson stat	2.022523			

**Annexure 6:-**

Q statistics of GARCH model					Q statistics of EGARCH model					Q statistics of TARCH model				
	AC	PA C	Q- Stat	Prob *		AC	PA C	Q- Stat	Prob *		AC	PA C	Q- Stat	Prob *
1	0.01 6	0.01 6	0.400 0	0.527	1	0.01 3	0.01 3	0.255 8	0.613	1	0.01 6	0.01 6	0.387 8	0.533
2	0.06 1	0.06 1	5.914 5	0.052	2	0.05 8	0.05 8	5.342 1	0.069	2	0.06 1	0.06 1	6.006 1	0.050
3	0.00 4	0.00 2	5.939 2	0.115	3	- 0.00 2	- 0.00 4	5.350 0	0.148	3	0.00 5	0.00 3	6.038 4	0.110
4	0.05 1	0.04 7	9.800 8	0.044	4	0.04 8	0.04 5	8.835 8	0.065	4	0.05 2	0.04 8	10.01 0	0.040
5	0.02 5	0.02 4	10.76 8	0.056	5	0.02 0	0.01 9	9.430 9	0.093	5	0.02 6	0.02 4	11.03 9	0.051
6	0.04 4	0.03 8	13.70 1	0.033	6	0.04 4	0.03 8	12.32 0	0.055	6	0.04 4	0.03 8	13.92 0	0.031
7	0.00 1	- 0.00 3	13.70 3	0.057	7	0.00 0	- 0.00 3	12.32 0	0.091	7	- 0.00 0	- 0.00 4	13.92 0	0.053
8	0.00 4	- 0.00 3	13.72 4	0.089	8	0.00 0	- 0.00 6	12.32 0	0.137	8	0.00 2	- 0.00 5	13.92 7	0.084
9	0.03 6	0.03 4	15.70 4	0.073	9	0.03 8	0.03 7	14.46 7	0.107	9	0.03 6	0.03 4	15.82 6	0.071
10	- 0.00 6	- 0.01 1	15.75 3	0.107	10	- 0.00 5	- 0.00 9	14.49 9	0.151	10	- 0.00 5	- 0.01 1	15.86 8	0.103
11	0.01 1	0.00 6	15.95 1	0.143	11	0.01 0	0.00 4	14.64 4	0.199	11	0.01 2	0.00 6	16.07 3	0.138
12	- 0.02 2	- 0.02 4	16.70 0	0.161	12	- 0.02 4	- 0.02 4	15.48 8	0.216	12	- 0.02 2	- 0.02 3	16.82 5	0.156
13	0.00 8	0.00 5	16.80 0	0.209	13	0.00 7	0.00 4	15.56 3	0.274	13	0.00 9	0.00 5	16.93 4	0.202
14	- 0.02 2	- 0.02 1	17.54 7	0.228	14	- 0.02 0	- 0.01 8	16.18 5	0.302	14	- 0.02 1	- 0.02 0	17.60 5	0.225
15	0.00 2	- 0.00	17.55 1	0.287	15	- 0.00	- 0.00	16.20 4	0.369	15	0.00 2	- 0.00	17.61 0	0.284

		2				4	8					2		
1 6	- 0.01 5	- 0.01 0	17.89 7	0.330	1 6	- 0.01 5	- 0.01 0	16.54 0	0.416	1 6	- 0.01 6	- 0.01 1	17.98 1	0.325
1 7	- 0.02 3	- 0.02 3	18.70 8	0.346	1 7	- 0.02 1	- 0.02 0	17.20 2	0.441	1 7	- 0.02 3	- 0.02 3	18.77 5	0.342
1 8	- 0.01 2	- 0.00 7	18.91 6	0.397	1 8	- 0.01 3	- 0.00 9	17.46 6	0.491	1 8	- 0.01 2	- 0.00 8	18.98 8	0.393
1 9	- 0.02 2	- 0.01 8	19.64 3	0.416	1 9	- 0.01 9	- 0.01 6	18.01 1	0.522	1 9	- 0.02 2	- 0.01 8	19.70 0	0.413
2 0	0.00 9	0.01 3	19.76 8	0.472	2 0	0.01 0	0.01 4	18.17 6	0.576	2 0	0.00 8	0.01 2	19.80 3	0.470
2 1	- 0.05 2	- 0.04 6	23.87 2	0.299	2 1	- 0.05 2	- 0.04 7	22.31 7	0.381	2 1	- 0.05 3	- 0.04 8	24.08 0	0.289
2 2	- 0.00 2	0.00 0	23.88 0	0.354	2 2	- 0.00 6	- 0.00 5	22.38 0	0.437	2 2	- 0.00 3	- 0.00 1	24.09 7	0.342
2 3	- 0.01 3	- 0.00 1	24.13 2	0.397	2 3	- 0.01 4	- 0.00 3	22.67 7	0.480	2 3	- 0.01 4	- 0.00 3	24.39 5	0.382
2 4	- 0.00 2	- 0.00 2	24.14 0	0.454	2 4	0.00 1	0.00 1	22.67 7	0.539	2 4	- 0.00 4	- 0.00 4	24.42 0	0.438
2 5	- 0.03 3	- 0.02 5	25.74 6	0.421	2 5	- 0.03 4	- 0.02 7	24.38 3	0.497	2 5	- 0.03 2	- 0.02 4	25.95 0	0.410
2 6	- 0.03 6	- 0.03 4	27.69 9	0.373	2 6	- 0.03 4	- 0.03 2	26.08 1	0.459	2 6	- 0.03 6	- 0.03 4	27.92 4	0.362
2 7	- 0.02 3	- 0.01 4	28.53 2	0.384	2 7	- 0.02 3	- 0.01 4	26.91 4	0.468	2 7	- 0.02 4	- 0.01 4	28.76 4	0.372
2 8	- 0.03 8	- 0.03 3	30.68 1	0.331	2 8	- 0.03 5	- 0.03 1	28.74 5	0.426	2 8	- 0.03 8	- 0.03 3	30.94 2	0.320
2 9	- 0.00 8	- 0.00 3	30.77 6	0.376	2 9	- 0.00 9	- 0.00 5	28.85 6	0.473	2 9	- 0.00 8	- 0.00 4	31.04 9	0.363
3 0	0.00 5	0.01 7	30.81 5	0.425	3 0	0.00 6	0.01 7	28.91 9	0.522	3 0	0.00 5	0.01 7	31.09 1	0.411
3 1	0.02 4	0.02 8	31.70 4	0.431	3 1	0.02 6	0.03 0	29.95 8	0.519	3 1	0.02 5	0.02 9	32.03 9	0.415
3 2	- 0.03 5	- 0.03 0	33.61 6	0.389	3 2	- 0.03 7	- 0.03 2	32.00 9	0.466	3 2	- 0.03 5	- 0.02 9	33.86 6	0.378
3 3	0.03 1	0.02 9	35.03 0	0.372	3 3	0.03 5	0.03 2	33.82 1	0.428	3 3	0.03 2	0.03 0	35.38 4	0.356
3 4	- 0.00 2	0.00 5	35.04 0	0.419	3 4	- 0.00 2	0.00 5	33.82 8	0.476	3 4	- 0.00 1	0.00 6	35.38 8	0.403
3	-	-	35.43	0.448	3	-	-	34.38	0.498	3	-	-	35.76	0.432

5	0.01	0.02	4		5	0.01	0.02	4		5	0.01	0.02	9	
6	6	4			9	7				6	6	4		
3	-	-	36.14	0.462	3	-	-	35.08	0.512	3	-	-	36.43	0.448
6	0.02	0.02	3		6	0.02	0.02	1		6	0.02	0.02	5	
	2	0				1	0				1	0		

**Annexure 7:-****ARCH Effect Test (GARCH Model):-**

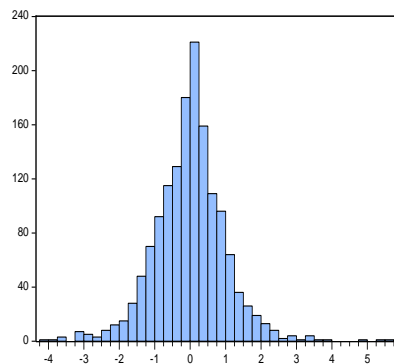
Heteroskedasticity Test: ARCH									
F-statistic		0.849574		Prob. F(1,1481)		0.3568			
Obs*R-squared		0.850233		Prob. Chi-Square(1)		0.3565			

**ARCH Effect Test (EGARCH Model):-**

Heteroskedasticity Test: ARCH									
F-statistic		4.048550		Prob. F(1,1481)		0.0444			
Obs*R-squared		4.042965		Prob. Chi-Square(1)		0.0444			

**ARCH Effect Test (TARCH Model)**

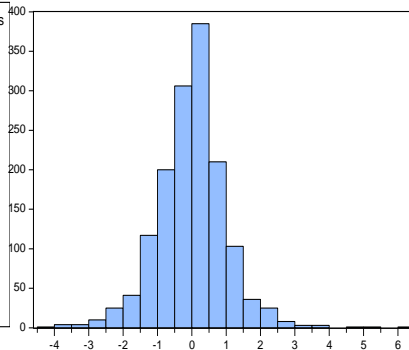
Heteroskedasticity Test: ARCH									
F-statistic		1.526397		Prob. F(1,1481)		0.2168			
Obs*R-squared		1.526884		Prob. Chi-Square(1)		0.2166			

**Annexure 8:-****Normality Test:-****GARCH**

Series: Standardized Residuals  
Sample 1/01/2011 6/29/2016  
Observations 1484

Mean -0.009789  
Median 0.012874  
Maximum 5.514878  
Minimum -4.188060  
Std. Dev. 1.000202  
Skewness 0.126246  
Kurtosis 5.581040

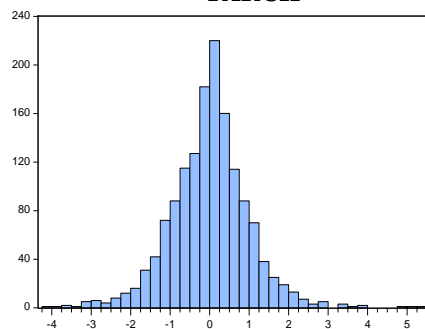
Jarque-Bera 415.8612  
Probability 0.000000

**EGARCH**

Series: Standardized Residuals  
Sample 1/01/2011 6/29/2016  
Observations 1484

Mean 0.001814  
Median 0.024021  
Maximum 6.101487  
Minimum -4.332049  
Std. Dev. 1.000371  
Skewness 0.173302  
Kurtosis 5.911033

Jarque-Bera 531.4110  
Probability 0.000000

**TARCH**

Series: Standardized Residuals  
Sample 1/01/2011 6/29/2016  
Observations 1484

Mean -0.003568  
Median 0.018033  
Maximum 5.313317  
Minimum -4.187178  
Std. Dev. 1.000236  
Skewness 0.141350  
Kurtosis 5.497816

Jarque-Bera 390.7251  
Probability 0.000000

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## RESEARCH ARTICLE

### A STUDY OF NEAR MISS OBSTETRIC EVENTS AND MATERNAL DEATHS IN A TERTIARY CARE HOSPITAL

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#### Abstract

**Introduction:** Maternal Near Miss refers to a women who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy.

**Aims and Objective:** To use the new WHO near miss criteria to investigate maternal morbidity and mortality. To determine the Maternal Near Miss Incidence ratio, maternal near miss to mortality ratio and to calculate the mortality index for each event.

**Methods:** Women showing the presence of any one of the markers in WHO near miss criteria and all maternal deaths from October 2012 to March 2014 were included in the study. The study was conducted in department of Obstetrics and Gynaecology at Lady Hardinge Medical College and SSK Hospital, New Delhi, India.

**Observation:** There were 19,077 deliveries, 18,631 live births, 161 near miss cases and 35 maternal deaths during the study period. Haemorrhage accounted for most common near miss event (39%) followed by infection (28.5%), anemia (19.2%) and eclampsia (13.3 %). The Mortality Index were 33.8%, 12.5%, 6% and 4.5 % for infection, hypertensive disorder, anemia and haemorrhage respectively. Near miss to maternal death ratio was 4.6:1 and maternal mortality ratio was 188 per 1,00,000 live birth.

**Conclusion:** The quality of care received by critically ill obstetric patients in this centre is optimal for near miss events like haemorrhage and anemia as the mortality index were lowest for both events but needs to be improved for infections and hypertensive disorders of pregnancy.

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#### Introduction:-

Maternal mortality is frequently described as “Just the Tip of The Iceberg” alluding that there is a vast base to the iceberg in the form of maternal near miss i.e. maternal morbidity which has remained largely undescribed.

Large differences were found among countries on the incidence of maternal near miss because of the different settings and variation in the criteria used to define the maternal near miss. In 2009, World Health Organization

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(WHO) defined a maternal near miss case as “A woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy”[1]

Considering the lack of standardization, WHO in 2009 has developed a set of criteria to identify near miss cases [Table 1][1]. These criteria are intended to be used in any setting, regardless of the development status. The new near miss definition may enable comparison between facilities and over time. Furthermore, relating the proportions of maternal complications, maternal near miss cases and maternal deaths (i.e. mortality index or case fatality ratio) would be useful to assess the quality of care that women with severe complications receive even in tertiary care setting.

Survivors of severe complications related to pregnancy (condition known as maternal near miss cases) have been studied in detail in recent years, mostly in developed countries. But, even in developing countries, information on maternal near miss cases was found to be useful to identify health system failures in maternal health care. [2]This is because near miss cases share many characteristics with maternal deaths and can directly inform on barriers that have to be overcome after the onset of an acute complication. These cases can complement the information obtained from reviewing maternal deaths and function as surrogates of maternal deaths. This will be a useful piece of information in small and medium size health care facilities or settings where few maternal deaths occur [3][4][5]. Hence, this study was conducted to provide insight into the quality of maternal care provided in our institution.

### **Material and Methods:-**

This study was conducted in the Department of Obstetrics and Gynaecology in Lady Hardinge Medical College and S.S.K Hospital, New Delhi for a period of 18 months from October 2012 to March 2014. This is a tertiary care institution, which serves as the major referral centre for other public and private hospitals within New Delhi and nearby states. In addition to providing emergency obstetric services to women referred from other centers, the hospital also provides antenatal care and delivery services for both unreferral low and high risk pregnant women. The hospital provides emergency obstetric and gynecological care for 24 hours a day.

The near miss cases were pregnant and parturient women showing the presence of any one of the markers of life threatening conditions in all the three criteria (clinical, laboratory and management based) given by WHO as shown in Table 1. All women during pregnancy and up to 42 days post delivery were included in the study. The maternal deaths occurring during the study period were also reviewed.

In the present study, data was collected and extracted retrospectively from the case records by members of study team in a structured performa. All maternal deaths were reviewed as well. Using the provisional and final diagnosis documented in the admission- discharge register of the hospital, case files of women whose diagnoses met the WHO criteria were extracted. Overall, 161 near- miss cases were collected. For each case, information on socio-demographic characteristics, parity, gestational age at the time of the near miss morbidity, educational status, nature of the obstetric complication, presence of organ and/or system dysfunction were collected. Socio-demographic characteristic data, parity and gestational age were compared between the near-miss cases and maternal deaths.

The following near miss indices were calculated –

1. Maternal Mortality Ratio (MMR) calculated using live births as the denominator.
2. Maternal Near Miss Incidence ratio (MNMIR)- Refers to the number of near miss cases per 1000 live births
3. Mortality index for each near miss event in order to evaluate the standard of care provided for each disease category. This is defined as the number of maternal deaths due to a particular obstetric condition divided by the sum of near-miss morbidities and maternal deaths which resulted from this condition, expressed as a percentage. It reflects the proportion of each life-threatening obstetric condition which ended in maternal death. Higher the index indicates poor obstetrics care.
4. Maternal near miss: Mortality ratio- Proportion between maternal near miss cases and maternal death. Higher ratio indicates better care.

Data was analyzed using SPSS software version 17. The study population was characterized using descriptive statistics. The difference between proportions of two groups was analyzed using chi square/fischer exact test. P value <0.05 was considered statistically significant.



Above study was carried out after approval from ethical committee of our institution.

### Results:-

During the 18 months period, there were total 19077 deliveries, 18631 live births, 161 near-miss cases and 35 maternal deaths. This resulted in a MMR of 188/100 000 live births and overall Mortality Index of 17.85%. Maternal near miss incidence ratio was 8.43. Maternal near miss to mortality ratio was 4.6: 1 reflecting a suboptimal care in the institution. 80% of maternal near miss cases and 86% of maternal deaths were referred from other health centres.

Demographic characteristics of women who sustained near-miss complications and those who died are comparable as presented in Table 2. Most of the women in each group were within the ages of 21 and 30 years and had gestational age between 29 to 36 weeks. Most of the patients in both the group were unbooked for antenatal care. A booked case is when the pregnant lady has had a minimum of three visits for antenatal checkup after she was registered as per WHO criteria. There was no significant difference in age, parity, educational levels and booking status in the near miss events compared with maternal deaths but for gestational age, significant difference was found.

Hemorrhage accounted for the most common near miss event (39%), followed by infection (28.5%), anemia (19.2%) and hypertensive disorders (13.3%) as shown in Table 3.

Most common cause of maternal death was septicemia (65.7%) followed by hypertensive disorders (8.6%) and haemorrhage (8.6%) as presented in Table 4. The mortality index was 33.8%, 12.5%, 6% and 4.5% for infection, hypertensive disorders, anemia and hemorrhage respectively as shown in Table 5.

The nature of organ-system dysfunction/failure and the associated obstetric factors among the near-miss cases and maternal death are shown in Table 6. 68 (42.23%) of near miss cases have organ-system dysfunction. The two most commonly affected organ- system were vascular and cardiac (pulmonary edema) systems.

**Table 1:-** The WHO Near Miss Criteria

Dysfunctional system	Clinical Criteria	Laboratory markers	Management based proxies
Cardiovascular	Shock Cardiac Arrest	pH <7.1 Lactate >5mEq/ml	Use of continuous vasoactive drugs Cardio-pulmonary resuscitation
Respiratory	Acute cynosis Gaspings Respiratory rate >40 or <6bpm	Oxygen saturation <90% for ≥60 minutes PaO <sub>2</sub> /FiO <sub>2</sub> <200mmHg	Intubation and ventilation not related to anesthesia
Renal	Oliguria non responsive to fluids or diuretics	Creatinine ≥300μmol/l or ≥3.5mg/dl	Dialysis for acute renal failure
Haematologic/Coagulation	Failure to form clots	Acute severe thrombocytopenia (<50,000 platelets/ml)	Transfusion of ≥5 units of blood/ red cells
Hepatic	Jaundice in the presence of preeclampsia	Bilirubin >100μmol/l or >6.0 mg/dl	
Neurologic	Any loss of consciousness lasting >12h Stroke Uncontrollable fit/ status epilepticus Total paralysis		
Alternative severity proxy			Hysterectomy following infection or haemorrhage

**Table 2:-** Comparison of demographic characteristic of women with Near Miss Events and Maternal Death

Demographic characteristic	Near miss Event (n=161)	Maternal death (n=35)	P value
Age (Years)			0.05
<=20	8	5	
21-25	70	17	
26-30	53	12	
31-35	26	0	
>35	4	1	
Parity			0.35
0	59	11	
1-2	77	15	
3-4	25	9	
Gestational Age (weeks)			0.005*
<=12	22	0	
13-28	18	11	
29-36	67	14	
>=37	39	5	
Postpartum	15	5	
Illiteracy (%)	72	81	0.18
Booking Status (%) (Unbooked)	82.4	88.2	0.23

\*p value&lt;0.05

**Table 3:-** Near Miss Events:

Near Miss Events	Number	Percentage
Haemorrhage		
o Ectopic	11	
o Abortion	4	
o Placenta Previa	21	39
o Abruptio Placenta	5	
o Postpartum Haemorrhage	22	
o Total	63	
Infection		
o Puerperal Sepsis	2	
o Chorioamnionitis	3	
o Septic abortion	3	28.5
o Jaundice	24	
o Others	14	
o Total	46	
Anemia	31	19.2
Hypertensive Disorders	21	13.3
Eclampsia		
Pre eclampsia		
Total	161	100

**Table 4:-** Causes of Maternal Mortality

Factor	Maternal Death	Percentage
Haemorrhage	3	8.6
Septicemia	23	65.7
Anemia	2	5.7
Heart Disease	2	5.7
Hypertensive Disorder	3	8.6
Amniotic fluid Embolism	2	5.7
Total	35	100

**Table 5:-** The Mortality Index of Near Miss Events:

Event	Near Miss	Death	Mortality Index (%)
Haemorrhage	63	3	4.5
Septicemia	46	23	33.8
Anemia	31	2	6
Heart Disease	0	2	0
Amniotic fluid Embolism	0	2	0
Hypertensive Disorder	21	3	12.5

**Table 6:-** Organ System Dysfunction in Near Miss Events and Maternal Death

Organ-System	Near Miss Event (n=161)	Obstetric Cause	Maternal Death (n=35)	Obstetric Cause
1.Cardiac (Pulmonary edema)	43	S. Anemia (26) S. Pre eclampsia ( 9) Eclampsia ( 8)	5	S. Anemia (2) S. Pre eclampsia (2) RHD* (1)
2. Coagulation	8	Jaundice (8)	5	Hepatic Encephalopathy(5)
3. Renal	7	Puerperal Sepsis(2) S. Preeclampsia(2) Abruptio(1) Atonic PPH** (1) Chorioamnionitis(1)	3	Hepatic Encephalopathy(2) S. Preeclampsia(1)
4. Vascular	35	Rup ectopic preg (11) Uterine Rupture (2) PPH (22)	5	Amniotic fluid embolism (2) PPH (3)
5. Respiratory	9	LRTI ***(9)	13	ARDS****(13)
6. Cerebral	1	Traumatic Quadriplegia (1)	3	Tubercular meningitis (2) Eclampsia (1)
7. Hysterectomy	22	Placenta percreta (8) Placenta previa + PPH(7) Retained placenta +PPH(3) Rupture Uterus + PPH(2) Abruptio + PPH(2)	2	Rupture Uterus + PPH (1) Atonic PPH(1)

\*Rheumatic heart disease

\*\*Post partum haemorrhage

\*\*\*Lower respiratory tract infection

\*\*\*\*Acute Respiratory distress syndrome

**Table 7:-** Comparison of various studies in Near Miss Events and Maternal Death

STUDY	MOST COMMON NEAR MISS EVENT	MOST COMMON CAUSE OF DEATH	MORTALITY INDEX
Mental et al (S.Africa) 1998	Hypertention(26%) Haemorrhage( 26%)	Hypertention (33%) Infection (27%)	-
Oladapo et al (Nigeria) 2005	Hypertention(31%) Haemorrhage(30%)	Hypertention(30%) Haemorrhage(21%)	-
Mustafa et al (Karachi) 2009	Haemorrhage(51%)	Haemorrhage(83.3%)	Infection (33.3%) Haemorrhage (17.2%)
Adbel et al (Sudan)2011	Haemorrhage(41%)	Infection (35%) Haemorrhage (23%)	Infection (22.2%) Haemorrhage (8.8%)
Fatima et al (Brazil) 2012	Haemorrhage(40%)	Haemorrhage (40%) Infection (20%)	Overall 10.4%
Roopa et al (India) 2013	Haemorrhage (44.2%)	Infection (52.2%)	Overall 14.9%

	Hypertension (23.6%)		Infection (36.3%)
Souza et al (WHOMCS)* 2013	Haemorrhage (26.7%) Hypertension (25.9%)	-	Overall 16.07%
Present Study	Haemorrhage (39%) Infection (28.5%)	Infection (65.7%)	Overall 17.8% Infection (33.8%)

\*WHO Multicountry Survey

### Discussion:-

Maternal mortality was used to assess the quality of obstetric care but this indicator is vulnerable to many flaws. A better assessment of obstetrical care now includes near miss events to be a useful complement tool for investigation of maternal mortality. Hence new “near miss” criteria take over maternal mortality ratio. In 2008, WHO recommended investigating near miss as a benchmark tool for monitoring maternal health care and has standardized the criteria for diagnosis. WHO criteria are unique in considering not only clinical but also laboratory and management based criteria.

A statistically significant difference was found between near miss events and maternal deaths as regard the gestational age because none of maternal deaths occurred before 12 weeks of gestation (Table 2).

In the present study, maternal mortality to near miss ratio was 1:4.6. This indicates that for every almost 5 women who survived life threatening complications, one died. This reflects a poor care and high maternal mortality in this setting. Other studies found the maternal death to near miss ratio as 1:5 and 1:7 respectively.[6][7] This is in contrast to what is observed in developed countries of the world. Studies carried out in Europe revealed a ratio of 1:117-223[8][9]. This ratio is indicative of the standard of obstetrical care. If this ratio decreases over a period of time, it reflects on the improvement achieved in obstetric care.

The most common near miss event in the present study was haemorrhage (39%) followed by infection (28.5%), anemia (19.2%) and hypertensive disorder (13.3%). The result were in accordance with various studies [10][11][12][13][14] where haemorrhage was the most common near miss event. In contrast to other studies, [6][15] hypertension was most common near miss event.

The most common cause of maternal mortality was septicemia (65.7%) followed by hypertensive disorders (8.6%) and haemorrhage (8.6%) in the present study. Similar results were seen in study conducted in south India [13]. The maternal mortality ratio at our setting was 188/100000 live births. The Brazilian study showed a similar mortality rate of 260/100000 live births [16]. In other developing countries the maternal mortality ratios were 423/100000 live births and 324/100000 live births respectively [17][18]. The major cause of maternal mortality was infectious diseases like tuberculosis, pneumonia and hepatic encephalopathy which were not related to pregnancy. There were three deaths due to haemorrhage and three deaths due to hypertensive disorder complicated with pulmonary edema and renal failure. Most of the maternal death were unpreventable in the present study as they occur in unbooked emergency cases that present too late to the hospital and die shortly after admission.

In this setting, the health care providers were faced with a high percentage of life- threatening obstetric situations. Despite the high morbidity from haemorrhage and anaemia (39%, 19.2% respectively) their mortality index was lower than that of the other events. This is due to presence of trained personnel, strict adherence to evidence based protocol and availability of all sorts of blood and blood products round the clock in the hospital. An increased level of care and effort are required to deal with near-miss events with high mortality index, e.g., infection and hypertensive disorder.

Lack of antenatal care services in peripheral health care centre, illiteracy, delayed diagnosis, late transfer, and inadequate utilization of resources might have been the cause for maternal morbidities and mortalities in our study.

One of the limitations of this study is weakness of retrospective method of data collection with respect to the quality of records. Other limitation is that ours is a tertiary referral center covering two nearby states, with most of the cases being referred from other health care centre in an already moribund state. The delays in referrals are a major cause of morbidity and mortality. Table 7 shows comparison of various studies in near miss and maternal death.

**Conclusion:-**

The quality of care received by critically ill obstetric patients in this centre is optimal for near miss events like haemorrhage and anemia as the mortality index were lowest for both events but needs to be improved for infections and hypertensive disorders of pregnancy. In a tertiary care hospital, it is possible to save most of the patients presenting with life threatening conditions by adopting evidence based protocol, training of personnel, improving the resources and multidisciplinary approach for managing severe morbidities. Overall reduction in maternal mortality can be achieved by improving the antenatal care and timely referral of cases to tertiary care hospital thus aiming to meet the Sustainable Development Goal 3.

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**Conflicts of Interest:-**

There are no conflicts of interest

**References:-**

1. Report on the World Health Organization Working Group on the classification of Maternal Deaths and Severe Maternal Morbidities. Geneva: World Health Organization, 2009.
2. Filippi V et al. Obstetric audit in resource-poor settings: lessons from a multi-country project auditing 'near miss' obstetrical emergencies. Health Policy Plan 2004;19 (1):57-66
3. Say L, Pattinson RC, Gulmezoglu AM. WHO systematic review of maternal morbidity and mortality: the prevalence of severe acute maternal morbidity (near miss). Reprod Health 2004; 1(1):3
4. Pattinson RC, Hall M. Near misses: a useful adjunct to maternal death enquiries. Br Med Bull 2003; 67:231-243.
5. Cochet L, Pattinson RC, Macdonald AP. Severe acute maternal morbidity and maternal death audit- a rapid diagnostic tool for evaluating maternal care. S Afr Med J 2003; 93(9):700-702.
6. Oladapo OT, Sule-Odu AO, Olatunji AO, Daniel OJ. "Near-miss" obstetric events and maternal deaths in Sagamu, Nigeria: a retrospective study. Reprod Health 2005; 2 :1186-95.
7. Pandey M, Mantel GD, Moodley J. Audit of severe acute morbidity in hypertensive pregnancies in a developing country. J Obstet Gynaecol 2004; 24: 387-391.
8. Waterstone M, Bewley S, Wolfe C. Incidence and predictors of severe obstetrics morbidity: case-control study. BMJ 2001; 322:1089-1094.
9. Minkauskiene M, Nadisauskiene R, Padaiger Z, Makari S. Systemic review on the incidence and prevalence of severe maternal morbidity. Medicina (Kuanas) 2004; 40: 299-309.
10. Lotufo FA, Parpinelli MA, Haddad SM, Surita FG, and Cecatti JG. Applying the concept of maternal near-miss in an intensive care unit. Clinics (Sao Paulo) 2012; 67(3): 225-230.
11. Rozina M, Haleema H. Near-Miss Obstetrical Events and Maternal Deaths. Journal of the college of Physicians and surgeons Pakistan 2009;19 (12):781-785
12. Abdel A, Awadia K, Amira O, Gamal K, Ishag A. Maternal near-miss in a rural hospital in Sudan. BMC Pregnancy Childbirth. 2011; 11:48.
13. Roopa PS et al. "Near Miss" Obstetric Events and Maternal Deaths in a Tertiary Care Hospital: An Audit. J Pregnancy 2013;393758
14. Souza JP, Gulmezoglu AM, Vogel J, Carroli G, Lumbiganon P, Qureshi Z, et al. Moving beyond essential interventions for reduction of Maternal mortality: a cross-sectionnal study. Lancet 2013; 381:1747-55.
15. Mentel GD, Buchmann E, Rees H, Pattinson RC. Severe acute maternal morbidity: a pilot study of a definition for a near-miss. Br J Obstet Gynaecol 1999; 106:397.
16. Souza JP, Cecatti JG, Parpinelli MA, Serruya SJ, and Amaral E. "Appropriate criteria for identification of near-miss maternal morbidity in tertiary care facilities: a cross sectional study," BMC Pregnancy and Childbirth 2007; 7 (20): 1-8
17. Shrestha NS, Saha R, Karki C. "Near miss maternal morbidity and maternal mortality at Kathmandu Medical College Teaching Hospital," Kathmandu University Medical Journal 2010;8(30): 222-226
18. Almerie Y, Almerie M.Q, Matar H.E, Shahrour Y, Chamat A, Abdulsalam A. "Obstetric near-miss and maternal mortality in maternity university hospital, Damascus, Syria: a retrospective study," BMC Pregnancy and Childbirth 2010; 10 (65): 2-7.



## RESEARCH ARTICLE

### PREVALENCE OF LOWER BACK PAIN AMONG TAIBAH UNIVERSITY STUDENTS.

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#### Abstract

**Background:** Lower back pain is a common multifactorial disorder that could be of neurological, musculoskeletal or even psychiatric origin. It affects multiple age groups ranging from adolescent to the geriatric age group.

**Objectives:** Our aim in this study is to determine the prevalence of lower back pain, assessing its impact on students' lives and detection of the most common risk factors of lower back pain among Taibah university students.

**Methodology:** A cross sectional study was carried out. The study was conducted in Al-medainh city among Taibah university students at any level and any faculty. (i.e. the sampling selection method was random) with nearly sample size of 500. A specially designed self-administered questionnaire in Arabic was used.

**Results:** Most of the respondents (82.35%) were between 21 to 25 years of age. Females responded more than males did (74.35%). Nearly half of the sample (41.2%) was comprised of medical students followed by students of applied medical science and science, respectively. Ninety-five students were in their third academic year. Lower back pain was significantly prevalent among Taibah University students as (56.47%) were complaining of it.

**Conclusion:** The prevalence of lower back pain among Taibah university students was approximately higher compared to other similar studies with a percentage of (56.74%). The impact of lower back pain on the students though not major yet still lead to the absence of some of them from university and to the consumption of pain killers.

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#### Introduction: -

Lower back pain is a common multifactorial disorder that could be of neurological, musculoskeletal or even psychiatric origin<sup>1</sup>. It affects multiple age groups ranging from adolescent to the geriatric age group<sup>1</sup>. It causes an impact on the patient's life socially and economically<sup>2</sup> in the form of either inability to work or working with the minimum physical activity leading to decrease in the income. It can also affect the patient psychologically subjecting him to an increased risk of developing anxiety and depression disorders<sup>4</sup>.

Lower back pain has a various risk factors. Some are related to habits such as smoking and alcohol consumption. Others include physical factors like strong physical activity, frequent lifting of heavy objects, postural stress. There are also some individual life style factors such as the occupation, age, gender, race, height and weight<sup>3</sup>. Furthermore,

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the deficiency of vitamin D was considered as a potential risk factor of Low back pain in the Gulf because of decreased adequate exposure to sunlight<sup>1</sup>. Finally poor general health and psychosocial factor are considered as significant risk factors as well<sup>3</sup>.

A remarkable number of preventive medicine literature has studied the influence of profession or lifestyle on the incidence of back pain<sup>5</sup>. University students however, usually have a demanding curricula, making the bulk of student's time consumed by long sitting hours spent either on studying or receiving lectures, hence leading to physical inactivity and a raising prevalence of lower back pain<sup>4</sup>.

According to recent studies, nearly 60-80% of individuals worldwide will suffer from LBP at a given time in their lives and 20-30% are already suffering from it<sup>3</sup>. Even though back pain in Arab countries presents at a much less frequency than some western nations, it still appears to be relatively common among its unindustrialized locations<sup>1,4</sup>. There are ongoing growing efforts aimed towards researching the prevalence of LBP in Saudi Arabia but reported data are still too limited to generalize such evidence<sup>1</sup>.

Our aim in this study is to determine the prevalence of lower back pain, assessing its impact on students' lives and detection of the most common risk factors of lower back pain among Taibah university students.

### **Methodology: -**

A cross sectional study was carried out. The study was conducted in Al-medainh city among Taibah university students at any level and any faculty. (i.e. the sampling selection method was random) with nearly sample size of 500. A specially designed self-administered questionnaire in Arabic was used.

The electronic self-administrated questionnaire, consisted of 3 main sections: students' demographic data, prevalence of lower back pain and it is associated symptomatology, risk factors and related medical history.

The statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 20.0. Chi Square analysis applied to compare the differences between the groups included in the study and a P value < 0.05 considered statistically significant.

### **Results: -**

The response rate of this survey was 85% (n=425/500). Most of the respondents (82.35%) were between 21 to 25 years of age (See figure 1). In figure 2 we can see that females responded more than males did (74.35%). Nearly half of the sample (41.2%) was comprised of medical students followed by students of applied medical science and science, respectively (Figure 3). Ninety-five students were in their third academic year (Figure 4). Lower back pain was significantly prevalent among Taibah University students as (56.47%) were complaining of it (Figure 5).

Regarding the association between lower back pain and students' demographics, there was a statistically significant association between lower back pain and gender (P=0.010). Females reported back pain more than did males. Lower back pain was more prominent among underweight students (71.67%). Among the medical students, responded (45.71%) have lower back pain. Majority (62.5%) of first year university students have lower back pain (Table 1).

Table 2 shows a statistically significant association between the lack of exercise and lower back pain (P=0.024). (61.54%) of the students that seldom exercise reported lower back pain. Long studying hours contributed to significant prevalence of lower back pain (P=0.039). Most of the students are usually studying on the floor which is significantly associated with lower back pain (P=0.002). Students that usually perform weight lifting exercises reported lower back pain less than those who don't do weight lifting with a statistically significant association with lower back pain (P=0.000). Many students are used to wear backpacks, among those (65.6%) are suffering from lower back pain with a significant association to the frequent backpack wearing (P=0.044). Drinking soft drinks is significantly associated with lower back pain (P=0.025). Among students who suffer from lower back pain (61.63%) have a positive family history (P=0.012). Anxiety and lower back pain are strongly associated among Taibah University (P=0.000). In our sample there is a strong evidence (P=0.000) that a bad body posture directly contributes to lower back pain with thoracic kyphosis being the most commonly associated with lower back pain (80.00%).

Most commonly reported symptoms associated with back pain among the participant are pain that improves by sitting (139 students) and increases by walking (97 students) suggesting a musculoskeletal origin. Alarming symptoms that necessitate medical attention also reported such as; paresthesia (101 students), pain radiating from

the back to the lower limb (82 students), urinary incontinence (29 students) and fecal incontinence (4 students) (See table 3).

Regarding the impact of lower back pain on Taibah University students', (15.36%) have absented from university due to lower back pain and (25.38%) of the students suffering from back pain used painkillers to relieve it.

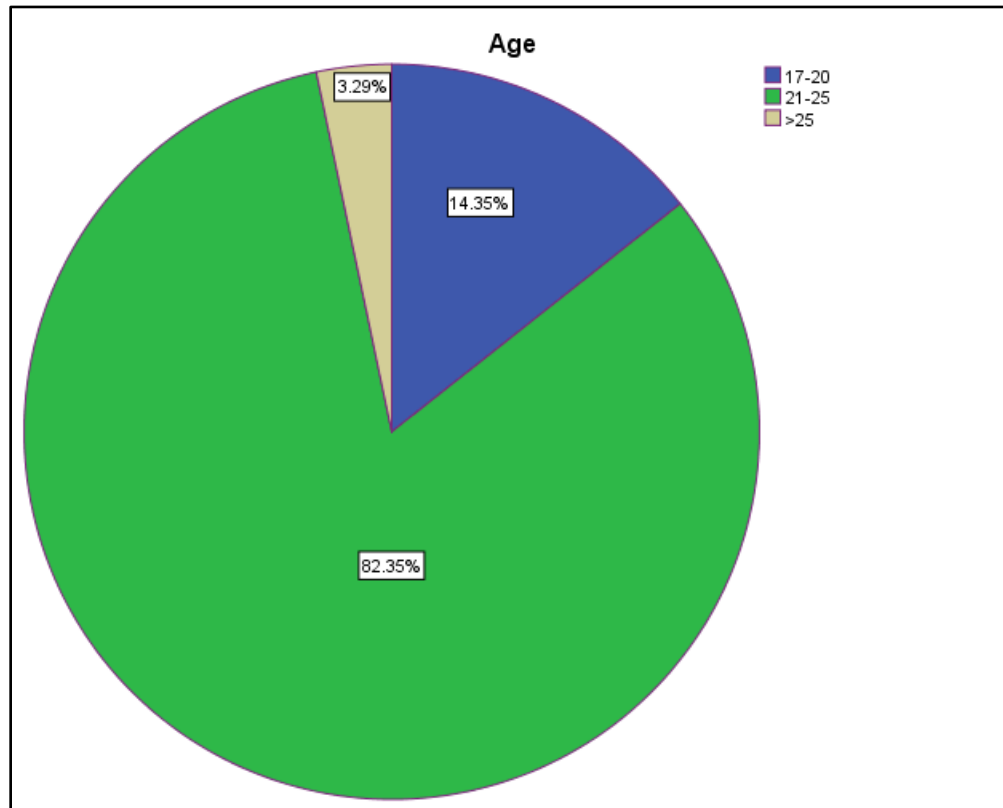


Figure 1:- Age distribution of the respondents

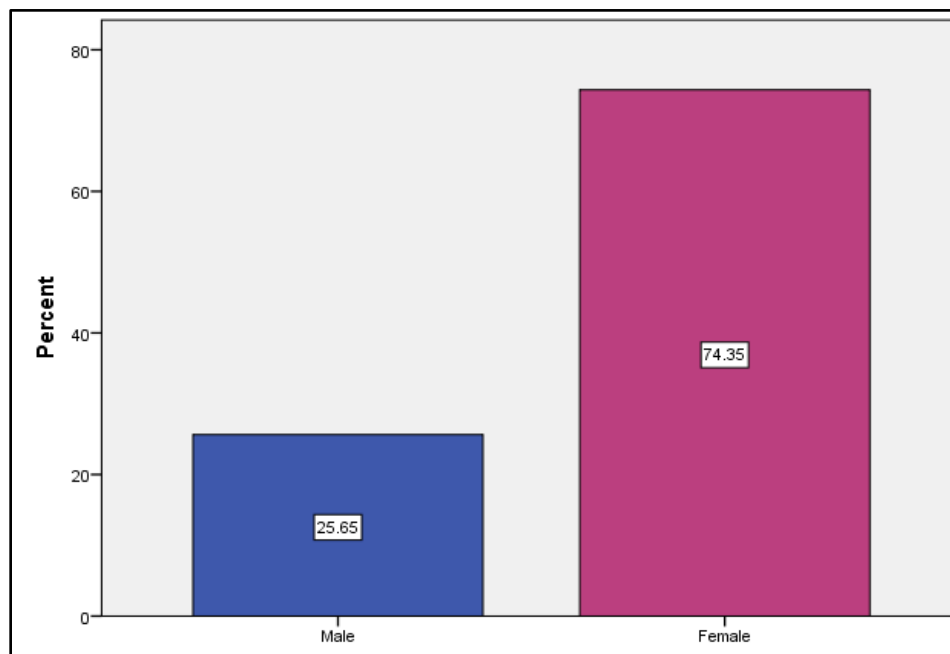
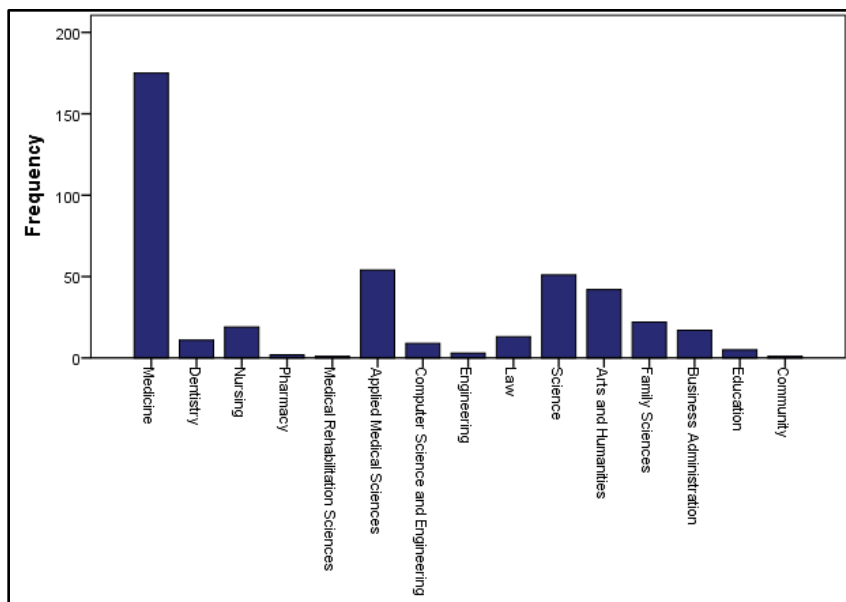
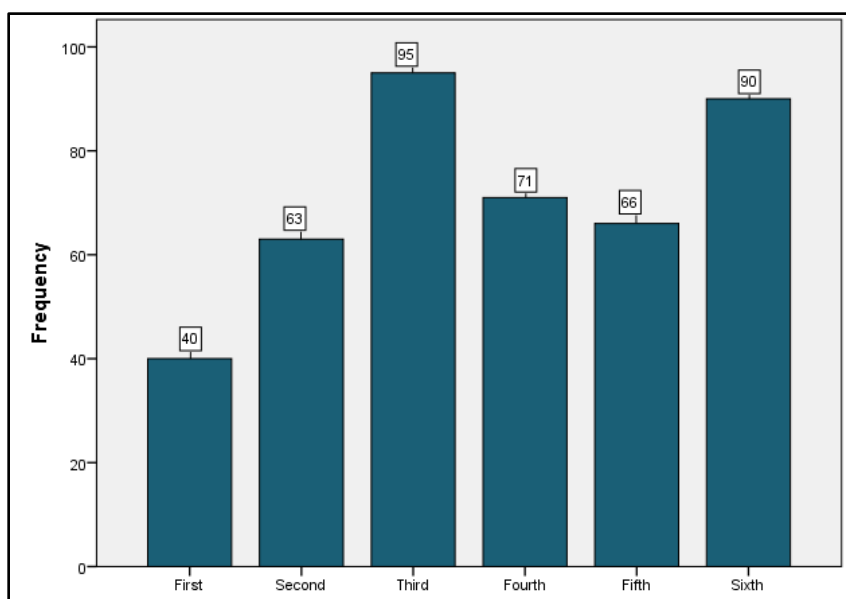


Figure 2:-Gender distribution of the respondents

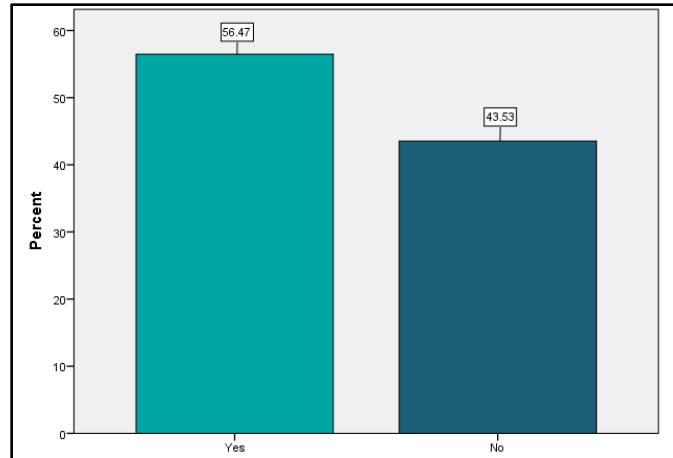




**Figure 3:-** Distribution of the respondents by colleges



**Figure 4:-** Distribution of the respondents by academic year



**Figure 5:-**Prevalence of lower back pain among Taibah University students

**Table 1:-** Association of students' demographics with lower back pain

Variable	LBP +	%	X2	P.Value
<b>Age</b>				
17-20 (N= 61)	38	62.35%	1.441	0.487
21-25 (N= 350)	193	55.14%		
>25 (N= 14)	9	64.35%		
<b>Gender</b>				
Male (N= 109)	50	45.87%	6.700	0.010*
Female (N= 316)	190	60.13%		
<b>BMI</b>				
Underweight (N= 60)	43	71.67%	7.343	0.062
Normal weight (N= 225)	124	55.11%		
Over weight (N= 90)	45	50.00%		
Obese (N= 50)	28	56.00%		
<b>College</b>				
Medicine (N= 175)	80	45.71%	19.561	0.145
Dentistry (N= 11)	6	54.55%		
Nursing (N= 19)	11	57.89%		
Pharmacy (N= 2)	2	100.0%		
Medical Rehabilitation Sciences (N= 1)	1	100.0%		
Applied Medical Sciences (N= 54)	33	61.11%		
Computer Science and Engineering (N= 9)	6	66.67%		
Engineering (N= 3)	2	66.67%		
Law (N= 13)	9	69.23%		
Science (N= 51)	30	58.82%		
Arts and Humanities (N= 42)	30	71.43%		
Family Sciences (N= 22)	16	72.72%		
Business Administration (N= 17)	10	58.82%		
Education (N= 5)	3	60.00%		
Community (N= 1)	1	100.0%		
<b>Academic year</b>				
First (N= 40)	25	62.5%	9.430	0.093
Second (N= 63)	36	57.14%		
Third (N= 95)	64	67.37%		
Fourth (N= 71)	34	47.89%		
Fifth (N= 66)	37	56.06%		
Sixth (N= 90)	44	48.89%		

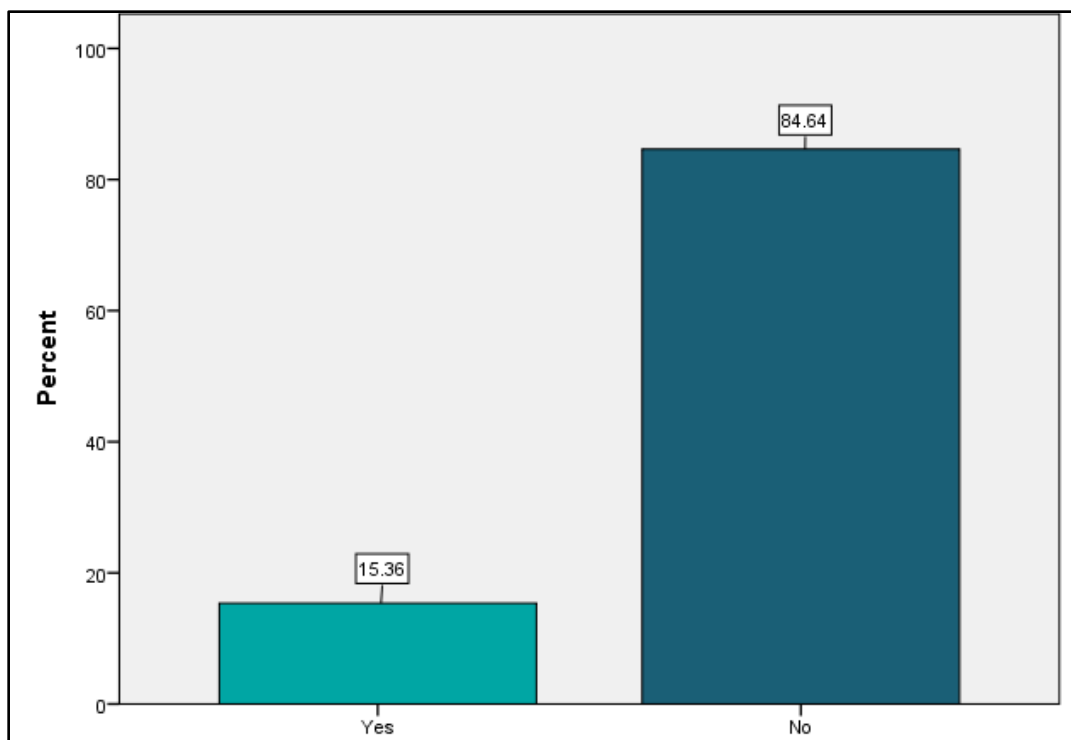
**Table 2:-** Association of life style, habits and students' medical history with lower back pain

Variable	LBP +	%	X2	P.Value
<b>Exercise</b>				
Always (N=53)	20	37.74%	9.467	0.024*
Sometimes (N=201)	118	58.71%		
Seldom (N=130)	80	61.54%		
Never (N=41)	22	53.66%		
<b>Smoking</b>				
Yes (N=25)	12	48.00%	0.775	0.379
No (N=400)	228	57.00%		
<b>Long studying hours</b>				
Yes (N=240)	146	60.83%	4.269	0.039*
No (N=185)	94	50.81%		
<b>Study place</b>				
Desk (N=104)	46	44.23%	12.030	0.002*
Bed (N=148)	81	54.73%		
Floor (N=173)	113	65.32%		
<b>Using computer for long hours</b>				
Always (N=137)	72	52.55%	2.067	0.559
Sometimes (N=205)	122	59.51%		
Seldom (N=67)	36	53.73%		
Never (N=16)	10	62.50%		
<b>Watching TV</b>				
Always (N=43)	22	51.16%	0.665	0.881
Sometimes (N=139)	80	57.55%		
Seldom (N=160)	92	57.50%		
Never (N=83)	46	55.43%		
<b>Weight lifting</b>				
Yes (N=66)	22	33.33%	17.016	0.000*
No (N=359)	218	60.72%		
<b>Driving for long hours (Males)</b>				
Always (N=21)	10	47.62% <sup>5</sup>	0.152	0.985
Sometimes (N=61)	27	44.26%		
Seldom (N=23)	11	47.83%		
Never (N=4)	2	50.00%		
<b>Wearing heels (Females)</b>				
Always (N=19)	13	68.42%	4.327	0.228
Sometimes (N=143)	82	57.34%		
Seldom (N=117)	70	59.83%		
Never (N=33)	25	75.76%		
<b>Wearing backpack</b>				
Always (N=125)	82	65.6%	8.125	0.044*
Sometimes (N=118)	57	48.31%		
Seldom (N=84)	44	52.38%		
Never (N=98)	57	58.2%		
<b>Daily diary products consumption</b>				
Yes (N=181)	98	54.14%	0.694	0.405
No (N=244)	142	58.26%		
<b>Vitamin D rich diet</b>				
Always (N=85)	42	49.41%	3.117	0.374
Sometimes (N=249)	144	57.83%		
Seldom (N=82)	50	60.98%		
Never (N=9)	4	44.44%		
<b>Daily sun exposure</b>				

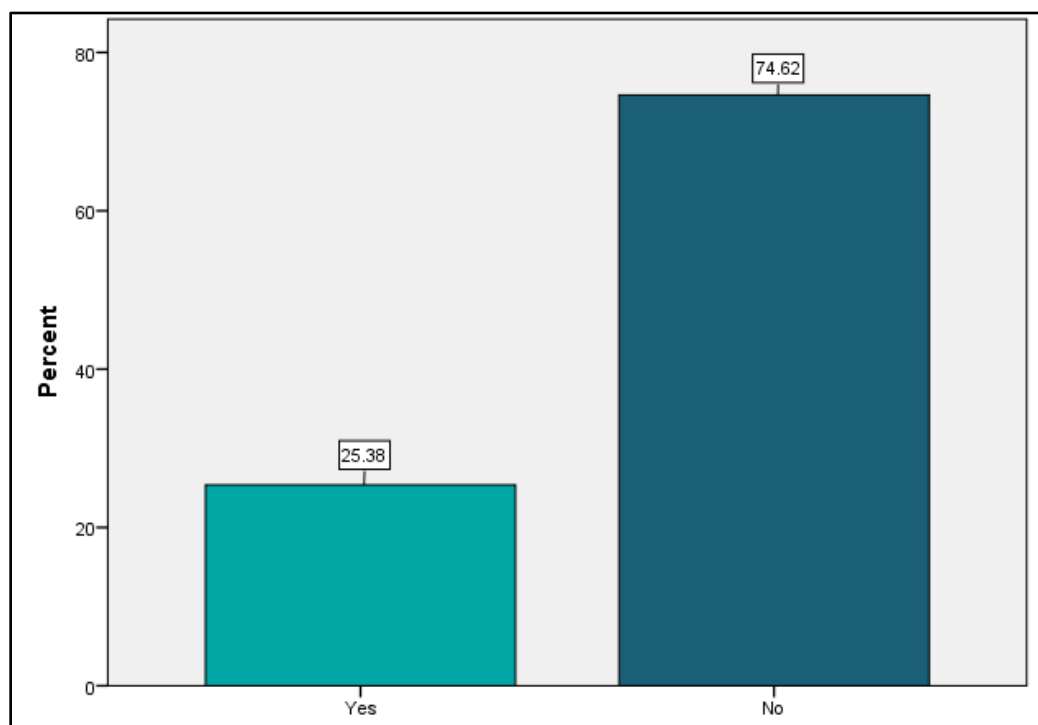
Yes (N=187)	103	55.08%	0.263	0.608
No (N=238)	137	57.56%		
Drinking soft drinks				
Always (N=91)	60	65.93%	9.353	0.025*
Sometimes (N=165)	79	47.87%		
Seldom (N=121)	74	61.27%		
Never (N=48)	27	56.25%		
Family history				
Yes (N=245)	151	61.63%	6.271	0.012*
No (N=180)	89	49.44%		
Anxiety				
Yes (N=202)	138	68.32%	21.978	0.000*
No (N=223)	102	45.74%		
Depression				
Yes (N=66)	47	71.21%	6.907	0.009
No (N=359)	193	53.76%		
Back Injury				
Yes (N=40)	26	65.00%	1.307	0.253
No (N=385)	171	44.42%		
Body posture				
Sway back (N=18)	13	72.22%	20.396	0.000*
Anterior pelvic tilt (N=18)	13	72.22%		
Thoracic kyphosis (N=45)	36	80.00%		
Forward Head (N=144)	38	26.38%		
Normal posture (N=200)	95	47.50%		
History of TB				
Yes (N=1)	1	100.0%	0.773	0.379
No (N=424)	239	56.37%		
History of Sciatica				
Yes (N=3)	2	66.67%	0.128	0.721
No (N=422)	238	56.41%		
History of desk prolapse				
Yes (N=8)	6	75.00%	1.139	0.286
No (N=417)	234	56.12%		

**Table 3:-**Frequency of lower back pain associated symptoms among the students

Symptoms	Frequency	%
Pain increases by walking (N=273)	97	35.5%
Pain improvesby Sitting(N=268)	139	51.9%
Pain radiating from the back downwards to the leg (N=425)	82	19.3%
Paresthesia (N=425)	101	23.8%
Muscle weakness (N=425)	73	17.2
Urinary incontinence (N=425)	29	6.8%
Fecal incontinence (N=425)	4	0.9%
Pain in lower limbs (N=425)	124	29.2%
Limping (N=425)	11	2.6%
Night sweating (N=425)	41	9.6%
Fever (N=425)	33	7.8%



**Figure 6:-**Absence from university due to back pain



**Figure 7:-** Using of painkillers due to back pain

**Discussion: -**

Lower back pain is a major problem throughout the world, and it is prevalent among adult population based on cross sectional study conducted in AlQassim (18.8%)<sup>5</sup>. Some studies have shown significant incidence in the rates of LBP between college students. As in Indian medical college revealed a LBP prevalence of 48% in medical students<sup>6</sup>, and 53% rate reported for medical students at Paracelsus Medical University in Austria<sup>7</sup>. Consistent with previous studies, we observed higher mean and median prevalence of lower back pain among Taibah university students approximately (56.74%). However, in the present study females reported LBP higher than males did, compatible with study done by Damian Hoy et al.<sup>2</sup>

In our study, we observed that incidence of LBP high in underweight students (71.67%). In contrast to Han et al, reported that women who are overweight, have a significantly increased likelihood of lower back pain<sup>8</sup>.

Lack of exercise is one of the main etiologies of LBP. In our study, we found significant association between prevalence of LBP and lack of exercise, a lower prevalence of lower back pain significantly found in students who usually perform weight lifting exercises. This finding supported by Damian Hoy et al<sup>2</sup> observed that low incidence of LBP in developing countries estimated to be attributable to higher levels of exercise.

On the other hand, long studying hours contributed to significant increase of lower back pain. Unlike Grace O et al<sup>9</sup>, they found no significant association between LBP and sitting for long time. However, (65.6%) among the students who complain of LBP used to wear backpacks and we found a significant association to the frequent backpack wearing consist with a study done by Heuscher et al.<sup>10</sup>

Abnormal body posture observed to be significantly higher in students suffers from LBP according to Nupur Aggarwal et al<sup>6</sup>. Similar to our study we found that (80.0%) of our respondents who have thoracic kyphosis suffer from LBP.

As a family history play, a significant risk factor for LBP based on Nupur Aggarwal et al<sup>6</sup> and other researches, among students who suffer from lower back pain (61.63%) have a positive family history.

Several psychological factors contribute to the prevalence of low back pain such as depression, anxiety and stress. According to that, Nupur Aggarwal et al<sup>6</sup> suggested that mental stress and depression are predisposing factors to LBP. Therefore, significant association between anxiety and LBP observed in the present study. Furthermore, have an influence on student's attendance in which (15.36%) have absented from university due to lower back pain.

**Limitation of the study: -**

Using of a self-administered questionnaire might create a misunderstanding of some asked questions. Also, students were not interviewed personally to assess the exact impact of low back pain on their lives.

**Conclusions: -**

The prevalence of lower back pain among Taibah university students was approximately higher compared to other similar studies with a percentage of (56.74%). The commonest risk factors included female gender, low BMI, lack of exercise, long studying hours on the floor, psychological factors in the form of anxiety, positive family history and most importantly bad body postures especially thoracic kyphosis. The impact of lower back pain on the students though not major yet still lead to the absence of some of them from university and to the consumption of pain killers.

**Recommendations: -**

Since lower back pain prevalence was higher in comparison to other studies, we recommend raising awareness of its risk factors among students to help them take the right precautions in order to protect themselves from developing such a condition in the future. Also, to teach the ones who already suffer from a LBP how to cope and if possible alleviate their pain aiming to achieve a better life style.

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**References: -**

1. Awaji M. Epidemiology of Low Back Pain in Saudi Arabia. *J Adv Med Pharm Sci.* 2016;6(4):1-9. doi:10.9734/JAMPS/2016/24173.
2. Hoy D, Bain C, Williams G, et al. A systematic review of the global prevalence of low back pain. *Arthritis Rheum.* 2012;64(6):2028-2037. doi:10.1002/art.34347.
3. Bal G. Topical Review. 2009;25(2):1-48. doi:10.1088/0266-5611/25/5/053001.
4. Aggarwal N, Anand T, Kishore J, Ingle GK. Low back pain and associated risk factors among undergraduate students of a medical college in Delhi. *Educ Health (Abingdon).* 2013;26(2):103-108. doi:10.4103/1357-6283.120702.
5. Abdurhman S. Al-Arfaj, Salman S. Al-SalehFRCP, Suliman R. Alballa,Abdullah N. Al-Dalaan, Sultan A. Bahabri,Mohammed A. Al-Sekeit, PhD,Mohammed A. Mousa. How common is back pain in Al-Qaseem. 2002
6. Aggarwal, N., Anand, T., Kishore, J., & Ingle, G. K. (2013). Low back pain and associated risk factors among undergraduate students of a medical college in Delhi. *Education for Health*, 26(2), 103.
7. Moroder, P., Runer, A., Resch, H., & Tauber, M. (2011). Low back pain among medical students. *Acta Orthopaedica Belgica*, 77(1), 88.
8. Han, T. S., Schouten, J. S. A. G., Lean, M. E. J., & Seidell, J. C. (1997). The prevalence of low back pain and associations with body fatness, fat distribution and height. *International journal of obesity*, 21(7), 600-607.
9. Vincent-Onabajo, G. O., Nweze, E., Kachalla Gujba, F., Ali Masta, M., Usman Ali, M., Alhaji Modu, A., & Umeonwuka, C. (2016). Prevalence of Low Back Pain among Undergraduate Physiotherapy Students in Nigeria. *Pain research and treatment*, 2016.
10. Heuscher, Z., Gilkey, D. P., Peel, J. L., & Kennedy, C. A. (2010). The association of self-reported backpack use and backpack weight with low back pain among college students. *Journal of manipulative and physiological therapeutics*, 33(6), 432-437.

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### RESEARCH ARTICLE

## “COMPARATIVE EVALUATION OF ETOMIDATE AND THIOPENTONE SODIUM WITH ROCURONIUM FOR RAPID SEQUENCE INTUBATION IN PREGNANT PATIENTS UNDERGOING LOWER SEGMENT CAESAREAN SECTION (LSCS)” A COMPARATIVE STUDY.

Dr. Mayank Agrey, Dr. Omprakash Sundrani, Dr. Santosh Tharwani and Dr. Jaya Lalwani.

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Intubating conditions, Rocuronium,  
Etomidate, Thiopentone Sodium.

### Abstract

The aim of this study was to compare the intubating conditions and haemodynamic response for rapid sequence intubation (RSI) of the induction agents, etomidate and thiopentone sodium, with a rapid acting neuromuscular blocking agent rocuronium in 100 ASA grade I-II patients of age 20-40 yrs, undergoing lower segment caesarean section. All the patients were divided in a randomized double blind fashion into two groups of 50 patients each. Group I patients received Etomidate(0.3 mg/kg) with Rocuronium 0.9 mg/kg and intubated at 90 seconds, group II patients received Thiopentone sodium(5-7 mg/kg) with rocuronium bromide 0.9 mg/kg and intubated at 90 seconds respectively. We observed intubating conditions in group I & group II, excellent intubating conditions were rated in 82% & 96% and good in 18% and 4%, respectively. The difference in intubating conditions of patients in both the groups was statistically significant (p value <0.05). Clinically acceptable intubation conditions (excellent & good) were observed in 100 % patients in both the groups, hence the difference being statistically non significant. There was no significant change in pulse rate and mean systolic blood pressure, diastolic blood pressure, mean arterial pressure from the baseline value after the administration of muscle relaxants in either of the two groups. We conclude that both the induction agents; Etomidate & Thiopentone sodium in combination with Rocuronium were comparable in terms of intubating conditions & haemodynamic response. Thus it could be concluded that either of them could be used for rapid sequence intubation in pregnant patients undergoing lower segment Caesarean section (LSCS).

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### Introduction:-

Obstetric anaesthesiologists face the unique situation of providing anaesthesia for caesarean sections, where they have to provide care for both the mother and the unborn baby.<sup>29</sup>

Obstetrics patients undergoing caesarean section under general anaesthesia require rapid sequence induction and intubation (RSII) due to the high risk of aspiration. High rates of caesarean section surgeries are encountered by anaesthesiologists now a days. Despite the popularity of central neuraxial blockade, general anaesthesia may have to be offered to these patients at times because of their choice or conditions.<sup>29</sup>



Pulmonary aspiration is one of the concerns of general anaesthesia in obstetric patients. Risk factors for increased risk of aspiration include a prolonged gastric emptying time in labour, increased intra-abdominal pressure due to the gravid uterus and relaxation of the lower oesophageal sphincter due to hormonal changes. To reduce this risk, prophylaxis against acid aspiration is administered prior to anaesthesia. The use of rapid sequence induction with thiopental and succinylcholine has remained standard and largely unchanged for the last four to five decades and was developed to decrease the incidence of pulmonary aspiration.<sup>9</sup>

Rapid sequence induction and intubation (RSII) is an anaesthesia induction technique designed to facilitate rapid tracheal intubation in patients at high risk of aspiration. The main objective of the technique is to minimize the time interval between loss of protective airway reflexes and tracheal intubation with a cuffed endotracheal tube. Because the airway is unprotected during this time, it is the most critical period during which aspiration of gastric contents is likely to occur.<sup>29</sup>

The depolarizing neuromuscular blocking agent, succinylcholine has been the drug of choice for rapid sequence induction and intubation (RSII) and anticipated difficult intubations for its short and rapid acting properties. Nothing had yet replaced succinylcholine in the scenarios of difficult intubation before yet, with advent of Rocuronium antagonist (ORG-25969, sugamedax) that chelates the drug and act as the reversal agent, Rocuronium can also be used in difficult intubation situations in RSII. Rocuronium may provide an alternative to Succinylcholine when it is contraindicated in conditions, such as hyperpyrexia, hyperkalemia or known family history of abnormal cholinesterase enzyme activity. Rocuronium does not cross placenta, therefore can safely be used in obstetrical surgeries where risk of regurgitation requires rapid sequence induction.

The purpose of the present study was to compare the effects on intubation conditions and haemodynamic response for rapid sequence intubation (RSI) of the two well proven but different anaesthetic induction agents, etomidate and thiopentone sodium, with a rapid acting neuromuscular blocking agent rocuronium in patients undergoing caesarean section.<sup>9</sup>

## Methods:-

After obtaining institutional ethical committee clearance and informed written consent for surgery and general anaesthesia. 100 pregnant females of age 20-40 yrs, (ASA) grade I and II undergoing LSCS were selected for the study. All patients underwent a thorough pre-anaesthetic checkup. Patients with known sensitivity to drugs, systemic dysfunction, patient refusal, pre-eclampsia, eclampsia were not included in the study.

The patients were divided into two groups in randomized double blind fashion. Etomidate (0.3 mg/kg) with Rocuronium (0.9 mg/kg) (Group I, n=50) and Thiopentone (5-7 gm/kg) with Rocuronium (0.9 mg/kg) (Group II, n=50). Each group had 50 patients.

All patients were evaluated and examined thoroughly with regards to history, physical examination and investigations. After taking written and informed consent, patients were shifted to operation theatre. Intravenous line was maintained by inserting 18 G i.v. cannula in dorsum of hand. Patients were premedicated with inj. Ranitidine 50 mg i.v., inj. Metoclopramide 10 mg i.v., and inj. Pentazocine 0.5 mg/kg. Philips MP 30 multipara monitor was applied to monitor pulse rate, non-invasive blood pressure, ECG, SpO<sub>2</sub>, and EtCO<sub>2</sub>.

Pre-oxygenation with 100% O<sub>2</sub> was done. Patients were induced with inj. Thiopentone sodium 5 mg/kg, or inj. Etomidate 0.3 mg/kg and inj. Rocuronium 0.9 mg/kg. After 90 sec., laryngoscopy was done, cricoid pressure was applied during placement of the proper size endotracheal tube and intubation was done. Endotracheal tube was fixed after checking for bilateral air entry. Anaesthesia was maintained with O<sub>2</sub> 50%, N<sub>2</sub>O 50% and isoflurane and neuromuscular blocker. At the end of surgery, when patient resumed some breathing effort, residual effects of neuromuscular block was reversed with inj. Neostigmine 0.05 mg/kg and inj. Glycopyrrolate 0.01 mg/kg. When the patient became fully awake, the patient was extubated after proper oral suction and oxygenation.

The following parameters were monitored at pre operative (baseline), after premedication, after induction at every 1 min. for 5 min., every 5 min. for 15 min and thereafter at every 15 min. till the end of procedure:-Heart rate (HR), Systolic blood pressure (SBP), Diastolic blood pressure (DBP), Mean blood pressure (MBP), Oxygen saturation (SpO<sub>2</sub>), End-tidal Carbon dioxide (EtCO<sub>2</sub>), Respiratory rate (RR), ease of laryngoscopy and intubating conditions were assessed using the criteria of Cooper & Colleagues.

### Scoring Condition for Intubating condition (given by Cooper and Colleagues)

SCORE	JAW RELAXATION (LARYNGOSCOP Y)	VOCAL CORDS	RESPONSE TO INTUBATION
0.	POOR (IMPOSSIBLE)	CLOSED	SEVERE COUGHING AND BUCKING
1.	MINIMAL (DIFFICULT)	CLOSING	MILD COUGHING
2.	MODERATE (FAIR)	MOVING	SLIGHT DIAPHRAGMATIC MOVEMENT
3.	GOOD (EASY)	OPEN	NONE
8-9 =EXCELLENT	6-7=GOOD	3-5=FAIR	0-2=POOR

**Excellent and good intubating conditions were considered clinically acceptable:** - All the observation were recorded, tabulated, and analyzed with SPSS (version 13.0, SPSS Inc., Chicago, IL) statistical software. Demographic data, systolic blood pressure, diastolic blood pressure, mean blood pressure, heart rate, respiratory rate, EtCO<sub>2</sub>, SpO<sub>2</sub>, condition of vocal cords and response to intubation data were compared between both the groups using unpaired student t-test. For intubating conditions, Chi-square test was used. The quantitative data were expressed as mean (standard deviation). A p-value less than 0.05 were considered significant.

On the basis of results obtained & statistical evaluation, inference was drawn.

#### Results:-

All the two groups were comparable to each other in terms of age, weight, gravida, parity and ASA grading.

TABLE-1 DEMOGRAPHIC DATA		
	GROUP I (n=50)	GROUP II (n=50)
AGE	25.07±3.50	25.36±3.46
WEIGHT	59.39±3.14	50.79±2.60

On comparison of intubating conditions in group I & group II, excellent intubating conditions were rated in 82% & 96% and good in 18% and 4%, respectively. The difference in intubating conditions of patients in both the groups was statistically significant (p value <0.05). More excellent intubating conditions were observed in group II compare to group I. (Table-2). Clinically acceptable intubation conditions (excellent & good) were observed in 100 % patients in both the groups, hence the difference being statistically non significant.

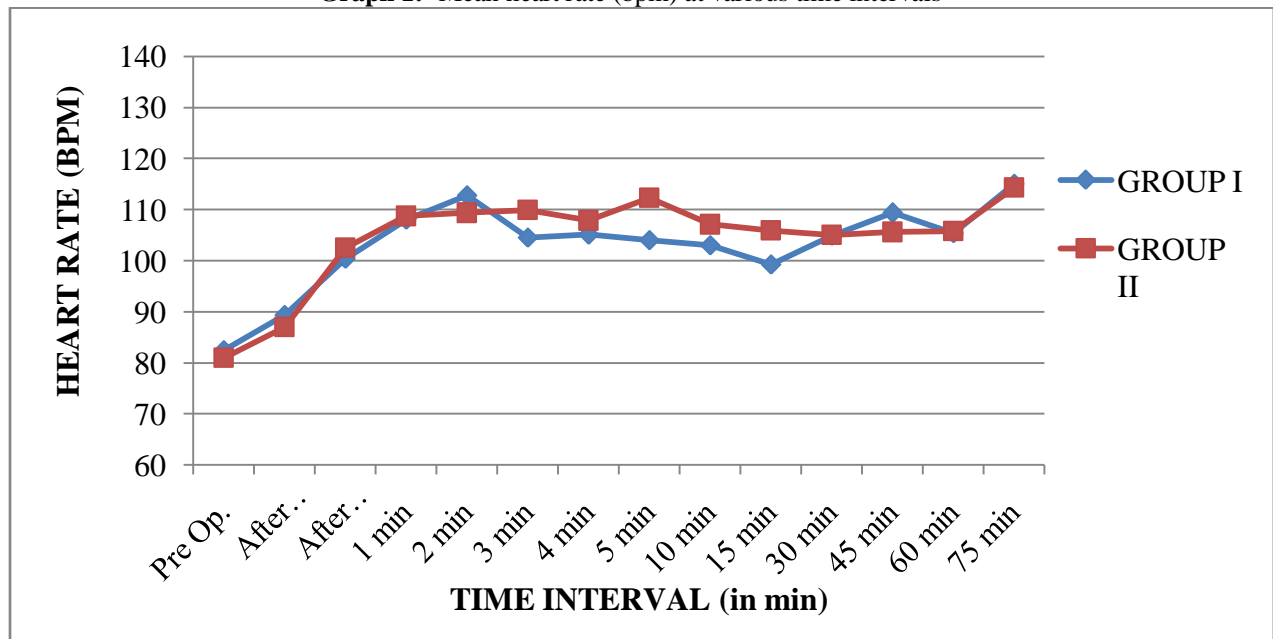
**Table 2:-** Intubating conditions

INTUBATING CONDITION	NO. OF PATIENTS		P VALUE
	GROUP I (n=50)	GROUP II (n=50)	
EXCELLENT	41(82%)	48(96%)	0.0001
GOOD	9(18%)	2(4%)	0.0001
FAIR	0	0	0
POOR	0	0	0

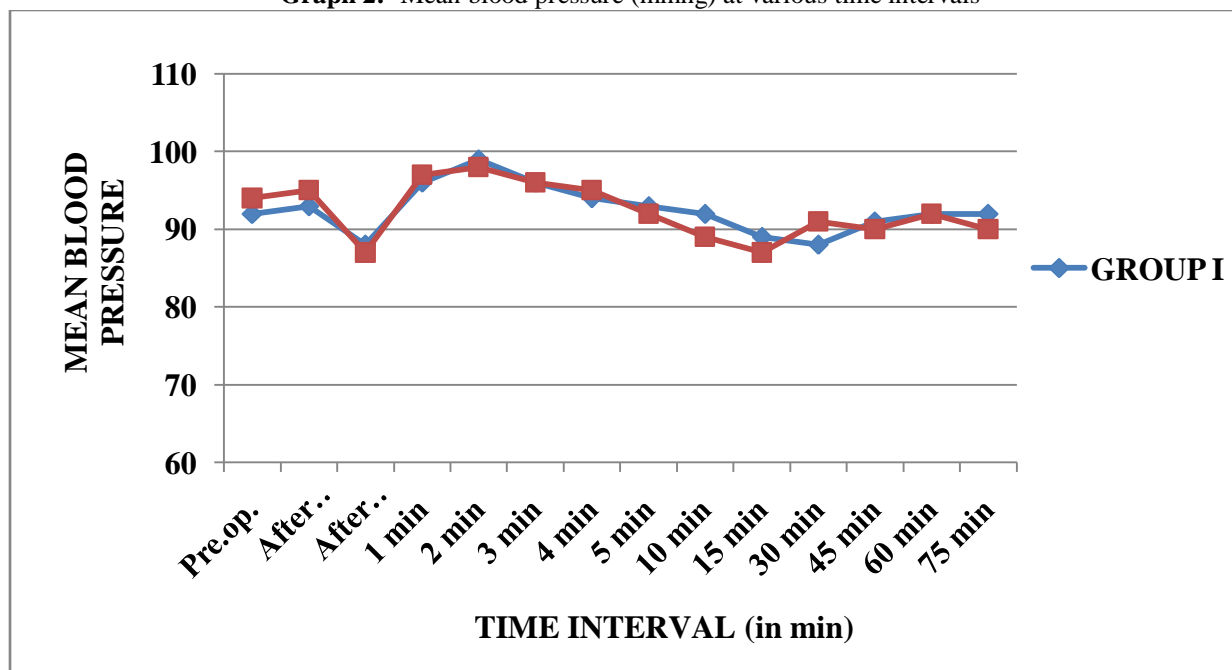
Baseline mean heart rate was  $82.45 \pm 8$  and  $80.94 \pm 8.17$  per min in group I and group II respectively (p value=0.37). Slight increase in mean heart rate was observed in both groups after the induction. Tracheal intubation caused further increase in mean heart rate in both groups compared with baseline and post induction values. At no time during the study period, significant difference was observed between both the groups ( $p>0.05$ ). (Graph 1)

Baseline mean blood pressure in group I was  $92 \pm 2.13$ mmHg and group II was  $94 \pm 4.91$  mmHg (p value 0.41). Decrease in MBP was observed after induction in both groups. At intubation there was an increase in these parameters. A gradual reduction in MBP was observed at 15 minutes after intubation. At no time during the study period, there was a significant difference between the groups ( $p>0.05$ ). (Graph-2)

**Graph 1:- Mean heart rate (bpm) at various time intervals**



**Graph 2:- Mean blood pressure (mmhg) at various time intervals**



**Discussion:-**

The aim of our study was to compare the effects on intubation conditions and haemodynamic response for rapid sequence intubation (RSI) of the two well proven but different anaesthetic induction agents, etomidate and thiopentone sodium, with a rapid acting neuromuscular blocking agent rocuronium in patients undergoing caesarean section.

One of the use of muscle relaxant is to provide conditions necessary for easy and atraumatic intubation.

Rocuronium is a low potency intermediate acting derivative of vecuronium with shorter onset time than the other non depolarizers. It is also devoid of cardiovascular side effects and does not cause histamine release.

In the present study we found that that clinically acceptable intubating conditions were formed in both group I & group II; excellent intubating conditions were rated in 82% (41/50) & 96% (48/50) and good in 18% (9/50) and 4%, (2/50) respectively. Similar results were found in the studies conducted by **Cooper R. et al (1992)<sup>4</sup>** and **Barve M. et al (2002)<sup>3</sup>**.

There was no significant change in heart rate, mean systolic blood pressure, diastolic blood pressure and mean blood pressure after the administration of the muscle relaxant in either of the groups in the study. The studies conducted by **Cooper R. et al (1992)<sup>4</sup>**, **Barve M. et al (2002)<sup>3</sup>** and **Gupta S. et al (2010)<sup>8</sup>** shows similar cardiovascular effects. In these patients rocuronium can be used safely as it does not cause bradycardia rather, it causes slight tachycardia which is not significant clinically. As there is no significant change in heart rate and mean blood pressure with rocuronium, it is the agent of choice in ASA PS I & II patients undergoing caesarean section cases.

**Conclusion:-**

We concluded that both the induction agents; Etomidate & Thiopentone sodium in combination with Rocuronium were comparable in terms of intubating conditions & haemodynamic response. Thus it could be concluded that either of them could be used for rapid sequence intubation in pregnant patients undergoing lower segment Caesarean section (LSCS).

**References:-**

1. Belekar V.R., Khamankar S. Rocuronium for tracheal intubation in patients undergoing emergency surgery. International Journal of Pharmacological Research. 2013; 3(2): 18-22.
2. Baraka A.S., Sahar S.S., Boutros A.A. Thiopental-Rocuronium Versus Ketamine-Rocuronium for Rapid-Sequence Intubation in Parturients Undergoing Cesarean Section. Anaesthesia Analgesia. 1997; 84: 1140-47.
3. Barve M., Sharma R. Comparison of intubating conditions and time course of action of rocuronium bromide and succinylcholine in paediatric patients. Indian Journal of anesthesiology. 2002; 46 (6): 465- 68.
4. Cooper R., Mirakhur R.K., Clarke R.S.J., Boules Z. Comparison of intubating conditions after administration of ORG 9426 (rocuronium) and suxamethonium. British Journal of Anaesthesia. 1992; 69: 269-73.
5. Dobson A.P., McCluskey A., Meakin G., Baker RD. Effective time to satisfactory intubation conditions after administration of rocuronium in adults Comparison of propofol and thiopentone for rapid sequence induction of anaesthesia. Anaesthesia, 1999; 54: 172-97.
6. El-Orbany M.I., Joseph N.J., Salem M.R. Tracheal intubating conditions and apnoea time after small-dose succinylcholine are not modified by the choice of induction agent. British Journal of Anaesthesia. 2005; 95 (5): 710-14.
7. Fuchs-Buder T., Sparr H.J., Ziegenfub T. Thiopentone or Etomidate for rapid sequence induction with rocuronium. British Journal of Anaesthesia. 1998; 80: 504-06.
8. Gupta S., Kirubahar R. A comparative study of intubating conditions of rocuronium bromide and suxamethonium in adult patients. Anesth Essays Res. Jan-Jun 2010; 4(1): 5-9.
9. Khalid S.A., Ali S.H., Aftab S., Kazmi W.H. Two Forgotten Agents; Etomidate versus Thiopental Sodium with Rocuronium for rapid sequence induction. Annals of Abbasi Shaheed Hospital & Karachi Medical & Dental College. 2014; 19(2): 79-84.
10. Khatri C., Khatri K., Jain V. Comparison of Onset, Duration of Action and Intubating Conditions of Three Dosages 0.3 mg/kg, 0.6 mg/kg, 0.9 mg/kg of Rocuronium Bromide. International Journal of Science and Research. May 2016; 5(5): 729-33.

11. Khurshid H., Khawer M., Shabir A.W. A comparative study of intubating conditions using succinylcholine and two doses of rocuronium. *International Journal of Advanced Research*. 2015; 3 (5): 1152-59.
12. Kirkegaard N.H., Caldwell J.E., Berry P.D. Rapid Tracheal Intubation with Rocuronium: A Probability Approach to Determining Dose. *Anesthesiology*. 1999; 91:131-36.
13. Kwon M.A., Song J., Ju-Ri Kim. "Tracheal intubation with rocuronium using a "modified timing principle" *Korean Journal of Anesthesiology*. Mar 2013; 64(3): 218-22
14. Lapisatepun W., Churnjongkolkul W., Nontawasee K., Punjasawadwong K. Rapid sequence induction with rocuronium at 0.45 mg/kg: Comparison of intubating conditions between ketamine and propofol induction. *Chiang Mai Med J* 2010; 49(1):11-17.
15. McCourt K.C., Salmela L., Mirakhur R.K., Carroll M., Ma' kinen M.T., Kansanaho M. et al. Comparison of rocuronium and suxamethonium for used during rapid sequence induction of anaesthesia. *Anaesthesia*. 1998; 53: 867-71.
16. Miller R.D., Vuyk J., Sisten E., Rockers M. *Miller's Anesthesia: Intravenous anaesthesia*. 7<sup>th</sup> ed. (26): 723-29.
17. Miranda L. C. G. de., Barrucand L., José Costa T.S.A., Verçosa N. A Comparative Study between One and Two Effective Doses (ED95) of Rocuronium for Tracheal Intubation. *Revista Brasileira de Anestesiologia* May-Jun 2008; 58(3): 202-09.
18. Piya R. Comparison of intubating conditions during rapid tracheal intubation between Rocuronium and combination of Rocuronium with Vecuronium. *JGPEMN*: Jan-June 2014; 3(1): 19-27.
19. Rohsbach C.B., Wirth S.O., Lenz K., Prieb H.J. Survey on the current management of rapid sequence induction in Germany: *Minerva Anesthesiologica*. July 2013; 79(7): 716-22.
20. Sathe V., Sivashankar K.R., Sharma R.C., Gangawane A.K. Comparison of intubating conditions with rocuronium and vecuronium at specific times judged by clinical criteria. *Neuroscience Research*. 2010; 1(1): 09-25.
21. Shahnawaz M. Md., Shahjahan B., and Siddiqui S.S. Evaluation of intubating conditions after rocuronium bromide in adults induced with propofol or thiopentone sodium. *Journal of Anaesthesiology Clinical Pharmacology*. Apr-Jun 2011; 27(2): 215-19.
22. Shukla A., Dubey K.P., Sharma M.S.N. Comparative evaluation of haemodynamic effects and intubating conditions after the administration of ORG9426 (Rocuronium) and succinylcholine e. *Indian Journal of Anaesthesiology*. 2004; 48(6): 476-79.
23. Singh A., Bhatia P.K., Tulsiani K.L. Comparison of onset time, duration of action and intubating conditions achieved with suxamethonium and rocuronium. *Indian journal of Anaesthesiology*. 2004; 48(2): 129- 33.
24. Skinner H.J., Biswas A., Mahajan R.P. Evaluation of intubating conditions with rocuronium and either propofol or Etomidate for rapid sequence induction. *Anaesthesia*. 1998; 53: 702-10.
25. Mathias S, Wolfgang U, Wolfgang S., Siegemund M.M, Stephan C. Rocuronium Versus Succinylcholine for Rapid Sequence Induction of Anesthesia and Endotracheal Intubation: A Prospective, Randomized Trial in Emergent Cases. *Anesthesia & Analgesia*: Nov 2005; 101(5): 1356-61.
26. Somani M., Sharma P, Sachdev S, Mathur V, Chaturvedi S. A Comparative Study between Vecuronium and Rocuronium for Intubating Condition and Hemodynamic Changes. *Journal of Dental and Medical Sciences*. Jun 2014; 13(6): 33-9.
27. Sparr H.J., Giesinger S, Ulmer H., Hollenstein-Zacke M., Luger T.J. Influence of induction technique on intubating conditions after rocuronium in adults: comparison with rapid-sequence induction using thiopentone and suxamethonium. *British Journal of Anaesthesia*. 1996; 77: 339-42.
28. Stoelting R.K, Rathmell J.P., Roscow C.E. *Stoelting's Pharmacology and physiology in anaesthetic practice*. Intravenous sedation and hypnotics. 3<sup>rd</sup> ed. (5): 127-30.
29. Yeoh S.B., Sng B.L, Alex S.T.H. Anaesthesia for lower segment caesarean section: Changing perspectives. *Indian Journal of Anaesthesia*. Sep-Oct 2010; 54(5): 409-14.



## RESEARCH ARTICLE

### BILATERAL SEQUENTIAL LUNG TRANSPLANT FOR PULMONARY ALVEOLAR MICROLITHIASIS.

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Double lung transplant

#### Abstract

Pulmonary alveolar microlithiasis is an uncommon infiltrative pulmonary disease characterized by deposition of microliths in the alveoli. Here, we present the case of a 45-year-old man with PAM who is a successful lung transplant recipient with end-stage PAM

**Introduction:** Pulmonary alveolar microlithiasis (PAM) is a rare idiopathic lung disease, characterized by the formation and accumulation of tiny, round corpuscles called “microliths” that consist primarily of calcium and phosphorus mixed with small amounts of magnesium and aluminum<sup>1</sup>. Most of the reported cases are of patients between 20 and 40 years of age. Autosomal recessive inheritance has been suggested to be a possible cause of the disease. Clinical features vary, and some patients may be asymptomatic for a long time until pulmonary function testing begins to demonstrate lung impairment along with progressive fibrosis and the development of a restrictive pulmonary defect culminating in cardiorespiratory decompensation.<sup>2</sup> Currently, there is no medical therapy capable of definitively changing the progression of the disease. Lung transplantation is required once end-stage lung disease is established.

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#### Case Description:-

Mr. Ibrahim Mohammed is a 45-year-old gentleman known case of pulmonary alveolar microlithiasis, severe pulmonary hypertension and respiratory failure on home oxygen. He was admitted on 04 February 2016 because of decline in lung function and exertional dyspnea for 2 weeks, at that time a suitable lung transplant donor was available. There was no history of smoking, no family history of PAM. His crossmatch was negative for both T cell and B cell. The induction therapy was started with methylprednisolone 500 mg for each lung and CellCept, and broad-spectrum antibiotics meropenem, colistin, and vancomycin as per lung transplant protocol. The intraoperative course remained smooth, was done on ECMO without any major intraoperative issue. The ischemia time for the right lung was 6 hours and for the left lung was 6.5 hours.

Posttransplant, there was a mild reperfusion injury and was shifted to ICU intubated with minimal inotropic requirements. He was successfully weaned off from inotrope and extubated on the next day with stable vitals and good recovery. On 08 February 2015, he had tonic clonic seizures. For that he had to be re-intubated. The labwork was normal, electrolytes were normal. Neurology was taken onboard and MRI was advised. His MRI showed bilateral predominant frontoparietal area of cortical signal abnormality, diffuse sulcal FLAIR hyperintensity noted,

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which is of uncertain etiology. Since there was no clear cause for his tonic clonic seizure, his tacrolimus was switched to cyclosporine and CellCept was changed to azathioprine.

He was successfully extubated in the next 2 days and then shifted to the floor. His respiratory cultures were negative except legionella for which he was treated. The transbronchial biopsy showed no evidence of any cellular rejection. He was discharged home in a stable condition on 18 February 2016 with a followup clinic visit in 1 week with repeat lab imaging and spirometry. Physical examination revealed athin, chronically ill appearing male with respiratory rate of 20bpm . Prominent inspiratory crackles were noted bilaterally, other examination were unremarkable. The spirometry done before discharge showed FEV1 1.92, FVC 2.26, FEV1/FVC ratio 85.07. Specimen is received in formalin labeled right lower lobe. It consists of multiple fragments of brownish and tan soft tissue, measuring in aggregate 0.4 x 0.4 x 0.1 cm.

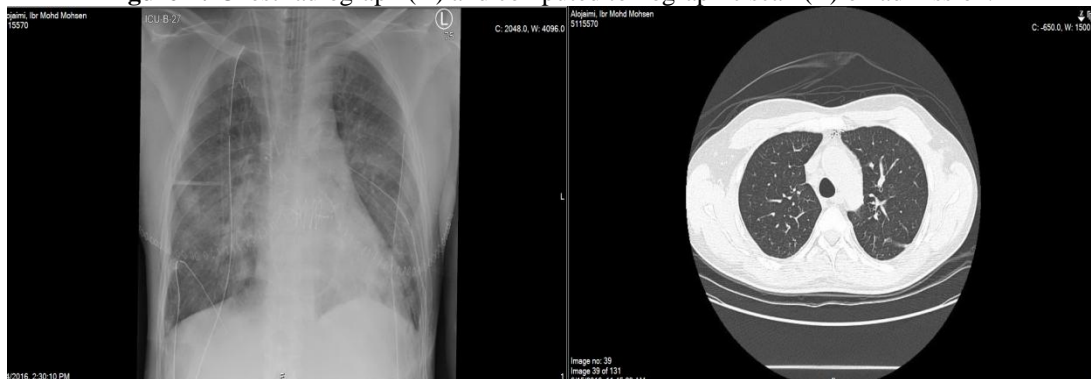
### Discussion:-

Although the first cases of PAM were described by Malphighi, the disease was first named by Phur. The disease exists on all continents, without regional or ethnic differences, although most of the cases (37%) have been reported in Europe and Asia Minor. Turkey is the country with the highest prevalence (16.3%), followed by Italy and the USA. The etiology of the condition remains unknown, although some theories have been posited. One theory is based on an exudate that is not easily absorbed and that is formed as a result of an abnormal inflammatory response to infections or irritants, ultimately undergoing calcification. Males and female are affected with equal frequency. There appears to be a family association in almost half of the reported cases.

A striking feature of this disease is discordance between the clinical and radiographic manifestation, many patient display only minor symptoms although impressive radiographic manifestation . Those patient who are symptomatic typically complain of dyspnea and nonproductive cough , and the disease may develop slowly into cor pulmonale.

The typical picture of PAM on chest X-ray is of fine, sand-like calcific micronodules (*sandstorm lung*) diffusely infiltrating both lungs; these characteristics are usually observed in the middle and lower zones. CT scans demonstrate micronodular calcific densities with a greater concentration in the subpleural parenchyma and along the bronchovascular bundles, whereas high resolution CT scans show thickening of the lobular septae with a distribution of microliths along the septae and around the centrilobular distal bronchioles.

**Figure 1:-** Chest radiograph (A) and computed tomographic scan (B) on admission.



Considering lung transplantation as a treatment method in PAM cases instead of medication or artificial respiratory support treatments, both of which are known to be ineffective, seems rational. The differences observed between the preoperative and postoperative periods demonstrated the importance of performing bilateral lung transplantation in such cases regardless of the recurrence risk.

Systemic corticosteroids, calcium-chelating agents and serial bronchopulmonary lavage have been shown to be ineffective and are used as palliative treatments. In the only postoperative death reported after bilateral lung transplantation, prolonged cardiopulmonary bypass (six hours) in combination with extensive pleural involvement and increased vascularity led to uncontrolled hemorrhagic complications. Shigemura et al. have reported the oldest successful lung transplant recipient, with ten years of follow-up.

Bilateral lung replacement is preferred to unilateral replacement, because the replacement of only one lung might result in persistent shunting of blood through the native lung, as PAM leads to filling of the alveolar spaces and the consequent creation of large areas of intrapulmonary shunt. However, two patients have undergone a single lung transplantation with acceptable results and have had no evidence of recurrence in the transplanted lung thus far. Furthermore, even for bilateral transplantation, it is not known whether PAM can recur. Recurrence after transplantation has not been reported to date, suggesting that, in fact, PAM is a result of local inflammatory responses or a genetically determined error in alveolar metabolism, rather than a systemic disorder.

lung transplantation has some drawbacks because not all patients are eligible for transplantation as factors such as age and comorbidities may pose an unacceptably high risk. In addition, patients with end-stage lung disease often become critically ill and may not survive until a donor organ is available. Lung transplantation creates new medical problems and the life expectancy after this operation remains limited.

**Acknowledgment:-**

None

Source(s) of support in the form of grants, equipment, drugs

None

**Conflicts of Interests:-**

None

**Conclusion:-**

we successfully performed a double lung transplantation in a case of respiratory failure resulting from end-stage PAM. Although elderly recipients with end-stage PAM may have technically difficult problems related to surgery, such transplantation can be done safely and successfully when sufficient strategies are used.

**References:-**

1. Lauta VM. Pulmonary alveolar microlithiasis: an overview of clinical and pathological features together with possible therapies. *Resp Med.* 2003;97:1081–5.[[PubMed](#)]
2. Castellana G, Gentile M, Castellana R, Fiorente P, Lamorgese V. Pulmonary Alveolar Microlithiasis: Clinical Features, Evolution of the Phenotype, and Review of Literature. *Am J Med Gen.* 2002;111:220–4.[[PubMed](#)]
3. Castellana G, Lamorgese V. Pulmonary Alveolar Microlithiasis: World Cases and Review of Literature. *Respiration.* 2003;70:549–55.[[PubMed](#)]



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### RESEARCH ARTICLE

#### VARIABILITY OF MESENCHYMAL VEGFR 1, 2, AND 3 PROTEIN EXPRESSION OF HUMANS AND MURINE SPECIES - A COMPARATIVE ANALYSIS.

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##### Key words:-

Vascular Endothelial Growth Factors, VEGFR 1, VEGFR 2, VEGFR 3, Protein Phylogenetic Analysis, Amino Acid Sequences.

#### Abstract

The Vascular Endothelial Growth Factor 1,2,3 (VEGFR 1,2,3) protein sequences from various species like *Mus musculus* (Mouse), *Rattus norvegicus* (Rat) and *Homo sapiens* (Human) were retrieved from SWISS PROT database and compared for their homology and variability. DNAMAN Software was used to create multiple sequence alignment and in assessment of the homology and variability. The results of the phylogenetic tree assessment for VEGFR1, 2, 3 depicts that the sequences from *Mus musculus* (Mouse) and *Rattus norvegicus* (Rat) showed high homology when compared with the sequences of the *Homo sapiens* (Human). The intra sequence homology within the human VEGFR1,2,3 protein predicted and analyzed for secondary structure show a characteristic variability in the amino acid positions on the random coils, alpha confirmations and extended strands without significant variation in the length.

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#### Introduction:-

Stem cells are totipotent primordial cells capable to differentiate into any known adult cell types with its typical physiological functions (Louveau I et al., 2016). The first stem cells originate within the developing embryo (blastocyst) and have two important characteristics that distinguish them from other types of cells. First, they are unspecialized cells that renew themselves for long periods through cell division. The second is that, under physiologic or experimental conditions, they can be induced to become cells with special functions such as the beating cells of the heart muscle or the insulin-producing cells of the pancreas (Adel Alhadlaq and Jeremy J. Mao, 2004). Stem Cells reside as resident population at various organs and can be isolated from variety of tissues like adipose tissue, bone marrow, embryos, olfactory ensheathing cells, peripheral blood, skin and umbilical cord blood. Further stem cells or progenitor cells can be mobilized from bone marrow upon signaling from the infarcted or damaged tissues.

There are different types of stem cells like **embryonic stem cells, endothelial stem cells, mesenchymal or stromal stem cells, hematopoietic progenitors, cardiac, cancer and neuronal stem cells, induced pluripotent stem cells** etc (Choudhery MS et al., 2015). **All these have been isolated, banked or used for research with few successful clinical applications. However identification of these cell with their characteristic phenotypic or genotypic markers are more difficult and challenging today. There are surface markers common for these cells with few**

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exceptions like common leucocyte markers like CD45 which is mostly observed only in the cells of the hematopoietic origin (Kobolak et al., 2016). Further many progenitor stem cells usually shares surface markers making it difficult to isolate or characterize as functional lineages, though these markers are very particular for some discrete functional adult differentiated cells. Therefore the identification and characterization of the stem cells with the available markers or cluster of differentiation (CD) on the surface of these naïve cells becomes more difficult and generalized rather than specific. Therefore it becomes necessary to eliminate such older cells based on the other markers characteristic to the anatomical site of the cells or type of the cells. The best example of these cases is Vascular Endothelial Growth Factor (VEGFR) group of the markers which are very specific to endothelial progenitors or endothelial cells (Igarashi Y et al., 2016). The presence of VEGFR has been well characterized in the mesenchymal stem cells too (Totsugawa T et al., 2002), though MSCs functions are much varied. The VEGFR family consists of three members, Vascular Endothelial Growth Factor Receptor -1 (Flt-1), Vascular Endothelial Growth Factor Receptor -2 (KDR/Flk-1) and Vascular Endothelial Growth Factor Receptor -3 (Flt-4), all of which belong to the receptor type tyrosine kinase superfamily (Matthias Clauss, et al., 1996, Kasper G et al., 2007.). In the current investigation we intended to examine the variability of VEGFR1,2 and 3 among the experimental animals and human origin. We tend to investigate the degree of identity among human and animals and within animal groups. The VEGFR 1,2 and 3 amino acid sequences from human origin and from the murine origin (Mouse and Rat) were assessed for the homogeneity and difference in their protein confirmation. This will give the information on the degree of the cross reactivity of the VEGFR antibodies against VEGFR 1,2,3 and species cross reactivity with murine origin.

## Materials and Methods:-

### Retrieval of sequences:-

The amino acid sequences of the surface marker Vascular Endothelial Growth Factor Receptor (VEGFR) was retrieved using NCBI and SWISS-PROT. Sequences of all three receptors, namely, VEGFR1, VEGFR2 and VEGFR3 from different species such as Homo sapiens (Human), Mus musculus (Mouse) and Rattus norvegicus (Rat) were used for this study.

SWISS-PROT (<http://www.expasy.org/sprot/>) (Amos Bairoch and Rolf Apweiler, 2000) Swiss-Prot is a curated biological database of protein sequences from different species created in 1986 by Amos Bairoch during his doctoral work and developed by the Swiss Institute of Bioinformatics and the European Bioinformatics Institute. It strives to provide a high level of annotation (such as the description of the function of a protein, its domains structure, post-translational modifications, variants, etc.), a minimal level of redundancy and high level of integration with other databases. Now funded by the NIH, Swiss-Prot and its automatically curated supplement TrEMBL have joined with the PIR to produce the UniProt Knowledgebase, the world's most comprehensive catalogue of information on proteins. It is a central repository of protein sequence and function created by joining the information contained in Swiss-Prot, TrEMBL, and PIR.

NCBI-ENTREZ (<http://www.ncbi.nlm.nih.gov/>) (Sayers EW and Karsch-Mizrachi I, 2016)

Established in 1988 as a national resource for molecular biology information, NCBI creates public databases, conducts research in computational biology, develops software tools for analyzing genome data, and disseminates biomedical information - all for the better understanding of molecular processes affecting human health and disease.

The Entrez system can provide views of gene and protein sequences and chromosome maps. Entrez can efficiently retrieve related sequences, structures, and references. Some textbooks are also available online through the Entrez system. Entrez Global Query is an integrated search and retrieval system that provides access to all databases simultaneously.

The sequences of the surface markers VEGFR 1, 2 and 3 were retrieved in FASTA format.

#### VEGFR 1

Source: Homo sapiens (Human)

Primary accession number P17948

Source: Mus musculus (Mouse)

Primary accession number P35969

Source: Rattus norvegicus (Rat)

Primary accession number P53767

**VEGFR 2**

Source: Homo sapiens (Human)

Primary accession number P35968

Source: Mus musculus (Mouse).

Primary accession number P35918

Source: Rattus norvegicus (Rat).

Primary accession number O08775

**V EGF 3**

Source: Homo sapiens (Human)

Primary accession number P35916

Source: Mus musculus (Mouse).

Primary accession number P35917

Source: Rattus norvegicus (Rat)

Primary accession number Q91ZT1

**Multiple sequence Alignment:-**

The retrieved sequences were aligned using DNAMAN Software.

DNAMAN Software. DNAMAN carries out multiple sequence alignment, designing PCR primers, protein sequence analysis or drawing plasmids. DNAMAN's speed, flexibility, accuracy and high quality presentations make it one of the fundamental tools used extensively in molecular biology. We used the Multiple Alignment Sequence Editor of DNAMAN (MASED) as an efficient tool for multiple sequence editing. The result of a multiple alignment is loaded directly into MASED. MASED can recognize DNAMAN multiple sequence format (MSD format), GCG/MSF format, Clustal format and GDE format. DNAMAN can open MSD file directly into MASED, other format files must be opened with the File | Open Special | Multiple Alignment command. The multiple alignment editor can output an alignment in different formats: GCG/MSF, CLUSTAL, NBRF/PIR, and GDE. The multiple input and output capacity of DNAMAN makes it compatible with major sequence analysis software.

**Producing Trees:-**

MASED can produce multiple alignment trees. It calculates the homology matrix and establishes related distances between all pairs of sequences. Bootstrapping of a phylogenetic tree. Bootstrap test can be carried out for the confidence values on the phylogenetic tree. DNAMAN calculates the homology matrix and establishes related distances between all pairs of sequences. Consequently, DNAMAN can output a distance matrix of multiple alignment, and draw phylogenetic trees or homology trees. Bootstrapping tests can be carried out for the confidence value of a phylogenetic tree.

**Secondary structure prediction for proteins:-**

Secondary Structure Prediction was performed for the human VEGFR sequences using HNN - Hierarchical Neural Network method (Guerneur, 1997). Expression provides an interface to a large range of sophisticated secondary structure prediction algorithms. Protein Expression presently supports nine different secondary structure prediction algorithms. All computations are performed via the Network Protein Sequence Analysis server (PBIL, France). In this study, the prediction method followed was The HNN (Hierarchical Neural Network) prediction method.

**Results and Discussion:-**

Multiple Sequence Alignment of the retrieved sequences was obtained using DNAMAN Software. The VEGFR sequences within each class were compared for homology between the sequences from different origins.

**Vascular endothelial growth factor receptor 1:-**

The VEGFR 1 sequences from *Homo sapiens* (Human), *Mus musculus* (Mouse), *Rattus norvegicus* (Rat) were aligned as follows.

**FILE 1: Multiple\_Sequence\_Alignment****PROJECT:****NUMBER: 3****MAXLENGTH: 1710****NAMES: P17948-VEGFR1-human P35969-VEGFR1-mouse P53767-VEGFR1-rat****MAXNAMELEN: 18**

**ORIGIN (Only representative portions)**

P17948-VEGFR1-human DCTYPEHTMLPUBLICWCDDHTMLTRANSITINALENSA 40  
 P35969-VEGFR1-mouse DCTYPEHTMLPUBLICWCDDHTMLTRANSITINALENSA 40  
 P53767-VEGFR1-rat DCTYPEHTMLPUBLICWCDDHTMLTRANSITINALENSA 40  
 Consensus dctypehtmlpublicwcddhtmltransitinalensa

P17948-VEGFR1-human .MVSYWDTGVLLCALLSCLLLTGSSSGSKLKDPPELSLKGT 381  
 P35969-VEGFR1-mouse eMVScWDTaVLpyALLgCLLLTGygSGSKLKvPELSLKGT 340  
 P53767-VEGFR1-rat .MVScWDTaVLpCALLgCLLLTGycSGSKLKgPELSLKGT 321  
 Consensus mvs wdt vl all cllltg sgsklk pelslkg

**Table 1:-** For VEGFR1 sequences, the Identity Percentage between *Homo sapiens* (Human), *Mus musculus* (Mouse) and *Rattus norvegicus* (Rat) was found to be **87.58%**.

SEQUENCE COMPARED	ORIGIN	HOMOLOGY PERCENTAGE
Vascular Endothelial Growth Factor Receptor 1	<i>Homo sapiens</i> (Human)	<b>87.58%</b>
	<i>Mus musculus</i> (Mouse)	
	<i>Rattus norvegicus</i> (Rat)	

**Table 2:-** On comparison of the individual VEGFR1 sequences with each other it was found that the homology between sequences from rat and mouse was greater (**91.57%**), when compared to the homology between human and mouse sequences (**80.92%**) and the homology between human and rat sequences (**81.12%**).

SEQUENCE COMPARED	ORIGIN	HOMOLOGY PERCENTAGE
Vascular Endothelial Growth Factor Receptor 1	<i>Homo sapiens</i> (Human) and <i>Mus musculus</i> (Mouse)	<b>80.92%</b>
	<i>Mus musculus</i> (Mouse) and <i>Rattus norvegicus</i> (Rat)	<b>91.57%</b>
	<i>Rattus norvegicus</i> (Rat) and <i>Homo sapiens</i> (Human)	<b>81.12%</b>

**Vascular endothelial growth factor receptor 2:-**

The VEGFR 2 sequences from *Homo sapiens* (Human), *Mus musculus* (Mouse), *Rattus norvegicus* (Rat) were aligned as follows.

**FILE 2: Multiple\_Sequence\_Alignment****PROJECT:****NUMBER: 3****MAXLENGTH: 1708****NAMES: P35968-VEGFR2-human P35918-VEGFR2-mouse O08775-VEGFR2-rat****MAXNAMELEN: 18****ORIGIN (Only representative portions)**

P35968-VEGFR2-human DCTYPEHTMLPUBLICWCDDHTMLTRANSITINALENSA 40  
 P35918-VEGFR2-mouse DCTYPEHTMLPUBLICWCDDHTMLTRANSITINALENSA 40  
 O08775-VEGFR2-rat DCTYPEHTMLPUBLICWCDDHTMLTRANSITINALENSA 40  
 Consensus dctypehtmlpublicwcddhtmltransitinalensa

P35968-VEGFR2-human VEVTECSDDL..FCKTLTIPKVGNDTGAYKCFYRETDLA 421  
 P35918-VEGFR2-mouse VIVTECGgGdsiFCKTLTIPrVvGNDTGAYKCsYRdvDiA 415  
 O08775-VEGFR2-rat VIVTECG..dsiFCKTLTIPrVvGNDTGAYKCFYRdTDvs 404  
 Consensus v vtec fcktltp v gndtgaykc yr d

**Table 3:-** For VEGFR 2 sequences, the Identity Percentage between *Homo sapiens* (Human), *Mus musculus* (Mouse) and *Rattus norvegicus* (Rat) was found to be **90.14%**

SEQUENCE COMPARED	ORIGIN	HOMOLOGY PERCENTAGE
Vascular Endothelial Growth Factor Receptor 2	<i>Homo sapiens</i> (Human)	<b>90.14%</b>
	<i>Mus musculus</i> (Mouse)	
	<i>Rattus norvegicus</i> (Rat)	

**Table 4:-** On comparison of the individual VEGFR 2 sequences with each other it was found that the homology between sequences from rat and mouse was greater (**92.44%**), when compared to the homology between human and mouse sequences (**83.36%**) and the homology between human and rat sequences (**82.85%**)

SEQUENCE COMPARED	ORIGIN	HOMOLOGY PERCENTAGE
Vascular Endothelial Growth Factor Receptor 2	<i>Homo sapiens</i> (Human) and <i>Mus musculus</i> (Mouse)	<b>83.36%</b>
	<i>Mus musculus</i> (Mouse) and <i>Rattus norvegicus</i> (Rat)	<b>92.44%</b>
	<i>Rattus norvegicus</i> (Rat) and <i>Homo sapiens</i> (Human)	<b>82.85%</b>

**vascular endothelial growth factor receptor 3:-**

The VEGFR 3 sequences from *Homo sapiens* (Human), *Mus musculus* (Mouse), *Rattus norvegicus* (Rat) were aligned as follows.

**FILE 3: Multiple\_Sequence\_Alignment****PROJECT:****NUMBER: 3****MAXLENGTH: 1657****NAMES: P35916-VEGFR3-human P35917-VEGFR3-mouse Q91ZT1-VEGFR3-rat****MAXNAMELEN: 18****ORIGIN (Only representative portions)**

P35916-VEGFR3-human DCTYPEHTMLPUBLICWCDDHTMLTRANSITINALENSA 40  
 P35917-VEGFR3-mouse DCTYPEHTMLPUBLICWCDDHTMLTRANSITINALENSA 40  
 Q91ZT1-VEGFR3-rat DCTYPEHTMLPUBLICWCDDHTMLTRANSITINALENSA 40  
 Consensus dctypehtmlpublicwcddhtmltransitinalensa

P35916-VEGFR3-human RGRFRAMVELARLDRRRPGSSDRVLFARFSKTEGGARRAS 1273  
 P35917-VEGFR3-mouse RrRFRAMVEgAkaDRRRPGSSDRaLFtRFImgkGsARRAp 1273  
 Q91ZT1-VEGFR3-rat RrRFRAMVEgAkaDRRRIGStDRaLFtRFImgkGsARRAp 1279  
 Consensus r rframve a drrr gs dr lf rf g arra

**Table 5:-** For VEGFR 3 sequences, the Identity Percentage between *Homo sapiens* (Human), *Mus musculus* (Mouse) and *Rattus norvegicus* (Rat) was found to be **93.24%**.

SEQUENCE COMPARED	ORIGIN	HOMOLOGY PERCENTAGE
Vascular Endothelial Growth Factor Receptor 3	<i>Homo sapiens</i> (Human)	<b>93.24%</b>
	<i>Mus musculus</i> (Mouse)	
	<i>Rattus norvegicus</i> (Rat)	

**Table 6:-** On comparison of the individual VEGFR3 sequences with each other it was found that the homology between sequences from rat and mouse was greater (**95.78%**), when compared to the homology between human and mouse sequences (**85.46%**) and the homology between human and rat sequences (**84.60%**).

SEQUENCE COMPARED	ORIGIN	HOMOLOGY PERCENTAGE
Vascular Endothelial Growth Factor Receptor 3	<i>Homo sapiens</i> (Human) and <i>Mus musculus</i> (Mouse)	<b>85.46%</b>
	<i>Mus musculus</i> (Mouse) and <i>Rattus norvegicus</i> (Rat)	<b>95.78%</b>
	<i>Rattus norvegicus</i> (Rat) and <i>Homo sapiens</i> (Human)	<b>84.60%</b>

#### Phylogenetic Analysis:-

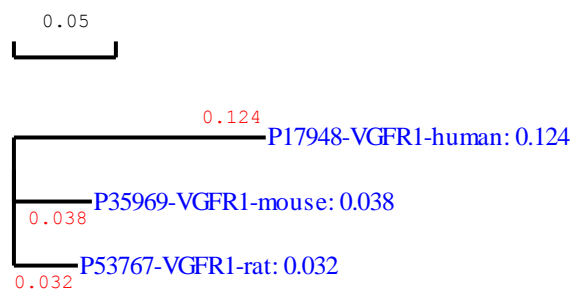
The phylogeny between the VEGFR sequences retrieved from various sources was established by plotting trees and the results were obtained as follows.

#### Vascular endothelial growth factor receptor 1:-

P17948-VEGFR1-human: 0.12358

P35969-VEGFR1-mouse: 0.03837

P53767-VEGFR1-rat: 0.03183



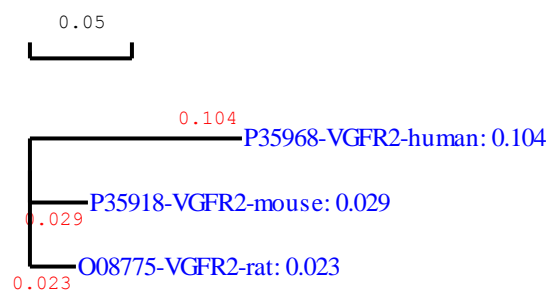
**Figure 1:-** Phylogenetic tree of VEGFR 1

#### Vascular endothelial growth factor receptor 2:-

P35968-VEGFR2-human: 0.10447

P35918-VEGFR2-mouse: 0.02910

O08775-VEGFR2-rat: 0.02315



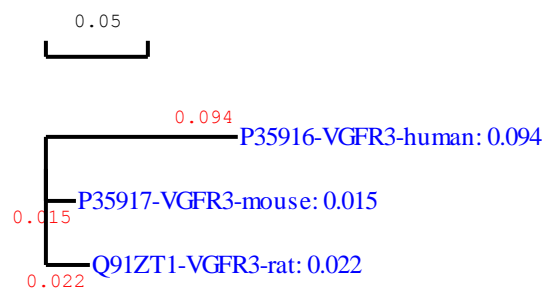
**Figure 2:-** Phylogenetic tree of VEGFR 2

#### VASCULAR ENDOTHELIAL GROWTH FACTOR RECEPTOR 3

P35916-VEGFR3-human: 0.09399

P35917-VEGFR3-mouse: 0.01550

Q91ZT1-VEGFR3-rat: 0.02210



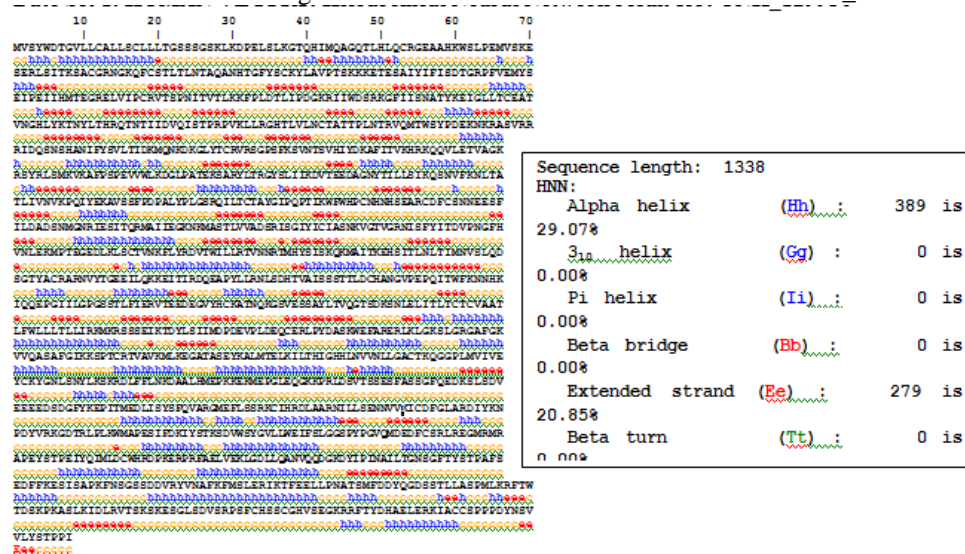
**Figure 3:-** Phylogenetic tree of VEGFR 3

The phylogenetic tree for VEGFR1 depicts that the sequences from *Mus musculus* (Mouse) and *Rattus norvegicus* (Rat) display greater similarity than with each of the sequences in comparison with *Homo sapiens* (Human) VEGFR 1 sequence. Similar results were obtained in case of phylogenetic tree generated between VEGFR2 as well as VEGFR 3 sequences of *Homo sapiens* (Human), *Mus musculus* (Mouse) and *Rattus norvegicus* (Rat).

### Secondary structure prediction for human vegfr:-

Secondary structure prediction was done for the Human VEGFR sequences using HNN Secondary Structure Prediction Method and the results were obtained as follows.

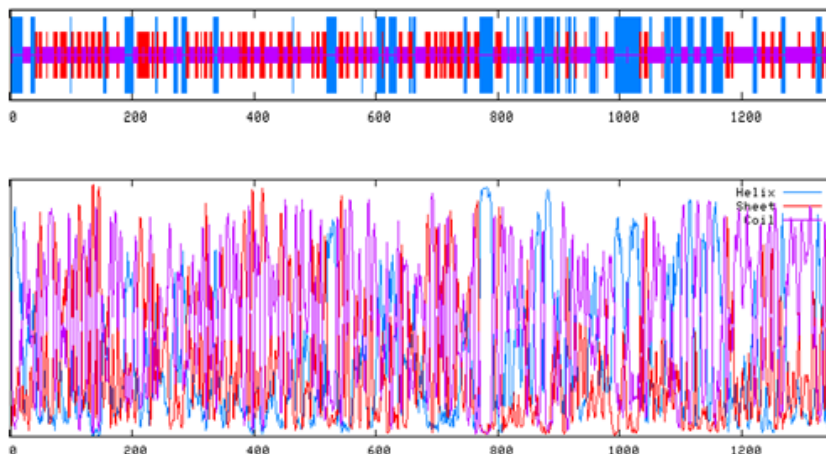
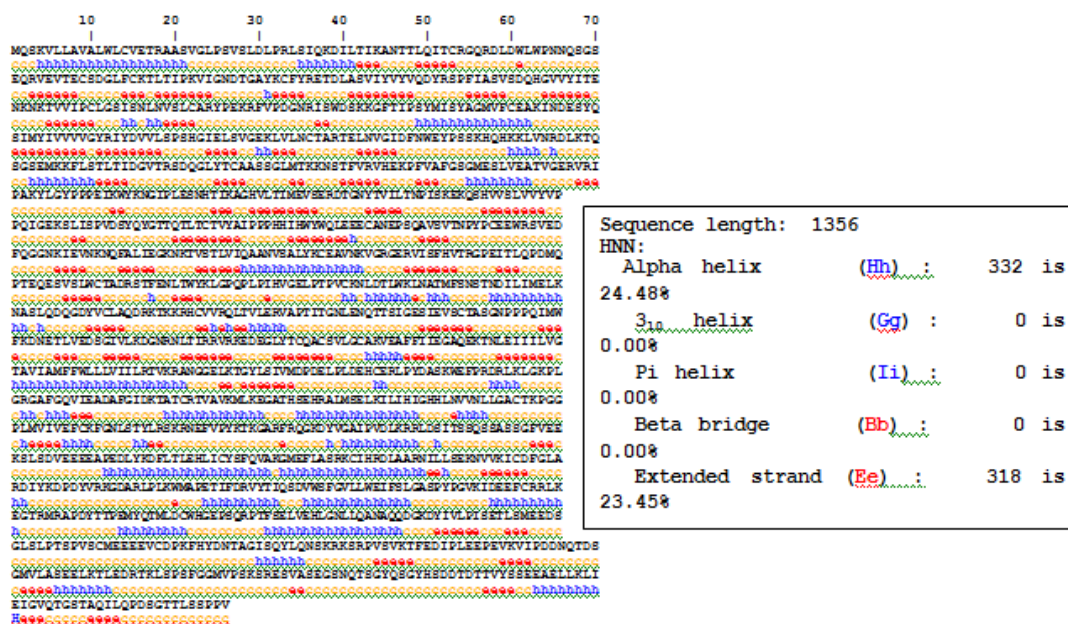
**Date Set 1:-** Human vegfr1: Hierarchical Neural Network result for: UNK\_129930



Date Set 1. Using HNN for VEGFR 1 sequence, the length of the sequence was found to be 1338. The protein is chiefly folded into random coils (50.07%) and also consists of alpha helix (29.07%) and extended strand (20.85%).

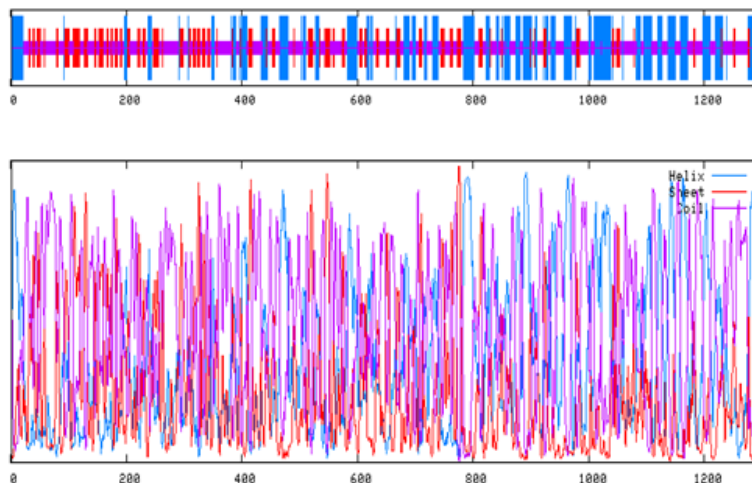
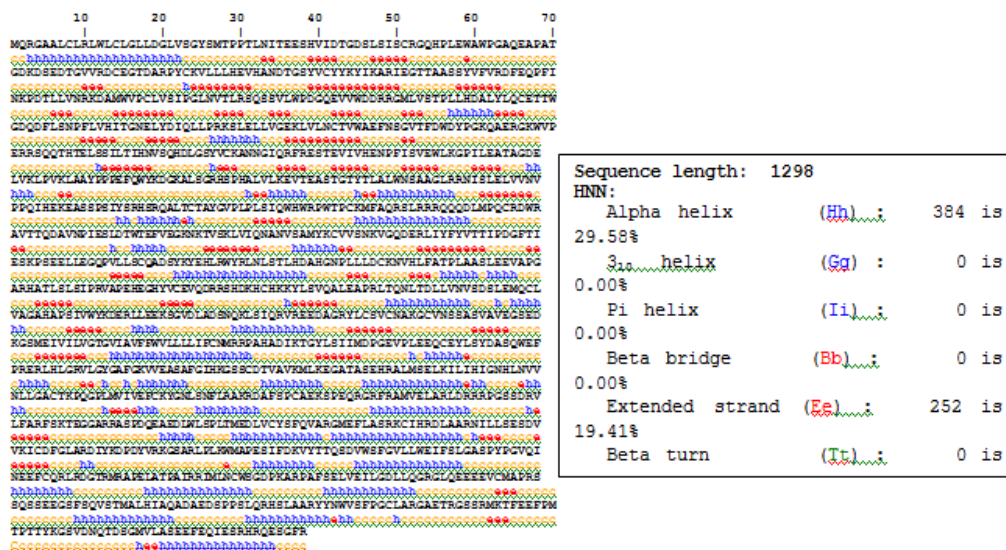


## Date Set 2:- HUMAN VEGFR2: Hierarchical Neural Network result for : UNK\_145240



Data Set 2.Using HNN for VEGFR 2 sequence, the length of the sequence was found to be 1356. The protein is chiefly folded into random coils (52.06%) and also consists of alpha helix (24.48%) and extended strand (23.45%).



**Data Set 3. HUMAN VEGFR3: Hierarchical Neural Network result for: UNK\_154230**

Data Set 3. Using HNN for VEGFR sequence, the length of the sequence was found to be 1298. The protein is chiefly folded into random coils (51.00%) and also consists of alpha helix (29.58%) and extended strand (19.41%).

**Discussion:-****Multiple sequence Alignment predicted the degree of variation of VEGFR 1 at genus levels:-**

Multiple sequence alignment (MSA) is an indispensable tool for studying the difference and homology of the macromolecules. There are many studies which compare with the protein sequence among different genus and species (Ramu Chenna et al., 2003). Therefore MSA becomes useful to know the difference in the amino acid composition which further gives the details of protein confirmation necessary for the functions like binding, activation etc. The current information of the VEGFR sequences retrieved from each species were assessed for homology using DNAMAN Software. The secondary protein structure further predicted showed the variations among each of the VEGFR1, 2, and 3 subtypes. More over the results are mostly from consistency-based programs with higher accuracy determined the reliability of the results. The VEGFR1 sequences showed an identity percentage of 87.58% between humans, mouse and rat (Table 1). On comparison of the individual VEGFR1 sequences among the species, we observed the homology between sequences from rat and mouse was 91.57% compared to the 80.92% homology between human and mouse and 81.12% homology between human and rat sequences respectively (Table 2).

In the case of VEGFR2 sequences, the indent percentage was found to be 90.14%. (Table 3) among human, mouse and rat. The individual comparison VEGFR2 sequences homology between rat and mouse was 92.44%, compared to the 83.36% homology between human and mouse and 82.85% homology between human and rat sequences (Table 4). The overall homology percentage for VEGFR 3 among the human, mouse and rat was 93.24% (Table 5). The sequence homology between rat and mouse is 95.78% compared to 85.46% human and mouse and 84.60% human and rat (Table 6). The homology between the VEGFR 1, 2 and 3 sequences from mouse and rat were more homogenous compared to humans showing the higher percent of variation with highly evolved vertebrate (Higgins DG et al 1996).

#### **Phylogenetic analysis of VEGFR 1,2 &3 reveals the evolutionary relationship between humans and murine species:-**

Phylogenetic trees were drawn using DNAMAN Software to establish the homology of the sequences from different sources. The algorithm and results were in compliance with the previous published works (Xin-Rong Liu et al., 2004) on evolutionary relationships and similarities among proteins. The phylogenetic tree for VEGFR1 depicts that the sequences from mouse and rat display greater similarity than with each of the sequences in comparison with humans (Figure 1). Similar results were obtained in case of phylogenetic tree generated between VEGFR2 (Figure 2) as well as VEGFR 3 (Figure 3) sequences of human, mouse and rat (Hernández-García et al., 2015).

#### **Secondary structure of VEGFR prediction shows the variation on the protein confirmation across species:-**

Secondary Structure prediction for human VEGFR sequences using Hierarchical Neural Network Secondary Structure Prediction Method was on par with the previous studies (Guermeur Y, 1997, Chandrasekaran V et al., 2007) and they proposed this algorithm for secondary structure for proteins. Using HNN for VEGFR 1 sequence, the length of the sequence was found to be 1338. The 50.07% protein is chiefly folded into random coils with 29.07% of alpha helix and 20.85% as extended strand (Data set 1). The length of the VEGFR 2 sequence was 1356. 52.06% protein is chiefly folded into random coils with 24.48% of alpha helix and 23.45% of extended strand (Data set 2). The length of the VEGFR 3 sequence was 1928. 51.00% protein is chiefly folded into random coils with 29.58% as alpha helix (29.58%) and 19.41% extended strand (Data set 3). Thus, secondary structure prediction reveals the structural similarity between the classes of VEGFR sequences. All classes of VEGFRs reveal that large regions of their secondary structure consist of random coils and the remainder is folded into alpha helix (Wu G et al., 2013).

#### **Conclusion:-**

The MSCs VEGFR 1, 2 and 3 show homology and identity upon multiple sequence alignment. The sequences retrieved from *Mus musculus* (Mouse) and *Rattus norvegicus* (Rat) show greater homology in comparison with *Homo sapiens* (Human). The Phylogenetic Tree asserts the similarity and homology among VEGFR sequences from different species. Secondary structure prediction of the VEGFR sequences from *Homo sapiens* (Human) revealed that all the three receptors, i.e., VEGFR1, VEGFR2 and VEGFR3 show about 50% similarities in their secondary structure in random coils while remaining regions exist either as alpha helices or as extended strands.

#### **Reference:-**

1. Amos Bairoch, Rolf Apweiler. The SWISS-PROT protein sequence database and its supplement TrEMBL in 2000. *Nucleic Acids Research*, 2000; 28:1: 45-48.
2. Adel Alhadlaq, Jeremy J. Mao. *Mesenchymal Stem Cells: Isolation and Therapeutics*. *Endocrinology*. 2004; 145(11):4838-4845.
3. Chandrasekaran V, Ambati J, Ambati BK, Taylor EW. Molecular docking and analysis of interactions between vascular endothelial growth factor (VEGF) and SPARC protein. *J Mol Graph Model*. 2007 Nov; 26(4):775-82.
4. Choudhery MS, Badowski M, Muise A, Pierce J, Harris DT. Subcutaneous Adipose Tissue-Derived Stem Cell Utility Is Independent of Anatomical Harvest Site. *Biores Open Access*. 2015 Feb 1; 4(1):131-45.
5. Guermeur Y. *Combinaison de classifieurs statistiques, Application a la prediction de structure secondaire des proteines*. PhD Thesis, 1997.
6. Higgins DG, Thompson JD, Gibson TJ. Using CLUSTAL for multiple sequence alignments. *Methods Enzymol*. 1996; 266:383-402.
7. Hernández-García R, Iruela-Arispe ML, Reyes-Cruz G, Vázquez-Prado J. Endothelial RhoGEFs: A systematic analysis of their expression profiles in VEGF-stimulated and tumor endothelial cells. *Vascul Pharmacol*. 2015 Nov; 74:60-72.

8. Igarashi Y, Chosa N, Sawada S, Kondo H, Yaegashi T, Ishisaki A. VEGF-C and TGF- $\beta$  reciprocally regulate mesenchymal stem cell commitment to differentiation into lymphatic endothelial or osteoblastic phenotypes. *Int J Mol Med*. 2016 Apr;37(4):1005-13.
9. Kasper G, Dankert N, Tuischer J, Hoeft M, Gaber T, Glaeser JD, Zander D, Tschirschmann M, Thompson M, Matziolis G, Duda GN. Mesenchymal stem cells regulate angiogenesis according to their mechanical environment. *Stem Cells*. 2007 Apr;25(4):903-10.
10. Kobolak J, Dinnyes A, Memic A, Khademhosseini A, Mobasheri A. Mesenchymal stem cells: Identification, phenotypic characterization, biological properties and potential for regenerative medicine through biomaterial micro-engineering of their niche. *Methods*. 2016 Apr 15;99:62-8.
11. Louveau I, Perruchot MH, Bonnet M, Gondret F. Invited review: Pre- and postnatal adipose tissue development in farm animals: from stem cells to adipocyte physiology. *Animal*. 2016; 10(11):1839-1847.
12. Matthias Clauss, Herbert Weich, Georg Breier, Ulrike Knies, Wolfgang Röckl, Johannes Waltenberger and Werner Risau. The Vascular Endothelial Growth Factor Receptor Flt-1 Mediates Biological Activities Implications for a functional role of placenta growth factor in monocyte activation and chemotaxis. *J. Biol. Chem* Volume. 1996; 271:30:17629-17634
13. Ramu Chenna, Hideaki Sugawara, Tadashi Koike, Rodrigo Lopez, Toby J. Gibson, Desmond G. Higgins and Julie D. Thompson Multiple sequence alignment with the Clustal series of programs. *Nucleic Acids Research*. 2003; 31:13:3497-3500.
14. Sayers EW, Karsch-Mizrachi I. Using GenBank. *Methods Mol Biol*. 2016;1374:1-22.
15. Totsugawa T, Kobayashi N, Okitsu T, Noguchi H, Watanabe T, Matsumura T, Maruyama M, Fujiwara T, Sakaguchi M, Tanaka N. Lentiviral transfer of the LacZ gene into human endothelial cells and human bone marrow mesenchymal stem cells. *Cell Transplant*. 2002;11(5):481-8.
16. Wu G, Han K, Lv F. Use of fast conformational sampling to improve the characterization of VEGF A-peptide interactions. *J Theor Biol*. 2013 Jan 21;317:293-300.
17. Xin-Rong Liu, Rou-Li Zhou, Qing-Yun Zhang, Ye Zhang, Yue-Ying Jin, Ming Lin, Jing-An Rui, Da-Xiong Ye. Structure analysis and expressions of a novel tetra transmembrane protein, lysosome-associated protein transmembrane 4 B associated with hepatocellular carcinoma. *World J Gastroenterol* 2004;10(11):1555-1559



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### RESEARCH ARTICLE

## EFFECT OF INTEGRATED WEED MANAGEMENT PRACTICES ON WEED DYNAMICS, YIELD AND ECONOMICS OF *RABI* GROUNDNUT (*ARACHIS HYPOGAEA*) IN SANDY LOAM SOILS OF ANDHRA PRADESH.

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### Abstract

A field experiment was conducted during *Rabi* season of 2002-03 on sandy loam soils at Bapatla, Andhra Pradesh to study the effects of pre and post-emergence herbicides, alone or integrated with manual/mechanical weeding on weed pressure, productivity and economic returns of *Rabi* groundnut (*Arachis hypogaea*). Pendimethalin @ 0.75kg/ha as pre-emergence (PE) + imazethapyr @ 75 g/ha as post-emergence (PoE) herbicides at 21 days after sowing (DAS) + Intercultivation with wheel hoeing followed by hand weeding resulted in significantly higher growth attributes, yield attributes, yield and net returns over the unweeded control and was found at par with T1: Hand-weeding at 20 and 40 DAS, T7: Pendimethalin @ 0.75kg a.i./ha (PE) + Intercultivation with wheel-hoeing followed by hand weeding and T5: Pendimethalin @ 0.75kg a.i./ha (PE) + imazethapyr @ 50 g a.i./ha (PoE).

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Groundnut is an important oil seed crop of India which is cultivated in India during *Rabi* nearly 6.41 million ha. Area with the production of 9.18 million tonnes and average productivity of 1.43 tonnes/ha (Srinivasarao et al., 2011). In Andhra Pradesh, Groundnut (*Arachis hypogaea*) is an important oil seed crop which occupies an area of 2.64 M.ha., production of 5.07 MT and productivity of 1.921 kg/ha respectively (Department of Agriculture, Andhra Pradesh, 2008-2009). Weed infestation is considered as one of the major factors in groundnut production. Weed interference resulted in yield loss ranging from 74 to 92% (Agostinho et al., 2006). Critical period of crop-weed competition for groundnut crop was reported to be up to 45 DAS and weed free environment during this period registered higher pod yield (Rao, 2000). Hand weeding and hoeing are common cultural and manual weed management methods for groundnut, but with scarcity of labours these methods are very costly and tedious. Use of pre and post emergence herbicides is the best alternative for weed control at critical periods. Combination of physical and chemical methods by use of post-emergence herbicides is the best alternative for weed control at critical periods. Combination of physical and chemical methods by use of post-emergence herbicides like imazethapyr or quizalofop-p-ethyl (Bhatt et al., 2008) were suggested for controlling weeds effectively at later stages of crop growth and maintenance of weed free environment at critical stages of crop growth (Sailaja et al., 2002). Therefore field experiment was initiated to find out an effective and economical integrated weed management practice in *Rabi* groundnut.

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## Materials and Methods:-

Field experiment was conducted during *Rabi* season 2002-03 at Agricultural College Farm, Bapatla, India to find out the response of integrated weed management practices on growth and yield of groundnut. The soil of the experimental site was sandy loam in texture with soil pH was neutral in reaction (7.0) and an electrical conductivity of  $0.14 \text{ dSm}^{-1}$ . The soil organic carbon content was low (0.50%). The soil was low in available nitrogen (185 kg/ha) and phosphorus (18 kg/ha) but rich in available potassium (320 kg/ha). The experimental site was located at an 5.0 m above mean sea level,  $15^{\circ} 41' \text{N}$  latitude,  $80^{\circ} 30' \text{E}$  longitude and the experiment was laid out in randomized block design with three replications. Groundnut variety "TMV-2" was sown at spacing of  $30 \times 10 \text{ cm}$ . A basal dose of 20 kg N, 40 kg  $\text{P}_2\text{O}_5$  and 50 kg  $\text{K}_2\text{O}$ /ha was applied through urea, single super phosphate and muriate of potash respectively. Herbicides were applied through using manually operated knapsack sprayer fitted with flat fan nozzle using spray volume of 500 L/ha.

The details of the treatments  $T_1$ : Handweeding at 20 and 40 DAS;  $T_2$ : Wheel-hoeing at 20 and 40 DAS;  $T_3$ : Pendimethalin @ 1.0 kg a.i./ha as pre-emergence (PE);  $T_4$ : Imazethapyr @ 62.5 g a.i./ha post-emergence (PoE) at 21 days after sowing;  $T_5$ : Pendimethalin @ 0.75 kg/ha (PE) + imazethapyr @ 50 g a.i./ha (PoE);  $T_6$ : Pendimethalin @ 0.75 kg a.i./ha (PE) + imazethapyr @ 50 g a.i./ha (PoE) + Intercultivation with wheel-hoeing followed by handweeding;  $T_7$ : Pendimethalin @ 0.75 kg/ha (PE) + Intercultivation with wheel-hoeing followed by handweeding;  $T_8$ : Unweeded check;  $T_9$ : Weed free check (weekly hand weeding). Pre emergence herbicide pendimethalin was applied on first day after sowing where as post-emergence herbicide was applied at 21 days after sowing. Weed free check was achieved by weekly interval of hand weeding was done throughout the crop period. Regarding five plants were selected from each plot and regular biometric observations of crop and weed parameters were recorded from 30 days after sowing upto harvest. However, observation data recorded at 30 DAS and at harvest is given in tables for study the results and discussion. Weed density ( $\text{no}/\text{m}^2$ ) was recorded by putting a quadrat of  $0.25 \text{ m}^2$  at two random spots in each plot. Weed control efficiency and weed index was calculated by standard formulae. Plant Height and plant dry matter at 30 DAS and 60 DAS were recorded for randomly selected five plants. Data on Pod yield (kg/ha) and yield components viz., number of pods/plant. Grass returns were calculated based on local market prices of groundnut and net returns by subtracting the total cost of cultivation from gross returns. Benefit:cost ratio was computed by dividing gross returns with cost of cultivation.

## Results and Discussion:-

### Effect on Weeds:-

Predominant weeds identified in the experimental groundnut fields were *Cynodon dactylon*, *Echinochloa colonum*, *Digitaria sanguinalis*, *Dactyloctenium aegyptium*, *Panicum repens*, *Cyperus rotundus*, *Trianthema portulacastrum*, *Commelinabenghalensis*, *Tridax procumbens*, *Trichodesma indicum*, *Parthenium hysterophorus*, *Acanthospermum hispidum*, *Eclipta alba*, *Phyllanthus niruri*, *Amaranthus viridis*, *Cleome viscosa*, *Celotia argentea* and *Acalypha indica*. All the treatments were found to reduce significantly population densities of grasses, sedges and dicot weeds at 30 days after sowing and harvesting as compared to unweeded control. After weed free control, treatment of pendimethalin 30% EC @ 0.75 kg/ha as (PE) + imazethapyr 50% EC @ 50 g/ha as PoE + Intercultivation with wheel hoeing followed by hand weeding was found to have significantly lowest weed densities of grasses, sedges and broad leaved weeds as compared to unweeded control and at par with Pendimethalin 30% EC @ 1.0 kg/ha (PE) + Intercultivation with wheel hoeing followed by handweeding, pendimethalin 30% EC @ 0.75 kg/ha PE + imazethapyr 50% EC @ 50 g/ha PoE at 21 DAS and Handweeding at 20 and 40 DAS at 30 DAS and harvest for Grasses, Sedges and Broad leaved weeds. Table – 1. Our results support the findings of Kalhapure et al. (2013), who reported that pendimethalin 1.5 kg/ha PE + Imazethapyr 0.15 kg/ha as PoE + 1 handweeding at 40 DAS was at par with weed free control in controlling the weed density in groundnut. Thus, pre-emergence application of pendimethalin prevents emergence of monocot and grassy weeds by inhibiting root and shoot growth while imazethapyr was responsible for inhibition of Aceto Lactate Synthase (ALS) or aceto hydroxyl acid synthase (AHAS) in broadleaved weeds which caused destruction of these weeds at 3-4 leaf stage. Remaining monocot weeds were controlled by intercultivation with wheel-hoeing followed by handweeding. Pendimethalin 30% EC @ 0.75 kg/ha PE + Imazethapyr 50% EC @ 50 g/ha PoE at 21 DAS + Intercultivation with wheel-hoeing followed by handweeding recorded highest WCE (Weed Control Efficiency) followed by Handweeding at 20 and 40 DAS, Pendimethalin 30% EC @ 1.0 kg/ha (PE) + Intercultivation with wheel hoeing followed by handweeding and Pendimethalin 30% EC @ 0.75 kg/ha (PE) + Imazethapyr 50% EC @ 50 g a.i./ha (PoE) at 30 DAS and at harvest. However, Pendimethalin 30% EC @ 0.75 kg/ha PE + imazethapyr 50% EC @ 50 g a.i./ha PoE at 21 DAS + Intercultivation with wheel-hoeing followed by handweeding followed by handweeding at 20 and 40

DAS, Pendimethalin 30% EC @ 1.0 kg/ha (PE) + Intercultivation with wheel hoeing followed by handweeding and pendimethalin 30% EC 0.75 kg/ha PE + Imazethapyr 50% EC 50 g a.i./ha PoE resulted in the lowest Weed Index. Kalhapure et al. (2013), reported higher WCE and lower Weed Index with Pendimethalin 1.5 kg/ha PE + Imazethapyr 0.15 kg/ha as PoE + handweeding at 40 DAS.

**Table 1:-** Effect of different weed-management practices on weed count at 30 DAS and at harvest, Total weed density, weed control efficiency at 30 DAS and at harvest and weed index.

Treatments	Grassy weeds / m <sup>2</sup>		Sedge weeds / m <sup>2</sup>		Dicot weeds / m <sup>2</sup>		Weed Control Efficiency (%)		Weed Index (%)
	30 DAS	At harvest	30 DAS	At harvest	30 DAS	At harvest	30 DAS	At harvest	
T <sub>1</sub> -Hand Weeding at 20 and 40 DAS	7.42	7.87	2.47	3.73	6.38	7.52	6.33	70.3	7.9
	(55.98)	(62.32)	(5.60)	(13.41)	(40.20)	(56.05)			
T <sub>2</sub> - Wheel – Hoeing at 20 and 40 DAS	9.15	9.46	3.37	5.12	7.99	9.01	43.2	56.0	29.4
	(83.22)	(89.00)	(10.85)	(25.72)	(63.34)	(80.68)			
T <sub>3</sub> - Pendimethalin 30%EC @ 1.0kg/ha PE	7.98	8.96	2.82	4.89	6.89	8.86	57.5	59.4	22.5
	(63.19)	(79.07)	(7.48)	(23.45)	(46.97)	(78.00)			
T <sub>4</sub> - Imazethapyr 50%EC @ 62.5g a.i./ha PoE at 21 DAS	8.21	9.24	2.86	4.98	7.15	8.95	54.8	57.5	24.8
	(66.91)	(84.88)	(7.67)	(24.30)	(50.62)	(79.60)			
T <sub>5</sub> -Pendimethalin 30%EC @ 0.75 kg/ha PE + Imazethapyr 50%EC 50g a.i./ha PoE	7.11	8.12	1.96	4.02	5.89	7.90	68.3	67.5	13.5
	(50.20)	(65.44)	(3.37)	(15.66)	(34.19)	(63.50)			
T <sub>6</sub> -Pendimethalin 30%EC @ 0.75kg/ha PE + Imazethapyr 50 g a.i./ha PoE + Intercultivation with wheel-hoeing followed by handweeding	6.63	7.14	1.77	3.42	5.60	7.48	72.2	73.9	5.7
	(43.46)	(50.49)	(2.63)	(11.20)	(30.86)	(54.26)			
T <sub>7</sub> -Pendimethalin 30%EC @ 0.75 kg/ha PE + IC with wheel hoeing followed by handweeding	6.89	7.99	1.89	3.92	5.72	7.73	70.3	69.1	11.1
	(46.98)	(63.35)	(3.20)	(14.87)	(32.22)	(59.26)			
T <sub>8</sub> - Unweeded control	11.64	16.99	6.59	7.10	9.93	10.33	0.0	0.0	52.1
	(135.0)	(288.17)	(43.06)	(49.91)	(98.10)	(106.21)			
T <sub>9</sub> – Weed Free	0.71	0.71	0.71	0.71	0.71	0.71	100.0	100.0	0.0
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)			
SEm ±	0.29	0.33	0.26	0.27	0.12	0.33			
CD (P=0.05)	0.85	0.83	0.85	0.83	0.40	0.94			

PE,Pre-emergence;PoE,post-emergence;HW,hand-weeding;IC,interculturing,DAS,days after sowing;WH-wheel-hoeing;EC,emulsifiable concentration

√ X+0.5 transformation, Figure in parentheses are original values

**Table 1:-** Effect of different weed-management practices on growth attributes,yield attributes,yield and economics of groundnut

Treatments	Plant height (cm)		Plant dry matter Accumulation(g)		Total number of pods/plant	Pod Yield (kg/ha)	Net Returns (×10 <sup>3</sup> Rs/ha)	B:C Ratio
	30 DAS	60 DAS	30DAS	60DAS				
T <sub>1</sub> -Hand Weeding at 20 and 40 DAS	11.8	38.3	76.5	394.9	21.8	2280	23.43	2.62
							(23430)	
T <sub>2</sub> - Wheel – Hoeing at 20 and 40 DAS	11.0	32.6	68.5	310.0	16.7	1751	16.46	1.95
							(16459)	
T <sub>3</sub> - Pendimethalin 30%EC @ 1.0kg/ha PE	11.3	34.8	69.9	338.4	18.5	1922	18.96	2.27
							(18959)	
T <sub>4</sub> - Imazethapyr50%EC@62.5ga.i./haPoE at 21DAS	11.2	34.7	69.0	322.8	17.9	1864	18.61	2.36
							(18611)	
T <sub>5</sub> -Pendimethalin30%EC @ 0.75 kg/ha PE + Imazethapyr 50%EC 50ga.i./ha PoE	12.9	38.0	78.8	378.3	20.5	2145	21.61	2.44
							(21614)	
T <sub>6</sub> .Pendimethalin 30%EC @ 0.75kg/ha PE + Imazethapyr 50 g a.i./ha PoE+Intercultivation with wheel-hoeing fallowed by handweeding	13.0	40.1	84.5	408.3	22.3	2338	24.22	2.72
							(24217)	
T <sub>7</sub> -Pendimethalin 30%EC@ 0.75 kg/ha PE + IC with wheel hoeing fallowed by handweeding	12.1	38.1	79.9	386.2	21.2	2205	22.59	2.60
							(22585)	
T <sub>8</sub> .Unweeded control	8.3	29.0	41.1	230.6	14.0	1189	9.86	1.38
							(9857)	
T <sub>9</sub> – Weed Free	14.4	42.0	88.3	438.7	23.8	2480	20.67	1.44
							(20674)	
SEm ±	0.5	1.1	2.7	10.8	0.43	66.53		
CD (P=0.05)	1.5	3.2	8.1	32.3	1.29	199		

PE,Pre-emergence;PoE,post-emergence;HW,hand-weeding;IC,interculturing,DAS,days after sowing;WH-wheel-hoeing;EC,emulsifiable concentration √ X+0.5 transformation, Figure in parentheses are original values

#### Effect on Crop:-

Weed free recorded significantly taller plants and plant drymatter production,at 30 DAS and 60 DAS fallowed by pendimethalin 30%EC 0.75 kg/ha PE + Imazethapyr 50% EC 50 g a.i./ ha PoE + Intercultivation with wheel hoeing fallowed by handweeding which were on a par with each other but were significantly superior over all other treatments.Among Integrated Weed Management practices the maximum plant height and drymatter production at 30 DAS and 60 DAS were recorded with T<sub>6</sub> fallowed by T<sub>7</sub> and T<sub>5</sub> which were on a par with one another and found significantly superior over herbicides alone and wheel hoeing.This might be due to the minimizing the competition of weeds with main crop for resources viz.,space,light,nutrients and moisture with adoption of effective weed control methods.Singh and Giri(2001) has also concluded that proper weed control was responsible for increase in

plant height and dry matter production in groundnut. Significantly lower values of plant height and dry matter production were recorded in treatment unweeded check

#### **Yield attributes and Yield:-**

Yield attributes and yield was significantly affected by weed control measures (Table-2). Among the weed control measures, weed-free check recorded significantly highest number of pods/plant and pod yield followed by Pendimethalin 30% EC @ 0.75 kg/ha (PE) + Imazethapyr @ 50% EC @ 50 g a.i./ha + Intercultivation with wheel-hoeing followed by handweeding. These two treatments were significantly superior over rest of the treatments and were statistically on a par with each other. Among the integrated weed management practices Pendimethalin 30% EC @ 0.75 kg/ha (PE) + imazethapyr 50% EC @ 75 g /ha (PoE) + Intercultivation with wheel hoeing followed by handweeding recorded higher number of pods/plant and pod yield followed by Pendimethalin 30% EC 1.0 kg/ha (PE) + Intercultivation with wheel hoeing followed by handweeding and Handweeding at 20 and 40 DAS which were significantly superior over herbicide alone and wheel hoeing. Those results are in conformity with the findings of Sharma et al. (2015), also reported that Pendimethalin 30 % EC @ 0.9 kg/ha as PE + imazethapyr @ 75 g /ha as PoE at 20 DAS and Pendimethalin 30 % EC @ 0.9 kg/ha as PE + Handweeding and IC at 40 DAS resulted in 94.3 and 92.69 % higher pod yield respectively.

Pendimethalin 30 % EC @ 0.75 kg/ha as PE + Imazethapyr 50% EC @ 50 g/ha as (PoE) + IC with wheel hoeing followed by handweeding was most effective not only to control weeds but also in obtaining higher pod yields in groundnut. Thus, weed free environment created with the help of application of pre-emergence and post-emergence herbicides at early and later stages of crop growth facilitates better growth and development of plants, flowering, peg initiation and entry in to the soil + handweeding allows pulverization and more pod formation ultimately increasing pod yield/ha compared to weed control through manual weeding alone.

#### **Economics:-**

Pendimethalin 30 % EC @ 0.75 kg/ha as PE + Imazethapyr 50 % EC @ 50 g/ha (PoE) + Intercultivation with wheel hoeing followed by hand weeding recorded significantly highest net returns Rs. 24,217/- and Benefit:Cost ratio 2.72 followed by hand weeding at 20 and 40 DAS, Pendimethalin 30% EC @ 1.0 kg/ha + Intercultivation with wheel hoeing followed by hand weeding and Pendimethalin 30 % EC @ 0.75 kg/ha (PE) + Imazethapyr 50 % EC 50 g a.i./ha (PoE). where as weed free check recorded lower net returns (Rs. 20,674/-) and low B:C ratio 1.44 this might be due to the cost of cultivation of groundnut was increased in treatment weed free check due to higher need of human labours and their wages. The cost was reduced in treatment (T<sub>6</sub>), using herbicides to effective control of weeds with minimizing human labours Kalhapure (2013) also reported that highest net returns and Benefit :Cost ratio with Pendimethalin @ 1.5 kg/ha as PE + imazethapyr @ 0.15 kg/ha as PoE + Hand weeding at 40 DAS . Weedy check recorded lowest net returns (Rs. 9857) and B:C ratio (1.38).

Thus, Treatment Pendimethalin 30 % EC 0.75 kg/ha (PE) + Imazethapyr 50% EC @ 50 g a.i./ha was proved practically more convenient and economically best feasible integrated weed management practice for groundnut considering the present condition of scarcity and high cost of labours, quality of weed control, yield and B:C ratio of cultivation of Groundnut.



**References:-**

1. Annual Reports of Department of Agriculture, Andhra Pradesh, 2008-2009.
2. Agostinho, F.H., Gravena, R., Alves, P.L.C.A., Salgado, T.P and Mattos, E.D. 2006. The Effect of Cultivar on Critical Periods of Weed control in Peanut Science 33(1):29-35.
3. Bhatt, R.K., Patel, B.J., Bhatt, V.K and Patel, P.P. 2008. Weed Management through Soil Solarization in *Kharif* Groundnut (*Arachis hypogaea*). Crop Research 36(1,2&3):115-119.
4. Kalhapure, A.H., Shete, B.T. and Bodake, P.S. 2013. Integration of Chemical and Cultural Methods for Weed Management in Groundnut. Indian Journal of Weed Science 45(2):116-119.
5. Rao, V.S. 2000. Principles of Weed Science, Second Edition, Oxford and IBH Publish Co. Pvt. Ltd., New Delhi
6. Sailaja, K., Buchu Reddy, B. and Davender Reddy, M. 2002. Effect of Seed Bed Preparation and Weed control Practices on Growth and Yield of Groundnut after *Kharif* Rice. Indian Journal of Dryland Agricultural Research and Development 17(2):152-157.
7. Sharma Satyakumari, Ram, A. JAT. and Sagarka, B.K. 2015. Effect of Weed Management Practices on Weed Dynamics, Yield and Economics of Groundnut in black calcareous Soil. Indian Journal of Agronomy 60(2):312-317.
8. Singh, V.B. and Giri, G. (2001). Influence of Intercropping and Weed Control Measures on Dry matter Accumulation and Nutrient Uptake by Sunflower and Groundnut and their effect on succeeding Maize. Indian Journal of Agronomy, 46(1):50-55.
9. Srinivasarao, S. Madhavi, M. and Reddy, C.R. 2011. Integrated Approach for Weed Control in *Rabi* Groundnut (*Arachis hypogaea*)



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### RESEARCH ARTICLE

## HISTOPATHOLOGICAL ANALYSIS OF BREAST LUMP IN A TERTIARY CARE HOSPITAL.

Mujahid Ahmad Mir and Farzana Manzoor.

### Manuscript Info

#### Manuscript History

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#### Key words:-

breast lump, carcinoma, fibroadenoma, benign.

### Abstract

**Introduction:** Though mostly benign in nature, breast lump can be malignant. Since breast carcinoma is the second most common killer of the female cancer, it is important to detect it at early stage. Our study aimed to analyse histopathology profile of breast lump.

**Methods:** Histopathology samples were received, processed, reported and recorded in the Pathology laboratory at the Department of Pathology, Govt. Medical College Srinagar. Data was analysed for the period of 1 year. Descriptive statistics was used to analyse the data.

**Results:** Out of 175 breast pathology specimens, seven of our patients were male, 142 (81.14%) were reported as benign and 33(18.86%) as malignant tumors. Mean age of carcinoma patients was 44.9 years. (41.38%) of the malignant neoplasm were of Stage IIIB.

**Conclusion:** Every fifth sample had carcinoma and it is mostly seen after 40 years of age.

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### Introduction:-

Women presenting with breast lump is common in surgical practice. Breast lump is a cause of significant disquiet in view of widespread and unrestricted wakefulness in general public<sup>1</sup>. The lesions of the breast have varied etiology and may be inflammatory, benign or malignant. It therefore becomes necessary for a treating physician to distinguish benign from malignant conditions and their prevalence.

The diagnostic methods should be rapid, cheap, accurate and least invasive to evaluate and discriminate between benign and malignant etiology of breast lump in outpatient clinics. Such methods benefit both patients and surgeons by promoting proper preoperative diagnosis and management and by limiting the unnecessary investigative workup<sup>2,3</sup>. FNAC is a simple, reliable, economical, atraumatic, easily repeatable and complication free technique for the evaluation of mass lesions. Histopathological study of biopsy specimen is one of the easiest and cheapest forms of diagnostic method which is affordable, available to give tissue diagnosis. Tissue diagnosis is considered as the minimum requirement to start specific treatment in breast lump<sup>4</sup>.

Both incidence and mortality from breast cancer is on rise especially in developing countries. This study aimed to find out the histopathological characteristics of breast lump at a tertiary care hospital in Kashmir valley.

### Methods:-

This is a cross sectional study of breast biopsy specimen received from 1st June 2015 to 30<sup>th</sup> May 2016 at the Department of Pathology, Govt. Medical College Srinagar, catering a population of 6.8 million. The breast specimens received from the surgical specialty departments within and associated with the college formed the data

for our study. After being labelled, entered in the data system of the laboratory, the specimens were kept for fixation in 10% Formalin overnight. After grossing, tissue processing, and making blocks, thin tissue slices of 0.4 micron thickness were obtained and prepared on a slide. Slides were examined after staining with hematoxylin and eosin. The findings were recorded in the database.

### Results:-

175 breast pathology specimens were received in our department during the study period. Seven of our patients were male, 142 (81.14%) were reported as benign and 33 (18.86%) as malignant tumors with a benign to malignant ratio of 4.3:1. The age of patients at presentation ranged from 14 to 72 years with a median age of 27 years. The age wise distribution of breast lump lesions is depicted in table 1.

**Table 1:-** Age group wise distribution of breast lump pathology

Age group	Benign	Malignant	Total
≤20	44	0	44
21-30	46	1	47
31-40	38	10	48
41-50	11	11	22
51-60	2	7	9
61-70	1	2	3
>70	0	2	2

The major diagnoses were fibroadenoma (in 48% of cases) at a mean age of 24 years, invasive carcinoma (18.86%) at a mean age of 47 years, fibrocystic disease (9.14%) at a mean age of 32 years and breast inflammation (9.14%) at a mean age of 32 years. The histopathological results of breast lumps are presented in Table 2.

**Table 2:-** Histopathological distribution of breast lump

S. No	Diagnosis	Frequency	Percentage(%)
1	Fibroadenoma	84	48
2	carcinoma	33	18.86
3	Fibrocystic disease	16	9.14
4	Inflammatory disease	16	9.14
5	Epithelial hyperplasia	6	3.43
6	Gynecomastia	6	3.43
7	Benign phyllodes	4	2.29
8	Fibroadenosis	3	1.71
9	Lactational adenoma	2	1.14
10	Sclerosing adenosis	1	0.57
11	Tubular adenoma	1	0.57
12	Pseudoangiomatous stromal hyperplasia (PASH)	1	0.57
13	Hamartoma	1	0.57
14	Neurofibroma	1	0.57
	Total	175	100

Of the malignant cases, 25/33 (75.76%) were the infiltrative ductal carcinoma. Not otherwise specified. The remainder were lobular carcinoma (2 cases, 6.06%), medullary carcinoma (2 cases, 6.06%), invasive ductal carcinoma with Paget's disease (1 case), inflammatory carcinoma (1 case), tubular carcinoma (1 case) and malignant phyllodes tumor (1 case). Out of 33 malignancies, 29 were Modified Radical Mastectomy (MRM) specimen. Size of tumor ranged from 2.2cmx1.3cm to 12.5cmx9 cm. Lymph nodes were identified in all MRM specimens and were positive for tumor cells in 21 cases. Maximum numbers of lymph nodes seen in the MRM specimen were 18. Out of 29 MRM specimens 3 cases were in stage IIA, 5 cases were in stage IIB, 9 cases were in Stage IIIA and 12 were of stage IIIA.

### Discussion:-

In our study majority of the specimens 142/175 (81.14 %) were reported to be benign similar to the study done by Phillip L. Chalya et al.<sup>5</sup> (80.4%). Fibroadenoma (48%) was the most common benign breast lesion comparable to the study by Naveen et al.<sup>6</sup> (52%), Greenberg et al.<sup>7</sup> (50%) and Malik et al.<sup>8</sup> (49%). The reasons for the high

frequency of fibroadenoma among females in this study are not clear. Demographic factors might play a role, considering the large number of young females within the population of these groups. Maximum number of cases of fibroadenoma was seen in third and fourth decade of life, similar to other studies<sup>9,10,11</sup>

The fibrocystic disease was seen in 9.14% cases in our study which is at par with studies by Jamal A et al<sup>12,13</sup> (13.1% and 12%). Hormonal imbalance with prolonged exposure to estrogen is hypothesized to be the main cause of these disorders<sup>14</sup>. Majority of the patients belonged to the 3rd and 4th decades. Most of the cases of fibrocystic disease diagnosed in our study (around 76.58%) were Simple and this is less dangerous than proliferative fibrocystic disease (23.41%), which is associated with an increased risk of breast cancer<sup>14,15</sup>

Inflammation of the breast was found in 9.14% of biopsies. The pattern of inflammatory breast disease in our study is relatively close to that observed in Saudi Arabia and Jordan<sup>16,17</sup>. Social factors and personal behaviors could be the possible cause of this condition where repeated pregnancies and lactations with accompanying change of breast physiology predispose women to breast infections.

Breast cancer is the most common neoplasia in women. A principal finding of our study was malignancy rate of 18.87%, which were consistent with past studies<sup>12,18</sup>. Mean age of its presentation was in 44.9 years which is at par with study conducted by A.K. Al-Thobhani et al<sup>19</sup>. In our study invasive ductal carcinoma became the most common variety of breast cancer as indicated in published data<sup>20,21</sup>. Invasive ductal carcinoma is the most common histological type with a poor prognosis rate of 30-35% 10 year survival rate. In our study the tumor size ranged from 2 to 6 cm. Five year survival in breast cancer less than 1 cm is 93% while as it is 63 % for larger than five cm in size<sup>22</sup>. Lymph nodes were identified in all cases of MRM specimens however it was positive for tumor cells in only 21 cases. There is 6 % additional risk of cancer death by each positive lymph node<sup>23</sup>. 41.38% of the MRM specimens were of stage IIIB. Due to lack of proper screening majority of women with breast cancer in developing countries are diagnosed in clinical stages III and IV.

Factors such as genetics, racial, social, cultural, hormonal and dietary habits which contribute to etiopathogenesis were not studied in this study. Breast cancer and breast diseases screening programs should be developed at the hospitals. These programs should ideally include clear objectives, plans and managements. Programs should be free of cost to encourage large number of women to enroll in such screening programs.

### Conclusions:-

81.14% breast lumps were benign in our study. All but two malignant lesions were invasive ductal carcinoma, seen at a mean age of 44.9 years and advanced stage with nearly 41.38% of mastectomy specimens in stage IIIA.

### References:-

1. Breast lumps in adolescent girls. [1] Br Med J. 1978;1(6108):260-61.
2. Thomas M.J, Fitz harris B.M, Redding H.W, et al. "clinical examination, xeromammography and fine needle aspiration cytology in diagnosis of breast tumors". BMJ 1978; 2:1139-41.
3. Yell and A, graham D.M, trott A.P, et al. "Diagnosing breast carcinoma in young women". BMJ 1991;302:618-20.
4. Reetu Baral: Histopathological analysis of breast lump in an urban community hospital laboratory: Journal of Patan Academy of Health Sciences. 2014 Dec;1(2):28-30
5. Phillip L. Chalya<sup>1\*</sup>, Mange Manyama et al: Clinicopathological pattern of benign breast diseases among female patients at a tertiary health institution in Tanzania : Tanzania Journal of Health Research Volume 18, Number 1, January 2016
6. Naveen N, Mukherjee A, Mahajan V; Clinical study of benign breast disease in rural population. JEMDS, 2013; 2(30): 5499-5511.
7. Greenberg R, Skornick Y, Kaplan O; Management of breast fibroadenomas. J Gen Intern Med., 1998; 13(9): 640-645.
8. Malik MAN, Salahudin O, Azar M, Irshad H, Sadia, Salahudin A; Breast diseases: spectrum in Wah Cantt, POF Hospital Experience. Professional Med J., 2010; 17(3): 366-372.
9. Khan S, Kapoor AK, Khan IU, Shrestha GB, Singh P. Prospective study of pattern of breast disease at Nepalgunj Medical College, Nepal. KUMJ. 2003;1(2):95- 100.

10. Giri R, Bhandari R, Mahato I, Poudel M, Kumari S, Yadav AK. Descriptive study of breast problems in women who present to the general outpatient of a tertiary hospital in eastern region of Nepal. *Health Renaissance*. 2013;11(1):33-7.
11. Kumar R. A clinicopathologic study of breast lumps in Bhairahwa, Nepal. *Asian Pacific J Cancer Prev*. 2010;11:855-8.
12. Jamal A et al. Profile of breast pathology at Asir central hospital: review of 312 breast biopsies. *Saudi medical journal*, 1997, 18:363–6.
13. Jamal AA. Pattern of breast diseases in a teaching hospital in Jeddah, Saudi Arabia. *Saudi medical journal*, 2001, 22(2):110–3.
14. Morgan JW, Gladson JE, Rau KS. Position paper of the American Council on Science and Health on risk factors for breast cancer: established, speculated, and unsupported. *The breast journal*, 1998, 4:177–97. }
15. Crum CP. The breast. In: Cotran RS, Kumar V, Robbins LR, eds. *Robbins pathologic basis of diseases*, 5th ed. Philadelphia, WB Saunders, 1994:1089–111.
16. Amr SS et al. The spectrum of breast diseases in Saudi Arab females: a 26 years pathological survey at Dhahran health center. *Annals of Saudi medicine*, 1995, 15:125–32.
17. Amr SS. Breast diseases in Jordanian females: a study of 1000 cases. *European journal of surgical oncology*, 1985, 11:257–67.
18. Jamal A et al. The spectrum of breast diseases in Saudi Arab females: a 26 years pathological survey at Dhahran health center. *Annals of Saudi medicine*, 1995, 15:125–32. }
19. A.K. Al-Thobhani,<sup>1</sup> Y.A. Raja'a,<sup>2</sup> T.A. Noman<sup>3</sup> and M.A. Al-Romaimah: Profile of breast lesions among women with positive biopsy findings in Yemen: *Eastern Mediterranean Health Journal*, Vol. 12, No. 5, 2006
20. Siddiqui M, Kayani N, Gill M, Pervez S, Muzaffar S, Aziz S, Setna Z, Israr M, Hasan S: Breast diseases: a histopathological analysis of 3279 cases at a tertiary care center in Pakistan. *J Pak Med Assoc* 2003, 53(3):94–97.
21. Hussain N, Bushra A, Nadia N, ZULFIQUAR A: Pattern of female breast diseases in karachi. *Biomedica* 2005, 21(2):36–38.
22. Elkin EB, Hudis C, Begg CB, Schrag D. The effect of changes in tumor size on breast carcinoma survival in the U.S.: 1975–1999. *Cancer*. 2005;104(6):1149-57.
23. Michaelson JS, Silverstein M, Sgroi D, Cheongsiamtoy JA, Taghian A, Powell S, et al. The effect of tumor size and lymph node status on breast carcinoma lethality. *Cancer*. 2003 Nov 15;98(10):2133-43. )



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### RESEARCH ARTICLE

#### LEVEL OF EDUCATION AMONG DIABETIC PATIENT REGARDING DIABETIC FOOT IN MAKKAHPOPULATION

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Diabetic foot, Knowledge, foot care, complications

#### Abstract

**Background:** As many of diabetic complications, diabetic foot are avoidable however proper education is essential as it leads the patient to be aware of the problem and its prevention which can save the patient's feet from amputations.

**Objectives:** To assess knowledge of diabetic patients regarding foot care and its determinants.

**Subjects and methods:** A retrospective study has been carried out to compare diabetic patients without foot problems to those who had them. It included all diabetic patients from four major hospitals in Makkahwith and without Diabetic foot from Makkah city. A study-specific questionnaire was designed included general information, level of education, and added questions at the end to measure the knowledge.

**Results:** The study included 392 patients. Their age ranged between 13 and 90 years (53.6±13.3 years). Almost two-thirds of the patients were males (62%). Majority were Saudis (86.1%). Type II diabetes was reported by 52.1% of the patients. Regular compliance with diabetic clinic/center was mentioned by 65% of them. Adherence to anti-diabetics was reported by majorities (87%). History of feet wound lasted 3-4 weeks was reported among 42.9% of diabetic patients. Where is a history of amputation was reported among 20.9% of them. The mean knowledge score was 5.6 out of 10 (56%). Good knowledge regarding foot care was higher among younger patients (≤30 years) compared to older patients (>50 years (68% versus 41.4%, p<0.001). Majority of postgraduate patients (87%) compared to 34.7% of illiterate patients had good knowledge regarding foot care knowledge, p<0.001. The highest level of good knowledge regarding foot care was reported among patients with onset of diabetes between 11 and 20 years (70%) whereas the lowest level was reported among those with onset after 20 years (46.2%), p=0.011. Good foot care knowledge was more reported among type 1 than type 2 patients (73.3% versus 51.7%, p<0.001). Regular compliance with diabetic

Clinic/center was accompanied with higher knowledge level,  $p < 0.001$ . Also, adherence to anti-diabetics was accompanied with higher knowledge level,  $p = 0.011$ .

**Conclusion:** Knowledge of diabetic foot care in Makkah is moderate (56%), younger, more educated, type 1 diabetic patients and those who attended diabetic clinics regularly and being more compliant with anti-diabetics were more knowledgeable. Health education programs are recommended particularly to older and less educated patients. In addition, patients should be encouraged to attend diabetic clinics regularly.

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## Introduction:-

Diabetes mellitus is one of the most common health problems affecting all age groups worldwide and was estimated to be 2.8% in 2000 and 4.4% in 2030.<sup>1</sup> The prevalence of diabetes in the Medicare population may be one-third higher than previously estimated.<sup>2</sup> Overall, approximately 8% of diabetic Medicare beneficiaries have a foot ulcer and 1.8% has an amputation. These prevalence rates are further elevated for the subset of beneficiaries with lower extremity peripheral artery disease.<sup>2</sup>

The prevalence rates for foot ulcer and lower extremity amputation among diabetic Medicare beneficiaries vary dramatically by geographic region. More than 16 million people in the United States (U.S.) have diabetes mellitus. The prevalence of diabetes among those over 65 years of age was last estimated by the Centers for Disease Control and Prevention (CDC) using 2008 data from the National Health Interview Survey. It is about 19.9 percent among those ages 65 to 74 and 17.1 percent among those more than 75 years of age. These estimates are based on self-reports and are thought to underestimate the true prevalence by one-third.<sup>2</sup>

The prevalence of diabetes in Saudi Arabia was 34.1% in males and 27.6% in females (mean age is 55 years), such high prevalence make diabetes an endemic and stands as a major health issue in our healthcare systems and society.<sup>3</sup>

One of diabetes common and serious complications is diabetic foot problem, which is a major cause of morbidity and mortality in patients with diabetes. Infection, ischemia and neuropathy are all contributing to produce tissue necrosis.<sup>3</sup>

Studies showed that up to 10% of patients with diabetes would develop a foot ulcer sometime during their lives<sup>4</sup> and it is the most common cause of non-traumatic lower limb amputation and precedes 85% of the cases<sup>5</sup>.

The prevalence of diabetic foot problems differs between countries in the world<sup>5</sup>. In Saudi Arabia, DF was prevalent in 13.5% of the diabetic patients referred to the nephrology clinic<sup>6</sup>; several factors make this prevalence higher as compared to the West including patient education.

As many of diabetic complications, diabetic foot are avoidable however proper education is essential as it leads the patient to be aware of the problem and its prevention which can save the patient's feet from amputations. Educators including physicians usually educate their patients on controlling their blood sugar either with insulin or diet mainly and rarely about the foot care.

As prevention requires knowledge it also needs change in behavior. To assess our ability to effect change in behavior we need to measure not only knowledge but also understanding the change of behaviors. This study was carried out using a structured questionnaire to assess the knowledge among diabetic patients regarding foot care.

## Subjects and Methods: -

A retrospective study has been carried out to compare diabetic patients without foot problems to those who had them. It included all diabetic patients with and without Diabetic foot from Makkah city, there was no age limit, the study excluded non-Makkah residents (pilgrims), non-diabetic.

A study-specific questionnaire was designed included general information, level of education, and added questions at the end to measure the knowledge.

Ethical approvals from Um AlQura University and the ministry of health in Makkah were taken to collect the data from four major hospitals in Makkah (AL Noor specialist hospital, King Faisal specialist hospital, Hera general hospital, king Abdulaziz hospital). Then, the questionnaires were distributed to patients from the general population with diabetes and from those attending and following in a diabetic center in Makkah. Patients were grouped into two categories; 1) diabetics without foot problems, and 2) and those with foot complications. Then data was collected and analyzed using (SPSS, version 22).

### Results: -

The study included 392 patients. Their age ranged between 13 and 90 years ( $53.6 \pm 13.3$  years). Almost two-thirds of the patients were males (62%). Majority were Saudis (86.1%). More than one-quarter of them were professionals (26.4%), retired (29.4%) or not working (26.1%). Almost one third of them (33.5%) were at least university graduated whereas 18.4% of them were illiterates.

Table 2 summarizes the diabetes-related characteristics of the participants. Among majority of the participants (84.9%), diabetes was diagnosed after age of 20 years. Type II diabetes was reported by 52.1% of the patients. Regular compliance with diabetic clinic/center was mentioned by 65% of them. Adherence to anti-diabetics was reported by majorities (87%).

History of feet wound lasted 3-4 weeks was reported among 42.9% of diabetic patients as shown in figure 1 whereas history of amputation was reported among 20.9% of them. Figure 2

Figure 3 showed that 78.3% of the patients knew that they should reach their sole of the foot and see if there is any problem, 42.9% knew that they should daily examine their feet. It was found that 90.3% of them recognized that washing feet should be daily, 54.8% of them recognized using warm water for that. Almost half of patients (46.9%) knew that a clean towel should be used to dry their feet after washing it. Less than half of them (48.7%) knew that they should crossed their legs on sitting. Around 54.6% of the participants knew that they should use a cream to moisturize their feet, 35.5% of them know that it should be used between their toes. We found also that 74.0% knew that they should cut nails by themselves, 35.2% knew the proper way of cutting nails.

The mean knowledge score was 5.6 out of 10 (56%). From table 3, it has been shown that good knowledge regarding foot care was higher among younger patients ( $\leq 30$  years) compared to older patients ( $> 50$  years) (68% versus 41.4%,  $p < 0.001$ ). Majority of postgraduate patients (87%) compared to 34.7% of illiterate patients had good knowledge regarding foot care knowledge,  $p < 0.001$ . Other demographic factors (gender, nationality, and occupation) were not significantly associated with foot care knowledge.

The highest level of good knowledge regarding foot care was reported among patients with onset of diabetes between 11 and 20 years (70%) whereas the lowest level was reported among those with onset after 20 years (46.2%),  $p = 0.011$ . Good foot care knowledge was more reported among type 1 than type 2 patients (73.3% versus 51.7%,  $p < 0.001$ ). Regular compliance with diabetic clinic/center was accompanied with higher knowledge level,  $p < 0.001$ . Also, adherence to anti-diabetics was accompanied with higher knowledge level,  $p = 0.011$ . There was no significant difference between patients with history of foot wound lasts 3-4 weeks/amputation and knowledge of diabetic foot care. Table 4



**Table 1:-**Demographic characteristics of the participants

	Frequency	Percentage
<b>Age (years) (n=389)</b>		
≤30	25	6.4
31-50	120	30.8
>50	244	62.8
<b>Range</b>	13-90	
<b>mean±SD</b>	53.6±13.3	
<b>Gender</b>		
Male	243	62.0
Female	149	38.0
<b>Nationality (n=381)</b>		
Saudi	328	86.1
Non-Saudi	53	13.9
<b>Occupation (n=360)</b>		
Professionals	95	26.4
Students	15	4.2
Military	15	4.2
Retired	106	29.4
Manual	35	9.7
Not working	94	26.1
<b>Education</b>		
Illiterate	72	18.4
Primary	74	19.0
Intermediate	47	12.0
Secondary	67	17.1
University	108	27.6
Postgraduate	23	5.9

**Table 2:-** Diabetes-related characteristics of the participants

	Frequency	Percentage
<b>Age of diabetes onset in years (n=385)</b>		
≤10	28	7.3
11-20	30	7.8
>20	327	84.9
<b>Type of diabetes (n=386)</b>		
Type I (n=)	45	11.7
Type II	201	52.1
Unknown	140	36.2
<b>Regular compliance with diabetic clinic/center (n=389)</b>		
Yes	253	65.0
No	136	35.0
<b>Adherence to anti-diabetics</b>		
Yes	341	87.0
No	51	13.0

**Table 3:-**Association between knowledge of foot care and demographic characteristics of patients

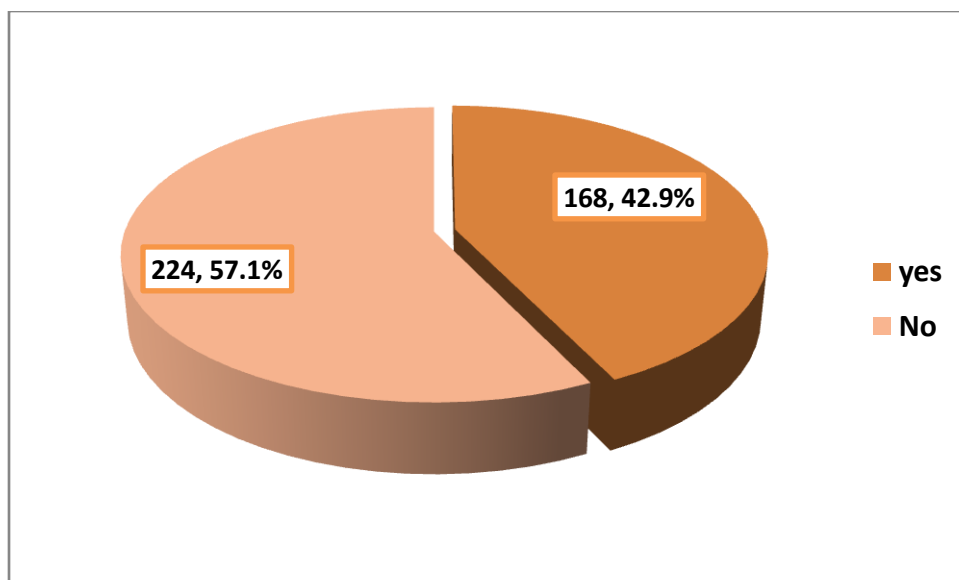
	Diabetic care knowledge		p-value*
	Poor N=196	Good N=196	
<b>Age (years) (n=389)</b>			
≤30 (n=25)	8 (32.0)	17 (68.0)	<0.001
31-50 (n=120)	44 (36.7)	76 (63.3)	
>50 (n=244)	143 (58.6)	101 (41.4)	
<b>Gender</b>			

Male (n=243)	127 (52.3)	116 (47.7)	0.252
Female (n=149)	69 (46.3)	80 (53.7)	
<b>Nationality (n=381)</b>			
Saudi (n=328)	162 (49.4)	166 (50.6)	0.642
Non-Saudi (n=53)	28 (52.8)	25 (47.2)	
<b>Occupation</b>			
Professionals (n=95)	44 (46.3)	51 (53.7)	0.251
Students (n=15)	5 (33.3)	10 (66.7)	
Military (n=15)	9 (60.0)	6 (40.0)	
Retired (n=106)	59 (55.7)	47 (44.3)	
Manual (n=35)	13 (37.1)	22 (62.9)	
Not working (n=94)	49 (52.1)	45 (47.9)	
<b>Education</b>			
Illiterate (n=72)	47 (65.3)	25 (34.7)	<0.001
Primary (n=74)	40 (54.1)	34 (45.9)	
Intermediate (n=47)	22 (46.8)	25 (53.2)	
Secondary (n=67)	38 (56.7)	29 (43.3)	
University (n=108)	45 (41.7)	63 (58.3)	
Postgraduate (n=23)	3 (13.0)	20 (87.0)	

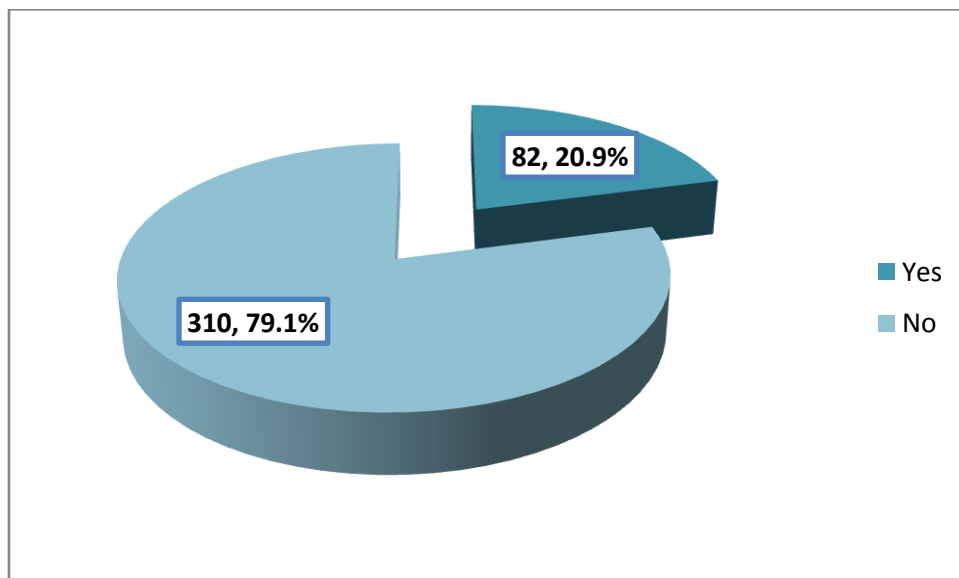
\* Chi-square test

**Table 4:-** Association between knowledge of foot care and diabetes-related characteristics of patients

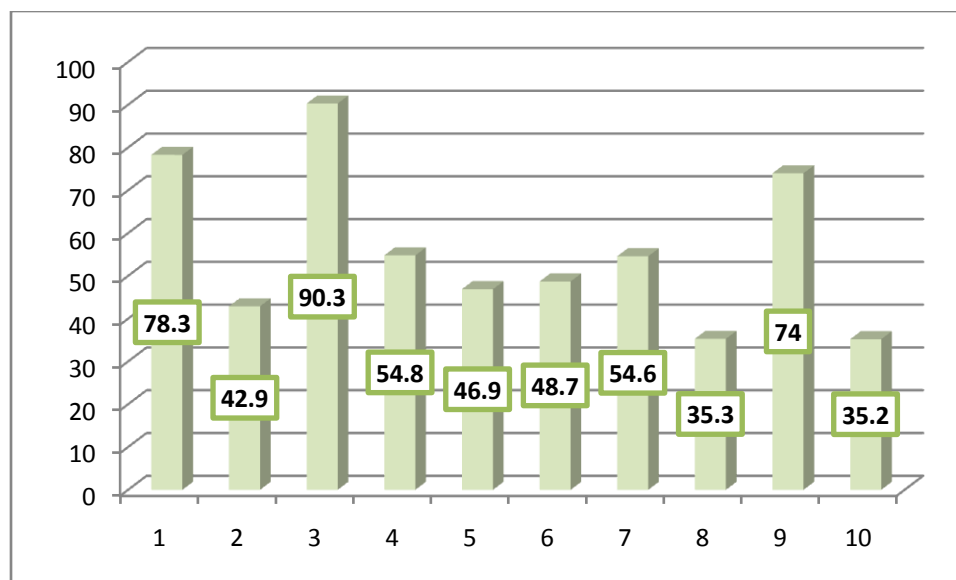
	Diabetic care knowledge		p-value
	Poor N=196	Good N=196	
<b>Age of diabetes onset in years (n=385)</b>			
≤10 (n=28)	10 (35.7)	18 (64.2)	0.011
11-20 (n=30)	9 (30.0)	21 (70.0)	
>20 (n=327)	176 (53.8)	151 (46.2)	
<b>Type of diabetes (n=386)</b>			
Type I (n=45)	12 (26.7)	33 (73.3)	<0.001
Type II (n=201)	97 (48.3)	104 (51.7)	
Unknown (n=140)	83 (60.0)	56 (40.0)	
<b>Regular compliance with diabetic clinic/center (n=389)</b>			
Yes (n=253)	111 (43.9)	142 (56.1)	<0.001
No (n=136)	84 (61.8)	52 (38.2)	
<b>Adherence to anti-diabetics</b>			
Yes (n=341)	162 (47.5)	179 (52.5)	0.011
No (n=51)	34 (33.3)	17 (33.3)	
<b>History of foot injury lasts for 3-4 weeks</b>			
Yes (n=168)	82 (48.8)	86 (51.2)	0.683
No (n=224)	114 (50.9)	110 (49.1)	
<b>History of toe/foot/lower limb amputation</b>			
Yes (n=82)	44 (53.7)	38 (46.3)	0.456
No (n=310)	152 (49.0)	158 (51.0)	



**Figure 1:-** History of feet wound lasted 3-4 weeks among diabetic patients



**Figure 2:-** History of amputation among diabetic patients



1: Ability to reach the sole of the foot  
 2: Daily foot examination  
 3: Washing foot daily  
 4: Using warm water to wash feet  
 5: Drying the feet after washing with clean towel  
 6: Sitting with the feet crossed  
 7: Using the cream to moisturize the feet  
 8: Using the cream to moisturize between toes  
 9: Self cutting of the toe nails  
 10: Way of cutting the nails  
**Figure 3:-** Diabetic foot care knowledge of 431 diabetic patients

### Discussion:-

In the current study, the mean score of knowledge was 5.6 out of 10 (56%). In a study conducted by Al-Juaid in Taif, Saudi Arabia (2005),<sup>7</sup> a main knowledge score of 66% has been reported. In Najran, Saudi Arabia the main knowledge score was 6.5 out of 11 (60%).<sup>8</sup> In USA, Southeastern State, the main score of knowledge of a group of diabetic patients without foot ulcer was 13.75 out of 20 (68%) whereas it was 13.88 out of 20 among those with foot ulcer (69.4%).<sup>9</sup>

In the current study, younger patients were more knowledgeable than older patients. The same has been reported by Al-Juaid in another previous Saudi study.<sup>7</sup> This could be attributed to the fact that, younger patients were healthier and they can take care of themselves.

In accordance with other studies,<sup>7, 10, 11</sup> higher educated patients were more knowledgeable than others. The knowledge of appropriate foot care has been suggested to be positively influenced by patient education which in turn reduces the risk of foot ulceration and amputation in high-risk diabetics.<sup>12</sup> The association between education and knowledge may be due to the fact that, educated patient were able to read and understand some of educational supportive materials and also use information technology to obtain more information about the disease. In addition, in a study conducted in India, it was concluded that low knowledge scores were common with poor formal education, thus confirming relationship between education and knowledge.<sup>13</sup> Role of formal/school education is further confirmed by a study from Italy where the presence of foot complications was correlated with cigarette smoking, insulin treatment, and low levels of school education.<sup>14</sup>

Patients who regularly compliant with diabetic clinics visits and anti-diabetics were more knowledgeable regarding diabetic foot. This could be attributed to the fact that patients usually got their information from primary care centers sources which help them to be more compliant with anti-diabetics and also more knowledgeable of foot care.

Therefore, health education is an essential task in primary health care centers as well it is one of the important task and responsibility of primary health care physicians.

Type 1 diabetic patients in the present survey reported better foot care knowledge than those of type 2. This could be attributed to the fact that type 1 diabetes is more associated with complications including diabetic foot.<sup>15</sup> Therefore, they had to be more knowledgeable about it.

Patient's gender has shown no relationship regarding knowledge and practices of foot care whereas in another study conducted in India, low scores for foot care knowledge were more common in women (78.5%) than in men (62.5%). However this can be explained on the basis that in that particular study, there were more women with low educational status.<sup>16</sup>

In conclusion, Knowledge of diabetic foot care in Makkah is moderate (56%), younger, more educated, type 1 diabetic patients and those who attended diabetic clinics regularly and being more compliant with anti-diabetics were more knowledgeable. Health education programs are recommended particularly to older and less educated patients. In addition, patients should be encouraged to attend diabetic clinics regularly.

The present research has some important limitations. First, our sample was recruited from attendees of major hospitals in Makkah ignoring those attending primary health care centers, which limits the representative of the sample. The used tool was not subjected to tests of validity and reliability. Despite of that, our study has been able to determine the knowledge of foot care among diabetic patients in Makkah, Saudi Arabia and identifying factors associated with that knowledge.

## References:-

1. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030. *Diabetes Care*. 2004;27:1047–53
2. Margolis DJ, Malay DS, Hoffstad OJ, Leonard CE, MaCurdy T, López de Nava K, et al. Prevalence of diabetes, diabetic foot ulcer, and lower extremity amputation among Medicare beneficiaries, 2006 to 2008: Data Points #1. *Data Points Publication Series [Internet]*. Rockville (MD): Agency for Healthcare Research and Quality (US); 2011-. 2011 Feb 17. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK63602/#dp1.s5>
3. Alqurashi KA, Aljabri KS, Bokhari SA. Prevalence of diabetes mellitus in a Saudi community. *Ann Saudi Med*. 2011 Jan-Feb; 31(1): 19–23.
4. Wu SC, Driver VR, Wroble JS, Armstrong DG. Foot ulcers in the diabetic patient, prevention and treatment. *Vasc Health Risk Manag*. 2007 Feb; 3(1): 65–76.
5. Ahmed AA, Elsharief E, Alsharief A. The diabetic foot In the Arab world. *The Journal of Diabetic Foot Complications* 2011; 3(3): 55-61
6. Boulton AJM. The diabetic foot: grand overview, epidemiology and pathogenesis *Diabetes Metab Res Rev* 2008; 24(Suppl 1): S3–S6.
7. Al-Juaid BM. Self care knowledge and practice among type 2 diabetic patients. A dissertation submitted for the Joint program of Family and Community Medicine, Jeddah, Saudi Arabia, 2005
8. Khan LA, Khan SA. Level of knowledge and self-care in diabetics in a community hospital in Najran. *Annals of Saudi Medicine* 2000;20(3-4):300-302
9. Neil JA. Assessing foot care knowledge in a rural population with diabetes. *ostomyWound Manage* 2002 Jan;48(1):50-6
10. Desalu OO, Salawu FK, Jimoh AK, Adekoya AO, Busari OA, Olokoba AB. Diabetic foot care: Self reported knowledge and practice among patients attending three tertiary hospitals in Nigeria. *Ghana Medical Journal* 2011;45(2):60-65
11. Hasnain S, Sheikh NH. Knowledge and practices regarding foot care in diabetic patients visiting diabetic clinic in Jinnah Hospital, Lahore. *JPMA* 2009; 59(10):687-690
12. Singh N, Armstrong DG, Lipsky BA. Preventing foot ulcers in patients with diabetes. *JAMA* 2005; 293: 217 – 228.
13. Viswanathan V, Shobhana R, Snehalatha C, Seena R, Ramachandran A. Need for education on foot care in diabetic patients in India. *J Assoc Physicians India* 1999; 47: 1083-5.

14. De Beradis G, Pellegrini F, Fanciosi M, Belfiglio M, Di Nardo B, Greenfield S, et al. Are Type 2 diabetic patients offered adequate foot care? The role of physician and patient characteristics. *J Diabetes Complications* 2005; 19: 319-27.
15. Al-Rubeaan K, Al Derwish M, Ouizi S, Youssef AM, Subhani SN, Ibrahim HM, Alamri BN. Diabetic Foot Complications and Their Risk Factors from a Large Retrospective Cohort Study. *PLoS One*. 2015; 10(5): e0124446.
16. Viswanathan V, Shobhana R, Snehalatha C, Seena R, Ramachandran A. Need for education on foot care in diabetic patients in India. *J Assoc Physicians India* 1999; 47: 1083-5.



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### RESEARCH ARTICLE

#### IMPLEMENTATION OF MARRIAGE DISSOLUTION BY *LI'AN* (INVOKING MUTUAL CURSES) IN ISLAM

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#### Abstract

*Li'an* as a mode of divorce is seldom used among the Muslim society. It involves taking an oath to avoid *hudud* punishment for the charge of adultery (*zina*). This research begins from a study by Abdul Rahim Abdullah which interpreted the term *li'an* as taking a religious oath due to a husband's accusation against his spouse, deemed as slander (*qazaf*) in the absence of four witnesses, whether to accuse her of adultery or to deny paternity of a child conceived by her. Thus, the purpose of this research is to explain in detail the concept and meaning of *li'an* in Islam. This research examines the law on *li'an* and its implementation according to Islam. In addition, this research also studies *li'an* as a mode of marriage dissolution according to al-Qur'an and al-Hadith. It also uncovers reasons for the occurrence of *li'an* and its implementation based on al-Qur'an and al-Hadith as well as the effect of legal implications on couples who go through it. The research methodology employed is literature review in order to obtain adequate related information on *li'an*.

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#### Introduction:-

*Li'an* is a method of taking oath to avoid *hudud* punishment for the charge of adultery (*zina*). *Li'an* is also a method for the purpose of denying paternity of a child. However, it is rarely practised as a form of divorce among the Muslim society.

#### Meaning of *Li'an*:-

*Al-Li'an* originates from the word (لاعن) and from *wazan* (فانل) which means to expel and being driven away from the mercy of Allah (al-Zuhayli, 1989). *Li'an* in *Ahwal al-Shakhsiyyah* (Muslim Family Law) terminology consists of specific words used as allegation by the accuser against his spouse for desecrating their conjugal bed and dishonour on the ground of adultery (*zina*). The act is named *li'an* because the words used by both parties in the procedure are swear words invoking the curse or wrath of Allah and in doing *li'an* the parties are distancing themselves from each other (al-Khin, 2007).

*Li'an* slightly differ according to the terminology of jurists from different schools of law (*fuqaha' al-Madhahib*). *Madhhab al-Hanafiyyah* states that *li'an* is a name which occurs between spouses with specific or prescribed pronouncements in their testimonies (Fath al-Qadir). In *al-Shafi'iyyah* school of law, the words used are for the

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accusation of tarnishing the bedspread or carpet (dishonour) and relating it to denial of paternity for a child (al-Ramli, 1967). In *al-Malikiyyah* school of law, *li'an* is an oath taken by a husband, who is Muslim and accountable (*mukallaf*), that his wife has committed adultery or denying paternity of a child conceived by her. The wife also swears that the husband is falsely accusing her. Thus both spouses swear four times by pronouncement of *Ashhadu bi Allah* in the presence of a judge (*al-Sharh al-Saghir li Dardir*, 1/492). According to *al-Hanabilah* school of law, *li'an* is the testimony under oath of both spouses followed by an oath invoking the curse of Allah on himself and wrath of Allah on herself in the place of accusation for adultery (al-Bahuti, n.d.). And lastly, according to *al-Jafariyyah* school of law, *al-mubahalalah* (invoking mutual curses) between the spouses to avoid punishment for adultery and deny of paternity of a child through prescribed pronouncement before a judge (al-'Amili, n.d.).

#### **Legal Establishment of *Li'an*:-**

Legal authority for *li'an* is based on a few sources. The first is the commandment of Allah in al-Qur'an, surah al-Nur, 24:6-9 which bears the following meaning:

And for those who launch a charge against their spouses and have (in support) no evidence but their own, their solitary evidence (can be received) if they bear witness four times (with an oath) by Allah that they are solemnly telling the truth; And the fifth (oath) (should be) that they solemnly invoke the curse of Allah on themselves if they are tell a lie; But it would avert punishment from the wife if she bears witness four times (with an oath) by Allah that (her husband) is telling a lie; And the fifth (oath) should be that she solemnly invokes the wrath of Allah on herself if (her accuser) is telling the truth.

#### **The second source is a Hadith as follows, meaning: -**

Sahl ibn Saad RA said: An Ansari man came to Allah's Apostle (pbuh) and said: "O Allah's Apostle! If a man saw another man with his wife, should he kill him, or what should he do? So Allah revealed concerning his affair what is mentioned in the Holy Qur'an about the affair of those involved in a case of *li'an*. Then the Prophet (pbuh) said: "Allah has given His verdict regarding you and your wife". Sahl RA said: "So they both carried out the process of *li'an* in the mosque while I was witness". In another narrative, it is mentioned: "Both of them carried out *li'an*. I was present among the people with Allah's Apostle(pbuh)" (al-Bukhari, 1993).

The third source is consensus of scholars. Scholars are unanimous in this matter and none of them dissented (al-Zuhayli, 2007).

#### **Conditions for *Li'an*:-**

There are six conditions for *li'an*. The first is that a person who does *li'an* must qualify to take an oath (al-Irdabili, 1970), that is, he must have passed puberty age and be of sound mind (Sabiq, 1969). The second condition is that the husband must have first accused his wife of adultery (al-Bujayrimi, 1951). The third is that the words of curse and wrath of Allah must come after the four oaths, and the four oaths must be consecutive. Any long pauses between the oaths will nullify or invalidate the *li'an* and require repetition of process.

The fourth condition is that the two *li'an* of the spouses are not required to be consecutive. The fifth condition is that the prescribed pronouncement of *li'an* may not be altered, hence both husband and wife must be committed to the truth of the words spoken. If one of them alters the pronouncement such as the oath (I swear in the name of Allah) or changes the pronouncement of wrath with curse or vice versa, the *li'an* becomes not valid. The pronouncements of *li'an* are narrated as clear evidence in the Book of Allah, therefore it is obligatory to maintain outwardly clear or definite statement in *li'an*.

The fifth condition is that the judge is obliged to advise the couple doing the *li'an* of the risk of severe punishment on the day of Judgment from Allah on the one who tells untruth. The sixth condition is that *li'an* may only begin upon order of the judge after he has instructed on how to do the pronouncement. If a husband does *li'an* before getting permission from the judge, his *li'an* is not considered valid. *Li'an* on the part of the wife may only be done subsequent to the husband's *li'an* (al-Irdabili, 1970).

#### **Reasons for Occurrence of *Li'an*:-**

*Li'an* occurs for two reasons. First, when a husband accuses his wife of adultery without producing four witnesses to support his allegation. The accusation may be true, for example if he himself witnessed with his own eyes his wife



in a compromising situation, but there are no four witnesses to corroborate his allegation or if the wife confesses to adultery and her confession is accepted and admitted based on clear and proven testimony. Thus in such a case, the husband shall as best as possible divorce his wife without *li'an*. But if her adultery is not proven with clear evidence, the husband may submit his allegation.

The second reason for occurrence of *li'an* is when a husband rejects the child conceived by his wife. For example, he admits that he has not consummated their marriage, or the wife has given birth to the child before six months from consummation. In this case, the *qadi* or judge shall remind and advise the couple, as explained by the Prophet (pbuh) in his hadith narrated by Abu Hurairah as follows, meaning:

Any woman who brings to a people (a child from fornication) not from that people, will not get any share from Allah, and shall not enter Paradise. Any man who rejects a child, whom he knows to be his, will be driven away from Allah, and will be humiliated in the presence of people before and after (Abu Dawud, 1990).

### **Implementation of *Li'an*:-**

The majority of jurists hold the opinion that the process of *li'an* shall not be carried out except as recommended by Allah in al-Qur'an (Salleh, 2003), including the use of (prescribed) pronouncement. It also cannot be carried prior to a judge's order (Salih, 1979).

Before *li'an* can be carried out, it is commendable (sunnah) to select a suitable time for the event. The most suitable time is after *'asar* (afternoon prayer) on Friday. The venue would be the most honourable and glorious place in a country such as the place between *Hajar al-Aswad* and *Maqam Ibrahim* in Mecca, in the Apostle's (pbuh) Pulpit in Medina (al-Irdabili 1951), by the rock which was the *qibla* of past prophets (al-Haytami, 1971) or other places such as the top of the pulpit in a mosque (al-Bujayrimi, 1951).

At the event, there should be at least four witnesses, comprising of four pious, righteous and just believers. At the beginning of the ceremony, the judge will remind both parties, husband and wife, to fear Allah and advise them of a very grievous and lasting doom in the hereafter. This reminder has to be served more solemnly after they have finished the fourth oath, that is, before the fifth oath. While doing *li'an*, it is commendable to stand on their feet (al-Irdabili 1951).

As mentioned above, the first party to initiate *li'an* is the husband. He has to say "I bear witness in the name of Allah, that I am one of the truthful in the allegation of adultery against my wife and the child is from fornication and not mine". This statement is uttered four times. By the fifth oath, the husband must confirm with the statement, "I solemnly invoke the Allah's curse upon me if I tell a lie".

Before the fifth oath, it is recommended for the judge to read what was once said by the Apostle (pbuh) to Hilal, "Fear Allah. Verily the penalty in this world is lighter than punishment in the hereafter". It is also desirable that the judge order a man to close the mouth of the husband with his hand so that hopefully he may refrain from the fifth oath.

The same procedure is followed when the wife begins *li'an* against her husband. Before she begins it and before the fifth oath, the judge will also remind her of the grievous penalty in the hereafter. Then, he will order a woman to cover the wife's mouth with her hand with the hope that she will discontinue her intention to take the fifth oath. If she still intends to continue, the judge will so order (al-Bujayrimi, 1951). But in her case, the words Allah's curse are changed to Allah's wrath, with the pronouncement, "I solemnly invoke Allah's wrath upon me if he (the husband) tells the truth" (al-Haytami, 1971).

Imam Shafi'i held the opinion that if a husband forgets in his *li'an* to deny paternity of the child conceived by his wife, he may pronounce again in front of the judge. If the wife denies it, she may repeat her *li'an* against her husband (al-Shafi'i, 1973). According to an authentic opinion, the wife's *li'an* is irrelevant to paternity for the child (al-Bujayrimi, 1951).

**Legal Implications of Husband's Refusal to do *Li'an* Upon Allegation:-**

According to *Madhhab* Maliki, Shafi'i and Hanbali, if a husband accuses the wife of adultery and then refuses to do *li'an* against her, he shall be punished for *qazaf* (slandering). By his failure to produce four witnesses to corroborate his allegation, he is considered as someone else (not as her husband). This means that the husband's accusation of adultery is treated as against another woman, not as against his own wife.

Therefore, in *Madhhab* Maliki, Shafi'i and Hanbali, the husband is considered as having slandered (*qazaf*) and faces two options, either to present evidence or face hudud punishment. This is based on the Prophet's (pbuh) hadith narrated by Ibn 'Abbas as in the following meaning:

That Hilal ibn Umayyah accused his wife of committing adultery with Sharik ibn Sahma' in front of the Prophet. So the Messenger of Allah said, "Produce proof or face punishment on your back". Hilal said, "O Messenger of Allah, one of us sees a man go on top of his wife's abdomen, you ask for evidence". The Messenger of Allah said, "Produce proof, or face punishment on your back" (al-Jawziyyah, 1990).

This hadith is authority that if a husband willfully accuses his wife of adultery without producing four witnesses, it becomes mandatory to sentence him with hudud punishment for slander. But however, if he does *li'an* against his wife, the sentence is dropped. This principle is based on the majority opinion of scholars. However, *Madhhab* Hanafi holds the opinion that if a husband refuses to go through the *li'an* process against his wife, he shall not be sentenced for *qazaf*, but shall instead be imprisoned until he carries out *li'an* against his wife or he admits to telling untruth, in which case, the sentence for *qazaf* is imposed on him, that is, eighty stripes. Similarly, if a wife refuses to neutralize her husband's *li'an* against her in his accusation of adultery with her *li'an*, then according to Imam Malik and Imam Shafi'i, the judge shall sentence her with hudud punishment for adultery, that is, death by stoning (Said, 2001).

Similarly, Imam Abu Hanifah held the opinion that if a wife refuses to respond to her husband's *li'an*, she will not be sentenced for adultery. Instead, she shall be imprisoned first until she agrees to do pronounce *li'an* against her husband or admits to having committed adultery. If she admits guilt to her husband's allegation, the judge shall sentence her for hudud punishment for adultery. Imam Abu Hanifah's opinion is reasoned from the Prophet's (pbuh) hadith as follows, meaning:

It is not permissible to shed the blood of a Muslim, except for three reasons, adultery (*zina*) of the married man or woman, apostasy after believing (*murtad*), and killing another person not in retaliation (*qisas*).

Shedding of blood because of refusal to swear in *li'an* contradicts the principles of Islamic jurisprudence (*usul al-fiqh*). Thus most jurists do not make hudud punishment mandatory for refusal to swear in *li'an*, preferring to follow the better opinion of Imam Abu Hanifah. Strictly speaking, Islamic law protects against the claim for blood and a wife shall not be killed by stoning to death except if adjudged with utmost fairness with clear evidence or by her own admission of guilt. Nevertheless, Imam Maliki and Imam Shafi'i maintained their opinion that a wife who refuses to swear against her husband's *li'an*, shall be sentenced with hudud punishment for adultery, that is, death by stoning.

**Legal Implications of Husband's *Li'an* against His Wife:-**

When a husband initiates *li'an* against his wife in the manner described above, five implications arise as follows:

First, the husband will not be subject to hudud punishment of *qazaf* (al-Nasa'i, 1964). Second, the wife will be sentenced with hudud punishment for adultery unless she also swears in *li'an*. Third, their marriage is permanently dissolved. Fourth, where the husband's paternity for any child conceived or thereafter born is denied, the child shall not take the husband's name and will be surrendered to the wife. Fifth, it is forbidden for the man and woman to re-marry forever as mentioned in two hadith of the Prophet (pbuh). The first hadith was narrated by Ibn Umar RA that: "The Prophet (pbuh) carried out *li'an* between a man and his wife, resulting in denial of paternity for the woman's child (the child could not take the father's name). The Prophet (pbuh) separated the couple, and established the child's lineage only to the mother" (al-Bukhari, 1993). The second hadith was narrated by Sahl ibn Saad RA who

said, "After that event, it became the practice (*sunnah*) that a couple who carried out *li'an* must be separated, and can never ever re-marry" (Abu Dawud, n.d).

### Effects of *Li'an*:-

Upon the husband's *li'an*, the divorce is affirmed between him and his wife. The effect of divorce gives rise to five legal implications as follows:

First, the hudud charge of *qazaf* (slandering) on the husband is dropped. Instead, hudud charge will be imposed on the wife who shall have to do *li'an*. Second, a wife who chooses not to do *li'an* against her husband will be charged with adultery. If she chooses to swear in *li'an* against her husband, the sentence for adultery will be averted. Third, the couple will be permanently divorced by *talaq ba'in* (irrevocable divorce). Fourth, the husband will be denied paternity of the child if he rejected it in his *li'an* against his wife. Instead the child will only maintain lineage to its mother (the wife). Fifth, it is not permissible (forever) for the husband to re-marry the wife who did the *li'an*, even if she thereafter marries other husbands.

### Conclusion:-

In conclusion, Islam is a simple and perfect religion. The laws relating to divorce are not to encourage divorce but may be taken and implemented in critical situations, that is, when a husband and his wife no longer have mutual love and affection for one another and married life becomes meaningless. In such cases, Shariah law allows mutual repudiation of the marriage. Most of the divorce cases frequently occurring between couples in Muslim society are by the modes of *talaq*, *talaq* by *ta'liq*, *fasakh* and *khulu'*. In comparison, divorce by *li'an* very rarely happens.

### References:-

1. al-Bahuti, Shaykh Mansur ibn Yunus al-Hanbali. (n.d.): *Sharh al-Muntaha*. Vol. 3. Damascus: Dar al-Qalam.
2. al-Bujayrimi, al-Shaykh Sulayman. (1951): *Bujayrimi 'ala al-Khatib*. Vol. 4. Cairo: Matba'at Mustafa al-Babi al-Halabi wa Awladih.
3. al-Bukhari, Imam Abu 'Abd Allah Muhammad ibn Isma'il. (1993): *Sahih al-Bukhari*. Vol. 3. Damascus: Dar al-'Ulum al-Insaniyyah.
4. al-Haythami, Abu al-'Abbas Ahmad Shihab al-Din ibn Hajr. (1971): *Fath al-Jawwad bi Sharh al-Irshad*. Vol. 2. Cairo: Matba'at Mustafa al-Babi al-Halabi wa Awladih.
5. al-Irdabili, al-Imam Yusuf. (1970): *al-Anwar li A'mal al-Abrar*. Vol. 2. Cairo: Mu'assasat al-Halabi wa Sharikah li al-Nashr wa al-Tawzi'.
6. al-Jaba'i, Shaykh Sa'id Zayn al-Din al-'Amili. (n.d.): *al-Rawdah al-Bahiyah Sharh al-Lam'ah al-Dimashqiyyah*. Cairo: Taba' Jami'ah al-Najf al-Diniyyah.
7. al-Jawziyyah, Ibn Qayyim. (1990): *'Awn al-Ma'bud Sharh Sunan Abi Dawud*. Vol. 3. Beirut: Dar al-Kutub al-'Ilmiyyah.
8. al-Khin, Mustafa, al-Bugha, Mustafa & al-Sharbaji, 'Ali, (2007): *al-Fiqh al-Manhaji 'ala Madhahib al-Imam al-Shafi'i*. Damascus: Dar al-Qalam.
9. al-Nasa'i, Abu 'Abd al-Rahman ibn Shu'ayb. (1964): *Sunan al-Nasa'i al-Mujtaba*. Vol. 6. Cairo: Matba'at Mustafa al-Babi al-Halabi wa Awladih.
10. al-Ramli, Sham al-Din Muhammad ibn Abi Ahmad al-'Abbas Ahmad ibn Hamzah ibn Shihab al-Din. (1967): *Nihayat al-Muhtaj Ila Sharh al-Minhaj*. Cairo: Matba'at Mustafa al-Babi al-Halabi wa Awladih.
11. Sabiq, al-Sayyid. (1969): *Fiqh al-Sunnah*. Vol. 3. Beirut: Dar al-Kitab al-'Arabi.
12. Said Ibrahim. (2001): *400 Soal Jawab Nikah Kahwin*. Kuala Lumpur: Darul Ma'rifah.
13. Salih, 'Abd al-Ghaffar Ibrahim. (1979): *al-Raj'ah fi al-Fiqh al-Islami Dirasah Muqaranah Ma'a bayan Ma Yajri 'alayh al-'Amal fi al-Mahakim al-Misriyyah wa al-Sudaniyyah*. Cairo: al-Nahdah al-Misriyyah.
14. Salleh Ismail. (2003): *Pembubaran Perkahwinan Mengikut Fiqh dan Undang-undang Keluarga Islam [Marriage Dissolution according to Fiqh and Muslim Family Law]*. Kuala Lumpur: Dewan Bahasa dan Pustaka.
15. al-Shafi'i, Abu 'Abd Allah Muhammad ibn Idris. (1973): *al-Umm*. Vol. 8. Beirut: Dar al-Ma'arif li al-Tiba' wa al-Nashr.
16. al-Zuhayli, Muhammad. (2007): *al-Mu'tamad fi al-Fiqh al-Shafi'i*. Vol. 4. Damascus: Dar al-Qalam.
17. al-Zuhayli, Wahbah. (1989): *al-Fiqh al-Islami wa Adillatuh*. Vol. 7. Cairo: Dar al-Fikr.



## RESEARCH ARTICLE

### NEUROLOGICAL DISEASES AMONG GERIATRIC POPULATION OF ARAR CITY, KINGDOM OF SAUDI ARABIA: A CROSS SECTIONAL STUDY

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#### Abstract

**Background:** The aging population presents a challenge for the public healthcare system. There is a need to more health and social support to that vulnerable group. Neurological diseases represent an important public health problem. Local level data concerning neurological diseases among elderly are essential for providing the needed health services. **Study objective:** To study some of the demographic characteristics of the elderly population and to estimate the prevalence of neurological diseases, its types and possible determinants among the elderly population of Arar city, Kingdom of Saudi Arabia. **Methodology:** The present cross sectional community based study was conducted in Arar city, the capital of Northern Borders Governorate of KSA, on 138 elderly people. Systematic random sampling technique was followed. Data was collected through personal interviews with the sampled elderly and filling the questionnaire, which guided us to the data of socio-demographic characteristics and neurological diseases, its types and its determinants. **Results:** The overall prevalence rate of neurological diseases observed in this study was 20.9%; the prevalence of stroke was 4.3%, parkinsonism was 3.6%, facial palsy 4.3%, headache syndrome was 6.5% and 2.1% previous nervous system surgery. Stroke is associated with depression. Headache and parkinsonism were more common in females but stroke was more in males.

**Conclusion and recommendations:** In light of the results of the present study; neurological diseases were prevalent among elderly population in Arar city, Kingdom of Saudi Arabia. Commitment from decision makers is the first step to decrease the burden caused by neurological disorders and its sequel on that vulnerable group. Health education campaigns and initiatives are needed to increase societal and professional awareness of public health aspects of neurological disorders. Strengthening the preventive, curative and rehabilitation care within the existing health systems. Defining the priorities for research, is one of the important ways for dealing with neurological disorders among geriatric population.

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## Introduction:

Arab countries, including Saudi Arabia (KSA) are passing through a phase of epidemiological transition with increasing burden of non-communicable diseases (NCD) consequent to transformation of scenario with improvement of health care services in preventive and promotive domains. Among the NCDs, neurological disorders form a significant proportion of global burden of disease [1].

A neurological disorder is any disorder of the nervous system. Structural, biochemical or electrical abnormalities in the brain, spinal cord or other nerves can result in a range of symptoms. Examples of symptoms include paralysis, muscle weakness, poor coordination, seizures, confusion, pain and altered levels of consciousness. There are many recognized neurological disorders, some relatively common, but many rare [2].

The specific causes of neurological problems vary, but can include genetic disorders, congenital abnormalities or disorders, infections, lifestyle or environmental health problems including malnutrition, and brain injury, spinal cord injury or nerve injury. The problem may start in another body system that interacts with the nervous system. For example, cerebrovascular disorders involve brain injury due to problems with the blood vessels (cardiovascular system) supplying the brain [3].

Neurological disorders are common and represent a major public health problem. For example, 50 million people have epilepsy. Neurological disorders and some of the other conditions with neurological impairments and sequelae constitute over 6% of the global burden of disease. This burden is especially high in many low and middle income countries. Public health challenges describes and discusses the increasing global public health importance of common neurological disorders such as dementia, epilepsy, headache disorders, multiple sclerosis, neuroinfections, neurological disorders associated with malnutrition, pain associated with neurological disorders, Parkinson's disease, stroke and traumatic brain injuries [2].

Neurology has an especially close relationship with psychology and psychiatry, as all three disciplines focus on the functions and disorders of a single organ, the brain. The main targets of the traditional British "neurological examination" may be elementary motor and sensory processes, but any adequate assessment of "brain function" must take account of cognition and behavior. Cognitive and behavioral involvement is the rule, not the exception, among patients with disorders of the central nervous system (CNS) [4].

Thus far, no nationwide, if any, research has been conducted recently on the incidence and prevalence of strokes in Saudi Arabia. However, over the past decade there was one study which reported that the crude incidence rate for first-ever incidence of stroke in Saudi Arabia was 29.8/100,000/year [5]. In addition, they reported that, the important risk factors were: systemic hypertension (38%), diabetes mellitus (37%), heart disease (27%), smoking (19%) and family history of stroke (14%) [5].

In 10 years of work on stroke in Saudi Arabia, the incidence and prevalence of strokes were low when compared to those reported from Western countries. However, the high prevalence of diabetes mellitus as a risk factor were quite distinctive. Undetected and untreated hypertension and a low frequency of cigarette smoking in the stroke-prone age group could be one explanation of these findings [6].

Parkinson's Disease (PD) is a common neurodegenerative disorder. Epidemiological studies of PD from 1985 to 2010, worldwide data showed a rising prevalence of PD with age (all per 100,000): 173 in 55 to 64 years; 428 in 60 to 69 years; 425 in 65 to 74 years; 1087 in 70 to 79 years; and 1903 in older than age 80. A significant difference was seen in prevalence by geographic location with 646 in individuals from Asia ( $P < 0.05$ ). A significant difference in prevalence by sex was found ( $P < 0.05$ ) [7].

Among the urban and rural population of Al Kharga District, New Valley, Egypt, the results revealed that the total prevalence rate of neurological disorders in Al Kharga District, New Valley was 2.4% with no significant difference among both sexes. The highest prevalence rate was recorded among elderly people (60+ years; 9.25%) [8].

In a study conducted in in Fayoum, Egypt, stroke was found in 2.8% of the studied elderly; 2.0% of males and 0.8% of females, headache was found in 58.4%; 31% of males and 27.4% of females [9].

In in Southern Saudi Arabia, Al-Modeer study, stroke was found in 34.9% of elderly, more in males than females (39.4% of males and 27.1% of females), parkinsonism was 4.3% (5.4% in males and 3.5% in females [10].

Between 1982 and 1992, in a study conducted by Al Rajeh et al., in a hospital that exclusively treated the Saudi Arabian National Guard community rated the crude annual incidence rate at 43.8 per 100,000 Males predominated

in all types of stroke. In both male and female groups the most likely stroke-prone age was 60 to 70 years. Hypertension (56%), diabetes mellitus (42%), and cardiopathy (33%) were common risk factors [11].

In Thugbah community in the Eastern Province of Saudi Arabia to determine its point prevalence of neurological diseases. only 1.5% were more than 60 years old. The overall crude prevalence ratio for all forms of neurological disease was 131/1,000 population. Headache syndromes were the most prevalent disorder (20.7). Stroke, Parkinson's disease, and Alzheimer's disease were uncommon with respective PRs of 1.8, 0.27 and 0.22. The major medical diseases that may be neurologically relevant were diabetes mellitus, hypertension, and connective tissue disorders [12].

As very few studies have focused on the elderly population, there is a lacuna in data of neurological disorders in elderly in Northern region of Saudi Arabia.

## Objectives:

To study some of the demographic characteristics of the elderly population and to estimate the prevalence of neurological diseases, its types and determinants among the elderly population of Arar city, Kingdom of Saudi Arabia.

## Participants and methods:

### Study design and setting:

The present cross sectional community based study was conducted in Arar city, the capital of Northern Borders Governorate

### Study period and target population:

This study was conducted during the period from 1 June to 30 September 2016, on elderly people of age 60 years and more.

### Sampling:

The sample size was calculated using the sample size equation:  $n = z^2 p(1-p)/e^2$ , considering target population more than 1000, and study power 95%. Data was collected from 138 elderly participant aged 60 years and above. Systematic random sampling technique was followed. After identifying the first house randomly in the selected area, every 9th house was visited to include all the elderly subjects residing in those selected houses till the required sample is covered.

### Data collection:

Data were collected by means of personal interview with the sampled elderly using a predesigned questionnaire covering the following items:

- (1) Socio-demographic characteristics including age, sex, educational and marital status.
- (2) Smoking status and certain types of diseases that may be prevalent among elderly suggested to affect neurological diseases such as diabetes mellitus and obesity.
- (3) The questionnaire included also questions regarding the already previously diagnosed neurological diseases, its types and its determinants, after ensuring the diagnosis by reviewing the accompanied health records and prescriptions and asking the caregivers about the case.

### Ethical considerations:

Data collector gave a brief introduction to the participants by explaining the aims and benefits of the study. Informed written consent was obtained from all participants. Anonymity and confidentiality of data were maintained throughout the study. There was no conflict of interest.

### Statistical analysis:

We utilized the statistical package for social sciences, version 16 (SPSS Inc., Chicago, Illinois, USA) to analyze the study data. The results were displayed as counts and percentages. The X<sup>2</sup> test was used as a test of significance, and differences were considered significant at P value less than 0.05.

## Results:

Table (1) illustrates the sociodemographic characteristics and BMI status of the studied elderly population. The table showed that mean age ( $\pm$  SD) was 70 ( $\pm$ 9.25) years, male to female ratio was 47.8 to 52.2, married were 62.3 while 33.3 were widow, illiteracy constitutes 54.3%, primary school literates were 23.9% and total of 91.3% had less than secondary education, about half (45.7%) were obese, 26.8% underweight and only 24.6% had normal weight.

Table (2) illustrates the percentage distribution of neurological diseases among the studied elderly population. The overall prevalence rate of neurological diseases observed in this study was 20.9%; the prevalence of stroke was 4.3%, parkinsonism was 3.6%, facial palsy 4.3%, headache syndrome was 6.5% and 2.1% previous nervous system surgery.

Table (3) illustrates the relationship between neurological diseases and socio-demographic characteristics in the studied elderly population. Headache, parkinsonism are more common in females but stroke is more in males. Headache is common in 60-69 years age group but parkinsonism and stroke are more common in 70-79 years age group. There is specific distribution with marital status.

Table (4) illustrates the relationship between neurological diseases and DM, obesity, hypertension and smoking history in the studied elderly population. Headache, parkinsonism and stroke are more in non diabetics than diabetics, in non obese than obese, non smokers and in non hypertensive studied elderly population.

Table (5) illustrates the relationship between neurological diseases and psychiatric diseases in the studied elderly population. Alzheimer's disease is not associated with neurological diseases, depression is associated with Stroke. No psychiatric diseases was associated with headache or parkinsonism in the studied elderly population.

**Table (1): sociodemographic characteristics and BMI status of the studied elderly population, Arar, 2016**

Age group	No. (n=138)	%
• 60-	90	65.2
• 70-	36	26.1
• 80+	12	8.7
Mean age ( $\pm$ SD)	70 $\pm$ 9.25	
Sex		
• Female	72	52.2
• Male	86	47.8
Marital status		
• Widow	46	33.3
• Single	3	2.2
• Married	86	62.3
• Divorced	3	2.2
Educational level		
• Illiterate	75	54.3
• Primary	33	23.9
• Preparatory	18	13.1
• Secondary or more	12	8.7
Working status		
• Shepherd	15	10.9
• House wife	21	15.2
• Military	3	2.2
• No work	53	38.4
• Retired	46	33.3
BMI (kg/m <sup>2</sup> ) status		
• Underweight	4	2.9
• Normal	34	24.6
• Overweight	37	26.8
• Obese	63	45.7
Mean BMI ( $\pm$ SD)	29.99 $\pm$ 9.73	
Psychological diseases		

• Depression	12	8.7
• Alzheimer's disease	4	2.9
• Obsessive compulsive disorder (OCD)	4	2.9

**Table (2): Percentage distribution of neurological diseases among the studied elderly population, Arar, 2016**

Neurological diseases	No.	%
<b>Yes</b>	<b>29</b>	<b>20.9</b>
• Headache syndrome	9	6.5
• Parkinson's Disease	5	3.6
• Stroke	6	4.3
• Facial palsy	6	4.3
• Previous nervous system surgery	3	2.1
<b>No</b>	<b>109</b>	<b>81.1</b>
Total	138	100.0

**Table (3): the relationship between neurological diseases and socio-demographic characteristics in the studied elderly population**

Variables	Neurological diseases				Total (138)	Chi-Square	P value
	Others* (n=118)	Headache ( n=9)	Parkinsonism (n=5)	Stroke (n=6)			
	No.(%)	No.(%)	No.(%)	No.(%)	No.(%)		
Sex							
• Female	62 (52.5)	6 (66.7)	3 (60.0)	1(16.7)	72(52.2)	3.91	0.27
• Male	56(47.5)	3(33.3)	2(40.0)	5(83.3)	66(47.8)		
Age group							
• 60 – 69	79(66.9)	8(88.9)	1(20.0)	2(33.3)	90(65.2)	9.68	0.138
• 70 – 79	29(24.6)	1(11.1)	3(60.0)	3(50.0)	36(26.1)		
• 80 +	10(8.5)	0	1(20.0)	1(16.7)	12(8.7)		
Marital status							
• Widow	40(33.9)	4(44.4)	1(20.0)	1(16.7)	46(33.3)	19.55	Non applicable
• Single	2(1.7)	1(11.1)	0	0	3(2.2)		
• Married	75(63.6)	4(44.4)	3(60.0)	4(66.7)	86(62.3)		
• Divorced	1(.8)	0	1(20.0)	1(16.7)	3(2.2)		

\* others include other neurological diseases and the participants without neurological diseases

**Table (4): The relationship between neurological diseases and DM, obesity, hypertension and smoking history in the studied elderly population**

Variables	Neurological diseases				Total (138)	Chi-Square	P value
	Others* (n=118)	Headache ( n=9)	Parkinsonism (n=5)	Stroke (n=6)			
	No.(%)	No.(%)	No.(%)	No.(%)	No.(%)		
DM							
• Yes	46(39.0)	2(22.2)	1(20.0)	2(33.3)	51(37.0)	1.697	0.637
• No	72(61.0)	7(77.8)	4(80.0)	4(66.7)	87(63.0)		
Obesity							
• Non obese	61(51.7)	5(55.6)	5(100.0)	4(66.7)	75(54.3)	4.907	0.179
• Obese	57(48.3)	4(44.4)	0	2(33.3)	63(45.7)		
Hypertension							
• Yes	56(47.5)	3(33.3)	1(20.0)	3(50.0)	63(45.7)	2.077	0.557
• No	62(52.5)	6(66.7)	4(80.0)	3(50.0)	75(54.3)		
Smoking history							



• No smoking	82(69.5)	6(66.7)	5(100.0)	2(33.3)	95(68.8)	9.523	0.146
• Smokers	7(5.9)	2(22.2)	0	1(16.7)	10(7.2)		
• Ex-smokers	29(24.6)	1(11.1)	0	3(50.0)	33(23.9)		

\* others include other neurological diseases and the participants without neurological diseases

**Table (5): the relationship between neurological diseases and psychiatric diseases in the studied elderly population**

Psychiatric diseases	Neurological diseases				Total (138)	P value
	Others* (n=118)	Headache (n=9)	Parkinsonism (n=5)	Stroke (n=6)		
Alzheimer's disease	4(3.4)	0	0	0	4(2.9)	Not applicable
Depression	8(6.8)	1(11.1)	0	3(50.0)	12(8.7)	
Obsessive compulsive disorder (OCD)	3(2.5)	0	0	1(16.7)	4(2.9)	
No psychiatric diseases	103(87.2)	8(88.8)	5(100.0)	2(33.3)	118(85.5)	

\* others include other neurological diseases and the participants without neurological diseases

## Discussion:

Ageing is inevitable and it is a concern of every one. Elderly life is full of problems- physical, social and economic. Older people are helpless and a disability is more likely to occur in the old age [13].

Neurological diseases considered a major concern because of its increasing frequency and serious consequences and related disability and dependency. The present study is a descriptive cross sectional survey, conducted to estimate the prevalence of neurological diseases, its types and determinants among the elderly population of Arar city, Kingdom of Saudi Arabia. In the Northern Province of Saudi Arabia, well-known cultural barriers to discussing sensitive issues, especially with strangers, exist. the information provided by the elderly would form a basis for more in-depth and large scale studies concerning neurological diseases in this vulnerable group in our region.

The present study showed that, the age of elderly ranges from 60-92 years with a mean age ( $\pm$  SD) was 70 ( $\pm$ 9.25) years, male to female ratio was 47.8 to 52.2. in southwest Saudi Arabia by Al-Modeer et al, the age of elderly ranges from 60-104 years with a mean of  $77.2 \pm 8.9$ . Most of the studied elderly (55.9%) were females [10]. In Al Rajeh et al., in a hospital that exclusively treated the Saudi Arabian National Guard hospital, the mean age of the patients was 63 ( $\pm$ 17) years [11]. In a study conducted on elderly in Dubai, United Arab Emirates, the gender ratio of the elderly patients in the study was 2.1 female: 1.0 male. the age of elderly ranges from 60-113 years with mean (SD) age was 78.77 (9.50) years [16].

In the present study, married were 62.3% while 33.3 were widow, illiteracy constitutes 48.6%, primary school literates were 19.6% and total of 76.2% had less than secondary education. In Ibrahim et al in Jeddah, widowed elderly represented about one- fifth (21.8 %) of the sample which is less than our figure. The majority of elderly (78.4 %) had less than secondary education which is consistent with our figure [14]. Khadervalli et al [15] in their study reported only 27% as illiterate and 31% as primary school literates, which is better than our figures.

The overall prevalence rate of neurological diseases observed in this study was 20.9% with no significant difference among both sexes. This results are comparable to other studies. For example, in Thugbah community in the Eastern Province of Saudi Arabia, Al Rajeh et al., reported overall prevalence rate of neurological diseases 13.1% which is more than our figure [12]. In Al Kharga District, New Valley, Egypt, the results revealed that the total prevalence rate of neurological disorders among elderly people (60+ years) was 9.25% with no significant difference among both sexes [8].

In our study the prevalence of stroke (4.3%) were more in males than females .

In Fayoum, Egypt study, the prevalence of stroke (2.8%) were more in males than females, this less than our finding [9]. In Al-Modeer study, Stroke was found in 34.9% of elderly, more in males than females (39.4% of males and 27.1% of females), which is far higher than our figure [10]. A stroke registry revealed 0.04% (0.03% males, 0.017% females) of first-ever strokes affecting Saudi nationals [5] which is far less than our figure. Al Rajeh et al., reported overall prevalence rate of stroke 1.8% which is also less than our figure [12]. In a study conducted in Dubai,

cerebrovascular accident affected 38.8% of the studied elderly, more prevalent in males than females which is consistent with our result but the figure is far higher than our figure [16].

In the present study the prevalence of parkinsonism was 3.6% were more in males than females. In in Southern Saudi Arabia, Al-Modeer study, parkinsonism was 4.3% (5.4% in males and 3.5% in females [10] which is consistent with our figure . Epidemiological studies of PD from 1985 to 2010, worldwide data showed a rising prevalence of PD with age 0.0173% in 55 to 64 years; 0.043% in 60 to 69 years; 0.04% in 65 to 74 years; 0.01% in 70 to 79 years; and 0.019% in older than age 80. Al Rajeh et al., reported overall prevalence of parkinsonism 0.27% which is also less than our figure [12]. In Asian population it was 0.065%. A significant difference in prevalence by sex [7] which is consistent with our finding but the figures are far less than ours. In Dubai study, parkinsonism was found in 17%, more in males than females (23.9% Vs.13.7%) [16]. These results are comparable with our results but the figures are higher than ours.

In our study the prevalence of headache syndrome was 6.5% was more in females than males. In Thugbah community in the Eastern Province of Saudi Arabia, Al Rajeh et al. [12], reported that, headache syndromes were the most prevalent disorder ( 20.7%). In Egyptian, Fayoum study, headache was found in 58.4%; 31% of males and 27.4% of females [9]. These results are not comparable with our results.

### Conclusion and recommendations:

In light of the results of the present study; neurological diseases were prevalent among elderly population in Arar city, Kingdom of Saudi Arabia. Commitment from decision makers is the first step to decrease the burden caused by neurological disorders and its sequel on that vulnerable group. Health education campaigns and initiatives are needed to increase societal and professional awareness of public health aspects of neurological disorders. Strategies to address the associated stigma and discrimination needs to be part of the public health activities for neurological disorders. Strengthening the preventive, curative and rehabilitation care within the existing health systems. Defining the priorities for research, is one of the important ways for dealing with neurological disorders among geriatric population. The above recommendations need to be implemented and appropriately adapted to local conditions of our region.

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### References:

1. P. Andlin-Sobocki, B. Jonsson, H.U. Wittchen, J. Olesen. Cost of disorders of the brain in Europe Eur J Neurol, 12 (Suppl. 1) (2005), pp. 1–27
2. WHO Neurological Disorders: Public Health Challenges
3. Merck Manual: Brain, Spinal Cord and Nerve Disorders
4. Butler, C (1 March 2005). "Neurological syndromes which can be mistaken for psychiatric conditions". *Journal of Neurology, Neurosurgery & Psychiatry*. 76 (suppl\_1): i31–i38. doi:10.1136/jnnp.2004.060459.
5. Al-Rajeh S. Larbi E.B. Bademosi O. Awada A. Yousef A. Al-Freih H. Miniawi H.g Stroke Register: Experience from the Eastern Province of Saudi Arabia. *Cerebrovasc Dis* 1998;8:86–89
6. Al Rajeh S.a · Awada A. Stroke in Saudi Arabia. *Cerebrovasc Dis* 2002;13:3–8
7. Pringsheim, T., Jette, N., Frolkis, A. and Steeves, T. D.L. (2014), The prevalence of Parkinson's disease: A systematic review and meta-analysis. *Mov Disord.*, 29: 1583–1590. doi:10.1002/mds.25945.
8. El Tallawy H.N.A. Farghaly W.M.A. Metwaly N.A. Rageh T.A. Shehata G.A. Elfetoh N.A. et al. Door-to-Door Survey of Major Neurological Disorders in Al Kharga District, New Valley, Egypt: Methodological Aspects. *Neuroepidemiology* 2010;35:185–190
9. Hassan SK. A Study of Morbidity Pattern among Geriatric Population in Fayoum Governorate, Egypt. *Journal of American Science* 2015;11(4).
10. Al-Modeer M, Hassanien S, Jabloun C. Profile of morbidity among elderly at home health care service in Southern Saudi Arabia (2013). *J Family Community Med*, 20(1):53-57.

11. Al Rajeh S, Awada A, Niazi G, Larbi E. Stroke in a Saudi Arabian National Guard community. Analysis of 500 consecutive cases from a population-based hospital. *Stroke*. 1993;24(11):1635–9.
12. Al Rajeh S, Bademosi O, Ismail H, Awada A, Dawodu A, al-Freihi H, Assuhaimi S, Borollosi M, al-Shammasi S. A community survey of neurological disorders in Saudi Arabia: the Thugbah study. *Neuroepidemiology*. 1993;12(3):164-78.
13. Balamurugan J, Ramathirtham G. Health problems of aged people, *IJRSS*, 2012 ; 2(3) : 139-150.
14. Ibrahim NK, Ghabrah TM, Qadi M. Morbidity profile of elderly attended/admitted in Jeddah health facilities, Saudi Arabia. *Bull High Inst Public Health*. 2005;35:173–90.
15. Khadervalli Nagoor et al Comparative study of health status among slum and non slum elderly population in Kadappa region South India *Journal of Evolution of Medical and Dental Sciences* 2014 Vol3 issue 5 Feb 03 pg 1298-1307.
16. Anood AlShaali Amal Al Jaziri. Health profile of elderly patients registered in the Elderly Home Based Primary Care, Dubai, United Arab Emirates. *Middle East Journal of Age and Ageing* Volume 12 Issue 1, February 2015.



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### RESEARCH ARTICLE

#### SPATIAL DIMENSIONS OF MULTIPLIERS IN SUMATRA ISLAND ECONOMY: AN INTER-REGIONAL INPUT-OUTPUT ANALYSIS.

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#### Abstract

This paper provides the results of analysis of total, sectoral-specific, and spatial-specific multipliers and flow-on effects in Sumatera Island economy. The model employed was Inter-Regional Input-Output Model (IRIOM) developed using new hybrid procedures with special attention on Island economy. Data used for model were updated Indonesian data for the year of 2015. The results show that firstly, the important sectors of Sumatera Island economy could be based on total multipliers and flow-on effects of output, income and employment. Secondly, important economic sectors could be based on sector-specific multipliers effects; multipliers that occurred in own sector and other sectors. Thirdly, important economic sectors could be based on spatial-specific multipliers; multipliers that occurred both in own region and other regions. Fourthly, important economic sectors could be based on spatial distribution of flow-on; flow-on effects that occurred in own region as well as in other regions.

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#### Introduction:-

Sumatra (Indonesian: *Sumatera*) is one of large island in Indonesia and the sixth-largest island in the world at 473,481 km<sup>2</sup>, including adjacent islands such as the Riau Islands and Bangka Belitung Islands. Sumatra is an elongated landmass spanning a diagonal northwest-southeast axis. The Indian Ocean borders the west, northwest, and southwest sides of Sumatra with the island chain of Simeulue, Nias and Mentawai bordering the southwestern coast. On the northeast side the narrow Strait of Malacca separates the island from the Malay Peninsula, an extension of the Eurasian continent. On the southeast the narrow Sunda Strait separates Sumatra from Java. The northern tip of Sumatra borders the Andaman Islands, while on the lower eastern side are the islands of Bangka and Belitung, Karimata Strait and the Java Sea (Wikipedia, 2016, <https://en.wikipedia.org/wiki/Sumatra>)

The ten administrative Provinces of Sumatra – including the smaller islands nearby – are: Nangroe Aceh Darussalam, a special province with Capital City Banda Aceh, North Sumatra with Capital City Medan, West Sumatra with Capital City Padang, Riau with Capital City Pekanbaru, Jambi with Capital City Jambi, South Sumatra with Capital City Palembang, Bengkulu with Capital City Bengkulu, Lampung with Capital City Bandar Lampung, Bangka-Belitung with Capital City Pangkal Pinang, and Riau Islands with Capital City Tanjung Pinang. Note some 4 million of these residents of Sumatra do not live on the island itself—but on nearby islands administered

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collectively as "Sumatra". The final two of the provinces below do not have territory on the actual island (Anonymous, 2015).

According to Prihawantoro, S., *etal* (2013), the main economic activities in Sumatra Island were Sector-1 Agriculture, livestock and fishery (Nangroe Aceh Darussalam, North Sumatra, West Sumatra, Jambi, Bengkulu, Lampung), Sector-2 Mining and quarrying (Riau Mainland, Riau Island, South Sumatra), Sector-3 Manufacturing (North Sumatra, Riau Mainland, South Sumatra, Bangka-Belitung), and Sector-6 Trade, hotel and restaurant (North Sumatra, Riau Island). Based on the statistical data by the year of 2013 which is released by Badan Pusat Statistik, Sumatra Island itself contributes at about 20% of Indonesia's Gross Domestic Product (Anonymous, 2015).

In macroeconomics, a multiplier is a factor of proportionality that measures how much an endogenous variable changes in response to a change in some exogenous variable (see among others: Dornbusch, R., & Stanley, F., 1994; McConnell, C., *et. al*, 2011; Pindyck, R & Rubinfeld, D., 2012). In monetary microeconomics and banking, the money multiplier measures how much the money supply increases in response to a change in the monetary base (see among others: Krugman & Wells 2009; Mankiw, 2008). Multipliers can be calculated to analyze the effects of fiscal policy, or other exogenous changes in spending, on aggregate output. Other types of fiscal multipliers can also be calculated, like multipliers that describe the effects of changing taxes (such as lump-sum taxes or proportional taxes).

Literature on the calculation of Keynesian multipliers traces back to Richard Kahn's (1931) description of an employment multiplier for government expenditure during a period of high unemployment. At this early stage, Kahn's calculations recognize the importance of supply constraints and possible increases in the general price level resulting from additional spending in the national economy (Ahiakpor, J.C.W., 2000). Hall (2009) discusses the way that behavioral assumptions about employment and spending affect econometrically estimated Keynesian multipliers.

The literature on the calculation of I-O multipliers traces back to Leontief (1951), who developed a set of national-level multipliers that could be used to estimate the economy-wide effect that an initial change in final demand has on an economy. Isard (1951) then applied input-output analysis to a regional economy. According to Richardson (1985), the first attempt to create regional multipliers by adjusting national data with regional data was Moore & Peterson (1955) for the state of Utah. In a parallel development, Tiebout (1956) specified a model of regional economic growth that focuses on regional exports. His economic base multipliers are based on a model that separates production sold to consumers from outside the region to production sold to consumers in the region. The magnitude of his multiplier is based on the regional supply chain and local consumer spending.

In a survey of input-output and economic base multipliers, Richardson (1985) notes the difficulty inherent in specifying the local share of spending. He notes the growth of survey-based regional input-output models in the 1960s and 1970s that allowed for more accurate estimation of local spending, though at a large cost in terms of resources. To bridge the gap between resource intensive survey-based multipliers and "off-the-shelf" multipliers, Beemiller (1990) of the BEA describes the use of primary data to improve the accuracy of regional multipliers. The literature on the use and misuse of regional multipliers and models is extensive. Coughlin & Mandelbaum (1991) provide an accessible introduction to regional I-O multipliers. They note that key limitations of regional I-O multipliers include the accuracy of leakage measures, the emphasis on short-term effects, the absence of supply constraints, and the inability to fully capture interregional feedback effects.

Three other papers on the general topic of the use and misuse of regional multipliers are briefly noted. Grady & Muller (1988) argued that regional I-O models that include household spending should not be used and argue that cost-benefit analysis is the most appropriate tool for analyzing the benefits of particular programs. Mills (1993) noted the lack of budget constraints for governments and no role for government debt in regional IO models. As a result, in less than careful hands, regional I-O models can be interpreted to over-estimate the economic benefit of government spending projects. Hughes (2003) discussed the limitations of the application of multipliers and provides a checklist to consider when conducting regional impact studies. Additional papers focus on the uses and misuse of regional multipliers for particular types of studies. Harris (1997) discussed the application of regional multipliers in the context of tourism impact studies, one area where the multipliers are commonly misused. Siegfried, *et al* (2006) discussed the application of regional multipliers in the context of college and university impact studies, another area where the multipliers are commonly misused. Input-output analysis, also known as the

inter-industry analysis, is the name given to an analytical work conducted by Leontief in the late 1930's. The fundamental purpose of the input-output framework is to analyze the interdependence of industries in an economy through market based transactions. Input-output analysis can provide important and timely information on the interrelationships in a regional economy and the impacts of changes on that economy.

The notion of multipliers rests upon the difference between the initial effect of an exogenous change (final demand) and the total effects of a change. Direct effects measure the response for a given industry given a change in final demand for that same industry. Indirect effects represent the response by all local industries from a change in final demand for a specific industry. Induced effects represent the response by all local industries caused by increased (decreased) expenditures of new household income and inter-institutional transfers generated (lost) from the direct and indirect effects of the change in final demand for a specific industry. Total effects are the sum of direct, indirect, and induced effects.

One of the major uses of input-output information is to assess the effect on an economy of changes in elements that are exogenous to the model of that economy. The capabilities and usefulness of the Leontief inverse matrix which is the source of analytical power of the model are well known. However, the meaning and interpretations are sometimes confusing. West & Jensen (1980) clarified the meaning of some of the components of the multipliers and suggested a multiplier format which is consistent and simpler to interpret but retains the essence of the conventional multipliers.

The objective of this paper is to report the research in developing and applying a model that provides information on multipliers: total, flow-on, sectoral-specific and spatial-specific, so they can further be used for planning and evaluating regional economic development in Sumatera Island.

### Method of Analysis:-

An inter-regional input-output model divides a national economy not only into sectors but also regions (Hulu, 1990 and West et.al, 1982; 1989). An industry in the Leontief model is split into as many regional sub-industries as there are regions. The table consists of two types of matrices representing the two types of economic interdependence. The first are the intra-regional matrices, which are on the main diagonal showing the inter-sectoral transactions which occur within each region. The second are the trade matrices, termed inter-regional matrices, representing inter-industry trade flows between each pair of regions. These matrices show the specific inter-industry linkages between regions, allowing each economic activity to be identified by industry as well as by location.

The inter-regional model can be expressed similar to the equations for the national as well as the single region model. In the general case:

$${}^rX_i = \sum_j \sum_s {}^{rs}X_{ij} + \sum_s {}^{rs}Y_i; (i, j = 1, 2, \dots, n) \text{ and } (r, s = 1, 2, \dots, m) \quad (1)$$

There are  $(m \times n)$  equations of this type for each sector in each region showing that the output of each sector is equal to the sales to all intermediate sectors in all regions plus sales to final demand in all regions.

The spatial input coefficients are derived in the same way as the direct input coefficients in the national or the single-region model. For region  $s$ , the spatial input coefficients are expressed as:

$${}^{rs}a_{ij} = {}^{rs}X_{ij} / {}^sX_j \quad (2)$$

Substituting (2) into (1):

$${}^rX_i = \sum_j \sum_s {}^{rs}a_{ij} {}^sX_j + \sum_s {}^{rs}Y_i; (i, j = 1, 2, \dots, n) \text{ and } (r, s = 1, 2, \dots, m) \quad (3)$$

Since equations (1) to (3) refer to general case, it is more convenient to refer specifically to each of the intra-regional and the inter-regional matrices:

$${}^rX_i = \sum_j {}^{rr}X_{ij} + \sum_j {}^{rs}X_{ij} + {}^rY_i; (i, j = 1, 2, \dots, n) \quad (4)$$

and

$${}^sX_i = \sum_j {}^{sr}X_{ij} + \sum_j {}^{ss}X_{ij} + {}^sY_i; (i, j = 1, 2, \dots, n) \quad (5)$$

From (4) and (5), it is possible to determine regionally defined input coefficients, according to the relevant intra-regional and inter-regional trade matrices:

$${}^{rr}a_{ij} = {}^{rr}X_{ij} / {}^rX_j \quad (6)$$

$${}^{rs}a_{ij} = {}^{rs}X_{ij} / {}^sX_j \quad (7)$$

$${}^{sr}a_{ij} = {}^{sr}X_{ij} / {}^rX_j \quad (8)$$

$${}^{ss}a_{ij} = {}^{ss}X_{ij} / {}^sX_j \quad (9)$$

Equations (6) and (9) present the familiar intra-regional direct input coefficients, while equations (7) and (8) represent inter-regional trade coefficients.

Equations (6) to (9) can be substituted into equation (4) and (5) resulting the traditional input-output equations:

$${}^rX_i = \sum_j {}^r a_{ij} {}^r X_j + \sum_j {}^r s_{aj} {}^s X_j + {}^r Y_i; (i, j = 1, 2, \dots, n) \quad (10)$$

and

$${}^sX_i = \sum_j {}^s a_{ij} {}^r X_j + \sum_j {}^s s_{aj} {}^s X_j + {}^s Y_i; (i, j = 1, 2, \dots, n) \quad (11)$$

The equations outlined above can be extended in parallel to the national or single region input-output system. In matrix terms they can be expressed as:

$${}^r x = {}^r A {}^r x + {}^r y \quad \text{or} \quad {}^r x = (I - {}^r A)^{-1} {}^r y \quad (12)$$

and

$${}^s x = {}^s A {}^s x + {}^s y \quad \text{or} \quad {}^s x = (I - {}^s A)^{-1} {}^s y \quad (13)$$

where  $(I - {}^r A)^{-1}$  and  $(I - {}^s A)^{-1}$  are the inverse of the open inter-regional model. In general term, equation (12) and (13) can be written as:

$$x = Ax + y \quad \text{or} \quad x = (I - A)^{-1} y \quad (14)$$

Since the regional input coefficients of equations (6) to (9) or the A matrix in equation (13) contains both technical and trade characteristics, Hartwick (1971) separated these input coefficients ( ${}^r s_{aj}$ ) into trade coefficients ( ${}^r t_{ij}$ ) and technical coefficients ( ${}^s a_{ij}$ ). This separation is essentially the same as one that has been done for the single region model. Equation (13) can then be rewritten as:

$$x = T(Ax + y) \quad \text{or} \quad x = (I - TA)^{-1} y \quad (15)$$

Method employed for constructing Indonesian Inter-regional Input-Output model was hybrid method that specified for studying Island economy of Indonesia. In this model, the regions were disaggregated into 5 regions, namely 5 big-group of Island, namely SUM for Sumatera Island, JAV for Java Island, KAL for Kalimantan Island, NUS for Nusa Tenggara Island and OTH for Other Island which includes Sulawesi, Maluku and Papua Islands. Meanwhile, economic activities were disaggregated into 9 economic sectors, namely: Sec-1 for Agriculture, livestock, forestry and fishery, Sec-2 for Mining and quarrying, Sec-3 for Manufacturing, Sec-4 for Electricity, water and gas, Sec-5 for Construction, Sec-6 for Trade, hotels and restaurants, Sec-7 for Transportation and communication, Sec-8 for Banking and other finance, and Sec-9: Other services.

The GIRIOT (Generation Inter-Regional Input-Output Tables) procedures proposed and developed by Muchdie (1998) and have been applied using Indonesian data for the year 1990 (Muchdie, 1998; 2011). The GIRIOT procedure consists of three stages, seven phases and twenty four steps. Stage I: Estimation of Regional Technical Coefficients, consists of two phases, namely Phase 1: Derivation of National Technical Coefficients and Phase 2: Adjustment for Regional Technology. Stage II: Estimation of Regional Input Coefficients, consists of two phases, namely Phase 3: Estimation of Intra-regional Input Coefficients, and Phase 4: Estimation of Inter-regional Input Coefficients, and Stage III: Derivation Transaction Tables, consists of three phases, namely Phase 5: Derivation of Initial Transaction Tables, Phase 6: Sectoral Aggregation, and Phase 7: Derivation of Final Transaction Tables. These procedures have been revisited, evaluated and up-dated using Indonesian data for the year 2015.

One of the major uses of input-output information is to assess the effect on an economy of changes in elements that are exogenous to the model of that economy. The capabilities and usefulness of the Leontief inverse matrix which is the source of analytical power of the model are well known. However, the meaning and interpretations are sometimes confusing. West & Jensen (1980) clarified the meaning of some of the components of the multipliers and suggested a multiplier format which is consistent and simpler to interpret but retains the essence of the conventional multipliers.

As a measurement of response to an economic stimulus, a multiplier expresses a cause and effect line of causality. In input-output analysis the stimulus is a change (increase or decrease) in sales to final demand. Similar to those in the single-region model, in the inter-regional model West *et.al*, (1982; 1989) defined the major categories of response as: initial, first-round, industrial-support, consumption-induced, total and flow-on effects. Formulas of such effects are provided in Table 1.

DiPasquale & Polenske (1980) specify four types of multipliers, in which two of them are relevant in the context of the inter-regional input-output model; sector-specific and region-specific multipliers. Table 2 provides formula for the calculation of both sector-specific and region-specific multipliers for output, income and employment. The inter-regional sector-specific multiplier expresses the inputs required from the whole economy to satisfy a unit expansion

of a named sector's exogenously determined final demand. The inter-regional region-specific multiplier quantifies the inputs required from all sectors in a specified region to satisfy the unit demand expansion in a given region.

**Table 1:-Component Effects of Output, Income and Employment Multipliers**

Effects	Output	Income	Employment
Initial	1	$h_i$	$e_i$
First-round	$\sum a_{ij}$	$\sum a_{ij} h_i$	$\sum a_{ij} e_i$
Industrial-support	$\sum b_{ij} - 1 - \sum a_{ij}$	$\sum b_{ij} h_i - h_i - \sum a_{ij} h_i$	$\sum b_{ij} e_i - e_i - \sum a_{ij} e_i$
Consumption-induced	$\sum (b^*_{ij} - b_{ij})$	$\sum (b^*_{ij} h_i - b_{ij} h_i)$	$\sum (b^*_{ij} e_i - b_{ij} e_i)$
Total	$\sum b^*_{ij}$	$\sum b^*_{ij} h_i$	$\sum b^*_{ij} e_i$
Flow-on	$\sum b^*_{ij} - 1$	$\sum b^*_{ij} h_i - h_i$	$\sum b^*_{ij} e_i - e_i$

**Source:** West, *et, al* (1982; 1989).

**Note:**  $h_j$  is household income coefficient,  $e_j$  is employment output ratio,  $a_{ij}$  is direct input coefficients,  $b_{ij}$  is the element of open inverse of Leontief matrix, and  $b^*_{ij}$  is the element of closed inverse Leontief matrix.

**Table 2:-Inter-regional Sector-Specific and Region-Specific Multipliers**

	Output	Income	Employment
Sector-Specific	$\sum^{rs} b^*_{ij}; r = 1,..m$	$\sum^{rs} b^*_{ij} h_i; r = 1,..m$	$\sum^{rs} b^*_{ij} e_i; r = 1,..m$
Region-Specific	$\sum^{rs} b^*_{ij}; i = 1,..n$	$\sum^{rs} b^*_{ij} h_i; i = 1,..n$	$\sum^{rs} b^*_{ij} e_i; i = 1,..n$

**Source:** DiPasquale & Polenske (1980).

**Note :**  $r$  and  $s$  are the  $m$  origin and destination regions,  $i$  and  $j$  are the  $n$  producing and purchasing sectors,  $^{rs}b^*_{ij}$  is the element of closed inverse of Leontief matrix,  $m$  is the number of regions and  $n$  is the number of sectors.

Formula provided in Table 1 and Table 2 were used to calculate total and flow-on multipliers, sector-specific multipliers and spatial-specific multipliers.

## Results and Discussion:-

### Total Multipliers and Flow-on:-

Table 3 present total output, income and employment multipliers and flow-on effects in Sumatra Island. In term of output, the highest output multipliers was SUM-4 (Electricity, water and gas), 2.761. It means that an increase of final demand of the sector by 1.000 would increase total output by 2.761 including the initial increase of 1.000. It was followed by SUM-9 (Other services), 2.542 meaning that an increase of final demand of that sector by 1.000 would increase total output by 2.542 including the initial increase of 1.000. The lowest total multipliers was in SUM-2 (Mining and quarrying), 1.241. An increase of final demand of that sector by 1.000 units would increase total output by 1.241 including the initial increase of 1.000. The flow-on effects of output were the difference between total increase and initial increase. Flow-on effect is summation of direct, indirect and induced effects of an economic activity. In case of highest total multipliers (SUM-4) the flow-on effect was 1.761, meaning the impact of increase of final demand of SUM-4 (Electricity, water and gas) to total output was 1.761 as the initial effect was not included. The rank of total output multipliers might be different than that of output flow-on effects. The evidence from Sumatra Island economy showed that the rank of total multipliers were the same as flow-on effects where SUM-4 (Electricity, water and gas) had the highest output flow-on effects, followed by SUM-9 (Other services) and the lowest value of output flow-on effects was SUM-2 (Mining and quarrying).

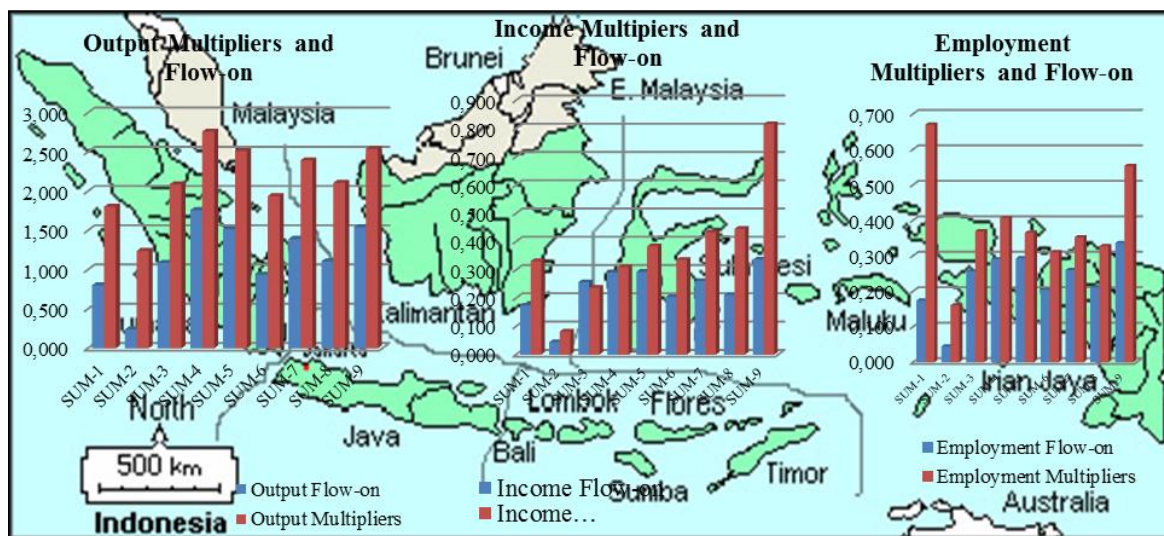
In term of household income, the highest total income multiplier was in SUM-9 (Other services), 0.815. It means that an increase of final demand of SUM-9 (Other services) by 1.000 units would increase initial household income by 0.553 and then would increase total income by 0.815. It was followed by SUM-8 (Banking and other finance) with total income multipliers of 0.445. The lowest total income multiplier was, again, in SUM-2 (Mining and quarrying) with total income multipliers of 0.082. Income flow-on effects were the difference between total income multipliers and initial income effects from the increase of final demand in that sector. It is the summation of direct, indirect and induced effects of an economic activity. For instance, in SUM-9 (Other services), the increase of final demand by 1.000 would have initial income effects by 0.553, resulting total income of 0.815. The income flow-on effect of SUM-9 (Other services) was 0.336. The highest income flow-on effect was in SUM-9 (Other services), followed by SUM-5 (Construction). The lowest income flow-on effect was in, again, SUM-2 (Mining and quarrying).



In term of employment, the highest total employment multiplier was in SUM-1 (Agriculture, livestock and fishery), 0.670. It means that an increase of final demand of SUM-1 (Agriculture, livestock and fishery) by 1.000 units would increase initial employment of SUM-1 (Agriculture, livestock and fishery) by 0.496 and then would increase total employment by 0.670. It was followed by SUM-9 (Other services) with total employment multipliers of 0.553. The lowest total employment multiplier was, again, in SUM-2 (Mining and quarrying) with total employment multipliers of 0.160. Employment flow-on effects were the difference between total employment multipliers and initial employment effects from the increase of final demand in that sector. It is the summation of direct, indirect and induced effects on employment from an economic activity. The highest employment flow-on was in SUM-9 (Other services), followed by SUM-5 (Construction). The lowest income flow-on effect was in, again, SUM-2 (Mining and quarrying).

**Table 3:-Multipliers and Flow-on Effects: Output, Income and Employment**

SECTOR	Output			Income			Employment		
	Initial	Flow-on	Total	Initial	Flow-on	Total	Initial	Flow-on	Total
SUM-1	1.000	0.804	1.804	0.203	0.174	0.331	0.496	0.174	0.670
SUM-2	1.000	0.241	1.241	0.039	0.044	0.082	0.116	0.044	0.160
SUM-3	1.000	1.088	2.088	0.087	0.256	0.237	0.113	0.256	0.369
SUM-4	1.000	1.761	2.761	0.091	0.290	0.310	0.116	0.290	0.406
SUM-5	1.000	1.515	2.515	0.165	0.293	0.383	0.063	0.293	0.356
SUM-6	1.000	0.939	1.939	0.176	0.204	0.335	0.106	0.204	0.310
SUM-7	1.000	1.395	2.395	0.182	0.260	0.433	0.092	0.260	0.352
SUM-8	1.000	1.108	2.108	0.243	0.211	0.445	0.116	0.211	0.327
SUM-9	1.000	1.542	2.542	0.553	0.336	0.815	0.217	0.336	0.553



**Figure 1:-Multipliers and Flow-on Effects: Output, Income and Employment**

#### Sector-Specific Multipliers:-

Table 4 and also Figure 2 provide sector-specific multipliers for output, income and employment in Sumatra Island economy. In term of output, there were 4 sectors in which multipliers occurred in own sector were less than 50 per cent, namely SUM-4 (Electricity, water and gas), SUM-5 (Construction), SUM-7 (Transportation and communication) and SUM-9 (Other services). Meanwhile, other 5 sectors in which multipliers occurred in own region were more than 50 per cent. These were: SUM-1 (Agriculture, livestock, forestry and fishery), SUM-2 (Mining and quarrying), SUM-3 (Manufacturing), SUM-6 (Trade, hotel and restaurant), and SUM-8 (Banking and other finance).

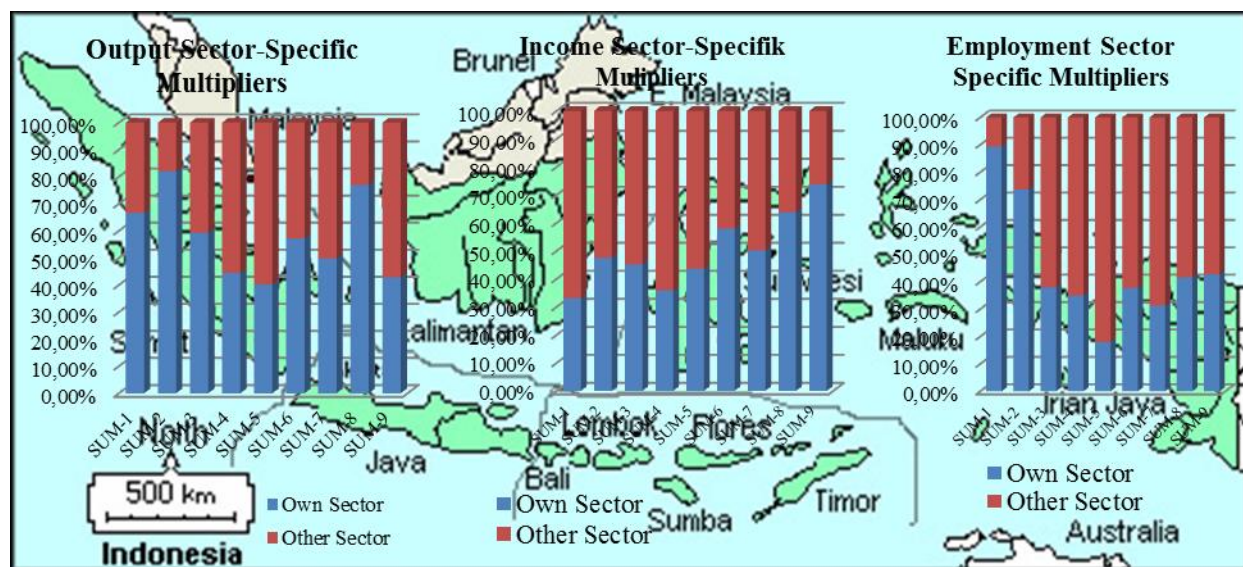
In term of income, there were 6 sectors in which multipliers occurred in own region were less than 50 per cent, namely SUM-1 (Agriculture, livestock and fishery), SUM-2 (Mining and Quarrying), SUM-3 (Manufacturing),

SUM-4 (Electricity, water and gas), SUM-5 (Construction) and SUM-7 (Transportation and communication). Meanwhile, other 3 sectors in which multipliers occurred in own region were more than 50 per cent. These sectors were: SUM-6 (Trade, hotel and restaurant), SUM-8 (Banking and other finance) and SUM-9 (Other services).

**Table 4:-Sector-Specific Multipliers: Output, Income and Employment**

SECTOR	Output			Income			Employment		
	Own Sector	Other Sector	Total	Own Sector	Other Sector	Total	Own Sector	Other Sector	Total
SUM-1	1.202	0.602	1.804	0.243	0.088	0.331	0.599	0.071	0.670
SUM-2	1.018	0.223	1.241	0.039	0.043	0.082	0.118	0.042	0.160
SUM-3	1.237	0.851	2.088	0.107	0.130	0.237	0.140	0.229	0.369
SUM-4	1.228	1.533	2.761	0.111	0.199	0.310	0.142	0.264	0.406
SUM-5	1.012	1.503	2.515	0.167	0.216	0.383	0.064	0.292	0.356
SUM-6	1.108	0.831	1.939	0.194	0.141	0.335	0.064	0.246	0.310
SUM-7	1.192	1.203	2.395	0.217	0.216	0.433	0.110	0.242	0.352
SUM-8	1.169	0.939	2.108	0.284	0.161	0.445	0.136	0.191	0.327
SUM-9	1.088	1.454	2.542	0.601	0.214	0.815	0.236	0.317	0.553

In term of employment, there were 7 sectors in which multipliers occurred in own sector were less than 50 per cent, namely SUM-3 (Manufacturing), SUM-4 (Electricity, water and gas), SUM-5 (Construction), SUM-6, SUM-7 (Transportation and communication), SUM-8 and SUM-9 (Other services). Meanwhile, only 2 sectors in which multipliers occurred in own sectors were more 50 per cent multipliers. These sectors were: SUM-1 (Agriculture, livestock, forestry and fishery), and SUM-2 (Mining and quarrying).



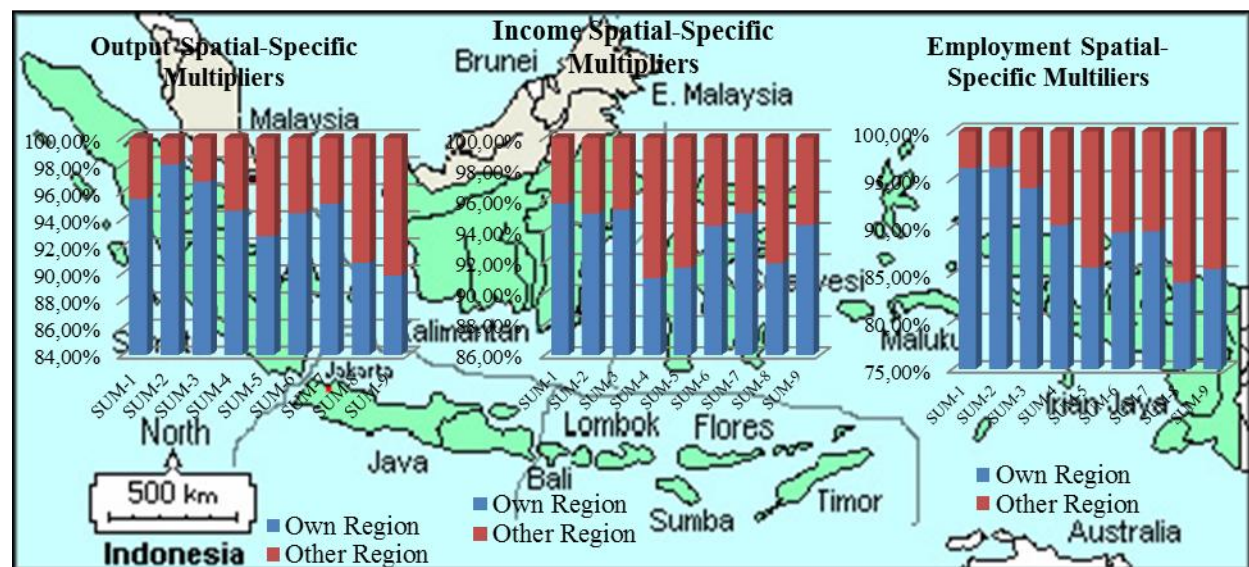
**Figure 2:-Sector-Specific Multipliers: Output, Income and Employment**

#### **Spatial-Specific Multipliers:-**

Table 5 and Figure 3 provide spatial-specific multipliers of output, income and employment multipliers in Sumatra. In term of output, all sectors had more than 50 per cent of multipliers that occurred in own region; in Sumatra Island. All sectors had less than 50 per cent of multipliers that occurred in other regions; other Islands. It applied for income. All sectors had more than 50 per cent of multipliers that occurred in own region; Sumatra Island. All sectors had less than 50 per cent of multipliers occurred in other regions; the rest of Indonesia. In term of employment, all sectors had more than 50 per cent of multipliers that occurred in own region; Sumatra Island. Again, all sectors had less than 50 per cent of multipliers that occurred in other regions; the rest of Indonesia.

**Table 5:-Spatial-Specific Multipliers: Output, Income and Employment**

SECTOR	Output			Income			Employment		
	Own Region	Other Region	Total	Own Region	Other Region	Total	Own Region	Other Region	Total
SUM-1	1.723	0.081	1.804	0.317	0.014	0.331	0.644	0.026	0.670
SUM-2	1.217	0.024	1.241	0.078	0.004	0.082	0.154	0.006	0.160
SUM-3	2.021	0.067	2.088	0.226	0.011	0.237	0.347	0.022	0.369
SUM-4	2.613	0.148	2.761	0.282	0.028	0.310	0.366	0.040	0.406
SUM-5	2.333	0.182	2.515	0.351	0.032	0.383	0.305	0.051	0.356
SUM-6	1.832	0.107	1.939	0.316	0.019	0.335	0.277	0.033	0.310
SUM-7	2.279	0.116	2.395	0.412	0.021	0.433	0.315	0.037	0.352
SUM-8	1.914	0.194	2.108	0.409	0.036	0.445	0.275	0.052	0.327
SUM-9	2.284	0.258	2.542	0.769	0.046	0.815	0.473	0.80	0.553

**Figure 3:-Spatial-Specific Multipliers: Output, Income and Employment****Spatial Distribution of Flow-on:-**

Flow-on effects are the difference between total effects (total multipliers) and initial effect. It consists of direct effects, indirect effect and induced effects of a change in final demand. As Table 3 and Figure 1 provided the total flow-on effects for every spatial sector in Sumatra Island, Table 6 and Figure 4 presents spatial distribution of flow-on effects in Sumatra Island economy. In term of output, all sectors had more than 50 per cent of flow-on occurred in own region. It means that, in all sectors, flow-on effects that occurred in other regions were less than 50 per cent. The highest output flow-on effect that occurred in other regions was in SUM-8 (Banking and other finance), followed by SUM-9 (Other services) and SUM-5 (Construction). The lowest output flow-on effect that occurred in other regions was in SUM-3 (Manufacturing).

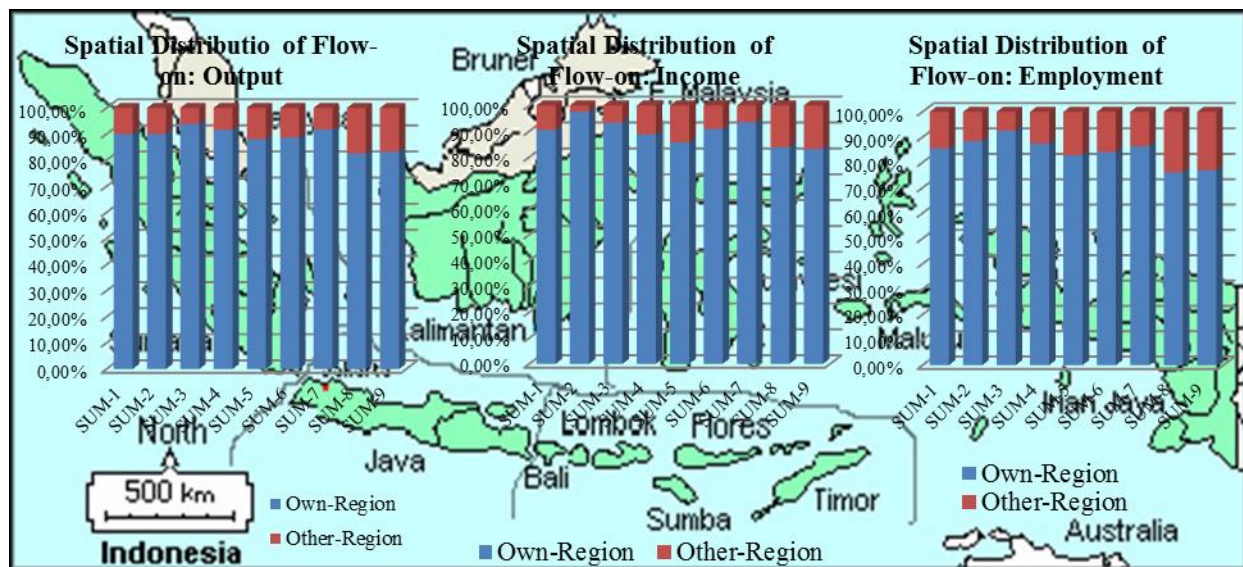
The same case also applies in income flow-on effects. All sectors had flow-on effects that more than 50 per cent of the flow-on occurred in own region. The flow-on effects that occurred in other regions were less than 50 per cent. The highest income flow-on effect that occurred in other regions was in SUM-9 (Other services), SUM-8 (Banking and other finance) and SUM-5 (Construction). The lowest income flow-on that occurred in other regions was in SUM-2 (Mining and quarrying).

In term of employment, again, all sector had employment flow-on that occurred in own region more than 50 per cent. All sectors had the flow-on effects that occurred in other regions were less than 50 per cent. The highest employment flow-on effect that occurred in other regions were in SUM-9 (Other services), SUM-8 (Banking and other finance) SUM-5 (Construction) and the lowest employment flow-on that occurred in other regions was in SUM-3 (Manufacturing).



**Table 6:-**Spatial Distribution of Flow-on: Output, Income and Employment

SECTOR	Output			Income			Employment		
	Own Region	Other Region	Total	Own Region	Other Region	Total	Own Region	Other Region	Total
SUM-1	90,00%	10,00%	0.804	90,50%	9,50%	0.128	85,50%	14,50%	0.174
SUM-2	90,00%	10,00%	0.241	97,50%	2,50%	0.043	88,40%	11,60%	0.044
SUM-3	93,80%	6,20%	1.088	93,30%	6,70%	0.150	92,50%	7,50%	0.256
SUM-4	91,60%	8,40%	1.761	88,80%	11,20%	0.219	87,40%	12,60%	0.290
SUM-5	88,00%	12,00%	1.515	85,70%	14,30%	0.218	82,90%	17,10%	0.293
SUM-6	88,60%	11,40%	0.939	90,90%	9,10%	0.159	84,20%	15,80%	0.204
SUM-7	91,70%	8,30%	1.395	93,50%	6,50%	0.251	86,40%	13,60%	0.260
SUM-8	82,50%	17,50%	1.108	83,80%	16,20%	0.202	76,10%	23,90%	0.211
SUM-9	83,30%	16,70%	1.542	83,10%	16,90%	0.262	76,90%	23,10%	0.336

**Figure 4:-**Spatial Distribution of Flow-on: Output, Income and Employment**Conclusion:-**

The conclusions could be drawn were: firstly, the important sectors of Sumatra Island economy could be based on total multipliers of output, income and employment. Based on total output multipliers, three important sectors in Sumatra Island economy were SUM-4 (Electricity, water and gas), SUM-9 (Other services) and SUM-5 (Construction). Based on total income multipliers, three important sectors in Sumatra Island economy were SUM-9 (Other services), SUM-8 (Banking and other finance) and SUM-7 (Transportation and communication). Based on total employment multipliers, three important sectors in Sumatra Island economy were SUM-1 (Agriculture, livestock, forestry and fishery), SUM-9 (Other services) and SUM-4 (Electricity, water and gas). Based on output flow-on effects, three important sectors in Sumatra Island economy were SUM-4 (Electricity, water and gas), SUM-9 (Other services), and SUM-5 (Construction). Based on income flow-on effects, three important sectors in Sumatra Island economy were SUM-9 (Other services), SUM-5 (Construction), and SUM-4 (Electricity, water and gas). Based on employment flow-on effects, three important sectors were SUM-9 (Other services), SUM-5 (Construction), and SUM-4 (Manufacturing).

Secondly, important economic sectors could be based on sector-specific multipliers effects. It could be based on the highest multipliers that occurred in own sectors. Based on output sector-specific multipliers that occurred in own sector, three important sectors were SUM-2 (Mining and quarrying), SUM-1 (Agriculture, livestock, and fishery) and SUM-3 (Manufacturing). Based on income sector-specific multipliers that occurred in own sectors, three important sectors were SUM-9 (Other services), SUM-1 (Agriculture, livestock and fishery) and SUM-8 (Banking and other finance). Based on employment sector-specific multipliers that occurred in own sector, three important sectors were

SUM-1 (Agriculture, livestock and fishery), SUM-2 (Mining and quarrying) and SUM-6 (Trade, hotel and restaurant).

Thirdly, important economic sectors could be based on spatial-specific multipliers. It could be based on the highest multipliers that occurred in own regions; in Sumatra Island. Based on output spatial-specific multipliers that occurred in own region, three important sectors were SUM-2 (Mining and quarrying), SUM-8 (Banking and other finance) and SUM-6 (Trade, hotel and restaurant). Based on income sector-specific multipliers that occurred in own region, three important sectors were SUM-9 (Other services), SUM-8 (Banking and other finance) and SUM-6 (Trade, hotel and restaurant). Based on employment spatial-specific multipliers that occurred in own region, three important sectors were SUM-1 (Agriculture, livestock and fishery), SUM-6 (Trade, hotel and restaurant) and SUM-8 (Banking and other finance).

Fourthly, important economic sectors could be based on spatial distribution of flow-on. It could be based on the highest flow-on that occurred in own regions; in Sumatra Island. Based on output spatial distribution of low-on that occurred in own region, three important sectors were SUM-8 (Banking and other finance), SUM-9 (Other services) and SUM-6 (Trade, hotel and restaurant). Based on income spatial distribution of low-on that occurred in own region, three important sectors were SUM-8 (Banking and other finance), SUM-9 (Other service) and SUM-6 (Trade, hotel and restaurant). Based on employment spatial distribution of flow-on that occurred in own region, three important sectors were SUM-3 (Manufacturing), SUM-8 (Banking and other finance) and SUM-6 (Trade, hotel and restaurant).

## References:-

1. Anonymous, 2015, Statistik Indonesia 2014, Badan Pusat Statistik, Jakarta.
2. Ahiakpor, J.C.W. (2000). Hawtrey on the Keynesian Multiplier: A Question of Cognitive Dissonance? History of Political Economy. 32 (4): 889-908.  
<https://muse.jhu.edu/article/13245/pdf>
3. Beemiller, R.M. (1990). Improving Accuracy by Combining Primary Data with RIMS: Comment on Bourque. International Regional Science Review, 13 (1-2):99-101.  
<http://journals.sagepub.com/doi/abs/10.1177/016001769001300107>
4. Coughlin, C. and Mandelbaum, T.B. (1991). A Consumer's Guide to Regional Economic Multipliers. Federal Reserve Bank of St. Louis Review. January/February 1991.19-32.  
<https://research.stlouisfed.org/publications/review/1991/01/01/a-consumers-guide-to-regional-economic-multipliers/>
5. DiPasquale, D. and Polenske, K.R. (1980). Output, Income and Employment Input-Output Multipliers in S. Pleeter. (Ed). Economic Impact Analysis: Methodology and Applications. Studies in Applied Regional Science. Boston: Martinus Nijhoff Publishing: 85-113.
6. Dornbusch, R. and Stanley, F. (1994). Macroeconomics. Sixth Edition. International Edition. McGraw-Hill.
7. Grady, P. and Muller, R., A. (1988). On the use and misuse of input-output based impact analysis in evaluation. The Canadian Journal of Program Evaluation. 2 (3): 49-61.  
[https://www.researchgate.net/publication/43126426\\_On\\_The\\_Use\\_and\\_Misuse\\_of\\_Input-Output\\_Based\\_Impact\\_Analysis\\_in\\_Evaluation](https://www.researchgate.net/publication/43126426_On_The_Use_and_Misuse_of_Input-Output_Based_Impact_Analysis_in_Evaluation)
8. Hall, R. E. (2009). By How Much Does GDP Rise if the Government Buys More Output? NBER Working Paper 15496. National Bureau of Economic Research.  
[www.nber.org/papers/w15496.pdf?new\\_window=1](http://www.nber.org/papers/w15496.pdf?new_window=1)
9. Harris, P. (1997). Limitations on the use of regional economic impact multipliers by practitioners: An application to the tourism industry. The Journal of Tourism Studies. 8(2): 1-12.  
<http://docplayer.net/14498955-Limitations-on-the-use-of-regional-economic-impact-multipliers-by-practitioners.html>
10. Hughes, D. W. (2003). Policy uses of economic multipliers and impact analysis. Choices Publication of the American Agricultural Economics Association, Second Quarter.  
<http://www.choicesmagazine.org/2003-2/2003-2-06.htm>
11. Hulu, E. (1990). Model Input-Output: Teori dan Aplikasinya (*Input-Output Model: Theory and Its Applications*). Pusat Antar Universitas-Studi Ekonomi (*Inter-University Centre-Economics*) Jakarta: Universitas Indonesia (*the University of Indonesia*).

12. Isard, W. (1951). Inter-regional and Regional Input-Output Analysis: A Model of a Space-Economy. *Review of Economics and Statistics*. 33(4): 318-328.  
<http://www.jstor.org/stable/1926459>
13. Kahn, R. (1931). The Relation of Home Investment to Unemployment. *Economic Journal*. 41(162):173-198.  
<http://dx.doi.org/10.2307/2223697>
14. Krugman, P., and Wells, R. (2009). *Economics*, Worth Publisher, p: 1200, Chapter 14: Money, Banking, and the Federal Reserve System: Reserves, Bank Deposits, and the Money Multiplier: 393–396.  
[http://bcs.worthpublishers.com/webpub/economics/krugmanwellsmacro3/Solutions%20Manual/KrugWellsECP S3e\\_Macro\\_CH14.pdf](http://bcs.worthpublishers.com/webpub/economics/krugmanwellsmacro3/Solutions%20Manual/KrugWellsECP S3e_Macro_CH14.pdf)
15. Leontief, W.W. (1951). *The Structure of American Economy 1919-1939*. Second Edition, Cambridge: Harvard University Press.  
<http://www.wleontief.ru/eng/40.html>
16. Mankiw, N.G. (2008). *Macroeconomics*, Eight Edition, South-Western Publishing, Part VI: Money and Prices in the Long Run: The Money Multiplier:347–349.  
[https://www.academia.edu/15354353/Mankiw\\_macro\\_economics\\_8th\\_edition](https://www.academia.edu/15354353/Mankiw_macro_economics_8th_edition)
17. McConnell, C, Brue, S, and Flynn, S. (2011). *Macroeconomics*. McGraw-Hill Series Economics, 19th Edition. ISBN-13: 978-0077337728, ISBN-10: 0077337727.  
<https://www.amazon.com/Macroeconomics-McGraw-Hill-Economics-Campbell-McConnell/dp/0077337727>
18. Mills, E. C. (1993). The Misuse of Regional Economic Models, *Cato Journal*, 13(1): 29-39.  
<https://ideas.repec.org/a/cto/journal/v13y1993i1p29-39.html>
19. Moore, F.T, and Petersen, J. (1955). Regional Analysis: An Inter-industry Model of Utah. *Review of Economics and Statistics*, 37: 368-383.  
[http://www.jstor.org/stable/1925851?seq=1#page\\_scan\\_tab\\_contents](http://www.jstor.org/stable/1925851?seq=1#page_scan_tab_contents)
20. Muchdie, (1998), *Spatial Structure of Island Economy of Indonesia: An Inter-Regional Input-Output Study*, unpublished PhD Thesis, Department of Economics, the University of Queensland, Australia.  
<http://espace.library.uq.edu.au/view/UQ:218710>
21. Muchdie,(2011), *Spatial Structure of Island Economy of Indonesia: A New Hybrid for Generation Inter-regional Input-Output Tables*, Lambert Academic Publishing, Germany, ISBN 978-3-8454-1847-6.  
<http://repository.uhamka.ac.id/139/>
22. Pindyck, R. and Rubinfeld, D. (2012). *Macroeconomics*. The Pearson Series in Economics, 8th Edition, ISBN-13:978-0132857123, ISBN-10: 013285712X  
<https://www.amazon.com/Microeconomics-Student-Value-Pearson-Economics/dp/0132870436>
23. Prihawantoro, S., Irawan Suryawijaya, Ramos Hutapea, Ugay Sugarmansyah, Alkadri, Wawan Rusiawan, dan Muhammad Yorga Permana. (2013). *Peranan Teknologi Dalam Pertumbuhan Koridor-Koridor Ekonomi Indonesia: Pendekatan Total Factor Productivity (The Role of Technology in Economic Growth in Indonesian Economic Corridors: Total Factor Productivity Approach)*. Jakarta: Badan Pengkajian dan Penerapan Teknologi.
24. Richardson, H.W. (1985). Input-Output and Economic Base Multipliers: Looking Backward and Forward. *Journal of Regional Science*. 25 (4): 607-661.  
<http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9787.1985.tb00325.x/abstract>
25. Siegfried, J, Allen R., Sanderson, A.R., and McHenry, P. (2006). *The Economic Impact of Colleges and Universities*. Working Paper No. 06-W12.  
<http://www.accessecon.com/pubs/VUECON/vu06-w12.pdf>
26. Tiebout, C.M. (1956). A Pure Theory of Local Expenditures. *The Journal of Political Economy*. 64(5): 416-424. <http://www.jstor.org/stable/1826343>
27. West, G.R, and Jensen, R.C. (1980). Some Reflections on Input-Output Multipliers. *Annals of Regional Science*. 14 (2): 77-89.  
[https://www.researchgate.net/publication/226244596\\_Some\\_Reflections\\_on\\_Input-Output\\_Multipliers](https://www.researchgate.net/publication/226244596_Some_Reflections_on_Input-Output_Multipliers)
28. West, G.R., and Jensen, R.C., Cheeseman, W.E., Bayne, B.A., Robinson, J.J., Jancic, H., and Garhart, R.E., 1989, *Regional and Inter-regional Input-Output Tables for Queensland 1985/86*, Report to the Queensland Treasury Department, Department of Economics, University of Queensland, St. Lucia.  
<https://www.library.ohiou.edu/indopubs/2001/08/25/0033.html>
29. West, G.R., Morison, J.B. and Jensen, R.C., 1982, *An Inter-regional Input-Output Table for Queensland 1978/79: GRIT III*, Report to the Department of Commercial and Industrial Development, Department of Economics, University of Queensland, St. Lucia.
30. Wikipedia, 2016, Sumatra. <https://en.wikipedia.org/wiki/Sumatra>



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### RESEARCH ARTICLE

## THE DRAMA OF AUGUST WILSON: FENCING A NEW IDENTITY IN AFRICAN AMERICAN THEATRICAL IMAGINATION.

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### Abstract

What is the image of the Black in contemporary American society, and how is it represented in drama, a form of artistic expression where African American voice has long been silenced by stereotypes and editorial marginality? This is the question which black playwright August Wilson tries to answer in an unusual theatrical production. Gifted with a talent for catching dialect and accents, which ironically contributed to fight down his image and voice in American drama, Wilson enriches his pieces with his poetical skills he learned to use in his early days as artist. He notably shows that the African American destiny is open to other possibilities than what the racist society offered. More specifically in *Fences* (1986), he shows that the African American can find wholeness if he accepts to work hard and uses his rich cultural heritage. These, he says, are what will make him a responsible person.

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### Introduction:-

Poet, essayist, multiple-prize winner including the Pulitzer Prize, Bush, McKnight, Rockefeller, and Guggenheim Foundation fellowship in playwriting, most of the adepts in African American literature present August Wilson as the first American playwright of African descent to have two plays running simultaneously on Broadway in late 1980s. And yet, nothing would have permitted to imagine African American drama at such a high level, at least before 1923 when a play produced by an African American playwright got performed in Broadway. As I have mentioned in a precedent work, a number of historical factors acted as hindrance to African American theatrical creativity. Among these, we have slavery and the conditions implied by it, that is, racist marginalization, lack of financial and editorial supports, and the stereotypes implied by the nature of drama as a genre used by white mainstream theatre to denigrate the image of the Black through minstrelsy and dialect poetry<sup>1</sup>. With an artistry which came to age in the 1970s and 1980s, Wilson has brought his work out of these mockeries and limitations; more than that, it has given a revitalized expression to black theatrical performance.

How significant is Drama to August Wilson who is reported to have started his literary career in poetry? What are the main issues developed in his work, and how does this personal artistry contribute to the enhancement of the African American in American theatrical development?

<sup>1</sup> - For further details on the African American's participation to American drama see: Kouamé SAYNI, "The African American Theatrical Expression in the USA: A Crippled Quest for Identity", *Particip'Action*, Vol 9, Janvier 2017 (97-110)

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This paper is an evaluation of African American drama through the work produced by August Wilson; it is the second of this kind of exercise which is meant to examine the development of American theatre in general, and African American play writing in particular with a focus on *Fences* (1986), Wilson's second major play. *Fences* (1986) tells the story of Troy Maxson, an ex-baseball player who is now obliged to work as a garbage collector because of the racism which crushed his dream of success in sports. Frustrated, he has decided to reshape the life of his family within the limits of a fence he wants to build to keep his household from the harm of society. In our work, we will first make an overview of Wilson's literary career, and take opportunity to expose his vision in play writing. Second, we will focus on *Fences* (1986), with the aim to probe in the significance of fence building.

## I/ An Overview of Wilson's Work

### a- From Poetry to Drama: Black Cultural and Historical Experience in Print

August Wilson is known as one of the most prominent African American playwrights today; but in reality his writing career was deeply inspired by the rising movement of black consciousness of the 1960s. This social, cultural, and political movement illustrated itself in poetry with more vitality than in other forms of literary production. This is not because poetry was more important than other forms of writings, but simply because it was the genre mostly used to echo the sentiment of Blacks to their cultural and historical heritage. For Wilson, two main events stimulated his poetical creativity. First, his involvement in the Black Power Movement which was the political expression of black consciousness; and second, his hearing of a record by black singer Bessie Smith, in 1965 which, he said, triggered his awareness that "I was a representative of a culture and the carrier of some very valuable antecedents"<sup>2</sup>.

These two events, and especially his connection with the black revolutionary aesthetic, inspired his writing of poems he dedicated to the leaders of the movement. One of these titles is "For Malcolm X and Others" which appeared in *Negro Digest* in September 1969; and another one devoted to the singer was entitled "Bessie" and got published in *Black Lines* in the summer of 1971. In 1973, Wilson wrote "Morning Statement", a poem he often cited as evidence of his mastery of his craft, and his poem "Theme One: The Variations" was included in the anthology *The Poetry of Black America* (1973).

During this time of poetic writing, Wilson also collaborated in drama projects. For example, he helped found the Black Horizons Theatre Company in Pittsburgh. But it was his move to St Paul, Minnesota in the early 1970s which served as a catalyst, permitting his skills as a dramatist to come to the fore. "St Paul" he said, "was a different environment from Pittsburgh". (Hilary DeVries, 1989, 25) Still, Wilson did not conceive of himself as a playwright until he received the first of several writing grants. After submitting an earlier play *Jitney* to Minneapolis's playwrights Center, he was granted a Jerome Foundation Fellowship in the 1970s. "I walked in and there were 16 playwrights," Wilson remembers about that grant. "It was the first time I had dinner with other playwrights. It was the first time I began to think of myself as one"<sup>3</sup>. This grant, two hundred dollars a month for a year, afforded Wilson the opportunity to re-work a previously written one-act play about a blues recording session into what became the full-length *Ma Rainey*, his first play which was accepted by the O'Neill Theatre center. When this play opened on Broadway at the Cort Theatre in 1984, it brought Wilson critical acclaim and launched his theatrical career.

Wilson published four other plays –*Fences* (1986), *Joe Turner's Come and Gone* (1984), *The Piano Lesson* (1990), *Two Trains Running* (1989) — which contributed to the confirmation of his skill as well as his fame on the national and international scene of drama. In 1988, Wilson became the first black dramatist to have two plays running concurrently on Broadway: *Fences* and *Joe Turner*.

### b- An Innovative Voice in Drama:-

When we consider the particular circumstances that determine the development of Drama in black artistic expression, August Wilson appeared as an exceptional playwright. Challenging American social and political norms, Wilson wanted to make of his theatrical artistry, one that expresses a totally new vision. First, because he had a potential in writing poetry, he used this competence as venue for play writing. In conditions marked by stereotypes and editorial marginality, the form of literary expression which had served to frame Blacks' skill in art was worth using to survive racist censorship.

<sup>2</sup> - Hilary DeVries, "The Drama of August Wilson", *Dialogue*, n° 1 1989, pp. 24

<sup>3</sup> - Bonnie Lyons, George Plimpton, "August Wilson, The Art of Theater", *The Paris Review*, n° 14, Winter 1999, 13-19



The second major impetus to Wilson's theatrical performance was the growing consciousness about black culture and history in the 1960s. In the boiling period of black consciousness, literature was the principal vehicle of the black voice in the American society. And for writers like Wilson, the main instrument which gave expression to this voice was black traditional culture and heritage. Wilson described his artistic agenda as an attempt to concretize black American tradition, to demonstrate how that tradition "can sustain a man once he has left his father's house"<sup>4</sup>. Indeed the theme that surges through his work is the need for black Americans to forge anew their identity, an identity that is at once African and American. And the main venue for this identity to blossom is in literary works where Wilson illustrated himself through such pioneer pieces as *Rite of Passage*, *Recycle*, and *The Homecoming* most of which were unpublished until the 1980s. Showing his concern for incorporating traditional black art forms and the lives of African American icons into his work, these early works were the ones which sharpened Wilson's skills into making his most serious plays like *Ma Rainey*, *Fences*, and *Joe Turner*. In 1977, Wilson wrote *Black Bart and the Sacred Hills*, a musical satire based on a group of poems about an outlaw of the Old West. Most critics consider this to be Wilson's serious theatrical debut; the play was produced in St Paul (Minnesota) in 1981.

Apart from these early works, the next major plays function according to a systematic project: each of them is set in a different decade starting from 1900 to the late 20<sup>th</sup> century. The idea, to paraphrase his vision about this writing project, is to take each decade and look back at one of the most important question that Blacks are confronted with, write a play about it. "Put them together", he says "and you have a history" (Bonnie Lyons, 1990, p.15). It is such a history that shapes each of the plays in what is known as "century cycle" or "ten-play cycle". For the purpose of concision, we will give an overview of the most common of these plays.

*Ma Rainey's Black Bottom* (1982), the first of this ten-play cycle was the real work of art which established Wilson's fame as a writer and a playwright. Set in the 1920s, the play looks at the economic exploitation of black musicians by white record companies and at the ways in which victims of racism were forced to direct their rage to each other rather than at their oppressors. The reading of the book brings out the pertinent question of identity through the notion of responsibility, which is also the core issue in the next books of the author. Concretely, the tension created by the characters' struggle for recognition ends in a violent conclusion. Ma, the recording star, knows the limits of her commercial success, admitting, "It's just like I been a whore". (*Ma Rainey*, 1982, p.35) The elderly pianist, Toledo, is an African nationalist who argues: "We done sold ourselves to the white man in order to be like him" (*Ma Rainey*, 1982, p.41). Levee, the headstrong trumpeter, is intent on making it in the white world, on seeing his name in lights. In the impossibility to confront his white oppressor, Levee inexorably takes it against his own people. Wilson describes Levee's condition in a rhetorical question: "How can I live this life in a society that refuses to allow me to contribute to its welfare?" Through this question that Levee puts in the play, one can perceive the notion of participation, the problem of one's place or responsibility in society. In 1984, *Ma Rainey* (1982) opened on Broadway at the Cort Theatre, bringing Wilson critical acclaim and launching his theatrical career. (Marilyn Elkins, 1997, p.782)

Coming in the third position in the list of Wilson's "Pittsburgh cycle", *Joe Turner's Come and Gone* (1984) deals with the same question of responsibility which is central to his work. Written in 1984, this play is considered as Wilson's favorite. It deals with the personal and cultural development of slavery and the black migration as one can see their manifestations in Pittsburgh. The desperate situation of people of African descent, trapped in sport and music as the only two possibilities left to them, leads them to turn back to their ancestral heritage as an alternative to failure in American society. As Wilson states, "if black folks would recognize themselves as Africans and not be afraid to respond to the world as Africans, then they could make their contribution to the world as Africans" (Hilary DeVries, 1989, p.24) This is what the protagonist Loomis chooses to do in *Joe Turner*, and so do the other leading figures in the subsequent plays. The story is set in 1911 and is imbued with African ancestral materials like ghosts, myths and spells, which become the basis for Loomis's search.

The framing of Black's identity is also central in *Fences* (1986), another important component of the cycle, which is going to be the focus of the next section of this study.

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<sup>4</sup> - Marilyn Elkins, "August Wilson", *The Oxford Companion to African American Literature*, New York, Oxford Univ. Press, 1997, 781-783

## II/ Fences (1986): Protection and Responsibility in African American Community

### a- The Metaphor of Separation from External Assaults

*Fences* (1986) is considered as the most popular of Wilson's plays, because of the huge critical response it received and the number of prizes it won compared to *Joe Turner* (1984) or *The Piano Lesson* (1990) which drew no less critical acclaim. But this multiple prize winning play chiefly consolidated its supremacy in the American and world theatre readership with the theme and the main setting of the story it represents: the heating period of the late 1950s and early 1960s. Perhaps the historical setting, that's to say, the increasing tension of the decade was influential in keeping *Fences* (1986) to the "hit" of the American theatrical production, more than the Pulitzer, or the John Gassner Outer Critics' Circle Award for Best American Playwright, to cite only two of the high ranked prizes the play brought to Wilson. And from this point of view, the title *Fences* is evocative of the social situation since it illustrates the fracture that existed in the American society in 1957, a society symbolized by the small unnamed city that bears all the traits of a Pittsburgh local town.

Troy Maxson, an African American garbage man, former prisoner and baseball player is in constant opposition with his family members, especially his sons who want to seize the only opportunity that the racially-ostracized society offered to them in the late 1950s. Cory, his younger son is offered a scholarship to integrate a training school for a football career. But Troy refuses to sign the papers because he is skeptical about the future of a black sportsman in the racist American social setting. As the type of father-son relationship crystallizes the story of Wilson's play, the reader—or spectator— notices that this relationship is strongly influenced by the racial tension that bowls along the streets during the late 1950s. As the play opens on a ritual scene of talk and drink between Troy Maxson and Bono his colleague and friend on a Friday night, it is the issue of racial inequality which dominates the conversation between the two friends:

**Troy:** I ain't worried about them firing me. They gonna fire me cause I asked a question? That's all I did. I went to Mr. Rand and asked him, "why?" why you got the white mens driving and the colored lifting?" Told him, "what's the matter, don't I count? You think only white fellows got sense enough to drive a truck. How come you got all whites driving and the colored lifting? He told me "take it to the union." Well, hell, that's what I done! (*Fences*, 2-3)

At a moment when the movement of desegregation had broken out with such resistant actions as Rosa Park's refusal to give her seat to white voyagers in Alabama public transport company in 1955, Troy Maxson's claim for equality in the distribution of tasks in the garbage company captures the general atmosphere of racial suspicion and vigilance. As a worker and active militant in their corporate union, Troy wants equal treatment. He protests against the fact that only white workers are posted in the position of driving the truck while blacks are assigned to lifting the rubbish. It is this injustice, basically nourished by racist hatred, which pushes him to complete the building of a fence around his house. The ancient two-story brick house Troy lives in with his family is "partially fenced" which means that the small dirty yard and his household are clearly exposed to the outward world. This seems absolutely unacceptable to Troy because of the potential danger the outside racist world represents to his family.

As an ex-con man and former player in the Negro Baseball League, Troy sees his life as a failure, because the racism in American institutions did not allow him to give full expression to his performances and benefit from his status as talented sportsman. Frustrated, he is not ready to expose his household to the same assault from that world; this is, to a large extent, the significance of this fence he is trying to build in his partially protected yard. The first person of the family that he intends to protect from the outside racist assault is Cory, his youngest son. Cory has been recruited in a football school and Troy is supposed to sign the paper authorizing him to join the team. To Rose, Troy's wife, who has been playing the mediator in convincing him to sign the papers of the recruiter, he replies: "The white man ain't gonna let him get nowhere with that football" (p.8). Later, upon her insistence, he burst out almost breathlessly:

I don't want him to be like me! I want him to move as far away from my life as he can get. You the only decent thing that ever happen to me. I wish him that. But I don't wish him a thing else from my life. I decided seventeen years ago that boy wasn't getting involved in no sports. Not after what they did to me in the sports. (*Fences*, p.39)

The experience that Troy had had as a baseball player was visibly painful from what we can read of his answers to Rose. He admits that though he had been a talented player in the past, and even if he was as good as the most

talented players like Babe Ruth and Josh Gibson, sports hadn't given him "a pot to piss in or a window to throw it out of" (p.9). This poor experience was caused, according to him, by the racist sentiment of white sports leaders who would not give colored players the same chance they gave whites: "they got colored on the team and don't use them. ...All them teams the same" (p.34) For Troy, thus, it is time to protect the "only decent thing that ever happen to [him]", and it becomes clear that he will use the fence which is being erected as protection, even if he is not fundamentally aware of Rose's motives for building it.

And yet there seems to be no doubt about the role of that fence as Bono unequivocally states: "Some people build fences to keep people out... and other people build fences to keep people in. Rose wants to hold on to you all. She loves you" (p.61). While the fence is supposed to protect Troy's family from white world racism, Bono senses it to be a barrier that is meant to safeguard Rose's love. This perspective developed by Troy's friend gives more than a symbolic character to the fence since Troy has been unfaithful to his wife and he is aware of it. Whenever he has had time to mention it with his friend, Bono has warned him about the possible danger of his unfaithful relation with Alberta, Troy's lover. Having the fence built is for Rose a kind of premonition, the necessity to anticipate an unpleasant interference in her marital life with Troy. Unfortunately, the completion of the fence comes up late, because Troy has already been with his lover for a long time and by the moment he reveals it to Rose, it is to inform her that he is "gonna be a daddy" (p.66) If for Rose the significance of the fence was the protection from a love intruder in her marriage, the fact that Troy announces he's going to have a baby with another woman is a total disillusion, which she expresses in moving terms:

I done tried to be everything a wife should be. Everything a wife could be. Been married eighteen years and I got to live to see the day you tell me you been seeing another woman and done fathered a child by her. And you know I ain't never wanted no half nothing in my family. (pp.67-68)

As one can see, the building of the fence has not saved Rose's love with her husband from an outside intrusion. As a result, she is totally left in disarray. Her statement above shows how disappointed she feels toward a man to whom she has devoted her life and who, in return, has had to do nothing but "lay in bed with another woman... and then bring it home to me" (p.70).

Even if Rose is right to blame Troy for his unfaithfulness and to accuse him for being ungrateful regarding the sacrifices she has made for their love, a careful examination of the story can also instruct the reader about the fact that such unfortunate intrusion could not be avoided, given the lack of vigilance from her. For, while she has wanted the fence to be completed and kept calling on her husband and Cory to work on it, the completion has always been deferred by Troy. One has to look in the lines of the following answer he gives her when she draws his attention to it: "I'm gonna walk down to Taylors'. Listen to the ball game. I'll be back in a bit. I'll work on it when I get back" (p.28). If the lack of vigilance has been disastrous for Rose's family with the intrusion of a rival in her home, the fact of postponing the building turns out even bitter to Troy himself. Indeed, not long after he informs Rose about his relation with Alberta, he is in turn informed that she has died in childbirth. Inconsolable, his mourning reveals the real significance of the fence for him:

Alright... Mr. Death. See now... I'm gonna tell you what I'm gonna do. I'm gonna take and build me a fence around this yard. See? I'm gonna build me a fence around what belongs to me. And then I want you to stay on the other side. See? You stay other there until you're ready for me. Then you come on. Bring your army. Bring your sickle. Bring your wrestling clothes. I ain't gonna fall down on my vigilance this time. You ain't gonna sneak up on me no more. When you ready for me... When the top of your list say Troy Maxson... (p.77)

Troy's mourning is nothing but an elegy; it is a sad expression of pain caused by death, a pain which has the effect of triggering a deep sentiment of defiance toward death itself as personified in his words. Hurt and dispossessed of his lover, Troy scowls his grief and challenges death with the fence he intends to erect in order to keep him "on the other side".

#### **b- The Fence of the African American's Responsibility**

More important than simply protecting the family from outward adversities is what the fence allows Troy to do, precisely in terms of charting an identity and a destiny for Maxson family which, in Wilson's play, represents the African American community. The issue of identity or destiny of the African American is a crucial issue in Wilson's

artistic work; and especially in *Fences* (1986) it is raised in the following terms: Is there an alternative to music and sports, the only outlets for the black in a racist American society? It is this question that sets the conflict between Troy Maxson, the main protagonist and father of the family, and Cory his youngest son.

In the story, indeed, Troy is portrayed as an uncompromising opponent to sports, because he considers himself as a living proof of this choice, which has earned him nothing, not even “a pot to piss in or a window to throw it out of” as he will often say. This is why he refuses to let Cory engage in the same career. And even if Cory refuses to listen to his father’s advice and holds on to his enrolment in a football school, Troy’s answer is evocative of what he suggests concerning the real destiny of his family in the racist social environment: Neither a football career nor the music of Lyons, the elder brother of Cory because they are the products of white racist ruling of American society. Troy rather insists on hard work, which he urges his children to embrace. Whenever one of them comes to ask him something, his answer is invariably negative. For example, when Cory entreats him to sign the paper of the football recruiter, he scowls at him saying: “The white man ain’t gonna let you get nowhere with that football noway. You go on and get your book-learning so you can work yourself up in the A&P or learn how to fix cars or build houses or something” (p.35).

To be trained to secure a job that helps everyone to take care of themselves is what matters for Troy. After all, he has done pretty well in supporting his family as a worker in the garbage-collect company of the town. Even if it is a lower job, it has permitted him to secure the minimum for them and he is ready to boast about it to Cory when answering his objection about his attitude to him:

**Troy:** You eat everyday [?]

**Cory:** Yessir!

**Troy:** You got a roof over your head [?]

**Cory:** Yessir!

**Troy:** Why you think that is?

**Cory:** (Hesitant) Cause you like me.

**Troy:** Like you? I go out of here every morning... bust my butt... putting up with them crackers every day ... cause I like you? You about the biggest fool I ever saw. (Pause)

It’s my job. It’s my responsibility! You understand that? A man got to take care of his family. ... Mr Rand don’t give me money come payday cause he likes me. He had to gives me cause he owe me. ... (pp.37-38)

The attention that one has toward one’s family and, precisely, the determination to provide for their needs is the measure of one’s responsibility in society. This responsibility is valued only by holding a job according to Troy. Linked together, these two notions are central in *Fences* (1986), which appears, thus, as a play in which the reader discovers a new framing of the African American identity. If responsibility is the most important thing for a man and, if for Troy it is nourished by work rather than music and sports, then one can say that it is the measure of one’s identity. Even if Wilson does not explicitly express his preference for his protagonist’s choice, the fact that Troy progresses from the position of simple garbage collector to position of driver in the company shows that other opportunities are opened to African Americans, precisely on the field of job market characterized by hard work and competition.

This perspective on work and responsibility developed in *Fences* (1986) is essential in the works of most of contemporary African American intellectuals like August Wilson and Shelby Steele, to cite the most popular of them. The point of contention in the debate is the association which is commonly drawn between African Americans and their racial heritage. Music and sports, for instance, described as the only outlets for people of African descent, are the expression of racial stigmatization. It is no wonder, then, that Wilson’s protagonist rejects them.

Still, Wilson does not totally break with the African American’s past. For example, in spite of Troy’s refusal of Lyons’ music, he is constantly tuning a song which plunges him back to his past:

Here it rings! Here it rings  
Had an old dog his name was Blue  
You know Blue was mighty true  
You know Blue was a good old dog  
Blue trees a possum in a hollow log

You know from that he was a good old dog (p.82)

Poetic in its rhetoric framing, this song which chants Troy's nostalgia for his "blue dog", also sounds like a blues that is regularly tuned to help him find his wholeness. In the end, Troy appears as a person with an ambivalent identity, an identity which cumulates the American values and the values of the African ancestral heritage. It is this double consciousness that Wilson articulates in the following statement: "if black folks would recognize themselves as Africans and not be afraid to respond to the world as Africans, then they could make their contribution to the world as Africans" (Hilary DeVries, 1989, p.24).

Sharing the same vision of responsibility and work as Wilson, Shelby Steele, has also written a lot on the issue of identity; but he is rather attached to American values of work, individual initiative and property ownership. As he writes in "On Being Black and Middle Class", these values are better than anything else for a respectable African American personality:

Hard work, education, individual initiative, stable family life, property ownership –these have always been the means by which ethnic groups have moved ahead in America. Regardless of past and present victimization, these "laws" of advancement apply absolutely to black Americans also. There is no getting around this. What we need is a form of racial identity that energizes the individual by putting him in touch with both his possibilities and his responsibilities. (Steele, 108)

Even if Steele talks about "racial identity", it is clear that the form of identity to which he refers has nothing to do with the race; it rather has to do with values which contribute to the promotion of a democratic and equalitarian society. Expressed in terms of work, education, individual initiative, or private ownership, these values shape, according to Steele, the notion of responsibility which African American intellectuals praise so much today.

Whether we are in a radically liberal perspective or in a double conscious worldview, the question of identity takes a new articulation in contemporary African American artistic production like in the drama of August Wilson. *Fences* (1986) is one among the theatrical works written by this playwright which charts a new definition to it.

### Conclusion:-

To learn about the life and work of playwright August Wilson is also to learn about the place of the Black in American theatrical development. For a long time, this place has been, marginal, as we showed in "The African American Theatrical Expression", a precedent work published in *Particip'Action* (2107)<sup>5</sup>. Because of the negative impact of some major phenomena like slavery, and the stereotypes that it contributed to develop about the image of people African descent, it has been historically difficult for African American artists to contribute to drama as easily as they did in other artistic genres. And yet, thanks to his artistic genius, playwright August Wilson has brought African American drama out of its historical lethargy.

Using his creative potentials as a venue, and notably his skills as a poet, Wilson has revitalized the public expression of African American drama since the black revolutionary movement of the 1960s. For example, he assigned himself the challenging task to "sketch the Black experience in the 20<sup>th</sup> century and raise consciousness through theater and echo the poetry in the everyday language of black America" (Bonnie Lyons et al., 1999, p.17). This exercise resulted in the writing of the ten-play series commonly known as "century cycle" or "ten-play cycle", and of which *Fences* (1986) is a significant component. In fact, these plays are the place where Wilson accomplishes one of his long-awaited goals: the shaping of a new identity for African Americans through drama.

This task has also been the concern of many other writers of African descent, principally those who constitute the contemporary middle class of the community and of which essayist Shelby Steele can be considered as the spokesperson. In a way because the African Americans of the popular class made abundant use of the black ancestral culture and racial heritage in the past, chiefly in claiming for rights and power during the Civil Rights movement, the middle class intellectuals of the community have always been reluctant to identify themselves with them. Worse, they have literally rejected what Shelby considers as a victim's identity. According to him this identity

<sup>5</sup> - Kouamé SAYNI, *ibidem*, p.100

is “devastating” for the image of African Americans in today’s American society characterized by values of work and competition.

This study has been an opportunity to cast a look at Wilson’s contribution to the framing of this new identity. After a quick but critical overview of his life and career, our exercise has focused on *Fences* (1986) through which Wilson tailors the main rhetoric of African American identity. Based on the building –more precisely, the completion— of the half-fenced home for the family of Troy Maxson, a frustrated garbage collector, the play points out the traumatizing heritage of racism in 1950 American society. Because racism led him to failure in sports, Troy cannot allow his family members to choose the same career, presented with music as the only two possibilities left to African Americans. A critical analysis of the tension that rises from the opposite positions in the family has given us an occasion to determine Wilson’s definition of his new vision for the destiny of the Black in contemporary American society. Relatively different from Steele’s perspective, it is a rather mitigated vision based on work and ancestral heritage.

### **Bibliography:-**

1. Wilson, August. *Fences*, New York, Penguin Books, 1986
2. Wilson, August. *Ma Rainey’s Black Bottom*, New York, New American Library, 1982
3. Wilson, August. *Joe Turner’s Come and Gone*, New York, Samuel French, Inc. 1990
4. Lyons, Bonnie. Plimpton, George. “August Wilson, The Art of Theater”, *The Paris Review*, n° 14, Winter 1999
5. DeVries, Hilary. “The Drama of August Wilson”, *Dialogue*, n° 1 1989
6. Elkins, Marilyn. “August Wilson”, *The Oxford Companion to African American Literature*, New York, Oxford Univ. Press, 1997
7. Kouamé, SAYNI. “The African American Theatrical Expression in the USA: A Crippled Quest for Identity”, *Particip’Action*, Vol 9, Janvier 2017
8. Steele, Shelby. *The Content of our Character: A New Vision of Race in America*, New York, Harper Perennial, 1990.

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### RESEARCH ARTICLE

#### REVIEW OF USABILITY AND DIGITAL DIVIDE FOR ICT IN AGRICULTURE.

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#### Abstract

Agriculture is the backbone of Indian economy and 70% of Indian population is mainly dependent on Agriculture for their livelihood. Since ages, lots of developments are going on in this field. Information and Communication Technologies (ICT) is a resource society which provides access and knowledge. ICT is a resource society which needs active participation along with literate participation of the user. The internet nowadays is of little use to people who are not able to make use of electronic access to digital data to improve their lives. In the past decade, farmers had access to various agricultural information provided by many information and communication technology (ICT) projects in Indian agriculture. Different services are provided by ICTs. ICTs have the potential to reach many farmers with timely, useful and accessible content. But the content delivered has importance and relevance only if the information is content specific and localized. In India most of the population lives in rural areas and is dependent on agriculture for their living. But because of digital illiteracy, farmers are not aware of different data of agriculture available for them, in spite of numerous efforts taken by Government. The prime focus is on improving the usability of knowledge shared by different digital media. Hence minimization of digital divide in rural areas will take place. It will help to design and implement better service tools.

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#### Introduction:-

India is an agriculture based developing country. Information dissemination to the knowledge intensive agriculture sector is upgraded by computers and mobile-enabled information services and rapid growth of mobile telephony. Mobile apps and websites in the area of agriculture can be the best option to increase countries net agriculture production. Today farmers receive diverse facts regarding farming like different types of seeds, crop diseases, crop selection, crop process weather, fertilizer, pesticides etc multiple resources are distributed on many different locations according to its origin, its producers or vendors. The data may have different format and contents, depicting heterogeneous nature in their structure and format. Therefore, developing a system from where the required information is available to the farmers directly and in localized form is needed.

This research focuses with following objectives.

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**Need and Objective:-**

This research focuses on following key points,

1. To know about usability and usability issues in agriculture domain
2. To identify the digital divide and the barriers to digital media among rural users especially farmers.
3. To improve the digital illiteracy among users.
4. To minimize digital divide and improve the usability of digital media by providing recommendations as solutions.
5. Help in decision making for the prediction of suitable crops with respect to climate and soil.
6. Identification of crop diagnosis by sending image through app.
7. To avoid linguistic problem solutions will be provided in local language.

**Literature Survey:-**

**Sukhpuneet Kaur et al.** [1] evaluated Educational Universities of Punjab and provides their ranks according to evaluation criteria. Usability is calculated using automated tools. Paper make use of two automated tools, **Site Analyzer**(which calculates different no of parameters such as Content, Design, Performance, SEO (Search Engines Optimization) and Page Analysis) and **Qualidator tool** (which checks Usability, Accessibility, SEO and Quality (technical quality)). Paper provides automated tool calculations for universities websites regarding the comparative importance of website assessment criteria's. From the results website designers can focus on the specific features where they are lacking and keep the website up-to-date.

**Sukhpuneet Kaur et al.** [2] discussed about the usability tools for testing and how they are used for determination of effectiveness and usability of websites. Performance evaluation is done by using tools which give detailed results of that website. The aim is to perform evaluation and comparison using the automated testing tools to determine their SEO (Search Engine Optimization), load time, speed, security, page size, performance, mobile and number of requests. The different Universities of Punjab were selected and evaluation was done using automated Usability Testing tools like **Site Speed Checker Tool**, **GTMetrix**, **Pingdom** and **Website Grader**. It was concluded which university website scores the maximum against the various factors used.

**Muhammad Faraz Khokhar et al.**[3] discussed about the different ways to empower or improve the role of technology. Also to bridge rural digital divide with ICT solutions. In the agriculture sector of rural belt of Pakistan those solutions were applied. E-boards and mobile phones for giving access to all latest agricultural updates and news were suggested. Idea was to provide automated updates on e-boards in form of pictography and text messages on users device such as phone that too in local language. In this way ,current updates are provided to the farmers. Research focused on making information easy and understanding. Thus, more usability and effectiveness is provided to the farmers, which helps to increase the productivity of crops. This helps in bring rural community to the (standards of) international level.

**Maria Tamoutsidou** [4] presented that agriculture is very much important domain for developing countries. There is need such that it should change to meet today's need. Agriculture has been a part of human life since the beginning of human race. The need for agricultural information is almost same as old agriculture itself. Paper proposed that E-learning in agriculture is a tool that provides various benefits to farmers education by expanding its access. Finally it was concluded that E-learning offers benefits and gives opportunities in agriculture area. So a proper education regarding E-learning is fruitful to the farmers.

**S. A. Adepoju and I. S. Shehu** [5] used automated tools such as **Web Accessibility checker**, **HERA** and **WAVE**. Calculation of usability level via accessibility evaluation of the federal universities in Nigeria is done using these tools. Usability was checked for conformance with both WCAG 1.0 and WCAG 2.0 using three tools. Different tools gave different errors. Based on the errors the website designers should try to minimize the error for increasing the usability.

**Soumalya Ghosh, A. B. Garg, Sayan Sarcar**[6] proposed an iconic interface for farmers. In Indian languages it had a special feature called as speech based interaction. It is essential for farmers to take the essential agriculture information. The proposed interface removes language gap of the Indian farmers with various multiple modes of interaction techniques. It also overcomes the digital gap among farmers.



**Ahmad A. Al-Ananbeh [7]** focused on two concepts such as Search Engine Optimization (SEO) and Usability. They evaluated automatically eighty Websites for universities in the Arabic region. Aim was to find out whether there is relevancy between Search Engine Optimization (SEO) and Usability. Attributes selected are: HTML errors checking, load time, and browser compatibility problems. For the selected attributes, tools used are HTML ToolBox, Page Rank Checker, and SEO Page Rank. Using these three tools, 80 websites for universities in the Arabic region were evaluated. Results showed that Usability is more important in many aspects than SEO. Primary focus should be on improving the usability and certain recommendations considering SEO PageRank into consideration. are given in order to increase the usability for websites.

**Sukhpal Kaur[8]** used automated tool called as **Sitechecker** for evaluation for web site accessibility. The tool performs the work of HTML validator. It also evaluates other contents such as CSS, hidden files, dead links, extra comments, java scripts, in the HTML code and code to text ratio in a web site.

**Fang Liu [9]** presented the importance of measuring usability and how it is measured. Using different evaluation techniques, web designers can know their users better, understand them in a better way and make their works meet various users' needs. Paper describes methods to evaluate a website. Evaluation techniques are usability testing, focus group, cognitive walkthrough, heuristic evaluation, thinking aloud and questionnaires. Paper concluded that designers should be aware about the techniques and should be used to evaluate websites skillfully.

**Gagandeep Kaur Grewal[10]** explained the importance for need of right information to the farmers for successful farming. For farmers various web portals and agricultural sites are available but many are not aware about it. Paper reviewed about the need for good communication among farmers and portals. Handy and useful information of weather, crops pests, irrigation schedule, etc should be available to the farmers from time to time.

**Ms. Ipsita Panda[11]** discussed how the Indian scenario as well as the global world is influenced by the digital divide. Rural library can play a much needed role in bridging digital divide. It will also help in literating the society and in building a well informed society.

**Rajender Singh Bist [12]** highlights the digital divide scenario in India. Further discusses various ICT initiatives undertaken by the government. The major challenges and key solutions in bridging the digital divide in the Indian context are provided.

**Neena Singh[13]** the paper informed about the role played by several programs taken by the government to bridge the digital divide. Also the initiatives taken in India towards digital access to information. Some of the projects initiated were as follows : "Grameen sanchar sevak," "Gyan Doot," the CARD and e-Seva projects, etc. It further discusses Digital Library Projects, viz. the National Science Digital Library (NSDL) and Vidya Vahini, digital mobile libraries and library networks and community information centers. These projects were initiated by the government to reach remote and rural areas. The other factors that help in bridging the digital divide in the country are good policy-making, political support and need for strong determination.

**Zhengjie Liu, Qingjun Meng[14]** they proposed that the main reasons for the digital divide are socio-economic factors. This is because most people have difficulties in understanding digital products' and their usability. The usability improvement for digital products help in the endeavor to eradicate the digital divide. The design should be user-centered design. It is a good method to eliminate usability factors of the digital divide. In short, it will help to bridge the digital divide.

**Tanuja R. Patil et al. [15]** discussed about making farmers available with precision agriculture information which will help them to get high crop rates and high crop yield using ICTs. SMS was the medium used to provide the information to various farmers. A software system was built to give the precise information about the crops using database. In local language automatic information delivery through website, app, as well as SMS was provided.

### **Review Of Research:-**

The study for improving the usability in agricultural area and for eliminating the digital gap among rural people especially the farmers will be done in following stages:

Stage 1: Review of agricultural information communication tools

Stage 2: Identification of Usability problems.

Stage 3: Recommendations and solutions to improve usability.

Stage 4: Development of tool to solve and improve usability in specific area.

Stage 5: Test usability with the help of users for development tool ie, website or application.

### Usability, issues of usability and evaluation of usability:-

The ISO 9241-11 standard defines usability as “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use”.

**Effectiveness:** It tells how users can achieve specified goals with accuracy and completeness

**Efficiency:** It tells with what rate users achieve goals with respect to the accuracy and completeness

**Satisfaction:** It tells how users accept the system, to what level they are comfortable in using it. [16]

A level of satisfaction is the highest when users find a Web site is useful with meaningful information and usable; this is can be termed an “**engaging user experience**”. Usability in agriculture has an important role to play in order to engage more and more farmers with newer digital data and technologies.

There is a limiting factor in use with many of the applications in agricultural with respect to new technology called as “User acceptance”. Farmers tend to become very conservative generally while choosing the technology. So with a mindset of reducing risks they tend to choose traditional or any old methods or techniques. The farmers also needs to trust on the reliability of data and accuracy of the information available. This needs to be changed so that there can be development in agriculture field by making farmers more and more involved in new methods.

A usability evaluation method is a systematic procedure in which data gets recorded for the communication that takes place between the user and the software. Various tools are available for evaluation of websites such as Website Grader, Dareboost, Qualidator, SEOptimer, GTMetrix, iwebchk, SortSite etc.

### Digital divide in agriculture:-

In common terms, definition of digital divide can be as the difference between those users who have access to digital data and can make effectively make use of it, and those who either lack it or don't use it effectively. Unequal access to digital content and different technologies has led to the digital divide among rural people. However, not everyone has access to this digital data or aware about how to use it. Especially the farmers are lacking behind in using the devices and the technology and the digital data available.

### Methodology:-

This can be divided into four steps.

#### Stage 1: Review of agricultural communication tools

**Table 1:-** Review of websites and apps

Sr. No	Name of Website/portal/apps	Features	Observation
1	Farmer.gov.in	Farmer Portal provides solution to the farmers and stakeholders to disseminate the information regarding fertilizers, seeds, pesticides etc.	<ul style="list-style-type: none"> <li>Navigation issue.</li> <li>Map is limited to district level.</li> <li>No disease diagnosis system.</li> <li>No proper language support.</li> </ul>
2	Mahagri.gov.in	This is a web portal of Agriculture Department of Maharashtra State (India), which is developed to provide information related to farming.	<ul style="list-style-type: none"> <li>Limited to only two languages i.e, English and Marathi</li> <li>Clumsy view of website</li> <li>Navigation issues</li> </ul>
3	Krishiworld	It provides information about agriculture and agriculture products, crops, fertilizers, floriculture vegetables and fruits	<ul style="list-style-type: none"> <li>More no. of ads</li> <li>Bad UI</li> <li>No diagnosis system</li> <li>Registration issues</li> </ul>
4	Kisan Suvidha	Latest information Call to kisan credit card	<ul style="list-style-type: none"> <li>Language issue</li> <li>Frequent crashes are seen</li> </ul>
5	Mkisan	Latest information	<ul style="list-style-type: none"> <li>App crashes</li> </ul>

**Stage 2: Identification of problems:-**

- Less knowledge about the latest technology.
- No availability of relevant and localized content.
- Productivity is very low because they are not aware about the new methods.
- Available systems focus on only one problem.eg: disease diagnosis, weather report, soil report etc.
- Language issues.
- Approach of systems are very area specific.
- Navigation issues.
- Lots of digital information but farmers are not able to make use of it.

**Stage 3: Recommendations and solutions to gaps identified:-**

With help of gaps identified, recommendations will be provided for designing the required framework. That will help farmers to take decision for agricultural activities with digital gadgets. Solutions to the farmers will be provided in the form of various services that will increase the usability of digital gadgets.

**Stage 4: Development of tool and testing in a specific area:-**

The agricultural app and website will be a tool which will help farmers to improve the productivity. Testing can be done by considering different types of users.

**Conclusion:-**

Therefore, a proper framework for an IT-based agricultural information dissemination system is required. Hence in this way an app and website be developed in the area of crop disease detection, decision making for the prediction of suitable crops with respect to climate and soil and pesticide recommendations which will improve the usability among farmers. The tool developed will provide multi-lingual support to user. This agriculture service provider tool will bridge the gap between the farmers and technology and would prove beneficial to all the rural people related to farming sectors. Need to increase the usability of digital media tools to minimize digital divide among rural people will be satisfied.

**Reference:-**

1. Sukhpuneet Kaur, Kulwant Kaur and Parminder Kaur, "Analysis of Website Usability Evaluation Methods", In INDIACOM-2016; ISSN 0973-7529; ISBN 978-93-80544-20-5, March, 2016.
2. Sukhpuneet Kaur, Kulwant Kaur and Parminder Kaur, "An Empirical Performance Evaluation of Universities Website", In International Journal of Computer Applications (0975-8887) Volume 146 – No.15, July 2016.
3. Muhammad Faraz Khokhar, Hassan Ejaz, Tayyab Asif Butt, Shahzaib Iftikhar, Umar Muzaffer, Abbas Ilyas, Faizan ul Mustafa, Adeel Mushtaq, Usman Ahmad, and Usman Asghar, "Enhancement of Usability for Farmers: User Interface for Rural Community", In Springer International Publishing Switzerland, 2014.
4. Maria Tamoutsidou, "The challenges of e-learning system usability in agriculture sector", scientific works of university of food technologies, volume Ixi, 2014.
5. S. A. Adepoju and I. S. Shehu, "Usability Evaluation of Academic Websites Using Automated Tools", In 3rd International Conference on User Science and Engineering (i-USER), 2014.
6. Soumalya Ghosh, A. B. Garg, Sayan Sarcar, "Krishi-Bharati: An Interface for Indian Farmer", In Proceeding of the 2014 IEEE Students' Technology Symposium, 2014.
7. Al-Ananbeh, A. A., Ata, B. A., Al-Kabi, M., & Alsmadi, I., "Website Usability Evaluation and Search Engine Optimization for Eighty Arab University Websites", Vol. 21, No. 1, pp.107-122, August 2012.
8. Sukhpal Kaur, "An Automated Tool for Web Site Evaluation", In (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 3 (3), 2012, 4310 – 4313.
9. Fang Liu, "Usability Evaluation on Websites", School of Art & Design, Wuhan University of Technology, Wuhan, Hubei Province, 2008 IEEE.
10. Gagandeep Kaur Grewal, Amandeep Singh Gill, Dr. Kiran Jyoti, "Comprehensive Role of Computer Applications in Agriculture: Review Paper", In International Journal of Advanced Research in Computer Science and Software Engineering 5(3), pp. 345-347, March – 2015.
11. Ms. Ipsita Panda, Mr. Durlav Charan Chhatar, Dr. Bulu Mharana, "A Brief View to Digital Divide in Indian Scenario", In International Journal of Scientific and Research Publications, Volume 3, Issue 12, ISSN 2250-3153, December 2013.

13. Rajender Singh Bist,” ICT ENABLED DEVELOPMENT AND DIGITAL DIVIDE : AN INDIAN PERSPECTIVE”, In 5th International CALIBER -2007, Panjab University, Chandigarh, 08-10 February, 2007
14. Neena Singh,” Bridging the Digital Divide in India: Some Challenges and Opportunities”.
15. Zhengjie Liu, Qingjun Meng,” Usability and Digital Divide: A Study on Usability Issues for Off-Farm Workers in China”.
16. Tanuja R. Patil, Shamshuddin K, Rajashekhar Patil, Sadanand P,” Krushi samriddhi: a decision support system for farmers to get high crop yield”, In International Conference on Computational Techniques in Information and Communication Technologies (ICCTICT),2016.
17. [http://www.idemployee.id.tue.nl/g.w.m.rauterberg/lecturenotes/0H420/Usability\\_standards.pdf](http://www.idemployee.id.tue.nl/g.w.m.rauterberg/lecturenotes/0H420/Usability_standards.pdf) (accessed on 13/1/2017).



### RESEARCH ARTICLE

#### THE TRENDS OF GALLSTONE SURGICAL TREATMENT IN SAUDI ARABIAN PROVINCE: IS THE LOCAL PRACTICE UP TO DATE?

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#### Abstract

Gallstone disease continues to be one of the leading problems in modern gastroenterology and in majority of cases requiring surgical management. This pathology has large impact on Saudi Arabian population and its Health system. Laparoscopic cholecystectomy has become a procedure of choice in current management of acute and chronic cholecystitis. The aim of this surgical audit based study was to analyze current management outcome in selected group of patients, who underwent laparoscopic cholecystectomy procedure in Saudi Arabian province of Al Kharj with relatively large local population. The multiple factors including patient's demographic characteristics, modality and results of investigations, as well as, surgical outcome were analyzed and compared. This study demonstrated satisfactory surgical outcomes in gallstone management in the Prince Sattam Bin Abdulaziz University affiliated hospital, which demonstrated low complications rate and cost effectiveness.

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#### Introduction:-

Gallstones are known to medical practice since ancient times and remain one of the most frequent pathological conditions of the gastrointestinal tract in modern time. The high prevalence gallstone diseases more shown in developed countries reaching from 10 to 20.8%. However, it is less common in the developing nations and remaining as low as 4.1% (1). At the same time majority (about 80%) of the patients with gallstones remain asymptomatic during their entire life, and only about 3% of patients with periodical symptoms may develop acute cholecystitis, which require eventual surgical intervention for removal of gall bladder.

It was estimated that about 20% of adults at the age of 40 and over would develop biliary calculi. This figure may be increased by 30% by the age of 70 and above. Female-to-male ratio is reaching about 4:1 in the reproductive years, and almost equal in the older population (2).

It appears that, factors like diet and socio-economic conditions are directly correlated with the incidence of gallstone disease. Risk factors known to contribute to the development of gall stones also include the family history of gallstone, obesity, multiple pregnancies, fat diet, and low physical activity lifestyle. Some co-morbidities, which have physiological predisposing factors like abnormal absorption in biliary digestive system, such as, Crohn's disease and liver related pathology also increase gall stone formation.

Specific clinical features supported by ultrasound scanning evidence are base for establishing the diagnosis of acute cholecystitis and define the reasoning for surgical treatment. However, the timing of surgery still debatable, and up to date there is no standard approach among different surgical schools.

The aim of this study was to investigate current trends in approach of investigation and management of gallstone disease patients from the population area in search of the possibility of any improvement in outcome and hospital stay.

### **Materials and Methods:-**

This retrospective surgical audit study was based on the identified hospital database, obtained from medical records at King Khaled Hospital (KKH), which is a teaching hospital affiliated with the Prince Sattam Bin Abdulaziz University in Al Kharj Governate of Saudi Arabia covering the population of over 650,000 people.

Medical records of 132 patients admitted from 2010 to 2015 inclusive, who presented with acute or chronic cholecystitis and received surgical treatment as emergency or elective cases, were reviewed.

Inclusion criteria for this study were all patients, who had laparoscopic or open cholecystectomies, presenting to KKH with the diagnosis of acute or chronic cholecystitis or symptomatic cholecystolithiasis.

Patients were discriminated by the gender and included in two major groups, such as the emergency case or elective case. Patient's characteristics were divided in few sections: 1) symptoms upon the presentation and family history, 2) blood inflammatory and biochemical values, such as white cell count (WCC) and Liver Function Test (LFT), 3) evaluation of gall stones together with common bile duct measurement by ultra-sonography (US) 4) types of surgical procedures and related complications, and 5) duration of hospital stay.

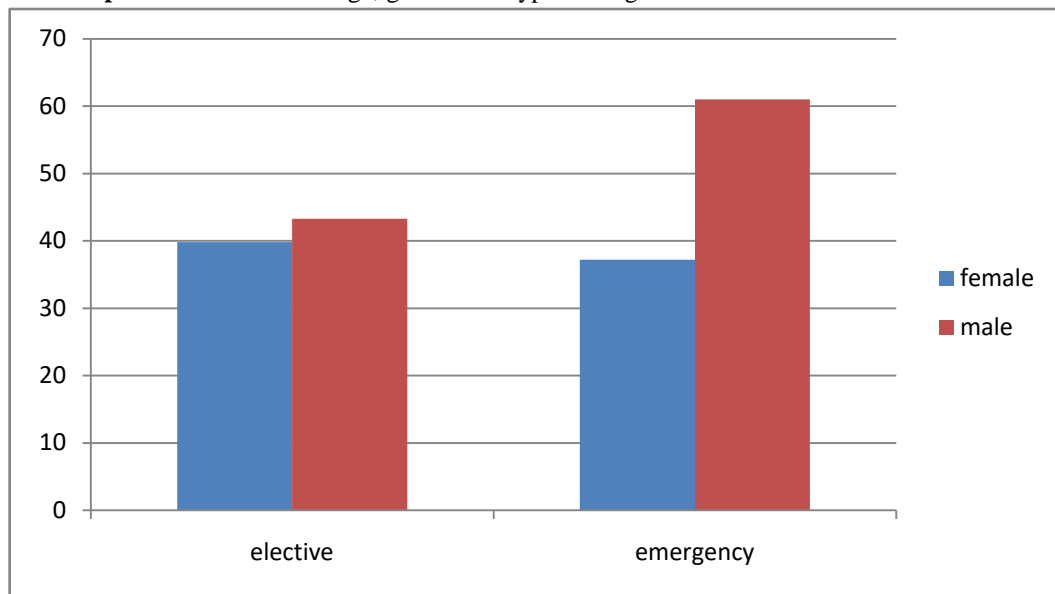
All patients had ultrasonography study to confirm the presents of gallstones and evaluate the severity of acute cholecystitis as well as exclude the gallstones in the common bile duct, which may change the strategy for the patient's management.

All of the patients received prophylactic antibiotics before the surgery or intra-operatively in order to prevent the possibility of infection.

Data for all these characteristics obtained from the medical records of the patients was analyzed for statistical value. For analysis of data the SPSS version 23 (Statistical Package for the Social Sciences) and Excel for Mac 2016 computer software programs were used in this study, which included unpaired *t*-test for comparison of means within groups, where  $p < 0.05$  was considered as statistically significant.

### **Results:-**

In total, 132 patient's data was collected from medical records and analysed, including 122 females and 10 males (92.4% and 7.6% respectively). For the majority of the patient's age distribution falls in the 4th decade. The median age for males was 41.1 year (range 26-68 year) and for females 39.5 years (range 20-75 years) respectively. Distribution of age, gender and type of surgical intervention is shown in the Graph 1.

**Graph 1:-**Distribution of age, gender and type of surgical intervention.

The median age in the elective surgery group was with male to female ratio 1:11.9. This was not much statistically different compare to the emergency group where median age was and male to female ratio 1: 15 ( $p > 0.8$ ). In both groups the diagnosis of cholecystitis was made on the basis of clinical presentation, evaluation of inflammatory markers, liver function tests (LFTs) results and ultrasound evidence of gallstones in all patients admitted for treatment.

Regarding the symptoms on the presentation to the hospital, nausea with vomiting were experienced by 67.2% of the patients in elective group, and 87.5% in emergency group respectively. Intermittent or constant right upper abdominal pain was present in 98.2% of patients in selective group and 93.8% in emergency group, which made this symptom as most constant. The characteristics of the symptoms in elective and emergency cases shown in the Table 1.

**Table 1:-** Characteristics of the presenting symptoms.

Symptoms on admission	Elective (116)	Emergency (16)
Nausea and vomiting	78 (66.7%)	12 (70.6%)
Right upper abdominal pain	114 (97.4%)	15 (88.2%)
Epigastric pain	80 (68.4%)	15 (88.2%)
Pain in tip of the right shoulder	12 (10.3%)	4 (23.5%)

There was no jaundice in elective group, however, 3 out 16 patients (18.8%) in emergency group presented with jaundice. None of the elective patients had concurrent pancreatitis compare to emergency group, where pancreatitis was evidently diagnosed in 37.5% of patients. Only one patient in elective group was with chronic liver disease, however, no chronic liver pathology was identified in the emergency group of patients.

Elevated bilirubin with the deranged liver function test was found in 11 patients, where 10 patients belonged to emergency group. Mean values for levels of bilirubin and liver function test in elective and emergency groups shown in the Table 2.

**Table 2:-**Mean values for levels of bilirubin and liver function test.

	Elective (mean +/- SD)		Emergency (mean +/- SD)	
Bilirubin (umol/L)	20.06	11.9	21.9	14.5
ALT (u/L)	78.8	48.7	575.4	141.6
AST (u/L)	44.2	29.2	384.4	141.6
ALP (u/L)	89.7	48.4	184.8	54.0

Biliary dilatation on ultrasound study was found in 17 out of 116 elective patients (14.7%), while in emergency group it was reaching 43.7% respectively.

Gallstones on ultrasound were diagnosed in 115 out of 116 patients in elective group and in 15 out of 16 in the emergency group respectively. Biliary dilatation identified by ultrasonography study was found in 17.2% of patients in elective group compare to 77.7% in emergency group.

In 4 out of 116 patients (3.4%) laparoscopic cholecystectomy had to be converted to open procedure due to technical difficulties in dissecting Calot's triangle in order to identify important biliary structures, which could be challenging because of the extensive scarring process after gall bladder inflammation. There was no conversion to open procedure in the emergency group of patients, as acutely inflamed tissues helping in laparoscopic dissection, but increasing the chance of intra-operative bleeding.

In our study, median length of hospital stay (LHS) was 2.7 days ranging from 1 to 18 days. For the elective group the median LHS was 2.5 days, while in the emergency group it was 4.7 days respectively ( $p < 0.03$ ). In total 3 patients (2.3%) had complications, 1 intra-operative bleeding in the elective group and 2 postoperative wound infections, when the laparoscopic procedure had to be converted to open.

The diagnosis of chronic cholecystitis was associated with gallstones in 115 out of 116 elective surgery patients (99%) and acute cholecystitis in all 16 patients from emergency group.

There was no intra or post-operative mortality in this study. Intra-operative perforation of the gall bladder and bleeding were considered as well recognized procedural complications. Only one intra-operative bleeding has occurred in the whole series of cholecystectomies for elective group and no bleeding was recorded in emergency group. Post-operative wound infection has developed in one patient from each group during post-operative period.

### Discussion:-

The prevalence and incidence of gallstones in Saudi Arabia is not well established, although recent studies demonstrate high numbers, which vary from region to region (3). Abu-Eshy et al (2007) in their cross-sectional community-based study of gallstone disease in a Saudi Arabian Asir region demonstrated that the overall prevalence was 11.7%. This study was based on abdominal ultra-sonography with structured interview and shown that hypochondrium pain was significantly correlated with gallstone disease (4).

The trends for changes in diet habits in Saudi Arabia demonstrated the increase of fat and sugar consumption with high calories intake and reduction of high-fiber food, which is related to introduction of the fast food and more sedentary life style among the younger generation over the past few decades. This leads to the higher number of population with increased body mass index (BMI) among Saudis. Also, international reports shown that female population more effected by the early formation of gall stone and development of cholecystitis compare to male population. Multiple pregnancies, which are traditional for Saudi females appeared as one of the risk factors for cholelithiasis in this population group. The formation of cholesterol sediments, so called "gall bladder sand" occurs more frequently compare to males. In our study 28.2% of females had multiple pregnancies.

Malatani et al. (1996) in their study demonstrated that, cholesterol was the most common component of the gallstones (82.6% to 90.4%) in various regions of Saudi Arabia, which was followed by calcium, bilirubin, and carbonate (5).



The presents of gallstone disease may have no specific symptoms, as the majority of the population with gallstones (70-90%) can remain asymptomatic until complications develop, which include acute cholecystitis, cholangitis or biliary pancreatitis. In our study, dyspeptic symptoms were more prominent in the emergency group of patients compare to the elective (70.6% vs 66.7% respectively) ( $p < 0.05$ ), which correlates well with more acute condition supporting the diagnosis of severe cholecystitis or development of pancreatitis and influencing the decision making to perform cholecystectomy as emergency.

Diagnosis of acute or chronic cholecystitis was made based on symptoms and signs of localized inflammation in epigastric and the right upper quadrant areas and differentiated from biliary colic by the presence of elevated inflammatory markers and liver function test. Patients may present with a history of biliary colic or may have been previously asymptomatic.

Plain X ray films have never been a reliable diagnostic tool in detecting gallstones, as the frequency of radio-opaque stones is low and can be demonstrated only in 10-15 % of cases.

Ultrasonography currently is gold standard non-invasive method for clinical diagnosis of gallstones and cholecystitis with sensitivity reaching 98%. However, it can be inconclusive in some cases as remain operator sensitive. Its ability to demonstrate the presence of pericholecystic fluid, gall bladder distention with the wall thickness and gallstones with their location and common bile duct dilatation make it the method of choice in diagnosis and screening. Together with color Doppler it can show local hyperemia and severity of the inflammation.

Biliary dilatation in the elective group (17.7%) could be explained as a transient passage of the gallstone into duodenum, as there was no record of pancreatitis in this group. However, in the emergency group, biliary dilatation was 77.7%, which correlates well with development of pancreatitis in 60% of emergency patients ( $p < 0.05$ ).

Today, laparoscopic cholecystectomy is a gold standard procedure in the management of gallstones. The technological advances and evolution of laparoscopic technique require continues reeducation and retraining by surgeons.

About 20% of patients with acute gall bladder inflammation would require emergency surgery with deterioration of the patient's condition and formation of localized peritonitis due to empyema of gall bladder.

However, the optimal timing of surgery for the rest 80% of patients continues to be debatable. Multiple studies suggest that early surgery has reduced complications and lower conversion rate as well as shorter hospital stay. Early laparoscopic surgery, less than 72 hours after presenting symptoms, allow easier dissection of edematous planes before the fibrous scarring process occur (6).

In the large randomized trial by Gutt et al. (2013), laparoscopic cholecystectomy, performed within first 24 hours of hospital admission demonstrated superior results compare to conservative approach regarding morbidity and cost effectiveness (7).

In our study intraoperative cholangiogram (IOC) was used selectively only in cases of high suspicion of gallstones in common bile duct (CBD), equivocal ultrasound findings or transient pancreatitis.

Polat et al. (2000) documented findings of CBD stones in up to 12% of all patients during cholecystectomy and claim that intra-operative cholangiography (IOC) is effective in identifying stones in CBD during surgery. Thus, they recommend routine IOC to identify duct anatomy in order to reduce the incidence of CBD injury (8). This recommendation supported by the Ragulin-Coyne et al (2013), who reached similar conclusions (9). Moreover, gallstone complications, such as biliary pancreatitis and CBD injury during laparoscopic cholecystectomy can dramatically increase the cost of recurrent hospitalization by 10 fold, as well as morbidity and mortality of patients with the gallstone pathology.

### **Conclusion:-**

Laparoscopic cholecystectomy is an operation of choice in the management of gallstones and in case of acute cholecystitis should be used earlier after the onset of symptoms. In many cases it is important action to prevent the variety of complications caused by gallstones.

Intra-operative cholangiogram is valuable methods in depicting biliary anatomy, which may exclude bile duct injuries and identify stones in common bile duct. Thus, indicating to further necessity for bile duct exploration or to perform ERCP modality to prevent gallstone pancreatitis.

Our study demonstrate that current management of acute and chronic cholecystitis in Al KharjGovernate area has relatively low rate of complications and sufficiently cost effective. This could be explained by careful and appropriate diagnosis and timing for surgery in majority of the cases, included in this study.

### References:-

1. Jarrar B.M., Meshref A Al-Rowaili M.A., Chemical Composition of Gallstones from Al-Jouf Province of Saudi Arabia, Malays J Med Sci. 2011 Apr-Jun;18(2):47–52.
2. Schirmer BD, Winters K., Edlich R. Cholelithiasis and CholecystitisJLong Term Eff Med Implants 2005, v15,:329-338.
3. Tamimi TM, Wosomu L, Al Khozaim A, Abdul-Ghani A. Increased cholecystectomy rates in Saudi Arabia. Lancet 1990;336:1235-7.
4. Abu-Eshy SA, et al. Prevalence and risk factors of gallstone disease in a high altitude Saudi population. East Mediterr Health J. 2007 Jul-Aug; 13(4):794-802.
5. Malatani TS, Bobo RA, Al-Kassab AS, et al. Gallbladder stones analyzes, bile and wound cultures in cholelithiasis. Saudi J Gastroenterol,1996;2:146-9.
6. Pessaux P, Tuech JJ, Rouge C, et al. Laparoscopic cholecystectomy in acute cholecystitis. A prospective comparative study in patients with acute vs. chronic cholecystitis. SurgEndosc. 2000;14:358–361.
7. Gutt CN<sup>1</sup>, Encke J, Königer Jet al., Acute Cholecystitis-early laparoscopic surgery versus antibiotic therapy and Delayed elective Cholecystectomy, Ann Surg. 2013 Sep;258(3):385-93.
8. Polat FR, Abci I, et al. The Importance of IntraoperativeCholangiography during Laparoscopic Cholecystectomy. JSLS, 2000 Apr-Jun; 4(2): 103–107.
9. Ragulin-Coyne E, Witkowski ER, Chau Z, et al. Is routine intraoperativecholangiogram necessary in the twenty-first century? A national view. J Gastrointest Surg. 2013 Mar; 17(3): 434–44.

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### RESEARCH ARTICLE

## NOVAL TRAITS FOR IDENTIFYING AMARANTHUS SPINOSUS L. USING SYSTEMATIC AND BIOCHEMICAL ANALYSIS.

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### Manuscript Info

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#### Key words:-

Amaranthus spinosus, Taxonomy,  
Biochemical analysis, Anatomy,  
Systematics

### Abstract

Amaranthus spinosus is commonly known as spiny amaranth and is distributed all around the Asian continent as an annual weed. Though it is seen as a weed the nutritive quality of the species is high. This paper attempts to explain the various biochemical composition of the plant qualitatively and quantitatively. Qualitative analysis carried out suggests the better solvent which could be used for its effective extraction. This paper also puts lights into the taxonomical traits and anatomical characters of the species.

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### Introduction:-

The genus Amaranthus, a widely cultivated taxonomic group, consists about 60–70 species<sup>1</sup>. Collectively known as Amaranth, it is a cosmopolitan genus of herbs belonging to the family Amaranthaceae<sup>2</sup>. Most of amaranth species are summer annual weeds and are commonly referred to as pig weed<sup>3</sup>. A rich array of poems and folklore has hints about the flower of amaranth which does not fade easily. Its etymology as well, has traces to its everlasting flower, with the word Amaranth, coming from the Greek word Amaranthon, which means 'one that does not wither'<sup>4</sup>. Throughout history, Amaranth (Amaranthus sp.) has been highly priced as a consumable. The Incas, Mayans and Aztecs used it as a staple food<sup>5</sup>. Amaranthus spinosus L. is an erect, monoecious, perennial, up to 1 m, stems is terete or obtusely angular, glabrous or slightly pubescent, green, reddish-brown, glabrous, and branched. The leaves of A.spinosa are alternate and simple without stipules; petiole is approximately as long as the leaf blade. The blade shape is ovate-lanceolate to rhomboid, acute and often slightly decurrent at base, obtuse, rounded and often short mucronate at apex, entire, glabrous or slightly pubescent on veins when young<sup>6</sup>. The inflorescence of the species possess terminal and axillary spike, which are, erect, slender and elongated, with remote axillary spikes at base, present in lower clusters<sup>7</sup>. The anatomy of A.spinosa shows the presence of vascular bundles in the pith, known as medullary bundles, in addition to the normal ring of vascular bundles<sup>8</sup>. The presence of medullary bundles has been reported as an 'anomaly', which according to Esau is 'a growth pattern which occur less common'<sup>9</sup>. The nutritional composition of spiny Amaranthus is carotene (11.94), Vitamin C (43 mg), calcium (374 mg), carbohydrates (5.0g), protein (5.3g), fat (0.1g) 100g of the edible portion<sup>10</sup>.

### Materials and Methods:-

#### Taxonomical studies:-

The fresh plant within one week of flowering was collected. It was identified and was subjected to taxonomical identification of different characters. The plants were worked out with the help of The Flora of The Presidency of Madras (Gamble) Volume 2. The characters and variations were noted. The herbariums of the plant species were also prepared.

**Anatomical studies:-**

Some mature and fresh parts of the leaves, stems and roots of the species among were collected. With the help of a razor blade different transverse sections of stem and root were obtained by cutting along the radial plane of a cylindrical portion of the stem and root. Leaf was dissected with the help of papaya pith. All the fine dissections were kept in watch glass along with water. The sections were mounted as performed by Omosun, with modifications. The obtained sections were mounted temporarily; photographed using Leica photomicroscope and the characters were noted. Safranin was used to stain the sections and glycerine was used as the mountant. The sections were then photographed.

**Biochemical analysis:-**

The fresh plant material was extracted in water, acetone, methanol, and chloroform and the presence of various biochemical entities were checked qualitatively. The qualitative analysis was done by the procedures of Sadashivam and Manickam<sup>11</sup>. Qualitative analysis for carbohydrates was performed by Molisch's test, iodine was noted by iodine test. The presence of reducing sugars was confirmed by Benedict's test. Biuret test and Ninhydrine test were performed for the confirmation of proteins and amino acids respectively. Ferric chloride test were performed for the confirmation of tannin. Qualitative analysis of flavonoid and phenolics were also carried out.

**Quantitative analysis for biochemical constituents in plant samples:-**

The total moisture content was determined based on Jim et al. in 1999. The differences in weights of fresh samples and oven dried samples were determined to find out the total moisture content. Carbohydrate content was measured spectrophotometrically (Hedge & Hofreiter, 1962)<sup>10</sup> using anthrone method. Glucose was used as the standard. Reducing sugars were determined based on Miller, 1972. Starch content was estimated spectrophotometrically using anthrone reagent (Hedge & Hofreiter, 1962)<sup>10</sup>. Determination of crude fiber was carried out by the method of Maynard, (Ed) (1970). Protein determination was carried out based on Lowry et al., 1951<sup>12</sup>. Determination of amino acid was carried out following the protocol of Moore & Stein, 1948. Total phenol content was detected spectrophotometrically based on Mallick & Singh, 1980<sup>7</sup>. The tannin content was determined by Vanillin Hydrochloride method. Flavonoid content was determined spectrophotometrically.

**Results and Discussions:-**

The taxonomical characters of *A. spinosus* suggests that it an erect annual herb with green spiny stem which is sparsely pubescent. It was earlier reported that the leaf is glabrous. In the present study presence of small microscopic hairs in the leaf suggests it to be sparsely pubescent and hence a new trait in identifying the species. The inflorescence is catkin type and is green in colour is similar to the one reported by Xian S, 2003 but the presence of spine throughout the length of the spike is also reported in the present study. The 5 lobed structure of the perianth can also be used as a major lead in identifying the species.

**Table 1:-** Description of vegetative characters in *A. spinosus*.

Vegetative characters	DESCRIPTION
Habit	Erect annual herb
Stem	Green, erect, branched, glabrous, spiny, terate
Leaf	Alternate, sparsely pubescent, ovate margin,
Root	Tap root, highly branched

**Table 2:-** Description of reproductive characters in *A. spinosus*

Reproductive characters	DESCRIPTION
Inflorescence	Terminal, axillary & nodal, green spikes, catkin type, spines present
Flower	Male flower in terminal spike, female flowers only in nodes, perianth 5 lobed, bract length equals perianth length



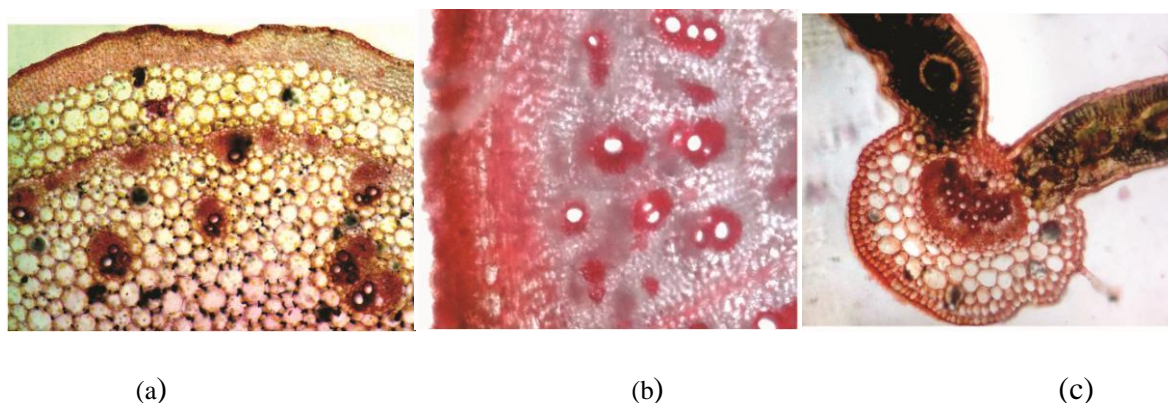
**Figure 1:** *A. spinosus* L.

**A.** Habit **B.** Male flower **C.** Female flower **D.** Fruit **E.** Seed V.S **F.** Female Flower L.S **G.** Floral diagram: Female flower **H.** Floral diagram: Male flower

The stem anatomy shows the presence of a single layered epidermis with papilose elongated cells. The cortex is composed of lacunar collenchyma. The vascular bundles are scattered and numerous. The pith region has the presence of sandy crystals. The leaf anatomy suggests that it has the presence of multicellular epidermal hairs. The vascular bundle in the midrib region is C shaped with a large apical vascular bundle. The results were almost similar to the one reported by Chandurkar 1983 except for the presence of lacunar collenchyma in the cortex region.

**Table 3:-** Anatomical description of *A. spinosus*

Vegetative parts	Description
Stem	Epidermis: 1-2 layered papilose elongated cells Cortex: 8-10 layered lacunar collenchyma Vascular bundles scattered Pith zone contains sandy crystal
Leaf	Epidermal hairs present only abaxial surface Vascular bundle C-shaped
Petiole	5 C shaped vascular bundle with basal bundles small and apical one large
Root	Secondary xylem more than 7 and arranged in two groups. Distribution of parenchyma



**Figure 2:** *A. spinosus* L. S (a) Stem (b) Root (c) Leaf

Ali Khoddami 2013<sup>13</sup> reported that carbohydrate starch reducing sugar proteins and amino-acids can be extracted effectively by polar solvents. The result obtained here was almost similar with slight variations like *A. spinosus* showed a positive result with acetone which is a non-polar solvent but showed absence of starch when extracted with polar solvents. According to Sowmya and Lakshmi Devi in 2013<sup>14</sup> carbohydrate and proteins were extracted effectively only in ethanol, contradictory to this report, the present study shows that carbohydrates and proteins could be extracted using aqueous and acetone also. Tannin, flavonoids and phenolic were qualitatively estimated and the result shows that tannin was present only in alcoholic extraction of sample. All the other polar and non-polar solvents showed complete absence of tannin when extracted. Phenols and flavonoids were extracted using alcohol and acetone. Rest of the solvents shows its complete absence. This was similar to the one reported by Okwu, 2004. According to the qualitative analysis it could be concluded that polar compounds could be extracted with polar solvents and non-polar compounds with non-polar solvents.

Quantitative analysis shows that *A. spinosus* has protein and amino-acids in large concentration than the other biochemical compounds. Soluble sugar content as reported by Begum in 2000 is 5 mg/100mg of tissue. The present study gave almost similar value but by a marginal increase of 0.55 mg. Starch content was in close proximity with the one reported by Costea et al., 2001. The protein content and amino acid content was higher than the one reported by Begum in 2000<sup>15</sup>. The result obtained was also in close proximity with the one reported by Haque in 1985. Secondary metabolites obtained were present in minimal amounts in both the species. Tannin, flavonoid and total phenolic content were much lower than the concentration reported by Akubugwo et al. in 2007. According to his report the values for flavonoid, tannin and phenols were 0.83, 0.49 and 0.35 mg/100g of sample respectively. The



present study shows that the content of flavonoid gave a lower value of 0.0002mg. Tannin content and total phenolic content was also lower than the one reported earlier and ranged from 0.0001 and 0.0021 respectively. The increase in tannin, flavonoid and total phenolic content in both the species treated with inorganic fertilizer can be attributed as a stress response of the plant against salt stress, caused by the usage of inorganic salts. With respect to the experimental data, it can be concluded that plants treated with organic nutrients make a more nutritious and filling diet

**Table 4:-** Quantitative analysis of different biochemical components (100mg of sample) in *A.spinosus*.

Biochemical compounds	Concentration /100mg of sample
CARBOHYDRATES	5.55
REDUCING SUGARS	3.19
STARCH	3.56
PROTEIN	7.14
AMINO ACID	6.16
TANNIN	0.0001
FLAVONOIDS	0.0002
PHENOLICS	0.0021

**Table 5:-** qualitative test with different solvents

TEST	Aqueous	Ethanol	Petroleum ether	Acetone
Molish's test	+	+	-	+
Iodine test	-	-	+	+
Benedict test	+	+	-	-
Biuret test	+	+	-	+
Ninhydrine test	+	+	-	+
Ferric chloride test	-	+	-	-
Test for phenolics	-	+	-	+
Test for flavonoids	-	+	-	+

### Conclusions:-

The taxonomical character of *A.spinosus* suggests certain new traits for identifying the species. In the present study presence of small microscopic hairs in the leaf suggests it to be sparsely pubescent. The presence of spine throughout the spike and the 5 lobed structure of the perianth can also be used as a major lead in identifying the species. The anatomy of the species were similar to the previous reports except for the fact that cortex region of the stem showed the presence of lacunar collenchyma. According to the qualitative analysis it could be concluded that polar compounds could be extracted with polar solvents and non-polar compounds with non-polar solvents. Quantitative analysis shows that *A. spinosus* has protein and amino acids in large concentration than the other biochemical compounds. Increased concentration of nutritive compounds and decreased concentration of secondary metabolites suggests it to be a more filling diet.

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### References:-

1. Costea, Mihai, and Darleen A. DeManson. "Stem Morphology and Anatomy in *Amaranthus L.* (Amaranthaceae)- Taxonomic Significance." *Journal of the Torrey Botanical Society* 128, no. 3 (2001): 254-281.
2. Erum, S., M. Naeemullah, S. Masood, A. Qayyum, and M. A. Rabbani. "Genetic Divergence in *Amaranthus* collected from Pakistan." *The Journal of Animal & Plant Sciences* 22, no. 3 (2012): 653-658.
3. Bensch, CN, and D Peterson. "Interference of redroot pigweed (*Amaranthus retroflexus*), Palmer amaranth (*A. palmeri*), and common waterhemp (*A. rudis*) in soybean." *Weed Science*, January 2003: 37-43
4. Nagy, Gregory. *Ancient Greek Hero in 24 Hours*. Harward University Press, 2013 Okwu, D.E. Phytochemicals and vitamin content of indigenous species of southeastern Nigeria. *J. Sustain. Agric. Environ.*, 6(1),2000: 30
5. Caselato-Sousa, Valeria Maria, and Jaime Amaya-Farfan. "State of Knowledge on Amaranth Grain: A Comprehensive Review." *Journal of Food Science* 77, no. 4 (2012): R93-R104.

6. Xian S. *Amaranthus Linnaeus*. Flora of China. 2003;5:417-421
7. Malick, C.P. and Singh, M.B., plant enzymology and Histo enzymology, 1980: p-286
8. Chandurkar, P.J. Plant Anatomy. New Delhi: Oxford and IBH Publishing Co., 1983.
9. Esau, K. Plant Anatomy. New York: John Wiley and Sons, 1965. Haque, biochemical composition in selected species of *Amaranthus*, International journal of plant sciences, 1985 vol 20, 43-45.
10. Hedge, J.E. and Hofreiter, B.T. Carbohydrate Chemistry, 1967, vol 17
11. Sadasivam, S. and Manickam, A. Biochemical methods. 3rd edn. New Age International Publishers, New Delhi, India, 2008.
12. Lowry, O.H., N.J. Ronserough, A.L. Farr, and R.J. Randell. "Protein measurement with the folin reagent." J. Biol. Chem., 1951: 265-275.
13. AliKhoddami, A., Wilkes, M.A. and Roberts, T.H. Techniques for Analysis of Plant Phenolic Compounds. Molecules, (2013) 18, 2328-2375
14. Sowmya and Lakshmidēvi, "qualitative phytochemical analysis of non-polar to polar solvent extracts of selected medicinal plants". International journal of current research, 22:3618-362.
15. Begum, M. N. Swastha-pustibabostapona (in Bengali) (1st ed., p. 138). Dhaka-1000, 2000: Bangla Academy.





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### RESEARCH ARTICLE

#### “THERE IS MORE TO THE WORLD THAN ONE PLUS ONE”: EXPLORING THE PROCESS OF SELF-ACTUALIZATION IN WALTER MOSLEY’S *THE MAN IN MY BASEMENT*.

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#### Abstract

In *The Man in My Basement*, Walter Mosley attempts to analyze the depths of the psychodynamic consequences of prejudice. The novel symbolizes the troubled self of the individual black American, who has to reject the given masks imposed on him by whites and see himself as an autonomous individual. With the tropes of masking (concealment) and unmasking (revelation), this paper discusses the cultural and identity distortion of the African American and focuses on the process of his self-actualization through an operation for a cultural amendment in order to secure his subjectivity. The itinerary of this emerging self or regeneration constitutes the kernel of this paper.

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#### Introduction:-

The history of African Americans is the history of a marginalized people with fragmented identities. The contemporary writing perspectives by African Americans are imbued with counter discourses that strategically reverse sail in order to bring an amendment to history. Walter Mosley’s *The Man in My Basement* is no exception. It specifically focuses on cultural amendment in the African American individual character as a step towards self-actualization.

In *The Man in My Basement*, Walter Mosley explores race and identity, and attempts to rewrite black identity into existence. Through a personal crusade, which highly articulates the “two-ness” of African Americans, the author first poses a black identity that hides behind the mask (the liar), and then proposes to “find ourselves” by “wearing the mask.” Thus, the novel examines the African American conflict between his desire for a private individual and his social responsibility, his inner struggle and tensions for a subjective self.

The major concern of this paper is to explore African American identity, focusing on the dialectic of the mask: between self-concealment and self-revelation. More specifically, I explore the process of self-actualization; first by articulating the existential and fragmented experience of the “man in the basement” focusing on the syndrome of invisibility, and then by framing the way the novel deconstructs this invisibility syndrome for an autonomous and authentic identity. The two sequences above constitute the framework of this paper.

#### External and Internalized Racism: Distortion of Identity:-

As Anderson Franklin and Nancy Boyd-Franklin (2000) point out, “Racial identity is a central facet in the African Americans’ development of their worldview.” (34) In *The Man in My Basement*, Walter Mosley uses the mask to reveal the difficulty in fully articulating a black self. In both a literal and an abstract sense, the mask plays a

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significant role within the narrative. It is a social mask, which corresponds to conscious knowledge. What it hides is the true self, the unconscious self that is hidden behind the mask. Black people indeed, become recognizable only when they suppress their real self and conform to emasculating parodies of the white man's self-contradictory image of them.

Positing the mask as an important trope of African American identity, the concept of self-projection and perception by the others, we can hypothesize that Charles Blakey, the main character epitomizes African American dual self, an incomplete self-seeking integration into the social fabric. In order to understand this existential individual, it is pertinent that we see this being from the dual perspective of the mask: concealment and revelation. Put otherwise, what does it hide? What does it reveal?

The first use of the mask image is the expression of concealment as experienced by Charles Blakey. From this standpoint, Blakey is constructed as a character seized by psychological tension, struggling with self-definition and perspective, oscillating between a first self and a second self. As a matter of fact, whites' dominance over blacks is a combination of material as well as symbolic containment of blacks; they have been socialized and institutionalized to act and behave. Blakey, who lives in "a secluded colored neighborhood way back from the highway," (3) is burdened with a marginal identity. He develops a sense of worthlessness which is the result of his internalization of inferiority.

As Anderson Franklin and Nancy Boyd-Franklin (2000) write, in a racialized context, individuals are likely to "believe that their true personality and unique abilities are hidden by a cloak of psychological invisibility woven by attitudes of prejudice and discrimination on the part of others." (34) They conceptualize it as the "invisibility syndrome." This subjective sense of psychological invisibility, as they point out, "takes the form of a struggle with inner feelings and beliefs that personal talents, abilities, and character are not acknowledged or valued by others, nor by the larger society, because of racial prejudice." (33)

It is this invisibility which is experienced by Ralph Ellison's invisible man. It is as though he were surrounded by "mirrors of hard, distorting glass." People see only his "surroundings, themselves, or figments of their imagination," except him. (*Invisible Man*, 1952, 7) In the same fashion, Blakey connects his experience to the collective unconscious about the legacy of depersonalization and dehumanization associated with African American history. It is toward the end of the narrative, that he became aware of his invisibility, his invisible presence.

Before Anniston Bennet had come into my life, I was invisible, moving silently among the people of the Harbor. No one wondered about me; no one questioned me. Even my best friends simply accepted what they saw. The card player with a sharp tongue who couldn't back up half the things he said. The petty thief, the man across the street, dead Samuel's son. I might as well have been a tree at the end of the block. People saw me well enough to walk around, but that was just about it. And for my part I treated everything and everyone around me in the same way. (207)

Confronted with prejudice and discrimination, Blakey develops a psychological struggle for acceptance. People around Blakey do not pay attention to his inner existence. They visualize him only as a symbol, an abstraction. Blakey appears as a split subject, a victim of the dialectic between the private and the public, between the inside and the outside. As a matter of fact, he appears as a ghost, a shadow of himself. Under some gazes, Blakey appears as an invisible person; for he wears the mask of invisibility.

To some extent, racism blinds blacks to reality, and generates internal conflicts from the choices it demands. As a result, blacks' life is a simulation; that is the acceptance of artifice, of role playing, or the assumption of disguise as a way toward moral truth. This moral truth consists in wearing a mask to hide one's true image from their oppressors in order to stay alive, as the dying grandfather in Ralph Ellison's *Invisible Man* has recommended the protagonist's father: "Live with your head in the lion's mouth. I want you to overcome 'em with yeses, undermine 'em with grins, agree 'em them to death and destruction, let 'em swoller you till they vomit or bust wide open.'" (17)

This duplicity is a survival strategy which impacts on blacks' lives. It takes them aloof from reality, above ground or on the surface. In the process, what is authentic or real stays underground, hidden in a secret sanctuary. As Traise Yamamoto (1999) writes, "While masking can be used against self, used by others to deny singularity and subjectivity, its function as concealment points to its potential doubleness." (117) Concerning Charles Blakey, the

mask has completely obscured his identity and the symptoms of this invisibility syndrome operate in a number of ways. Basically, he sees himself and behaves according to what is expected from him by the others. With the feeling that his own worth is not valued or recognized because of prejudice and racism, his personal identity and ability are undermined.

He goes through that experience when Mr. Anniston Bennet came to him in his basement and told him: "I can make it very much worth your while." (5) For Blakey, this is a racist affront, a racial slur which creates and confirms within him the feeling of not being seen as a person of worth. It is this implicit assumption that Blakey tries to articulate in the following: "It was his tone that cut me off. Suddenly he was one of those nonsense-white-men in charge. What he seemed to be saying was 'I know something that you had better listen to, fool. Here you think you know what's going on when really you don't have a clue.'" (5)

Of course, these kinds of racial slurs are disorienting, distorting. They breed confusion and disillusionment. According to Anderson Franklin and Nancy Boyd-Franklin (2000), the outcome of "everyday racism becomes a part of the individual's intrapsychic structure; it is a catalyst for feelings of invisibility, which incline one toward alternative roles that appear able to resolve conflicted identity and provide acceptance." (37) Blakey sees himself through Bennet's eyes, and he lives in a zone of invisibility, an imaginary or assumptive world. In his daily life, Blakey strives to adapt to this experience of racism, this subjective experience of invisibility, which shows his superficial being instead of his authentic or intimate nature.

Moreover, Blakey remains affected by the syndrome of invisibility even in his relations with the members of his racial group. Oscillating between the invisible and the visible, Blakey struggles for a psychological visibility, perhaps to compensate for the indignities of racism. Telling lies is, for instance, one manifestation of his invisibility syndrome. As he puts it,

I've lied all my life. To my parents and teachers and friends at school. I lied about being sick and not coming in to work, about romantic conquests, my salary, my father's job. I've lied about where I was last night and where I was right then if I was on the phone and no one could see me. I have lied and been called a liar and then lied again to cover other falsehoods. Sometimes I pretend to know things that I don't know. Sometimes I lie to tell people what I think they want to hear. (51)

In order to gain the acknowledgement and the validation of the members of his group, Blakey becomes a ghost, a shadow of himself. He has become a constant liar; his life is made of facticity, falsehood, and irresponsibility, which are the ways he adapts to the contours of racism and people's expectations. As he notes,

The only chance I had at intimacy was with Clarence and Cat, but 90 percent of my time with them was spent under the influence of alcohol (...) Nobody saw me (...) Bethany and Narciss saw something that was like me — an image of what I thought I wanted to be — but they had no idea what was on my mind. (207-208).

Close to telling lies, Blakey is also a thief, another symptom of his invisibility syndrome. Stealing derives from his willingness to conform to social constraints and norms. An exemplary instance is when he got fired as a bank teller from Harbor Savings because he has stolen money in order to satisfy his girlfriend's desires: "My account was empty because I had paid for an electric food processor and China wanted to be taken out." (28)

This marginal social status due to racism is reinforced by the haunting memory of his uncle Brent that dominates Blakey's behavior. Actually, though racism is an absent cause in the narrative, Blakey's attitude is deeply affected by racial prejudice and discrimination. Early in the story, he makes a link between Bennet and his own uncle, Brent, a detail that resurfaces at various points in the novel. This connection or association holds from the fact that Brent unconsciously perpetrates white racism on him. Uncle Brent has internalized white racism, and behaves exactly like an Uncle Tom, a black who perpetrates whites' absurd racial myths. He blames the black race, and it is that self-blame that he projects onto Blakey whom he sees as a failure. "My uncle Brent used to say that I was lazy and worthless. He said it whenever my mother was out. 'I'm surprised that a boy like you don't starve 'cause he too lazy to lift the fork to his lips.'" (69)

For Uncle Brent, Blakey's life is doomed to failure, and this has something to do with his skin color. "Ricky was darker than his cousin but not nearly my color. When my uncle Brent used to see us coming, he'd say, 'If it ain't the three shit-colored patches on a tatty brown quilt.'" (9) White racism is relayed by him and his comments and judgments reflect whites' ideological fantasies about blacks, which affect Blakey's behavior. Blakey actually inherits the burdens, the expectations of his uncle, and his personal life and development are deeply impacted by stereotyped assumptions.

Influenced by the dominant white cultural values, Brent contributes to the distortion, the marginalization of the black race. For him, as Blakey reports, "Negro so poor, that he'd sell his shadow just to stand in your shade." (21) In addition, he used to hold a contradictory and debasing view about the Blakeys. Charles Blakey says that he used to steal money from Brent because

My father's family had come directly from Africa, but Brent said that my father really didn't know our roots. He said that we were like all other American blacks, that we came from 'slave-caliber Negroes who were defeated in war and sold into slavery because they didn't have the guts to die in battle.' He said that there was no such thing as free Africans who had 'chosen to come over and sell their labor in indentured servitude' and that American Negro citizens never existed before 1865, as my father claimed. (30)

Assigned to a zone of negation, Blakey has definitely succumbed to the distorted images ascribed on him by his uncle. "I was everything that my uncle Brent said that I was, and less. Nothing ever changed and I never got any better or worse." (104) For these reasons, Blakey despises him, holding him as responsible of his failure. "I blamed Brent for everything that ever befell me. My father's death, my mother's, the feeling I had that I couldn't tie my shoes right – all of that I blamed Brent for." (70)

On the whole, Blakey is the victim of an assumptive blackness which signifies absence, failure, meaninglessness and worthlessness. Confined in social expectations, definitions, norms and categorizations that negate the black self, Blakey's worldview is reduced to superficiality. His own self is blinded by the reductive and demeaning gazes projected onto him out of racism. Thus, locked in social conventions, stereotyped assumptions, his knowledge of the world is always biased. That bias is here rendered by his incapacity to appreciate a painting:

If I think a painting is ugly, somebody just tells me that I don't understand. If I think a painting is good, they tell me the same thing. It's like artists see a different place, a higher place, whereas I'm on the level of some stray dog who only knows how to hunt for pussy and food in a world that's black and white. (92)

Within imposed definitions of reality, what people see in him is not his true self, but what he has to pretend to be according to social constraints and norms. He wears an existential mask, a mask for a meaningful existence, which hides his demented world. His interactions with the people evolve from superficial rather than authentic and intimate relations. He has learned to repress not only his emotions, but his humanity. Alienation and psychological distress or paralysis, are among others the disorienting effects of his psychological invisibility. Ultimately, he sinks ineluctably and metaphorically underground:

I went back into the kitchen as if I were descending into a pit. Every step brought me lower. And all it was was just that double d; a stuttering skip and my fingers were tingling, the light in the room refused to illuminate. I didn't feel hungry; I didn't want a drink. My months of unemployment, my loneliness, my drunken poverty all came to the surface then. I would have liked to cry but I couldn't. The prince in my novel was reduced to a mass of unreadable words. (95)

Blakey's whole life is conditioned by white racism: an actualization of the white man's fantasy. All his experience brings to light the fact that he has been living in a world of illusion, imprisoned in his double consciousness: the mask which oscillates between the lens of the others and his perception of his existence. Locked in the conflicting cages of identity (who he should be and who he is), his self is cloaked within the imaginary realm of the mask. The source of his self-actualization, as the novel suggests, resides in the mask as the symbolic mandate for a recovery of the self, the overcoming of identity distortion.

### The Rehabilitation Process: Resurrection of the Black Self:-

*The Man in My Basement* deconstructs the experience or the syndrome of African American invisibility. In the perspective of recasting a new black identity, the novel functions as a conversion narrative, which implies a movement from inside to outside for an emerging sense of self-discovery. As Sean Homer (2005) writes, Hegel elaborates that "For the human subject to emerge it must not simply be conscious of its own distinctiveness but must be recognized as a human subject by another." (23) Self-hood therefore emerges through a process of developing self-consciousness triggered by a self-reflection activity. Self-consciousness in the novel is symbolized by protagonist's assimilation with the cultural heritage and materialized by his ancestors' relics which have been stored and forgotten in the basement of the familial house. Among those ancestral objects, the prime are three masks, three "passport masks" whose story or cultural significance help Blakey recover the truth about his identity. The masks here are no more figurative, but literal and they are no longer playing self-concealment role; but rather operate in the realm of self-revelation.

Thus, in order to come to self-consciousness, and overcome his invisibility, Blakey metaphorically travels inward to look inside himself with his own eyes, not from the eyes of others to discover his true self. In this perspective, "the man in his basement" stands as a metaphor of himself, his truer self that needs to be discovered for self-recovery. *The Man in My Basement* is therefore a quest for the self; and the development of Blakey's personal identity is a dynamic process of auto-revelation for self-realization, which evolves over the course of the novel, following a reversing sail trajectory.

It is a metaphorical quest into Blakey's black psychology, materialized by a self incarceration, an isolation or confinement into his basement, during which he receives help, guidance and lessons from two pivotal characters: Anniston Bennet and Narciss Gulli. The basement where he works as Bennet's warden, is described as "a large, dark room crowded with stuff from the Dodd and Blakey families. A little something was there from every generation. I had one great-auntie, Blythe, who considered herself a painter..." (39) This basement, according to Blakey is "more like a crypt." (37) But unlike the traditional aim of the prison for the African American: a system whose purpose is to define, confine, and control black Americans; Blakey's self-incarceration is a psychological prison which helps him reshape his identity from negative self-image to new positive self-image. In other words, it is an imprisonment that helps him break the iron bars of the white physical imposed prison.

When Bennet asks permission to inhabit Blakey's basement, he is asking to enter Blakey's inner world, his interior world, which will later reveal that which is hidden in Blakey. In accepting Bennet in the basement of his house, Blakey is begrudgingly accepting to uncover accidentally and make alive his past through the cultural objects of his ancestors. It is a confrontation with his past, his culture, a confrontation with himself. It is a self deeply anchored and abandoned in the basement of the house. Therefore, in opening his basement for Bennet, Blakey is unknowingly venturing upon a journey towards selfhood, that is a journey to meet himself, "the man in his basement." Among other things, the basement stands for the individual's interiority, or intimacy, the individual's consciousness. As Blakey argues, it is not for money, but because of knowledge and intimacy, that he has agreed to give in his basement to Bennet:

Anniston Bennet knew more about me than any other person – and he was still willing to enter this business deal. Those shocking blue eyes looked right into mine and knew what they were seeing. Not like Bethany and not like Clarence. Unlike Uncle Brent, Bennet made no judgments. If he felt he was better than me, it was only because he felt better than everyone, and that, in some strange whiskey-soaked way, made an equal in the world – at least in the world as seen through his eyes.  
124

Blakey and Bennet become associates, collaborators; and the primary lesson or principle Blakey learns from Bennet is that lies can destroy and be fatal instead of guaranteeing one's life. In other words, Bennet encourages Blakey into throwing off his mask, his invisibility syndrome. "In my experience, Mr. Blakey, people rarely renege on their promises. It's always easier to keep your word than to enter into lies or intrigue." (74) This requirement is supposed to jar Blakey into an awareness of his true nature, and activate the process of his self-recovery. Upon Bennet's requirement, Blakey is first a bit hesitant. He muses:

Looking back on it I should have been scared by his words, but instead I was confused. I wondered what point of view could see honesty as the stronger virtue in a world I knew was full of cheating and lies. Didn't they lie in commercials on TV and ads in newspapers? Didn't politicians lie about what they've done and what they're about to do? Clarence lied all the time to his wife, and he had more girlfriends than I did. (75)

When he accepts this principle, which is inscribed against the syndrome of invisibility imposed by the social norms and expectations, Blakey simultaneously accepts to re-envision reality. One reality he has become aware of thanks to Bennet is his visibility. Indeed, by spotting Blakey down in that black neighbourhood, and asking to use his basement, Bennet is contradicting Blakey's invisibility. It is a fact that contributes to arouse the fiber of visibility in Blakey, which eventually helps him connect with his deep self. Later, his closeness with Bennet makes him realize that there was no significant difference between him and Bennet. Though both men are racially different (Bennet is white and Blakey is black), the novel works to melt away or cleanse this human characteristic or categorization toward the end. The novel reveals no particular difference between Bennet and Blakey; they are just symbols of human identity, and both men experience self-imprisonment for self-rehabilitation.

Sharing almost the same experience with Anniston Bennet, Blakey engages into self-discovery. As a result, he confesses: "It was then that I realized what had happened to me. Really, what had happened to the world around me. Before Anniston Bennet had come into my life, I was invisible....And for my part I treated everything and everyone around me in the same way." (207) What Blakey realizes here is the permeability of the mask he has been wearing. Bennet knew everything about Blakey before both men met for the first time; this fact is a testimony of the superficiality of the mask. Before meeting Bennet, the use of this mask has allowed Blakey to shy away from his interlocutors.

When he asserts: "But now everything was different – half different, really," (207) it is like he has torn the quilt, the veil that has blinded him so far. He elaborates on the change as he states:

What had changed was that I saw. It was as if everybody had become like a mirror, and I saw reflections of what they saw instead of what it was they were trying to show me or tell me. Narciss had become a mirror and an echo chamber, giving me back every word uttered and gesture made. And when I saw or heard something I didn't like, I had the chance to alter my behavior. (208)

Moreover, Bennet teaches him that there is so much more to learn about the world, and nothing can be judged on absolute terms, because it is a multi-dimensional world based on simulation. The world is fluid and shifting; and sometimes reality merges into the unreal. As he summarizes, "There is more to the world than one plus one." (134) Bennet illustrates this lesson using the relationship between good and evil. According to Bennet, there is a dualistic conflict between good and evil. Evil is much more integral to the system of Good. Good turns into its opposite, that is, absolute Evil. Evil is just a mask that we contrast with Good that we are supposed to defend.

Blakey benefits from Bennet's philosophical knowledge and experience of the human nature to acquire a new vision of himself. However, Bennet is not the only agent who actually helps Blakey accomplish his self-actualization. Narciss Gulli, the curator plays a substantial role in Blakey's spiritual and cultural voyage for self-recovery. She is the one who teaches Blakey the function of the literal mask. For her, and as a specialist in anthropology, the masks found in the basement, are an art of individual assertion within and against the group. The acceptance of the masks is a metaphor of Blakey's reunion with black pride and African American culture. It is the manifestation of a rather positive meaning of blackness, a therapeutic intervention, which opens a space for possible transformation.

At the outset of their discovery, Blakey actually does not highly rate the objects in his basement. For him, they are useless, just "a pile of refuse that, if it weren't for her concern, I would have used to make a bonfire in the backyard." (57) Inside that pile, "there were three hand-carved masks, rust to dark brown, ivory I was sure." (62) For Narciss, these masks are the repository of Blakey's family history, his ancestors' soul, their identity, as she states: "It's the history of your history," (63) or, "the spirit of your heritage." (64)

In Narciss's lessons to Blakey, the salient perspective is the following: "Everything I know about antiques comes from the inside out. It's more than a business with me; it's a way to see our history." (65) It is this anthropological principle, which reverses the angle of vision: from the inside out but not from outside in. This strategy operates

Blakey's transformation. This principle poses the self, not as the objectified being, but the subject that perceives. In other terms, instead of being seen through the lens of the others, one has to see oneself through one's own self-defined perspective.

Blakey now assimilates himself with his ancestor's culture. The attachment with the masks is an effective way of reversing cultural hegemony and reviving African American culture. Like the nameless hero in Ralph Ellison's *Invisible Man*, Blakey has been looking for himself. When he finds out about the masks, he comes to the realization that his cultural heritage defines him. He has just discovered that he has been an invisible man.

I was looking for myself and asking everyone except myself questions which I, and only I, could answer. It took me a long time and much painful boomeranging of my expectations to achieve a realization everyone else appears to have been born with: That I am nobody but myself. (Ralph Ellison, 1952: 17)

By accepting the masks of his ancestors, Blakey breaks down the psychological barrier between the figurative mask and the literal mask, and thereby makes the mask as an element of superficial identity into a real and substantial object of identity. The mask, in its figurative sense (superficiality), has completely obscured Blakey's identity. With Bennet and Narciss, Blakey has realized the superficiality of his invisibility made possible by the mask. This realization is a significant stage in the self-discovery. Blakey's re-connection with the masks liberates him from his dualistic relationships for a better knowledge and understanding with his fellows. Thus, as Zizek (2001) points out,

'Role-playing and disguise can lead to a liberation and realization of the self.' "The dialectic at work here is that of symbolic identification, of assuming a symbolic mandate: insisting on a false mask brings us nearer to a true, authentic subjective position than throwing off the mask and displaying our 'true face.' (38)

The mask is the seat of one's personality, and research done by Narciss, the anthropologist reveals that Blakey's ancestral masks were used as passport.

That's what this is and it's also what we found in that box. They were used as identification but also as a way of bringing home along with you when you were away on a long journey. It's hard to say, but the masks you have could represent a family, maybe three brothers or friends who set sail for America as indentured servants. The majority of passport masks are made of wood, so the fact that these are ivory might have special significance. (96)

Thus, instead of concealment, the masks here are self-revelatory, passport for self-recovery or symbolic mandate for self-identification. What they reveal is contradictory to what Uncle Brent used to deny. The masks "were used for tribal identification, but they also were to remind their owner of their home and family – their people." (141) Through them, Blakey learns that his ancestors were indentured servants instead of slaves, and that his family "might descend from a direct bloodline of kings." (96)

The masks represent an important tool to fight back the invisibility and marginalization of the black experience. They are a source of a new life, and Blakey identifies with them. He bears a new meaning to them, celebrates them, and finds pride in them: "Every night I sat up late with my ancestors, Leonard, the geeky-looking one, Jojo, the warrior, and Singer, the mask with his lips set into an O. I named them and thought about them. I had made up their characters and histories, but they were real to me." (232) Blakey is now acutely conscious of the masks, his cultural heritage, and to some extent, his self-realization and assimilation with the masks entail self-consciousness. As he states, "I realized that my feeling of invisibility was false. People did see me. They knew when I passed in the street. My actions were noted no matter how small I thought I was." (223)

The masks have the potential to contribute to heightening the consciousness of black people about their identity; they are a source of his self-recovery, his self-empowerment that defies his invisibility. As Anderson Franklin and Nancy Boyd-Franklin (2000) argue,

The painful encounters with racism move some African Americans to immerse themselves in the ethnic and cultural traditions of African people as a means of attaining a status that provides an intrapsychic structuring for visibility. Achieving racial identity solidifies one's perspective about self in relation to others, and becomes a part of a protective mechanism shielding the individual from the effects of racism. (40)

The process of Blakey's self-realization is the process of his identification with his ancestors' masks. The masks discovered in the basement represent the hope of self-discovery which reconciles Blakey's racial and cultural heritage within the dominant white society. Blakey redefines himself by identifying himself with his ancestors' masks. Narciss Gulli is instrumental in Blakey's transformation, his self-realization. She specializes in anthropology, and she is a curator. Through her teaching about his ancestors' masks excavated in his basement, she leads him to self-discovery, and eventually he reshapes his self-identity, integrating the masks. The masks in question here are physical, they are cultural objects belonging to Charles Blakey's ancestors. The masks are metaphor of his African cultural heritage.

### Conclusion:-

*The Man in My Basement* is an exploration of race and identity. It is an existential and philosophical novel, which symbolizes a divided self or the projection of two selves, the true self and an imposed version of self. African American's life has been essentially led on the surface, hiding the ground where he has been obliged to hide his true self. *The Man in My Basement* is therefore a spiritual and archaeological journey into the African American familial treasure in order to excavate his real self. *The Man in My Basement* is therefore a cultural amendment.

In Walter Mosley's *The Man in My Basement*, the mask functions as a double-sided trope: a strategy of self-concealment to protect the subject and it serves as a metaphor for the construction of the true self, as well. In other words, it helps to hide the true identity, or make oneself invisible and, at the same time, it contributes to reshape the self for dignity, making the self visible. Realizing the devastating and marginalizing impact of racism, Mosley advocates the restoration of African Americans' identity through the celebration of their cultural heritage. My exploration of the individual's self actualization has focused on the trope of the mask first in its imaginary realm and then as a symbolic mandate.

### Bibliography:-

1. Baudrillard, Jean. "Toward a Principle of Evil." *Postmodernism. A Reader*. Thomas Docherty. Ed. New York: Columbia University Press, 1993. Pp. 355-361. Print
2. Du Bois, W. E. B. *The Souls of Black Folk*. New York: New American Library, 1969. print
3. Du, Juan. "Exploring the Theme of Self-Actualization in Maya Angelou's Poetry." *English Language and Literature Studies*. Vol. 4 No. 3 2014, Pp. 63-70 Online. Accessed on December 4, 2016.
4. Dubey, Madhu and Elizabeth Swanson Golberg. "New Frontiers, Cross Currents and Convergences: Emerging Cultural Paradigms." *The Cambridge History of African American Literature*. Maryemma Graham and Jerry W. Ward, JR. Ed. Cambridge: Cambridge University Press, 2011. Pp. 566-617. Print.
5. Ellison, Ralph. *Invisible Man*. New York: Penguin Books, 1952. Print
6. Franklin, Anderson J. And Nancy Boyd-Franklin. "Invisibility Syndrome: A Clinical Model of the Effects of Racism on African-American Males." *American Journal of Orthopsychiatry*. Vol. No. 1, January 2000. Pp. 33-41 Accessed November 12, 2016
7. Gordon, Lewis R. "Through the Zone of Nonbeing: A Reading of Black Skin, White Masks in Celebration of Fanon's Eightieth Birthday." *The C.L.R. James Journal* Vol. 11 No. 1 (Summer 2005) Pp.1-43. Online. Accessed on November 12, 2016.
8. Homer, Sean. *Jacques Lacan*. New York: Routledge, 2005. Print Lane, James B. "Underground to Manhood: Ralph Ellison's *Invisible Man*." *Negro American Literature Forum*. Vol. 7 No. 2 1973. Pp. 64-72. Online. Accessed on September 9, 2015.
9. Larson, Jennifer. "Folding and Unfolding History. Identity Fabrication in Suzan-Lori Parks's *Topdog/Underdog*." *Reading Contemporary African American Drama. Fragments of History, Fragments of Self*. Trudier Harris. Ed. New York: Peter Lang, 2007. Pp. 183-202. Print
10. Mostley, Walter. *The Man in My Basement*. New York: Back Bay Books, 2004. Print Yamamoto, Traise. *Masking Selves, Making Subjects. Japanese American Women, Identity and the Body*. Ed. Berkeley: University of California Press, 1999. Print
11. young, Robert. "Invisibility and Blue Eyes: African American Subjectivity." *Revista Canaria de Estudios Ingleses*. No. 39, 1999, Pp. 169-190. Online. Accessed on January 7, 2016.
12. Zizek, Slavoj. *Enjoy Your Symptom*. New York: Routledge, 2008. Print



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### RESEARCH ARTICLE

#### MATERNAL PARENTING STYLE AND CHILDREN'S ELECTRONIC USE AMONG UNIVERSITY FEMALE EMPLOYEES, SAUDI ARABIA.

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##### Key words:-

Parenting style, Screen time,  
Restrictions, health hazards, Children.

#### Abstract

**Background:** Technology is becoming an essential part of life, especially for children born and growing up with it. Therefore, it is important to know how it is affecting them socially, physically and behaviorally. Different parents have different attitudes and behaviors that determine how they deal with their children, the variety of parenting styles can have different outcomes on the children's use of electronics.

**Objectives:** Firstly, to identify different parenting style among mother employees at Princess Nora University, then determine the effect of different parenting styles on the hours spent by children on electronic devices and lastly, assess the level of perceived potential negative hazards of electronics.

**Methods:** A cross-sectional study has been conducted, with a standard, multi-sectional modified questionnaire. Sample size was 280 females obtained by multistage stratified sampling.

**Results:** The most common parenting style was the Authoritative. Screen time use was positively correlated with permissive parenting style (.09), and was negatively correlated with the authoritarian and authoritative parenting style (-.01). The majority of mothers perceived that the use of electronics has a mild impact on their children's physical health. Overall, there is a significant relationship between permissive parenting style and setting restrictions on electronics use ( $p = 0.04$ ), and significant effect on children's time spent on electronics per week ( $p = .057$ ).

**Conclusion:** Findings showed no significance between parenting style and children's screen time use. However, children's health was affected, therefore, parents must apply restrictions on screen-time use.

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#### Introduction:-

In recent modern days, parenting styles have changed according to the technological evolution. Every parent has a different approach to the uprising technological use depending on their parenting style which can be explained as

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“parenting style as a typology of attitudes and behaviors that characterize how a parent will interact with a child across domains of parenting”<sup>(1)</sup>, and other authors defined it as “Complex activity that includes many specific behaviors that work individually and together to influence child’s outcomes. The construct of parenting style is used to capture normal variation in parents’ attempts to control and socialize their children”. As a result of the sudden invasion of technology and its increasing usage among children as they grow older ” Children’s screen time increases with age and patterns of screen time appear to be stable over time”<sup>(2)</sup>, and some studies suggested that communication and parenting style predicted disagreements between parents and children about technological devices and internet usage<sup>(3)</sup>.

Parenting style includes four basic patterns that were identified by Baumrind: The Authoritarian parents who are known to be obedience- and status-oriented are characterized by high standardized guidelines and demands, tend to be direct with their instructions and are unresponsive. Due to fear of losing control, they discourage open communication, provide ordinal and structural rules, which are expected to be obeyed by their children without any explanation. Authoritarian-Directive parenting can have two forms of styles: Authoritarian parents who are not intrusive or autocratic in their use of power, and authoritarian parents who are highly intrusive. The Authoritative parents who use supportive disciplinary methods are characterized by moderate demands, acceptance and responsiveness as well as open communication. They are assertive and restrictive rather than intrusive, thus setting clear rules and guideline for their children and tend to encourage their children to be autonomic, assertive and socially responsible as well as cooperative. The Permissive parents who are also known as (Indulgent) or (Nondirective) are characterized by high acceptance and responsiveness, and non-demanding. These parents lack control over their children and avoid confrontation. They are also known to be lenient, non-traditional, do not require mature behaviors and allow self-autonomy by giving their children the freedom to be independent .In some cases, some parents tend to be democratic permissive parents who are more conscientious, engaged and committed to their child unlike the non-directive permissive parents who are known to be less engaged and committed to their children. The Uninvolved parents who might encompass both rejecting-neglecting attitudes are characterized by unresponsiveness nor demanding, fail to monitor and supervise the child’s behavior and are uninvolved in with their children’s hobbies and activities.<sup>(4)</sup>

The Saudi community has shown an increased interest in technology in the past years, especially children and teenagers who are early adopters and heavy users of technology, who are referred to as digital natives and whose electronic devices are becoming an essential part of their daily lives, whether it’s for an educational or entertainment purposes<sup>(5)</sup>. This huge technology revolution alerted parents who are digital immigrants, about the impact of electronic devices on their children<sup>(5)</sup> and alerted them about several technological hazards which included intensive usage for technological devices, increased aggressive thoughts, angry feelings, physiological arousal, aggressive behaviors, and physiological desensitization to violence due to violent video game exposure<sup>(6)</sup>, and obesity, which is another hazard for technology use due to its bi-relationship with the amount of hours spent on devices like TV, computer and iPad, which means the more time spent on technology, the chance of becoming an obese increases.<sup>(7)</sup> A study conducted on parenting Style, the Home Environment, and Screen Time concluded that “The global increase in prevalence of childhood overweight and obesity has been ascribed to several trends including the increase in consumption of energy-dense diets and the increase in sedentary behavior (in particular the increase in screen time; time spent watching TV and on computers or game consoles)”<sup>(8)</sup>.

A great number of studies regarding parental control were conducted and concentrated on the impact of technology consumption on children’s physical activity and sedentary lifestyle “Parents with greater support for physical activity did not report higher use for parenting practices that restricted child’s screen media use. Greater reported use of restrictive TV parenting practices were associated with lower level of child PA”.<sup>(4)</sup> In contrast, there have been a number of researches conducted to study the benefits of technological devices use among children. In one study it was concluded that video games contributes to consolidates the cognitive skills by prompting reactions, improved alertness, attention and reinforces the mental abilities of children in addition to the satisfaction of emotional needs actively.<sup>(9)(10)</sup>

Level of autonomy available is affected by the number of children in a household and determined by the parents rules “family rules on watching TV are associated with less TV viewing and that high child autonomy is associated with more TV viewing”.<sup>(11)(5)</sup>

A previous study have highlighted that the amount of parent's knowledge about technology influences their control over their child's use of it. It was aforesaid that in many cases, parents who have enough knowledge about technology tend to check their children's browsing history and 30% of parents in the UK and US remain physically present to censor their children's internet use and go to the extent of blocking what they perceive as unsuitable.<sup>(5)</sup> In other words, parents have a great influence on their children's screen time.<sup>(2)</sup> Although parenting style was assessed in relation to different domains like (child's physical activity, dietary habits, and as mentioned previously, internet censorship). "Parental use of reinforcement styles for activity was positively related to children's physical activity. Parents' use of appropriate disciplinary styles was positively related to children's healthy eating"<sup>(12)</sup> and technology use on the side effects of the child's health and cognitive intelligence has been assessed in previous studies, yet gaps exist in assessing the association between the parenting style and the time spent on technology use. To fill this gap, we decided to conduct a study to assess the parenting style in relation to children's electronic use and try to identify the determinants of children's use of electronics especially the parenting style to see if a future intervention is needed.

#### **Research question:-**

Is there an association between different parenting style and children electronic use and screen time exposure?

#### **Hypothesis:-**

The screen time use is affected by the different parenting style.

#### **Objectives:-**

To identify different parenting style among mother employees at PNU. Then, to determine the effect of different parenting styles on the screen time and the hours spent by children on electronic devices use, and to assess the level of perceived potential negative hazards of electronics use, they observe in their children.

#### **Methodology:-**

##### **Study design and setting:-**

A cross-sectional study conducted from April 2016 to December 2016 at PNU.

##### **Target population:-**

PNU female employees in Riyadh, Saudi Arabia whom have preschool and school children, whether administrative and teaching employees, since mothers, not only spend a lot more time with children than fathers, but also has more opportunities than the father to influence her offspring's psychological growth and behavior.

##### **Sampling technique and sample size:-**

A multi-stage stratified random sample was done on the 13 colleges in PNU, which were categorized under three main types, which are Health Colleges, Science Colleges and humanities colleges. From them, we randomly selected the college of Art and Design, Computer and Information Sciences, Health and Rehabilitation Sciences, Business Administration, Arts and Sciences. Then total sample size of 297, was calculated by using open epi<sup>(14)</sup> adopting the following parameters: 80% power of the study to detect a statistical significant difference, 95% confidence interval and 34% of the members interviewed in the pilot study, reported that their children's exposure to electronic screens was less than 2 hours. The sample was stratified according to the number of administrative and teaching staff in each of the previously randomly chosen college.

##### **Tools for data collection:-**

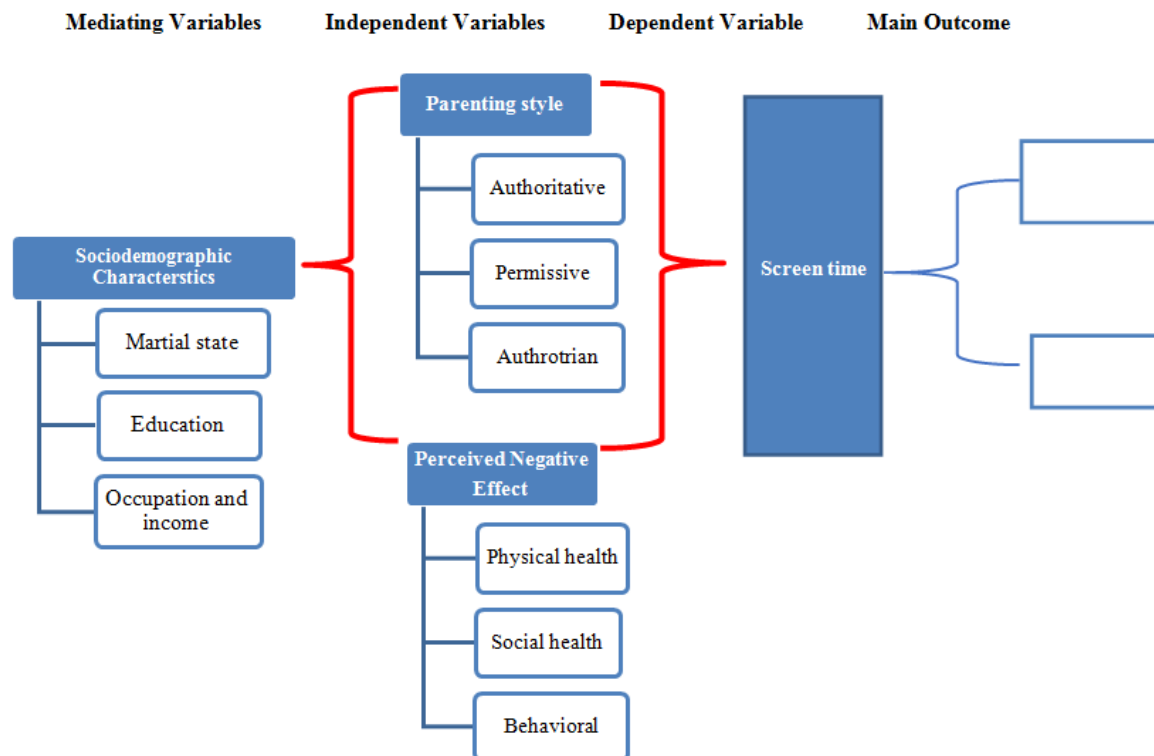
A standard multi-section modified questionnaire has been translated and used to collect data and it includes several parts and guided by the conceptual framework illustrated in figure 1:

**The first part** covers the family characteristics (Mother, father and children) and home-physical environment.<sup>(5)</sup> **The second part** includes questions about the use of electronic devices, which will include as the mothers were asked about the average time their child spent during recreational electronic use daily and during the weekend. In our study, we used 2 hours per day as the cut-off according to the international recommendations<sup>(14,15)</sup> in addition to asking the mothers about the frequency with which they set limits on the time of recreational electronics use. **The third part** of the questionnaire assesses the level of perceived potential negative hazards of electronics use, they observe on their children in different domains: **physical health** (9 items), **social relationships** (3 items), **behavioral changes** (2 items), and **educational performance** (2 items) with four point responses (None, Mild, Moderate and

Severe). <sup>(16)</sup>*The last part* is derived from the modified 21-item Parenting Styles and Dimensions Questionnaire (PSDQ) designed to categorize mothers' parenting style based on various behaviors displayed by parents towards their children. This scale has three dimensions that are authoritative parenting style includes (9 items), *authoritarian parenting styles includes* (6 items), and *permissive parenting style* includes (6 items). The response to each item is measured on a 5-point Likert scale, 1="never", 2="once in a while", 3="about half of the time", 4="very often", 5="always". <sup>(17)</sup>

#### Questionnaire translation process and validation:-

The questionnaire was translated into Arabic using forwards-backwards blind translation process by two bilingual expert translators, whose native language is Arabic and comparison (between the original English version and the back translation version) was done to measure the level Of agreement between both.



**Figure 1:-** Conceptual framework of factors used in the study

#### Pilot testing:-

The Arabic version of the tools has been pilot tested on 20 females in college of Nursing to assure comprehension and ease of administration, determining the time needed to fill the questionnaire in addition to calculating sample size based on the findings from the pilot study. According to the pilot test results, we made the necessary adjustments on the questionnaire. For example, we changed some of the open ended questions to close ended questions like age and nationality because a great number of participants left it blank.

#### Data management and Statistical analysis:-

After collecting data, it was analyzed by SPSS 20<sup>th</sup> version <sup>(18)</sup>. Checking the normality for the quantitative variables was performed using the Kolmogorov test, all variables were normally distributed except for the Authoritative subscale. Then the data were described by frequency and percentage for categorical data, mean and standard deviation for normally distributed continuous variable and median and IQR for the authoritative. Inferential analysis was performed using Independent T-test, One-Way ANOVA and for continuous normally distributed variables while Mann-Whitney and Kruskal-Wallis tests for continuous not normally distributed variables. Chi square to assess the association between recreational screen time use and educational achievement and social change. Spearman correlation coefficient to determine direction and strength of the relationship between different parenting style subscales and screen time use of their children on screen time. The reliability of the total parenting scale and its 3 subscales was assessed by using Cronbach alpha coefficient.

**Ethical considerations:-**

Before collecting data, an approval has been taken from the ethics committee and research center in health sciences and rehabilitation collage, PNU. Consent from the participant after being informed about the purpose of the study, the confidentiality of the shared information and anonymity of the participants.

**Results:-**

**Table 1:-** Personal Characteristics of mother employee working at princess Nora Bint Abdulrhman University (n=280)

Personal characteristics	Categories	Frequency	Percentage
Age groups (years)	25-35	137	48.9
	36-45	117	41.8
	More than 46	26	9.3
Nationality	Saudi	239	85.4
	Non-Saudi	41	14.6
Colleges	Art and Designs	63	22.5
	Computer and Information Science	42	15.0
	Health and Rehabilitation Science	54	19.3
	Business Administration	43	15.4
	Arts	41	14.6
Educational Level	Science	37	13.2
	High School	43	15.4
	Bachelor	140	50.0
	Master	41	14.6
	PhD	56	20.0
Work Nature	Educational	64	22.9
	Administrative	184	65.7
	Both	32	11.4
Marital Status	Married	261	93.2
	Divorced	13	4.6
	Widowed	6	2.1
Number of children	1-2	125	44.6
	3-4	112	40.0
	More than 5	43	15.4

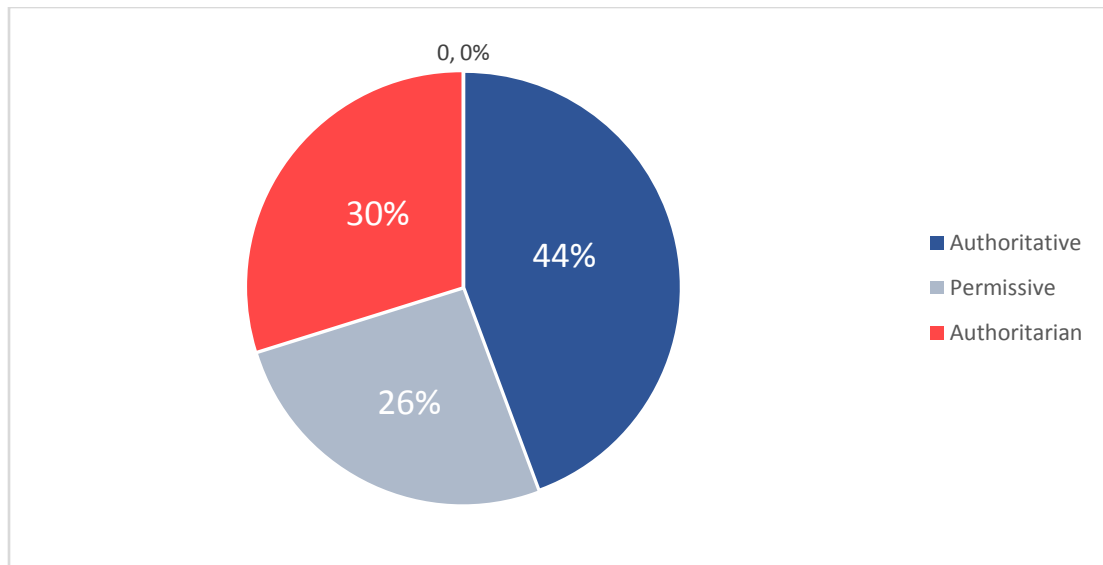
Personal characteristics of the 280 mothers participated displayed in (Table 1). (48.9%) are aged between 25 to 35. (85%) were Saudi and (50.0%) of the participants hold a bachelor degree. (65.7%) of participants were administrative employee, (93.2%) were married, and the high proportion of them has 1-2 child (44.6%)

**Table 2:-** 0 Mean scores and the reliability scale for total parenting scale and subscales.

Parenting style	Minimum scores	Maximum scores	Number of items	M ± SD	Cronbach alpha
<b>Authoritarian</b>	6.0	30.0	6.0	17.97±5.60	.80
<b>Permissive</b>	6.0	26.0	6.0	16.48±4.01	.79
<b>Authoritative*</b>	9.0	45.0	9.0	32.15±8.66 Median=34, IQR=29-39	.88
<b>Total parenting scale</b>	25.0	89.0	21.0	65.96 ±9.46	.72

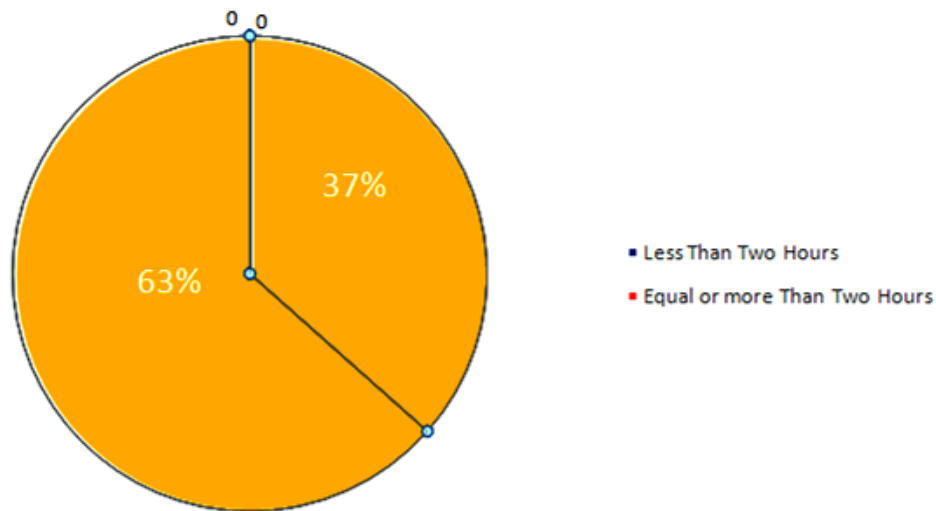
\* Not normally distributed

As shown in (Table 2), after calculating the mean score for the 3 parenting subscales and assessing their normality, we found that the average for the mean score of authoritarian subscale was ( $M = 17.97$ ,  $SD = 5.7$ ), the mean score of permissive subscale was ( $M = 16.48$ ,  $SD = 4.01$ ). Regarding the authoritative subscale the median was 34 and IQR was (29-39), and after assessing the reliability of three parenting subscales, wassatisfactory the Cronbach alpha coefficient were ( $\alpha = .80$ ,  $.79$  and  $.88$ ) forauthoritarian subscale, the permissive subscale and the authoritarian respectively.



**Figure 2:-** Different types of parenting style among PNU female employees.

According to the findings shown in figure 2, 44% of the participant mothers were adopting authoritative parenting style, 30% were authoritarian, while the rest 26% of participant were permissive



**Figure 3:-** Percentage of Screen Time Use by PNU Employee's children on Electronics Devices  
The majority of sampled mothers (63%) stated that their children spent more than two hours on their electronic devices (Figure 3).

**Table 3:-** Relationship Between Parenting Style, Perceived Negative Effect and Recreational Screen Time Use by The Children

	Recreational Screen Time		Test used	P value
	<2 h (n=103)	≥ 2 h (n= 177)		
<b>Variables</b>				
<b>Parenting Style</b>				
<b>Authoritative **</b>				
<b>M±SD</b>	31.98±9.03	32.24±8.45	-.22	.83
<b>Authoritarian</b>				
<b>M±SD</b>	18.10±6.04	17.90±5.41	.27	.78

<b>Permissive</b>				
<b>M±SD</b>	15.94±4.08	16.80±3.93	-1.65	.09
<b>Perceived negative effect</b>				
<b>Physical health problems</b>				
<b>M±SD</b>	3.65±3.99	6.75±5.16	-5.26	.00 *
<b>Behavioral health problems</b>				
<b>M±SD</b>	1.08±1.12	1.38±1.21	-2.03	.04 *

\*Significant difference at  $p \leq .05$ 

\*\* Mann Whitney

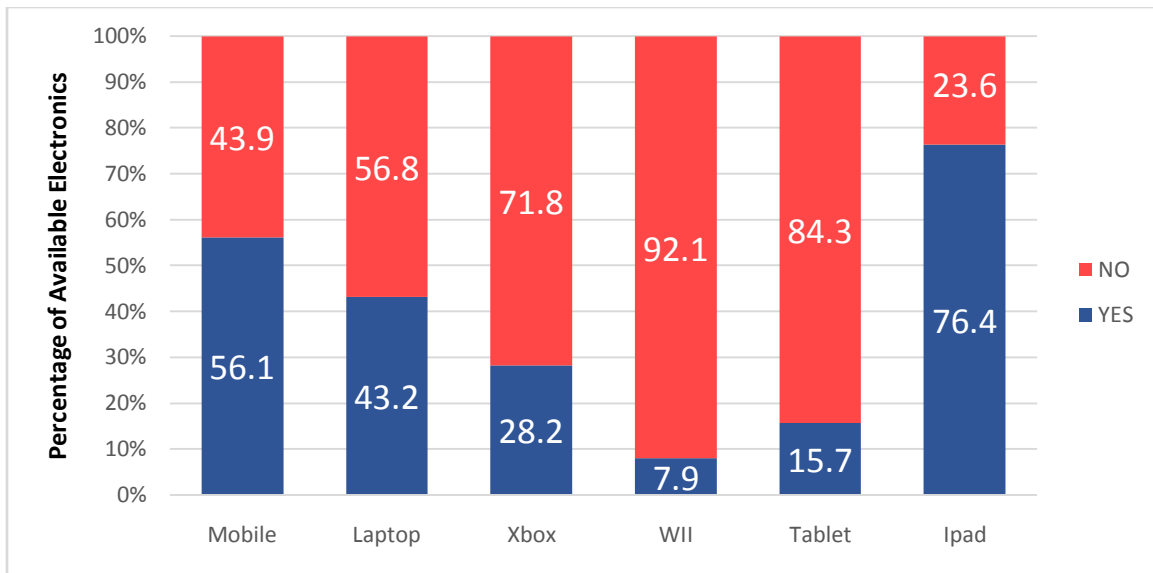
As displayed, there was no significant effect found for the three parenting style subscales on recreational screen time. Nevertheless, a significant difference was found between perceived negative effect and recreational screen time. There was a significant difference between mothers perception of both physical health problems and behavioral health problems and the recreational screen time they allow for their children,  $p$  (.00 and .04). (Table 3).

**Table 4:-** The Difference between Sociodemographic factors and screen time use

Sociodemographic factors	Categories	Recreational Screen Time		Total	Chi	P value
		2 hours No(%)	≥ 2 hours No(%)			
Age	25-35	62(60.2)	75(42.4)	137(48.9)	8.33	.02*
	36-45	33(32.0)	84(47.5)	117(41.8)		
	More than 46	8(7.8)	18(10.2)	26(9.3)		
Nationality	Saudi	95(92.2)	144(81.4)	239(85.4)	6.163	.01*
	Non-Saudi	8(7.8)	33(18.6)	41(40.6)		
Marital	Married	97(92.2)	164(92.7)	261(93.2)	.25	.88
	Divorced	4(3.9)	9(5.1)	13(4.6)		
	Widowed	2(1.9)	4(2.3)	6(2.1)		
Educational level	High school	16(15.5)	27(15.3)	43(15.4)	3.12	.37
	Bachelor	56(54.4)	84(47.5)	140(50.0)		
	Master	16(15.5)	25(14.1)	41(14.6)		
	PhD	15(14.6)	41(23.2)	56(20.0)		
Collage	Art and Designs	26(25.2)	37(20.9)	63(22.5)	7.41	.2
	Computer and Information Science	20(19.4)	22(12.4)	42(15.0)		
	Health and Rehabilitation Science	16(15.5)	38(21.5)	54(19.3)		
	Business Administration	19(18.4)	24(13.6)	43(15.4)		
	Collage of art	11(10.7)	30(16.9)	41(14.6)		
	Collage of science	11(10.7)	26(14.7)	37(13.2)		
Work nature	Educational	25(24.3)	39(22.0)	64(22.9)	.56	.75
	Administrative	68(66.0)	116(65.5)	184(65.7)		
	Both	10(9.7)	22(12.4)	32(11.4)		
Work time	Full shift	92(89.3)	164(92.6)	256(91.4)	.924	.34
	Part time	11(10.7)	13(7.3)	24(8.6)		

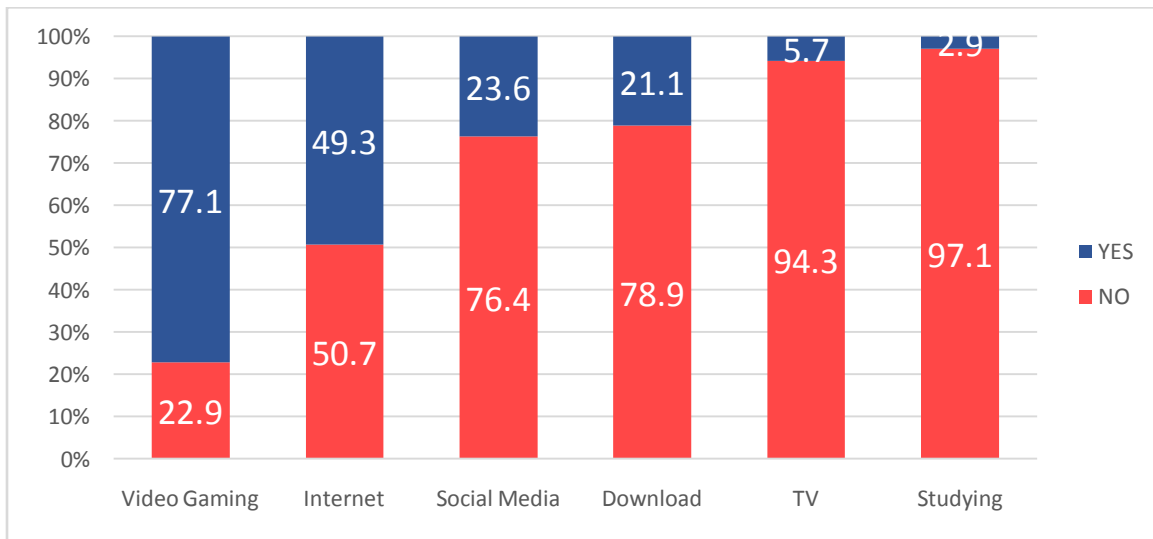
\* Significant difference at  $p \leq .05$ 

As revealed, age of mothers was significantly related to the hours spent by children on electronics ( $\chi^2(2) = 8.33$ ,  $p = 0.02$ ). Younger Mothers aged from 25 to 35 (48.9%) are more likely to apply restrictions on time spent by their children on electronic devices than mothers aged from 36 to 45 (41.8%) and from 46 and more (9.3%). On the other hand, there was a significant relationship between the nationality of the mother and screen time use by the child ( $\chi^2(2) = 6.163$ ,  $p = 0.01$ ). (Table 4).



**Figure 4:-** Available Electronic devices for children in home

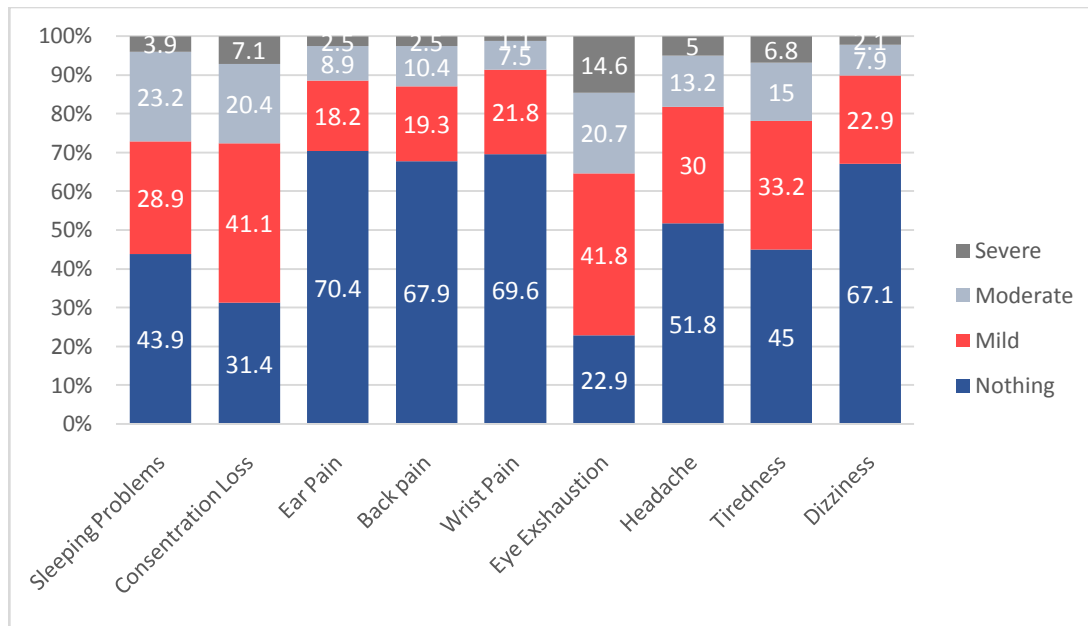
The most frequently available electronics for the children as stated by the mother were, iPad (76.4%), mobile (56.1%) and laptops (43.2%) (Figure 4).



**Figure 5:-** Practiced activities by the child on electronic devices

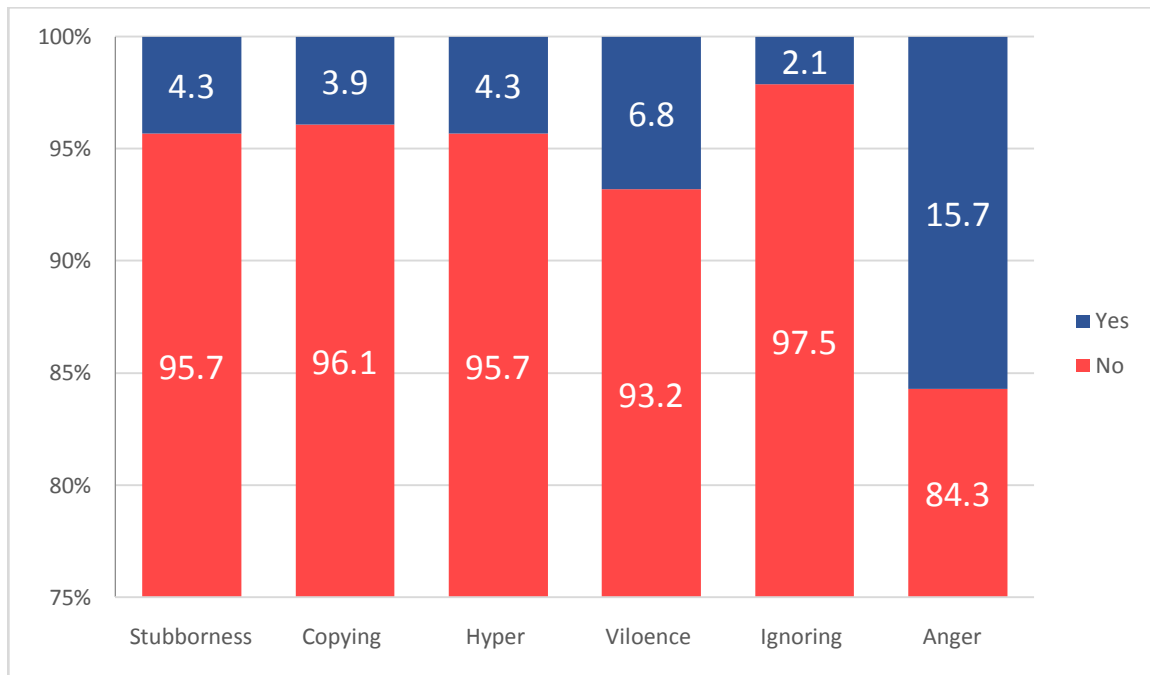
According to the mother's responses, the child's most practiced activities on electronic devices were video gaming (77.1%), internet surfing (49.3%) and activities on social media (23.6%) (Figure 5).





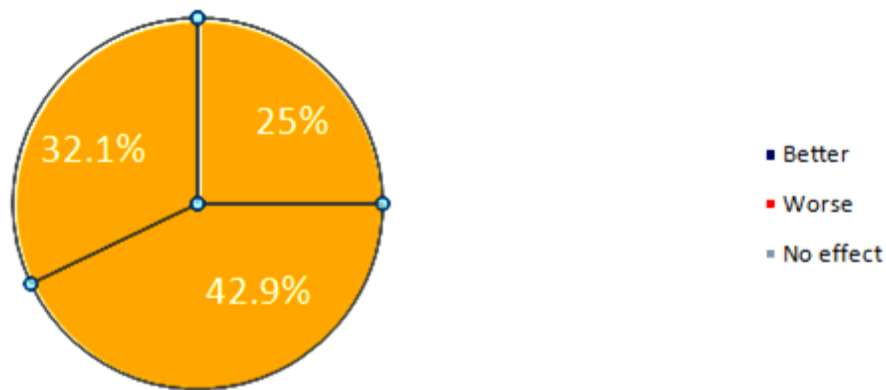
**Figure 6:-** Children with physical health problems as observed by their mothers due to Electronics use

The majority of the mothers perceived that the use of electronics have mild impact on their children physical health especially eye exhaustion, concentration loss, tiredness, headache and sleeping problems (41.8%, 41.1%, 33.2%, 30% and 28.9%) respectively as displayed in (figure 6).



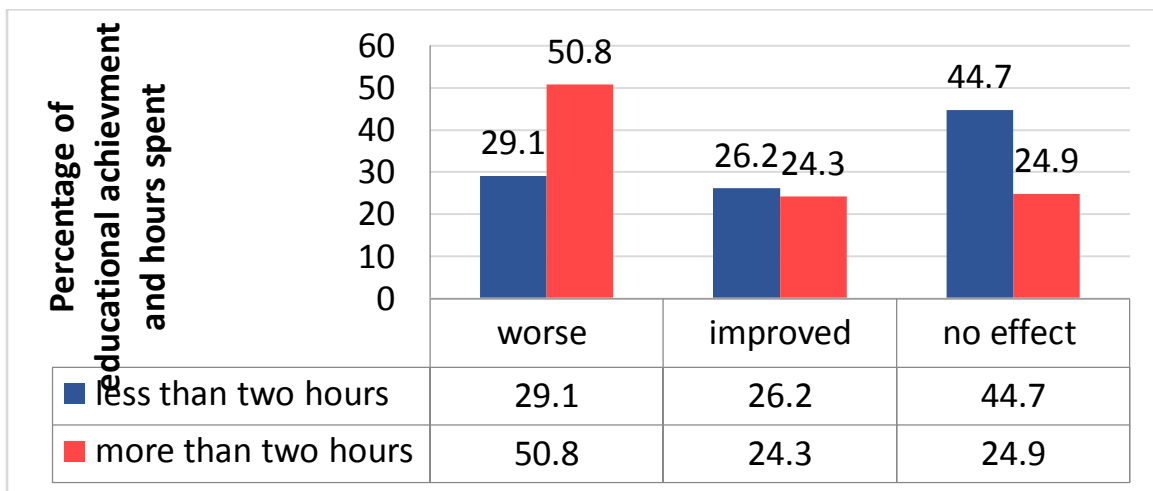
**Figure 7:-** Children's behavioral health problems observed by parents

The most frequent behavioral changes the mothers observed on their children after using electronic devices were stubbornness, anger, hyperactive, violence, ignoring (4.3%, 15.7%, 4.3%, 6.8%, 2.1%) (Figure 7).



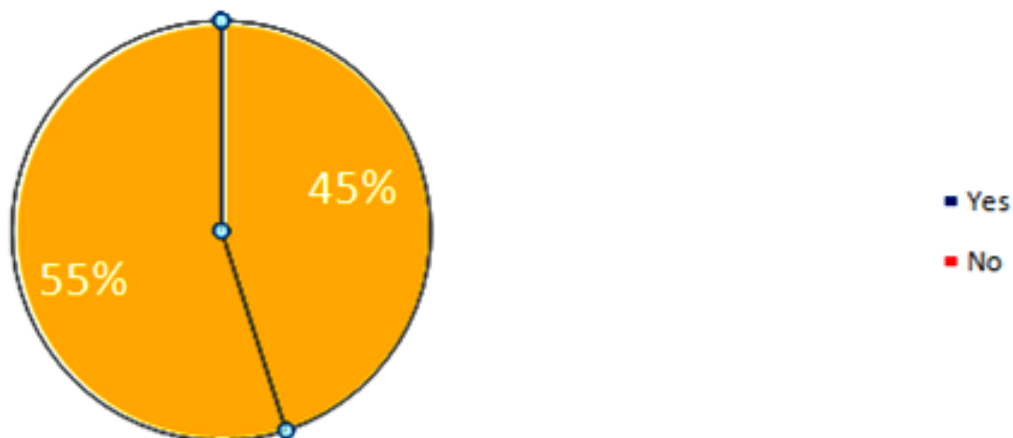
**Figure 8:-** Educational performance changes of children due to electronics use observed by mothers

The most observed change on the children's educational performance after using electronic devices as stated by the mothers was to the worse (42.9%) (Figure 8).



**Figure 9:-** Association between educational achievement and screen time use

After assessing the relation between educational achievement and screen time use, 50.8% of the children who their educational performance got worse spend equal or more than Two hours on the electronic devices (Figure 9).



**Figure 10:-** Mothers observations on social changes on their children

55% of the mothers did not observe social changes in their children (Figure 10).

**Table 5:-** The relationship between parenting style and child electronic use

Electronic Use	Categories	Authoritative M $\pm$ SD	Authoritarian M $\pm$ SD	Permissive M $\pm$ SD
<b>Day/week</b>				
	<b>Every day</b>	31.95 $\pm$ 8.98	18.17 $\pm$ 5.71	16.90 $\pm$ 3.94
	<b>4-6 D / W</b>	33.95 $\pm$ 7.02	15.50 $\pm$ 4.68	15.95 $\pm$ 4.02
	<b>3-2 D / W</b>	31.72 $\pm$ 8.30	18.83 $\pm$ 5.02	16.03 $\pm$ 3.86
	<b>1 D / W</b>	34.09 $\pm$ 8.72	16.91 $\pm$ 6.78	14.63 $\pm$ 3.98
<b>F</b>		.702	2.354	2.538
<b>P value</b>		.552	.073	.057*
<b>Setting Restrictions In Electronics Use</b>				
	<b>Never</b>	33.11 $\pm$ 9.66	16.70 $\pm$ 5.87	16.19 $\pm$ 3.94
	<b>Rarely</b>	31.64 $\pm$ 7.60	18.0 $\pm$ 4.20	18.44 $\pm$ 3.58
	<b>Sometimes</b>	32.06 $\pm$ 7.91	17.53 $\pm$ 5.11	16.80 $\pm$ 3.83
	<b>Always</b>	32.27 $\pm$ 9.49	18.67 $\pm$ 6.25	15.84 $\pm$ 4.17
<b>Kruskal</b>		.095	1.119	2.652
<b>P value</b>		.963	.342	.049*

\* Significant difference at  $p \leq .05$

According to the table 5 , the findings of restrictions imposed by parents for children's electronics use, the permissive parenting style has a significant effect on restrictions in electronic use;  $Kruskal (257) = 2.65$ ,  $p = 0.04$ , and significant effect on the times the child use electronics per week;  $f(257) = 2.53$ ,  $p = .057$ .

**Table 6:-** The relationship between family Characteristics and parenting style

Family characteristics	Categories	Authoritative	Authoritarian	Permissive
<b>Mother</b>				
<b>Age</b>				
(years)	<b>25-35</b>	32.20 $\pm$ 8.44	18.47 $\pm$ 5.82	16.62 $\pm$ 3.98
	<b>36-45</b>	31.95 $\pm$ 9.10	17.60 $\pm$ 5.65	16.35 $\pm$ 4.14
	<b>More than 46</b>	32.42 $\pm$ 8.59	17.82 $\pm$ 4.92	16.43 $\pm$ 3.84
<b>F</b>		.034	.903	.139
<b>p value</b>		.966	.407	.871
<b>Nationality</b>				
	<b>Saudi</b>	31.38 $\pm$ 8.70	18.074 $\pm$ 5.68	16.46 $\pm$ 4.053
	<b>Non-Saudi</b>	36.61 $\pm$ 6.27	16.918 $\pm$ 5.57	16.342 $\pm$ 3.981
<b>T</b>		-4.198	1.160	.173
<b>p value</b>		.016*	.339	.708
<b>Edu level</b>				
	<b>High School</b>	31.52 $\pm$ 9.84	17.97 $\pm$ 6.02	17.44 $\pm$ 3.87
	<b>Bachelor</b>	31.31 $\pm$ 8.29	18.05 $\pm$ 5.53	16.51 $\pm$ 3.97
	<b>Master</b>	31.89 $\pm$ 8.48	19.47 $\pm$ 6.16	17.27 $\pm$ 4.33
	<b>Phd</b>	34.60 $\pm$ 8.57	16.74 $\pm$ 5.16	15.16 $\pm$ 3.66
<b>F</b>		1.762	1.773	3.238
<b>P value</b>		.155	.153	.023*
<b>Work Nature</b>				
	<b>Educational</b>	32.95 $\pm$ 7.37	18.55 $\pm$ 5.87	16.87 $\pm$ 4.40
	<b>Administrative</b>	31.82 $\pm$ 8.61	17.86 $\pm$ 5.62	16.51 $\pm$ 3.90
	<b>Both</b>	32.10 $\pm$ 11.44	17.46 $\pm$ 5.42	15.35 $\pm$ 3.58
<b>F</b>		.353	.484	1.530
<b>P value</b>		.703	.617	.219
<b>Marital Status</b>				
	<b>Married</b>	32.25 $\pm$ 8.74	18.11 $\pm$ 5.61	16.52 $\pm$ 3.91
	<b>Divorced</b>	32.58 $\pm$ 6.88	15.33 $\pm$ 6.32	14.25 $\pm$ 4.71

	<b>Widowed</b>	28.80±8.92	17.66±5.85	18.16±4.91
<b>F</b>		.401	1.389	2.437
<b>P value</b>		.670	.251	.089
<b>Children No.</b>				
	<b>1-2</b>	32.36±8.45	18.05±5.84	16.26±3.97
	<b>3-4</b>	31.56±9.05	17.83±5.67	16.56±4.21
	<b>More than 5</b>	33.03±8.53	18.10±5.18	16.85±3.69
<b>F</b>		.405	.053	.371
<b>P value</b>		.668	.949	.690

\* Significant difference at  $p \leq .05$  Nationality is assessed by Mann Whitney

As illustrated in table 6, there was a significant association between permissive parenting style and educational level;  $f(257) = 3.23$ ,  $p = 0.02$ . There was no significant association between authoritarian parenting style and mothers characteristics, significant association between authoritative parenting style and nationality;  $t(232) = -4.19$ ,  $p = .01$ .

**Table 7:-** Correlation between Different Parenting Style Subscales and Screen Time Use of their Children on Electronic Use

	1	2	3	4
1. Screen time use	1			
2. Authoritative	-.009	1		
3. Authoritarian	-.020	-.356**	1	
4. Permissive	.090	-.272**	.488**	1

\*\*Correlation is significant at the 0.01 level (2-tailed).

As shown in the table 7, the authoritative and authoritarian parenting style were negatively correlated to the screen time use of their children ( $r_s = -.009$ ,  $p = .89$ ), ( $r_s = -.020$ ,  $p = .75$ ). Only the permissive parenting style is directly correlated to the screen time use ( $r_s = .090$ ,  $p = .15$ ).

## Discussion:-

The percentage of different maternal parenting style among female employees at PNU was identified and according to the findings, the majority of the participants were authoritative mothers and the minority were permissive ones. Our findings are consistent with a study conducted in Europe, where the majority were similarly authoritative, and the minority were authoritarian and permissive. It has been found that there is no significant correlation between different parenting style and screen time they allow for their children. In the authoritarian and the authoritative, the result showed a negatively correlated relationship with screen time. In contrast, permissive parenting style has a direct relationship, therefore, children with parents who are permissive have the ability to spend more hours on screen. Similarly, the permissive parenting style has a significant effect on the number of times the child use electronics per week, because of the low restrictions applied, then the other children with authoritarian and authoritative parents who apply high restrictions on screen time use. The association between permissive parenting style and television viewing among children, proportionate with the results of this study and showed that children with permissive parents were twice as likely to spend more hours watching TV compared with children from high-restriction families. <sup>(19)</sup> A body of researches has concluded similar results which stated that the permissive parenting style is associated with high rates of physical activities because of their support and low restrictions applied, unlike the authoritative parenting style which was not associated PA. Authoritative parent's children scored lower levels of physical activities because of their high demands, strict discipline and high restriction. Complementary to the previous findings, the authoritative parents were more likely to monitor their children's eating habits while the authoritarian parents apply restrictions on their children's eating habits unlike the permissive parents who were less likely to use restriction on their children in general. <sup>(20)</sup> The physical and behavioral wellbeing, and social ability of children were affected after the time spent on electronic devices as reported by the mothers and were more likely to be negatively influenced. Our surveys documented a statistically significant relationship between the screen time and perceived negative health effects on 63% of children who spent equal or more than two hours on electronic devices. The children's physical health was assessed and the results showed that the majority of children were suffering mildly from eye exhaustion, concentration loss, tiredness and headache, and sleeping problems, in addition to behavioral changes where children adopted violent and anger behaviors alone with social changes where children became unsocial. The educational performance was another important domain of the children's life that has been

influenced by the screen time use. A high percentage of mothers who reported that their children spent more than two hours on electronic devices faced a deterioration in their children's educational performance and in support for this finding, another study has suggested that heavy users of video games suffered from a detrimental effect on their educational performance, counter to the moderate users of video games and internet who had positive educational performance. Indeed, similar to our findings, a recent study conducted in Iran provided a robust evidence that more than 15% of children spend more than 10 hours per week playing video games and concluded that the longer the hours spent on playing games - the more negative affects detected such as aggressive behaviors. <sup>(21,22)</sup> Therefore, parents must apply restrictions to limit the effect of perceived negative hazards of electronics devices, and according to our study, an association between permissive parenting style and educational level was noted and a study conducted in Saudi Arabia found that there is a relationship between the parent's educational level and knowledge about internet use and risk of websites on children and unexpectedly suggested that the educational level of parents had no significant effect on how they apply restrictions on their children's internet use along counter to our study. <sup>(23)</sup>

Age of mothers played an important role in determining the application of restrictions upon children's screen time use and it was found that younger mothers are more likely to force restrictions upon their children compared to older mothers who were less likely to apply restrictions.

#### **Strengths and Limitation of the study:-**

To our knowledge, it is the first study in Saudi Arabia that assessed the effect of different parenting styles on the hours spent by children on electronic devices. In addition, we used a tool proved to be of high validity and reliability. The study faced several other limitations such as the short time of the study was an important obstacle that has limited the research, especially the data collection phase in addition to the availability for employees that also has affected the data collection because most of them were either on vacation or on giving lectures. In addition, no enough body of researches conducted in Saudi Arabia on the parenting style and its effect on the children's electronic use, which has made the comparative analysis difficult.

#### **Conclusion:-**

Our study presented findings that showed there is no significance between parenting style and level of control on children screen time use. However, children's physical, behavioral wellbeing, social and educational performance were affected when children spent more than two hours on electronics. Hence, parents must apply more restrictions and limitation to bind their children from the perceived negative hazards of electronic.

#### **Recommendations and Implications of the research:-**

The results we concluded in our study may participate in the implication of extensive policies therefore the following are recommended:

- 1- Additional studies in this domain are recommended in order to understand the effect of maternal parenting style on the children's electronic use on a bigger sample using different type of studies to generalize the results.
- 2- Further interventions are needed to improve the awareness of parents on the effect of electronic devices on children and how to deal with them and provide alternative activities for children to lessen the time spent on electronics.
- 3- Implement intervention programs in schools that targets children and aims to teach them about the consequences of excessive electronics use and encourage different physical activities.

**Conflict of interest:-** The author declared no conflict of interest.

#### **References:-**

1. Law, C.S. The impact of changing parenting styles on the advancement of pediatric oral health. CDA Journal, 2007;3, 192-197
2. Darling N, Steinberg L: Parenting style as context: An integrative model. Psychological Bulletin. 1993, 113: 487-496. 10.1037/0033-2909.113.3.487.
3. Teresia M. Physical Activity and Screen-Media-Related Parenting Practices Have Different Associations with Children's Objectively Measured Physical Activity. Childhood Obesity. September 12, 2013.9(5).451.
4. Hoda N, Ahmad A, Melibari A. Analysis of Demographic Factors, Internet Usage and Online Shopping for Social Media Users in Saudi Arabia. SSRN Electronic Journal.

5. Hart C Robinson. (2001). The parenting styles and dimensions questionnaire (PSQD). In B. F. Perlmutter, J. Touliatos & G. W. Holden (Eds.), *Handbook of family measurement techniques: Vol. 3. Instruments & Index* (pp. 319-321). Thousand Oaks: Sage.
6. Joseph M, John J. Impact of parenting styles on child development. 2008. *Global Academic Society Journal: Social Science Insight*. 1(5). 17.
7. Veldhuis L, van Grieken A, Renders C, HiraSing R, Raat H. Parenting Style, the Home Environment, and Screen Time of 5-Year-Old Children; The 'Be Active, Eat Right' Study. *PLoS ONE*. 2014;9(2):e88486.
8. Sălceanu C. The Influence of Computer Games on Children's Development. Exploratory Study on the Attitudes of Parents. *Procedia - Social and Behavioral Sciences*. 2014;149:837-841.
9. Gunter B. The effects of video games on children. Sheffield, England: Sheffield Academic Press; 1998.
10. Arredondo E, Elder J, Ayala G, Campbell N. Is parenting style related to children's healthy eating and physical activity in Latino families?. *Health Education Research*. 2006;21(6):862-871.
11. Sarita A. Yardi. *Social Media At The Boundaries: Supporting Parents In Managing Youth's Social Media Use*. 2012;.
12. Joseph M, John J. Impact of parenting styles on child development. 2008. *Global Academic Society Journal: Social Science Insight*. 1(5). 17.
13. O'Keeffe G, Clarke-Pearson K. The Impact of Social Media on Children, Adolescents, and families. *Pediatrics*. 2011;127(4):800-804.
14. Dean AG, Sullivan KM, Soe MM. OpenEpi: Open Source Epidemiologic Statistics for Public Health, Version. [www.OpenEpi.com](http://www.OpenEpi.com), updated 2013/04/06, accessed 2016/5/10
15. Allahverdipour H, Bazargan M, Farhadinasab A, Moeini B. Correlates of video games playing among adolescents in an Islamic country. *BMC Public Health*. 2010;10:286.
16. American Academy of Pediatrics. (2013). Policy statement. Children, adolescents, and the media. *Pediatrics*, 132, 958-961
17. Nagwa A. Zein El Dein. Harmful Effect of Commonly Used Electronic Devices on Adolescence and its Safeguard at Shebin El-Kom *IOSR Journal of Nursing and Health Science (IOSR-JNHS)*. e-ISSN: 2320-1959. p-ISSN: 2320-1940 Volume 2, Issue 1 (Sep. – Oct. 2013), PP 32-46
18. IBM Corp. Released 2016. *IBM SPSS Statistics For Windows, Version 20.0* Armonk, NY: BMI Corp.
19. Jago R, Davison K, Thompson J, Page A, Brockman R, Fox K. Parental Sedentary Restriction, Maternal Parenting Style, and Television Viewing Among 10- to 11-Year-Olds. *PEDIATRICS*. 2011;.
20. Hennessy E, Hughes S, Goldberg J, Hyatt R, Economos C. Parent-child interactions and objectively measured child physical activity: a cross-sectional study. *International Journal of Behavioral Nutrition and Physical Activity*. 2010;7(1):71.
21. Allahverdipour H, Bazargan M, Farhadinasab A, Moeini B. Correlates of video games playing among adolescents in an Islamic country. *BMC Public Health*. 2010;10(1).
22. Willoughby T, Willoughby T: A short-term longitudinal study of Internet and computer game use by adolescent boys and girls: prevalence, frequency of use, and psychosocial predictors. *Developmental Psychology* 2008, 44:195-204.
23. Almogbel, A., Begg, M. and Wilford, S.H. Analysis of the relationship between Saudi Arabia parents' education and economic level parental control of internet usage. *The Macrotheme Review* 2015, 4 (2), pp. 142-15



## RESEARCH ARTICLE

### THE ROLE OF AUDITING QUALITY IN NARROWING THE EXPECTATIONS GAP IN AUDITING PROFESSION.

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#### Abstract

The primary aim of this study is to find out the role of auditing quality in bridging the expectations gap in auditing, Which is considered one of the main factors that has a great effect on the profession of auditing, The study builds on the frameworks developed by Porter (1993), Porter & Gowthorpe (2004) and Porter et al. (2012). To investigate the influence / importance of the audit expectation gap to the auditing profession, the study also aims to Study and analyze the concept of audit quality and that of expectation Gap and to highlight the role of ways to improve the Audit in order to reduce this discrepancy, has been highlighted on literature and has been used both of the historical approach, inductive approach and descriptive approach to determine the role of auditing quality in bridging the expectations gap in auditing. This study concludes to compliance the auditor with auditing standards effective, auditor independence, importance of the role of professional institutions leads to ensure the reduction of the expectations Audit gap. And, the study recommends to necessary of focus on factors that lead to the emergence of the expectation gap and to raise awareness of the concept of the audit process and to issue audit standards that regulate the profession.

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#### Introduction:-

Accounting and auditing plays an important role in developing and enhancing the economical companies and international works. as they are critical components of any economic enterprise and it plays an important role in contributing to the effective and efficient functioning of business operations, the capital markets, and the economy by adding credibility to financial statements (Lee, Azham & Kandasamy, 2008). While accounting keeps track of transactions as a basis for providing information about the enterprise through financial reporting to users of the information, audit expresses an opinion on the financial statements whether it presents a true and fair view of the enterprise (Okafor & Otolor, 2013). These information are considered as the green light for decision makers in their investments and knowing the expected revenues, costs and risks which participate in enhancing the investments whether on the level of the individual or the level of total income. (Al-Khaddash, et al, 2013).

Historically, Humphrey et al. (1992) argue that some hints of “audit expectation gap” (AEG) can be found on the back in the 19th century with the introduction of companies auditing, which appeared to exist for more than 100 years (Flint, 1988). Audit firms have been shaken in the atheist and the twentieth century because of the so-called scandal of Enron, leading to a major audit companies in the world such as the bankruptcy of Arthur Andersen, and

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increasing trust between the audit profession and the gap users of financial statements, which cast a shadow on the job market and review the services and raised doubts in production services in the review of the standards shortcomings audit and regulate the audit profession in general (Benston & Hartgraves, 2002 ; Albeksh, 2016).

The auditing profession believes that there is widely criticized and litigation against auditors, this may be due to auditors not meeting the Public's expectations of them on the state of affairs of the audit companies. The auditing profession believes that there is widely criticized and litigation against auditors, this may be due to auditors not meeting the Public's expectations of them on the state of affairs of the audit companies, to investigate the influence / importance of the audit expectation gap to the auditing profession. According to the frameworks developed by (Porter 1993 ; Porter & Gowthorpe 2004 ; Porter et al. 2012). In a way or another, users of financial information expects that the auditors function to verification of the financial reports to assure safety management's prepared financial statements is free of fraud and is of a high quality. This was a misunderstanding between the perception of auditors for the preparation of financial reports and what the public expects such perceptions are a recurring problem in the literature of accounting and auditing, and usually referred to as the audit expectations gap (Dibia, 2015).

The expectations gap in the audit of the most important issues addressed in accounting thought in the various countries of the world, and despite the many studies on the gap, but it still exists and is widening and require further research and study, in early 1970s, Liggio was first used the word of 'AEG' in the literature, and continues to be debated on until today (Liggio, 1974; Lee et al., 2010). In this context, the study examines the problems associated with the expectation gap in auditing, Which is considered one of the main factors that has a great effect on the profession of auditing, and the audit expectations gap has got with great interest by researchers in the field of auditing and the reason for this is that audit quality as the primary basis have role in narrowing of the expectations gap and then the confidence of investors in the financial and non-financial information, and in this area have tried many of the studies revealed the relationship between narrowing of the expectations gap and that the difference in views among all parties interested in the audit about the concept of expectations gap and the quality of the audit indicates that the crystallization of this concept once and for all as a concept and comprehensive reference , and this requires us to stand on the study of the concept of audit quality and its role in narrowing of the expectations gap in auditing profession.

The researcher followed both of the historical approach to keep track of previous studies that have to relation the study, inductive approach and descriptive approach to determine the expectations gap in the auditing, through extrapolation of studies and research to explaining and describe role of auditing quality in bridging the expectations gap in auditing, even the ideas, relations and the scientific and practical aspects which were included in these researches and studies were descriptive. The method used in this study is considered one of the qualitative descriptive studies non quantitative, which are characterized by giving the researcher an actual and clear theoretical basis in the understanding and interpreting.

It has been divided this paper into six segments. The first segment examines general introduction. The second segment discusses the theoretical framework and approach employed to support this paper where it examines basic concepts: the concept of audit quality and expectations gap and the structure of the components of this gap as well as the manifestations of this gap in the modern audit environment and the reasons that led to the emergence of the expectations gap. The third segment discusses the analysis and evaluation of previous studies in the fields of the expectations gap and Proposed means to narrow the expectations gap in the audit. The fourth segment addressed reflection of the Audit quality on the expectations gap. While the fifth segment addressed the role played by the accounting profession in bridging the gap in auditing of methods and procedures for monitoring the quality of professional performance for audit and activate the role of professional organizations in control of the profession and the issuance of new legislation accommodate the latest changes in the fields of the expectations gap. Finally, the sixth segment contains the results and recommendations which concluded for it this study.

### **Problem of the Study:-**

#### **Problem of the study in the main question as follow:-**

What is the role of auditing quality in narrowing the expectations gap in auditing?

The variation in understanding the role of auditors and their responsibility in society and the differences and conflicts of milestones and goals between the authors of the reports and financial statements published and users Under this conflict, the role of the external auditor as a neutral party comes only that there is a difference in



understanding his role, this led to expectations Gap in auditing, which affected to some extent, the confidence of user of financial statement in auditors' performance in the presence of variables in the modern business environment.

### **Significance of the Study:-**

Which reflected the importance of attention in auditing quality and the extent of their impact on the audit expectations gap in the presence of many variables in the modern business environment and the impact of these variables on the audit profession, derives this study scientific and practical importance in the quality of services provided by the auditor for all related parties in the financial statements that, and represents the scientific importance in drawing academics and research centers Scientific define the concept of the review and its impact on quality narrow the expectations gap to conduct further studies in this area and examine the importance of scientific and practical training for references as a criterion for the quality of the audit and its role in narrowing the expectations gap, and represent the practical relevance in a statement the importance of the quality of the review on factors narrow the expectations gap and the statement of the importance of audit quality According to the interpretation of the relationship between audit and the customer and users of financial statements.

### **Objectives of the Study:-**

1. Identify the role of auditing quality in narrowing the expectations gap in auditing.
2. Determination of the concepts of audit quality from different entrances, as well as the its importance and objectives and the means used to improve the performance of the audit process.
3. Determination of the concepts of expectations gap, as well as the its importance and objectives.
4. Identify the factors have an impact upon narrowing the audit expectations gap.

### **The Theoretical Framework:-**

#### **Concept of auditing quality:-**

Audit with the history of commercial and financial events began. If business and financial events occur which, in the modern sense, but there is not necessarily a matter of control. Many people and resources to the case is the definition of a comprehensive review which is expressed in different ways scrutiny (Erdoğan, 2002). It showed several terms in the field of auditing, which is used to describe the quality of the review process, including audit quality and quality control and quality assurance, and each of these terms are private interpretation has emerged, has concluded accountants, Hong Kong Association that quality assurance is an examination of internal and supervision of the audit quality procedures and carried out by the same bureau of quality supervision is intended to external examination by a neutral third party.

So that it has been a lot of important questions about the honesty of the fiscal reports of the auditor, and it has been prevailed a state of mistrust in the auditing profession plus the suspicion of the quality of audit services, and auditing profession had faced more pressures and criticism in purpose of study and assess the quality of the audit, and what increasing these pressures is the absence of the ways to evaluate these qualities (Albeksh, 2016).

DeAngelo (1981a) defines audit quality as the probability that an auditor will discover report a breach in the client's accounting system. The probability of discovering a breach depends on the auditor's technical capabilities and reveals it and the probability of reporting the error depends on the auditor's independence (DeAngelo 1981a; Goldman & Barlev 1974; Nichols & Price 1976 ; Adeyemi & Fagbemi, 2010). The Audit Quality is a management tool used to evaluate, verify, or confirm activities related to quality which serves as the compliance with the professional standards and the contractual terms when carrying out the audit (Syamsuddin, Habbe & Mediaty, 2014).

Audit quality is a discipline that relies on competent individuals using their experience and applying integrity, objectivity, and skepticism to enable them to make appropriate judgments that are supported by the facts and circumstances of the engagement. The qualities of perseverance and robustness are also important in ensuring that necessary changes are made to the financial statements, or, where such changes are not made, to ensure that the auditor's report is appropriately qualified. In addition to the judgmental nature of aspects of the underlying financial statements, there are a number of factors that make it challenging to describe and evaluate the quality of an audit, including that:-

- The existence, or lack of material misstatements in the audited financial statements provides only a partial insight into audit quality.

- Audits vary and what is considered to be sufficient appropriate audit evidence to support an audit opinion is, to a degree, judgmental.
- Perspectives on audit quality vary among stakeholders.
- There is limited transparency about the work performed and audit findings (IAASB, 2013; Albeksh, 2016).

Based on the above interpreted audit quality definitions and related aspects, it might be stated that audit quality is a multidimensional construct. In a simplified statement, it can be defined as a level of confirmation between the value audit creates and the expectations to audit of third-party users and audit clients (Vaicekauskas & Mackevičius, 2014).

#### **The Importance of Auditing Quality:-**

Audit quality is critical for financial markets to function smoothly. And importance of audit quality in the audit process outputs, represented by the auditors' report, which a lot of external users relied upon in the decision-making quality, so the quality of the audit is a common interest to all users of the audit process, including references, companies and administrations, associations and institutions the organization of the profession and creditors. In addition to the above, the adoption of a system to control the quality of the audit can bring many advantages and features, giving proper confirmation that the services performed by the auditors in offices audited, line with professional requirements and generally accepted auditing standards, according to the following:-

- Improve the audit program by following the instructions and guidelines issued in this regard.
- Methods of checking the quality of help to gain new customers for the Office of Audit and maintained.
- A high level of reliability in the functions of the audit means the financial statements are free of material misstatement.
- High quality audit can be considered as part of the owners to control the system from their inability to conduct the direct control of management.
- Quality Audit is one of the important issues that lead to the development of the audit with an advanced level of professional performance to the offices of the audit profession is considered ((DeAngelo 1981a ; Autrey & Crowley, 2013).

#### **Audit expectations gap:-**

Commission (Cohen, 1978) concluded after studying continued for four years to find out responsibilities of auditors that there are important expectations of the performance of auditors gap and expectations of users of financial statements about the performance of auditors and their responsibilities adversely affects auditing quality, and the Commission found that the responsibility lies with the auditors to reduce that gap.

#### **Definitions:-**

There are many definitions relevant on audit expectation gap, but it revolves around one idea which is the difference or the difference between what he is doing or what can be done by auditors and what should be, or expected to be undertaken by auditors on the basis of society's expectations required of them. (Aljaaidi, 2009). Liggio (1974a) defines it as the difference between the levels of expected performance as envisioned by the independent accountant and by the user of financial statements, through considering whether a gap may exist between what the public expects or needs and what auditors can and should reasonably expect to accomplish.

Porter (1993) carried out an empirical study of the audit expectation-performance gap and defined the expectations gap as the gap between society's expectations of auditors and auditors' performance, as perceived by society.

AICPA (1993), the 'audit expectation gap' refers to the difference between what the public and financial statement users believe the responsibilities of auditors to be; and what auditors believe their responsibilities are. While Epstein and Geiger (1994) defined audit expectation gap as: "differences in perceptions, especially regarding assurances provided between users, preparers and auditors".

Lee, Ali & Bien (2009) defined audit expectation gap "difference between what the public expects from an audit and what the audit profession accepts the audit objective to be." And mentioned that the AEG is "critical to the auditing profession because the greater the unfulfilled expectations from the public, the lower is the credibility, earnings potential and prestige associated with the work of auditors" (Lee, Ali & Bien 2009). Also, Audit expectation gap was originally defined as the difference between levels of expected performance as envisaged by auditors and users

of financial reports. and It is the gap between society's expectations of auditors and auditors' performance, as perceived by society (Shaikh & Talha, 2003).

Through looking at definitions of mentioned above reveals that the expectation gap may refer to the following:-

- Difference in perceptions on actual performance and expected performance of auditors.
- Existence of these perceptual differences in auditors, accountants or users of financial statements and the society independently and also comparatively.
- The focus of comparative analysis of audit expectation gap is attempted by considering accountants and auditors, the perceptions of society and auditors, investors and auditors (Salehi, 2011).

#### **The structure of components the expectations gap in auditing:-**

Some studies confirm that should blame for auditors because they not meeting users' expectations. Auditors had long been asked to detect errors or frauds. To a large extent, the profession's refusal of performing the fraud detection duties had fueled the 'expectation gap. and confirms that the 'expectation gap' is an outcome of the contradiction of minimum government regulation and the profession's self-regulation, especially, the profession's over-protection of self-interest which has widened the 'expectation gap (Lin & Chen, 2004).

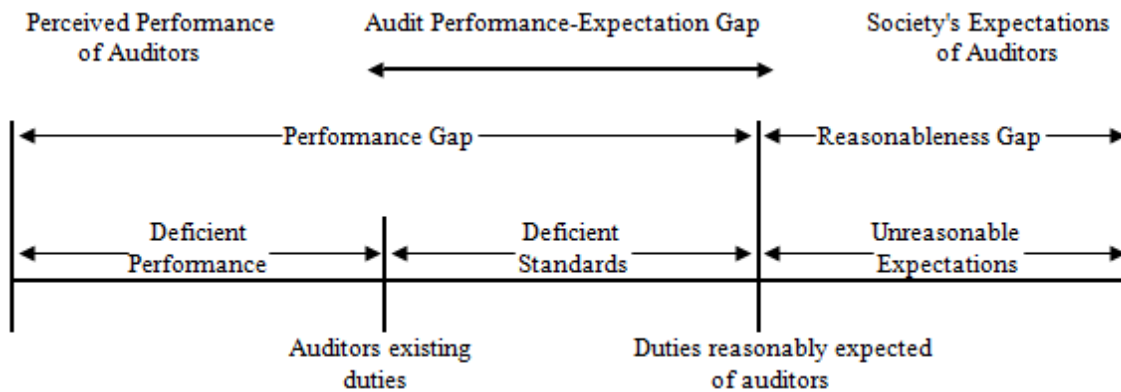
To knowledge of structure of the expectations gap components will help in reaching a correct understanding of the nature of the gap which helps to narrow it. But as researchers and scholars disagreed gap expectations of access to a specific concept for the gap expectations also differed in determining the structure of the components of the expectations gap (Porter, 1993) .

Adopting the title "audit expectation performance gap", she defined it as "the gap between society's expectations of auditors and auditors' performance, as perceived by society". She proposed that the gap comprises two major components, namely:

1. Reasonableness gap: represented a gap between what society expects auditors to achieve and what they can reasonably be expected to accomplish "this coincides approximately with the Cohen Commission's definition of the gap".
2. Performance gap: represented a gap between what society can reasonably expect auditors to accomplish and what society perceives they achieve. This component may be further subdivided into: (a) the deficient standards gap: represented a gap between the responsibilities that can reasonably be expected of auditors and auditors' existing responsibilities as defined by statute and case law, regulations and professional promulgations; and (b) the deficient performance gap: represented a gap between the expected standard of performance of auditors 'existing responsibilities and auditors' performance, as expected and perceived by society.

Additionally, the existence of the expectation gap is due to the shortage of regulations, and to the auditing and accounting standards being founded by the profession; i.e., where users rationally anticipate the auditors to call the users' attention to a special issue, but the profession does not want this since an inadequate standards gap exists (Porter 1993; Koh & Woo, 1998).

The Canadian Institute of Chartered Accountants (1988) sponsored a study on the public's expectations of audit. The commission developed a detailed audit expectation gap model that analyzed the individual components of the expectation gap into unreasonable expectation, deficient performance and deficient standard (Salehi, 2011). In this aspect, Porter (1993) has provided structure components of the expectations gap in the audit. The structure of the audit expectation-performance gap is depicted in Figure1:-

**Figure 1.** Shows structure of the audit expectation-performance gap.

Source: Adapted from Porter (1993).

Perceived performance	← Gap →	Society's expectation of auditors
Performance gap	Standard gap	Reasonableness gap
Reasonable expectation of auditor performance	Reasonable expectation of standard	Unreasonable expectations
		Over expectation of audit performance
		Over expectation of standards
		Miscommunication of users

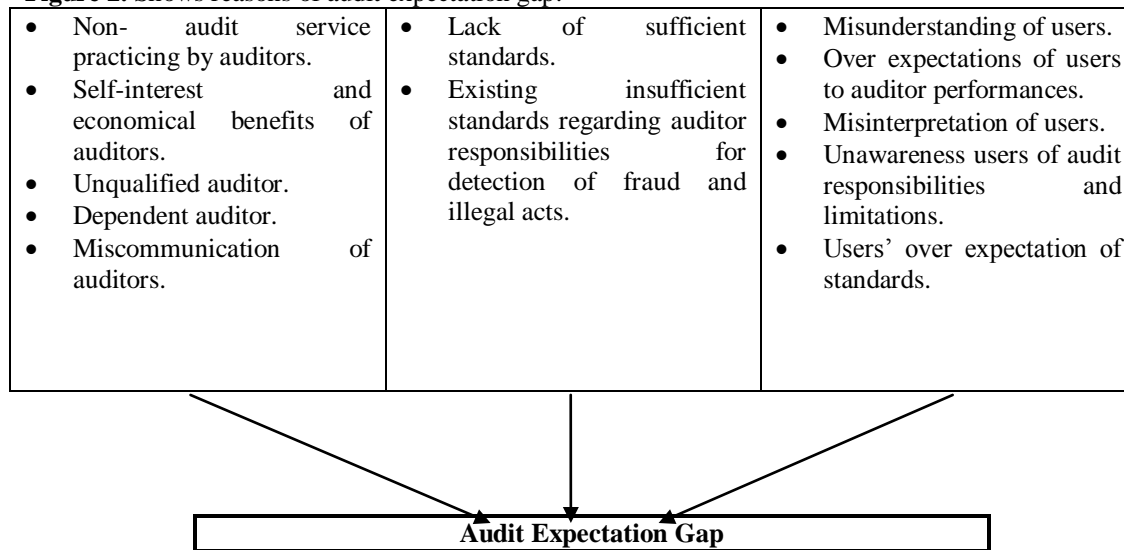
Source: Adapted from Porter (1993).

The researcher sees that the structure of the components of the expectations gap in the audit presented by Porter has included all the components and elements of the gap and pointed out the reasons that led to the occurrence of the profession, whether these reasons stemming from the audit profession or from outside the profession.

#### Reasons of audit expectation gap:-

One of the many issues that involve the accounting profession and the community is exists the expectation gap, researchers have already identified a number of causes for this gap while conducting their research into this issue the most important:-

- The probabilistic nature of auditing.
- The skepticism in the auditor independence.
- The ignorance, naivety, misunderstanding and unreasonable expectations of non-auditors about the audit function.
- The evaluation of audit performance based upon information or data not available to the auditor at the time the audit was completed.
- Insufficiency of self-control system in the audit profession.
- The evolutionary development of audit responsibilities, which creates time lags in responding to changing expectations.
- Decline the quality of professional performance in audit
- Corporate crises which lead to new expectations and accountability requirements.
- The profession attempting to control the direction and outcome of the expectation debate to maintain the status quo.
- lack of legislation and issues professional organization for the profession (Shaikh & Talha, 2003 ; Salehi, 2007 ; Humphrey, et al, 1993).

**Figure 2.** Shows reasons of audit expectation gap:-

Source: (Salehi, 2007).

### The Previous Studies:-

The growing literature on the AEG can be seen as an indicator that it is a significant problem, which needs additional research. It is not a new research area, there are several of the literature review have focused on the expectations gap and especially during the last two decades. The issue of "gap" between society's expectations of auditors and what auditors expect "or are perceived by society". Extant literature suggests that, while the term AEG was not applied to the gap between society's "or financial statement users" and auditors' expectations of an audit until about 30 years ago, the existence of the gap was recognised more than 100 years ago. Conducting numerous attempts to understand and define the scope and causes of the gap between auditor on the one hand, and the parties used for his services on the other hand, of these studies follows:

Porter (1993) Stated in his empirical study which conducted in New Zealand in 1989 and it aimed to investigate the audit expectation-performance gap to know the reasons and the components of the expectations gap in the return and propose curriculum narrowed through doing a survey to reach this goal, The study enables the duties which constitute the reasonableness, deficient standards and deficient performance components of the gap to be identified. It also provides the means to estimate the relative contribution of the duties to their respective components, and of the components to the overall gap between society's expectations of auditors and auditors' perceived performance. The study concluded to new insights into the structure, composition and extent of the audit expectation-performance gap but, more importantly, it signals a rational, comprehensive approach towards narrowing the gap. If adopted, this should bring society's expectations of auditors and auditors' performance into closer accord and, as a consequence, reduce the criticism and litigation which auditors face today.

There is no doubt that this study has provided a new vision of the details of the constituent tasks for each component of the gap components and the relative contribution of each component to the gap as a whole and this will help to develop an integrated, comprehensive framework to narrow the gap, the study found that narrow the expectations gap will lead to ease the pressure and reduction criticism oriented career.

As Conducted other study to Porter, et al (2012). Audit Expectation-Performance Gap Revisited: Evidence from New Zealand and the United Kingdom. Investigation of changes in the audit expectation-performance gap in New Zealand (NZ) and the United Kingdom (UK) revealed that, between 1989 and 1999, in both countries the reasonableness gap widened as developments in auditing external environment stimulated an increase in society's unreasonable expectations of auditors but the deficient performance gap narrowed as monitoring of auditors' performance resulted in societal perceptions of improved performance. Between 1999 and 2008, in the UK, widespread discussion of the environmental developments and related audit issues, along with more stringent monitoring of auditors' performance, resulted in a narrowing of the reasonableness and deficient performance gaps. In NZ, lacking these factors, these gaps widened. Additionally, changes to auditing standards resulted in some

'reasonably expected' responsibilities becoming actual responsibilities of auditors and, in both countries, the deficient standards gap narrowed. The research findings illuminate the means by which the audit expectation-performance gap might be narrowed.

While Salehi, (2007; 2011; 2016). Stated in his studies "Reasonableness of Audit Expectation Gap: Possible Approach to Reducing" Which aimed to focus on the reasonableness expectation gap, And "Audit expectation gap: Concept, nature and trace", which aimed to understand the nature and different dimensions of audit expectation gap around the world. In addition to "Quantifying Audit Expectation Gap: A New approach to Measuring Expectation Gap", which aimed to identifying the expectation gap about audit responsibility and quantifying the expectation gap in Iran. The researcher reached to conclusion that for reducing such a gap, a possible way is through increased public awareness of the nature and limitation of audit and the nature and different dimensions of audit expectation gap around the world. And the conclusion that this kind of gap should be reduced by the auditor himself, by improving audit responsibilities, educating various users, and mandating new standards, and that there is an expectation gap between auditors and investors in Iran.

Hassink, et al. (2009). Clarified in their study "Corporate fraud and the audit expectations gap: A study among business managers" which aimed to Assess the importance of a plausibility gap and gap-performance and gap of incomplete standards and this in a specified window companies to defraud, and he clarified that for this to distinguish between all these three elements of the expectations gap, business managers, based on their responsibilities to own about fraud, as banks use as an observer to evaluate the potential differences between the views of business managers and society in general has to be for the participants to be aware and experienced enough on fraud and therefore has been the study of the expectations gap, The findings revealed that there are clear evidence of the existence of great expectations gap in the context of fraud both in terms of the performance of the references or the extent of his commitment to legal texts accepted.

Olowookere, J. K. (2011). Pointed in his study entitled " Stakeholders Perception Of Audit Performance Gap In Nigeria. Which aimed to Search the nature and level of the expectations gap (performance gap) between the auditors and users of financial statements, which sought to determine the presence or absence of differences between the perceptions of financial and reliability of data users and useful for decision-making. The results of the study were the presence of a wide expectation regarding the responsibility of the Auditor gap, which had a negative impact on the credibility of the auditor and the confidence of users of financial statements, The study also showed the media should be more about the responsibilities of the auditor for the financial statements should also clarify the role of the auditor and the observance of quality control measures in the review of institutions' accounts.

The study recommended that it should be the owners of the profession inform the users of financial statements on more responsibilities of auditors as well as raise the educational level of the users of the financial statements, it are tools to limit the expectations gap in the review, also recommended that there should be quality control of audit firms is necessary in order to raise Auditors performance and compliance with recognized standards, also urged the training and continuous improvement of Auditors and the establishment of an independent government body to oversee the implementation of the laws applicable to the review and also recommended expanding the responsibilities of auditors to meet the public's expectations and reducing the missing standards gap through a review of existing auditing standards.

The study dealt with Okafor & Otolor (2013). under title "narrowing the expectation gap in auditing: The role of the auditing profession. The result shows that the public is ignorant of the duties of the auditor and this lack of knowledge is responsible for unreasonable expectations of the public from auditors. Based on the findings and conclusion, it was recommended that the public need more education on the duties and responsibilities of the auditor, the standard auditor's report should be expanded to include disclaimer clauses clearly showing that it is not a certificate or guarantee of the financial soundness of the audit , it should be clearly stated in the audit report that the auditor is not the compliance officer of the audited company and that the auditor's report should add that the opinion expressed by the auditor should not be construed to mean a guarantee of accuracy of the financial statements .

The study examined Humphrey, et al. (1992). which under title "The Audit Expectation Gap, investigated the expectation gap in both the UK and Spain. Auditors, finance directors and users were asked, inter alia, whether audit firms should not provide NAS to their audit clients. In both countries, the average response was close to neutral for all groups except UK auditors who expressed strong disagreement.

About this, A survey taken up by Al qtaish. (2014) in his study the factors affecting in narrowing the audit expectations gap from the viewpoint of the investors in Jordan which aimed to identify the nature of the audit expectations gap and analyzing the factors that may affect in narrowing the audit expectations gap from the viewpoint of the investors in Jordan, mentioned that, the study concluded a set of results including: the factors that influence audit expectations gap, which are: the efficiency of the auditor and his professional care, the auditor's responsibility for the certified accounting numbers, the verification of the auditor on the level of the disclosure in the financial statement, improvement of communication with the users of the financial statements, the auditor's commitment to integrity and honesty, and the independence of the Auditors. It was found that the effect of these factors was high and uneven. The study recommended that the necessity to enhance communication, information and the education of the users of the financial statements on the functions of auditing, responsibilities and duties of the auditor, management responsibilities, and the expansion of the auditor's responsibilities to meet the reasonable expectations, and to adopt the detailed auditor's report to mitigate the audit expectations gap.

#### **Evaluation of the Previous Studies:-**

The litigious environment which in the auditing profession today can be traced to the audit expectation gap and from here there are calls for operates a good monitoring of public opinion and attitudes towards the level of services and assurance provided by the auditors individually and as a profession. Where investors expect and counts begin to uphold a standard of absolute assurance, audit liability inevitably will increase substantially. It is necessary therefore that from both societal and professional perspective that the profession should try to narrow the expectation gap. To achieve this both groups need to become active agents or players for positive change.

These the evaluation are based upon the prior study's results in the field of the expectations gap, and through what the researcher mentioned above about a literature review and a critical and in depth evaluation of previous research about the role of auditing quality in narrowing the expectations gap in auditing profession. The literature has shown that most the studies which addressed the expectations gap of several entrances, it has the impact of a high level for this the gap on auditing profession, studies have focused upon the research in its concept and components and reasons leading to that gap as a plausibility gap and gap-performance and gap of incomplete standards, Other studies have dealt with the impact of factors such as an audit report and the expectations gap, and the role of auditing quality in reducing this gap among auditors and investors. The reasonableness gap widened as developments in auditing external environment stimulated an increase in society's unreasonable expectations of auditors, but the deficient performance gap narrowed as monitoring of auditors' performance resulted in societal perceptions of improved performance. The most study found that narrow the expectations gap will lead to ease the pressure and reduction criticism oriented career. and this will help to develop an integrated, comprehensive framework to limit of risk audit profession.

Last but not least, the common belief that external auditors are able to solve all the problems faced audit profession, while it is a part of the justice system in the audit profession. When the narrow the gap was discussed, researchers recommended that there should be quality control of audit firms in order to raise Auditor's performance and compliance with recognized standards, until be financial reports are reliability for users of financial statements and useful for decision-making, and necessity of vocational rehabilitation of the internal and external auditor. In addition to continuous training of auditors and make courses for auditing companies in the specializations of accounting and financial sciences to reinforce the important role of the commitment to auditing standards effected in audit quality to be an effective prevention from falling in cheating, manipulating, embezzlement and betraying honesty.

#### **Reflection of the Audit quality on the expectations gap:-**

Concept of audit quality is based on that commitment to professional standards issued by international and professional organizations achieve audit quality. Usually focus audit quality programs to these organizations about the extent of commitment audit firms to accepted professional standards (GAAS) own to audit which put in place to ensure minimum audit quality when the implementation of the audit. This concept of quality means that if the auditor's commitment to professional standards for the audit, it will achieve a good level of professional performance quality. The audit quality normally consists of two components: auditor competence and auditor independence. The deterioration in audit quality in a short tenure audit may be due to either lack of competence or loss of independence, while a loss in quality in a long tenure audit is most likely due to a loss of independence (DeAngelo, 1981a ; Enofe et al, 2013).

Auditing standards provide an important foundation supporting audit quality. In particular, the International Standards on Auditing (ISAs) issued by the IAASB describe the auditor's objectives and establish minimum requirements. However, the majority of the requirements in ISAs either provide a framework for the judgments made in an audit or need judgment for them to be properly applied ((IAASB, 2013).

As clarified Porter (1993) the audit expectation-performance gap and defined the expectations gap as the gap between society's expectations of auditors and auditors' performance, as perceived by society.

The quality gap is one a sub-components to the expectations gap in the audit, it has identified its one of the researchers quality gap as "the differences between the expectations of both users and auditors about the quality of performed audit services, and factors of formation and the formation of that quality, "and stressed that the main reason for its existence is to decrease the actual performance of references for auditing standards and quality standards recognized (Carcello, et al, 1992).

And considered decline the quality of professional performance in audit is one of the main reasons for the existence of the expectations gap. So it considered improving the quality of audit services one of the methods to narrow the expectations gap in the audit.

#### **The Role Played by the Accounting Profession in Bridging the Gap in auditing:-**

The accounting profession has recognized that there is the expectation gap as an issue of fundamental relevance that has a great effect on the profession of auditing. It is in the best interest of both the auditing profession from side and the society at large on the other hand, because the gap between society's expectations of auditors and auditors' performance, as perceived by society, the expectation gap in auditing profession be narrowed as much practicable (Ijeoma, 2014).

In 1988, Committee and the Auditing Standards Board in the American Institute of Certified Public Accountants (AICPA) tried to reduce the expectation gap by issuing series of statement of accounting standard. In this aspect, General Accounting Office and the AICPA in 1996 reported that an expectation gap still exists and no empirical evidence was however offered to that effect. Investors and other users of financial statement seek for absolute assurance but the auditing profession has relied on the concept of reasonable assurance. Current auditing standards still reflect material mismanagement focus or financial statement reasonable assurance.

In 1997, Statement on Auditing Standards No. 53 (SAS 53) "the auditors responsibility to detect and report errors and irregularities" which is one of the expectation gap SASs rely on the concept of reasonable assurance. The profession in further attempts to narrow the expectation gap issued new (SASs) statement of Auditing Standards, partly to address public criticism of the auditing profession and partly to increase level of service to audit clients and the public, and No. 82 (SAS 82) replaced one of the Expectation Gap standards. It was intended to provide more explicit guidance for the auditor's consideration of fraud in a financial statement audit.

Also, In 1988, the Auditing Standards Board (ASB) issued a number of pronouncements that have been referred to as the Expectation Gap standards. The intent of these standards was to reduce the gap between public expectations and the perceptions of auditors with respect to auditors' roles and responsibilities in conducting financial statement audits. The Expectation Gap standards were intended to:-

- Address public concerns regarding detection of errors, irregularities and illegal acts.
- Assist auditors in planning more effective audits.
- Improve external auditor communications.
- Improve internal communications for the purposes of the current study, the breach between public expectations and auditors' perceptions of their responsibilities will be referred to as "Expectation Gap" (Specht & Sandlin, 2011).

And in this regard (Erdoğan, 2012). Clarified that, Training on the audit, the whole exercise consists of checking with the academic knowledge of control theory. It is necessary to establish the cause of development and control theory. Courses in auditing, licensing, education and learning in graduate programs, and this is an important issue is related to a large extent on the quality of education and increase efficiency (Erdoğan Murat, 2012).



Last but not least, the common belief that auditors are able to solve all the problems faced audit profession, including expectation gap, while they are a part of the justice system in the audit profession. when the independence of the external auditor was discussed, researchers recommended to necessity of auditors commitment to audit and develop their standards on an ongoing basis to ensure the quality of work and narrow expectations in the gap and the need to audit the appointment of auditors with experience and skill to carry out the audit to narrow the expectations gap and pre-planning of the audit process because it ensures the continuation of the process effectively and thus narrow the expectations gap in the audit.

### **Results:-**

The study reached a number of conclusions, including:-

1. Auditors commitment to standards audit and develop their abilities on an ongoing basis leads to ensure the quality of work and to narrow the expectations gap in the audit.
2. The reasons that led to the emergence of the expectations gap and the reason was in the weakness of auditor independence and the lack of professionalism of the auditor and not the reasonableness of expectations of users of financial statements and lack of clear definition of the role of auditor in the community and inadequate system of self-censorship in the profession and the decline of professional performance and inadequate of financial reporting as well as lack of legislation and issues professional organization for the profession.
3. One of the most important reasons for the expectations gap in the revision auditor independence in doubt. As well as the reasons for the gap of lack of professionalism and lack of reasonable expectations of the profession and the public lack of effective communication and lack of financial reporting.
4. The admission of new clients and continuation of the relationship with a reputable existing customers good reduces the problems and increases to narrow the gap and the commitment of the references standard examination league program sufficiently on the quality of performance raises the audit quality degree and narrow the expectations gap and the commitment of the audit team of accounting and auditing standards narrowing of the expectations gap.

### **Recommendations:-**

In the light of the results of theoretical studies can provide a range of the following recommendations:-

1. The necessity of Auditors commitment to standards audit and develop their abilities on an ongoing basis to ensure the quality of work and to narrow the expectations gap in the audit.
2. The necessity of focus on the analysis and characterization of the expectations gap in the review, where it is one of the most serious issues facing the auditing profession and effect on audit quality and the decisions of investors.
3. The necessity of professional organizations, associations, scientific inventory of the most important proposals narrow the expectations gap in the review. And work on the application of the best proposals to get on high of audit quality.
4. The necessity of define the beneficiaries of the services of auditing the most important concepts used by the audit profession in order to reduce the size of the expectations of the unacceptable.
5. The necessity of focus on factors that lead to the emergence of the expectations gap and the most important are: uncertainty in the auditor independence and low professional performance and inadequate financial reporting issues, legislation and organization of the profession and not the reasonableness of expectations of beneficiaries and take the necessary measures to eliminate these factors.

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**References:-**

1. Al qtaish, H.F. (2014). The Factors Affecting in Narrowing the Audit Expectations Gap from the Viewpoint of the Investors in Jordan. *Research journal of finance and accounting* Vo 1.5, No.12, 2014.
2. Albeksh, H. M. (2016). Compliance of Auditors to Ethics and Rules of Professional Conduct and Its Impact on Audit Quality. *Imperial Journal of Interdisciplinary Research*, 2(12).
3. Albeksh, H. M. A. (2016). Factors affecting the independence of the external auditor within the auditing profession. *International journal of management and commerce Innovations* ISSN 2348-7585(online). vol.4,Issue2,pp-680-689).
4. Albeksh, H. M. A. (2016). The Crisis of the Ethics of Audit Profession: Collapse of Enron Company and the Lessons Learned. *Library Journal*, 3, e3205.
5. Aljaaidi, K. S. Y. (2009). Reviewing The Audit Expectation Gap Literature from 1974 to 2007.
6. Al-Khaddash, H., Al Nawas, R., & Ramadan, A. (2013). Factors affecting the quality of auditing: The case of Jordanian commercial banks. *International Journal of Business and Social Science*, 4(11).
7. American Institute of Certified Public Accountants AICPA. (1993), "Professional Standards", Report, Conclusions and Recommendations, New York, USA.
8. Autrey, R., & Crowley, R. (2013). The Importance of Audit Quality Standards.
9. Benston, G. J., & Hartgraves, A. L. (2002). Enron: what happened and what we can learn from it. *Journal of Accounting and Public Policy*, 21(2), 105-127.
10. Carcello, J. V., Hermanson, R. H., & McGrath, N. T. (1992). Audit quality attributes: The perceptions of audit partners, preparers, and financial statement users. *Auditing*, 11(1), 1.
11. Chye Koh, H., & Woo, E. S. (1998). The expectation gap in auditing. *Managerial Auditing Journal*, 13(3), 147-154.
12. Cohen Commission. (1978). Report of the Commission on Auditor Reasonability's: Conclusions and Recommendations. New York: American Institute of Certified Public Accounts.
13. DeAngelo, L. E. (1981a). Auditor independence, "low balling," and disclosure regulation. *Journal of Accounting & Economics* 3(August): 113-27.
14. Dibia, N. O. (2015). Audit Expectations Gap and Perception of Financial Reporting. *International Journal of Managerial Studies and Research (IJMSR) Volume 3, Issue 3, March 2015, PP 23-31*.
15. Enofe, A. O., Okunega, C. N., & Ediae, O. O. (2013). Audit Quality and Auditors Independence in Nigeria: An Empirical Evaluation.
16. Erdoğan Murat, (2012). "VUK-TFRS Geçiş Sürecinde Üniversitelerde Denetim Eğitim ve Öğretim Döngüsü Önerisi ve Web Tabanlı Bir Yazılım ile Denetim Uygulaması" 24. *Dünya Sürekli Denetim ve Raporlama Sempozyumu*, 3-4 Mayıs 2012, Malatya.
17. Erdoğan Murat, (2002). Finansal Muhasebe (Yöneticilerin Karar Verme Aracı Olarak), *Beta Basın Yayım Dağıtım A.Ş., İstanbul, 2002 (975-295-131-7)*.
18. Flint, D. (1988), "Philosophy and principles of auditing", Hampshire: Macmillan Education Ltd.
19. Goldman, A., and B. Barlev. (1974). The auditor-firm conflict of interests: Its implications for independence. *The Accounting Review* 49(October): 707-18.
20. Hassink, H. F., Bollen, L. H., Meuwissen, R. H., & de Vries, M. J. (2009). Corporate fraud and the audit expectations gap: A study among business managers. *Journal of International Accounting, Auditing and Taxation*, 18(2), 85-100.
21. Humphrey, C., Moizer, P., & Turley, S. (1993). The audit expectations gap in Britain: An empirical investigation. *Accounting and Business Research*, 23(sup1), 395-411.
22. IAASB (2013). A Framework for Audit Quality, International Auditing and Assurance Standards Board. <https://www.ifac.org>.
23. Ijeoma, N. B. (2014). Bridging The Expectation Gap In Auditing: The Role Of The Accounting Profession In Nigeria.
24. Lee, T. H., Ali, A. M., & Bien, D. (2009). Towards an Understanding of the Audit Expectation Gap. *ICFAI Journal of Audit Practice*, 6(1).
25. Lee, T.H., Ali, A.M., Gleock, J.D., Yap, C.S., Ng, Y.L. and Boonyanet, W. (2010), "The audit expectation gap in Thailand", *Southern African Journal of Accountability and Auditing Research*, Vol. 10, pp. 1-17.
26. Lee, T.H; Azham, Md. Ali & Kandasamy, S. (2008), Towards reducing the audit expectation gap: Possible mission? *Accountants Today*, pp. 18-22, Feb. Available at: <http://www.mia.org.my/at/at/200802/06>. PDF. Viewed 8th August, 2011.
27. Liggio CD (1974a). The Expectation Gap: The Accountant's Waterloo. *J. Contemp. Bus.*, 3(3):27-44.

28. Lin, Z. J., & Chen, F. (2004). An empirical study of audit 'expectation gap' in the People's Republic of China. *International Journal of Auditing*, 8(2), 93-115.
29. Nichols, D. R., and K. H. Price. (1976). The auditor-firm conflict: An analysis using concepts of exchange theory. *The Accounting Review* 51(April): 335-46.
30. Okafor, C. A., & Otolor, J. I. (2013). Narrowing the Expectation Gap in Auditing: The Role of the Auditing Profession. *Research Journal of Finance and Accounting*, 4(2), 43-52.
31. Olowookere, J. K. (2011). Stakeholders' Perception of Audit Performance Gap in Nigeria. *International Journal of Accounting and Financial Reporting*, 1(1), 29.
32. Porter, B. (1993), An empirical study of the audit expectation-performance gap, *Accounting and Business Research*, Vol. 24, No. 93, Winter, pp. 49-68.
33. Porter, B., & Gowthorpe, C. (2004). *Audit expectation-performance gap in the United Kingdom in 1999 and comparison with the Gap in New Zealand in 1989 and in 1999*. Institute of Chartered Accountants of Scotland.
34. Porter, B., Ó hÓgartaigh, C., & Baskerville, R. (2012). Audit Expectation-Performance Gap Revisited: Evidence from New Zealand and the United Kingdom. Part 1: The Gap in New Zealand and the United Kingdom in 2008. *International Journal of Auditing*, 16(2), 101-129.
35. Salehi M (2007). Reasonableness of Audit Expectation Gap: Possible Approach to Reducing. *J. Audit Pract.*, 4(3): 50-59.
36. Salehi, M. (2011). Audit expectation gap: Concept, nature and trace. *African Journal of Business Management*, 5(21), 8376-8392.
37. Salehi, M. (2016). Quantifying Audit Expectation Gap: A New approach to Measuring Expectation Gap. *Zagreb International Review of Economics and Business*, 19(1), 25-44.
38. Salehi, M., Mansoury, A., & Azary, Z. (2009). Audit independence and expectation gap: Empirical evidences from Iran. *International Journal of Economics and Finance*, 1(1), 165.
39. Shaikh, J. M., & Talha, M. (2003). Credibility and expectation gap in reporting on uncertainties. *Managerial auditing journal*, 18(6/7), 517-529.
40. Specht, L. B., & Sandlin, P. (2011). Auditor perceptions of SAS 99: Do two expectation gaps still exist?. *Journal of Applied Business Research (JABR)*, 20(4).
41. Syamsuddin, Abdul Hamid Habbe & Mediaty, (2014). The Influences of Ethics, Independence, And Competence on the Quality of An Audit through the Influence of Professional Skepticism in Bpk of South Sulawesi, Central Sulawesi And West Sulawesi. *Quest Journals Journal of Research in Business and Management Volume 2 ~ Issue 7 (2014) pp: 08-14 ISSN(Online): 2347-3002 www.questjournals.org*.



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### RESEARCH ARTICLE

#### KNOWLEDGE AND PRACTICE IN CHRONIC PAIN MANAGEMENT AMONG PRIMARY HEALTHCARE PHYSICIANS.

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#### Abstract

**Objective:** To evaluate the knowledge and practice in chronic pain management among primary healthcare physicians (PHCPs).

**Methods:** A cross-sectional questionnaire-based study was carried out in a selected 15 primary healthcare centers in Jeddah, Saudi Arabia from October 15, 2016 to November 15, 2016. An auto-questionnaire was administered. The outcome measures included clinical practice score (CPS; range 20-100) and confidence level score (CLS; range 20-100).

**Results:** Physicians' practice showed a mean  $\pm$  SD (range) CPS =  $76.13 \pm 15.12$  (41.11; 100.00). Most frequently assessed parameters included topography of the pain; followed by prior medications and physical impact. Less frequently assessed parameters included underlying cause, psychological impact and pain onset time. Frequent physical examinations assessed the painful area; followed by general physical exam and inflammation signs. Less frequent examinations screened for neuropathic pain component and motor and sensory abnormalities. Physicians in high patient-flow centers ( $\geq 30$  patients seen per day) had lower CPS. Physicians' confidence in chronic pain management showed a CLS =  $69.60 \pm 16.61$  (30.00; 100.00). Physicians declared being less confident of cancer chronic pain management, use of antidepressants, non-cancer chronic pain management, and use of anticonvulsant drugs. Higher CLS was reported in family physicians (CLS =  $82.18 \pm 15.60$ ) as compared to pediatrics ( $73.50 \pm 14.09$ ) and general medicine ( $62.62 \pm 15.17$ ); ( $p = 0.000001$ ). CLS was proportional to age and experience.

**Conclusion:** Relatively insufficient practice and low levels of confidence among physicians regarding all aspects of chronic pain management was reported. Employing national or local protocols can be useful.

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#### Introduction:-

Chronic pain is a common condition affecting 10% to 20% of the population across the world (Smith BH et al, 1999; Breivik et al, 2006). It is associated with physical disability and psychological, social and economic adverse

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effects(Breivik Het al, 2006, Gureje Oet al, 1998). Consequently, chronic pain is responsible for severe, multidimensional impact on patients' quality of life (Becker Net al, 1997). According to The International Association for the Study of Pain (IASP), pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described by the patient in terms of such damage(IASP Taxonomy, 2014).Chronic pain is defined in more subjective terms, as a pain persisting beyond normal tissue healing time. Practically, it is admitted that pain persisting for 3 months or more indicates chronicity of the pain ( Upshur CC,et al 2006; Purves AM et al, 1998).

Ideal management of chronic pain requires careful assessment of the underlying causes, evolution, intensity along with sensory components to determine the type of pain, particularly neuropathic versus nociceptive pain. Additionally, it also demands the assessment of associated psychological, social and economic repercussions, which conditions the therapeutic approach Turk DC et al, 1987; Haanpää ML et al, 2009; Karoly and Jensen, 2013).

Despite the emergence of specialty pain management centers, majority of patients with pain complaints seek medical assistance in primary healthcare centers( Smith BHet al, 1999; Breivik Het al, 2006; Upshur CC,et al 2006). Pain is one of the most frequent complaints encountered in almost 1 in 2 patients attending primary healthcare centers(Mäntyselkä Pet al, 2001). This highlights the need for optimal knowledge of pain and the practice in chronic pain management among primary healthcare (PHC) providers, especially physicians.

On the other hand, assessment of practice in chronic pain management among family and primary healthcare physicians (PHCPs) showed unsatisfactory levels of knowledge, low therapeutic goals and high prevalence of undertreated patients (Green CR et al, 2001; Ponte CD et al, 2005). Studies also showed that physicians are uncomfortable with the choice of drugs specified for the use in pain management especially with opioid analgesics, raising concerns about adverse effects, medication interactions and addiction, which often limits the prescribing of efficacious pain therapy (Bhamb Bet al, 2006; Von Roenn JHet al, 1993). This data highlights the lack of training and an urgent need for awareness among PHC providers.

Very few studies have assessed practice and knowledge about pain management in Saudi Arabia, majority of which were interested in nurses. This study showed a deficient knowledge, frequent misconceptions and inappropriate attitudes regarding assessment and treatment of pain. Need for training and national policies was highlighted (Eid Tet al, 2014; Kaki AMet al, 2009).

#### **Aim & objectives:-**

This study aimed to evaluate the practice and self-assessed confidence level in chronic pain management among PHCPs in Jeddah, Saudi Arabia. Factors associated with good/bad practice and low/high confidence were explored.

#### **Methods:-**

A cross-sectional study was conducted among PHCPs practicing in selected PHC centers in Jeddah, Saudi Arabia. A semi-structured questionnaire was administered to participants, which was divided into 3 parts:

Demographic data including age, gender, marital status, years of practice, and specialty; in addition to average number of patients seen per day, approximate percentage of pain complaints, approximate percentage of patients suffering from chronic pain, and whether the participant or one of his close relatives suffered from chronic pain.

Assessment of practice in chronic pain including 4 sub-parts: practice in patient interview (12 items), physical examination (6 items), investigations (8 items) and therapy (11 items) in chronic pain. Each item is a 5-point likert-type scale assessing the frequency of the related practice (1=never, to 5=always). A clinical practice score (CPS; range= 20 to 90) was calculated for patient interview + physical exam practice part by adding scores of related items. This score was used as an indicator for complete level of the clinical assessment in chronic pain and was analyzed as an ordinal variable.

Self-rated confidence regarding various aspects of chronic pain management (20 items); using 5-point likert-type scale (1=not confident; to 5=extremely confident). A confidence level score (CLS; range=20 to 100) was calculated by adding the scores of these items and was analyzed as a continuous variable.

The questionnaire underwent face and content validity by authors and reliability was tested by calculation of the Cronbach's alpha for each relevant part.

#### Sampling technique:-

Participants (PHCPs) were recruited using a stratified two-stage cluster sampling method (Sedgwick P, 2013). The city of Jeddah was divided into five sectors (strata); each containing 7 to 13 PHCs. Three PHCs (clusters) were randomly selected from each sector. A convenience sampling was used to include all physicians who were present at the participating PHC centers during the study period. Data was collected in an anonymous form.

The study was approved by the Medical Research and Studies Department, Directorate of Health Affairs – Jeddah, Ministry of Health.

#### Statistical Methods:-

Statistical analysis was performed with the Statistical Package for Social Sciences version 21.0 for Windows (SPSS Inc., Chicago, IL, USA). Categorical variables were presented as frequency and percentage; while both continuous and ordinal variables as mean  $\pm$  standard deviation (SD). Correlations were analyzed using independent *t*-test or OneWay analysis of variance (ANOVA) for continuous variables; chi-square test or Fisher's exact test for categorical variables; as appropriate; and nonparametric tests for ordinal variables. Significant factors of practice and confidence levels were analyzed as independent variables in linear regression analysis. A *p*-value  $< 0.05$  was considered for statistical significance.

#### Results:-

##### Characteristics of the study population:-

A total 124 PHCPs were included in the study. Of all the participants, 72.6% were females, 41.9% were aged between 30-39 years, 54.0% were married, and 32.3% had 0-5 years' professional experience. Regarding specialty, almost half of the participants (49.2%) were general practitioners, 22.6% were family physicians and 12.9% were pediatricians. Participants reported a mean  $\pm$  SD number of patients =  $38.89 \pm 26.89$  per day; among whom  $41.09 \pm 25.80\%$  were estimated to present with pain complaint and  $23.24 \pm 19.42$  were estimated to suffer from chronic pain. Half (50.0%) of the participants reported having personal or family history of chronic pain (Table 1).

**Table 1.** Characteristics of the population.

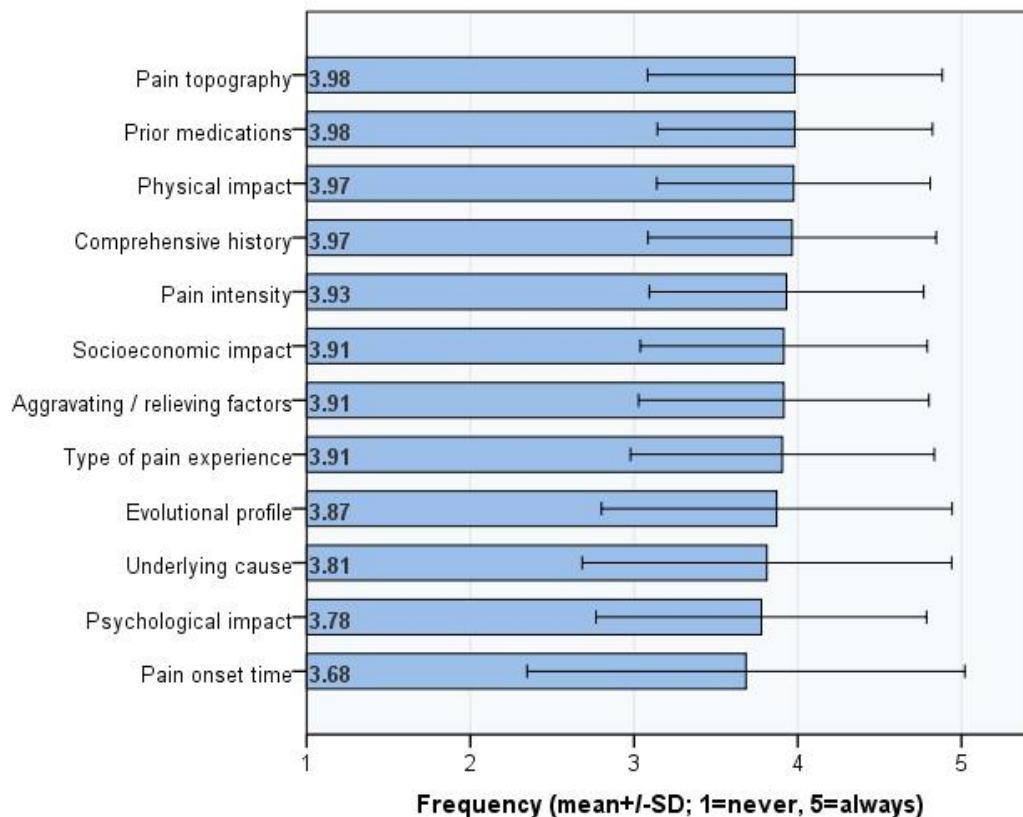
Parameter	Category	Frequency	Percentage
Gender	Male	34	27.4
	Female	90	72.6
Age category (years)	20-29	37	29.8
	30-39	52	41.9
	40-49	29	23.4
	50-59	5	4.0
	60-69	1	0.8
Marital status	Single	52	41.9
	Married	67	54.0
	Divorced	5	4.0
	Widowed	0	0.0
Nationality	Saudi	104	83.9
	Non-Saudi	12	9.7
Years of practice (years)	0-5	40	32.3
	5-10	48	38.7
	10-15	23	18.5
	>15	10	8.1
Specialty	General medicine	61	49.2
	Family medicine	28	22.6
	Pediatrics	16	12.9
	Ob-gyn	3	2.4
	Endocrinology	1	.8
	Internal medicine	4	3.2
Number of patients per	Mean, SD	38.89	26.89

day			
Approximate percentage of patients presenting with pain complaint	Mean, SD	41.09	25.80
Estimated percentage of PHC patients suffering from chronic pain	Mean, SD	23.24	19.42
Personal of family history of chronic pain	Frequency, percentage	62	50.0

#### Assessment of practice in chronic pain:-

Analysis of reliability of part 2 of the questionnaire assessing PHCPs practice showed an excellent Cronbach's  $\alpha=0.933$  (37 items). Reliability of clinical practice part (interview + physical examination) was even better (18 items; Cronbach's  $\alpha=0.964$ ).

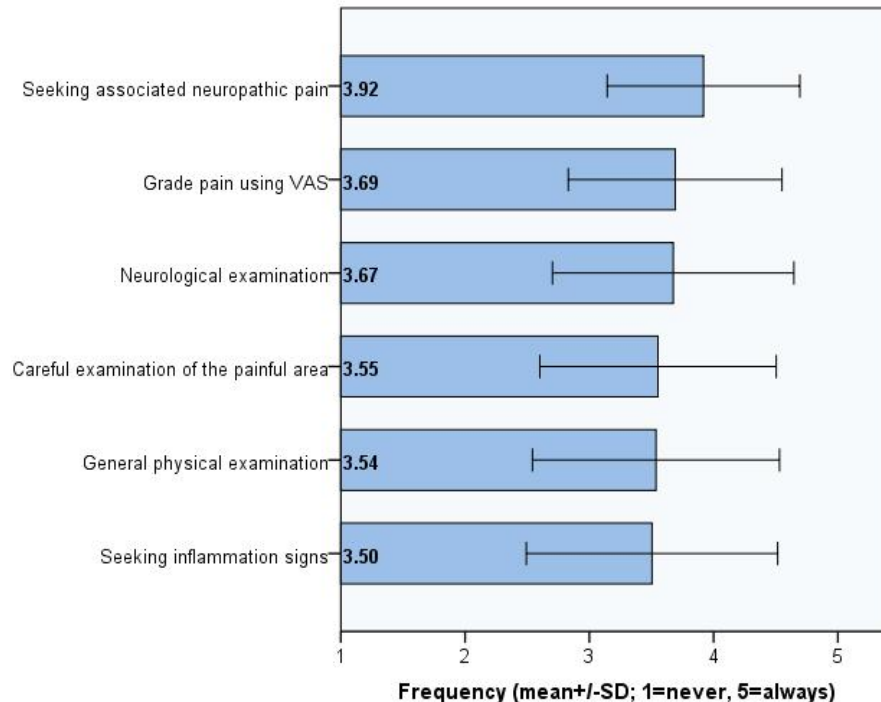
Assessment of overall clinical practice showed mean $\pm$ SD (range) CPS=76.13 $\pm$ 15.12 (41.11; 100.00). Assessment of patient's interview practice in chronic pain management showed moderate scores for all 12 interview items. On a scale from 1=never to 5=always, the most frequently assessed parameter during interview of patient with chronic pain was topography of the pain including localization and irradiations (mean $\pm$ SD score=3.98 $\pm$ 0.91), followed by prior medications (3.97 $\pm$ 0.85) and physical impact such as disability, sleep disturbance, etc. (3.96 $\pm$ 0.84). Whereas less frequently assessed parameters included underlying cause (3.84 $\pm$ 1.11), psychological impact (3.78 $\pm$ 0.99) and pain onset time (3.70 $\pm$ 1.33)(Figure 1).



**Figure 1:-** Assessment of patient's interview practice in chronic pain management among primary healthcare physicians.

Physicians replied to the following question: "When receiving a patient with a chronic pain, how often do you perform each of the following actions?". Possible answers were: 1=never; 2=rarely; 3=sometimes; 4=often; 5=always. Bars represent mean $\pm$ SD frequency in each item.

Assessment of physical examination practice showed that the most frequently carried out examination was careful examination of the painful area (mean $\pm$ SD=3.93 $\pm$ 0.78), followed by general physical exam (3.69 $\pm$ 0.86) and evaluation of inflammation signs (3.66 $\pm$ 0.98). The least carried out examinations included the screening for neuropathic component of the pain (3.54 $\pm$ 0.96), use of VAS to grade pain severity (3.53 $\pm$ 1.00) and screening for motor and sensory abnormalities (3.49 $\pm$ 1.02) (Figure 2).



**Figure 2:-** Assessment of physical examination practice in chronic pain management among primary healthcare physicians.

Physicians replied to the following question: “When receiving a patient with a chronic pain, how often do you perform each of the following actions?” Possible answers were: 1=never; 2=rarely; 3=sometimes; 4=often; 5=always. Bars represent mean $\pm$ SD frequency in each item. Regarding paraclinical and therapeutic practice in chronic pain management, PHCPs replied by yes/no to the question – “Have you ever prescribed the following for patients with chronic pain?” Analysis showed that the most frequently prescribed paraclinical investigations in chronic pain were x-rays and ultrasound of the painful zone (74.2% and 67.7% respectively), followed by MRI and inflammatory marker (62.1%) each. The most frequently prescribed treatments for chronic pain were non-steroidal anti-inflammatory drugs (NSAIDs), which were reported by 82.3% of the PHCPs, followed by muscle relaxants (65.3%), non-opioid analgesics (64.5%) and steroids (63.7%); whereas antidepressants, anticonvulsant drugs. Psychotherapy was only reported by 43.5%, 46.0% and 48.4% of the PHCPs, respectively (Table 2).



**Table 2:-** Assessment of paraclinical and therapeutic practice in chronic pain management among primary healthcare professionals.

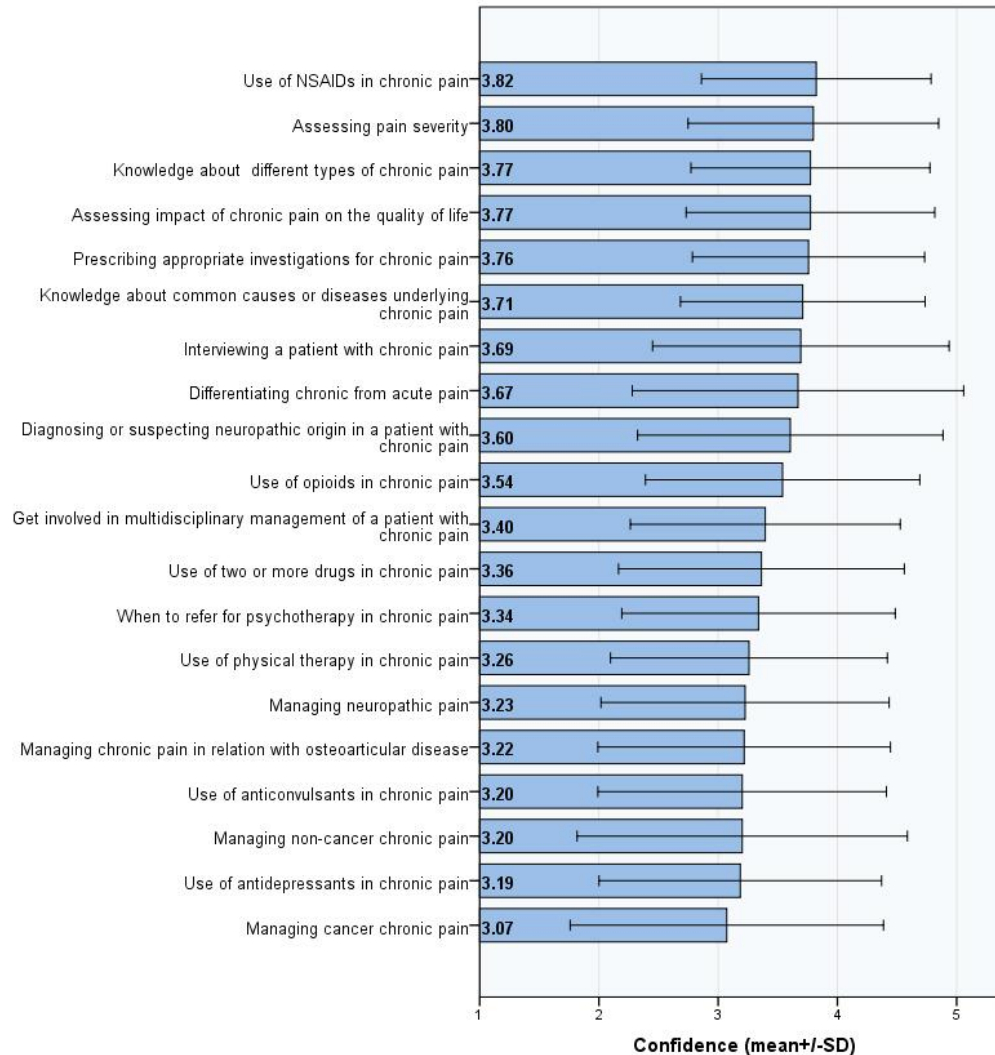
Practice	Frequency	Percentage
<b>Paraclinical investigations</b>		
X-rays imaging for the painful zone	92	74.2
Ultrasound / Echography for the painful region	84	67.7
CT Scanner	67	54.4
Magnetic Resonance Imaging (MRI)	77	62.1
Electromyogram	72	58.1
Inflammatory markers	77	62.1
Psychiatric evaluation	71	57.3
Others	31	25.0
<b>Therapy Prescribing</b>		
Non-opioid analgesics	80	64.5
Non-steroid anti-inflammatory drugs (NSAIDs)	102	82.3
Steroids	79	63.7
Opioid analgesics	75	60.5
Anticonvulsant / antiepileptic drugs	57	46.0
Antidepressant drugs	54	43.5
Muscle relaxants	81	65.3
Physical therapy / Rehabilitation	67	54.0
Psychotherapy	60	48.4
Referral to specialist pain clinic	77	62.1
Others	15	12.1

Participants replied to the question: have you ever prescribed the following for patients with chronic pain? “Yes” answers were reported in the Table.

#### **Assessment of confidence in chronic pain management:-**

Analysis of reliability of part 3 of the questionnaire assessing PHCPs confidence showed an excellent Cronbach's alpha=0.948 (20 items).

Assessment of physicians' confidence in chronic pain management showed a mean $\pm$ SD (range) CLS=69.60 $\pm$ 16.61 (30.00; 100.00). Per-item assessments showed relatively higher confidence regarding the use of NSAIDs (mean $\pm$ SD score=3.82 $\pm$ 0.96), the assessment of pain severity (3.80 $\pm$ 1.05), knowledge about different types of chronic pain (3.77 $\pm$ 1.00) and assessment of impact of chronic pain on QOL (3.77 $\pm$ 1.04). Participants declared being relatively less confident regarding cancer-related chronic pain management (mean $\pm$ SD score=3.07 $\pm$ 1.31), use of antidepressants in chronic pain (3.19 $\pm$ 1.19), non-cancer chronic pain management (3.20 $\pm$ 1.39), and use of anticonvulsant drugs (3.20 $\pm$ 1.21) (Figure 3).



**Figure 3:-** Assessment of physician's confidence in chronic pain management.

Physicians replied to the following question: "How confident do you feel performing the following actions?" Possible answers were: 1=not confident; 2=not too confident; 3=confident; 4=very confident; 5=extremely confident. Bars represent mean±SD confidence level in each item.

#### **Factors associated with practice and confidence in chronic pain management:-**

When compared between male and female PHCPs, the female PHCPs had better practice indicators than male PHCPs with mean±SD CPS=78.28±14.27 versus 70.42±16.02;  $p=0.009$ , respectively. Participants who work in high patient-flow centers/services ( $\geq 30$  patients seen per day) had lower CPS as compared to those who work in low patient-flow services (mean±SD) CPS=72.52±15.26 versus 82.24±12.89;  $p=0.000422$ , respectively. However, no significant difference in practice was observed across age categories ( $p=0.062$ ); marital status ( $p=0.453$ ); years of practice ( $p=0.388$ ); and specialty ( $p=0.117$ ); or between physicians who had personal or family history of chronic pain and those who had not ( $p=0.202$ ).

Regarding confidence, CLS was proportional to PHCPs age ( $p=0.000025$ ) and years of practice ( $p=0.022$ ), and was higher in family physicians (mean±SD CLS=82.18±15.60) as compared with other specialties such as pediatrics (73.50±14.09) and general medicine (62.62±15.17); ( $p=0.000001$ ). Confidence was also higher in physicians with personal or family history of chronic pain ( $p=0.013$ ), as well as in physicians working in low patient-flow centers

(<30 patients per day) as compared with their counterparts ( $p=0.006$ ). However, no statistical difference was reported between the genders regarding confidence ( $p=0.804$ ) (Table 3).

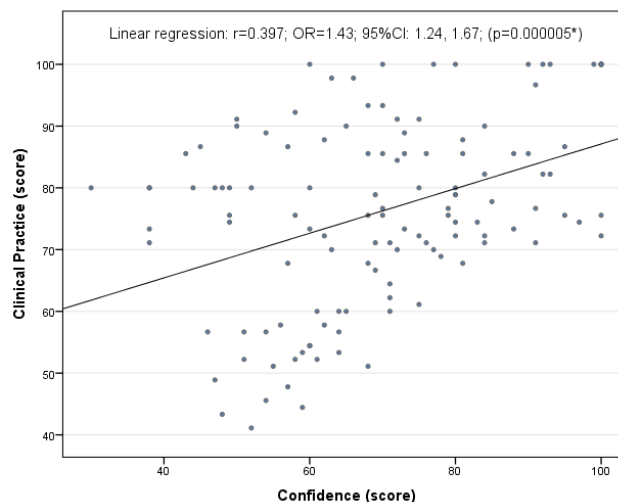
**Table 3:-** Factors associated with low confidence and poor practice in chronic pain management among primary care physicians

Factor	Category	Practice (CPS)			Confidence (CLS)		
		Mean	SD	p-value	Mean	SD	p-value
Gender	Male	70.42	16.02	.009*	69.00	14.75	.804
	Female	78.28	14.27		69.83	17.32	
Age category (years)	20-29	74.02	14.31	.062	63.49	15.17	.000025*
	30-39	76.99	13.14		69.08	16.41	
	40-49	74.18	18.28		72.72	14.10	
	$\geq 50$	91.11	13.79		96.83	6.40	
Marital status	Single	74.51	14.01	.453	64.88	15.90	.009*
	Married	76.93	16.33		72.27	16.46	
	Divorced	82.22	5.98		83.00	12.39	
Years of practice (years)	0-5	74.67	14.10	.388	65.40	16.07	.022*
	5-10	77.91	11.09		69.94	16.26	
	10-15	72.80	19.79		70.22	15.12	
	$>15$	80.56	23.39		83.30	18.23	
Specialty	General med.	74.77	12.77	.117	62.62	15.17	.000001*
	Family med.	81.94	15.57		82.18	15.60	
	Pediatrics	78.89	15.60		73.50	14.09	
	Others	82.08	15.96		79.13	12.80	
Personal or family history of chronic pain	No	78.13	11.18	.202	65.75	18.35	.013*
	Yes	74.62	17.62		73.32	14.14	
Average number of patients per day	$<30$	82.24	12.89	.000422*	74.89	15.81	.006*
	$\geq 30$	72.52	15.26		66.49	16.36	

CPS: Clinical practice score; CLS: confidence level score; \* Statistically significant result ( $P<0.05$ ); med.: Medicine.

#### Correlation between confidence and practice:-

Linear regression analysis showed a positive correlation between confidence and practice in chronic pain management, with a weak correlation coefficient ( $r=0.397$ ; odds-ratio [OR]=1.43; 95%CI: 1.24 to 1.67;  $p=0.000005$ ), (Figure 4).



**Figure 4:-** Correlation between confidence and practice in chronic pain management among primary healthcare physicians.

## Discussion:-

This study highlighted the insufficient practice and relatively low confidence in chronic pain management among PHCPs. The calculated scores including CPS and CLS were used as an indicator of the quality of clinical practice and self-assessed confidence of physicians in chronic pain management respectively. Results showed an unsatisfactory practice as well as the confidence. These results may reflect a lack of training among PHCPs along with a weak implementation of pain specialized healthcare chain. Comparable observations were reported in the USA, where patients' access to pain specialized centers is still inadequate due to lack of optimal training among healthcare professionals and uncoordinated interdisciplinary management. These results indicate the frequent undertreatment among patients and unmet needs for care within the society (Dubois and Follett, 2014). Studies from Europe estimated that 1 in 2 patients with chronic pain have inadequate management of their condition (<sup>a</sup>Breivik H, 2006; <sup>b</sup>Breivik H, 2012). On the other hand, pain management has recently emerged as a subspecialty. Therefore, cultural changes should be operated, both among patients and health professionals, to promote proper understanding of chronic pain, its related factors and specific assessment and the treatment aspects (Medicine Io, 2011).

Regarding clinical assessment, item-specific analysis demonstrated that physicians often failed to investigate the important features of chronic pain through patient's interview and physical examination, which further resulted in insufficient diagnosis and poor treatment decisions. For example, failure to explore psychological impact of chronic pain exposes the physician to the risk of missing the diagnosis of an adjacent psychiatric disorders such as anxiety or depression, which is highly associated with impaired quality of life and compromises management and therapeutic outcomes (Kroenke et al, 2013). The prevalence of depression in relation to chronic pain is higher than in the general population and was reported to be as high as 21%. In addition, patients suffering from chronic pain are highly exposed to social and professional exclusion (<sup>a</sup>Breivik H, 2006; <sup>b</sup>Breivik H, 2012). Psychosocial aspects constitute a major concern in chronic pain management and should be integrated in the treatment goals by promoting patient's rehabilitation and improving quality of life (Mills et al, 2016).

Participants estimated that approximately 25% of their patients suffered from chronic pain, which is as high as the prevalence reported in the general population (McQuay and Moore, 2008). Such a high prevalence makes chronic pain become a burdensome public health issue, both medically and economically (Nahin et al, 2015; Gaskin and Richard, 2012). Studies have demonstrated that patients with chronic pain have increased mortality and cardiovascular morbidity, and frequently associated multi-pathological conditions (Guthrie et al, 2012; Barnett et al, 2012). The existence of such comorbidities often limits pain management and restricts the use of efficacious therapeutic options. Consequently, PHCPs should be aware and attentive about the necessity of a comprehensive approach in the management of chronic pain as majority of these patients are exclusively managed in primary care; elicit considerable care resources and have greater use of emergency services while only a minority are referred to secondary care (<sup>a</sup>Breivik H et al, 2006; Briggs et al, 2011; McLeod and Nelson, 2013; Anderson et al, 2012).

Confidence in the use of opioids in chronic pain management was relatively low as compared to that in use of NSAIDs. The use of opioid analgesics is often limited by physicians' misconception and apprehensive attitude evoking concerns about medication misuse, addiction risk among patient and insufficient training (Canada RE et al, 2014; Jamison et al, 2014). This attitude exposes to an odd risk of undertreatment among patients with chronic pain and engenders unsatisfactory results. Adequate trainings on opioids use and misuse risk assessment should be proposed to PHCPs to improve their knowledge and confidence and to also dissipate their apprehensions and change their attitude towards the use of opioids in primary care for chronic pain (Kavukcu et al, 2015). Also, physicians should be trained on ways to assess the patients' benefits from opioids and how to ensure that the risks justify the benefits to boost their confidence in the use of these agents (Frank et al, 2014).

In addition, prescribing guidelines and protocols should be implemented to support the therapeutic decision making in chronic pain and to ensure better adherence to good practice (Canada RE et al, 2014). However, several other aspects in prescribing opioids should be taken into consideration, including availability, cost and form of the medication (transdermal, sublingual, etc.), in addition to individual tolerability, compliance and efficacy profiles requiring personalized titration and dosage techniques (Pergolizzi et al, 2008).

Considering other aspects of physical examination, participants reported frequent examination for neuropathic pain in patients with chronic pain, while underlying cause of pain is less frequently sought. Neuropathic pain, as opposed to nociceptive pain, results from damage or dysfunction of nerve fibers responsible for abnormal pain perception. It is a frequent condition encountered in up to 17% of cases of chronic pain and has been reported to be on the rise in

the last decade (Frank JW et al, 2014). It may be associated to specific syndromes, such as diabetic peripheral neuropathy, postherpetic neuralgia, trigeminal neuralgia and low-back pain with spinal disorders (Boogaard S et al, 2015; van Hecke O et al, 2014; Yamashita T et al, 2014). It is generally associated with greater impact on quality of life (Hiyama A et al, 2015). Several screening tools have been developed for clinical detection of neuropathic pain, such as the Neuropathic Pain Diagnosis Questionnaire (DN4) and the Neuropathic Pain Questionnaire (NPQ) which are reliable and simple to use in routine practice (Haanpää ML et al, 2009).

Female gender and low workload (<30 patients per day) were the only two favorable factors for good clinical practice in chronic pain management, including an adequate patient's interview and physical examination. The other factors such as age, years of practice and specialty had no effect on the practice. However, increased confidence level was associated with age and years of practice and was higher in family physicians as compared to their counterparts. In addition, the existence of a personal or family history of chronic pain increased the confidence but did not improve clinical practice. Overall quality of practice showed weak correlation with confidence level in linear regression ( $r=0.397$ ).

This data suggests that, beyond insufficient knowledge and confidence, a lack of awareness and investment exist among PHCPs in the management of chronic pain. Corrective measures should be undertaken to promote interest and good clinical practice in pain management among PHCPs.

### Conclusion:-

This study explored chronic pain management in PHC centers of Jeddah and revealed insufficient practice and low levels of confidence among physicians regarding different aspects of chronic pain management. Although physicians' confidence increased with age and experience and was shown to be higher in family physicians, the level of practice remains comparably inappropriate.

The correlation between confidence and practice indicates the importance of enhancing knowledge about chronic pain management by the means of training and increase of clinical exposure among physicians to improve their practice. However, the weak correlation coefficient suggests the existence of other adverse factors for good practice, such as a lack of awareness or investment, which requires the implementation of awareness raising strategy. The implementation of national guidelines and or local protocols can be useful in prompting physicians' confidence and improving physicians' adherence to good practice, especially regarding specific aspects such as opioids use, diagnosis and treatment of neuropathic pain and assessment and management of multi-dimension impact of chronic pain on patient's quality of life.

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### References:-

1. Green CR, Wheeler JRC, Marchant B, LaPorte F, Guerrero E. (2001): Analysis of the physician variable in pain management. *Pain Med. Wiley Online Library.*, 2(4):317–27.
2. Gureje O, Von Korff M, Simon GE, Gater R. (1998): Persistent pain and well-being: a World Health Organization study in primary care. *Jama American Medical Association.*, 280(2):147–51.
3. Guthrie B, Payne K, Alderson P, McMurdo MET, Mercer SW. (2012): Adapting clinical guidelines to take account of multimorbidity. *Br Med J. BMJ Publishing Group.*, 345(oct04):e6341–e6341.
4. Haanpää ML, Backonja M-M, Bennett MI, Bouhassira D, Cruccu G, Hansson PT, et al. (2012): Assessment of neuropathic pain in primary care. *Am J Med. Elsevier.*, 122(10):S13–S21.
5. Hiyama A, Watanabe M, Katoh H, Sato M, Sakai D, Mochida J. (2015): Evaluation of quality of life and neuropathic pain in patients with low back pain using the Japanese Orthopedic Association Back Pain Evaluation Questionnaire. *Eur Spine J [Internet].*, 14;24(3):503–12. Available from: <http://link.springer.com/10.1007/s00586-014-3723-y>
6. International Association for the Study of Pain (IASP). (2014): IASP Taxonomy [Internet]. Available from: <http://www.iasp-pain.org/Taxonomy>

7. Jamison RN, Sheehan KA, Scanlan E, Matthews M, Ross EL. (2014): Beliefs and attitudes about opioid prescribing and chronic pain management: survey of primary care providers. *J Opioid Manag* [Internet]., 10(6):375–82. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/25531955>
8. Kaki AM, Daghistani MF, Msabeh AA. (2009); Nurses' knowledge of pharmacological measures on acute pain management in Western Saudi Arabia. *Saudi Med J.*, 30(2):279–83.
9. Karoly P, Jensen MP. (2013) *Multimethod Assessment of Chronic Pain: Psychology Practitioner Guidebooks*. Elsevier.
10. Kavukcu E, Akdeniz M, Avci HH, Altuğ M, Öner M.(2015): Chronic noncancer pain management in primary care: family medicine physicians' risk assessment of opioid misuse. *Postgrad Med* [Internet]., 127(1):22–6. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/25539797>
11. Kroenke K, Outcalt S, Krebs E, Bair MJ, Wu J, Chumbler N, et al. (2013): Association between anxiety, health-related quality of life and functional impairment in primary care patients with chronic pain. *Gen Hosp Psychiatry* [Internet]., 35(4):359–65. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/23639186>
12. Mäntyselkä P, Kumpusalo E, Ahonen R, Kumpusalo A, Kauhanen J, Viinamäki H, et al. (2001): Pain as a reason to visit the doctor: a study in Finnish primary health care. *Pain*. Elsevier., Jensen 89(2):175–80.
13. McLeod D, Nelson K. (2013): The role of the emergency department in the acute management of chronic or recurrent pain. *Australas Emerg Nurs J*. Elsevier., 16(1):30–6.
14. McQuay H, Moore R. (2008): *Epidemiology of chronic pain*. IASP Press. Seattle: IASP Press.
15. Medicine Io. (2011): *Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research*. Washington, DC: The National Academies Press.
16. Mills S, Torrance N, Smith BH. (2016): Identification and Management of Chronic Pain in Primary Care: a Review. *Curr Psychiatry Rep* [Internet]., 28;18(2):22. Available from: <http://link.springer.com/10.1007/s11920-015-0659-9>
17. Nahin RL. (2015): Estimates of pain prevalence and severity in adults: United States, 2012. *J Pain*. Elsevier., 16(8):769–80.
18. Pergolizzi J, Böger RH, Budd K, Dahan A, Erdine S, Hans G, et al. (2008): Opioids and the management of chronic severe pain in the elderly: consensus statement of an International Expert Panel with focus on the six clinically most often used World Health Organization Step III opioids (buprenorphine, fentanyl, hydromorphone, met. *Pain Pract* [Internet]., 8(4):287–313. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/18503626>
19. Ponte CD, Johnson-Tribino J. (2005): Attitudes and knowledge about pain: An assessment of West Virginia family physicians. In: *Family Medicine*., p. 477–80.
20. Purves AM, Penny KI, Munro C, Smith BH, Grimshaw J, Wilson B, et al. (1998): Defining chronic pain for epidemiological research-assessing a subjective definition. *Pain Clin. VSP BV PO BOX 346, 3700 AH ZEIST, NETHERLANDS*., 10(3):139–47.
21. Sedgwick P. (2013): Stratified cluster sampling. *BMJ*. British Medical Journal Publishing Group., 347:f7016.
22. Smith BH, Hopton JL, Chambers WA. (1999): Chronic pain in primary care. *Fam Pract*. Oxford Univ Press., 16(5):475–82.
23. Turk DC, Rudy TE. (1987) Towards a comprehensive assessment of chronic pain patients. *Behav Res Ther* [Internet]., 25(4):237–49. Available from: <http://linkinghub.elsevier.com/retrieve/pii/0005796787900027>
24. Upshur CC, Luckmann RS, Savageau JA. (2006): Primary care provider concerns about management of chronic pain in community clinic populations. *J Gen Intern Med*. Wiley Online Library., 21(6):652–5.
25. vanHecke O, Austin SK, Khan RA, Smith BH, Torrance N. (2014): Neuropathic pain in the general population: A systematic review of epidemiological studies. *Pain* [Internet]. 155(4):654–62. Available from: <http://content.wkhealth.com/linkback/openurl?sid=WKPTLP:landingpage&an=00006396-201404000-00004>
26. Von Roenn JH, Cleeland CS, Gonin R, Hatfield AK, Pandya KJ. (1993): Physician attitudes and practice in cancer pain management: a survey from the Eastern Cooperative Oncology Group. *Ann Intern Med*. Am CollPhysicians. 119(2):121–6.
27. Yamashita T, Takahashi K, Yonenobu K, Kikuchi S. (2014): Prevalence of neuropathic pain in cases with chronic pain related to spinal disorders. *J OrthopSci* [Internet]. 19(1):15–21. Available from: <http://linkinghub.elsevier.com/retrieve/pii/S0949265815303560>



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### RESEARCH ARTICLE

#### A STUDY ON CUSTOMER PERCEPTION TOWARDS ONLINE SHOPPING, SALEM.

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Customer Perception, online shopping,  
 Consumer behavior, Websites, Salem.

#### Abstract

The present article is an attempt that has been made to study the customer perception towards online shopping at Salem district. In this study an attempt has been made customer perception on online shoppers has been playing a vital role in these scenarios day to day activities in the mind of customers. Customer perception is typically affected in the way of broadly such as advertising, reviews, public relations, social media and personal experiences etc.,. Today we say that customers are mind blowing while go for an online shopping because the wide range of internet facilities in the era. The questionnaire was prepared through the inputs taken from the past researches and also from the feedback of the pilot study. Thus the validated final questionnaire was used to collect data from 150 respondents. The researchers have adopted random convenient sampling technique to gather the data. The data are analyzed using the simple percentage analysis and ANOVA (analysis of variances) methods. The result of this study reveals that customers are intake in the future online shopping in the way of intention for getting a products through internet websites such as EBay, Flipkart etc.,. The study suggested that the advertisers need to focus on their every customer's effort to ticket the market assuming that the influence of the television ads in the online shopping behavior.

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#### Introduction:-

Customer's perception equities are built over a period of moment in time by hi-tech innovations, consistent high quality, hostile advertisement and encouragement and accessibility of the products is another influential success factor, as commodities are of small value, frequently purchased daily use items. So, there is always a chance of customer's discernment switching due to whim buying. (Purna Kumar 2013) author pointed that the Organisations have long used the traditional media like television, cinema, radio and newspapers for promotional purposes of online shoppers in the mind of customers. Advertisements have been ongoing in various forms such as print, radio, outdoor are prefer to influence the online or internet shopping.

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## Objectives of the Study:-

### Primary Objective:-

- ❖ The primary objective is to the study perception of customers towards online shopping.

### Secondary Objective:-

- ❖ To determine consumer behaviour in online environment
- ❖ To identify the main influencers in online buying process
- ❖ To identify people's attitude towards benefits and risks of online shopping
- ❖ To find out the preferences of the consumer regarding the attributes of online shopping website.

## Materials and Methods:-

A straight survey was used to collect the data for this study. It was administered to random shoppers at local respondents and to students at Salem district in the interior town. The survey questions were compiled from previous study questions pertaining to the electronic trade shopping behaviors [1, 2, 3, 4, 5, 6, 7, 11, and 12]. These questions were premeditated to gather data on the subjects' perceptions toward online shopping, especially their enthusiasm to perceived online. To validate the clarity of these questions, four professors and nine researchers were asked to read through the survey questions. Revisions to the survey were made based on the feedback received. The survey consists of 52 questions. Besides 7 questions on demographics, the remaining 17 questions were designed to examine subjects' customer perceptions on online shoppers.

The questions has been collected randomly from different region in the Salem district both interior town and exterior region. The questionnaire has been collected 210 and out of 210 One hundred and fifty (150) individuals provided responses to the survey. However, sixty of the responses were not completed, and thus were excluded from the result. Details on the subjects' demographics are provided in Table 1 and 2 below (Results and Discussion).

## Results and Discussion:-

**Table 1:- Subject's Demographics.**

<b>Gender</b>	Male 96(64%)			Female 54(36%)
<b>Age (in years)</b>	18-25 42(28%)	26-35 48(32%)	36-40 39(26%)	41 and above 21(14%)
<b>Marital Status</b>	Married 54(36%)			Unmarried 96(54%)
<b>Educational Qualification</b>	Up to 10 <sup>th</sup> 24(16%)	Up to 12th 33(22%)	UG 57(38%)	PG and above 36(24%)
<b>Occupation</b>	Farmer 21(14%)	Employee 15(10%)	Professional 15(10%)	
	Business 24(16%)	House wife 5(3.3%)	Student 70(46.7%)	
<b>Family income (per annum in lakhs)</b>	Below 2 30(20%)	2-4 66(44%)	4-6 33(22%)	Above 6 21(14%)
<b>Place of residence</b>	Urban 72(48%)			Semi-urban 42(28%) Rural 36(24%)
<b>Methods of payment while purchasing in online</b>	Credit Card 39(26%)	Cash on delivery 75(50%)	Transfer Online 36(24%)	
<b>Most preferable website to purchase product</b>	Flipkart 51(34%)	Amazon 24(16%)	Snapdeal 30(20%)	
	EBay 27(18%)	Others 18(12%)		

## Interpretation:-

It was the evident table 1 shows that the genders of the respondents on male (64%) of the online shoppers are perceived day to day activities, 26-35 age groups of the respondents (32%) are mostly preferred online shopping's in the Salem district in both interior and exterior region , most of the respondents are unmarried (54%) are preferred online shoppers because of the time constraints in the tight busy schedule , most of the respondents under graduate (38%) are preferred used to go with online shopping for getting the products at easily, majorities of the respondents



are Student (46.7%) are go with online shopping because the internet is in his/her hand at any time to know the detail of the products, Mode of payment while purchasing in online Cash on delivery (50%) because some of the respondents are not trust the payment mode through internet, so especially in India most of the customers are used to preferred to go with cash on delivery, Most preferable website to purchase product for Flipkart (34%) are the majorities' perceived online shoppers and remaining are not much perceived from online shopping .

### Table 2:- ANOVA

In this table 2 we concluded that the [two groups] age (3<sup>rd</sup> question) and most preferable website to purchase product (13<sup>th</sup> question).

### NULL HYPOTHESIS (H<sub>0</sub>)

There is no significant difference between age and most preferable website to purchase product.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	54.204	3	18.068	26.207	.000
Within Groups	100.656	146	.689		
Total	154.860	149			

### Interpretation:-

From the above table, it was identified that the calculated value (0.00) is less than the table value (0.05). Hence, the null hypothesis was rejected and was concluded that there is significant difference between age and most preferable website to purchase product.

### Conclusion:-

The consumer's perception on online shopping varies from person to another and the perception is limited to a certain extent with the availability of the proper connectivity and the exposure to the online shopping has to be improved to make the customer satisfied. The perception of the consumer also has similarities and difference based on their personal characteristics usage based on their needs and demand. The study reveals that mostly the students are attached to the online shopping and hence the elder people don't use online shopping much as compared to the younger ones, so awareness has been fashioned in the coming era. Finally we are suggested that the online transaction should be flexible for the customers who perceived in shopping.

### Reference:-

1. Dolatabadi, H. R., & Poursaeedi, A. (2012). An Analysis of Factors Affecting onOnline Shopping Behavior of Consumers. International Journal of Marketing Studies , 4 (5), 81-98.
2. Kannaiah, D. (2015). Consumers' Perception on Online Shopping. Journal of Marketing and Consumer Research , 13, 14-20.
3. Khitoliya, P. (2014). Customers Attitude and Perception Towards Online Shopping. Indian journal of research , 3 (6), 18-21.
4. Krishnamurthy. (2015). Customer perception and response towards online marketingin chennai city. Asia Pacific Journal of Research , 1 (XXVII), 44-56.
5. Kumar, P. (2013). A Study on Customer Perceptions towards Online Promotions. IRC'S international journal of multidisciplinary research in social & management sciences , 1 (3), 116-124.
6. Ling, G. H. (2012). Factors influencing consumers' attitude towards e-commercepurchases through online shopping. International Journal of Humanities and Social Science , 2 (4), 223-230.
7. Puranik, R., & Bansal, A. (2014). A Study of Internet Users' Perception towards E-shopping. Pacific Business Review International , 6 (9), 37-44.
8. Sapna. ( 2016). Customer Perception Towards Online Shopping. International Research Journal of Commerce and Law , 3 (2), 17-22.
9. Shukla, R. (2016). Gender effect on customers' perceptiontowards online shopping. BVIMSR's Journal of Management Research , 8 (1), 25-30.

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### RESEARCH ARTICLE

## THE ROLE OF COMMERCIAL STREETS AS A CHANNEL OF MOVEMENT IN RELATING TO THE SENSE OF PLACE

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Commercial streets, city centre, sense of place, channel of movement.

### Abstract

Streets are an important part of open public spaces that reflect the character and the sense of place of cities. People depend on streets for many functional activities. One of these functions is its role as a channel of movement. Yet today, more and more streets are simply choked with car traffic vying for space with pedestrians and bicyclists. This means that priority is given to the function of the streets as a channel of movement for motor vehicles. Hence, this study tries to answer two questions. Firstly, does Nineveh Street have a role as a channel of movement in giving the sense of place to Mosul City Centre? Secondly, how do people use the street in terms of movement? The objective of the study is to examine the role of Nineveh Street in terms of movement and determine the travel mode used by people to move from one place to another in order to establish the role of Nineveh Street in giving the sense of place to Mosul City Centre in Iraq. This paper has adopted the mixed mode method. It used 330 questionnaire surveys which were designed to provide quantitative data, as well as 30 interviews and direct observation as a qualitative method.

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### Introduction:-

Streets are considered one of the important parts of open public spaces which reflect the character and the sense of place of cities (Najafi and Shariff, 2011). They have different functions that give them their sense of place which is reflected in the city. People use streets for their social, cultural and leisure activities, and for travel, shopping, playing and meeting other people (Abbaszadeh, 2011; Sholihah, 2006; Moughtin, 2003). Accordingly, the main objective of this research is to identify the role of one of these functional characteristics of Nineveh Street, namely movement and its contribution to the sense of place in Mosul City Centre. Understanding streets characteristics and their roles in urban studies is important to reinforce the sense of place of city centres (Cadw, 2013). Hence, this study is significant in further forming the street character of the city.

Many authors and environmental psychologists such as Steele (1981), Shamai (1991), Lynch (1981), Barker (1979), Relph (1976) believe that the experience of place is an important factor contributing to the sense of place. In this study, sense of place is defined as the qualities that differentiate between one place and another (Shamsuddin, and

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Sulaiman, 2002; Shamsuddin, et al., 2008). Therefore, the focus will be upon the qualities of the street which make it a channel of movement.

Sammas (2008) quoted from Jacobs (1961), recognised the role of streets as communication spaces, public spaces, places of social and commercial encounters and exchanges, places to do business, political spaces and symbolic and ceremonial spaces in the city. Nowadays, narrow streets accommodate old buildings, which, consequently, creates traffic congestion. For this reason, the street expansion policy has been introduced (Ja'afar et al., 2012). Besides, streets are the fundamental public space in every city, and the lifeblood of social and economic exchange. However, more and more streets are nowadays choked with car traffic vying for space with pedestrians and bicyclists. (PPS, 2012, pp.7). This means that priority is given to the function of the streets as a channel of movement for motor vehicles. Accordingly, having a central location in Mosul City, Nineveh Street is expected to be a crowded street for the movement from one place to another using various types of transportation such as cars, buses, and carts (Al-Janabi, 2013). With the development of transportation modes, streets of Mosul City could not accommodate the large numbers of cars. As a result, a lot of traffic jam takes place in them.

Hence, the study addresses two questions: Firstly, does Nineveh Street have a role as a channel of movement in giving the sense of place to Mosul City Centre? Secondly, how do people use the street in terms of movements? The objective of the study is to examine the role of Nineveh Street in terms of movement and determine the travel mode used by people to move from one place to another in order to establish the role of Nineveh Street in giving the sense of place to Mosul City Centre in Iraq.

### **Literature Review:-**

Since the present study examines the role of Nineveh commercial street, specifically its function as a channel of movement, this section explains the concept of city centre and street as one component of a city, and the role of streets as a channel of movement in relationship with sense of place.

#### **Concept of City Centre and its components:-**

Since the topic of this research refers to Mosul City Centre, it is necessary to explain the concept and definition of city centres. There are many definitions for city centre. According to Oxford (2012), a city centre defined as the central part or main business and commercial area of a city. According to Shamsuddin, et al. (2008), the street is one of the earliest components of urban spaces known to man and the most prominent 'public open space' which plays an important role especially in Asian cities. It determines the urban pattern of the cities by creating its 'sense of place'. Moughtin (2003) and Krier (1979) defined the street as one of the important elements that act as a public open space. The street acts as a medium of movement for all categories, including humans, vehicles, goods and services (Moughtin, 2003).

Depending on the predominant building use and activities taking place, streets are categorised into several types, such as civic streets, commercial streets, residential streets, pedestrian streets and a combination of commercial/residential streets (Shamsuddin and Sulaiman, 2002). This research studies Nineveh Street as one of the commercial streets in Mosul City Centre. According to many authors, commercial streets are regarded as one of the important street types. Nineveh street primarily functions as a pathway for people going from their own houses to the main square. Commercial streets, as described by Krier (1979), are by nature relatively narrower than residential streets, so that the passer-by can cast an eye over all the goods on display in the shops on the opposite side without having to cross the road. Hassan and Hamid (2010) state that commercial streets are one of the most important components of the urban system due to their facilitation of the shopping activity carried out by urban residents. Moreover, the dynamic space of a street is its formal body since it connects stable spaces which are specified by blocks on the two sides of the street. Therefore, the City Council (2003) reckons that commercial streets located in the centres should be designed to accommodate pedestrians, slow traffic, and to provide on-street parking, and create pleasant shopping environments.

#### **Streets as Channels of Movement:-**

Movement is the most important feature in determining the character of a street (Telford, 2007), and it is the main functional role of the street (Mahdzar, 2003). As a channel of movement, streets have several functions. They connect one place to another (Sholihah, 2005; Sammas, 2008). They are used by People to move from one place to another whether on foot or by cars. They provide a link between buildings, both within the street and in the city at large. They also facilitate the movement of goods (see Table 1.1). In correlation to this function, Sammas (2008) and

Sholihah (2005) quoted from Eichner and Tobey (1987) have identified various activities regarding the use of streets as a channel of movement.

**Table 1.1:-** Streets as channels of movement.

Functional Uses
Vehicular Circulation <ul style="list-style-type: none"> <li>• Through movement</li> <li>• Picking up/dropping off passengers</li> <li>• Curb side parking</li> <li>• Access to parking</li> <li>• Buses</li> <li>• On-street service</li> <li>• Off-street service</li> <li>• Emergency vehicle</li> </ul>
Pedestrian Circulation <ul style="list-style-type: none"> <li>• Through movement</li> <li>• Waiting for, boarding and alighting from vehicles (buses, taxis, cars)</li> <li>• Entering and leaving subways</li> <li>• Crossing streets</li> <li>• Entering and leaving buildings</li> </ul>

Source: Sholihah (2005) and Sammas (2008) quoted from Eichner and Tobey (1987).

Mahdzar (2003) affirms the importance of streets' function as a channel of movement. He states that the spatial function is performed where streets serve as a channel for urban space use or movement from one point of origin to another point of destination. Streets provide a link between buildings, both within the street, and in the city at large. They facilitate the movement of people as pedestrians or by vehicles and the movement of goods to sustain the wider market and some particular uses within the street (Moughtin, 2003, pp.130-133). What is important about a street is not only its width and the number of lanes through which one can move or the types of transportation modes used, but also what the street is linking and the kind of movement involved (Moughtin, 2003, p.130-133).

According to PPS (2008), streets are places where people walk, stroll, look, gaze, meet, play, shop and even work, but not places for cars. Although public movement involves walking, riding horses, camels and other animals, using pull carts, cycling, and driving more modern and sophisticated vehicles such as cars and motorcycles, many streets nowadays have become inundated with motorized vehicles to such an extent that the pedestrian and public life have almost been squeezed out (Sholihah, 2005; Sammas, 2008).

### Methodology:-

The study adopts both quantitative and qualitative methods (see Table 1.2). The use of these methods is determined by many factors, such as the nature of the research, the research objectives, the research questions, and the methodology used in previous research. An eclectic method is used in this study because quantitative and qualitative methods each has its strengths and weaknesses, so an eclectic method helps balance out any potential weaknesses in each data collection method (Gray, 2014).

As a quantitative method, the study relied on questionnaire surveys to examine the role of Nineveh Street in terms of movement and to determine the travel mode used by people to move from one place to another. The study used 330 questionnaire surveys based on 5.5% sampling error at 95% confidence level, which are employed by many considerable researchers (Shuhana 1997; Hilmilia 2005; Ja'afar, 2006; Ja'afar and Usman, 2009; Ja'afar, et al., 2012; Ujang and Dola, 2007; Ujang, 2010). A pilot survey was done before conducting the actual survey to ensure that the questions are understood by the respondents. Besides, the study made 30 semi-structured interviews, direct observations and photos as a qualitative method to measure the same street qualities measured by the quantitative method.

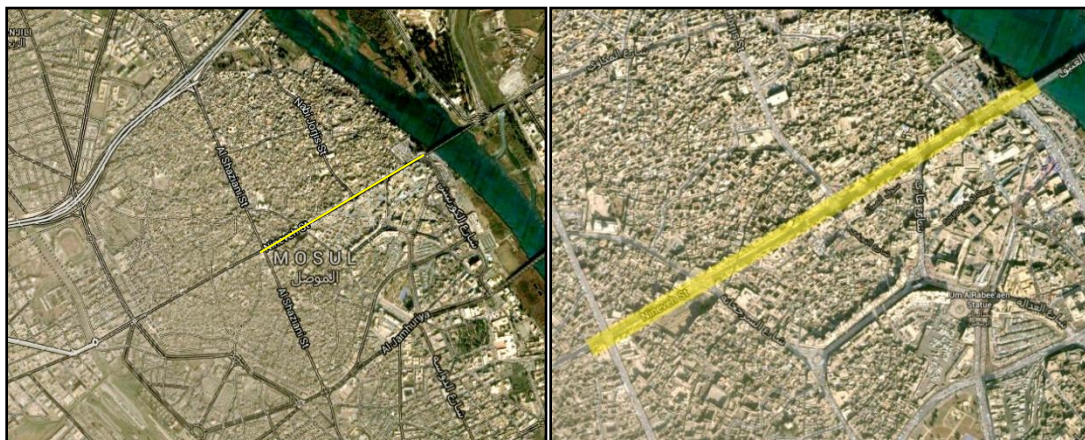
**Table 1.2:-** Research methodology used in the study

Research questions	Research objectives	Technique	Method
Does Nineveh Street have a role as a channel of movement in giving the sense of place to Mosul City Centre?	To examine the role of Nineveh Street in terms of movement in giving the sense of place to Mosul City Centre.	Questionnaire	Quantitative
		Direct observation	Qualitative
		Semi-structured interviews	Qualitative
How do people use the street in terms of movements?	To determine the travel mode used by people from one place to another.	Questionnaire	Quantitative
		Direct observation	Qualitative
		Semi-structured interviews	Qualitative

For questionnaire design based on reference to the previous research of Dolbani (2000) quoted from Ujang (2010), the targeted population for this study was the static and mobile users. Static users comprise shop-owners, shopkeepers, vendors, office workers, residents, and students. Mobile users comprise shoppers and visitors. Meanwhile, this study used the approach of "non-probability sampling" of "Time-interval and Cluster Sampling" (cluster sample interval), as did Hilmilia (2005) and Ja'afar (2006). In non-probability sampling, the researcher chooses the sample based on who they think would be appropriate for the study.

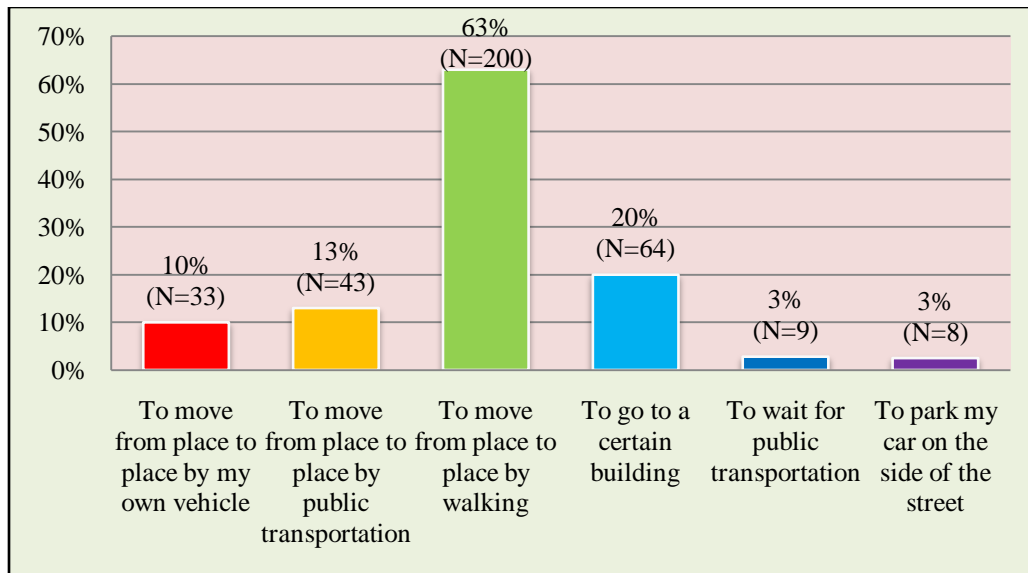
### The Study Area and Justifications:-

Nineveh Street has been selected as the setting of the investigation of this study. It was chosen based on the functional characteristics that represent the character of Mosul City Centre after the first decade of the last century, which emerged after the British occupation of Mosul City, when the process of planning and architectural transformation occurred in these areas (see Figure 1.1). It is located within the main commercial/shopping district of the City Centre. It also receives the highest concentration of pedestrians, shoppers and visitors.

**Figure 1.1:-** Top view of case study area, Source: Google earth.

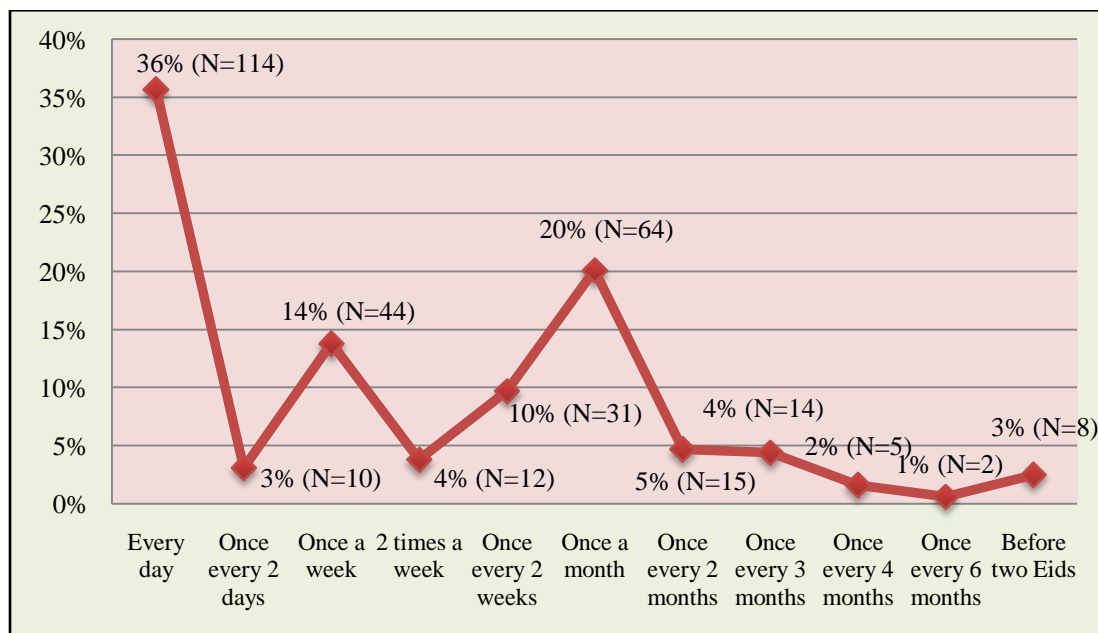
### Findings and Discussions:-

Nineveh Street played an important role as a channel of movement. From the survey, people used the street for many purposes in terms of movement. About 63% (N=63) of the respondents mentioned that they moved from place to place accessing this Street on foot. Besides, 20% (N=64) of the respondents said that they used this Street to go to certain buildings (see Figure 1.2). The other 13% (N=43) of the respondents used the Street to move from place to place by public transportation and 10% (N=33) used their own vehicles. In field interviews, many of the respondents explained why they used this street to move from place to place by walking. They often use this Street to go from one place to another by foot because walking is enjoyable, and closer to being a form of entertainment. In addition, this street directly connects with surrounding streets and nearby markets, which people cannot access by car.



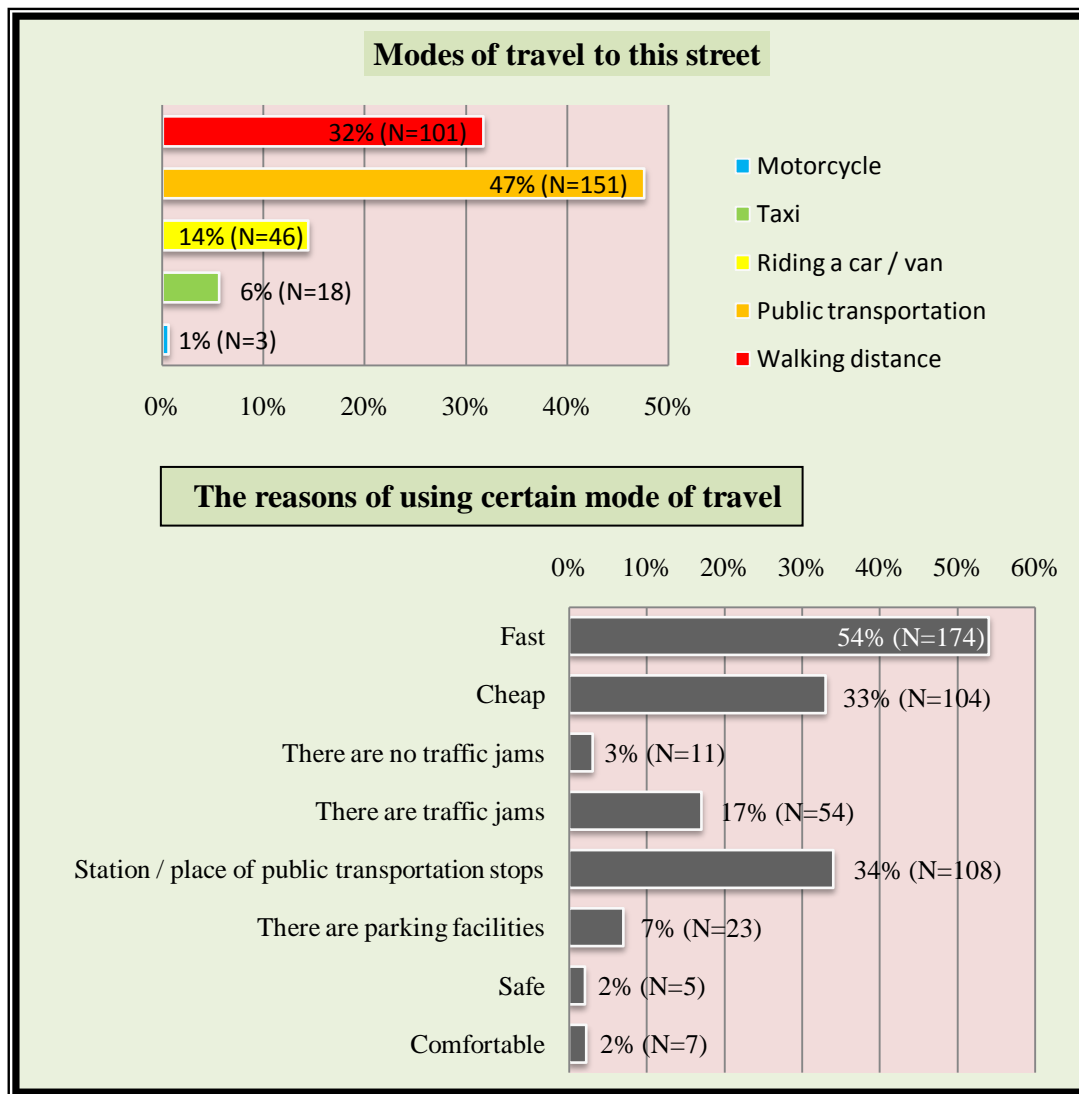
**Figure 1.2:-** The purpose of using the Street

The results of the survey show that Nineveh Street witnesses the arrival of a large number of respondents during daylight and as follows: 36% (N=114) respondents every day, 3% (N=10) respondents once every two days, 14% (N=44) respondents once a week, 4% (N=12) respondents two times a week, 10% (N=31) respondents once every two weeks, and 20% (N=64) respondents once a month (see Figure 1.3).



**Figure 1.3:-** Frequency of going to the Street

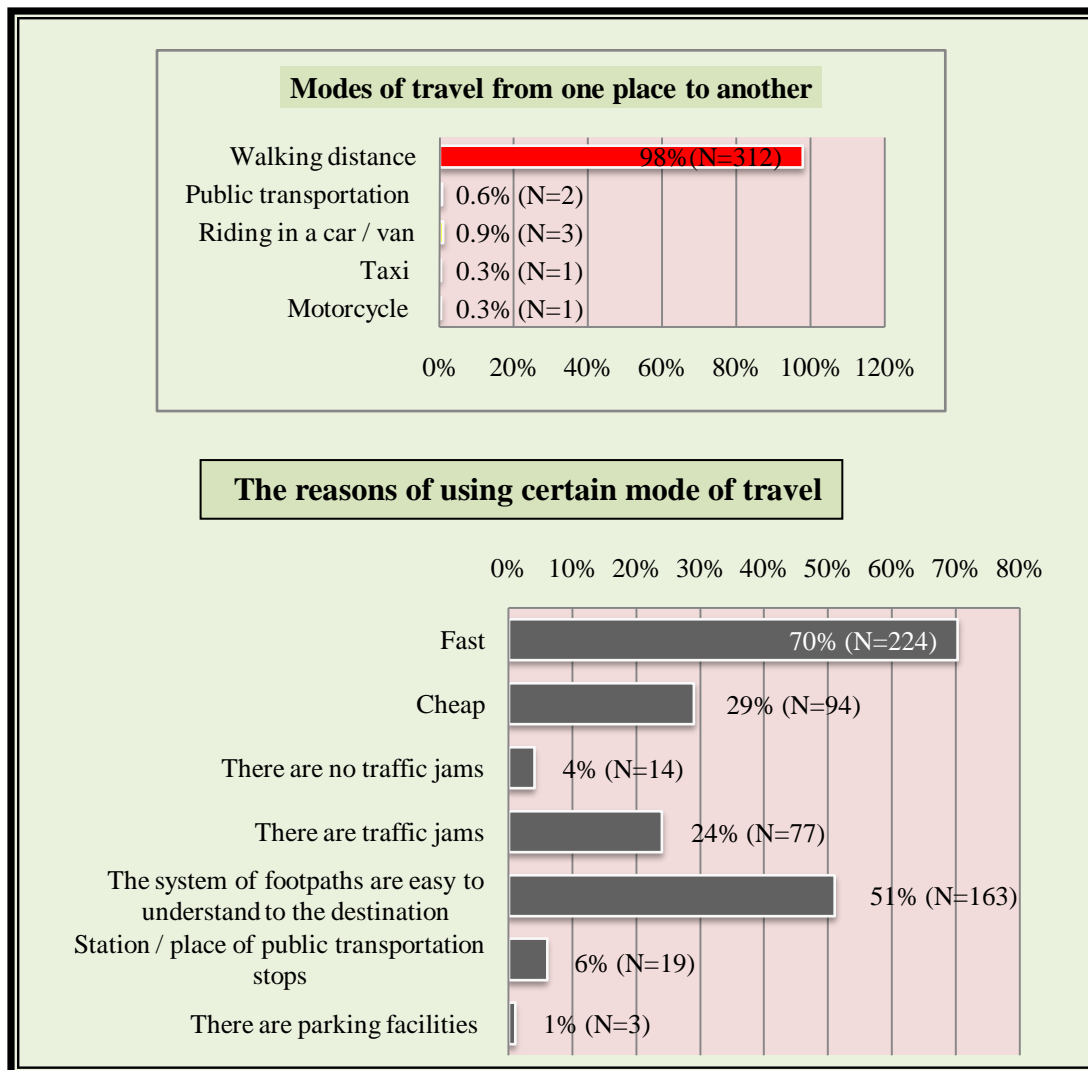
The results also show that the respondents implemented various modes of travel to reach the street from far places. The majority of them, about 47% (N=151), used public transportation (Figure 1.4). However, about 32% (N=101) of them reached the street on foot, while only 14% (N=46) of the respondents reached it by their own cars or by vans. Speed, low cost of the mode of travel and the presence of nearby public transportation stations are influential factors in people's choice of these modes of travel rather than others.



**Figure 1.4:-** Modes of travel to this Street from a distance and the reasons of selecting them

The survey also targeted people who were present in the street. Almost all the respondents chose walking as a mode of travel to move from one place to another (see Figure 1.5). Two striking reasons were behind people's preference of the walking mode: firstly, it is considered fast by 70% (N=224) of the respondents, and secondly, it makes it easy to understand and connect the destinations in the Street according to 51% (N=163) of the respondents. Other respondents reported cheap cost and traffic jam as reasons for preferring the walking mode to other modes of travel inside the Street. This result was also supported by many respondents who were interviewed.





**Figure 1.5:-** Modes of travel used by respondents in the Street and the reasons of selecting them

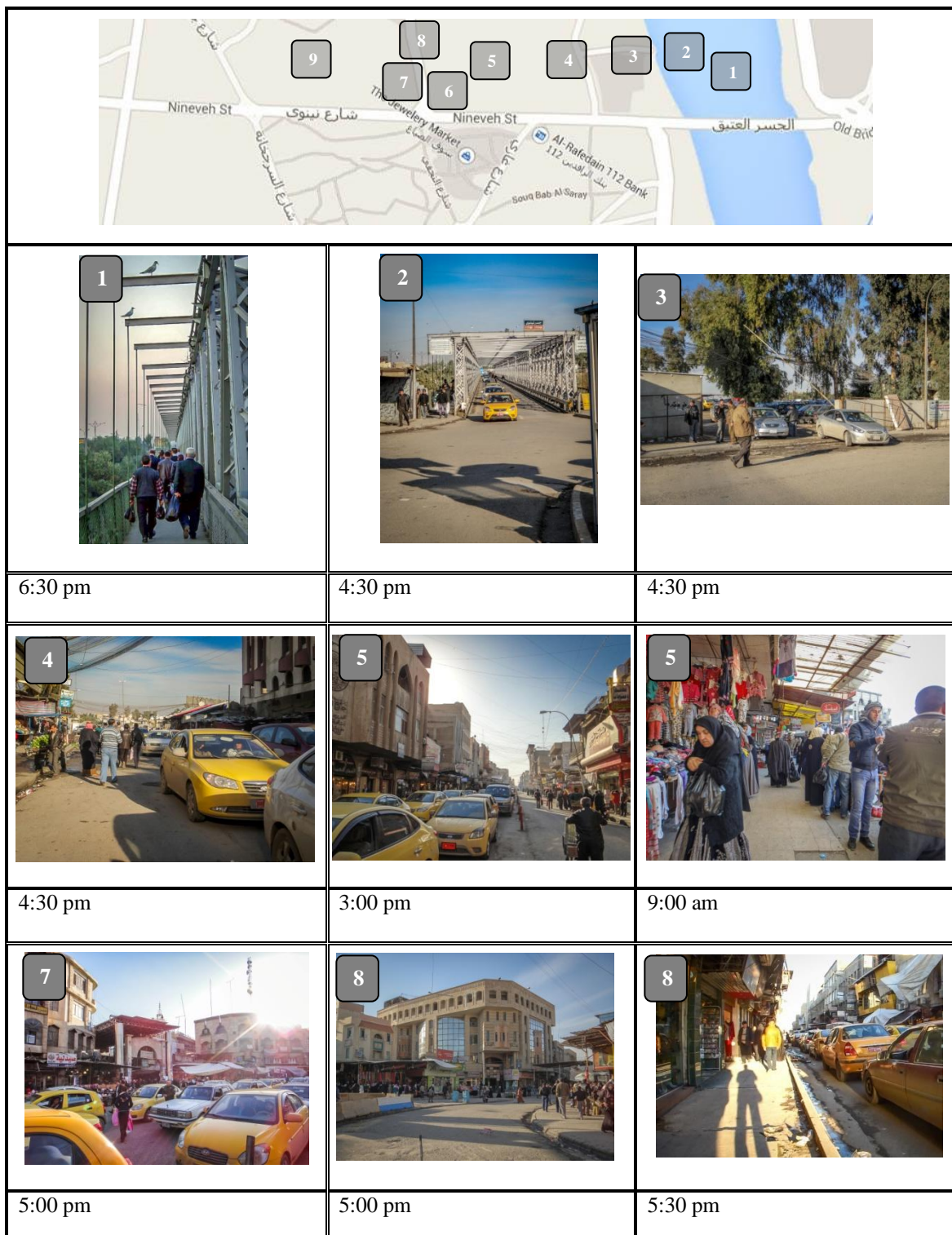
The analysis of the observation photo shows that Nineveh Street is very busy during the daytime (see Figure 1.6). Due to lack of safety in Mosul City after the war in 2003, many military checkpoints have been set up in Nineveh Street and other streets. Before Eid al-Adha and Eid al-Fitr, the directorate of traffic decided to prevent vehicles from entering Nineveh Street due to the vast number of people who visit the street for shopping (see Figure 1.7).



**Figure 1.6:-** Nineveh Street before the two Eids



In addition, there is no doubt that the location of Nineveh Street in the core of Mosul City Centre contributes to the creation of congestion along the street, especially at the street junctions with other streets. Figure 5.41 shows the intensity of the movement of vehicles and pedestrians along the street which was observed from 9 am - 6:30 pm.



**Figure 1.7:-** The role of the Street as a channel of movement

So, we can say that Nineveh Street plays an important role as a channel of movement. This result is consistent with what Ja'afar, et al. (2012) reported; however, they stated that priority is given to the function of the streets as a channel of movement for motor vehicles over other functions. Most of the respondents used Nineveh Street to move from one place to another or for other purposes in terms of movement. This was due to its location in the core of Mosul City Centre, its many links to other places, and its closeness to the public transportation area.

### Conclusion:-

The study demonstrates that the role of commercial streets as a channel of movement is strongly linked to the sense of place of city centres. Nineveh Street have played effective role in relating to the sense of place as reflected in the users' high degree of dependence on the streets for movement from place to place. This is because of its strategic location in the core of Mosul city centre and overlooking the Old Bridge is considered as the gateway for users who live on the left side of Mosul City. Nevertheless, Nineveh Street misses some of its sense because of the congestion that brought about by traffic and the military checkpoints. Political issues which lead to incredible jam and effect on the role of a street as a channel of movement can also weaken sense of place of city centres. In other words, bad political conditions should be counted as one of the negative factors that reduce the importance of commercial streets in terms of serving people to move from a place to another, thus reducing the sense of place of city centres.

In addition, people move from a place to another in the street by walking more than by other modes. There is no doubt that the commercial nature of the street was the main reason that encouraged people to walk; people should walk to buy things. They cannot buy a dress, for example, while driving a car as PPS (2014) mentioned. This means that sense of place can be created by streets when they are pathways, not car roads. Meanwhile, the importance of Nineveh Street as a commercial space was stated by Al-Obeidy (2015). He argues that Nineveh Street has played a pioneer role as a commercial space due to the presence of diverse goods and shops. This means that there are relationships among street functions. Therefore, in studying commercial street roles, this study recommends studying all the functional activities together to avoid lack of information, misinterpretation, thus unconvincing results.

### References:-

1. Abbaszadeh, F. A. (2011). Characterization of Physical Elements of Street Design. Unpublished PhD thesis. Universiti Teknologi Malaysia, Skudai.
2. Al-Janabi, S. (2013, May 13). Nineveh Street in Mosul: its functional importance and future. The Iraqis news agency. Retrieved on July 15, 2013, from [http://iraqyoon.net/articles/news\\_details.php?details=459](http://iraqyoon.net/articles/news_details.php?details=459)
3. Al\_ Obeidy, M. S., and Shamsuddin, S. (2015). Evaluating Diversity of Commercial Streets by the Approach of Sense of Place. *Advances in Environmental Biology Journal*. 9(4), pp. 193-196.
4. Barker, J. F. (1979). Designing for a Sense of Place in Mississippi Small Towns. Preshaw, P. W. and McKee, J. O. (Eds). *Sense of Place: Mississippi*. pp:162-178. University Press of Mississippi.
5. Cadw (2013). *Successful Places: A Guide to Sustainable Housing Layout and Design*. (1st ed.). Crown, UK
6. City Council (2003). *West Side Plan*. Farmers Branch.
7. Dolbani Mijan (2000). *Responsive Public Open Space In The City Centre Of Kuala Lumpur*. Unpublished PhD Thesis. Oxford Brookes University, England.
8. Eichner and Tobey (1987). In Moudon, A. V. (ed). *Public Streets for Public Use*. Van Nostrand Reinhold Company Inc., New York.
9. Gray, D. E. (2014). *Doing Research in the Real World*. (4th ed). British, SAGE publication.
10. Hassan, A. A. A. R., and Hamid, L. R. (2010). Effect of Furnishing Street Space on Harmony and Consistency of Construction Environment. *Al-Taqani Journal*. 24(3), pp. A102-A119.
11. Himilia (2005). *Apek Keselamatan Jalan Dan Kemudahan Pejalan Kaki Di Dalam Pusat Bandar Dr Perspektif Wanita: Kajian Kes Jalan Tuanku Abdul Rahman, Kuala Lumpur*. Fakulti Alam Bina. Malaysia, Universiti Teknologi Malaysia.
12. Ja'afar, N. H. (2006). *Criteria "Success" in the Traditional Way to Attract Visitors: Kuala Lumpur: A Case Study*. Unpublished Master Thesis. Universiti Teknologi Malaysia, Skudi.
13. Ja'afar, N. H., and Sulaiman, A. B. and Shamsuddin, S. (2012). Traditional Street Activities in Kuala Lumpur City centre. *International Journal of Multidisciplinary Thoughts*. Volume 2 (1), p. 93-105.
14. Ja'afar, N. H. and Usman, I. M. S. (2009). Physical and Transportation Elements of Traditional Street in Malaysia. *European Journal of Social Sciences*. Volume 9 (4), p.669- 676.

15. Jacob, J. (1961). The death and life of great American cities: The Failure of Modern Town Planning. London: Peregrine Books, pp. 155
16. Krier, R. (1979). Urban Space. Rizzolli International Publication, Inc.
17. Lynch, K. (1981). A Theory of Good City Form. Cambridge, MA: The MIT press. pp.118-119
18. Moughtin, C. (2003). Urban Design: Street and Square. Oxford, Butterworth, Heinemann Ltd.
19. Mahdzar, S. (2003). Sociability Vs. Accessibility: Static Pattern of Uses as New Urban Design Dimension in Measuring the Liveliness of Street Spaces in Urban Spaces. Proceedings 4th International Space Syntax Symposium London 2003, pp.101.1- 101.2.
20. Najafi, M. and Shariff, M. K. B. M. (2011). The Concept of Place and Sense of Place in Architectural Studies. International Journal of Human and Social Sciences. 6 (3), p. 187- 193
21. Oxford Dictionary (2013). Eighth edition. Oxford University Press.
22. Project for Public Spaces (PPS) (2012). Placemaking and the future of cities. Project for Public Spaces, Inc (www.pps.org).
23. Project for Public Spaces (PPS) (2014). Streets as Places: How Transportation can Create a Sense of Community. Retrieved on Nov. 1, 2013 from <http://www.pps.org/>
24. Project for Public Spaces (PPS) (2008). Streets as Places: Using Streets to Rebuild Communities. New York. Project for Public Spaces, Inc (www.pps.org).
25. Relphs, E. (1976). Place and Placelessness. Pion Limited, London.
26. Sammas, Y. A. A. (2008). The Role of Active Public Street as Prerequisite for Livable Cities. Unpublished Master Thesis. Universiti Teknologi Malaysia
27. Shamai, S. (1991). Sense of Place: an Empirical Measurement. Geofmm. Vol. 22 (3), PP. 347-358.
28. Shamsuddin, S. (1997). Identity of Place: A Case Study of Kuantan Town Centre, Malaysia. Unpublished PhD thesis. University of Nottingham.
29. Shamsuddin, S., and Sulaiman, A. B. (2002). The Role of Streets in Influencing the Sense of Place of Malaysian Towns and Cities. Proceeding of Great Asian Streets Symposium: "Public Space 2002". 25-26 July 2002, Singapore. Centre for Advanced Studies in Architecture (CASA), Department Of Architecture, School of Design and Environment, National University of Singapore, 35-43
30. Shamsuddin, S., Sulaiman, A. B., and Ja'afar, N. H. (2008). The Traditional Shopping Streets and its Attractions to the Users. Sulaiman, A. B., and Mai, M. M. (eds.). Urban Design Issues in the Developing World: The Case of Malaysia and Nigeria. (1st ed.). Kuala Lumpur, Malaysia.
31. Sholihah, A. B. (2005). The Role of Informal Street Activities in the Context of Conserving Urban Cultural Entity; Case Study: Maliobro Street, Yogyakarta, Indonesia. Unpublished Master thesis. Universiti Teknologi Malaysia, Skudi.
32. Steel, F. (1981). The Sense of Place. CBI Publishing Company, Inc.
33. Telford, T. (2007). Manual for Streets. Thomas Telford Ltd. The Great Britain.
34. Ujang, N. (2010). Place Attachment and Continuity of Urban Place Identity. Asian Journal of Environment-Behaviour Studies. pp.61-76
35. Ujang, N. and Dola, K. (2007). Linking Activity and Place Attachment Dimensions in Enhancing the Sense of Place. Alam Cipta, International Journal on Sustainable Tropical Design Research and Practice. 2 (1). pp. 59-67. ISSN 1823-7231.



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## RESEARCH ARTICLE

### PERIPHERAL GIANT CELL GRANULOMA OF ANTERIOR MAXILLA.

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Peripheral Giant Cell Granuloma (PGCG), maxillary anterior, differential diagnosis

#### Abstract

Peripheral giant cell granuloma (PGCG) is a benign lesion regarded as a hyperplastic reaction to local injury or chronic trauma, developing only within the oral cavity. The common site for PGCG is the premolar gingival tissue and the crest of the edentulous alveolar ridge. PGCG presents as a firm, soft, bright pedunculated or sessile nodule with various sizes; that range from small papules to enlarged masses; though they are generally less than 20 mm in diameter and is asymptomatic. We describe a 41-year-old male who presented with a peripheral cell giant granuloma of the maxillary anterior area.

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#### Introduction:-

Peripheral giant cell granuloma (PGCG) (giant cell epulis, osteoclastoma, giant cell reparative granuloma, or giant-cell hyperplasia) is an infrequent exophytic lesion of the oral cavity occurring on the gingiva and alveolar ridge usually as a result of local irritating factors such as tooth extraction, poor dental restorations, food impaction, ill fitting dentures, and calculus.<sup>1</sup> Peripheral giant cell granuloma accounts for less than 10% of all hyperplastic gingival lesions.<sup>2</sup> PGCG arise interdentally or from the gingival margin, occur most frequently on the labial surface, and may be sessile or pedunculated.<sup>1</sup> Histopathologically PGCG has a non-encapsulated mass of tissue containing reticular and fibrillar connective tissue containing ovoid or fusiform shaped cells and multi-nucleated giant cells.<sup>3</sup> We describe a 41-year-old male who presented with a peripheral cell giant granuloma of the maxillary anterior area.

#### Case History:-

A 41 years old male complained of growth in upper front tooth region since one and a half years. There was no history of any serious or significant illness. Patient brushed his teeth once daily with tooth paste and medium bristle tooth brush, using horizontal strokes. There was no history of smoking or tobacco chewing. Patient was apparently normal one and a half years ago when he observed a growth in upper front tooth region. The growth was sudden in onset and gradually increased in size to attain the present dimensions. Initially the growth was painless but since 6 months patient reported that the growth bleeds while brushing and pain is associated during brushing only. Patient also feels difficulty in speech. A solitary, sessile, round-ovoid growth with normal mucosal color is present on anterior maxillary gingiva. The growth measured 3x3 cm approximately (Fig. 1). On Palpation inspector findings were confirmed. The growth was firm in consistency, slightly rough on surface texture, non-tender on palpation and bleeds on provocation. Gingiva was generalized red and enlarged with generalised loss of stippling and knife edge margins. A provisional diagnosis of Pyogenic granuloma was done. Peripheral ossifying fibroma, Peripheral giant cell fibroma, Gingival hyperplasia and Peripheral giant cell granuloma were also considered in the differential diagnosis. Routine haematological and serological investigations were normal. Radiological examination revealed no evidence of bony involvement (Fig. 2). Histopathological features revealed stratified squamous epithelium overlying

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the connective tissue stroma. The epithelium shows ulcerations in some areas. The underlying mass of fibrillar connective tissue stroma consists of large numbers of plump spindle shaped connective tissue cells and many multinucleated giant cells which contain varying number of nuclei. Some of the giant cells are found in lumina of blood vessels. Numerous capillaries and haemorrhagic areas are seen around the periphery of the lesion. The findings were consistent with a diagnosis of **Peripheral giant cell granuloma**. Patient was explained about the condition and was reassured. The patient was placed on follow-up.

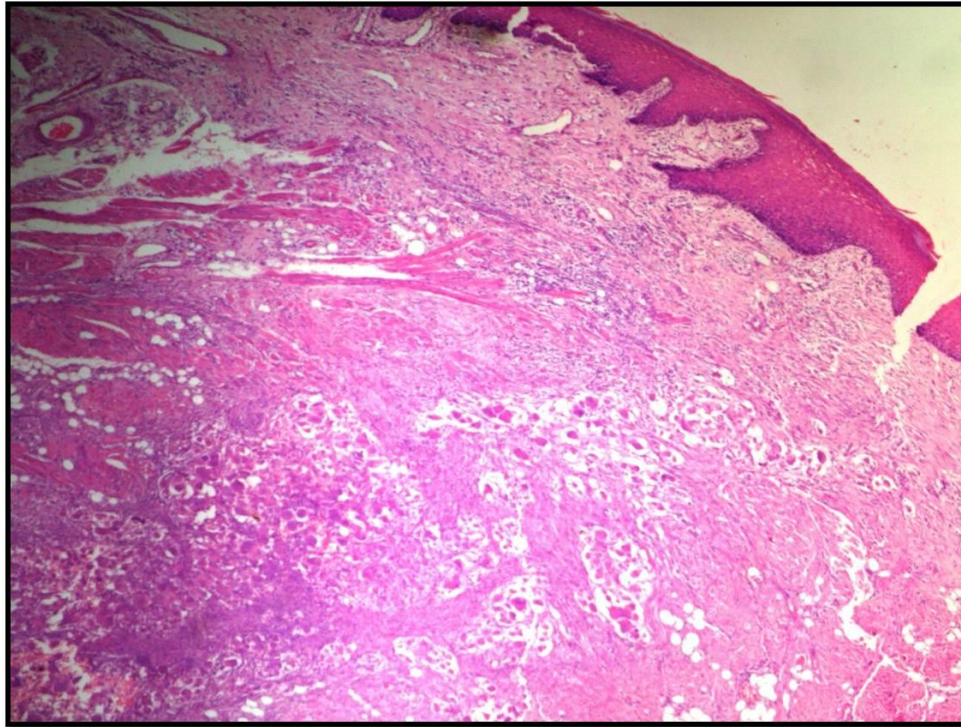
**Figure 1:-** Intraoral swelling observed in anterior maxilla.



**Fig. 2:-** Intraoral periapical radiograph showing no abnormal changes



**Fig. 3:-** Photomicrograph showing focal aggregates of multinucleated giant cells in deeper connective with overlying epithelium. Inset reveals higher power of giant cells. (x40,x400; H&E)



### Discussion:-

PGCGs can occur at any age, but most commonly are noted between the fourth and sixth decades and appear to be more common in women, with the most prevalent site being the posterior mandibular alveolar mucosa.<sup>4</sup> PGCG has clinical features which separates it from the fibrous and vascular gingival enlargements.<sup>5</sup> PGCG presents as a firm, soft, bright pedunculated or sessile nodule with various sizes: that range from small papules to enlarged masses; though they are generally less than 20 mm in diameter and is asymptomatic.<sup>5</sup> The growth of PGCG is generated by repeated trauma. There is a variation in color from dark red to purple or blue commonly with ulcerated surface.<sup>4, 5</sup>

The etiology of PGCG is still not precisely defined. Gottsegen suggested the development of PGCG often after periodontal surgery. Local irritating factors such as tooth extraction, poor dental restorations, food impaction, ill fitting dentures, and calculus are often considered predisposing factors for PGCG. Low socioeconomic status of the patients and unfavorable oral hygiene also seem to be predisposing factors to peripheral giant cell granuloma.<sup>6</sup> Choi had reported the correlation of PGCG with hyperparathyroidism secondary to renal failure.<sup>7</sup>

The differential diagnosis of PGCG includes pyogenic granuloma, fibrous epulis, peripheral ossifying fibroma, inflammatory fibrous hyperplasia, peripheral odontogenic fibroma, and papilloma, all of which present with similar clinical and radiographic findings.<sup>8</sup> Radiographic examinations typically reveal no findings, because the lesion is a soft tissue mass. PGCG has been found to be more common in the mandible as compared to maxilla.<sup>9</sup> The reported proportion is 2.4:1 and in most cases, it occurs anterior to molar region.<sup>10</sup>

The treatment of PGCG comprises surgical resection with elimination of the entire base of the lesion and suppression of the etiologic factor. If resection is only superficial, the growth may recur. Most lesions respond satisfactorily to thorough surgical resection, with exposure of all the bone walls. When the periodontal membrane is affected, extraction of the adjacent teeth may prove necessary to insure full resection though this is initially contraindicated.<sup>11</sup> There are no dissimilarities between cold scalpel or carbon dioxide laser resection of PGCG. The advantages of laser resection are that it causes less intraoperative bleeding, sterilizes the wound, requires no suturing and affords improved postoperative patient comfort.<sup>12</sup> Carbon dioxide laser is of limited applicability in lesions with adjacent bone involvement, where careful surgical curettage is required and laser resection is not indicated in such cases.<sup>12</sup> Recurrence of PGCG is infrequent, ranges as little as 5–11% have been reported.<sup>5</sup> Although incipient lesions

may bleed and induce minor changes in gingival contour, gradual growth in some cases produces an important tumor mass that adversely affects normal oral function.

Liu et al concluded that RANKL and OPG expressed in lesions may play an important role in the formation of multinucleated giant cells.<sup>13</sup> Histopathologic characteristics of PGCG are harmonious with periodontal ligament or periosteum origin.<sup>14</sup> The histopathological findings of PGCG is characteristic chiefly due to the considerable quantity of multinucleated giant cells that are scattered in the connective tissue stroma.<sup>14</sup> Vascular capillaries are profusely available, especially in the peripheral areas, and giant cells are occasionally recognised in the internal wall of these vessels.<sup>12</sup> Hemorrhagic foci are also observed with the release of hemosiderin pigment and posterior invasion by mononuclear phagocytes and inflammatory cells.<sup>15</sup> The fibrocellular reaction is similar to that of other reactive lesions such as fibrous hyperplasia and peripheral ossifying fibroma. The calcified material or newly formed bone may also be seen all over the cellular connective tissue, and some of the lesions may be either woven bone or lamellar bone produced by the mononuclear stromal cells, which might be similar to latent proliferative osteoblasts or osteoprogenitor cells.<sup>9</sup> The exact source or origin of the giant cells is still uncertain.<sup>9</sup> Many theories have been proposed in the English literature, as osteoblasts, phagocytes, endothelial cells, and spindle cells are thought to be responsible for giant cell proliferation.<sup>9</sup> Thus, in such cases a definitive diagnosis can only be established through histopathological examination.

PGCG is histologically identical to its central equivalent, the central giant cell granuloma (CGCG) and the brown tumor of hyperparathyroidism. Radiological investigations are hence imperative for diagnosis to confirm that this giant cell lesion arises within the oral mucosa and does not represent a central gnathic lesion with cortical perforation and soft tissue invasion. In conclusion, the timely and accurate diagnosis of PGCG, centred on the clinical and radiographic findings and histopathological study, allows conservative therapy with a minor possibility of less risk for tooth and bone loss for the teeth and adjacent bone.

## References:-

1. Ozcan E, Bodur S, Erdem G. Peripheral giant cell granuloma- a case report. *Pak Oral dent J* 2011; 31(1); 171-2.
2. Kaya GS, Yalcin E, Tozoglu U, Sipal S, Demirci E. Huge peripheral giant cell granuloma leading to bone resorption: A report of two cases. *Cumhuriyet Dent J* 2011; 14; 3: 219-224
3. Mannem S, Chava VK. Management of an unusual peripheral giant cell granuloma: A diagnostic dilemma. *Contemp Clin Dent* 2012; 3; 93-6.
4. Pirih, F., Barroso, A.D., Tatarakis, N., Cordell, K., McCauley, L. and Edwards, P. A Case Report of a Peripheral Giant Cell Granuloma in a Patient on Forteo. *Open J Stomatolog* 2015; 5: 147-151.
5. Abu Gharbyah AZ, Assaf M. Management of a Peripheral Giant Cell Granuloma in the esthetic area of upper jaw: A case report. *nt J Surg Case Rep*. 2014; 5(11): 779-82.
6. Eronat N, Aktug M, Glinbay T, Unal T. Peripheral giant cell granuloma: Three case reports. *J Clin Pediatr Dent* 2000; 24: 245-8. Back to cited text no. 6
7. Choi C, Terzian E, Schneider R, Trocheset DA. Peripheral giant cell granuloma: Associated with hyperparathyroidism secondary to end-stage renal disease: A case report. *J Oral Maxillofac Surg* 2008; 66: 1063-6.
8. Adlakha V K, Chandna P, Rehani U, Rana V, Malik P. Peripheral giant cell granuloma. *J Indian Soc Pedod Prev Dent* 2010; 28: 293-6
9. Etoz OA, Demirbas AE, Bulbul M, Akay E. The peripheral giant cell granuloma in edentulous patients: report of three unique cases. *Eur J Dent*. 2010 Jul; 4(3): 329-33.
10. Reichart P, Philipsen H P. Peripheral giant cell granuloma: review of 720 cases. *J Oral Surg*. 2000; 164.
11. Shadman N, Ebrahimi SF, Jafari S, Eslami M. Peripheral giant cell granuloma: a review of 123 cases. *Dent Res J (Isfahan)*. 2009 Spring; 6(1): 47-50.
12. Chapparro-Avendano AV, Berini-Aytes L, Gay-Escoda C. Peripheral giant cell granuloma. A report of five cases and review of literature. *MED ORAL PATOL ORAL CIR BUCAL* 2005; 10: 48-57.
13. Liu B, Yu SF, Li TJ. Multinucleated giant cells in various forms of giant cell containing lesions of the jaws express features of osteoclasts. *J Oral Pathol Med* 2003; 32(6): 367-375.
14. Bodner L, Peist M, Gatot A, Fliss DM. Growth potential of peripheral giant cell granuloma. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1997; 83: 548-551.
15. Flaitz CM. Peripheral giant cell granuloma: a potentially aggressive lesion in children. *Pediatr Dent* 2000; 22: 232-3.

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### RESEARCH ARTICLE

#### “SUSTAINING A COMPETITIVE EDGE IN THE CHANGING GLOBAL SCENARIO – BALANCED SCORECARD AND INDIAN BUSINESS ENVIRONMENT – AN EXCLUSIVE STUDY”

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Sustainable Competitive Edge, Balanced Scorecard, Strategy Map.

#### Abstract

India is the world's fastest growing large economy with GDP being 7.6% and IMF predicts that India would continue to retain this until 2020. (KPMG, Feb 2016). In the next 10 years, India is going to be young and restless as the projected median age in 2030 is 32 years which is much lesser than China and US which are 43 and 39 years respectively. By 2020, most of the countries are going to face labour force deficit including china (-10 million) and US (-17 million) where as India is going to have a surplus of about 47 millions. These metrics evidences, there is an ample of opportunities to explore and exploit the resources in India. The business environment in India is so favourable for companies to establish and reap the benefit. At the same time, this situation leads to increased competition. Thus achieving a Sustainable Competitive Edge would be predominant challenge that companies need to focus on.

Competitive Edge is the fact that the company has an advantage over its competitors and sustainability is the ability to continue at a particular level for a period of time. Achieving this two would be core objective of all the company. For this company should develop sound strategies and carry out rigorous action plan to implement these strategies. As an aid to this, Balanced Scorecard could serve as a best tool which can help companies in achieving its core objectives. This conceptual paper, explains the importance of Balanced Scorecard and how it could help companies in achieving its sustainable competitive edge. This paper, theoretically establishes the relationship between Business Strategy and Competitive Edge and Balanced Scorecard as a performance measurement tool acting as a mediating variable which could help companies in achieving Sustainable Competitive Edge.

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#### Introduction:-

The present Global business environment and the constantly increasing global competition ask for innovation, knowledge enhancement and striving efforts of the stakeholders. In this changed business paradigm relying on only the financial measures, which are considered as the indicators of short-run performance, to measure the corporate performance is puzzling and often misleading. A recent survey conducted has highlighted that the change in the business environment can be summarized with following (MSG EXPERTS):

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- Globalization and opening up of markets has not only increased competition but also has allowed companies to operate in markets previously considered forbidden.
- Inclusion of information technology as integral part of business environment has ensured that companies are able to process, store and retrieve the huge amount of data at ever dwindling costs.
- Globalization has encouraged free movement of capital, goods and service across countries.

Competitive Edge is the fact that the company has an advantage over its competitors and sustainability is the ability to continue at a particular level for a period of time. Sustainability involves long-term strategic planning that allies business growth with positive environmental and societal continuity. Sustainable Competitive Edge is an advantage that allows a business to be more successful than its competitors over a long period of time

Balanced scorecard is a strategic measurement and management system. It translates an organization's mission and strategy into a balanced set of integrated performance measures. It complements the traditional financial perspective with other non-financial perspectives such as customer satisfaction, internal business process, and learning and growth. It also mixes outcome measures, the lagging indicator, with performance drivers, the leading indicator, because "outcome measures without performance drivers do not communicate how the outcomes are to be achieved" (Kaplan and Norton 1996, p. 150). By selecting appropriate performance drivers and outcome measures to fit in the theory of business in a chain of cause and effect relationship, the organization will have a better idea of how to achieve its potential competitive advantage.

The measures for Balanced Scorecard on Four different perspectives are selected on the basis of a set of 'Strategic Objective' plotted on a Strategy Map. Within each perspective, goals are identified and links are established across and between the perspectives and suitable measures are identified for each objective. The methodology provides a greater contextual justification for choosing the measures and thus making it easier to work with. (Sabah M. Al-Najjar, July 2012)

Balanced Scorecard, being an effective tool for translating Strategies into action enables organizations to achieve breakthrough performance which in turn can provide a better platform for the companies to achieve sustainable competitive edge. Competitive advantage and firm performance are two different constructs with an apparently complex relationship (Ma, 2000). Understanding the sources of sustained competitive advantage has become a major area of study in strategic management (Porter, 1985, 1991; Barney, 1991; Peteraf, 1993; Ma, 1999a, 1999b, 2004; Flint & Van Fleet, 2005; King, 2007). When this strategy is well-formulated and implemented, it can significantly affect a firm's level of competitive advantage (Richard, 2000; Arend, 2003; Powell, 2003; Porter & Kramer, 2006).

To figure out the competitive edge, the companies should focus on its corporate strategy and how to translate strategies into achievable goals. The Balanced Scorecard is one of the most popular tool which helps management in translating corporate strategies into achievable goals or targets. Thus, Balanced Scorecard can serve as a best tool for companies to achieve sustainable competitive edge.

## **Review of Literature:-**

**Milad Abdelnabi Salem, Dr. Norlena Hasnan & Dr. Nor Hasni Osman (2012):-**

In this paper titled "**Balanced Scorecard: Weaknesses, Strengths and its Ability As Performance Management Systems Versus Other Performance Management Systems**" the authors have elucidated that performance management has become a legislative requirement for all companies, both Public and Private. Hence it is crucial to identify an appropriate tool that enables to measure the performance effectively. In this paper the author have made a theoretical framework of Balanced Scorecard and made a comparison with other performance measurement tools such as Total Quality Management, ISO 14001, Performance Pyramid, Performance Prism, EFQM Excellence Model, MBO, BOS etc. They have made a comparative analysis of advantages and limitations of Balanced Scorecard with each measurement tool and has concluded that though Balanced Scorecard suffers from certain criticism, still it has many advantages over other tools and that many organisations have used Balanced Scorecard to create strategy focused organisations and have got successful strategy execution.

**Manoj Anand, B S Sahay and Subhashish Saha (2005):-**

In this article titled "**Balanced Scorecard in Indian Companies**" Performance evaluation of financial measures alone has been severely criticized as it lacks holistic approach, historical in nature and their relevance in the present information age in building company's internal assets and capabilities is challenged. Kaplan and Norton's Balanced

Scorecard developed as an innovative and multi-dimensional corporate performance scorecard compels firms to align performance measurement from Non-financial variables and investigate their impact on the financial indicators. In this paper, the authors has made an empirical study on implementation of Balanced Scorecard by Corporates in India and explored its usage and has identified the management's motivation for its implementations and has concluded that establishing cause-effect relationship among different perspectives is the most critical issues among corporate India. They have also stated that Balanced Scorecard has resulted in improvement of the bottom line through cost reduction opportunities.

**Eric M Olson and Stanley F Slater (2002):-**

In this Paper titled “**The Balanced Scorecard, Competitive Strategy and Performance**” different organizations adopt different strategies based on various factors like organization structure, process etc. in order to be successful. In the same way, all organization cannot have equal emphasis on performance measures. The ‘balance’ in the Balanced Scorecard implies that all measures are equally important in all setting and this idea is challenged. The author has made an empirical study where more than 200 responded. He made the study to determine whether benefits can be derived from matching an emphasis in the scorecard to strategy type with the analysis made, the author found the emphasis made on different measures of Balanced Scorecard differed with the differences between high performers and low performers by strategy type. The study has provided new insight into the performance evaluations requirements of different strategy type and their associations for successful implementation.

**AliminIsmadi Ismail, RaduanChe Rose, Haslinda Abdullah and JegakUli (2010):-**

In this paper titled “**The Relationship Between Organisational Competitive Advantage And Performance Moderated By The Age And Size Of Firms**” the author empirically examined the relationship between the organizational Competitive Advantage and Performance by considering moderating variable Age and Size of the firm. The paper delivers valuable information to firms, specifically with regard to strategic management directed toward performance and attaining a competitive advantage.

**Ionel BOSTON and Veronica GROSU (2011):-**

In this paper titled “**Contribution of Balanced Scorecard Model in Efficiency of Managerial Control**” the authors studied the applicative use of Balanced Scorecard for measuring the economic and financial performance and highlight its importance as a means for communicating to all stakeholders. The concept of Balanced Scorecard is thoroughly studied and analysed and has been justified how it can produce changes and lead to results and achieve sustainable competitive advantage. The author has developed a Balanced Scorecard model for Alpha Group and has studied completely the pros and cons of Balanced Scorecard. The paper has concluded that Balanced Scorecard is able to fill the gap in management system which is created by lack of systematic process and that Balanced Scorecard ensures a coherent development of economic activities of the organization (long-term Strategies). Balanced Scorecard is more than a modern system of evaluating the economic-financial performance.

**Objectives of the Study:-**

1. To comprehend the importance of Balanced Scorecard and the Strategy Map in performance measurement
2. To conceptualize a relationship between Sustainable Competitive Edge and Performance Measurement

**Scope of the Study:-**

The present study is exclusive to the concept of Sustaining Competitive Edge and the role of Balanced Scorecard in achieving competitive edge. The paper focuses on the importance of Balanced Scorecard in the Indian Business Environment and how it could help Indian Companies to achieve sustaining competitive edge.

**Significance of the study:-**

India is the world's fastest growing large economy. India's Economy size (FY 2014-15) is US \$ 2 Trillion, being third largest in PPP terms. The projected Economic prospects during FY 2012 – 2030, India would have CAGR Growth of 6.7% whereas in China it is 6.6% and US 2.5%. These projected statuses assure huge potential for new age entrepreneurs, favourable ecosystem to spur innovation, increased women participation, rising rural and middle class market and largest base for young businesses etc.

It is very much evidence from the above that the Indian Companies and its business Environment has got huge potential in the near future. Exploring this situation, achieving Competitive edge and sustaining it over a period of time is going to be the need of the day. Thus, the present study plays a significant role in bringing some clarity on

the concept of Balanced Scorecard and how BSC model could help Indian Companies in achieving sustaining Competitive edge.

### **Research Methodology:-**

The Research approach adopted in this paper is a descriptive and theoretical study. On the theoretical background, the importance of Balanced Scorecard and what impact it could create on Sustaining Competitive Edge has been studied. This paper focused on analyzing the information provided by various literatures and documents and establishes the relationship between the Balanced Scorecard and Company's Competitive Edge.

### **Sources of Data Collection:-**

For the purpose of this research, secondary data has been collected to understand the current Indian Business environment. The concepts and information from various books, literatures, business reports and web sources has served as important sources for data.

### **Limitation of the Study:-**

This study is limited to understanding how sustainable Competitive Edge could be achieved by the Companies in the Indian Business environment alone. In relation to this, how Balanced Scorecard, as a performance measurement tool, could aid companies in achieving this goal. The Other Factors which could influence the Competitive Edge of the companies are not considered in this study.

With the mere description of Sustainable Competitive Edge, the whole study has been undertaken and how Balanced Scorecard could make a difference for the companies.

### **Discussion:-**

#### **Balanced Scorecard:-**

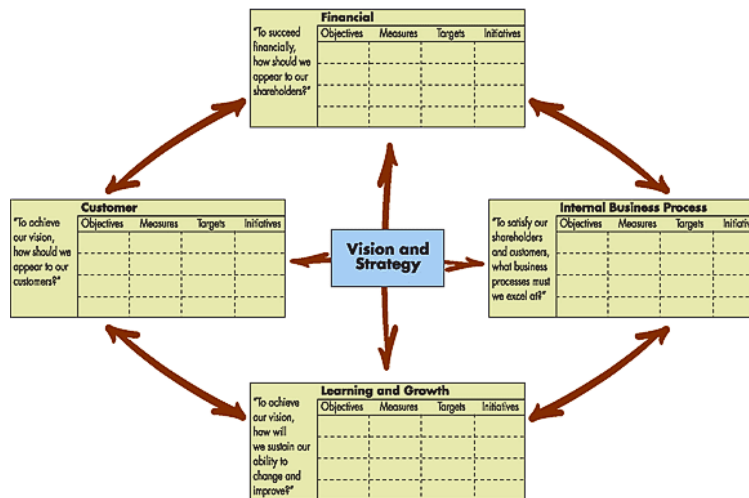
The concept of 'Balanced Scorecard' was first introduced in the journal "Harvard Business Review" (January-February, 1992) by Robert S. Kaplan and David P. Norton. The Balanced Scorecard is an organizational framework for implementing and managing strategy at all levels of an enterprise by linking objectives, initiatives and measures to an organization's strategy. The Balanced Scorecard is a strategic management system (not only a measurement system) that enables organizations to clarify their vision and strategy and translate them into action.

Kaplan and Norton want "to incorporate the valuation of a company's intangible and intellectual assets, such as high quality products and services, motivated and skilled employees, responsive and predictable internal processes, and satisfied and loyal customers" (Kaplan and Norton 1996, 7). So "the Balanced Scorecard complements financial measures of past performance with measures of the drivers of future performance.

#### **Balanced Scorecard Perspectives:-**

The Balanced Scorecard enables managers to view the well-being of the business from four important perspectives or quadrants. Each quadrant of the scorecard reports performance measures directly related to the corporate vision in the form of key performance measures or indicators (KPI). The Balanced Scorecard is a mechanism for translating an organization's vision and strategy into a coherent set of objectives and performance measures. It uses measurement to communicate the drivers of current and future success. The four perspectives of the Scorecard provide a balance between short term and long term objectives, between desired outcomes and the drivers of those outcomes, and between objective and subjective performance measures. Many measurement frameworks advocate a balanced range of measures. The Balanced Scorecard is prescriptive about this range, and about how one perspective defines the drivers of the next.

### Translating Vision and Strategy: Four Perspectives



The Balanced Scorecard starts with the vision and the strategy of a company. Then translate these vision, mission and strategies into tangible objectives and measures. For these objectives and measures, targets are set and initiatives are taken through continued learning and innovation. There is a link between these perspectives and its impact on the various variables can be understood better with the help of the strategy map.

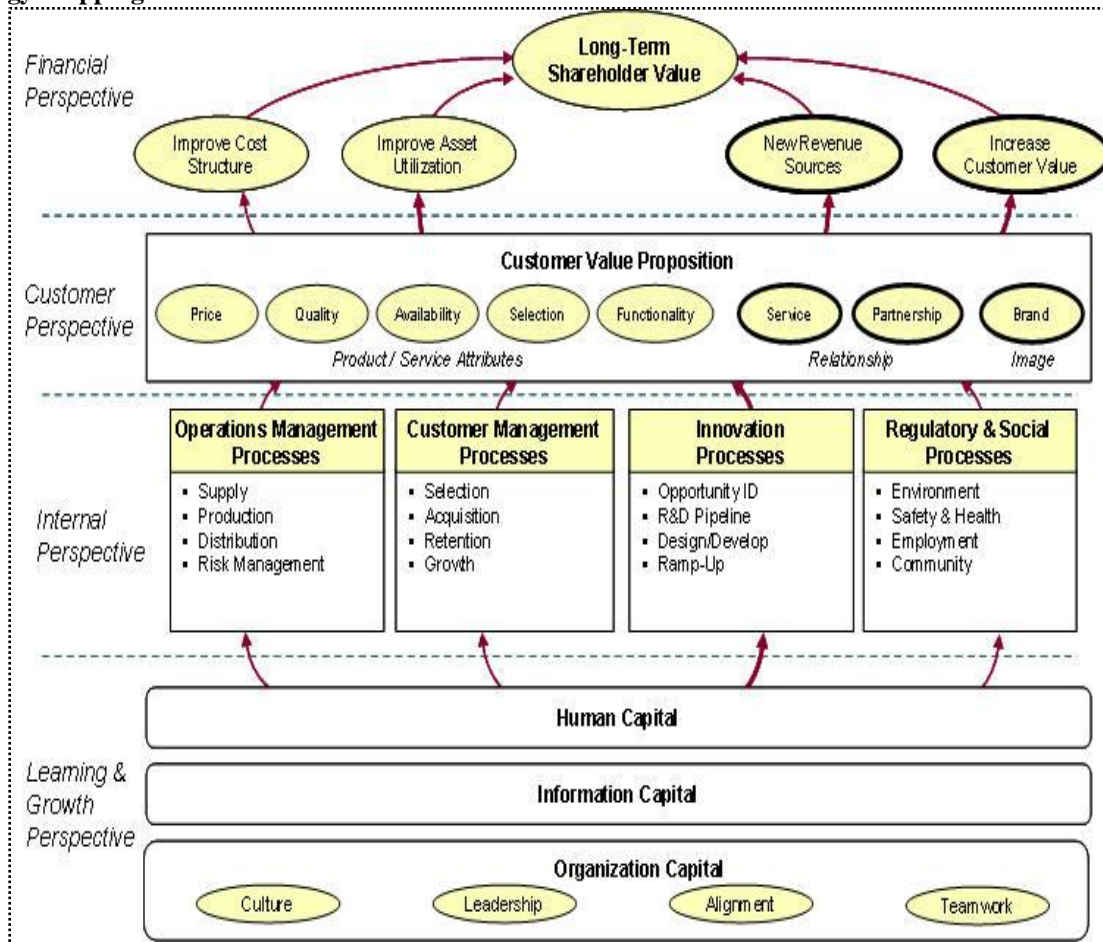
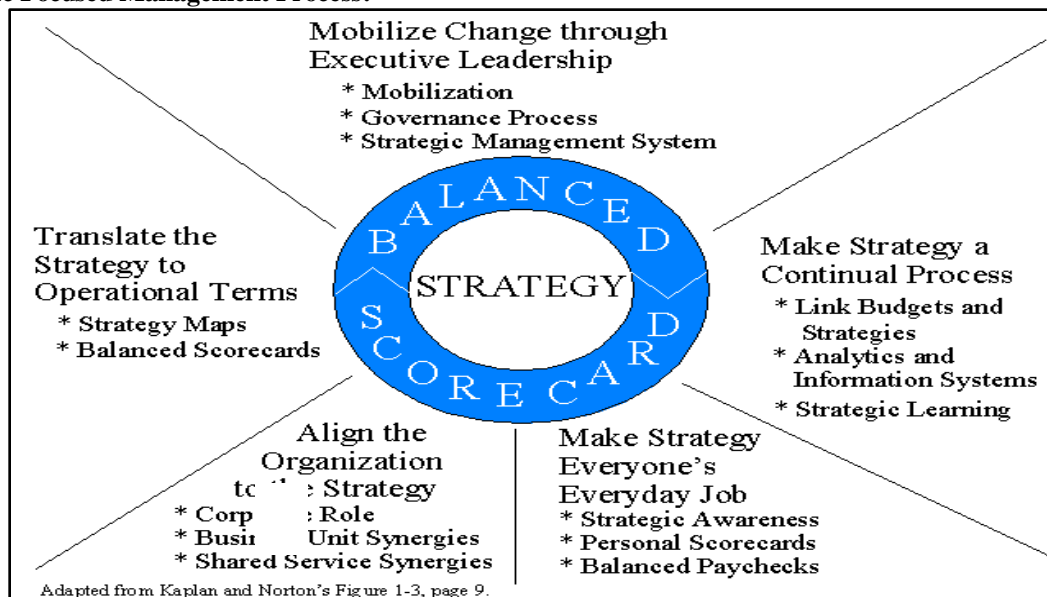
#### Strategy Map:-

A strategy map is a diagram that is used to document the primary strategic goals being pursued by an organization or management team.

#### The Kaplan and Norton approach to strategy maps has:-

- An underlying framework of horizontal perspectives arranged in a cause and effect relationship. Typically Financial, Customer, Process and Learning & Growth
- Objectives within those perspectives. Each objective as text appearing within a shape (usually an oval or rectangle). Relatively few objectives (usually less than 20)
- Vertical sets of linked objectives that span the perspectives. These are called strategic themes.
- Clear cause and effect relationships between these objectives, across the perspectives. The strategic themes representing hypotheses about how the strategy will bring about change to the outcomes of the organisation.

Strategy maps provide increased granularity for executives to describe and manage strategy at an operational level of detail. The Strategy mapping helps company to identify various perspectives and variables involved in each perspective. It also helps to establish the interrelationship with different variables and different perspectives.

**Strategy Mapping:-****Strategic Focused Management Process:-**

**Advantages of Balanced Scorecard:-**

Balanced Scorecard as a key performance measurement tools provides various advantages to the companies, which are as follows

- Focusing the whole organisation on the few key things needed to create breakthrough performance
- Breaking down strategic measures to lower levels of the organisation, so managers and employees both know what is required to achieve excellent overall performance
- Strategic initiatives that follow "best practices" methodologies cascade through the entire organization
- Increased Creativity and Unexpected Ideas.
- The Balanced Scorecard helps align key performance measures with strategy at all levels of an organization.
- The Balanced Scorecard provides management with a comprehensive picture of business operations.
- The methodology facilitates communication and understanding of business goals and strategies at all levels of an organization.
- Helping to integrate various corporate programmes (like quality and customer service)
- Usable Results - Transforms strategy into action and desired behaviors.
- The Balanced Scorecard concept provides strategic feedback and learning.
- A cross organizational team - More open channels of communications - Enthusiastic People.
- Initiatives are continually measured and evaluated against industry standards
- Unique Competitive Advantage
  - Reduced Time-frames.
  - Improved Decisions and Better Solutions.
  - Improved Processes.
- The Balanced Scorecard provides an effective way of communicating priorities to all levels of organization, and then all employees can see and understand how their work is related to the business and its success as a whole.

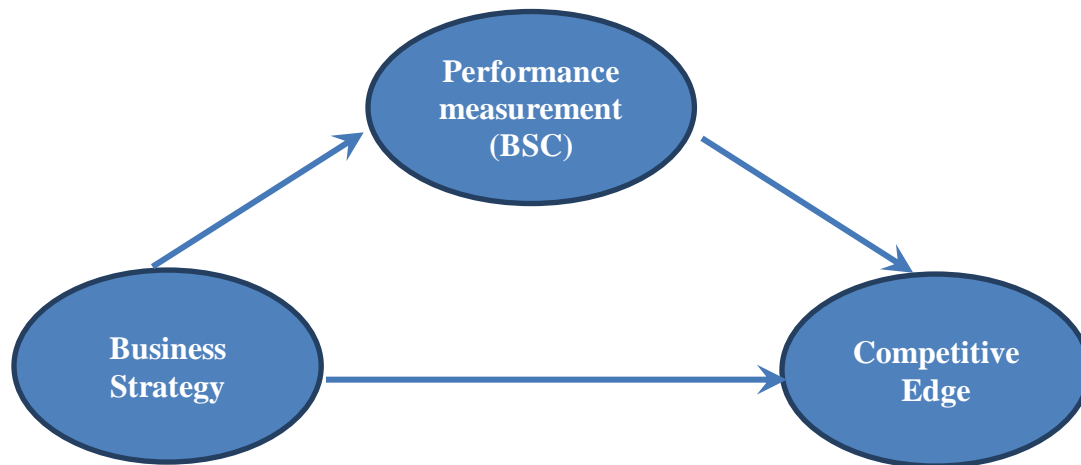
**Disadvantages:-**

Though Balanced Scorecard serves lot of advantages to the companies, it still suffers from some drawbacks. The most important among these are

1. The Balanced Scorecard decomposes the organization's primary objectives (financial perspective) into customer, internal process and learning and growth objectives (operating perspectives) in a way that is reminiscent of the way that the Dupont formula decomposed the return on capital employed metric into front-line operational measures. But such type of relationship does not necessarily hold between financial and operational measures and operational achievements do not guarantee the improved bottom-line measures; and in that case the management has to reexamine the basic assumptions of their strategy and mission to capitalize the operational achievements.
2. Companies may bias their scorecards to the dimension that support specific strategic path. In order to make scorecard useful, it should be prepared in conformity with the overall business strategies.
3. Sometimes it is difficult to integrate a company's scorecard into its planning, budgeting and resource allocation process; especially when scorecard metrics are changed.
4. Balanced scorecard considers different perspectives equally thus, ensuring a balance between these. But in some companies under unique situations, all perspectives may not have equal importance.
5. Creating the Balanced Scorecard is a critical step in the strategic process. So many organizations create a strategic plan and then dutifully ignore it because day-to-day issues tend to take precedence.

**Findings:-**

The Discussions and analysis reveals that there is an ample of opportunities to explore and exploit the resources for the Companies in India in the near future as in the projected Economic prospects during FY 2012 – 2030, India would have CAGR Growth of 6.7% whereas in China it is 6.6% and US 2.5%. To feat the opportunities, companies should work on achieving sustaining competitive edge. To achieve a competitive edge, companies should develop and execute sound strategies. Balanced Scorecard is a powerful management tool that could help companies in developing Strategies, convert those strategies into measureable terms and communicate to the lower level for their execution with the help of Strategy mapping. Balanced Scorecard helps companies to achieve competitive advantage through Reduced Time-Frames, Improved Decisions, Better Solutions and Improved Processes. Balanced Scorecard plays a vital role in the Strategy Mapping and measuring performance of the companies.



From the above discussions and analysis, theoretically a relationship can be established between Company's Business Strategies and Competitive Edge and Performance measurement through BSC acting as a mediating factor which can create impact on the sustaining the competitive edge.

### Conclusions:-

Every company strives harder to achieve competitive edge, which will ensure their sustainability in the business environment. Balanced scorecard, being one of the best tools that measure the performance of the company in real time can help companies in achieving sustainable competitive edge.

The real strength of the linkages between the strategy map, Balanced Scorecard and action plan is consistency. Instead of a fragmented approach where one part of the organization pursues a different agenda from another part, everyone uses the same overall strategy. The vision is consistent with the strategy to get there. People can be inspired to act because they see that it is feasible to get to where the management wants to head.

The scorecard periodically reminds the organization what the critical strategic issues are and gives the necessary feedback on the progress toward achieving them. It has neither beginning nor end. Its task is not directly concerned about the mission of the organization, but rather with internal processes (diagnostic measures) and external outcomes (strategic measures). The system's control is based on performance metrics that are tracked continuously over time to look for trends, best and worst practices, and areas for improvement. Thus, balanced scorecard can play an important role in bringing a big change in the organisation and can help the company in achieving sustainable competitive edge.

### Suggestions:-

Balanced Scorecard contemplates all the perspective equally which may not suit all the companies especially those which are facing unique circumstances. Assigning weights to different perspectives under differing circumstances may add more values.

Though Balanced Scorecard serves as best tool, still there is no complete acceptance by all the companies. The main reason behind it is companies find difficulties in formulating strategy itself. This could be overcome by provided training and expertise knowledge to the top management personnel so that a suitable business strategy can be formulated to suit the need the company.

**References:-**

1. IŠORAITÉ, M. (2008). THE BALANCED SCORECARD METHOD:FROM THEORY TO PRACTICE. *INTELLECTUAL ECONOMICS*, 18 - 28.
2. MSG EXPERTS. (n.d.). <http://www.managementstudyguide.com/>. Retrieved from <http://www.managementstudyguide.com/changing-face-of-business-environment.htm>:
3. Kaplan, R.S. and Norton, D.P., "Putting the balanced scorecard to work", *Harvard Business Review*, September-October 1993, pp. 134-42.
4. Norton, R. S. (1996). *THE BALANCED SCORECARD: Translating Strategy into Action* . United States of America: Harvard Business Review Press.
5. Norton, R. S. (2001). *The Strategy Focused Organization - How the Balance Scorecard companies thrive in the New Business Environment*. USA: Harvard Business School Publishing Corporation.
6. S.Kaplan, R. (2010). Conceptual Foundations of the Balanced Scorecard. *Harvard Business School*.
7. Kaplan, R. S., & Norton, D. P. (2004). Measuring the strategic readiness of intangible assets. *Harvard Business Review*, 82(2), p.52-63.
8. Elliot, S., and Binney, D. "Environmentally Sustainable ICT: Developing Corporate Capabilities and an Industry Relevant IS Research Agenda", In PACIS Proceedings, July 4-7 2008, Suzhou, China.
9. Samir Ghosh, S. M. (2006, March). MEASUREMENT OF CORPORATE PERFORMANCE THROUGH BALANCED SCORECARD : AN OVERVIEW. *Journal of Commerce*, 11, 60 - 70.
10. <https://balancedscorecard.org/Resources/About-the-Balanced-Scorecard>
11. [http://pure.au.dk/portal-asb-student/files/75039640/Executing\\_strategy\\_using\\_the\\_balanced\\_Scorecard](http://pure.au.dk/portal-asb-student/files/75039640/Executing_strategy_using_the_balanced_Scorecard)
12. Porter, M. E., & Kramer, M. R. (2006). Strategy and society: The link between competitive advantage and corporate social responsibility. *Harvard Business Review*, 79–92.
13. Arend, R. J. (2003). Revisiting the logical and research considerations of competitive advantage. *Strategic Management Journal*, 24, 279–284
14. Ma, H. (2000). Competitive advantage and firm performance. *Competitiveness Review*, 10(2), 16.
15. Kaplan, R. S., and Norton, D. P. *The Balanced Scorecard. Translating Strategy into Action*. Boston, Massachusetts: Harvard Business School Press, 1996.





### RESEARCH ARTICLE

## GROSS, HISTOMORPHOLOGICAL AND HISTOCHEMICAL STUDY OF JEJUNUM IN VANARAJA AND CARI SHYAMA.

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#### Key words:-

Jejunum, CARI Shyama and Vanaraja

### Abstract

A study was conducted on jejunum of CARI Shyama and Vanaraja crossbreds of poultry developed to improve the livelihood of peoples in the tribal area with less availability of good quality feed. Jejunum is the part of intestine plays significant role in absorption of nutrients and improves the feed utilization. Grossly, length of jejunum was significantly more in chicks and pullets of Vanaraja, however, width was more in chicks and pullets of CARI Shyama. Histologically, height of villi decreased progressively from proximal to distal segment of jejunum. Height of villi was significantly more in pullets of CARI Shyama than Vanaraja. Density of collagen fibers was more in pullets of Vanaraja than CARI Shyama. PAS activity was comparatively more in all age group of CARI Shyama than Vanaraja.

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### Introduction:-

CARI Shyama and Vanaraja are two hybrids introduced by the central government in the tribal area to improve the livelihood of peoples as these breeds required less classified diet than exotic breeds in Indian climate and give production better than the desi breeds. Jejunum is the part of intestine plays significant role in absorption of nutrients and improves the feed utilization. Therefore this study was undertaken to explore the status of jejunum in different age group of these birds.

### Material and Methods:-

The present study was conducted on ten apparently healthy chicks (0 day old), growers (8 weeks old) and pullets (16 weeks old) of CARI Shyama and Vanaraja. Jejunum was collected, and preserved in 10% buffered formalin. The tissue samples were processed, cut and stained with H&E for normal histological structure, Van Gieson's for collagen fibers, Gomori's for reticular fibers, Periodic Acid Schiff (PAS) for mucopolysaccharides and AB-PAS for acid mucopolysaccharides (Singh and Sulochana, 1997).

### Result and Discussion:-

The jejunum was longest and coiled part of the intestine, suspended by the mesentery and arranged in the loops at the edge of dorsal mesentery confirmed the reports of McLelland(1975), Nickel *et al.* (1977) and Verma (1998). Well developed yolk sac was present in the day old chick. The remnant of yolk sac in the form of Meckel's diverticulum was also noticed in growers and pullets supported the findings of King and McLelland(1975) and Nasrin *et al.* (2012). Number of coils of jejunum also increased with age. In pullets, number of coils ranged between 11-13,

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similar to the observation of Nickel *et al.* (1977).

Significantly higher length of jejunum was noticed in chicks of Vanaraja (18.1 cm) than CARI Shyama (15.55 cm), however width was significantly more in chicks of CARI Shyama than Vanaraja with an average value 0.21 cm and 0.15 cm, respectively. Nasrin *et al.* measured 22.38 cm length of jejunum in day old broiler chicks and reported jejunum as longest part of the small intestine.

In growers, significantly higher width was noticed in Vanaraja with an average 0.60 cm than CARI Shyama (0.56cm); however length was comparatively less in Vanaraja.

In pullets, pattern of length and width was similar to chicks and significant difference was noticed in the length, as length was higher in Vanaraja with mean value 74.77cm than CARI Shyama (65.4 cm). In the present study, length and width of jejunum ranged as 65-75cm and 0.50-0.60 cm in growers and pullets, were lesser than the findings of McLelland (1975), Nickel *et al.* (1977) and Verma (1998).

**Table:-** gross morphometrical observations of jejunum

Group	Length of Intestine (cm)		Jejunum					
			Length (cm)		Diameter (cm)		% (out of total length of intestine)	
	CARI Shyama	Vanaraja	CARI Shyama	Vanaraja	CARI Shyama	Vanaraja	CARI Shyama	Vanaraja
Chicks	27.5 ± 1.02	31.4 ± 0.79*	15.55 ± 0.67	18.1 ± 0.51*	0.21 ± 0.006*	0.15 ± 0.004	56.71 ± 1.87	57.70 ± 1.12
Growers	113.3 ± 1.4	119 ± 2.62	73.5 ± 0.74	71.83 ± 2.57	0.56 ± 0.014	0.60 ± 0.014*	64.91 ± 0.50	60.35 ± 1.85
Pullets	108.4 ± 2.41	122.1 ± 1.40*	65.4 ± 2.14	74.77 ± 2.02*	0.57 ± 0.013	0.59 ± 0.012	60.38 ± 1.62	61.20 ± 1.40

**Table:-** Histomorphometrical Observations Of Jejunum.

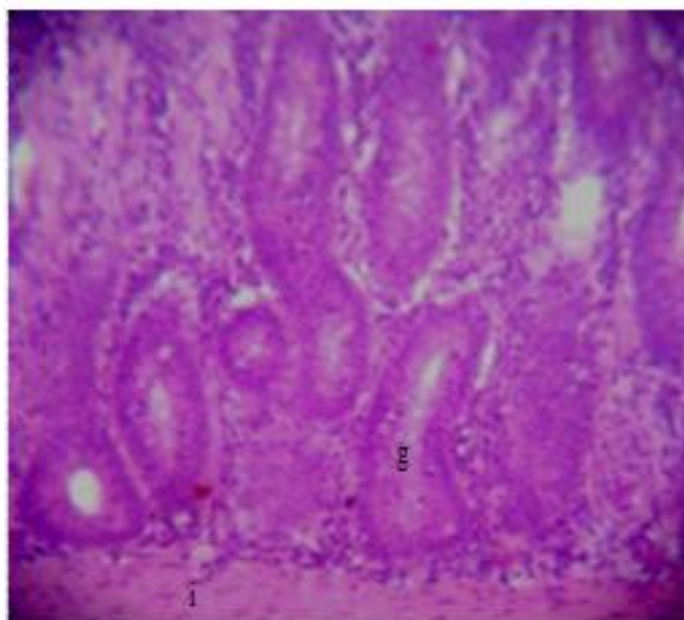
Group	Breed	Thickness of wall <sup>a</sup> (µm)		Thickness of tunica muscular (µm)		Thickness of propria submucosa <sup>a,b</sup> (µm)		Diameter of gland (µm)				Height of epithelium of villi/folds (µm)					
								Maximum		minimum		Base		middle		Apex	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Chicks	CARI Shyama	123.44	4.16	60.8	3.52	47.38	3.04	18.72	2.92	14.36	2.36	13.2	0.72	13.04	0.68	11.44	1.08
	Vanaraja	133.28	4.32	62.72	2.24	50.72	2.08	24.36	2.96	15.48	2.04	14.08	0.84	14.32	0.72	11.88	1.24
Growers	CARI Shyama	293.28	20.8	139.2	10.56	123.36	12.96	81.6	3.36	50.4	1.44	38.4	1.92	34.88	2.56	29.12	3.2
	Vanaraja	319.04	17.6	183.68*	11.2	128	8.96	90.56	5.52	52.8	1.92	41.6	1.76	36.16	2.72	25.28	1.44
Pullets	CARI Shyama	404.4*	20.8	188*	12.16	152	10.24	83*	1.34	60.64*	1.6	66.4	4.32	68.16	4	52	3.68
	Vanaraja	287.68	26.4	126.72	14.24	115.36	14.56	70.4	4	52.16	1.76	65.92	1.92	67.04	3.68	56.16	2.88

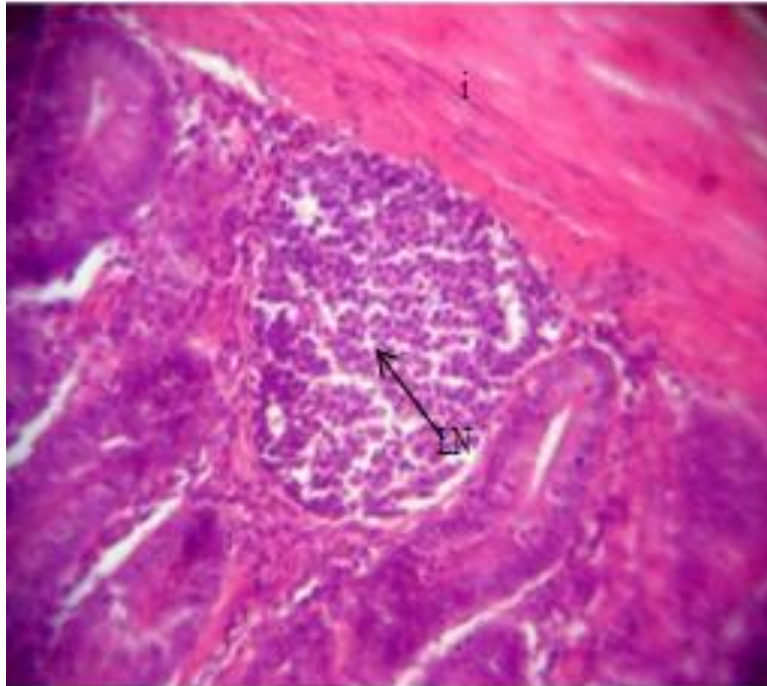
Thickness of wall from base of the villi to tunica serosa, b. Thickness of propria submucosa from base of the villi, - observations could not be taken. Mean values with \* are significant (P< 0.05)

**Table:-** Histomorphometrical Observations Of Jejunum.

Group	Breed	Average height of villi/ folds (µm)		Height of villi/ folds (µm)						Width of villi/ folds (µm)						No. of villi/ folds	
				Long (above 1000 µm)		Medium (500-1000 µm)		Small (0-500 µm)		Base		Middle		Apex			
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Chicks	CARI Shyama	198.4	22.4							65.28	3.68	63.68	3.2	51.2	2.4	28.8	1.05
	Vanaraja	164	12.16							60.32	2.08	61.76	2.08	51.52	2.24	28.8	1.6
Growers	CARI Shyama	759.28	79.52	1086.88	9.6	813.4	35.2	355.52	9.92	198.24*	4.48	126.72	8	94.72	8.32	45.4	2.44
	Vanaraja	682.4	53.44	1044.48	6.56	745.82	41.6	346.88	15.68	168	11.52	122.48	10.24	83.2	3.84	45.1	2.33
Pullets	CARI Shyama	922.4*	75.2	1215.36	16.64	779.68	26.56	412.16*	10.24	136.8	6.56	121.92	6.72	119.04	7.68	42.3	2.87
	Vanaraja	635.2	69.92	1220.48	21.6	709.12	31.04	346.4	7.84	123.36	13.12	105.6	7.68	100.8	6.24	42.8	2.24

Blank- Villi of these categories were not present

Mean values with \* are significant ( $P < 0.05$ )**Fig.1:-** Photomicrograph of jejunum of CARI Shyama (group 3) showing glandular unit (g) and tunica muscularis (i) (H&E, 400X).

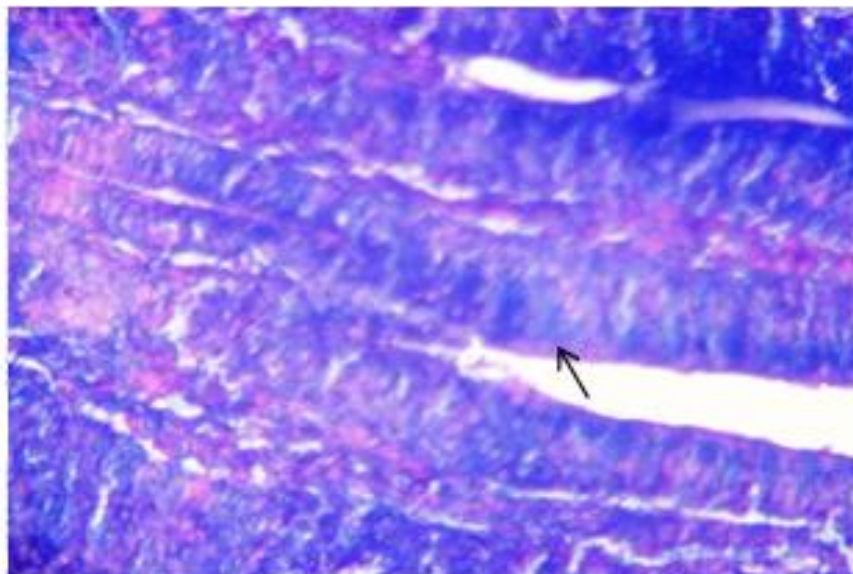


**Fig. 2:-** Photomicrograph of jejunum of Vannaraja (group 2) showing lymphatic nodule (LN) and tunica muscularis (i) (H&E, 400X)



**Fig.3:-** Photomicrograph of jejunum of Vanaraja (group 3) showing reticular fibers (arrow) in the core of villi (Gomori's, 100X)





**Fig.4:-** Photomicrograph of jejunum of CARI Shyama (group 2) showing AB-PAS activity (arrow) in mucosal epithelium (AB-PAS, 400X)

In chicks, more uniformity was observed in height and shape of villi in proximal part of jejunum than the distal part. Number of goblet cells was comparatively more in pullets of Vanaraja than CARI Shyama. Height of villi decreased progressively than the earlier segment; it is in accordance to the findings of Hodges (1974), McLelland (1975) and Verma *et al.* (1998). In chicks, villi were tongue or leaf shaped. The average height of villi was significantly more in pullets of CARI Shyama with mean value 922.4  $\mu\text{m}$  than Vanaraja (635.2  $\mu\text{m}$ ). Height of villi in pullets of CARI Shyama exceeded than in the duodenum and might be indicative of more active jejunum. Height of villi ranged between 150-200  $\mu\text{m}$  in chicks, 300-1100  $\mu\text{m}$  in growers and 300-1250  $\mu\text{m}$  in pullets. In growers, width of villi increased at all level in CARI Shyama, however in Vanaraja, width only increased at middle of villi. Observation in present study are in accordance to the reports of Hodges (1974), McLelland (1975), Verma *et al.* (1998) and Nasrin *et al.* (2012), that broad villi were observed in the jejunum. Significant difference in width was noticed only at base of villi in growers of CARI Shyama with mean value 198.24  $\mu\text{m}$  than Vanaraja (168  $\mu\text{m}$ ). Height of small sized villi was significantly less in pullets of Vanaraja (346.4  $\mu\text{m}$ ) than CARI Shyama (412.16  $\mu\text{m}$ ). In growers and pullets, distance between adjacent villi increased, which might be due to decrease in total number of villi. Cellularity of lamina propria decreased than earlier segment due to less infiltration of lymphocytes.

The glandular units in lamina propria were more in pullets of CARI Shyama than Vanaraja, however overall number of glandular units decreased than the earlier segment in all age groups (fig.1). Tubular glands were significantly larger in pullets of CARI Shyama than Vanaraja.

Lymphocytes infiltration was more marked in the pullets of CARI Shyama than Vanaraja. Less lymphocytic infiltration than the earlier region of intestine supported the finding of Bradley and Grahame (1960) and was not in agreement to McLelland (1975) who reported increased lymphatic infiltration in jejunum. Lymphatic nodule formation was noticed in the proximal segment of jejunum of growers and pullets (fig.2), however nodules were absent in chicks.

Significant differences were noticed in the thickness of tunica muscularis of growers of Vanaraja than CARI Shyama with the mean value 183.68  $\mu\text{m}$  and 139.2  $\mu\text{m}$ , respectively. In growers of Vanaraja, thickness of tunica muscularis was comparatively more than the duodenum, which is in agreement to the finding of Vaish (2005), however in other birds such pattern was not found. In pullets, total thickness of wall and tunica muscularis was significantly more in CARI Shyama with mean value 404.4  $\mu\text{m}$  and 188  $\mu\text{m}$  than 287.68  $\mu\text{m}$  and 126.72  $\mu\text{m}$  in Vanaraja, respectively.

Localization of collagen, elastic and reticular fibers was established in the core of the villi, inter glandular connective tissue, lamina muscularis, submucosa, inter muscular connective tissue and in subserosal connective

tissue. The density of the collagen fibers in the intestinal wall was more in comparison to elastic and reticular fibers which confirmed the findings of Verma *et al.* (1999) and Vaish (2005). In initial segment of jejunum, density of collagen fibers was more in chicks and growers of CARI Shyama, while in distal segment density was more in chicks and growers of Vanaraja.

Density of reticular fibers was more in chicks of CARI Shyama and growers of Vanaraja, while in pullets, density was more in Vanaraja (fig.3). Peculiar arrangement of fibers was seen in the jejunum as peripheral thick fibers were joined by thin fibers net in the core of villi. Crossing strands of reticular fibers in the circular muscle bundles were also noticed.

PAS positive material was noticed in the mucosal and glandular epithelium and in smooth muscles of lamina propria and tunica muscularis. In jejunum, activity was comparatively more in all age groups of CARI Shyama than Vanaraja. PAS activity was mild in chicks and growers of Vanaraja and mild to moderate in pullets; however activity was moderate to intense in chicks and pullets of CARI Shyama and moderate in growers. More activity was recorded in distal region of jejunum in chicks of CARI Shyama, which might be indicative of early maturity of these regions in the respective breed to digest the complex carbohydrate.

Droplet like AB-PAS positive material was noticed in the apical part of epithelium of villi and glandular units in chicks and pullet. Diffuse activity was noticed in growers (fig.4). In Jejunum, more activity was noticed in the initial two third segments, in chicks and pullets of Vanaraja and growers of CARI Shyama. However, in distal segment, activity was more pronounced in chicks and pullets of CARI Shyama and growers of Vanaraja.

## References:-

1. Bradley, O.C. and Grahame, T. 1960. The Structure of the Fowl. 4<sup>th</sup> ed. Oliver and Boyd, Edinburgh, London. pp. 31-50.
2. Hodges, R.D. 1974. The Histology of the Fowl. Academic Press, London. pp. 35-112.
3. King, A.S. and McLelland, J. 1975. Outlines of Avian Anatomy. 1<sup>st</sup> ed. Bailliere Tindall, London. pp. 33-42.
4. McLelland, J. 1975. Aves digestive system. In: Getty, R. (ed). Sisson and Grossman's The Anatomy of the Domestic Animals. Vol. 2. 5<sup>th</sup> ed. W.B. Saunders Company, Philadelphia. pp. 1857-1882.
5. Nasrin, M., Siddiqi, M.N.H., Masum, M.A. and Wares, M.A. 2012. Gross and histological studies of digestive tract of broilers during postnatal growth and development. J.Bangladesh Agril.Univ. **10(1)** :69-77.
6. Nickel, R., Schummer, A. and Seiferle, E. 1977. Anatomy of the Domestic Birds (Translated by W. J. Siller and P.A. L. Wright), Verlag Paul Parey, Berlin pp. 75-81.
7. Singh, U.B. and Sulochana, S. 1997. Handbook of Histological Technique. Premier Publishing House, Kothi, Hyderabad. pp. 42-63.
8. Vaish, M.K. 2005. Pre and post hatch developmental studies on digestive system of Kadaknath fowl. M.V.Sc. Thesis, Jawaharlal Nehru Krishi Vishwavidalaya, Jabalpur. pp. 25-58.
9. Verma, D. 1998. Pre and posthatch morphogenesis of digestive system in fowl (*Gallus domesticus*). M.V.Sc. Thesis, Jawaharlal Nehru Krishi Vishwavidalaya, Jabalpur. pp. 24-57.
10. Verma, D., Malik, M.R., Parmar, M.L. and Shrivastava, A.M. 1999. Histochemical studies of intestine in pre and post hatch fowl (*Gallus domesticus*). Indian J. Vet. Anat. **11(1)** : 11-14.
11. Verma, D., Malik, M.R., Parmar, M.L. and Taluja, J.S. 1998. Histogenesis of intestine in pre and posthatch chicken. Indian J. Vet. Anat. **10 (1/2)**: 76-85.



### RESEARCH ARTICLE

#### EFFECT OF MCKENZIE EXTENSION BIAS EXERCISES WITH THAT OF STRENGTHENING EXERCISES IN LOW BACK PAIN IN POWER LIFTERS.

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##### Key words:-

McKenzie exercises, Back strengthening, Low back pain, Power lifters.

#### Abstract

**Background:** Chronic nonspecific low back pain (i.e., low back pain of at least 12 weeks' duration and without a specific cause) is one of the most common health conditions worldwide. Chronic low back pain is highly associated with disability, emotional changes, and work absenteeism. Power lifting has many potential benefits for spinal health, but also has the potential to create or worsen back injuries. Extending or flexing the back muscles against resistance during power lifting may result in a number of injuries, including muscle strain and ligament injury. Currently no randomized studies examining the effect of this method for patient with low back pain have been published so the need of study is to find out the effect of McKenzie extension bias treatment method with that of back strengthening exercises in low back pain.

**Method:** A randomized controlled comparative trial with a 4 weeks treatment period was conducted. 40 consecutive power lifters both male and female between the age group 20-35 years with low back pain and at least 8 weeks duration of symptoms were randomized into two groups: Group A was treated with the McKenzie method and Group B was treated with back strengthening exercises. Oswestry scale and VAS scale was taken pre-treatment and post treatment. Results were recorded at the end of the treatment.

**Result:** The correlation coefficient  $r = 0.619$  is positive therefore there is improvement by using the Back strengthening treatment method in power lifters. The correlation coefficient  $r = 0.821$  is positive and therefore shows more improvement by using McKenzie treatment method. Coefficient of variation of McKenzie treatment method that is 11.9335 is better than coefficient of variation of back strengthening method that is 14.0311 since coefficient of variation of McKenzie is smaller than back strengthening.

**Conclusion-** It was found that both McKenzie treatment method and back strengthening exercises were effective for Low back pain but McKenzie treatment method is more effective than back strengthening method.

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## Introduction:-

Chronic nonspecific low back pain (i.e., low back pain of at least 12 weeks' duration and without a specific cause) is one of the most common health conditions worldwide. Chronic low back pain is highly associated with disability, emotional changes, and work absenteeism. (1)

A typical response to experiencing back pain is to take it easy - either staying in bed or at least stopping any activity that is at all strenuous. While this approach is understandable and may even be recommended in the short term, when done for more than a day or two it can actually undermine healing. Instead, active forms of back exercises are almost always necessary to rehabilitate the spine and help alleviate back pain. When done in a controlled, gradual, and progressive manner, active back exercises distribute nutrients into the disc space and soft tissues in the back to keep the discs, muscles, ligaments and joints healthy. Consequently, a regular routine of lower back exercises helps patients avoid stiffness and weakness, minimize recurrences of lower back pain, and reduce the severity and duration of possible future episodes of low back pain. Depending upon the patient's specific diagnosis and level of pain, the back pain exercises and rehabilitation programs will be very different, so it is important for patients to see a spine specialist trained to develop an individualized program of back exercises and to provide instruction on using the correct form and technique. To be effective, a patient's program of back exercises should be comprehensive, working the whole body even if it targets the back. Two back exercises commonly advised by physical therapists to treat back pain are McKenzie exercises and dynamic lumbar stabilization.

Power lifting is a strength sport that consists of three attempts at maximal weight on three lifts: squat, bench press, and deadlift. It evolved from a sport known as "odd lifts", which followed the same three-attempt format but used a wider variety of events. Like most forms of exercise, power lifting has many potential benefits for spinal health, but also has the potential to create or worsen back injuries. Extending or flexing the back muscles against resistance (the weight) during power lifting may result in a number of injuries, including muscle strain and ligament injury. (2)

Disability related to lumbo-sacral pain is a major problem across many regions. Two recent consensus reports on the treatment of patients with chronic low back pain recommended back training programs as effective treatment for reduction of disability and improvement of physical function. (3)

Many back exercises can help strengthen the spinal column and the supporting muscles, ligaments and tendons. Most of these back exercises focus not only on the back, but also the abdominal (stomach) muscles and gluteus (buttocks) and hip muscles. Taken together, these strong 'core' muscles can provide back pain relief because they provide strong support for the spine, keeping it in alignment and facilitating movements that extend or twist the spine. Two of the most well-known back strengthening exercises are: McKenzie exercises and Dynamic Lumbar Stabilization. These back exercises are generally first learned by working with a physical therapist who can demonstrate the exercises and correct a patient's form to ensure strengthening and/or back pain relief is achieved. Although McKenzie exercises and dynamic lumbar stabilization exercises tend to be used for specific conditions, the two forms of physical therapy exercise may also be combined when appropriate.

Exercise therapy by the McKenzie method is a popular treatment for low back pain among physical therapists. It is grounded in finding a cause and effect relationship between the positions the patient usually assumes while sitting, standing or moving, and the location of pain as a result of those positions or activities. The therapeutic approach requires a patient to move through a series of activities and test movements to gauge the patient's pain response.

There are three types of classifications:

- Postural Syndrome: is the result of prolonged positions or postures that can affect muscles, tendons, or joint surfaces. Pain may be local and reproducible when end range positions, such as slouching, are maintained for sustained periods of time.
- Dysfunction Syndrome: Implies some sort of adaptive shortening, scarring or adherence of connective tissue causing discomfort. A dysfunction may be intermittent or chronic, but its hallmark is a consistent movement loss and pain at the end range of movement. When the patient moves away from end range their pain is decreased.
- Derangement Syndrome: is the most common syndrome of the three. Certain movements and particular movement patterns can cause more sensitivity. Such as a flexion or extension, the symptoms (low back pain) become either more central (just in the low back) or less intense.



In this study, patients treated were suffered from derangement syndrome due to lifting heavy weight and postural deformity.

The McKenzie assessment consists of taking a patient history and performing a physical exam. Both are used to gauge the degree of impairment as well as identify any red flags that might be contrary to exercise-based treatment (e.g. fracture, tumor, infections, or systemic inflammatory disease). During the McKenzie physical examination, patients are taken through movements that help classify the patient and determine the best treatment approach. The movements are intended to either increase or decrease symptoms. For example, patients may be asked to perform single and/or repeated flexion or extension movements forward and backward.

McKenzie treatment prescribes a series of individualized exercises. The emphasis is on active patient involvement, which minimizes the number of visits to the clinic. It is important for the patient undergoing the McKenzie method of treatment to know what to do to manage any future low back pain episodes. The McKenzie approach then uses that information to develop an exercise program designed to centralize or alleviate the pain. The goal of McKenzie Method is to centralize the pain or move the pain from the leg into the low back. Although no randomized controlled trials have been published to support the effectiveness of the method. (4)

Currently no randomized studies examining the effect of this method for patient with low back pain have been published so the need of study is to find out the effect of McKenzie extension bias treatment method with that of back strengthening exercises in low back pain.

### **Materials and Methodology:-**

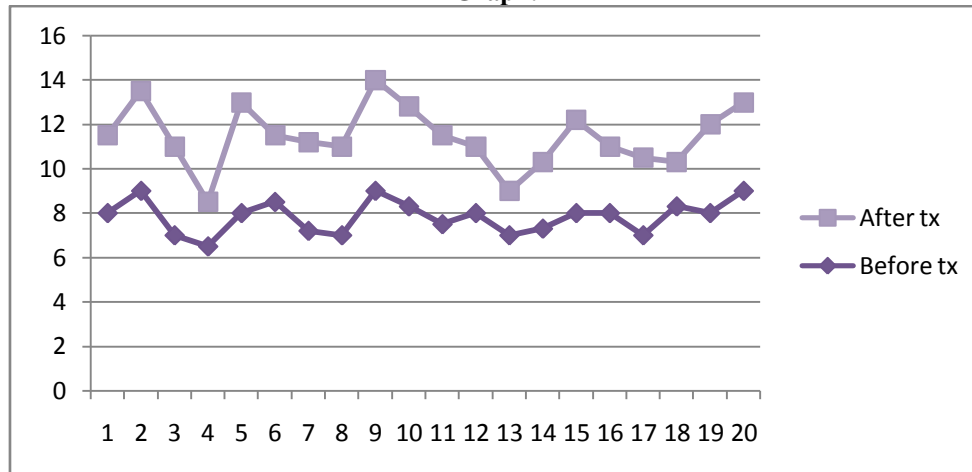
Materials: Pen, paper, Questionnaire, outcome measures: Oswestry disability index and visual analog scale

### **Methodology:-**

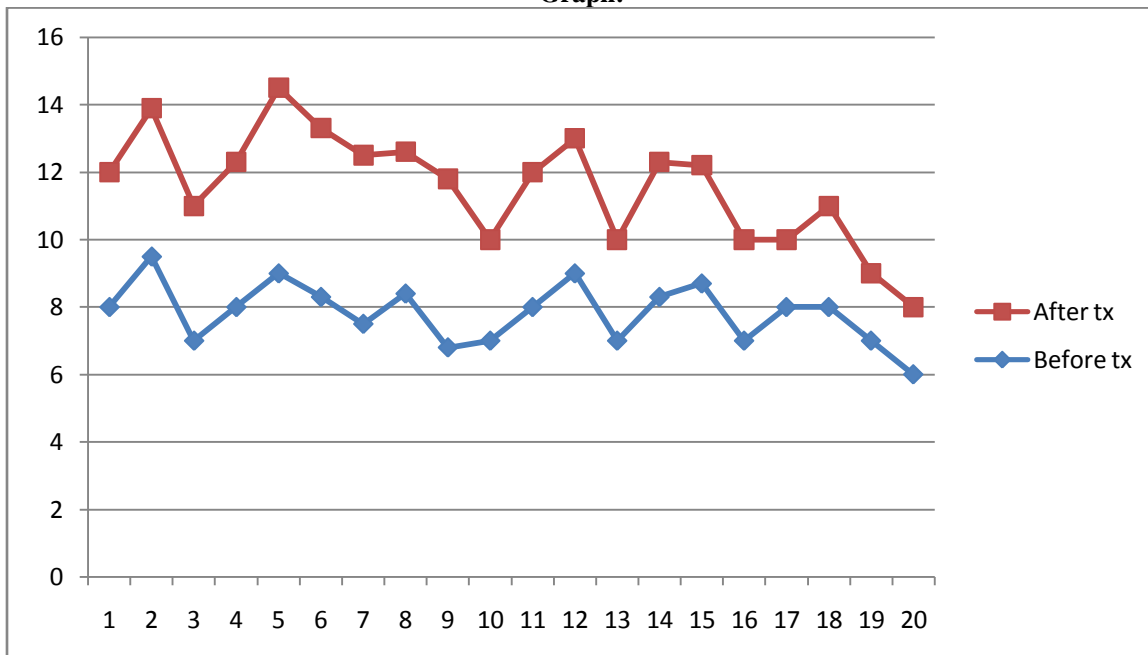
The study was performed across the gymnasiums of pune where the power lifters who had left the gymnasium were called for the assessment and treatment purpose. . Subjects were taken between the age group of 20- 35 years, both male and female. Total 89 Power lifters were called to the gym for assessment from which 27 power lifters were excluded due to recent history of fracture and previous history of Spondylolisthesis. 12 power lifters did not showed up later. Finally 40 power lifters agreed to take the treatment and filled the consent form. Those 40 power lifters were divided into 2 groups: 20 were treated by using McKenzie method and remaining 20 were treated by back strengthening exercises. Visual Analog scale and Oswestry Scale was taken before and after the treatment. The treatment period was 8 weeks and after that home exercise protocol was given. It was seen that there was improvement in the patient's low back pain as the pain score reduced in VAS scale. Similarly in Oswestry scale the percentage of pain reduced when compared to the pain patient felt before treatment. Complete assessment was done. Subjects from this study were selected from a subject group normally considered suitable for strengthening training in as much as all patients with clinical signs of affected nerve root were excluded.

### **Procedure:-**

For study research, 40 subjects were selected. According to the inclusion and exclusion , each patient was explained the purpose of the study and a consent form was given to be filled by the patient. Two treatment protocols were followed: McKenzie Exercise protocol and Backstrengthening exercises. Oswestry disability scale and Visual analog scale was taken before and after the treatment session.

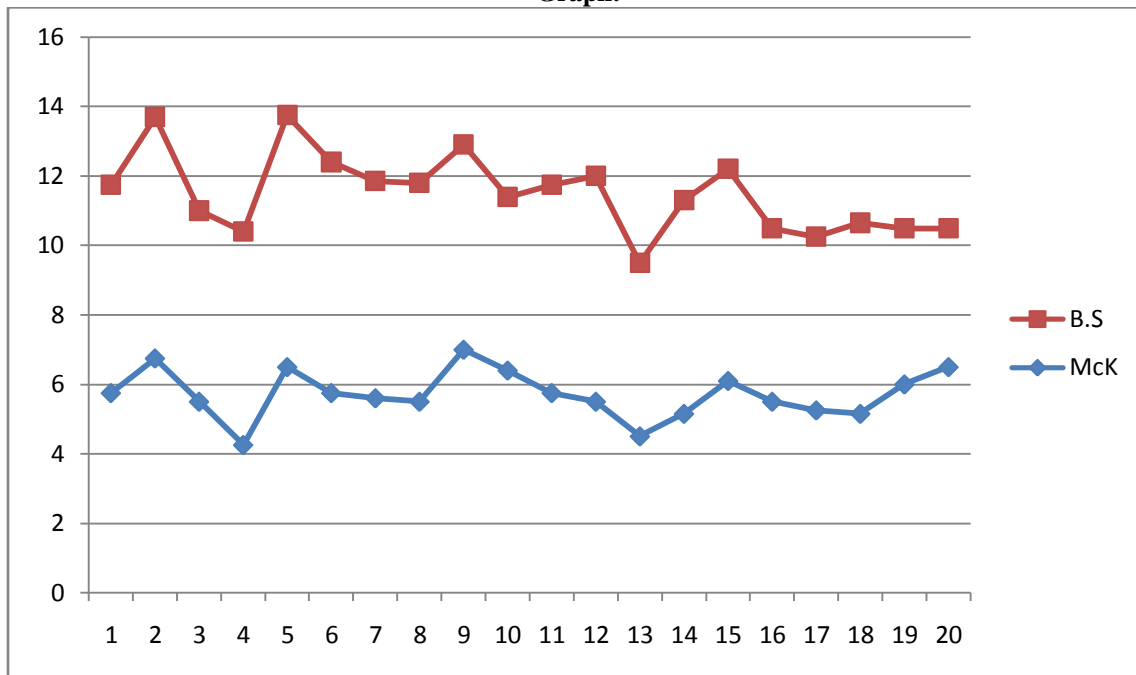
**Results:-****Result 1:-** Improvement in back pain by using VAS in McKenzie treatment method.**Graph:-**

Interpretation: Correlation coefficient  $r=0.821$  is more than 0.5, therefore it is positive so there is improvement seen in VAS by using McKenzie treatment method.

**Result 2:-** Improvement in back pain by using VAS in Back strengthening treatment method.**Graph:-**

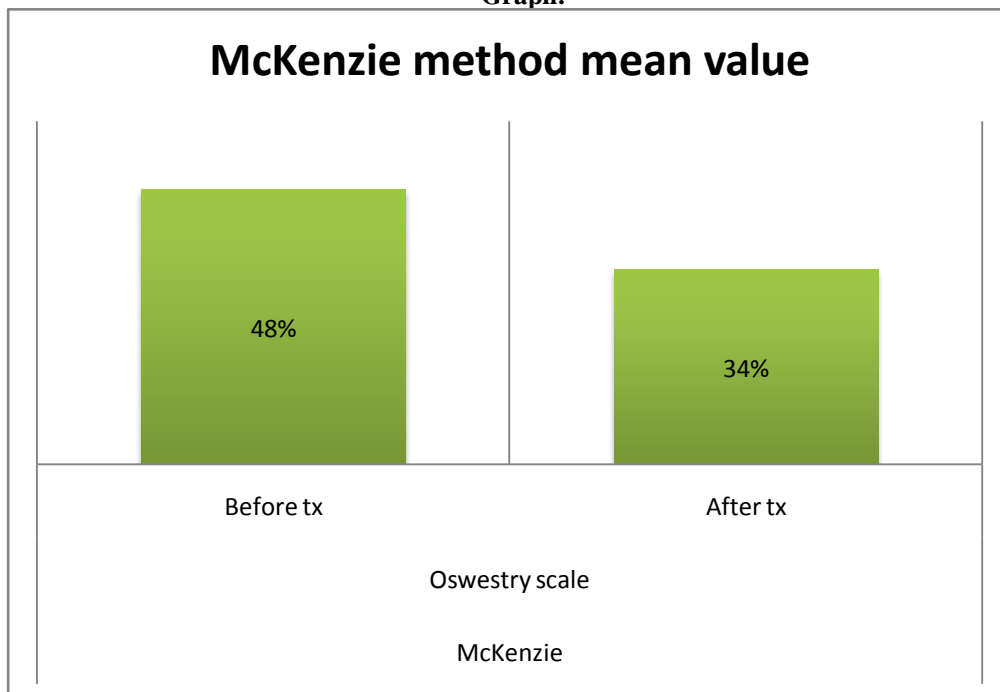
Interpretation: Correlation coefficient  $r=0.619$  is more than 0.5 therefore it is positive so there is improvement seen in by using back strengthening exercises.

**Result 3:- McKenzie vs. back strengthening by using VAS**  
**Graph:**



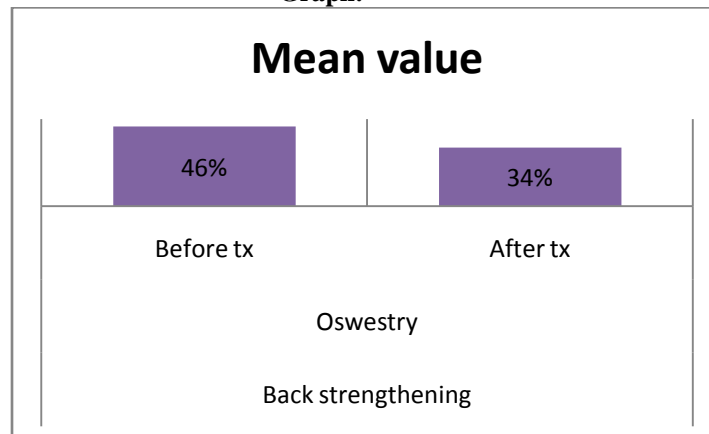
Interpretation: Coefficient of variation of McKenzie treatment method using VAS is 11.9335 is less than coefficient of variation of back strengthening method that is 14.0311 since coefficient of variation of McKenzie is lesser than back strengthening therefore McKenzie is better.

**Result 4:- Mean value of Oswestry scale in McKenzie method**  
**Graph:**



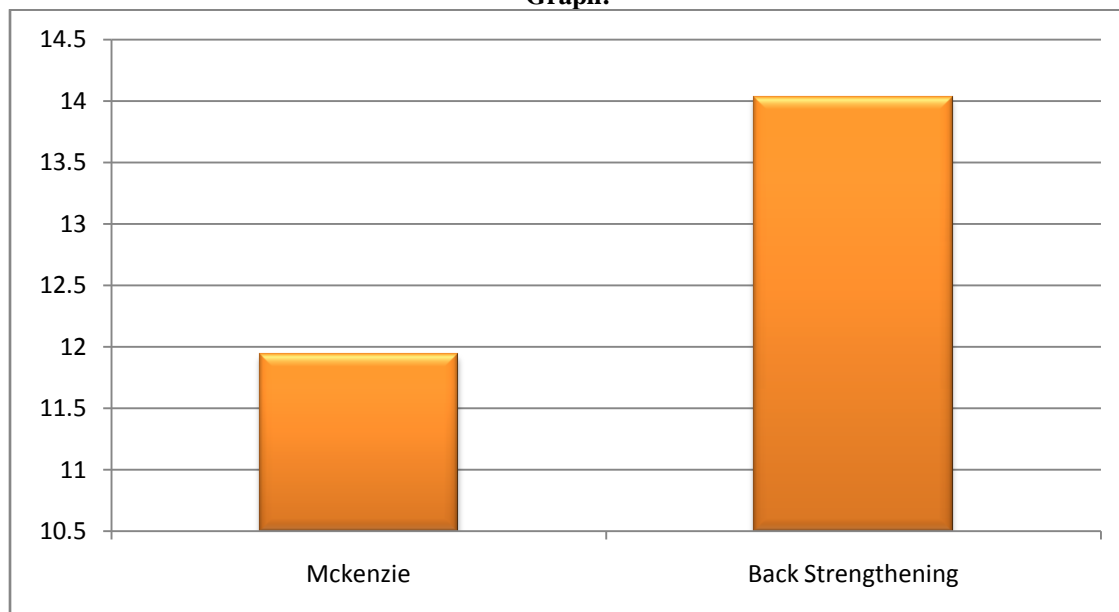
Interpretation: The mean Oswestry scale value of McKenzie method before treatment was 48% and after the treatment it was 34

**Result 5:- Mean value of Oswestry scale in Back strengthening**  
**Graph:-**



Interpretation: The mean Oswestry scale value of back strengthening method before treatment was 46% and after the treatment it was 34%.

**Result 6:- McKenzie vs. back strengthening by using Oswestry scale**  
**Graph:-**



Coefficient of variation of McKenzie treatment method using Oswestry scale is 12.84 is less than coefficient of variation of back strengthening method that is 16.56.

**Discussion:-**

In this study it was found that in McKenzie group the Pain score were considerably lower as compare to back strengthening after completion of the treatment. It seems reasonable to conclude that the McKenzie treatment method has some potential as compared to back strengthening in the treatment of low back pain because the McKenzie treatment method follows a specific pattern of exercises whereas back strengthening exercises are effective but do not follow any pattern.

No previous study has been published comparing McKenzie exercises with strengthening training for low back pain patients. However several recent studies have provided evidence that treatment program containing active exercises are equally effective in patient with chronic low back pain, irrespective of the type of exercises compared.

Our explanation might maintain that any type of intensive exercise program that manages to make the patients expand the limits to their physical functioning may provide the patients with a method for increasing the feeling of pain control, thus inhibiting negative pain behaviour relating to a chronic low back problem. (3) When done in a controlled, gradual, and progressive manner, active back exercises distribute nutrients into the disc space and soft tissues in the back to keep the discs, muscles, ligaments and joints healthy.

In Tom Petersen et al, the McKenzie method and intensive dynamic strengthening training seems to be equally effective in the treatment of patients with sub-acute or chronic low back pain where as in my study McKenzie method as well as Back strengthening method both were effective but McKenzie treatment method was more effective than back strengthening (3).

In Roger Adams et al, the study says that McKenzie method is effective in back pain which supports this study since in this study McKenzie treatment method was effective and relieved the low back pain (5).

In Keating JL et al, McKenzie exercises were found to be more effective than intensive strengthening for short term and long term pain and short term function, which supports my study(6).

Machado, L. A de Souza et al, suggests that the McKenzie method is more effective than strengthening protocol for acute low back pain which supports the study (7).

Alessandra N Garcia et al suggested that the McKenzie and back school's approaches may be beneficial for the treatment of patients with chronic nonspecific low back pain for the outcomes pain intensity and disability which supports my study. (1) (8)

Based on the results from the articles by Miller *et al*, spinal stabilization/back strengthening exercises and McKenzie exercises appear equally effective in decreasing pain and disability for individuals with chronic low back pain. Miller *et al*. found statistically significant improvements in pain reduction, for both McKenzie ( $p=0.05$ ) and spinal Stabilization groups ( $p=0.002$ ), but no statistically significant differences were detected between groups for pain reduction or disability scores ( $p>0.05$ ). Poor internal validity, particularly lack of blinding and concealment of group allocation, means that results should very cautiously be applied to the clinical population. (9)

Skikic EM et al suggested that McKenzie exercises for low back pain are beneficial treatment for increasing flexibility of spine and improving the pain with better results in pain relief. Although done by minimally trained physiotherapists in McKenzie approach, McKenzie exercises are successful method for decreasing and centralizing the pain and increasing spinal movements in patients with low back pain which supports my study. (10)

Tarang Srivastava et al, suggested that there was definite decrease in the value of VAS in both the groups but there was more significant improvement in experimental group in comparison to the controlled group. It may be quite safely stated that McKenzie technique is an effective, scientific and economical method for reducing dysfunction pain which supports the study. (11)

Ajit Dabholkar et al says that the effect of extension based treatment program in McKenzie's derangement syndrome improves the recruitment of multifidus on the affected side. Effect of extension based treatment program in McKenzie's derangement syndrome improves the endurance of back extensor muscles. Effect of extension based treatment program in McKenzie's derangement syndrome was found to be functionally beneficial. (12)

Given the outcomes of the current study, the equally distributed amount of time spent with each patient, the types of patients investigated, and the apparent difficulties in proving the effectiveness of a particular type of active exercises over that of others, It seems reasonable to conclude that the McKenzie treatment has some potential, as compared with strengthening training, in the treatment of non-specific chronic low back pain. This conclusion is supported by the results from the supplementary analysis of the patients who completed the full intervention. A strong tendency in favor of the McKenzie treatment was found with regard to a change in the back pain at the end of the treatment that reached a statistically significant difference at the 2 month assessment. (3) (13)

Therefore on the basis of the data, it appears that in managing patients with more than 8 weeks of low back pain, McKenzie treatment method is more effective than compared to back strengthening method.

Larger sample size can be taken to obtain more accurate results. More such studies should be done by comparing different treatment methods for nonspecific low back pain. If the patient continues the exercises it might give a better and permanent recovery.

### References:-

1. Effectiveness of Back School Versus McKenzie Exercises in Patients With Chronic Nonspecific Low Back Pain: A Randomized Controlled Trial :Alessandra Narciso Garcia, Luci'ola da Cunha Menezes Costa Et al.
2. Van Tulder M, Malmivaara A, Esmail R, et al. Exercise therapy for low back pain: A systemic review within the framework of the Cochrane collaboration back review group, spine 2000;25:2784-96
3. Tom Petersen, Peter Kryger et al. The effect of McKenzie therapy as compared with that of intensive strengthening training for the treatment of patients with acute or chronic low back pain. SPINE Volume 27, Number 16, pp 1702-1709, 2002.
4. Foster NE, Thompson KA, Baxter GD, et al. Management of non- specific low back pain by physiotherapists in Britain and Ireland: A descriptive questionnaire of current clinical practice. Spine 1999;24:1332-42
5. Helen A Clare, Roger Adams et al, A systemic review of efficacy of McKenzie therapy for spine pain. Australian Journal of physiotherapy 2004, vol.50(4):209-216
6. Slade SC, Keating JL et al, Treatment of nonspecific low back pain: McKenzie versus traditional treatment. Journal of Manipulative and physiological therapeutics. 2007;30:301-311.
7. Machao, L. A., de Souza et al, The McKenzie method for low back pain: a systemic review of the literature with a meta-analysis approach. Spine 31, E254-E262
8. Effectiveness of Back School Versus McKenzie Exercises in Patients With Chronic Nonspecific Low Back Pain: A Randomized Controlled Trial :Alessandra Narciso Garcia, Luci'ola da Cunha Menezes Costa Et al.
9. Miller ER, Schnek RJ, Karnes JL, Rousselle JG. A comparison of the McKenzie approach to a specific spine stabilization program for chronic low back pai Journal of Manual and Manipulative Therapy 2005; 12(2):103-12.
10. Skikic EM, et al. Bosn J Basic Med Sci 2003. The effects of McKenzie exercises for patients with low back pain, our experience.
11. Tarang Srivastava et al, Efficacy of McKenzie exercise over conventional physiotherapy therapy in ;ow back pain [dysfunction syndrome]
12. Ajit Dabholkar et al, The effect of extension based treatment technique in McKenzie's derangement syndrome on recruitment of multifidus and endurance of back extensor muscles.
13. Tom Petersen, Peter Kryger et al. The effect of McKenzie therapy as compared with that of intensive strengthening training for the treatment of patients with acute or chronic low back pain. SPINE Volume 27, Number 16, pp 1702-1709, 2002..
14. Fairbank JC, Pynsent PB. The Oswestry Disability Index. Spine 2000 Nov 15;25(22):2940-52.



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### RESEARCH ARTICLE

#### EPIDEMIOLOGICAL STUDY OF END STAGE RENAL DISEASE PATIENTS MAINTAINED ON HAEMODIALYSIS IN EL-MINIA GOVERNORATE; EGYPT.

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ESRD, Epidemiology, Egypt,  
 Haemodialysis

#### Abstract

**Objective:** The epidemiology of ESRD is important as it determines the need for RRT, a complex, costly and lifelong package of care for which demand and provision have grown significantly in the last decade. Aim of this study is to describe the prevalence and etiology of ESRD in EL-Minia Governorate using a structured questionnaire.

**Methods;** Epidemiological, clinical and laboratory data of patients with ESRD on regular hemodialysis from all districts of El-Minia governorate were collected on a structured questionnaire.

**Results;** Out of 1700 ESRD patients on regular HD (314 per million population, pmp), only 1433 patients (84.3%) agreed to participate in this study, with mean age of  $51.6 \pm 13.7$  years. Male patients were 67.8% (n = 972), 79.9% were living in rural areas. Illiterates were 60.6% of all patients. HTN represents the main cause of ESRD 32.03%, while unknown etiology represents 26.87%, and 11.4% DM.

**Conclusion;** In Egypt, Low prevalence may be due to lack of documentation programs and registration for ESRD and short life expectancy for these patients due to lack of health care

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#### Introduction: -

CKD is a major cause of morbidity, mortality, and high medical costs in the United States, particularly among older adults. Nearly 1 in 7 adults has CKD, and recent data suggest that the number of deaths from CKD has doubled in the past 2 decades [1]. In people aged 65 through 74 worldwide, it is estimated that one in five men, and one in four women, have CKD [2]. The lack of community-based screening programs has led to patients being detected with CKD at an advanced stage. It is possible that early detection of kidney disease through community based screening programs might have an impact on this problem through earlier intervention [3]. The epidemiology of ESRD is important as it determines the need for RRT, a complex, costly and lifelong package of care for which demand and provision have grown significantly in the last decade. One year of dialysis costs about £25,000, the first year of transplantation £15,000, with subsequent years over £5,000. It has been estimated that RRT costs consume 1.5–2% of the NHS budget, a figure that is predicted to rise to at least 3% [1]. Aim of this study is to describe the prevalence and etiology of ESRD in EL-Minia Governorate using a structured questionnaire.

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## Patients and Methods: -

### Patients: -

The study included the patients with ESRD on regular hemodialysis in all districts of El-Minia governorate. El-Minia Governorate is one of the Upper Egypt's Governorates, about 234 kilometres to the south of Cairo, it comprises nine districts (fig.1), its population was 5405353 populations according to the records of the Egyptian Ministry of Health and population and the Central Agency of Egypt for public mobilization & Statistics 2015.

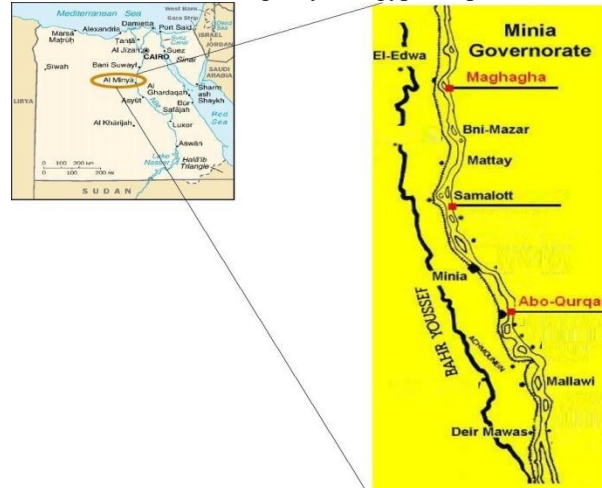


Figure.1: - El-Minia Governorate

The study was conducted between December 2014 to May 2015, the study included 14 dialysis unites, El- Minia University hospital, all general hospitals in the nine districts (El-Edowa general hospital, Maghagha general hospital, Bani-Mazar general hospital, Matti general hospital, Samalout general hospital, El-Minia general hospital, Abo-Korkas general hospital, Mallawi general hospital, Deir-Mawas general hospital), El-Minia Insurance hospital, El-Minia Fever hospital, and two special centers (Samalout One Day Surgery hospital and Konoze center).

### Methods: -

Data were collected on a structured questionnaire. The questionnaire included name of the dialysis unit, name of the patient, age, sex, and residence, degree of education, marital status, and their occupation, history of smoking, and the cause of ESRD, history of HCV and HBV infection and if the patient was HCV positive we asked about the time of infection whether it was from the start of the dialysis or not, and asked about risk factor of HCV infection include the following (history of Blood transfusion, going to the dentist, chronic injection, surgeries, relatives infected by HCV, and if the patients deals with other HCV patients, history of bilharziasis and if he was injected with its medication (tartar treatment). Clinical examination was done with special attention to type of vascular access and blood pressure measurement. Blood pressure was measure with a standard sphygmomanometer while the patient was seated, BP measured according to the standared guidelines of the eighth report of the joint national committee (JNC-VIII) on prevention, detection evaluation and treatment of high BP [4]. Hypertension was considered as a cause of ESRD when renal failure was progressive in a patient with long-lasting hypertension, with moderate proteinuria, and no evidence suggestive of another diagnosis. Diabetic nephropathy was diagnosed as history of long-standing diabetes mellitus, with persistent proteinuria, occurrence of diabetic retinopathy and absence of any other renal disease. Diagnosis of chronic glomerulonephritis present on the base of presence of microscopic proteinuria and hematuria with hypertension. Obstructive uropathy was diagnosed by history of being a stone passer and imaging studies. Data obtained from the patients' files included date of the first dialysis session, their laboratory investigations include viral marker (HCV, HBV infection), Urea before dialysis, Urea after dialysis, Creatinine, Hb level, serum iron, Total iron binding capacity (TIBC), serum ferritin, albumin, serum Ca, serum Phosphorus, and parathrmone hormone level, random blood sugar for diabetic patients only, not all patients under go this investigation in dialysis units as it not reported in their files. Data obtained from imaging studies (abdominal ultrasound) the site, size, shape and echogenicity of both kidney, and the stat of the liver, spleen and other organs. Ultrasound can help to identify polycystic kidney disease, cancer, stones, and obstruction. Data obtained about dialysis units: Type of dialysate, type and size of filter. Ethical consideration; the study was conducted after obtaining approvals from the ethical committee of the faculty of medicine Minia University and Beni Suf Faculty of Medicine. Informed consent was obtained from every patient prior to starting filling the questionnaire.



**Statistical methods: -**

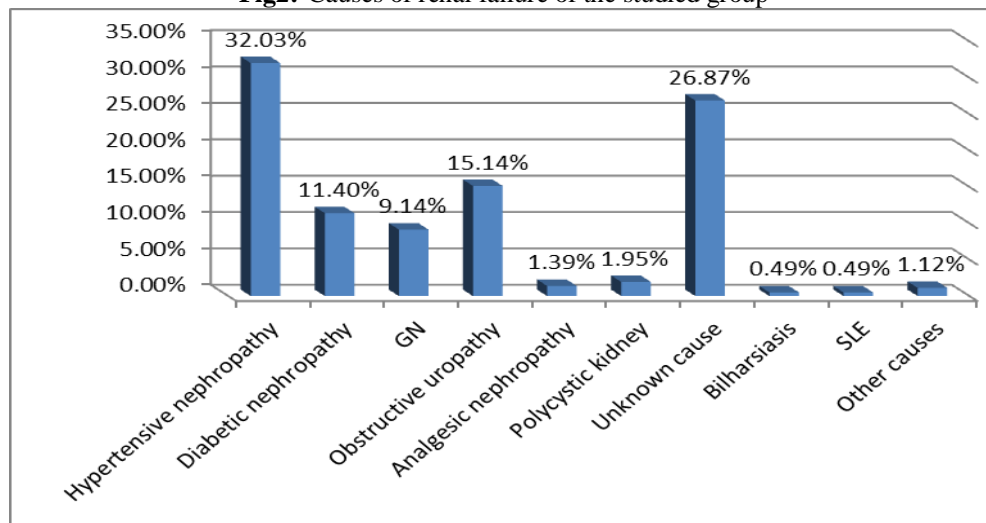
Data management; the collected data were coded and entered to the computer. SPSS "Statistical package for social sciences" Version 19 was used for performing the statistical analysis. Qualitative data is presented as frequencies and percentages whereas quantitative data were presented as means and standard deviations. Chi squared test, student t test and other tests of significance were performed whenever needed. P values of less than 0.05 were considered significant.

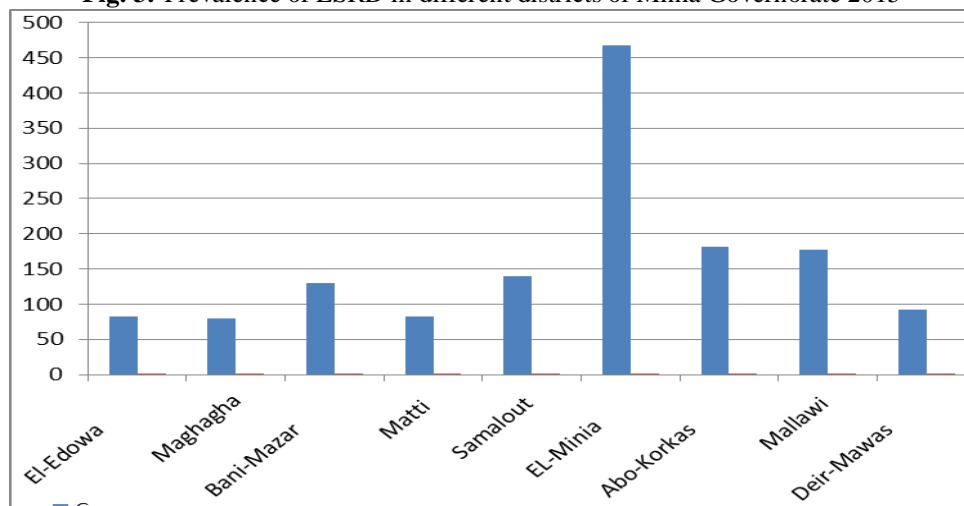
**Results: -**

Out of 1700 ESRD patients on regular HD (314 pmp), only 1433 patients (84.3%) agreed to participate in this study, their age ranged 13–93 years with mean age of  $51.6 \pm 13.7$  years. Male patients 67.8% (n = 972) were more than female patients 32.2% (n = 461), 79.9% of ESRD patients are living in rural areas and 20.1% are living in urban areas, illiterates were 60.6% of all patients while 39.4% were educated (**table 1**). 14% were smoker, 24.5% were ex-smokers and 61.5% were non-smoker. About the marital status of ESRD patients, 10.9% were single, 76.6% were married and 11% were widow. Only 13.6% of ESRD patients work, and 86.4% not work (**table 1**). As regard causes of ESRD, patients with HTN represents 32.03%, unknown etiology were 26.87%, 11.4% DM, 15.14% were due to obstructive uropathy, 9.14% due to Glomerulonephritis (GN), 1.39% were due to Analgesic nephropathy, 1.95% were due to Polycystic kidney, 0.49% were due to bilharziasis, 0.49 were due to Systemic Lupus Erythematosus (SLE) and 1.12% were due to other causes (obstetric cause and malignancy) (**fig. 2**). 32.7% of the patients were in El-Minia city (the capital of El Minia governorate) as it contains 4 units so the main bulk of patients present in it, 12.6 % of the patients were in Abo-Korkas and 12.4% of the patients were in Mallawi(**fig.3**). The prevalence of ESRD among different age groups was 8.9% in those aged < 30 years, 12.1% in those aged 30–40 years, 19.3% in those aged 41–50 years, 31.8% in those aged 51–60 years, and 27.9% in those aged >60 years. The incidence increased by age and peaked in the 51–60 years age group, slightly decrease after the age of 60 years (**table 1**). 12.5% of female patients were less than 30 years, while only 7.2% of male patients were in the same age group. In female patients, the incidence increase by age, peaked at 41–50 years age group and slightly decrease after the age group 51–60, as regard male patients the incidence increased by the age, peaked in the 51–60 years age group and slightly decrease after the age of 60 years (**table 2**). 11.1% from all patients living in urban area were less than 30 years, while 8.4% from all patients living in rural area were in the same age group, the incidence increased by the age and peaked in the 51–60 years age group, slightly decrease after the age of 60 years and at this age the incidence of the disease were more in rural area (**table 2**). Table 2 show the highly significant difference (P-value <0.001\*) between patients with different age groups according to their level of education as regard this table the incidence of educated patients with ESRD were decreased progressively with age, while the incidence of illiterate patients with ESRD were increased progressively with age (**table 2**). In our study, diabetic nephropathy as a cause of ESRD was found to be higher in urban area than rural area (13.2% vs 10.8%), also higher in female than male (14.2% vs 10%) and higher in illiterate than educated patients (12.8% vs 9.9%) (**table 3**). Obstructive uropathy was higher among male patients 19.6% with male to female ratio 7:1, polycystic kidney and bilharziasis higher among male patients 2.1%, 0.7% respectively, analgesic nephropathy was higher in female patients as 2.2% of female patients develop analgesic nephropathy, also SLE was higher in female patients 1.3% than male patients (**table 3**). The incidence of obstructive uropathy, analgesic nephropathy and bilharziasis as a cause of ESRD (16%, 1.6% and 0.5% respectively) were higher in patients living in rural area than those living in urban area, also the incidence of unknown cause was higher in patients living in rural area 28.4% but the incidence of GN, polycystic kidney, SLE as a cause of ESRD (13.5%, 4.3%, and 1.4% respectively) were higher in patients living in urban area than those living in rural area (**table 3**). The incidence of hypertensive nephropathy (34%), diabetic nephropathy (12.8%), obstructive uropathy (15.5%), analgesic nephropathy (1.7%) and bilharziasis (0.7%) were higher in illiterate patients but the incidence of GN (15.6%), and SLE (1.1%) were higher in educated patients (**table 3**). The incidence of house wife was higher in both areas (81.8% in urban, and in rural 98.7%) (**table 4**). The incidence of don't work male patients were higher in rural area 88.9%, worker patients were higher in urban 43.5% (**table 4**). The incidence of lupus nephritis 4.5%, analgesic nephropathy 2.3% were higher in female patients living in urban area (**table 5**). The incidence of obstructive uropathy (20.6%), analgesic nephropathy (1.3%), to bilharziasis (0.8%), were higher in male patients living in urban area (**table 5**). As regard virus status of HD patients in our study, there were 744 patients with positive HCV antibodies (52%) including 199 were negative at start of HD then seroconverted, while 689 patients were negative to HCV antibodies (48%), and only 1.4% were positive HBsAg (**table 6, fig.4**). Out of 199 seroconverted patients 164 patients (82.4%) were on different frequencies blood transfusion, only 35 patients (17.6%) never receive blood transfusion and were on erythropoietin and iron replacement therapy, 36.7% of them under go surgeries and 15.6% going to dentist (**table 7**). There was highly significant difference between seroconversion of HCVab+ve and those who remains HCVab–ve as regarding the age and duration of dialysis (P

value=0,000) (**table 8**). In **table 9** a correlation test show that seroconverted patients had longer duration of dialysis than other HCV negative patients. There was no statistically significant difference between seroconversion of HCVab+ve and those who remains HCVab-ve as regard the gender (P value=0.562) (**Tab 10**). The rate of seroconversion of HCVab is variable in different districts of ElMinia governorate, the highest in University hospital (44.7%) and the lowest in Malawi hospital (5.6%) (**Tab 11, Fig 5**). Our study showed that a highly significant difference was present among patients received parenteral therapy for Schistosomiasis than those who did not receive parenteral therapy, as 79.5% of patients who did not receive parenteral therapy was negative for HCV infection, while 51.1% of those received parenteral therapy for Schistosomiasis were positive for HCV infection (**Table 12**). Out of 1433 HD patients 20 patients were positive for HBVsAg (1.4%), 8 (0.6%) patients were Combined positive for HBVsAg and HCVabs and 12(0.8%) patients were positive for HBVsAg only (**table 13, fig 6**). The incidence of hypertensive patients was 67.06%, diabetic patients were 11.6%, cardiac patient were 2.7% (**table 14**). In our study diabetes represent 11.4% of the cause of ESRD, 60.73% of the diabetic patients were controlled with medical treatment, 38.05% patients were controlled without medical treatment and 1.22% was not controlled with medical treatment (**table 15**). 59.52% of hypertensive patients were controlled with medical treatment, 43.34% was not controlled with medical treatment (**table 16**). In our study number of patients undergoes laboratory investigation widely variant; Hb level, Creatinine and urea before dialysis were the most common laboratory investigation done to HD patients in El-Minia governorate (**table 17**). In our study, we found that the mean duration of dialysis was  $59.1 \pm 39.7$  months. As regard the vascular access, only 2.6% of the cases used jugular venous catheter, 0.1% of the cases used femoral venous catheter during dialysis and 97.3% of patients used arteriovenous fistula (**table 18**). As regard type of dialysate solution used for dialysis, 1138 patients (79.4%) used acetate solution in dialysis while only 295 patients (20.6%) used bicarbonate solution. Dialysis units of Minia General hospital and Kono center are the only units that used only bicarbonate solutions for all patients (**table 19**). As regard Size of filters used for dialysis, 1036 patients (72.3%) used filters of size 1.3 m<sup>2</sup>, while only 332 patients (23%) used filters of size 1.6 m<sup>2</sup> (**table 20**).

**Fig2:-Causes of renal failure of the studied group**



**Fig. 3:-Prevalence of ESRD in different districts of Minia Governorate 2015****Table 1:-General characteristics of the studied group (N = 1433)**

Baseline characteristics		
Age (years)	Range	13 – 93
	Mean $\pm$ SD	51.6 $\pm$ 13.7
Age group in(years)	< 30	128 (8.9%)
	30 – 40	173 (12.1%)
	41 – 50	277 (19.3%)
	50 – 60	456 (31.8%)
	> 60	399 (27.9%)
Sex	Male	971 (67.8%)
	Female	462 (32.2%)
Residence	Urban	288 (20.1%)
	Rural	1145 (79.9%)
Education	Illiterate	869 (60.6%)
	Primary	102 (7.1%)
	Preparatory	102 (7.1%)
	Secondary	276 (19.3%)
	University	80 (5.6%)
	Higher education	4 (3%)
Marital status	Single	156 (10.9%)
	Married	1098 (76.6%)
	Divorced	21 (1.5%)
	Widow	158 (11%)
Occupation	Don't work	1238 (86.5%)
	Employee	173 (12.2%)
	Business owner	3 (0.2%)
	Handicraft	5 (0.3%)
	Farmer	6 (0.4%)
	Professional	5 (0.3%)
	Missing	3 (0.2%)
Smoking	Smoker	200 (14%)
	Non-smoker	881 (61.5%)
	Ex-smokers	352 (24.6%)

**Table 2:-** Comparison between different age groups and gender, residence and level of education among patients (N = 1433)

	Age group	< 30	30-40	41-50	51-60	> 60
<b>Gender</b>	Male N =971	70 (7.2%)	110 (11.3%)	190 (19.5%)	303 (31.2%)	299 (30.8%)
	Female N=462	58 (12.5%)	63 (13.6%)	87 (31.4%)	153 (18.8%)	100 (21.6%)
<b>Residence</b>	Urban N= 288	32 (11.1%)	4 (14.2%)	55 (19.1%)	94 (32.6%)	66 (23%)
	Rural N=1145	96 (8.4%)	132 (11.5%)	222 (19.5%)	362 (31.6%)	333 (29%)
<b>Education</b>	Illiterate N=869	31 (24.2%)	68 (39.3%)	163 (58.8%)	307 (67.3%)	300 (75.2%)
	Educated N=564	97 (75.7%)	105 (60.7%)	114 (41.1%)	149 (32.7%)	99 (24.9%)

**Table 3:-** Comparison between gender, residence and level of education regarding the etiology of the ESRD.

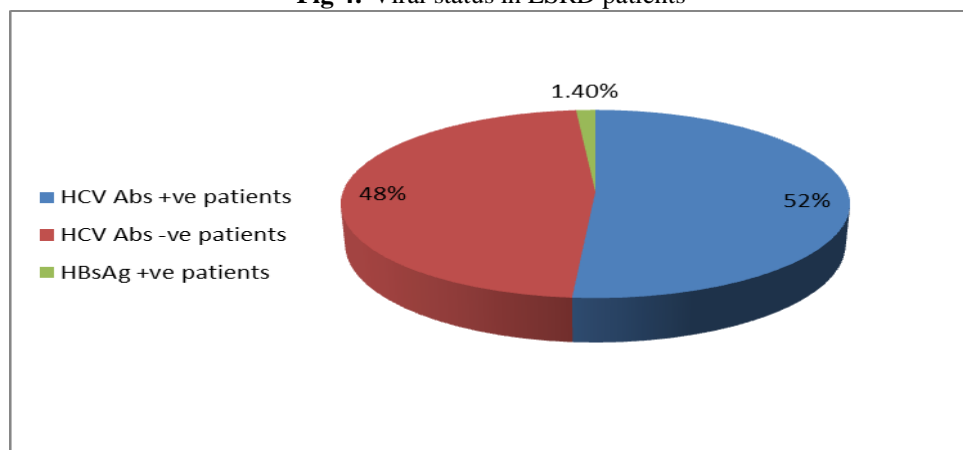
	Male N=971	Female N=462	Urban N=288	Rural N=1145	Illiterate N=869	Educated N=564
<b>Hypertensive nephropathy</b>	306 (31.5%)	153 (33.3%)	95 (33%)	364 (32%)	310 (34%)	149 (26%)
<b>Diabetic nephropathy</b>	79 (10%)	66 (14.2%)	38 (13.2%)	125 (10.8%)	109 (12.8%)	54 (9.9%)
<b>GN</b>	88 (9.1%)	43 (9.4%)	39 (13.5%)	92 (8%)	43 (5%)	88 (15.6%)
<b>Obstructive Uropathy</b>	190 (19.6%)	27 (5.8%)	34 (11.8%)	183 (16%)	135 (15.5%)	82 (14.5%)
<b>Analgesic nephropathy</b>	10 (1%)	10 (2.2%)	2 (0.7%)	18 (1.6%)	15 (1.7%)	5 (0.9%)
<b>Polycystic kidney</b>	20 (2.1%)	8 (1.7%)	12 (4.3%)	16 (1.3%)	11 (1.3%)	17 (3%)
<b>Unknown cause</b>	250 (25.7%)	135 (29.3%)	59 (20.5%)	326 (28.4%)	231 (26.6%)	326 (28.4%)
<b>Bilharziasis</b>	7 (0.7%)	0 (0%)	1 (0.3%)	6 (0.5%)	6 (0.7%)	1 (0.2%)
<b>Others</b>	2 (0.2%)	14 (3%)	4 (1.3%)	12 (1.1%)	8 (0.92%)	8 (1.5%)
<b>SLE</b>	1 (0.1%)	6 (1.3%)	4 (1.3%)	3 (0.3%)	1 (0.1%)	6 (1.1%)

**Table 4:-** Occupation per residence in female and male patients

	female patient (N = 461)		male patient (N = 972)	
	Urban N=88	Rural N=373	Urban N=200	Rural N=772
<b>Not work</b>	72 (81.8%)	367 (98.7%)	113 (56.5%)	686 (88.9%)
<b>Work</b>	16 (18.2%)	5 (1.3%)	87 (43.5%)	86 (11.1%)
<b>Total</b>	88 (100%)	373 (100%)	200 (100%)	772 (100%)

**Table 5:-** Causes of ESRD according to residence in female and male patient (N = 461)

Etiology	female patient (N = 461)		male patient (N = 972)	
	Urban N=88	Rural N=373	Urban N=200	Rural N=772
<b>Hypertensive nephropathy</b>	30 (34.1%)	123 (33%)	65 (32.5%)	241 (31.2%)
<b>Diabetic nephropathy</b>	12 (13.6%)	54 (14.5%)	26 (13%)	71 (9.2%)
<b>GN</b>	12 (13.6%)	31 (8.3%)	27 (13.5%)	61 (7.9%)
<b>Obstructive Uropathy</b>	3 (3.4%)	24 (6.4%)	31 (15.5%)	159 (20.6%)
<b>Analgesic nephropathy</b>	2 (2.3%)	8 (2.1%)	0 (0%)	10 (1.3%)
<b>Polycystic kidney</b>	3 (3.4%)	5 (1.3%)	9 (4.5%)	11 (1.4%)
<b>Unknown cause</b>	19 (21.6%)	116 (31.1%)	40 (20%)	210 (27.2%)
<b>Bilharziasis</b>	0 (0%)	0 (0%)	1 (0.5%)	6 (0.8%)
<b>Other</b>	4 (4.5%)	10 (2.7%)	1 (0.5%)	1 (0.1%)
<b>SLE</b>	4 (4.5%)	2 (0.5%)	1 (0.1%)	1 (0.1%)
<b>Total</b>	88 (100%)	373 (100%)	200 (100%)	772 (100%)

**Fig 4:-** Viral status in ESRD patients**Table 6:-** HCV Seroconversion in ESRD patients

Status	N0 (%)
HCV Abs +ve patients from the start	545 (38%)
HCV Abs -ve patients from the start	888 (62%)
HCV Seroconverted patients	199 (22.4%)

**Table 7:-** Risk factor of HCV infection among seroconversion (N = 199)

Risk factor of HCV among seroconversion		
Blood transfusion	Yes	164 (82.4%)
	No	35 (17.6%)
Going to the dentist	Yes	31 (15.6%)
	No	168 (84.4%)
Injection	Yes	7 (3.5%)
	No	192 (96.5%)
Surgeries	Yes	73 (36.7%)
	No	126 (63.3%)
Relatives infected by HCV	Yes	24 (12.1%)
	No	175 (87.9%)
Deal with HCV patient	Yes	25 (12.6%)
	No	174 (87.4%)

**Table 8:-** Comparison between HCV seroconversion and both the age and duration of dialysis.

Age(months)	Category	N	Mean	Std. Deviation	P
	HCVab -VE	689	49.77	14.84	
	Seroconverted	199	44.3	13.14	0,000
Duration of dialysis(months)	HCVab -VE	689	47.44	27.42	0,000
	Seroconverted	199	96.35	48.76	

**Table 9:-**Correlation between HCV seroconversion and both the age and duration of dialysis.

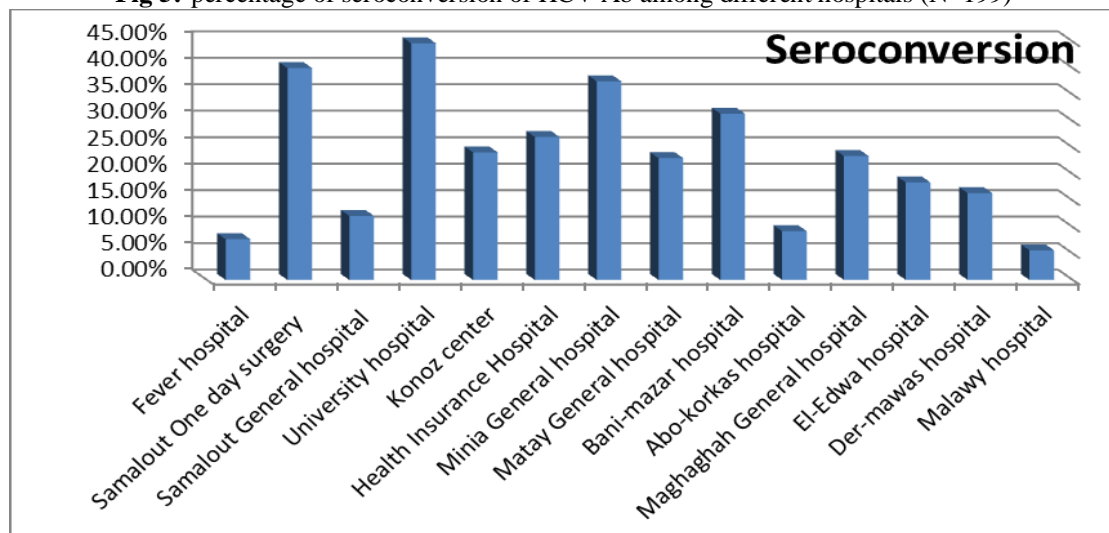
Correlations		Age	Duration of dialysis
<b>HCV GROUP</b> n=887	<b>Spearman's rho (r)</b>	-0.16279	0.467
	<b>P value</b>	0,000	0,000

**Table 10:-**Comparison between HCV seroconversion as regard the gender

			HCV Group		P
			HCV –VE	Seroconverted	
<b>Gender</b>	<b>Male</b>	<b>N Count</b>	<b>429</b>	<b>129</b>	<b>0.562</b>
		<b>Within % HCV GROUP</b>	<b>62</b>	<b>65</b>	
	<b>Female</b>	<b>Count</b>	<b>260</b>	<b>70</b>	
		<b>Within % HCV GROUP</b>	<b>38</b>	<b>35</b>	

**Table 11:-** Number and percentage of seroconversion of HCV Ab among different hospitals (N=199)

Hospital	Seroconversion N 199		HCV Ab-ve N=689	Total HCV Ab-ve before seroconversion
Samalout One day surgery hospital	10	40%	15(60%)	25
Samalout General hospital	8	12.1%	58(87.9%)	66
Minia University hospital	42	44.7%	52(55.3%)	94
Konoz center	7	24.1%	22(75.9%)	29
Health Insurance Hospital	24	27%	65(73%)	89
Minia General hospital	27	37.5%	45(62.5%)	72
Mattai General hospital	12	23%	40(77%)	52
Bani-mazar hospital	22	31.4%	48(68.6%)	70
Abo-korkas hospital	11	9.2%	109(90.8%)	120
Maghagha General hospital	11	23.4%	36(76.6%)	47
El-Edowa hospital	9	18.4%	40(81.6%)	49
Der-mawas hospital	9	16.4%	46(83.6%)	55
Malawi hospital	6	5.6%	101(94.4%)	107
Fever hospital	1	7.7%	12(92.3%)	13
<b>Total</b>	<b>199</b>	<b>100%</b>	<b>689</b>	<b>888</b>

**Fig 5:-**percentage of seroconversion of HCV Ab among different hospitals (N=199)

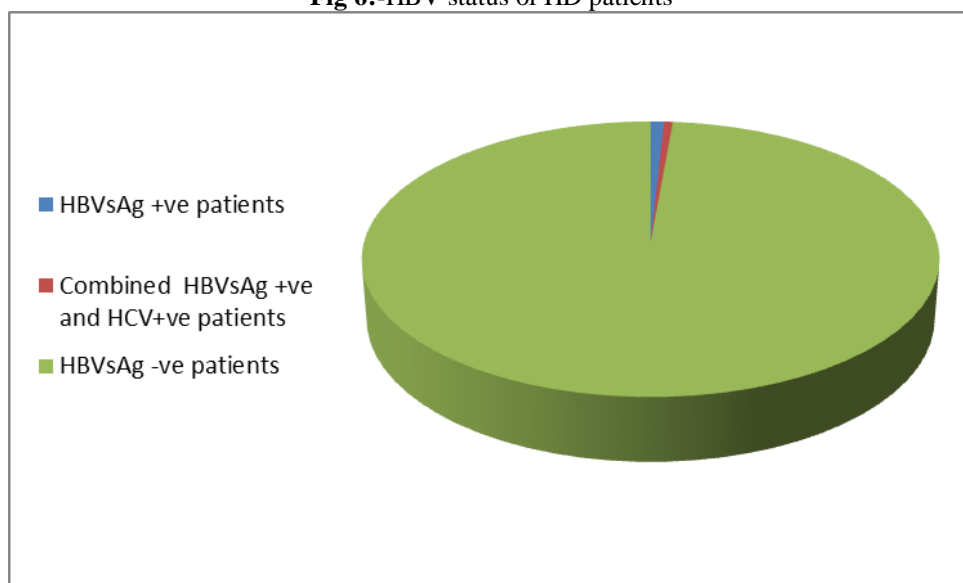
**Table 12:-**Comparison between HCV +ve and HCV -ve according to parenteral therapy for Schistosomiasis

Parenteral therapy for Schistosomiasis	HCV +ve N(%)	HCV -ve N(%)	P – value
Yes	364 (48.9%)	141 (20.5%)	<0.001*
No	380 (51.1%)	548 (79.5%)	
Total	744 (100%)	689 (100%)	

\*: Significant difference ( $p$  value  $\leq 0.05$ )

**Table 13:-**Classification of patients according to their HBV status

HBV infection	
HBVsAg +ve patients	12 (0.8%)
Combined HBVsAg +ve and HCV+ve patients	8 (0.6%)
Total HBVsAg +ve	20 (1.4%)
HBVsAg -ve patient	1413 (98.6%)
Total	1433 (100%)

**Fig 6:-**HBV status of HD patients**Table 14:-**Co-morbidities associated with ESRD

Chronic disease	No	430 (30%)
	DM	163(11.4%)
	HTN	961(67.06%)
	Cardiac	39 (2.7%)
	Others disease	9(0.6%)
Bilharziasis	Yes	48 (3.3%)
	No	645 (45%)
	Don't know	740 (51.6%)
Back pain	Yes	462 (32.2%)
	No	971 (67.8%)

**Table 15:-** Diabetic control state in HD patients

Diabetic patients N=163	Controlled with treatment	99 (60.73%)
	Controlled without treatment	62 (38.05%)
	Not controlled with treatment	2 (1.22%)

**Table 16:-** HTN control state in HD patients

<b>Hypertensive patients N=961</b>	<b>Controlled with treatment</b>	<b>572 (59.52%)</b>
	<b>Controlled without treatment</b>	<b>59 (6.14%)</b>
	<b>Not Controlled with treatment</b>	<b>330 (34.34%)</b>

**Table 17:-**Laboratory data of all patients

<b>Laboratory data</b>	<b>Number</b>	<b>Range</b>	<b>Mean <math>\pm</math> SD</b>
Urea before dialysis	1365	90 – 320	144.2 $\pm$ 42.8
Urea after dialysis	308	50 – 186	70.6 $\pm$ 22.6
Creatinine	1364	2.5 – 17.3	7.3 $\pm$ 3.14
HB	1432	4.2 – 16	9.5 $\pm$ 1.8
Ca in blood	281	3.25 – 11.2	7.7 $\pm$ 1.36
Phosphorus	275	1.2 – 10.5	5.87 $\pm$ 1.42
Parathormon	280	24 – 5841	95.8 $\pm$ 368.4
Albumin	143	3 – 4.5	3.9 $\pm$ 0.29
Serum iron	147	10 – 614	83.5 $\pm$ 67
TIBC	174	11 – 2645	239 $\pm$ 238
Feritin	171	11.4 – 8781	1158 $\pm$ 1422

**Table 18:-**Duration and site of dialysis of the studied group (N =1433)

<b>Dialysis</b>		
<b>Duration of dialysis (months)</b>	<b>Range</b>	<b>7 – 281</b>
	<b>Mean <math>\pm</math> SD</b>	<b>59.1 <math>\pm</math> 39.7</b>
<b>Vascular access</b>	<b>A-V shunt</b>	<b>1395 (97.3%)</b>
	<b>Jugular catheter</b>	<b>37 (2.6%)</b>
	<b>Femoral catheter</b>	<b>1 (0.1%)</b>

*N.B: Quantitative data represented by Range (mean $\pm$ SD), While Qualitative data represented by number and (%).*

**Table 19:-**Solution used for dialysis among different hospitals

<b>Hospital</b>	<b>Acetate solution</b>	<b>Bicarbonate solution</b>	<b>Total</b>
Samalout One day surgery	54(100%)	-	54(100%)
Samalout General hospital	72(83%)	14(16%)	86(100%)
Minia University hospital	146(100%)	-	146(100%)
Konoz center	-	34(100%)	34(100%)
Health Insurance Hospital	154(100%)	-	154(100%)
Minia General hospital	-	114(100%)	114(100%)
Mattai General hospital	54(65.1%)	29(34.9%)	83(100%)
Bani-mazar hospital	96(73.8%)	34(26.2%)	130(100%)
Abo-korkas hospital	158(87.3%)	23(12.7%)	181(100%)
Maghagha General hospital	79(100%)	-	79(100%)
El-Edowa hospital	78(94%)	5(6%)	83(100%)
Der-mawas hospital	92(100%)	-	92(100%)
Malawi hospital	154(87%)	23(13%)	177(100%)
Fever hospital	1(5%)	19(95%)	20(100%)
<b>Total</b>	<b>1138(79.4%)</b>	<b>295(20.6%)</b>	<b>1433(100%)</b>



**Table 20:-Size of filters among different hospitals**

Hospital	1.2m <sup>2</sup>	1.3 m <sup>2</sup>	1.4 m <sup>2</sup>	1.6 m <sup>2</sup>	1.8 m <sup>2</sup>	Total
Samalout One day surgery	-	54 (100%)	-	-	-	54 (100%)
Samalout General hospital	-	13 (15%)	27 (31.6%)	45 (52.4%)	-	86 (100%)
Minia University hospital	-	146 (100%)	-	-	-	146 (100%)
Konoz center	-	34 (100%)	-	-	-	34 (100%)
Health Insurance Hospital	-	154 (100%)	-	-	-	154 (100%)
Minia General hospital	-	114 (100%)	-	-	-	114 (100%)
Mattai General hospital	-	83 (100%)	-	-	-	83 (100%)
Bani mazar General hospital	-	-	-	94 (72.3%)	36 (27.7%)	130 (100%)
Abo-korkas hospital	1 (0.6%)	129 (71.3%)	-	51 (28.2%)	-	181 (100%)
Maghagha General hospital	-	23 (29.1%)	-	256 (70.9%)	-	79 (100%)
El-Edowa General hospital	-	58 (69.9%)	-	25 (30.1%)	-	83 (100%)
Der mawas hospital	-	47 (51.1%)	-	45 (48.9%)	-	92 (100%)
Malawi hospital	-	161 (91%)	-	16 (9%)	-	177 (100%)
Fever hospital	-	20 (100%)	-	-	-	20 (100%)

**Discussion: -**

The lack of community-based screening programs has led to patients being detected with CKD at an advanced stage. It is possible that early detection of kidney disease through community based screening programs might improve this problem through earlier treatment [3]. Hemodialysis is the most frequent type of RRT. Mortality is highest during the first 3 months of hemodialysis. Treatment with dialysis or kidney transplantation produces an immense financial burden for many patients who need it [2]. The total cost of the ESRD program in the US was approximately \$49.3 billion in 2011. Medicare costs per person per year were more than \$75,000 overall, ranging from \$32,922 for transplant patients to \$87,945 for those receiving hemodialysis therapy [5]. The epidemiology of ESRD is significant as it limits the need for RRT. The rapid increase in the prevalence of ESRD requires practical strategies to prevent its development and progression, especially in the developing world [6]. El-Minia Governorate is one of Egypt Governorates located in the central part of Egypt. In the current study, the total number of patients on RRT were 1700 living in nine districts covering 5.4 million populations only 1433 patients (84%) agree to participate in this study, in El-Minia Governorate in 2006 the total number of patients on RRT were 1356 only 800 patients (59%) agree to participate in the study and in 2007 they were 1615 only 950 patients (59%) agree to participate in the study [7]. As regard these results the number of ESRD patients was increased annually. The results of our study revealed that in El-Minia Governorate the prevalence of ESRD patients on regular hemodialysis were 314 PMP, this rate was 250 PMP in 2002 [8] and progressively increased to 260 PMP in 2005 [9] then became 308 PMP in 2006 [10], and was 367 pmp in 2007 [7]. In other Egyptian governorates, the prevalence of ESRD patients on regular hemodialysis was 330 pmp in Menoufia Governorate in the year 2013 [11], 282.6 pmp in Kafer El-Shakh Governorate during the year 2012 [12]. The prevalence worldwide was greatly differing. According to USRDS the prevalence was highest in Taiwan with 2447 pmp and was lowest in Philippines with 110 pmp. In United States was 1811 pmp[13]. In Europe, the prevalence in 2004 was 760 pmp and increased to 889 pmp in 2008 [14]. In Egypt, Low prevalence may be due to lack of documentation programs and registration for ESRD also short life expectancy for these patients due to lack of health care may play a rule. In the current study 32.7% of patients on regular HD present in El-Minia city this due to the presence of three large hospitals (university hospital, health insurance hospital, and El-Minia general hospital) in addition to Konozcenter. In the current study, the mean age was  $51.6 \pm 13.7$  but in the year 2006 it was  $46 \pm 13$  years [10], this difference may also reflect improvement in the medical services provided for diagnosis and management of ESRD patients which is still much less than in developed

countries. In France, the median age of patients on RRT is 70.4 years [15]. This marked increase in median age in patients in the European countries may reflect the improvement in ESRD care that requires strong support from the government. The incidence of ESRD in our study increased by age peaked in the 51–60 years age group, and slightly decrease after the age of 60 years. In Bani Suef governorate the mean age was  $42.45 \pm 16.2$  years [16], in Menoufia Governorate in the year 2013 the mean age was 52 years [11], and it was 51 years in Kafer El-Shakh Governorate during the year 2012 [12]. In Egypt, the mean age was 45.6 years in 1996 and increased to 49.8 years in 2008 [17]. On studying the patient's residence and its relation to ESRD we find that large number of ESRD patients (79.9%) live in rural areas and have limited contact to healthcare, only 20.1% are living in urban areas, also in El-Minia Governorate at the year 2006, 55% of patients were living in rural areas and 45% are living in urban areas [10]. In the current study, we found that in the age groups < 30 years patients living in urban area (11.1%) were more than those in rural area (8.4%) while the reverse occur after the age > 60 as 23% in urban area and 29% in rural area this difference in the age groups reflects the difference in awareness of the patients as 75.2% of the age > 60 years were illiterate. The incidence of obstructive uropathy, analgesic nephropathy, bilharziasis and unknown aetiology as a cause of ESRD was higher in patients living in rural area than those living in urban area. The incidence of hypertensive nephropathy (34%), diabetic nephropathy (12.8%), obstructive uropathy (15.5%), analgesic nephropathy (1.7%) and bilharsiasis (0.7%) were higher in Illiterate patients but the incidence of GN (15.6%), and SLE (1.1%) were higher in educated patients. These differences may reflect the strong link between level of education, living in rural area, health services available and awareness of the patients about the disease status and early referral to nephrologist. In the United Arab Emirates, the highest incidence rate of ESRD was reported in Abu-Dhabi city among the 45–55 years age group [18], while in Kuwait it was 45 years [19]. The incidence of ESRD was more common in male gender worldwide, as USRD System, 2012 revealed that in the US males constituting 56%, UK, 2009 revealed that males constituting 60% in the UK, in the KSA males constituting 54.5% [20]. In our study the prevalence in male was nearly twice that of females (67.8% vs 32.2%). Our results show that only 13.6% of ESRD patients work, and 86.4% not work, this reflects the major health problem of ESRD patients because it is a devastating medical condition, and the cost of treatment is a huge economic burden. In the current study the incidence of ESRD of unknown etiology was 26.87%, and during the year 2006 was 27% [9], in Bani Suef governorate was 42.2% [16], in Menoufia Governorate in the year 2013 was 20.5 % of all causes of ESRD [11], and it was 15.2 % in all Egypt [21]. In Sudan, uncertain etiology of ESRD was estimated to be more than 40% [22]. While in the US it was only 3.9% [13]. In Saudi Arabia it was 19.9 % [23]. The incidence of ESRD due to unknown etiology in Egypt is like that in Saudi Arabia, but so much higher than that in the US. This difference may be attributed to lack of awareness of the patients, delay referral to nephrologist in developing countries and reduced health care system. In the current study, hypertensive nephropathy was the first leading cause of ESRD in El-Minia Governorate and the incidence was 32.03%, while it was 27% in the year 2002 [8], 20% in the year 2006 [10]. In Bani Suef governorate hypertension represented 15.2% [16]. In Menoufia Governorate in the year 2013 hypertension (31.1 %) was the main cause of ESRD [11], also the main cause of ESRD in Cairo was hypertension (29.7%), followed by DN (12.5%), in Canal governorates it was 27.3%, followed by DN (10.7%) [12]. In Tabuk Saudi Arabia 24% of patients were hypertensive [24]. In Sudan hypertension was responsible for about 26% [22]. Similarly, In US it was 28% [13]. But this percentage of HTN may be not accurate as a cause of ESRD as it is difficult to decide if long-standing hypertension is the cause of ESRD or a previous undiagnosed renal disease is the cause of secondary HTN. In our study the prevalence of hypertension was higher in females 33.3% than in males 31.5%. In our study the incidence of diabetic nephropathy was 11.3%, it was 5% during the year 2005 [8], 8% during the year of 2006 [10], and 13% in the year of 2007 [7]. In Bani Suef governorate it was 13.2% [16]. The prevalence of diabetic nephropathy was higher in females 14.2% than in males 10%, and more in urban 13.2% than in rural 10.8%, this agree with [7] in 2007 diabetic nephropathy was higher in urban (8%) than in rural areas (5%), also in Emarate prevalence of diabetic nephropathy appears to be higher in urban and more developed areas than rural areas [18]. In Menoufia Governorate in the year 2013 diabetic nephropathy was 15.9 % [11], 14% in Kafer El-Shakh Governorate during the year 2012 [12]. The prevalence of DN in Egypt as a cause of ESRD was 8.9% in 1997 and increased to 13.5% in 2008 and accounting the 2nd cause of ESRD as the main cause is hypertension 36.6% [21]. In South Africa, it was 14% to 16%, and in Sudan it was 9% [25]. In France, during the year 2007, 39% of patients with ESRD on HD were diabetics [15]. According to the 2008 United States Renal Data System annual report the major cause of ESRD leading to kidney failure in the US was diabetes [26], 28.9% of patients on RRT while in Iran diabetes mellitus constitutes 30.1% of ESRD patients [27]. In Gulf countries like Qatar, diabetic nephropathy was the commonest cause of ESRD 48% [28], and in Saudi Arabia it was 25.2 % [23]. In France in year 2007, 39 % of ESRD on regular hemodialysis was due to DN [15]. In United Kingdom DN accounts 14.7 % the 2nd cause of ESRD following GN 16% [29]. This difference in prevalence of DN as a cause of ESRD may be due to the low prevalence of obesity in the less developed areas compared to that in the developed regions because of their

rapid economic growth and associated changes in lifestyle. Chronic glomerulonephritis was seen in 9.14% in the current study, in 2006 it represented 11% of ESRD patients [10], while it was only 1% in the US. In our study hepatitis C prevalence was found to be 52%, In Menoufia Governorate in the year 2013 hepatitis C prevalence was 38.6 % [11], and was 39.7% in the Kafer El-Shakh Governorate during the year 2012 [12]. In Bani Suef governorate was 55.79% [16]. There was a wide variation in hepatitis C prevalence in dialysis patients present worldwide. It was 52% in Egypt [21], 54.4 % in Syria [30], 21 % in Jordan [31], and in Saudi Arabia 18.9 % [32]. Our study showed that 51.1% of patients received parenteral therapy for Schistosomiasis were positive for HCV infection, this is because previous parenteral therapy for Schistosomiasis without adequate sterilization techniques has been concerned as the cause for this high prevalence rate of hepatitis C in Egypt. Hepatitis C prevalence was high in El-Minia Governorate may be credited to the high hepatitis C prevalence in the general population, also blood transfusion used by high rate in dialysis units to treat anemia instead of erythropoietin and iron therapy, as it is costly, and lack of infection control standard methods in dialysis units. In our study, HCV seroconversion rate was 22.4% among patients who were HCV-free at the start of the study, while it was 14.5% in Menoufia governorate [21], and in Bani Suef governorate was 7.33% [16]. In the current study the duration of dialysis was significantly high (P-value 0.0001) in seroconverted patients than those remain HCV ab negative, this agree with a study in Bani Suef governorate as the duration of dialysis was significantly high in HCV seroconverted patients [16], in Menoufia governorate **Zahran, 2014** showed that the duration of dialysis was the predictor of HCV seroconversion [34]. Also, in India a study demonstrated that the duration of haemodialysis was the important risk factors for HCV seroconversion [35]. **Okuda and Hayashi, 1996** showed that 31.6% were seroconverted at a large dialysis unit in USA a study on 152 patients who had not received blood, and seroconversion was correlated with the dialysis duration [36]. In our study the age was a highly significant risk factor for seroconversion as age decreased incidence of seroconversion increased, the study of **Selm, 2010** in Yemen showed that old age was significant risk factor for seroconversion [37], while in Bani Suef governorate age was insignificant risk factor for seroconversion [16]. Our results agree with a study in Bani Suef governorate that gender was insignificant risk factor for seroconversion [16], while in Yemen male gender was significant risk factors for HCV seroconversion [37].

### Recommendations:-

As a significant proportion of ESRD patients discovered their kidney problem very late and were not well equipped for renal replacement therapy with a high prevalence of hepatitis C. We recommend the following; first, education program for physicians should be strengthened with special emphasis on etiological factors causing ESRD, increase awareness of primary health care physician and treating physician about the proper time for referral to the nephrologists and increase awareness of nephrologists about the proper time for preparing patient for renal replacement therapy. Statistical evaluation and patient registry of ESRD patients for each governorate is useful to explain the characteristics of ESRD patients and dialysis therapy, to assess complications on the scientific evidence basis, for improving quality of dialysis therapy and to provide information about socioeconomic health administration for a future health plan. Another study for assessment of dialysis adequacy, anemic state of the ESRD patients would be practical and beneficial in providing safe and cost-effective HD treatment. Also, to improve the quality of dialysis therapy all laboratory investigation must be regularly evaluated to all ESRD patients. Proper control of hypertension and follow-up of diabetic patients and annual registry of diabetics on HD. Using of iron therapy and erythropoietin instead of the high rate of blood transfusion to treat anemia in dialysis units and proper use of guidelines for infection control in dialysis units to prevent HCV Seroconversion.

### References:-

1. **Hoerger T. J., Sean A., Simpson M.A., Benjamin O et al (2015):** The Future Burden of CKD in the United States: A Simulation Model for the CDC CKD Initiative. *Am J Kidney Dis.*;65(3):403-411
2. **National Kidney Foundation(2015):** Global Facts: About Kidney Disease,
3. **Singh A, Youssef M, Bharati V , Kuyilan K. et al(2013):** Epidemiology and risk factors of chronic kidney disease in India results from the SEEK (Screening and Early Evaluation of Kidney Disease) study *BioMed Central Nephrology (BMC)*, 14:114
4. **Kayce Bell, June Twiggs, Bernie R. (2015):** Hypertension The Silent Killer: Updated JNC-8 Guideline Recommendations Alabama pharmacy ASSOCIATION 2 | Summer: Continuing EDUCATION
5. **Gregorio T Obrador, MD, Brian JG et al.,(2014):** Epidemiology of chronic kidney disease Topic 7236 Version 16.0 Official reprint from UpTo Date.
6. **Aghighi M., Mahdavi MM, Zamyadi M, Heidary A R, et al (2009) :** Changing Epidemiology of End-Stage Renal Disease in Last 10 Years in Iran, *Iranian Journal of Kidney Disease,(IJKD)* 2009;3:192-6

7. **El-Minshawy O. (2011):** End Stage Renal Disease in El-Minia Governorate, Egypt: Data of the Year 2007. *Nephro-Urol Mon.*;3(2):118-121.
8. **El Minshawy O, El Sharqawy M, Ewis A. (2002):** End stage renal disease in El Minia Governorate (Central Egypt): An epidemiological Study. *J Egypt SocNephrol*; 4(1):34–41.
9. **El Minshawy O and Kamel EG.(2006):** Renal replacement therapy and increased risk of cardiovascular disease in El-Minia Governorate, Upper Egypt. *Egypt J Hosp Med*; 22:29-38..
10. **El Minshawy O.(2011):** End-Stage Renal Disease in the El-Minia Governorate, Upper Egypt: An Epidemiological Study *Saudi J Kidney Dis Transpl*; 22(5):10481054
11. **11-Ahmed R, Mahmoud K, Hany S, Hala G and Ahmed S.(2015):** Prevalence of End Stage Renal Disease in Menoufia Governorate. *Nature and Science Nat Sci*;13(6):154-158
12. **Hassan A. Ahmeda, Yassine S. Yassinea, Ahmed R. Tawafea, Mohammed M. Ebazawayb(2015):** Egypt, end-stage renal disease, epidemiology of haemodialysis, etiology of end-stage renal disease, Kafer El-Shakh Governorate *Menoufia Medical Journal*, 28:267–271.
13. **U S Renal Data System, USRDS (2011):** Annual Data Report Atlas of Chronic Kidney Disease and End-Stage Renal Disease in the United States, National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD.
14. **Stel VS, van de Luijngaarden MW, Wanner C, Jager KJ(2011):** On behalf of the European Renal Registry Investigators, the 2008 ERA-EDTA Registry Annual Report-a précis. *NDT Plus*. Feb; 4(1):1-13.
15. **Couchoud C, Lassalle M, Stengel B, Jacquelinet C.(2009):** Renal Epidemiology and Information Network: annual report *Nephrol Ther*;5 Suppl 1:S3-144.
16. **Genina A M, Ebrahim M, Mohamed Z, (2012):** African Journal of Nephrology,Prevalence of hepatitis C virus antibodies in end stage renal disease patients in Beni-Suif/Egypt16:132-139.
17. **Afifi A.(2015):** Egyptian Renal Registry 9th Annual Report.
18. **Hassanien A, Al-Shaikh F , Eszter P. et al (2012):** Epidemiology of end-stage renal disease in the countries of the Gulf Cooperation Council; *J R Soc Med Sh R* 2012;3:38. DOI 10.1258/shorts.2012.011150.
19. **El-Reshaid K, Johny KV, Sugathan TN, et al. (1994):** End-stage renal disease and renal replacement therapy in Kuwaitepidemiological profile over the past 412 years. *Nephrol Dial Transplant*;9:532–8.
20. **Al-Sayyari AA, Shaheen FA. (2011):** End Stage Chronic Kidney disease. A rapidly changing scene. *Saudi Med J*;32:339-46.
21. **Zahran A.(2011):** Epidemiology of hemodialysis patients in Menoufia governorate, Egypt. *MNF medical J* ; 24:59-70.
22. **El-Amin A, Obeid W, Abu-Aisha H. (2010):** Renal Replacement Therapy in Sudan. *Arab J Nephrol Transpl*;3:31-6.
23. **Shaheen FA, Al-Khader AA. (2005):** Epidemiology and causes of end stage renal disease (ESRD). *Saudi J Kidney Dis Transpl*. July-September; 16(3):27781.
24. **El Minshawy O, Ghabrah T., El Bassuoni E. (2014):** End-stage Renal Disease in Tabuk Area, Saudi Arabia:An Epidemiological Study *Saudi J Kidney Dis Transpl* ;25(1):192-195.
25. **Naicker S. (2009) :** End-stage renal disease in sub-Saharan Africa. *Ethn Dis*. spring; 19(1 Suppl 1):S1-13-5.
26. **Collins AJ, Foley RN, Herzog C, et al.(2009):** United States Renal Data System 2008 Annual Data Report. *Am J Kidney Dis.*;53:S1–374.
27. **Malekmakan L, Haghpanah S, Pakfetrat M, et al(2009):** Causes of chronic renal failure among Iranian hemodialysis patients. *Saudi J Kidney Dis Transpl*;20 (3):501-4.
28. **Shigidi MM, Ramachandiran G, Rashed AH, Fituri OM. (2009):**
29. **Demographic data and hemodialysis population dynamics in Qatar: A five year survey.** *Saudi J Kidney Dis Transpl.*; 20(3):493-500
30. **Steenkamp R, Castledine C, Feest T, Fogarty D UK (2011):** Renal Registry 13th Annual Report : Chapter 2: UK RRT prevalence in 2009: national and centre-specific analyses. *Nephron ClinPract*; 119 Suppl 2:c27-52.
31. **Moukeh G, Yacoub R, Fahdi F, Rastam S, Albitar S.(2009):** Epidemiology of hemodialysis patients in Aleppo city. *Saudi J Kidney Dis Transpl*. Jan; 20(1):140-6.
32. **Batieha A, Abdallah S, Maghaireh M, Awad Z, Al-Akash N, et al (2007):** Epidemiology and cost of haemodialysis in Jordan. *East Mediterr Health J*; 13:654–663.
33. **Hussein M.M., Mooij J.M., Hegazy M.S., et al (2007):** The impact of polymerase chain reaction assays for the detection of hepatitis C virus infection in hemodialysis units. *Saudi J Kidney Dis. Transpl.*;18:107-113.
34. **Zahran AM (2014):** HCV seroconversion in hemodialysis units ,*Menoufia Medical Journal*, 27:551–555

35. **35-Kumar p. S., Venu G., Madhusudhana Rao A., et al (2011):** Prevalence and Risk Factors of Hepatitis C Among Maintenance Hemodialysis Patients At A Tertiary-Care Hospital In Coimbatore, India. Journal of Clinical and Diagnostic Research; 5:725-728.
36. **36- Okuda K. And Hayashi H.(1996):** Hepatitis C virus infection among maintenance hemodialysis patients: A preventable problem of the world. Saudi J Gastroenterol,; 2:1-7.
37. **37- Selm S.B.(2010):** Prevalence of hepatitis C virus infection among hemodialysis patients in a single center in Yemen. Saudi J Kidney Dis Transpl,; 21:1165-8.



### RESEARCH ARTICLE

## THE PRACTICES OF UNIVERSITY STUDENTS REGARDING TESTICULAR SELF-EXAMINATION AND AN EVALUATION ON THE EDUCATION GIVEN TO UNIVERSITY STUDENTS

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### Abstract

This study was planned to determine the practice of university students regarding testicular cancer and testicular self-examination.

The population of this quasi-experimental study was male nursing students (n=150). The sample consisted of 98 students who had agreed to participate in the study. The data was collected through a questionnaire, which was developed by the researcher in the direction of the literature. In the analyses; the percentage, mean, and t-tests, and Kruskal-Wallis H test were performed.

The students mean age was  $21.12 \pm 1.82$ . There was no testicular cancer students' in the students' families. While more than half of the students (59.2%) reported that they had prior knowledge regarding testicular cancer, the remainder, (54.1%), stated that they acquired their knowledge from their degree course. 49% of the students reported that they knew how to perform a testicular self-examination, but 31.6% said that they had. The average correct answer to 22 questions concerning testicular cancer and testicular self-examination was  $16.55 \pm 2.14$  prior to study, and the average correct answers was  $18.22 \pm 2.93$  after education. This increase was statistically significant ( $p < 0.001$ ).

As a result, it was determined that most university students have a moderate level of knowledge on testicular cancer and testicular self-examination.

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### Introduction:-

The incidence of cancer is increasing worldwide every year. According to data from 2012, the incidence of cancer in males was 205.4 at 100.000 (Ferlay et al., 2013). According to 2010 data, the ratio was 234.4 out of 100,000 in Turkey (Turkey Cancer Statistics, 2010).

Although testicular cancer is rarely seen, it is the most common cancer among 15-35 year olds (Turkey Cancer Statistics, 2010). Testicular cancer represents 1% of male neoplasm, and 5% of urological tumours (Albers et al., 2015). According to the 2010 data, incidences of testicular cancer was 3.4 out of 100,000, in Turkey (Turkey Cancer Statistics, 2010).

Testicular tumours show excellent cure rates with staging at the time of diagnosis; and adequate early treatment based on chemotherapeutic combinations, either with or without radiotherapy and surgery (Kuzgunbay et al., 2013).

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Testicular cancer is highly curable if caught early, with a five-year survival rate of 90% (American Cancer Society, 2013). A testicular self-examination is the easiest way for an early detection of physical abnormalities in the testicles. The American Medical Association, and the American Urological Association suggests that public information and education regarding testicular self-examination for an early diagnosis of testicular cancer (Kuzgunbay, 2014). The European Association of Urology recommends a testicular self-examination to men with clinical risk factors (Albers et al., 2015).

Testicular self-examination involves palpating the testis, epididymis, and spermatic cord between the thumb and the first two fingers. This practice should be done either in the shower or after the shower using a mirror, once a month (Göggeldi and Koçak, 2010).

Studies have shown that the knowledge and awareness of society concerning testicular cancer and a testicular self-examination is limited (Kuzgunbay et al., 2013; Khadra and Oakeshott, 2002; Brenner et al., 2003; Casey et al., 2010). Thus, a knowledge of testicular self-examination is critical in self-detection and the subsequent treatment of testicular cancer. For this reason, this study was planned to determine the knowledge and practice of university students of testicular cancer and testicular self-examination, and then it was conducted to determine the extent of knowledge after study.

## **Methods:-**

### **Setting and Participants:-**

This quasi-experimental study was conducted in the Gümüşhane University health school department of nursing, from December 2014 to February 2015. The population of the study were male nursing students (n=150). The sample consisted of 98 students who had agreed to participate in the study.

### **Measures and instruments:-**

Data was collected through a questionnaire which was developed by the researcher in the direction of the literature. The socio-demographical form included 14 questions, which included socio-demographical characteristics and those related to testicular cancer and testicular self-examination. The knowledge form included 22 questions, which also included general knowledge towards testicular cancer and testicular self-examination.

The students completed the socio-demographical form prior to study. They also completed the knowledge form, which include 4 question about testicular cancer, and 18 questions about the testicular self-examination before education. Afterwards, 30-minutes of training was given on testicular cancer and testicular self-examination. The Students were asked to fill out information forms again after this training.

### **Ethical considerations:-**

The required permission was taken from the administration of the Gümüşhane University Health School Nursing Department. The students were informed, and verbal consent was obtained.

### **Data analysis:-**

The descriptive statistics, means, median, frequencies, and percentages, were used to show the socio demographic characteristics of the students. The comparisons were made using the t test and Kruskal-Wallis H test for all the statistical analyses, and a 2 sided p value of less than 0.05 was considered statistically significant.

## **Results:-**

### **Socio Demographic Characteristics of Students:-**

The students mean age was  $21.12 \pm 1.82$ . There was no history of testicular cancer in the students' families. The students had spent the majority of their life in the city. It was determined that half of the students (50%) were living in the school dormitory, and 47% either in the family home, or with friends. Half of the students' mothers were primary school graduates (56.1%), but the vast majority of mothers were housewives (93.9%). Half of the students' fathers' were also primary school graduates, and 34.7% were labourers. The majority of the students' level of income was moderate (71.4%). The majority of those participating in the study were non-smokers (63.3%) and did not consume alcohol (92.9%) (Table 1).

**Table 1:-** Socio-demographic characteristics of students (n=98)

	<b>n</b>	<b>%</b>
<b>Class</b>		
1	28	28.6
2	26	26.5
3	19	19.4
4	25	25.5
<b>The occurrence of most of the living</b>		
Village	22	22.4
Town	27	27.6
City	49	50.0
<b>Current place of stay</b>		
In addition to family	3	3
Dormitory	49	50
At home with my friends	46	47
<b>Mother's education</b>		
Illiterate	23	23.5
Primary school	55	56.1
Secondary school	13	13.3
High school	5	5.1
University	2	2
<b>Mother's occupation</b>		
Housewife	92	93.9
Workers	6	6
<b>Father's education</b>		
Illiterate	7	7.2
Primary school	46	46.9
Secondary school	18	18.4
High school	21	21.4
University	6	6.1
<b>Father's occupation</b>		
Retired	23	23.5
Workers	34	34.7
Officer	20	20.3
Self-employment	21	21.5
<b>Level of income</b>		
Bad	21	21.4
Moderate	70	71.4
Good	7	7.1
<b>Smoking status</b>		
Yes	36	36.7
No	62	63.3
<b>Alcohol drinking status</b>		
Yes	7	7.1
No	91	92.9

**Testicular Cancer and Testicular Self-Examination:-**

58 of the students (59.2%) reported that they had knowledge about testicular cancer, and that they had acquired this information in undergraduate courses (54.1%). The students reported that they did not know how to perform a testicular self-examination (51%) and that they had never performed one either (68.4%). Only 13.3% of the group was found to have performed a regular monthly testicular self-examination (Table 2).

The students reported that the reason for not doing a testicular self-examination were; not knowing how to do a testicular self-examination (47.3%), a disregard for a testicular self-examination (27%), and the fear of discovering something negative during the testicular self-examination (25.7%) (Table 2).



**Table 2:**Information about Testicular Cancer and Testicular Self-Examination

	n	%
<b>Do you have information about testicular cancer?</b>		
Yes	58	59.2
No	40	40.8
<b>Where did you get the information about testicular cancer?</b>		
In undergraduate lessons	53	54.1
Newspapers and magazines	5	5.1
<b>Do you know how to do testicular self-examination?</b>		
Yes	48	49
No	50	51
<b>Do you do testicular self-examination?</b>		
Yes	31	31.6
No	67	68.4
<b>What is your time to do testicular self-examination?</b>		
Few times in a last year	15	35.7
Once in the last 6 months	14	33.3
Regularly each month	13	13.3
<b>What is your reason not to do testicular self-examination?</b>		
Don't know how to do testicular self-examination	35	47.3
Disregard of testicular self-examination	20	27.0
Fear from a bad thing during testicular self-examination	19	25.7

The mean for correct answers given in the test of knowledge by the participants before study was  $16.55 \pm 2.14$ , and  $18.22 \pm 2.93$  afterwards. This increase was statistically significant ( $p < 0.001$ ).

There was a significant difference between the students' class and level of knowledge before training ( $p = 0.03$ ) which showed the lowest mean score was for the lower class. There was a significant difference between the students' mothers' education and level of knowledge before training ( $p = 0.03$ ). Students whose mothers were university graduates, were found to have a lower mean score. After the study, there was not a significant difference between the students' class and the level of knowledge and between the students' mothers' education and level of knowledge (Table 3).

**Table 3:** Comparison of some socio-demographic characteristics with the average number of correct answers to given the knowledge test before and after education

			Before Education		After Education	
		n	mean	p	mean	p
Class	1	28	16.29	0.03*	18.10	0.81*
	2	26	14.84		17.88	
	3	19	17.05		18.26	
	4	25	17.08		18.68	
Mother's education	Illiterate	23	16.82	0.03*	17.86	0.20*
	Primary school	55	16.87		18.34	
	Secondary school	13	15.46		19.23	
	High school	5	15.60		16.60	
	University	2	14.00		16.50	

\*Kruskal-Wallis H test

## Discussion:-

The chances of curing testicular cancer are high if detected at an early stage. Early diagnosis is important in terms of being conscious individuals do testicular self-examination (Yılmaz et al., 2009; Ugurlu et al., 2011; Pinar et al., 2011). Thus, this study was planned to determine the knowledge and practices of university students regarding testicular cancer and testicular self-examination. It was also conducted to determine the exchange of knowledge through training.

Our study showed that 59.2% of the students had information regarding testicular cancer, and 54.1% had acquired this information in undergraduate courses. A study reported that 11.1% of the participants had knowledge concerning testicular cancer, and 5.6% of them received this information from school (Kuzgunbay et al., 2013). In our study, nursing students were considered to be better informed as a result of being a student.

Our study showed that 51% of the students did not know how to perform a testicular self-examination, and 68.4% of them had not performed one before. A study which questioned male university students on testicular cancer, identified that the participants were generally uninformed about testicular cancer risks and screening (Rovito et al., 2011). A study which surveyed 7304 college students throughout Europe, reported that 87% of the participants had never performed a testicular self-examination (Wardle et al., 1994). Göçgeldi and Koçak reported that 8.8% of the participants had performed testicular self-examination at least once in their lifetime (Göçgeldi and Koçak, 2010). Another study which was conducted in Turkey, showed that 3.3% of students knew how to do a testicular self-examination, and had performed one (Altinel and Avci, 2013). Referring to these studies; it can be observed that a higher proportion of our students do perform testicular self-examinations. This rate is affordably normal because they are nursing students. A study which was conducted on male nursing students reported that 89.4% of them did not know how to do a testicular self-examination (Asgar and Çam, 2014). According to this study on nursing students, it was determined that it is advantageous for our students to know how to perform a self-examination.

In our study, only 13.3% of the students had done a regular monthly testicular self-examination. A study which surveyed 7304 college students showed that only 3% of them performed a monthly self-examination (Wardle et al., 1994). Another study reported that 2.5% of the participants had performed a testicular self-examination, but only 1% of these had been performing it routinely once a month (Kuzgunbay et al., 2013). A study conducted in 2011 with 750 participants, showed that the ratio of regular testicular self-examination was found to be 1% (Ugboma and Aburoma, 2011). In a study conducted with university students, the rates for doing a regular testicular self-examination was found to be 2.5% (Uğurlu et al., 2011). Another study reported that the rates for performing a regular testicular self-examination was 4.3% (Özbaş et al., 2011). According to these studies, the result of our work was more positive than the aforementioned ones. However, a study conducted in England, in 2002, showed that the ratio of regular testicular self-examination performed was found to be 22% (Khadra and Oakeshott, 2002). These results may be considered similar to our result.

In our study, the students reported that the reasons for not doing a testicular self-examination were: not knowing how to do a testicular self-examination (47.3%), a disregard for testicular self-examination (27%) and a fear of finding something bad during a testicular self-examination (25.7%). A study conducted with 750 participants, reported that 27% of the men were afraid of detecting a lump, and thus declined doing a testicular self-examination (Ugboma and Aburoma, 2011). These results are similar to our study.

Our study showed that knowledge of testicular cancer and testicular self-examination was of a moderate level. A study which was conducted in Africa, reported that knowledge of testicular cancer and testicular self-examination was not common (Setdwe, 2014). Moreover, the other two studies reported that knowledge of testicular cancer and of testicular self-examination was low also (Rudberg et al., 2005; Vadaparampil et al., 2009). This difference is normal because it concurred with our study on the nursing students.

Our study showed that the education given to the participants regarding testicular self-examination contributed to the increase in the level of knowledge of the participants. Similar results were seen in the Göçgeldi and Koçak's study also (Göçgeldi and Koçak, 2010). Consequently, courses on testicular cancer and testicular self-examination will be held in order to raise awareness. This will certainly increase the amount of testicular self-examinations carried out by the male population.

### **Conclusion:-**

As a result of our study, the rate of men who knew how to perform a testicular self-examination, and who did this regularly, was found to be better than that in other studies. In fact, this ratio is better than the other study, but regarded as low for students making nursing their profession. It would be difficult to create an awareness in society on this issue in health care workers who have not performed a testicular self-examination regularly.

As a result, courses on the subject were found to be effective. We suggest that young men attending healthcare institutions for any reason, should be given opportunistic health education on testicular self-examination.

### References:-

1. Ferlay, J., Soerjomataram, I., Ervik, M., Dikshit, R., Eser, S., Mathers, C., et al. GLOBOCAN 2012 v1.0, Cancer Incidence and Mortality Worldwide: IARC Cancer Base No. 11 [Internet]. Lyon, France: International Agency for Research on Cancer; 2013. [Cited 28.01.2014] Available from URL: <http://globocan.iarc.fr>
2. The Ministry of Health of Turkey Cancer Statistics Yearbook 2010. [Cited 25 June 2015] Available from URL: [http://kanser.gov.tr/Dosya/ca\\_istatistik/2010\\_Yili\\_Turkiye\\_Kanser\\_istatistikleri.pdf](http://kanser.gov.tr/Dosya/ca_istatistik/2010_Yili_Turkiye_Kanser_istatistikleri.pdf).
3. Albers, P., Albrecht, W., Algaba, F., Bokemeyer, C., Cohn-Cedermark, G., Fizazi, K., et al., 2015. Guidelines on testicular cancer. EAU 1,1–52.
4. Kuzgunbay, B., Yaycioglu, Ö., Soyupak, B., Kayis, A., Ayan, S., Yavascaoglu, I., et al., 2013. Public awareness of testicular cancer and self-examination in Turkey: A multicenter study of Turkish Urooncology Society. Urologic Oncology: Seminars and Original Investigations 31,386–391.
5. American Cancer Society. (2013). Survival rates for testicular cancer. [Cited 25 June 2014] Available from URL: <http://www.cancer.org/cancer/testicularcancer/overviewguide/testicular-cancer-overview-survival-rates>.
6. Kuzgunbay, B., 2014. The Status of Testicular Self-Examination in the Early Diagnosis of Testicular Cancer: Conjunction in the World and in Turkey. Bulletin of Urooncology 13,127-129. (in Turkish)
7. Göçgeldi, E., Koçak, N., 2010. Evaluation of the education given to the young adult males about testicular self examination. Gülhane Tıp Derg 52, 270-275. (in Turkish)
8. Khadra, A., Oakeshott, P., 2002. Pilot study of testicular cancer awareness and testicular self-examination in men attending two South London general practices. Family Practice 19, 294-296.
9. Brenner, J.S., Hergenroeder, A.C., Kozinetz, C.A., Kelder, S.H., 2003. Teaching testicular self-examination: Education and practices in pediatric residents. Pediatrics 111, 239-244.
10. Casey, R.G., Grainger, R., Butler, M.R., McDermott, T.E., Thornhill, J.A., 2010. Public awareness of testis cancer and the prevalence of testicular self-examination-changing patterns over 20 years. Urology 76, 915-918.
11. Yılmaz, E., Koca, Kutlu, A., Çeçen, D., 2009. The Knowledge, Attitude and Behaviors School of Health Students related Testicular Cancer and Testicular Self Examination. Fırat Sağlık Hizmetleri Dergisi 4, 72-85. (in Turkish)
12. Ugurlu, Z., Akkuzu, G., Karahan, A., Beder, A., Dogan, N., Okdem, S., et al., 2011. Testicular cancer awareness and testicular self-examination among university students. Asian Pac J Cancer Prev 12, 695-698.
13. Pinar, G., Öksüz, E., Beder, A., Elbaş, N., 2011. Reliability and validity of the Turkish adaptation of the Champion's health belief model scale at testicular cancer screening. Tıp Araştırmaları Dergisi 9(2), 89-96. (in Turkish)
14. Rovito, M.J., Gordon, T.F., Bass, S.B., Ducette, J., 2011. Perceptions of testicular cancer and testicular self-examination among college men: a report on intention, vulnerability, and promotional material preferences, Am J Mens Health 5(6), 500-507.
15. Wardle, J., Steptoe, A., Burckhardt, R., Vögele, C., Vila, J., Zaczynski, Z., 1994. Testicular self examination: attitudes and practices among young men in Europe. Prev Med 23, 206–10.
16. Altınel, B., Avci, İ., 2013. The Knowledge, Beliefs and Practices of University Students on Testicular Cancer and Testicular Self-Examination. TAF Prev Med Bull 12(4), 365-370. (in Turkish)
17. Asgar Pour, H., Çam, R., 2014. Evaluation of Men's Knowledge, Attitude and Behavior About Testicular Self-Examination and Testicular Cancer. FN Hem Derg 22(1), 33-38. (in Turkish)
18. Ugboma, H.A., Aburoma, H.L., 2011. Public awareness of testicular cancer and testicular self-examination in academic environments: a lost opportunity. Clinics (Sao Paulo) 66, 1125-1128.
19. Özbaş, A., Çavdar, İ., Findik, Ü.Y., Akyüz, N., 2011. Inadequate knowledge levels of Turkish male university students about testicular self-examination. Asian Pac J Cancer Prev 12, 919-922.
20. Setswe, G., 2014. Gender Differences in Knowledge of Testicular Cancer among Students at a South African University. Palliat Med Nurs Open Access 1, 107.
21. Rudberg, L., Nilsson, S., Wikblad, K., Carlsson M., 2005. Testicular cancer and testicular self-examination: knowledge and attitudes of adolescent Swedish men. Cancer Nurs 28, 256–62.
22. Vadaparampil, S.T., Moser, R.P., Loud, J., Peters, J.A., Greene, M.H., Korde, L., 2009. Factors associated with testicular self-examination among unaffected men from multiple-case testicular cancer families. Hered Cancer Clin Pract 7, 11–21.

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### RESEARCH ARTICLE

## A STUDY OF TORSIONAL EFFECT ON MULTI-STORIED BUILDING WITH PLAN-IRRREGULARITY.

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Asymmetrical building, Earthquake, Torsion, Response Spectrum, Remedies on torsion & Better solution.

#### Abstract

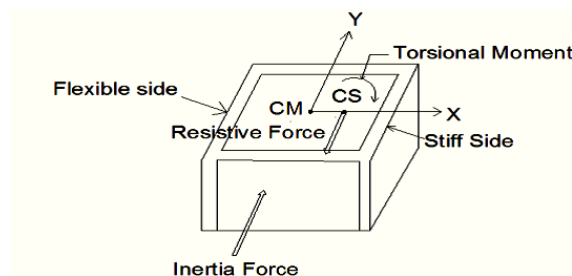
In this paper seismic performance of multistory building is checked with asymmetrical plan. At re-entrant corner maximum damage is occurred during earthquake. A G+20 and G+22 building having plan asymmetry is modeled in finite element analysis using STADD-Pro v8i. Accidental torsional load is applied with reference to 1893(part-1)-2002. In this paper we provide architectural relief and providing shear wall at re-entrant corner in the buildings.

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#### Introduction:-

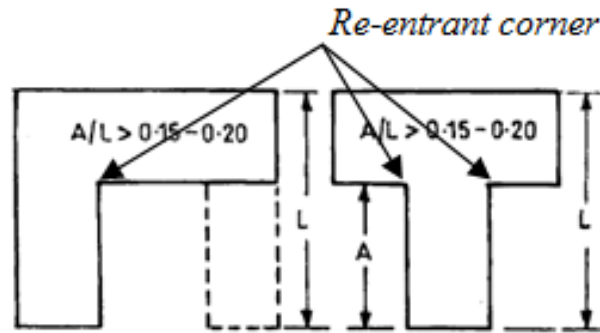
A building should possess four main attributes, namely simple and regular configuration, and adequate lateral strength, stiffness and ductility to perform well in earthquake. Buildings having simple regular geometry and uniformly distributed mass and stiffness in plan as well as in elevation, suffer much less damage than buildings with irregular configurations. But due to architectural consideration we have to construct buildings with irregular according to 1893 clause 7.1 irregular define in two ways plan irregularities and vertical irregularity.

Torsion is caused in building during earthquake due to various reasons, mainly due to non-symmetric mass distribution and stiffness. Torsion is generated in asymmetrical building when the distance between storey's center of rigidity and storey's center of mass is greater than 20% of the width of the structure in either major plan dimension. In torsion irregularity, inertia force acts through the center of mass while the resistive force acts through the center of rigidity as shown in fig 1.



**Fig 1:-** Generation of torsional moment in asymmetric structures

The torsion will be developed at Re-entrant corners in L-shape and T-shape Building. The Re-entrant corner, lack of continuity corner is the common characteristic of overall building configuration that in plan. L-shape and T-shape occurs due to lack of tensile capacity and force concentration. According to IS-1893(Part1)-2002, Plan configurations of a structure and its lateral force resisting system contain re-entrant corners, where both projections of the structure beyond the re-entrant corner are greater than 15 percent of its plan dimension in the given direction. In fig 2 shows differential motion between different parts of building, resulting in local stress concentration at the notch of the re-entrant corners.



**Fig 2:-** Examples of building with plan irregularities

There are many remedies to avoid the torsion irregularity are as follows

1. By providing shear wall.
2. By providing uniform box
3. By providing Architectural Relief
4. By providing Diagonal Reinforcement

There are many research carried out on the torsional behavior of building. They give the better solution to avoid the torsion. But they didn't apply it on actual building. In my research paper work, I have applied the solution such as shear wall and architectural relief providing to the building. By analysis I observed that architectural relief is better solution.

### Objectives

1. To study the torsional effect due to plan irregularity on L-Shape Multi-Storied Building at Re-entrant corner.
2. To study the torsional effect due to plan irregularity on T-Shape Multi-Storied Building at Re-entrant corner.
3. To discuss remedies for torsion irregularities and giving optimize solution for cases as per IS 1893(Part-I)-2002.

### Literature Review:-

1. Mr. Sandesh N. Suryawanshi<sup>1</sup>, Prof. S. B. Kadam<sup>2</sup>, Dr. S. N. Tande<sup>3</sup>(2014)“Torsional Behavior of Asymmetrical Buildings in Plan under Seismic Forces”

In this paper tells us about the torsional behavior of asymmetric building subjected to ground motion using Response Spectrum method. Then he used the non-linear push over analysis has been used to find the structural description.

In this paper the gravity load analysis & lateral load analysis as per the seismic code IS 1893(part-1):2002 is carried out for three building one is symmetric and other two are asymmetric in plan for variation in building height. Determining the torsional moment, Base shear, displacement & time period by Response spectrum method & there capacity & demand is equivalent using non-linear push over analysis. This paper concluded that time period and base shear calculation by using equivalent static method is approximately equal with response spectrum method in SAP. It also concluded that torsional moment is more in the asymmetry building so beam and column are necessary to design considering torsional moment. The base shear and roof displacement of asymmetry building is more than symmetrical building. By using push over analysis performance of symmetrical building is better than asymmetrical building.

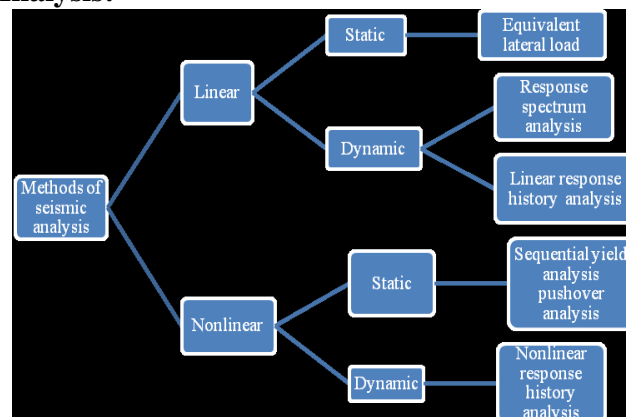
**Prof. Wakchaure M. R<sup>1</sup>, Nagare Y U<sup>2</sup> (2013) “Effect of Torsion Consideration in Analysis of Multi Storey frame”**

This paper tells that the study on the influence of the torsion effects on the behavior of structure is done. In this paper two building are considered one is without considering torsion and other is considering the torsion. The building is analyzed and design using method and as per IS1893 (part1):2002. the result are compared in terms % Ast in column. This paper concluded that In the asymmetric building second building, that is without considering torsion, it was observed that the area of steel in the beams at critical stage are much smaller than those obtained in the case of first building, that is with considering torsion. The bottom bars should be more critical, because they seem to be subjected to more tension than the top bars therefore torsional behavior of asymmetric building is one of the most frequent source of structural damage and failure during strong ground motions. He also concluded that the torsion is the most critical factor causes damage in building, so the irregular buildings are analyzed for torsion.

**M.D. Bensalah, M. Bensaibi, A. Modaressi, (2012) “Assessment of the Torsion Effect in Asymmetric Buildings under Seismic Load”**

This paper studied on the influences of torsional effect on the behavior of the structure. In this paper two buildings are considered one symmetrical and other un-symmetrical building in terms of rigidity. He focused on some parameter such as displacement, ductility, reduction factor and dynamic non accidental eccentricity. This paper concluded that lateral yielding strength in terms of capacity of asymmetric structure is higher than symmetrical structure. The ductility increases with increasing input motion (Arias intensity) and decrease with increasing predominant period with significant variation in asymmetrical structure than those symmetrical structures. The reduction factor decreases when the dominant period of the earthquake increases.

**Methods for Seismic Analysis:-**



**Fig 3:- Methods of seismic analysis**

The method of analysis used here is Response Spectrum method and analysis using Stadd-Pro.

**Linear static method:-**

The linear static method also known as Equivalent Static Method is used to estimate the demand for the buildings whose response is particularly dominated by the first mode and expected to behave in elastic range. In this method the lateral loads are calculated based on the fundamental period of the structural and applied on the design centre of mass at every floor level and the demands are estimated. The magnitude of these pseudo lateral loads has been selected with the intention that when applied to the linearly elastic model of the building, it will result in design displacement expected during the design earthquake.

If the building responds elastically to the design earthquake, the calculated internal forces will be reasonable approximation of those expected during the design earthquake. If the building Responds in elastically to the design earthquake as is quite common in most of the cases, the actual internal forces that would develop in the yielding building will be less than the internal forces calculated using the pseudo lateral load.

To take these inelasticity account the Response reduction factor (R) is used to calculate the reduced forces. IS1893:2002 uses the empirical formulae to estimate the fundamental time period of the structure. It is used for spectral acceleration determination from the response spectrum, which in turn is used for the calculation of Base

shear modified by some coefficient. Then this base shear is distributed in the parabolic fashion along the height of building. The effect of the torsion is taken into consideration by calculating the design center of mass by means of design eccentricity.

Design eccentricity is the sum of the actual eccentricity (distance between centre of mass and centre of rigidity at floor level) and accidental eccentricity (5% of the horizontal dimension at the given floor level measured perpendicular to the direction of the applied load). For two dimensional modeling the design forces are suitably increased to account for torsion.

#### **Linear Dynamic Method:-**

For the building whose response is dominated by more than one mode, the Linear Dynamic Method is used to estimate the demand of the structure. There are two ways to carry out the Linear Dynamic Analysis.

1. Response Spectrum Method
2. Time History Method

#### **Response Spectrum Method:-**

In this method the load vectors are calculated corresponding to predefined number of modes. These load vectors are applied at the design centre of mass to calculate the respective modal responses. These modal responses are then combined according to SRSS or CQC rule to get the total response. From the fundamentals of dynamics it is quite clear that modal response of the structure subjected to particular ground motion, is estimated by the combination of the results of static analysis of the structures subjected to corresponding modal load vector and dynamic analysis of the corresponding single degree of freedom system subjected to same ground motion. Static response of MDOF system is then multiplied with the spectral ordinate obtained from dynamic analysis of SDOF system to get that modal response.

#### **Time History Analysis (Response History Analysis):-**

Dynamic analysis using the time history analysis calculates the building responses at discrete time steps using discredited record of synthetic time history as base motion. If three or more time history analyses are performed, only the maximum responses of the parameter of interest are selected.

#### **Non-linear Static Method:-**

This can be defined as the procedure in which the structure (taking into account the material nonlinearity) is pushed till collapse to generate the pushover curve, which is then used to estimate the target displacement at which the response quantity is extracted from the deformed modal. This is discussed later in detail.

#### **Non-linear Dynamic Analysis:-**

This is the most accurate method to determine the seismic responses of structures. In this method the structure is subjected to actual ground motion which is the representation of the ground acceleration vs. time. The ground acceleration is determined at small time step to give the ground motion record.

Then the structure response is calculated at every time instant, to know its time history and the peak value from this time history is chosen to be the design demand. Hence "a Mathematical model directly incorporating the nonlinear characteristic of individual component and element of the building shall be subjected to earthquake shaking represented by ground by ground motion time history to obtain forces and the displacement"(FEMA 356 & FEMA 273).

#### **Using Stadd-Pro:-**

In the analysis of the building we consider the accidental torsion in Stadd-Pro. In Stadd-Pro uses the Finite Analysis Method.

#### **Building Details:-**

In the present study the seismic load analysis and lateral load analysis as per the seismic code IS 1893 (Part 1): 2002 are carried out. For Two Buildings, one is L-Shape and other T-shape asymmetric in plan for building height G+20 and G+22 for comparison criteria is that numbers of columns are kept same for all three buildings and an effort is made to study the effect of seismic loads on them also determine torsional moments, base shear, displacement and time period by using response spectrum method.

Problem statement –A G+20 and G+24 storied bare RC Ordinary Moment Resisting Frame has plan as shown in fig. is situated in seismic zone III

A) T-shape Building -

In X-direction-6 Bays of 5m @30m

In Z-direction- 6Bays of 5m @30m

B) L-shape Building

In X-direction- 6Bays of 5m @30m

In Z-direction- 8Bays of 5m@40m

Beam size - 0.23m x 0.45m

Column size - 0.23m x 0.45m

Thickness of slab- 150mm

Height of storied – 3m

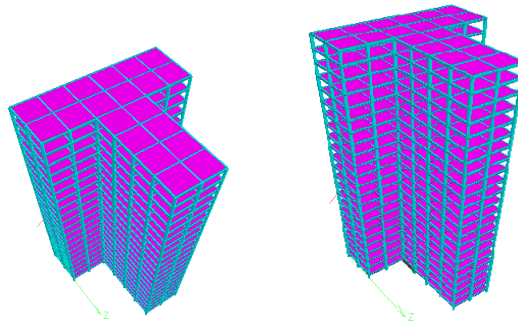
Plinth height above GL – 1.5m

Unit weight of concrete – 25kN/m<sup>3</sup>

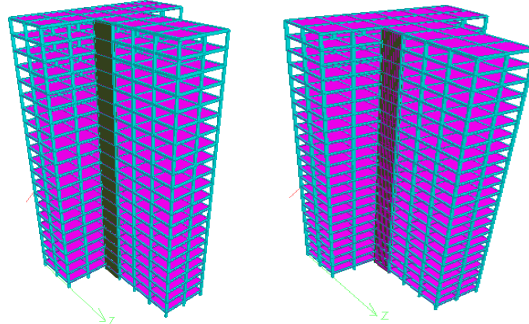
Live load – 3kN/m<sup>2</sup>

Grade of concrete – M20

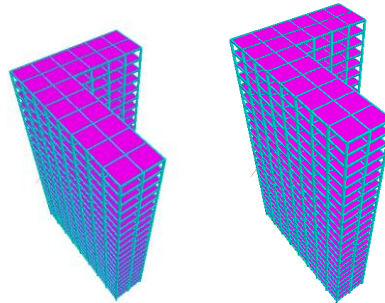
Grade of Steel – Fe415



**Fig 4:-** (a). T-Shape G+20 and G+22 Building without shear wall.

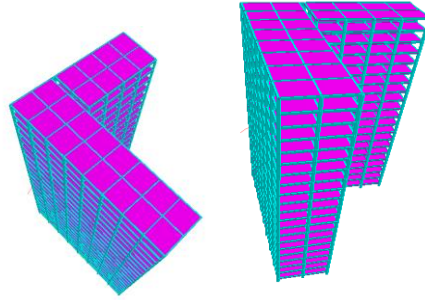


**Fig 4:-** (b). T-Shape G+20 and G+22 Building with shear wall



**Fig 4:-** (c). L-Shape G+20 and G+22 Building





**Fig 4:-** (d). L-Shape G+20 and G+22 Building with architectural relief

### Result and Discussion:-

**Table 1:-** (a) Results of L-Shape, G+20 storied building by using STADD-Pro.

G+20 Storied building	By using software STADDPRO Response Spectrum Method		
	Seismic weight (KN)	Time Period(Sec)	Base Shear(KN)
L-Shape	66255.94	0.87	1378.12
L-Shape with Architectural Relief	67356.25	0.875	1394.27

**Table 1:-** (b) Results of L-Shape, G+20 storied building by using STADD-Pro.

G+20 Storied building	Displacement(mm)	Torsional Moment (kN-mm)
L-Shape	129.091	11226
L-Shape with Architectural Relief	128	7063

**Table 2:-** (a) Results of L-Shape, G+22 storied building by using STADD-Pro.

G+22 Storied building	By using software STADDPRO		
	Seismic weight (KN)	Time Period(Sec)	Base Shear(KN)
L-Shape	72579.62	0.87	1509.65
L-Shape with Architectural Relief	73881.18	0.875	1529.34

**Table 2:-** (b) Results of L-Shape, G+22 storied building by using STADD-Pro.

G+22 Storied building	Displacement(mm)	Torsional Moment (kN-mm)
L-Shape	165.699	11269
L-Shape with Architectural Relief	164.397	7090

**Table 3:-** (a) Results of T-Shape, G+20 storied building by using STADD-Pro

G+20 Storied building	By using software STADDPRO		
	Seismic weight (KN)	Time Period(Sec)	Base Shear(KN)
T-Shape	55373.61	1.01	996.72
T-Shape with Shear wall	58996.92	0.84	1964.52

**Table 3:-** (b) Results of T-Shape, G+20 storied building by using STADD-Pro.

G+20 Storied building	Displacement(mm)	Torsional Moment (KN-mm)
T-Shape	81.519	5894
T-Shape with Shear wall	80.959	5160

**Table 4:-** (a) Results of T-Shape, G+22 storied building by using STADD-Pro.

G+22 Storied building	By using software STADDPRO		
	Seismic weight (KN)	Time Period(Sec)	Base Shear(KN)
T-Shape	60658.79	1.01	1091.85
T-Shape with Shear wall	64634.62	1.01	1163.42

**Table 4:-** (b) Results of T-Shape, G+22 storied building by using STADD-Pro.

G+22 Storied building	Displacement(mm)	Torsional Moment (kN-mm)
T-Shape	99.722	6085
T-Shape with Shear wall	96.363	5669

**Table 5:-** (a) Results of L-Shape, G+24 storied building by using STADD-Pro.

G+24 Storied building	By using software STADDPRO		
	Seismic weight (KN)	Time Period(Sec)	Base Shear(KN)
L-Shape	78903.3	0.87	1641.18
L-Shape with Architectural Relief	80416.73	0.875	1664.62

**Table 5:-** (b) Results of L-Shape, G+24 storied building by using STADD-Pro.

G+24 Storied building	Displacement(mm)	Torsional Moment (KN-mm)
L-Shape	202.318	11630
L-Shape with Architectural Relief	200	7511

**Table 6:-** (a) Results of T-Shape, G+24 storied building by using STADD-Pro.

G+24 Storied building	By using software STADDPRO		
	Seismic weight (KN)	Time Period(Sec)	Base Shear(KN)
T-Shape	65943.96	1.01	1186.99
T-Shape with Shear wall	70273.41	0.875	1264.92

**Table 6:-** (b) Results of T-Shape, G+24 storied building by using STADD-Pro.

G+24 Storied building	Displacement(mm)	Torsional Moment (kN-mm)
T-Shape	124.22	6105
T-Shape with Shear wall	123	5804

### Discussion:-

- 1) As the height of L-shape building increases, there is increases in the base shear by 9.54% from the results tabulated in table 5(a) & 6(a).
- 2) The torsional moment in L- Shape building decreases using architectural relief by 37% from results tabulated in table 1(b).

### Conclusions:-

In this paper modeling of multistoried building with plan irregularity is done. In accordance with IS1893-2002 for simulation purpose finite element analysis STADD-Pro V 8i is used following conclusions are formed after studying T-shape and L-shape Building with variation of height.

- 1) Increase in height of L-shape building directly increase in relative displacement & stress at re-entrant corners
- 2) Architectural Relief is given for L-Shape building relatively considerable decrease in displacement and also decrease in stresses at re-entrant corners.

- 3) Increase in height of T-shape building directly increase in relative displacement and stress will be developed at re-entrant corner.
- 4) A T-shape building with shear wall and without shear wall is analyzed and it is observed that nodal displacement and beam displacement reduced comparatively but stresses at re-entrant corners does not vary
- 5) In T- shape building shear wall must be provided at re-entrant corners only
- 6) Architectural Relief is the better solution on the re-entrant corner on which maximum earthquake damage is done.
- 7) The torsional moment in symmetrical building is very less as compared with unsymmetrical building.

**References:-**

1. Mr. Sandesh N. Suryawanshi<sup>1</sup>, Prof. S. B. Kadam<sup>2</sup>, Dr. S. N. Tande<sup>3</sup>,(2014), Torsional Behaviour of Asymmetrical Buildings in Plan under Seismic Forces, Volume 2, 170-176
2. Dr. B. G. Naresh Kumar, Avinash Gornale and Abdullah Mubashir “Seismic Performance Evaluation of R c-Framed Buildings - An Approach to Torsionally Asymmetric Buildings” IOSR Journal of Engineering (IOSRJEN) ISSN: 2250-3021 Volume 2, Issue 7(July 2012), PP 01-12
3. Mahdi & V. Soltangharaie “Static and Dynamic Analyses of Asymmetric Reinforced Concrete Frames” 15 WCEE, LISBOA 2012
4. Sachin G. Maske, Dr. P. S. Pajgade “Torsional Behaviour of Asymmetrical Building” International Journal of Modern Engineering Research (IJMER) www.ijmer.com Vol.3, Issue.2, March-April. 2013 pp-1146-1149 ISSN: 2249-664
5. IS:1893(Part-1):2002 Criteria for earth quake resistant design of structure,



### RESEARCH ARTICLE

#### TO STUDY THE NECESSITY AND SPECIAL TECHNIQUES USED FOR FORT REHABILITATION.

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#### Abstract

This Paper discuss about need of fort rehabilitation and techniques used for fort rehabilitation. In order to pass on to future generations what is currently identified as being of cultural significance today, we must imbibe good conservation practices especially for the heritage buildings in order to prevent them from deterioration and extend the life and basic functions of these buildings. Heritage buildings were constructed in the past that have high historical, architectural, spiritual, social, political and economical values. Similarly heritage buildings are highly valuable and informative in terms of socio-cultural, socio-political, socio-economical and even technological activities of a specific society or group of individual. we need to prevent deterioration of fort and use the special techniques for fort rehabilitation

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#### Introduction:-

Forts have been created for thousands of years and they are often the most durable and famous symbols of ancient civilizations. These are the icons of the nation having their own cultural and historic values therefore, it is very essential to conserve them. Forts which have no further utilization tend to decay rapidly, while which are still in use have a better chance of being maintained. Rehabilitation involves contribution of high end technology, advanced skills and calculations. This is a very responsible job of saving hazardous failure of structures due to deterioration. The success in rehabilitating the structure totally depends on gaining expertise in the field and day to day advancements. Rehabilitation is highly recommended for age-old buildings showing signs of decay and save human lives from failures.

#### Types of fort:-

Traditionally the Forts in Maharashtra were of the following types:

##### Hill Forts:-

The hill forts were constructed from stones carved out from the very mountains and joined with the help of lime, rubble, gravel, stones, bricks, molten metal and sand. Lime mortar was ground on the fort itself with the help of a roller passing through a circular channel. The stones formed the outer layer of the fort. Stone layers were often sandwiched between earth, rubble and mortar. At several places the stones appear joint in the male female format devoid of any use of mortar. The stones were joined by mortar. There were even instances of molten metal used to fill up fissures and strengthen the construction. Together they gave a construction that's lasted for centuries.

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**Land Fort:-**

These forts were created on the plains. In Marathi they were called Bhuikot. e.g Chakan fort, Bahadurgad, Solapur fort, Ahmednagar fort etc

**Sea Fort:-**

These forts were created in the middle of the sea at a shallow point with a solid foundation base and protected by its vicious waves. In Marathi they were called 'JalDurg'. Ch. Shivaji was quick to realize the importance of sea forts. They provided a efficient base for controlling sea traffic and trade. e.g Janjeera, Sindhudurg, Padmadurg, Khanderi , Underi etc.

**Forest Fort:-**

These forts were created amidst a dense jungle, protected by the trees, the reptiles and wild animals. They were the 'Vana Durg'. e.g Javali.

**Human Fort:-**

Human war formations, encampments often resembled forts. These were the 'Nar Durg'. Barring the last which is a type of a field fortification.

**Causes of Deterioration of Fort:-****Natural Factors:-****Floods:-**

Floods can cause massive damage where forts are being destroyed by nature's water pressure. Though some might dry out, yet the moisture remaining within the floors, walls and roof may cause serious mold problems that will eventually wear the building away and create health dangers.

**Biological Factors:-**

Biological agencies such as mosses, fungus, algae, and insects affect construction materials like timber, bricks, stucco etc. Biological agencies attack generally wet timber that has over 20% moisture contents. Wet timber decomposes in damp condition, and once germination occurred it enters cracks and spreads fast making the timber to loose cellulose, thereby loosing its strength and shape which results in cracks, shrinkages and loose fittings.

**Moisture:-**

Moisture is regarded as a key agent causing gradual deterioration of Fort. It can be in solid, liquid or vapor form and it is always present in the atmosphere. When the surface temperature falls, condensation occurs and this can cause severe damages to heritage buildings.

**Ground salts and water:-**

Soluble salts are a principal agent of decay in porous building materials and a source of great frustration to those involved in the conservation of historic buildings. The behavior of salts may seem unpredictable since they can remain dormant for long periods and then suddenly become active causing damage and disfiguring historic fabric. In other cases the action of salts is progressive, weakening surfaces on a microscopic level over decades and centuries, causing natural erosion of the kind that would occur to stone in a quarry face. Weathering of Natural Building Stones and his description remains the most comprehensive source on the subject, outlining all the essential facts, the salts typically found and the mechanisms of crystallization and decay. Ground water table and salinity i.e. higher salt loads on building materials, for example due to capillary rising damp from the soil. The higher salt load may lead to faster decay of heritage building materials.

- Both increasing and decreasing ground water tables.
- Increasing salt concentration in ground water.

**Windstorm:-**

Wind primarily causes loading and mechanical damage to structures and materials. Windstorm damaged roofs was quiet often recorded in the past at is still as a major threat to historical structures. Most of the damage caused by the strong winds concerned the roof covering. Wooden shingles were much more resistant than for example ceramic of slate tiles.

**Social Factors:-****Fire**

Fire has long been enemy of heritage buildings. Uncontrolled fire can cause an entire destruction of heritage buildings and its contents in only a few hours and its major effect is the potential loss of authenticity. Although the destroyed parts of the buildings can be replicated, the loss of the original historic fabric takes away from the building the cultural significance which makes it unique and important.

**Urban Development:-**

Large urban scale development has continued to threaten the existence of heritage buildings in the region for a long time. Many heritage buildings are being demolished to pave way for the construction of wider roads, schools, hospitals, shopping malls and parking. Some of these buildings, especially those located in the central business district, have been under threats of demolition from the public and private developers seeking more lucrative ventures only.

**Vandalism:-**

It is the behavior attributed originally to the Vandals, in respect of culture: ruthless destruction or spoiling of anything beautiful or venerable. The term also includes criminal damage such as graffiti and defacement directed towards any property without permission of the owner.

**Literature Review:-**

During last few decades lot of research has been carried out to discuss the special techniques for rehabilitation of fort. In this chapter the research work carried out by various by researchers on Rehabilitation of fort for better understanding of the present work.

**Necessity of Rehabilitation:-**

In this paper for the rehabilitation of any heritage structure or monument, first of all the grade of the building should be taken into account. Depending upon the grade of that structure, the rehabilitation program should be planned with the permission of Heritage Conservation Committee. Secondly, engineers should be aware of the materials available in the market. Engineers should select proper material and technique for the rehabilitation of the particular monument so that its aesthetic look is not changed. Properties of the old materials and new should match each other. All conditions of using the new materials should be suitable. For strengthening of members materials like FRP can be useful rather using jacketing of the members. Epoxy can be used for better strengthening instead of using cementations grout. While using these materials or techniques, compatibility of the new materials with old materials should be checked properly. And a periodic maintenance should be adopted. (Mulani and Kumthekar, 2015).

Egypt with its long distinctive history as the oldest civilization of the world and has hosted most of other civilizations; has a unique historical patrimony of buildings and sites that are considered a world heritage and need to be conserved. However, with the huge amount of these historical building and sites, which need substantial investments for conservation, the problem of prioritization comes on the surface. Rehabilitation and conservation strategies should aim to avoid the idea of static preservation, and not attempt to fossilize the past and convert it into a sort of open-air museum. Therefore, there is an urgent need for rehabilitation approaches which, maintain and sustain the essential qualities of the historical areas in old cities and of the life of the resident communities, but which can also adapt these physical structures and organic approach of revitalization is needed. Adaptation of form and function can proceed, however, within a stable matrix of building and urban patterns. Selectivity is crucial. This implies, for example, a choice of new design concepts and relevant new technologies to enable older buildings and areas to adapt successfully to modern needs but without destroying existing urban form. (Ayman and Nour, 1964).

The existing buildings nearing its serviceability life and showing sign of breakdown does calls for technical intervention for enhancing their life and to avoid any accidental failure due to seismic event or other structural reason. The deterioration of the structures takes place due to weathering action, Fire, Natural calamities like earthquake, Flood, Tsunami, cyclones, Soil and structure interaction, defects in construction and many more. Post the technical evaluation of such structures, the decision to repair or replace a structure or its component has to be taken. This has to be in compliance with economy, construction feasibility and as per latest trends and techniques. The approach towards rehabilitation of any building can be categorized in following steps and actions. Evaluating various retrofitting options, materials, feasibility and economy, Performing structural calculations and capacity

demand ratio for structural members, Suggesting retrofitting/construction system and getting the rehabilitation of the building done, Post retrofitting tests on the building.(Chandar, 2014)

In this paper it is discussed that India has a very rich historic background which is evident from various buildings, forts, temples, landscapes, objects of historic era. Many of these were constructed several hundred years ago when the Indian Civilization was at its peak. Their architecture, design and construction at the time when computers, code of practice, design guidelines, research institutions and modern construction techniques did not exist makes one to realize the wisdom and expertise of our forefathers. These structures have managed to survive for hundreds of years while most of the modern constructions need repair after couple of years of service. Physical materials of an earlier time, that might have been state of the art at the time of construction, might have failed and now need replacement with contemporary better functioning, but aesthetically similar materials. Such reasons make it mandatory to instigate a systematic approach in the area of heritage conservation. Deterioration of the structure may be caused due to various reasons, some of which are long life, lack of maintenance, unchecked growth of trees and creepers on the structures, improper drainage system, irregular inspection, material deterioration and weathering effect etc. Also, modern codes and building standards, observance of cultural context, conservation criteria, attainable benefit, traditional and innovative methods etc. pose major challenges in restoration of heritage structure. The best therapy to reduce decay is preventive maintenance. Adequate maintenance can limit or postpone the need for subsequent intervention. The choice between “traditional” and “innovative” techniques should be weighed up on a case-by-case basis and preference given to those that are least invasive and most compatible with heritage values, bearing in mind safety and durability requirements. The removal or alteration of any historic material or distinctive architectural features should be avoided whenever possible. Deteriorated structures whenever possible should be repaired rather than replaced.(Sandbhor and Botre, 2013)

### **Methodology:-**

For carrying out the proposed work, following methodology will be adopted for data collecting and analysis.

1. Collection of relevant research data from national and international journals, web source etc.
2. Physically visiting the forts & collecting information.
3. Interviewing the personal associated with rehabilitation.

Interviewing the personal associated with the archeological department to study the feasibility the various materials recently developed in market

### **Techniques Used In Fort Rehabilitation:-**

There are new materials and techniques which can be used for rehabilitation work .By this new technique the work can be done in a perfect way. Some of the techniques and material are as follows:

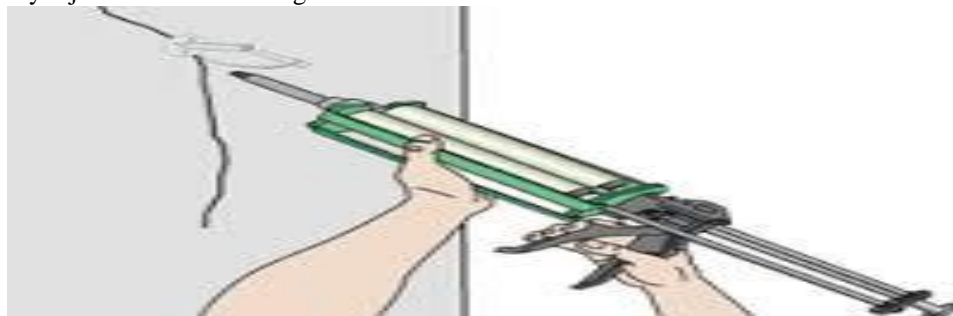
1. Epoxy injection
2. Guniting or Shotcrete
3. Mortar repair for cracks
4. Foamed concrete
5. Mortar and dry pack
6. Vacuum Concrete
7. Shoring and underpinning
8. Repointing
9. Grouting Techniques

### **Epoxy injection:-**

Resin injection is based to repair concrete that is cracked or delaminated and to seal cracks in concrete to water leakage. Two basic types of resin and injection techniques are used to repair concrete; epoxy resins and polyurethane resins. Epoxy resins cure to form solids with high strength and relatively high module of elasticity. These materials bond readily to concrete and are capable, when properly applied, of restoring the original structural strength to cracked concrete. The high modules of elasticity causes epoxy resin systems to be unsuitable for rebonding cracked concrete that will undergo subsequent movement. The epoxies, however, do not cure very quickly, particularly at low temperatures, and using them to stop large flows of water may not be practical. Cracks to be injected with epoxy resins should be between 0.005 inch and 0.25 inch in width. It is difficult or impossible to inject resin into cracks less than 0.005 inch in width, while it is very difficult to retain injected epoxy resin in cracks greater than 0.25 inch in width, although high viscosity epoxies have been used with some success Epoxy resins

cure to form relatively brittle materials with bond strengths exceeding the shear or tensile strength of the concrete. If these materials are used to rebound cracked concrete that is subsequently exposed to loads exceeding the tensile or shear strength of the concrete, it should be accepted that the cracks will recur adjacent to the epoxy bond line. In other words, epoxy resin should not be used to rebond “working” cracks. Epoxy resins will bond with varying degrees of success to wet concrete, and there are a number of special techniques that have been developed and used to rebond and seal water leaking cracks with epoxy resins. These special techniques and procedures are highly technical and, in most cases, are proprietary in nature. Polyurethane resins are used to seal and eliminate or reduce water leakage from concrete cracks and joints. They can also be injected into cracks that experience some small degree of movement. Such systems, with the exception of the two-part solid polyurethanes, have relatively low strengths and should not be used to structurally rebond cracked concrete. Cracks to be injected with polyurethane resin should not be less than 0.005 inch in width. No upper limit on crack width has been established for the polyurethane resins at the time this is being written. Polyurethane resins are available with substantial variation in their physical properties. Some of the polyurethanes cure into flexible foams. Other polyurethane systems cure to semi-flexible, high-density solids that can be used to rebond concrete cracks subject to movement. Most of the foaming polyurethane resins require some form of water to initiate the curing reaction and are, thus, a natural selection for use in repairing concrete exposed to water or in wet environments. At the time this is written, there are no standard specifications for polyurethane resins equivalent to the standard specification for Epoxy-Resin-Base Bonding Systems for Concrete.

The injections in cracks, internal or at the face, of a masonry wall are a solution of strengthening that is irreversible. They are, however, used frequently because, they preserve the original aspect of the exterior of the wall. It is particularly indicated for the rehabilitation of the masonry that has internal cracks connected between them. For this solution a cementitious based grout is used or a hydraulic based grout or others such as organic resins based grout. This solution is based on the injection in holes previously made with injection tubes and spread throughout the wall, to fill with the grout the internal cracks. For the external Cracks the coating should be removed previously and the Injection tubes may be used the aggregate grading of the grout depends on the size of the cracks but it can be used a grout without the sand. This technique shows improvements in the mechanical characteristics of the masonry. It seems a better application in stone masonry. To deliver a specific injection grout one must carry on in-situ and laboratory tests to refine the grout. Depending on the used process, there are several solutions for the injections. The process of Epoxy injection is shown in figure 8.1.



**Figure 1:- Epoxy injection**

1. Injection under pressure: It is frequently used in masonry. To avoid Structural failure of the wall, the holes are done from bottom to top and from side to centre.
2. Injection trough gravity: It is used to highly damaged walls.

Injection trough vacuum: It is used in small interventions, mainly architectural, statues, etc. The grout is very fluid for instance resins can be used. In old structures, the inorganic grouts, non cementitious, like hydraulic lime, should be preferred because of compatibility issues with the already existing mortars. The organic mortars (polyester or epoxy), more fluid, should only be used when there are needs for higher resistance, hopefully without

#### **Gunite or Shotcrete:-**

Gunite can be defined as mortar conveyed through a hose and pneumatically projected at a high velocity on to a surface. Recently the method has been further developed by the introduction of small sized coarse aggregate into the mix deposited to obtain considerably greater thickness in one operation and also to make the process economical by reducing the cement content. Normally fresh material with zero slumps can support itself without sagging or peeling



off. Sometimes use of set accelerators to assist overhead placing is practiced. The newly developed 'Ready set cement' can also be used for shotcreting process. There is not much difference guniting and shotcreting. Guniting was first used in the early 1900 and this process is mostly used of pneumatically application of mortar of less thickness, whereas shotcrete is a recent development on the similar principal of guniting for achieving greater thickness with small coarse aggregates. There are two different processes in use, namely the 'Wet-mix' process and the 'dry-mix' process. They dry mix process is more successful and generally used.

**References:-**

1. Ayman M, Nour Afify , (1964), "New approaches for rehabilitation and conservation of urbanHeritage", Proceedings of 14<sup>th</sup> paper of Center of Planning and Architectural studies, Egypt Vol. 20, pp. 1-12.
2. Chandar S.S., (2014), "Rehabilitation of Buildings", International Journal of Civil Engineering Research, Vol. 5, No. 4, pp. 333-338.
3. Mulani Heena R., Prof Kumthekar M. B, (2015), "Special Materials for Rehabilitation of Monuments", International Journal of Engineering Research and Technology, Vol. 4, No. 04, pp. 264-267.
4. Paulo B. Lourenço, (2006), "Structural Restoration of Monuments: Recommendations and Advances in Research and Practice", Proceedings of 1st International Conference on Restoration of Heritage Masonry Structures, Egypt. pp 1-16
5. Penelis G.R, (1996), "Techniques and materials for structural restoration", Proceedings of Eleventh world Conference on Earthquake Engineering, Greece, Paper No.2089.
6. Raluca Plesu, George Taranu, Daniel Covatariu, (2011) "Strengthening and rehabilitation Conventional Methods for masonry structures", Gheorghe Asachi, Technical University of Iași, Faculty of Civil Engineering and Building Services, Vol. 4, pp 166-176.
7. Rehman Abdul, (2011), "Conservation of Historic Monuments in Lahore: Lessons from Successes and Failures", Pakistan Engineering and Application Science, Vol. 8, pp. 61-69.

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### RESEARCH ARTICLE

#### ANTIBACTERIAL MODE OF ACTION OF THE ROSEMARY/EUCALYPTUS OIL COMBINATION ON THE MEMBRANE INTEGRITY OF SELECTED FOOD BORNE PATHOGENS.

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Food borne pathogens, combination of oils, MIC, mode of action.

#### Abstract

Deterioration of food can be caused by various factors such as physical, chemical, enzymatic or microbiological. Due to increasing side effect of chemicals in food, consumers demand for some natural alternative to these chemical preservatives. One of these alternatives is use of plant essential oils. The aim of this study was to understand the effect of combination of two commercial essential oils (rosemary/eucalyptus oil) on the membrane of one gram positive and one gram negative bacteria at MIC concentration. The release of cell constituents at 260 nm and potassium ions from the bacterial cell were measured after they were treated with essential oil combination of rosemary /eucalyptus oil at their MIC concentrations. The result showed that there was damage in the cell covering of bacteria because of the treatment of combination of oils. The assays performed to study the effect of combination of oil on cell membrane of both selected bacteria exhibited that the combination at MIC concentration damaged the cell membrane of both bacteria. These results provide the useful information that the rosemary /eucalyptus oil combination might be used as efficient and safe natural antimicrobial agent in food industry.

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#### Introduction:-

Essential oils are the aromatic liquids, result of secondary metabolism in plants (Guenther, 1948). Essential oils are natural antimicrobials, which are used in flavor and fragrance industries (Van de Braak and Leijten, 1999). In food industries the essential oils are used as natural preservatives, which are the demand of time. As the chemical preservatives have their own set of problems like carcinogenicity, teratogenicity, acute toxicity and the environmental problems they cause due to long degradation time taken by them (Smid and Gorris, 1999).

Essentials oils have antibacterial, antifungal, antioxidant and anticarcinogenic properties which help them to be used as food additives. Essential oils when used as antimicrobial in food are required in higher quantity, which can demonstrate negative effect in taste and odor of food (Yamazaki et al., 2004.). To tackle this problem the combinations of different oil can be used which solves two purposes, one being the increase in antimicrobial effect and second is the decrease of concentration required of the oils.

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Rosemary and Eucalyptus oils are good antimicrobials alone. There is no information regarding their antibacterial action on bacteria. Hence, in the present study the mode of action of this combination at MIC value for *E. coli* and *Micrococcus yunnanensis* will be studied on their cell walls by determining the release of cellular materials at 260 nm and potassium ion efflux.

## Materials and Methods:-

### Material:-

**Essential oil combination:-** Rosemary/Eucalyptus oil combination.

**Bacterial strains:-** *Micrococcus yunnanensis*, *E. coli*.

### Methods:-

**Preparation of inoculum:-** The bacterial inoculum used for testing the activity was prepared in nutrient broth. Five ml of broth was suspended in test tubes and autoclaved. The medium was cooled and inoculated with a loopful of bacterial cultures from the nutrient agar slants under aseptic conditions and then incubated at  $37 \pm 1^\circ\text{C}$  for 24 hours. In order to standardize the inoculums density for test,  $\text{BaSO}_4$  turbidity standard equivalent to 0.5 McFarland (turbidity equals to  $0.5 = 1$  to  $2 \times 10^8$  CFU /ml) was used (Burt, 2004).

**Determination of minimal inhibitory concentration (MIC):-** Investigation of the MIC of Rosemary and Eucalyptus essential oils was done in 96 well titre plate (Schelz *et al.*, 2006). In each well Muller Hinton broth (90  $\mu\text{l}$ ) was added. The essential oils alone were taken from range 100  $\mu\text{l}$  to 3.25  $\mu\text{l}$  along x axis. 10  $\mu\text{l}$  of working inoculum suspension ( $8 \times 10^8$  CFU/ml) was added to the each well. The bacteria tested were 80  $\mu\text{l}$  in which well. Ciprofloxacin was used as positive control and DMSO was used as negative control. The plate was incubated at  $37^\circ\text{C}$  for 24 hours. The plates were then incubated for 24 hour at  $37^\circ\text{C}$ . After incubation, O.D was measured using ELISA reader at 595 nm. The lowest dilution showing no visible growth was considered as the MIC for that individual oil. The tests were performed in triplicate.

**Determination of Fractional Inhibitory Concentration Index (FICI):-** Fractional inhibitory concentration index was determined by checkerboard titration method but with some modifications (CLSI, 2005). Along the rows Rosemary oil concentration was reduced to half in each subsequent well, whereas Eucalyptus oil concentration was fixed at 50  $\mu\text{l}$  and in another row eucalyptus oil concentration was reduced and rosemary oil concentration was fixed at 50  $\mu\text{l}$ . The bacteria tested were 80  $\mu\text{l}$  in which well. Ciprofloxacin was used as positive control and DMSO was used as negative control. The plates were then incubated for 24 hour at  $37^\circ\text{C}$ . After incubation, O.D was measured at 595 nm. The combination which showed maximum inhibition at lower concentration was taken as MIC.

### Fractional inhibitory concentration indices (FICI) were calculated using the formula:

**FICI** = (MIC of EOA in combination with EOB / MIC of EOA alone) + (MIC of EOB in combination with EOA/ MIC of EOB alone).

Where, EOA= rosemary oil and EOB= eucalyptus oil. The results were interpreted according to FIC indices as follows:

FICI  $\leq 0.5$ : Synergy;  $0.5 < \text{FICI} \leq 4$ : Additive; and FICI  $> 4$ : Antagonistic (Leclercq *et al.*, 1991). All the experiments were repeated thrice.

**Mode of action:-** The effect of combination of essential oils at its MIC concentration was studied on cell membrane of both selected bacteria by following assays:

**Potassium leakage assay:-** The potassium leakage from cells was studied by following the methodology of Cox *et al.* (2000). 2 ml Suspensions of selected bacteria were exposed to essential oils combination (MIC) in sterile peptone water (0.1 g/ 100mL) for 0, 30, 60, and 120 minutes at  $37^\circ\text{C}$ . After predetermined interval the samples were collected and extracellular potassium concentration was measured by photometric method. Controls were devoid of Essential oils combination. Results were calculated as amount of extracellular potassium (mmol/L) in the growth media at each interval of time.

**Leakage of 260 nm and 280 nm cellular materials:-** This assay was performed according to the methodology of Carson *et al.* (2002). To 2 ml of bacterial culture in sterile peptone water (0.1 g/ ml) essential oil(s) combination at their MIC concentration was added. The mixture was incubated at  $37^\circ\text{C}$  for 0, 30, 60 and 120 minutes. Cells for measurement were collected after 0, 30, 60, and 120 minutes, cells were then centrifuged at 3500 rpm for 15

minutes. The supernatant were collected and absorbance was measured at 260 nm UV/Vis Spectrophotometer. Controls were kept under same conditions, except that they were not treated with essential oils combination. The experiment was performed in triplicates and mean values were plotted against time.

### Results:-

#### Determination of Minimum Inhibitory concentration (MIC) and Fractional inhibitory concentration (FIC) of essential oils alone and in combination:-

The combination effect of oils on *E. coli* and *Micrococcus yunnanensis* (taken as models for further studies) was studied by Checkerboard method.

In tables (i) and (ii) the results of combination of rosemary oil and eucalyptus oil are summarized for *E. coli* and *Micrococcus yunnanensis* respectively. In case of *E. coli* when 6.25  $\mu$ L of rosemary oil was mixed with 50  $\mu$ L of eucalyptus oil, **0.125 $\pm$ 0.01** MIC was obtained. Whereas for *Micrococcus yunnanensis* **0.098 $\pm$ 0.01** MIC was obtained when 12.5  $\mu$ L rosemary oil was mixed with 50  $\mu$ L eucalyptus oil.

**Table i:-** Determination of MIC of rosemary oil with eucalyptus oil against *E. coli*.

Concentration of oil	Rosemary oil conc. ( $\mu$ L)					
	100	50	25	12.5	6.25	3.125
Eucalyptus( 50 $\mu$ L)	0.431 $\pm$ 0.01	0.279 $\pm$ 0.04	0.248 $\pm$ 0.03	0.245 $\pm$ 0.01	0.125 $\pm$ 0.01	0.458 $\pm$ 0.02
Rosemary oil alone	1.417 $\pm$ 0.2	1.304 $\pm$ 0.4	1.186 $\pm$ 0.3	1.224 $\pm$ 0.4	1.262 $\pm$ 0.4	1.313 $\pm$ 0.6
Control	0.100 $\pm$ 0.01	0.098 $\pm$ 0.09	0.100 $\pm$ 0.02	0.099 $\pm$ 0.05	0.100 $\pm$ 0.01	0.100 $\pm$ 0.08

**Table ii:-** Determination of MIC of rosemary with eucalyptus oil for *Micrococcus yunnanensis*:

Concentration of oil	Rosemary oil conc. ( $\mu$ L)					
	100 $\mu$ L	50 $\mu$ L	25 $\mu$ L	12.5 $\mu$ L	6.25 $\mu$ L	3.125 $\mu$ L
Eucalyptus( 50 $\mu$ L)	0.376 $\pm$ 0.07	0.294 $\pm$ 0.06	0.127 $\pm$ 0.03	0.098 $\pm$ 0.01	0.122 $\pm$ 0.03	0.113 $\pm$ 0.01
Rosemary oil alone	1.482 $\pm$ 0.2	1.379 $\pm$ 0.6	1.263 $\pm$ 0.4	1.188 $\pm$ 0.4	1.253 $\pm$ 0.1	1.246 $\pm$ 0.5
Control	0.093 $\pm$ 0.1	0.095 $\pm$ 0.03	0.092 $\pm$ 0.01	0.093 $\pm$ 0.02	0.094 $\pm$ 0.01	0.094 $\pm$ 0.03

In tables (iii) and (iv) the results of combination of eucalyptus oil with rosemary oil are shown. For *E. coli* the best MIC value of **0.166 $\pm$ 0.02** was depicted by eucalyptus oil (6.25  $\mu$ L) with rosemary oil (50  $\mu$ L). **0.144 $\pm$ 0.01** values were obtained in case of *Micrococcus yunnanensis* when mixed in ratio of 1:1 with rosemary oil. Eucalyptus oil combination with rosemary oil exhibited better result as compared to eucalyptus oil alone.

**Table iii:-** Determination of MIC of Eucalyptus oil with rosemary oil for *E. coli*.

Concentration of oil	Eucalyptus oil conc. ( $\mu$ L)					
	100 $\mu$ L	50 $\mu$ L	25 $\mu$ L	12.5 $\mu$ L	6.25 $\mu$ L	3.125 $\mu$ L
Rosemary( 50 $\mu$ L)	0.516 $\pm$ 0.01	0.336 $\pm$ 0.01	0.254 $\pm$ 0.01	0.202 $\pm$ 0.01	0.166 $\pm$ 0.02	0.178 $\pm$ 0.01
Eucalyptus oil alone	1.488 $\pm$ 0.3	1.377 $\pm$ 0.3	1.238 $\pm$ 0.6	1.013 $\pm$ 0.2	1.805 $\pm$ 0.2	1.728 $\pm$ 0.5
Control	0.101 $\pm$ 0.03	0.095 $\pm$ 0.02	0.101 $\pm$ 0.02	0.099 $\pm$ 0.01	0.100 $\pm$ 0.03	0.101 $\pm$ 0.04

**Table iv:-** Determination of MIC of Eucalyptus oil with rosemary oil for *Micrococcus*.

Concentration of oil	Eucalyptus oil conc. ( $\mu$ L)					
	100 $\mu$ L	50 $\mu$ L	25 $\mu$ L	12.5 $\mu$ L	6.25 $\mu$ L	3.125 $\mu$ L
Rosemary( 50 $\mu$ L)	0.255 $\pm$ 0.01	0.144 $\pm$ 0.01	0.156 $\pm$ 0.8	1.231 $\pm$ 0.1	1.195 $\pm$ 0.5	1.190 $\pm$ 0.5
Eucalyptus oil alone	1.116 $\pm$ 0.6	1.006 $\pm$ 0.6	1.103 $\pm$ 0.3	1.17 $\pm$ 0.5	1.156 $\pm$ 0.2	1.178 $\pm$ 0.5
Control	0.093 $\pm$ 0.02	0.095 $\pm$ 0.03	0.092 $\pm$ 0.01	0.093 $\pm$ 0.05	0.093 $\pm$ 0.02	0.093 $\pm$ 0.01

**Determination of Fractional Inhibitory Concentration Indic (FICI):-** The FIC value of the combinations was calculated, the results are shown in table (v). The combination of rosemary and eucalyptus showed synergistic effect for both the organism.

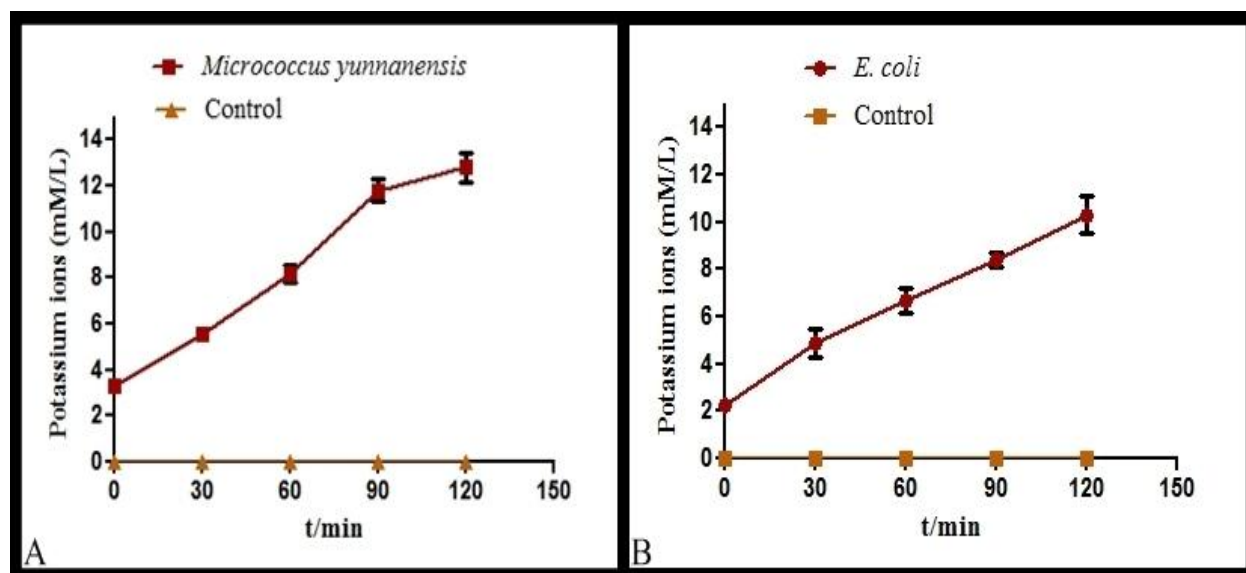
**Table v:-** Combination effects of rosemary and eucalyptus oil combination against food-borne bacteria using checkerboard titration method

Food borne bacteria	Oil combination		
	Rosemary +Eucalyptus		
	FIC	FICI	Remarks
<i>E. coli</i>	0.105 (Rosemary)	0.268	S
	0.163 (Eucalyptus)		
<i>Micrococcus yunnanensis</i>	0.082 (Rosemary)	0.225	S
	0.143 (Eucalyptus)		

S: Synergistic; ADD: Additive; ANTA: Antagonistic.

**Mechanism of action:-** The effect of rosemary and eucalyptus oil combination at their MIC concentration on cell membrane of *E. coli* and *Micrococcus yunnanensis* was studied using two assays:

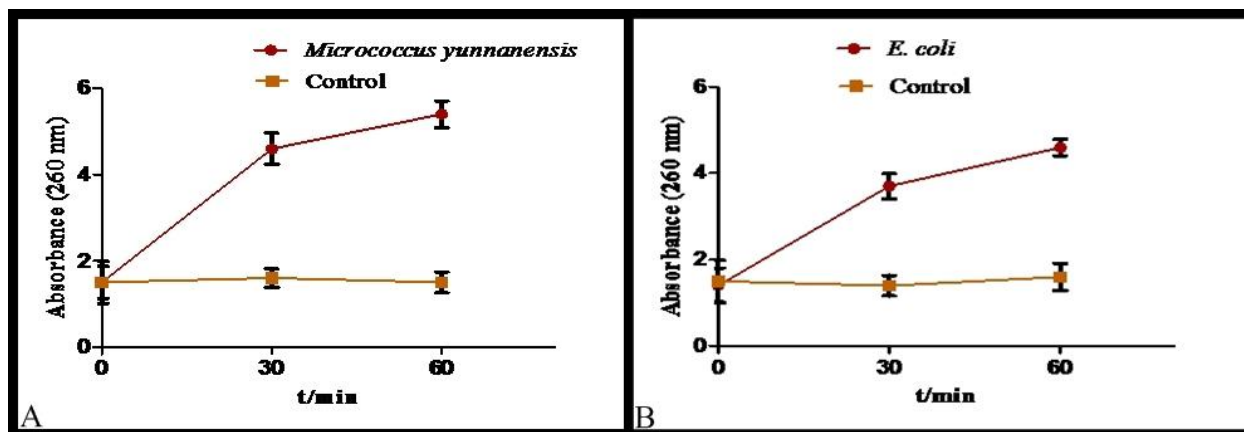
**Assay of Potassium ions efflux:-** The mode of antibacterial action of combination of oils (rosemary and eucalyptus) at MIC against two tested food borne pathogen was further confirmed using the assay for the release of  $K^+$  ions from treated cells of *E. coli* and *Micrococcus yunnanensis* (**figure i (A, B)**). Treatment of bacterial cells with oil combination at the MIC concentration induced a major efflux of intracellular  $K^+$  ions. The leakage of potassium ions in case of both the bacteria increased with increase in time interval (**figure i (A, B)**). However no  $K^+$  ions efflux was observed in control cells of the tested bacteria during the study.



**Figures i (A, B):-** Effect of Rosemary and Eucalyptus oil combination at MIC concentration on the leakage of potassium ions from the tested food borne bacteria: **A)** *Micrococcus yunnanensis*, and **B)** *E. coli*.

#### Leakage of Cellular Metabolites:-

The results of the release of cellular material at the absorbance value of 260nm from *E. coli* and *Micrococcus yunnanensis* cells exposed to concentration (rosemary + eucalyptus) of oils at the MIC concentrations indicated that the higher exposure time led to higher cell leakage of nucleic acids (**figure ii(A, B)**). However, no changes in the absorbance of untreated cells (control) of tested bacteria were seen. At 30 and 60 minutes of treatment, significant increase in the absorbance of the bacterial cells treated with oil combination was demonstrated. The leakage of the material absorbing at 260nm from the bacterial cells treated with combination of rosemary and eucalyptus at MIC, confirms the damage of cell membrane.



**Figures ii (A, B):-** Effect of Rosemary and Eucalyptus oil combination at MIC concentration on the release rate of material that absorbs at 260 nm from: **A)** *Micrococcus yunnanensis*, and **B)** *E. coli*. Data are expressed as mean values  $\pm$  standard deviations (S.D.),  $N=3$ . CT=control without treatment.

### Discussion:-

Essential oils are natural antimicrobials produced by many aromatic plants and exhibit a great potential to be used in food industry, but their use is restricted due to strong smell and alteration of taste food. To overcome such problem combination of oils can be good option.

In this study commercially available rosemary and eucalyptus essential oils were briefly studied, obtained from local market of Solan, Himachal Pradesh for their potential to be used as food preservative. Rosemary and eucalyptus oil showed potent synergistic interaction ( $FICI=0.268$  for *E. coli* and  $FICI=0.225$  for *Micrococcus yunnanensis*). Similar study on synergism of essential oils was done by **Gibriel et al. (2013)** he reported that the combination of rosemary and cumin showed synergistic effect and rosemary and thyme oils combination demonstrated additive effect against *E. coli*. In another antibacterial combination study by **Anwesa Bag and Rabi Ranjan Chattopadhyay (2015)** on three combinations (coriander/cumin, coriander/ mustard and cumin/mustard) against *Bacillus cereus*, *Listeria monocytogenes*, *Micrococcus luteus*, *Staphylococcus aureus*, *E. coli* and *Salmonella typhimurium*, only coriander/cumin combination showed synergistic interaction ( $FICI: 0.25-0.50$ ) against the studied bacteria except *S. typhimurium* and *M. luteus* where it showed additive effect ( $FICI: 0.75-0.81$ ). Other tested combinations showed additive effect ( $FICI: 0.75-2.25$ ) against all the studied bacteria. The results of present investigations depicted that oils when used in combinations gave MIC value at lower concentrations as compared to MIC value of oil when used alone. These findings collaborates with illustrations of **Tajkarimi et al. (2010)** who stated use of less concentration of essential oils combination in food stuff to avoid the sensory impact of higher concentration and also providing the food safety is the foundation of usage of essential oil combination.

One of the indicator of increased permeability and loss of viability by cells is the loss of potassium ions into extracellular space, confirmed by various studies of **Cox et al. (2001)** and **Bouhdid et al. (2010)**. In this study, we report the effect of rosemary and eucalyptus oil combination on *Micrococcus yunnanensis* and *E. coli*.  $K^+$  release during exposure to the oil combination was measured in both strains, and was found to be induced at MIC concentration. The release of potassium ions was observed to increase with time interval in case of both bacteria. Therefore, it can be concluded from results that rosemary and eucalyptus oil combination interact with cellular membranes of bacteria, changing their permeability to cations like  $K^+$ . These results collaborates with illustrations of various researchers namely, **Bajpai et al. (2015)** examined the effect of *Ginkgo biloba* essential oil on *B. cereus* and *E. coli*, and evaluated that oil caused release of potassium ions; **Bouhdid et al. (2010)** noticed the increase in potassium ion concentration extracellularly in case of *S. aureus* and *P. aeruginosa* when exposed to *Cinnamomum verum* oil; **Trombetta et al. (2005)** who reported that oregano essential oil cause potassium ion release in *S. aureus* and *P. aeruginosa*.

*E. coli* and *Micrococcus* suspension treated with combination of rosemary and eucalyptus oil at MIC, lost significant 260 absorbing materials with increase of time interval, suggesting that nucleic acids and certain protein were lost through a damaged cytoplasmic membrane. Similar studies was carried out by **De Souza et al. (2013)** who studied the effect of rosemary and oregano oil on *Pseudomonas aeruginosa*, when used alone and in combination. It was

observed that immediately after the contact of essential oil alone or in combination with bacteria caused leakage of 260 nm absorbing material. **Ifesan et al. (2009)** observed the leakage of 260nm absorbing material by *S. aureus* when exposed to *Eleutherine Americana*. **Carson and Riley (2002)** showed leakage of 260nm absorbing material by *S. aureus* when treated with tea tree oil.

### Conclusion:-

The present study confirms the antimicrobial action of rosemary and eucalyptus oil combination on the permeability of cell membrane at its MIC conc. on the tested bacteria. It leads to the loss of some cellular components from the cell to outside. In future studies should be dedicated to see the implication of essential oil combination treatment to different food matrices. The toxicology study of the combination should also be carried out.

### References:-

1. Guenther, E. (1948): The Essential Oils. D. Van Nostrand, New York.
2. Van de Braak, S.A.A.J and Leijten, G.C.J.J. (1999): Essential Oils and Oleoresins: A Survey in the Netherlands and other Major Markets in the European Union. CBI, Centre for the Promotion of Imports from Developing Countries, Rotterdam. p.116.
3. Smid, E.J and Gorris, L.G.M. (1999): Natural antimicrobials for food preservation. In: Rahman, M.S. (Ed.), Handbook of Food Preservation. Marcel Dekker, New York, pp. 285 – 308.
4. Yamazaki, D., Motohashi, K., Kasama, T., Hra, Y., Hisabori, T. (2004): Target proteins of the cytosolic thioredoxins in *Arabidopsis thaliana*. Plant and Cell Physiology. 45:18-27.
5. Burt, S. (2004): Essential oils: their antibacterial properties and potential applications in foods-A review. International Journal of Food Microbiology. 94:223-253.
6. Schelz, Z., Molnar, J., Hohmann, J. (2006): Antimicrobial and antiplasmid activities of essential oils. Fitoterapia. 77:279-285.
7. Clinical and Laboratory Standards Institute (CLSI; formerly NCCLS), National Committee for Clinical Laboratory Standards. (2006): Performance standards for Antimicrobial Susceptibility Testing; 16th Informational supplement. CLSI document M7-A7, 940 West Valley Road, Wayne, Pennsylvania 19087.
8. Leclercq, R., Bingen, E., Su, Q.H., Lambert-Zechovski, N., Courvalin, P. and Duval, J. (1991): Effects of combinations of b-lactams, daptomycin, gentamicin and glycopeptides against glycopeptides-resistant enterococci. Antimicrob Agents Chemother 35, 92–98.
9. Cox, S.D., Mann, C.M., Markham, J.L., Bell, H.C., Gustafson, J.E., Warmington, J.R., et al. (2000): The mode of antimicrobial action of the essential oil of *Melaleuca alternifolia* (tea tree oil). Journal of Applied Microbiology. 88:170-176.
10. Carson, C.F., Mee, B.J., Riley, T.V. (2002): Mechanism of action of *Melaleuca alternifolia* (tea tree) oil on *Staphylococcus aureus* determined by time-kill, lysis, leakage, and salt tolerance assays and electron microscopy. Antimicrobial Agents and Chemotherapy. 46:1914-1920.
11. Gibriel, A.Y., Al-Sayed, H., Rady, A.H., Abdelaleem, M.A. (2013): Synergistic antibacterial activity of irradiated and non irradiated cumin, thyme and rosemary essential oils. Journal of Food Safety. 33:222-228.
12. Tajkarimi, M.M., Ibrahim, S.A., Cliver, D.O. (2010): Antimicrobial herb and spice compounds in food. Food Control. 21:1199–1218.
13. Cox, S.D., Mann, C.M., Markham, J.L., Gustafson, J.E., Warmington, J.R., Wyllie, S.G. (2001): Determining the antimicrobial actions of tea tree oil. Molecules. 6:87-91.
14. Bouhdid, S., Abrini, J., Amensour, M., Zhiri, A., Espuny, M.J., Manresa, A. (2010): Functional and ultra structural changes in *Pseudomonas aeruginosa* and *Staphylococcus aureus* cells induced by *Cinnamomum verum* essential oil. Journal of Applied Microbiology. 109:1139-1149.
15. Bajpai, V.K., Sharma, A., Baek, K.H. (2015): Antibacterial mode of action of *Ginkgo biloba* leaf essential oil: effect on morphology and membrane permeability. Bangladesh Journal of Pharmacology. 10:337-50.
16. Trombetta, D., Castelli, F., Sarpietro, M.G., Venuti, V., Cristani, M., Daniele, C., et al. (2005): Mechanisms of antibacterial action of three monoterpenes. Antimicrobial Agents and Chemotherapy. 49:2474-2478.
17. de Souza, E.L, De Azeredo, G.A., De Sousa, J.P., De Figueiredo, R.C.B.Q., Stamford, T.L.M. (2013): Cytotoxic effects of *Origanum vulgare* L. and *Rosmarinus officinalis* L. essential oils alone and combined at sub lethal amounts on *Pseudomonas fluorescens* in a vegetable broth. Journal of Food Safety. 33:163-71.
18. Ifesan, B.O.T., Joycharat, N., Voravuthikunchai, S.P. (2009): The mode of antistaphylococcal action of *Eleutherine americana*. FEMS Immunology and Medical Microbiology. 57:193-201.





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### RESEARCH ARTICLE

#### KNOWLEDGE AND AWARENESS ABOUT OSTEOPOROSIS AMONG SAUDI ADULTS IN RIYADH, SAUDI ARABIA, 2016

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Disease, Osteoporosis, Bone, Physical activity, Knowledge, Lifestyle, Calcium.

#### Abstract

**Introduction:** Osteoporosis is a major public health problem, which affects millions of people around the world and its frequency increases by age, and the Kingdom of Saudi Arabia (KSA) is not an exception. Osteoporosis is a disease characterized by low bone mass and micro-architectural deterioration of bone tissue.

**Objectives:** This study aimed to evaluate knowledge and awareness of osteoporosis among general Saudi adult in Riyadh.

**Methodology:** An Observational, descriptive cross-sectional study conducted on 150 males and females participants of general Saudi adult in Riyadh city, 2016. Inclusion criteria: Saudi adults, and Exclusion criteria: other than Saudi nationalities and children. The Sample technique used in this study: convenience consecutive sampling. The data was cleared, coded, entered and analyzed by SPSS (Static Package For Social Science) and Microsoft excel was used to generate figures and charts. Chi-square test with significance level (P value 0.05).

**Results:** Out of 150 participants, 145 have heard about osteoporosis. About (60.66%) of participants have moderate general knowledge about osteoporosis. while only (25.33%) have good general knowledge about osteoporosis. Males participants had the best knowledge about the high risk age group of getting Osteoporosis (55.44%) compared to females participants (44.89%). Approximately most of the participants (48%) thought that they are susceptible to contracting osteoporosis at a point of their lives. Out of 49 females, who participated in the study, on asking about their susceptibility to contracting osteoporosis, approximately half (51.02%) of them knew that they are susceptible of contracting osteoporosis, while males were (46.53%) out of 101. This indicates that there is no statistically significant between males and females on perceived susceptibility. This study showed there is significant relations (P-Value: 0.046) between participants with high perceived knowledge (87.76%), low perceived knowledge (66.67%) and their knowledge about relation between eating a diet low in milk products and getting osteoporosis.

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**Conclusion:** Knowledge and awareness are moderate towards this disease. This finding is similar to other studies done in the kingdom in different cities implying no serious actions were taken to improve this situation. Health authorities should create programs to upraise the awareness of the community for this important disease, especially at primary health care levels and community pharmacies.

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## ..... Introduction:-

Osteoporosis is an irreversible [1] systemic skeletal disorder that affects bone density and quality, leading to bone fragility and increased risk of fractures [2]. It is a major public health problem [1], which affects millions of people around the world and its frequency increases by age [2]. It affects almost: one-tenth of women aged 60, one-fifth of women aged 70 years, as well as two-fifths of women aged 80 years [3] but men are also at risk [1], and the Kingdom of Saudi Arabia (KSA) is not an exception [2]. It was also considered as one of the major contributors of mortality and morbidity among elderly people [1]. The prevalence of osteoporosis among Saudi population was estimated at 34% in a review of the published articles in to 2011 [2]. Sun-light exposure can increase the bone mineral density of vitamin D deficient bone and lead to the prevention of non-vertebral fractures [11], Women in particular receive little or no sun-light since they cover their bodies with dark veils completely. Studies about the prevalence of this disease in Kingdom of Saudi Arabia (KSA), have shown that among postmenopausal Saudi women 50–80 years of age, 39.5 % had osteoporosis [4]; there were 24.3, 62 and 73.8 % of affected women in the age groups 50–59, 60–69 and 70–80 years, respectively [3], among Saudi males 21.4 % were osteoporotic [4]. There is evidence suggesting that osteoporosis knowledge is one contributor to osteoporosis prevention behavior [1]. Awareness about osteoporosis can aid in its prevention [3]. Knowledge, perception of personal susceptibility and belief in the seriousness of the disease are important for influencing behavioral change by prevention programs [2]. The assessment of these parameters can be done through what is called knowledge, attitude and practice, hereafter referred as “KAP” [4]. Small numbers of KAP studies was carried out with regard to this disease, especially in Asian countries [1]. In KSA, there is scarcity of local studies which discussed the level of awareness toward osteoporosis, in both females and males members. The study compares KAP scores between males and females, and also to investigate the relations between socio-demographic characteristics and KAP scores. Awareness about osteoporosis can aid in its prevention [3]. Estimating the level of knowledge of populations through this research can help to guide prevention public health programs and tailor them according to needs of community [3]. Osteoporosis includes several controllable and uncontrollable risk factors; the controllable risk factors (environmental) include low activity level, sedentary lifestyle over many years, smoking, alcohol abuse and inadequate diet including eating disorder, low calcium intake, low vitamin D intake and excessive consumption of soft drinks [1]. Caffeine use of more than three cups of coffee every day might increase calcium excretion in the urine and it affects bone health. Whilst the uncontrollable factors include gender, family history, ethnicity and race, advancing age, postmenopausal status and body frame size [2]. Although there is an increased interest in the level of knowledge and believes among general physicians about osteoporosis, it remains a sidelined issue in the clinical practice field [1]. More and more sedentary lifestyle of children and adolescents is also alarming [3]. This trend is even more serious among adolescent females who live a sedentary lifestyle more often than boys [4]. One of the risk factors of osteoporosis and thus also easier occurrences of fractures is smoking. The explanation of the negative influence of smoking on the bones is not simple because the individual elements of the smoke interfere differently with the bone tissue metabolism [2]. This study aimed to assess level of knowledge and awareness toward osteoporosis among Saudi adults population [2]. One of The goals of this work was to evaluate the knowledge, attitudes and practices of adolescent females in relation to the risk factors of osteoporosis, specifically their physical activity, smoking and diet and to find out the differences in the knowledge in relation to age, sex and school types. In the nutrition area the goal was to set the average intake of nutrients that are in relation to the bone health – calcium, phosphorus, vitamin D, proteins and sodium [2]. Our study aims to assess the level of knowledge regarding osteoporosis.

**Objectives:-****General Objective:-**

To assess level of knowledge toward osteoporosis among Saudi adult population.

**Specific Objectives:-**

1. To assess Knowledge about effect of physical activity on osteoporosis among Economic classes.
2. To compare between knowledge about prevention of osteoporosis and education levels.
3. To assess knowledge about relations between eating dithery milk products and getting osteoporosis among High and low perceived knowledge adults.
4. To compare between male, female and knowledge about common ages get osteoporosis.
5. To assess knowledge about susceptibility to contracting osteoporosis among adult females.
6. To assess knowledge about complication of osteoporosis among employers.
7. To investigate awareness about risk factors of osteoporosis among illiterate and educated people.
8. To compare between general knowledge about osteoporosis and people have good and low perceived knowledge.

**Methodology:-**

An Observational, descriptive cross-sectional study conducted on 150 male and female participants of general Saudi adult in Riyadh city 2016. Inclusion criteria: Saudi adults, and Exclusion criteria: other than Saudi nationalities and children .The Sample technique used in this study: convenience consecutive sampling. The data was cleared, coded, entered and analyzed by SPSS (Static Package For Social Science) and Microsoft excel was used to generate figures and charts. Chi-square test with significance level (P value 0.05).Consent was obtained before data collection from each participant.

**Results:-**

After data collection we realized that majority of participant were male (67.3%). More than half (54.7%) of respondents are between 20-24 years. Almost half of participants (48.7%) were university educated. Fifty two percent of the sample living in own villa (High class).

From all questions that asses level of general knowledge of osteoporosis, about sixty one percent of all participants , have moderate general knowledge about Osteoporosis as shown in table 1-A.

In table 2-A showed that (44.7%) of respondents answered correctly that smoking can cause Osteoporosis. About 50% (47.3%) of participants answered that Osteoporosis can't be hereditary .while only (31.3%) were correct. About drinking cola as risk factor of osteoporosis,(82%) of participants mentioned that Cola affect bones as risk, while (11.3%) don't think so. Regarding Milk-Rich diet and getting Osteoporosis,(79.3%) of all participants said Yes. There was no big difference between people agreed(38%) or disagreed(30%) about irregular period in excessive exercise, as risk of Osteoporosis increase. So (54%) of respondents have good knowledge of risk factors about osteoporosis , while (35.33%) they carrying moderate knowledge about them .

Table 3-A showed that (62.7%) of participants thought that Osteoporosis can be prevented by physical activity, while only (22.7%) of participants didn't. The majority (82.7%) identify exposure to the sunlight one of prevention methods of osteoporosis. Also (55.3%) stated that children at age 6 need more calcium .

Most of participants (48%) thought that they are susceptible to contracting Osteoporosis.

The majority of participants rated their knowledge as either moderate knowledge (37.3%) or poor knowledge (30%). While only (32.7%) rated their knowledge as good.

(69.3%) of the participants know that Osteoporosis can lead to fractures .While (48%) of participants believed Osteoporosis can't lead to death as mentioned in table 4-A. Table 4-b:approximately 50% of participants out of have poor knowledge regarding Osteoporosis complication ,and (34%) have good ideas .

### Discussion:-

Our study showed the General knowledge of osteoporosis is moderate (60.66%) for the majority of the studied sample and this goes in line with Maria Tahir<sup>1</sup>, 26 January 2016 [6] both studies showed moderate knowledge about osteoporosis. Notable, the comparison study focus on female only.

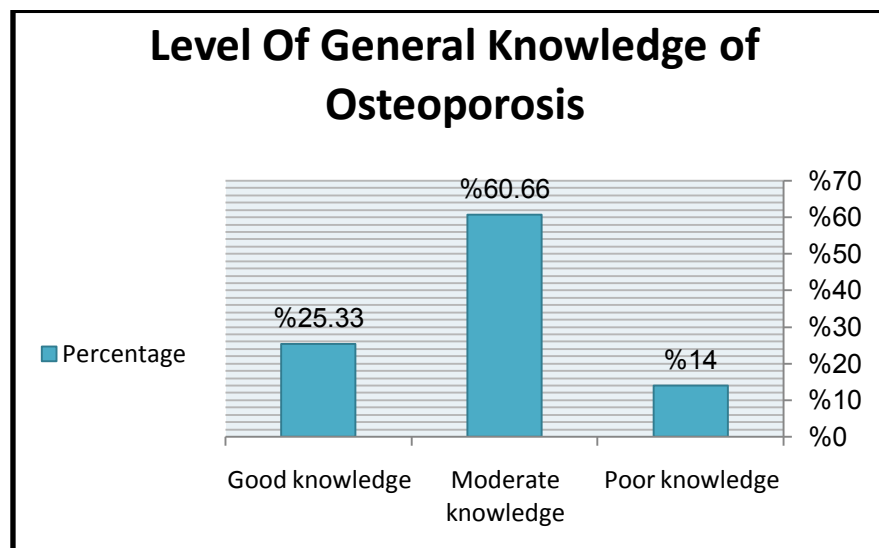
Our study showed that the majority of participants have moderate and good knowledge (89.33%) in the questions, cause of osteoporosis include family history, post-menopausal status and excess in soft drinks and this goes in line with Maria Tahir<sup>1</sup>, 26 January 2016 [6] and Yosria El-Said Hossien<sup>2</sup>, May 20, 2014 [9]. Notable, the comparison study focus on female only.

In our study the majority of participant whom answered correctly (on: smoking is a risk factor for osteoporosis) had a secondary school education level (49.21%). Which goes in contrary to a study done by Mohammed Yehia Saeedi<sup>13</sup> El. Tlt; in Riyadh, Saudi Arabia, 2014, [2], where he found: the majority of the participants considered the smoking as a risk factor for osteoporosis (88.5%), were all with university education. That contributed to the fact that our sample was from the general population, and his was among primary health care physicians.

Our study goes in line with (Afraa talal<sup>14</sup> et al), (19 June 2013 in Riyadh), [1] which showed more susceptibility toward osteoporosis among female, our results indicates (60.64%) of the participants who agree with this, and our study shows that there is no statistically significant difference ( $p = 0.419$ ) between knowledge if osteoporosis more common in female among poor and high knowledge. And the reason may be due to they think it related to menopause.

Our study revealed that (79.33%) of participants with different education levels have answered correctly on whether there is relation between eating a diet low in milk products and getting osteoporosis. Similar results were found by Noman-ul-Haq<sup>1</sup> El Tlt; in Quetta, Pakistan, 2015, [6] which showed that, (82.1%) answer correctly. On the other hand, a study done by Yosria El-Said Hossien<sup>1</sup> El Tlt; in El-Minia, Egypt, 2014, [9], stated that only (5.7%) answered correctly. That might be attributed to the fact that her study was done on secondary school students, but our study was done on general population with the majority of participants (48.7%) with university education.

Our study showed the majority of the studied sample answered to “Sunlight exposure can prevent from osteoporosis” correctly (82.7%) and this goes in line with Yosria El-Said Hossien<sup>2</sup>, May 20, 2014 [9]. The majority of the studied sample has a moderate knowledge about prevention (62%) and goes in line with KafiFraih Alshammari<sup>3</sup>, .2014.11.3 [36] and Maria Tahir<sup>1</sup>, 26 January 2016 [6], which mentioned prevention of osteoporosis by exposure to sunlight, physical activity and calcium intake. Notable, the comparison study focus on female only.



**Table 1-A :- Level Of General Knowledge of Osteoporosis:**

Have you ever heard about osteoporosis ?	YES	NO	I don't know		Total
No.	145	5			150
%	96.7%	3.3%			100%
Which ages of these carries highest risk of getting osteoporosis?	Elderly ages	Middle ages	Young ages	I don't know	
No.	78	26	36	10	150
%	52%	17.3%	24%	6.7%	100%
Normally, bone loss speeds up in elderly ages?	YES	NO	I don't know		
No.	101	23	28		150
%	67.3%	15.3%	17.3%		100%
osteoporosis is more common in female ?	YES	NO	I don't know		
No.	89	34	27		150
%	59.3%	22.7%	18%		100%

**Table 1-B**

	Poor knowledge	Moderate knowledge	Good knowledge
Number	21	91	38
Percentage	14%	60.66%	25.33%

**Table2-A:-Level Of Knowledge of Risk factors Of Osteoporosis:**

Can smoking cause osteoporosis ?	YES	NO	I don't know	Total
No.	67	37	46	150
%	44.7%	24.7%	30.7%	100%
Do you think that osteoporosis may be hereditary ?				
No.	47	71	32	150
%	31.3%	47.3%	21.3%	100%
Is there any relation between eating a diet low in milk products and getting osteoporosis ?				
No.	119	18	13	150
%	79.3%	12%	8.7%	100%
Is drinking too much cola harmful to your bones ?				
No.	123	10	17	150
%	82%	6.7%	11.3%	100%
Irregular or complete loss of your periods due to excessive exercise does it increase the risk of osteoporosis?	Agree	Disagree	I don't know	
No.	57	45	48	150
%	38%	30%	32%	100%

**Table 2-B**

	Poor knowledge	Moderate knowledge	Good knowledge
Number	16	53	81
Percentage	10.66%	35.33%	54%

**Table3-A:-Level of Knowledge Regarding Prevention of Osteoporosis:**

Can physical activity prevent osteoporosis?	YES	NO	I don't know	Total
No.	94	34	22	150
%	62.7%	22.7%	14.7%	100%
Can exposure to the sunlight participate in prevention of osteoporosis ?				
No.	124	17	9	150
%	82.7%	11.3%	6%	100%
In which age you think need to take calcium ?	Adolescents	Children age 6	I don't know	
No.	44	83	23	150
%	29.3%	55.3%	15.3%	100%

For the first six months of life a baby does not need any food or drink except breast milk ?	<b>YES</b>	<b>NO</b>	<b>I don't know</b>	
<b>No</b>	100	36	14	150
<b>%</b>	66.7%	24%	9.3%	100%

**Table 3-B**

	<b>Poor knowledge</b>	<b>Moderate knowledge</b>	<b>Good knowledge</b>
<b>Number</b>	51	93	6
<b>Percentage</b>	34%	62%	4%

**Table 4-A :- Level Of Knowledge Of Complication Of Osteoporosis:**

Can osteoporosis lead to fractures ?	<b>Yes</b>	<b>No</b>	<b>May be</b>	<b>I don't know</b>	<b>Total</b>
<b>No.</b>	104	9	34	3	150
<b>%</b>	69.3%	6%	22.7%	2%	100%
Can osteoporosis lead to death ?	<b>Yes</b>	<b>No</b>	<b>I don't know</b>		
<b>No.</b>	28	72	52		150
<b>%</b>	17.3%	48%	34.7%		100%

**Table 4-B**

	<b>Poor knowledge</b>	<b>Moderate knowledge</b>	<b>Good knowledge</b>
<b>Number</b>	73	26	51
<b>Percentage</b>	48%	17.33%	34%

**Conclusion:-**

In conclusion, general knowledge about Osteoporosis considered to be moderate among Saudi population as this study reveals. Thus knowledge and awareness are also low towards this disease. This finding is similar to other studies done in the kingdom in different cities implying no serious actions were taken to improve this situation.

**Recommendation:-**

Ministry of Education should be involved in health education about osteoporosis and its related factors in schools or even could provide educational program via their curriculum to improve the awareness of this disease among students and thus ensuring that they received accurate information .

Health authorities should create programs to upraise the awareness of the community for this important disease, especially at primary health care levels and community pharmacies.

A good knowledge and awareness of a disease are pre-requisites for success of preventive measures, modifications in life styles and treatment adherence.

The study suggested that better training and motivation may improve cooperation SAUDI population, which will consequently lead to methods of breaking down barriers to change in clinical practice and promoting the fully integrated care of patients with OP.

**References:-**

1. AfraaTalalBarzanji, FahadAbdulrahmanAlamri, Ashry Gad Mohamed. Osteoporosis: A Study of Knowledge, Attitude and Practice Among Adults in Riyadh, Saudi Arabia.*Journal of American Medical Association*, 2013; 38 (6):1098-1105.
2. Mohammed YehiaSaeedi , Fahd Al-Amri , Ashry Mohamed ,Ahmed Khair Ibrahim. Knowledge, attitude and practice towards osteoporosis Among primary health care physicians in Riyadh, Saudi Arabia. *Science Journal of Public Health*, 2014; 2 (6):624-630.
3. Khalid ElTohami, Waqas Sami, Ahmed AL Eidan, etal. Study of Knowledge, Attitude and Practice of Osteoporosis among Adult Women in Majmaah City, Saudi Arabia. *International Journal of Health and Rehabilitation Sciences*, 2015; 4 (3, September 2015): 185 – 93.
4. El-Desonki.M.ISulaimani R.A Knowledge on Osteoporosis among Saudi population.*Saudi Medical Journal*, 2011; 28 (5): 747-777.

5. YusraHabib Khan\*, AzmiSarriff, Amer Hayat Khan , et al. Knowledge, Attitude and Practice (KAP) Survey of Osteoporosis among Students of a Tertiary Institution in Malaysia. *Tropical Journal of Pharmaceutical Research, African Journal Online*, 2013; 13 (22):347-353.
6. Noman-ul-Haq, Maria Tahir\*, QaiserIqbal and AqeelNaseem . Exploration of Osteoporosis Knowledge and Perception among Young Women in Quetta, Pakistan. *Journal of Osteoporosis and Physical Activity*, 2015; 3 (3):152-344.
7. Ji-Hoon Baek,Young-Kyun Lee,Seok-Woo Hong [ETAL]. Knowledge on osteoporosis in guardians of hip fracture patients. *Journal of Bone and Mineral Metabolism*, 2013; 31: (4) 481-484
8. Author: SaadMoryahAlqahtani. A study of knowledge of women toward osteoporosis in primary care in King Abdul-Aziz military hospital in Tabuk. *International Journal of Medical Science and Public Health*. (July 2014) 3(7) 803-807
9. Yosria El-Said Hossien1 , Hanan M. M. Tork2 , Amirat Ali El-Sabeely2 Osteoporosis Knowledge among Female Adolescents in Egypt*American Journal of Nursing Science* May 20, 20143, 13-17 .
10. SherineGaber Mohamed1 , Dalia Ibrahim Tayel2 Dietary Behavior toward Osteoporosis among Women in a Slum Area Influenced by Nutritional Knowledge and Stages of Precaution Adoption Mode *Journal of American Science* 2012 8(8): 222- 227.
11. Authors :Salem A. Beshyah1, Wafa Al Mehri2, Ali B. Khalil 2 Osteoporosis and Its Management: Knowledge, Attitudes and Practices of Physicians in United Arab Emirates *Ibnosina Journal of Medicine and Biomedical Sciences* 2013,5(5) 270-279.
12. Access Economics Pty Limited (2006) Breaking Point: the economic cost of not adhering to bisphosphonate treatment for osteoporosis. [http://anzbms.org.au/news/documents/Breaking\\_point\\_Oct-06.pdf](http://anzbms.org.au/news/documents/Breaking_point_Oct-06.pdf). Accessed 30 March 2012.
13. Elliot-Gibson V, Bogoch ER, Jamal SA, Beaton DE (2004) Practice patterns in the diagnosis and treatment of osteoporosis after a fragility fracture: a systematic review. *OsteoporosInt* 15:767–778PubMedCrossRef .
14. Randell A, Sambrook PN, Nguyen TV, Lapsley H, Jones G, Kelly PJ, Eisman JA: Direct clinical and welfare costs of osteoporotic fractures in elderly men and women. *OsteoporosInt* 1995, 5:427–432.CrossRefPubMed.
15. Lewinnek GE, Kelsey J, White AA III, Kreiger NJ. The significance and a comparative analysis of the epidemiology of hip fractures. *ClinOrthop* 1980;152:35–43.
16. Rozenberg S, Twagirayezu P, Paesmans M, Ham H (1999) Perception of osteoporosis by Belgian women who work in a university hospital. *OsteoporosInt* 10:312–315CrossRefPubMed .
17. Lindsay R, Cosman F, Braunwald E, Facui A, Kasperet D. Osteoporosis, Harrison's Principles of Internal Medicine. Philadelphia: McGraw-Hill; 2001. pp. 2226–2237.
18. 1M. Allison Ford, 1Martha Bass, 1Yan Zhao and et al." Osteoporosis knowledge, self-efficacy, and beliefs among college students in the USA and China." *Journal of Osteoporosis*, 2011.vol. 2011, no. 729219, pp. 8.
19. 1M. Allison Ford, 1Martha Bass, 1Yan Zhao and et al." Osteoporosis knowledge, self-efficacy, and beliefs among college students in the USA and China." *Journal of Osteoporosis*, 2011.vol. 2011, no. 729219, pp. 8.
20. 1M. Allison Ford, 1Martha A. Bass and 2Roseanne Keathley," Osteoporosis Knowledge and Attitudes: A Cross-Sectional Study Among College-Age Students." *Journal of American College Health*, 01/2007.vol. 56, no. 1, pp. 43 – 48.
21. ManasaJagarlamudi, VinayUmeshRao, K.Nitya, etal. A Community Based Study on Knowledge Attitudes and Practice of Osteoporosis in Women.*IndoAmerican Journal of Pharmaceutical Research*, 2015; (5 02: 2015): 846 – 57.
22. GhadeerZakai<sup>[1]</sup> and HaythamZakai<sup>[2]</sup>. Awareness about osteoporosis among university students in Jeddah, Saudi Arabia. *Journal of Advanced Laboratory Research in Biology*, 2015; VI (II, April 2015): 43 – 7.
23. Fatimah Sham, EmadShdaifat, Etal.Knowledge and Perception of calcium Intake among students in University Technology MARA. *International journal of public Health Research*, 2013; 3 2: 370-375.
24. Fahad M. Al-Shahrani, Abdullah M, Al-Zahrani, Ali I. Al-Haqawi. Knowledge of osteoporosis in middle-aged and elderly women *Saudi Medical Journal*, 2010; 31.06: 684-687.
25. Ahmed Al-Zubi\*<sup>1</sup>, Naheyah Almuhtaseb<sup>2</sup>, Ibrahim Amayreh<sup>2</sup> OSTEOPOROSIS AWARENESS IN A SAMPLE OF TEENAGE GIRLS IN JORDAN. *Jordan Medical Journal* 2010; 44 04: 420-426.
26. Sayed-Hassan, Rima, HyamBashour, and AbirKoudsi. "Osteoporosis knowledge and attitudes: a cross-sectional study among female nursing school students in Damascus." *Archives of osteoporosis* 8.1-2 (2013): 1-8.
27. Sabzevari, Ahmad, et al. "Students' awareness on osteoporosis in Khalkhal city, 2014." *International Journal of Advances in Medicine* 2.4 (2015): 354-358.

28. Fok, Margaret WM, H. B. Leung, and W. M. Lee. "Osteoporosis: Public awareness, commitment, and perspectives." *Hong Kong Medical Journal* 14.3 (2008): 203.
29. Amani A Osman. Assessment of Osteoporosis KAP among women in Assir region, Saudi Arabia. *Journal of Medicine and Medical Sciences* 2013; 4(2): 50-55.
30. Author :1-Dr. Diem N. Nguyen Pharm.D.1 and 2-Dr. Mary Beth O'Connell Pharm.D., FASHP, FCCP, BCPS2 "Asian and Asian-American College Students' Awareness of Osteoporosis" *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy* Article first published online: 17 JAN 2012 Volume 22, Issue 8, pp 1047–1054.
31. Author : 1-Roberto Hernandez-Rauda and 2-Sandra Martinez-Garcia "Osteoporosis-related life habits and knowledge about osteoporosis among women in El Salvador: a cross-sectional study" *BMC Musculoskeletal Disorders* / 26 August 2004/ Volume 5 / Issue 29 / pp 747-753.
32. Author : 1-Pamela R von Hurst1 c1 and 2-Carol A Whama1 " Attitudes and knowledge about osteoporosis risk prevention: a survey of New Zealand women " *Public Health Nutrition* /July 2007/ Volume 10 / Issue 07 / pp 747-753.
33. Parsons LC (2005). Osteoporosis in cidence prevention, and treatment of the silent killer. *NursClin North Am*, 40(1): 119-33...
34. Z Jalili ,\*N Nakhaee ,R Askari ,Knowledge, Attitude and Preventive Practice of Women Concerning Osteoporosis, *Iranian J Publ Health*;2007: 36, No.2, p.19-24.
35. L. Abushaikha,1 S. Omran1 and L. Barrouq, Osteoporosis knowledge among female school students in Jordan. *Tikrit Medical Journa*. 2007 2 4 pp.127-130 .
36. 36)- KafiFraihAlshammari," Women Knowledge, Attitude and Practices About Osteoporosis Prevention "Riyadh Saudi Arabia"". *World Journal of Medical Sciences*,2014.11.vol.11, pp. 422-431.
37. Azza El. Tlt1\*, Samia S. Barghash2 and Norah I. Al-Salamah3,13(4): 1-10, 2016, Article no.BJMMR.23131,*British Journal of Medicine & Medical Research*,Knowledge, Attitude and Practice (KAP) Regarding Osteoporosis among General Population in Saudi Arabia.

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### RESEARCH ARTICLE

#### TONGUE MALIGNANT MELANOMA

Ahmed Abu-Zaid, Ibrahim Saud Altamimi, Mohammad Ahmed Al Sahabi and Feras Khaled AL Edrees.

#### Manuscript Info

#### Abstract

#### Manuscript History

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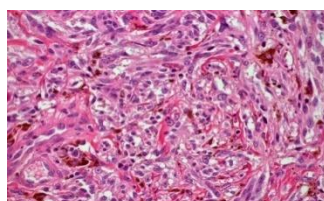
#### Case Report:-

A 30-year-old man presented with a 2-month history of numerous, flat to slightly raised, ill defined, non-tender, painless and purple lesions involving the dorsum of the tongue with scattered islands of leukoplakia.



**A:** Gross picture of the tongue showing multiple, flat to slightly elevated, non-tender, ill-defined, and whitish-purple lesions.

Patient had no other lesions within the oral cavity. Biopsy of the lesions showed malignant melanoma. Full oncological workup showed no evidence of regional or distant metastasis. Patient was managed with subtotal glossectomy, bilateral supraomohyoid neck dissections and reconstruction with a revascularized radial forearm free flap. Histopathological examination showed sheets of epithelioid and spindle-shaped malignant melanocytes.

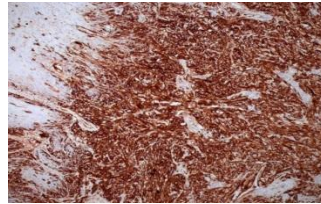


**B:** Histopathological examination of tongue biopsy showing sheets of epithelioid and spindle-shaped malignant melanocytes (H&E stain, magnification power: 40x).

Immunohistochemical examination showed positive reactivity to S-100 and HMB-45 proteins (Figure 1D). The bilateral supraomohyoid neck dissections were negative for malignancy. Final histopathological diagnosis was

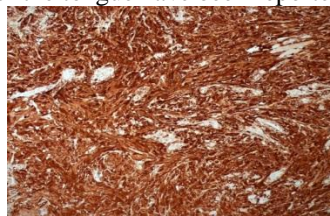


compatible with primary malignant melanoma of the tongue. Postoperatively, no adjuvant therapy was administered and patient had an uneventful recovery course. No recurrence was detected during a 12-month follow-up.



**C:** Immunohistochemical staining of tongue biopsy showing positive reactivity to S-100 protein (Magnification power: 40x).

Oral malignant melanoma (OMM) is an exceedingly uncommon neoplasm. Its reported incidence is approximately 1-2 cases per 10 million individuals per year.<sup>[1]</sup> Hard palate and maxillary gingiva are the two most frequent sites of involvement in primary OMM.<sup>[1]</sup> Primary malignant melanoma of tongue is exceptionally rare. As of 2012, less than 30 cases of primary malignant melanoma of the tongue have been reported in English literature.



**D:** Immunohistochemical staining of tongue showing positive reactivity to HMB-45 protein.

### Discussion:-

Primary OMM can originate from pre-existing melanocytic (pigmented) lesions or de novo (mostly) from malignant transformation and uncontrolled proliferation of neural crest-derived melanocytes that are normally situated in the basal layer of oral mucosa.<sup>[1]</sup>

Risk factors for development of OMM are poorly understood.<sup>[2]</sup> Poor oral hygiene, cigarette smoking, tobacco chewing, alcohol intake, sun exposure, dentures and other oral apparatuses have been assumed as potential etiological factors in the past. However, there has been no strong evidence to validate these assumptions, and etiology of oral melanoma remains largely unknown.<sup>[2]</sup> At present, almost all primary oral cavity (mucosal) melanomas are believed to originate in a de novo fashion.<sup>[1]</sup>

Clinical symptoms of malignant melanoma of tongue include: bleeding (most common presenting symptom), pain (occurs late in the course of disease) and melanotic pigmentation (present in almost one-third of patients).<sup>[2]</sup> Other oral symptoms may include: gingival discoloration/disfiguration, tooth mobility, tooth erosion, numbness, ulceration, irritation, dysphagia, dysphonia and breathing difficulty.

Histopathological and immunohistochemical examination provide the definitive diagnosis of OMM. Immunohistochemically, melanocytes typically stain positive for HMB-45, S-100 and Melan-A.<sup>[3]</sup> HMB-45 is more specific than S-100 protein. Melan-A is positive in nearly 80% of melanomas.

Surgical resection with at least 1.5 cm tumor-free margins, whenever technically feasible, is the gold standard of management in patients with OMM.<sup>[4]</sup> As lymph node metastasis is present in roughly 25% of patients at time of clinical diagnosis,<sup>[5]</sup> neck dissection is highly recommended.

Surgery can be utilized in conjunction with radiotherapy, chemotherapy or immunotherapy — although effectiveness of such therapeutic modalities is largely unclear.<sup>[6]</sup>

Prognosis of OMM, despite aggressive management, is extremely grave with an estimated 5-year survival rate of roughly 15%.<sup>[1]</sup> Plausible reasons include: (1) absent clinical signs and symptoms early in the course of disease, (2) delayed diagnosis, (3) anatomic restrictions to achieve radical surgical resection with tumor-negative margins, (4)

rich vascularity of oral cavity mucosal membranes and hence facilitating rapid hematogenous metastasis, and (5) increased propensity to recur locally (within 10-15 years), invade regional lymph nodes (25%) and metastasize distally (10%).[5,6] Long-term follow-up is highly recommended.

**Conclusion:-**

In conclusion, OMM of the tongue is an exceedingly uncommon, yet, highly aggressive neoplasm with an extremely graving prognosis. Diagnosis is often delayed and most patients present with advanced disease and regional lymph node invasions and/or distant metastases. Careful history taking, meticulous physical examination and early biopsy of pigmented and non-pigmented lesions suspicious for malignant melanoma of tongue are highly recommended. Immunohistochemical examination provides the definitive diagnosis of OMM. Early diagnosis and prompt appropriate management yield better prognosis

**References:-**

1. Hicks MJ, Flaitz CM. Oral mucosal melanoma: epidemiology and pathobiology. *Oral Oncol.* 2000;36:152-169.
2. Rapidis AD, Apostolidis C, Vilos G, Valsamis S. Primary malignant melanoma of the oral mucosa. *J Oral Maxillofac Surg.* 2003;61:1132-1139.
3. Meleti M, Leemans CR, Mooi WJ, van der Waal I. Oral malignant melanoma: the amsterdam experience. *J Oral Maxillofac Surg.* 2007;65:2181-2186.
4. Umeda M, Shimada K. Primary malignant melanoma of the oral cavity--its histological classification and treatment. *Br J Oral Maxillofac Surg.* 1994;32:39-47.
5. Patel SG, Prasad ML, Escrig M, Singh B, Shaha AR, Kraus DH, et al. Primary mucosal malignant melanoma of the head and neck. *Head Neck.* 2002;24:247-257
6. Sharma N. 145 Primary Oral Malignant Melanoma: Two Case Reports and Review of Literature. *Case Rep Dent.* 2012;2012:975358

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### RESEARCH ARTICLE

## QUALITY ASSESSMENT ON EMERGENCY MEDICAL SERVICES DOCUMENTATIONS IN TRAUMA CASES

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#### Key words:-

documentation, emergency medical services, quality assessment, trauma cases

### Abstract

**Background:** The quality assessment would enhance accountability in emergency medical services (EMS) and provide EMS agencies with data to measure their system's overall performance and to develop sound strategic quality improvement planning. The aim of this study was to determine the quality assessment of emergency medical service documentation for trauma cases.

**Methods:** The quality assessment of emergency medical services (EMS) documentation for trauma cases was conducted in the Emergency Medical Communication Centre, Hospital Tengku Ampuan Afzan (HTAA), Kuantan Pahang. A stratified convenience sampling was used as sampling method and the EMS documentation checklist was adopted by Monash University, Centre for Ambulance and Paramedic Studies. The score of the documentation will be reflected with the health care personnel background. The data were analysed by using (SPSS) version 19.0 for windows.

**Results:** 235(100%) of EMS healthcare personnel had fulfilled the requirement for date, patient details, caller details, police notification and also hospital destination. However, for the medications given, only 15 out of 235 documents were documented and 235 (100%) were excluded the adverse effect and allergic reaction of medication to the patient. The overall mean of the quality assessment documentation was 75.013 while the standard deviation was 11.780. Based on the result shown, there was a significant association between years of employment with the quality assessment ( $t=-4.01$ ,  $p<0.001$ ).

**Conclusion:** Only 40% of the documentation were categorised as quality documentations. And only years of employment had significant association with the quality of emergency medical service documentation. Meanwhile, there was no significant association of races and gender with the quality emergency medical service documentation.

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### Introduction:-

Emergency Medical Services (EMS) is a specialty domain that offers clinical care to a wide range of acute medical infirmities, illness or injury. The quality assessment would enhance accountability in EMS and provide EMS agencies with data to measure their system's overall performance and to develop sound strategic quality improvement planning (EI Sayed MJ, 2011). High-quality EMS services must consistently meet customers' needs and expectations, and develop the full potential of resources used in the process (Badsar et al, 2013). Current recommendations by the American College of Surgeons Committee on Trauma (ACS-COT) include a performance improvement (PI) process, which describes the continuous evaluation of the center and providers through a structured review of the process of care and patient outcome (Laudermilch et al., 2010). Trauma patients are a reasonable subgroup to begin to evaluate the integrity of information transmitted between EMS providers and receiving clinicians, as the trauma literature describes a set of prehospital data points that are known to have an impact on the outcome and therefore should be included in the EMS report and known by the receiving team (Carter et al., 2009).

A study done by Bette (2009) stated that the most important role of documentation is to assure high quality patient care. The ambulance service patient report form (PRF) contains important documentation of the early phases of care, and because of the dynamic nature of trauma and acute illness, this clinical information may be important for the interpretation of clinical findings and treatment strategies after admission (Knutsen&Fredriksen, 2013). However, according to Staff and Sovik (2011) EMS documentation is often performed in chaotic and complex settings: in the dark, rain, and cold, under time pressure, and sometimes under threat to personal safety. At the same time, when reviewing patient care, for audit or review, the written record is often the only data source available, and is admissible as evidence in legal proceedings (Murray et al., 2010).

### Material and Methods:-

A retrospective study on quality assessment of emergency medical services (EMS) documentation in trauma cases at Emergency Medical Coordinating Centre, Hospital Tengku Ampuan Afzan (HTAA), Kuantan, Pahang was done. All patients' documents admitted to emergency medical services and reported on the emergency medical communicating centre (EMCC) in HTAA with trauma cases (n=235) from 1<sup>st</sup> June 2014 until 31 December 2014 were collected and quality assessment, emergency medical services documentation checklist was used as a research instrument. The checklist consists of seven key data which are patient information, observation, assessment and management, call cut, time of arrival and incident time, and health care personnel name and background. The collected data were analysed using the Statistical Package of Social Sciences (SPSS) version 19.0 for windows. The ethical approval was taken from Kulliyah of Nursing Research Committee (KNRC), International Islamic University Malaysia Research Ethics Committee (IREC) and hospital data protection officer.

### Results:-

235(100%) of EMS healthcare personnel had fulfilled the requirement for date, patient details, caller details, police notification and also hospital destination. However, for the medications given, only 15 out of 235 documents were documented and 235 (100%) were excluded the adverse effect and allergic reaction of medication to the patient. Some of the documentations were not completely recorded regarding the management to the patient. In addition, most of the documentations were handover with 229(97.4) without completing the required elements from the checklist. There were 53 out of 235 documentations were not legible. The details were shown in table 1.

**Table 1:-** Frequency and percentage of the quality assessment

No.	Data item	Complete n (%)	Incomplete n (%)
1	Is the date, time and call card number is filled up?	235(100)	0(0)

2	Are all patient ID field complete?	235(100)	0(0)
3	Are all patients' address fields complete?	235(100)	0(0)
4	Is patient's charge classification specified?		
5	Are patient's caller details recorded where?	235(100)	0(0)
6	Are attending police call where recorded?	235(100)	0(0)
7	Is patient pick up location specified?	235(100)	0(0)
8	Is hospital destination specified?	235(100)	0(0)
9	Are all ambulance crew details complete?	220(93.6)	15(6.4)
10	Are call out, arrival times and incident time complete?	235(100)	0(0)
11	Is 'the triage' field stated?	197(83.8)	38(16.2)
12	Are observation fields complete?	95(40)	140(60)
13	Is the main problem identified?	80(34)	155(66)
14	Is previous history identified?	0(0)	235(100)
15	Are medications listed?	15(6.4)	220(93.6)
16	Allergies and adverse reactions to medication clearly displayed?	0(0)	235(100)
17	Is a complete event history documented?	205(87.2)	30(12.8)
18	Are on attendance observations documented?	174(74)	61(26)
19	Are examination procedures documented?	25(10.6)	210(89.4)
20	Is initial assessment documented?	102(43.4)	133(56.6)
21	Is time critical assessment documented?	223(95)	15(5)
22	Is road traffic section complete (for appropriate documentation)?	235(100)	0(0)
23	Is physical examination clearly stated?	86(36.6)	149(63.4)
24	Are CPR and first aid check boxes use where appropriate?	201(85.5)	34(14.5)
25	Are all sections of the patient management documented?	49(20.9)	186(79.1)
26	Is final assessment documented?	227(96.6)	8(3.4)
27	Are MPT reasons documented?	189(80.4)	46(9.6)
28	Are patient refusals documented? (if applicable)	0(0)	235(100)
29	Is handover section complete?	229(97.4)	6(2.6)
30	Is EMS documents approved by ambulance office?	176(74.9)	59(25.1)
31	Is ambulance officer badge number documented?	235(100)	0(0)
32	Is the patient response documented?	24(10.2)	211(89.8)
33	Is the documentation legible?	182(77.4)	53(22.6)

Table 2 presented mean and standard deviation of quality assessment, emergency medical service documentation for trauma cases. The overall mean of the quality assessment was 75.013 while the standard deviation was 11.780. The

total score for the quality assessment checklist was 100%. However, the researcher set the minimum score was 80% to pass and the documents can be categorised as quality documentation. The highest score for the quality assessment of emergency medical service documentation for trauma cases in the year of 2014 was 97% and the lowest score was 44%.

Table 2: Mean and standard deviation categorised by quality assessment documentation

Variable	mean	SD
Quality assessment emergency medical services of documentation for trauma cases (n=235)	75.0128	11.779

The majority of the documentations was handled by male healthcare personnel 198 (84.3%) out of 235 emergency medical service documentation. It then followed by 37 (15.7%) handled by a female. There were 219 (93.2%) of Malay health care personnel involved and 16 (6.8%) were non-Malay. All the health care personnel had diploma qualification. The mean and the standard deviation of years of employment were 2.46 and  $\pm 1.26$  as shown in table 3.

Table 3i : Analysis of socio-demographic data frequency and percentage (N=235)

Variable	Frequency (n)	Percentage (%)
<b>Gender</b>		
Male	198	84.3
Female	37	15.7
<b>Race</b>		
Malay	219	93.2
Non-Malay	16	6.8
<b>Qualification</b>		
Diploma	235	100
<b>Years of employment</b>	2.46	1.26

Based on the result shown, there was a significant association between years of employment with the quality assessment ( $t=-4.01$ ,  $p<0.001$ ). Those who score  $\geq 80\%$  were having  $2.85 \pm 1.30$  years of experience, whereas those who scored  $<80\%$  were having  $2.19 \pm 1.17$  years of experience. In addition, the gender and the races were not significant to the quality of emergency medical services with the p-values were 0.006 and 0.779. It showed in Table 4.

Table 4:-Analysis of socio-demographic data and quality assessment emergency medical services documentation for trauma cases (N=235)

Variables		$\geq 80\%$	$<80\%$	statistical value	p-value
		mean (SD)	t-value		
<b>Years of employment</b>	2.85 (1.30)	2.19 (1.17)	-4.10		$<0.001$
<b>Gender</b>	3.39		0.066		
Male	75 (37.9)	123 (62.1)			
Female	20 (54.1)	17 (45.9)			
<b>Races</b>	0.79		0.779		
Malay	131 (59.8)	88 (40.2)			
Chinese	9 (56.2)	7 (43.8)			

## Discussion:-

The result showed that only 95 out of 235 emergency medical service documentation were categorised as quality documentation with the score 80% and above. All the EMS healthcare personnel documented the patient's details, time and address, hospital destination and police call record. These elements should be prioritised to confirm the

cases and to transport the patient with the rapid response time and patient time arrival to the destination hospital at the exact time for further treatment and intervention. According to Staff and Sovik (2011) evaluation of the time of trauma to definitive care is of great importance, where patients may be in need of rapid transportation to a competent surgical facility. However, the most critical elements such as patients overall observation, intervention and medication given mostly were not documented and missing. This study found that only 15 out of 235 documents for trauma cases were documented the medication given. Medication administration was the most crucial elements that should be documented as there were a lot of cases regarding medication error done by the healthcare personnel. According to Risavi, Buzzard and Heile (2013) the top three causes of complaints in EMS system were rude or unprofessional behaviour, failure to transport and also problems with medical treatment. This showed the medication treatment was the most crucial intervention that should be documented in the patients' documentation form in terms of effective treatment and patient safety.

General observation of patients may help the secondary treatment in the emergency department in saving time of diagnosing and provide better treatment. In addition, some of the documents were illegible. Those documents may be affected by the inappropriate time management for documenting the treatment, while conducting the intervention and transporting the patient. It can be shown in the results which were related to the competency of the healthcare personnel to document all the intervention while handling the patients. A quality criterion in documentation was for appropriate care and is crucial for clinical audit and trauma research.

The result showed that the years of employment affect the quality of emergency medical documentation. There was a significant association between the quality of emergency medical service documentation and the years of employment. Basically, the quality of work will be affected by the work experiences. According to Fapuhunda (2013) employees who have positive perceptions and experiences in their workplaces will have an increased desire, willingness and ability to go the extra mile. This showed that the working experience had a more influencing factor to produce the quality of documentation indirectly produce the quality of health care personnel. Other than that, there was no significant association of gender and races with the quality assessment emergency medical service documentation. A study showed that gender also one of the affecting factors to produce the quality of documentation. Women had lower job quality compared to men (Ervasti, H.2008) However, in this study, gender of healthcare personnel was not reflecting the quality assessment emergency medical service documentation.

### Conclusion:-

By performing the quality assessment for emergency medical service documentation, the quality of documentation can be described and provide better skills of documentation to the emergency medical services health care personnel to become more effective to achieve better management and intervention. Knowledge gained from this study will help the healthcare personnel to improve their performance and to realize the importance of documentations in order to achieve a quality patient care. It also can add a new knowledge about the quality of emergency medical service documentation to increase the standard of quality documentation and upgrading the Malaysia healthcare system for the sake of the holistic healthcare institution.

### References:-

1. Badsar A. et al (2013). Assessment of pre-hospital emergency performance in missions of 115 emergency bases of Rasht, Iran , *Annals of Biological Research*, 2013, 4 (12):75-81 Retrieved from <http://scholarsresearchlibrary.com/ABR-vol4-iss12/ABR-2013-4-12-75-81.pdf>
2. Bette, C.D.L (2011). Professional Documentation: Safe, Effective, and Legal Retrieved from: <https://lms.rn.com/getpdf.php/1939.pdf>
3. Carter, A. J. E., Davis, K. a, Evans, L. V, & Cone, D. C. (n.d.). Information loss in emergency medical services handover of trauma patients. *Prehospital Emergency Care : Official Journal of the National Association of EMS Physicians and the National Association of State EMS Directors*, 13(3), 280-5. doi:10.1080/10903120802706260
4. El Sayed MJ (2011). Measuring quality in emergency medical services: a review of clinical performance indicators. *Emerg Med Int*. 2012; 2012:161630. doi: 10.1155/2012/161630.
5. Ervasti, H, 2008. *Nordic Social Attitudes ina European Perspective*. Cheltenham: Edward, Elgar.
6. Fapohunda, T.M (2013) .An evaluation of the perceptions &expperiences of Quality work life in Nigera. *International Journal of Academic Research in Management (IJARM)*Vol. 2, No. 4, 2013,Page:96-108

- Retrieved from <http://elvedit.com/journals/IJARM/wp-content/uploads/2012/08/An-Evaluation-of-the-Perceptions-and-Experiences-of-Quality-of-Work-Life-in-Nigeria.pdf>
7. Knutsen, G. O., & Fredriksen, K. (2013). Usage of documented pre-hospital observations in secondary care: a questionnaire study and retrospective comparison of records. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine*, 21(1), 13. doi:10.1186/1757-7241-21-13
  8. Laudermitch, Dann J. et al. (2010)'Lack Of Emergency Medical Services Documentation Is Associated With Poor Patient Outcomes: A Validation Of Audit Filters For Prehospital Trauma Care'. *Journal of the American College of Surgeons* 210.2: 220-227.
  9. Murray, S. L., Crouch, R., & Ainsworth-Smith, M. (2012). Quality of the handover of patient care: a comparison of pre-Hospital and Emergency Department notes. *International Emergency Nursing*, 20(1), 24–7. doi:10.1016/j.ienj.2010.09.004
  10. Risavi, Brian L., Erik Buzzard, and Christopher J. Heile. (2013) 'Analysis Of Complaints In A Rural Emergency Medical Service System'. *Prehosp. Disaster med.* 28.02 (2013): 184-186.
  11. Staff, T., & Søvik, S. (2011). A retrospective quality assessment of pre-hospital emergency medical documentation in motor vehicle accidents in south-eastern Norway. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine*, 19(1), 20. doi:10.1186/1757-7241-19-20



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## RESEARCH ARTICLE

### BIOMETHANIZATION OF OLIVE MILL SOLID WASTE WITH TURKEY MANURE AT MESOPHILIC CONDITIONS

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##### Key words:-

Anaerobic digestion, Biomethanization, Biogas, OMSW, Animal wastes, Turkey waste.

#### Abstract

Biomethanization or biogas production from olive mill solid waste (OMSW) attempted by co-digestion with Turkey manure at mesophilic conditions. A series of laboratory experiments were performed in anaerobic batch operating reactors, fed with mixtures of OMSW and Turkey manure at various concentrations. Anaerobic co-digestion is well-established process for treating solid organic wastes evaluated for biogas (methane) production.

The biogas production and some biochemical parameters of anaerobic digestion at 30°C for 40 days were studied as affected by two factors: (a) The type of the animal waste. (b) The ratio of animal waste to OMSW that constitute four levels (100:0 for P<sub>1</sub>; 80:20 for P<sub>2</sub>; 60:40 for P<sub>3</sub> and 40:60 for P<sub>4</sub>) of 8% total solid.

The total volume of biogas production at P<sub>1</sub> was (6247ml), P<sub>2</sub> (4316ml), P<sub>3</sub> (1847ml) & P<sub>4</sub> (1613ml). The results indicated that there was a gradual decrease in total gas production in the digester by increasing the OMSW ratio, and the highest production was in the first week of the experiments in all digesters.

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#### Introduction:-

Animal and agricultural wastes constitute a high proportion of biomass and their utilization and recycling is important for economic and environmental aspects. Anaerobic digestion one of the most widely used processes for treating these wastes and represents an attractive method for treating organic wastes for biogas production as alternative energy sources (Marques, 2001).

The two phases olive oil extraction process is the most important technology for olive oil production. In this technology, the olive paste is separated into two phases: olive oil and wet pomace or olive mill solid waste (OMSW). The OMSW is a semi-solid by-product composed by olive husk, olive pulp and olive vegetation water, which is usually reprocessed to further extract the residual oil increasing oil yields (Demerche et al., 2013)

OMSW represents poor agricultural residues that cannot be used alone for ruminant nutrition because it has high amounts of lignocellulosic materials that have low digestibility (Al-Masri, 2012). On the other hand, the other wastes such as Turkey manure are different because it already hydrolyzed but is considered as a source of mixed

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microbial culture that can be used in anaerobic digestion. These raw materials alone do not give specific applications up to date.

However, their elimination, mostly by burning, is the cause of various environmental problems (pollution and fires). The large volumes of OMSW generated in Gaza Strip pose important environmental problems such as aquifer contamination, eutrophication, undesirable smells, etc. (Tortosa et al., 2012 and 2014). However, OMSW in addition to animal wastes can be used as a source of fermentable organic matter in biomass technologies for gas production in a biomethanization process (El-Bashiti, 2010; Rodriguez-Gutierrez et al., 2012).

While some of the manure can be used as fertilizer, not all of it can be consumed in this way and the excess is an environmental liability. Another possibility is to use the manure as a direct or indirect source of fuel for remote power generation, avoids the cost of disposal, reduces odor and other nuisances associated with large livestock and poultry operations. The potential applications of the energy-from-manure concept include space heating, steam, and electricity (Ahn and Smith, 2008; Serio, 2002; Ro et al, 2010).

Because of lack of natural gas resources in Gaza Strip as a result of Israeli siege. Therefore, our goal of this research was to find a natural alternative. The alternative solution is to produce biogas from the natural resources, which can be available in Gaza Strip such as OMSW and animal manure as a source of digester culture.

## Materials and Method:-

### Materials:-

Turkey waste was collected from a farm at Rafah city in the south of Gaza Strip. OMSW was collected as by-product of olive production. Both Turkey manure and OMSW were dried at room temperature. The OMSW was ground and sieved by 0.2 cm sieves size.

### Method:-

Four digesters were prepared with four different Turkey waste and OMSW ratios P1, P2, P3, P4 as described in Table (1). Each digester was filled by tap water to 1 liter. The pH was adjusted at 7 and electric conductivity(E.C) was measured by sharp electric conductivity water proof (Table 2).

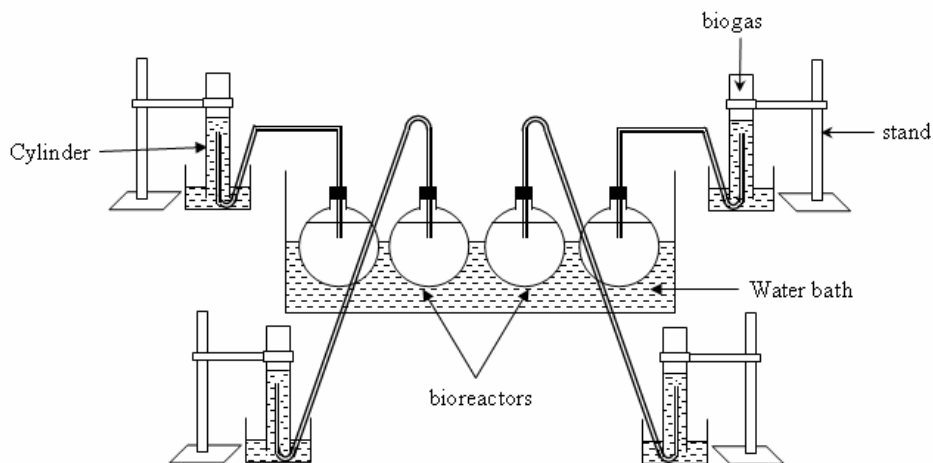
Then the digesters were kept at 30 °C in water bath for 40 days. The released biogas was collected in the graduated cylinders by water displacement (Figure 1&2). At the end, the final pH and E.C were measured.

**Table 1:-** Anaerobic digester of different ratios of Turkey waste to OMSW

Digester	Turkey waste/ OMSW (%)	OMSW (g)	Turkey waste (g)
P1	100/0	0	80
P2	80/20	16	64
P3	60/40	32	48
P4	40/60	48	32

**Table 2:-** pH was adjusted at 7 and electric conductivity (E.C) values at the beginning of the experiments.

Digester	Turkey waste/ OMSW(ratio)	E.C (m.s)	pH
P1	100/0	6.9	7
P2	80/20	6.1	7
P3	60/40	6.25	7
P4	40/60	5.5	7



**Figure 1:-** The experimental set up of biogas production and collection.



**Figure 2:-** The photograph of the experimental set up of biogas production and collection.

### Results:-

As shown in Table 3 and Figure 3, P1 has the highest amount of total biogas production and the lowest amount was found at P4. The highest productivity of biogas was found in the first week by P1&P2 (Figure 4). At the last week, P2 produces large amount of biogas when compared with the others (Figure 4). At the end of the fermentation process, we found the PH at the acidic range, and Electric conductivity was increased (Table 4).

**Table 3:-** Rate of biogas production within different time intervals and total biogas production of different ratios of Turkey wastes and OMSW.

Turkey waste\ OMSW ratio of total 80g	Volume of Biogas (ml)										Total biogas production (ml)
	Day										
	1	2	3	4	5	6	7	8-21	22-27	27-40	
P1(100/0)	1000	730	1090	200	1140	720	640	586	82	59	6247
P2(80/20)	1000	850	420	125	570	70	20	53	59	1149	4316
P3(60/40)	0	600	700	110	256	50	10	42	33	46	1847
P4(40/60)	0	450	587	200	208	25	5	36	30	45	1613

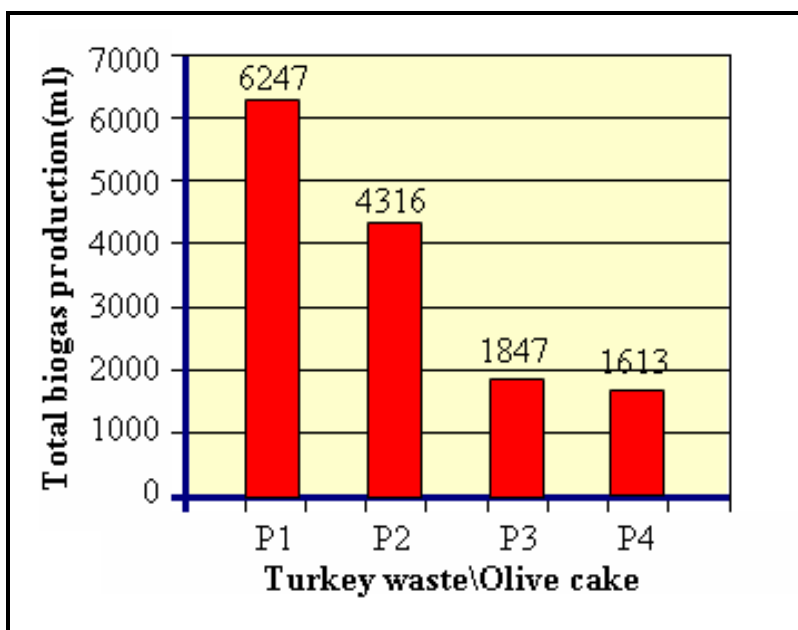


Figure 3:- Total biogas production (ml) at the end of the fermentation process.

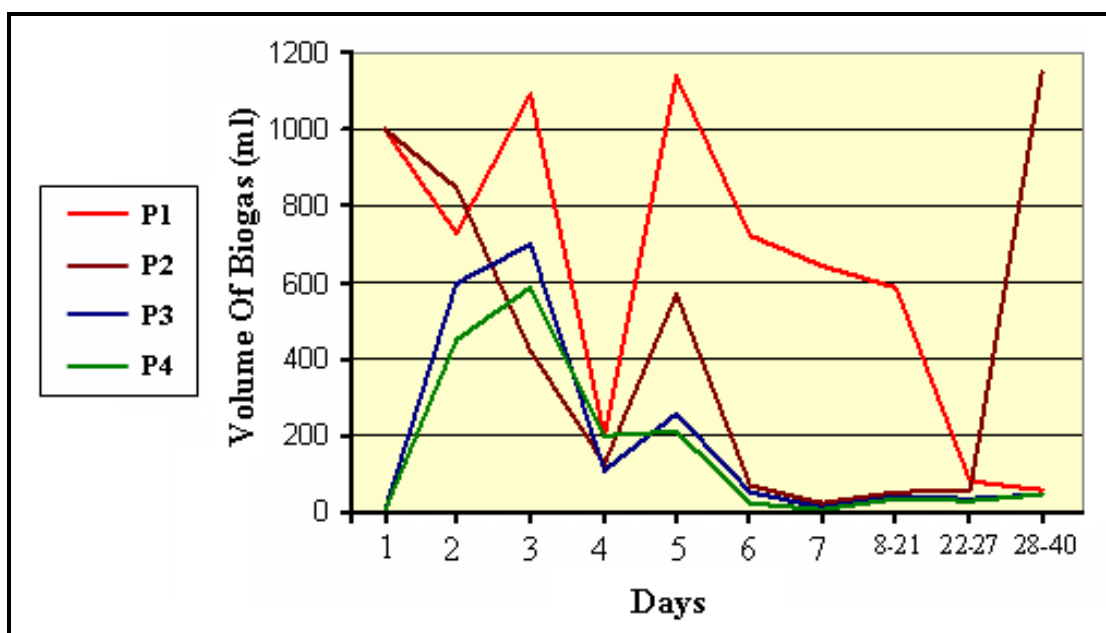


Figure 4:- Volume of biogas production during anaerobic fermentation (days).

Table 4:- The pH and electric conductivity at the end of fermentation process

Reactor	pH (final)	E.C (final)m.s
P1	4.98	14.73
P2	4.77	17.76
P3	4.73	13.83
P4	4.53	10.69

## Discussion:-

High production at p1 refers to its Turkey content only as a digestive materials. The low product in other digesters refers to their contents of OMSW ratio. Percentage of biogas production is very low due to its content of high level of poly phenols (Battista et al, 2014), which considered as a toxic substances to the microorganisms.

Also, the late production of biogas is referring to the lignocellulosic compounds that constitute the major content of OMSW that increase the time of hydrolysis. Therefore, we needed to pretreatment of lignocellulosic materials to break it into simple components for easily digestion (Vintila et al, 2010).

The optimum pH for Anaerobic digestion is within a range of 6.8 to 8.0 (Ogiehor and Ovueni, 2014). More acidic or basic mixtures will ferment at a lower speed. *Because* the high amounts of dissolved CO<sub>2</sub> can *affect* the pH (Dobre et al, 2014). Accumulation of volatile fatty acids (VFA) lead to imbalance in an anaerobic digester, which causes harp decrease in the pH (Acharya et al, 2011 and Zhang et al, 2015).

## Conclusion and Recommendation:-

It was good idea as an alternative solution, to produce biogas from natural resources in order to provide a healthy product, which is friendly to environment, easy to produce, and available for common people. Thus, biomethanization or biogas production from OMSW and Turkey manure can be the most optimal method to fulfill our requirements for its safety, affordability, and availability in nature.

To be more beneficial and vital process, we strongly recommend pretreatment of the OMSW to help in degradation of the lignocellulosic materials before biomethanization process to increase the biogas productivity.

## References:-

1. Acharya, B. K., Pathak, H., Mohana, S., Shouche, Y., Singh, V., &Madamwar, D. (2011). Kinetic modelling and microbial community assessment of anaerobic biphasic fixed film bioreactor treating distillery spent wash. *Water research*, 45(14), 4248-4259.
2. Ahn, H. K., & Smith, M. C. (2008). Biogas production potential from switch grass-animal manure mixture using dry anaerobic digestion. In 2008 Providence, Rhode Island, June 29–July 2, 2008 (p. 1). American Society of Agricultural and Biological Engineers.
3. Al-Masri, M. R. (2012). An in vitro nutritive evaluation of olive tree (*Olea europaea*) pruning residues as affected by cutting regimen. *Bioresource technology*, 103(1), 234-238.
4. Battista, F., Fino, D., & Ruggeri, B. (2014). Polyphenols concentration's effect on the biogas production by wastes derived from olive oil production. *CHEMICAL ENGINEERING*, 38.
5. Demerche, S., Nadour, M., Laroche, C., Moulti-Mati, F., Michaud, P. (2013) Olive mill wastes: Biochemical characterization and valorization strategies. *Process Biochemistry*, 48, 1532-1552.
6. Dobre, P., Nicolae, F. A. R. C. A. Ş., & Matei, F. (2014). Main factors affecting biogas production-an overview. *Romanian Biotechnological Letters*, 19(3), 9283-9296.
7. El Bashiti, T. (2010). Biogas production by co digestion of animal. *Journal of Al Azhar University-Gaza (ICBAS Special Issue)*, vol. 12, 27-30.
8. Marques, I.P., "Anaerobic digestion treatment of olive mill wastewater for effluent re-use in irrigation", *Desalination* (2001), vol. 37, pp233-239.
9. Ogiehor I.S. and Ovueni U.J. (2014). Effect of temperature, pH, and solids concentration on biogas production from poultry waste. *International Journal of Scientific & Engineering Research*, 5(1), 62-69.
10. Rodriguez-Gutierrez, G., Lama, A., Ruiz, M. V., Rubio, F., Fernandez-Bolanos, J. (2012) New olive pomace oil improved by hydrothermal pre-treatment. In: *Olive oil-Constituents-Quality, Health Properties and Bioconversions*. Edited by D. Boskou. Intech Europe, Rijeka, Croatia, 249-266.
11. Ro, K. S., Cantrell, K. B., & Hunt, P. G. (2010). Pyrogasification of blended animal manures to produce combustable gas and biochar. In *International Symposium on Air Quality and Manure Management for Agriculture Conference Proceedings*, 13-16 September 2010, Dallas, Texas (p. 1). American Society of Agricultural and Biological Engineers.
12. Serio, M. A., Bassilakis, R., Kroo, E., &Wójtowicz, M. A. (2002). Pyrolysis processing of animal manure to produce fuel gases. *Fuel Chemistry Division Preprints*, 47(2), 588.

13. Tortosa, G., Albuquerque, J.A., Ait-Baddi,G., Cegarra, J. (2012) The production of commercial organic amendments and fertilizers by composting of two-phase olive mill waste (alperujo). *Journal of Clean Production*, 26, 48-55.
14. Tortosa, G., Albuquerque, J.A., Bedmar, E.J., Ait-Baddi,G., Cegarra, J. (2014) Strategies to produce commercial liquid organic fertilizers (alperujo) composts. *Journal of Clean Production*, 82, 37-44.
15. Vintila, T., Dragomirescu, M., Croitoriu, V. E. R. O. N. I. C. A., Vintila, C., Barbu, H. O. R. I. A., & Sand, C. (2010). Saccharification of lignocellulose-with reference to *Miscanthus*-using different cellulases. *Romanian Biotechnological Letters*, 15(4), 5498.
16. Zhang, C., Su, H., Wang, Z., Tan, T., & Qin, P. (2015). Biogas by semi-continuous anaerobic digestion of food waste. *Applied biochemistry and biotechnology*, 175(8), 3901-3914.

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### RESEARCH ARTICLE

#### A STUDY ON SOCIO-ECONOMIC AND CULTURAL PROFILE OF FISHERMEN IN PUDUCHERRY REGION, INDIA.

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Fishermen, socio-economic condition,  
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#### Abstract

The study focused on the socio-economic and cultural profile of the fishermen living in community villages in Puducherry Region. The objective of the study is to analyse the socio-economic conditions as well as the problems faced by the fisher folk. To study the factors 200 sample respondents were interviewed with duly constructed schedule of questions by using the simple random sampling method. The outcome of the study revealed that 92% belong to Hindus and very meager (8%) from Christian community. Fishermen venture into sea is aging between 41 and 45 years (43%) and they only have primary level education. Regarding their income it ranges between Rs. 5,000 and Rs.20,000 p.m. Only 12% of the respondents earn more than Rs.20,000 p.m. Majority of the respondents are living in the Government provided tsunami houses. Rest of them dwells in their own house. Good majority of the fishermen habituated to use latest mobile phones (86%) and accustomed to live with basic necessities such as TVs and other home appliances despite of their low income. Puducherry is famous for liquor since its French regime. Therefore most of the fishermen (62%) addict to liquor. More than 30% of their total income is spent for consumption of liquor. This is the cause of concern for this community. The major problems of fishermen were identified as selling of fish, price fixing, marketplace & finance for investment. Those problems are perceived by the fishermen as serious issues. The fishermen expect the from the Government to arrange certain facilities like short period loans, transportation, set up of more fish markets and processing units open for marketing of fish.

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#### Introduction:-

Fishing is the ancient and one of the most important livelihood options of the inhabitants of the coastal line of the country since the time immemorial. Fish and fisheries is an important sector in most of the developing and developed countries of the world from the standpoint of income and employment generation. It is one of the oldest economic activities of the human race and ranks next to agriculture. The fisher folk purely depend on the marine

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environment for their day-to-day affairs and it has been considered as the custodian of livelihood security. The fisheries sector contributes to the national income, exports, food and nutritional protection and employment generation. Approximately, 1% of the total populations rely on the fishery sector in India as a primary source of income and life dependency. (Ministry of Statistics and Programme Implementation, 2011). India occupies the third position in fish production and second in aquaculture production in the world ranking. The fish production in the country in 2014-15 was 100.69 lakh tones, of which 34.91 lakh tones were harvested from marine sector and the rest was from inland sector. The rapid economic growth and expansion of the domestic retail sector in India has created a significant market for fresh and processed fish and fishery products within the country (Sathiadhas, *et al.* 2011). Indian fishery sector significantly contribute to foreign exchange too.

#### **Puducherry and Fishery:-**

The Union Territory of Puducherry comprises of four regions, viz., Puducherry, Karaikal, Mahe & Yanam. The UT's capital is the city of Puducherry. The UT of Puducherry has total fishermen population around 95,467 (Dept. of Fisheries statistics, Puducherry) of which 29,383 fishermen are actively engaged in fishing from 29 marine fishing villages and 23 inland fishing villages / hamlets scattered across the region. For this study, the researcher has taken three dense populated fishing villages. First, Veerampattinam village has 1,777 fishermen families, second Vambakeerapalayam has 1,390 fishermen families and the third one is Solainagar has 767 fishermen families.

#### **Review of Literature:-**

**Basavakumar et al. (2011)** the research paper entitled "A study on profile of fishing community of a village in Karnataka" from Dharwad district. The study revealed that the male population constitute around 52.33 per cent and 13.84 per cent of fishermen are only literate. It is noted that 56.14 per cent respondent's income was less than of 30,000 per month. The study also reveals that smoking, betel nut chewing and consumption of liquor were the common habits of adult fishermen.

**Bijayalakshmi and Ajitkumar (2014)** in their research paper "Socio-economic conditions and cultural profile of the fishers in India- a review" states that the socio-economic conditions of the fisheries in India are considerably low. Fishers generally have pursued less education and live under improper housing conditions. With a very low income from fishing, fishers supported large members in the family which compels the fishermen to borrow credits to fulfill their basic needs. The study concluded that proper fishery management policies, effective input supply, technical and social supports may improve the livelihood of the fishers which will ultimately increase the overall fisheries productivity of India.

**Tapashi and Methra (2014)** in their paper "Socio-economic and cultural profile of fish farmers: A study in and around Lumding town, Nagaon District of Assam" the data were collected from 110 respondents by using random sampling method. It was found that most of the inland fish farmers belong to the scheduled caste and majority of the fish farmers had their own land and practiced fish farming as a primary occupation for many decades. Their income from fish farming was too low (between Rs. 20,000 and 30,000/- p.a.). Most of them took financial help from their friends and relative of their day to day investment. They spent their major earnings for basic needs, food and children's education. Poverty, lack of marketing facilities and lack of technical training are the major hurdles they face.

**Kadam (2015)** in his paper entitled "Socio economic conditions of fishermen of Masoli Reservoir, in Gangakhed (Tq), Parbhani Dist., Maharashtra state, India" the data collected from 35 families. The results disclosed that 45.26% of the fishers are literate and the economic status of the people was fairly poor as they are unable to engage work due to many reasons. They used traditional fishing methods instead of modern aquaculture techniques. The Govt. of Maharashtra provides fishermen welfare programmes such as Group Accident Insurance Scheme for active fishermen, Development of Model Fishermen Villages etc.

**Jacob and Rao (2015)** in their article "Socio-ecological studies on marine fishing villages in the selective south coastal districts of Andhra Pradesh", the study revealed that the fishermen in coastal villages are in pathetic condition because of poverty and lack of financial support either from the Govt. or from the banks. The study reveals that almost, 90% of the traditional fishermen live below poverty line. The large scale industrialization in the recent years in coastal areas without having any strict regulatory framework has a devastating impact on the marine livestock, health of fishermen and their livelihood. The fishing villages are totally deprived of the basic infrastructure such as proper drinking water, connectivity of road, street electrification and good sanitation.



**Statement of the Problem:-**

Pondicherry lies on the east coast of Bay of Bengal therefore; emergence of fishing and related activities is inevitable among the people of coastal villages naturally called as fishermen. Their productive capacity, performance and earnings are based on their living style, comforts, societal investments and economic status. Despite the enormous increase in the fishermen population, their prosperity, welfare and development is measured by the Government are seemed to be not up to the mark. Hence, this is to be addressed. Majority of the fishermen family live in below poverty line. Their financial instability, low profile in socio-economic status brought them down to earth not allowing them to prosper in their life. The fishermen's children aspire for good education but they are unable to pursue because of the inability of family head to spare considerable money for that purpose. All these factors rely on the prosperity of the fishermen community who dwell in the areas in which basic facilities like pure drinking water, sanitation and toilets are still inadequate. Taking in to account of the facts, it would be pertinent to study the socio-economic factors and problems of fishermen community in Pondicherry Region.

**Objectives of the Study:-**

The following are the basic objectives of the study.

1. To study the Socio-Economic status and problem faced by the fishermen in Puducherry Region.
2. To suggest better ways and means for improving the standard of living of the fishermen.

**Methodology:-**

The data required for the study have been obtained from both primary and secondary sources. The primary data were collected through interview schedule and secondary sources of data were collected through books, journals, magazines and related websites. Three fishermen outfits had been chosen for this study Viz., Veerampattinam, Vambakeerapalayam and Solainagar in Puducherry region. The combined populations of three villages are 15,736. Out of which 70 respondents from each villages has been chosen on the basis of simple random sampling method. Out of 210 samples ten respondents neither provide necessary information nor co-operate to the investigator. Hence, 200 samples were finally taken for the study.

**Socio-Economic Research Variables:-**

In the fisheries, socio-economic status of fishermen plays a key role in their productive activities. Socio-economic parameters such as religion of fishermen, castes, age, marital status, standard of living, duration of stay, family structure, member of family, earning members in family, employment of sons /daughters, member of family venture into sea, occupation of female households, residence ownership, nature of house, toilet facilities, food habit, source of lighting, household amenities, cultural activities, competition among inland fishermen, consumption habits of fishermen are considered as important variables for analysis.

**Analysis and Interpretation:-**

The Socio-economic profile of the Fishermen in the study area was analysed and the results are presented in table 1.

**Table 1:- Socio-Economic Profile of Fishermen**

No.	SOCIOECONOMIC PROFILE		Frequency	Percentage
1.	<b>Religion of Fishermen</b>	Hindu	184	92%
		Christian	16	8%
		Muslim	0	0%
		<b>Total</b>	<b>200</b>	<b>100%</b>
2.	<b>Castes of Fishermen</b>	Scheduled Caste	0	0%
		Scheduled tribe	0	0%
		E.B.C	200	100%
		M.B.C	0	0%
		General	0	0%
		<b>Total</b>	<b>200</b>	<b>100%</b>
3.	<b>Age of Fishermen</b>	Below 30 years	22	11%
		31-35 years	16	8%
		36-40 years	28	14%
		41-45 years	86	43%
		Above 45 years	48	24%
		<b>Total</b>	<b>200</b>	<b>100%</b>

4.	<b>Marital Status of Fishermen</b>	Married	176	88%
		Unmarried	24	12%
		Others	0	0%
		<b>Total</b>	<b>200</b>	<b>100%</b>
5.	<b>Educational Status of Fishermen</b>	Uneducated	32	16%
		Up to Primary	130	65%
		Secondary	28	14%
		Higher Secondary	4	2%
		Degree and above	6	3%
		<b>Total</b>	<b>200</b>	<b>100%</b>
6.	<b>Standard of living</b>	Above poverty line	10	5%
		Below poverty line	190	95%
		<b>Total</b>	<b>200</b>	<b>100%</b>
7.	<b>Duration of stay</b>	1-5 years	8	4%
		6-15 years	2	1%
		16-25 years	36	18%
		26-35 years	16	8%
		Above 35 years	138	69%
		<b>Total</b>	<b>200</b>	<b>100%</b>
8.	<b>Family Structure</b>	Nuclear family	130	65%
		Joint family	70	35%
		<b>Total</b>	<b>200</b>	<b>100</b>
9.	<b>Number of members in the family</b>	Up to 3 members	18	9%
		4 to 5 members	118	59%
		Above 5 members	64	32%
		<b>Total</b>	<b>200</b>	<b>100%</b>
10.	<b>Number of earning members in the family</b>	Up to 3 members	164	82%
		4 to 5 members	20	10%
		Above 5 members	16	8%
		<b>Total</b>	<b>200</b>	<b>100%</b>
11.	<b>Employment of their Sons / Daughters(200-24 (Unmarried) = 176)</b>	Fish catch	126	71.59%
		Private Job	36	20.46%
		Govt. Job	4	2.27%
		Students	10	5.68%
		<b>Total</b>	<b>176</b>	<b>100%</b>
12.	<b>Occupation of Fisherwomen (200-24 (Unmarried) = 176)</b>	Housewife	70	39.8%
		Fish Vendors	106	60.2%
		<b>Total</b>	<b>176</b>	<b>100%</b>
13.	<b>Ownership residence of the respondents</b>	Rented House	4	2%
		Own House	70	35%
		Govt. Provided Tsunami House	126	63%
		<b>Total</b>	<b>200</b>	<b>100%</b>
14.	<b>Nature of House</b>	Thatched House	4	2%
		Titled House	34	17%
		Concrete House	162	81%
		<b>Total</b>	<b>200</b>	<b>100%</b>
15.	<b>Usage Telephone/Mobile</b>	Landline Telephone	4	2%
		Mobile Phone	172	86%
		Having Both	2	1%
		Not Having Both	22	11%
		<b>Total</b>	<b>200</b>	<b>100%</b>

16.	<b>Food Habit</b>	Rice with fish	200	100%
		Wheat	0	0%
		Others	0	0%
		<b>Total</b>	<b>200</b>	<b>100%</b>
17.	<b>Source of Lighting</b>	Electricity	200	100%
		Kerosene	0	0%
		Solar	0	0%
		<b>Total</b>	<b>200</b>	<b>100%</b>
18.	<b>Attitude towards entertainment of fishermen</b>	Reading Newspapers & Magazines	36	18%
		Listening Radio	2	1%
		Watching T.V	156	78%
		Cinema	6	3%
		<b>Total</b>	<b>200</b>	<b>100</b>
19.	<b>Conflicts / Competition among inland fishermen</b>	Yes	8	4%
		No	192	96%
		<b>Total</b>	<b>200</b>	<b>100%</b>

Source: Primary data

**Religion, Caste & Age of respondents:** Hindus were featured as the absolute majority (92 per cent) among the fishermen in those villages. Meager 8 per cent are Christians. No Muslim fishermen found in the study area. Most of the fishermen are belong to fishermen community which comes under “Extreme Backward Class” (EBC). Majority of the fishermen (43 per cent) are at the age group between 41 and 45 years, 25 per cent of respondents are above 45 years, 14 per cent of the respondents aged between 36 years and 40 years, 11 per cent respondents are aged below 30 years. Meagre (8 per cent) respondents are aged between 31 and 35 years.

**Education, Marital Status and Standard of living:** Education plays a vital role in efficient management and successful production of fish. An educated fisherman easily adopts new technology than an uneducated one. With regard to the education status of fishermen, 65 per cent of respondents have only primary level of education, 14 per cent of respondents at secondary level. Further, it was found that 16 per cent of the respondents are uneducated. Fishermen possess higher secondary education and above are only 5 per cent.

Marital status is the important factor for socio-economic and cultural profile of fisher folk because this factor molds behaviour of the any individual. It is evident from this study that 88 per cent of the respondents are found to be married and the remaining 12 per cent are unmarried. Taking into account of standard of living, the study divided into two categories viz., living below and above poverty line. The Government of Puducherry issued ration cards based on their income level. The red ration card holders are identified as living below the poverty line and yellow ration card holders are treated as living above the poverty line. The study reveals that 95 per cent fishermen (possess red cards) are living below poverty line and the rest (5 per cent yellow card holders) are in the above poverty line.

**Duration of stay:** Regarding duration of stay, most of the fishermen (69 per cent) live in the same locality for more than 35 years. The study also revealed that 31 per cent of the respondents migrated from other locality (villages) within Puducherry region for getting better employment, children’s education, transportation etc.

**Family Structure:** Family structure is another important factor for analyzing socio-economic status of fishermen. In the present of study, families were classified into two types such as nuclear family and joint family. Majority (65 per cent) of fishermen are living as nuclear family and 35 per cent as joint family. The size of the family has considerable influence on the income and expenditure pattern of the family.

**Number of members in the family:** Around 60 per cent of the fishermen family have 4 to 5 members followed by fishermen family have more than 5 members (32 per cent). Only 9 per cent have only 3 family members.

**Number of earning members in the family:** It was revealed that, majority (82 per cent) of the respondents family three members work and earn income for their family. Only 8 per cent of the respondents, all the members of family go for work and earn for their livelihood.

**Employment of their sons / daughters:** God majority of the fishermen (71.59 per cent) sons & daughter (unmarried) engage fishing and related activities. Only 20.46 per cent of the fishermen children go for private job. Very meagre 2.27 per cent fishermen sons and daughters could get the Government job and 5.68% of sons/daughters of fishermen are students.

**Occupation of fisherwomen:** The occupation of fisherwomen (60.2 per cent) is fish vending and 39.8 per cent of fisherwomen manage house.

**Ownership of residence:** The residential house of the fishermen (63 per cent) is Government provided Tsunami houses. 35 per cent of fishermen reside in their own house and only 2 per cent live in rented house.

**Nature of house:** Housing pattern is one of the most important indicators used to assess the economic well-being of any community. During the survey, attempts were made to find out the conditions of living house of the fishermen. The study revealed that good majority of fishermen are living in concrete house (81 per cent) followed by the titled house (17 per cent) and thatched house is 2 per cent. This reflects the better living condition of the people in the study area. The reason because the Govt. has provided tsunami house to fishermen.

**Usage of telephone /mobile phone:** Majority (86 per cent) of the fishermen use mobile phones where as only 2 per cent use landline telephone. Both mobile phone and landline telephone using respondents are only one per cent. It is interested to state that 11 per cent of the respondents neither use mobile nor use landline phone because they are unable to buy the costly gadgets. During emergency needs they use phone of their relatives or neighbours.

**Food Habit:** Regarding food pattern of the fishermen in Puducherry region, cent of fishermen take rice with fish gravy. Because they like the taste of food and most of them add fish in day-to-day food habit. No one prefers wheat related food in their homes.

**Source of lighting:** It was found that all the respondents in the study area are using the electricity as source of lighting. They use the Kerosene lamp or candle as alternative source of lighting if electricity fails.

**Entertainment Actives:** The entertainment activities of fishermen are watching T.V (78 per cent) followed by reading newspaper& magazines (in vernacular) is 18 per cent then going to cinema theaters is 3 per cent and listening to FM radio is only one per cent.

**Conflicts / Competition:** The study reveals that 96 per cent of the fishermen expressed that there is no conflict/competition between the fishermen in respect of their employment or any other socio-cultural aspects.

**Table 2:-** Adequacy basic facilities to the Fishermen

No.	Basic Facilities	Adequate	Inadequate	Total
1.	Access to safe drinking water	69%	31%	100%
2.	Proper Sanitation facilities	69%	31%	100%
3.	Access to healthcare facilities	78%	22%	100%

Source: Primary data

From the above table it is found that the basic facilities like provision of clean& safe drinking water, proper sanitation facilities and accessibility of healthcare facilities are considered as vital factors for the healthy society. The study reveals that 70% of the respondents agreed that the Government of Puducherry have provided a good sanitation facility, safe and clean drinking water facilities. Good majority of respondents opined that health care facilities are adequate.

**Table 3:-** Toilet facilities available to the Fishermen

Toilet Facilities	Frequency	Per cent
Yes	160	80%
No	40	20%
<b>Total</b>	<b>200</b>	<b>100%</b>
<b>If No, Toilet facilities</b>		
	Frequency	Per cent
Open Place	32	80%
Govt. Provided common toilets	8	20%
<b>Total</b>	<b>40</b>	<b>100%</b>

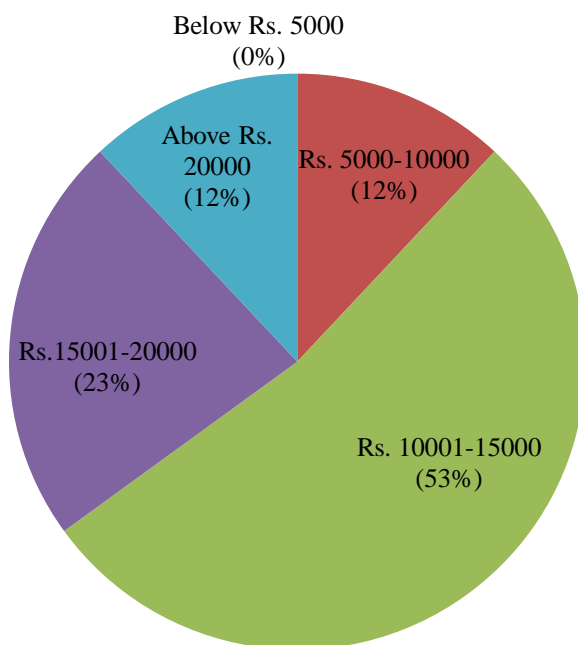
Source: Primary data

Table -3 shows that the availability and usage of toilets are one of the important yardsticks of the socio-economic factors to measure their life style. Hence, the question was raised among the respondents to find the availability and usage of toilets. It was found that 80 per cent of fishermen have own toilet facilities in their residence, but 20 per cent of fishermen have no toilet facilities and they go either open place or common toilets for their natural calls.

**Table 4:-** Monthly Income of Fishermen

No.	Monthly Income	Frequency	Per cent
1.	Below Rs. 5000	0	0%
2.	Rs. 5000-10000	24	12%
3.	Rs. 10001-15000	106	53%
4.	Rs.15001-20000	46	23%
5.	Above Rs. 20000	24	12%
	<b>Total</b>	<b>200</b>	<b>100%</b>

Source: Primary data

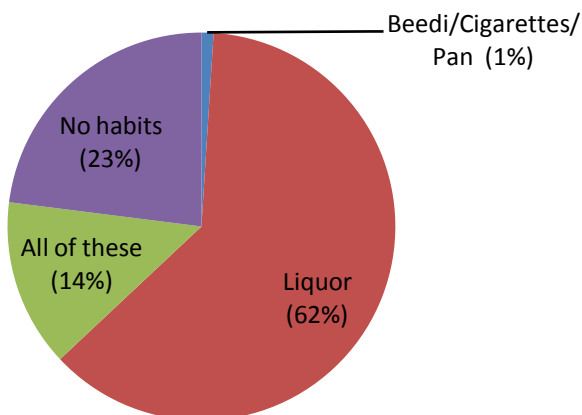


In general, employment and income are the twin decisive factors mostly used to determine the living standard of any community. Equitable distribution of income further enhances the social harmony among different sections of population. In this connection, the monthly income of the respondents was found that 53 per cent of respondents earn income between Rs. 10,000 and 15,000 p.m. followed by 23 per cent earn between Rs. 15,000 and Rs. 20,000 p.m. Only 12 per cent of the fishermen earn more than Rs. 20,000 p.m.

**Table 5:-** Habits of the Fishermen

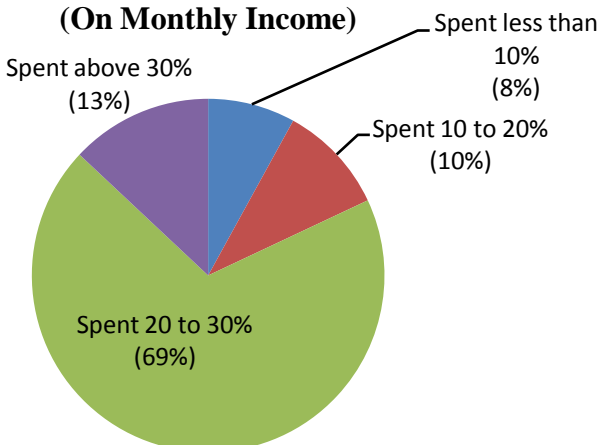
No.	Habits of fishermen	Frequency	Per cent
1.	Beedi / Cigarettes / Pan	2	1%
2.	Liquor	124	62%
3.	All of these	28	14%
4.	Clean habits	46	23%
	<b>Total</b>	<b>200</b>	<b>100%</b>

Source: Primary data

**Exhibit -2: Habits of Fishermen****Table 5a:-** Income spent on Alcohol consumption

	Income spent on Alcohol consumption	Frequency	Per cent
1.	Spent less than 10%	12	8%
2.	Spent 10-20%	16	10%
3.	Spent 20-30%	106	69%
4.	Spent above 30%	20	13%
	<b>Total</b>	<b>154</b>	<b>100%</b>

Source: Primary data

**Exhibit -3: Income spent on Alcohol Consumption (On Monthly Income)**

**Table 5b:-** Place of consumption of Alcohol

	Place of Consumption of Alcohol	Frequency	Per cent
1.	Bar	102	67%
2.	Home	50	33%
	<b>Total</b>	<b>152</b>	<b>100%</b>

Source: Primary data

It is evident that liquor consumption is quite common among the people of Puducherry, particularly among the fishermen community. Table-5reveals that majority 102 respondents of the respondents have the habit of consume liquor regularly. Out of which, 67 per cent of respondents go to local bars for liquor in-take, rest of them consume liquor in their home itself. Further, it is keen to observe that majority (69%) of the respondents spend around 30 per cent of their total earnings for liquor consumption. It is noteworthy to state that 46 (23 per cent) respondents have clean habits.

### Problems Faced by Fishermen:-

The study also analysed the basic problems faced by the fishermen community. The data were analysed and results are presented in the table 6.

**Table 6:-** Problems faced by the fishermen

(NAP-Not at all Problem, MIP-Minor Problem, MOP-Moderate Problem, SP-Serious Problem)

S.No	Problems faced by the fishermen	NAP	MIP	MOP	SP	Mean Score	SD	Rank
1.	During the fishing	84%	16%	0%	0%	1.16	.368	8
2.	During fish selling	53%	35%	8%	4%	1.65	.833	6
3.	Related with gears and crafts	74%	12%	14%	0%	1.40	.725	7
4.	In the society	15%	65%	13%	7%	2.12	.742	4
5.	In the family	38%	42%	16%	4%	1.86	.829	5
6.	Related to transportation of fish products	8%	26%	35%	31%	2.89	.942	2
7.	Obtaining loan from banks and other financial sources	23%	5%	72%	0%	3.21	1.289	1
8.	Owners, labours, buyers and sellers	5%	54%	32%	9%	2.45	.730	3

Sources: Primary Data

From the above table the results reveals that while ranking the problems faced by the fishermen, the mean score (3.21) the highest refers the procurement of finance from banks and other financial sources is a fundamental problem faced by the fishermen because, tedious of formalities. Demanding security for the loans is a hectic problem for the fishermen. Second major problem cited by the respondents is transportation. The respondents expressed that transporting their fish products to market and other places found costly since petrol / Diesel prices, rent for load carriers are more expensive. Problem with owners of boats / launches / crafts, labours, buyers and sellers is the third problem of fishermen. Fixing the wages for labours and rent for crafts, fixation of selling price for fish products are also some of the other problems faced by the fishers.

### Findings:-

The present study highlights some of the major findings are as follows:

- The socio-economic conditions of the fishermen in Puducherry region (villages like Veerampattinam, Vambakeeralayam and Solainagar) are moderate (neither poor nor good).
- Good majority (92%) of fishermen belong to Hindu region only 8 per cent belong to Christian community.
- The study reveals that 67 per cent of the fishermen are engaged in active fishing at the age group of more than 40 years. Only 11 per cent of fishermen belong to below 30 years category venture in to sea.
- The study reveals that 88 per cent of the fishermen are married.
- It is found that 65 per cent of the fishermen have primary education only.
- Majority (95%) of respondents live below the poverty line.
- The study found that 65 per cent of fishermen are living as Nuclear family.
- The study reveals that 63 per cent of fishermen sons venture into sea and involving in fish catch.
- It is also found that 60.2 per cent of fisherwomen engage fish vending.

- Regarding residence it is found that 63 per cent of fishermen live in Government provided Tsunami houses.
- The study also reveals that 81 per cent of the fishermen live in concrete houses.
- For communication, 86 per cent of fishermen use mobile phone, out of which 70 per cent are smart phone users.
- It is found that all respondents (100%) are using electricity for lighting.
- Good majority of the fishermen's food habit is rice with fish related dishes.
- The entertainment activities of the fishermen are watching television, newspaper reading and listening FM radio.
- Majority (96 per cent) of respondents opined that there is no conflicts and competition between themselves and inland fishermen.
- The study reveals that 80 per cent of fishermen have toilet facilities. Rest of them use either open space or municipality common toilets for their natural calls.
- The study found that the basic facilities like drinking water, sanitation and healthcare facilities are adequate.
- The study found that the 53 per cent of fishermen monthly income is between Rs. 10,000 and 15,000.
- The study reveals that 76 per cent of fishermen have a habit of consumption of liquor. More than 53 per cent of fishermen spend around 30 per cent of their monthly income for liquor consumption.
- The major problem faced by the fishermen is finance related issues.

### Suggestions:-

The following are the important suggestions.

1. The Government should arrange regular awareness program against use of alcohol, drugs and pan masalas.
2. As per the central Government's clean India programme, the UT administration should ensure the provision of toilets to every house of fishermen so that the use of open space as toilets may be avoided.
3. The children from fisheries communities should be provided with more reservation for their higher education and employment.
4. The government must take steps to solve transportation blocks for the fishing community. So that caught fish can be marketed in the right time at the right place. If there are ways to sell the fish through government channels like fishermen sangam, and through fisheries department etc. will benefit to the fisher folk.
5. Sophisticated markets and processing units should be opened for the marketing of the fish products. Hence it will boost up their economy and paves way to change in the lifestyle.
6. More technical devices should be introduced in the fisheries sector. It will enable the fishermen to catch more fish.
7. Government should make necessary arrangements with bankers for easy availability of bank loans for the financial needs of fishermen community for periodical investments and working capital etc.

### Conclusion:-

Though tremendous increase in GDP from the fisheries sector during the last two decades, living conditions of fishermen all over India is still remains unchanged. In this situation, it is highly essential to take steps to improve their income and reduces their expenditure to obtain a socio-economic balanced society. More particularly, the socio-economic profile of the fishermen in Puducherry region ranked as moderate living, efforts should be taken by the local administration to uplift their lifestyle by providing good education, create awareness and create more responsibility towards the society through various awareness / welfare programmes and financial schemes.

### Reference:-

1. Basavakumar, K. V., Devendrappa, S. and Srenivas, T. (2011) "A study on profile of fishing community of a village in Karnataka" Karnataka Journal Agriculture Science. Vol. 24, Issue. 5, pp. 684 – 687.
2. Bijayalakshmi, D.N. and Ajitkumar, N. (2014) "Socioeconomic conditions and cultural profile of the fishers in India- a review" IOSR Journal of Agriculture and Veterinary Science. Vol. 7, Issue. 9, pp. 42-48.
3. Tapashi Gupta and MethraDey (2014) "Socio-economic and cultural profile of fish farmers: A study in and around Lumding town, Nagaon District of Assam" International journal of life science biotechnology and pharma research. Vol. 3, Issue. 4, pp. 83-93.
4. Kadam, M. S. (2015) "Socio economic conditions of fishermen of Masoli Reservoir, in Gangakhed (Tq), Parbhani Dist., Maharashtra state, India" Indian Journal of Applied Research. Vol. 5, Issue. 5, pp. 781-782.
5. Jacob, M.J.K., and Rao, R.B. (2015) "Socio-ecological studies on marine fishing villages in the selective south coastal districts of Andhra Pradesh" Ecotoxicology and Environmental Safety. pp. 1-6. <http://dx.doi.org/10.1016/j.ecoenv.2015.08.026>





### RESEARCH ARTICLE

#### CORRELATION OF CHILD'S AGGRESSIVE BEHAVIOR AND TELEVISION EXPOSURE: A CROSS SECTIONAL STUDY IN AL AHSA, KINGDOM OF SAUDI ARABIA

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#### Abstract

**Objective:** establishing a clear and direct correlation between the aggressive behaviors of the children and the exposure to TV violent programs.

**Method:** 593 children represented the main sample of this research. 51,5% of the sample are males, whereas 48,5% are females. They had ages among 6 and 13 years old. They are residents in Al-Ahsa region (2016). The qui-square test was the main tool to check the influence of the TV watching by children and their aggressive actions.

**Results:** Almost all the respondents (99,3%), reported watching TV, most of them reported watching TV 2hours per day (33,4%) , while the most of the children (43,7%) esteemed to watch TV a period that exceeds 4 hrs / week. Data analysis prevailed that Children's the TV exposure was not related to children's behavior according to parents ( $p=0,379$ ) and teachers ( $p=0,078$ ).

**Conclusion:** Although this research detected a lowproportion of aggressive children, the aggressive behavior is still a recurrent broad global problem that should be reported and treated in early ages. This can happen through reducing the exposure to media as it the key reason for the growth of violence among children.

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#### Methodology:-

The researcher depended on the descriptive analysis approach to estimate the socio-demographic factors and behavior characteristics under the influence of TV watching and computer use.

#### Case study population:-

It composed of children who are residents of Al-Ahsa region. They were withages among 6 and 13 years old. In this case study, the parents and the teachers have responded to 2 questionnaires (BPI questionnaires).

#### Study tool:-

The pre-formed and self-administered questionnaire was prepared and it requires information about:

1. Socio-demographic and lifestyle data such as: age, gender, residence, number of brothers and sisters, parent's education level, parent's monthly income, TV watching, average/day, average/week, Computer use, average computer/day, average computer/week.

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2. Behavior score by parents' assessment including 28 questions. A score of 1 was given to "always" and 2 to "sometimes" and 3 to "never". For each subject, the researcher calculated a maximum score of 84. A scoring system was used with the purpose to measure the value of the respondents' aggressive behavior. The children behavior was categorized into 3 levels indicated by inadequate behavior (0-28), average behavior (29-56) and adequate behavior (57-84).
3. Behavior score by teachers' assessment including 25 questions. A score of 1 was given to "always" and 2 to "sometimes" and 3 to "never". For each subject, the researcher calculated a maximum score of 75. A scoring system was applied to measure the respondents' aggressive behavior. The children behavior was categorized into 3 levels indicated by inadequate behavior (0-25), average behavior (26-50) and adequate behavior (51-75).

#### Statistical analysis:-

(SPSS, version 20) was the program that was used to apply the descriptive analysis on the data using the Statistical Package for Social Sciences in the program.

The correlation of the participants' scores of the behaviors as a function of the exposure to TV was evaluated using:

1. The frequencies and the percentages.
2. The Chi-squared test which is famous for its accurate results.

The statistical significance for the data was accepted at value of  $p < 0.05$ .

#### Results:-

##### Socio-demographic and lifestyle characteristics:-

The socio-demographic characteristics gave results that are listed in the next table (1)

**Table 1:-Socio-demographic factors**

Data		Frequency	Percent (%)
<b>Gender</b>			
	Male	305	51,5
	Female	287	48,5
	Total	592	100,0
<b>Residence</b>			
	Falt	295	50,2
	Small house	144	24,5
	Villa	141	24,0
	Other	8	1,4
	Total	588	100,0
<b>Income</b>			
	Poor	38	6,5
	Enough	248	42,6
	Average	238	40,9
	High	58	10,0
	Total	582	100,0
<b>Father education</b>			
	Illiterate	26	4,4
	Primary	64	10,9
	Intermediate	173	29,5
	Secondary	104	17,7
	Higher	220	37,5
	Total	587	100,0
<b>Mother education</b>			
	Illiterate	34	5,8
	Primary	93	15,7
	Intermediate	179	30,3
	Secondary	128	21,7
	Higher	157	26,6

	Total	591	100,0

Our study included 593 children from Al-Ahsa region aged between 6 and 13 years old with a meanage of (7,90 years). Overall, studied children had between 0 and 13 brothers (mean number: 2,53) and between 0 and 10 sisters (mean number: 2,33). By looking at table (1), related to the distribution of respondents according to demographic factors:

The survey included(51,5%) of males and (48,5%)of females.

Nearly the half of participants lived in Falt (50,2%).

Most of the children's families had enough monthly income (42,6%)and only 10% had a high monthly income.

The majority of the children had parents with education as follows:afather with high level of education (37,5%) and a mother with an intermediate level of education (30,3%).

The lifestyle characteristics are shown in tables below

**Table:-Watching TV**

Data		Frequency	Percent (%)
<b>Watching TV</b>			
	Yes	586	99,3
	No	4	,7
	Total	590	100,0
<b>Average/day</b>			
	< 1 hour	10	1,7
	1 hour	184	31,5
	2 hours	195	33,4
	3 hours	121	20,7
	4 hours	63	10,8
	> 4 hours	11	1,9
	Total	584	100,0
<b>Average/week</b>			
	<1 hour	1	,2
	1 hour	34	5,9
	2 hours	75	13,1
	3 hours	70	12,2
	4 hours	143	24,9
	> 4 hours	251	43,7
	Total	574	100,0

Approximately all of the children,(99,3%), were reported to watch TV. While, 2hours per day TV viewing was reported by the third of participants (33,4%),also 31,5% of respondents reported spending 1 hour daily watching television.

43,7% of the children are esteemed to spend more than 4 hours weekly on TV watching.

**Table :-Computer use**

Data		Frequency	Percent (%)
<b>Computer use</b>			
	Yes	501	85,5
	No	85	14,5
	Total	586	100,0
<b>Average Computer/day</b>			
	< 1 hour	17	3,5

	1 hour	269	54,9
	2 hours	125	25,5
	3 hours	47	9,6
	4 hours	21	4,3
	> 4 hours	7	1,4
	Other	4	,8
	Total	490	100,0
<b>Average Computer/week</b>			
	< 1 hour	3	,6
	1 hour	84	17,0
	2 hours	88	17,8
	3 hours	88	17,8
	4 hours	121	24,4
	> 4 hours	111	22,4
	Total	495	100,0

High number and percentage, 501 and 85,5%, of the little participants were report to using computer. Overall, almost the half of respondents (54,9%) were allowed to use the computer 1 hour daily, while the quarter (25,5%) used the computer 2 hours daily. Among the participants, approximately the quarter (24,4%), were permitted to use the computer for 4 hours per week where 22,4% of children used computer for more than 4 hours weekly, and nearly 17% of the studied respondents used the computer 1 hour, 2 hours or 3 hours weekly (17%, 17,8%, 17,8% respectively).

#### Behavior scores:-

Data		Frequency	Percent (%)
<b>Score by parents</b>			
	Inadequate behavior	9	1,5
	Average behavior	240	40,9
	Adequate behavior	338	57,6
	Total	587	100,0
<b>Score by teachers</b>			
	Averagebehavior	118	39,5
	Adequatebehavior	181	60,5
	Total	299	100,0

Referring to the responses of the parents, most of the children had an adequate behavior (57,6%), where 40,9% had average behavior, and only 1,5% had aggressive behavior.

Referring to the responses of the teachers, the majority of the investigated children (60,5%) had an adequate behavior and approximately 39,5% of participants had average behavior.

#### The Correlation between the aggressive behavior of the children and the exposure to TV:-

Data analysis showed that Children's television exposure was not related to children's behavior according to parents ( $p=0,379$ ) and teachers ( $p=0,078$ ). Referring to the BPI by teachers ( $p=0,012$ ), the study of relationship between the children's aggression and the television exposure showed a significant association between the aggressive actions against others and the daily-spent time in watching TV during childhood. On the other hand, referring to the BPI by parents ( $p=0,212$ ), the effect sizes for the relationship between television exposure and inadequate behavior were not statistically significant as it was close to zero. Furthermore, while a significant association was observed between weakly-TV exposure and child behavior according to parents, ( $p=0,000$ ); the effect of weakly-TV exposure was not significant referring to the BPI by teachers, ( $p=0,104$ ).

**Table:-** Correlation between the aggressive behavior of children and the exposure to TV

**Table:-** Correlation between Childs aggressive behavior and TV exposure

Characteristic		Watching TV		p-value (%)
		Yes n (%)	No n (%)	
<b>Overall (n=593)</b>		586 (99,3)	4 (0,7)	-
<b>Score by parents</b>				
	Inadequate behavior	9 (1,5)	0 (0,0)	0,379
	Average behavior	237 (40,4)	3 (0,5)	
	Adequate behavior	336 (57,7)	1 (25,0)	
	Total	582 (100,0)	4 (100,0)	
<b>Score by teachers</b>				
	Average behavior	115 (39,0)	2 (100,0)	0,078
	Adequate behavior	180 (61,0)	0 (0,0)	
	Total	295 (100,0)	2 (100,0)	

Chi-Square Tests			
Score by parents * Watching TV	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1,942 <sup>a</sup>	2	,379
Likelihood Ratio	1,977	2	,372
Linear-by-Linear Association	1,392	1	,238
N of Valid Cases	586		

a. 3 cells of about (50,0%) are expected to have count with less than 5. The minimum expected count is ,06.

Chi-Square Tests					
Score by teachers * Watching TV	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3,098 <sup>a</sup>	1	,078		
Continuity Correction <sup>b</sup>	1,069	1	,301		
Likelihood Ratio	3,747	1	,053		
Fisher's Exact Test				,154	,154
Linear-by-Linear Association	3,087	1	,079		
N of Valid Cases	297				

a. 2 cells of about (50,0%) have expected to have count less than 5. The minimum expected count is ,79.  
b. This can only computed for a 2x2 table.

**Average/day \* Score by parents.**

Average/day Score by parents						
			Crosstab			Total
			Score by parents			
			Inadequate behavior	Average behavior	Adequate behavior	
Average/day	< 1 hour	Count	0	1	9	10
		% within Score by parents	0,0%	0,4%	2,7%	1,7%
	1 hour	Count	2	82	96	180
		% within Score by parents	28,6%	34,5%	28,7%	31,0%
	2 hours	Count	5	76	114	195
		% within Score by parents	71,4%	31,9%	34,0%	33,6%
	3 hours	Count	0	53	68	121
		% within Score by	0,0%	22,3%	20,3%	20,9%

		parents				
	4 hours	Count	0	23	40	63
		% within Score by parents	0,0%	9,7%	11,9%	10,9%
	> 4 hours	Count	0	3	8	11
		% within Score by parents	0,0%	1,3%	2,4%	1,9%
Total		Count	7	238	335	580
		% within Score by parents	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13,220 <sup>a</sup>	10	,212
Likelihood Ratio	15,754	10	,107
Linear-by-Linear Association	1,183	1	,277
N of Valid Cases	580		
a. 8 cells of about (44,4%) are expected to have count less than 5. The minimum expected count is ,12.			

**Average/day \* Score by teachers**

Crosstab					
			Score by teachers		Total
			Average behavior	Adequate behavior	
Average/day	< 1 hour	Count	0	3	3
		% within Score by teachers	0,0%	1,7%	1,0%
	1 hour	Count	32	59	91
		% within Score by teachers	27,8%	33,1%	31,1%
	2 hours	Count	44	49	93
		% within Score by teachers	38,3%	27,5%	31,7%
	3 hours	Count	32	35	67
		% within Score by teachers	27,8%	19,7%	22,9%
	4 hours	Count	6	27	33
		% within Score by teachers	5,2%	15,2%	11,3%
	> 4 hours	Count	1	5	6
		% within Score by teachers	0,9%	2,8%	2,0%
Total		Count	115	178	293
		% within Score by teachers	100,0%	100,0%	100,0%

Chi-Square Tests			
	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14,572 <sup>a</sup>	5	,012
Likelihood Ratio	16,408	5	,006
Linear-by-Linear Association	,463	1	,496
N of Valid Cases	293		
a. 4 cells of approximately (33,3%) are expected to have count less than 5. The minimum expected count is 1,18.			

**Average/week \* Score by parents.**

Crosstab						
			Score by parents			Total
			Inadequate behavior	Average behavior	Adequate behavior	
Average/week	< 1 hour	Count	0	1	0	1
		% within Score by parents	0,0%	0,4%	0,0%	0,2%
	1 hour	Count	2	10	21	33
		% within Score by parents	28,6%	4,3%	6,3%	5,8%
	2 hours	Count	0	47	28	75
		% within Score by parents	0,0%	20,1%	8,5%	13,1%
	3 hours	Count	0	38	32	70
		% within Score by parents	0,0%	16,2%	9,7%	12,2%
	4 hours	Count	2	49	91	142
		% within Score by parents	28,6%	20,9%	27,5%	24,8%
	> 4 hours	Count	3	89	159	251
		% within Score by parents	42,9%	38,0%	48,0%	43,9%
Total		Count	7	234	331	572
		% within Score by parents	100,0%	100,0%	100,0%	100,0%

<b>Chi-Square Tests</b>			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	35,155 <sup>a</sup>	10	,000
Likelihood Ratio	33,768	10	,000
Linear-by-Linear Association	10,716	1	,001
N of Valid Cases	572		

a. 8 cells of about (44,4%) are expected to have count less than 5. The minimum expected count is ,01.

**Average/week \* Score by teachers.**

Crosstab					
			Score by teachers		Total
			Average behavior	Adequate behavior	
Average/week	0	Count	0	1	1
		% within Score by teachers	0,0%	0,6%	0,3%
	1 hour	Count	6	3	9
		% within Score by teachers	5,3%	1,7%	3,1%
	2 hours	Count	8	26	34
		% within Score by teachers	7,1%	15,0%	11,9%
	3 hours	Count	17	16	33
		% within Score by teachers	15,0%	9,2%	11,5%
	4 hours	Count	25	41	66
		% within Score by teachers	22,1%	23,7%	23,1%
	> 4 hours	Count	57	86	143
		% within Score by teachers	50,4%	49,7%	50,0%
Total		Count	113	173	286

	% within Score by teachers	100,0%	100,0%	100,0%
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Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9,134 <sup>a</sup>	5	,104
Likelihood Ratio	9,628	5	,086
Linear-by-Linear Association	,028	1	,867
N of Valid Cases	286		
a. 3 cells of about (25,0%) are expected to have count less than 5. The minimum expected count is ,40.			

### Recommendations:-

Huesmann, L. R. et al. mentioned that children as increasingly becoming heavy media consumers (1), they also noted the violent content of much of the media directed at children and their harmful influence on the advancement of the outcomes of the behaviors of the children. This study suggests that the ACT program can detect the influence of media violence on the advancement of the young children, and it can teach parents some strategies that can help them decreasing the watching of violence TV programs by their children. Further, the researchers recommended the restriction as much as possible of violent TV programs by parents for young children and preteens, and stressed on the importance of the strict control on the media content before allowing their child to view TV programs even those that seemed to be safe.

In addition, the American Academy of Pediatrics suggested dropping the total time that children spend watching TV to just 1 to 2 hrs / day high quality entertainment programs (2) and this suggestion was also adopted by Robertson LA et al. who wanted to study “check if the excessive watching of the television during the childhood and the adolescence is related to the increased antisocial behavior in the early adulthood” (3), in fact researchers have found that each extra hour of watching the TV can increase the tendency to the odds for antisocial outcomes.

Behavior aggression is multi-factorie<sup>1</sup>, it can also be present as a part of other neuro-psychic disorders and psychiatric syndromes (autism, Tourette...), or related to direct or indirect exposure to violence (4), in all cases children should be supported at many levels: socially by parents and close entourage, and at larger scale by the teachers or even medical stuff experts. Actually, several aggressively control activities can be set<sup>1</sup> to help children to solve their violent behavior issues. Ruble and Seidman (Ruble & Seidman, 1996, cited in National Crime Prevention 1999: 52) reported the need for preventive programs targeting the child and his parents. Hence sincere work should be exerted to at the level of the parents / children relationship. Additionally as verbal skills had found to be inversely correlated with the impulsivity and the crime behavior (Moffitt, 1993; Lynam, Moffitt & Stouhamer-Loeber, 1993; Moffitt & Silva, 1988), better communication skills by early language intervention and development makes easy for the child to socialise (Keenan & Shaw, 1997) and feel being understood.

High quality care of children is essential as it seems that the behavior of the children has a direct relationship with the quality of this care. In their study Vandell and Wolfe (Vandell & Wolfe, 2000) have found that the more quality of care was high, the fewer reports of behavior problems were.

Parents and educators could also play a primordial role helping children to develop social skills, by being patients and spending more time directly teaching them skills.

### Conclusion:-

According to this research, most of the children that were included in this study showed an adequate behavior. On the other hand, although both parents and teachers detected low proportions of aggressive children, effective efforts and strategies for reducing children's exposure to media should be followed. This is because many studies stated the negative effect of the exposure to TV on the health and the behavior of the children. This can surely avoid the society the risk of the development of the aggressive and violent actions and behaviors in adulthood.



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**References:-**

1. Huesmann LR, Moise-Titus J, Podolski C-L, Eron LD. Longitudinal relations between children's exposure to TV violence and their aggressive and violent behavior in young adulthood: 1977-1992. *Developmental psychology*. 2003;39(2):201.
2. American Academy of Pediatrics: Children, adolescents, and television. *Pediatrics*. 2001 Feb;107(2):423-6. PubMed PMID: 11158483. Epub 2001/02/07. eng.
3. Robertson LA, McAnally HM, Hancox RJ. Childhood and Adolescent Television Viewing and Antisocial Behavior in Early Adulthood. *Pediatrics*. 2013 10/26/accepted;131(3):439-46. PubMed PMID: PMC3581845.
4. Reebye P. Aggression During Early Years — Infancy and Preschool. *The Canadian child and adolescent psychiatry review*. 2005 Feb;14(1):16-20. PubMed PMID: 19030496.



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## RESEARCH ARTICLE

### THE EFFECTIVE VALUE OF PET/CT IN DIAGNOSING CARDIOVASCULAR DISEASE AND PEDIATRIC CANCER; A COMPARATIVE STUDY

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#### Abstract

**Overview:** Combined PET/CT systems have emerged as promising imaging modalities and are being more routinely used in clinical situations. <sup>18</sup>F-FDG PET/CT is an established entity in the work-up of several oncologic disorders and is making forays in the diagnosis of inflammatory diseases, leading to increased use for cardiac and neurologic applications. Although PET is on the move in cardiovascular medicine and new developments are likely to increase its application and impact in clinical practice, some similarities and interrelationships between its cardiac applications and applications for tumor imaging should be noted.

**The study aimed** to prospectively study the clinical experience with PET/CT in Cardiac diseases and in pediatric malignancies to evaluate and compare the efficacy of this imaging system in both diseases, and to determine if it provided additional diagnostic information on the disease status.

**Methodology:** Thirty two cardiac patients with previous history of myocardial infarction & left ventricular dysfunction and coronary artery disease (CAD) were underwent the imaging procedures consisting of PET/CT, echocardiography and invasive angiography. Diagnostic sensitivity of these less invasive modalities for detection of myocardial viability was compared to invasive coronary angiography. Additionally, 54 pediatric cancer patients were included in this study [28 had lymphoma and 26 had soft tissue sarcoma (STS)]. Seventy two scans were performed for whole body in all patients for initial diagnosis and staging.

**Results:** In the current study, Coronary angiography was used as the gold standard; PET/CT has high diagnostic value in the assessment of myocardial viability when compared to echocardiography; and also in malignant disease if distant metastases or second primary tumors are detected with regard to staging of the primary tumor. It may influence the treatment decision in both diseases. The diagnostic sensitivity of cardiac PET/CT, cardiac angiography and echocardiography was 98.2%, 93.4% and 82.5%, respectively. Diagnostic sensitivity of PET/CT in myocardial viability at per-vessel based assessment

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was 80.2% for LAD (left anterior descending), 77.6% for LCX (left circumflex), and 100% for RCA (right coronary) coronary arteries. The overall sensitivities, specificities & positive and negative predictive values of the imaging system for all the suspicious sites in pediatric malignancy were 94.22%, 92.72%, 93.68% and 93.33% respectively. The sensitivities and specificities for initial staging of malignant lymphomas were ranged 70%-100% and 90.48%-100% respectively. They ranged 80%-100% and 92%-100% respectively in STS.

**Conclusion:** The study concluded that the PET/CT is the gold standard for noninvasive functional imaging in cardiovascular disease as well as in oncology. It has high diagnostic value in the assessment of myocardial viability in patients with known CAD. Technical developments in PET/CT scanning in cancer management may increase the precision of radiotherapy planning and thus improve tumor control and reduce treatment-related morbidity. The use of PET/CT in the management of pediatric malignancy is recommended to facilitate the sparing of normal structures and the escalation of dose. Further studies are recommended in cardiovascular patients for the incorporation of PET/CT into patient management is warranted.

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## Introduction:-

Cardiovascular diseases are progressive and there are a number of physiological and morphological changes that occur with aging that could alter cardiovascular function and subsequently increase risk of cardiovascular disease (Li et al., 2014). Despite considerable advances in prevention and treatment over the last decades, cardiovascular diseases remain the most frequent causes of death worldwide and represent a great challenge for modern research and medicine. This requires urgent development of sensitive and noninvasive methods for early detection and personalized treatment of cardiovascular diseases (Gaemperli and Kaufmann, 2011). Traditional medical imaging techniques have been routinely used to provide early diagnosis and prognosis of cardiovascular diseases (Schwaiger et al., 2010). Ideally it would be possible to detect molecular and cellular processes early and characterize cardiovascular diseases before manifestation of gross anatomical features or physiological consequences. Current advanced molecular imaging modalities include positron emission tomography (PET), single photon emission computed tomography (SPECT), magnetic resonance imaging (MRI), and optical imaging, all of which could provide critical molecular and cellular level information for early diagnostics, advanced therapeutics, and better understanding of fundamental biological processes of cardiovascular disease (Jang et al., 2012; Li et al., 2014).

Positron emission tomography (PET) has contributed significantly to the advances in our understanding of cardiac physiology and pathophysiology for more than 20 years (Nekolla et al., 2009). The introduction of PET/CT scanners combined the functional data of PET with the detailed anatomic information of CT into a single examination. The poor spatial resolution of PET is substantially compensated for by integrated PET/CT, with co-registration of functional imaging with PET and anatomic imaging with CT (Xu et al., 2012/2015). In addition to being a powerful research tool in cardiology, recent technical development and improved availability facilitated also its routine clinical use in cardiology. PET is the most reliable non-invasive tool for the identification of myocardial viability and also allows accurate assessment of myocardial perfusion and coronary artery disease (CAD), which is known to be the leading cause of mortality in adults. Assessment of myocardial perfusion plays an important role in the diagnostic work-up of patients with suspected CAD as well as in the assessment of prognosis and guiding of therapy in patients with established CAD (Nekolla et al., 2009).

Although PET is on the move in cardiovascular medicine and new developments are likely to increase its application and impact in clinical practice, some similarities and interrelationships between its cardiac applications and applications for tumor imaging should be noted. First, the success of PET as a key modality in tumor staging and evaluation of anti-tumor therapy has resulted in dissemination of the technique and in improved availability for cardiac imaging. Second, expensive equipment, such as scanners, radiochemistry laboratories, and cyclotrons, is most effectively used when it serves multiple areas of PET imaging applications. And finally, many existing and novel biologic targets for PET imaging are important not only in heart and vessels, but also in tumors. This is highly

relevant not only because advances in tumor biology may help advance cardiovascular biology via improved understanding of related biomechanisms, but also because multiple applications in heart, vessels, and tumors will be helpful to stimulate interest in commercialization of compounds with a broader spectrum of target groups (Bengel et al., 2009).

Cardiac PET imaging is another well-established tool for the evaluation of ischemia, blood flow quantification, myocardial viability and perfusion (Berman et al., 2006; Machac, 2005). Cardiac PET utilizing  $^{18}\text{F}$ -FDG is considered the most sensitive modality for detecting hibernating viable myocardium and predicting left ventricular functional recovery post-coronary revascularization. PET has higher spatial and temporal resolution than SPECT due to more robust methods of attenuation correction, thus, PET allows quantification of resting and hyperemic regional myocardial perfusion. When PET was integrated into clinical patient management, a significant reduction in cardiac events was observed in patients with  $^{18}\text{F}$ -FDG PET-assisted management, according to randomized controlled trials (Abraham et al., 2010; Beanland et al., 2007). PET images provide incremental prognostic information to the clinical and angiographic findings with regard to event-free survival. An increased extent and severity of perfusion defects with stress PET were reported to be associated with increased frequency of adverse cardiac events, thus, this indicates PET can be used to predict cardiac mortality (Dorbala et al., 2009). Cardiac PET is not yet as widely available as SPECT imaging. Furthermore, experience in image interpretation and operation may vary widely. Cardiac PET will continue to play a key role in the investigation of myocardial viability and perfusion contributing more to available data (Sun, 2013).

Combined PET and CT systems (PET/CT) have emerged as promising imaging modalities and are being more routinely used in clinical situations (von Schulthess et al., 2006). Although many studies about whole-body PET/CT for various cancers were done, the results were still controversial and inconclusive. In several previous studies,  $^{18}\text{F}$ -FDG PET/CT was shown to be more sensitive and specific than conventional imaging procedures for the detection of distant malignancies in cancer patients at initial staging before treatment or restaging after treatment (Antoch et al., 2004; Fuster et al., 2008; Ng et al., 2009; Strobel et al., 2007; Veit-Haibach et al., 2009). Despite growing numbers of reports on imaging adult malignancies with PET/CT, little data have been reported so far about the clinical relevance of this modality in pediatric patients (Xu et al., 2012/2015).

Although radiation exposure from CT when used for attenuation correction can be limited (Souvatzoglou et al., 2007), the radiation dose from coronary CT angiography (CTA) is  $>10$  mSv in recent clinical trials has been  $>10$  mSv, which is clearly higher than from standard radiography or X-ray angiography (Bluemke et al., 2008). Moreover, precise alignment between emission and “transmission” PET images may benefit from repeated, simultaneously acquired attenuation maps. – From a practical point of view, advances in CT technology are likely to result in substantial changes in hardware in hybrid PET/CT systems while advances in MRI are frequently based on imaging sequences and less complex pieces of hardware, such as coils, which makes upgrading easier and less expensive. – Both cardiac MRI and PET examinations can be rather time consuming. Thus, improvements in patient compliance as a result of reduced scan time could be significant, particularly in patients with dyspnea due to heart failure who have difficulty holding their breath during MRI acquisitions (Nekolla et al., 2009).

**The study aimed** to prospectively study the clinical experience with  $^{18}\text{F}$ -FDG PET/CT in Cardiac disease and in pediatric malignancies to evaluate and compare the efficacy of this new imaging system in both disease, and to determine if PET/CT provided additional diagnostic information on disease status.

## **Patients and Methods:-**

### **Cardiac patients:-**

A multi-centric prospective study that involved patients with previous history of myocardial infarction & left ventricular dysfunction and coronary artery disease (CAD) over a period of 6 months was performed. All patients were suggested to undergo full clinical history and examination, cardiac PET/CT myocardial viability, echocardiography and invasive coronary angiography examinations with an interval of less than 20 days between the imaging tests. Coronary angiography was used as the gold standard. Thirty two patients (17(53.1%) male & 15(46.9%) female; mean age  $58.5 \pm 10.5$  years) are concluded in the study. Consent forms were obtained from all patients, and ethical approval was granted from institutional review boards.

All patients were informed for fasting at least 6 h before the scan and baseline blood sugar was checked. Blood sugar was checked 45–60 min after injection of a glucose loading dose (50–75 g). If it was  $< 140$  mg/dL, a 444

MBq(12 mCi) of  $^{18}\text{F}$ -FDG was injected intravenously. If it was  $> 140$  mg/dL, intravenous regular insulin was injected according to blood glucose level. Myocardial  $^{18}\text{F}$ -FDG PET/CT study was performed 45–60 min after injection of  $^{18}\text{F}$ -FDG. The data were analyzed based on a 5-point scale examining the segment of three main coronary arteries, namely: left anterior descending (LAD), left circumflex (LCX) and right coronary artery (RCA): 0 = normal perfusion, 1 = mild defect, 2 = moderate defect, 3 = severe defect and 4 = absent uptake. For echocardiography, the assessment used was according to the 16-segment model as recommended by the American Society of Echocardiography (Klocke et al., 2003).

Coronary angiography was carried out using the standard Seldinger's technique on an angiographic machine by femoral approach which was performed by cardiologists. The minimal lumen diameter was measured in projections showing the most severe narrowing. The degree of stenosis was classified into four categories: (1) no stenosis, (2) minimal or mild stenosis ( $\leq 50\%$ ), (3) moderate stenosis ( $50\%–70\%$ ), and (4) severe stenosis ( $> 70\%$ ). CAD was defined when lumen diameter reduction was greater than 50% (moderate or severe stenosis).

Resting echocardiography was performed by a consultant cardiologist using a standard protocol. Images were acquired in the normal parasternal long-axis and short-axis views, with particular attention paid to determine the regional cardiac function. Calculations of the regional wall motion were assumed using a 16-segment model according to the American Society of Echocardiography (American Society of Nuclear Cardiology Imaging guidelines., 1999; Cerqueria et al., 2002; Schiller et al., 1989). These 16 segments were classified as 0 = normal; 1 = hypokinetic; 2 = akinetic; and 3 = dyskinetic. The segments founded within the infarction-related coronary segment were the segments analyzed for wall motion. Then, the regional wall motion score was calculated.

#### **Pediatric Patients with Malignancy:-**

Fifty four pediatric patients (33(61.1%) male and 21(38.9%) female) with suspected or known malignancy, evaluated by  $^{18}\text{F}$ -FDG imaging using a combined PET/CT system, between May 2011 and October 2015, included in the study. The male to female ratio was 1.57:1. The patient's age was from 9 month to 18 years (y) old with a median age of 12 y at their first PET/CT examination. 33 (66.7%) of the patients were below 10 years old. Twenty eight patients had lymphoma and 26 had STS soft tissue sarcoma. The indication, purpose, and findings of each PET/CT examination were taken in consideration, in addition to other imaging findings as well as clinical information. PET/CT examination was performed for whole body in all patients (72 scan) for initial diagnosis and staging.

Three hundred and twenty four suspicious sites were evaluated in the 54 included patients. Patients were selected according to their reports which indicate areas of increased FDG uptake. PET findings were considered positive when uptake occurred at sites of suspected disease, in asymmetrical lymph nodes or in nodes unlikely to be affected by inflammation (mediastinal, except for hilar, and abdominal). PET findings were adjudged negative for neoplastic localizations in the following instances: physiological uptake (urinary, muscular, thymic or gastrointestinal), symmetrical nodal uptake, very low uptake and non-focal uptake. PET findings were compared with the results of other diagnostic procedures (including CT and ultrasound), biopsy findings and other clinical data.

After at least 4 h of fasting, a total body PET scan was done one hour after IV injection of 300 MBq of  $^{18}\text{F}$ -FDG. 64 MSCT scan was performed using GE Discovery VCT simultaneously and used for attenuation correction, anatomical localization and diagnosis. Max. Variant of SUV; a semi-quantitative analysis would be done for selected ROI.s and the normal threshold is  $<2.5$ .

#### **Statistical Analysis:-**

The usefulness of diagnostic tests is known as their ability to detect a person with disease or exclude a person without disease. It is usually described by terms such as sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) (Akobeng, 2007).

- **Sensitivity** is the ability of a test to correctly classify an individual as 'diseased', i.e. probability that a test result will be positive when the disease is present (true positive rate) (Parikh et al., 2008). *Sensitivity* = the number of ill persons with positive test results / the number of all persons who have the disease (Nyari, 2011).
- **Specificity** is the ability of a test to correctly classify an individual as disease-free is called the test's specificity, i.e. the probability that a test result will be negative when the disease is not present (true negative rate) (Parikh et al., 2008). *Specificity* = the number of healthy persons with negative test results / the number of all healthy persons (Nyari, 2011).

- **Positive Predictive Value (PPV)** is the probability that the disease is present when the test is positive (MedCalc Software., 2016).  $PPV = \frac{\text{the number of persons diagnosed as have that disease with positive test results}}{\text{the number of all positive test results}}$  (Nyari, 2011).
- **Negative Predictive Value (NPV)** is the probability that the disease is not present when the test is negative (MedCalc Software, 2016).  $NPV = \frac{\text{the number of healthy persons with negative test results}}{\text{the number of all negative test results}}$  (Nyari, 2011).
- **Prevalence** is defined as the prior probability of the disease before the test is carried out (Peacock and Peacock, 2011). *Prevalence* rate is the total number of cases of a disease existing in a population divided by the total population (Health.ny.gov, 2015).
- **Accuracy** is the efficiency of a test that indicates the percentage of patients who are correctly classified as having disease or not having disease (Mahon et al., 2011).  $Accuracy = \frac{\text{the total number of ill persons with positive test results and healthy persons with negative test results}}{\text{the total number of population}}$ .

## Results:-

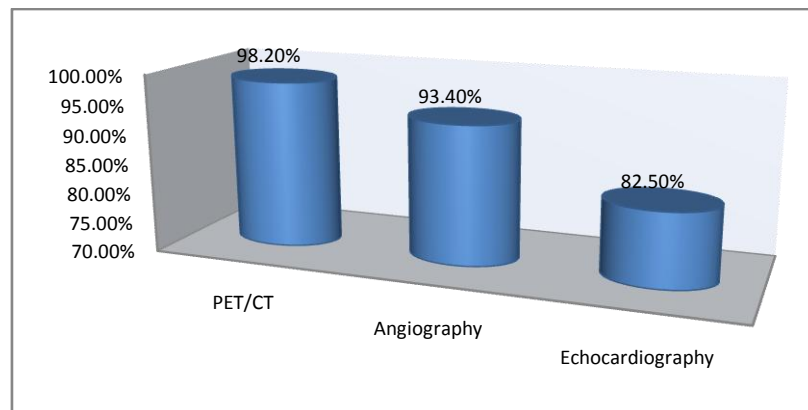
### Cardiac Patients:-

The patient's characteristics are shown in table (1). A total of 1088 segments in all patients were analyzed for cardiac PET/CT imaging examinations, while for echocardiography there were 512 segments that were analyzed in comparison with PET findings. Comparison was also performed between the accuracy of coronary PET and that for angiography and echocardiography. All patients were found to have CAD and the triple vessel disease with  $\geq 50\%$  stenosis involving LAD, LCX and RCA was founded in 37.5% of them, and revealing severely reduced FGD uptake in different regions. By invasive coronary angiography, there were a significant coronary stenosis or occlusion ( $> 70\%$  lumen stenosis); with mild to moderate stenosis in 260 of the coronary arteries (LAD, LCX, and RCA) and by echocardiography it was found in 230 of the coronary arteries. So, the cardiac PET has the highest diagnostic value in the assessment of all of the three main coronary arteries.

**Table 1:-**patients Characteristics:

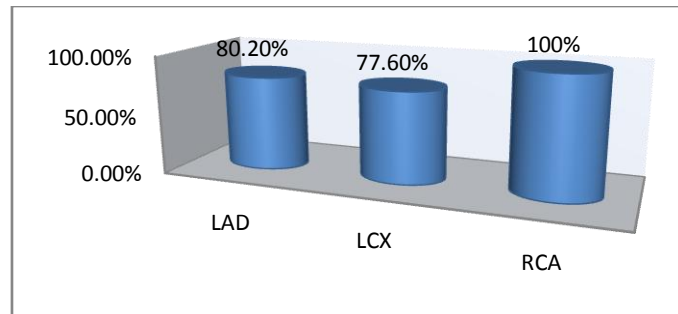
Items	Patients		Items	Patients	
	No.	%		No.	%
<b><i>Diagnoses:</i></b>			<b><i>Risk factors:</i></b>		
Ischemic Heart Disease	4	12.5	Hypertension	26	81.3
Ischemic Dilated Cardiomyopathy	7	21.9	Diabetes Mellitus	24	75
Thrombolysis	6	18.8	History of Smoking	5	15.6
Myocardial Infarction	3	9.4	Dyslipidemia	10	31.3
Triple Vessel Disease	12	37.5	Obesity	13	40.6
Double Vessel Disease	10	31.3			

The diagnostic sensitivity of cardiac PET/CT, cardiac angiography and echocardiography was 98.2%, 93.4% and 82.5%, respectively, as shown in Figure (1). The specificity was not analyzed, since all patients had confirmed CAD, (true negative value was zero).



**Figure 1:-**Diagnostic sensitivity of cardiac PET/CT, cardiac angiography and echocardiography

Diagnostic sensitivity of PET/CT in myocardial viability at per-vessel based assessment was 80.2% for LAD, 77.6% for LCX, and 100% for RCA coronary arteries (figure 2)



**Figure 2:-** Diagnostic sensitivity of PET/CT in myocardial viability at per-vessel based assessment

The mean score for assessment of myocardial viability by PET/CT at per-vessel based analysis was  $3.5 \pm 0.83$ ,  $3.9 \pm 0.44$ , and  $4.1 \pm 0.10$ , corresponding to the LAD, LCX and RCA coronary arteries, respectively (table 2). The cardiac PET/CT was found to be superior in terms of image quality with more accurate assessment of all of the segments.

**Table 2:-** The mean score for assessment of myocardial viability by PET/CT at per-vessel based analysis

Item	LAD	LCX	RCA
The mean score	$3.5 \pm 0.83$	$3.9 \pm 0.44$	$4.1 \pm 0.10$

#### **Pediatric Patient with Malignancy:-**

The results of the present work are presented in tables (3-6). A table (3) shows the patients characters. The stage of the malignant disease patients can be seen before and after the evaluation by PET/CT in table (4).

**Table 3:-** Patients Characteristics

Items	Lymphoma (28 Patients)		Soft Tissue Sarcoma (26 patients)		Total (54 patients)	
	No.	%	No.	%	No.	%
Age						
<10 years	21	75	15	57.7	36	66.7
>10 years	7	25	11	42.3	18	33.3
Sex						
Male	16	57.1	17	65.4	33	61.1
Female	12	42.9	9	34.6	21	38.9
Stage						
I	9	32.1	6	23.1	15	27.8
II	7	25	3	11.5	10	18.5
III	8	28.6	16	61.5	24	44.4
IV	4	14.3	1	3.9	5	9.3
Tumor size						
>5cm	18	64.3	18	69.2	36	66.7
<5cm	10	35.7	8	30.8	18	33.3
Metastases:						
Present	8	28.6	2	7.7	10	18.5
Absent	20	71.4	24	92.3	44	81.5

**Table 4:-**Evaluating the Stage of Pediatric Malignancy by of PET/CT Scan

Stage	Lymphoma (28 Patients)		Soft Tissue Sarcoma (26 patients)		Total (54 patients)	
	Before PET/CT	After PET/CT	Before PET/CT	After PET/CT	Before PET/CT	After PET/CT
I	9	7	4	5	13	12
II	7	10	5	4	12	14
III	8	9	14	16	22	25
IV	4	2	3	1	7	3

The true positive and negative sites of the 324 regions analyzed, was 163 and 140 respectively. The overall sensitivities, specificities & positive and negative predictive values of the imaging system for all the suspicious sites were 94.22%, 92.72%, 93.68% and 93.33% respectively. (Tables 5)

The sensitivities and specificities of 18F-FDG PET/CT for initial staging of malignant lymphomas were ranged 70%-100% and 90.48%-100% respectively. They ranged 80%-100% and 92%-100% respectively in STS. The negative and positive predictive values in evaluating the stage of lymphoma were 85.71%-100% and 50%-100% respectively. It was 83.33% -100% and 33.33% -100% respectively for STS (Table 6).

**Table 5:-** Efficacy of PET/CT Scan in Detecting the Site of Lesion in Pediatric Malignancy

PET/CT Scan	Prevalence	Sensitivity	Specificity	PPV	NPV	Accuracy
Head & Neck	60.34%	94.30%	86.96%	91.67%	90.91%	91.38%
Chest	37.25%	84.21%	96.88%	94.12%	91.18%	92.16%
Abdomen & Pelvis	58.47%	98.55%	95.92%	97.14%	97.92%	97.46%
Extremities	40.63%	92.31%	94.74%	92.31%	94.74%	93.75%
Bony skeleton	40.91%	88.89%	84.62%	80.00%	91.67%	86.36%
Body LN chains	65.12%	92.86%	86.67%	92.86%	86.67%	90.70%
Total	53.40%	94.22%	92.72%	93.68%	93.33%	93.52%

PPV: Positive predictive value, NPV: Negative predictive value

**Table 6:-** Efficiency of PET/CT Scan in Evaluating the Stage of Pediatric Malignancy

PET/CT Scan	Prevalence	Sensitivity	Specificity	PPV	NPV	Accuracy
<b>Lymphoma</b>						
Stage I	25.00%	100.00%	90.48%	77.78%	100.00%	92.86%
Stage II	35.71%	70.00%	100.00%	100.00%	85.71%	89.29%
Stage III	32.14%	88.89%	100.00%	100.00%	95.00%	96.43%
Stage IV	7.14%	100.00%	92.31%	50.00%	100.00%	92.86%
<b>Soft Tissue Sarcoma</b>						
Stage I	19.23%	80.00%	100.00%	100.00%	95.45%	96.15%
Stage II	15.38%	100.00%	95.45%	80.00%	100.00%	96.15%
Stage III	61.54%	87.50%	100.00%	100.00%	83.33%	92.31%
Stage IV	3.85%	100.00%	92.00%	33.33%	100.00%	92.31%

PPV: Positive predictive value, NPV: Negative predictive value

## Discussion:-

Coronary artery disease (CAD) is the leading cause of death in advanced countries and its prevalence is increasing among developing countries (Lloyd-Jones et al., 2010; Gaziano et al., 2010). Various less-invasive imaging modalities are increasingly used in the diagnosis of CAD including coronary CT angiography, cardiac magnetic resonance imaging (MRI), and cardiac single photon emission computed tomography (SPECT), positron emission tomography (PET) and integrated SPECT/CT and PET/CT (Sun et al., 2011). To improve early diagnosis and patient management, it is essential to have an overview of the diagnostic value of different imaging modalities in CAD (Sun, 2013). Due to their success in oncology, all currently offered PET imaging systems are hybrid PET-CT scanners. This has brought challenges for cardiac imaging that is related mainly to the use of a separate CT for



attenuation correction of subsequently acquired PET data (Bengel et al., 2009). Although less routine than whole-body imaging, cardiac PET using  $^{18}\text{F}$ -FDG have been demonstrated as a valuable tool in the adult population and to a lesser degree in children. Cardiac imaging using  $^{18}\text{F}$ -FDG plays an important role in the assessment of myocardial viability and can be particularly valuable when used in conjunction with other imaging modalities such as  $^{99\text{m}}\text{Tc}$ -sestamibi scanning. To enhance  $^{18}\text{F}$ -FDG uptake into viable myocardium, patients are administered oral or intravenous glucose before the injection of  $^{18}\text{F}$ -FDG (McQuattie, 2008).

This prospective study investigates the diagnostic value of non-invasive cardiac modalities with the aim of determining myocardial viability in patients with known CAD through comparing  $^{18}\text{F}$ -FDG PET/CT and echocardiography with invasive coronary angiography as the gold standard. Our results showed that cardiac  $^{18}\text{F}$ -FDG PET/CT has superior diagnostic value in patients with CAD, when compared to echocardiography and cardiac angiography either at per-patient or per-vessel based analysis. The diagnostic sensitivity of cardiac PET/CT, cardiac angiography and echocardiography was 98.2%, 93.4% and 82.5%, respectively. Diagnostic sensitivity of PET in myocardial viability at per-vessel based assessment was 80.2% for LAD, 77.6% for LCX, and 100% for RCA coronary arteries. Although based on a small number of patients, results of this study highlight the high diagnostic value of  $^{18}\text{F}$ -FDG PET/CT in the detection of myocardial viability. Combined SPECT/CT and PET/CT systems are today well established in clinical routine imaging with promising results reported (Namdar et al., 2005; Rispler et al., 2007; Groves et al., 2009; Sato et al., 2010; Al Moudi et al., 2011), although more multicentric trials are needed to validate the diagnostic value of the hybrid imaging modalities (Sun, 2013).

Recent advances in radiopharmaceuticals, hardware, and software of cardiac PET imaging have improved the diagnostic accuracy and risk assessment of patients with suspected cardiac disorders (Underwood et al., 2014; Danad et al., 2013; Flotats et al., 2011; Ratib and Nodulous, 2014). For example, the rapid evolution of hybrid PET/CT and PET/MR imaging with the advanced tracers has provided a new perspective on cardiac imaging by providing combined anatomic and functional evaluation of coronary disease and alterations in cardiac function. Because of the pivotal role of tracers in the realization of the power of cardiac PET imaging, the design and development of tracers is becoming one of the major subjects of cardiac PET imaging (Sogbein et al., 2014; Li, 2014). Additionally, the assessment of myocardial viability with  $^{18}\text{F}$ -FDG PET is based on its ability to distinguish the two main pathogenic mechanisms for chronic myocardial dysfunction in ischemic cardiomyopathy: irreversible loss of myocardium due to prior myocardial infarction (scar), and at least partially reversible loss of contractility owing to chronic or repetitive ischemia (hibernating myocardium) (Schinkel et al., 2007). The distinctive feature of these two mechanisms is that revascularization has the potential to restore contractile function of the hibernating myocardium but not scar (Ghosh et al., 2010). This distinction may be of paramount importance in clinical decision-making because of the upfront morbidity and mortality associated with revascularization procedures in patients with severe left ventricular dysfunction (Al Moudi et al., 2014). It is likely; however, that increasing availability of 64-slice CT in PET-CT systems, along with new prospectively gated CT acquisition techniques, which lower radiation exposure for CT angiography by more than 70%, will contribute to a more widespread use in hybrid PET-CT protocols. Innovative integrated imaging protocols may include CT for morphologic assessment of coronary arteries and PET for functional assessment of myocardial blood flow. A CT delayed enhancement study may be done after CT angiography to identify the presence or absence of scar. This may obviate the need for a rest perfusion study (Bengel et al., 2009). It should be noted, however, that positron emitting tracers typically provide less radiation burden to the patient when compared with SPECT tracers used for the same diagnostic purpose, which is, in part, due to their much shorter half-lives. Also, the radiation burden to staff involved in cardiac PET imaging has been investigated, and due to differences in radiotracer administration, scan acquisition, and stress-testing tasks, doses with PET seem to be lower for staff (as for patients) when compared with single-photon emitting tracers (Bengel et al., 2009).

Additionally, hybrid tomographs make it possible to perform a rapid and comprehensive evaluation of functional and anatomical severity of CAD by assessment of myocardial perfusion and non-invasive angiography. On the one hand, optimal evaluation of hemodynamic consequences requires integration of anatomical information with demonstration of myocardial ischemia. On the other hand, myocardial infarction and sudden cardiac death result from the rupture of plaques that do not necessitate significant flow limitations. Several features, such as severe luminal obstruction, thin fibrous cap, large lipid core, and the presence of active inflammation are characteristic of vulnerable plaques. Non-invasive imaging of plaque burden in combination with the features of plaque vulnerability might, therefore, lead to an improved assessment of individuals at risk of acute coronary events and help to refine estimates of the cardiovascular risk in the subclinical phase of atherosclerosis (Nekolla et al., 2009). The incremental value of hybrid

imaging lies in accurate spatial co-localization of myocardial perfusion defects and anatomic coronary arteries. This combined technology allows detection and quantification of the burden of calcified and non-calcified plaques, quantification of vascular activity and endothelial health, identification of flow-limiting coronary stenosis, and potentially identification of high-risk plaques in the coronary artery tree (Di Carli and Murthy, 2011).

Successful management of solid tumors in children requires imaging tests for accurate disease detection, characterization, and treatment monitoring. Technologic developments aim toward the creation of integrated imaging approaches that provide a comprehensive diagnosis with a single visit. These integrated diagnostic tests are not only convenient for young patients but also save direct and indirect health-care costs by streamlining procedures, minimizing hospitalizations, and minimizing school or work time lost for children and their parents (Uslu et al., 2015). However, modern radiotherapy techniques heavily rely on high-quality medical imaging. PET provides biologic information about the tumor, complementary to anatomic imaging. Integrated PET/CT has found its way into the practice of radiation oncology, and  $^{18}\text{F}$ -FDG PET is being introduced for radiotherapy planning. The functional information possibly augments accurate delineation and treatment of the tumor and its extensions while reducing the dose to surrounding healthy tissues. In addition to  $^{18}\text{F}$ -FDG, other PET tracers are available for imaging specific biologic tumor characteristics determining radiation resistance (Troost et al., 2015). The use of  $^{18}\text{F}$ -FDG in PET/CT is well documented as a valuable tool in the staging and diagnosis of disease for many oncology patients. Although considered routine in adults, PET/CT in children has been somewhat limited. On the other hand, paramount to any successful PET/CT examination is the establishment of acquisition protocols that allow high quality images to be obtained while ALARA principles are followed (McQuattie, 2008).

In the current study, The overall sensitivities, specificities & positive and negative predictive values of the imaging system for all the suspicious sites were 94.22%, 92.72%, 93.68% and 93.33% respectively. The sensitivities and specificities of  $^{18}\text{F}$ -FDG PET/CT for initial staging of malignant lymphomas were ranged 70%-100% and 90.48%-100% respectively. They ranged 80%-100% and 92%-100% respectively in STS. The negative and positive predictive values in evaluating the stage of lymphoma were 85.71%-100% and 50%-100% respectively. It was 83.33% -100% and 33.33% -100% respectively for STS. Some studies reported the sensitivities and specificities of  $^{18}\text{F}$ -FDG PET/CT for initial staging of malignant lymphomas were 96%–99% and 95%–100%, respectively (Kabickova et al., 2006; Furth et al., 2006; Cheng et al., 2013; Miller et al., 2006; Paulino et al., 2012; Punwani et al., 2010; Uslu et al., 2015). Others, reported high negative predictive value (negative predictive value, 85.7%–100%; positive predictive value, 41.2%–85.7%) which is comparable to the present study (Riad et al., 2010; Bakhshi et al., 2012; Ilivitzki et al., 2013; Uslu et al., 2015). Furth et al., 2009 reported that a negative  $^{18}\text{F}$ -FDG PET/CT scan after 2 cycles of chemotherapy is a strong indicator of relapse-free survival, with a negative predictive value of 100% in HL patients. Therefore, an  $^{18}\text{F}$ -FDG PET/CT scan has been advocated by many investigators and has led to early intensification of chemotherapy in apparent non-responders (Furth et al., 2009; Levine et al., 2006; Meany et al., 2007; Uslu et al., 2015). Additionally, PET or PET/CT has clear advantage in evaluating soft-tissue masses and, thus, has been reported to be useful in patients with lymphoma or other malignancies after treatment (Weber, 2005). Early detection of distant malignancies in cancer patients is crucial for guiding subsequent staging procedures and treatment (Xu et al., 2012/2015). In several previous studies,  $^{18}\text{F}$ -FDG PET/CT was shown to be more sensitive and specific than conventional imaging procedures for the detection of distant malignancies in cancer patients at initial staging before treatment or restaging after treatment (Ng et al., 2009; Fuster et al., 2008; Antoch et al., 2004; Strobel et al., 2007; Veit-Haibach et al., 2009). The introduction of PET/CT scanners combined the functional data of PET with the detailed anatomic information of CT into a single examination (Xu et al., 2012/2015). The combination of high-quality PET scans with diagnostic or low-dose CT scans aids physicians in the staging, therapy planning, and treatment of many pediatric oncology patients. Fusion of the physiologic PET scan with the anatomic CT scan can help in distinguishing disease from other physiologic processes and can be an invaluable tool for referring physicians when they are evaluating for recurrence of disease. This relatively noninvasive scan can provide, through a single study, information and insight that in previous years required multiple scans using several different imaging modalities (McQuattie, 2008).

### Summary and Conclusion:-

Cardiac PET is a powerful, quantitative, noninvasive imaging technique that is increasingly penetrating the clinical arena. For clinical assessment of myocardial perfusion and viability, evidence for diagnostic and prognostic usefulness is increasing and cost-effectiveness due to high accuracy despite high single-test costs is suggested. The advent of hybrid imaging enables routine combination of PET with CT-derived morphologic parameters. New molecular imaging compounds will be key elements in the emerging paradigm of personalized medicine (Bengel et

al., 2009). Additionally, integrated PET/CT has found its way into the practice of radiation oncology, and  $^{18}\text{F}$ -FDG PET is being introduced for radiotherapy planning. The functional information possibly augments accurate delineation and treatment of the tumor and its extensions while reducing the dose to surrounding healthy tissues. In addition to  $^{18}\text{F}$ -FDG, other PET tracers are available for imaging specific biologic tumor characteristics determining radiation resistance (Troost et al., 2015). **The study aimed** to prospectively study the clinical experience with  $^{18}\text{F}$ -FDG PET/CT in cardiac diseases and in pediatric malignancies to evaluate and compare the efficacy of this new imaging system in both diseases, and to determine if PET/CT provided additional diagnostic information on disease status. The study concluded that the PET/CT is the gold standard for noninvasive functional imaging in cardiovascular disease as well as in oncology. It has high diagnostic value in the assessment of myocardial viability in patients with known CAD. Technical developments in PET scanning in cancer management may increase the precision of radiotherapy planning and thus improve tumor control and reduce treatment-related morbidity. **Recommendation** regarding the use of PET/CT in the management of pediatric malignancy to facilitates the sparing of normal structures and the escalation of dose. Further studies were recommended in cardiovascular patients for the incorporation of PET/CT into patient management is warranted. The goals of future investigation will be to refine these technologies, address the issue of cost-effectiveness, and validate a range of clinical applications in large-scale clinical trials.

### Reference:-

1. Abraham, A., Nichol, G., Williams, K.A., Guo, A., deKemp, R.A., Garrard, L., Davies, R.A., Duchesne, L., Haddad, H., Chow, B., DaSilva, J., Beanlands, R.S. and ;PARR 2 Investigators. (2010):  $^{18}\text{F}$ -FDG PET imaging of myocardial viability in an experienced center with access to  $^{18}\text{F}$ -FDG and integration with clinical management teams: the Ottawa-FIVE substudy of the PARR 2 trial. *J Nucl. Med.*, 51:567-574.
2. Al Moudi, M. and Sun, Z. (2014): Diagnostic value of  $^{18}\text{F}$ -FDG PET in the assessment of myocardial viability in coronary artery disease: A comparative study with  $^{99\text{m}}\text{Tc}$  SPECT and echocardiography. *J Geriatr. Cardiol.*, 11(3):229-236. doi: 10.11909/j.issn.1671 5411.2014.03.008 PMID: PMC4178515
3. Al Moudi, M., Sun, Z., and Lenzo, N. (2011): Diagnostic value of SPECT, PET and PET/CT in the diagnosis of coronary artery disease: A systematic review. *Biomed Imaging Interv J.*, 7(2): e9.
4. Akobeng, A.K. (2006): Review Article, Understanding diagnostic tests 1: sensitivity, specificity and predictive values. *Journal Compilation*, 2007, Foundation ActaPædiatrica. *ActaPædiatrica*, 96:338-341.
5. American Society of Nuclear Cardiology Imaging guidelines for nuclear cardiology procedures (1999): Part 2. *J Nucl. Cardiol.*, 6(2):G47-G84.
6. Antoch, G., Saoudi, N., Kuehl, H., Dahmen, G., Mueller, S.P., Beyer, T., Bockisch, A., Debatin, J.F., and Freudenberg, L.S. (2004): Accuracy of Whole-body dual-modality fluorine-18-2-fluoro-2-deoxy-d-glucose positron emission tomography and computed tomography (FDG-PET-CT) for tumor staging in solid tumor: comparison with CT and PET. *J Clin. Oncol.* 22(1):4357-4368.
7. Bakhshi, S., Radhakrishnan, V., Sharma, P., Kumar, R., Thulkar, S., Vishnubhatla, S., Dhawan, D., and Malhotra, A. (2012): Pediatric non-lymphoblastic non-Hodgkin lymphoma: baseline, interim, and posttreatment PET/CT versus contrast-enhanced CT for evaluation—a prospective study. *Radiology*, 262(3):956-968.
8. Beanlands, R.S., Nichol, G., Huszti, E., Humen, D., Racine, N., Freeman, M., Gulenchyn, K.Y., Garrard, L., deKemp, R., Guo, A., Ruddy, T.D., Benard, F., Lamy, A., Iwanochko, R.M. and; PARR-2 Investigators. (2007): F-18-fluorodeoxyglucose positron emission tomography imaging-assisted management of patients with severe left ventricular dysfunction and suspected coronary disease: a randomized controlled trial (PARR-2). *J Am. Coll. Cardiol.*, 50(20):2002-2012.
9. Bengel, F.M., Higuchi, T., Javadi, M.S. and Lautamäki, R. (2009): Cardiac Positron Emission Tomography. *J Am. Coll. Cardiol.*, 54(1):1-15.
10. Berman, D.S., Hachamovitch, R., Shaw, L.J., Friedman, J.D., Hayes, S.W., Thomson, L.E., Fieno, D.S., Germano, G., Slomka, P., Wong, N.D., Kang, X. and Rozanski, A. (2006): Roles of nuclear cardiology, cardiac computed tomography, and cardiac magnetic resonance: assessment of patients with suspected coronary artery disease. *J Nucl. Med.*, 47(1):74-82.
11. Bluemke, D.A., Achenbach, S., Budoff, M., Gerber, T.C., Gersh, B., Hillis, L.D., Hundley, W.G., Manning, W.J., Printz, B.F., Stuber, M. and Woodard, P.K. (2008): Noninvasive coronary artery imaging: magnetic resonance angiography and multidetector computed tomography angiography: a scientific statement from the American Heart Association Committee on cardiovascular imaging and intervention of the council on cardiovascular radiology and intervention, and the councils on clinical cardiology and cardiovascular disease in the young. *Circulation*, 118(5):586-606.

12. **Cerqueira, M.D., Weissman, N.J., Dilsizian, V., Jacobs, A.K., Kaul, S., Laskey, W.K., Pennell, D.J., Rumberger, J.A., Ryan, T., Verani, M.S. and American Heart Association Writing Group on Myocardial Segmentation and Registration for Cardiac Imaging.(2002):**Standardization myocardial segmentation and nomenclature for tomographic imaging of the heart: A statement for healthcare professionals from the Cardiac Imaging committee of the Council on Clinical Cardiology of the American Heart Association. *Circulation*,105(4):539–542.
13. **Cheng, G., Servaes, S. and Zhuang, H.(2013):** Value of 18F-fluoro-2-deoxy-D-glucose positron emission tomography/computed tomography scan versus diagnostic contrast computed tomography in initial staging of pediatric patients with lymphoma. *Leuk. Lymphoma*, 54(4):737–742.
14. **Danad, I., Raijmakers, P.G. and Knaapen, P.(2013):** Diagnosing coronary artery disease with hybrid PET/CT: it takes two to tango. *J Nucl. Cardiology*, 20(5):874–890.
15. **Dorbala, S., Hachamovitch, R., Curillova, Z., Thomas, D., Vangala, D., Kwong, R.Y. and Di Carli, M.F.(2009):**Incremental prognostic value of gated Rb-82 positron emission tomography myocardial perfusion imaging over clinical variables and rest LVEF. *JACC Cardiovasc. Imaging*, 2(7):846-854.
16. **Di Carli, M.F. and Murthy, V.L.(2011):**Cardiac PET/CT for the evaluation of known or suspected coronary artery disease. *Radiographics*, 31(5):1239-1254.
17. **Flotats, A., Knuuti, J., Gutberlet, M., Marcassa, C., Bengel, F.M., Kaufmann, P.A., Rees, M.R., Hesse, B. and Cardiovascular Committee of the EANM, the ESCR and the ECNC.(2011):** Hybrid cardiac imaging: SPECT/CT and PET/CT. A joint position statement by the European Association of Nuclear Medicine (EANM), the European Society of Cardiac Radiology (ESCR) and the European Council of Nuclear Cardiology (ECNC). *Eur J Nucl. Med. Mol. Imaging*, 38(1):201–212.
18. **Furth, C., Denecke, T., Steffen, I., Ruf, J., Voelker, T., Misch, D., Vondran, F., Plotkin, M., Stöver, B., Henze, G., Lemke, A.J. and Amthauer, H.(2006):**Correlative imaging strategies implementing CT, MRI, and PET for staging of childhood Hodgkin disease. *J Pediatr. Hematol. Oncol.*, 28(8):501–512.
19. **Furth, C., Steffen, I.G., Amthauer, H., Ruf, J., Misch, D., Schönberger, S., Kobe, C., Denecke, T., Stöver, B., Hautzel, H., Henze, G. and Hundsdoerfer, P.(2009):**Early and late therapy response assessment with [18F] fluorodeoxyglucose positron emission tomography in pediatric Hodgkin's lymphoma: analysis of a prospective multicenter trial. *J Clin. Oncol.*, 27(26):4385–4391.
20. **Fuster, D., Duck, J., Paredes, P., Velasco, M., Muñoz, M., Santamaría, G., Fontanillas, M. and Pons, F.(2008):**Preoperative staging of large primary breast cancer with [<sup>18</sup>F] fluorodeoxyglucose positron emission tomography/computed tomography compared with conventional imaging procedures. *J Clin. Oncol.*, 26(29):4746–4751.
21. **Gaemperli, O. and Kaufmann, P.A.(2011):** PET and PET/CT in cardiovascular disease. *Ann N Y Acad Sci.*, 1228(1):109–136.
22. **Gaziano, T.A., Bitton, A., Anand, S., Abrahams-Gessel, S. and Murphy, A (2010):** Growing epidemic of coronary heart disease in low- and middle-income countries. *Curr. Probl. Cardiol.*, 35(2):72–115.
23. **Ghosh, N., Rimoldi, O.E., Beanlands, R.S. and Camici, P.G.(2010):**Assessment of myocardial ischaemia and viability: role of positron emission tomography. *Eur Heart J.*, 31(24):2984–2995.
24. **Groves, A.M., Speechly-Dick, M.E., Kayani, I., Pugliese, F., Endozo, R., McEwan, J., Menezes, L.J., Habib, S.B., Prvulovich, E. and Ell, P.J.(2009):**First experience of combined cardiac PET/64-detector CT angiography with invasive angiographic validation. *Eur J Nucl. Med. Mol. Imaging*, 36(12):2027-2033.
25. **Health.ny.gov.(2015):** 'Basic Statistics: About Incidence, Prevalence, Morbidity, and Mortality - Statistics Teaching Tools - New York State Department of Health'. N.p., 1999. Web. 7 Apr. 2015.
26. **Ilivitzki, A., Radan, L., Ben-Arush, M., Israel, O. and Ben-Barak, A.(2013):** Early interim FDG PET/CT prediction of treatment response and prognosis in pediatric Hodgkin disease: added value of low-dose CT. *Pediatr. Radiol.*, 43(1):86–92.
27. **Jang, B., Park, S., Kang, S.H., Kim, J.K., Kim, S.K., Kim, I.H. and Choi, Y.(2012):** Gold nanorods for target selective SPECT/CT imaging and photothermal therapy in vivo. *Quant Imaging Med Surg.*, 2(1):1–11.
28. **Kabickova, E., Sumerauer, D., Cumlivska, E., Drahokoupilova, E., Nekolna, M., Chanova, M., Hladikova, M., Kodet, R. and Belohlavek, O.(2006):**Comparison of 18F-FDG-PET and standard procedures for the pretreatment staging of children and adolescents with Hodgkin's disease. *Eur J Nucl. Med. Mol. Imaging*, 33(9):1025–1031.
29. **Klocke, F.J., Baird, M.G., Lorell, B.H., Bateman, T.M., Messer, J.V., Berman, D.S., O'Gara, P.T., Carabello, B.A., Russell, R.O. Jr, Cerqueira, M.D., St John Sutton, M.G., DeMaria, A.N., Udelson, J.E., Kennedy, J.W., Verani, M.S., Williams, K.A., Antman, E.M., Smith, S.C. Jr, Alpert, J.S., Gregoratos, G., Anderson, J.L., Hiratzka, L.F., Faxon, D.P., Hunt, S.A., Fuster, V., Jacobs, A.K., Gibbons, R.J., Russell,**

- R.O.; American College of Cardiology; American Heart Association Task Force on Practice Guidelines; and American Society for Nuclear Cardiology.(2003):** ACC/AHA/ASNC Guidelines for the clinical use of cardiac radionuclide imaging-executive summary: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (ACC/AHA/ASNC Committee to revise the 1995 Guidelines for the clinical use of cardiac radionuclide imaging) *Circulation*,108:1404–1418. *J Am Coll. Cardiol.* 2003;42:1318–1333.
30. **Levine, J.M., Weiner, M. and Kelly, K.M.(2006):** Routine use of PET scans after completion of therapy in pediatric Hodgkin disease results in a high false positive rate. *J Pediatr. Hematol. Oncol.*, 28:711–714
  31. **Li, Y., Zhang, W., Wu, H. and Liu G.(2014):**Review Article: Advanced Tracers in PET Imaging of Cardiovascular Disease; *BioMed Res Int.*,2014, Article ID 504532, 13 pages <http://dx.doi.org/10.1155/2014/504532>
  32. **Lloyd-Jones, D., Adams, R.J., Brown, T.M., Carnethon, M., Dai, S., De Simone, G., Ferguson, T.B., Ford, E., Furie, K., Gillespie, C., Go, A., Greenlund, K., Haase, N., Hailpern, S., Ho, P.M., Howard, V., Kissela, B., Kittner, S., Lackland, D., Lisabeth, L., Marelli, A., McDermott, M.M., Meigs, J., Mozaffarian, D., Mussolino, M., Nichol, G., Roger, V.L., Rosamond, W., Sacco, R., Sorlie, P., Stafford, R., Thom, T., Wasserthiel-Smolter, S., Wong, N.D., Wylie-Rosett, J. and;American Heart Association Statistics Committee and Stroke Statistics Subcommittee.(2010):**Executive summary: heart disease and stroke statistics--2010 update: a report from the American Heart Association. *Circulation*, 121(7): 948-954. Erratum in: *Circulation*. 2010; 121(12):e259.
  33. **Machac, J.(2005):**Cardiac positron emission tomography imaging. *Semin. Nucl. Med.*, 35(1): 17-36.Review.
  34. **Mahon, C.R., Lehman, D.C. andManuselis, G.(2011):** Textbook of Diagnostic Microbiology. Fifth Edition, Saunders.
  35. **McQuattie, S. (2008):**Pediatric PET/CT imaging: tips and techniques.*J Nucl. Med. Technol.*, 36(4):171-80. doi: 10.2967/jnmt.108.051995. Epub2008 Nov 13. Review. PMID:19008284
  36. **Meany, H.J., Gidvani, V.K. andMinniti, C.P. (2007):**Utility of PET scans to predict disease relapse in pediatric patients with Hodgkin lymphoma. *Pediatr. Blood Cancer* 48(4):399–402.
  37. **MedCalc, easy-to-use statistical software,(2016):** MedCalc manual, Statistic Menu, ROC Curve Analysis in MedCalc, Version 16.2.1 - Last modified: March 4, 2016 © 1993-2016. MedCalc Software bvba. <https://www.medcalc.org/manual/roc-curves.php>
  38. **Miller, E., Metser, U., Avrahami, G., Dvir, R., Valdman, D., Sira, L.B., Sayar, D., Burstein, Y., Toren, A., Yaniv, I. and Even-Sapir, E.(2006):**Role of 18F-FDG PET/CT in staging and follow-up of lymphoma in pediatric and young adult patients. *J Comput. Assist. Tomogr.*, 30(4):689–694.
  39. **Namdar, M., Hany, T.F., Koepfli, P., Siegrist, P.T., Burger, C., Wyss, C.A., Luscher, T.F., von Schulthess, G.K. and Kaufmann, P.A.(2005):**Integrated PET/CT for the assessment of coronary artery disease: a feasibility study. *J Nucl. Med.*, 46(6):930-935.
  40. **Nekolla, S.G., Martinez-Moeller, A. andSaraste, A.(2009):**PET and MRI in cardiac imaging: from validation studies to integrated applications. *J Nucl Med Mol Imaging*, 36(Suppl 1):S121–S130. DOI 10.1007/s00259-008-0980-1
  41. **Ng, S.H., Chan, S.C., Yen, T.C., Chang, J.T., Liao, C.T., Ko, S.F., Liu, F.Y., Chin, S.C., Fan, K.H. and Hsu, C.L.(2009):**Staging of untreated nasopharyngeal carcinoma with PET/CT: comparison with conventional imaging work-up.*Eur J Nucl Med Mol Imaging*, 36(1):12–22. Epub 2008 Aug 15. Erratum in: *Eur J Nucl. Med. Mol. Imaging*.2009 Mar; 36(3):538.
  42. **Nyari, T.(2011):** Mathematical and Statistical Modelling in Medicine, Diagnostic Study: Conditional probability. [www.model.u-szeged.hu/data/.../Nyari\\_HU\\_SRB\\_03.pdf](http://www.model.u-szeged.hu/data/.../Nyari_HU_SRB_03.pdf)
  43. **Parikh, R., Mathai, A., Parikh, S., Chandra Sekhar, G. andThomas, R.(2008):** Understanding and Using Sensitivity, Specificity and Predictive Values. *Indian J Ophthalmol.*,56(1):45-50.
  44. **Paulino, A.C., Margolin, J., Dreyer, Z., The, B.S. and Chiang, S.(2012):** Impact of PET-CT on involved field radiotherapy design for pediatric Hodgkin lymphoma. *Pediatr Blood Cancer*, 58(6):860–864.
  45. **Peacock, J. and Peacock, P.(2011):**Oxford Handbook of Medical Statistics.Oxford Medical Handbooks. Chapter 9, pp. 342 Oxford University Press.United Kingdom.
  46. **Punwani, S., Taylor, S.A., Bainbridge, A., Prakash, V., Bandula, S., De Vita, E., Olsen, O.E., Hain, S.F., Stevens, N., Daw, S., Shankar, A., Bomanji, J.B. and Humphries, P.D.(2010):**Pediatric and adolescent lymphoma: comparison of whole-body STIR half-Fourier RARE MR imaging with an enhanced PET/CT reference for initial staging. *Radiology*, 255(1):182–190.

47. **Ratib, O. and Nkoulou, R.(2014):** Potential applications of PET/MR imaging in cardiology. *J Nucl. Med.*, 55(Supplement 2):40S-46S.
48. **Riad, R., Omar, W., Kotb, M., Hafez, M., Sidhom, I., Zamzam, M., Zaky, I. and Abdel-Dayem, H.(2010):** Role of PET/CT in malignant pediatric lymphoma. *Eur J Nucl. Med. Mol. Imaging*, 37(2):319–329.
49. **Rispler, S., Keidar, Z., Ghersin, E., Roguin, A., Soli, A., Dragu, R., Litmanovich, D., Frenkel, A., Aronson, D., Engel, A., Beyar, R. and Israel, O.(2007):** Integrated single photon emission computed tomography and computed tomography coronary angiography for the assessment of hemodynamically significant coronary artery lesions. *J Am Coll. Cardiol.*, 49(10):1059–1067.
50. **Sato, A., Nozato, T., Hikita, H., Miyazaki, S., Takahashi, Y., Kuwahara, T., Takahashi, A., Hiroe, M. and Aonuma, K.(2010):** Incremental value of combining 64-slice computed tomography angiography with stress nuclear myocardial perfusion imaging to improve noninvasive detection of coronary artery disease. *J Nucl Cardiol.*, 17(1):19–26.
51. **Schiller, N.B., Shah, P.M., Crawford, M., DeMaria, A., Devereux, R., Feigenbaum, H., Gutgesell, H., Reichek, N., Sahn, D., Schnittger, I. and et al.(1989):** Recommendations for quantitation of the left ventricle by two-dimensional echocardiography. *J Am Soc Echocardiogr.*, 2(5):358–367.
52. **Schinkel, A.F., Bax, J.J., Poldermans, D., Elhendy, A., Ferrari, R. and Rahimtoola, S.H.(2007):** Hibernating myocardium: diagnosis and patient outcomes. *Curr. Probl. Cardiol.*, 32(7):375–410. Review.
53. **Schwaiger, M., Ziegler, S. I. and Nekolla, S. G.(2010):** PET/CT challenge for the non-invasive diagnosis of coronary artery disease. *Eur J Radiol.*, 73(3):494–503. Review.
54. **Sogbein, O.O., Pelletier-Galarneau, M., Schindler, T. H., Wei, L., Wells, R. G. and Ruddy, T.D.(2014):** New SPECT and PET radiopharmaceuticals for imaging cardiovascular disease. *BioMed. Res Int.*, 2014: 942960. 25 pages. doi: 10.1155/2014/942960. Epub 2014 May 11.
55. **Souvatoglou, M., Bengel, F., Busch, R., Kruschke, C., Fernolendt, H., Lee, D., Schwaiger, M. and Nekolla, S.G.(2007):** Attenuation correction in cardiac PET/CT with three different CT protocols: a comparison with conventional PET. *Eur J Nucl. Med. Mol. Imaging*, 34(12):1991–2000.
56. **Strobel, K., Skalsky, J., Kalff, V., Baumann, K., Seifert, B., Joller-Jemelka, H., Dummer, R. and Steinert, H.C.(2007):** Tumour assessment in advanced melanoma: value of FDG PET/CT in patients with elevated serum S-100B. *Eur J Nucl. Med. Mol. Imaging*, 34(9):1366–1375.
57. **Sun, Z.(2013):** Cardiac Imaging Modalities in the Diagnosis of Coronary Artery Disease. *J Clin. Exp. Cardiol.*, S6:e001. <http://dx.doi.org/10.4172/2155-9880.S6-e001>
58. **Sun, Z.H., Cao, Y. and Li, H.F.(2011):** Multislice computed tomography angiography in the diagnosis of coronary artery disease. *J Geriatr. Cardiol.*, 8(2):104–113.
59. **Troost, E.G.C., Schinagel, D.A.X., Bussink, J., Boerman, O.C., van der Kogel, A.J., Oyen, W.J.G. and Kaanders, J.H.A.M.(2015):** Innovations in Radiotherapy Planning of Head and Neck Cancers: Role of PET. *J Nucl. Med.* 2015, Print ISSN: 1540-1405. Online ISSN: 1540-1413. Copyright © 2015 by Journal of the National Comprehensive Cancer Network. *J Nucl. Med.* 2010;51(1):66–76. doi: 10.2967/jnumed.108.061499. Epub 2009 Dec 15.
60. **Underwood, S.R., de Bondt, P., Flotats, A., Marcasa, C., Pinto, F., Schaefer, W. and Verberne, H.J.(2014):** The current and future status of nuclear cardiology: a consensus report. *Eur Heart J Cardiovasc Imaging*, 15(9):949–55. doi: 10.1093/ehjci/jeu060. Epub 2014 May 12.
61. **Uslu, L., Doing, J., Link, M., Rosenberg, J., Quon, A. and Daldrup-Link, H.E.(2015):** Value of 18F-FDG PET and PET/CT for evaluation of pediatric malignancies. *J Nucl Med.*, 56(2):274–286. DOI: 10.2967/jnumed.114.146290
62. **Veit-Haibach, P., Vogt, F.M., Jablonka, R., Kuehl, H., Bockisch, A., Beyer, T., Dahmen, G., Rosenbaum, S. and Antoch, G.(2009):** Diagnostic accuracy of contrast-enhanced FDG PET/CT in primary staging of cutaneous malignant melanoma. *Eur J Nucl Med Mol Imaging*, 36(6):910–918.
63. **von Schulthess, G.K., Steinert, H.C. and Hany, T.F.(2006):** Integrated PET/CT: current applications and future directions. *Radiology*, 238(2):405–422.
64. **Weber, W.A.(2005):** Use of PET for monitoring cancer therapy and for predicting outcome. *J Nucl Med.*, 46(6):983–995. Review.
65. **Xu, G., Zhao, L. and He Z.(2012/2015):** Performance of Whole-Body PET/CT for the Detection of Distant Malignancies in Various Cancers: A Systematic Review and Meta-Analysis. *Journal of Nuclear Medicine* Print ISSN: 0161-5505. Online ISSN: 2159-662X Copyright © 2015 Society of Nuclear Medicine and Molecular Imaging. *J Nucl Med.*, 53(12):1847–54. doi: 10.2967/jnumed.112.105049. Epub 2012 Oct 16.



### RESEARCH ARTICLE

#### EFFECT OF THE METHANOLIC LEAF EXTRACT OF *BOSWELLIA DALZIELII* HUTCH ON THE LIVER INTEGRITY OF SELENITE-INDUCED CATARACT PUPS.

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#### Abstract

The effect of *Boswellia dalzielii* Hutch extract on the liver integrity of selenite-induced cataract pups was investigated. Nine groups of five pups each were used for this study. Group 1 received normal saline, groups 2 to 9 received 30µmol/kg BW of sodium selenite. Eight days post administration of selenite, the presence of cataract was confirmed with the aid of an ophthalmoscope, after which the treatment commenced and lasted for 28 days. The extract significantly ( $p < 0.05$ ) lowered alkaline phosphatase activity and total bilirubin concentration. The obtained results infer that *B. dalzielii* Hutch leaf extract had no harmful effect on the liver integrity of selenite-induced cataract pups.

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#### Introduction:-

The liver is an organ of great importance which plays an essential role in metabolism of xenobiotics and toxins in the body (Onoriose *et al.*, 2012). Strinath *et al* (2010) reported that such compounds produce a wide variety of toxic metabolites which adversely affect the functions and integrity of the liver. Prolong intake as well as over dosage of some drug and toxins stimulate oxidative stress and liver injury. Quantitative determination of the liver function parameters are essential pointer to the level and type of liver disorder (Rekha *et al.*, 2009). Because detoxification of xenobiotics and toxins are functions of the liver, damage to the liver becomes a major health challenge (Mitra *et al.*, 1998).

*Boswellia dalzielii* Hutch is a savannah tree which belong to the family of Burseraceae (Younoussa *et al.*, 2014) and it is mostly called the "Frankincense tree" (Sani and Qamar, 2015). The qualitative and quantitative phytochemical analysis of the leaves reveal the presence of flavonoids, saponins, steroids, glycosides, tannins, terpenoids, alkaloids, balsam and resins (Onoriose, 2012; Uzama *et al.*, 2015). Uzama *et al* (2015) reported that the proximate analysis of the leaf revealed: moisture 12.24%, ash 7.43%, crude fibre 32.85%, crude lipids 20.41%, crude protein 1.00% and carbohydrate 26.07%. That of the bark is: a moisture of 8.51%, ash 14.23%, crude fibre 42.86%, crude lipid 14.23%, crude protein 0.40% and carbohydrate 19.56%. The phytochemical studies on *B. dalzielii* revealed potent antioxidant constituents such as catechin, quercetin, kaempferol, myricetin, epicatechin, luteolin, alpha-beta-pinene and others (Onoriose, 2012). Aliyu *et al* (2007) reported that the aqueous extract of *B. dalzielii* tree bark significantly strengthens the liver and it was recommended in the management of hepatic disorders. Onoriose *et al.*, (2012) reported that the methanolic extract of *B. dalzielii* Hutch could alleviate the toxic action of  $\text{CCl}_4$  in the liver of rat. Onobrudu *et al* (2016) reported that *B. dalzielii* Hutch leaf extract is a potential anti-oxidant modulator for the development of anti-cataract formulation but its safety on the liver of selenite-induced cataract pups has not been

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studied. Hence, this present study was designed to investigate the effect of the methanol leaf extract of *B. dalzielii* Hutch on the liver integrity of selenite-induced cataract pups.

## Methods and Materials:-

### Collection and identification of plant leaves:-

The leaves of *Boswellia dalzielii* Hutch were obtained from Maitunku hill, Bambam, Dadiya District in Gombe state, Nigeria. Identified and confirmed by Dr. Ekeke Chimezie, University of Port-Harcourt Reference Herbarium for Research and Germplasm Conservation, Department of Plant Science and Biotechnology, University of Port-Harcourt, Nigeria and was given the voucher number UPH/V/1247.

### Extraction of plant

Collected leaves were air dried, pulverized and 600 grams of the pulverized plant samples was soaked in 6 L of methanol, and allowed to stand overnight for 24 hours. Thereafter it was sieved, concentrated using rotary evaporator, weighed and stored in an air tight plastic can.

### Experimental animals

Neonatal Wistar albino rat pups which initially weighed 10–18 g on the seventh day of age were obtained together with their dams from Biochemistry Department, University of Port Harcourt. The pups were kept along with their dams in wired cages, at  $27 \pm 1$  °C. All authors hereby declare that "Principles of laboratory animal care" (NIH publication No. 85-23, revised 1985) were followed, as well as specific national laws where applied.

### Experimental design

A total of 45 neonatal Wistar albino rat pups, initially weighed 10–18 g on the seventh day of age, kept along with their dams in wired cages, were used. They were divided into nine groups comprising of five pups each, such that the difference in weight between one rat group and another was  $\pm 1$  g. Group 1 received normal saline, groups 2 to 9 received  $30 \mu\text{mol} \cdot \text{kg}^{-1}$  BW of sodium selenite. The  $30 \mu\text{mol} \cdot \text{kg}^{-1}$  body weight of sodium selenite was adopted from Mohammed (2012). Eight days post administration of selenite, the presence of cataract was confirmed and the treatment commenced and lasted for 28 days. The extract was administered at doses of 300 mg/kg body weight, 400 mg/kg, 500 mg/kg, 600 mg/kg and 700 mg/kg to groups 5 to 9 respectively; groups 3 and 4 received 50 mg/kg each of vitamins A and C respectively; while groups 1 and 2 received water in place of the extract. At the end of the treatment period, the animals were anaesthetized with chloroform and sacrificed by cutting through their jugular vein. The blood pooled from each rat was collected into labelled plain bottles, centrifuged at 1200 g for 5 min and the serum separated into clean plain bottles for biochemical analysis.

### Biochemical assays on the serum

#### Serum alkaline phosphatase (ALP) activity

Serum alkaline phosphatase was determined using the Reflotron Assay method by Roche Diagnostics Ltd, Bell Lane, Lewes, United Kingdom. The principle states that Alkaline phosphatase hydrolyzes O-cresolphthalein phosphate to O-cresolphthalein and transfers the phosphate group to the acceptor molecule methylglucamine. The coloured hydrolysis product O-cresolphthalein that is produced per unit of time under alkaline conditions is directly proportional to alkaline phosphatase activity.

#### Determination of alanine aminotransferase (ALT) activity

Serum ALT was determined using the Reflotron Assay method by Roche Diagnostics Ltd, Bell Lane, Lewes, United Kingdom. The principle states that in the presence of ALT,  $\alpha$ -ketoglutarate and alanine are converted to glutamate and pyruvate. The resultant pyruvate is cleaved by Pyruvate oxidase into acetyl phosphate, carbon dioxide and hydrogen peroxide. Hydrogen peroxide converts an indicator into its oxidized blue form. The formation of the dye is measured kinetically at 567 nm as a measure of ALT activity.

#### Determination of the aspartate aminotransferase (AST) activity

Serum aspartate aminotransferase was determined using the Reflotron Assay method by Roche Diagnostics Ltd, Bell Lane, Lewes, United Kingdom. The principle states that in the presence of AST,  $\alpha$ -ketoglutarate and alanine sulphinate are converted to glutamate and pyruvate. The resultant pyruvate is cleaved by pyruvate oxidase into acetyl phosphate, carbon dioxide and hydrogen peroxide. Hydrogen peroxide converts an indicator into its oxidized blue form. The formation of the dye is measured kinetically at 567 nm as a measure of AST activity.



### Determination of total protein (TP) concentration

Serum total protein was determined according to the Biuret method using Randox kit by Randox Laboratories Ltd, England, and United Kingdom. The principle is based on the fact that cupric ions, in an alkaline medium, react with protein peptide bonds resulting in the formation of a purple coloured complex. The intensity of the final coloured complex is measured colorimetrically at 540 nm and it is proportional to the concentration of the total protein in the sample.

### Determination of serum albumin

Serum albumin was determined by the Bromocresol green colorimetric method using Randox kit by Randox Laboratories Ltd, England, United Kingdom. The principle is based on the fact that Bromocresol green is an indicator which is yellow between pH 3.5- 4.2 when it binds to albumin the colour of the indicator changes from yellow to blue green. The absorbance of the albumin-bromocresol green coloured complex is directly proportional to the concentration of albumin at 578 nm.

### Determination of serum total bilirubin concentration

Serum total bilirubin was determined using the Reflotron Assay method by Roche Diagnostics Ltd, Bell Lane, Lewes, United Kingdom. Before the reaction start, the protein bound indirect bilirubin is released by means of dyphylline [7- (2,3-dihydroxypropyl)-theophylline]. Both the direct and the indirect bilirubin react with the diazonium salt 2-methoxy-4-nitrophenyldiazonium. Indirect bilirubin is released by means of dyphylline. The bilirubin concentration is proportional to the dye formed at 567 nm and 37 °C.

### Statistical analysis of data

Data were expressed as mean  $\pm$  standard deviation (SD). The results were analysed statistically by one way analysis of variance (ANOVA), followed by multiple comparison test of least significant difference (LSD). Significance was accepted at a  $p$ -value of 0.05.

## Results

**Table 1** Effect of the methanol leaf extract of *Boswellia dalzielii* Hutch on serum indicators of liver integrity in selenite-induced cataract pups

Treatment groups	ALP activity(U/L)	AST activity (U/L)	ALT activity(U/L)
Normal control	134.68 $\pm$ 08.61 <sup>a</sup>	70.28 $\pm$ 06.12 <sup>a</sup>	18.18 $\pm$ 04.61 <sup>a</sup>
Toxic control	141.52 $\pm$ 11.08 <sup>a,c</sup>	53.40 $\pm$ 10.53 <sup>c</sup>	14.28 $\pm$ 04.29 <sup>a,c</sup>
Vitamin A treated	125.00 $\pm$ 15.00 <sup>a,f</sup>	56.50 $\pm$ 11.21 <sup>c</sup>	17.93 $\pm$ 02.31 <sup>a,c,d</sup>
Vitamin C treated	145.00 $\pm$ 19.90 <sup>a,c,e</sup>	70.82 $\pm$ 14.48 <sup>a,d</sup>	22.65 $\pm$ 04.78 <sup>d</sup>
300 mg/kg extract	141.53 $\pm$ 13.28 <sup>a,c,e</sup>	58.90 $\pm$ 03.35 <sup>a,c,d</sup>	16.83 $\pm$ 03.39 <sup>a,c</sup>
400 mg/kg extract	147.63 $\pm$ 01.61 <sup>a,c,e</sup>	56.38 $\pm$ 14.70 <sup>c</sup>	19.23 $\pm$ 01.30 <sup>a,c,d</sup>
500 mg/kg extract	124.00 $\pm$ 09.02 <sup>a,f</sup>	53.48 $\pm$ 03.10 <sup>c</sup>	22.08 $\pm$ 02.08 <sup>a,d</sup>
600 mg/kg extract	143.25 $\pm$ 11.59 <sup>a,c,e</sup>	58.80 $\pm$ 09.51 <sup>a,c,d</sup>	20.30 $\pm$ 06.13 <sup>a,d</sup>
700 mg/kg extract	147.25 $\pm$ 09.43 <sup>a,c,e</sup>	78.60 $\pm$ 07.23 <sup>a,d,e</sup>	20.28 $\pm$ 05.71 <sup>a,d</sup>

Data were represented as mean  $\pm$  standard deviation of n=5 or 4

Values in the same column with different superscript letters (a, b, c, d and f) are significantly different at  $p < 0.05$

**Table 2:-** Effect of the methanol leaf extract of *Boswellia dalzielii* Hutch on serum markers of liver function in selenite-induced cataract pups.

Treatment groups	Total protein (g/dL)	Albumin(g/dL)	Total bilirubin(mg/dL)	Direct bilirubin(mg/dL)
Normal control	03.80 $\pm$ 00.23 <sup>a</sup>	02.88 $\pm$ 00.11 <sup>a</sup>	00.44 $\pm$ 00.05 <sup>a</sup>	00.11 $\pm$ 00.03 <sup>a</sup>
Toxic control	04.04 $\pm$ 00.34 <sup>a,c</sup>	02.88 $\pm$ 00.08 <sup>a,c</sup>	00.48 $\pm$ 00.08 <sup>a,c</sup>	00.13 $\pm$ 00.05 <sup>a,b</sup>
Vitamin A treated	03.70 $\pm$ 00.30 <sup>a,b</sup>	03.23 $\pm$ 00.58 <sup>a,c</sup>	00.43 $\pm$ 00.05 <sup>c,d</sup>	00.17 $\pm$ 00.06 <sup>a,c,d</sup>
Vitamin C treated	03.83 $\pm$ 00.13 <sup>a,b,c</sup>	02.95 $\pm$ 03.52 <sup>d</sup>	00.53 $\pm$ 00.10 <sup>a,c,d</sup>	00.16 $\pm$ 00.05 <sup>a,c</sup>
300 mg/kg extract	03.83 $\pm$ 00.05 <sup>a,b,c</sup>	02.95 $\pm$ 00.10 <sup>a,c</sup>	00.43 $\pm$ 00.13 <sup>c,d,e</sup>	00.10 $\pm$ 00.02 <sup>a,e</sup>
400 mg/kg extract	03.95 $\pm$ 00.31 <sup>a,b,c</sup>	02.93 $\pm$ 00.05 <sup>a,c</sup>	00.38 $\pm$ 00.05 <sup>e</sup>	00.14 $\pm$ 00.06 <sup>a,c,e,f</sup>
500 mg/kg extract	03.88 $\pm$ 00.15 <sup>a,b,c</sup>	02.90 $\pm$ 00.14 <sup>a,c</sup>	00.53 $\pm$ 00.10 <sup>c,d,f</sup>	00.16 $\pm$ 00.04 <sup>a,c,f</sup>
600 mg/kg extract	03.85 $\pm$ 00.06 <sup>a,b,c</sup>	02.83 $\pm$ 00.10 <sup>a,c</sup>	00.33 $\pm$ 00.05 <sup>e</sup>	00.09 $\pm$ 00.02 <sup>a,e</sup>
700 mg/kg extract	03.78 $\pm$ 00.15 <sup>a,b,c</sup>	02.95 $\pm$ 00.13 <sup>a,c</sup>	00.38 $\pm$ 00.05 <sup>e</sup>	00.11 $\pm$ 00.03 <sup>a,e,f</sup>

Data were represented as mean  $\pm$  standard deviation of n=5

Values in the same column with different superscript letters (a, b, c, d, e and f) are significantly different at  $p < 0.05$

Table 1 and 2 shows the Effect of the methanol leaf extract of *B. dalzielii* Hutch on liver function parameters.

The ALP activity of the vitamin A and 500 mg/kg extract treated group showed significant ( $p < 0.05$ ) reduction when compared to the toxic control group. The ALP activity of the extract treated (300 mg/kg, 400 mg/kg, 600 mg/kg and 700 mg/kg) and vitamin C treated groups showed increase when compared to the toxic control group, although the increase was not significant at ( $p < 0.05$ ). The activity of ALP ranged from 124.00 U/L in 500 mg/kg extract treated pups to 147.63 U/L in 400 mg/kg extract treated group. The plasma AST activity of the vitamin C and 700 mg/kg extract treated group showed significant ( $p < 0.05$ ) increase when compared to the toxic control group. The AST activity of the 300 mg/kg, 400 mg/kg, 500 mg/kg and 600 mg/kg extract treated and vitamin A treated groups showed non-significant ( $p < 0.05$ ) increase when compared to the toxic control group. The activity of AST (U/L) in the 700 mg/kg extract treated group ( $78.60 \pm 07.23$ ) was highest followed by the vitamin C treated group ( $70.82 \pm 14.48$ ) and was lowest in the toxic control group ( $53.40 \pm 10.53$ ). The ALT activity (U/L) was highest in vitamin C treated group ( $22.65 \pm 04.78$ ) followed by 500 mg/kg extract treated group ( $22.08 \pm 02.08$ ) and was lowest in the toxic control group ( $14.28 \pm 04.29$ ). The ALT activity of the vitamin C treated and 500 mg/kg, 600 mg/kg and 700 mg/kg extract treated groups showed significant ( $p < 0.05$ ) increase when compared to the toxic control group, while the ALT activity of the 300 mg/kg and 400 mg/kg extract treated, and vitamin A treated groups showed non-significant ( $p < 0.05$ ) increase when compared to the toxic control group. As shown (Table 2), the plasma total protein concentration of the vitamin A ( $03.70 \pm 0.30$ ) treated showed significant ( $p < 0.05$ ) reduction when compared to the toxic control group ( $04.04 \pm 0.34$ ), while the total protein of the 300 mg/kg, 400 mg/kg, 500 mg/kg, 600 mg/kg and 700 mg/kg extract and vitamin C treated groups showed reduction when compared to the toxic control group, although these changes were not significant at  $p < 0.05$ . The plasma albumin concentration of the vitamin C treated group showed significant ( $p < 0.05$ ) increase when compared to the toxic control groups. Plasma albumin concentration of the 600 mg/kg extract treated group showed non-significant ( $p < 0.05$ ) reduction when compared to the toxic control group, while 300 mg/kg, 400 mg/kg, 500 mg/kg and 700 mg/kg extract treated and vitamin A treated groups showed non-significant ( $p < 0.05$ ) increase when compared to the toxic control group. Total bilirubin concentration 400 mg/kg, 600 mg/kg and 700 mg/kg extract treated groups showed significant ( $p < 0.05$ ) reduction, while the vitamin A treated and 300 mg/kg extract treated groups showed non-significant ( $p < 0.05$ ) reduction when compared to the toxic control group. The total bilirubin concentration of the vitamin C treated and 500 mg/kg extract treated groups showed non-significant ( $p < 0.05$ ) increase when compared to the toxic control group. The direct bilirubin of the extract treated (300 mg/kg, 600 mg/kg and 700 mg/kg) groups showed reduction when compared to the toxic control group, while 400 mg/kg and 500 mg/kg extract treated and vitamins C and A treated group showed increase when compared to the toxic control group. These changes in direct bilirubin were not significant at ( $p < 0.05$ ).

## Discussion

In this study, the treatment produced dose dependent significant increase in serum activities of alanine aminotransferase. However, this was not accompanied by a similar elevation in AST and ALP activities, and therefore did not confirm whether the increase in plasma ALT activities was due to liver inflammatory reactions or damage. Hepatocellular damage that involves the cytoplasmic or mitochondrial membranes is often characterized by increase in the activities of aminotransferase enzymes (Crook, 2006). Plasma enzyme activities of aminotransferases are elevated when the membranes of only very few cells of the hepatocytes are damaged. The raised plasma transaminase concentrations observed in this study are indicative of hepatocyte damage.

The liver responds to any type of hepatobiliary obstruction by inducing ALP synthesis which enters the blood circulation to elevate the level of the enzyme in the serum (Burtis and Ashwood, 2001). Therefore, the reduction in the plasma activities of ALP observed in *B. dalzielii* treated groups indicates that there was no obstruction of the hepatobiliary system in the experimental pups.

Compared to the toxic control group, the treatment dose dependently lowered the plasma total bilirubin levels of the treated animals, while having no significant effects on the plasma conjugated bilirubin levels. This means that there was no deterioration of the hepatobiliary system, and no compromise of the ability of the liver to take up, process and secrete bilirubin into the bile.

The plasma albumin and total protein levels of the treated animals were higher but not significantly, than those of the toxic control groups at the 5% level. The increase in the levels of albumin and total protein as observed in this study reflects restoration in the capacity of the liver to synthesize protein. Earlier, studies have reported the ability of the extract to enhance the integrity of the liver (Aliyu *et al.*, 2007), and alleviate liver damage in Wistar rats (Onoriose, 2012). However, the increased levels of plasma ALT activities produced by the high doses of the extract

confirms earlier concern raised by Abdulazeez *et al* (2013), that the consumption of *B. dalzielii* extract at high doses and over a lengthened duration should be done with caution as it seems to compromise the integrity or function of the liver.

## Conclusion

This study revealed that the extracts had no deleterious effect on the liver integrity of selenite induced cataract pups hence it is a potential agent for the management of cataract.

## Reference

1. Abdulazeez, A.T., Kabele-Toge, B., Lawal, M. and Abubakar, M.G. (2013). Phytochemical, antibacterial and Toxicological studies of aqueous stem bark extract of *Boswellia dalzielii*. *African Journal of Pharmaceutical Research Development*, 5(1): 61-67.
2. Aliyu, R., Gatsing, D. and Jaryum, K.H. (2007). The effect of *Boswellia dalzielii* (Buseraceae) aqueous bark extract on rat liver function. *Asian Journal of Biochemistry*, 2(5):359-363
3. Burtis, C.A. and Ashwood, E.R. (2001). Tiez Fundamentals of Clinical Chemistry. (5<sup>th</sup>ed) W. B. Saunders Company, Philadelphia. Pp 352–768.
4. Mitra, S.K., Venkataranganna, M.V., Sundaram, R. and Gopumadhavan, S. (1998), Protective effect of HD-03, a herbal formulation, against various hepatotoxic agents in rats. *Journal of Ethnopharmacology*, 63:181-186.
5. Mohammed, H.H.H. (2012). Effect of some functional foods on induced cataract in experimental animals. Thesis Submitted for Doctor Philosophy Degree in Science in “Biochemistry and Nutrition”, Biochemistry and Nutrition Department, Women’s College for Art, Science and Education, Ain Shams University.
6. Onobrudu, D.A., Ikewuchi, J.C. and Onyeike E.N. (2016). Moderation of ocular markers of oxidative stress of selenite induced cataractous pups by *Boswellia dazielii* Hutch extract. *Global Advance Journal of Medicinal Plant*. 4(2):007-011
7. Onoriose, D.A. (2012). Phytochemistry and biochemical effect of methanolic extract of *Boswellia dalzielii* Hutch leaves on carbon tetrachloride induced hepatotoxicity in albino rats. An M.Sc. thesis submitted to the Department of Biochemistry, University of Port-Harcourt. Pp123-133
8. Onoriose, D.A., Uwakwe, A.A. and Monago, C.C. (2012). Hepatoprotective effect of the methanolic leaf extract of *Boswellia dalzielii* Hutch on carbon tetrachloride induced hepatotoxicity in wistar rats. *Indian Journal of Medicine and Healthcare*, 1(3): 55-63
9. Rekha, R., Hemalatha, S., Akasakalai, K., Mudhukrisna, C.H., Vittal, S.B. and Sundaram, R.M. (2009). Hepatoprotective activity of *Mimosa pudica* leaves against CCl<sub>4</sub> induced toxicity. *Journal of Natural Products*, 2:116-122
10. Sani, Z. and Qamar, M. (2015). Comparative effects of *Boswellia dalzielii* parts on survival of adult *callosobruchusmaculatus* (fabricius) [coleoptera: chrysomelidae] reared on cowpea seeds. *Annals of Biological Sciences*, 3(2): 1-4
11. Strinath, A., Jyothi, V. and Asha, J.V. (2010). Hepatoprotective activity. *International Journal of Pharmacy and Technology*, 2(3):354-366.
12. Uzama, D., Gbubele, J.D., Bwai, M.D. and kabir, M.G. (2015). Phytochemistry, nutritional and anti-microbial screening of hexane, ethyl acetate and ethanolic extract of *Boswellia dalzielii* leaves and bark. *American Journal of Bioscience and Bioengineering*, 3(5):76-79.
13. Younoussa, L., Elias, N.N., Danga, Y.S.P. and Okechukwu, E. (2014). Larvicidal activity of *Annonasenegalensis* and *Boswellia dalzielii* leaf extract against *Aedesegypti* (Diptera: colicidac). *International Journal of Mosquito Research*, 1(4): 25-29

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### RESEARCH ARTICLE

#### TRAUMATIC APPENDICITIS: A CASE REPORT.

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##### Manuscript History

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Appendicitis Abdominal trauma.

#### Abstract

Appendicitis and trauma may exist together, which causes an interesting debate whether trauma has led to appendicitis. We report a case of appendicitis after an abdominal trauma. Our patient developed acute appendicitis following a stab wound in the right iliac fossa. Surgical exploration confirmed the traumatic origin of appendicitis, appendectomy was performed and our patient made an excellent recovery. In non operative management of abdominal trauma, physical examinations and radiological explorations should be repeated in order to diagnose traumatic appendicitis.

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#### Introduction:-

Trauma and appendicitis are the commonest emergency conditions requiring surgery, especially in young adults. The pathological process in appendicitis generally starts with obstruction of the appendiceal lumen and may progress to peritonitis and development of intraabdominal abscess via appendiceal inflammation and perforation. An abdominal trauma may be responsible for damage of digestive tract or solid organs (liver or spleen). Occasionally, appendicitis and trauma exist together, which causes an interesting debate whether trauma has led to appendicitis. Actually, the role of abdominal trauma is still uncertain in the etiology of appendicitis. Blunt abdominal trauma or penetrating trauma like a stab wound may lead to an acute inflammatory response which is suggested to be the probable mechanism of traumatic appendicitis.

We report a case of appendicitis after an abdominal trauma (stab wound). To our knowledge, it is the first case of acute appendicitis after a stab wound reported in the literature.

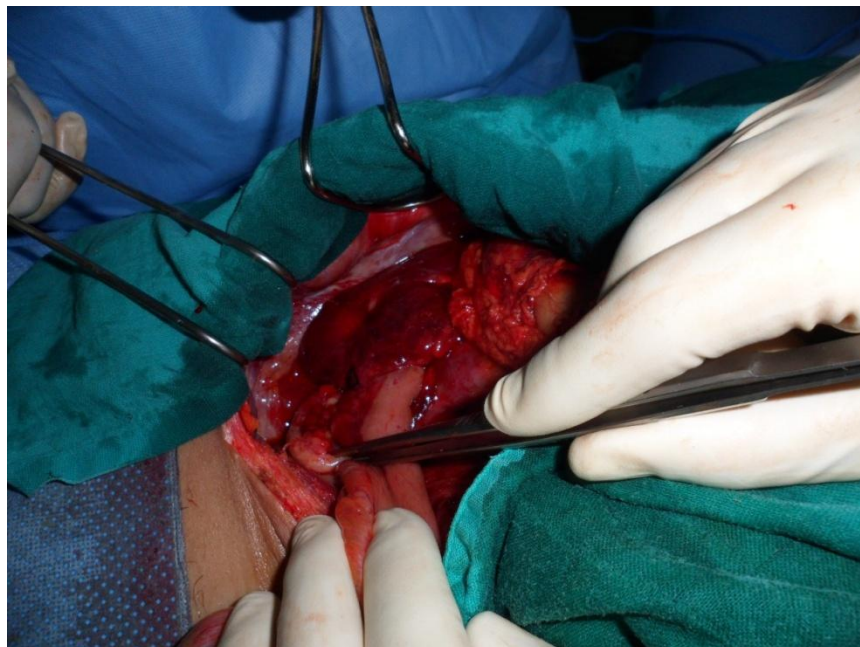
#### Case report:-

A 24 year-old man was admitted to the emergency department because of an abdominal injury following a stab wound which occurred on the same day. He said he was assaulted one hour before his admission by a stab wound in the right iliac fossa. His assailant used a sharp instrument (kitchen knife). The physical examination showed a conscious patient hemodynamically stable whose temperature was 37°C, whose pulse rate was 80 beats/min, whose respiratory rate of 20 breaths/min and whose blood pressure was 130/80 mmHg. Abdominal examination was normal out of mild tenderness at the abdominal wound which was located in the right iliac fossa. Laboratory investigations showed that the hemoglobin level was 12.8 g/dl, and the white blood cell count was 9800/mm<sup>3</sup>. Abdominal ultra sonography (US) was normal. So, a non operative management was decided. The penetrating abdominal wound (2 centimeters in length) was located in the right iliac fossa. It was disinfected and sutured. The

day after his hospitalization, he had acute right iliac fossa pain. On examination, he was found to have a blood pressure of 120/80 mmHg, a pulse rate of 80 beats/min and a respiratory rate of 20 breaths/min; he was mildly pyrexial at 37.5°C. Abdominal examination revealed tenderness in the right iliac fossa. Laboratory investigations showed that the hemoglobin level was stable, but the white blood cell count was significant for a leukocyte count of 14,000/mm<sup>3</sup> with 80% polymorphonuclear leukocytes. Then, abdominal US showed acute appendicitis (Figure 1). An emergency operation was performed. At laparotomy, a right paracolic retroperitoneal hematoma was detected. The patient had pelvic appendix in position. The appendix was hyperemic and edematous. Hematomas of the caecal wall and of the appendiceal wall were found (Figure 2). Appendectomy was performed. Histopathology confirmed diagnosis of acute appendicitis. Our patient made an excellent recovery, and he was discharged from the hospital in stable condition 2 days later.



**Figure 1:-** Abdominal ultra sonography of our patient showing appendicitis.



**Figure 2:-** Intra operative photo showing the right para colic retroperitoneal hematoma and the appendicitis.

This study was performed according to the declaration of Helsinki and approved by the Local Ethical Committee.

### Discussion:-

The acute appendicitis is the most common abdominal surgical emergency. It is an acute inflammation of the appendix related mostly with obstruction of the appendiceal lumen. This obstruction is usually caused by an inspissated stool, a mucus plug, or a foreign body [1]. Non-obstructive causes are also discussed such as bacterial invasion of the lymphoid tissue of the appendix [2]. Abdominal trauma was also mentioned as a possible etiologic factor in acute appendicitis. Interest in the association between appendicitis and blunt abdominal trauma may have begun with illusionist Harry Houdini's untimely death in 1926: he is said to have died from a rupture appendix after a blow to the abdomen. During the 1930s, reports of blunt abdominal trauma and subsequent appendicitis began to appear [3] (Table 1). However, only few cases of minor BAT and TA have been reported in the literature, which may be attributed to the rarity or the difficulty to diagnose this relationship. Hennington and al. reported two cases of blunt abdominal trauma producing acute appendicitis. In both cases, blunt abdominal trauma has produced appendiceal edema with inflammation and hyperplasia of appendix lymphoid tissue, and then, obstruction of the appendiceal lumen, leading to acute appendicitis [4]. Ciftçi and al reported 5 cases of appendicitis occurring after abdominal trauma suggesting the same mechanism [2]. It is well known that intra-abdominal pressure increases in varying degrees in every blunt abdominal trauma case [5, 6, 7]. According to Ramsook [3], a sudden increase in intra abdominal pressure may lead to an increased intra ceecal pressure followed by a rapid distention of the appendix which may result in appendicitis.

**Table 1:-** Review of the cases of traumatic appendicitis reported in the literature

Year	Authors	Cause of traumatic appendicitis	Mechanism of traumatism
1927	Richard J. Behan, Ann Surg. 1927 Feb 85(2):263–8.	14 cases	Bicycle Fall, Industrial accident
1940	G.K. Rhodes, California and western medicine, vol 53 n°4	7 cases	Abdominal trauma during scuffle, sports injury, industrial accident, car crash
1991	Hennington and al. Annales of surgery, 1991	2 cases	Industrial accident, Bicycle fall
1993 – 2002	B. Etensel and al. Emerg Med J 2005 22:874–877	5 cases	4 car crashes, 1 fall from a height of 10 meters
1996	A.O. Ciftçi, and al. Eur J Pediatr Surg 1996;6:350–3.	5 cases	Abdominal trauma
2002	Hager and al., Emerg Med J 2002 19:366–367	1 case	Fall from a ladder
2006	L. Pisoni and al. Ann Ital Chir. 2006 Sep Oct 77(5):441-2	1 case	Abdominal trauma
2010	Atalla MA and al. ANZ J Surg. 2010 Jul-Aug 80(7–8):572-3	1 case	Car Crash
2012	Paschos KA and al., Emerg Med Australas. 2012 Jun 24(3):343–6.	1 case	Blunt abdominal trauma
2013	Wani I. Post traumatic retrocecal appendicitis. OA Case reports 2013 May 01; 2 (4): 31	8 cases	Fall, Kicked in the abdomen, Bicycle fall

Serour and al have claimed that direct appendiceal injury is generally coexistent with other intra-abdominal organ injuries, and that the appendix is very rarely affected by direct trauma as it is very mobile and its dimensions very small [8]. As for our patient, hypothesis of appendicitis and abdominal trauma both existing together was easily dismissed because he was attacked by a sharp instrument. The stab wound in the right iliac fossa produced a penetrating abdominal wound. Then, the sharp instrument traumatized the meso colon and the meso appendix, causing the para colic retroperitoneal hematoma and hematomas of the caecal wall and the appendiceal wall. The result of these anatomic lesions was acute appendicitis due to the consequent luminal obstruction of the appendix.

**Conclusion:-**

Appendicitis may follow abdominal trauma. Blunt abdominal trauma leading to appendicitis is rare, and occasionally, appendicitis and trauma exist together, which causes an interesting debate whether trauma has led to appendicitis. We report a case of abdominal trauma due to a sharp instrument which directly led to acute appendicitis. As the abdominal trauma was not a BAT, it was easy to relate the stab wound in the right iliac fossa to acute appendicitis. In non operative management of abdominal trauma, physical examinations, abdominal ultra sonography and/or abdominal computed tomography should be repeated for diagnosis of traumatic appendicitis in order to prevent potential complications of appendicitis.

**Consent:-**

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

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Declarations

**Authors' original submitted files for images**

Below are the links to the authors' original submitted files for images.

13017\_2013\_308\_MOESM1\_ESM.jpeg Authors' original file for figure 1

13017\_2013\_308\_MOESM2\_ESM.jpeg Authors' original file for figure 2

**Competing interests**

All authors declare no competing interests.

**Authors' contributions**

none.

**References:-**

1. Etensel B, Yazici M, Gursoy H, Ozkisacik S, Erkus M: The effect of blunt abdominal trauma on appendix vermiformis. *Emerg Med J.* 2005, 22: 874-877. 10.1136/emj.2004.018895.**PubMed CentralView ArticlePubMedGoogle Scholar**
2. Ciftçi AO, Tanyel FC, Buyukpamukçu N: Appendicitis after blunt abdominal trauma: cause or coincidence?. *Eur J Pediatr Surg.* 1996, 6: 350-353. 10.1055/s-2008-1071013.**View ArticlePubMedGoogle Scholar**
3. Ramsook C: Traumatic appendicitis: fact or fiction?. *Pediatr Emerg Care.* 2001, 17: 264-266. 10.1097/00006565-200108000-00011.**View ArticlePubMedGoogle Scholar**
4. Hennington MH, Tinsley JR EA, Proctor HJ: Acute appendicitis following blunt abdominal trauma. *Ann Surg.* 1991, 214: 61-63.**PubMed CentralView ArticlePubMedGoogle Scholar**
5. Schein M, Klipfel A: Local peritoneal responses in peritonitis-clinical scenarios i: peritoneal compartment responses and its clinical consequences. *Sepsis.* 1999, 3: 327-334. 10.1023/A:1009861629215.**View ArticleGoogle Scholar**
6. Km S, Pm B, Miller JS: Abdominal compartment syndrome after mesenteric revascularization. *J Vasc Surg.* 2001, 34: 559-561. 10.1067/mva.2001.117150.**View ArticleGoogle Scholar**
7. Saggi B, Sugerman H, Ivatury R: Abdominal compartment syndrome. *J Trauma.* 1998, 45: 597-609. 10.1097/00005373-199809000-00033.**View ArticlePubMedGoogle Scholar**
8. Serour F, Efrati Y, Klin B: Acute appendicitis following abdominal trauma. *Arch Surg.* 1996, 131: 785-786. 10.1001/archsurg.1996.01430190107026.**View ArticlePubMedGoogle Scholar**.



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### RESEARCH ARTICLE

## PRIORITY BASED FAIR RESOURCE ALLOCATION AND ADMISSION CONTROL TECHNIQUE FOR MULTICLASS TRAFFIC IN LTE-ADVANCED NETWORK.

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Resource Allocation, PRAAC, LTE-A Networks, real-time, virtual partitioning

### Abstract

In order to allocate resources for real-time traffic flows to meet their Quality of Service (QoS) requirements, Priority based fair Resource Allocation and Admission Control (PRAAC) technique for Multi-class downlink Traffic in LTE-A networks is proposed. In this technique, priority of the nodes is estimated based on the Tolerance of Latency, bandwidth and data arrival rate. This technique includes a two level resource allocation scheme, wherein the first level a radio admission control (RAC) scheme is introduced. In the second level, RAC combines the complete sharing (CS) and virtual partitioning (VP) resource allocation models. Simulation results show that the proposed technique achieves better throughput for Video and the Exponential traffic performs well when compared to CBR traffics in all aspects.

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### Introduction:-

The past few years have brought new possibilities that changed the mobile users' expectations regarding connectivity. New social applications, high-definition multimedia, and other services have made mobile terminals the main connectivity tool for several users, i.e., users want to have the same experience as on a fixed computer. The upcoming standard from 3rd Generation Partnership Program (3GPP) named long-term evolution advanced (LTE-A) targets the support of such high requirements services. Relaying is an appealing technology that was introduced in LTE-A to provide seamless connection and high achievable data rates to the users located in the cell-edge or in coverage holes. Relay nodes (RN) are low power evolved NodeB (eNB) which, when deployed in the macro cell, improve the signal quality between the user equipment (UE) and eNB by dividing the radio link into two hops: the so-called backhaul link between the RN and the eNB, which in this context, is referred to as the Donor eNB (DeNB), and the so-called access link between the RN and the UE [1].

Resource allocation among multiple users sharing the whole spectrum bandwidth is one of the key design tasks in LTE systems. The aim here is to optimally assign resources to those users which need them, keeping in view not only their resource requirements, but also their instantaneous channel quality, instantaneous service quality, and the allocation history. Although, the presence of RN (multi-hop transmission) has proved to enhance the LTE system, it introduces some additional design challenges in the traditional resource allocation task [1]. In order to maintain minimal QoS, proper utilization of the bandwidth in the form of appropriate distribution is to be done. The resource allocation impacts on the applications utilizing the LTE network.

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Non-Real Time (NRT) services must possess minimum bit-rate and Real Time (RT) services require a high level of QoS [12]. The NRT services are bandwidth adaptive and do not require QoS guarantees. Several calls can be accommodated in a system by reducing the allocated bandwidth for the existing NRT traffic calls and by reducing the requested bandwidth for the incoming NRT traffic calls. Though decreasing the same amount of bandwidth from the NRT traffic calls to accept a handover call and a new call reduces the call blocking probability, it cannot reduce the handover call dropping probability significantly [11].

Too much users and limited Resource Blocks (RB) leads to infeasibility in guaranteeing all ongoing users' QoS as a result calls will be blocked and/or lost. Their types are New-call blocking, the failure of the initial call connection establishment and Handoff call dropping, the blocking of in-service calls when they move from one cell to another [9,10]. From user's point of view, it is better to block a new call rather than dropping a call in the middle [12].

The scheduling problem in downlink LTE should provide solution for resource allocation and fairness for all types of classes. The resource allocation should clearly describe the admission control and bandwidth allocation mechanisms.

A novel RAC scheme [13] was proposed for handling multiclass services in LTE systems to maximize the number of admitted users to enhance the system capacity. A combined complete sharing (CS) and virtual partitioning (VP) resource allocation model was presented for optimization and a service degradation scheme was found out for resource limitations. But it fails to present the standard techniques to determine the priority of each user of each class. Moreover fairness among the users of same group is not handled.

### Literature Review:-

Mohammad J. Abdel-Rahman et al [3] have proposed novel stochastic joint channel and BS allocation schemes that account for uncertainty in channel availability. First, they developed two static (proactive) joint allocation models. They referred to these models as Het-SMKP1 and Hom-SMKP. In these models, the allocation is done once such that user demands are probabilistically met. In Het-SMKP1, a user can request different probabilistic rates for different small cells, whereas in Hom-SMKP each user requests the same probabilistic rate for the entire network. Second, they proposed an adaptive (proactive and reactive), two-stage allocation model for heterogeneous rate demands, which they referred to as Het-SMKP2. The adaptive model allows for correcting the initial resource allocation once the channel availability uncertainties are partially resolved.

DardouriSamia et al [4] have proposed a scheduling algorithm in two levels based on cooperative game theory, aiming at improving performance and justice in the distribution of radio resources. Simulations demonstrate that the proposed algorithm improve the level of the system's QoS more effectively than other algorithms under the circumstance that guarantees users minimum QoS requirement.

NasimFerdosian et al [5] have presented a greedy algorithm to evaluate user candidates which are waiting for scheduling and select an optimal set of the users to maximize system performance, without exceeding available bandwidth capacity. The greedyknapsack algorithm is defined as an optimal solution to the resource allocation problem, formulated based on the fractional knapsack problem. A compromise between throughput and QoS provisioning is obtained by proposing a class-based ranking function, which is a combination of throughput and QoS related parameters defined for each application.

MundeleTshienda Serge et al [6] have proposed optimal resource allocation strategy. In this method two variants of technique called Queue Based Control (QBC) are presented. These two variants are QBC version 1 and QBC version 2. Performance of QBC version 1 and QBC version 2 showing that QBC version 1 is having better Delay and Los performance as compared to QBC version 2, and QBC version 2 is having better power consumption performance as compared to QBC version 1. It means both this techniques are based on concepts of carrier aggregation of LTE networks. Both approaches showing that, they failed to address the tradeoff between power efficient and QoS efficiency.

M. J. Rezaei et al [7] have proposed a new fairness index to measure resource allocation performance for real-time/delay-tolerant applications. This index can suggest a new approach for resource allocation. There are several methods in resource allocation of cellular networks which employ fairness index for performance evaluation. Here, they focused on utility-function-based resources allocation and related algorithms. According to the suggested

method, the base station (BS) allocates resources based on different services requirements. Appropriate utility function for each application is defined, and the requested quality-of-services (QoS) are satisfied through solving the corresponding optimization problem.

### Proposed Solution:-

#### Overview:-

Based on the problems identified, we propose to develop a multi level resource allocation technique for prioritized multi-class downlink traffic flows in LTE-A networks. Here the priority of the user class will be determined based on the parameters such as class type, Data Arrival Rate, Requested bandwidth, Bandwidth Utilization and Tolerance Level. Once the priority is determined, using the CS and VP schemes, resource will be allocated to the various classes of the traffic as per [13].

In this approach initially, when the data packets arrives, the node enters into the first level. In this level, the priority of the node is checked based on the fault tolerance, data arrival rate and bandwidth. In the second level the resource required for the nodes is allocated based on the complete sharing (CS) and virtual partitioning (VP) schemes. This schemes describes whether a service data flow can drop the resources allotted to it in order to acknowledge a service data flow with a higher priority level.

#### Priority Assignment:-

##### Data Arrival Rate:-

Through the data arrival rate, it is possible to estimate the number of data packets received by a node in the network.

$$r_a = \frac{s_i}{R} \quad (1)$$

Where,

$r_a$  is the data arrival rate

$s_i$  is the data packet size

$R$  is the data rate.

##### Utilized Bandwidth:-

The utilized bandwidth by the nodes in the network is estimated by the following equation

$$B_u = B - r_k \quad (2)$$

Where,

$B_u$  is the utilized bandwidth

$B$  is the total bandwidth

##### Tolerance of Latency (TOL):-

Along with the user's requirement of resources, the tolerance of latency (TOL) is also specified which indicates the minimum level of delay the user can expect. It ranges from 0 to 2, where 0 stands for no tolerance, 1 for medium level and 2 for highest tolerance.

##### Setting Priority of Users:-

Initially the node's data arrival rate, utilized bandwidth and TOL are estimated.

If  $DA > DA_{th}$  and  $BW > BW_{th}$  and  $TOL = 0$

Then set  $Pr = 4$

Else If  $DA > DA_{th}$  and  $BW > BW_{th}$  and  $TOL = 1$

Then set  $Pr = 3$

Else If  $DA > DA_{th}$  and  $BW < BW_{th}$  and  $TOL = 1$

Then set  $Pr = 2$

Else If  $DA > DA_{th}$  and  $BW < BW_{th}$  and  $TOL = 2$

Then set  $Pr = 1$

Else If  $DA < DA_{th}$  and  $BW < BW_{th}$  and  $TOL = 2$

Then set  $Pr = 0$

**Resource Allocation:-**

According to the resource allocation, the pre-emption vulnerability information describes whether a service data flow can lose the resources allotted to it in order to admit a service data flow with a higher priority level. Therefore, the network categorizes the multiclass services into three groups.

- Group 1 represents the services where the resources can be pre-empted.
- Group 2 and 3 are for services where the resources cannot be pre-empted while group 2 can pre-empt the resources that are allotted to services in group 1.
- Group 3 can be described based on the traffic flows that need to provide a guaranteed bit rate while service groups 1 and 2 have to provide a variable bit rate.

These groups are respectively discussed to as “guaranteed bit rate” and “maximum bit rate”.

**Complete Sharing (CS) and Virtual Partitioning (VP) Schemes:-**

Here the resource allocation method adopts the basic concept of the Complete Sharing (CS) and Virtual Partitioning (VP) schemes and keeps the system ready for resource allocation in using radio admission control scheme. Here in radio admission control scheme according to the feature of every service group, within service group 1, network have CS, where each service class shares the nominal bandwidth B1. Groups 2 and 3 also have CS and the nominal bandwidth B2 is completely mutual. In group 1 and 2 have VP, where the nominal bandwidth B2 is fully utilized and also acknowledge some traffic of service group 2 subject to pre-emption by degradation of the services in group 1 by which the system capacity can be enlarged.

i.

$$r_k = \begin{cases} r_k^g, & \sum_{i=1}^1 \sum_{j=1}^{n_i} r_j + r_k^g \leq B1 \\ r_k^{\max}, & \sum_{i=1}^1 \sum_{j=1}^{n_i} r_j + r_k^{\max} \leq B1 \\ 0, & \text{otherwise} \end{cases} \quad (3)$$

Where,

$r_k$  is the instantaneous bandwidth allocated to service class k user;

$r_k^g$  is the guaranteed bit rate of service class k;

$r_k^{\max}$  is the maximum bit rate of service class k;

B1 is the nominal bandwidth for Group 1,

where  $B1 = \alpha * B$ ;

B is the total amount of bandwidth available in the system;

$\alpha$  is the ratio of nominal bandwidth to system capacity for Group 1;

ii.

$$r_k = \begin{cases} r_k^g, & \sum_{i=l+1}^K \sum_{j=1}^{n_i} r_j + r_k^g \leq B2 \\ r_k^{\max}, & \sum_{i=l+1}^K \sum_{j=1}^{n_i} r_j + r_k^{\max} \leq B2 \end{cases} \quad (4)$$

Where,

K is the total number of service classes where Group 1 includes traffic classes from 1 to l, Group 2 includes traffic classes from l+1 to m and Group 3 includes traffic classes from m + 1 to K;

B2 is the nominal bandwidth for Group 2 and 3,

where  $B1 + B2 = B$

iii.

$$r_k = \begin{cases} r_k^g, & \sum_{i=l+1}^K \sum_{j=1}^{n_i} r_j + r_k^g > B2 \text{ and } R_a \geq r_k^g \\ 0, & \text{otherwise} \end{cases} \quad (5)$$

Where,

 $R_a$  is the service degradation.

iv.

$$r_k = \begin{cases} r_k^g, & \sum_{i=l+1}^K \sum_{j=1}^{n_i} r_j + r_k^g \leq C2 \\ 0, & \text{otherwise} \end{cases} \quad (6)$$

During the resource allocation in the network the Radio Admission Control (**RCA**) rules combines the CS resource allocation and VP resource allocation models.

When a new call is organised in service class  $k$  which belongs to service group 1 and the remaining bandwidth in Group 1 is greater than or equal to  $r_k^k$ , the call is acknowledged into the system; otherwise the call is excluded. The allotted bandwidth  $r_k$  is given by (3).

In the second rule a new call in service class  $k$  which belongs to service group 2 and the residual bandwidth in Group 2 and 3 is greater than or equal to  $r_k^k$ , the call is admitted into the system and the allotted bandwidth  $r_k$  is given by (4).

If a new call in service class  $k$  which belongs to service group 2 and the remaining bandwidth in Group 2 and 3 is less than  $r_k^k$ , according to pre-emption over Group 1, network assume that the bandwidth consumed by using the service degradation  $R_a$ . If  $R_a$  is larger than or equal to the necessary bandwidth, the call is admitted into the system; else the call is rejected. The allotted bandwidth is given by (5).

When a new call which belongs to service group 3 in service class  $k$  and the left out bandwidth in Group 2 and 3 is larger than or equal to  $r_k^k$ , the call is sent the system else the call is rejected. The allotted bandwidth  $r_k$  is given by (6).

## Simulation Results;-

### Simulation Model and Parameters:-

In this section, we simulate the proposed PRAAC scheme using Network simulator (NS2) [14] which is a general-purpose simulation tool that provides discrete event simulation of user defined networks. We have used the LTE/SAE implementation model for NS2. We compare the proposed PRAAC scheme with the radio admission control (RAC) scheme.

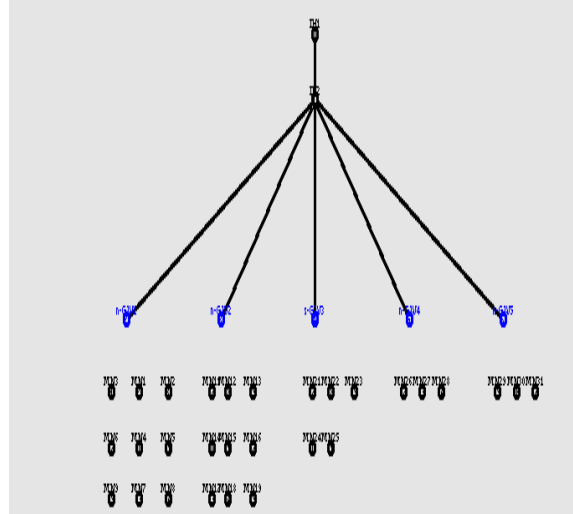
The simulation parameters are given in Table 1.

**Table 1:-** Simulation Parameters

Number of cells	5
Number of eNB	5
Number of UE	31
Area Size	1200x1200
Simulation time	50 seconds
Traffic Type	CBR, Exponential and Video
Packet Size	500,750,1000 and 1250 bytes
Total Bandwidth	100Mb
Traffic Rate	10Mb
MT Speed	30m/s

Transmission power	40 dBm
Scheduling duration	2 ms
Cell radius	500m
Number of Flows	6,12,18 and 24.

The scenario is defined for the urban macrocell environment of 1000m with heterogeneous distribution of users and services. The simulation consists of 5 cells and the users are occupied in 1200 m x1200 m NS2 simulation grid. The simulation time take 50 seconds, depending on the growing number of users and BSs in the network as well as its load, thus consuming a substantial amount of time. The simulation topology is given in the Fig 1.



**Fig 1:- Simulation Topology**

### Traffic generators in NS2

In order to make the simulation results more reliable different traffic generators that have a diverse range of statistical properties are used. This helps to analyze the network performance more effectively. In this research work, three applications are considered namely CBR VoIP, Exponential VoIP and Video traffic.

### CBR Traffic

CBR traffic generate packets at fixed bit rate and it come under guaranteed bit rate. The applications include services such as video conferencing, telephony (voice services) or any type of on-demand service, such as interactive voice and audio. Configuration parameters for CBR traffic are presented in Table 2

**Table 2 Parameters for CBR traffic**

Parameters	Values	Discription
Packet Size	210	Application payload size in bytes
Rate	488 x 103	Sending Rate in bps
Max.packets	167	Max. number of application payload packets that CBR can send
Interburst transmission interval	3.44 ms	-

### Exponential Traffic

Exponential traffic generates On/Off periods. During "on" periods, packets are generated at a constant bit rate. During "off" periods, no traffic is generated. Burst times and idle times are taken from exponential distributions. The application includes real time VoIP, compressed audio and video. The configuration parameters are described in Table 3

**Table 3 Parameters for Exponential traffic**

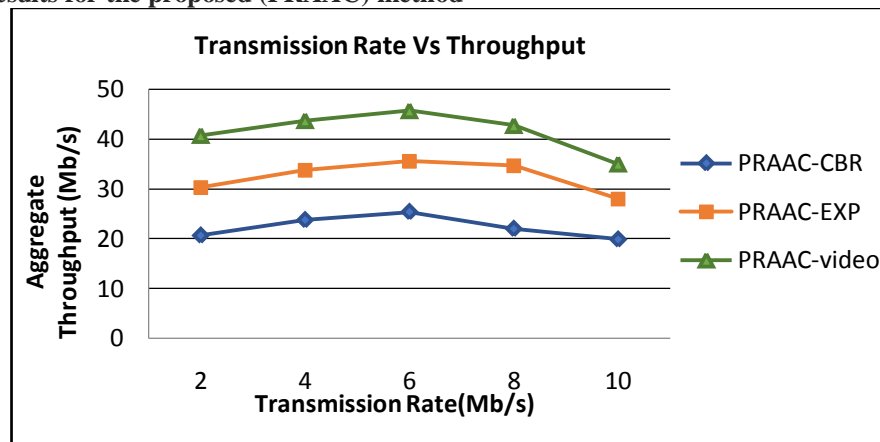
Parameters	Values	Description
Packet Size	210	Application Payload size in bytes
Rate	$64 \times 10^3$	Sending rate in bps during ON period
Burst time	0.5	Average On period in secs
Idle Time	0.5	Average Off Period in secs

### Video as Trace file

The video flow is a trace-based application that sends packets based on realistic video trace files. Traffic trace generates payload burst according to given trace file. Trace objects are used to generate traffic from a trace file. Unlike other traffic generators, traffic trace file is to be specified in the OTcl domain using the OTcl command. A trace file consists of any number of fixed length records. Each record consists of two 32 bit fields. The first indicates the interval until the next packet is generated in microseconds. The second indicates the length of the next packet in bytes. The application includes VBR H.264 compression video. Context Adaptive Binary Arithmetic Coding (CABAC) which is used as entropy coding. The video size considered here is 1920 \*1080 with frame rate of 30.

### Results:-

#### Performance results for the proposed (PRAAC) method



**Fig 2 Aggregate Throughput performance of PRAAC method for various types of traffic**

Figure 2 shows aggregate throughput versus transmission rate for CBR, Exponential and Video traffic based on the proposed PRAAC method for 40 number of users. Aggregate throughput is the sum of throughput that is delivered to all terminals in a network.

From Figure 2 it can be observed that the video traffic by adopting H.264 compression standard achieves better throughput such that the video bit stream are improved and consequently experiences an enhanced fluent video quality. Further the throughput of Exponential traffic outperforms CBR traffic. It is because the exponential traffic allows a higher bitrate to be distributed to the more complex segments of audio/video files while less space is allocated to less complex segments. i.e., it adjusts the bit rate down and to the upper limit based on the data required by the system. While CBR traffic will not realize the differentiation between the more complex segments and less complex segments and maintains constant bit rate over the entire audio/video clip. This leads to congestion in the network and thus decreases the throughput when compared to the exponential traffic.

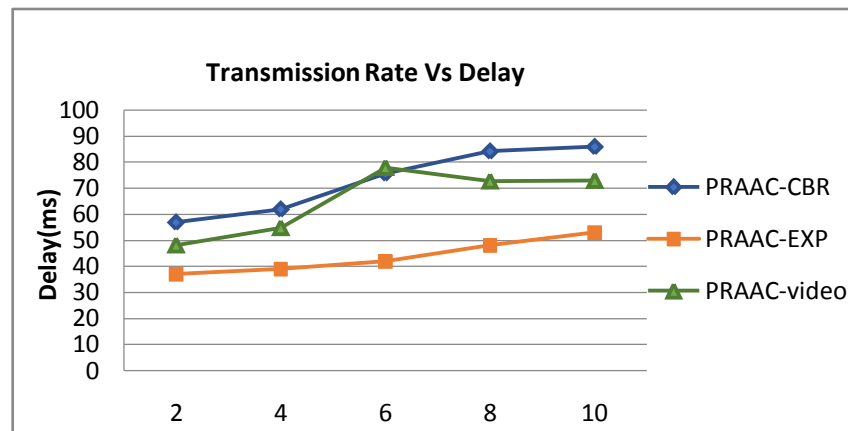


Figure 3 Delay performance of PRAAC method for various types of traffic

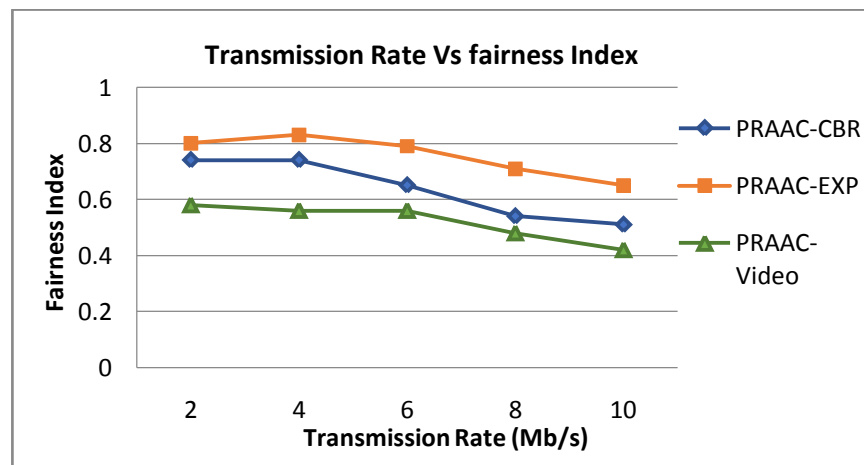


Figure 4 Fairness Index performance of PRAAC method for various types of traffic

From Fig 2 it can be observed that the video traffic by adopting H.264 compression standard achieves better throughput such that the bit stream are improved and experience an enhanced fluent video quality. Further the throughput of Exponential traffic outperforms CBR traffic. It is because the exponential traffic allows a higher bitrate to be distributed to the more complex segments of audio/video files while less space is allocated to less complex segments. i.e., it adjusts the bit rate down and to the upper limit based on the data required by the system. While CBR traffic will not realize the differentiation between the more complex segments and less complex segments and maintains constant bit rate over the entire audio/video clip. This leads to congestion in the network and thus decreases the throughput when compared to the exponential traffic.

Fig 3 shows Delay versus transmission rate for CBR, exponential and video traffic based on the proposed PRAAC method with the number of 40 users. The figure shows that there is a dramatic increase in the delay of CBR traffic when compared to Exponential traffic. This is due to the characteristics of CBR sources whose constant stream of packets cause traffic congestion. Further it can be observed that the video traffic also realizes unpredictable delay when compared to Exponential traffic. It is because of the bursty nature of video traffic and high storage space. As known H.264 has a complex process which is more susceptible to errors when compared to CBR VoIP and Exponential VoIP.

Fig 4 illustrates Fairness Index versus transmission rate for CBR, exponential and video traffic achieved by the proposed PRAAC method with the same fixed number of 40 users. From the figure it can be seen that when the

transmission rate increases the network experiences better fairness for the Exponential traffic when compared to CBR and Video traffic and also it depicts that the average throughput only reflects the long term fairness.

### Conclusion:-

In this paper, Priority based Fair Resource Allocation and admission control Technique (PRAAC) for Multi-class downlink Traffic in LTE-A networks is proposed. It includes a two level resource allocation scheme, wherein the first level a radio admission control (RAC) scheme is introduced. This RCA combines the complete sharing (CS) and virtual partitioning (VP) resource allocation models. Through this approach it is possible to achieve an enhanced Quality of Service (QoS) for multimedia services mainly in LTE downlink system. Simulation results show that the proposed technique PRAAC achieves better throughput for Video and the Exponential traffic performs well when compared to CBR traffics in all aspects.

### References:-

1. Thiago Martins de Moraes, Muhammad Danish Nisar, Arturo Antonio Gonzalez and Eiko Seidel.,(2012), "Resource allocation in relay enhanced LTE-Advanced networks",*EURASIP Journal on Wireless Communications and Networking*.
2. Hong-Sheng Liao, Po-Yu Chen and Wen-Tsuen Chen.,(2014), "An Efficient Downlink Radio Resource Allocation with Carrier Aggregation in LTE-Advanced Networks",*IEEE TRANSACTIONS ON MOBILE COMPUTING*, VOL. 13.
3. Mohammad J. Abdel-Rahman, Mohamed AbdelRaheem and Allen B. MacKenzie., (2015) "Stochastic Resource Allocation in Opportunistic LTE-A Networks with Heterogeneous Self-interference Cancellation Capabilities",*IEEE International Symposium on Dynamic Spectrum Access Networks (DySPAN)*, pp:200-208.
4. Dardouri Samia, Bouallegue Ridhay and Anne Weiz.,(2016) "Resource Allocation Using Nucleolus Value in Downlink LTE Networks",*IEEE UIMTS'2016 EDITION ITALY (International Workshop on Urban Mobility & Intelligent Transportation Systems)*.
5. Nasim Ferdosian, Mohamed Othman, Borhanuddin Mohd Ali, Kweh and Yeah Lun.,(2016) "Greedy-Knapsack Algorithm for Optimal Downlink Resource Allocation in LTE Networks",*Wireless Networks*.
6. Mundele Tshienda Serge and Yingzhuang Liu.,(2016) "Dynamic and Efficient Power Efficient Bandwidth Allocation Method for LTE Networks",*International Journal on Recent and Innovation Trends in Computing and Communication*, Vol-4, Issue-7.
7. M. J. Rezaei, M. F. Sabahi, K. Shahtalebi, R. Mahin Zaeeml and R. Sadeghi.,(2015) "New Fairness Index and Novel Approach for QoS-Aware Resource Allocation in LTE Networks Based on Utility Functions",*Amirkabir International Journal of Science & Research, (Electrical & Electronics Engineering), AIJ-EEE*, Vol. 47, No. 2, pp:19-25.
8. Mr. J Vijay Franklin and Dr. K Paramasivam.,(2012) "Efficient Channel State Based Call Admission Control for Non Real Time traffic in LTE (3GPP) Networks", *IJCSI International Journal of Computer Science*, Issues, Vol. 9, No 2.
9. J Vijay Franklin and K Paramasivam.,(2012) "Hybrid Adaptive Call Admission Control Mechanism for Ensuring QoS in 3GPP: LTE Networks", *International Journal of Computer Applications*, Vol. 42, No.21, pp. 0975 – 8887.
10. Haipeng Lei, Mingliang Yu, Anjun Zhao, Yongyu Chang and Dacheng Yang.,(2008) "Adaptive Connection Admission Control Algorithm for LTE Systems", *Vehicular Technology Conference, VTC Spring, IEEE*.
11. Bilal Sadiq, Ritesh Madan and Ashwin Sampath., (2009) "Downlink Scheduling for Multiclass Traffic in LTE", *Hindawi Publishing Corporation, EURASIP Journal on Wireless Communications and Networking*.
12. Mostafa Zaman Chowdhury, Yeong Min Jang, and Zygmunt J. Haas.,(2010) "Call Admission Control based on Adaptive Bandwidth Allocation for Multi-Class Services in Wireless Networks" *International Conference on Information and Communication Technology Convergence (ICTC)*, IEEE.
13. Manli Qian, Yi Huang, Jinglin Shi, Yao Yuan, Lin Tian and Eryk Dutkiewicz.,(2009) "A novel radio admission control scheme for multiclass services in LTE systems." *Global Telecommunications Conference, GLOBECOM IEEE*.
14. Network Simulator: <http://www.isi.edu/nsnam/ns>



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### RESEARCH ARTICLE

#### DIVERSITY OF TRUE AND MANGROVE ASSOCIATES OF BHITARKANIKA NATIONAL PARK (ODISHA), INDIA.

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#### Abstract

In the present study, an attempt has been made to distinguish and separated the true mangroves from mangrove associates. The characteristics chosen for true mangrove identification were presence of aerial roots, viviparous or crypto-viviparous embryo development, tidal dispersal of propagules, ability to form pure stands, absence of understory, highly efficient mechanisms for nutrient retention and physiological mechanisms to tolerate salt. The present investigation which was carried out between the periods from September 2014 to July 2016 had recorded a total 29 true mangrove species and 72 associate species from various regions of Bhitarkanika National Park. The recorded true mangroves belong to 11 families and 15 genera and the associates recorded from 39 family and 56 genera. Among the studied true mangrove families, Rhizophoraceae showed maximum richness both at species and generic level with 10 true mangrove species. The present study will solve the confusion about actual number of true mangrove species of Bhitarkanika Wildlife Sanctuary & Mangrove National Park (Odisha), India and will help for conservation of the endemic and diverse flora of this internationally important mangrove wetland.

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#### Introduction:-

Mangroves are diverse group of trees and shrubs that flourish in flooded and saline habitats (Hogarth, 2015) and share a common ability to live in waterlogged saline soils subjected to regular tidal flooding (Kathiresan and Bingham, 2001). The mangrove habit is the complex of physiological adaptations enabling survival and success. The mangroves thrive in such environment where normal flora can't exist due to their highly specialized morphological and physiological adaptations; most striking adaptations are various forms of aerial root (Hogarth, 2015). Mangroves act as nutrient sinks and protect offshore ecosystems and often referred to as bio-shields or natural sea defense (Roy *et al.*, 2009). Mangroves are quite old, possibly arising just after the first angiosperms, around 114 million years ago (Duke, 1992). The mangrove ecosystems are widely recognized as providers of a wide variety of goods and services to people, including storm abatement, sediment trapping, land accretion, nutrient uptake & transformation and provision of a variety of plant and animal products (Badola and Hussain, 2003).

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However, across the globe, the world's mangroves are threatened (Arunprasth and Gomarhinayagam, 2014; Rao *et al.*, 2015). The continued decline of the mangrove forests is due to conversion to agriculture, aquaculture, tourism, urban development and overexploitation (Alongi, 2002; Giri *et al.*, 2008; Latiff, 2012). Reduced mangrove area and health will increase the threat to human safety and shoreline development from coastal hazards such as erosion, flooding, storm waves and surges, and tsunamis (Danielsen *et al.*, 2005; Chaudhuri *et al.*, 2015).

Along the Orissa coast, mangroves are present on the Mahanadi delta & Brahmani- Baitarani delta between 86° 48' - 86° 58' E longitude and 20° 30' - 20° 50' N latitude (Nayak and Bahuguna, 2001). The mangrove area in Odisha is nearly 200 sq.km in extent and its degradation was placed at 20 sq.km over ten years, as percent estimates (Arunprasth and Gomarhinayagam, 2014). The Brahmani-Baitarani delta is enriched with rich mangrove genetic diversity and has been declared as the Bhitarkanika Wild Life Sanctuary (650 sq.km deltaic area of major rivers like Brahmani, Baitarani & the Dhamra, many creeks, mudflats and mangrove forests) in 1975 (Nayak and Bahuguna, 2001; Upadhyay and Mishra, 2008). The Bhitarkanika mangrove vegetation is very thick, difficult to penetrate and legally protected (SAC, 2012).

The 'true' or 'exclusive' mangroves are those that occur only in mangrove habitat (Santisuk, 1983; Tomlinson, 1986; Duke, 1992 and Giesen *et al.*, 2007) or only rarely elsewhere and the 'mangrove associates' or non-exclusive mangroves are those which comprise a large number of species typically occurring on the landward margin of the mangal and often the non-mangal habitats such as rainforest, salt marsh, peat swamp or low land fresh water swamps (Santisuk, 1983 and Hogarth, 2015). According to Tomlinson (1986), the following criteria are required for a species to be designated a "true or strict mangrove": complete fidelity to the mangrove environment, major role in the structure of the community and has the ability to form pure stands. The exclusive mangroves show the characteristics like aerial roots, viviparous or crypto-viviparous embryo development, tidal dispersal of propagules, absence of understory and growth rings, highly efficient mechanisms for nutrient retention and physiological mechanisms to tolerate salt (Alongi, 2009).

Adaptation to salt tolerance is of three types i.e., salt excluders, salt secretors and salt accumulators (Ong and Gong, 2013). The salt excluders are from the members of the genera like, *Rhizophora*, *Bruguiera* and *Ceriops* of the family Rhizophoraceae. The species in the genera *Acanthus*, *Aegialitis*, *Aegiceras* and *Avicennia* have salt-secreting glands on the leaf surface. The species like *Sonneratia*, *Xylocarpus* and *Excoecaria* are the salt accumulators. Various types of root adaptations of mangroves in the habitat are lenticels (*Bruguiera spp.*), pneumatophores (*Sonneratia spp.* & *Avicennia spp.*), knee roots (*Bruguiera spp.*), cable roots (*Avicennia spp.*), and stilt roots (*Rhizophora spp.*) (Ong and Gong, 2013).

A total 114 species of mangroves and associates were found in the world (Tomlinson, 1986) which includes 54 true mangroves found exclusively only in the mangrove habitats. But, Chapman (1975) described 11 families comprising of 55 species as true mangroves found exclusively in the mangrove swamps. Hogarth (2015) described occurrence of around 70 true mangrove species in 28 genera and belonging to 20 families. Giesen *et al.* (2007) described 52 species in Southeast Asian countries as true mangrove species which includes 42 trees and shrubs. Mangrove associates are usually not immersed by high tides. They comprise of herbs, ferns, creepers, vines, shrubs, trees and orchids and are mostly found in the landward margin (Giesen *et al.*, 2007). Wang *et al.* (2010) based on leaf trait and salt content classified the controversial mangrove species like *Acrostichum aureum*, *Acrostichum speciosum*, *Excoecaria agallocha*, *Heritiera littoralis* as mangrove associates, the species like *Acanthus ilicifolius*, *Acanthus ebracteatus*, *Xylocarpus granatum*, *Pemphis acidula* as true mangroves. Mangrove region of India constitutes major forests area with rich diversity of flora and fauna but with uneven distribution (Rajendran and Sanjeevi, 2004). The actual true mangrove species of India is a matter of controversy as there exists a difference in the definition of true species and the mangrove associates. Various taxonomists/authors have worked extensively on this topic yet there is no consensus on the agreement of true mangroves versus mangrove associates. Indian mangroves are diverse and variously estimated due to the addition of associate species, 82 species (Mandal and Naskar, 2008), about 125 species, comprising of 39 mangroves and 86 mangrove associates (Kathiresan, 2010). The review of Ragavan *et al.* (2016) on Indian mangroves showed 46 true mangroves which consists of 42 species and 4 natural hybrids. About 26 true mangrove species and 58 mangrove associates, giving a total of 84 species have been recorded from Sundarbans (Banerjee, 1998), while 24 pure mangroves are reported from Kerala (Mahandas, 2012).

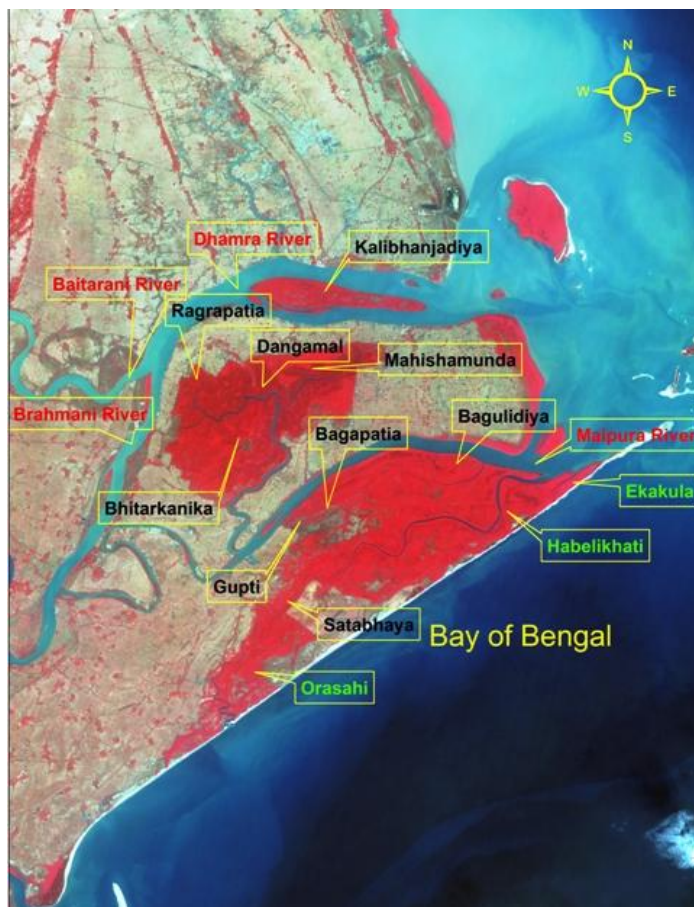
The number of mangrove species of Bhitarkanika is varied in opinions and thought to be about 55 (Banerjee and Rao, 1990), 62-67 (Nayak and Bahuguna, 2001), 51 (Pattanaik *et al.*, 2007), 57 (Mandal and Naskar, 2008), 64

(Hussain and Badola, 2010). The Bhitarkanika NP with such diverse species of mangroves is considered as the third important mangrove habitat among the Indian mangals with respect to mangrove species diversity (SAC, 2012). The number of true mangrove species of Bhitarkanika NP is also varies, 28 (Hussain and Badola, 2010), 35 (Raghvan *et al.*, 2016). The flora of Bhitarkanika is typical of the Sundarbans (Barik and Chowdhury, 2014), and Indo-Malesian type (Banerjee and Rao, 1990).

The present investigation tried to give a detail mangrove species list of Bhitarkanika Wildlife Sanctuary & National Park, separated the true mangroves from associates based on the characteristic features like viviparous and crypto-viviparous seed germination, salt adaptation strategies, ability for tidal dispersal of propagules, root modifications like pneumatophores, stilt roots, buttress and knee roots, horizontal spreading roots & presence of lenticels, whether the species can form pure stand or not and formation of understory or not, etc.

### Study Area:-

The present study was carried out inside the mangrove forests which is a part of Bhitarkanika Wildlife Sanctuary and situated between 20° 30' to 20° 47' N latitude and 86° 39'E to 87° 04' E longitudes in Kendrapara district of Odisha along the east cost of India. It occupies an area of 672 sq km. Bhitarkanika mangrove ecosystem flourishes in the deltaic region, formed by the rich alluvial deposits of Brahmani, Baitarani & the Dhamra River.



**Map 1:-** Study sites of Bhitarkanika Wildlife Sanctuary & National Park (Odisha), India.

The river, Brahmani played major role for the establishment of mangrove forests. The river, Brahmani is branched one at Hansina bridge and another at Khola and both enters to Bhitarkanika Wildlife Sanctuary and National Park with different names. Both these river again meet at Gupti and one flows towards Ekakula and meets Bay of Bengal with the name of Pathasala river and Maipura river, the other flows towards Bhitarkanika and Dangmal forest blocks by the name of Bhitarkanika River.

## Materials and Methods:-

Intensive field study to different locations within Bhitarkanika National Park was carried out during, September-2014 to July-2016. The sites covered for data sampling were Dangmal, Bhitarkanika, Ragarapatia, Habelikhathi, Ekakula, Mahishamunda, Kalibhanjadiya island, Khola, Gupti, Orasahi, Satabhaya, Bagulidiya, Krishnapriyapur and other riverine sites which come under reserve forests of the Bhitarkanika National Park. The present mangrove species and associate flora of each forest sites were recorded, photographed and identified with available literature, Hains (1921-25), Saxena and Brahamam (1994-1996), Santisuk (1983), Tomlinson (1986), Banerjee and Rao (1990), Naskar (2004), Rajendran and Sanjeevi (2004), Selvam *et al.*, (2004), Singh and Odaki (2004), Spalding *et al.*, (2010), Panda *et al.*, (2013), Giesen *et al.*, (2007) and Roy *et al.*, (2009). The identified mangrove species are categorized into true or exclusive and mangrove associate as the characters used by Santisuk (1983), Tomlinson (1986), Hutchings and Saenger (1987), Duke (1992), Spalding *et al.*, (1997), Singh and Odaki (2004), Giesen *et al.*, (2007) and Wang *et al.*, (2010) with consideration of local physiological adaptations of these mangroves.

The species of contention for present classified true or associate mangroves were also justified by comparing the literature explained by different workers. A check list of mangrove species and their associates has been prepared for Bhitarkanika mangrove National Park.

## Results and Discussion:-

Present study recorded a total of 29 true mangrove species (Table 1 and Plate 1) and 72 mangrove associates from different reserve mangrove forest sites of the Bhitarkanika National Park (Table 2 and Plate 2). The classified true mangroves have adaptation mechanisms to resist the physiologically dry surrounding environment and they generally form pure stands in Bhitarkanika National Park.

### True or exclusive Mangroves:-

The recorded true mangroves belong to a total of 11 angiosperm family and 15 genera (Table 1 and Fig. 1). Highest number of true mangrove species were recorded from the family Rhizophoraceae i.e., 10 species. The family Meliaceae, Avicenniaceae and Sonneratiaceae were found to have 3 true mangrove species each. Another three family Acanthaceae, Arecaceae, Sterculiaceae were found to have 2 true mangrove species each. Single species of true mangrove were recorded from four families, i.e., Combretaceae, Euphorbiaceae, Plumbaginaceae and Myrcinaceae. The study also noted that the species *A.ilicifolius* L., *A.officinalis* L., *A.marina* (Forsk.) Vierh., *E.agallocha* L., *H.fomes* Buch-Ham., *H.littoralis* Dryand ex Ait., *P.paludosa* Roxb., *R.mucronata* Lamk., *C.decandra* (Griff.) Ding Hau, *K.candel* (L) Druce, *S.apetala* Buch.-Ham., *X.granatum* Koenig, as the frequently occurring true mangrove species of Bhitarkanika National Park. Other species showed site specific restricted distribution and rare type of occurrences. The species like *R.apiculata* Blume is restricted to Khola and Habelikhathi, *B.sexangula* (Lour.) Poir. and *B.gymnorhiza* (L.) Lamk. were recorded from forest blocks of Dangmal, Bhitarkanika, Khola and Krishnapriyapur sites, *C.tagal* (Perr.) C.B. Robinson was recorded from Ranahansua and Habelikhathi reserve forests. The species like, *R.stylosa* Griff., *A.corniculatum* (L.) Blanco, *A.alba* Blume were recorded as the riverine mangroves of Maipura river and its branch Angari at Satabhaya. The mangrove species, *L.racemosa* Willd. and *A.rotundifolia* Roxb. were only recorded from Kalibhanjadiya island, Habelikhathi and Ekakula reserve forest sites which are situated close to Bay of Bengal. *A.ebracteatus* Vahl. is of rare occurrence and recorded only from Ragrapatia and Khola reserve forests. *X.mekongensis* Pierre and *X.moluccensis* (Lamk.) Roem., mostly confined to Dangmal and Bhitarkanika forest blocks. *S.alba* J Smith was found at Ekakula and *S.caseolaris* (L.) Engler was recorded to occur at Khola jetty and as a riverine mangrove of Bhitarkanika and Maipura river. The recorded exclusive and true mangrove species were of three growth forms in habit (i.e., tree, shrub and herb). Out of 29 true species, 26 species were trees, 2 species were herbs, (*A.ilicifolius* L., and *A.ebracteatus* Vahl.) and one species (*P.paludosa* Roxb.) was recorded as shrub (Fig. 3). All the present listed true mangrove species showed their prominent morphological and physiological adaptations like presence of one or more type of aerial roots, ability to resist long term saline water inundation, all form pure stands and lack understory vegetation, most of them have viviparous or crypto-viviparous embryo development and the species of family Rhizophoraceae with long distance seed or propagule dispersal abilities.

### Associate mangroves:-

The mangrove associate flora study listed a total of 72 plant species which belongs to 39 families and 56 genera (Table 2 and Fig. 2). Highest number of species recorded from the families Fabaceae & Asclepiadaceae, i.e., 8 species each. The second highest numbers of mangrove associate species, (i.e., 5) were recorded from the family

Poaceae. Five families were found to bear 3 associate species each, i.e., Caesalpiniaceae, Salvadoraceae, Pandanaceae, Malvaceae and Chenopodiaceae. Another five families were found to bear 2 associate species each and these families were Pteridaceae, Verbenaceae, Amarylidaceae, Convolvulaceae and Aizoaceae. A total of 26 families were found to have one species each and these families were Acanthaceae, Meliaceae, Apoceanaceae, Bignoniaceae, Cyperaceae, Flagillariaceae, Colchicaceae, Boraginaceae, Rubiaceae, Anacardiaceae, Asteraceae, Rutaceae, Lythraceae, Celastraceae, Goodeniaceae, Solanaceae, Blechnaceae, Tamaricaceae, Combretaceae, Loranthaceae, Araceae, Ebenaceae Opuntiaceae, Tiliaceae, Leguminaceae and Euphorbiaceae (Table 2 and Fig. 3). The growth habit study of the recorded associate species resulted, Herb (20 spp.), Shrub (16 spp.), Tree (14 spp.), Climber (17 spp.), Fern (3 spp.), Creeper (2 spp.) (Fig. 4). All the recorded mangrove associates lack the adaptation characters to be a true mangrove and depend on true mangrove species for their own existence on this mangrove wetland. The comparison of growth habit of the recorded mangrove associates showed 58 species as non tree plants and generally found understory or hanging on the surface of true mangrove species.

Besides associate mangrove flora, Bhitarkanika Wildlife Sanctuary and National Park was found to host many non-mangroves of purely terrestrial angiosperms and cryptogams but present study excludes listing of them.

### Species of Contention:-

A total of 17 mangrove species were found to be in a position of controversy and various opinions exists whether they are true or mangrove associates (Table 3).

The mangrove species like, *Acanthus ebracteatus* Vahl., *Nypa fruticans* (Thumb.) Wurmb., *Heritiera littoralis* Dryand ex Ait., *Kandelia candel* (L) Druce, *Phoenix paludosa* Roxb., *Xylocarpus moluccensis* (Lam.) Roem., are presently classified as true mangroves due to their physiological and morphological adaptations and mostly supported the work of Santisuk (1983) and Singh and Odaki (2004). Other species, *Acanthus volubilis* Wall., *Acrostichum aureum* L., *Acrostichum speciosum* Willdenow, *Aglaia cucullata* (Roxb.) Pellegrin, *Brownlowia tersa* (L.) Kostern, *Cerbera odollam* Gaertn., *Cynometra iripa* Kostel, *Dalbergia spinosa* Roxb., *Dolichandrone spathacea* K.Schu., *Excoecaria indica* (Willd.) Mull. and *Suaeda maritima* L. (Dumort) are classified as mangrove associates due to the lack of adaptation modifications, poor capability of toleration to long term saline water inundation and most of them found as the understory vegetation.

Latiff (2012) included the mangrove species like *Nypa fruticans* (Thunb.) Wurmb., *Intsia bijuga* (Colebr.) Kuntz. and *Heritiera littoralis* Dryand ex Ait. as non exclusive mangroves. Wang et al., (2010) classified the species like *E. agallocha* L. and *H. littoralis* Dryand ex Ait. as mangrove associate although they have wide range of salinity tolerance and both physiological and morphological adaptation modifications. Similarly, the species *Pemphis acidula* Forst. is described as true mangrove by different workers (Table 3) but our present classification included it into mangrove associate due to lack of adaptation modifications, like aerial roots, viviparous or crypto viviparous seed development and salt resisting abilities etc. *Pemphis acidula* Forst is an understory mangrove with succulent leaves and the species need freshwater input. The species, *Acanthus volubilis* Wall. being having viviparous embryo development, classified as mangrove associate due to absence of required characters to be a true mangrove and the important one, this species is a climber and grow on the surface of other true mangrove species (i.e., most frequently on *E. agallocha* L.) and lack forming pure stands.

The previously recorded species *Heritiera kanikensis* (Majumdar and Banerjee, 1985) and *Sonneratia griffithii* Kurz., *Cynometra ramiflora* L. (Selvam, et al., 2004; Upadhyay, 2008) were not recorded during our present study. The mangrove species *Excoecaria indica* (Willd.) Mull. Arg. is commonly known as *Sapium indicum* Willd. in Bhitarkanika NP. But our present classification explained it as *E. indica* (Willd.) Mull. Arg. due to the presence of characters like spiny stem and trunk, leaf morphology etc. and the name is globally used. *H. fomes* Buch-Ham. is a globally threatened species of extinction but this is one of the dominating species of Bhitarkanika NP. Another species, *Brownlowia tersa* (L) Kostern. which is in the category of near threatened (Kathiresan, 2010) is abundantly found at the sites like Ragrapatia and river banks close to Dangmal, Bhitarkanika and Mahisamunda reserve forests of Bhitarkanika NP.

The recorded flowering period of each mangrove species favors the work done by (Upadhyay and Mishra, 2010) with small variation. The phenological study of mangrove species showed most of the mangrove species go flowering during winter or late winter but before start of monsoon rain due imposed stress of nutrient scarcity and high water and soil salinity.

Many mangrove species of Bhitarkanika are endemic and not found elsewhere in India. The species like *C. iripa* Kostel, *I. bijuga* (Colebr.), *Dolicandron spathecia* (L.f.) K.Schum., *A. volubilis* Wall., *A. ebracteatus* Vahl. etc. are endemic to Bhitarkanika NP and only found in some part of Sundarbans and Andaman mangrove ecosystem (Rajendran and Sanjeevi, 2004; Raghvan *et al.*, 2014). *E. indica* (Willd.) Mull. Arg. is only found close to Khola creek in Bhitarkanika NP and not elsewhere in India. The global trend of *E. indica* (Willd.) Mull. Arg. is decreasing. The mangrove plant, *N. fruticans* (Thumb.) Wurmb, was extinct from Bhitarkanika NP but it has been reintroduced to the site from Sundarban to maintain the diversity of the ecosystem (Panda *et al.*, 2013). Many associate flora are also endemic to this site and not found elsewhere in India. The number of true mangroves and dominating mangrove species of Bhitarkanika and Sundarban is of similar (Selvom, 2003). The present recorded mangrove diversity of Bhitarkanika ecosystem shows it is one among the most diversified mangrove ecosystems of world (Kathiresan and Rajendran, 2005) and if the mangrove associate flora is taken into consideration, then Bhitarkanika mangrove ecosystem will be the most species diversified ecosystem of India.

### Conclusion:-

Our present work classified two groups of mangroves (i.e., true or associate mangroves) based on individual species adaptation and not divided the exclusive or true mangroves further into 'major' and 'minor' as done by Tomlinson (1986). Mangroves have great ecological role and provides resource to the coastal livelihoods of Odisha. The past conditions favored the luxuriant growth of *E. agallocha* L. and *H. fomes* Buch-Ham. inside Bhitarkanika National Park but both are low saline tolerating species. The study noted many mangroves of Bhitarkanika National Park had site specific distribution. The sites with more freshwater inputs and water inundation, housed more number of species than the site with less fresh water input. But still there are some areas (i.e., Habelikhati, Ekakula) where many riverine mangroves (i.e., *Rhizophora* spp.) were found towards land in number of patches. The global climate change induced sea level rise may become a critical factor (Gilman, *et al.*, 2008) for the present existing dominating species of Bhitarkanika mangrove reserve forests and for change in mangrove habitat (Selvom, 2003; SAC, 2012 and Rao, *et al.*, 2015). The study of Upadhyaya and Mishra (2008), showed that more than 80% of death and damages of mangrove trees have been due to anthropogenic (human induced) disturbances. The mangroves and associates are likely to become vulnerable in near future due to both man-made and natural threats (Kathiresan, 2010). The Coastal Vulnerability Index (CVI) study also showed that some part in coastal area of Kendrapara district (close to Dhamara mouth) has high risk of vulnerable to coastal change (Kumar, *et al.*, 2010). Many species of this wetland is under pressure of extinction (Panda *et al.*, 2013) and must be conserved before the genetic erosion. Many mangrove species in Bhitarkanika were found as rare of occurrence (i.e., *C. tagel* (Per.) Rob., *B. parviflora* Wt. & Arn., *B. gymnorhiza* (L.) Lamk, *R. stylosa* Griff., *A. ebracteatus* Vahl., *A. volubilis* Wall., *E. indica* (Willd.) Mull. Arg., *I. bijuga* (Colebr.) Kuntz, *Tylophora* spp. and *Sarcobolobus* spp.) and these species should be given priority for conservation.

### Acknowledgements:-

The authors are thankful to Principal Chief Conservator of Forest (PCCF- Wildlife), Odisha and Divisional Forest Officer (DFO), Rajnagar block of district Kendrapara for their approval and collaboration during field surveys inside Bhitarkanika Wildlife Sanctuary & Mangrove National Park (Odisha), India.

**Table 1:-** List of recorded true mangrove species of Bhitarkanika mangrove forest and their phenology (Odisha), India.

Sl No .	True mangrove species	Family	Flowerin g period	Adaptation	Seed devel- opment	IUC N stat us	Hab it
1	<i>Aegiceras corniculatum</i> (L.) Blanco	Myrcinaceae	April	Cable roots	CV	LC	Tree
2	<i>Aegialitis rotundifolia</i> Roxb.	Plumbaginaceae	March	Peg like roots	CV	NT	Tree
3	<i>Acanthus ilicifolius</i> L.	Acanthaceae	April	Cable & Stilt roots	CV	LC	Herb
4	<i>Acanthus ebracteatus</i> Vahl.	Acanthaceae	March	Cable & Stilt roots	CV	LC	Herb
5	<i>Avicennia alba</i> Blume	Avicenniaceae	May	Knee root & Pneumatophores	CV	LC	Tree
6	<i>Avicennia marina</i> (Forsk.) Veierh	Avicenniaceae	April/May	Pneumatophores	CV	LC	Tree
7	<i>Avicennia officinalis</i> L.	Avicenniaceae	April	Pneumatophores	CV	LC	Tree
8	<i>Bruguiera cylindrica</i> (L.) Blume	Rhizophoraceae	January	Buttress, Knee & Stilt roots	V	LC	Tree
9	<i>Bruguiera gymnorhiza</i> (L.) Lamk.	Rhizophoraceae	February	Buttress, Knee & Stilt roots	V	LC	Tree
10	<i>Bruguiera parviflora</i> Wt. & Arn.	Rhizophoraceae	August	Stilt & Knee roots	V	LC	Tree
11	<i>Bruguiera sexangula</i> (Lour.) Poir	Rhizophoraceae	March	Stilt & Knee roots	V	LC	Tree
12	<i>Ceriops decandra</i> (Griff.) Ding Hou	Rhizophoraceae	November	Buttress, Knee & Stilt roots	V	NT	Tree
13	<i>Ceriops tagal</i> (Per.) Rob.	Rhizophoraceae	May/June	Buttress, Knee & Stilt roots	V	LC	Tree
14	<i>Excoecaria agallocha</i> L.	Euphorbiaceae	April	Spreading horizontal root	NV	LC	Tree
15	<i>Heritiera littoralis</i> Dryand ex Ait	Sterculiaceae	April	Peg & Buttress root	NV	LC	Tree
16	<i>Heritiera fomes</i> Buch.-Ham.	Sterculiaceae	September	Peg & Buttress root	NV	EN	Tree
17	<i>Kandelia candel</i> (L.) Druce	Rhizophoraceae	November	Stilt roots	V	LC	Tree
18	<i>Lumnitzera racemosa</i> Willd.	Combretaceae	December	Knee & Stilt roots	NV	LC	Tree
19	<i>Nypa fruticans</i> (Thumb.) Wurm.	Arecaceae	----- -	No aerial roots	V	LC	Tree
20	<i>Phoenix paludosa</i> Roxb.	Arecaceae	December	Pneumatophores	V	NT	Shrub
21	<i>Rhizophora apiculata</i> Blume	Rhizophoraceae	November	Prop & stilt roots	V	LC	Tree
22	<i>Rhizophora mucronata</i> Lamk.	Rhizophoraceae	September	Prop & stilt roots	V	LC	Tree
23	<i>Rhizophora stylosa</i> Griff.	Rhizophoraceae	September	Prop & stilt roots	V	LC	Tree
24	<i>Sonneratia alba</i> J. Smith	Sonneratiaceae	March	Pneumatophores	NV	LC	Tree
25	<i>Sonneratia apetala</i> Buch. – Ham.	Sonneratiaceae	February	Pneumatophores	NV	LC	Tree
26	<i>Sonneratia caseolaris</i> (L.) Engler	Sonneratiaceae	December	Pneumatophores	NV	LC	Tree
27	<i>Xylocarpus granatum</i> Koenig	Meliaceae	November	Buttress	NV	LC	Tree
28	<i>Xylocarpus mekongensis</i> Pierre	Meliaceae	November	Plank root	NV	LC	Tree
29	<i>Xylocarpus moluccensis</i> (Lamk.) Roem.	Meliaceae	November	Buttress & Pneumatophores	NV	LC	Tree



**Table 2:-** List of recorded mangrove associate flora of Bhitarkanika mangrove forest and their phenology (Odisha), India.

Sl. No.	Mangrove associates	Family	Flowering period	Habit
1	Acanthus volubilis Wall.	Acanthaceae	April	Climber
2	Acrostichum aureum L.	Pteridaceae	.....	Fern
3	Acrostichum speciosum Willd	Pteridaceae	.....	Fern
4	Aeluropus lagopoides (L.) Trin.	Poaceae	December	Herb (Grass)
5	Aglaia cucullata (Roxb.) Pellegrin	Meliaceae	March	Tree
6	Allophylus serratus (Roxb.) Kurz	Verbenaceae	December	Shrub
7	Azima tetracantha Lam.	Salvadoraceae	October	Shrub
8	Brownlowia tersa (L.) Kostern.	Tiliaceae	May	Shrub
9	Caesalpinia bundoc (L.) Roxb.	Caesalpiniaceae	January	shrub
10	Caesalpinia crista L.	Caesalpiniaceae	March	Shrub
11	Canavalia maritime (Aubl.) Thouars	Fabaceae	December	Climber
12	Cerbera odollam Gaertn	Apoecanaceae	Year	Tree
13	Clerodendron inerme (L.) Gaertn	Verbenaceae	April	Shrub
14	Crinum asiaticum L.	Amaryllidaceae	December	Herb
15	Crinum defixum Ker Gawl.	Amaryllidaceae	December	Herb
16	Cryptocoryne ciliata (Roxb.) Fisch. ex Wydler	Araceae	July	Herb
17	Cynometra iripa Kostel	Caesalpiniaceae	November	Shrub
18	Dalbergia candenatensis (Dennst.) Prain	Fabaceae	May	Shrub
19	Dalbergia spinosa Roxb	Fabaceae	October	Shrub
20	Derris heterophylla (Willd.) K. Heyne	Fabaceae	April	Climber
21	Derris scandens (Roxb.) Benth.	Fabaceae	April	Climber
22	Derris trifolia Lour.	Fabaceae	February	Climber
23	Dendrophthoe falcate (L.f.) Etting.	Loranthaceae	August	Tree
24	Diospyros melanoxylon Roxb.	Ebenaceae	November	Tree
25	Dolicandrone spathacea (L.f.) K.Schum.	Bignoniaceae	January	Tree
26	Excoecaria indica (Willd.) Mull. Arg.	Euphorbiaceae	March	Tree
27	Fimbristylis ferruginea (L.) Vahl	Cyperaceae	August	Herb
28	Flagilaria indica L.	Flagillariaceae	September	Climber
29	Finlaysonia obovata Wall.	Asclepiadaceae	November	Climber
30	Gloriosa superba L.	Colchicaceae	October	Climber
31	Heliotropium curassavicum L.	Boraginaceae	March	Herb
32	Hibiscus tiliaceus L.	Malvaceae	November	Tree
33	Hoya parasitica (Roxb.) Wall	Asclepiadaceae	August	Climber
34	Hydrophylax maritime L.f.	Rubiaceae	February	Herb
35	Intsia bijuba (Colebr.) Kuntz.	Caesalpiniaceae	March	Tree
36	Ipomoea pes-caprae (L.) R. Br.	Convolvulaceae	February	Creeper
37	Ipomoea tuba (Sch.) G. Don	Convolvulaceae	January/February	Creeper
38	Lanea coramandelica (Houtt.) Merr	Anacardiaceae	March	Tree
39	Launea sarmentosa (Willd.) Schultz-Bip.	Asteraceae	April	Herb
40	Macuna gigantea (Willd.) DC.	Fabaceae	September	Climber
41	Merope angulata (Willd.) Swingle	Rutaceae	May	Shrub
42	Myriostachya wightiana (Nees ex Steud) Hook. F	Poaceae	February	Herb (Grass)
43	Opuntia dillenii (Ker-Gawl.)Haw.	Opuntiaceae	April	Herb (Succulent)
44	Pandanus fascicularis Lam.	Pandanaceae	April	Shrub
45	Pandanus foetidus Roxb.	Pandanaceae	February	Shrub
46	Pandanus odoratissimus L.f.	Pandanaceae	February	Shrub
47	Pemphis acidula Forst.	Lythraceae	April	Shrub

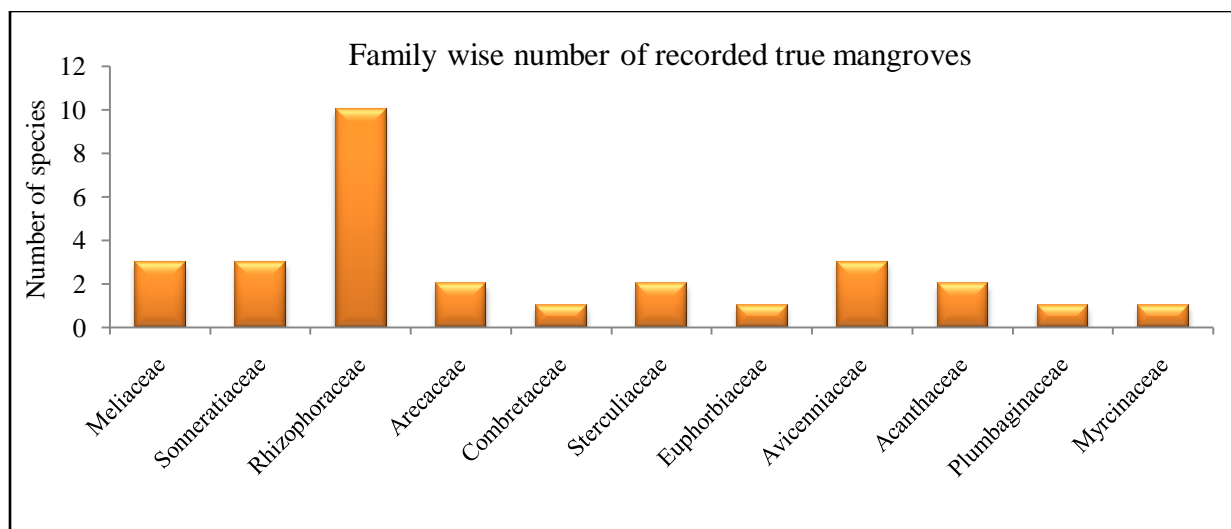


48	<i>Pentotropis capensis</i> (L.f.) Bullock	Asclepiadaceae	April	Climber
49	<i>Phragmites karka</i> (Retz.) Trin.	Poaceae	January	Herb
50	<i>Pongamia piñata</i> (L.) Pierre	Fabaceae	March	Tree
51	<i>Porteresia coarctata</i> (Roxb.) Takeoka	Poaceae	July	Herb (Grass)
52	<i>Salacia prinoidea</i> DC	Celastraceae	October	Climber
53	<i>Salicornia brachiata</i> Roxb.	Salvadoraceae	February	Herb
54	<i>Salvadora persica</i> Linn.	Salvadoraceae	November	Shrub
55	<i>Sarcobolobus carinatus</i> Wall.	Asclepiadaceae	July	Climber
56	<i>Sarcobolobus globosus</i> Wall.	Asclepiadaceae	October	Climber
57	<i>Scaevola plumieri</i> Vahi.	Goodeniaceae	September	Shrub
58	<i>Sesuvium portulacastrum</i> (L.) L.	Aizoaceae	November	Herb (Succulent)
59	<i>Solanum trilobatum</i> L.	Solanaceae	February	Herb
60	<i>Spinifex squarrosus</i> L.	Poaceae	November	Herb
61	<i>Stenochlaena palustre</i> (Burm. f.) Bedd	Blechnaceae	-----	Herb (Fern)
62	<i>Suaeda maritima</i> (L.) Dumort	Chenopodiaceae	October	Herb (Succulent)
63	<i>Suaeda monoica</i> Forssk. Ex Gmel.	Chenopodiaceae	September	Herb (Succulent)
64	<i>Suaeda nudiflora</i> (Wild.) Moq.	Chenopodiaceae	December	Herb (Succulent)
65	<i>Tamarix troupii</i> H.	Tamaricaceae	January	Tree
66	<i>Terminalia catappa</i> L.	Combretaceae	December	Tree
67	<i>Thespesia populnea</i> (L.) Sol. Ex Corr.	Malvaceae	November	Tree
68	<i>Thespesia populneoides</i> (Roxb. ) Kostel	Malvaceae	November	Tree
69	<i>Trianthema portulacastrum</i> L.	Aizoaceae	August	Herb
70	<i>Tylophora fleuxosa</i> R. Br.	Asclepiadaceae	Oct./Nov.	Climber
71	<i>Tylophora indica</i> (Burm. f.) Merr.	Asclepiadaceae	Oct./Nov.	Climber
72	<i>Tylophora tenuis</i> Blume.	Asclepiadaceae	Oct./Nov.	Climber

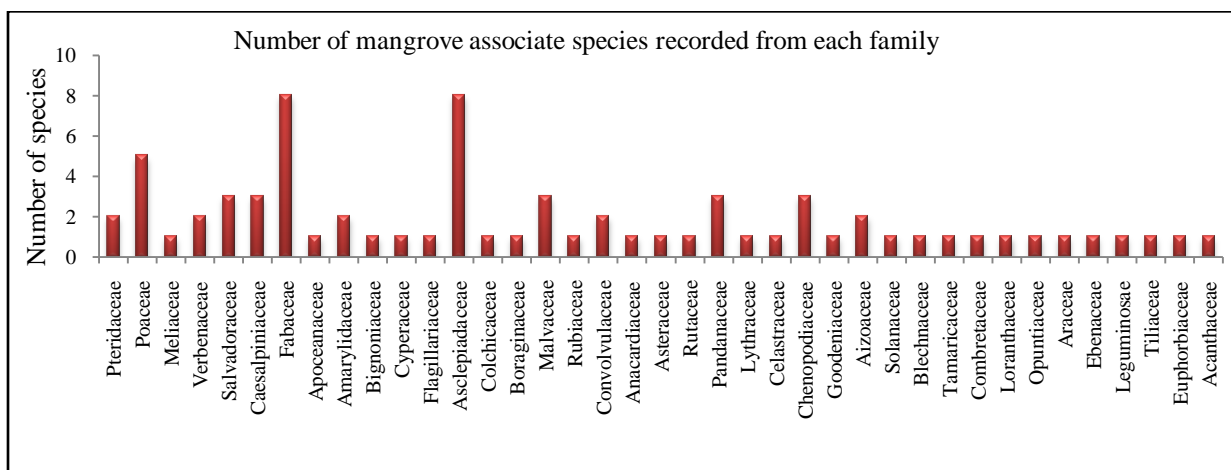
**Table 3:-** The mangrove species of controversy in position (Justification by comparing the work of various authors and present classified mangrove type)

Sl. No.	Mangrove species	True Mangrove	Mangrove Associate	Present Classification
1	<i>Acanthus ebracteatus</i> Vahl.	Santisuk (1983), Singh & Odaki (2004), Kathiresan & Rajendran (2005), Giesen et al., (2007), Balachandran et al. (2009), Polidoro et al (2010), Wang et al. (2010)	Tomlinson (1986), Spalding et al. (2010)	True mangroves
2	<i>Acanthus volubilis</i> Wall.	Naskar (2004), Ravishankar et al. (2004), Singh & Odaki (2004), Giesen et al (2007), Polidoro et al (2010)	Tomlinson (1986), Naskar (2004)	Mangrove Associate
3	<i>Acrostichum aureum</i> L.	Tomlinson (1986), Ravishankar et al. (2004), Selvam et al. (2004), Kathiresan & Rajendran (2005), Giesen et al (2007), Polidoro et al (2010), Sakthive (2014), Donoso (2016), Wang et al. (2010)	Santisuk (1983), Naskar (2004), Singh & Odaki (2004), Spalding et al. (2010)	Mangrove Associate
4	<i>Acrostichum speciosum</i> Willdenow	Tomlinson (1986), Kathiresan & Rajendran (2005), Giesen et al (2007), Polidoro et al (2010), Donoso (2016), Wang et al. (2010)	Santisuk (1983), Singh & Odaki (2004), Naskar (2004), Spalding et al. (2010)	Mangrove Associate
5	<i>Aglaia cucullata</i> (Roxb.) Pellegrin	Naskar (2004), Ravishankar et al. (2004), Selvam et al. (2004),	Santisuk (1983), Spalding et al. (2010)	Mangrove Associate

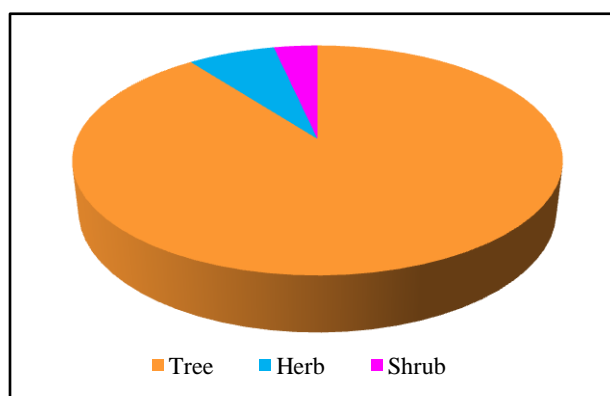
		Kathiresan & Rajendran (2005), Polidoro et al (2010), , Bark & Chowdhury (2014)		
6	<i>Brownlowia tersa</i> (L.) Kostern.	Naskar (2004), Selvam et al. (2004), Giesen et al (2007), Polidoro et al (2010), Donoso (2016)	Santisuk (1983), Ravishankar et al. (2004), Singh & Odaki (2004)	Mangrove Associate
7	<i>Cerbera odollam</i> Gaertn.	Ravishankar et al. (2004)	Santisuk (1983)	Mangrove Associate
8	<i>Cynometra iripa</i> Kostel	Selvam et al. (2004), Singh & Odaki (2004), Kathiresan & Rajendran (2005), Polidoro et al (2010)	Santisuk (1983), Naskar (2004) Spalding et al. (2010)	Mangrove Associate
9	<i>Dalbergia spinosa</i> Roxb.	Balachandran et al. (2009)	Naskar (2004), Rao (2015)	Mangrove Associate
10	<i>Dolichandrone spathacea</i> (L. f.) K.Schum.	Tomlinson (1986), , Ravishankar et al. (2004), Kathiresan & Rajendran (2005), Polidoro et al (2010)	Santisuk (1983), Naskar (2004), Singh & Odaki (2004), Spalding et al. (2010), Wang et al. (2010)	Mangrove Associate
11	<i>Excoecaria indica</i> (Willd.) Mull.	Kathiresan & Rajendran (2005), Polidoro et al (2010)	Santisuk (1983), Spalding et al. (2010)	Mangrove Associate
12	<i>Heritiera littoralis</i> Dryand ex Ait.	Sakthive (2014), Singh & Odaki (2004), Polidoro et al (2010), Tomlinson (1986) Ravishankar et al. (2004), Kathiresan & Rajendran (2005)	Santisuk (1983), Spalding et al. (2010), Wang et al. (2010)	True mangroves
13	<i>Kandelia candel</i> (L) Druce	Naskar (2004), Ravishankar et al. (2004), Selvam et al. (2004), Singh & Odaki (2004), Kathiresan & Rajendran (2005), Giesen et al (2007), Polidoro et al (2010) Spalding et al. (2010), Bark & Chowdhury (2014)	Santisuk (1983)	True mangroves
14	<i>Nypa fruticans</i> (Thumb.) Wurmb.	Santisuk (1983), Selvam et al. (2004), Singh & Odaki (2004), Kathiresan & Rajendran (2005), Giesen et al (2007), Polidoro et al (2010), Bark & Chowdhury (2014) Donoso (2016)	Spalding et al. (2010)	True mangroves
15	<i>Pemphis acidula</i> J.R.Forst. and G.Forst	Tomlinson (1986), Selvam et al. (2004), Kathiresan & Rajendran (2005), Giesen et al (2007), Polidoro et al (2010), Wang et al. (2010)	Santisuk (1983), Singh & Odaki (2004), Spalding et al. (2010)	Mangrove Associate
16	<i>Phoenix paludosa</i> Roxb.	Santisuk (1983), Singh & Odaki (2004), Polidoro et al (2010), Bark & Chowdhury (2014), Donoso (2016)	Ravishankar et al. (2004)	True mangroves
17	<i>Suaeda maritima</i> L. (Dumort)	Santisuk (1983)	Untawale (1986), Naskar (2004), Ravishankar et al. (2004), Sakthive (2014), , Rao (2015), Balachandran et al. (2009)	Mangrove Associate



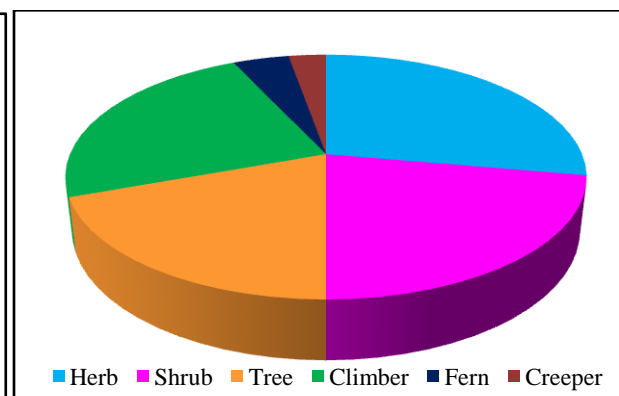
**Fig 1:-** Family wise recorded number true mangroves of Bhitarkanika mangrove National Park



**Fig 2:-** Family wise recorded number of mangrove associate species of Bhitarkanika mangrove NP (Odisha), India



**Fig 3:-** Number of true mangroves in each habit form



**Fig 4:-** Number of mangrove associates in each habit form



**Plate 1:-** The true mangrove flora of Bhitarkanika National Park (Odisha), India

**Note:** 1: Fruit of *Avicennia alba* 2: Pneumatophore of *Avicennia marina* 3: Fruit of *Avicennia officinalis* 4: Flower of *Bruguiera cylindrica* 5: Flower bud of *Bruguiera gymnorhiza* 6: Propagules of *Bruguiera sexangula* 9: Propagules of *Ceriops tagel* 10: Spreading horizontal roots of *Excoecaria agallocha* 11: Fruit of *Heritiera littoralis* 12: Buttress root of *Heritiera fomes* 13: Propagules of *Kandelia candel* 14: Flower and seed of *Lumnitzera racemosa* 15: *Nypa fruticans* 16: Fruiting branch of *Phoenix paludosa* 17: *Rhizophora mucronata* with stilt root 18: *Rhizophora stylosa* 19: Stilt root of *Rhizophora apiculata* 20: *Sonneratia alba* 21: Pneumatophores of *Sonneratia apetala* 22: Fruit of *Sonneratia caseolaris* 23: Inflorescence of *Xylocarpus granatum* 24: Fruit of *Xylocarpus granatum* 25: *Xylocarpus mekongensis* 26: Flower of *Aegiceras corniculatum* 27: Fruit of *Aegiceras corniculatum* 28: *Aegialitis rotundifolia* 29: Inflorescence of *Acanthus ilicifolius* 30: Fruit of *Acanthus ilicifolius*





**Plate 1:-** Some mangrove associate flora of Bhitarkanika National Park (Odisha), India

**Note: 1:-** Acanthus volubilis 2 & 3: Excoecaria indica 4: Suaeda monoica 5: Suaeda nudiflora 6: Suaeda maritima 7: Cynometra iripa 8: Dolicanthrone spathacea 9: Aglaia cucullata 10: Cerbera odollam 11: Tylophora indica 12: Intsia bijuga 13: Acrostichum speciosum 14: Acrostichum aureum 15: Finlaysonia obovata 16: Flagellaria indica 17: Porteresia coarctata 18: Macuna gigantea 19: Derris scandens 20: Pongamia pinnata 21: Derris candenatensis 22: Opuntia dillenii 23: Stenochlaena palustre 24: Salvadora persica 25: Ipomoea pes-caprae 26: Caesalpinia crista 27: Sesuvium portulacastrum 28: Tamarix troupii 29: Thespesia populnea 30: Cryptocoryne ciliata 31: Hibiscus tiliaceus 32: Canavalia maritima 33: Clerodendrom inerme 34: Fimbristylis ferruginea 35: Diospyros melanoxylon 36: Allophylus serratus

### References:-

1. Alongi, D.M. (2002): Present state and future of the world's mangrove forests. Environmental Conservation, **29**: 331-349.
2. Alongi, D.M. (2009): The energetics of mangrove forests. Springer Science + Business Media B.V., 1-6.
3. Arunprasad, A. and Gomathinayagam, M. (2014): Distribution and Composition of True Mangroves Species in three major Coastal Regions of Tamilnadu, India. International Journal of Advanced Research, 2(10): 241-247.

4. Badola, R. and Hussain S.A. (2003): Valuation of the Bhitarkanika Mangrove ecosystem for ecological security and sustainable resource use. Study Report. Wildlife Institute of India. Dehra Dun, 1-101.
5. Balachandran, N., Kichenamourthy, S., Muthukumaran, J., Jayakanthan, M., Chandrasekhar, S., Punetha, A and Sundar, D. (2009): Diversity of true mangroves and their associates in the Pondicherry region of South India and development of a mangrove knowledgebase. *Journal of Ecology and The Natural Environment* 1(5): 099-105.
6. Banerjee, L.K. (1998): Species diversity and distribution of Mangroves in India. In: Anonymous, *An Anthology of Indian Mangroves*. Environmental Information System Centre, Centre of Advanced Study in Marine Biology, Annamalai University, Annamalainagar.
7. Banerjee, L.K. and Rao, T.A. (1990): Mangroves of Orissa coast and their ecology. Bishen Singh Mahendra Palsingh, Dehradun, India.
8. Barik, J. and Chowdhury, S. (2014): True Mangrove Species of Sundarbans Delta, West Bengal, Eastern India. *Check List*, 10(2): 329–334.
9. Chapman, V.J. (1975): Mangrove biogeography. In G.E. Welsh, S.C. Snedaker et H.J. Taes, (éds). *Proc. International Symposium on Biology and Management of Mangroves*, Vol. 1. Gainesville, Etats-Unis, University of Florida Press.
10. Ghosh, S., Bakshi, M., Bhattacharyya, S., Nath, B. and Chaudhuri, P. (2015): A Review of Threats and Vulnerabilities to Mangrove Habitats: With Special Emphasis on East Coast of India. *J Earth Sci Clim Change*, 6: 270.
11. Clough, B. (2013): Continuing the Journey Amongst Mangroves. ISME Mangrove Educational Book Series No. 1. International Society for Mangrove Ecosystems (ISME), Okinawa, Japan, and International Tropical Timber Organization (ITTO), Yokohama, Japan.
12. Danielsen, F., Sorensen, M.K., Olwig M.F., Selvam, V., Parish, F., Burgess, N.D., Hiraishi, T., Karunakaran, V.M., Rasmussen, M.S., Hansen, L.B., Quarto, A. and Suryadiputra, N (2005): The Asian tsunami: a protective role for coastal vegetation. *Science*, 310: 643.
13. Donoso, A.B. (2016): Floristic Composition of the Mangroves in Siargao Island. *International Journal of Agriculture Innovations and Research*, 4(4): 661-664.
14. Duke, N.C. (1992): Mangrove Floristics and Biogeography, Chapter 4 (p63-100) in: *Tropical Mangrove Ecosystems* (Volume 41), A.I. Robertson and D.M. Alongi, (Eds.), Coastal and Estuarine Studies Series, American Geophysical Union, Washington, D.C., 329.
15. Duke, N.C., Ball, M.C. and Ellison, J.C. (1998): Factors influencing biodiversity and distribution gradients in mangroves. *Global Ecology and Biogeography Letters*, 7: 27-47.
16. Ellison, A.M., Mukherjee, B.B. and Karim, A. (2000): Testing patterns of zonation in mangroves: scale dependence and environmental correlates in the Sundarbans of Bangladesh. *Journal of Ecology*, 88: 813-824.
17. Giesen, W., Wulffraat, S., Zieren, M. and Scholten, L. (2007): *Mangrove Guidebook for Southeast Asia*. FAO and Wetlands International.
18. Gilman, E.L., Ellison, J., Duke, N.C. and Field, C. (2008): Threats to mangroves from climate change and adaptation options. *Aquat. Bot.* 89(2): 237-250. doi:10.1016/j.aquabot.2007.12.009.
19. Giri, C., Zhu, Z., Tieszen, L.L., Singh, A., Gillette, S. and Kelmelis, J.A. (2008): Mangrove forest distributions and dynamics (1975–2005) of the tsunami-affected region of Asia. *Journal of Biogeography*, 35: 519–528.
20. Hains, H.H. (1921-25): *Botany of Bihar and Orissa* (Ed.1961), Botanical survey of India, Calcutta.
21. Hogarth, P.J. (2015): *The biology of mangroves and Seagrasses*. Oxford University Press, New York.
22. Hussain, S.A. and Badola, R. (2010): Valuing mangrove benefits: Contribution of mangrove forests to local livelihoods in Bhitarkanika Conservation Area, East Coast of India. *Wetlands Ecol Manage*, 18: 321–331.
23. Hutchings, P. and Saenger, P. (1987): *Ecology of mangroves*. University of Queensland Press.
24. Kathiresan, K. (2010): Importance of Mangrove Forests of India. *Jour. Coast. Env.*, 1(1):11-26.
25. Kathiresan, K. and Bingham, B.L. (2001): *Biology of Mangroves and Mangrove Ecosystems*. *Advance in marine biology*, 40: 81-251.
26. Kathiresan, K. and Rajendran, N. (2005). Mangrove ecosystems of Indian Ocean region. *Indian Journal of Marine Science*, 34(1): 104-113.
27. Kumar, T.S., Mahendra, R.S., Nayak, S., Radhakrishnan, K. and Sahu, K.C. (2010): Coastal Vulnerability Assessment for Orissa State, East Coast of India. *Journal of Coastal Research*, 26(3): 523-534.
28. Latiff, A. (2012): Conservation strategies for endangered mangrove swamp forests in Malaysia. *Pak. J. Bot.*, 44: 27-36.
29. Rajendran, N. and Sanjeevi, S.B. (2004): Flowering Plants and Fern in Mangrove Ecosystems of India (T. Balasubramanian and S. Ajmal Khan, eds.). ENVIS Publication Series, 1: 110.
30. Rao, M.K., Krishna, P.V. and Kumar, H.V. (2015): Mangrove flora diversity and necessity for conservation of Interu mangrove swamp of River Krishna estuaries regions of Andhra Pradesh, India. *International Journal of Advanced Research*, 3(6): 829-839.
31. Majumdar, N.C. and Banerjee, L.K. (1985): A new species of *Heritiera* (Sterculiaceae) from Orissa. *Bulletin of Botanical Survey of India*, 27: 150-151.

32. Mandal, R.N. and Naskar, K.R. (2008): Diversity and classification of Indian Mangroves: a review. *Tropical Ecology*, 49(2): 131-146.
33. Mohandas, M., Lekshmy, S. and Radhakrishnan, T. (2012): Kerala Mangroves– Pastures of Estuaries – Their Present Status and Challenges. *International Journal of Science and Research (IJSR)*, 3 (11): 2804-2809.
34. Naskar, K. (2004): *Manual of Indian Mangroves*. Daya Publishing House, Delhi.
35. Nayak, S. and Bahuguna, A. (2001): Application of remote sensing data to monitor mangroves and other coastal vegetation of India. *Indian Journal of Marine Sciences*, 30: 195- 213.
36. Ong, J.E. and Gong, W.K. (ed.) (2013): *Structure, Function and Management of Mangrove Ecosystems*. ISME Mangrove Educational Book Series No. 2. International Society for Mangrove Ecosystems (ISME), Okinawa, Japan, and International Tropical Timber Organization (ITTO), Yokohama, Japan.
37. Panda, S.P., Subudhi, H. and Patra, H.K. (2013): Mangrove forests of river estuaries of Odisha, India. *International Journal of Biodiversity and Conservation*, 5(8): 446-454.
38. Pattanaik, C., Reddy, C.S., Dhal, N.K. and Das, R. (2007): Utilisation of mangrove forests in Bhitarkanika Wildlife Sanctuary, Orissa. *Indian Journal of Traditional Knowledge*, 7(4): 598-603.
39. Polidoro, B.A., Carpenter, K.E., Collins, L., Duke, N.C. et al. (2010): The Loss of Species: Mangrove Extinction Risk and Geographic Areas of Global Concern. *PLoS ONE* 5(4): 1-10.
40. Ragavan, P., Saxena, A., Jayaraj, R.S.C., Mohan, P.M., Ravichandran, K., Saravanan, S. and Vijayaraghavan, A. (2016): A review of the mangrove floristics of India. *Taiwania*, 61(3): 224-242.
41. Ravishankar, T., Navamuniyammal, M., Gnanppazham, L., Nayak, S.S., Mahapatra, G.H. and Selvam, V. (2004): *Atlas of Mangrove Wetlands of India. Part 3-Orissa*, M. S. Swaminathan Research Foundation Chennai, India.
42. Roy, S.D., Krishnan, P., George, G., Kaliyamoorthy, M. and Bharthi, M.P.G. (2009): *Mangroves of Andaman and Nicobar Islands*. Central Agricultural Research Institute, ICAR- Port Blair.
43. Sakthive, K., Thirunavukkarasu, P. and Kathiresan, K. (2014): Mangroves and associates in the estuaries of Tamil Nadu coast of India, *International Journal of Marine Science*, 4(58): 1-7.
44. Santisuk, T. (1983): Taxonomy and Distribution of Terrestrial Trees and Shrubs in the mangrove formations in Thailand. *Nat.Hist. Bull. Siam Soc.*, 31(1): 63-91.
45. Saxena, H.O. and Brahamam, M. (1994-96): *The flora of Orissa*, vol. I-IV, RRL & OFDC Ltd., BBSR.
46. Selvom, V. (2003): Environmental classification of mangrove wetlands of India. *Current science*, 84 (6): 757-765.
47. Selvam, V., Eganathan, P., Karunakaran, V.M., Ravishankar, T. and Ramasubramanian, R. (2004): *Mangrove Plants of Tamil Nadu*. M.S. Swaminathan Research Foundation Chennai.
48. Singh, V.P. and Odaki, K. (2004): *Mangrove ecosystem: Structure and function*. Scientific publishers (India), Jodhpur.
49. SAC (2012): *Coastal Zones of India*. Ahmedabad, India.
50. Spalding, M.D., Blasco, F. and Field, C.D. (1997): *World Mangrove Atlas*. The International society for mangrove ecosystem, Okinawa, Japan.
51. Spalding, M., Kainuma, M. and Collins, L. (2010): *World Atlas of Mangroves*. Earthscan, London, UK and Washington DC, USA.
52. Tomlinson, P.B. (1986): *The Botany of mangroves*. Cambridge University Press.
53. Untawale, A.G. (1986): India, Country Report: Asia. In. *Mangroves in Asia and Pacific: Status and management*, Technical Report of the UNDP/UNESCO Research and Training Pilot Programme on Mangrove Ecosystems in Asia and Pacific (RAS/79/002), Quezon City, Metro, Manila, 51-87.
54. Upadhyay V.P. and Mishra P.K. (2008): Population status of mangrove species in estuarine regions of Orissa coast, India. *Tropical Ecology*, 49(2): 183-188.
55. Upadhyay, V.P. and Mishra, P.K. (2010): Phenology of mangroves tree species on Orissa coast, India. *Tropical Ecology*, 51(2): 289-295.
56. Upadhyay, V.P., Mishra, P.K. and Sahu, J.R. (2007): Vegetation Structure and Species Distribution Pattern of Mangrove Species in Bhitarkanika Ecosystem, Orissa, India. *Asian Journal of Water, Environment and Pollution*, 5(4): 69-76.
57. Wang, L., Mu, M., Li, X., Lin, P. and Wang, W. (2010): Differentiation between true mangroves and mangrove associates based on leaf traits and salt contents. *Journal of Plant Ecology*, 1–10.



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### RESEARCH ARTICLE

#### STUDY OF TEACHERS' AND SCHOOL PRINCIPALS' AWARENESS AND PRACTICES IN FOSTERING CHILDREN CREATIVITY.

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Creativity, Creative climate, children creativity, awareness, and practice

#### **Abstract**

In order to cope up with fast changing world, creativity development from early life is essential. Thus, primary school teachers are required to foster children ability in discovery, solving problems, being creative in writing, art, music, developing their self-confidence as learners and maturing socially and emotionally. In establishing classroom and school environment conducive to creative thinking of children, teachers and school principals have great roles and responsibilities. The purpose of this study was to examine teachers' and school principals' awareness and practice in fostering children creativity. A total of 54 samples (45 teachers, 3 principals, 3 vice principals, and 3 supervisors) were selected from Debre Tabor Town elementary school teachers, principals, vice principals, and supervisors (281, 7, 4, and 4 respectively). Stage random sampling technique was used to select samples from the population. Data were collected through questionnaire, observations and focus group discussion. Results revealed that the level of teachers', Principals' and supervisors' awareness of characteristics of creative person such as tendency to practice with alternative solutions, synthetic ability, insight ability, sensitivity to problems, tolerance of anxiety, passionate involvement in tasks, affective pleasure in challenge, tolerance of ambiguity, risk taking, openness to experience, unconventional values, curiosity, preference for challenges and complexity, and independence of judgment was below the average. And also regarding their familiarity with statements indicating characteristics of creative person, teachers were more familiar with self- confidence ( $M=4.98$ ,  $S=0.51$ ) and least familiar with tolerance of ambiguity ( $M=2.65$ ,  $S=0.79$ ). Under affective processes teachers were more familiar with statements indicating affective fantasy in play ( $M=4.10$ ,  $S=0.66$ ) and least familiar with affective pleasure in challenge ( $M=2.99$ ,  $S=0.61$ ). From cognitive processes, teachers were more familiar with practical contextual ability ( $M=4.91$ ,  $S=0.58$ ) and least familiar with tendency to practice with alternative solutions ( $M=3.56$ ,  $S=0.52$ ). Regarding children creativity, teachers were focused more on the products than processes – missing to consider what is happening in children's mind. The school observation showed that 33.3% ( $N=1$ ) of the school has not stored children creative products and 66.7 % ( $N=2$ ) of the schools have stored some of children

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products. Inversely, 66.7% (N=2) of the school never used different colors in children creative products and 33.3 % (N=1) of the schools used different colors. The focus group discussion result also showed that, there were lack of materials provision like different color chalk, marker, play materials, charts and the like. In measuring children creativity, teachers have been focused more on product. Teachers had been motivating children more to recall what they have learnt rather than motivating them to communicate their idea, imagination and creative work with other students. Suggestions were made on the ways of promoting teachers awareness and practice in fostering children creativity by organizing training for them, providing required materials and support.

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## ..... **Introduction:-**

In literature, creativity is defined differently by different researchers. According to Runco (2003) and Runco, (2004), creativity is usually tied to originality – the development of original ideas that are useful or influential, ability of problem solving and problem finding, any thinking or problem solving that involves the construction of new meaning is creative. For Ryhmmar and Brolin (1999), creativity is exceptional human capacity for thought and creation. National Curriculum Handbook for Primary and Secondary Teachers (1999) as cited in Craft (2001) on the other hand describe Creativity as a thinking skills enable pupils to generate and extend ideas, to suggest hypotheses, to apply imagination, and to look for alternative innovative outcomes.

Creativity has clear benefit for individual and society as a whole. The current fast changing world places high demands on schools all over the world that students need to be creative and problem solver. Therefore, care should be given for students starting from their early life.

Researchers relate creativity development to the four generally acknowledged locations or expressions such as a creative person, creative product, creative process and creative environment (see Lemons, 2005; McCammon et al., 2010). These finding also suggested that young children's creativity can be nurtured through educational settings in three respects: the creative environment, creative programs and creative teachers and ways of teaching.

It was suggested that a process rather than a product orientation would be much more adequate for our understanding of creativity of children (Glăveanu, 2011). In this research, teachers' awareness and practice in fostering children creativity were assessed. In assessing so, the focus was on: person, process, product and press (environment) perspective of children creativity. In person perspective, teachers and school principals' level of awareness to the term indicating the creativity characteristics were assessed through questionnaire and focus group discussion. In the case of product perspective, teachers' familiarity and practice to the creative product were assessed through questionnaire, focus group discussion, and school observation. Similarly in the case of process perspective, methods in which teachers use to enhance children creativity and observing their creative outcome also assessed through both open ended questions and focus group discussion. In press perspective, teachers practice in creating conducive environments for children to foster creativity was assessed through questionnaire, observation checklists and focus group discussion. Data gained from these techniques were triangulated and summarized.

It is a worldwide concern to have creative and entrepreneur citizens. It could surprise people to think children as creative. Children play, sing, draw, tell stories and build blocks in such a natural and creative way that it goes without saying that there is such a thing as "children creativity" (Glăveanu V. P., 2011)

Creativity facilitates late-life adaptations and growth. It plays an important role in technological advance, in the social and behavioral sciences, and in the humanities and arts. Because of its role in innovation and entrepreneurship, creativity has become one of the key concerns of organizations and businesses (Runco, 2004)

When considering young children, it is appropriate to adopt a broad, democratic definition of creativity. In this way, every child can be considered to have creative potential and to be capable of creative expression (Sharp, 2004). There are two notions adults should consider on children creativity. The first if that, child creative ability will be

related to his or her personal stage of development. For example a young child's work may be adaptive and original for that particular child and/or in relation to children in their class or age group. The second is to put the emphasis on the creative process, rather than to judge the quality of their 'products'. This is because young children may not have developed all the skills they need to achieve a successful creative outcome (see Sharp, 2004, Craft, 2003 & Runco, 2003). On the other hand on Discussion document and proceedings of the Consultative Conference on Education 2009, children creativity discussed as follows:

Creativity can be understood as having the power or quality to express yourself in your own way. Children are naturally creative. They see the world through fresh, new eyes and then use what they see in original ways. One of the most rewarding aspect of working with children is the chance to watch them creative. Every child is born with creative potential, but this potential may be stifled if care is not taken to nurture and stimulate creativity. Young children are naturally curious. They wonder about people and the world. Even before they enter primary school, they already have the variety of learning skills acquired through questioning, inquiring, searching, manipulating, experimenting, and playing. Children need opportunities for a closer look; they need time for the creative encounter (p. 12).

As indicated in Sharp (2004), the creative process involves a number of components, most commonly: imagination, originality (the ability to come up with ideas and products that are new and unusual), problem solving (application of knowledge and imagination to a given situation) and the ability to produce an outcome of value and worth.

Creativity is manifested in the interplay of different processes (see Ferrari, et al, 2009; Amabile, 1998; Russ, 1996 & Runco, 2003): a) personal traits (i.e. tolerance of ambiguity, openness to experience, independent of judgment, unconventional values, curiosity, preference for challenge and complexity, self-confidence, risk-taking, intrinsic motivation); b) emotional or affective processes (i.e. affective fantasy in play, passionate involvement in tasks, affective pleasure in challenge, tolerance of anxiety) ; c) cognitive abilities (i.e. divergent thinking, transformation abilities, sensitivity to problems, tendency to practice with alternative solutions, wide breadth of knowledge, insight ability and evaluative ability) and d) intellectual abilities (i.e. synthetic, analytic and practical- contextual abilities).

Creativity thrives in the environment that allow questions, observing, exploring, skill-building, communicating, and self-expression. To develop creativity, the home or classroom environment should contain a variety of materials and encourage lots of different experiences (Davidson, 2003). The classroom learning will be democratic which emphasize taking the individual as the reference for the originality and value pillar (Ferrari, et al, 2009). Current pedagogical discourses attempt to view learners as the center of teaching and learning processes, with an active role in the production of knowledge and meaning, democratically bringing their expertise, experiences and ideas into the classroom (Williamson & Payton, 2009). Teaching for creativity implies allowing people to take responsibility for their own learning. Pupils out not to be considered as merely receivers of information: on the contrary, it is important that they assume the role of discovery, but support and guidance are needed in order for them to succeed. For this, teachers need to be prepared both on the pedagogical side, being aware of the ways and means to foster autonomy and student-centeredness (Simplicio, 2010). The thinking of children at all levels of ability is significantly influenced by the type of opportunities they are given (Runco, 1990). Offering the learners the right chances to develop their cognitive and creative potential should be a priority in the design of this project.

The government of Ethiopia has recognized the fundamental importance of care and education of children for holistic development (MoE, MH, MoWA, 2010a). In Ethiopia, there is a need to ensure a healthy start in life for children, enabling and stimulating environment for developing their talents and stimulating and help them to become caring and productive citizens (MoE, MH, MoWA, 2010b). Thus, this study was intended to assess the extent to which theories of children creativity development are implemented in the school. This was by examining teachers' and school principals' awareness and practice in fostering creativity. Hence, this is intended to describe the awareness and practices of teachers' and school principals in fostering children creativity. More specifically, the following objectives were intended to be achieved:

- To describe the level of teachers familiarity with creativity characteristics (person)
- To explain the level of teachers' awareness and practice on children creative product (product)
- To evaluate the characteristics of children creative product (product)
- To describe awareness and practice of teachers on the process of children creativity development. (process)
- To evaluate practices of teachers in creating conducive environments for children to foster their creativity (press)

- To measure the familiarity of teachers with creativity measurement criteria (assessment of creativity)

## Materials and Methods:-

### Sample and Sampling Techniques:-

Sample for the research was selected from elementary school teachers (n = 281), principals (n = 7), vice principals (n = 4), and supervisors (n = 4) found at Debre Tabor Town. Through simple random sampling technique, 54 samples (45 teachers, 3 principals, 3 vice principals, and 3 supervise) were selected from Fitawurari gebriyye primary school, Tewodros primary school, and Tabor primary and especial needs education school from government school. This is by using stage random sampling techniques in which samples of the study selected from selected schools.

### Research Design:-

The research design was survey study method. In this method there were different techniques used such as questionnaire, observation, and focus group discussion to triangulate the finding.

### Instruments:-

Different instruments were used in data collection. These are rating scale, open-ended questions, observation checklists, focus group discussion guides, and photo camera.

### Validity of the instrument:-

The validity of questionnaire was assessed by measurement experts. Experts have evaluated the extent to which each questionnaire are able to measure what they intended to measure.

### Reliability of questionnaire:-

The reliability of questionnaire was tested by Chronback alpha after pilot testing. After poor items are discarded, Chronback alpha for teachers familiarity to creativity characteristics, product and creativity assessment criteria rating scale was  $\alpha = .78$  ; and for classroom and school environment characteristics rating scale the reliability was  $\alpha = .73$ .

### Data Collection Technique:-

Data were collected through direct observation, focus group discussion and questionnaire. During observation, students' work products were observed in the store. The process of producing the output also discussed during focus group discussion.

## Results:-

### Person related Results:-

#### Teachers' familiarity to the statements indicating characteristics of creative person:-

**Table 1:-** Result of teachers' familiarity to the statements indicating characteristics of creative person

Characteristics	Mean	Standard deviation
<b>Personal traits</b>		
Tolerance of ambiguity	2.65	0.79
Openness to experience	3.01	0.66
Independence of judgment	2.91	0.92
Unconventional values	2.87	0.54
Curiosity	2.77	0.69
Preference for challenges and complexity	3.24	0.73
Self confidence	4.98	0.51
Risk- taking	2.98	0.67
Intrinsic motivation	3.96	0.59
<b>Emotional or affective process</b>		
Affective fantasy in play	4.10	0.66
Passionate involvement in tasks	3.97	0.71
Affective pleasure in challenge	2.99	0.61
Tolerance of anxiety	3.01	0.59
<b>Cognitive ability</b>		

Divergent thinking	4.78	0.62
Transformation ability	4.10	0.72
Sensitivity to problems	3.81	0.62
Tendency to practice with alternative solutions	3.56	0.52
Wide breadth of knowledge	4.84	0.53
Insight ability	3.69	0.91
Evaluative ability	4.21	0.93
Synthetic ability	3.94	0.79
Analytical ability	4.01	0.87
Practical-contextual ability	4.91	0.58

From the above table which indicates that the level of teachers' familiarity with statements indicating characteristics of creative person, teachers are more relatively familiar with self- confidence ( $M=4.98$  ,  $S=0.51$ ) and least familiar with tolerance of ambiguity ( $M=2.65$ ,  $S=0.79$ ) under personal trait. Under affective processes teachers are more familiar with affective fantasy in play ( $M=4.10$  ,  $S=0.66$ ) and least familiar with affective pleasure in challenge ( $M=2.99$ ,  $S= 0.61$ ). From cognitive processes, teachers are more familiar with practical contextual ability ( $M=4.91$ ,  $S= 0.58$ ) and least familiar with tendency to practice with alternative solutions ( $M=3.56$ ,  $S= 0.52$ ). More importantly, teachers' awareness to terms indicating creative personal trait such as tolerance of ambiguity, risk- taking, unconventional values, curiosity and independence of judgment are below average. Moreover, focus group discussion with directors, vice directors, some teachers, and supervisors also strength this finding.

There were two questions raised for the focus group discussion: (1) what are the characteristics of creative person? (2) What are the sources of these creative characteristics? In their discussion to the first question, participants have raised three important characteristics of creative children. These are neatness of their handwriting, ability to create new thing (for example physical play) that teachers are even not familiar with, and need of different colors and materials. For the second question a debating issues were raised in each group between the effect of nature and environment on children creativity. Some of them from each group argued that nature takes important part in creativity. In their argument, they raised an example of individuals getting enough care from their parents but not creative and individuals lack care from poor family but shows creative ability in the school. On the other hand others have supported the effect of the environment (such as the school and home environment) on children creativity. As they have argued, there are children in their schools who had got material support from siblings and showed excitement and improvement in drawing ability.

### Product of Children Creativity:-

#### Teachers' familiarity to the characteristic of children creative product:-

Teachers' response to 5 point likert scale about characteristics of children creative product was presented in the following table here after.

**Table 2:-** the result of teachers' familiarity to the characteristics of children creative product.

Products	M	SD
Creativity outcome by drawing	4.67	0.56
Creativity outcome by creating models	4.84	0.87
Creative outcome by coloring	3.58	0.69
Creative outcome by playing with peers	3.33	0.54
Creative outcome by playing with different materials	4.11	0.77

The above table indicates that teachers are most familiar with creativity of children by model ( $M = 4.84$ ,  $SD = 0.87$ ) and least familiar with creativity of children by playing with their peers ( $M = 3.33$ ,  $SD = 0.54$ ).

#### Focus group discussion result on product:-

To measure the level of teachers' familiarity and practice on characteristics of children creative product, focus group discussion with directors, vice directors, supervisors and some teachers was conducted. The discussion was based on the following questions: (1) Can we gain some original products from children? (2) In what ways we can observe children creativity?

To the response of the first question, group members have raised two distinct issues. The first one was as children creative product could be original and the second one was as every work of children is based on what they have seen and learnt from older person. Teachers who were agreed with the first issue raised the product of exceptional children as an example. On the other hand those teachers who were agreed with the second issue have raised children product such as drawing, model, picture and the like as they are not original but the result of modeling or imitating others to produce similar products. In the discussion on the second question, participants have raised ways they can observe children creativity. These are by allowing children to draw pictures, construct models, write letters in different modes, write poems, create drama and sing. However, they said so, they witnessed as they hadn't applied these ways to foster and observe children creativity as a result of scarcity of materials.

#### Result of school observation:-

Children creative products in sampled schools were also assessed through observation checklists and photo camera.

**Table 3:-** the result of observation checklists which indicates children creativity practice at school

Checklists	Never	Some	Most
Stored products of children creativity	33.3	66.7	0
Preparation of creative product in the school	100	0	0
Product show originality	100	0	0
Use of different colors	66.7	33.3	0

The above table shows that 33.3% (N=1) of the school has not stored children creative products and 66.7 % (N=2) of the schools have stored some of children products. Inversely, 66.7% (N=2) of the school never used different colors in children creative products and 33.3 % (N=1) of the schools used different colors. On the other hand, no schools ever allowed children to produce their creativity in the school. They used home assignment rather than creating conducive environments at school. Similarly no products of children creativity showed originality.

#### Process of children creativity development:-

##### Responses of participants to open ended questions asking the way they follow to observe children creative ability:-

The open ended question was asked participants to explain the methods they follow to observe children creative ability. Their responses were analyzed by using content analysis. Their responses were categorized into similar characteristics. As a result, the major category of methods in which teachers used to observe children creativity were belongs to the product not to the process.

**Table 4:-** Teachers response to open ended questions

<b>From their creative product of assignment/ home work</b>	From drawing pictures
	From creation of blocks, letters, and models
	From writing of poem/arts
	From modeling machines

#### Focus group Discussion process:-

The first discussion question was limited to ask understanding of participants' about the indication of children product. During the discussion, participants were asked to discuss on whether the products of children are the indications for their creative ability. In their discussion, some of the participants were said that the products of children are the indication of their creative ability. Their argument was based on the comparisons between children who had no involved in the creating products and who had involved in the product creation. They said that whatever the quality and type of the product, unless they have the interest and ability to create they couldn't participated in such activity. On the other hand others were arguing as products of children may/may not be the indication of their creative ability. They raised the main reason that as children can copy and perform what older person performed and as a result it will be considered as reproductive ability rather than creative ability.

#### Press (Environment):-

This perspective concerned about the eminence of classroom and school environment on children creative ability development.

**Practice of teachers in creating conducive environments for children to foster creativity: response of teachers on 3 point scale (average = 2):-**

**Table 5:-** the result of teachers practice in creating conducive environment which motivate students/children to create

Teachers practice in creating conducive environment which motivate students/children to create	Mean	Standard deviation
To question	1.98	0.62
To summarize what I have thought them in classroom	2.89	0.55
To explore the solution to a given problem	2.54	0.71
To skill-building	2.37	0.65
To communicate their idea, imagination and creative work with other students	1.49	0.89
To self-expression	2.23	0.58
To recall what they have learnt	2.96	0.54
To create different models, pictures, drawing and shapes	2.11	0.99

Table 5 indicates that teachers were slightly practicing in motivating children to communicate their idea, imagination and creative work with other students ( $M = 1.49$ ,  $S = .89$ ) which is below average and highly practicing in motivating children to recall what they have learnt ( $M = 2.96$ ,  $S = .54$ ) which is above average.

**Teachers practice in using different materials which can foster creativity in children: teachers response on 3 point scale:-**

**Table 6:-** the result of teachers practice in using different materials which can foster creativity in children

Teachers practice in using different materials which can foster creativity in children	M	S
Different color chalk	1.89	0.58
Different chart	2.56	0.98
Different Marker	1.67	0.67
Model	2.19	0.49
Picture	2.91	0.77
Graphs	2.96	0.55

Table 6 indicates that teachers were practicing slightly in providing different marker ( $M = 1.67$ ,  $S = .67$ ) and different color chalk ( $M = 1.89$ ,  $S = .58$ ) for children in order to enhance creativity which are below average, and highly practicing in providing graphs ( $M = 2.96$ ,  $S = .55$ ) which is above average. The result reveals that teachers practice in using different color chalk, marker, and model to enhance children creativity is very low when it is compared with the use of graphs, pictures and charts. This show us as there is a need of some training or intervention for teachers on how to use different materials to foster children creativity.

**Teachers practice in allowing children to involve in creative tasks:-**

**Table 7:-** the result of teachers practice in allowing children to involve in creative tasks

Teachers practice in allowing children to involve in creative tasks	M	S
Allowing children to use different color chalk	1.53	0.65
Allowing children to draw Different picture, graphs and charts	2.95	0.57
Allowing children to use different color (marker)	1.31	0.77
Allowing children to design different models	1.21	0.66

As the table 7 indicates teachers were working intensely on allowing children to draw different picture, graphs and charts ( $M = 2.95$ ,  $S = .57$ ). However, in allowing children to design different models ( $M = 1.21$ ,  $S = .66$ ), to use different color (marker) ( $M = 1.31$ ,  $S = .77$ ), and to use different color chalk ( $M = 1.53$ ,  $S = .65$ ), teachers are working below average. The resultrevealed that teachers are not effective in allowing them to use different materials such as color chalk, different markers in preparing different materials and models.

**School observation:-**

**Table 8:-** the result of school environment assessment

School environment are suitable	Mean	Standard deviation
To use different colors	1.91	.94
To play with different materials	1.26	.97

To construct different models, picture, graphs, and charts	2.54	.55
To celebrate and exhibit their creative product	2.43	.99
To solve different problems	2.47	.84
To work collaboratively	1.96	.73

Table 8 indicates that schools environment was conducive for children to work collaboratively ( $M = 2.89$ ,  $S = .73$ ) and to construct different models, pictures graphs, and charts ( $M = 2.54$ ,  $S = .55$ ). In contrast the result shows that there is lack of conducive school environment to encourage children to play with different materials ( $M = 1.26$ ,  $S = .97$ ) and solve different problems ( $M = 1.87$ ,  $S = .84$ ).

The discussion with participants of this research revealed that, lack of resources such as paper, color pencil, drawing chart, simple machines, school infra structures and others determine children creativity. On the other hand they have raised also the effect of social interaction among children and their peers, family, and the teacher. For example, they said, children motivated to do things and to play in group; they most of the time influenced by their peers; if any person from their family is out standing in education, they probably influenced by their older siblings; if the teacher assist, motivate and support children with material provision, their creative ability could be enhanced.



**Creativity Measures:-****Teachers' familiarity to creativity measurement criteria:-****Result from questionnaire:-****Table 9:-** result on criteria of creativity measures

Criteria	M	SD
Fluency	4.33	0.66
Flexibility	3.00	0.75
Elaboration	3.58	0.53
Originality	4.57	0.74
Resolution	4.01	0.69

Table 9 indicates the familiarity of teachers to criteria of measuring creativity. As the result reveals, teachers are familiar with each criteria almost at average and above average. Teachers are familiar with originality ( $M = 4.57$ ,  $S = .74$ ), fluency ( $M = 4.33$ ,  $S = .66$ ) and resolution ( $M = 4.01$ ,  $S = .69$ ) above average.

**Result from focus group Discussion:-**

The discussion questions for this part were: (1) can children creativity be measured? How? (2) What criteria should be considered in evaluating children creativity? Regarding the first question participants said that creativity can be measured by evaluating their product critically. However some of them were raised the difficulty of observing children creative ability while they create the product doubting the contribution of older person to the preparation of their children creative product. At the same time they were discussed on the second question. To the responses of the question, the criteria to evaluate children creativity raised by each focus group were summarized. There are two criteria raised by them: the ability of children to create something new in relation to other children, and the ability of creating similar object to the original – the ability of drawing picture similar to the real object.

**Discussion:-**

Teachers are familiar with some creative person characteristics such as cognitive ability and affective characteristics. But there was awareness gap in other cognitive characteristics such as tendency to practice with alternative solutions, synthetic ability, insight ability and sensitivity to problems. Regarding terms of emotional or affective processes, such as tolerance of anxiety, passionate involvement in tasks and affective pleasure in challenge, teachers' awareness was low. And also regarding terms indicating personal traits such as tolerance of ambiguity, risk taking, openness to experience, unconventional values, curiosity, preference for challenges and complexity, and independence of judgment, teachers need awareness creation training.

The result of this research also indicates that teachers awareness of how children's creative product demonstrated through coloring, how playing with peers indicate children creative products was below average. Although they have hints about children creative product, how children produce their creativity, they had not practiced in allowing children to produce creative products due to lack of raw materials. Regarding teachers' familiarity with criteria of creative evaluation, the result showed us the need of awareness creation and further involvement in evaluating children creative product. Thus in any support that will be provided on creativity measures, discussion on criteria such as flexibility and elaboration will be prioritized. From the conducted focus group discussion with participants, the result about measurement of children creativity revealed that most of teachers had been using product as an indication of children creativity. Others argued that children product might not use as indication of creativity because they may imitate produce what older children produced. This gives us insight to search for training on how to enhance, monitor, and measure children creativity through continuous improvement techniques.

On the other hand this research revealed that, elementary school teachers and principals' awareness and practices on how to enhance children creativity by allowing them to practice in the school, providing different colors, observing while they perform, supporting while they perform and storing their products need improvement. As participants of this research argued, observing children product is a method of measuring children creativity. This finding show that teachers have been focusing on the product perspective not on the process one. However it is impossible to know the totality of children creativity by observing only at their product because it is impossible to know what is happening in their mind. As Glaveanu, (2011) discussed, if we restrict creativity to products we are bound to miss out on much of what creativity is or can be.



Hence, this finding also showed that teachers need support on how to help children to question, create different product and communicate their thought with their college. Whatever the case, teachers are not effective in allowing them to use different materials such as color chalk, different markers in preparing different materials and models. From the result we can also conclude that there is a need to make school environment conducive by providing different colors for children, allowing them to play with different materials, work collaboratively with their college, solve different problems creatively and exhibit their creative product. In line with this study, Jeffrey and Woods (2003) discussed that the learning environment at school can either support or limit creativity so that teacher's creativity and ability helps to offer a creative learning environment with creative experiences.

### **Conclusion:-**

To strength the finding of this research, data from questionnaire, observation and focus group discussion result were triangulated. In general the findings of this research were summarized as follows.

Although teachers are aware of some characteristics of creative person, they lack knowledge about other characteristics such as tendency to practice with alternative solutions, synthetic ability, insight ability, sensitivity to problems, tolerance of anxiety, passionate involvement in tasks, affective pleasure in challenge, tolerance of ambiguity, risk taking, openness to experience, unconventional values, curiosity, preference for challenges and complexity, and independence of judgment.

Teachers awareness of how children's creative product demonstrated through coloring, how playing with peers indicate children creative products is below average. Their practice in allowing children to produce creative products is very low due to lack of raw materials.

Teachers' knowledge about observing and measuring children creativity is by considering children products as an indication of their creative ability. Elementary school teachers and principals' awareness and practices on how to enhance children creativity by allowing them to practice in the school, providing different colors, observing while they perform, supporting while they perform and storing their products need improvement.

The practice of using different materials such as color chalk, different markers in preparing different materials and models was another area which seeks improvement. And also, there is a need to make school environment conducive by providing different colors for children, allowing them to play with different materials, work collaboratively with their college, solve different problems creatively and exhibit their creative product. Thus, the result showed the great need of awareness creation and further involvement in evaluating children creative process and product.

### **Recommendation:-**

As a result of this finding the following recommendation should be taken in to consideration. First, to enhance children creativity teachers' knowledge and skill are mandatory. So, any concerned body especially educational institutions and professionals should provide training on how to enhance children creativity, and how to monitor the process of children creativity development. Second, it is important to make school environment conducive enough to scale up children creativity. Therefore material provision which contribute to children creativity should be provided by any organization.

### **Reference:-**

1. Amabile, T.M. (1998). How to kill creativity. Harvard business review, 76 (5), 76-87.
2. Baek, Y.K. (2008). What hinders teachers in using computer and video games in the lassroom? Exploring factors inhibiting the uptake of computer and video games. Cyberpsychology & Behavior, 11(6), 665-671.
3. Beghetto, R.A. (2007). Does creativity have a place in classroom discussion? Prospective teachers' response preferences. Thinking skills and creativity, vol. 15, no. 3, 158-177.
4. Besemer, S. P. & Teffinger, D. J., (1981). Analysis of creative products: Review and synthesis. The journal of creative behavior, Vol. 15, no. 3, 158-177
5. Bottino, R.M. (2003). ICT, national policies, and impact on schools and teachers' development. Paer presented at the ICT and the teacher of the future.
6. Craft, A. (2001). An analysis of research and literature on creativity in education,
7. Craft, A. (2003). Creativity in schools: tension and dilemmas. London: Routledge.

8. Craft, A. (2005). Creativity in schools: tension and dilemmas. London: Routledge.
9. Davidson, D.H. (2003). Developing creativity. Cooperating extension service. Manoa.
10. Discussion Document and Proceedings of the Consultative Conference on Education (2009). Creativity and the Arts in the primary school. Iris national teachers organization.
11. Esquivel, G.B. (1995). Teachers behaviors that foster creativity. Educational psychology review, 7(2), 185-202.
12. Ferrari, A., Cachia, R., and Punie, Y. (2009). Innovation and creativity in education and training in the EU members state: Fostering creativity learning and supporting innovative teaching – literature review on innovation and creativity in E&T in the EU member states. European commission joint research center.
13. Glaveanu, Vlad Petre (2011) Children and creativity: a most (un)likely pair? Thinking skills and creativity, 6 (2). pp. 122-131.
14. Glaveanu, Vlad Petre (2011) Children and creativity: a most (un)likely pair? Thinking skills and creativity, 6 (2). pp. 122-131.
15. Jackson, N. (2002). A guide for busy academics: Nurturing creativity. York, UK: LTSN Generic center. Retrieved October 2014, from <http://www.palatine.ac.uk/files/1029.pdf>
16. Kleiman, P. (2008). Towards transformation: conceptions of creativity in higher education. Innovation in education and teaching international, Vol. 45, No. 3, 209-217.
17. Knight, P. (2002). The idea of a creative curriculum. Retrived November 4, 2014, from <http://www.palatine.ac.uk/files/999.pdf>
18. Lemons, G. (2005). When the horse drinks: enhancing everyday creativity using the elements of improvisation. Creativity Research Journal, 17(1), 25–36.
19. McCammon, L.A., O’Farrell, L., Saebø, A.B. & Heap, B. (2010). Connecting with their inner beings: an international survey of drama/theatre teachers’ perceptions of creative teaching and teaching for creative achievement. Youth Theatre Journal, 24, 140–159.
20. Moe, Moh, and Mowa (2010): Policy document for Early Childhood Care and Education (ECCE). Ultimate printing press.
21. Moe, Moh, and Mowa (2010): Strategic operational plan and guidelines for early childhood care and education in Ethiopian. Ultimate printing press.
22. Runco, M.A. (1990). The divergent thinking of young children: Implications of the research. Gifted child today (GCT), 13(4), 37-39.
23. Runco, M.A. (2003). Education for creative potential. Scandinavian journal of education research, 47 (3), 317-324.
24. Russ, S. (1996). Development of creative processes in children. New directions for child development, 72, 31-42.
25. Ryhammar, L. & Brolin, C, (1999) ‘Creativity research: historical considerations and main lines of development’ in Scandinavian Journal of Educational Research, vol.43, no.3, pages 259-273
26. Sawyer, R.K. (2000). Improvisation and the creative process: Dewey, Collingwood, and the aesthetics of spontaneity. The Journal of Aesthetics and Art Criticism, 58(2), 149-161.
27. Sharp, C. (2004). Developing young children’s creativity: what can we learn from research? Topic, 32, 5-12.
28. Simplicio, J.S.C. (2000). Teaching classroom educators how to be more effective and creative teachers. Education, 120 (4), 675-680.



### RESEARCH ARTICLE

#### “A STUDY ON CUSTOMERS AWARENESS AND ADAPTABILITY TO GREEN BANKING WITH SPECIAL REFERENCE TO GRATUDATES IN DAKSHINA KANNADA DISTRICT”

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#### Abstract

Green banking is a new concept of banking were in all other activities of banking remains the same, but extra protection is given on sustainability environmental protection through paper less banking. It is that part of banking which aim at reduction of operational cost, improving efficiency and total productivity. This paper makes an attempt to find out the awareness and adoptability of concept of green banking. We know that India is a developing nation were nearly 40% of population are youths. It makes an investigation into the various modes of e – banking services available to the customers and extent they use the services.

It probes the reasons for the failure of services or popularity of service among the customers. Youths around the Mangalore region were interviewed and opinions were collected. Attempt was also made to interact with bank managers to collect their opinion the customer's request for e services, problems encountered with existing services and attempts made to promote e-services as a part of green banking approach.

It is found from our study that majority of the respondents are aware about the word green banking. But not adopted to the e- banking services, the paper concludes with the suggestion that e- banking promotion has to be done more effectively as most of the youth population themselves has not adopted to the use of e- banking as they are integral part in framing the future of the nation . Since India has witnessed demonetization, the effort should be made to promote e-banking as it is the right time which will help in development of the cashless economy where transactions through e -banking makes life easier, and there will be reduction in parallel economy. Country can have complete information about the transactions, there will be accountability, complete record with the govt, circulation of black money which has shadowed equal distribution of wealth and resulted in unrealistic inflation in the country can be encountered and overcome resulting in a welfare state.

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**Introduction:-**

Green Banking is a new phenomenon in the financial world. It encompasses the type of banking which takes into account the social and environmental impacts with the intension of protecting and preserving the environment. Green banking is like a normal bank, which considers all the social and environmental factors with an aim to protect the environment and conserve natural resources. It is also called as Ethical Bank or Sustainable Bank. They are controlled by same authorities with an agenda toward taking care of the earth's environment and resources. Green Banking means promoting environmental friendly practices and reducing carbon footprint from banking activities. This comes in many forms like using online banking instead of branch banking, paying bills online, opening up accounts at online etc.

The government of India has issued guidelines and instructions to banks on Green initiatives. In order to implement the green initiatives of the government, all banks were asked to Increase use of Electronic Payment, Increase use of Core Banking Solutions, increase use of Video Conferencing , offer Centralized Payment system. Many banks in India have taken various green banking initiatives be it in the form of green products or services, green communication like online bill payment, green projects or green events. State Bank of India had launched its 'Green Channel Counter' facility on State Bank Day (1-7-2010), at 57 branches of the bank spread across the country as a step towards paperless Green Banking for deposit, withdrawal and remittance transactions.

**Green banking /Electronic banking services:-****Neft:-**

National Electronic Funds Transfer (NEFT) is a nation-wide payment system facilitating one-to-one funds transfer. Under this Scheme, individuals, firms and corporate can electronically transfer funds from any bank branch to any individual, firm or corporate having an account with any other bank branch in the country participating in the Scheme. The beneficiary can expect to get credit for the NEFT transactions within two business hours from the batch in which the transaction was settled. NEFT operates in hourly batches - there are twelve settlements from 8 am to 7 pm on week days (Monday through Friday) and six settlements from 8 am to 1 pm on Saturdays.

**RTGS:-**

The acronym 'RTGS' stands for Real Time Gross Settlement, which can be defined as the continuous (real-time) settlement of funds transfers individually on an order by order basis (without netting). The RTGS system is primarily meant for large value transactions. The minimum amount to be remitted through RTGS is ` 2 lakh. Under normal circumstances the beneficiary branches are expected to receive the funds in real time as soon as funds are transferred by the remitting bank. The beneficiary bank has to credit the beneficiary's account within 30 minutes of receiving the funds transfer message.

**Debit card and atm Card:-**

Debit cards are used to electronically withdraw funds directly from the cardholders' accounts. Most debit cards require a Personal Identification Number (PIN) to be used to verify the transaction. It is a payment card that deducts money directly from a consumer's checking account to pay for a purchase. Debit cards eliminate the need to carry cash or physical checks to make purchases.

**Credit Card:-**

Credit card are cards that allow their holders to make purchases of goods and services in exchange for the credit card's provider immediately paying for the goods or service, and the card holder promising to pay back the amount of the purchase to the card provider over a period of time, and with interest. The card issuer (usually a bank) creates a revolving account and grants a line of credit to the cardholder, from which the cardholder can borrow money for payment to a merchant or as a cash advance.

**Mobile Banking:-**

Mobile banking is a service provided by a bank or other financial institution that allows its customers to conduct financial transactions remotely using a mobile device such as a mobile phone or tablet. It uses software, usually called an app, provided by the financial institution for the purpose. Mobile banking is usually available on a 24-hour basis. Transactions through mobile banking may include obtaining account balances and lists of latest transactions, electronic bill payments, and funds transfers between a customer's or another's accounts. From the bank's point of view, mobile banking reduces the cost of handling transactions by reducing the need for customers to visit a bank branch for non-cash withdrawal and deposit transactions.

**E-lobby:-**

E-Lobby is fully computerized Electronic Lobby operational 24X7 .It is a novel concept which provides virtual banking to provide all the essential banking facilities under one roof even at the odd hours at night. When a common person these days work 9am to 9pm, E-Lobby brings a relief to them by providing them services beyond the normal banking hours also through its automated and advance machines like Automated Teller Machines (ATM's) -To Dispense Cash through ATM cards of customers of all banks. **Self service facilities which can be done at banking e-lobbies include**ATM withdrawals, cash deposits, card-to-card transfers, mobile phone top-ups, railway booking, passbook printing, NEFT, opening of FD/RD accounts, SMS alerts, cheque drop box, bill payments, mini statements, etc.

**Research Design:-****Objective of the study:-**

- To find out the awareness of the concept of green banking among the customers of D. K
- To find out the measures taken by the bank to promote green banking
- To know the customer's adoptability to internet banking, mobile banking, use of plastic cards and e-lobby services.
- To find out the conveniences and inconveniences of green banking to customers.

**Need for the study:-**

The needs for the study arise mainly because of changes that are taking place in the banking field as a result of reduction of operational cost and environment protection. The paper has made an attempt to find out the impact of modern banking facilities on youth. Paper has identified the need for adoption of modern banking facilities as it can reduce operational cost, saves time, provides better service to the customers and make banking as eco-friendly.

**Research Methodology:-**

The data was collected mainly from primary source of information through questionnaires and secondary data was collected from websites, magazines, newspaper articles and previous research study done in this field.

**Primary data:-**

The study was conducted with the use of primary data which was collected through structured questionnaire given to the graduates in and around Mangalore city. Specific sampling method was used. It was targeted to interact with 150 respondents ultimately. It was possible to collect the information from 147 respondents. Response from 3 respondents could not be received in spite of repeated attempts.

An interview was also made with managers of various the banks. 25 bank managers were targeted for the personal interview to collect their opinion about customer's awareness and adoptability and the problems reported to the banks in relation to the e-banking services. But it was possible to interview only 17 managers of different banks. 8 bank managers were very busy, couldn't be interviewed because of the work pressure caused by demonetization.

**Secondary data:-**

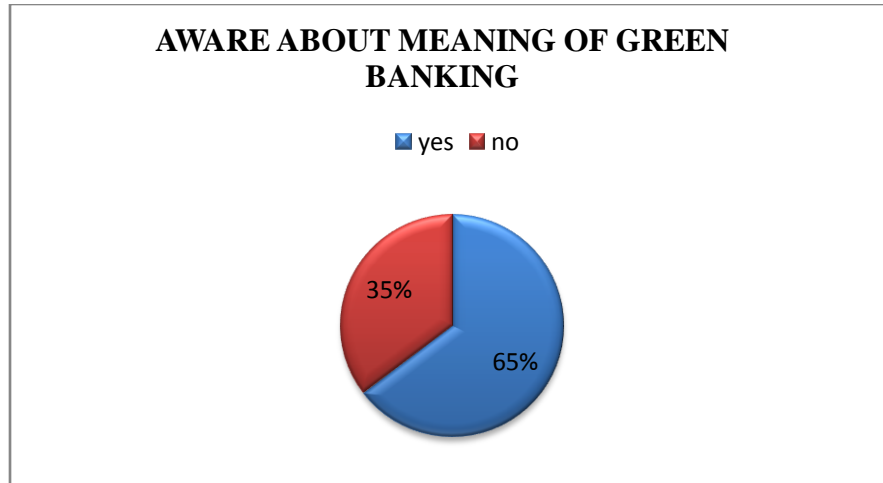
The paper also took the help of secondary data like various websites, newspaper articles, journals and study done by the researches in past.

**Limitations of the study:-**

- ✓ The study was conducted by using specific sampling method. The people who are not a part of the study will make a significant impact on the result of the study.
- ✓ The respondents were using the services of different banks. So opinion collected may be biased to a certain extent.
- ✓ In some cases the respondents were deprived of certain banking services in their locality which is also a part of limitation of study.
- ✓ In case of interview with the bank managers they have given their opinion to the best of their knowledge, and not based on the records maintained by them.

**Data Analysis And Interpretation:-****Awareness about the meaning of green banking**

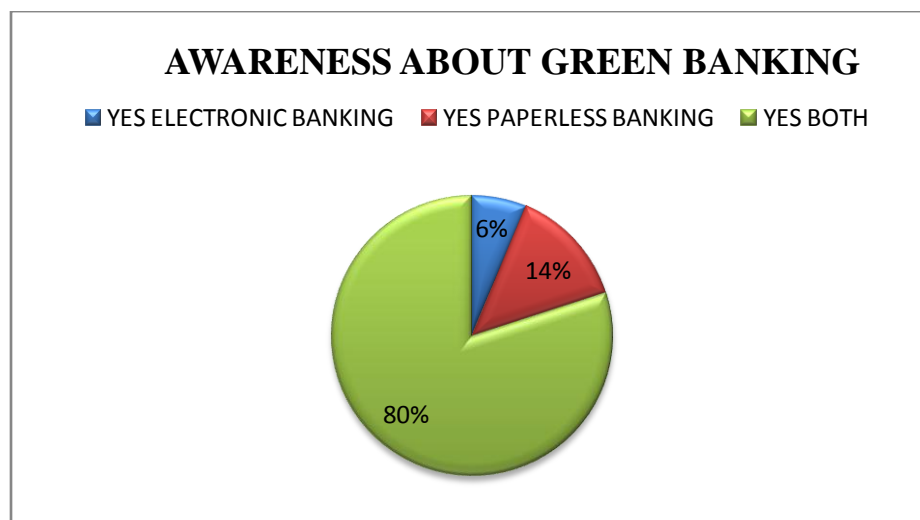
PARTICULARS	RESPONDENTS	
	IN NUMBERS	IN PERCENTAGE
YES	95	65
NO	52	35
TOTAL	147	100



Majority of the respondents are aware about the meaning of Green Banking. Only 35% of the respondents are not aware about the meaning of Green Banking

**Awareness about the meaning of green banking:-**

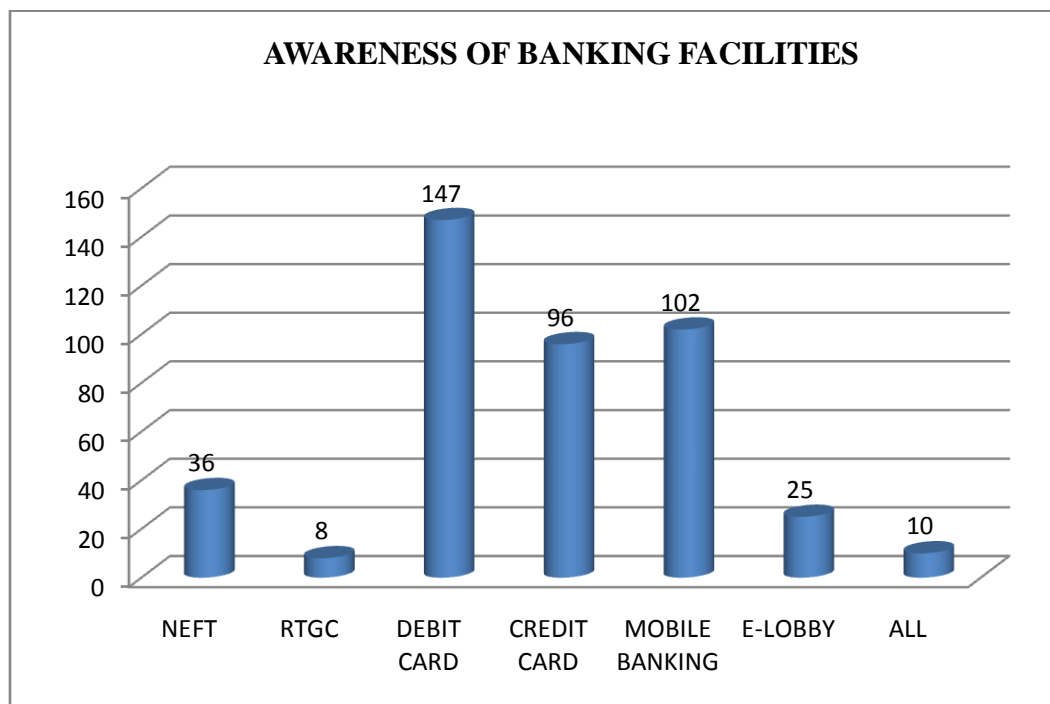
PARTICULARS	VIEWS	RESPONDENTS	PERCENTAGE
YES	ELECTRONIC BANKING	6	6.3
	PAPERLESS BANKING	13	13.7
	BOTH	76	80
TOTAL		95	100



For most of the respondents Green Banking means it is both Electronic banking and paperless banking. Only few respondents told that it is either Electronic banking or Paperless banking

**Awareness of electronic banking facility.**

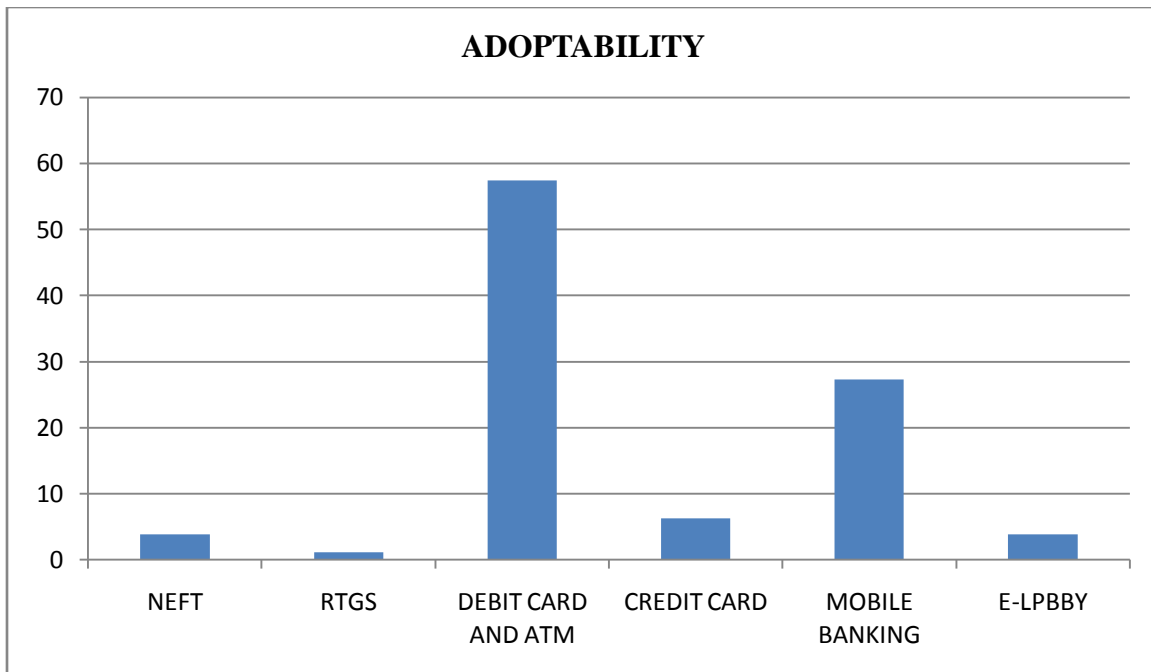
BANKING FACILITY	RESPONDENT	WEIGHTS
NEFT	36	8.5
RTGC	8	1.9
DEBIT CARD	147	34.6
CREDIT CARD	96	22.6
MOBILE BANKING	102	24
E-LOBBY	25	5.9
ALL	10	2.5
TOTAL	424	100



All the respondents are aware about debit card facility. Good number of respondents had the knowledge of mobile banking facility. Only few respondents are aware about all the modern banking facilities. Average number of respondents is aware about credit card facilities.

**Adoptability of the green banking facilities.**

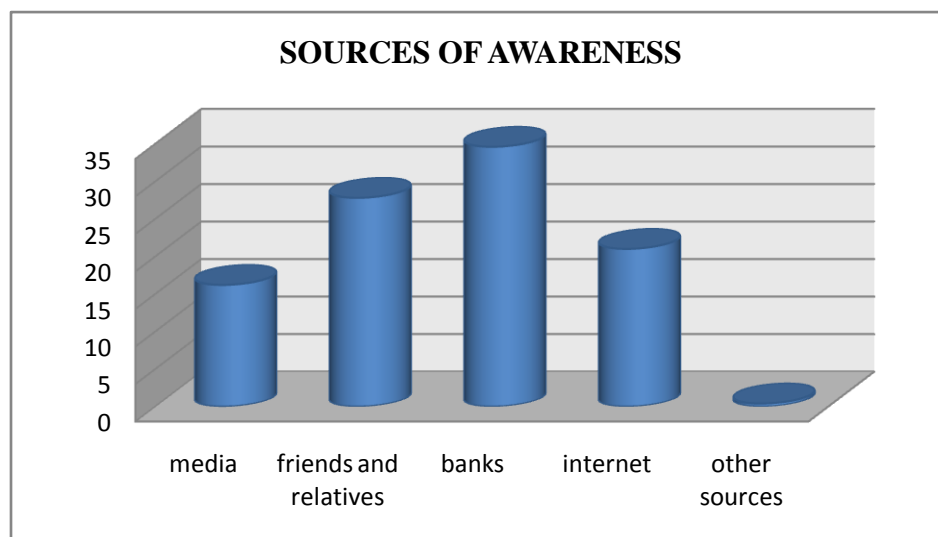
BANKING FACILITIES	WEIGHTS	RESPONDENTS
NEFT	3.91	10
RTGC	1.17	3
DEBIT CARD AND ATM	57.42	147
CREDIT CARD	6.25	16
MOBILE BANKING	27.34	70
E-LOBBY	3.91	10
TOTAL	100	256



From the study it is clear that the majority of the respondents are aware about the green banking facilities. But they are not adopting them for their day today life. All the respondents are using debit card facility. Along with debit card only few respondents were using other facilities also.

#### Source of awareness.

SOURCES	WEIGHT	RESPONDENT
MEDIA	16.2	50
FRIENDS AND RELATIVES	27.8	86
BANKS	34.6	107
INTERNET	21	65
OTHER SOURCES	0.4	1
	100	309

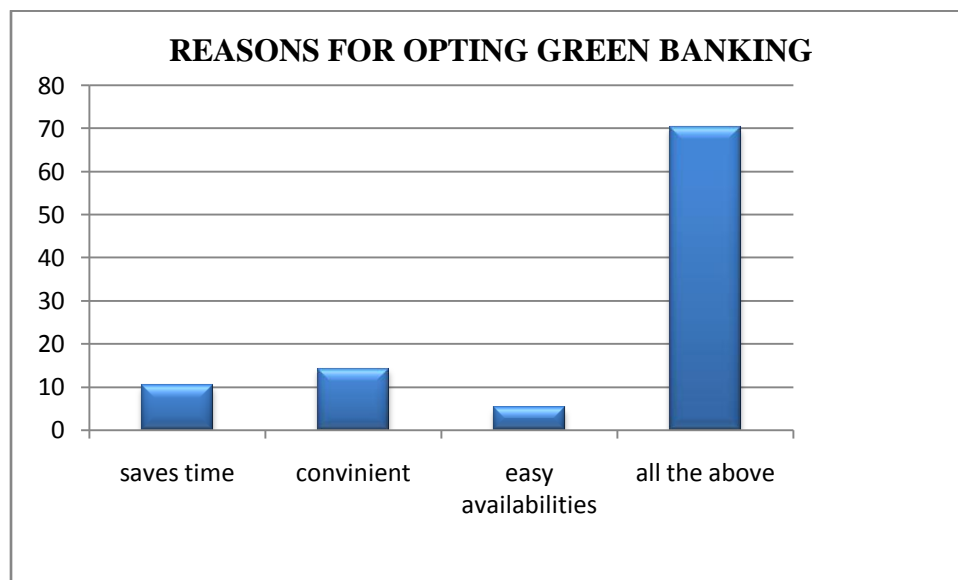


Most of the respondents got information about green banking facilities from banks only. Good number of respondents got information from their friends and relatives. Other source of information is college.



**Reason for opting green banking:-**

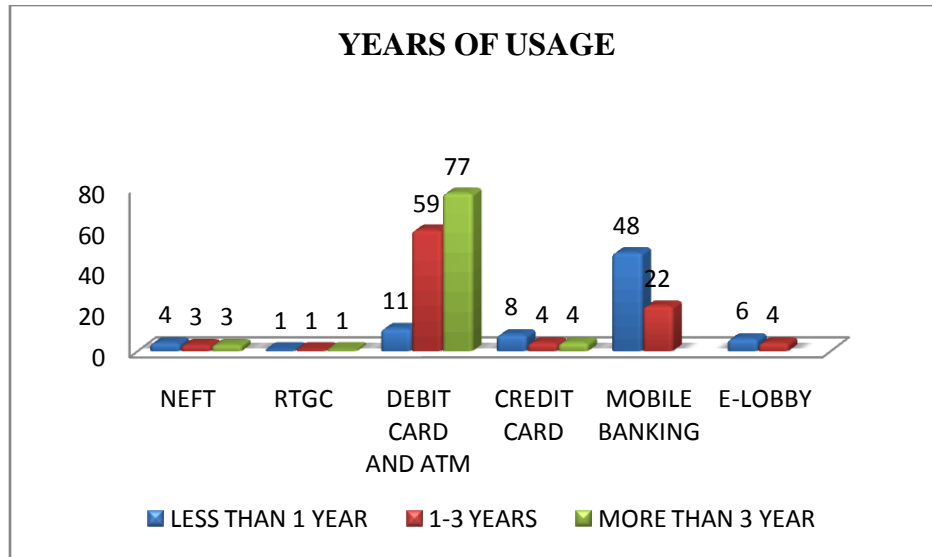
REASONS	WEIGHTS	RESPONDENTS
SAVES TIME	10.3	16
CONVENIENT	14.2	22
EASY AVAILABILITIES	5.2	8
ALL THE ABOVE	70.3	109
	100	155



Majority of the respondents are using these facilities because of convenience, easy availability and saves time.

**Years of usage of electronic banking services.**

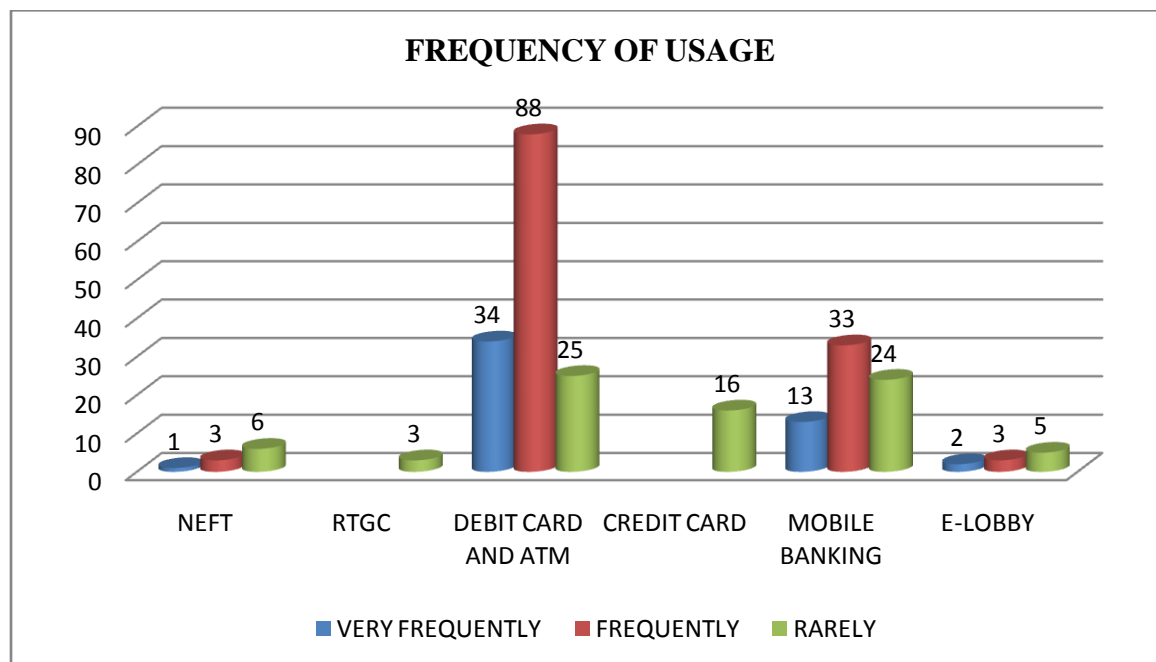
SERVICES	YEARS OF USAGE			TOTAL
	LESS THAN 1 YEAR	1-3 YEARS	MORE THAN 3 YEAR	
NEFT	4	3	3	10
RTGC	1	1	1	3
DEBIT CARD AND ATM	11	59	77	147
CREDIT CARD	8	4	4	16
MOBILE BANKING	48	22		70
E-LOBBY	6	4		10
	78	93	85	256



77 respondents are using debit card from more than 3 years. No one is using E-lobby and mobile banking more than 3 years. Most of mobile banking users started using that facility recently.

#### Frequency of usage of green banking services

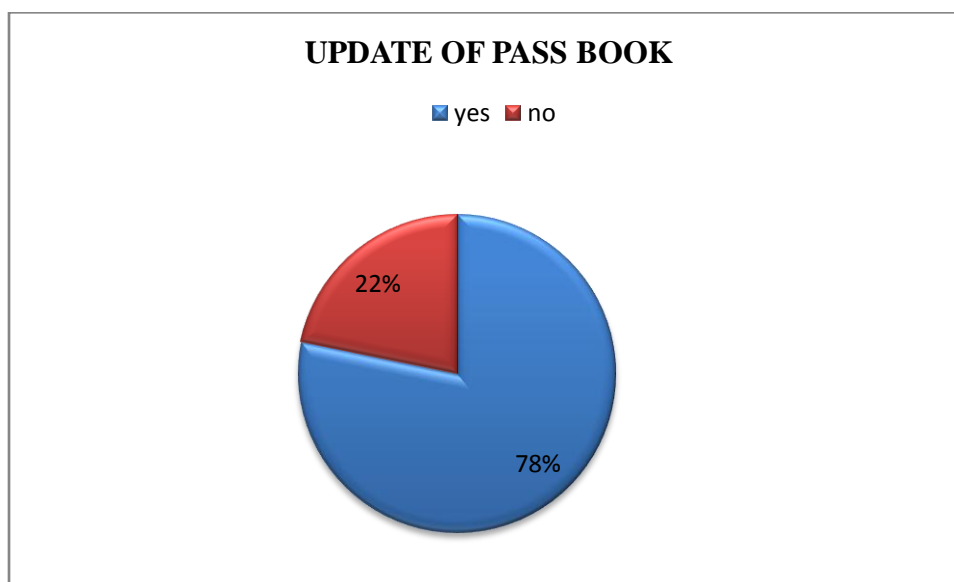
SERVICES	FREQUENCY OF USAGE			TOTAL
	VERY FREQUENTLY	FREQUENTLY	RARELY	
NEFT	1	3	6	10
RTGC			3	3
DEBIT CARD AND ATM	34	88	25	147
CREDIT CARD			16	16
MOBILE BANKING	13	33	24	70
E-LOBBY	2	3	5	10
	50	127	79	256



Majority of the debit card holders are using debit card frequently. Only few users of NEFT and E-LOBBY are using those facilities frequently. Average number of users is using mobile banking facility frequently. Credit card holders are using the credit card rarely.

#### Update of pass book:-

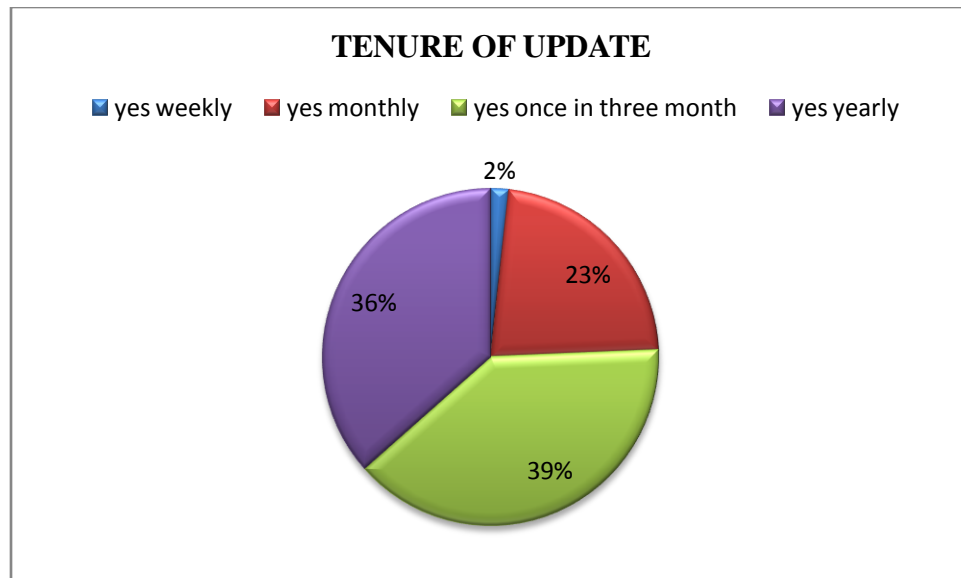
PASS BOOK UPDATE	RESPONDENTS	PERCENTAGE
YES	115	78.2
NO	32	21.8
	147	100



Most of the respondents are updating their passbook. Only few respondents are not updating their passbook.

#### Frequency of updating passbook

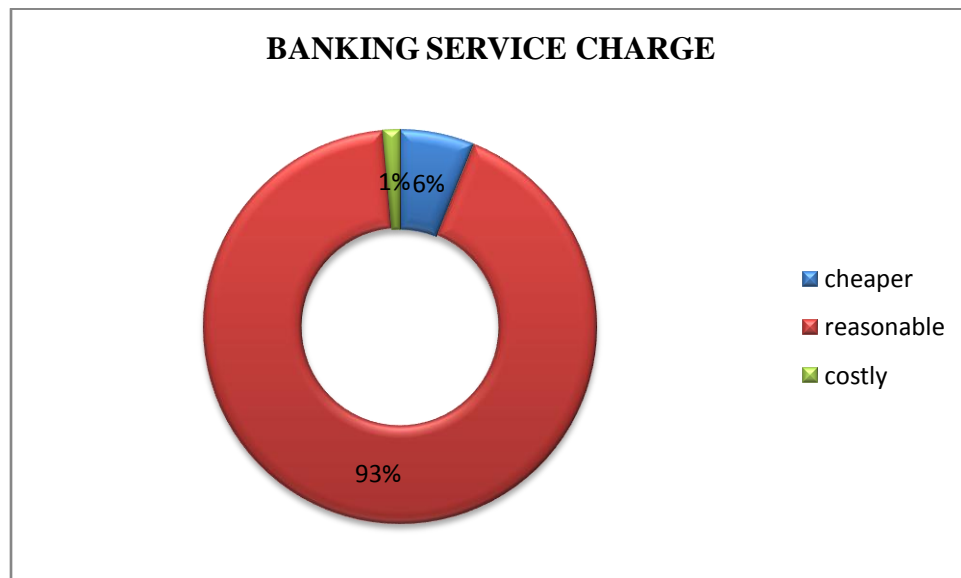
PASS BOOK UPDATE	TENURE	RESPONDENTS	PERCENTAGE
YES	WEEKLY	2	1.7
	MONTHLY	26	22.6
	ONCE IN THREE MONTH	45	39.2
	YEARLY	42	36.5
TOTAL		115	100



Nearly 40% of the respondents are updating their passbook once in 3 months. Few respondents update their passbook monthly

**Views regarding modern banking service charges.**

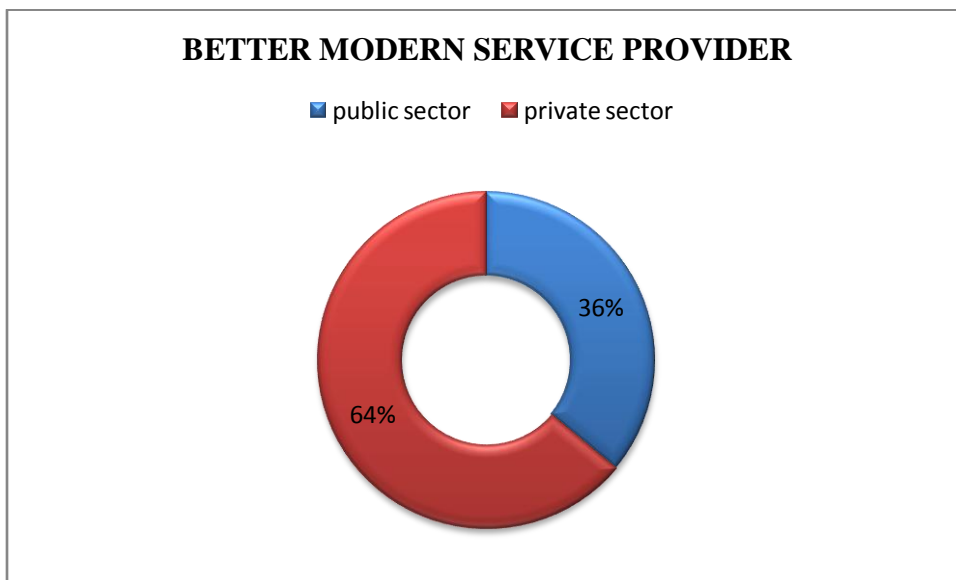
MODERN BANKING CHARGES	RESPONDENTS	PERCENTAGE
CHEAPER	9	6
REASONABLE	136	93
COSTLY	2	1
	147	100



About 93% of the respondents have opinion that the service charges for modern banking facilities are reasonable. Only few respondents are felt that service charges are cheaper.

**Better modern banking service provider**

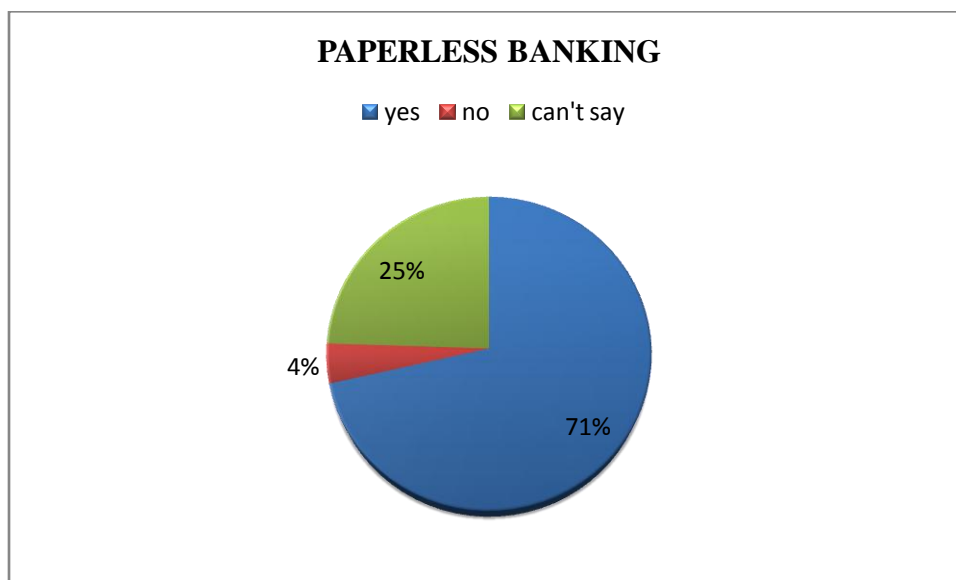
BANKS	VIEWS	PERCENTAGE
PUBLIC SECTOR	53	36
PRIVATE SECTOR	94	64
TOTAL	147	100



64% of the respondents are responded that private sector banks provide better services than the public sector banks.

**Views stating whether modern banking services has led to paperless banking.**

VIEWS	RESPONDENTS	PERCENTAGE
YES	105	71.4
NO	6	4
CAN'T SAY	36	24.6
TOTAL	147	100



Majority of the respondents have opinion that modern banking facilities will lead to paperless banking. Only few respondents are telling that it will not lead to paperless banking.

#### Hypothesis testing:-

**H<sub>0</sub>:** There is no significant relationship between gender and awareness of green banking facility

**H<sub>1</sub>:** there is significant relationship between gender and awareness of green banking facility

O	E	O-E	(O-E) <sup>2</sup>	(O-E) <sup>2</sup> /E
9	11.12	-2.12	4.4944	0.404173
1	2.47	-1.47	2.1609	0.874858
44	45.42	-1.42	2.0164	0.044395
24	29.67	-5.67	32.1489	1.083549

GREEN BANKING SERVICES								
GENDE R	NEF T	RTG S	DEBIT CARD AND ATM	CREDIT CARD	MOBILE BANKING	E- LOBBY	AL L	TOTA L
MALE	9	1	44	24	30	18	5	131
FEMAL E	27	7	103	72	72	7	5	293
TOTAL	36	8	147	96	102	25	10	424
	30		31.51	-1.51	2.2801			0.072361
	18		7.72	10.28	105.6784			13.68891
	5		3.09	1.91	3.6481			1.180615
	27		41.86	-14.86	220.8196			5.275194
	7		5.53	1.47	2.1609			0.390759
	103		101.58	1.42	2.0164			0.01985
	72		66.34	5.66	32.0356			0.4829
	72		70.49	1.51	2.2801			0.032346
	7		17.28	-10.28	105.6784			6.115648
	5		6.91	-1.91	3.6481			0.527945
$\chi^2$								30.19351

X-squared= 30.19351 df=6

#### Interpretation:-

Tabulated value of chi-square at 5% level of significance and 6 degrees of freedom is 12.59 and calculated value is 30.19351. So we can conclude that there is significant relationship between gender and awareness of green banking facility

**H<sub>0</sub>:** There is no significant relationship between gender and adoptability of green banking facilities

**H<sub>1</sub>:** there is significant relationship between gender and adoptability of green banking facilities

GENDE R	GRREN BANKING SERVICES						TOTA L
	NEF T	RTG S	DEBIT CARD AND ATM	CREDIT CARD	MOBILE BANKING	E- LOBBY	
MALE	3	1	44	3	28	9	88
FEMAL E	7	2	103	13	42	1	168
TOTAL	10	3	147	16	70	10	256

O	E	O-E	(O-E) <sup>2</sup>	(O-E) <sup>2</sup> /E
3	34.37	-31.37	984.0769	28.63186
1	1.03	-0.03	0.0009	0.000874
44	50.53	-6.53	42.6409	0.843873
3	5.5	-2.5	6.25	1.136364
28	24.06	3.94	15.5236	0.645204
9	3.44	5.56	30.9136	8.986512
7	6.56	0.44	0.1936	0.029512

3	1.97	1.03	1.0609	0.538528
103	96.47	6.53	42.6409	0.442012
13	10.5	2.5	6.25	0.595238
42	45.94	-3.94	15.5236	0.33791
1	6.56	-5.56	30.9136	4.712439
$\chi^2$				46.90032

X-squared=46.90032 df=5

#### Interpretation:-

Tabulated value of chi-square at 5% level of significance and 5 degrees of freedom is 11.070 and calculated value is 46.90032. So we can conclude that there is significant relationship between gender and adoptability of green banking facility

#### Findings of the study:-

- Majority of the respondents are aware about the meaning of Green Banking. Only 35% of the respondents are not aware about the meaning of Green Banking
- For most of the respondents Green Banking means it is both Electronic banking and paperless banking. Only few respondents told that it is either Electronic banking or Paperless banking
- All the respondents are aware about debit card facility. Good number of respondents had the knowledge of mobile banking facility. Only few respondents are aware about all the modern banking facilities.
- From the study it is clear that the majority of the respondents are aware about the green banking facilities. But they are not adopting them for their day today life. All the respondents are using debit card facility. Along with debit card only few respondents were using other facilities also.
- 34% of the respondents got information about green banking facilities from banks only. Good number of respondents got information from their friends and relatives. Among Other source of information major source is college.
- Majority of the respondents are using these facilities because of convenience, easy availability and saves time.
- 77 respondents are using debit card from more than 3 years. No one is using E-lobby and mobile banking more than 3 years. Most of mobile banking users started using that facility recently.
- Majority of the debit card holders are using debit card frequently. Only few users of NEFT and E-LOBBY are using those facilities frequently. Average number of users is using mobile banking facility frequently. Credit card holders are using the credit card rarely.
- 78% of the respondents are updating their passbook. Only few respondents are not updating their passbook
- Nearly 40% of the respondents are updating their passbook once in 3 months. Few respondents update their passbook monthly
- About 93% of the respondents have opinion that the service charges for modern banking facilities are reasonable. Only few respondents are felt that service charges are cheaper.
- 64% of the respondents are responded that private sector banks provide better services than the public sector banks.
- Majority of the respondents have opinion that modern banking facilities will lead to paperless banking. Only few respondents are telling that it will not lead to paperless banking.
- Tabulated value of chi-square at 5% level of significance and 6 degrees of freedom is 12.59 and calculated value is 30.19351. So we can conclude that there is significant relationship between gender and awareness of green banking facility. Majority of the female respondents are aware about green banking
- Tabulated value of chi-square at 5% level of significance and 5 degrees of freedom is 11.070 and calculated value is 46.90032. So we can conclude that there is significant relationship between gender and adoptability of green banking facility. Majority of the female respondents have adopted green banking.
- It is was found from our interaction with the bank managers that most of the customers are aware about green banking
- Bankers responded that customer face lot of technical issues during the execution of transactions such as delay in OTP, slow network and delay in response from their bank technical support team
- Bankers are of the opinion that security feature should be improved in case of e banking services because most of the customers are relying on traditional banking because of security threats caused by hackers.

- Some bankers have also stated that since some banks are in the interior parts and in rural areas reach of technology is difficult as the access to internet and mobile network is poor. They told that there are some educated customers in these parts they share their dissatisfaction because of the above.
- Majority of the bank managers agree that e-banking has led to reduction of operating cost, clerical work and saves a lot of time. The issue of debit card to all the customers itself has reduced frequent visit of customers to branch for withdrawal. This will reduce work in long run number of staff too. Other facilities can also help them in reducing their workload.
- Some of the bank managers also admitted that lack of knowledge and expertise among their own staff has led to poor response for e-banking services. Because they are not in a position to provide information or solve the issues of the customers which in some cases has also led the situation of complaints, closing of accounts with the bank.
- Majority of the bank managers stated that they are making all possible effort from their side to promote e-banking as it is a boon for them. Of course response depends on the customer's education level, knowledge, interest and even sometimes need too.

### **Suggestions:-**

- As effect of demonization all the banks and government of India is encouraging cashless transactions. It is very essential for the government to take the banks into confidence and make effort to educate the people regarding the various modes of cash less transactions.
- Banks should organize awareness programs were in at least once in a quarter at the branch level where in they call their customers and provide complete information's about the latest services, benefits and solutions for the problems in case if the customers encounter when they use a particular e-banking service. This will help in developing confidence of the customers and overcome the misconceptions about the e-banking services
- Banks should develop proper infrastructures so that there is a continuous and uninterrupted availability of service.
- All the mobile operators should improve their service coverage with proper availability of 3G / 4G services. Since mobile network is a key factor for internet and mobile banking services.
- Banks should setup more e-lobby centers where cash deposit, cheque deposit, passbook update and cash withdrawal is facilitated. This will help in reduce the customers at the branch saves time and, reduces operational cost.
- Staff has to be trained properly regarding the activation, execution and solving the issues relating to e banking services. It is pointed out from the survey that some staff doesn't provide e-banking facilities as they are not having the proper knowledge. They give escaping answers or postpone the request ultimately making the customers to get frustrated and forget about the option.
- Self-user creation should be encouraged in case of internet banking, mobile banking and other services. Because it can save time and activation can be done more quickly. This can reduce repeated visit of the customer to branch
- Banks should provide Internet Banking, Mobile Banking with activation pins when the customers open account with the bank in the form of Welcome Kit.
- Banks should remove transaction cost on various e-banking services, it should be minimized or eliminated if possible. After demonetization many customers are expressing their dissatisfaction because of cess charges levied on using of the debit/credit cards in petrol pumps. This will discourage the customers to go for cashless banking.
- Banks should improve the security features in the e-services so that risk of hacking and other misuse of the account can be eliminated. It's very essential to educate the customers regarding these security features because it will help them to build confidence about e-banking services and use the same.

### **Conclusion:-**

India is developing nation with majority of the population (about 65%) who belong to the age group of 21-35. It is cream of the country as it is the most productive population. Making this population technologically enabled will help in the advancement of the nation. It is believed that demonetization will increase the cash less transactions in the country. As India is a democratic nation real democracy can be achieved with the elimination of black money which is a major threat for the balanced economic development and equal distribution of wealth. For achieving the same the contribution of banks, RBI and Income Tax department is vital. Green Banking (E-Banking) is a main weapon which will help in achieving the welfare state.



**References:-**

1. www.economic times.com
2. www.businessstandard .com
3. www.crisilratings.com
4. www.scribd.com
5. www.ndtv.com

**Annexure:-****Objective of the study:**

- To find out the awareness of the concept of green banking among the customers of D.K
- To find out the measures taken by the bank to promote green banking
- To know the customer's adoptability to internet banking, mobile banking, use of plastic cards and e-lobby services.
- To find out the conveniences and inconveniences of green banking to customers.

**Personal information:-**

- Age :
- Gender :
- Level of education :
- Occupation :
- Income :

1) Are you aware about the meaning of green banking?

A) Yes

B) No

If yes,

A) It is an electronic banking

B) Paperless banking

C) Both a and b

2) I) of the following which electronic banking facility you are aware of?( mark the relevant)

A) NEFT

B) RTGS

C) Debit card and ATM

D) Credit card

E) Mobile banking

F) E-lobby

Which of the following facilities you have adopted?

A) NEFT

B) RTGS

C) Debit card and ATM

D) Credit card

E) Mobile banking

F) E-lobby

G)

3) How you are aware of these services?

A) Media

B) Friends and relatives

C) banks

D) Internet

E) Any other ( specify)

4) You opted green banking services because

A) Saves time

B) Convenient

C) Easy availability

D) All the above

5)

Services	Use	Years(mark the relevant)			Frequency of usage		
		Less than 1 year	1 to 3 years	More than 3 years	Very frequently	Frequently	Rarely
NEFT	Yes /no						
RTGS	Yes /no						
Debit card and ATM	Yes /no						
Credit card	Yes /no						
Mobile banking	Yes /no						
E-lobby	Yes /no						

6) Whether you update your bank pass book?

A) Yes

B) No

a) Weekly

b) Monthly

c) Once in 3 months

d) Once in a year

7) Do you think modern banking service charges are

A) Cheaper

B) Reasonable

C) Costly

If it is costly which of the service do you think it is costly?.....

8) According to you , the modern banking services offered better by

A) Public sector banks

B) Private sector banks

9) Do you think that modern banking services has led to paperless banking?

A) Yes

B) No

C) Can't say

D)

10) According to you, which of the following measures you recommend for paperless banking?

A) E-statement and mobile statement

B) Transfer to other account through ATM cards instead of issuing cheques

C) Use of plastic cards(debit &amp; credit cards) for making payments instead of cash and cheque

D) Transfer through Aadhar number (along with branch IFSC code)

E) All the above.

F)

11) What are the demerits of the following services (mark the problems)

Types of services	Problems
NEFT	a)Weekend services are not available b)Technical problems c)Delay in OTP
RTGS	a)Weekend services are not available b)Technical problems c)Delay in OTP
DEBIT CARD AND ATM	a)Technical problems b) Non availability of cash c) Withdrawal restrictions

	d) High service charges
CREDIT CARD	a) High service charges b) High interest c) Restriction for usage( card limit)
MOBILE BANKING	a) Network problem b) Operating system problem c) Security
E-LOBBY	a) Technical problems b) Lack of knowledge c) Non availability

 <p>ISSN NO. 2320-5407</p>	<p>Journal Homepage: - <a href="http://www.journalijar.com">www.journalijar.com</a></p> <h2 style="text-align: center;">INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)</h2> <p style="text-align: center;">Article DOI: 10.21474/IJAR01/3092 DOI URL: <a href="http://dx.doi.org/10.21474/IJAR01/3092">http://dx.doi.org/10.21474/IJAR01/3092</a></p>	 <p>INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR) ISSN 2320-5407 Journal homepage: <a href="http://www.journalijar.com">http://www.journalijar.com</a> Journal DOI: 10.21474/IJAR01</p>
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### RESEARCH ARTICLE

#### THE DISTRIBUTION OF ABO BLOOD GROUPS AND RHESUS FACTOR AMONG REGULAR BLOOD DONORS IN AL-MADINAH AL-MONAWARAH , SAUDI ARABIA 2016 .

\*Abdullah Mohammed AlBilali, Omar Badr AlFraidy, Hatem Hussein AlHarbi, Sultan Jameel Mhros, Hussam Atallah AlSayed, Khaled Majdi Tolah, Abduljawad Salem AlHarbi and Azhar AbdulRahman Kurban.

Taibah University.

#### Manuscript Info

##### Manuscript History

Received: 03 November 2016

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Published: January 2017

#### Abstract

**Objectives:** The study aimed to determine the distribution of ABO and Rhesus D (RhD) blood groups in Al-Madinah Blood Bank regular donors .

**Methods:** A cross-sectional study that was carried out at Al-Madinah Blood Bank during the period from 21 November 2016 to 15 December 2016 . The participants were regular blood donors , and the samples were collected during the time of blood donation.

**Results:** The frequencies of ABO groups were 45.3% for O group, 27.7% for A group , 18.9% for B group and 8.1% for AB group. For Rhesus factor it was 87.9% positive and 12.1% negative.

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#### Introduction:-

Until now , around 30 blood group systems are recognized according to International Society of Blood Transfusion[1]. Among these systems , ABO and Rh blood group systems have utmost importance. The importance of these two groups is due to the fatal complications that could be encountered in case there was incompatibility between the blood groups during the process of blood transfusion[2]. In addition to that , studies show relations between blood groups and some diseases [3-9].

In Saudi Arabia , some studies have been done to determine the distribution of ABO and Rh group systems . O group have had the highest incidence in the all-region of the kingdom and AB group were the lowest , while there was differences in the A and B groups distribution as A group tend to be higher in the west and lower in the east , while B group was higher in the east and lower in the south[10-13] .

#### Objective:-

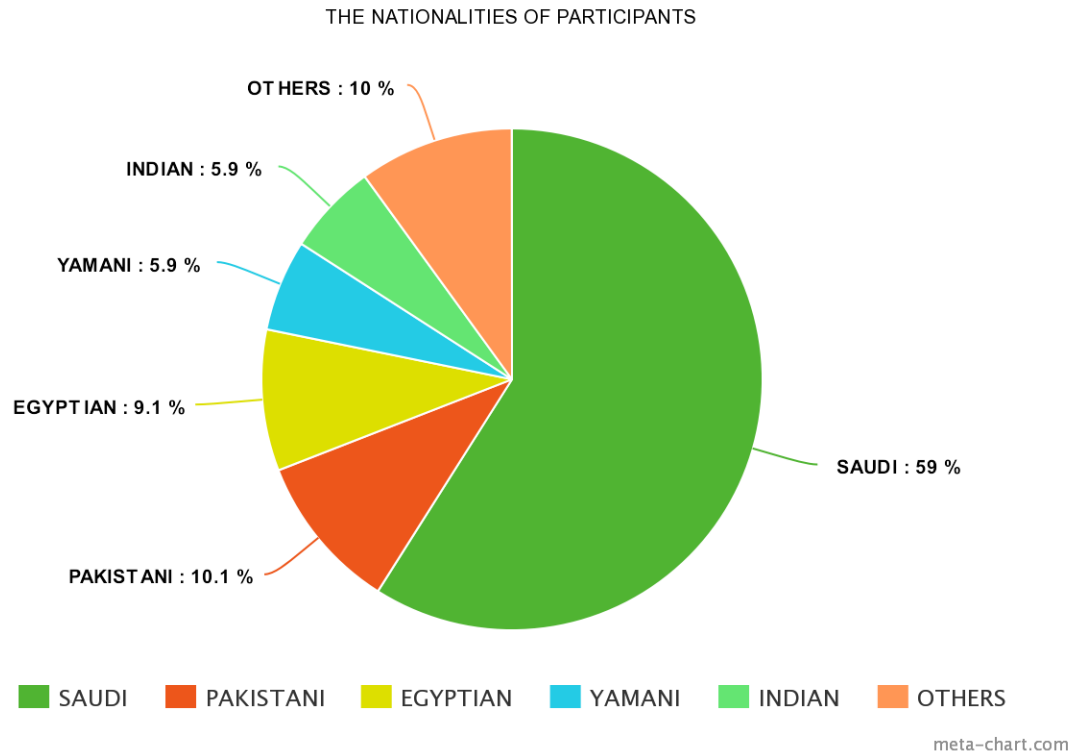
To know the frequencies of ABO and Rhesus D (RhD) blood groups in AL-Madinah Blood Bank regular donors and compare our results with the others that carried out in the kingdom.

#### Methodology:-

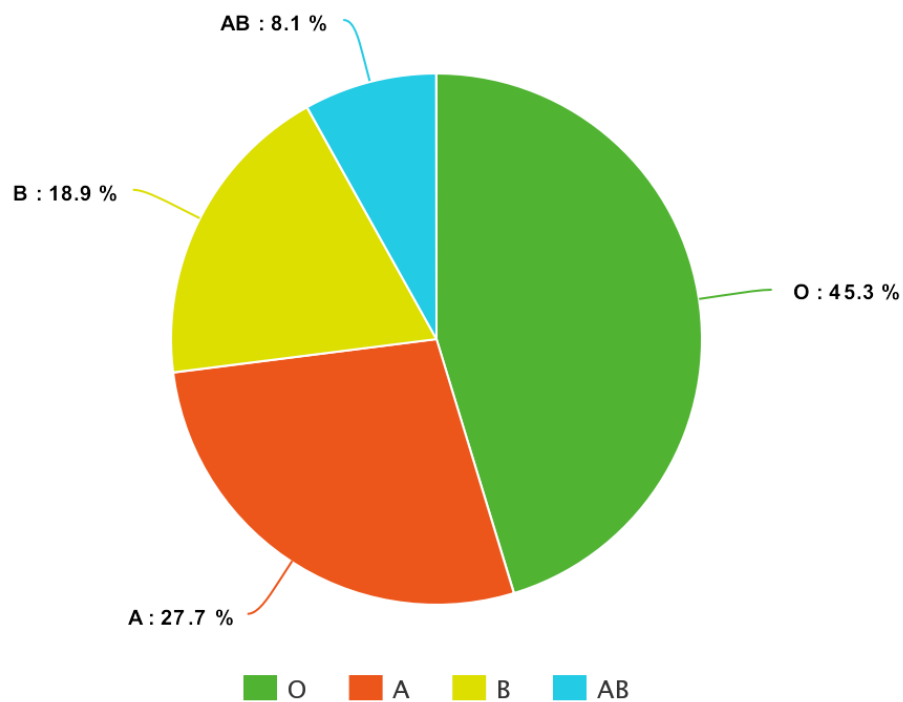
It was a cross-sectional study that was carried out at Al-Madinah blood Bank during the period from 21 November 2016 to 15 December 2016 . The subjects were 307 and they were regular blood donors . The sample was collected during the blood donation process after explaining the idea of the research to the subjects and taking the consent from them . Then the ABO blood groups and Rh factor were determined and the frequencies of the distribution of them were calculated .

**Result:-**

The total number of the subjects was 307 as 305 were male and 3 were female . 59% of the participants were Saudis and 41% were non-Saudis. The non-Saudis nationalities were as following: Pakistani 10.1% , Egyptian 9.1% , Indian and Yamani each of both were 5.9% and 10% were other nationalities . The frequencies of ABO groups for all the sample were 45.3% for O group, 27.7% for A group , 18.9% for B group and 8.1% for AB group. For RhD it was 87.9% positive and 12.1% negative. Overall frequency of ABO and Rhesus blood groups were as following : 38.4% O+ , 25.1% A+ , 16.9% B+ , 6.8% O- , 6.5% AB+ , 2.6% A- , 2.0% B- and 1.6% AB- . For Saudis, ABO frequencies were : O 47.0% , A 28.2% , B 15.5% and AB 9.4% , while the RhD were positive in 87.3% and negative in 12.7% . The overall frequencies for Saudis were O+ 38.1% , A+ 26.5% , B+ 14.4% , O- 8.8% , AB+ 7.7% , A- and AB- 1.7% for each of them and B- 1.1%.

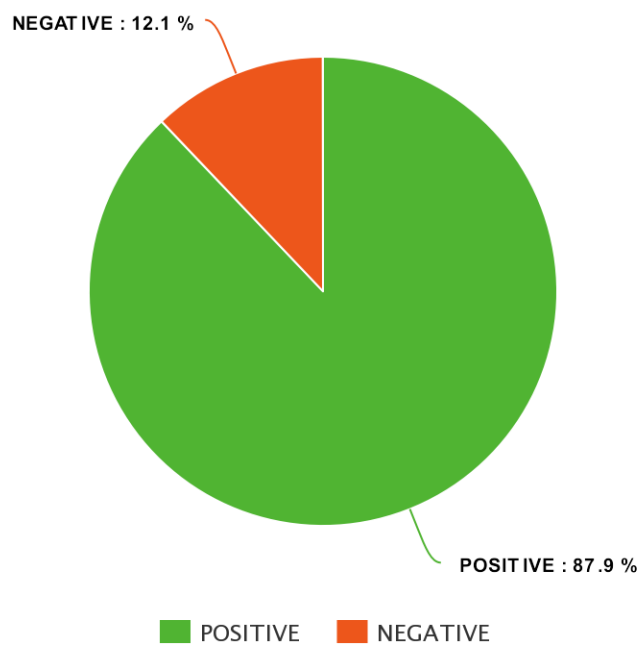


Frequencies of ABO groups in the whole sample



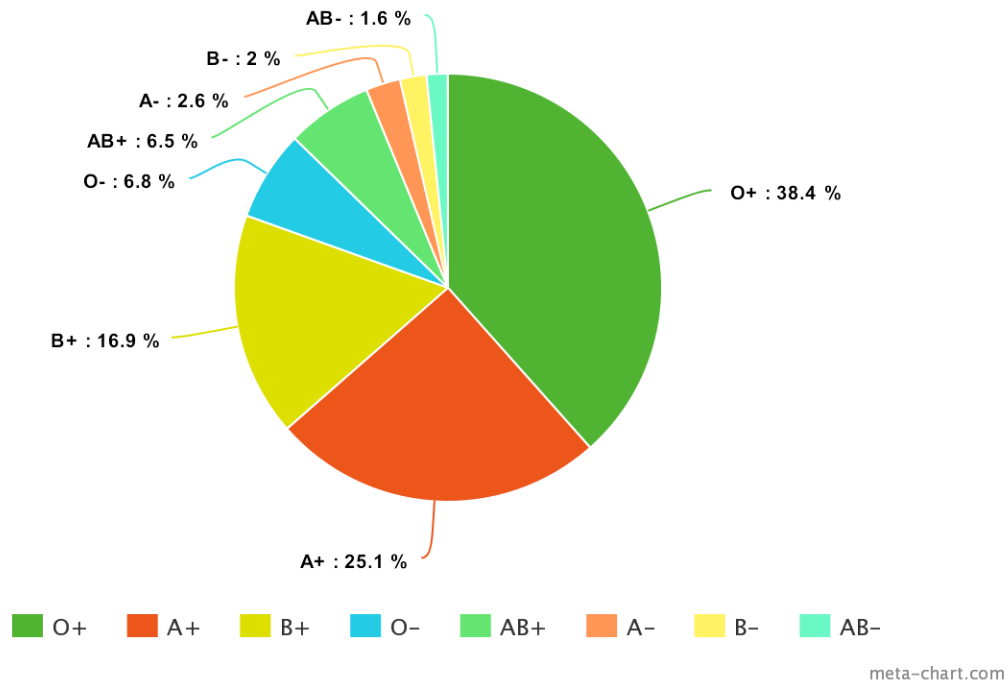
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THE PERCENTAGE OF Rh(D) FACTOR IN THE WHOLE SAMPLE

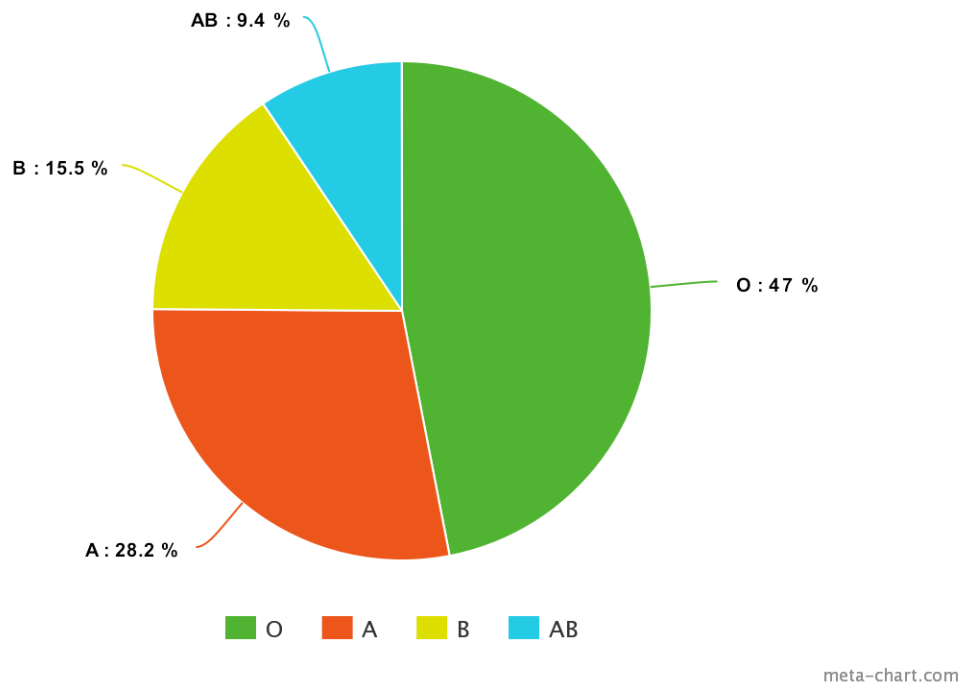


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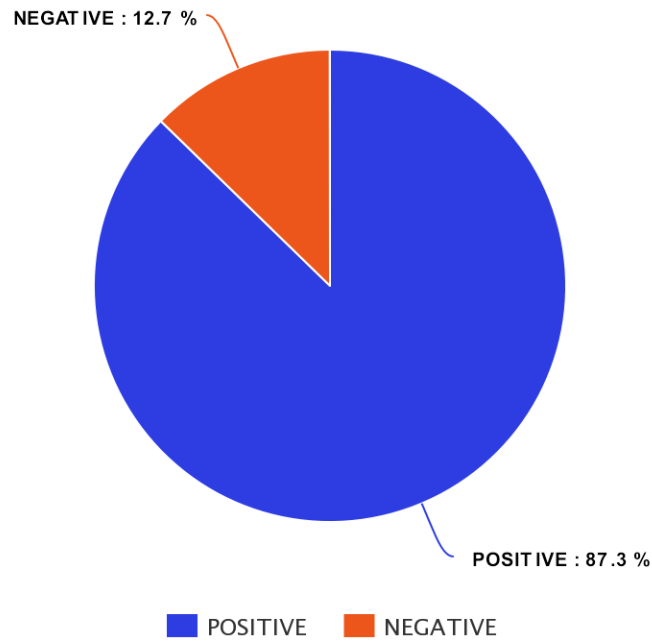
THE FREQUENCIES OF OVERALL ABO AND Rh(D) GROUPS IN THE WHLE SAMPLE



THE FREQUENCIES OF ABO GROUPS AMONG SAUDIS

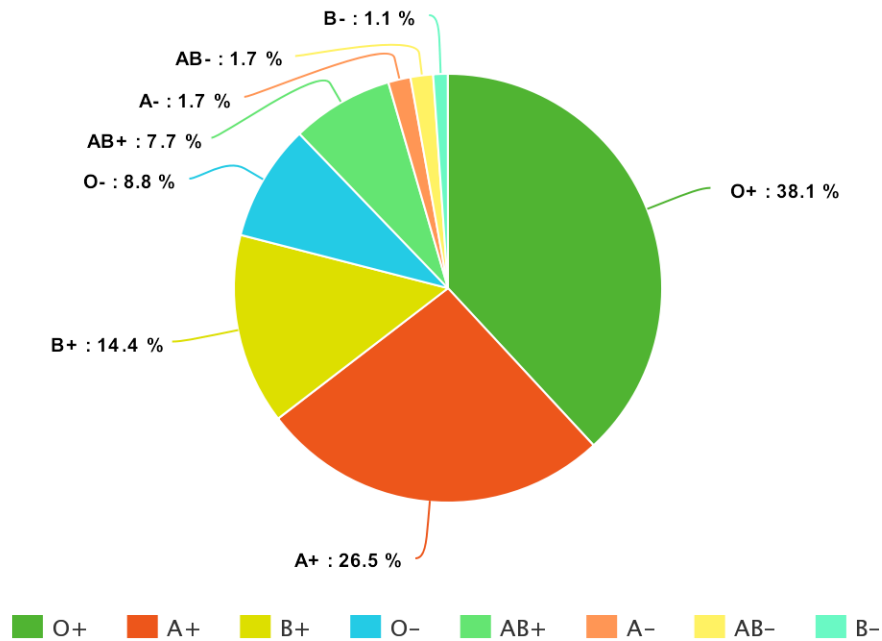


THE PERCENTAGE OF Rh(D) FACTOR AMONG SAUDIS



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THE FREQUENCIES OF OVERALL ABO AND Rh(D) GROUPS AMONG SAUDIS



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**Discussion:-**

The results of this study showed agreement with other studies that done in the kingdom in that O group has the highest prevalence and AB is the lowest[10-13]. In addition , it showed agreement in that A group has higher prevalence among Saudis in Al-Madinah (northwest) in compare with eastern region of the kingdom [10-12].

**Conclusion:-**

The study shows similarity in the frequencies of ABO and Rh blood groups with other studies that was done in Arabian Peninsula area .

**Conflict of interest and Funding:-**

The investigators have no conflict of interest to disclose , and they have not received any research grant from any organization for this project .

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3. Mr. Ibrahim AlNugrani .
4. ALL the workers in the Al Madinah Blood Bank

**References:**

1. Logdberg L, Reid ME, Zelinski T: **Human blood group genes 2010: chromosomal locations and cloning strategies revisited**. Transfusion medicine reviews 2011, **25**(1):36-46.
2. Mitra R, Mishra N, Rath GP: **Blood groups systems**. Indian Journal of Anaesthesia 2014, **58**(5):524-528.
3. Anstee DJ: **The relationship between blood groups and disease**. Blood 2010, **115**(23):4635-4643.
4. Gates MA, Wolpin BM, Cramer DW, Hankinson SE, Tworoger SS: **ABO blood group and incidence of epithelial ovarian cancer**. International journal of cancer 2011, **128**(2):482-486.
5. Hiltunen LM, Laivuori H, Rautanen A, Kaaja R, Kere J, Krusius T, Paunio M, Rasi V: **Blood group AB and factor V Leiden as risk factors for pre-eclampsia: a population-based nested case-control study**. Thrombosis research 2009, **124**(2):167-173.
6. Tufano A, Coppola A, Nardo A, Bonfanti C, Crestani S, Cerbone AM, Franchini M: **Non-O blood group as a risk factor for cerebral vein thrombosis**. Thrombosis and haemostasis 2013, **110**(1):197-199.
7. Wang DS, Chen DL, Ren C, Wang ZQ, Qiu MZ, Luo HY, Zhang DS, Wang FH, Li YH, Xu RH: **ABO blood group, hepatitis B viral infection and risk of pancreatic cancer**. International journal of cancer 2012, **131**(2):461-468.
8. Wiggins KL, Smith NL, Glazer NL, Rosendaal FR, Heckbert SR, Psaty BM, Rice KM, Lumley T: **ABO genotype and risk of thrombotic events and hemorrhagic stroke**. Journal of thrombosis and haemostasis : JTH 2009, **7**(2):263-269.
9. Zhang H, Mooney CJ, Reilly MP: **ABO Blood Groups and Cardiovascular Diseases**. International journal of vascular medicine 2012, **2012**:641917.
10. Al-Himaidi AR, Umar M: **ABO blood group distribution among Saudi citizens related to their regional and original tribal location**. Kuwait J Sc Eng 2002, **29**(11):75-81.
11. Bashwari LA, Al-Mulhim AA, Ahmad MS, Ahmed MA: **Frequency of ABO blood groups in the Eastern region of Saudi Arabia**. Saudi medical journal 2001, **22**(11):1008-1012.
12. Ozsoylu S, Alhejaily M: **The distribution of ABO and Rh blood groups in the Tabuk region and Medina Munewera, Saudi Arabia**. The Turkish journal of pediatrics 1987, **29**(4):239-241.
13. Sarhan MA, Saleh KA, Bin-Dajem SM: **Distribution of ABO blood groups and rhesus factor in Southwest Saudi Arabia**. Saudi medical journal 2009, **30**(1):116-119.



### RESEARCH ARTICLE

## INTRADURAL EXTRAMEDULLARY SPINAL CORD TUMORS: A RETROSPECTIVE STUDY OF LOCATIONS, TUMOR TYPES, AND SURGICAL OUTCOME

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### Abstract

**Introduction:** Intradural extramedullary spinal cord tumors (IESCT) account for approximately two thirds of all intraspinal neoplasms. The purpose of this study was to determine short- and long-term outcomes of surgery in patients with IESCT, and to study the clinical features that could be helpful in treatment of patients with these lesions.

**Methods:** A retrospective review of 25 operative IESCT cases between 2012 and 2014 was performed. Outcomes were scored at one month and at mean follow-up of 9 months postoperatively. In addition, patient demographics, tumor subtypes and locations were also considered. Statistical analysis was calculated utilizing Chi-square and Student's t-tests.

**Results:** There were 8 men and 17 women (mean age 48 y/o, range 18-87 y/o). Men presented at a younger age than women (44 vs 53 y/o,  $P < 0.02$ ). 18 (72%) patients presented with severe radiculopathy and/or myelopathy. The remaining 7 (28%) had symptoms typical of disc herniation. Mean duration of symptoms prior to diagnosis was 11 months. Schwannomas (10 patients) had the longest mean duration of symptoms (14.9 months), followed by meningiomas (8 patients, 8.4 months), and ependymomas (7 patients, 2 months).

**Conclusions:** Intradural extramedullary tumors, easily detected by MRI, are mostly benign and excellent clinicoradiological results can be obtained by microneurosurgery. Therefore, more active surgical approaches by neurosurgeons are recommended to decrease morbidity.

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### Introduction:-

Spinal tumors account for less than around 5-15% of the system neoplasms (1, 2). Intradural extramedullary spinal tumors (IESCT) represent around two thirds of those tumors (2, 3). Comparatively few printed reports have enough sample sizes to adequately analyze surgical outcomes, demographics, symptoms, and knowledge on growth varieties and locations (3,4,5,6). The foremost unremarkably encountered kinds of IESCT are schwannomas and meningiomas, with myxopapillary ependymomas encountered less oftentimes. The first objective of this study was to look at surgical outcomes following procedures for IESCT in a large retrospective cohort of patients. Secondary goals enclosed examination of clinical knowledge relating demographics, symptoms, growth location and sort that might be useful in clinical deciding.

## Materials and Methods:-

This is a retrospective study of twenty five surgical patients underwent operative removal of IESCT between 2012 and 2014 at Dr. D. Y. PATIL HOSPITAL KOLHAPUR. Parameters recorded according to patients demographics, symptoms (severity and duration), growth characteristics (anatomic and pathologic), operative follow-up and surgical outcomes.

Surgical intervention was indicated by combination of presenting symptoms (radiculopathy and/or myelopathy) and photography findings of magnetic resonance imaging (MRI), and computed tomographic (CT)-myelography.

Surgical outcomes were scored at one month and so at the mean follow-up amount. The mean follow-up was calculated from the interval between surgery and therefore the last complete clinical examination within the patient chart (in this study, 9 months). Patient records were fastidiously reviewed and surgical outcomes were scored strictly in step with the changed criteria of Odom, et al (Table 1) (7).

While recognizing the shortcomings of the Odom's criteria as a 'rough' outcome and morbidity assessment scale, we have a tendency to selected to use this methodology attributable to the uniform and standardized recording of those criteria altogether of our patient charts.

Descriptive statistics, Chi-square check and Student's t-test were used for knowledge analysis. Applied math significance was set at  $\alpha = 0.05$ .

### Figure 1

**Table 1:-** Modified Criteria of Odom, et al ().

<i>Excellent</i>	complete relief of pain and other symptoms*, return to full activity
<i>Good</i>	partial relief of pain, complete relief of other symptoms*, return to full activity
<i>Fair</i>	improvement with persistent limitation of activities
<i>Poor</i>	no improvement or further deterioration

\*note other symptoms = paresthesias, paresis, sensory loss

## Results:-

There were seventeen ladies and eight men (mean age  $48.7 \pm 16.56$  y/o, median 45.7 y/o, varies 18-88 y/o). Overall, men of younger age group presented than ladies (44.1 vs 53.5 y/o,  $P < 0.02$ ). The age distribution was bimodal with a serious peak around 40 y/o and a minor peak at around 70 y/o.

There were 3 primary growth types: schwannomas (10/25), meningiomas (8/25), and myxopapillary ependymomas (7/25) (Table 2A). Schwannomas were comparatively more common in men, meningiomas comparatively more common in ladies, and ependymomas distributed equally (Table 2A). Patients with meningiomas attended be older (57.6 y/o) than those with schwannomas (44.0 y/o) and ependymomas (40.2 y/o,  $P < 0.01$ ) (Table 2B). Growth locations varied between the 3 growths varieties in a very foreseeable fashion (Table 2C). Whereas schwannomas were distributed fairly equally among the 3 anatomic regions (cervical, thoracic, and lumbosacral), meningiomas predominated within the cervical and thoracic and ependymomas were predictably localized to the lumbar region. Of note, the magnitude relation of Schwannomas to Meningiomas to Ependymomas was around 5:4:2 during this study (actual magnitude relation 10:8:7).

The mean length of symptoms before designation was 11.3 months. Schwannomas had a statistically longer length of symptoms (14.9 months) than did meningiomas (8.4 months,  $P < 0.05$ ) for cervical and body part tumors. Ependymomas had shorter length of symptoms (2.0 months) than schwannomas (10.8 months,  $P < 0.05$ ) for lumbosacral tumors.

Out of twenty five patients, 20 (80.0%) had good results at one month, and twenty two (88%) had good results at 9 months postoperatively (the mean follow-up, range 1.5 to thirty six months). At the one month follow-up, 32% (8/25) patients had wonderful results, 56% (14/25) had good results, 8% (2/25) had fair results, and 2.5% (1/25) had Poor result. The patient with a Poor result at one month follow-up had terribly severe presenting symptoms, had very little immediate post-surgical improvement, and however was upgraded to the good result upon future follow-up.

At mean follow-up of 9 months (range 1.5 to thirty six months), overall outcomes improved considerably. Fifteen patients (60%) had wonderful results, thirty second (8/25) had good results, and 8 % ( 2/25) had fair results. Though at the 9 months mean follow-up the quantity of patients with poor results inflated by one, none of the patients had Poor results. The number of patients with wonderful results inflated by sixty fourth and therefore the number of patients with good results diminished by forty second (largely upgrades to wonderful). Just one patient with previously good result was downgraded to a fair result.

Three patients had multiple IESCT, all of that were schwannomas. One amongst these patients was NF-II positive. 3 patients developed repetition of their IESCT. 2 of those were schwannomas associate degreed one was an ependymoma.

While no metastases were noted throughout the 9 month mean follow-up amount (range one.5 to thirty six months), this study failed to specifically examine whether or not pathologic process illness did seem at a later time. No mortality was noted during this series, and therefore the solely complications enclosed a superficial wound infection and ending huskiness n one patient.

## Figure 2

**Table 1:-** Histological, demographic, and anatomic considerations for IESCT

### A. Distrubution of tumor by histologic type and patient gender in the series

Patient gender	Men	Ladies	Total
Schwanoma	3	7	10
Meningioma	3	5	8
Ependymoma	2	5	7
Total	8	17	25

### B. Tumor incidence by age group

Age	<40	40-80	>80
Schwanoma	3	3	4
Meningioma	1	4	3
Ependymoma	3	2	2
Total	7	9	9

### C. Tumor incidence by antomic location

Location	Cervical	Thoracic	Lumbar
Schwanoma	3	3	4
Meningioma	4	3	1
Ependymoma	1	3	3
Total	8	9	8

## Discussion:-

Surgery for IESCT is that the best treatment choice manufacturing wonderful overall results, with completes microsurgical excision being the modality of selection (6, 8). Trendy techniques change smart surgical outcomes with minmal morbidity and mortality (2, 3, 6, and 9). The present series corroborates this rivalry in this largely wonderful or smart results were achieved with few complications. In fact, no Poor results were noted during this study at the mean 9 month follow-up. Our findings believe those of others, with majority of clinical improvement noted either directly or at intervals 6 months of the operative intervention, with less notable clinical modification when this first amount (2). Alternative studies reported that length of surgical symptoms seems to correlate with operative improvement, which productive complete microsurgical neoplasm excision is of utmost importance (2,

10,11). In terms of mortality, our result correlate well with alternative series, with a reported vary between 0-4.4% (2, 5, 12, and 13).

Approximately 2/3 of patients during this study intimate with residual focal deficits, none of that were disabling. Others report similar outcomes among patients with similarities to our patient sample, with important improvement in 62-88% of cases and clinical worsening in exactly a minority of patients (1-5%) (2, 3). Number of the patient outcomes and practical scores on discharge and/or follow-up might differ across studies because of different assessment tools being used by different authors (2,3).

Reported frequencies of schwannomas among IESCT vary from forty third to sixty seven in alternative studies (53.7% during this series) (2, 6, 14,15). Schwannomas tend to supply localized pain, radiculopathy, and bodily structure equina syndrome. Most report schwannomas to be solitary, with a 2.5% malignancy rate, which carries a poor prognosis (16). During this study, schwannomas were the sole cluster of tumors while not a predominant location of incidence, and grooved seventy fifth of perennial tumors.

In this series, patients with meningiomas were older than those with alternative neoplasm varieties. Findings during this series believe the literature in this meningiomas area unit the second commonest IESCT, with about 80% localized to the pectoral region (71% during this series) (6, 10, 16,17). Between 75% to 85% of patients with meningiomas area unit ladies (81% during this series), UN agency tend to be older than patients with schwannomas or ependymomas (6, 10, 16). In line with previous reports, we have a tendency to found meningiomas to be additional aggressive in younger patients, with the higher incidence of myelopathy probably because of predilection of meningiomas for the thoracic region (18). Others describe higher operative morbidity related to IESCT set within the thoracic region (6). Meningiomas tend to supply the “dural tail” check in imaging scans in sagittal, axial, and coronal planes, and it's counseled that every one 3 planes of image be used (19). We have a tendency to follow this recommendation as a result of as several as 100 percent of meningiomas will be each intradural and meninges (20).

Myxopapillary ependymomas represent 14.9% on IESCT during this study, and though during this study ependymomas had equal distribution among men and ladies, another series reported doubly as several men as ladies (21). During this series, the mean age of the ependymoma cluster was below the mean age of patients with tumor or schwannoma. Symptomatically, ependymomas cared-for turn out bodily structure equina syndrome, localized pain, and radiculopathy.

A 4:2:1 quantitative relation of schwannomas to meningiomas to ependymomas was ascertained during this series. Though not specifically delineate by others, similar quantitative relation of neoplasm varieties will be noted in previous reports (2, 6, 15).

### Conclusions:-

Surgery for IESCT, with goal of complete neoplasm removal, may be a safe and effective choice. At the 9 month mean follow-up, majority of patients had complete or close to complete relief of symptoms and come back to full activity. In others, symptoms stopped progressing, and none of the twenty five patients worsened. Schwannomas and ependymomas were the sole histological varieties to recur. Demographic, tumor-specific and anatomic concerns are also clinically helpful once approaching IESCT.

### References:-

1. Porchet F, Sajadi A, Villemure JG. Spinal tumors: clinical aspects, classification and surgical treatment. *Schweiz Rundsch Med Prax.* 2003;92:1897-1905.
2. Hufana V, Tan JSH, Tan KK. Microsurgical treatment for spinal tumors. *Singapore med J.* 2005;46:74-77.
3. Albanese V, Platania N. Spinal intradural extramedullary tumors. Personal experience. *J Neurosurg Sci.* 2002;46:18-24.
4. Slin'ko EI, Al-Qashqish II. Intradural ventral and ventrolateral tumors of the spinal cord: surgical treatment and results. *Neurosurg Focus.* 2004;15:ECP2.
5. Peker S, Cerci A, Ozgen S, Isik N, Kalelioglu M, Pamir MN. Spinal meningiomas: evaluation of 41 patients. *J Neurosurg Sci.* 2005;49:7-11.
6. Prevedello DM, Koerbel A, Tatsui CE, Truite L, Grande CV, Ditzel LF, Araujo JC. Prognostic factors in the treatment of the intradural extramedullary tumors: a study of cases. *Arq Neuropsiquiatr.* 2003;61:241-247.

8. Odom GL, Finney W, Woodhall B. Cervical disk lesions. JAMA. 1958;166:23-28.
9. Yasargil MG, DeLong WB, Guarnaschelli JJ: Complete microsurgical excision of cervical extramedullary and intramedullary vascular malformations. Surg Neurol. 1975;4:211-24.
10. Schaller B. Spinal meningioma: relationship between histological subtypes and surgical outcome? 2005;75:157-161.
11. Gelabert-Gonzalez M. Primary spinal cord tumors. An analysis of a series of 168 patients. Rev Neurol. 2007;44:269-274.
12. Sandalcioğlu IE, Gasser T, Asgari S, Lazorisak A, Engelhorn T, Egelhof T, Stolke D, Wiedemayer H. Functional outcome after surgical treatment of intramedullary spinal cord tumors: experience with 78 patients. Spinal Cord. 2005;43:34-41.
13. Allen JC, Aviner S, Yates AJ, Boyett JM, Cherlow JM, Turski PA, et al. Treatment of high-grade spinal cord astrocytoma of children with "8 in 1" chemotherapy and radiotherapy: a pilot study of CCG-945. Children's Cancer Group. J Neurosurg. 1998;88:215-220.
14. Cohen AR, Wisoff JH, Allen JC, Epstein F. Malignant astrocytomas of the spinal cord. J Neurosurg. 1989;70:50-54.
15. el-Mahdy W, Kane PJ, Powell MP, Crockard HA: Spinal intradural tumors: Part I - Extramedullary. Br J Neurosurg. 1999;13:550-557.
16. Garrido P, Laher-Mooncey S, Murphree NL, Jonker N, Levy LF, and Makarawo S. Neoplasms involving the spinal cord in Zimbabweans: an analysis of 262 cases. Cent Afr J Med. 1994;40:201-204.
17. Fromme K, Miltner FO, Klawki P, Friedrich M. Spinal cord monitoring during intraspinal extramedullary tumor operations (peroneal nerve evoked responses). Neurosurg Rev. 1990;13:195-9.
18. Gelabert-Gonzalez M, Garcia-Allut A, Martinez-Rumbo R. Spinal meningiomas. Neurocirurgia (Astur). 2006;17:125-131.
19. Cohen-Gadol AA, Zikel OM, Koch CA, Scheithauer BW, Krauss WE. Spinal meningiomas in patients younger than 50 years of age: a 21-year experience. J Neurosurg. 2003;98:258-63.
20. Queckel LG, Versteeg CW. The "dural tail sign" in MRI of spinal meningiomas. J Comput Assist Tomogr. 1995;19:890-2.
21. Souweidane MM, Benjamin V. Spinal cord meningiomas. Neurosurg Clin North Am. 1994;5:283-291.
22. Wippold FJ 2nd, Smirniotopoulos JG, Moran CJ, Suojanen JN, Vollmer DG. MR imaging of myxopapillary ependymoma: findings and value to determine extent of tumor and its relation to intraspinal structures. AJR Am J Roentgenol. 1995;165:1263-7.
23. Brazier JE, Harper R, Jones NM, O'Cathain A, Thomas KJ, Usherwood T, Westlake L. Validating the SF-36 health survey questionnaire: new outcome measure for primary care. BMJ 1992;305:160-4.
24. Nurick S. The pathogenesis of the spinal cord disorder associated with cervical spondylosis. Brain 1972; 95:87-100.

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### RESEARCH ARTICLE

## BIOLOGICAL IMPACT OF MELATONIN ON THE HEALING OF ALBINO RATS' TONGUE ULCER

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#### Key words:-

melatonin, tongue ulcer, angiogenesis, collagen and  $\alpha$  smooth muscle actin.

### Abstract

The pineal gland hormone melatonin is known to have both anti inflammatory and immunomodulatory effect. The present study assessed the effects of intraperitoneal injection of 10 mg/kg melatonin on the healing of induced tongue ulcer. 40 male albino rats were subjected to tongue ulcer using biopsy punch, group I (n=20), received daily 6% ethanol as vehicle. Group II (n=20), received daily melatonin. Specimens were taken after 1<sup>st</sup>, 4<sup>th</sup>, 10<sup>th</sup> day. The histological examination revealed prominent inflammatory cells infiltrations and increased new blood vessels formation. Ultrastructural studies showed marked increase in collagen fibers synthesis. Immunohistochemical results using  $\alpha$  smooth muscle actin indicated significant difference between two groups after 4<sup>th</sup> days. Melatonin treatment improved the wound healing, both in terms of angiogenesis and orientation of collagen fibers. Considering our results, melatonin has powerful anti-inflammatory properties and has proven to be highly effective.

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### Introduction:-

Oral mucosal wound or mouth ulcers are sores or open lesions in the mouth which are caused by various disorders<sup>(1)</sup>. Wounds are not just physical problems due to blood loss or tissue damage, but they may threaten the individual survival by development of infection and sepsis due to invasion of micro-organisms or contaminants. Mucosal wounds occur frequently, and the healing of the mucosa is important in most surgical outcomes. Although wound healing in the oral mucosa is improved by sound surgical principles, yet it is also mediated by biologic processes beyond the surgeon's control<sup>(2)</sup>. It should also be noted that ulcers and/or erosions can be the final common manifestation, often clinically indistinguishable, of a wide and complex spectrum of conditions including traumatic lesions, infectious, vesiculo-bullous, neoplastic and gastrointestinal diseases<sup>(3)</sup>.

The process of wound healing takes place in three stages, the inflammatory, proliferative, and remodeling phases<sup>(4)</sup>. These phases consist of a sequence of events that ultimately leads to the re-establishment of tissue integrity and function. Persistence of inflammation during repair may lead to the development of chronic wounds that are of great concern to society. During the inflammatory phase, several enzyme systems are induced and growth factors are recruited, such as nitric oxide synthase (NOS), which help in the progression of healing and are critical for the repair process<sup>(5,6)</sup>.

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Platelets and fibroblasts, as well as macrophages and neutrophils, are important cellular elements of wound healing, engendering influential factors that affect processes of healing such as migration and proliferation. In addition, some specific proteins produced by the macrophages, such as growth factors, proteases, chemo attractants, and inhibitory factors, also play roles in the wound-healing process <sup>(7)</sup>.

Immune system cells and their products (including cytokines and growth factors) stimulate wound healing, especially during the proliferative phase and angiogenesis. Fibroblasts serve as the source of the endothelial cells that generate neovascularization during the angiogenesis process <sup>(8)</sup>.

Fibroblasts are the most abundant cellular components of connective tissue. They possess phenotypical heterogeneity and may be present in the form of smooth muscle cells or myofibroblasts (MFs). MFs are spindle-shaped cells with stress fibers and well developed fibronexus, and they display  $\alpha$ -smooth muscle actin immunohistochemically and smooth muscle myofilaments ultrastructurally. MFs play pivotal roles not only by synthesizing and producing extracellular matrix components, such as other connective tissue cells, but also are involved in force production. <sup>(9)</sup>

MFs generate forces in two ways. Initially, actin filaments present within the cell form a fibronexus by connecting intracellular actin and extracellular fibronectin fibrils using integrins. Integrins mediate the reorganisation and contraction of collagen matrices with the help of fibroblasts. Later, MFs connect to each other through gap junctions to form a "multicellular contractile unit". They again exert a force on the ECM by implicating the use of this unit. Both mechanisms exert a high level of tractional forces for wound closure <sup>(10,11)</sup>.

Wound healing in the oral cavity essentially occurs without scarring and is faster than skin healing. Fibroblasts in the oral mesenchyme possess a unique phenotypical character by constitutively expressing elevated  $\alpha$ -SMA levels, along with a higher capacity to contract collagen gel and a higher replicative potential than dermal fibroblasts, ultimately leading to a "scar-free" healing process. Factors, such as epidermal growth factor, vascular endothelial growth factor, bFGF, and insulin-like growth factor, present in saliva and crevicular fluid are responsible for wound healing in the oral cavity <sup>(12)</sup>.

The pineal gland hormone, melatonin (N-acetyl-5-methoxytryptamine) has a variety of physiological, immunological and biochemical functions. It is a direct endogenous free-radical scavenger and indirectly exerts chemoprotective, immunostimulatory and myelostimulatory effects <sup>(13)</sup>.

Melatonin is capable of entering the oral cavity by diffusing into the saliva from blood. As the majority of the melatonin remains bound to serum albumin, the amount of melatonin in saliva is approximately one third of that present in the blood <sup>(14)</sup>.

Melatonin is an anti-inflammatory agent known to reduce several hallmarks of inflammation. Melatonin down-regulates a variety of pro-inflammatory cytokines such as interleukin (IL)-1b, IL-6 and tumour necrosis factor- $\alpha$  by preventing the translocation of nuclear factor kappa B to the nucleus and its binding to DNA <sup>(15,16)</sup>. In addition, melatonin has been shown to inhibit the production of adhesion molecules that promote the sticking of leukocytes to endothelial cells and by reduces oxidative stress <sup>(15)</sup>. We therefore investigate if melatonin administration would improve the course of wound healing in albino rats' tongue ulcers

## Materials and Methods:-

This study was undertaken in the animal house of Faculty of Pharmacy of Mansoura University, based on an ethical approved protocol. 40 albino rats of average weight (150-200gm) were used in this study. The animals were fed a standard diet and free access to water.

The animals were divided into two groups

Group I: twenty rats were subjected to tongue ulcer and received daily 6% ethanol saline as a vehicle. Group II: twenty rats were subjected to tongue ulcer and received daily 10 mg/kg BW melatonin through intraperitoneal injection (IP).

## Melatonin preparation:-



Pineal indole melatonin (Sigma, St. Louis, MO, USA) was freshly dissolved in saline containing 6% ethanol (total volume of 1 ml/kg). Daily IP injections of 10 mg/kg BW were administered using a 1-mL syringe with a 25-gauge needle. To avoid interfering with the daily circadian rhythm, melatonin and saline were administered at 8:00 and 9:00 am<sup>(17)</sup>.

#### **Ulcer induction:-**

All surgical procedures were performed under general anesthesia, by intramuscular administration of 0.1 ml of ketamine hydrochloride (SIGMATEC Company) combined with 0.05 ml of xylazine hydrochloride (ADWIA Company), per 100 g body weight of the animal. After anesthesia, the lingual mucosa was antiseptically cleaned with 2% chlorhexidine then a surgical mucosal wound was made by using biopsy punch (Acu-Punch, Acuderm Inc., Ft. Lauderdale, FL, USA) to ensure that all ulcers will have the same size. The ulcer was circular in shape about 4mm in diameter and 2mm in depth.

#### **Specimens' preparation:-**

After ulcer induction both groups, specimens were obtained from each animal after one day, 4 days and 10 days respectively; tongue from each animal were removed and immediately fixed with 10% formalin solution and become ready for histological, and immunohistochemical for alpha smooth muscle actin. Specimens were put in glutaraldehyde fixative (4%) solution for electron microscope preparation.

#### **Computer Assisted digital image analysis (Digital morphometric study):-**

Slides of IHC (alpha smooth muscle actin) were photographed using Olympus<sup>®</sup> digital camera installed on Olympus<sup>®</sup> microscope with 1/2 X photo adaptor, using 40 X objective. The result images were analyzed on Intel<sup>®</sup> Core I3<sup>®</sup> based computer using VideoTest Morphology<sup>®</sup> software (Russia) with a specific built-in routine for stain quantification, results were expressed as integrated density.

#### **Statistical Analysis:-**

Data was analyzed using Statistical Package for Social Science software computer program version 17 (SPSS, Inc., Chicago, IL, USA). Quantitative data was presented in mean and standard deviation. Student's t-test was used for comparing means of the two groups. P value less than 0.05 was considered statistically significant.

#### **Results:-**

##### **Clinical Observations:-**

Three rats were excluded from our study; 2 rats from group I were died after one day of ulcer induction, one rats from group II was died after one week of ulcer induction. All these rats were compensated by others.

##### **Light microscopic results:-**

##### **Haematoxylin and Eosin Stain:-**

##### **After one day of ulcer induction:-**

The specimens of group I revealed discontinuity of the epithelium and the underlying connective tissue, the granulation tissue showed inflammatory cell infiltration (Figs. 1A&1a). While group II section showed granulation tissue formation, inflammatory cell infiltration and dilated blood vessels. Mitotic figures appeared in the epithelium which representing the beginning of the epithelial proliferation (Figs. 1B&1b)

##### **After four days of ulcer induction:-**

The sections of group I showed slight proliferation of the covering epithelium and formation of the granulation tissue with dense inflammatory cell infiltration (Figs. 2A, 2a). While in group II : The sections showed the beginning of the healing process via proliferation of the epithelium. The granulation tissue appeared with fibroblasts, collagen fibers, inflammatory cell infiltrations (lymphocytes and macrophage appeared) and newly formed blood vessels (Figs. 2 B, 2b).

##### **After ten days of ulcer induction:-**

Group (I) showed the healing process appeared by prominent proliferation of the covering epithelium to close the ulcer margin as well as the connective tissue stroma that showed fibroblasts, collagen bundles, newly formed blood vessels and few inflammatory cells (Figs. 3 A, 3a).

Group (II) showed complete reepithelialization of the ulcerative area with normal stratification, reorganization of the

epithelium and the underlying connective tissue (Figs. 3 B, 3b).

Immunohistochemical stain results:

The immunohistochemical positive results were detected as brown deposits using alpha smooth muscle actin stain (Figs. 4).

Statistical results: using Paired Student's t-Test. There were no significant difference after one and ten days, while after four days, there were significant difference in the mean of  $\alpha$  smooth actin of group I, II (Table 1).

Transmission electron microscope results

After one day; group I: There was little infiltration of the granulation tissue with neutrophils with widening of the intercellular spaces between the cells of the mucosa (Figs. 5, A). Group II: There was heavy infiltration of the granulation tissue with inflammatory cells (neutrophils) with normal intercellular spaces between the cells of the mucosa (Figs. 5, B)

After four days; group I: the sections showed irregular shaped fibroblasts and loosely arranged collagen bundles (Figs. 5 ,C).. Group II: the fibroblasts cells appeared regular spindle shaped with more closely packed collagen bundles (Figs. 5, D)

After 10 ten days; group I: the collagen fibers are loosely aligned (Figs.5,E) while in group II there were more better aligned collagen fibers (Figs. 5,F).

## Discussion:-

In this study, a model of wound healing has a clinical condition that is frequently encountered in traumatic oral ulcers. An experimental time period of 10 days was chosen because most oral wounds even if infected, would show complete healing by the end of this time period. The wounds of this study were all made under the same experimental conditions and were standardized for size, depth and site. The choice of male rats also cancelled the effect of sex hormones on wound healing.

Melatonin, a hormone secreted mainly by pineal gland has been found to have antioxidant and anti-inflammatory properties in the oral cavity where it reaches through saliva<sup>(18)</sup>. The histological study demonstrates that melatonin accelerates the process of normal wound healing by interfering and modulating key biological processes involved in driving the wound healing response including inflammation, angiogenesis and collagen synthesis in rats. the healing process appeared by prominent proliferation of the covering epithelium to close the ulcer margins as well as the connective tissue stroma that showed fibroblasts, collagen bundles, newly formed blood vessels and few inflammatory cell. The present study reported the beneficial effects of melatonin on wound healing, which comes in accordance with Soybir et al., who investigated the role of melatonin in an experimental wound healing model and detected a higher number of macrophages, fibroblasts, neovascularizations, and higher collagen density in treated animals. They determined that exogenous melatonin has positive effects on the angiogenic phase of wound healing<sup>(19)</sup>.

Angiogenesis occurs during the proliferative phase of healing which is an important part of the wound healing process<sup>(20)</sup>. Endothelial cells proliferate and migrate during new blood vessel formation and new vessels provide nutrients and oxygen to the newly formed tissue. These events are known to be initiated and driven by various growth factors especially VEGF165, the biologically active and most potent angiogenic protein known<sup>(21)</sup>. During normal wound healing, new blood vessel formation is initiated on day 3, peaks at day 7 and is essential for the formation of granulation tissue<sup>(22)</sup>. In the present study, the angiogenic process peaked after fourth day in the melatonin treated wounds, implying that granulation tissue formation was accelerated. This results on the effect of melatonin on angiogenesis in wounded tissue is supported by Pugazhenth et al., that melatonin treatment accelerate the angiogenic process, increasing the formation of new blood vessels and elevating the level of vascular endothelial growth factor protein expression during granulation tissue formation<sup>(23)</sup>.

The role of growth factors in the wound-healing process has been demonstrated. Platelet derived growth factor (PDGF) and TGF are well known growth factors secreted during wound healing by the  $\alpha$  granules of platelets, macrophages, and fibroblasts<sup>(24)</sup>. Both showed an increase in the content of collagen in the early phase of wound healing. Growth factors bind to the target with their specific cellular surface receptors and induce the cells to migrate, to divide, and to produce the other elements that influence the wound-healing process<sup>(25)</sup>. Melatonin induces

the production of interleukin-1, tumor necrosis factor (TNF)- $\alpha$  cytokines, and transforming growth factor (TGF). In addition, melatonin is an immunomodulator and a neuroendocrine hormone, and stimulates both monocyte cytokine and fibroblast proliferation, which influence angiogenesis<sup>(26-28)</sup>.

Melatonin mainly exerts antioxidant effects by interacting with melatonin receptor 1 (MT1) and melatonin receptor 2 (MT2) receptors on cells<sup>(29-30)</sup>. Perhaps, a potent anti-inflammatory property of melatonin is linked to its ability to act as a scavenger of exogenous and endogenous reactive oxygen species (ROS) and reactive nitrogen species (RNS)<sup>(31)</sup>.

During wound healing, fibroblasts differentiate into myofibroblasts, which generate large traction forces for wound closure and tissue remodeling. One of the best-characterized markers of myofibroblast phenotype is  $\alpha$ -SMA<sup>(32)</sup>.

In our study  $\alpha$ -SMA results peaks after 4<sup>th</sup> days, with significant difference in melatonin treated groups. In agreement with our results Cornelissen et al., found that normally no  $\alpha$  SMA was found until 4 days post wounding and the number of positive cells increase from 4 to 8 days post wounding, at 8 or 9 days the majority of the granulation tissue fibroblasts were stained for  $\alpha$  SMA and at about 12 days the proportion of  $\alpha$  -SMA positive cells are steadily decreased till 22 post wounding where they found no single positive myofibroblast in the newly formed connective tissue<sup>(33)</sup>.

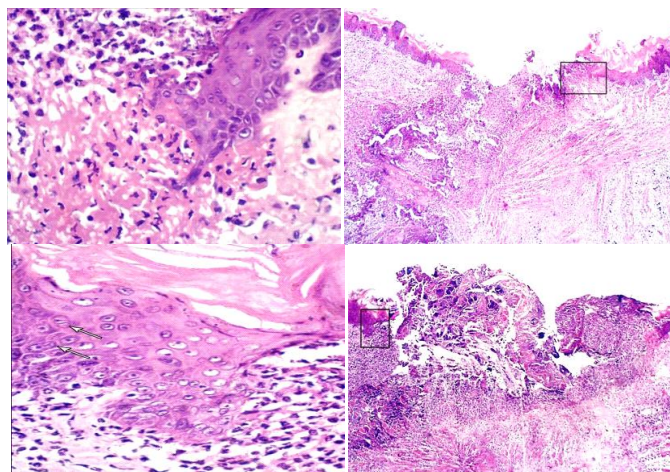
The favorable effects of exogenous melatonin on wound healing were detected using ultrastructural study. Fibroblasts were denser with higher proliferation and more closely packed collagen fibers. Mechanisms associated with melatonin that may accelerate wound healing were presently investigated. One mechanism was TGF- $\beta$  associated collagen synthesis. Melatonin has been shown to induce production of TGF- $\beta$ ,<sup>(19)</sup> which plays a significant role in promoting collagen synthesis and healing the wound, also the direct action of pineal hormone on the myofibroblasts of the scar could be responsible for melatonin-induced augmentation of collagen level<sup>(34)</sup>. Moreover, this effect is dependent on the activation of melatonin membrane receptors on the cells synthesizing collagen<sup>(35)</sup>.

Melatonin affects the activity and the levels of cellular mRNA of antioxidant enzymes including superoxide dismutase, glutathione peroxidase, and glutathione reductase<sup>(36)</sup>. It may stimulate and regulate gene transcription of these enzymes via its receptors<sup>(37)</sup>. Melatonin can cross all biological membranes, and thus it can indicate protective effects against oxidative stress. Melatonin reaches the nucleus of the cell and protects essential intracellular structures, including DNA, from oxidative damage<sup>(38)</sup>.

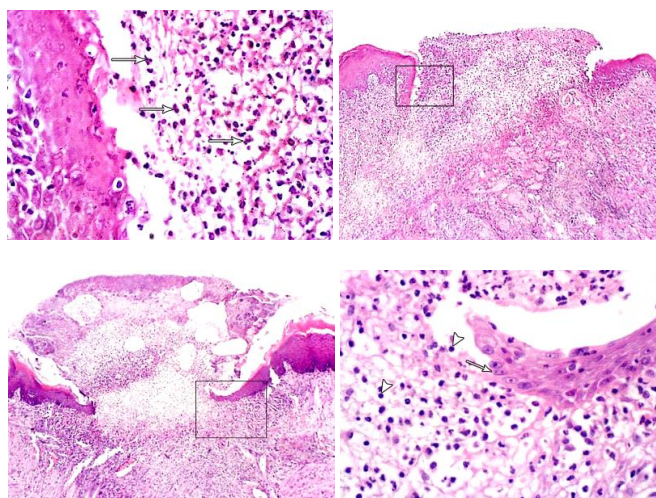
Another investigation of the same authors revealed that collagen accumulation in the intact skin is under the control of the pineal gland. However, it was also reported that the effect of melatonin depends on the time of the application, so that morning injections increase the level of collagen in a wound<sup>(39)</sup>. Hence, in the current experiment, melatonin injections were administered in the morning, between 8:00 am and 9:00 am for regular collagen production during wound healing. Previous studies showed that dosage and duration of the exogenous melatonin administration is variable and depends on the purpose of usage. The suggested dose required to exert antioxidant properties was considered

10mg/kg BW, in animal experiments<sup>(40)</sup>. However Bulbulla et al. observed that subcutaneous melatonin application decreased collagen synthesis and epithelium proliferation and indicated undesirable effects on incision and anastomotic wound healing in normal and pinealectomized rats<sup>(41)</sup>.

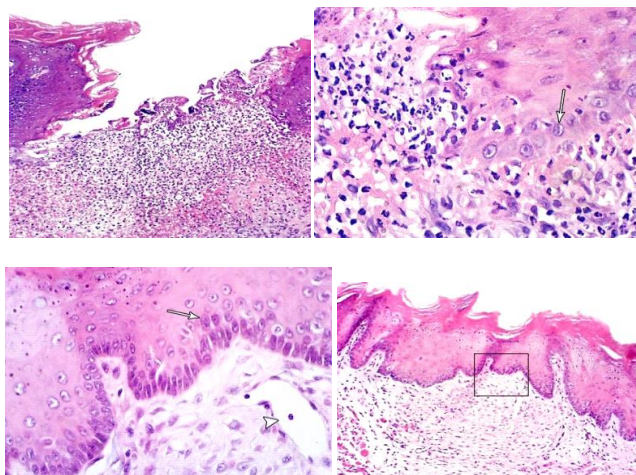
Our study demonstrates that the administration of melatonin leads to significantly improved wound healing, the mechanism by which melatonin acts in this process, may be secondary to growth factors. Further research is required to establish in greater detail the effects of melatonin on the wound-healing process.



**Fig 1:-** Group I: A, a: showing discontinuity of the epithelium and the underlying connective tissue. The granulation tissue appears with inflammatory cell infiltration. Group II: B, b: showing the granulation tissue appears with inflammatory cell infiltration with different form of mitotic figure (arrow) (H&E, x100, x400)

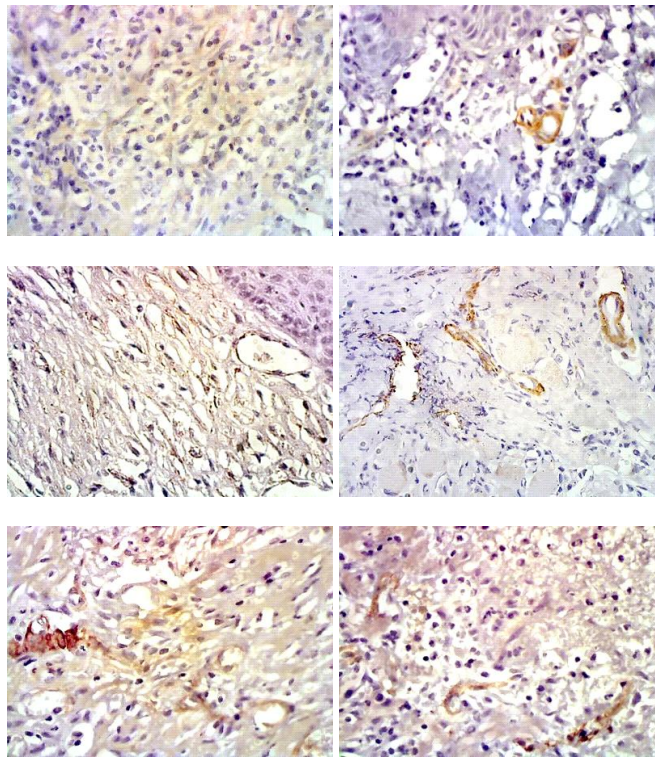


**Fig 2:-** Group I: A,a showing slight proliferation of the covering epithelium and formation of granulation tissues with heavy inflammatory cell infiltrations (white arrows). Group II: B,b showing beginning of the process via proliferation of the epithelium. The granulation tissue consists of fibroblasts, blood vessels, and inflammatory cell infiltration (arrow heads) and the epithelium shows mitotic figures (white arrow) (H & E stain, x100, 400).





**Fig 3:-** Group I: A,a showing proliferation of the epithelium with different mitotic figure (arrow) and inflammatory cell infiltration. Group II: B,b showing complete reepithelialization (arrow) of the ulcer with proper architecture of collagen bundles in the lamina propria and dilated blood vessels (arrow head) (H & E stain, x100, 400).



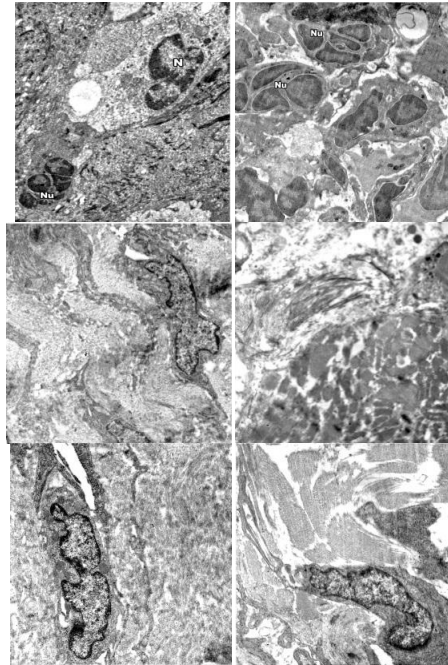
**Figs. 4:-** Group I (a) after 1 day, showing expression of  $\alpha$ -SMA in the wall of blood vessels only. (b) After 4 days, positive immunoreactive at the granulation tissues. (c) After 10 days expression of  $\alpha$ -SMA in fibroblasts and newly formed blood vessels. Group II (d) After 1 day, showing expression of  $\alpha$ -SMA in the wall of blood vessels and very weak reaction in the lamina propria. (e) After 4 days, increased expression of  $\alpha$ -SMA in the granulation tissues. (f) After 10 days, increased expression of  $\alpha$ -SMA in the wall of blood vessels and lamina propria (IHC stain,  $\alpha$ -SMA, x400)

**Table 1:-** difference in the mean of  $\alpha$  smooth actin of group I, II using Paired Student's t-Test:

	Group I		Group II		P
	Mean	$\pm$ SD	Mean	$\pm$ SD	
Day1(10*5)	210854.3	61123.39	222756.23	65369.27	0.67
Day4	4708992.000	1472369.	7219015.000	1918931.	0.006
Day10	1647870.000	436412.	1889056.000	574152.	0.3

Not significance ( $p > 0.05$ )

**Figure 4:-** Line chart represents the mean differences between group (I, II) at 4<sup>th</sup> days.



**Figs 5:-** Transmission electron micrograph showing (A) Group I, after 1 day, showing neutrophils(Nu) and abnormal configuration of the nuclei of the cell of the epithelium. (B) Group II, after 1 day, showing heavy infiltration with neutrophils (A,B x 11700). (C) Group I, after 4 day showing loosely packed collagen fibers and irregularly arranged. (D) Group II, after 4 day showing regular spindle shaped fibroblasts with more packed and better aligned collagen fibers (C,D x17500). (E) Group I, after 10 day. The fibroblast was irregular in shape and collagen fibers were loosely packed. (F) Group II, after 10 day, showing spindle shaped fibroblast and densely packed collagen fibers (E,F x14600).

### References:-

1. Gonsalves W.C, Chi A.C, Neville B.W. Common oral lesions: Part I. Superficial mucosal lesions. *Am. Fam. Physician.* 2007;75(4):501-507.
2. Markiewicz M.R, Margarone III J.E, Barbagli G, Scannapieco F.A. Oral Mucosa Harvest: An Overview of Anatomic and Biologic Considerations. *EAU-EBU Update Series.* 2007; 5:179-187
3. Campisi G, Compilato D, Cirillo N, Ciavarella D, Panzarella V, Amato S, Lo Muzio L. Oral ulcers: three questions on their physiopathology. *Minerva Stomato.* 2007; 56 (5):293-302.
4. Cohen KI, Diegelmann RF, Yager DR, Wornum IL, Graham, Crossland MC. Wound care and wound healing. In: Schwartz SI, editor. *Principles of surgery.* 9th ed. New York: McGraw-Hill; 1999. p. 263–295.
5. Appleton I. Wound healing: future directions. *I Drugs* 2003; 6:1067–1072.
6. Kapoor M, Howard R, Hall I, Appleton I. Effects of epicatechin gallate on wound healing and scar formation in a full thickness incisional wound healing model in rats. *Am J Pathol.* 2004; 165:299–307.
7. Gruber BI, Marchese MJ, Kew R. Angiogenic factors stimulate mast-cell migration. *Blood.* 1995;86:2488–2493.
8. Gu XH, Terenghi G, Kangesu T, Navsaria HA, Springall DR, Leigh IM, et al. Regeneration pattern of blood vessels and nerves in cultured keratinocyte grafts assessed by confocal laser scanning microscopy. *Br J Dermatol.* 1995;132:376–383
9. Bagul N1, Ganjre A1, Goryawala SN1, Kathariya R1, Dusane S1. Dynamic role of myofibroblasts in oral lesions. *World J Clin Oncol.* 2015; 10(6):264-271.
10. Tomasek JJ, Gabbiani G, Hinz B, Chaponnier C, Brown RA. Myofibroblasts and mechano-regulation of connective tissue remodelling. *Nat Rev Mol Cell Biol.* 2002; 3: 349-363.
11. Grinnell F. Mini-Review on the cellular mechanisms of disease, fibroblasts, myofibroblasts, and wound contraction. *J Cell Biol.*1994; 124: 401-404
12. Lygoe KA, Wall I, Stephens P, Lewis MP. Role of vitronectin and fibronectin receptors in oral mucosal and dermal myofibroblast differentiation. *Biol Cell.* 2007; 99: 601-614
13. Winiarska K, Fraczyk T, Malinska D, Drozak J, Bryla J. Melatonin attenuates diabetes-induced oxidative stress in rabbits. *J. Pineal Res.* 2006; 40:168-176.
14. Cutando A, Galindo P, Gomez-Moreno G, Arana C, Bolanos J, Acuna-Castroviejo D. Relationship between salivary

- melatonin and severity of periodontal disease. *J Periodontol.* 2006;77:1533e8.
15. Reiter RJ, Tan DX, Osuna C, Gitto E. Actions of melatonin in the reduction of oxidative stress: a review. *J Biomed Sci.* 2000; 7:444–458.
  16. Rodríguez MI, Escames G, Lo'pez LC. Chronic melatonin treatment reduces the age-dependent inflammatory process in senescence-accelerated mice. *J Pineal Res.* 2007; 42:272–279.
  17. Klimentova J, Cebova M, Barta A, Matuskova Z, Vrankova S, Rehakova R, Kovacsova M, Pechanova O. Effect of melatonin on blood pressure and nitric oxide generation in rats with metabolic syndrome. *Physiol Res.* 2016; 24: 65.
  18. Mehta A, Kaur G. Potential role of melatonin in prevention and treatment of oral carcinoma. *Indian Journal of Dentistry.* 2014 ; 5(2):86-91.
  19. Soybir G, Topuzlu C, Odabas O et al. The effects of melatonin on angiogenesis and wound healing. *Surg Today* 2003; 33:896–901.
  20. Hoeben A, Landuyt B, Highley MS. Vascular endothelial growth factor and angiogenesis. *Pharmacol Rev.* 2004; 56:549–580.
  21. Abd-El-Aleem SA, Ferguson MW, Appleton I. Expression of COX isoforms in normal human skin and chronic venous ulcers. *J Pathol.* 2001; 195:616–623.
  22. Galiano RD, Tepper OM, Pelo CR. Topical VEGF accelerates diabetic wound healing through increased angiogenesis and by mobilizing and recruiting bone marrow-derived cells. *Am J Pathol.* 2004; 164:1935–1947.
  23. Pugazhenth K , Kapoor M, Clarkson AN, Hall, Appleton. Melatonin accelerates the process of wound repair in full-thickness incisional wounds. *J Pineal Res.* 2008;44(4):387-96.
  24. Hosgood G. Wound healing. The role of platelet-derived growth factor and transforming growth factor beta. *Vet Surg.* 1993;22: 490–495.
  25. Herndon DN, Nguyen TT, Gilpin DA. Growth factors. Local and systemic. *Arch Surg.* 1993;128:1227–1233.
  26. Maestroni GJ. T-helper-2 lymphocytes as a peripheral target of melatonin. *J Pineal Res.* 1995;18:84–9.
  27. Drobnik J, Dabrowski R. Melatonin suppresses the pinealectomy-induced elevation of collagen content in a wound. *Cytobios.* 1996; 85:51–58.
  28. Brackowski R, Zubelewicz B, Romanowski W, Lissoni P, Barni S, Tancini G. Preliminary study on modulation of the biological effects of tumor necrosis factor-alpha in advanced cancer patients by the pineal hormone melatonin. *J Biol Regul Homeost Agents.* 1994;8:77–80.
  29. Slominski RM, Reiter RJ, Schlabritz-Loutsevitch N, Ostrom RS, Slominski AT. Melatonin membrane receptors in peripheral tissues: distribution and functions. *Mol Cell Endocrinol.* 2012; 351:152-166.
  30. Garcia-Maurino S, Gonzalez-Haba MG, Calvo JR, Rafii-El-Idrissi M, Sanchez-Margalet V, Goberna R. Melatonin enhances IL-2, IL-6, and IFN-gamma production by human circulating CD4<sup>+</sup> cells: a possible nuclear receptor-mediated mechanism involving T helper type 1 lymphocytes and monocytes. *J Immunol.* 1997;159:574-581.
  31. Manchester LC, Coto-Montes A, Boga JA, Andersen LPH, Zhou Z, Galano A, et al. Melatonin: an ancient molecule that makes oxygen metabolically tolerable. *J Pineal Res* 2015;59: 403-419.
  32. Chen J, Li H, SundarRaj N & Wang JH: Alpha-Smooth Muscle Actin Expression Enhances Cell Traction Force. *Cell Motility and the Cytoskeleton.* 2007; 64:248–257.
  33. Cornelissen AM, Stoop R, Von den Hoff HW, Maltha JC, Kuijpers-Jagtman AM. Myofibroblasts and matrix components in healing palatal wounds in the rat. *J Oral Pathol Med.* 2000; 29:1-7.
  34. Drobnik J, Karbownik-Lewińska M, Szczepanowska A, Sotwińska D, Olczak S, Jakubowski L, Dbrowski R. Regulatory influence of melatonin on collagen accumulation in the infarcted heart scar. *J Pineal Res.* 2008, 45, 285–290.
  35. Ersoy ÖF, Özkan N, Özsoy Z, Kayaoğlu HA, Yenidoğan E, Çelik A, Özügürlü AF, Arabacı Çakır E, Lortlar N. Effects of melatonin on cytokine release and healing of colonic anastomoses in an experimental sepsis model. *Ulus Travma Acil Cerrahi Derg.* 2016;22(4):315-21.
  36. Reiter RJ, Tan DX, Mayo JC, Sainz RM, Leon J, Czarnocki Z. Melatonin as an antioxidant: biochemical mechanisms and pathophysiological implications in humans. *Acta Biochim Pol.* 2003; 50: 1129–1146.
  37. Tomas-Zapico C, Coto-Montes A. A proposed mechanism to explain the stimulatory effect of melatonin on antioxidative enzymes. *J Pineal Res.* 2005; 39: 99–104.
  38. Fischer TW, Slominski A, Zmijewski MA, Reiter RJ, Paul A. Melatonin as a major skin protectant: from free radical scavenging to DNA damage repair. *Exp Dermatol.* 2008; 17: 713–730.
  39. Drobnik J, Dabrowski R. Melatonin influence on the collagen content in the granulation tissue of a wound depends on the time of its application. *J Endocrinol Invest.* 1996; 19: 48.
  40. Gultekin F, Delibas N, Yasar S. In vivo changes in antioxidant systems and protective role of melatonin and a combination of vitamin C and vitamin E on oxidative damage in erythrocytes induced by chlorpyrifos-ethyl in rats. *Arch Toxicol.* 2001; 75: 88-96.
  41. Bulbul N, Dogru O, Yekeler H, Cetinkaya Z, Ilhan N, Kirkil C. Effect of melatonin on wound healing in normal pinealectomized rats. *J Surg Res.* 2005; 123: 3–7.



### RESEARCH ARTICLE

## SPECTROSCOPIC PROPERTIES OF LITHIUM SODIUM BORATE GLASS BY THE ADDITION OF $\text{MoO}_3$

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### Abstract

The spectroscopic properties of  $\text{Li}_2\text{O}-\text{Na}_2\text{O}_3-\text{B}_2\text{O}_3$  glass containing different concentrations of  $\text{MoO}_3$  (ranging from 0 to 1 mol %) were prepared by melt quenching are studied. Spectroscopic (XRD, infrared, optical absorption spectra and EPR) properties of these glasses have been carried out. As the concentration of  $\text{MoO}_3$  is increased especially beyond 0.4 mol %, the colour of the glasses increased, which is indicating the reduction of molybdenum ions from the  $\text{Mo}^{6+}$  state to the  $\text{Mo}^{5+}$  state. The Optical absorption Spectrum contains one broad absorption band around 695 nm is attributed to the excitation of  $\text{Mo}^{5+}$  ( $^4d_1$ ) ion. EPR studies reveal Molybdenum ions are expected to exist mainly in the  $\text{Mo}^{6+}$  state in the glass network. EPR, FTIR and Optical absorption spectra of paramagnetic ion in the above glasses reveal that the site symmetry of the transition metal ion is elongated octahedral.

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### Introduction:-

The glasses containing transition metal ions came into prominence because of their notable spectroscopic properties and their suitability for fibre optic communications, luminescent solar energy concentrators (LSC)[1]. Among the many glasses, borate glasses have been known to be excellent host materials for transition metal oxides because of their glass forming nature compared to other conventional glass systems. Borate glasses are used as wave-guides, electro-optic switches, electro-optic modulators, magneto-optic materials, solid-state laser materials and non-linear optical parametric converters [2-4]. In addition, they are often used as dielectric and insulating materials and it is known that borate glass constitute a good shield against IR radiation [5]. In general  $\text{B}_2\text{O}_3$  glasses have a property of showing minimum expansion due to the large amount of boric oxide which is of great importance in obtaining thermal durability. It also decreases the tendency for glass to devitrify or crystallize.  $\text{B}_2\text{O}_3$  is a basic glass former because of its higher bond strength, lower cation size and smaller heat of fusion. The ions of molybdenum introduce high activity and selectivity in a series of oxidation reactions of practical importance in the glass matrices [6,7].

Molybdenum oxide belongs to the intermediate class of glass forming oxides. It does not readily form the glass but does so in the presence of the modifier with  $\text{MoO}_4^{4-}$ . Molybdenum ions in the glasses have been the subject of many investigations due to their catalytic properties. Interesting studies are available on the environment of molybdenum ion in different inorganic glasses [8-13]. Mo-O bond in molybdenum hexavalent oxide is identified as significantly covalent. The Mo ion exist a stable valence state viz., MoV and MoVI in the glass network. Molybdenum ions act both as network formers as well as network modifiers depending upon their concentration and nature of the host network. Mo-O bond in molybdenum hexavalent oxide is identified as covalent. The Mo ion exists at least in two

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stable valence states viz., Mo (V) and Mo (VI) in the glass network. Earlier EPR studies on the glasses containing molybdenum ions have identified the presence of octahedrally coordinated Mo (V) ions along with octahedral distortion approaching tetragons [14,15]. These ions act both as network formers as well as network modifiers depending upon their concentration and nature of the host network. The  $\text{Mo}^{6+}$  ions are expected to participate in the glass network with tetrahedral  $\text{MoO}_4^{2-}$  structural units and may alternate with  $\text{BO}_4$  tetrahedral units. Most of the studies available on  $\text{MoO}_3$  containing glasses are on the understanding of their structure by spectroscopic investigations [16, 17] and ionic conductivity studies [18].

In the present work the influence of  $\text{MoO}_3$  in varying concentrations, on resonance and absorption properties of lithium-sodium-borate glasses are studied. Optical band gaps for both direct and indirect transitions and Urbach energies were calculated and those glasses were also characterized by XRD and FTIR studies.

### Experimental:-

The glasses of the system  $20\text{Li}_2\text{O} - 10\text{Na}_2\text{O} - (70-X)\text{B}_2\text{O}_3$  ( $X=\text{MoO}_3$ ) have been prepared by melt quenching technique varying the concentration of molybdenum ranging from 0.2-1.0(mol%) . The raw materials used were analytical pure (99.5%). Appropriate amounts of weighed chemicals  $\text{Na}_2\text{O}$ ,  $\text{Li}_2\text{O}$ ,  $\text{B}_2\text{O}_3$ ,  $\text{MoO}_3$  were grounded thoroughly in a mortar to produce homogeneous mixture. This homogenized mixture was then placed in porcelain crucibles and melted in an electrical furnace at  $870^\circ\text{C}$ - $920^\circ\text{C}$  for half an hour until a bubble free liquid was formed . The melt was then quenched to room temperature by pouring it on a plane brass plate and pressing it with another brass plate. Finally the vitreous samples were annealed for 3 hrs at 423K to relieve residual internal stress and slowly cooled to room temperature. The glasses so obtained were brown in colour with good optical quality and transparency. Details of experimental procedure and calculations are similar to the earlier work [14].

### Results and Discussion:-

#### X-ray diffraction:-

X-ray diffraction technique has been widely used to characterize inorganic glasses as it readily detects crystals in glassy matrix.

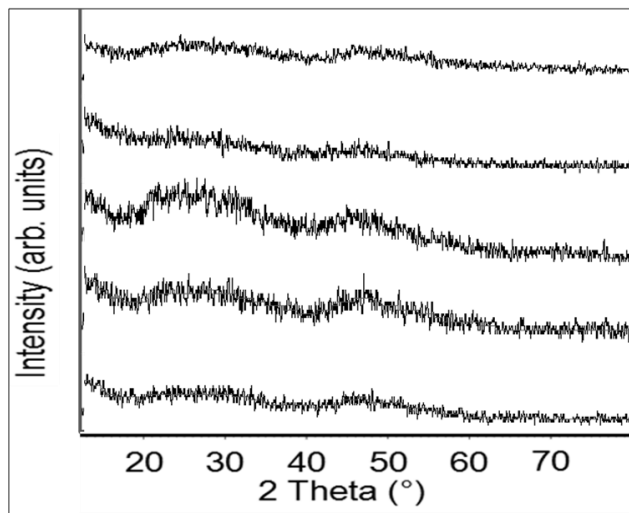


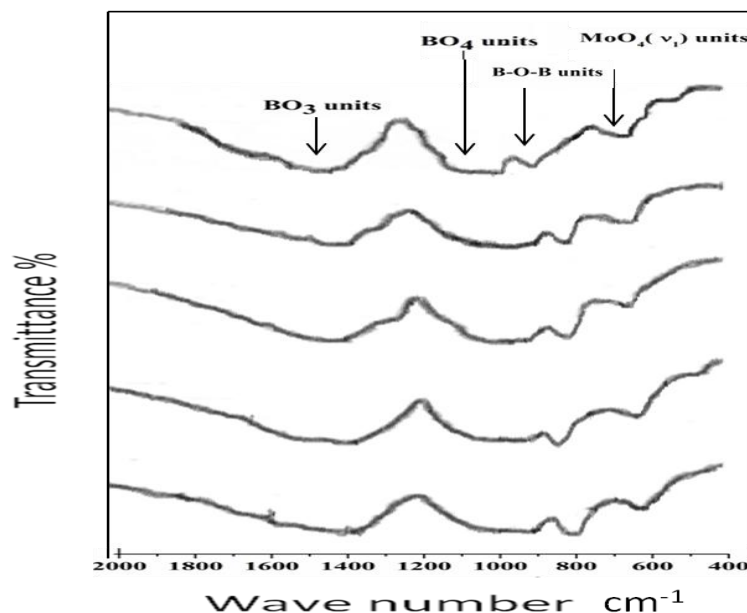
Figure 1:- The XRD patterns of molybdenum doped LNB glass system

Figure 1 represents the XRD patterns for  $\text{Li}_2\text{O}-\text{Na}_2\text{O}-\text{B}_2\text{O}_3:\text{MoO}_3$  compositions of glasses and as can be seen diffraction patterns of all the prepared glasses do not demonstrate any detectable crystalline peaks indicating amorphous or non-crystalline nature of the samples.

#### Infrared Spectra:-

The prominent IR bands shown in Fig. 2 are observed for  $\text{Li}_2\text{O}-\text{Na}_2\text{O}-\text{B}_2\text{O}_3:\text{MoO}_3$  glasses and these bands are effectively influenced by the molybdenum content in the glasses network. The molybdenum free glasses exhibited in the regions  $1300\text{-}1450\text{ cm}^{-1}$ ,  $1100\text{-}1200\text{ cm}^{-1}$ . These bands are identified as stretching relaxations of B-O bonds of the trigonal  $\text{BO}_3$  units. Broad absorption bands are observed at  $1050\text{-}850\text{ cm}^{-1}$  and  $800\text{-}700\text{ cm}^{-1}$ ; these bands are

identified due to stretching vibrations of the  $[\text{BO}_4]$  units. When molybdenum is added, two new bands attributed, to  $\nu_1$  and  $\nu_3$  vibrational modes of  $[\text{MoO}_4]^{2-}$  tetrahedral units and  $[\text{MoO}_6]^{6-}$  was located at about 810 and 550  $\text{cm}^{-1}$ . The bands at 448 and 548  $\text{cm}^{-1}$  were specific to the vibrations of Li–O bonds in  $\text{Li}_2\text{O}$  octahedral units. The summary of various band position of  $\text{Li}_2\text{O}-\text{Na}_2\text{O}-\text{B}_2\text{O}_3:\text{MoO}_3$  is presented in the Table II



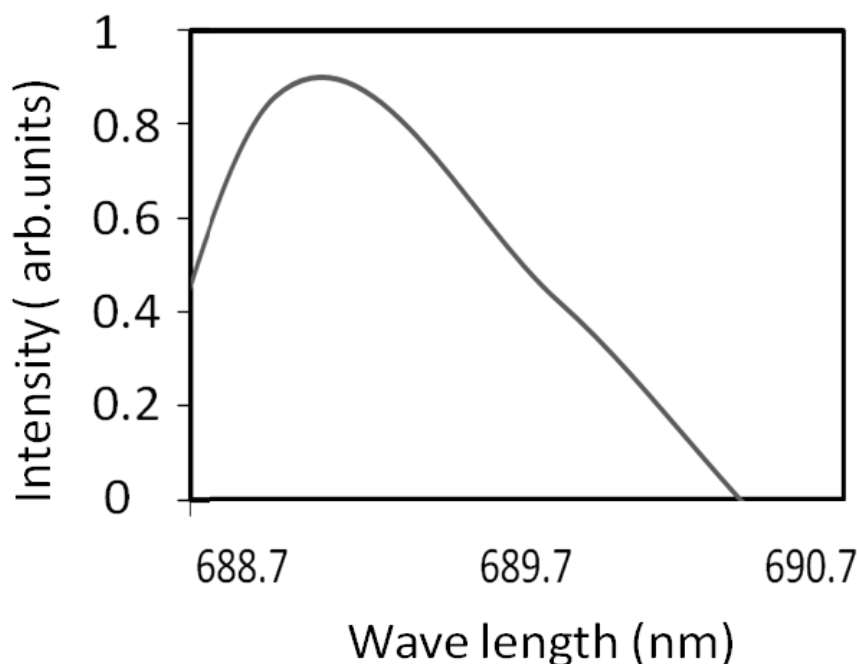
**Figure 2:-** FTIR spectrum of Lithium-Sodium-Borate glass system containing molybdenum ions of all concentrations.

**Table I:-** The summary of various band positions of IR spectra of  $\text{Li}_2\text{O}-\text{B}_2\text{O}_3:\text{MoO}_3$  glasses

Glass Code	Trigonal $[\text{BO}_3]$ units ( $\text{cm}^{-1}$ )	Stretching vibrations of $[\text{BO}_4]$ Units ( $\text{cm}^{-1}$ )	$\nu_1$ vibrational modes of $[\text{MoO}_4]^{2-}$ tetrahedral units ( $\text{cm}^{-1}$ )	$\nu_3$ vibrational modes of $[\text{MoO}_4]^{6-}$ tetrahedral units ( $\text{cm}^{-1}$ )
M0.2	1379	1021	811	694
M0.4	1379	1019	840	699
M0.6	1376	1012	820	697
M0.8	1372	1022	820	698
M1.0	1369	994	914	698

#### Absorption Spectra:-

The Optical absorption spectra of the  $\text{Li}_2\text{O}-\text{Na}_2\text{O}-\text{B}_2\text{O}_3:\text{MoO}_3$  glasses are recorded at room temperature in the wavelength range 400nm-1400nm. The Optical absorption spectrum of molybdenum doped lithium sodium borate glass (with  $x=0.6$  mol %) is shown in the Fig. 3. The absorption edge is observed to shift towards higher wavelength side.

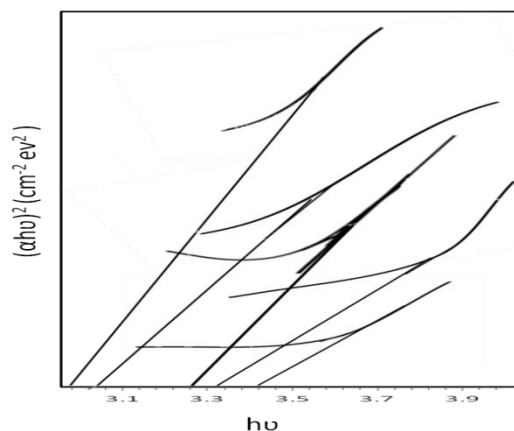


**Figure 3:-** Optical absorption spectrum of Lithium-Sodium-Borate glass system containing 0.6 mol % of  $\text{Mo}^{+5}$  ions at room temperature

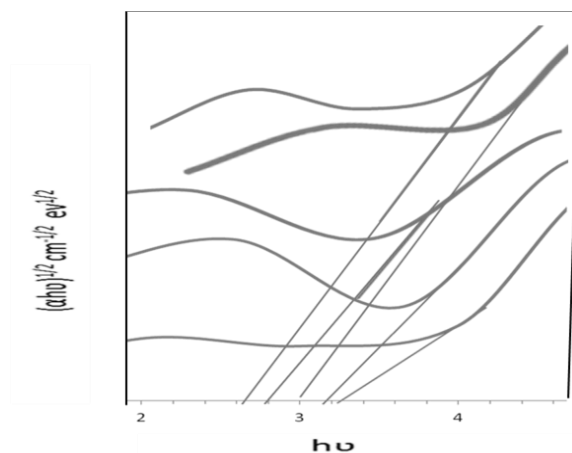
The spectrum of  $\text{MoO}_3$  free glasses does not exhibit any absorption band. But small amount of molybdenum is added to glasses matrix shows a broad optical absorption band at about 695 nm (for  $x=0.6\%$ ). The intensity of this band was observed to increase gradually as the concentration of  $\text{MoO}_3$  increased. From the observed absorption edges (fig3a,fig3b,fig3c) direct, indirect band and Urbach energy gap are evaluated and are presented in Table II. The values of direct and indirect band gap energies, decreases from M0.2 to M1.0.

**Table II:-** Summary of the data on optical absorption spectra  $\text{Li}_2\text{O}-\text{Na}_2\text{O}-\text{B}_2\text{O}_3:\text{MoO}_3$  glasses

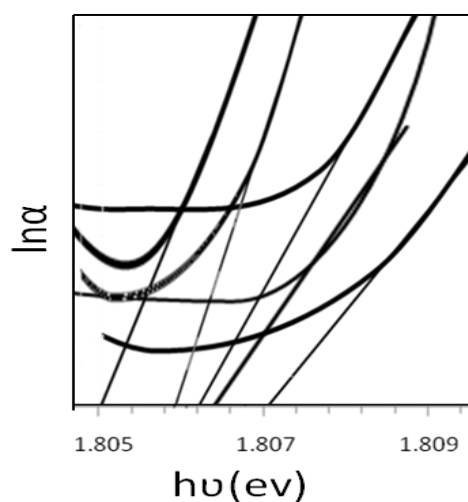
Glass Code	Cut-off wavelength(nm)	Band position(nm)	Direct band gap (eV)	Indirect band gap (eV)	Urbach Energy (eV)
M0.2	283	690	3.42	3.2	1.8071
M0.4	288	675	3.34	3.2	1.8064
M0.6	290	695	3.28	3.0	1.8062
M0.8	328	683	3.10	2.8	1.8060
M1.0	388	699	3.16	2.6	1.8050



**Figure 3(a):-** A plot between  $(\alpha h\nu)^2$  and  $h\nu$  for glass samples



**Figure 3(b):-** A plot between  $(\alpha h\nu)^{1/2}$  and  $h\nu$  for LNBM glass samples



**Figure 3 (c):-** A plot between  $\ln(\alpha)$  and  $h\nu$  for LNBM glass samples

#### EPR Spectra:-

EPR spectra of  $\text{Li}_2\text{O}-\text{Na}_2\text{O}-\text{B}_2\text{O}_3:\text{MoO}_3$  glasses doped with different concentrations of  $\text{MoO}_3$  were recorded at room temperature. The EPR spectra of these glasses consist of a main central line surrounded by less intense satellites. The EPR spectra of the glasses recorded at room temperature exhibit signals consisting of a central line surrounded by smaller peaks at about  $g_{\parallel}=1.811$  and  $g_{\perp}=1.956$  for M0.6 glass system and is shown in Fig.4.

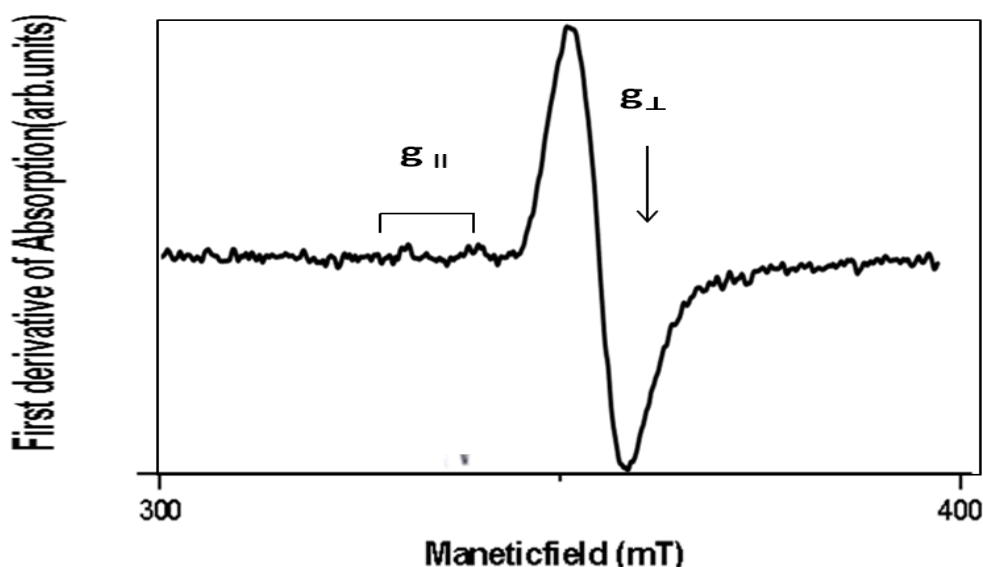


Figure 4:- EPR spectra of M0.6 glass sample ( $\nu = 9.205\text{GHz}$ )

The EPR spectra obtained for the molybdenum ions in the titled glasses are similar to those obtained for various other glass systems [20–22]. The spectra shown in Fig. 4 can best be analyzed using a spin-Hamiltonian of the form:  $H = \beta SgB + SAI$ , where the symbols have their usual meaning. It contains the electronic Zeeman term ( $\beta$  is the bohr magneton,  $S = 1/2$  the electron spin,  $g$  is the  $g$  tensor and  $B$  is the applied field), perturbed by the hyperfine coupling term between the unpaired electron and the nuclear spin  $I$  of molybdenum ion,  $A$  being the hyperfine structure tensor. The central line arises from even molybdenum isotopes ( $I = 0$ ), while the smaller lines correspond to the hyperfine structure from odd  $^{95}\text{Mo}$  and  $^{97}\text{Mo}$  isotopes ( $I = 5/2$ ). The nuclear magnetic moments of  $^{95}\text{Mo}$  and  $^{97}\text{Mo}$  being close, so the isotope splitting is not resolved in the EPR spectra. It can be assumed that  $\text{Mo}^{5+}$  ions in the glasses studied has an octahedral coordination with a weak axial distortion. An octahedral site with a tetragonal compression usually shows of and  $g_{\parallel} < g_{\perp} < g_e (=2.0023)$  [23]. It is found that the values obtained for the glasses under study, are more close to those of the molybdenyl ions. The values of  $g_{\parallel}$  and  $g_{\perp}$  from these spectra have been evaluated and presented in Table III. Further, the  $g$  values obtained for these glasses are found to be consistent with the reported values for many other glass systems containing molybdenum ions.  $A_{\parallel}$  and  $A_{\perp}$  are the parallel and perpendicular components of the hyperfine tensor  $A$ . It is observed that the intensity of the resonance signal increases with increase in the concentration of  $\text{MoO}_3$ .

Table III:- EPR data of  $\text{Li}_2\text{O-ZnO-B}_2\text{O}_3$ :  $\text{MoO}_3$  glasses

Glass Code	$g_{\parallel}$	$g_{\perp}$	$A_{\parallel} (\text{X } 10^{-4} \text{ cm}^{-1})$	$A_{\perp} (\text{X } 10^{-4} \text{ cm}^{-1})$
M0.2	1.812	1.950	107.9	1.68
M0.4	1.806	1.956	113.0	1.87
M0.6	1.811	1.956	107.3	1.88
M0.8	1.811	1.950	109.8	1.31
M1.0	1.810	1.940	106.2	1.67

The EPR transition can be explained as because of decrease of the effective charge of the surrounding oxygen ligands, there is decrease in their electron donating ability ( $\sigma$ -bonds), hence the charge of the central molybdenum remains high. Therefore, this induces the promotion of strong  $\pi$ -bond with the two axial oxygens of the compressed octahedron hence axially distorted environment is developed. By this the  $\text{Mo(V)}$  is strongly displaced in its octahedron so that it adopts a pyramidal configuration  $\text{MoO}_5$  with a very short  $\text{Mo-O}$  distance, which would correspond to the molybdenyl ion [24].

### Conclusions:-

The conclusions drawn from analysis of the results of the various properties of  $\text{Li}_2\text{O}-\text{Na}_2\text{O}-\text{B}_2\text{O}_3:\text{MoO}_3$  glasses reported in this study are as follows:

- XRD spectra revealed amorphous of the sample.
- The FTIR Spectral studies indicate that the molybdenum ions occupy tetrahedral positions in higher concentrations.
- The Optical absorption Spectra of  $\text{Li}_2\text{O}-\text{Na}_2\text{O}-\text{B}_2\text{O}_3:\text{MoO}_3$  glasses exhibits bands associated with transitions at  $\text{Mo}^{5+}$  ions, indicating that the molybdenum ions is in pentavalent state, in addition to tetravalent and hexavalent states respectively in these glass samples.
- The EPR Spectra of these glasses exhibit a signal consisting of a triplet separated by smaller satellites. The signal has been identified as arising from tetragonally distorted octahedral positions of  $\text{Mo}^{5+}$  ions.

### References:-

1. A. Murali, R.P.S. Chandrasekar, J.L Rao, *Physica B*. 19, 358 (2005).
2. A. Paul, R.W. Douglas, *Phys. Chem. Glasses* 6, 212 (1965).
3. J.L. Piguet, & J.E. Shelly, *J.A.M. Ceram. Soc.* 68, 450 (1985).
4. A.R. Kumar, J.L Rao, N.O. Gopal, *Mater. Res. Bull.* 40, 1256 (2005).
5. J.L. Chakradhar, A. Murali, J. Rao, *Alloys Compd.* 29, 265 (1998).
6. S. M. D. Nery, W. M. Pontuschka, S. Isotani, C. G. Rouse, *Phys. Rev. B*, **49**, 3760 (1994).
7. Bjorn O. Mysen, *Journal of Non-Crystalline Solids*, **95-96**(1), 247 (1987).
8. M. Srinivasa Reddy, V. L. N. Sridhar Raja, N. Veeraiah, *EPJ Appl. Phys.*, **37**(2), 203(2007).
9. P. Syam Prasad, B. V. Raghavaiah, R. Balaji Rao, C. Laxmi Kanth, N. Veeraiah, *Solid State Commun.*, **132**(3-4), 235 (2004).
10. G. D. Khattak, M. A. Salim, A. S. AlHarthi, David J. Thompson, L. E. Wegner, *J. Non-Cryst. Solids*, **212**(2-3), 180 (1997).
11. K. S. Sidhu, S. Singh, S. S. Sekhon, S. Chandra, A. Kumar, *Phys. Chem. Glasses*, **32**(6), 255 (1991).
12. A. A. Bahgat, M. M. El-Samanoudy, Al. Sabry, *Journal of physics and chemistry in solids*, **60**(12), 1921 (1999).
13. Manisha Pal, K. Hirota, Y. Tsujigami, H. Sakata, *Journal of Physics D: Applied Physics*, **34**(4), 459(2001).
14. A. M. Milankovic, A. Gajovic, D.E. Day, *J. Non-Cryst. Solids*. 76, 325(2003).
15. S. Simon, A.C. Nicula, *J. Non-Cryst. Solids*. 23, 57 (1983).
16. J.F. Lyne, S.L. Segel, G. Rosenblatt, *J. Appl. Phys.* 42, 2587 (1971).
17. B. Bridge, N.D. Patel, *J. Non-Cryst. Solids* 27, 91 (1987).
18. B.V.R. Chowdary, P. P. Kumari, *Solid State Ionics* 113, 665 (1998).
19. P. Madhusudana Rao, M. Sugathri Lap Lambert Academic Publishing GmbH KG, 2013 Advances in Materials Science and Technologies: AMST-2012 Conference Proceedings, 74-81.
20. A. Bals, J. Kliava, *J. Phys. Cond. Matter* 3 (1991) 6209.
21. M. Haddad, A. Nadiri, A. Biyadi, M.E. Archidi, J.V. Folgado, D.B. Porter, *J. Alloys Compd.* 188 (1992) 161.
22. D. Boudlich, M. Haddad, A. Nadiri, R. Berger, J. Kliava, *J. Non-Cryst. Solids* 224 (1998) 135.
23. A. Bals, J. Kliava, *J. Magn. Reson.* 53 (1983) 243.
24. L. Bih, L. Abbas, A. Nadiri, H. Khemakhem, B. Elouadi, *J. Mol. Structure* 872 (2008).

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### RESEARCH ARTICLE

#### COMPARATIVE STUDIES OF GENETIC VARIABILITY IN SOYBEAN (*GLYCINE MAX. (L.) MERRILL*) DERIVED GENOTYPES USING MOLECULAR MARKER.

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Molecular markers, dendrogram.

#### Abstract

The vast Mutagenic effect showed by application of mutagens (Sodium Azide -3mM, 5mM, 7mM; Ethyl Methane Sulphonate -5mM, 10mM, 15mM; And Gamma Irradiation -100kr, 200kr, 300kr). That clearly showed in field as well as laboratory testing; by using molecular markers, PCR (Polymerase chain reaction) ISSR( Inter Simple Sequence Repeat). Mutagenic variation founded in all the mutagens, but selected Genotypes were obtained from 100kr and 10mM Mutagenic lines. We demonstrate these genotypes for phenotypic screening and associated maturity, morphology, pigmentation traits. ISSR analysis done by two Primers and it was detected polymorphisms. For analysis, two primers were designed from consensus sequence regions on protein homolog genes, and used to amplify the genomic region. PCR samples were sequenced. The total number of polymorphic ISSR bands showed specific range and scored on all genotypes and their homology was measured.

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#### Introduction:-

The genus Glycine consists of two subgenera, i.e. Glycine and Soja. Glycine max (L.) Merr. And G. soja Sib. & Zucc. Belongs to Soja subgenus. Glycine max is the cultivated soybean while Glycine Soja is its wild progenitor. Soybean (Glycine max (L.) Merrill) is an important crop as a source of protein and oil. Charles and Morse (1923) reported that the origin of soybean is china, Manchuria and Korea. Soybean is one of the best valued crops for its ability to fix nitrogen and provide seed protein and oil. In this importance the species are needed to develop new strain by mutagenesis to prove key step for identifying gene function in cultivar. A number of mutagen sources exist for introducing genomic variation. These include chemical, radiation, and transformation-induced mutagenesis of plant genomes (Waugh et al; 2006; Kuromori et al; 2009). Each of these methods results in a signature footprint of structural variation across the genome (Alonso and Ecker, 2006).

Molecular markers have become new tools and technique to help reduces workers effort(in identifying genotypes , save time i.e. work performed in short period of time, in most plant breeding programme, including introduction, selection and certification. Among them, SSR also known as micro satellite or short tandem repeat or simple sequence length polymorphisms is a repeated nucleotide sequence of 2-7 base pair units. Repeatability of fragment resulted from slippage in replication ( Schlotterer and Tautz, 1992) and unequal crossover (Smith, 1976). The SSR technique uses PCR to amplify DNA fragments by repeated cycles of DNA denaturing, annealing and extension using DNA polymerase enzyme. The resulting DNA was separated by banding on gel (Akkaya et al; 1992). This

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method has many advantages such as rapid, reliable (Diwan and Cregan,1997), abundance (Lagerkrantz et al;1993),co-dominant(Akkaya et al;1992), high heterozygosity (Powell et al;1996), and high polymorphism(Akkaya et al;1995).

SSR has been used in the construction of genetic linkage map of human(Gyapay et al;1994),soybean shoe-marker Morgante, 1994; Akkaya et al;1995;Maughan et al;1995)and also used in DNA fingerprint of soybean (Yanagisawa et al;1994;Diwan and Cregan,1997).

SNP is single base variation between two identical DNA sequences. Brooks (1999) reported that SNP was single base pair positions in genomic DNA at which different sequence alternatives (alleles) exist in normal individuals of natural populations. This technology allows greater number of tests to be run at a significantly lower cost than existing technology. This technology has application in genome sequencing, SNP identification and typing, screening for genetically-linked diseases, identification of genetic drug targets, screening for individuals for potential drug side effects, gene cloning, screening potential tissue donors, screening cancer cells for genes conferring chemotherapy resistance. This technique has more advantages than markers such as isozyme, RFLP, RAPD, SSR. These advantages include very large number of polymorphic loci which distributed throughout the genome, marker present within coding regions, introns and regions that flank genes, simple and unambiguous assay techniques, high level of polymorphism in the population, stable Mendelian inheritance and low levels of spontaneous mutation (Brown, 1999).

Soybean genotypes were grown for said phenotypic characters indicating the different genetic variability among 12 genotypes. The objective of this study was to evaluate genetic variability and relationship among 12 soybean genotypes. by using PCR-ISSR .

## Materials and Methods:-

### Plant material and DNA isolation:-

Fresh seeds of soybean genotypes were used in this study for DNA extraction and isolation. The genotypes of soybean were grown in Aurangabad district (MS). The analyzed samples included dried soybean seeds that were used directly for DNA extraction. They found to yield DNA's comparable in quality and quantity when using EZI nucleic acid isolation analyzer (QIAGEN, 2007), CTAB method. Plant genomic DNA purification kit method, and DNA extraction with phenol purification and liquid nitrogen method, a soybean seed bulk sample was ground to fine powder. The experiment was carried out under the same conditions for all DNA samples.

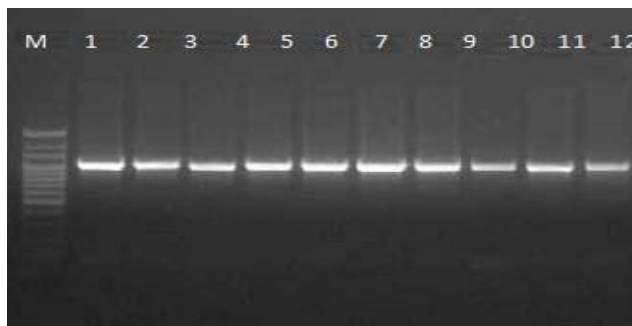
### Molecular material:-

DNA was extracted from seeds of soybean genotypes (*Glycine max* (L.) Merrill.) were grown in Aurangabad (MS) and isolated genomic DNA was amplified with two primers.

**Table 1:-** Primers for PCR amplification of Soybean (*Glycine max* (L.) Merrill.) Used in the study

Primer	Annealing Tm	Primer bp	Primer Sequence
SPA	54°C	320	5'-CCACTATCCTTCGCAAGACCCTTCC-3'
SPB	54°C	320	5'-CTTCTGTGCTGTAGCCACTGATGC-3'
LE5	53°C	180	5'-TCAACGAAAACGAGTCTGGTG-3'
LE6	53°C	180	5'-GGTGGAGGCATCATAGGTAAT-3'





**Fig.1:-** Agarose gel electrophoresis of genomic DNA isolated from soybean genotypes were grown in Aurangabad (MS) .DNA loaded in 1% Agarose gel and separated by electrophoresis for 90 min at 50V, then visualized by ethidium bromide staining with transillumination. Respectively; Lane I-1kb M, Lane II to Lane XII-genomic DNA isolated from soybean genotype viz. 1. (GENO-1), 2. (GENO-2), 3. (GENO-3), 4. (GENO-4), 5. (GENO-5), 6. (GENO-6), 7. (GENO-7), 8. (GENO-8), 9. (GENO-9), 10. (GENO-10), 11. (GENO-11), 12. (GENO-12)

#### **Digestion of DNA:-**

The restriction enzyme recognizes a unique, specific sequence of, usually, 4-6 base pairs (bp) in length, termed a restriction site, where the enzyme cuts (restricts) the DNA. In general, restriction sites will occur throughout the genomic and, consequently, application of the enzyme to total genomic DNA (Restriction of DNA) results in its conversion into millions of fragments. The frequency of restriction sites will vary depending on both the restriction enzyme and on the genome.

#### **Polymerase Chain Reaction Amplifications:-**

Here, in study two primer pairs were used for PCR amplification. We performed different PCR optimizations of the PCR reaction mix and conditions for each primer pair.

#### **SPA/SPB Primer Pair:-**

Works carried in two tubes of a total volume of 25 $\mu$ l. The tubes contained 2 $\mu$ l of genomic DNA, 0.2 $\mu$ l of each primer, 2.5 $\mu$ l 10x PCR Buffer, 3.5 $\mu$ l of 50mmol/1MgCl<sub>2</sub>, 2.5 $\mu$ l of 10mmol/1 dNTPs, and 0.3 $\mu$ l of Taq DNA polymerase. The program was initiated on Bio-Rad PCR amplifier with 5 min of denaturation, followed by 10 cycles of amplification with denaturation for 15 sec at 94 $^{\circ}$ C first annealing for 20 sec at 54 $^{\circ}$ C and extension at 72 $^{\circ}$ C for 15 sec; followed by 40 cycles of amplification with denaturation for 1.5 min, second annealing for 1.5 min at 61 $^{\circ}$ C,an extension at 72 $^{\circ}$ C for 1min, and final elongation at 72 $^{\circ}$ C for 5min.

#### **LE5/LE6 Primer Pair:-**

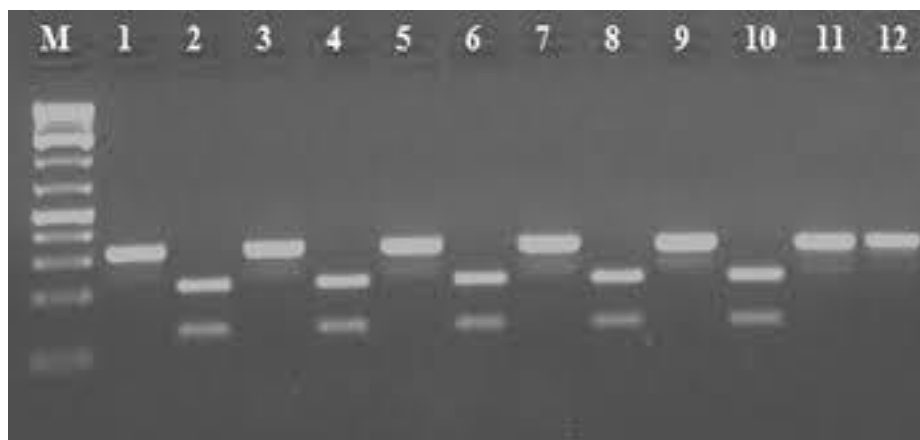
Works carried in two tubes of a total volume of 25 $\mu$ l. The tubes contained 2 $\mu$ l of genomic DNA, 0.2 $\mu$ l of each primer, 2.5 $\mu$ l 10x PCR Buffer, 3.5 $\mu$ l of 50mmol/1MgCl<sub>2</sub>, 2.5 $\mu$ l of 10mmol/1 dNTPs, and 0.3 $\mu$ l of Taq DNA polymerase. The program was initiated on Bio-Rad PCR amplifier with 5 min of denaturatuion, followed by 10 cycles of amplification with denaturation for 15 sec at 94 $^{\circ}$ C first annealing for 20 sec at 55 $^{\circ}$ C and extension at 72 $^{\circ}$ C for 15 sec; followed by 40 cycles of amplification with denaturation for 1.5 min, second annealing for 1.5 min at 53 $^{\circ}$ C,an extension at 72 $^{\circ}$ C for 1min, and final elongation at 72 $^{\circ}$ C for 5min

All amplification products (10 $\mu$ l) were electrophorised in 1.5% (w/v) TAE Agarose gels containing 1 g/ml ethidium bromide. The electrophoresis was run in TBE at 100v for 40min and DNA bands were observed under UV light and photographed by image system.

**Fig.2.** Specificity of the PCR method using the primer pairs SPA/SPB and LE5/LE6 to identify the DNA. Agarose Gel Electrophoresis of PCR products amplified from genomic DNA of soybean genotypes.

Lane I-100bp ladder size standard;

Lane II-Lane XIII- sample Genomic DNA PCR products of Primer Pairs Respectively as above.

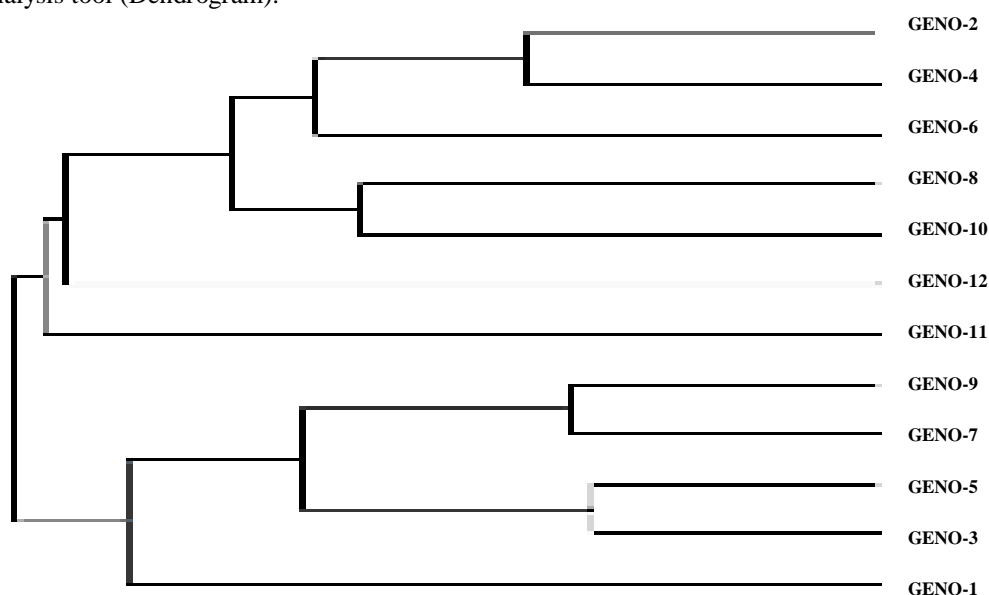


**Fig 2:-** Specificity of the polymerase chain reaction method using the primer pairs SPA/SPB and LE5/LE6 to identify the DNA Agarose gel electrophoresis of PCR products amplified from genomic DNA of Soybean genotypes. Lane 1-100bp ladder size standard(M); Lane 1,III,V,VII,IX,XI and XII sample genomic PCR product of SPA/SPB; Lane II,IV,VI,VIII and X sample genomic PCR product of LE5/LE6.

#### PCR-RFLP Data analysis:-

The PCR-RFLP analysis were performed in Agarose gel electrophoresis and its makes the banding pattern with high molecular weight DNA running fast in the lane; while low molecular weight run slow shown in the lane. The high molecular weight DNA was digested with an appropriate restriction endonuclease and the digest was fractioned by electrophoresis in 1% Agarose gel by Shiraishi et.al. The banding patterns obtained from the ISSR markers were scored as present (1) and absent (0). The PCR-RFLP method enabled to identify nucleotides at each of the variable sites clearly reliable.

Each sample has amplified by using two primers for each fragment and it was treated as rearrangement in genome. The primers shows scoring and reproducibility were considered for the scoring of bands. The gel pictures were taken and documented to the computer by using alpha imager gel documentation system and each amplicon were measured by software. The dendrogram was plotted by using phylogeny free and tree view of DNA fingerprinting analysis tool (Dendrogram).



**Fig 3:-** Dendrogram based on bioinformatics phylogeny tool Free Tree and tree view of DNA fingerprint analysis.

## Result and Discussion:-

The selected samples of isolated DNA was run on 1 % w/v Tris-Acetate EDTA gel were to check the quality of DNA sample have shown high molecular weight of DNA band (Fig.1). The amplification of genomic DNA of twelve selected genotypes using ISSR marker yielded total amplified 207 fragments were obtained while analysis of ISSR some fragments showed monomorphic and polymorphic in nature (Fig.2). In ISSR number of amplified fragments were ranged from 118bp to 320 bp. The PCR amplification using ISSR primers have potential to reproducibility of amplification of the product. The dendrogram analysis was carried out by using bioinformatics phylogeny tools free tree and tree view of DNA fingerprint analysis (Fig.3). Earlier the comparative analysis of genetic diversity was also attempted by using SNP, ISSR and RAPD markers in soybean genotypes, Vigna genotypes and Mung bean genotypes. The twelve *Glycine max*. (L.) Merrill derived genotypes were clustered in three groups. Cluster-I, II and III. The narrow genetic diversity identified among the soybean genotypes which derived from variety of JS-335. The present study may be the serve as the source of new alleles in soybean breeding programme.

## Conclusion:-

The derived genotypes were identified for qualitative and quantitative characteristics. In cross breeding between the superior genetically different individuals which are having different gene of interest characteristics rather than involving individual belonging close relative genetic group. The analysis reported that in the present study could be useful to the selection of screened individuals for cross breeding purpose.

## References:-

1. **H.C.Vural (2010):** Genetic identification of soybean [*Glycine max* (L.) Merr.] Growing in Turkey for Molecular Breeding using Molecular markers; Biotechnology & Biotechnological Equipment; ISSN: 1310-2818.
2. **P.Tanya\*, P.Srinives\*et.al; (2001):** Evaluation of Genetic Diversity among Soybean Genotypes Using SSR and SNP; Korean Journal of Crop Sciences 46(4): 334-340.
3. **Pardhe Deepak D.\*, Satpute Rajendra A. (2011):** A comparative Analysis of Genetic Diversity in Genus *Vigna* savi Genotypes using ISSR; International Journal of PharmTech Research CODEN (USA): IJPRIF, ISSN: 0974-4304, Vol.3, No.1, pp464-470.
4. **Giriraj Kumawat, Gourav Singh et. al;(2015):** Molecular Characterisation and Genetic Diversity analysis of Soybean (*Glycine max*(L) Merr.) germplasm accessions in India;Physiology and Molecular Biology of Plants;2015 Jan;21(1): 101-107.
5. **Anchal Bisen, Dharendra Khare et. al ;( 2015):** SSR analysis 38 genotypes of Soybean (*Glycine max*(L) Merr.) genetic diversity in India ;Physiology and Molecular Biology of Plants;2015 Jan;21(1): 109-115.
6. **M.Sesli and E.D.Yegnoglu (2010):** Compare various combinations of similarity coefficients and clustering methods for *Olea europaea sativa*; Scientific Research and Essays August 2010, Vol.5 (16), pp.2318-2326.
7. **Gu-wen Zhang, Sheng-chun Xu et.al; (2013):** Determination of the genetic diversity of vegetable soybean [*Glycine max*(L.) Merr.] using EST-SSR markers; Journal of Zhejiang University Science B.2013 April;14(4): 279-288.
8. **Alonso JM, Ecker JR (2006):** Moving forward in reverse: genetic technologies to enable genome-wide phenomic screens in *Arabidopsis*. Nat Rev Genet 7: 524-536.
9. **Waugh, Leader DJ, McCallum N, Caldwell D (2006):** Harvesting the potential of induced biological diversity. Trends Plant Sci.11:71-79.
10. **Kuromori T, Takahashi S, Kondou Y, Shinozhaki K, Matsui M (2009):** Phenome analysis in plant species using loss-of -function and gain-of-function mutants. Plant Cell Physiology 50:1215-1231.
11. **Akkaya, M.S; A.A.Bhagwat and P.B.Cregan (1992):** Length polymorphisms of simple sequence repeat DNA in soybean. Genetics 132:1131-1139.
12. **Akkaya M.S; R.C.Shoemaker, J.E.Specht et.al;(1995):** Integration of simple sequence repeat DNA markers into a soybean linkage map. Crop Sci.35:1439-1445.
13. **Brown S.M. (1999):** Snapping up SNP. Biotechniques 26(6):1090-1094.
14. **Brooks A.J.(1999):** The essence of SNP. Gene 234:177-186.
15. **Powell W, M.Morgante, C.Andre et.al;(1996):** The comparison of RFLP,RAPD,AFLP and SSR (microsatellite)markers for germplasm analysis.Mol.Bre.2:225-238.

16. **Diwan N., and P.B.Cregan (1997):** Automated sizing of fluorescent-labeled simple sequence repeat (SSR) markers to assay genetic variation in soybean. *Theor.Appl.Genet.*95:723-733.
17. **Morgante M. (1994):** Genetic mapping and variability of seven soybean simple sequence repeat loci. *Genome* 37:763-769.
18. **Lagerkrantz U, H.Ellegran and L.Anderson (1993):** The abundance of various polymorphic microsatellite motifs differs between plants and vertebrates. *Nucleic acids Res.*21:1111-1115.
19. **Maughan P.J., A.S.Marroof and G.R.Buss(1995):** Microsatellite and amplified sequence length polymorphisms in cultivated and wild soybean. *Genome* 38:715-723.
20. **Gyapay G.J., Morissette A. et.al;(1994):** The 1993-94 Genethon human genetic linkage map. *Nat.Genet.*7:246-249.
21. **Schlotterer C. and D.Tautz (1992):** Slippage synthesis of simple sequence DNA. *Nucleic Acids Res.*20:211-215.
22. **Smith G.P.(1976):** Evolution of repeated DNA sequences by unequal crossover *Science.*191:528-535.
23. **Yanagisawa T., M. Hayashi , A.Hirai, K.Harada (1994):** DNA fingerprinting in soybean (*Glycine max*(L.) Merrill.) with oligonucleotide probes for simple repetitive sequences. *Euphytica* 80:129-136.

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### RESEARCH ARTICLE

#### RISK PREDICTORS FOR HEART FAILURE IN AL-MADINA AL-MONAWRA

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Heart Failure, risk factors, Saudi Arabia.

#### Abstract

**Introduction:** heart failure has emerged over the past several decades as a major global public health problem. In addition to the enormous costs in human suffering and loss of productivity, heart failure has imposed an increasingly heavy financial burden on health-care systems throughout the world.

**Subject and methods:** We held a cross sectional analytical study in the Cardiac Center in Al-Madina Al-Monawara. A total of 64 patient with heart failure admitted to the center between 1/3/2012 to 10/4/2012 were subjected to questionnaire to determine the risk factors including age, sex, occupation, smoking, physical activity, co-morbid conditions, and family history.

**Results:** About one third of the total patients admitted to the medical department in Madina Cardiac Centre have heart failure (30.3%). Half of the patients with heart failure are retired and illiterates. DM, hypertension and hyperlipidemia were a common findings in patients with heart failure (45%, 45%, and 40%) respectively. Ischemic heart diseases was the commonest etiology for those with heart failure (85%).

**Conclusion:** Many factors are associated with heart failure, the most common of which is ischemic heart disease. DM, hypertension and hyperlipidemia are also common findings in patients with heart failure.

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#### Introduction:-

Heart failure has emerged over the past several decades as a major global public health problem, with rising prevalence reported in both industrialized and developing nations alike (1–6). In addition to the enormous costs inhuman suffering and loss of productivity, heart failure has imposed an increasingly heavy financial burden on health-care systems throughout the world. Although highly effective treatments including new drug therapies and devices have been developed for patients with chronic heart failure (specifically those with systolic dysfunction), episodes of decompensation that require hospitalization still occur commonly in this population (7,8).

Registry data from the USA and elsewhere provide insight into the clinical characteristics of patients who are hospitalized due to ADHF (9–11), these patients are, in general, elderly, with an average age in the low to mid-70s.

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In Asia, however, the average age is considerably lower (12). Approximately half of them are female. Hypertension, coronary artery disease (CAD) and diabetes are common, and one-fourth have atrial fibrillation. Hypertension on admissions more frequent than previously imagined, with systolic pressure averaging between 140 and 150 mmHg. Blood pressure in patients hospitalized with decompensated heart failure in Japan, however, tends to be considerably lower (8). Patients with evidence of hypotension comprise only a small percentage of those hospitalized with ADHF. Approximately half of the patients admitted with decompensation in the USA have heart failure with preserved ejection fraction (HFpEF) and this percentage is even higher in Japan (8,14). Overall 60–90 day post-discharge morbidity and mortality risk, however, does not differ significantly between the HFpEF patients and patients with heart failure and reduced ejection fraction (HFrEF) (13). The echocardiography is the most useful complementary examination when evaluating patients with HF. It provides important information regarding heart morphology; quantifies the systolic and diastolic functions and helps define the etiology and prognostic parameters in response to different therapeutic interventions. In recent years, two new and fundamental echocardiographic evaluations were incorporated into daily practice: the evaluation of ventricular dyssynchrony and hemodynamic evaluation. The latter has been very important to understand the hemodynamic profile of patients with HF, especially decompensated ones or those difficult to manage (15).

**Aim of the work:-**

To establish a program for prevention and decreasing morbidity and mortality due to heart failure.

**Specific objectives:-**

1. To determine the major risk factors for developing heart failure in our community.
2. To determine echo findings in these patients

**Materials and Methods:-**

We held a cross sectional analytical study in the Cardiac Center in Al-Madina Al-Monawara. A total of 64 patient with heart failure admitted to the center between 1/3/2012 to 10/4/2012 were subjected to questionnaire to determine the risk factors including age, sex, occupation, smoking, physical activity, co-morbid conditions, and family history. And we recorded the echocardiographic findings and the final clinical diagnosis for every patient for determining the type, severity, and presence of etiological findings for the heart failure.

**Data Analysis:-**

The gathered data was processed using Statistical Package of Social Sciences version 17 (SPSS version 17 Inc., Chicago, IL, USA), data was analyzed presented in terms of percentage, means and standard deviations.

**Ethical consideration:-**

The search aim and method is explained for every patient and a verbal consent is taken, and every one had the right to accept or refuse sharing in our search.

**Results:-**

About one third of the total patients admitted to the medical department in Madina Cardiac Centre have heart failure (30.3%). Heart failure is more common in males (75%) and in those over the age of 65 (65%) (Table 2). Half of the patients with heart failure are retired and illiterates. DM, hypertension and hyperlipidemia were a common findings in patients with heart failure (45%, 45%, and 40%) respectively (Table 4). Ischemic heart diseases was the commonest etiology for those with heart failure (85%) (Table 3). Though most of the studied cardiovascular risk factors were prevalent in both patients with heart failure and those with the other cardiac diseases, only smoking and gout (Table 4) were significantly more in the patients with heart failure.

**Table 1:-** presence of chronic illness in the study subjects

The illness	number	%
Diabetes	31	48.4
Hypertension	34	53.1
Hyperlipedemia	29	45.3
Gout	10	15.6
Ch. Liver disease	3	4.7
Ch. Renal disease	6	9.4

**Table 2:-** age distribution for the patients with heart failure

age	number	%
21-30	2	10
31-40	0	0
41-50	1	5
51-60	4	20
60	13	65

**Table 3:-**The associated cardiac diseases in the patients with heart failure

Cardiac diseases	number	%
Acquired disease	19	95
Congenital disease	1	5
Ischemic heart diseases	17	85
Valvular heart diseases	5	25

**Table 4:-**risk factors for cardiac diseases in patients with and without heart failure

The risk	Heart failur		No H. F.		total	
	No.	%	No.	%	No.	%
DM	9	45	22	50	31	48.4
Hypertension	9	45	25	56.8	34	53.1
Hyperlipedemia	8	40	21	47.7	29	45.3
Gout	4	20	6	13.6	10	15.6
Ch.liver disease	2	10	1	2.3	3	4.7
Ch.renal disease	4	20	2	4.5	6	9.1
+ve family h.	1	5	6	13.6	7	10.6
Sedentary life	14	70	37	84.1	51	77.3
Smoking	4	20	7	15.9	11	17.1
total	20	100	44	100	64	100

### Discussion:-

In our study many factors are associated with heart failure, the most common of which is ischemic heart disease which is also the most common cause of HF in western countries (18) . Male sex , illiterates , DM, hypertension and hyperlipidemia are also common Factors and these findings were reported in many studies that investigated patients with HF. One of these studies is the First National Health and Nutrition Examination Survey done in the United States that followed 13643 patients who didn't have a history of HF over 20 years period and the incidence of HF was associated significantly with : male sex , less than a high school education, low physical activity, cigarette smoking, overweight, hypertension, diabetes, valvular heart disease and coronary heart disease(19). Also Framingham Heart Study found that patients with blood pressure  $\geq 100/160$  mm Hg have 2 times more risk for developing HF when compared to patients with blood pressure  $< 90/140$ mmHg. They also reported that Older people are at increased risk for developing HF (20) .

**Conclusion:-**

Many factors are associated with heart failure, the most common of which is ischemic heart disease. DM, hypertension and hyperlipidemia are also common findings in patients with heart failure.

**Study limitations:-**

The main limitation in our study is the cross-sectional study design, with its limitations, including recall bias. Also the low number of the patient included in the study .

**Conflict of interest:-**

The authors declare that they do not have any conflicts of interest to declare.

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**References:-**

1. Rosamond W, Flegal K, Friday G, Furie K, Go A, Greenlund K, et al. Heart disease and stroke statistics – 2007 update: A report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation* 2007; 115: e69 – e171.
2. Schocken DD, Benjamin EJ, Fonarow GC, Krumholz HM, Levy D, Mensah GA, et al. Prevention of heart failure: A scientific statement from the American Heart Association Councils on Epidemiology and Prevention, Clinical Cardiology, Cardiovascular Nursing, and High Blood Pressure Research; Quality of Care and Outcomes Research Interdisciplinary Working Group; and Functional Genomics and Translational Biology Interdisciplinary Working Group. *Circulation* 2008; 117: 2544 – 2565.
3. Albert MA. Heart failure in the urban African enclave of Soweto: A case study of contemporary epidemiological transition in the developing world. *Circulation* 2008; 118: 2323 – 2325.
4. Shantsila E, Lip GY, Gill PS. Systolic heart failure in South Asians. *Int J Clin Pract* 2011; 65: 1274 – 1282.
5. Khanam MA, Streatfield PK, Kabir ZN, Qiu C, Cornelius C, Wahlin A. Prevalence and patterns of multimorbidity among elderly people in rural Bangladesh: A cross-sectional study. *J Health Popul Nutr* 2011; 29: 406 – 414.
6. Roger VL, Go AS, Lloyd-Jones DM, Benjamin EJ, Berry JD, Borden WB, et al. Heart disease and stroke statistics – 2012 update: A report from the American Heart Association. *Circulation* 2012; 125: e2 – e220.
7. Chen J, Normand SL, Wang Y, Krumholz HM. National and regional trends in heart failure hospitalization and mortality rates for Medicare beneficiaries, 1998–2008. *JAMA* 2011; 306: 1669 – 1678.
9. Shiba N, Nochioka K from the CHART-2 study. *Circ J* 2011; 75: 823 – 833.
10. Adams KF Jr, Fonarow GC, Emerman CL, LeJemtel TH, Costanzo MR, Abraham WT, et al. Characteristics and outcomes of patients hospitalized for heart failure in the United States: Rationale, design, and preliminary observations from the first 100,000 cases in the Acute Decompensated Heart Failure National Registry (ADHERE). *Am Heart J* 2005; 149: 209 – 216.
11. Fonarow GC, Abraham WT, Albert NM, Gattis WA, Gheorghiade M, Greenberg B, et al. Organized Program to Initiate Life saving Treatment in Hospitalized Patients with Heart Failure (OPTIMIZE-HF): Rationale and design. *Am Heart J* 2004; 148: 4351.
12. Fonarow GC, Corday E. Overview of acutely decompensated congestive heart failure (ADHF): A report from the ADHERE registry. *Heart Fail Rev* 2004; 9: 179 – 185.
13. Atherton JJ, Hayward CS, Wan Ahmad WA, Kwok B, Jorge J, Hernandez AF, et al. Patient Characteristics From a Regional Multicenter Database of Acute Decompensated Heart Failure in Asia Pacific (ADHERE International-Asia Pacific). *J Card Fail* 2012; 18: 82 – 88.
15. Fonarow GC, Stough WG, Abraham WT, Albert NM, Gheorghiade M, Greenberg BH, et al. Characteristics, treatments, and outcomes of patients with preserved systolic function hospitalized for heart failure: A report from the OPTIMIZE-HF Registry. *J Am Coll Cardiol* 2007; 50: 768 – 777.
16. Tsuchihashi-Makaya M, Hamaguchi S, Kinugawa S, Yokota T, Goto D, Yokoshiki H, et al. Characteristics and outcomes of hospitalized patients with heart failure and reduced vs preserved ejection fraction: Report from the Japanese Cardiac Registry of Heart Failure in Cardiology (JCARE-CARD). *Circ J* 2009; 73: 1893 – 1900.



17. Gustavo Luiz Almeida Junior<sup>I</sup>; Sérgio Salles Xavier<sup>III</sup>; Marcelo Iorio Garcia<sup>II</sup>; Nadine Clausell<sup>IV</sup>. Hemodynamic assessment in heart failure: role of physical examination and noninvasive methods. Arq. Bras. Cardiol. vol.98 no.1 São Paulo Jan. 2012
18. Vasan, R. S., and Peter Wilson. "Epidemiology and causes of heart failure." Up To Date 16 (2014).
19. He, Jiang, et al. "Risk factors for congestive heart failure in US men and women: NHANES I epidemiologic follow-up study." Archives of internal medicine 161.7 (2001): 996-1002.
20. Lloyd-Jones, Donald M., et al. "Lifetime risk for developing congestive heart failure." Circulation 106.24 (2002): 3068-3072.

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### RESEARCH ARTICLE

#### OIL-ON-WATER MQL MACHINING OF NICKEL BASED SUPER ALLOY NIMONIC C.263

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temperature; Surface roughness

#### Abstract

Increasing demand for gas turbines (air and automobile industry) resulted in need for materials resistant at elevated work temperatures. Use of these materials increases the utilization factor since input temperatures are higher. For these applications high dynamic strength materials and materials with small elongation at elevated temperatures are needed. Furthermore, these materials should be resistant on corrosion of exhaust gases. High strength at elevated temperatures classifies them in the group of hard-to-machine materials. Since machining of super alloys generates great deal of heat, it must be dissipated using large quantity of metal working fluids (MWFs). Cost of metal working fluids is increasing as the number and extent of environmental regulations increase. To decrease the impact on environment new machining techniques are developed. These techniques use minimal quantities of metal working fluids in quantities from 10 to 50 ml/h. Furthermore, there is no cost associated with treatment and disposal of MWFs, simply because there is nothing to dispose. It is well known that flood technique produces large quantity of waste which is classified as hazardous. This work deals with research of machinability of these super alloys using dry and semi-dry machining techniques, as environmental friendly techniques and as answer to the ever rising costs of production of machining operation with flooding of cutting zone.

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#### Introduction:-

Increasing impact of machining process on environment resulted in increasing costs of production mostly because of the cost of MWFs regarding its disposal since they are classified as a hazardous waste. Misunderstanding of the role of metal working fluid in machining and wrong assumption that MWFs application is needed but not necessary element of the machining process lead towards inadequate use of the metalworking fluids. This inadequate use increases the impact on environment even more. Yet, positive applications of MWFs, concerning cutting forces, surface roughness, tool life and cutting temperatures, are reported every day, so this necessary part of machining process somehow must be reconciled with environment protection. If MWFs are going to be used, impact on environment must be minimized, and now days this is obligatory requirement.

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Basic functions of MWFs in machining are: lubrication, cooling, chip transport and protection of work piece and machine tool against corrosion (if only oil as MWF is used [1]). Cooling, chip transport and corrosion protection are pretty much explainable mechanisms but lubrication mechanism is still poorly explained. Extensive research is done and no proof is found for penetration of MWF into chip-tool interface. If there is no penetration how could lubrication occur? Still, there are no valid scientific explanations on how metal forming fluids actually work. Given explanations [2] are not fully accepted because there are no experimental conformations to support given theoretical assumptions. Hence, this field is still wide open for research.

Some experiments [2] about efficiency of MQL technique against conventional machining operations (flood machining) offered very interesting and promising mechanism of the penetration of MWFs into the chip-tool interface based on Rebinders' effect. These explanations could lead towards explaining how MQL actually works. Performed experiments led to conclusion that MQL enhance embrittlement of the material being removed, hence lowering cutting forces in that way. Since MQL machining is inferior in comparison to flood machining especially to high pressure supply of MWFs, the size of the particles and the way they enter into the cutting zone got to play important role in MQL machining. Maybe, that's the reason why in some cases (when machining aluminum) MQL machining gives better results even than flood machining [3]. Furthermore, Thakur et al. (2009) proved that MQL could successfully be used to perform machining of super alloy Inconel 718 [4].

Dry and semi-dry machining are promising alternatives for conventional (flood) machining. Dry machining considers machining with only compressed air to replace MWF, and in semi-dry machining beside compressed air some other components such as oil, water, CO<sub>2</sub>, liquid nitrogen etc. are used. There are no accepted classifications of MQL machining but literature and practice offer two levels of classification [5]. The first level includes the way in which aerosol is supplied into the machining zone (internal-through tool or external). Second level of classification includes the composition of the aerosol (simple: air-oil mixture or advanced: air-oil and some other components which enhance cooling and/or lubricating characteristic).

Studies showed that MQL machining with simple aerosol composition that includes only compressed air and oil has poor cooling capabilities and is not suitable for machining difficult-to-machine materials such as titanium and nickel based alloys where excessive heat generation is the main problem [6]. To increase cooling capability of the aerosol mixture, some other components such as: water, solid or gaseous CO<sub>2</sub> are added to the aerosol [2].

Another way to increase cooling capability of MWF is to use liquefied gases such as: carbon dioxide, nitrogen and helium as a cooling medium. As this machining is performed at very low temperatures it is often referred to as cryogenic machining. Nitrogen and helium are not considered as pollutants. On the other hand carbon dioxide is air pollutant and unlike nitrogen and helium is heavier than air and could cause CO<sub>2</sub> accumulation and oxygen deficiency problems on the shop floor [7]. Since carbon dioxide is gas without smell, its accumulation on the shop floor is very dangerous for machine tool operators.

Effectiveness of cryogenic machining in reducing tool wear, cutting force and surface quality of the work piece is already proven in experiments [8-11]. These experiments showed that cryogenic machining is superior in comparison to MQL and dry machining. However, due to the high initial costs of cryogenic machining systems, application and development of MQL machining systems is in constant up rise. One of examples of MQL machining which performs similar as flood machining (or even better [3, 12]) is advanced MQL machining with external supply of aerosol that includes compressed air, oil and water. The system supplies machining zone with water droplets covered with thin oil film. This semi-dry machining system is used in experimental research. In this experimental research, dry machining is performed without use of any metal working fluids.

Nickel-based super alloys are found in a wide range of applications. The most prominent use is in the manufacture of gas turbines for use in commercial and military aircraft, power generation, and marine propulsion [13]. Super alloys also find important applications in the oil and gas industry, space vehicles, submarines, nuclear reactors, military electric motors, chemical processing vessels, and heat exchanger tubing.

Application of nickel based super alloys depends upon their characteristics. Among the important characteristics high temperature creep resistance is one of most important properties. Creep takes place over time and results from long-term exposure to stress levels, and is more severe in materials subjected to heat for long periods. If the working temperatures are closer to the material melting point creep is even more intense. For example, a turbine blade made

of a non-creep resistant material and used in a high temperature environment may creep over time, contact the housing and damage the blade. Component failure is often the result of creep. Another important property of super alloys is corrosion resistance. Corrosion resistance arises from the formation of a protective oxide layer which protects the underlying material.

Since their introduction, a wide range of nickel-based super alloys have been developed. However, two families of nickel-based super alloys stand out. The first family of nickel-based super alloys, developed in the 1940s for use in early jet engines is known as Nimonic family. These alloys typically consist of more than 50% nickel and 20% chromium. The second family of nickel-based super alloys is the Inconel alloys, which are made using nickel, chrome and some iron. These two families become synonyms for heat resistant high strength materials.

Nimonic 263 is typical representative of heat resistant nickel based super alloys used for machine parts that work on elevated temperatures. Nimonic alloy 263 is an age-hardenable nickel-cobalt-chrome-molybdenum alloy which was designed to have excellent fabrication characteristics in the annealed condition but also very good aged strength properties. Nimonic alloy 263 was developed to provide a sheet material which could be readily fabricated and would offer improved ductility in welded assemblies to replace NIMONIC alloy 80A. It is supplied in the annealed condition and its excellent ductility in this condition makes it suitable for cold forming as well as hot working. Alloy 263 can be welded using matching composition filler wire in both Tungsten Inert Gas (TIG) and Metal Inert Gas (MIG) forms. Regarding the composition of Nimonic alloys, they are regarded as difficult-to-machine materials [14]. These materials produce excessive heat during machining operations. Since nickel based alloys have low heat conductivity, heat produced during machining operations results in very high cutting temperatures. High cutting temperatures led to excessive tool wear and low surface quality. Concerning this, large quantity of coolant is recommended during machining operations.

To make this experimental research as environmentally friendly as possible, oil used in experiments was refined rapeseed oil. Besides that, experiments showed that bio-based oils exhibit better results than petroleum based oils [15, 16].

### Experimental work:-

Experimental research was conducted in LORAM – Laboratory for Metal Cutting and Machine Tools of University of Zenica. Conventional lathe has been used. Experimental setup is shown in Figure 1. Three component dynamometer (Kistler Type-9265B) was used to measure cutting forces. Cutting temperature was measured by means of infrared camera Fluke Type-TI32 and surface roughness was measured with Perthometer M1. All three devices are shown in Figure 2.

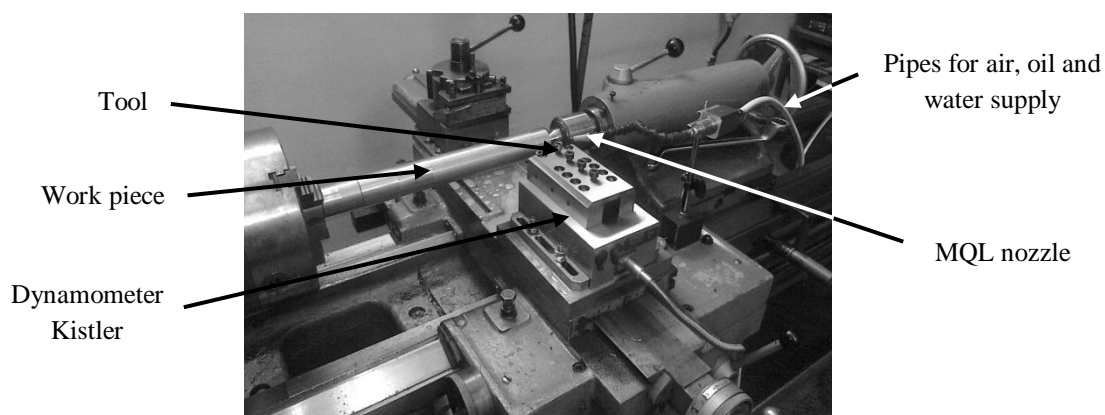
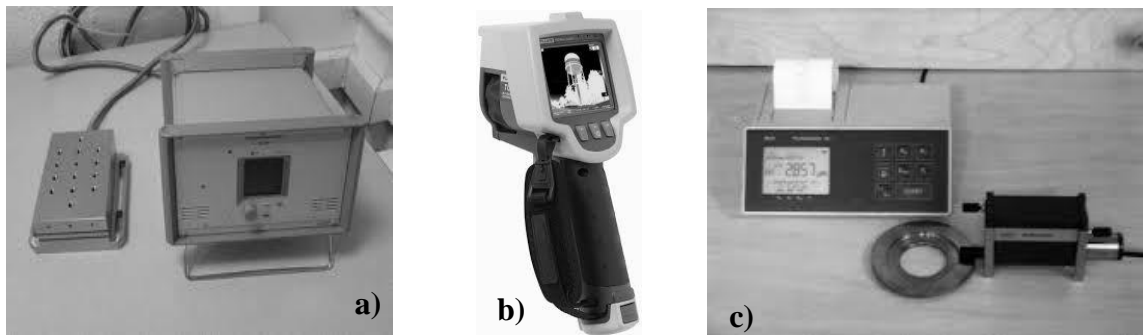
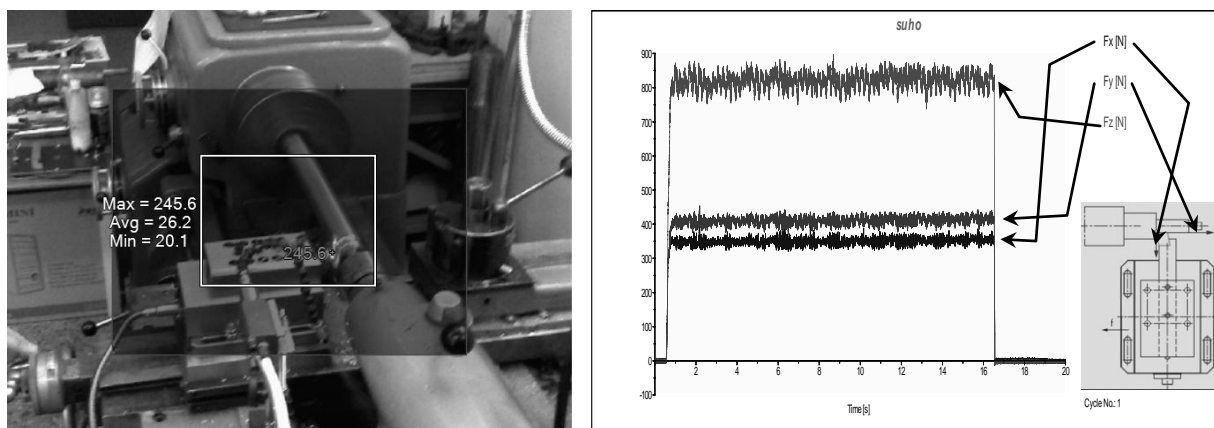


Figure 1:- Experimental setup



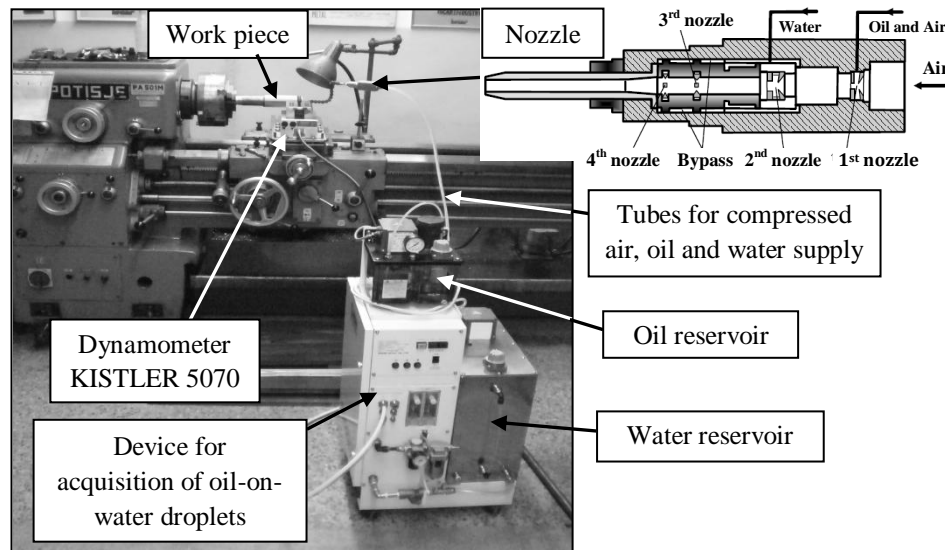
**Figure 2:-** Equipment for measurement of:  
a) cutting forces, b) temperatures and c) surface roughness

Temperature measurements should be used with caution since using this apparatus only temperature of chip that is being removed could be measured (Figure 3(left)). Temperature of tool tip cannot be measured with this apparatus, because it is not visible during machining. It was assumed that temperature of the chip being removed is in direct proportion to cutting temperature.

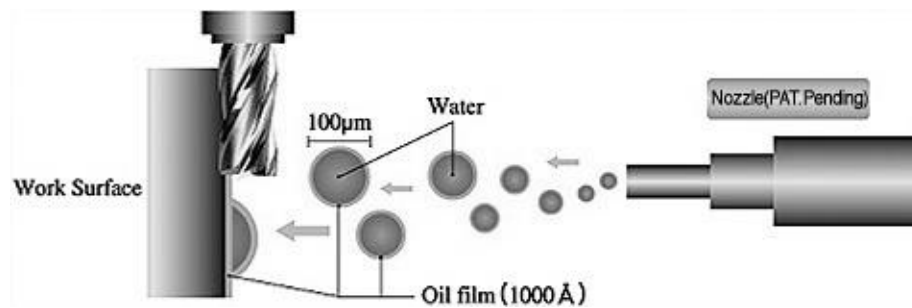


**Figure 3:-** Example of temperature measurement (left) and cutting forces measurement (right)

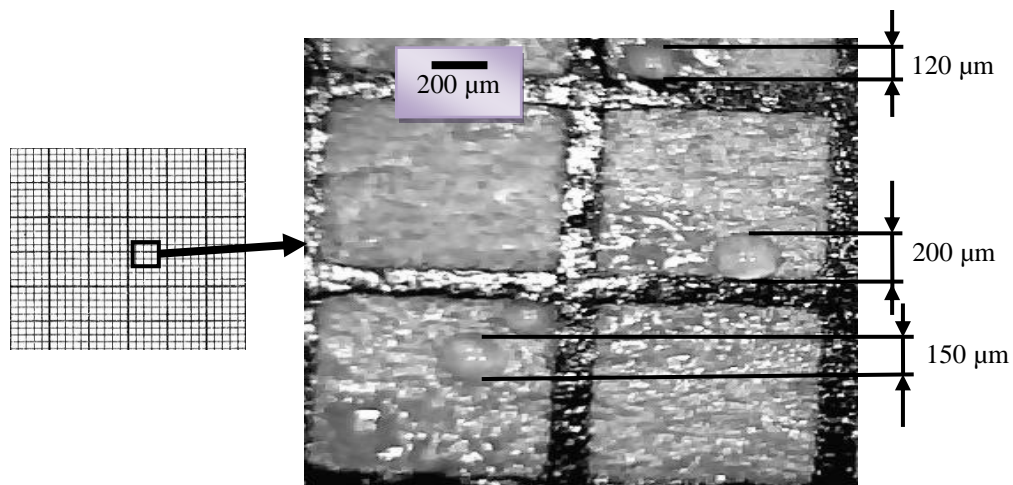
Semi-dry machining is performed using advanced MQL system type OoW (Oil-on-Water) produced by Daido Metal Co Japan. Main components of OoW system are presented in Figure 4. This MQL system makes droplets of water 100-200  $\mu\text{m}$  in diameter with oily film around it, as shown in Figures 5 and 6. Droplets captured on paper show that diameter of droplets is in the given range. Taking into account that diameter of droplets is larger after contact with hard surface, diameter of a flying droplet is closer to 100  $\mu\text{m}$ . Comparing to MQL with only compressed air and oil used (size of the particles 5 to 30  $\mu\text{m}$ ) these particles are up to 20 times larger. Studies show that size of the particles could be essential for effectiveness of MQL machining. Reported effectiveness of this system [2, 12, 17] indicates that size of OoW droplets could still be in acceptable range.



**Figure 4:-** Device for acquisition of Oil-On-Water droplets with detail of nozzle cross section



**Figure 5:-** Oil-On-Water droplets [17]



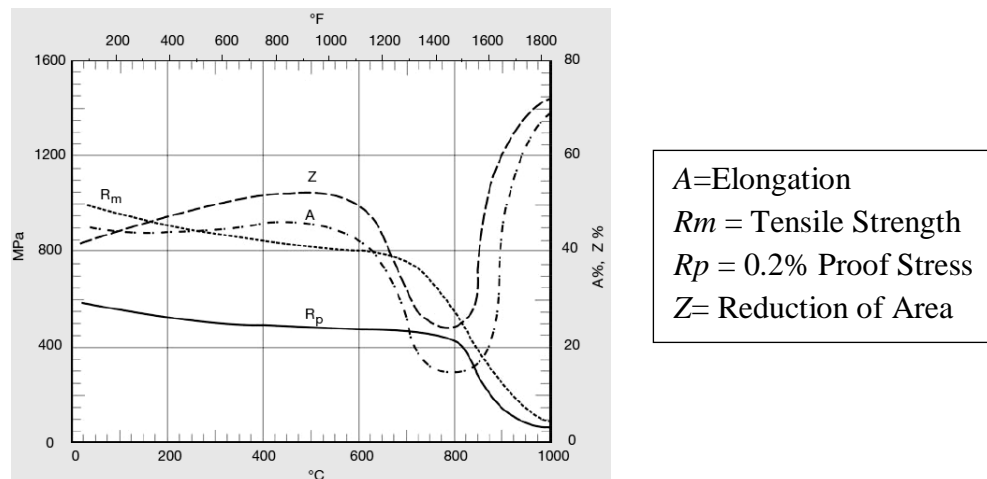
**Figure 6:-** Oil-On-Water droplets captured on paper with millimeter division

MQL system settings are as follows: oil consumption is in range from 10-50 ml/h and water from 300 to 1800 ml/h. The pressure of compressed air used for atomization of oil and water is 0.2 MPa.

Oil used in experiments is refined rapeseed oil with excellent lubrication properties. Rapeseed oil is probably the best natural lubrication media on the market but widely avoided because of residue oil that makes gummy and sticky stains on the machine and work piece, especially undesirable on finish surface of the work piece.

Work piece material is nickel based super alloy Nimonic 263 which is a typical representative of heat resistant alloys used in gas turbines. Chemical composition of Nimonic 263 is presented in Table 1, and its mechanical properties are shown in Figure 7. Two work pieces are selected. First one was in cast condition and second one was after casting forged with 60% deformation.

The aim of this research is to investigate difference between dry and semi-dry machining concerning cutting forces, cutting temperatures and surface roughness  $R_a$  and to optimize the MQL parameters such as: quantity of oil, quantity of water and nozzle position in relation to cutting force, cutting temperature and surface roughness.



**Figure 7:-** Tensile properties of bar. Heat treatment 2h/1150°C/WQ + 8h/800°C/AC

**Table 1:-** Chemical composition of Nimonic 263 and Nimocast 263

Alloy	Composition (%)												
	C	Si	Cu	Fe	Mn	Cr	Ti	Al	Co	Mo	B	Zr	Ni
Nimonic 263	0.04 0.08	0.04 max	0.2 max	0.7 max	0.2 0.6	19.0 21.0	1.9 2.4	0.3 0.6	19.0 21.0	5.6 6.1	0.001 max	0.02 max	Rest
Nimocast 263	0.06	0.04 max	0.2 max	0.7 max	0.6 max	20.0	2.3	0.5	20.0	6.0	0.001 max	0.02 max	Rest

Two series of experiments are performed. In the first set of experiments, cutting speed, depth of cut and feed are varied and MQL parameters are held on constant level (quantity of water 250 ml/h; quantity of oil 50 ml/h; pressure of compressed air 0.2 MPa, nozzle position: rake side of the tool). This experiment was performed to check a level of cutting speed, feed, depth of cut and type of cutting tool to be used in second set of experiments which were conducted by varying MQL machining parameters. The second set of experiments was planned using full factorial experimental design and following, MQL parameters were varied: quantity of water, quantity of oil and nozzle position.

## Results and Discussion:-

### Experimental setup No.1 – castings:-

Settings for first series of experiments are shown in Table 2. Experiments were performed and cutting forces, temperatures and surface roughness were measured; data is presented in the Table 3. Graphical interpretation of results from Table 3 is shown in Figures 8, 9 and 10.

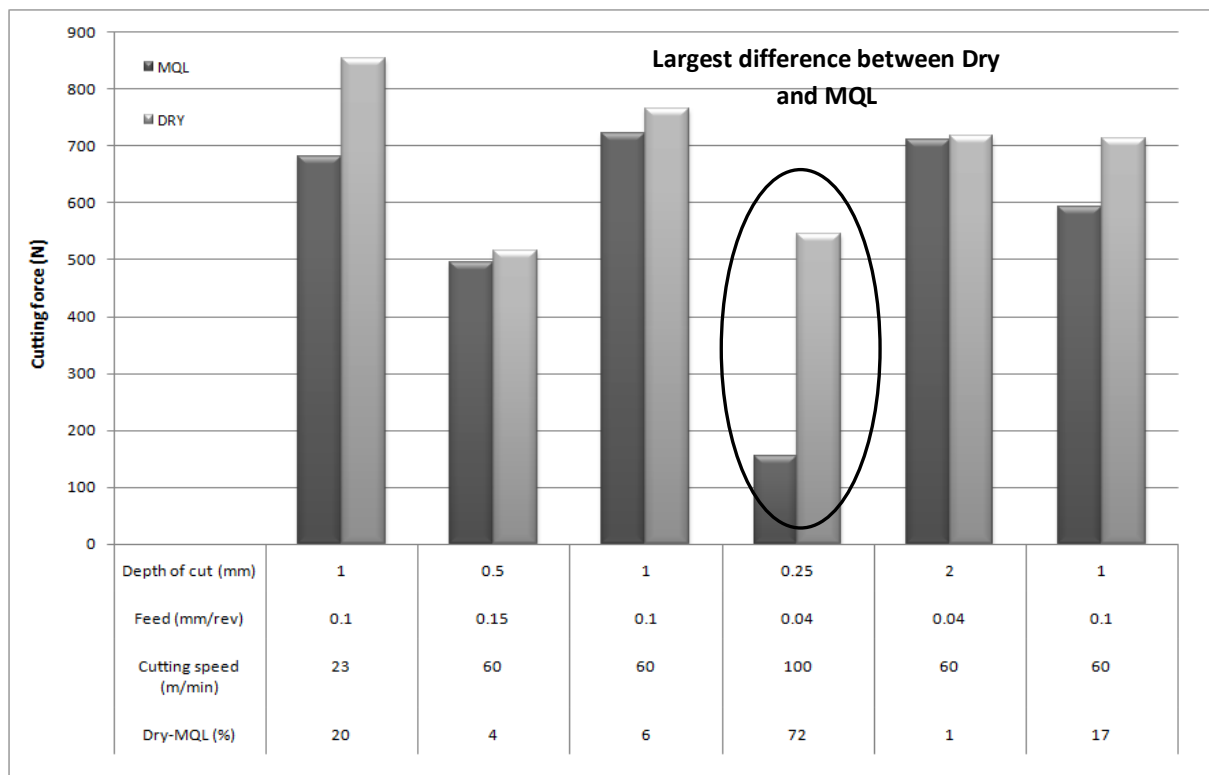
All experiments with first work piece are characterized by the intensive tool wear (Figure 11). It can be seen that wear occurs on rake face and flank face. Tool edge shown in Figure 11 is used in experiment number 5 on a machining length approximately 50 mm. Same tool edge was used for MQL and dry machining. First 25 mm was for MQL machining and remaining 25 mm was for dry machining.

**Table 2:-** Experimental settings for the first work piece

OoW (Oil on Water)	Quantities	Oil: 50 ml/h, Water: 250 ml/h, Air 6000 NI/h (100 NI/min)
	Particle size	100 – 200 $\mu$ m
Dry machining		Without use of MWFs
Work piece material		Nimonic 263 – casting
Tool		PVD coated cemented carbides with following designation: SNMG 120408-SM and CNMG 120408
Work piece material diameter		$\varnothing$ 60 mm
Depth of cut		0.25, 0.5, 1.0 and 2.0 mm
Feed		0.04, 0.1 and 0.15 mm/rev.
Cutting speed		23, 60 and 100 m/min

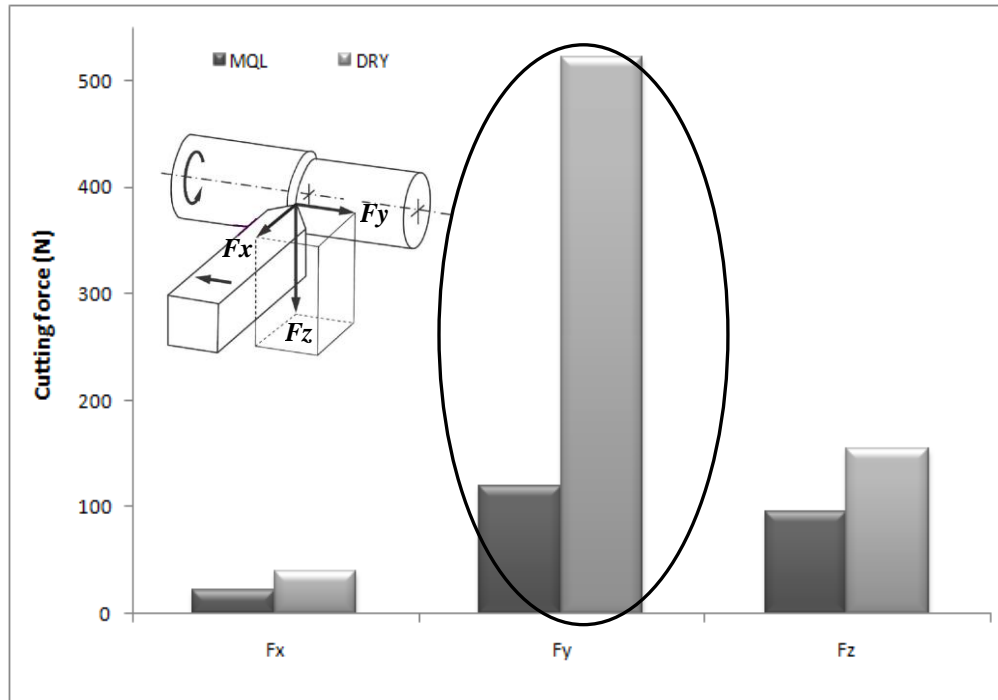
**Table 3:-** Results of experiments with first work piece (settings according to Table 1.)

Number of experiment	Cutting speed (m/min)	Feed (mm/rev)	Depth of cut (mm)	MQL machining		Dry machining	
				TemM $^{\circ}$ C	FrezM N	TemS $^{\circ}$ C	FrezS N
1	23	0.098	1.0	128	628	201	855
2	60	0.142	0.5	121	495	176	516
3	60	0.098	1.0	124	722	183	767
4	100	0.04	0.25	45	154	72	545
5	60	0.04	2.0	37	712	43	719
6	60	0.098	1.0	218	592	242	714

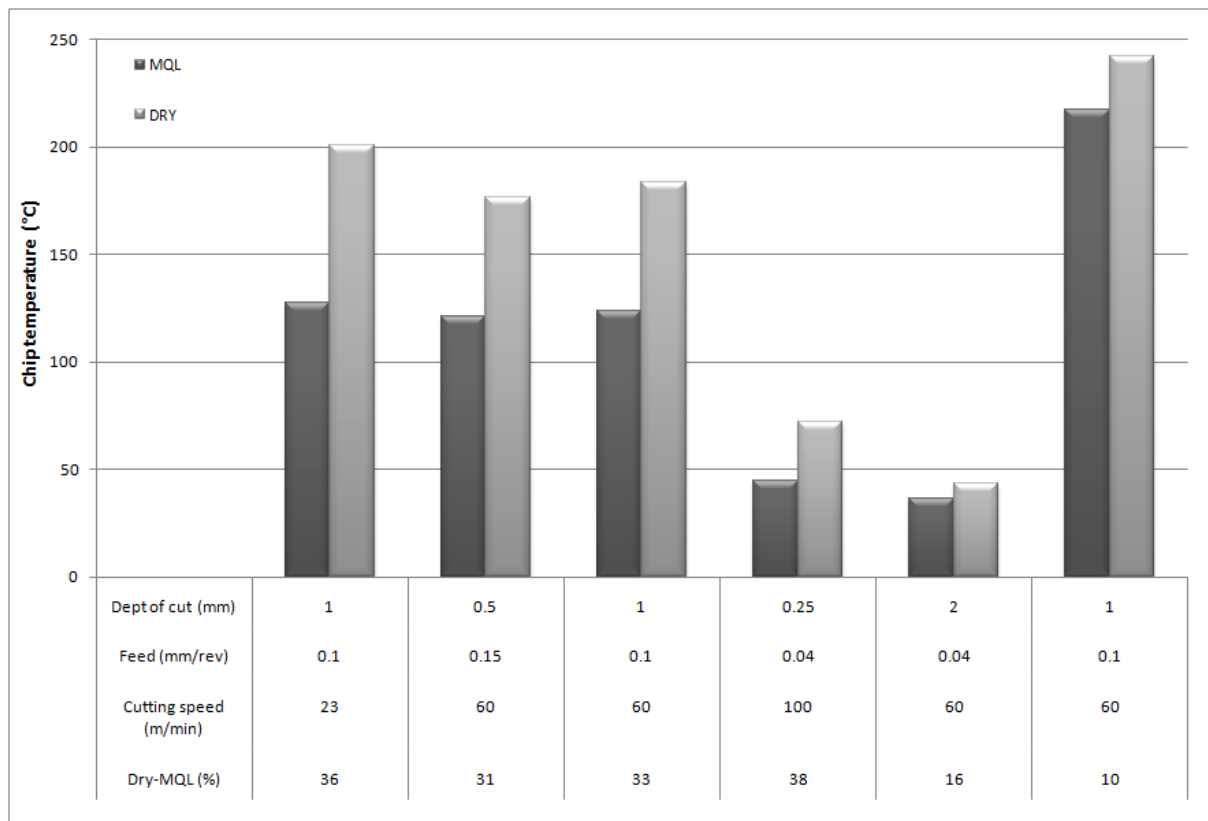


**Figure 8:-** Cutting force for experiments with first work piece (refer Table 3.)

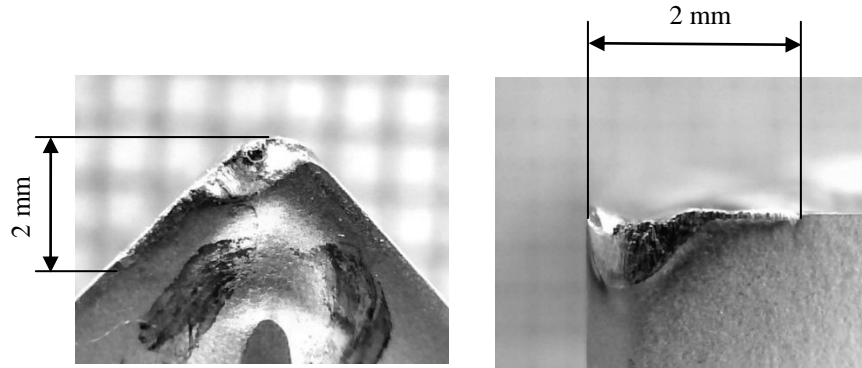




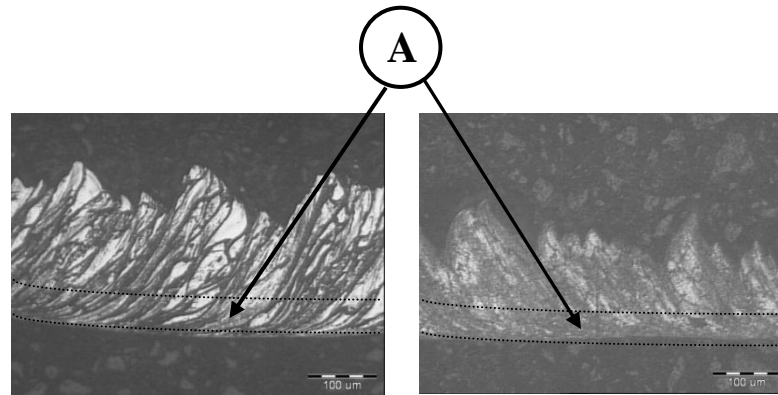
**Figure 9:-** Cutting force components for the experiment number 4 according to Table 3



**Figure 10:-** Chip temperatures for experiments with first work piece (refer Table 3.)



**Figure 11:-**Cutting tool SNMG 120408-SM rake face (left) flank face (right)



**Figure 12:-**Metallographic image of chip, MQL (left) and dry machining (right)

On the basis of generated experimental data for experimental setup No.1 presented in Tables 2 and 3, as well as Figures 8 to 12 the following conclusions were made:

- For the same depth of cut and feed, MQL machining gives 20% smaller cutting force when machining is performed at lower cutting speed of 23 m/min, Figure 8. That means 20% less energy for cutting process is needed when using MQL, concerning proper power calculation from spindle to drive.
- The largest difference between cutting forces (MQL vs. dry machining) is at a cutting speed of 100 m/min and at feed of 0.04 mm/rev, as shown in Figure 8 experiment number 4. Cutting force components for this experiment are shown in Figure 9. Analysis of cutting force components showed that, under given machining conditions, feed force component  $F_y$  decreased significantly. This is the main reason of this large difference between MQL and dry machining.
- As it can be seen in the Figure 10, temperature of the chip is always smaller with MQL machining. Maximum difference between MQL and dry machining is 38% in experiment number 4 (cutting speed 100 m/min, feed 0.04 mm/rev and depth of cut 0.25 mm) in favor to MQL machining. It is difficult to define influence of cutting speed, feed and depth of cut on chip temperature. On the other hand, chip temperature measurement was performed in a nonconventional way using infrared camera. In this way only temperature of chip moving away from the cutting zone could be measured and not in any case temperature on tool tip.
- Intensive tool wear shown in Figure 11 clearly indicate that this material belongs in a group of hard-to-machine materials. Figure show that tool wear is happening on both rake face and flank face. Metallographic images shown in Figure 12 reveal obstruction of proper flow of material with the formation of additional friction layer in root of the chip (designated with A in Figure 12).

#### **Experimental setup No.2 – cast then forged with 60% deformation:-**

Machining conditions for the experiment No.2 were: cutting speed  $v=60$  m/min, depth of cut  $d=1$  mm and feed  $f=1.5$  mm/rev. Selection has been made upon data from the experiment No.1. Selected tool for experiment No.2 is cemented carbide insert SNMG 120408.

Settings for this experiment are shown in Table 4. This experiment is performed according to factorial experimental design. Factor levels and intervals of variations are given in Table 5. Following factors have been controlled: quantity of water (ml/h); quantity of oil (ml/h) and nozzle position (rake face of the tool and flank face of the tool). Cutting speed, depth of cut and feed were held on a constant level  $v=60$  m/min,  $d=1$  mm and  $f=1.5$  mm/rev.

Experiments were performed and cutting forces, temperatures and surface roughness were measured; data is presented in the Table 6. Graphical interpretation of results from Table 6 is shown in Figures 13, 14, and 15.

**Table 4:-** Experimental settings for second work piece.

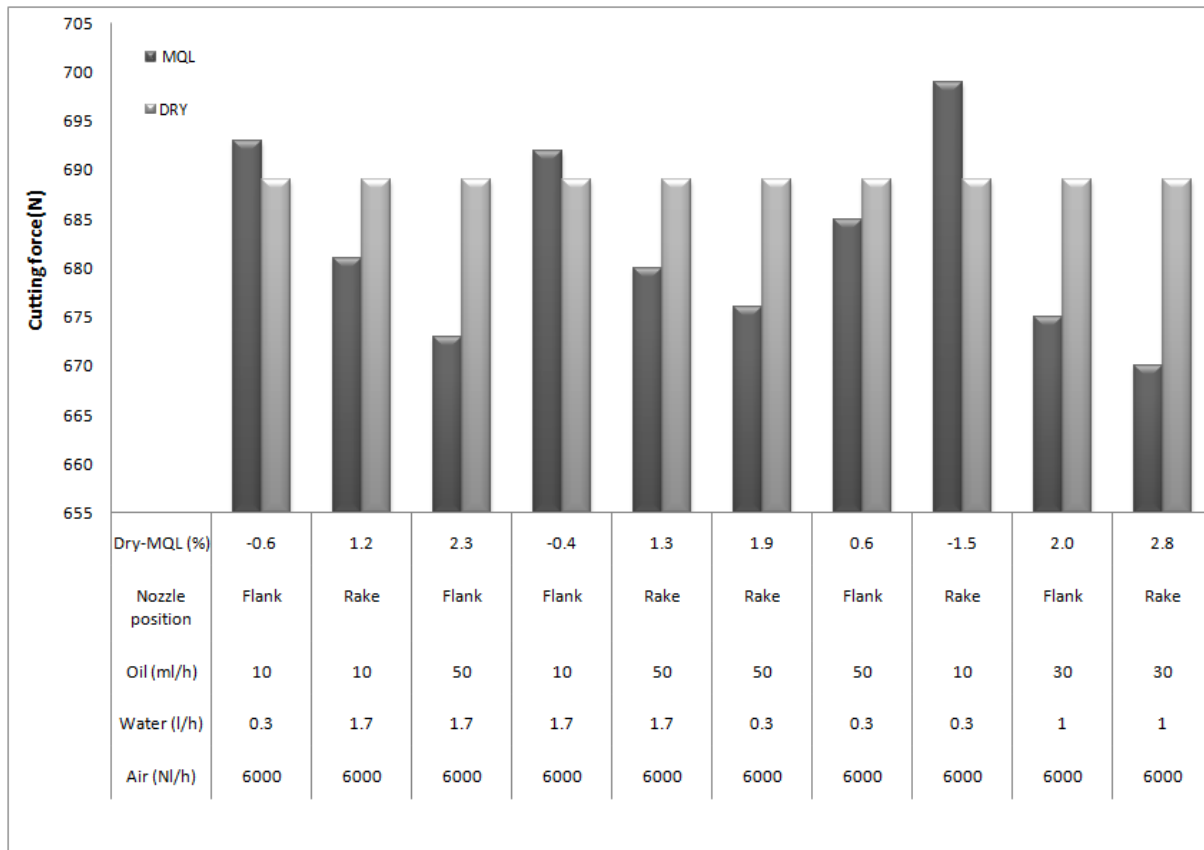
OoW (Oil on Water)	Quantities	Oil: 10 to 50 ml/h, Water: 300 to 1700 ml/h, Air 6000 NI/h (100 NI/min), Nozzle position: Rake side and Flank side
	Particle size	100 – 200 $\mu$ m
Dry machining		Without use of MWFs
Work piece material		Nimonic 263 – forgings with 60% deformation
Tool		PVD coated cemented carbide with following designation: SNMG 120408-SM
Work piece diameter		$\varnothing 46$ mm
Depth of cut		0.25 mm
Feed		0.04 mm/rev
Cutting speed		23 m/min

**Table 5:-** Levels of factors and their intervals of variation

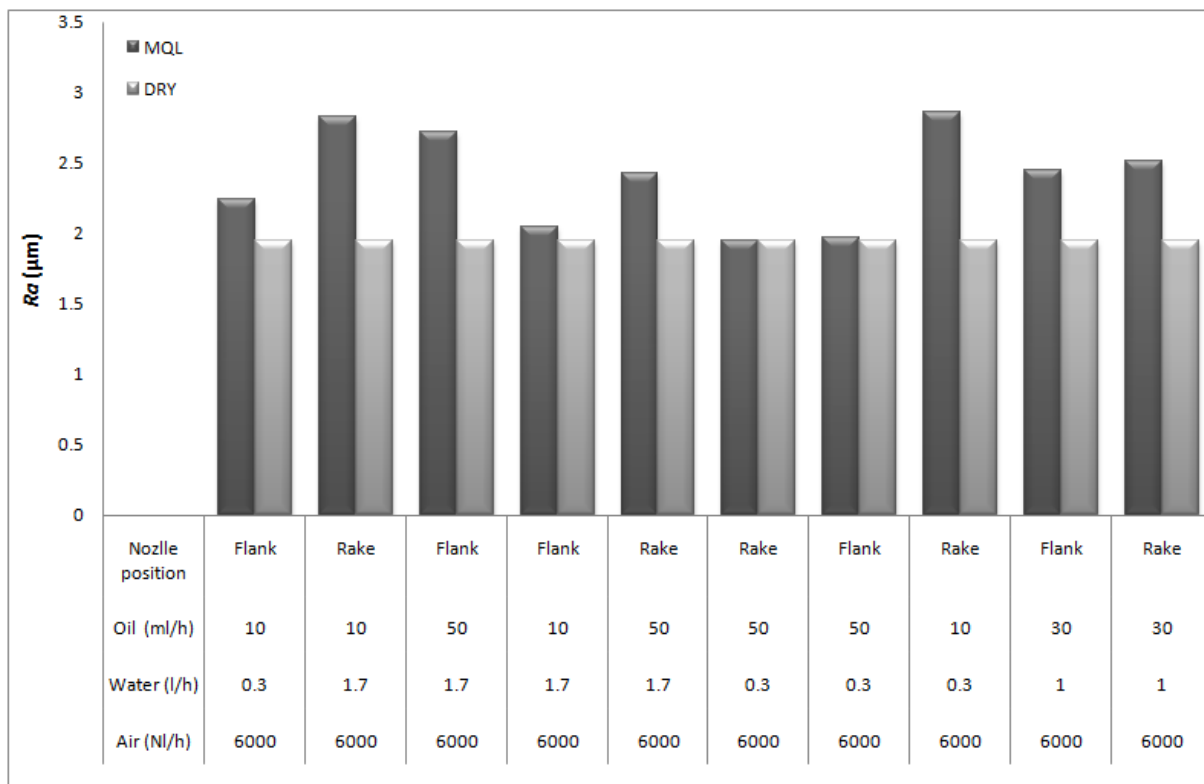
Level	Designation	Water (l/h)	Oil (ml/h)	Nozzle position
		$x_1$	$x_2$	$x_3$
Basic	0	1.0	30	-
Interval of variation	$\Delta x_i$	0.7	20	-
Upper	+1	1.7	50	Rake
Lower	-1	0.3	10	Flank

**Table 6:-** Plan matrix with natural levels of factors for experiments with second work piece

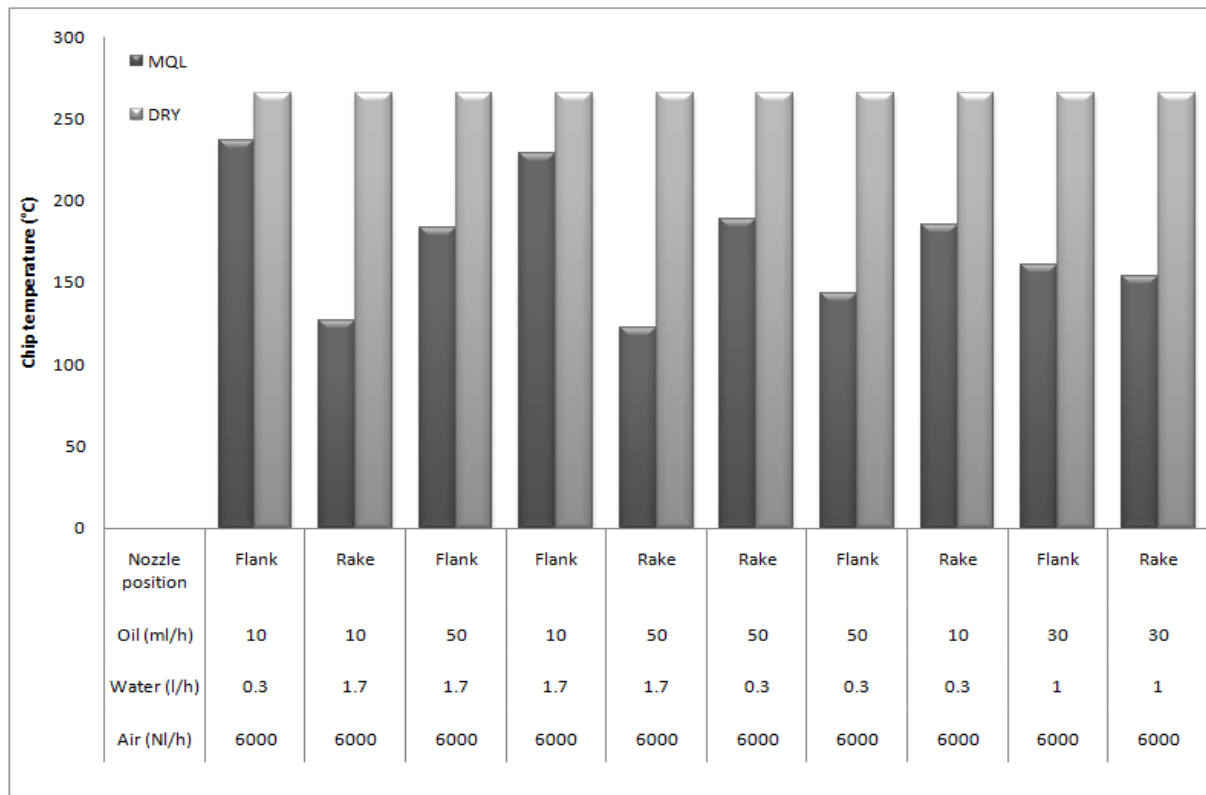
Point of the matrix	Water (l/h)	Oil (ml/h)	Nozzle position	Force N	Ra $\mu$ m	Chip Temperature $^{\circ}$ C
1	1.7	50	Flank	673	2.72	183
2	1.7	10	Flank	692	2.05	143
3	0.3	50	Flank	685	1.97	229
4	0.3	10	Flank	693	2.24	237
5	0.3	10	Rake	699	2.86	185
6	0.3	50	Rake	676	1.95	189
7	1.7	50	Rake	680	2.43	122
8	1.7	10	Rake	681	2.83	127
9	1.0	30	Flank	670	2.45	161
10	1.0	30	Rake	675	2.51	154
Dry machining		Trial No. 1		649	2.05	273
		Trial No. 2		729	1.84	257
		Average		689	1.94	265



**Figure 13:-** Cutting force for experiments with second work piece (refer Table 6.)



**Figure 14:-** Surface roughness  $R_a$  for experiments with second work piece (refer Table 6.)



**Figure 15:-** Chiptemperature for experiments with second work piece (refer Table 6.)

The goal of these experiments is to investigate influence of three parameters of MQL system i.e.: quantity of water ( $W$ , ml/h), quantity of oil ( $O$ , ml/h) and nozzle position ( $NP$ , rake or flank face of the tool) on resultant cutting force ( $F$ ), surface roughness ( $R_a$ ) and cutting temperature ( $T$ ). In that sense full factorial DOE with two repetitions at central point is used. Plan matrix with natural level of factors and results of experiments are shown in Table 6. Just for comparison, two trials with dry machining were performed; results are shown in Table 6, too. For the purpose of regression analysis, following designations are used:

**W** – Water, ml/h

**O** – Oil, ml/h

**NP** – Nozzle Position, Rake face or Flank face of the tool

**WO** – Water Oil

**WNP** – Water Nozzle Position

**ONP** – Oil Nozzle Position

**WONP** – Water Oil Nozzle Position

Regression analysis of experimental data from Table 6 gave the following regression models:

- Resultant cutting force  $F$ :

$$F = 702.20 - 0.007 W - 0.41 O + 7.25 NP + 0.00009 WO - 0.009 WNP - 0.27 ONP + 0.00029 WONP \quad \dots\dots\dots (1)$$

- Surface roughness  $R_a$ :

$$Ra = 2.75 - 0.0002 W - 0.018 O + 0.34 NP + 0.00001 WO + 0.00009 WNP - 0.006 ONP + 0.000003 WONP \quad \dots\dots\dots (2)$$

- Cutting temperature  $T$ :

$$T = 228.83 - 0.057 W - 0.154 O - 29.75 NP + 0.00034 WO + 0.0179 WNP - 0.302 ONP + 0.0005 WONP \dots\dots\dots (3)$$

**On the basis of experimental data and presented regression analysis, following conclusions were made:-**

- Cutting forces are generally smaller with MQL machining, as shown in Figure 13. Exceptions are trials with minimal quantity of oil and minimal quantity of water when cutting forces are greater with MQL machining, regardless of nozzle position.
- Surface roughness  $R_a$ , shown in Figure 14 is mostly higher with MQL machining compared to dry machining without use of any MWFs. Exceptions are trials with maximum quantity of oil and minimum quantity of water when surface roughness  $R_a$  is at same level,
- Chip temperature shown in Figure 15 is always smaller with MQL machining. Depending on combination of parameters, quantity of oil, quantity of water and nozzle position this difference can be up to 54% in the favor to MQL machining,
- Second order fitted line plots shown in Figure 16, 17 and 18 are used to find minimum cutting force, surface roughness and chip temperature.

Minimal cutting force is obtained for the following combination of parameters (Figure 16.):

**Oil = 35.08 ml/h, Water = 1100 ml/h**

As shown in Figure 17 regression equation for surface roughness has no local minimum. Minimal surface roughness  $R_a$  is obtained when parameters are chosen left or right from local maximum i.e.:

**Oil = 18 ml/h, Water = 1166 ml/h**

Minimal chip temperature is obtained by the following combination of parameters (Figure 18.):

**Oil = 28.05 ml/h, Water = 1688.57 ml/h**

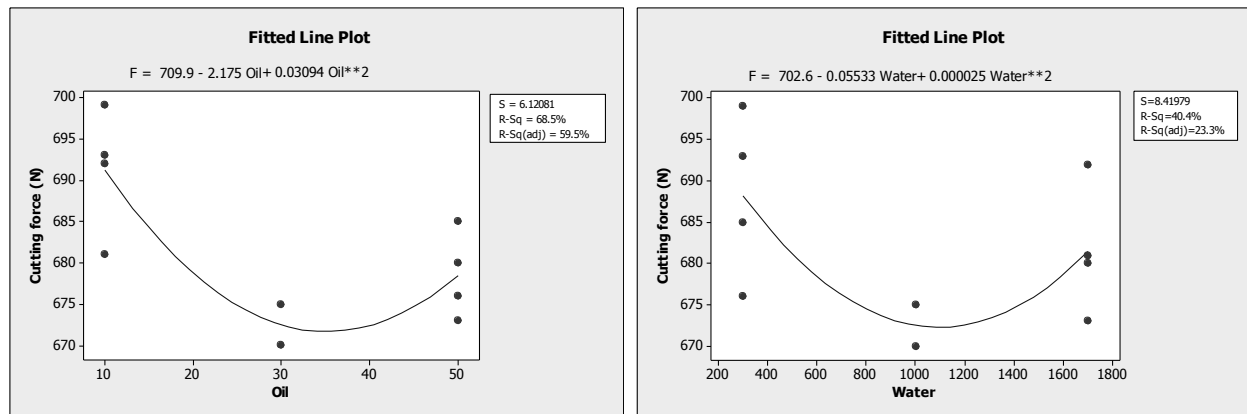
- Main effect plots for cutting force, surface roughness and chip temperature presented in Figure 19. show:

An increase of quantity of oil and water reduces cutting forces provided that increase of quantity of oil reduces cutting forces more quickly. Rake face position of nozzle gives smaller cutting forces compared to flank face position,

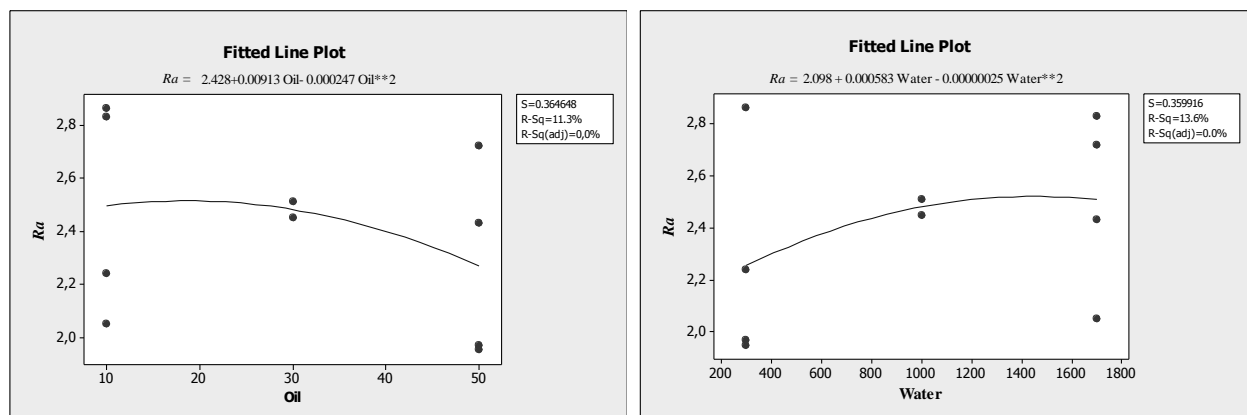
An increase of oil quantity reduces surface roughness  $R_a$ ; on the other hand an increase of water quantity increases surface roughness  $R_a$ . Flank face position of nozzle gives smaller surface roughness  $R_a$ ,

Naturally, increase of water quantity quickly decreases chip temperature. It is interesting that an increase of oil quantity slightly increases chip temperature. Rake position of nozzle gives smaller chip temperatures compared to a flank position of nozzle.

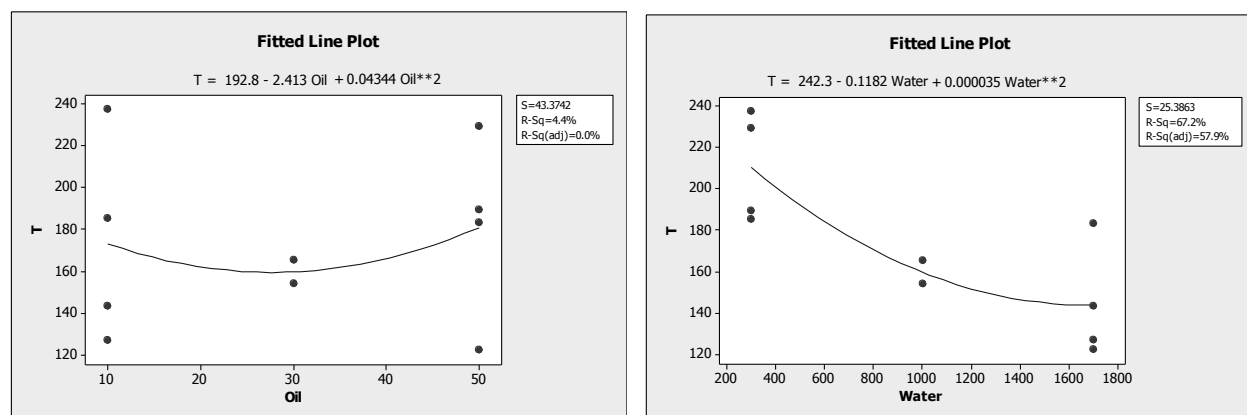
- From regression equations, it is obvious that nozzle position is the most influencing parameter on cutting force, surface roughness  $R_a$  and chip temperature. Although, MQL machining gives better results concerning cutting force and chip temperature, that advantage for example for cutting force is only 2.8% maximum.



**Figure 16.-** Fitted line plot of the resultant cutting force versus quantity of oil (left) and quantity of water (right)



**Figure 17:-** Fitted line plot of the surface roughness  $R_a$  versus quantity of oil (left) and quantity of water (right)



**Figure 18:-** Fitted line plot of the chip temperature versus quantity of oil (left) and quantity of water (right)

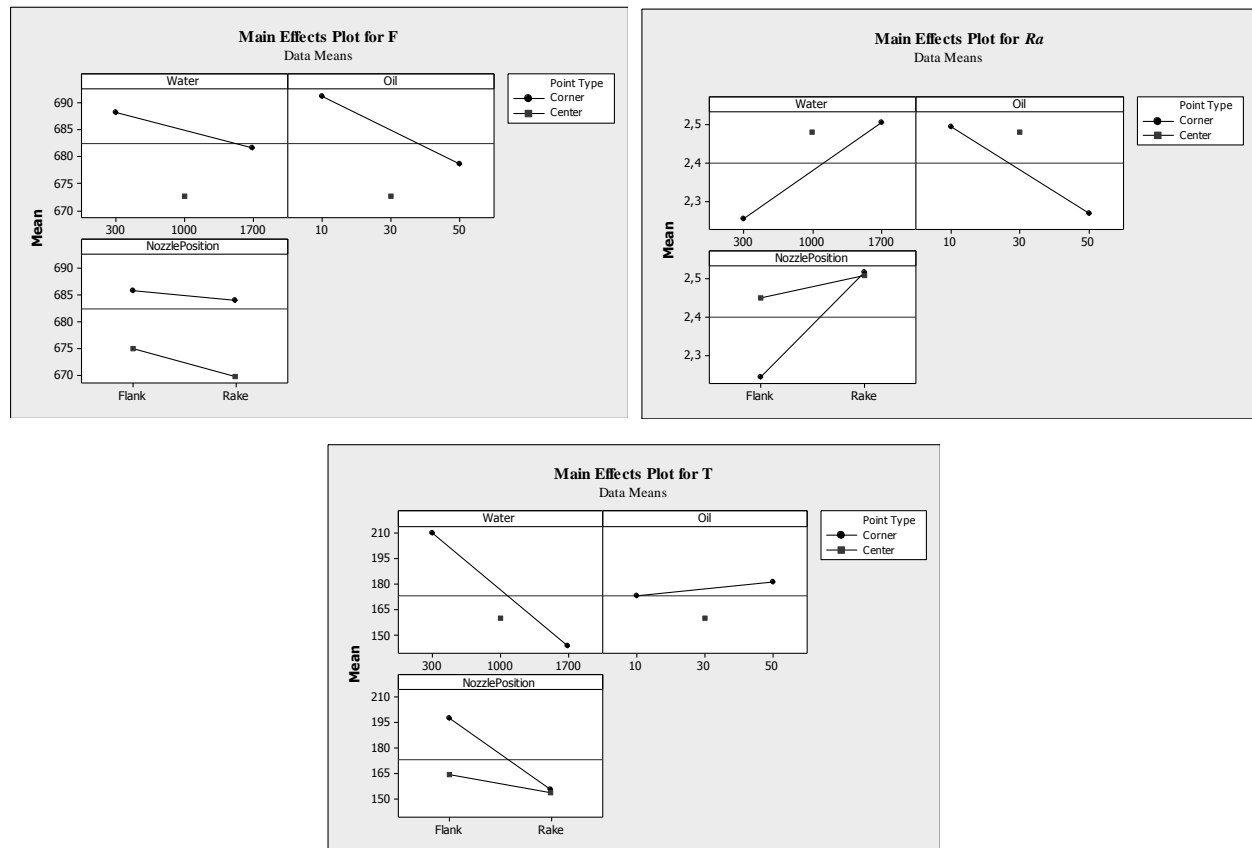


Figure 19:- Main effect plots

### Conclusion:-

Machining of nickel based super alloy, especially NIMONIC 263, according to literature [14,18] even with intensive supply of MWFs to cutting zone, is a difficult process characterized by short tool life.

The economical application of MQL machining in this research is analyzed through lower cutting forces, better surface roughness and smaller chip temperature. Experiments are performed in order to find MQL machining conditions under which MQL machining gives results similar to flood machining. These experiments showed that recommended machining data from literature (cutting speed, feed and depth) and recommended tool geometry do not give expected results. According to [18] tool life of uncoated carbide has 20 to 30 min tool life, whereas coated carbide tool used in experiments with PVD coating designed for high temperatures resistant alloys has tool life less than 1 min.

An experiment performed with cast specimen showed that cutting forces could be 20% smaller in comparison to the dry machining. That means that 20% less energy is needed when MQL is engaged. Chip temperature is 38% smaller with MQL. Intensive tool wear of both tools used in experiments points out that Nimonic 263 is hard-to-machine material. On the other hand, experiment with second specimen showed that application of advanced semi-dry machining technique (Oil-On-Water droplet) gives only 2.8% decrease of cutting force. It is obvious that MQL application must be optimized not only through optimization of MQL parameters like quantity of oil, quantity of water and nozzle position but through cutting force, feed and depth of cut as well.

Regression models (1), (2) and (3) clearly indicated that nozzle position is most influenced factor on cutting force, surface roughness  $R_a$  and chip temperature. But, in this research nozzle position parameter was of smallest attention and only two positions were chosen relatively to cutting zone (rake and flank). Future research of MQL machining should be performed with detailed definition of nozzle position like: angle of nozzle, distance from cutting zone, and pressure of compressed air used for atomization of oil and water.



Cutting force are smaller with MQL machining and minimal cutting force for given variation of MQL parameters is achieved with water quantity 1100 ml/h and oil quantity 35.08 ml/h.

Performed research shows that smallest surface roughness is achieved when aerosol mixture contains maximum quantity of oil and minimum quantity of water.

In comparison to dry machining cutting temperatures are significantly lower with MQL machining and that difference goes up to 54%.

## References:-

1. Oberg, E., Jones, F.D., Horton, H.L. & Ryffel, H.H. (2004). Machinery's handbook (27th Edition) & Guide to Machinery's Handbook, *Industrial Press*, pp. 1143-1146.
2. Astakhov, V.P. (2004). Tribology of Metal Cutting, *Elsevier*, London.
3. Yoshimura, H., Itoigawa, F., Nakamura, T., & Niwa, K. (2005). Development of nozzle system for oil-on-water droplet metalworking fluid and its application to practical production line, *JSME International Journal, Series C* 48(4): pp. 723-729.
4. Thakur, D.G., Ramamoorthy, B., & Vijayaraghavan, L. (2009). Optimisation of Minimum Quantity Lubrication Parameters in High Speed Turning of super alloy Inconel 718 for Sustainable Development, *World Academy of Science, Engineering and Technology* 54, pp. 224-226.
5. Davim, J.P. (2008) Machining: Fundamentals and recent advances, *Springer*, London.
6. Su, Y., He, N., Li, L., Iqbal, A., Xiao, M., Xu, S. & Qiu, B. (2007). Refrigerated cooling air cutting of difficult-to-cut materials, *International Journal of Machine Tools and Manufacture*, 47, pp. 927-933.
7. Hong, S.Y. (1999). Economical and Ecological Cryogenic Machining, *Journal of Manufacturing Science and Engineering*, 123, pp. 331-338.
8. Outerio, J.C., Pina, J.C., M'Saoubi, R., Pusavec, F. & Jawahir, I.S. (2008) Analysis of residual stresses induced by turning of difficult-to-machine materials, *CIRP Annals – Manufacturing technology* 57, pp. 77-80.
9. Pusavec, F., Hamadi, H., Kopac, J. & Jawahir, I.S. (2011). Surface integrity in cryogenic machining of nickel-based alloy-Inconel 718, *Journal of Materials Processing Technology*, 4, pp. 773-783.
10. Yang, S., Puleo, D.A., Dillon, O.W. & Jawahir, I.S. (2011). Surface layer modifications in Co-Cr-Mo biomedical Alloy from cryogenic burnishing, *1st CIRP Conference on surface integrity (CSI), Procedia Engineering* 19, pp. 383-388.
11. Kaynak, Y., Karaca, H.E., Noebe, R.D. & Jawahir, I.S. (2013). Tool-wear analysis in cryogenic machining of Ni-Ti Shape memory alloys: A comparison of tool-wear performance with dry and MQL machining, *Wear* 306, pp. 51-63.
12. Itoigawa, F., Childs, T.H.C., Nakamura, T. & Belluco, W. (2006). Effects and mechanisms in minimal quantity lubrication machining of an aluminium alloy, *Wear* 260, pp. 339-344.
13. International Nickel Study Group (2013), Secretariat briefing paper No.20.
14. Betteridge, W. & Heslop, J. (1974) The Nimonic alloys and other Nickel-Base High Temperature Alloys, *Edward Arnold Limited – London*.
15. Zhang, J. Z., Rao, P.N. & Eckman, M. (2012). Experimental evaluation of bio-based cutting fluid using multiple machining characteristics, *International journal of modern engineering*, Volume 12, 2, pp. 35-44.
16. Safian, S., Hisyam, M.A. & Aman, S. (2009). Evaluation of vegetable oil as alternative cutting lubricant when end milling martensitic stainless steel using uncoated carbide tool, *Journal of advanced manufacturing and technology*, 3, 2, pp. 49-55.
17. Yoshimura, H., Itoigawa, F., Nakamura, T. & Niwa, K. (2006). Study on stabilization of formation of oil film on water droplet cutting fluid. 2006, *Trans. Jpn. Soc. Mech. Eng. C* 72: 941-946.
18. Hračić, S., Optimizacija obradestrujanjem legure Nimonic-C.263. (1988). Magistrski rad, *Mašinska fakultet Univerziteta „Džemal Bijedić“*, Mostar.



## RESEARCH ARTICLE

### PHENOTYPIC AND MOLECULAR ANALYSIS IN TINOSPORA CORDIFOLIA.

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#### Abstract

Natural products with medicinal value are gradually gaining importance in clinical research due to their well-known property of no side effects as compared to drugs. *Tinospora cordifolia* commonly named as “Guduchi” is known for its immense application in the treatment of various diseases in the traditional ayurvedic literature. Recently the discovery of active components from the plant and their biological function in disease control has led to active interest in the plant across the globe. Our present study in this review encompasses (i) the genetic diversity of the plant and (ii) active components isolated from the plant and their biological role in disease targeting. The future scope of the review remains in exploiting the biochemical and signaling pathways affected by the compounds isolated from *Tinospora* so as to enable new and effective formulation in disease eradication.

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#### Introduction:-

*Tinospora cordifolia* commonly named as “Guduchi” in Sanskrit belonging to family Menispermaceae is a genetically diverse, large, deciduous climbing shrub with greenish yellow typical flowers, found at higher altitude.[1–3] In racemes or racemose panicles, the male flowers are clustered and female are solitary. The flowering season expands over summers and winters.[4] A variety of active components derived from the plant like alkaloids, steroids, diterpenoid lactones, aliphatics, and glycosides[4] have been isolated from the different parts of the plant body, including root, stem, and whole plant. Recently, the plant is of great interest to researchers across the globe because of its reported medicinal properties like anti-diabetic, anti-periodic, anti-spasmodic, anti-inflammatory, anti-arthritis, anti-oxidant, anti-allergic, anti-stress, anti-leprotic, anti-malarial, hepatoprotective, immunomodulatory and anti-neoplastic activities. In this review, we focus our attention to: (i) the reported genetic diversity in the Plant (ii) biological roles reported in humans and animals and active components from the plant. (iii) biological roles reported in humans and animals.

#### Material and Method:-

Published literature on recent developments in research in *Tinospora cordifolia*, including original articles and papers in Pubmed and Pubmed Central Databases were taken into study for the report. Information extracted from a total of 175 published articles of which five review articles and cross references thereof were collected. The search criteria were restricted to the roles of the plant in the field of medical advancements and the effects that has been observed with different experiments.

All the reports of experiments on different model types (*in vitro*, *ex vivo*, and *in vivo*) were taken varying from

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animal and human model systems. Reported data was analysed and represented in the form of figures and tables for the current review. ChemDraw Ultra 9.0 Software, Cambridge soft Life Science Enterprise Solutions was used for drawing the figures in the review. The figures of the compounds were obtained as reported in different journal sources.

## Results:-

### ***Tinospora cordifolia*: A genetically diverse plant:-**

Reports on studies of morphological and physiological characters of the plant, including plant length, stem diameter, growth habit, floral morphology, flower color, stomatal density, trichomal density, lenticels density, petiole length, plant biomass, and other characteristics of the plant and diversity in the genetic components identified by markers have indicated the diversity in the medicinal plant which has profound importance for efficient and effective management of plant genetic resources. Reports using markers for random amplified polymorphic DNA,[5] and inter-simple sequence repeat primers[1,5] have pointed toward the genetic variation within the population. However, reports on conservation strategies and propagation of the germplasm are few.

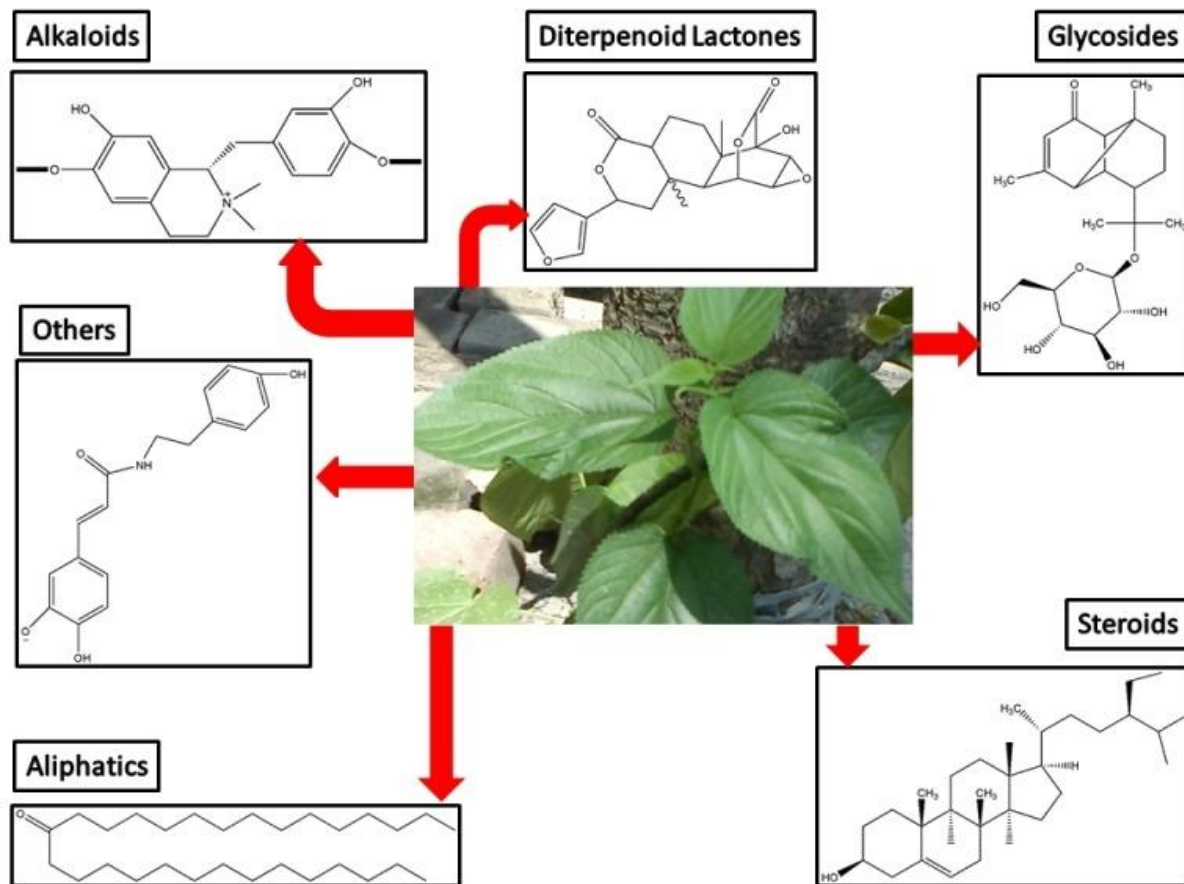
### ***Tinospora cordifolia*: Biological roles:-**

A myriad of biologically active compounds, including alkaloids, diterpenoid lactones, glycosides, steroids, sesquiterpenoid, phenolics, aliphatic compounds, and polysaccharides have been isolated from different parts of the plant body [Table 1], Figure 1]. These compounds have been reported to have different biological roles in disease conditions thus enabling potential application in clinical research. *Tinospora cordifolia* extracts are extensively used in various herbal preparations for the treatment of different ailments for its anti-periodic, anti-spasmodic, anti-microbial, anti-osteoporotic, anti-inflammatory, anti-arthritic, anti-allergic, and anti-diabetic properties[6] [Table 1].

**Table 1**

Active components and biological roles in humans and animals

Active component types	Compounds	Source	Reported biological effects in animals	In humans
Alkaloids	Berberine Choline Palmatine Tambetarine Magnoflorine Tetrahydropalmatine Tinosporin Isocolumbin Tetrahydropalmatine Jatrorrhizine Aporphine alkaloids, N-formylasimilobine 2-O-β-D-glucopyranosyl-(1→2)-β-D-glucopyranoside (tinoscorside A, 1) Aporphine alkaloids, N acetyl asimilobine 2-O-β-D-glucopyranosyl-(1→2)-β-D-glucopyr	Stem root	Isoquinoline alkaloids have anti-cataract potential in rats. Anti-oxidant activity in mice, anti-cancer in ehrlich ascites carcinoma (EAC) mice, hypoglycemic activity in RINm5F rat insulinoma cell line	Anti-cancer, infections, immuno-mod Neurological, anti-diabetes



#### The major biological property of *Tinospora cordifolia* includes:-

##### Immunomodulatory property:-

The immunomodulatory property of *Tinospora cordifolia* is well documented. Active compounds 11-hydroxymustakone, N-methyl-2-pyrrolidone, N-formylannonain, cordifolioside A, magnoflorine, tinocordiside and syringin[6] has been reported to have potential immunomodulatory and cytotoxic effects.[13] They have been reported to function by boosting the phagocytic activity of macrophages, production of reactive oxygen species (ROS) in human neutrophil cells, enhancement in nitric oxide (NO) production by stimulation of splenocytes and macrophages indicative of anti-tumor effects. Aqueous *Tinospora* extracts has been also reported to influence the cytokine production, mitogenicity, stimulation and activation of immune effector cells. In mice, *Tinospora cordifolia* extracts has been shown to result in up-regulation of IL-6 cytokine, resulting in acute reactions to injury, inflammation, activation of cytotoxic T cells, and B cell differentiation. Active compounds in aqueous extracts like alkaloids, di-terpenoid lactones, glycosides, steroids, sesquiterpenoid, phenolics, aliphatic compounds or polysaccharides[19] in experimental rat model have been reported for their cytotoxic action. Dry stem crude extracts of *Tinospora cordifolia* with a polyclonal B cell mitogen, G1-4A on binding to macrophages have been reported to enhance immune response in mice by inducing secretion of IL-1, together with activation of macrophages. Reports on *Tinospora cordifolia* in prevention of oxidative damage also exist. The (1,4)-alpha-d-glucan (alpha-d-glucan), derived *Tinospora cordifolia* have been shown to activate human lymphocytes with downstream synthesis of the pro- and anti-inflammatory cytokines, *in vitro*. Synergistic effects of compounds in the immunomodulatory activity of *Tinospora cordifolia* are reported.[6]

##### Anti-diabetes property:-

The stem of *Tinospora cordifolia* is widely used in the therapy of diabetes by regulating the blood glucose in traditional folk medicine of India. It has been reported to mediate its anti-diabetic potential through mitigating oxidative stress (OS), promoting insulin secretion and also by inhibiting gluconeogenesis and glycogenolysis, thereby regulating blood glucose. Alkaloids, tannins, cardiac glycosides, flavonoids, saponins, and steroids as the

major phytoconstituents of *Tinospora cordifolia* have been reported to play an anti-diabetic role.

The isoquinoline alkaloid rich fraction from stem, including, palmatine, jatrorrhizine, and magnoflorine have been reported for insulin-mimicking and insulin-releasing effect both *in vitro* and *in vivo*. [10] Oral treatments of root extracts have been reported to regulate blood glucose levels, enhance insulin secretion and suppress OS markers. Initiation and restoration of cellular defence anti-oxidant markers including superoxide dismutase (SOD), glutathione peroxidase (GPx) and glutathione (GSH), inhibition of glucose 6-phosphatase and fructose 1, 6-diphosphatase, restoration of glycogen content in liver was reported in *in vitro* studies. [10] The crude stem ethyl acetate, dichloromethane (DCM), chloroforms and hexane extracts of *Tinospora cordifolia* inhibited the enzyme's salivary and pancreatic amylase and glucosidase thus increasing the post-prandial glucose level and finds potential application in treatment of diabetes mellitus.

The root extract has been reported to decrease the levels of glycosylated hemoglobin, plasma thiobarbituric acid reactive substances, hydroperoxides, ceruloplasmin and vitamin E diabetic rats. Oral administration of *Tinospora cordifolia* extract in "Ilogen-Excel" formulation (Ayurvedic herbal formulation) composed of eight medicinal plants including *Curcuma longa*, *Strychnos potatorum*, *Salacia oblonga*, *Tinospora cordifolia*, *Vetivelia zizanioides*, *Coscinium fenestratum*, *Andrographis paniculata*, and *Mimosa pudica* is reported to reduce GSH and vitamin C in blood and urine glucose and lipids in the serum and tissues in alloxan diabetic rats with a subsequent decrease in body weight. Decreased concentration of GSH, GPx, and SOD, catalase activity is reported in heart and brain of diabetic rats. *T. cordifolia* root extract (TCE) has been reported to cause an increase in body weight, total hemoglobin and hepatic hexokinase and lowering hepatic glucose-6-phosphatase, serum acid phosphatase (ACP), alkaline phosphatase (ALP), and lactate dehydrogenase (LDH) in diabetic rats thus having hypoglycemic and hypolipidaemic effect.

The protective effects of TCE were reported in presence of higher levels of anti-oxidant molecules and enzymes. TCE has been shown to significantly counterbalance the diabetes-associated OS in the maternal liver by lowering the levels of malondialdehyde and ROS and the increased levels of GSH and total thiols.

#### **Anti-toxic effects:-**

*Tinospora cordifolia* extracts have been reported to scavenge free radicals generated during aflatoxicosis. It exhibited protective effects by lowering thiobarbituric acid reactive substances (TBARS) levels and enhancing the GSH, ascorbic acid, protein, and the activities of anti-oxidant enzymes viz., SOD, CAT, GPx, Glutathione S-transferase (GST) and glutathione reductase (GR) in kidney. Alkaloids such as a choline, tinosporin, isocolumbin, palmatine, tetrahydropalmatine, and magnoflorine from *Tinospora cordifolia* showed protection against aflatoxin-induced nephrotoxicity. *Tinospora cordifolia* stem and leaves extract has shown hepatoprotective effect in Swiss albino male mice against lead nitrate induced toxicity. Oral administration of plant extracts prevented the occurrence of lead nitrate induced liver damage. Decreased level of SOD, CAT and increased level of aspartate aminotransferase (AST), alanine aminotransferase (ALT), ALP, and ACP were observed in mice suffering from lead toxicity. Synergistic administration of aqueous extract of stem and leaf along with the lead nitrate increased the activities of SOD and CAT and decreased the levels of AST, ALT, ALP, and ACP enzymes. Protective role of aqueous extract of stem and leaves of *Tinospora cordifolia* overcoming the toxic effects of lead is shown as its effects on the hematological values. Cyclophosphamide (CP) an anti-cancer drug has been reported to reduce the GSH content in both bladder and liver and lowered levels of cytokines Interferon- $\gamma$  and IL-2 an increased levels of pro-inflammatory cytokine TNF- $\alpha$ . This effect could be reversed on *Tinospora cordifolia* treatment indicating the role of *Tinospora cordifolia* in overcoming CP induced toxicities in cancer treatment.

#### **Anti-arthritis, anti-osteoporotic effects:-**

Single or synergistic formulations of *Tinospora cordifolia* with *Zingiber officinale* has been used in rheumatoid arthritis treatment in traditional medicine. *Tinospora cordifolia* have been reported to affect the proliferation, differentiation and mineralization of bone like matrix on osteoblast model systems *in vitro* and hence finds potential application as an anti-osteoporotic agent. Alcoholic extract of *Tinospora cordifolia* have been shown to stimulate the growth of osteoblasts, increasing the differentiation of cells into osteoblastic lineage and also increasing the mineralization of bone like matrix. Ecdysteroids isolated from the plant have been reported of protein anabolic and anti-osteoporotic effects in mammals. Beta-Ecdysone (Ecd) from *Tinospora cordifolia* extracts have been reported to induce a significant increase in the thickness of joint cartilage, induce the osteogenic differentiation in mouse mesenchymal stem cells and to relieve osteoporosis in osteoporotic animal models. Further 20-OH- $\beta$ -Ecd isolated

from *Tinospora cordifolia* has been reported of its anti-osteoporotic effects thus highlighting the role of *Tinospora cordifolia* in the treatment of osteoporosis and osteoarthritis.

#### **Anti-HIV effects:-**

TCE has been shown to demonstrate a decrease in the recurrent resistance of HIV virus thus improving the therapeutic outcome. Anti-HIV effects of TCE was revealed by reduction in eosinophil count, stimulation of B lymphocytes, macrophages and polymorphonuclear leucocytes and hemoglobin percentage thus, revealing its promising role of application in management of the disease.

#### **Anti-cancer effects:-**

The anti-cancer effects of *Tinospora cordifolia* are mostly studied in animal models. TCE have been shown to have a radioprotective role by significantly increase in body weight, tissue weight, testes-body weight ratio and tubular diameter and inhibit the harmful effects of sub-lethal gamma radiation on testes in male Swiss albino mice. In pre-irradiating mice, TCE significantly affected radiation induced rise in lipid peroxidation and resulted in the decline of GSH concentration in testes. Pre-treatment of HeLa cells by TCE have been shown to decrease the cell viability, increase LDH and decrease in GSH S-transferase activity. Dihydrotestosterone (DHT) in TCE has been reported to stimulate the growth and proliferation of Human LNCaP cells (which are androgen-sensitive human prostate adenocarcinoma cells). Androgenic compounds in TCE act via androgen receptor. Newly isolated compounds like (5R, 10R)-4R, 8R-dihydroxy-2S, 3R: 15, 16-diepoxyleroda-13 (16), 17, 12S: 18, 1S-dilactone (ECD), a diterpenoid from *Tinospora cordifolia* has been reported for its chemopreventive potential in diethylnitrosamine (DEN) induced hepatocellular carcinoma (HCC) in rats by decreasing anti-oxidant activities via SOD, CAT and detoxification enzymes like GSH, GPx and subsequent increase in the activities of the hepatic markers ((Serum glutamic oxaloacetic transaminase)SGOT, (Serum Glutamic Pyruvate Transaminase) SGPT, LDH) and decreased serum transaminase level thus confirming its anti-tumor effects and promising application as a potent chemo preventive drug for HCC.[26]

The radiosensitizing activity of DCM extract of *Tinospora cordifolia* has been reported in Ehrlich ascites carcinoma (EAC) mice enabling tumor-free survival via depletion of GSH and glutathione-S-transferase by elevated levels of lipid peroxidation and DNA damage to tumor cells. TCE hexane fraction has been shown to block the G1 phase in EAC mice and cause apoptosis by the formation of apoptotic bodies, nuclear condensation, activation of caspase-3, decreased cell number and ascites volume, increased expression of pro-apoptotic gene, *Bax*, and decreased expression of anti-apoptotic gene, *Bcl-2*. TCE could induce a reduction of papillomas, tumor yield, tumor burden, and tumor weight while increase phase II detoxifying enzymes in skin carcinoma animal models. The effect of a hydroalcoholic (80% ethanol: 20% distilled water) extract of aerial roots of *Tinospora cordifolia* on Swiss albino mice revealed a significant increase in acid-soluble sulfhydryl (-SH), cytochrome P (450) contents, and enzyme activities of cytochrome P (450) reductase, cytochrome b5 reductase, GST, DT-diaphorase (DTD), SOD, catalase, GPX, and GR activity in the liver highlighting the chemopreventive role of *Tinospora cordifolia* against carcinogenicity.

*In vivo* anti-angiogenic activity of TCE in B16-F10 melanoma was detected by increased levels of pro-inflammatory cytokines, including IL-1  $\beta$ , IL-6, TNF- $\alpha$ , granulocyte monocyte-colony stimulating factor (GM-CSF) and the vascular endothelial cell growth factor (VEGF), increased production of anti-angiogenic agents IL-2 and tissue inhibitor of metalloprotease-1 (TIMP-1) in the B16-F10 extract-treated animals. The polysaccharide fraction from *Tinospora cordifolia* was found to be very effective in reducing the metastatic potential of B16-F10 melanoma cells. Markers of neoplastic development were reduced significantly in the treated animals compared with the untreated control animals. Most of the synthetic chemotherapeutic agents suffer from toxic side effects.[ The effect of Guduchi extracts was comparable or better than doxorubicin treatment.

#### **Tinospora cordifolia: Anti-microbial activity:-**

The methanol extracts of *Tinospora cordifolia* have been reported to have potential against microbial infections. The anti-bacterial activity of *Tinospora cordifolia* extracts has been assayed against *Escherichia coli*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Proteus vulgaris*, *Salmonella typhi*, *Shigella flexneri*, *Salmonella paratyphi*, *Salmonella typhimurium*, *Pseudomonas aeruginosa*, *Enterobacter aerogene*, and *Serratia marcescens* (Gram-positive bacteria). In mice models, TCE has been reported to function in bacterial clearance and improved phagocytic and intracellular bactericidal capacities of neutrophils. TCE has been reported of immunostimulant properties on macrophages. Intra-mammary infusion of hydro-methanolic extracts of *Tinospora cordifolia* treatment

showed enhanced phagocytic activity of polymorphonuclear cells in bovine subclinical mastitis.

#### ***Tinospora cordifolia*: Anti-oxidant activity:-**

The anti-oxidant capacity of *Tinospora cordifolia* stem methanol extracts administered orally increased the erythrocytes membrane lipid peroxide and catalase activity. It also decreased the activities of SOD, GPx in alloxan-induced diabetic rats. *Tinospora cordifolia* Willd.(Menispermaceae) extracts possess possible inhibitors of aldose reductase and anti-oxidant agents thereby reducing chemotoxicity induced by free radicals.

TCE has been reported of its strong free radical scavenging properties against superoxide anion ( $O_2^-$ ), hydroxyl radicals (OH), NO radical, and peroxynitrite anion (ONOO<sup>-</sup>). The extract was also found to reduce the toxic side effects of CP in mice by the free radical formation. *Tinospora cordifolia* lowers the levels of malondialdehyde and ROS and the higher levels of GSH and total thiols. The protective effects of *Tinospora cordifolia* could be observed even in the fetal milieu, with higher levels of anti-oxidant molecules and enzymes.

*Tinospora cordifolia* has the ability to scavenge free radicals generated during aflatoxicosis. *Tinospora cordifolia* showed protection against aflatoxin-induced nephrotoxicity due to the presence of alkaloids such as a choline, tinosporin, isocolumbin, palmatine, tetrahydropalmatine, and magnoflorine.[8] A significant increase in the concentration of TBARS in brain along with a decrease in heart has been observed in diabetic rats. It also enhanced formation of SOD, GPx, and GSH in liver. Treatment with *Tinospora cordifolia* also inhibited glucose 6-phosphatase and fructose 1, 6-diphosphatase; and restored glycogen content in liver. *Tinospora cordifolia* has been shown to regulate blood glucose (5R, 10R)-4R, 8R-dihydroxy-2S, 3R: 15, 16-diepoxycleroda-13 (16), 17, 12S: 18,1S-dilactone (ECD), a diterpenoid from *Tinospora cordifolia* has been shown to possess chemo-preventive potential in DEN induced HCC rats. Treatment of ECD in both preventive and curative DEN induced animals increased the level of anti-oxidants and detoxification enzymes.[26]

An aqueous extract of *Tinospora cordifolia* has a radio-protective enhancing the survival of mice against a sub-lethal dose of gamma radiation. *Tinospora cordifolia* was effective in elevating the GSH levels, expression of the gamma-glutamylcysteine ligase and Cu-Zn SOD genes. Aqueous extract of *Tinospora cordifolia* inhibited radiation mediated 2-deoxyribose degradation by inhibiting the formation of ( $Fe^{2+}$ )-bipyridyl complex formation to confer radio-protective effects.

The arabinogalactan polysaccharide (TSP) isolated from *Tinospora cordifolia* showed good protection against iron-mediated lipid peroxidation of rat brain homogenate as revealed by the TBARS and lipid hydroperoxide (LOOH) assays.

*Tinospora cordifolia* also has the components that decrease the recurrent resistance of HIV virus to antiretroviral therapy (ART) and improve the outcome of the therapy. The effect of a hydroalcoholic (80% ethanol: 20% distilled water) extract of aerial roots of *Tinospora cordifolia* on carcinogen/drug metabolizing phase-I and phase-II enzymes, anti-oxidant enzymes, GSH content, LDH and lipid peroxidation has been shown in liver of Swiss albino mice. The enhanced GSH level and enzyme activities involved in xenobiotic metabolism and maintaining anti-oxidant status of cells are suggestive of a chemo-preventive efficacy of *Tinospora cordifolia*.

*Tinospora cordifolia* has been reported to contain an alpha-glucosidase inhibitor, characterized as saponarin (apigenin-6-C-glucosyl-7-O-glucoside). The leaf extract had appreciable anti-oxidant and hydroxyl radical scavenging activities. Pepticare, a herbomineral formulation of the Ayurveda medicine consisting of the herbal drugs: *Glycyrrhiza glabra*, *Emblica officinalis* and *Tinospora cordifolia*, has anti-ulcer and anti-oxidant activity in rats.

Hyponidd is another herbomineral formulation composed of the extracts of 10 medicinal plants (*Momordica charantia*, *Melia azadirachta*, *Pterocarpus marsupium*, *Tinospora cordifolia*, *Gymnema sylvestre*, *Encicostemma littorale*, *Emblica officinalis*, *Eugenia jambolana*, *Cassia auriculata* and *Curcuma longa*). Hyponidd administration also decreased levels of glycosylated hemoglobin, plasma thiobarbituric acid reactive substances, hydroperoxides, ceruloplasmin and alpha-tocopherol in diabetic rats.

Anti-oxidant activities of Dihar, a polyherbal formulation containing drugs from eight different herbs viz., *Syzygium cumini*, *Momordica charantia*, *Emblica officinalis*, *Gymnema sylvestre*, *Encicostemma littorale*, *Azadirachta indica*,

*Tinospora cordifolia* and *Curcuma longa* in streptozotocin induced type 1 diabetic rats. Dihar produced a significant decrease in serum creatinine and urea levels in diabetic rats.[7]

#### **Tinospora cordifolia: Effects on other diseases:-**

A dose dependent reduction in infarct size and in lipid peroxide levels of serum and heart tissue were observed with the prior treatment of *Tinospora cordifolia*. The activation of macrophages by cytotoxic T cells leads to increase in GM-CSF which leads to leucocytosis and improved neutrophil function. Octacosanol isolated from *Tinospora cordifolia* inhibits proliferation of endothelial cells and Ehrlich ascites tumor cells, inhibits neovascularization induced by angiogenic factors in chick chorioallantoic membrane and rat cornea *in vivo* angiogenesis assays and also inhibits secretion of ascites fluid in the growing tumor cells *in vivo*[33] by inhibiting activity of matrix metalloproteinases (MMPs) and translocation of transcription factor nuclear factor-kappa-B (NF-κB) to nucleus. Oral administration of 70% methanolic extract of *Tinospora cordifolia* stem reduces sperm motility and density, lowering of serum testosterone, protein, sialic acid, glycogen contents, and depletion of vesicular fructose of testes leading to reduction of male fertility in rats. The *in vivo* administration of alcoholic extract of *Tinospora cordifolia* has been reported to increase bone marrow derived macrophages (BMDM) in bearing Dalton's lymphoma (DL). The polyherbal preparations Caps HT2 of *Tinospora cordifolia*, could reduce plasma recalcification time and enhanced the release of lipoprotein lipase enzyme. Other polyherbal HP-1 has hepatocurative and anti-oxidant effects.

#### **Discussion:-**

*Tinospora cordifolia* has an importance in traditional ayurvedic medicine used for ages in the treatment of fever, jaundice, chronic diarrhea, cancer, dysentery, bone fracture, pain, asthma, skin disease, poisonous insect, snake bite, eye disorders.[2] Recent reports have shown the compounds and their biological roles in *Tinospora cordifolia* extract. Such properties may be exploited for production of new formulations, which may be better and promising over conventional one. Although genetically diverse and reports of application of tissue culture based propagation of *Tinospora* exist, effective conservation strategies of the germplasm for such an economically important medicinal plant with many biological role remains yet to be accomplished.

#### **Conclusion:-**

A plant with as diverse a role as *Tinospora cordifolia* is a versatile resource for all forms of life. There are reports as already discussed that the plant extracts have active compounds in the form of alkaloids, glycosides, lactones and steroids. All these active compounds have immunomodulatory and physiological roles of different types, thereby demonstrating the diverse versatility of the plant. Studies need to be conducted with aspects how the active compounds actually interact with the living systems and affects the structure-function relationships. Crystal structures of the membrane bound receptors and the activation of the downstream signaling cascades and the changes in the immediate environment of the site of action can lead us into identification of novel perspectives into our understanding of nature. The search into the vivacious sources of nature can also lead us into differential interactions among the evolutionarily related groups of organisms. The future scope of the review remains in exploiting the biochemical and signaling pathways of the active components of *Tinospora* thus, enabling effective disease targeting. With so much to offer to the scientific world of medicine, the plant *Tinospora* truly acts as an incredible source.

#### **References:-**

1. Upadhyay A.K., Kumar K., Kumar A., Mishra H.S., *Tinospora cordifolia* (Willd.) Hook. f. and Thomas. 2010.,(Guduchi)-validation of the Ayurvedic pharmacology through experimental and clinical studies. Int J Ayurveda Res.;1:112–21
2. Rout G.R. 2006., Identification of *Tinospora cordifolia* (Willd.) Miers ex Hook F & Thomas using RAPD markers. Z Naturforsch C.;61:118–22.
3. Sharma U., Bala M., Kumar N., Singh B., Munshi R.K., Bhalerao S.2012., Immunomodulatory active compounds from *Tinospora cordifolia*. J Ethnopharmacol.;141:918–26.
4. Karpova E.A., Voznyi Y. V., Dudukina T.V., Tsvetkova I.V. 1991., 4-Trifluoromethylumbelliferyl glycosides as new substrates for revealing diseases connected with hereditary deficiency of lysosome glycosidases. Biochem Int.;24:1135–44.
5. Kapil A., Sharma S. 1997., Immunopotentiating compounds from *Tinospora cordifolia*. J Ethnopharmacol.;58:89–95.
6. Swaminathan K., Sinha U.C., Bhatt R.K., Sabata B.K., Tavale S.S. 1989;Structure of tinosporide, a



- diterpenoid furanolactone from *Tinospora cordifolia* Miers. Acta Crystallogr C. 45:134–6.
7. **Sundarraj S., Thangam R., Sreevani V., Kaveri K., Gunasekaran P., Achiraman S., 2012.,** et al.  $\gamma$ -Sitosterol from *acacia nilotica* L. induces G2/M cell cycle arrest and apoptosis through c-Myc suppression in MCF-7 and A549 cells. J Ethnopharmacol.;141:803–9.
  8. **Thippeswamy G., Sheela M.L., Salimath B.P. 2008.,** Octacosanol isolated from *Tinospora cordifolia* downregulates VEGF gene expression by inhibiting nuclear translocation of NF- $\kappa$ B and its DNA binding activity. Eur J Pharmacol.;588:141–50.
  9. **Ghosh A.K., Chapsal B.D., Weber I.T., Mitsuya H. 2008.,** Design of HIV protease inhibitors targeting protein backbone: An effective strategy for combating drug resistance. Acc Chem Res.;41:78–86.
  10. **Tripathi Y.B., Sharma M., Manickam M. 1997.,** Rubia 5 din, a new antioxidant from *rubia cordifolia*. Indian J Biochem Biophys.;34:302–6.
  11. **More P., Pai K. 2012.,** In vitro NADH-oxidase, NADPH-oxidase and myeloperoxidase activity of macrophages after *Tinospora cordifolia* (guduchi) treatment. Immunopharmacol Immunotoxicol.;34:368–72.
  12. **Upadhyaya R., P.R., Sharma V., Anita K.V., 2011.,** Assessment of the multifaceted immunomodulatory potential of the aqueous extract of *Tinospora cordifolia*. Res J Chem Sci.;1:71–9.
  13. **Sudhakaran D.S., Sirekha P., Devasree L.D., Premsingh S., Michael R.D. 2006.,** Immunostimulatory effect of *Tinospora cordifolia* Miers leaf extract in *Oreochromis mossambicus*. Indian J Exp Biol.;44:726–32.
  14. **Raghu R., Sharma D., Ramakrishnan R., Khanam S., Chintalwar G.J., Sainis K.B., 2009.,** Molecular events in the activation of B cells and macrophages by a non-microbial TLR4 agonist, G1-4A from *Tinospora cordifolia*. Immunol Lett.;123:60–71.
  15. **Shivananjappa M.M., 2012.,** Muralidhara Abrogation of maternal and fetal oxidative stress in the streptozotocin-induced diabetic rat by dietary supplements of *Tinospora cordifolia*. Nutrition.;28:581–7.
  16. **Gupta R., Sharma V. 2011.,** Ameliorative effects of *Tinospora cordifolia* root extract on histopathological and biochemical changes induced by aflatoxin-b (1) in mice kidney. Toxicol Int.;18:94–8.
  17. **Kapur P., Wuttke W., Jarry H., Seidlova-Wuttke D. 2010.,** Beneficial effects of beta-Ecdysone on the joint, epiphyseal cartilage tissue and trabecular bone in ovariectomized rats. Phytomedicine.;17:350–5.
  18. **Akhtar S., 2010.,** Use of *Tinospora cordifolia* in HIV infection. Indian J Pharmacol.;42:57.
  19. **Rao S.K., Rao P.S., 2010** Alteration in the radiosensitivity of HeLa cells by dichloromethane extract of guduchi (*Tinospora cordifolia*) Integr Cancer Ther. ;9:378–84.
  20. **Chaudhary R., Jahan S., Goyal P.K. 2008.,** Chemopreventive potential of an Indian medicinal plant (*Tinospora cordifolia*) on skin carcinogenesis in mice. J Environ Pathol Toxicol Oncol.;27:233–43.
  21. **Leyon P.V., Kuttan G. 2004** Inhibitory effect of a polysaccharide from *Tinospora cordifolia* on experimental metastasis. J Ethnopharmacol.;90:233–7.
  22. **Diwanay S, Chitre D, Patwardhan B. 2004.,** Immunoprotection by botanical drugs in cancer chemotherapy. J Ethnopharmacol.;90:49–55.
  23. **Jagetia G.C, Nayak V., Vidyasagar M.S. 1998** Evaluation of the antineoplastic activity of guduchi (*Tinospora cordifolia*) in cultured HeLa cells. Cancer Lett.; 127:71–82.
  24. **Narayanan A.S., Raja S.S., Ponmurugan K., Kandekar S.C., Natarajaseenivasan K., Maripandi A.2011., et al.** Antibacterial activity of selected medicinal plants against multiple antibiotic resistant uropathogens: A study from Kolli Hills, Tamil Nadu, India. Benef Microbes.; 2:235–43.
  25. **Jeyachandran R., Xavier T.F., Anand S.P. 2003.,** Antibacterial activity of stem extracts of *Tinospora cordifolia* (Willd) Hook. f and Thomson. Anc Sci Life.; 23:40–3.
  26. **Tambekar D.H., Khante B.S., Chandak B.R., Titare A.S., Boralkar S.S., Aghadte S.N.2009.,** Screening of antibacterial potentials of some medicinal plants from Melghat forest in India. Afr J Tradit Complement Altern Med.; 6:228–32.
  27. **Thatte U.M., Kulkarni M.R., Dahanukar S.A. 1992,** Immunotherapeutic modification of *Escherichia coli* peritonitis and bacteremia by *Tinospora cordifolia*. J Postgrad Med.; 38:13–5
  28. **Sengupta M., Sharma G.D., Chakraborty B. 2011.,** Effect of aqueous extract of *Tinospora cordifolia* on functions of peritoneal macrophages isolated from CCl 4 intoxicated male albino mice. BMC Complement Altern Med.; 11:102.
  29. **Purandare H, Supe A. 2007.,** Immunomodulatory role of *Tinospora cordifolia* as an adjuvant in surgical treatment of diabetic foot ulcers: A prospective randomized controlled study. Indian J Med Sci.; 61:347–55.
  30. **Sivakumar V., Rajan M.S. 2010.** Antioxidant Effect of *Tinospora cordifolia* Extract in Alloxan-induced Diabetic Rats. Indian J Pharm Sci.; 72:795–8
  31. **Prince Stanely Mainzen P., Menon V.P. 2001,** Antioxidant action of *Tinospora cordifolia* root extract in alloxan diabetic rats. Phytother Res.; 15:213–8.

32. **Gacche R.N., Dhole N.A., 2011.** Profile of aldose reductase inhibition, anti-cataract and free radical scavenging activity of selected medicinal plants: An attempt to standardize the botanicals for amelioration of diabetes complications. *Food Chem Toxicol.*; 49:1806–13.
33. **Rawal A., Muddeshwar M., Biswas S., 2004** Effect of *rubia cordifolia*, *Fagonia cretica* linn, and *Tinospora cordifolia* on free radical generation and lipid peroxidation during oxygen-glucose deprivation in rat hippocampal slices. *Biochem Biophys Res Commun.*; 324:588–96.
34. **Mathew S., Kuttan G., 1997** Antioxidant activity of *Tinospora cordifolia* and its usefulness in the amelioration of cyclophosphamide induced toxicity. *J Exp Clin Cancer Res.*;16:407–11.
35. **Khan ML, Harsha PS., Giridhar P, Ravishankar G. A.2011** Pigment identification, antioxidant activity, and nutrient composition of *Tinospora cordifolia* (willd.) Miers ex Hook. f and Thomas fruit. *Int J Food Sci Nutr.*;62:239–49.

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### RESEARCH ARTICLE

#### EFFLUX AS AN ARISING CAUSE OF DRUG RESISTANCE IN E. COLI.

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#### Abstract

Multidrug resistant strains of bacteria which are characterized as serious public health problem may arise due to over expression of efflux pumps. Efflux pumps in bacteria can be detected by using specialized instruments. In the present study simple instrument free agar cartwheel method was used to detect efflux pumps in *E.coli* with some modification. Four isolates of *E.coli* were collected and processed. Biochemical analysis of all the strains was done using standard protocol. Further cartwheel assay was performed. MIC method was used to confirm the observations of agar cartwheel assay. In Cartwheel assay, a total of 4 strains of *E.coli* were analyzed for the presence of efflux pumps, active efflux pump was detected in 1 isolate while it was not observed in 3 strains. Bacterial isolate which contains efflux pump also showed high MIC value for the antibiotics used. But in the presence of an EPI, a considerable decrease in the MIC of antibiotics was observed among isolate containing efflux pump, while there was no decrease in MIC of antibiotics for strains without efflux pumps. Present study revealed that cartwheel assay to detect efflux pumps is a reliable, fast and sensitive technique, which may reduce time and efforts to detect efflux pumps.

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#### Introduction:-

*Escherichia coli* is a principal facultative organism present in the human gastrointestinal tract. Pathogenic strains of *E. coli* have the capability to cause different types of diseases in humans and animals because of the presence of definite colonisation factors, virulence factors and pathogenically associated genes. *E. coli* major cause of nosocomial infections in humans is a Gram-negative, flagellated, rod-shaped, Oxidase negative, motile, facultative anaerobe and classified under the family Enterobacteriaceae<sup>1</sup>. *E. coli* is genetically classified as the most versatile bacteria and is major source of many plasmid and phage mediated genes. It causes septicemia and diarrhoea in overall hosts including man, avian and animals such as cattle, piglets, kids, foals, lambs and buffaloes. The pathogenic strains of *E. coli* which are isolated from hospitalized patients were more resistant to amoxicillin, ciprofloxacin, cephalexin and Gentamycin compared to those from outpatients<sup>2</sup>. Some strains of *E. coli* develop resistance to third-generation cephalosporins and monobactams. Most members of gram negative bacteria family are less susceptible to most classes of the antibiotics, mainly lipophilic and amphiphilic ones; this is due to the presence of outer membrane in gram negative bacteria. Constant increase in drug resistant strains of bacteria becomes a big threat to human health<sup>3</sup>. Multidrug efflux pumps unfavorably affect the clinical effectiveness of existing antibiotics and also affect the process of discovery of new antibiotics<sup>4</sup>. Active efflux is established as

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important factor of bacterial resistance in case of most classes of antibiotics. The mechanism of active efflux is mediated by efflux pumps<sup>5-7</sup>. Efflux pumps are known as membrane associated active transporters which help in expelling out toxic compounds, including antibiotics from the cell<sup>5-8</sup>.

Antibiotic efflux was first reported in 1980, in case of *E. coli* bacteria as a mechanism for tetracycline resistance. Recently the role of efflux mechanism is reported in bacterial resistance in case of almost all major groups of antibiotics<sup>5,7,9-11</sup>. Bacterial resistance to most of the classes of antibiotics is provided by membrane transporter proteins which are known as drug efflux pumps<sup>12</sup>. Efflux pumps are present as single component system or multi-component systems. Increasing resistance of bacteria against most classes of antibiotics in recent days becomes a big problem<sup>13</sup>. Resistance in antibiotics develops very rapidly because of the changes in the expression of efflux pumps. So it is important to characterize new antibiotics, efflux pump inhibitors and the agents which are resistance modifying<sup>14</sup>. Resistance of bacterial isolates to most classes of antibiotics is widespread mostly in developing countries. Schedule monitoring of antibiotic resistance gives data for the antibiotic therapy and control of resistance, and evaluates the effectiveness of both of these<sup>15</sup>. In spite of the fact that antibiotics are originally emerged for the treatment of infectious disease caused by bacteria in humans, multidrug resistance to most classes of antibiotics becomes a worldwide problem. Efflux pumps are reported in both gram positive and gram negative bacteria and as well as in eukaryotic organisms. Some of the bacterial efflux pumps are selective for only one substrate while some of them are not. The non-selective group of efflux pumps are involved in shifting of wide range of compounds and different classes of antibiotics which confer a multiple drug resistance phenotype<sup>5,6-11</sup>. The AcrAB efflux system present in *E. coli* is multidrug efflux pump which is a major efflux system present in *E. coli* and responsible for intrinsic resistance of the bacteria against antibiotics, dyes and detergents<sup>16-17</sup>. The AcrAB efflux pump existing in *E. coli* belongs to resistance- nodulation- division (RND) family of efflux pumps which is a more usual in Gram – negative bacteria. AcrAB – TolC is specified as one of the best efflux pump in case of *E. coli*<sup>18-27</sup>. AcrAB efflux pump is the only single efflux pump of RND family in case of *E. coli* which plays an important role in antibiotic resistance against different antibiotics because of its prenominal expression. The Ethidium bromide (Et Br) agar cartwheel assay is a newly investigated simple, instrument free method used for the detection of efflux pump activity in bacteria<sup>28</sup>. The present study was aimed to detect efflux pumps in Gram negative bacteria *E.coli* with the help of EtBr agar Cartwheel assay.

## **Material and Methods:-**

### **Microbial strains:-**

The strains of *Escherichia coli* used in the present study were procured from Sabine Schuster and Winfried V. Kern, Center for Infectious Diseases and Travel Medicine, University Hospital, and Department of Medicine, Albert-Ludwig's-University, Freiburg, Germany and from MTCC and NCTC. The *E. coli* strains used were one knock out strain 1- DC14, wild type strain K-12 AG100 and two standard strains with NCTC number 12923 and MTCC number 1302.

### **Chemicals and reagents:-**

Nutrient broth, DMSO, Methanol, CCCP, Ethidium bromide, Tryptic soy agar were purchased from Hi-media Pvt. Ltd.

## **Methods:-**

### **Characterization of *Escherichia coli* strains:-**

Characterization of *Escherichia coli* was performed by gram staining and biochemical analysis.

### **Gram's staining:-**

Gram's staining was done following the methodology of Aneja<sup>29</sup>. The smear on a glass slide was covered with few drops of the primary stain (Crystal violet). After a minute of exposure to the staining solution, the slide was washed with water. The smear was treated with few drop of Gram's Iodine and allowed to stand for a minute. This results in formation of a dye-iodine complex in the cytoplasm. Gram's iodine serves as a mordant. The slide was again washed with water and then decolorized with absolute ethyl alcohol or acetone. After the smear was decolorized, it was washed with water without any delay. The smear was finally treated with few drops of counter stain (Safranin). The slide was washed in water; excess water was removed using a blotting paper, dried in air and heat fixed before observing under microscope.

**Biochemical Analysis:-**

Biochemical analysis was done according to Bergey's manuals of systematic bacteriology (1993). Following biochemical tests were performed for identification of *E. coli* isolates;

**Indole test:-**

Tryptone broth was prepared. The broth was dispensed into the tubes and sterilized. Culture of *E. coli* was inoculated into the tubes and one tube was left uninoculated as control. The tubes were inoculated at 37°C for 48 hours. After incubation 1 ml of KOVAC's reagent was added to all the tubes including control. The tubes were shaken gently and allowed to stand for 1-2 min.

**Positive test result:-** The indole reagent change colour to red.

**Negative test result:-** The indole reagent remains pale yellow.

**Methyl Red Test:-**

This test was performed by inoculating a colony of *E. coli* in 0.5 ml sterile glucose phosphate broth. After incubating overnight at 37°C for 24-48 hours. Few drops of methyl red reagent was added and the tubes were shaken gently.

**Positive test result:** Red colour change.

**Negative test result:** No colour change.

**Voges Proskauer Test:-**

Glucose phosphate broth was prepared and inoculated with *E. coli* culture. Inoculated tubes were incubated for 24-48 hours at 37°C. 1 mL of 40% KOH and 3 mL of 5% solution of the alpha naphthol was added in the inoculated test tubes. The medium was shaken at intervals for enhancement of the reaction by aeration.

**Positive test result:** Colour change to pink.

**Negative test result:** No colour change.

**Citrate Utilization Test:-**

Citrate utilization test is used to determine the ability of bacteria to utilize sodium citrate as its carbon source. Simmons's citrate agar slant were prepared and streaked with 18-24 hours old culture of *E. coli*. The slants were incubated at 37°C for 24-48 hours.

**Positive result:** Growth in citrate medium or growth with colour change to blue in Simmons citrate tube.

**Negative result:** No growth in citrate medium.

**Urease Test:-**

Urease broth was prepared and inoculated with a loopful of *E. coli* culture. Then inoculated broth was incubated at 37°C for 24-48 hours.

**Positive test result:** Change in colour to red.

**Negative test result:** No colour change.

**Nitrate Reduction Test:-**

Nitrate broth was prepared and inoculated with *E. coli* culture. The inoculated broth was incubated at 37°C for 24-48 hours. After that 4-5 drops of mixture of solution A (8g of sulphanilic acid in 1000mL of 5N acetic acid) and solution B (5 of alpha naphthylamine in 1000mL of 5N acetic acid) were added.

**Positive test result:** Red colour after addition of sulphanilic acid and alpha-naphthylamine.

**Negative test result:** No colour change after addition of sulphanilic acid and alpha naphthylamine.

**Catalase test:-**

This test demonstrates the presence of catalase enzyme which catalyses the release of oxygen from hydrogen peroxide. This test was used to differentiate those bacteria which produce catalase enzyme from non-catalase producing bacteria. A small amount of colony of *E. coli* culture was transferred to surface of a clean, dry glass slide using an inoculating loop. A drop of hydrogen peroxide was placed on the slide.

**Positive test results:** Gas formation in the form of bubbles shows that the bacterium is catalase positive.

**Negative test result:** No gas formation shows negative result.

**Carbohydrate fermentation test:-**

Four test tubes were taken containing four different kinds of broth namely glucose, lactose, sucrose, Mannitol. Each tube consist of 1% sugar, 1% peptone water and 1% Andrade's reagent. Inverted Durham tube were kept in each tube. Tubes were autoclaved at 15 lb. (121°C) for 30 minutes. After cooling tubes were inoculated with loopful culture of *E.coli* and incubated at 37°C for 24 hours. The broth was examined for acid and gas formation.

**Positive test result:** Acid production was indicated by the colour change from red to yellow.

**Negative test result:** No colour change.

**Motility test:-**

Semi solid motility medium was prepared in a test tube and inoculated with *E.coli* culture with a straight wire by making a single stab down the center of the tube about 8- 10 mm deep into the medium and incubated at 37°C for 24hours. Examined after one day.

**Positive result:-**

Diffuse, hazy growths that spread throughout the medium rendering it slightly opaque.

**Negative result:-** Generally give growths that are confined to the stab-line, have sharply defined margins and the surrounding material completely transparent.

**Oxidase test:-**

Oxidase test is used to identify bacteria that produces oxidase enzyme of bacterial electron transport chain. A filter paper was soaked in substrate tetra methyl-p-phenylenediamine dihydrochloride. A loop full colony of *E.coli* culture was smeared onto the filter paper strip.

**Positive test result:** Dark blue-purple colour change within 10-30sec.

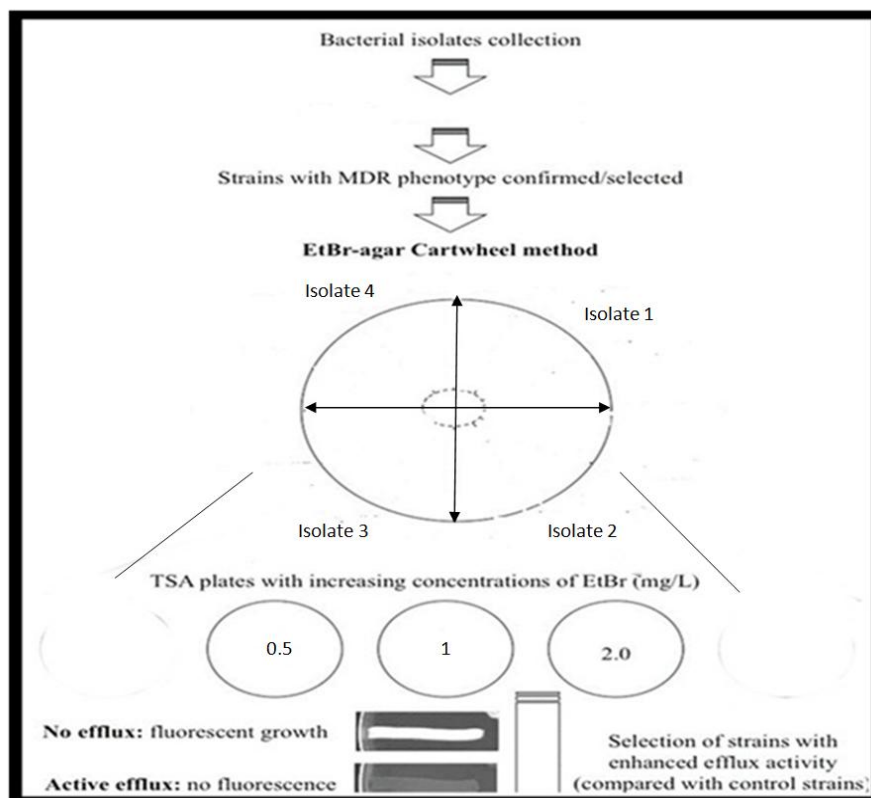
**Negative test result:** No colour change or colour change after more than 30 sec.

**Agar cartwheel assay for the detection of efflux pumps:-**

The Etbr- agar cartwheel assay method was used to assess the presence of efflux activity in *E.coli* strains following the methodology of with slight modifications<sup>28-30</sup>. All the strains of *E.coli* were grown in nutrient broth and incubated at 37°C for 24 hours. The TSA plates are then divided into four sectors, forming a cartwheel pattern. *E. coli* culture was inoculated by swabbing on tryptic soya agar plates starting from the center of the plate to the margin, these plates containing different concentrations (0.5µg/ml, 1µg/ml and 2.0µg/ml) of Etbr. Plates were incubated at 37°C for 16 hours and then observed under UV light (Gel Doc- it2 310 imager).The minimum concentration of Etbr that produces fluorescence of the bacterial mass was recorded. (fig.1)

**MIC Determination:-**

The MIC was determined in all strains of *E.coli* used for Etbr agar cartwheel assay to confirm the presence of efflux pumps. Pure cultures of *E.coli* were diluted in nutrient broth to a concentration between  $1 \times 10^5$  and  $1 \times 10^6$  cfu/mL. A stock dilution of the antibiotics i.e., Ciprofloxacin, Tetracycline and Erythromycin were made at approximately 100x the level of the expected MIC for *E.coli*. The concentrations used for each of the antibiotics were (0.003–128) µg/mL and Further 1:1 dilutions of antibiotics were made with nutrient broth in 96 well microtiter plates. Then the bacterial culture was inoculated from lower concentration to higher concentration of antibiotic in equal amount (30µl). Positive and negative control was also included. Then microtiter plates were incubated at 37°C for 24 hrs. And then plates were observed in ELISA plate reader (BioTek) at 490 nm. MIC was recorded as the lowest concentration where no growth was visually observed. Then MIC of antibiotics was again observed in the presence of an EPI (CCCP).



**Fig.1:-**Flowchart followed to test bacterial strains using the EtBr-agar Cartwheel method.

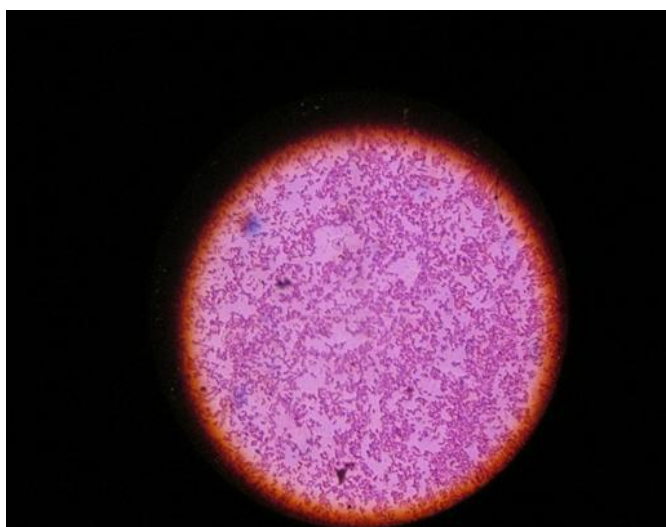
## Results:-

### Characterization of *E. coli* strains:-

Characterization of *E. coli* was performed by Gram's staining and biochemical testing.

### Gram's staining:-

The results of gram's staining are summarized in figure 2. Gram- negative bacilli of *E. coli* were seen under the microscope. Rod shaped pinkish colony of *E. coli* were appeared.



**Figure 2:-** Gram-negative rod shaped bacilli of *E. coli*

**Biochemical Analysis:-**

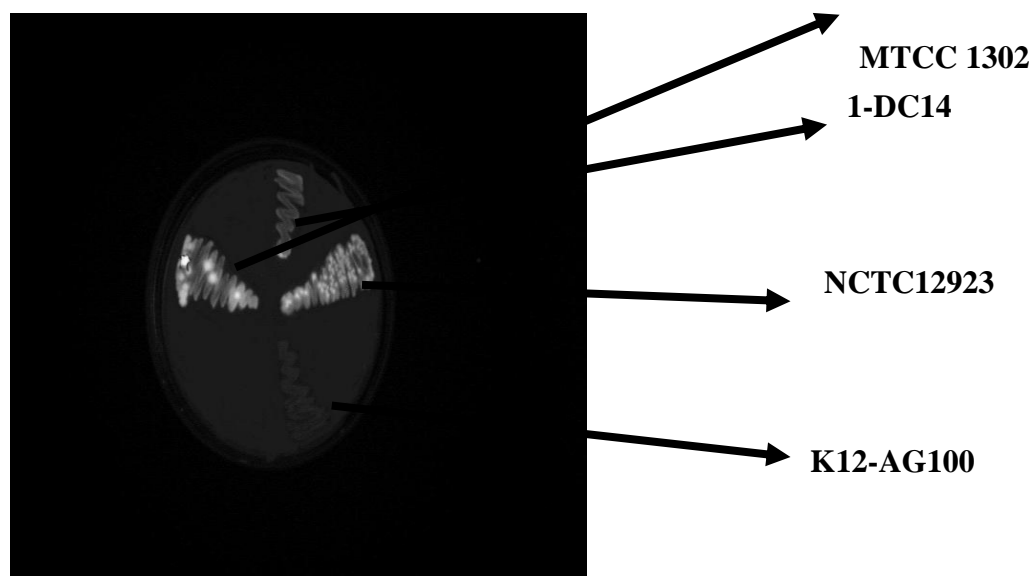
The results described in table 1 shows that all the strains of *E. coli* were positive for, Catalase test, Indole test, Methyl red test, Carbohydrate fermentation, Nitrate reduction and Motility test. The strains of *E. coli* showed negative results for, Oxidase test, urease test, Sucrose fermentation and Maltose fermentation.

**Table 1:-** Biochemical analysis of *E. coli* strains

Biochemical tests	<i>E. coli</i> strains			
	1-DC14	K12-AG100	MTCC	NCTC
Catalase test	Positive	Positive	Positive	Positive
Oxidase test	Negative	Negative	Negative	Negative
Indole test	Positive	Positive	Positive	Positive
Methyl red test	Positive	Positive	Positive	Positive
Voges Proskauer Test	Negative	Negative	Negative	Negative
Citrate utilization test	Negative	Negative	Negative	Negative
Urease test	Negative	Negative	Negative	Negative
Nitrate reduction	Positive	Positive	Positive	Positive
Glucose fermentation	Positive	Positive	Positive	Positive
Lactose fermentation	Positive	Positive	Positive	Positive
Maltose fermentation	Negative	Negative	Negative	Negative
Sucrose fermentation	Negative	Negative	Negative	Negative
Motility test	Positive	Positive	Positive	Positive

**Etbr Agar Cartwheel Assay:-**

Etbr agar Cartwheel assay was performed for the detection of efflux pumps. The result of Etbr assay is summarized in figure 3. Agar cartwheel assay was performed for all 4 strains of *E. coli*, out of these four strains efflux pump was detected only in K12-AG100 strain and the other three strains (knockout strain 1-DC14, MTCC strain 1302 and NCTC strain 12923) have shown fluorescence hence confirms the absence of efflux pump.



**Figure 3:-** Ethidium bromide fluorescence detected in three strains of *E. coli*. The resistant strain showing the absence of Etbr fluorescence confirming the presence of Efflux pump.

**Minimum Inhibitory Concentration:-**

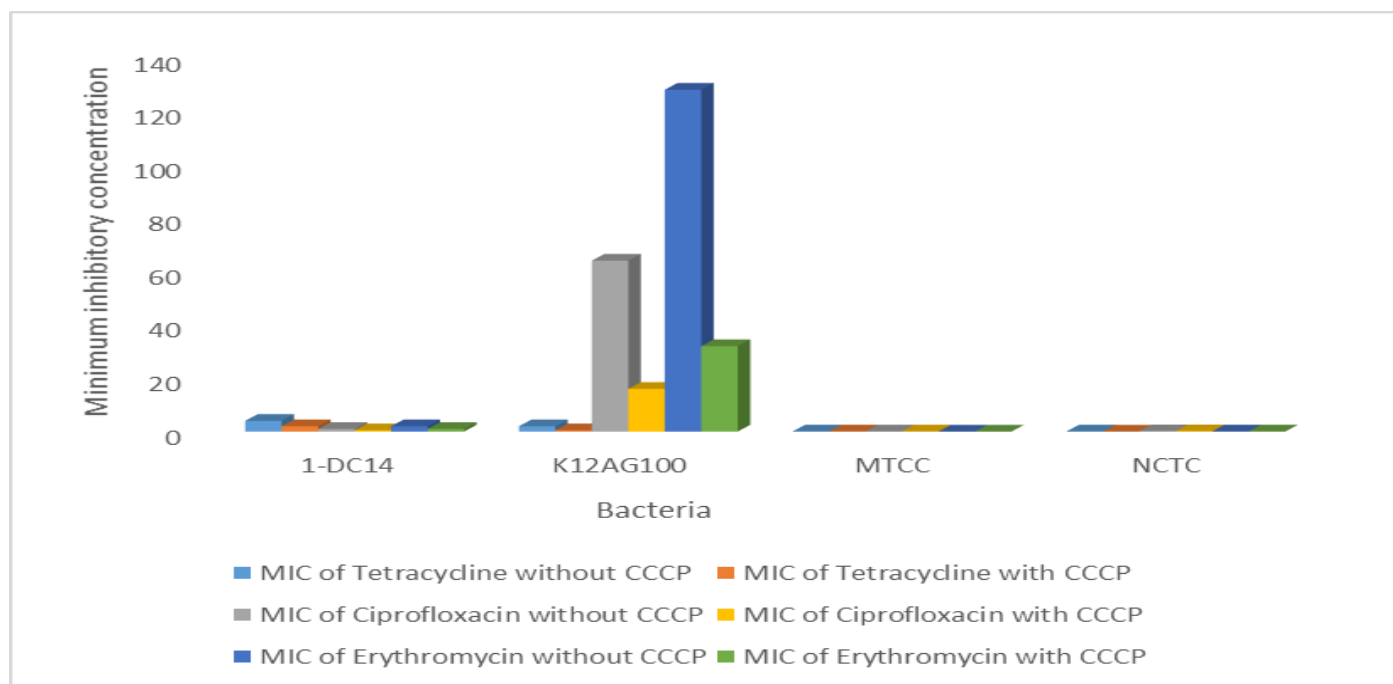
The observations of Etbr agar cartwheel assay was further confirmed by the determination of MIC values for selected antibiotics, known to be efflux pump substrates viz., Tetracycline, Erythromycin and ciprofloxacin. The Wild type strain K12-AG100 containing AcrAB- TolC efflux pump has shown very high MIC values ranging from



0.5 µg/mL to 128 µg/mL for all antibiotics known to be efflux pump substrates. Further the assay was performed with an Efflux pump inhibitor EPI a significant decrease was observed in MIC of antibiotics for the resistant strain and these values were ranging from 0.5 µg/mL to 32 µg/mL. While three strains (1-DC14 Knockout strain, 1 MTCC strain and 1 NCTC strain) without efflux pump have shown very low MIC value of antibiotics which had remain constant even in the presence of an EPI (CCCP), (Table 2 and Fig 4). The observations of MIC assay were found similar to those of EtBr agar cartwheel assay.

**Table 2:-** MIC determination in *E.coli* strains for ciprofloxacin, Tetracycline and Erythromycin (µg/mL) to confirm the presence of active efflux pump

Sr.No	Name of strain	MIC for Tetracycline		MIC for Ciprofloxacin		MIC for Erythromycin	
		Without CCCP	With CCCP	Without CCCP	With CCCP	Without CCCP	With CCCP
1	1-DC14	4	2	1	0.5	2	2
2	K12-AG100	2.0	0.5	64	16	128	32
3	MTCC	0.06	0.03	0.05	0.05	0.003	0.003
4	NCTC	0.003	0.003	0.125	0.125	0.05	0.05



**Fig. 4:-** MIC of Ciprofloxacin, Tetracycline and Erythromycin (µg/mL) with or without CCCP for *E.coli* strains.

### Discussion:-

*Escherichia coli* has recognized as an emerging opportunistic pathogen of clinical relevance. The intrinsic resistance of *E.coli* has been attributed due to the outer membrane barrier. From many years, role of efflux mechanisms in bacterial resistance to most classes of antibiotics<sup>5,7,9,11</sup>. Ethidium bromide is a substrate for all efflux pumps and is not allowed to accumulate inside the bacterial cell<sup>32</sup>. Ethidium bromide used as a marker to detect efflux pump in resistant bacteria which have efflux pump mediated drug resistance mechanism. Those bacteria have efflux pump does not show EtBr fluorescence because they do not accumulate the EtBr and effluxed out. In the present study, EtBr Agar Cartwheel assay was performed to detect AcrAB-TolC efflux pump in *E.coli* isolates. In the present study, we observed the EtBr fluorescence among three strains 1-DC14 Knockout strain, MTCC-1302 and NCTC-12923 these strains get accumulated EtBr and shows EtBr fluorescence. While K12-AG100 wild type strain has not shown the EtBr fluorescence hence it confirms the presence of efflux pump.

Martins *et al.*, (2013) reported that Gram negative bacteria *Acinetobacter* has shown significant increase in the fluorescence after the incubation at 4°C while less fluorescence was observed at 37°C. The observations of the present study suggested that the drug efflux mechanism is an energy mediated mechanism and direct perpetuate to the temperature when the temperature decreased the energy of membrane decreased and the other factor may be responsible for less efflux is low metabolic rate at low temperature, which is not able to produce sufficient energy, hence the available energy is not sufficient to efflux out the accumulated compounds. Therefore, more fluorescence occurs at low temperature. In addition to this, the isolates having potentially less active efflux systems showed higher fluorescence and isolates having more active efflux systems showed less fluorescence<sup>32</sup>. In the present study, the MIC value was determined for the selected antibiotics, known as efflux pump substrates viz., Tetracycline, Erythromycin and Ciprofloxacin. K12-AG100 strain with known AcrAB-TolC efflux pump have shown very high MIC values ranging from 0.06 µg/mL to 128 µg/mL confirm the presence of AcrAB-TolC efflux pump. While the other three strains have shown very low MIC value. Further the assay was performed with an Efflux pump inhibitor (EPI) CCCP. A significant decrease was observed in MIC of antibiotics for the resistant strain and these values were ranging from 0.003 µg/mL to 64µg/mL. While the MIC of control sensitive strains (1 MTCC- 1302 and 1NCTC-12923) without efflux pump was not change and remain constant even in the presence of an EPI (CCCP). Similarly, Abdi- Ali *et al.*, (2006) has reported significant decrease in MIC of resistant antibiotics used in combination with EPI (CCCP). The observations of the study again suggested that the drug resistance in MDR isolates is mediated by an active efflux pump which effluxed out the accumulated drug.

### Conclusion:-

EtBr agar cartwheel assay is a simple trustworthy method and can be used for the detection of efflux pumps in bacteria and on the basis of present study it can be concluded that efflux pump over expression is an leading cause of drug resistance in *E.coli* therefore proper measures should be used to solve this problem.

### References:-

1. Buxton, A., Fraser, G. (1977). *Escherichia coli*, in animal microbiology. Blackwell Scientific Publications., 1:78-80.
2. Rosa, D., Jose, G., Gonzalo, P.(2001). Antibiotic susceptibility of bacterial strains isolated from patients with community- acquired urinary tract infections. International Journal of Antimicrobial Agents., 18:211-5.
3. Levy, SB.(1994). Balancing the drug-resistance equation. Trends in Microbiology., 2:341-2.
4. Andersen, C., Koronakis, E., Bokma, E., Eswaran, J., Humphreys, D., Hughes, C., *et al.* (2002). Transition to the open state of the Tol C periplasmic tunnel entrance. Proceedings of the National Academy of Sciences USA., 99:11103-08.
5. Piddock L.J.(2006). Multidrug-resistance efflux pumps - not just for resistance. Nature Reviews Microbiology., 4:629-36.
6. Webber, M.A., Piddock, L.J.V.(2003). The importance of efflux pumps in antibiotic resistance. Journal of Antimicrobial Chemotherapy., 51:9-11.
7. Li, H.Z., Nikaido, H.(2004). Efflux – mediated drug resistance in bacteria. Drugs., 64:159 - 04.
8. Bambeke, V.F., Balzi, E., Tulkens, P.M.(2000). Antibiotic efflux pumps. Biochemical pharmacology., 60:457 - 70.
9. Stavri, M., Piddock, L.J.W., Gibbons, S. (2007). Bacterial efflux pumps from natural sources. Journal of Antimicrobial Chemotherapy., 59:1247- 60.
10. Levy, S.B. (2002). Active efflux, a common mechanism for biocide and antibiotic resistance. Journal of Applied Microbiology., 92 (Supplement):65S- 71S.
11. Poole, K. (2005). Efflux-mediated antimicrobial resistance. Journal of Antimicrobial Chemotherapy., 56:20-51.
12. Nikaido, H. (1998). Multiple antibiotic resistance and efflux. Current Opinion in Microbiology., 1:516- 23.
13. Barbara, Z., Versace, I. (2009). Inhibitors of multidrug resistant efflux systems in bacteria. Recent Patents on Anti-infective Drug Discovery., 4:37-50.
14. Stermitz, F.R., Lorenz, P., Tawara, J.N. (2009). Synergy in a medicinal plant : antimicrobial action of berberine potentiated by 5' – methoxyhydnocarpin, a multidrug pump inhibitor. Proceeding of the National Academy of Sciences USA., 97:1433- 7.
15. Omigie, O., Enweani, IB., Ohenhen, R.E., Umolu, I.P., Edo, O.O.B. (2006). Bacteriological survey of wound infections in Benin City, Nigeria. Nigerian Annual National Sciences., 6.

16. Andersen, C. (2003). Channel- tunnels: outer membrane components of type 1 Secretion systems and multidrug efflux pumps of Gram - negative bacteria. Review of Physiology, Biochemistry and Pharmacology., 147:122- 65.
17. Zgurskaya, H.I., Nikaido, H. (2000a). Multidrug resistance mechanisms: drug efflux across two membranes. Molecular Microbiology., 37:219- 25.
18. Bohnert, J.A., Schuster, S., Seeger, M.A., Fahnrich, E., Pos, K.M., Kern, W.V, *et al.* (2008). Site-directed mutagenesis reveals putative substrate binding residues in the *Escherichia coli* RND efflux pump AcrB. Journal of Bacteriology., 190:8225-9.
19. Bohnert, J.A, Schuster, S., Szymaniak,-Vits, M., Kern, W.V. (2011). Determination of real time efflux phenotypes in *Escherichia coli* AcrB binding pocket phenylalanine mutants using a 1, 2 ‘- Dinaphthylamine Efflux assay. PLOS ONE., 6(6):e21196.
20. Eicher, T., Cha, H.J., Seeger, M.A. (2012). Transport of drugs by the multidrug transporter AcrB involves an access and a deep binding pocket that are separated by a switch- loop. Proceedings in National Academy of Sciences USA. 109:5687-92.
21. Husain, F., Nikaido, H. (2010). Substrate path in the AcrB multidrug efflux pump of *Escherichia coli* Journal of Molecular Microbiology., 78 (2):320-30.
22. Koronakis, V., Sharff, A., Koronakis, E., Luisi, B., Hughes, C. (2000). Crystal structure of the bacterial membrane protein TolC central to multidrug efflux and protein export. Nature., 405:914.
23. Mikolosko, J., Bobyk, K., Zgurskaya, H.I., Ghosh, P. (2006). Conformational flexibility in multidrug efflux system protein AcrA. Structure., 14:577- 87.
24. Murakami, S., Nakashima, R., Yamashita, E., Matsumoto, T., Yamagu- chi, A. (2006). Crystal structure of a multidrug transporter reveals a functionally rotating mechanism. Nature., 443:173-9.
25. Nakashima, R., Sakurai, K., Yamasaki, S., Nishino, K., Yamaguchi, A. (2011). Structures of the multidrug exporter AcrB reveal a proximal multisite drug binding pocket. Nature., 480:565- 9.
26. Seeger, M.A., Schiefner, A., Eicher, T., Verrey, F., Diederichs, K., Pos, K.M. (2006). Structural asymmetry of AcrB trimer suggests a peristaltic pump mechanism. Science., 313: 1295-8.
27. Takatsuka, Y., Nikaido, H. (2009). Covalently linked trimer of the AcrB multidrug efflux pump provides support for the functional rotating mechanism. Journal of Bacteriology., 191:1729-37.
28. Martins, M., McCuskin, M.P., Viveiros, M., Couto, I., Fannings, S., Pages, J.M *et al.* (2013). Simple Method for Assessment of MDR Bacteria for Over –Expressed Efflux Pumps, Open Microbiol J, 7: (1-M6), 2013, 72- 82.
29. Aneja, K.R. (2003). Experiments in Microbiology, Plant Pathology and Biotechnology. 4th edition. New Age International.
30. Costa, S.S., Junqueira, E., Palma, C., Viveiros, M., Cristino, J.M., Amaral, L., *et al.* (2013). Resistance to Antimicrobials Mediated by Efflux Pumps in *Staphylococcus aureus*. Antibiotics., 2:83-99.
31. Patel, D., Kosmidis, C., Seo, S.M., Kaatz, G.W. (2010). Ethidium bromide MIC screening for enhanced efflux pumps gene expression or efflux activity in *Staphylococcus aureus*. Antimicrobial Agents and Chemotherapy., 54:5070-3.
32. Martins, M., Viveiros, M., Couto, I., Costa, S.S., Pacheco, T., Fanning, S., *et al.* (2011). Identification of efflux pump-mediated multidrug-resistant bacteria by the Ethidium Bromide-agar Cartwheel Method *In Vivo*. 25:171- 8.
33. Abdi-Ali, A., Mohammadi-Mehr, M., Agha Alaei, Y. (2006). Bactericidal activity of various antibiotics against biofilm producing *Pseudomonas aeruginosa*. Int J Antimicrob Agents., 27, 196-200.

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### RESEARCH ARTICLE

#### AN ONLINE SURVEY OF USING SKIN-LIGHTENING PRODUCTS IN SAUDI FEMALE

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Skin lightening, Saudi, Women;  
utilization; non-prescription

#### Abstract

**Background:** Production and marketing of skin lightening products has become a multi-billion dollar industry, servicing all parts of the world, making it one of the most common forms of potentially harmful body modification practices worldwide.

**Objectives:** to study the practices of Saudi women regarding topical skin lightening agents.

**Subjects and methods:** This is a cross sectional study covered different areas of the Kingdom of Saudi Arabia. It included women aged between 16 and 60 years, Saudis and live in the kingdom permanently as well as has online access. Self-administered valid Arabic questionnaire has been used to collect data from the participants. It includes personal information, detailed information regarding the use of skin lightening agents and knowledge of the safety of these agents. Using all online tools (face book, twitter, what's app, etc...), the questionnaire was distributed.

**Results:** Six hundreds and five subjects were included in the study, their mean age was  $35.8 \pm 6.6$  years, with a range from 20–50 years, slightly more than half of them (50.9%) were singles while 45.6% were married. Sixty five percent of the participants (393 out of 605) were current users of topical skin lightening products and 198 (32.7) had previously used these products. Thus, overall, 438 women out of 605 (72.4%) ever used topical skin lightening products. Almost half of them (49.9%) obtained these preparations from the pharmacy without prescription. Among current users, 13.6% had used skin lightening agents continuously for more than one year. These agents were applied to the whole body in 11.9% of ever users whereas almost two-thirds of them (61.8%) used the products on their faces. Only 27.3% of the participants could recognize that Mercury is the most harmful chemical to human health, which could be one of the components of skin lightening agents whereas cortisone was chosen by 41.5% of them. Fifty-two women (10.1%) reported that they would use skin lightening creams that gave fast results, even if the components were unknown.

**Conclusion:** The utilization of skin lightening agents among Saudi women is a common practice, mostly without prescription.

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2008

**Introduction:-****Background:-**

Skin lightening is “the practice of utilizing chemical substances or any other products with a depigmenting potential in an attempt to lighten skin tone or provide an even skin complexion by lessening the concentration of melanin and obtain a reduction of the physiological skin pigmentation”.<sup>(1)</sup>

Whiteness of the skin is considered as important element in constructing female beauty worldwide, particularly in cultures with black colored skin as in Africa, South America and parts in Asia.<sup>(2)</sup> Skin bleaching preparations typically used by people with skin phototypes IV to VI on a cosmetic basis, primarily to lighten normally dark skin in order to fit within the larger society's definition of beauty that is linked to having a fair skin.<sup>(3)</sup>

Skin lightening is a growing phenomenon around the world and it's becoming a bigger business. The prevalence rates of using skin bleaching products are variable in different parts of the world. They ranged from 24% among Japanese women<sup>(4)</sup> and 30% among women from Ghana<sup>(5)</sup> to alarming rates in India (65%)<sup>(4)</sup> and Lagos, Nigeria (77%).<sup>(6)</sup>

Production and marketing of skin lightening products has become a multi-billion dollar industry, servicing all parts of the world, particularly low- and middle-income countries<sup>(4)</sup> making it one of the most common forms of potentially harmful body modification practices worldwide as they include potentially harmful over-the-counter creams, putting them at greater risk for a variety of negative health outcomes.<sup>(7)</sup>

The active ingredients used in skin lightening creams are hydroquinone,<sup>(8, 9)</sup> highly potent corticosteroids and mercury salts.<sup>(10)</sup>

The use of skin lightening creams can be potentially dangerous and harmful and carry out several complications ranging from dermatologic consequences include: epidermal atrophy, ochronosis, eczema, dermatitis, acne to more serious health risks include diabetes, skin cancer, foetal toxicity, renal and liver impairment and failure.<sup>(8-13)</sup>

The harms caused by using skin lightening products extend from the acute or chronic long-term exposure to the often hazardous chemical agents that are present in these products.<sup>(14)</sup> In addition, the damage from bleaching products is often exacerbated when users mix skin bleaching products with household chemicals such as toothpaste, laundry bleach, detergents and even automotive battery acid, a very common practice in some areas, to try to enhance their effect.<sup>(8, 10)</sup>

With this global growing phenomenon only few studies were conducted in Saudi Arabia. Therefore more studies need to be done to assess the magnitude of problem of usage of topical lightening agents among Saudi women.

This study aimed to study the practices of Saudi women regarding topical skin lightening agents.

**Subjects and Methods:-**

This is a cross sectional study covered different areas of the Kingdom of Saudi Arabia. It included women aged between 16 and 60 years, Saudis and live in the kingdom permanently as well as has online access.

The minimum sample size for this study has been estimated using Epi-info software and found as 571 women.

Self-administered valid Arabic questionnaire has been used to collect data from the participants. It has been created and used previously in KSA by Al-Ghamdi.<sup>(15)</sup> Permission to use the questionnaire was obtained from the author through an e-mail communication. It includes 27 questions; personal information (age, marital status, educational level, occupation and household average monthly income), detailed information regarding the use of skin lightening agents such as the age at which the participants started using them, the duration and frequency of usage, source of obtaining these agents, reason/s for usage during pregnancy and lactation, money spent monthly on bleaching agents, parts of bodies they applied these products to and the amounts (grams) applied. The women were also asked about the safety of the bleaching agents, whether or not they believed that bleaching creams obtained at herbal stores were safe, whether they thought bleaching creams might harm their skin or general health, and whether they were willing to use bleaching creams even if the components of the cream were unknown. From the given components

such as corticosteroids, hydroquinone and mercury, they were asked to choose the most dangerous component to human health.

Using all online tools (face book, twitter, what's app, etc..), the questionnaire was distributed. Only Saudi women living in KSA and aged between 16 and 60 years were asked to participate in the study by filling the questionnaire. It was explained that the research concern is skin lightening agents not regular cosmetics.

Approvals from the local training committee and local ethical committee were obtained prior to study conduction. Participants' permission (completing and sending the questionnaire was considered as consent).

Statistical Package for Social Sciences (SPSS) software version 22.0 will be used for data entry and analysis. Descriptive statistics (number, percentage) and analytic statistics using Chi Square tests ( $\chi^2$ ) to test for the association and/or the difference between two categorical variables will be applied. P-value equal or less than 0.05 will be considered statistically significant.

### Results:-

According to the study design, 605 subjects were included in the study, their mean age was  $35.8 \pm 6.6$  years, with a range from 20–50 years, slightly more than half of them (50.9%) were singles while 45.6% were married. Majority of them (78.8%) were university and above graduated. More than one-third of them (37.7%) were students and 26.4% were employees. Household average monthly income ranged between 10001 and 20000 SR among 31.1% of the participants whereas it exceeded 20000 SR among 10.9% of them.

As shown in figure 1, 65% of the participants (393 out of 605) were current users of topical skin lightening products and 198 (32.7) had previously used these products. Thus, overall, 438 women out of 605 (72.4%) ever used topical skin lightening products.

Details of using topical skin lightening agents among ever users are described in table 2. Almost half of them (49.9%) obtained these preparations from the pharmacy without prescription whereas 10% from beauty and cosmetic shops. The nature of the used agent was most frequently a mixture composed of a readymade drug at the pharmacy (42.7%) or a beauty non-medical product (29.9%).

The commonest reported reasons for using these preparations were just to lighten the color of the skin (34.5%), to heal pigmented areas like freckles (25.6%) or both (28.3%).

The age of the women when they first started using bleaching agents varied from 1 to 57 years (mean  $21.3 \pm 6.8$  years) and in 66.9% of them, it ranged between 16 and 25 years. Skin lightening products were used by 35.8% participants at least once daily. The monthly cost of the skin lightening agents ranged between 4 to 3000 Saudi Riyals (SR) (mean  $173.9 \pm 310.1$  SR). Seventy-seven women (18.9%) reported that they spent more than 200 SR per month on skin lightening preparations. The amount of the skin lightening agent consumed per month ranged between 1 to 1000 gm (mean  $29.0 \pm 103.9$  gm). Thirty-one women (11.3%) consumed more than 50 gm of skin lightening agent per month. Additionally, 6.8% of women continued applying the skin lightening agents throughout pregnancy whereas 15.9% did so during lactation.

Among current users, 13.6% had used skin lightening agents continuously for more than one year whereas 61.4% of them had used them continuously between 2 and 12 months. Overall the duration of continuing use ranged between one and 200 months ( $6.7 \pm 16.8$ ). Table 3

Figure 2 shows that these agents were applied to the whole body in 11.9% of ever users whereas almost two-thirds of them (61.8%) used the products on their faces, 46.7% used them on their necks and 24.9% used them on their hands.

Almost one-third of the respondents (38.7%) reported that the colour of their skin returned to normal once they discontinued the use of skin lightening products whereas 10.1% of then reported that their skin became even darker than before use. Skin dryness was reported by 8.2% of users.

Only 27.3% of the participants could recognize that Mercury is the most harmful chemical to human health, which could be one of the components of skin lightening agents whereas cortisone was chosen by 41.5% of them.

About one-fifth (20.6%) of the participants believed that misusing skin lightening products could harm their skin whereas 48.2% agreed that using skin lightening agents could harm their general health.

About one-third of the participants (32.4%) considered the use of skin lightening agents sold at herbal stores safe whereas 24.6% of them would recommend the use of skin lightening sold at herbal shops to others. Almost two thirds of the respondents (67.3%) wanted the color of their skin to be lighter than its normal color.

From figure 3, it is shown that 46.6% of the participants believed that lighter skin colour made them more beautiful, whereas 42.5% believed that lighter skin colour made them more self-confident. More than one-third of them (40.4%) used skin lightening agents to renew look. Only 12.3% of singles believed that lighter skin colour increase chances of finding a spouse and 14.9% of married participants believed that it stabilizes marriage.

Fifty-two women (10.1%) reported that they would use skin lightening creams that gave fast results, even if the components were unknown.

Table 3 showed that all studied socio-demographic factors were not significantly associated with current usage of skin lightening agents.

**Table 1:-** Socio-demographic characteristics of the participants.

Variables	Frequency N=605	Percentage
<b>Age (years)</b>		
16-25	334	55.2
26-35	161	26.6
36-45	86	14.2
>45	24	4.0
<b>Marital status</b>		
Single	308	50.9
Married	276	45.6
Divorced/separated	11	1.8
Widowed	10	1.7
<b>Educational Level</b>		
High school or lower	128	21.2
University or higher	477	78.8
<b>Occupation</b>		
Student	228	37.7
Unemployed	78	12.6
House wife	121	20.0
Employee	160	26.4
Others	20	3.3
<b>Household average monthly income in Saudi Riyals</b>		
<2000		
2000-5000	68	11.2
5001-10000	103	17.0
10001-20000	180	29.8
>20000	188	31.1
	66	10.9

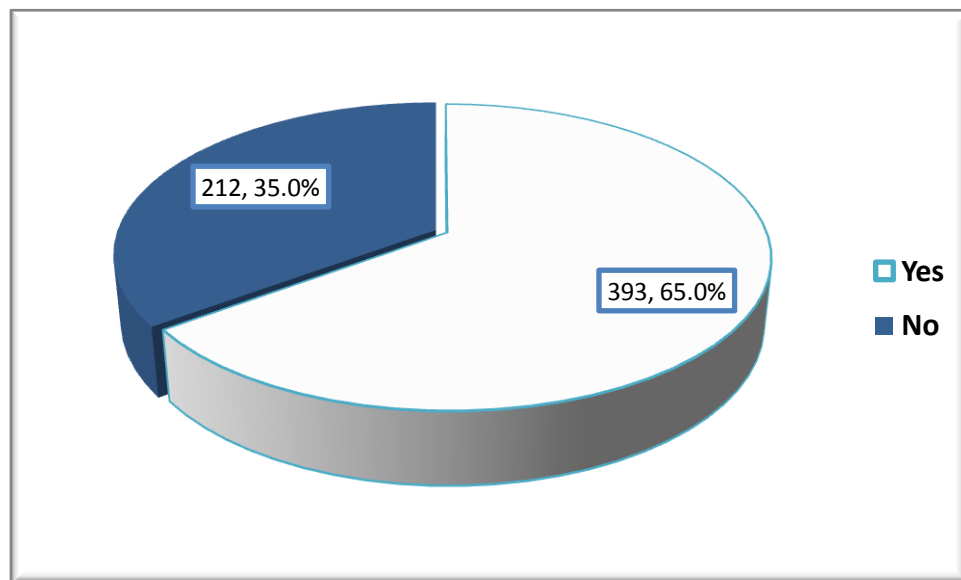
**Table 2:-** Details of using topical skin lightening agents among women who ever used them (n=438)

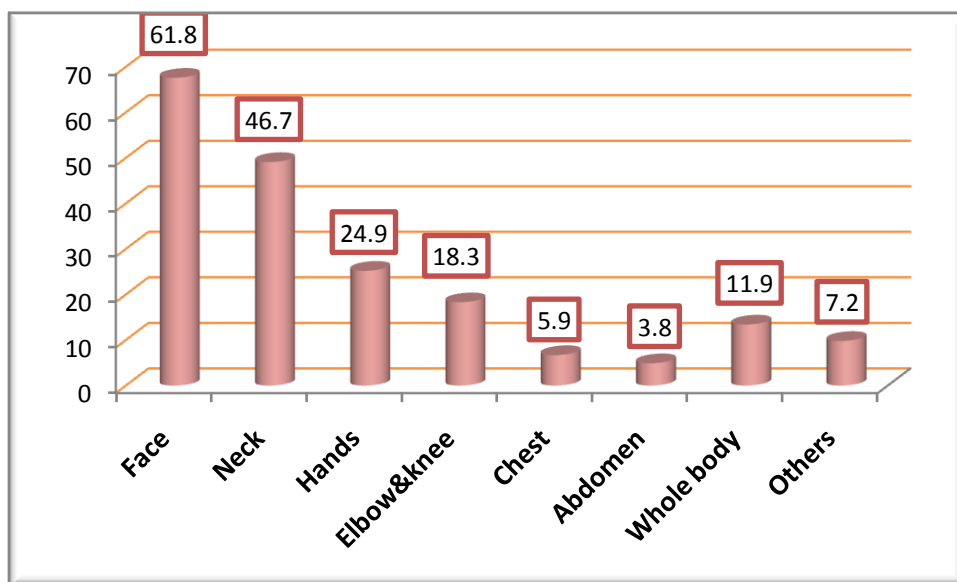
Statements	Responses	Frequency	Percentage
Method of obtaining the skin lightening agent	-Prescription	126	28.8
	-From the pharmacy without prescription	214	49.9
	-From herbal shops and open markets	44	10.0
	-Beauty and cosmetic shops.	54	12.3
The nature of the agent used	-Is composed of a readymade drug at the pharmacy	187	42.7
	-Mixture composed at the pharmacy	85	19.4
	-Mixture composed at herbal shops	35	8.0
	-Beauty product, non-medical	131	29.9
The reason behind the use	-To heal pigmented areas like freckles	112	25.6
	-Just to lighten the color of the skin	151	34.5
	-Both of the above reasons	124	28.3
	-Others	51	11.6
Frequency of applying skin lightening agent	Once daily	157	35.8
	Twice daily	84	19.2
	Three times daily	10	2.3
	Not daily	158	36.1
	Before a year	29	6.6
Using the agent during pregnancy (n=311)	-Yes	21	6.8
	-No	290	93.2
Using the agent during lactation (n=295)	-Yes	47	15.9
	-No	248	84.1
Monthly cost of the agent in Saudi Riyals (n=408)	<100	197	48.3
	100-200	134	32.8
	>200	77	18.9
Amount of cream you use monthly (gms) (n=275)	≤10	211	76.7
	11-50	33	12.0
	>50	31	11.3
Age (years) at starting using skin lightening agent (n=417)	≤15	61	14.6
	16-25	279	66.9
	>25	77	18.5
Duration of using skin lightening agents continuously (Months) (n=264)	1	66	25.0
	2-12	162	61.4
	>12	36	13.6



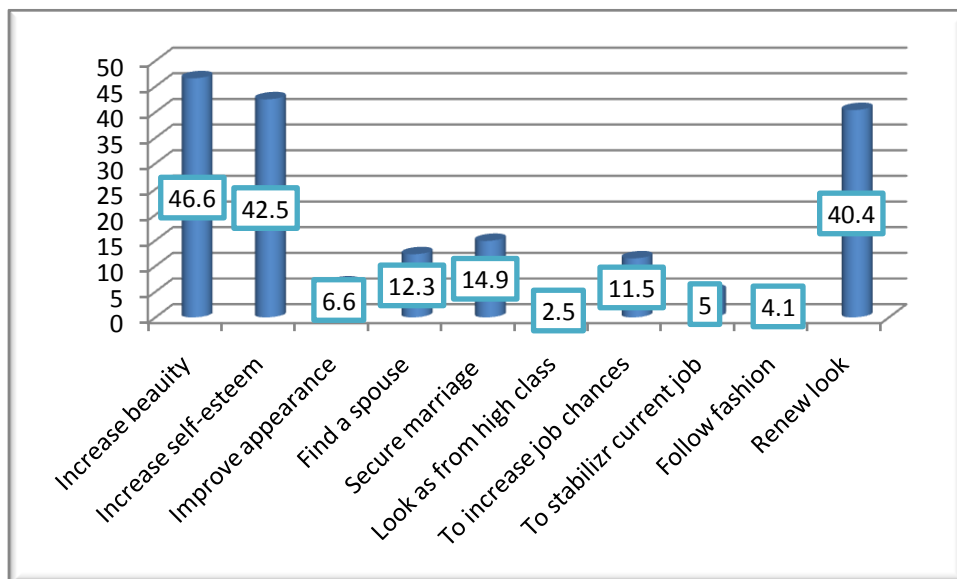
**Table 3:-** Socio-demographic factors associated with current usage of skin lightening products

	Ever use of skin lightening products		$\chi^2$	p-value
	No N=167	Yes N=438		
<b>Age (years)</b>				
16-25 (n=334)	86 (25.7)	248 (74.3)	3.48	0.323
26-35 (n=161)	46 (28.6)	115 (71.4)		
36-45 (n=86)	30 (34.9)	56 (65.1)		
>45 (n=24)	5 (20.8)	19 (79.2)		
<b>Marital status</b>				
Single (n=308)	80 (26.0)	228 (74.0)	2.99	0.393
Married (n=276)	78 (28.3)	198 (71.7)		
Divorced/separated (n=11)	5 (45.5)	6 (54.5)		
Widowed (n=10)	4 (40.0)	6 (60.0)		
<b>Educational Level</b>				
High school or lower (n=128)	34 (26.6)	94 (73.4)	0.09	0.767
University or higher (n=477)	133 (17.9)	344 (72.1)		
<b>Occupation</b>				
Student (n=228)	60 (26.3)	168 (73.7)	3.55	0.471
Unemployed (n=76)	22 (28.9)	54 (71.1)		
House wife (n=121)	31 (25.6)	90 (74.4)		
Employee (n=160)	45 (28.1)	115 (71.9)		
Others (n=20)	9 (45.0)	11 (55.0)		
<b>Household average monthly income in Saudi Riyals</b>				
<2000 (n=68)	23 (33.8)	45 (66.2)	3.68	0.451
2000-5000 (n=103)	33 (32.0)	70 (68.0)		
5001-10000 (n=180)	48 (26.7)	132 (73.3)		
10001-20000 (n=188)	45 (23.9)	143 (76.1)		
>20000 (n=66)	18 (27.3)	48 (72.7)		

**Figure 1:-** Prevalence of using skin lightening products among of Saudi females.



**Figure 2:-** Areas for application of skin bleaching agents among the participants



**Figure 3:-** Reasons for ever using skin lightening agents among the participants (n=438)

### Discussion:-

This study was carried out to fill a gap of knowledge regarding the magnitude of utilizing skin lightening agents despite their deleterious health risk among Saudi women.

The prevalence of current utilization of skin lightening agents in the current study was 65% whereas that of ever usage was 72.4%. This figure agrees with those reported in different places of the world. Prevalence rates of 67.2% has been observed in Singal, <sup>(16)</sup> Jordan (60.7%), <sup>(17)</sup> and Nigeria (72.4%). <sup>(18)</sup> In Malaysia, a rate of 60.6% has been reported. <sup>(19)</sup> In Lahore, <sup>(20)</sup> a rate of 59% of skin lightening agents usage was reported while in Sudan, a rate of 55.4% was observed among university students. <sup>(21)</sup> However, it is lower than that reported in another Saudi study (38.9%). <sup>(15)</sup> These figures are of great importance as the overuse of such preparations has various health outcomes.

In the current study, 13.6% had utilized skin lightening agents continuously for more than one year with an overall duration ranged between one and 200 months. Al Ghamdi reported that the duration of the skin lightening ranged between 1 to 150 months, <sup>(15)</sup> while in Senegal, the duration ranged between 1 to 420 months. <sup>(9)</sup>

Skin lightening agents are harmful to general health at a level that is comparable or even exceeds the level of other risk behaviours.<sup>(14)</sup> Despite of this fact, knowledge of the dangerousness of skin lightening agents is lacking in the present study as Mercury which is the most dangerous constituent of skin lightening agents, was identified by only 27.3% of the participants as the most toxic product of these agents whereas 41.5% selected cortisone. Similar results have been observed in another Saudi study.<sup>(16)</sup>

Regarding the amount of skin lightening cream used each month, it ranged between 1 to 1000 gm (mean  $29.0 \pm 103.9$  gm). In another Saudi study, it ranged between 2 and 600 g (mean 90.09 g/month). In African countries like Senegal,<sup>(9)</sup> the amount ranged between 15 and 350 / month while in Nigeria, the amount ranged between 60 to 150 gram/month.<sup>(22)</sup> The maximum amount used in the present study (1000 gm) is considered very high if we know that 45 gm of skin lightening cream is quite enough to cover the whole body.<sup>(15)</sup> The difference between our figures and those reported in African countries is attributed to the fact that skin colour in African countries is dark black while in Saudi Arabia, it is lighter.<sup>(15)</sup>

In the present study, 6.8% of women continued applying the skin lightening agents throughout pregnancy whereas 15.9% did so during lactation. Comparable results were observed in another study carried by Al Ghamdi in Saudi Arabia where 10.3% of women continued applying skin lightening agents during pregnancy and 20.8% during lactation.<sup>(15)</sup> These figures are very low compared to those reported in Senegal where rate of application of skin lightening products throughout pregnancy or lactation were 81% and 87%, respectively.<sup>(9)</sup>

In accordance with Hamed et al. (2010),<sup>(17)</sup> beauty and self-confidence were commonly identified as reasons for using these agents in the present study as they reported that women who use skin lightening agents were more likely to consider having a lighter skin colour plays a positive role in self confidence, perception of beauty, employment and marriage opportunities compared with non-users.

In the current study, 11.9% of women applied skin lightening agents to their whole body. This figure is higher than that reported in another Saudi study conducted among women visiting outpatient clinics (7.3%).<sup>(15)</sup> However, it is much lower than figures reported from African countries (Nigeria “81.3%”<sup>(22)</sup> and Senegal “92%”).<sup>(9)</sup>

In accordance with others,<sup>(15, 17, 21)</sup> the chief area for application of skin lightening agents in the present study was the face. This is could be due to the fact that the face is the beauty and attraction sign among females, also it has a relatively small surface area, but the women might think that the white face is more beautiful than the black one regardless the homogeneity of the face colour with other body areas.

Complications of continuous application of skin lightening agents reported in the present study were return of skin colour to its normal skin colour or even to darker on, skin dryness and skin rash. These adverse effects prevent the consumers to continue the application. Therefore, there is a need to aware the general population of women to seek medical advice instead of continuing using these preparations without advice.

Among important limitations of the present study its cross-sectional design that doesn't prove causality. Also, it includes women who had an internet access which limits the generalizability of results. However, it includes a relatively considerable sample size as well as it faces an important health issue rarely investigated in Saudi Arabia

Conclusively, the utilization of skin lightening agents among Saudi women is a common practice, mostly without prescription. Therefore we recommended supervising sale and marketing of these products, particularly the herbal preparations that have unknown or harmful components and enhancing public awareness about the dangerous effects of uncontrolled using of such agents.

**References:-**

1. Yetunde MO. Use of Skin Lightening Creams. *British Medical Journal* 2010; 341, c6102.
2. Li EPH, Min HJ, Belk RW, Kimura J, Bahl S. Skin Lightening and Beauty in Four Asian Cultures. *Advances in Consumer Research* 2008; 35: 444-449.
3. Dadzie OE, Petit A. Skin bleaching: highlighting the misuse of cutaneous depigmenting agents. *Journal of the European Academy of Dermatology and Venereology* 2009;23(7):741-50.
4. Glenn EN. Yearning for lightness: Transnational circuits in the marketing and consumption of skin lighteners. *Gender & Society* 2008; 22(3): 281-302.
5. Blay YA. Ahoofe kasa!: Skin bleaching and the function of beauty among Ghanaian women. *JENdA: A Journal of Culture and African Women Studies* 2010; 14. Retrieved July 1, 2013, from <http://www.africaknowledgeproject.org/index.php/jenda/article/viewArticle/528>.
6. Kpanake L, Muñoz Sastre MT, Mullet E. Skin bleaching among Togolese: A preliminary inventory of motives. *Journal of Black Psychology* 2010; 36(3): 350-368.
7. del Giudice P, Yves P. The widespread use of skin lightening creams in Senegal: A persistent public health problem in West Africa. *International Journal of Dermatology* 2002; 41(2): 69-72.
8. Ajose FO. Consequences of skin bleaching in Nigerian men and women. *International journal of dermatology*. 2005;44 Suppl 1:41-3.
9. Mahe A, Ly F, Aymard G, Dangou JM. Skin diseases associated with the cosmetic use of bleaching products in women from Dakar, Senegal. *The British journal of dermatology*. 2003;148(3):493-500.
10. Lewis KM, Robkin N, Gaska K, Njoki LC, Andrews E, Jetha K. The Tanzanian response to dangerous skin bleaching products and the gendered politics involved: A critical analysis. *JENdA: Journal of Culture and African Women Studies* 2009;10: 18-35
11. Mahe A, Ly F, Perret JL. Systemic complications of the cosmetic use of skin-bleaching products. *International journal of dermatology*. 2005;44 Suppl 1:37-8.
12. Petit A, Cohen-Ludmann C, Clevenbergh P, Bergmann JF, Dubertret L. Skin lightening and its complications among African people living in Paris. *Journal of the American Academy of Dermatology*. 2006;55(5):873-8.
13. Pitche P, Kombate K, Tchangai-Walla K. Cosmetic use of skin-bleaching products and associated complications. *International journal of dermatology*. 2005;44 Suppl 1:39-40.
14. Street JC, Gaska K, Lewis KM, Wilson ML. Skin bleaching: A neglected form of injury and threat to global skin. *African Safety Promotion Journal* 2014;12(1):52-71
15. Alghamdi KM. The use of topical bleaching agents among women: a cross-sectional study of knowledge, attitude and practices. *J Eur Acad Dermatol Venereol*. 2010 Oct;24(10):1214-9.
16. Wone I, Tal-Dia A, Diallo OF, Badiane M, Tour'e K, Diallo I. Prevalence of the use of skin bleaching cosmetics in two areas in Dakar (S'en'egal). *Dakar M'edical* 2000; 45( 2): 154-157.
17. Hamed SH, Tayyem R, Nimer N, Alkhatib HS. Skin-lightening practice among women living in Jordan: prevalence, determinants, and user's awareness. *Int J Dermatol*. 2010 Apr;49(4):414-20.
18. Adebajo SB. An epidemiological survey of the use of cosmetic skin lightening cosmetics among traders in Lagos, Nigeria. *West African Journal of Medicine*. 2002;21(1):51-55.
19. Rusmadi SZ, Ismail SNS, Praveena SM. Preliminary study on the skin lightening practice and health symptoms among female students in Malaysia. *Journal of Environmental and Public Health* Volume 2015 (2015), Article ID 591790, 6 pages
20. Askari SH, Sajid A, Faran Z, Sarwar SZ. Skin-lightening practice among women living in Lahore: Prevalence, determinants, and user's awareness. *Proceedings of 3rd International Conference on Business Management*. School of Business and Economics University of Management and Technology, Lahore, Pakistan, 2012. Available at: <http://cgr.umt.edu.pk/icobm2013/papers/Papers/IC3-Dec-2012-066.pdf>
21. Yousif AK, Ahmed AAE, Idris AE, Elmustafa MO, Ahmed EHS. The use of bleaching creams among central Sudan students, 2010. *Pharmacology & Pharmacy*, 2014; 5: 532-539
22. Nnoruka E, Okoye O. Topical steroid abuse: its use as a depigmenting agent. *J Natl Med Assoc* 2006; 98: 934-939

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### RESEARCH ARTICLE

#### “A STUDY ON THE STATISTICAL ESTIMATION OF URANIUM ION IN GROUNDWATER OF CUDDALORE DISTRICT, TAMILNADU, INDIA”.

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#### Abstract

The present study aim to examine mapping of uranium distribution in the Cuddalore district, Tamil Nadu, India. Uranium is a relatively abundant element with the highest atomic number of all naturally occurring elements. The occurrences of groundwater are identified porous formation and in fractured and the weathered hard rock aquifer matrix. The geology of the district underline by different range of age from oldest Archean rocks to recent sediments. The study area occupy in 3,678 Sq.km. Totally 93 groundwater samples were collected during Pre- Monsoon, 2015. The collected samples were analyzed for major cations and anions in standard scientific manner. U was analyzed by using laser fluorimeter. The uranium concentration in the groundwater of this region ranges from 0.1 ppb to 24.67 ppb with an average of 1.82 ppb. The analysis results shows the following order of dominance of ion  $Cl^- > H_2SiO_4 > HCO_3^- > NO_3^- > Na^+ > Ca^{2+} > Mg^{2+} > K^+ > SO_4^{2-} > F^- > PO_4^{3-}$ . It is inferred that most of the samples are fresh to slightly saline in nature. The spatial interpolation maps were prepared for demarcating the Uranium enriched region. Thus the regions with higher “U” concentration were delineated and the process responsible for the higher U was determined by statistical analysis.

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#### Introduction:-

The groundwater chemistry is concern with a global perspective in groundwater Scenario. The hydrogeological characteristics and geochemical assessment of the basin has been discussed by (Anandan et al. 2010a, b, ; Ravi Kumar et al. 2010; Prasanna et al. 2011). In this, Coastal aquifers constitute an important source of clean water supply, but are frequently faced with the problem of saltwater intrusion (Lenin et al., 2008). Uranium naturally occurs in three isotopic forms in soil, water, plants, animals and human beings. U-238 and U-235 are the parent nuclides of two independent decay series, while U-234 is a decay product of the U-238 series (Balvinder Singh et al., 2014). Uranium concentration in groundwater depends on several factors including lithological, geomorphologic and other geological conditions of the area (Sridhar-Babu MN, 2008). Uranium estimation of water systems of India has been reported by some authors likely Singh et al., 1984, 1995, 2001, 2002, 2008; Ramola et al., 1988; Sarin et al., 1992). Most of the uranium (upto 100 ppb) occurrences in groundwater in India are around the mining regions, uraniferous conglomerates and around granitic intrusions. In Statistical methods use statistics to determine associations between spatial variables and actual occurrence of pollutants in the groundwater. Their

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limitations include insufficient water quality observations, data accuracy, and careful selection of spatial variables (Babiker et al. 2005). The estimation of uranium in water may be significant for the hydrogeochemical prospection and for health risk assessments. This study mainly focuses on the spatial distribution of uranium and its behavior of groundwater, moreover to evaluate the geochemical process in the study area.

## Description of the study area:-

### Study Area:-

The area chosen for study in Cuddalore district, which falls in between South of the Ponnaiyar river and North of the Vellar River. It covers an area about 3,678 Sq.km, and lies between  $15^{\circ} 5''$  and  $12^{\circ} 35''$  N,  $78^{\circ} 38''$  and  $80^{\circ} 00''$  E. It falls in Survey of India Map No: 56M/10, 14, 58M/11 and 15. (Fig1). The significant role for East of Pichavaram Mangroves; south of Cuddalore port, SIPCOT Industries, followed by Coleroon River flowing is there. Major part of the study area is devoted to agricultural activities, which include paddy, sugarcane, and groundnut and gingili cultivation. The geological reserves are Lignite, Limestone, White clay materials. In other important of Forest the total areas covered under the woodland in the district are 4171 lifts.

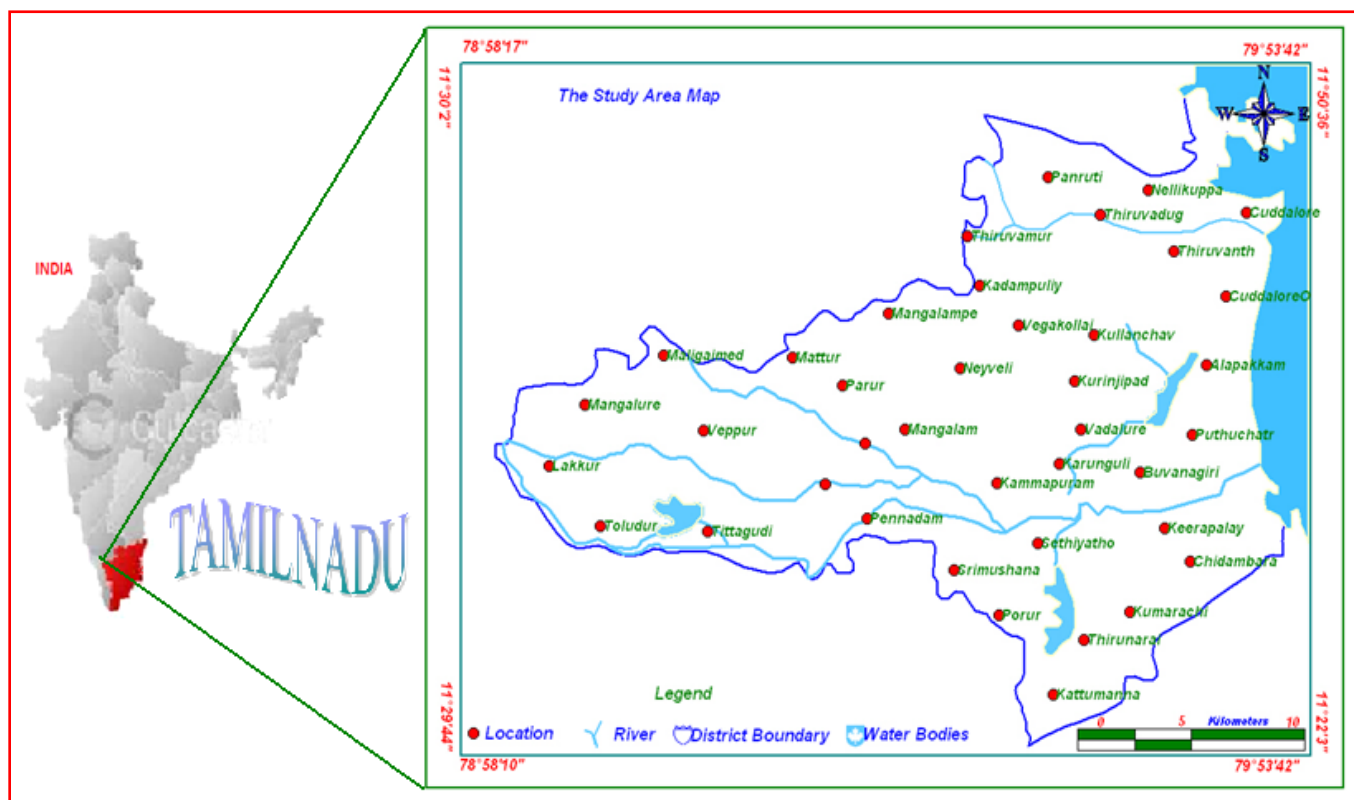
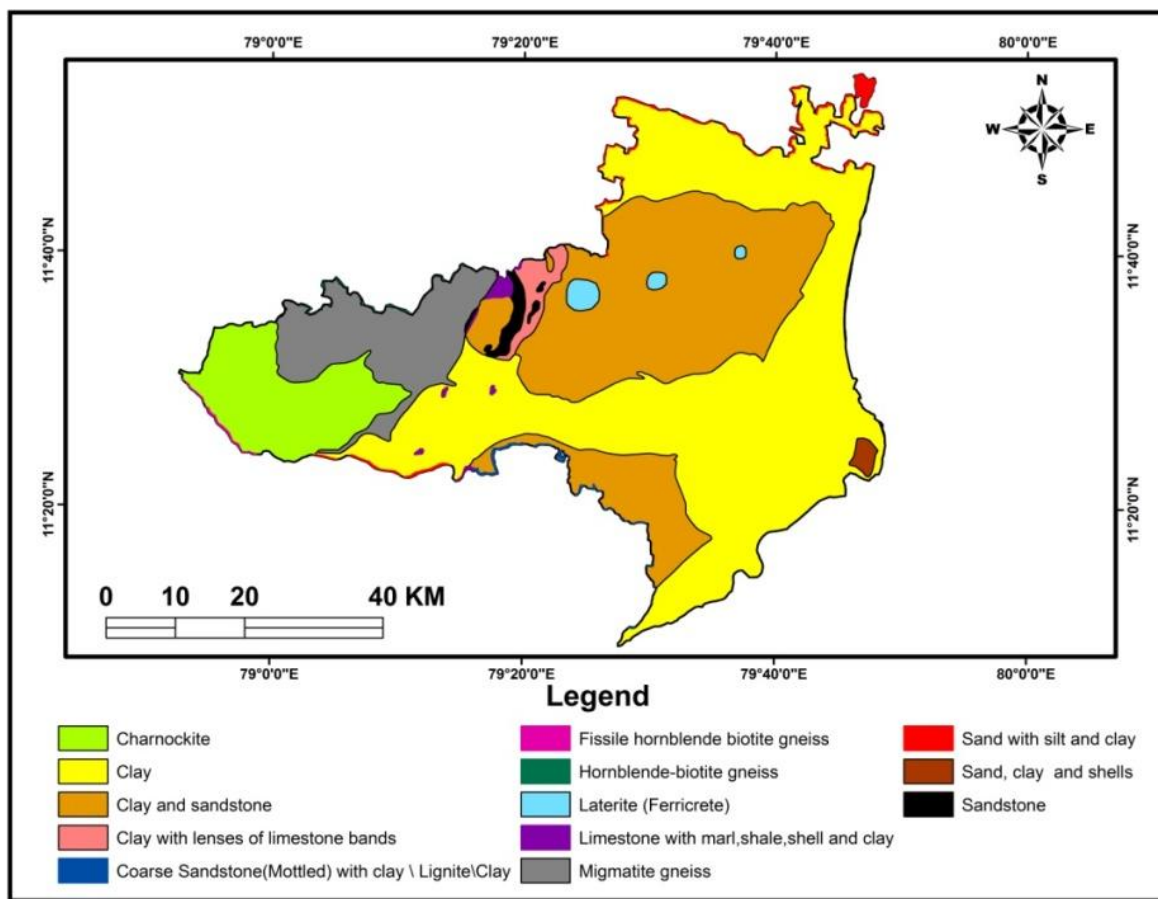


Fig 1:- Sampling Location map of the study area



**Fig 2:-** Geology map of the study area

#### Geology of the study area:-

The geology of the area plays a significant role for assessing groundwater potential zone of the region. This district underline by different range of age from oldest Archean rocks to recent sediments. Tertiary and quaternary sedimentary rocks mainly make up the study area (Fig 2). The litho units represents mostly cover by Clay and Clay Sandstone in sedimentary formations and other than expose clay with lenses of limestone bands and bottom layer of coarse s.s.t with mottled clay with lignite, then small portion of cover by massive rock of Charnokite formation.

#### Materials and Methods:-

In total 93 samples of groundwater were taken into consideration collected from the study area pre-monsoon 2015. Samples were collected using polythene bottles washed with clear acid and standard procedures were used for analysis. The parameter, such as Temperature, pH, EC (Electrical Conductivity) and TDS (Total Dissolved Solids) were analyzed in Thermo Orion ion electrode probe Portable kit) were measured in the field.  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{HCO}_3^-$ ,  $\text{Cl}^-$ , were analyzed in titrimetric Methods procedure adapting by (Ramesh, R., Anbu, M.1996).  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{H}_4\text{SiO}_4$ , and  $\text{NO}_3^-$  were determined by using UV Spectrophotometer HACH 6000 Instrument. The analytical precision for the measurements of ions was determined by calculating the ionic balance error, which is generally within  $\pm 5\%$ . The fluoride ions were analyzed in Thermo Orion ion electrode (F). The Na and K were analyzed in Flame photometer (Elico CL 378). The maps were prepared by Map info professional 8.5 and piper plot done by Aquachem4.0. Calculation & graphical representations were done by a computer program WATCLAST in C++.

#### Groundwater chemistry:-

##### pH:-

The chemistry of groundwater samples studied about pH range between lowest for 5.59 maximum of 8.7 and with an average of 7.05 observed in the study area. A Water with a pH > 8.5 could indicate that the water is hard and acidic to alkaline in nature. The Hardness of the water results in aesthetic issues.



**EC:-**

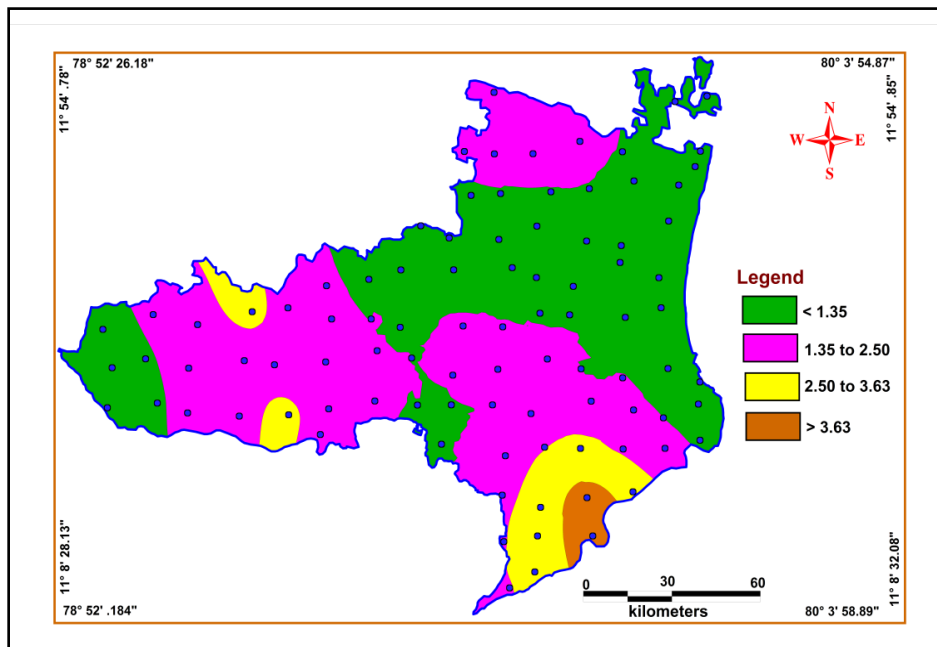
The Electrical conductivity (EC) values range from 95.7  $\mu\text{S}/\text{cm}$  to 4890  $\mu\text{S}/\text{cm}$  at 25°C, averaging of about 1253  $\mu\text{S}/\text{cm}$ . The EC values reported in channels near location 27 are high & inconsistent because of industrial discharge and urban waste disposition which results in leaching and accumulation of chemicals.

**TDS:-**

The total dissolved Solids were observed in maximum of 2410 ppm to 50.1 ppm in lowest with an average of 615 ppm in the study area. The cuddalore coastal region is generally occupied with alluvium soil. The study area is mostly covered by alluvial soil, because they having groundwater contain in very shallow depth. Some physical disturbance has been attempt it influence mining activities and under construction process, it cause the groundwater quality is suffered.

**Spatial Estimation of Uranium:-**

In this technique, on excitation of uranium complexes with UV light of 337.1 nm wavelength, the complexes emit green fluorescence that is measured by Photo Multiplier Tubes (PMT). Uranium concentration in aqueous samples is given by the measurement of fluorescence. The minimum detection limit (MDL) of the instrument was 0.2  $\mu\text{g L}^{-1}$ . To avoid error due to different uranium complexes sodium pyrophosphate reagent was used to convert various complexes into single form having same fluorescence yield (Sahoo SK, 2009). The spatial contribution of uranium is observed in higher concentration of U is  $>3.63$  ppb, minimum of 1.35 ppb with an average of 2.50 to 3.60 ppb. The majority of the samples fall in South side and Eastern part and rest of them is Western part of study area (Fig 3). In specifically, indicate that maximum range of U is noted in the South margin and South west and north side is falls in moderate range and minimum concentration noted in towards East and small amount of western part. The obtained values and falling locations were identified in the contamination places and its describing the nature of geochemical behavior of groundwater.



**Figure 3:-** Spatial distribution of Uranium in the study area

In specifically, indicate that maximum range of U is noted in the South margin and South west and north side is falls in moderate range and minimum concentration noted in towards East and small amount of western part. The obtained values and falling locations were identified in the contamination places and its describing the in order to classify their saturation of geochemical contribution in the groundwater.

**Statistical Analysis:-****Correlation matrix:-**

The correlation matrix for groundwater samples collected from Cuddalore region is shown in (Table 1.1). Moderate correlation was observed between pH,  $\text{HCO}_3^-$  and Ca, Mg and  $\text{Cl}^-$ ,  $\text{Ca}^{+}$  and U, Mg and Na, Mg, and Cl, Mg and



good correlation of  $\text{Na}^+$ ,  $\text{Cl}^-$ , and moderately correlate the  $\text{Na}$ ,  $\text{SO}_4^-$ ,  $\text{U}$ ,  $\text{Na}^+$  and  $\text{EC}$ ,  $\text{Na}$ ,  $\text{TDS}$  and  $\text{Cl}^-$ ,  $\text{TDS}$  and  $\text{EC}$ ,  $\text{HCO}_3^-$  and  $\text{TDS}$ ,  $\text{SO}_4^-$  and  $\text{U}$ ,  $\text{EC}$  and  $\text{TDS}$ ,  $\text{EC}$  indicating that all of them have the same origin (Chidambaram and Ramanathan 2000).

**Table:-** Correlation matrix of Groundwater sample from Cuddalore district

	pH	$\text{Ca}^+$	$\text{Mg}^+$	$\text{Na}^+$	$\text{K}^+$	$\text{Cl}^-$	$\text{HCO}_3^-$	$\text{F}^-$	$\text{NO}_3^-$	$\text{PO}_4$	$\text{SO}_4^-$	$\text{H}_4\text{SiO}_4$	U	EC	TDS
pH	1														
$\text{Ca}^+$	0.06	1.00													
$\text{Mg}^+$	0.25	<b>0.57</b>	1.00												
$\text{Na}^+$	0.35	0.38	<b>0.58</b>	1.00											
$\text{K}^+$	0.12	0.20	0.26	0.31	1.00										
$\text{Cl}^-$	0.09	<b>0.71</b>	<b>0.74</b>	<b>0.80</b>	0.38	1.00									
$\text{HCO}_3^-$	<b>0.63</b>	0.21	<b>0.42</b>	0.41	0.00	0.10	1.00								
$\text{F}^-$	0.20	-0.24	0.02	0.17	-0.12	-0.13	0.38	1.00							
$\text{NO}_3^-$	0.08	0.03	0.14	0.12	0.11	-0.02	0.22	0.15	1.00						
$\text{PO}_4$	0.02	-0.05	-0.14	0.06	<b>0.54</b>	0.00	-0.02	-0.08	0.05	1.00					
$\text{SO}_4^-$	0.28	0.17	<b>0.44</b>	<b>0.50</b>	0.10	0.40	0.33	0.11	-0.02	-0.09	1.00				
$\text{H}_4\text{SiO}_4$	-0.12	0.09	-0.07	-0.10	-0.09	-0.05	-0.11	-0.01	0.33	-0.05	0.07	1.00			
U	0.15	0.30	<b>0.52</b>	<b>0.56</b>	0.10	<b>0.48</b>	0.28	0.04	0.07	-0.03	0.32	-0.08	1.00		
Ec	0.46	0.30	0.47	<b>0.59</b>	0.12	0.37	<b>0.62</b>	0.08	0.12	0.01	<b>0.47</b>	-0.12	<b>0.50</b>	1.00	
TDS	0.33	0.31	0.45	<b>0.65</b>	0.19	<b>0.53</b>	<b>0.44</b>	0.09	0.16	0.04	<b>0.50</b>	0.00	<b>0.45</b>	<b>0.61</b>	1.00

#### PCA analysis and Factor Analysis:-

Statistical computations adopting a discrete method to point out the Principal component analysis (PCA) is a powerful tool that attempts to explain the variance of a large dataset of inter-correlated variables with a smaller set of independent variables (Simeonov *et al.* 2003). PCA technique extracts the Eigenvalues and eigenvectors from the covariance matrix of original variables. The Principal Components (PC) is the uncorrelated (orthogonal) variables obtained by multiplying the original correlated variables with the eigenvector, which is a list of coefficients (loadings or weightings). It includes loading for the rotated component matrix, eigen values for each component, per cent and cumulative per cent of variance explained by each component. It indicates that principal components together account for **66.12%** of the total variance in the dataset, in which the first principal component is **29.2%**, second principal component is **46.04%**, and the third principal component is **57.05 %** & fourth principal component is **66.1%** of the total variance.

The Eigenvalues of the first three principal components ( $>1$ ) can be used to assess the dominant hydro geochemical processes. The concentrations of **Ca**, **Mg**, **Na** and **Cl** show high positive loadings (0.75-0.95) whereas concentrations of **EC**, **TDS**,  **$\text{SO}_4$** ,  **$\text{NO}_3$**  and **U** is the moderate positive loadings range between (0.50-0.75) and remaining of **pH**,  **$\text{K}^+$** ,  **$\text{HCO}_3$** , have low positive loadings (0.16-0.34), for the first principal component.

**Table 1.2:-** Principal Component Analysis (Rotated Varimax)

Rotated Component Matrix				
	Component			
	1	2	3	4
pH	.172	.727	.116	-.104
EC	.577	.570	.055	-.061
TDS	.650	.401	.110	.088
Ca+	.746	-.241	.022	.085
Mg+	.824	.137	-.017	.022
Na+	.775	.335	.184	-.025
K+	.266	-.060	.843	.005
Cl-	.921	-.154	.157	-.049
HCO <sub>3</sub>	.298	.809	-.029	.040
F-	-.152	.628	-.147	.133
NO <sub>3</sub>	.035	.237	.155	.790
PO <sub>4</sub>	-.127	.019	.882	.004
SO <sub>4</sub>	.546	.336	-.097	.018
H <sub>4</sub> SiO <sub>4</sub>	-.002	-.171	-.135	.826
U	.652	.186	-.027	-.048
Extraction Method: Principal Component Analysis.				
Rotation Method: Varimax with Kaiser Normalization.				

### Results and Discussion:-

The groundwater vulnerability assessment is a critical point in decision-making processes, aiming to land use and resource management optimization. Therefore, it is imperative the adoption of preventive measures as well as accurate monitoring processes. Here, we discuss about the spatial distribution of these factors will permit the identification of potential pollution sources, taking into account the primary activities in the subject area: agriculture, mining, industrial or urban activities. Groundwater is unsuitable for domestic use in 2 % of this area based on the limit of 60 ppb prescribed by the AERB (Atomic Energy Regulatory Board of India). The reported that the concentration of uranium was relatively higher than the USEPA drinking water limit of 30 ppb.

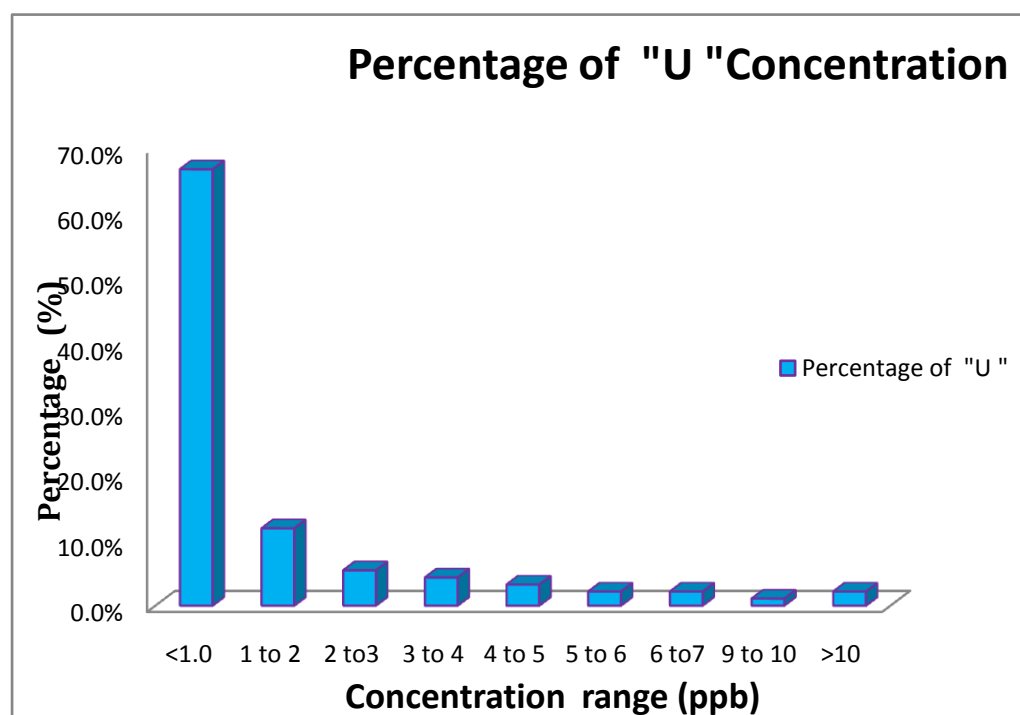
The concentration of uranium in groundwater greatly depends on the composition of the rocks in the aquifer. WHO, 2004 had recommended 15 ppb of uranium in drinking water as safe limit. The (table 1.3) shows that to understand the variability of uranium and also we can estimate the percentage of contaminate into the study area. Some anthropogenic activities like mining, milling, and nuclear fuel processing add uranium to various environmental components (EPA (2009)). These values represent mostly covered 0.1ppb to 1.0 ppb of 62 samples in 66.7 % were found very mild rate of pollution. Then 1 ppb to 2 ppb of 11.8 % 11 samples denotes small range of pollution, and remaining, 5 samples represents 2ppb to 3ppb 5.40 %, 3ppb to 4 ppb of 4 samples falls in 4.30% , and others 4ppb to 5 ppb in 3 samples are covers 3.22% & 5ppb to 7ppb of 2.15% in 2 samples were found and In such that we can infer the very highest range of uranium concentration is observed that following range: 9ppb to 1.0 ppb 1.07 % of 1 sample and 2.15 % sample are fall in > 10 ppb range of concentration in the study area (table 1.4). The source of u has been carried the mining activity and some chemical solvents are dissolves in surface water as well as groundwater due can possible to have the uranium or uranyl particle in that water system. So these proportions are demarcating the variability of geochemical contribution of uranium in the present groundwater.

**Table 1.3:-** Shows different range of Uranium concentration in the Cuddalore region

S.No	Country	Range of U( $\mu\text{g}\cdot\text{l}^{-1}$ )	References
1	Turkey	0.24 - 17.65	Kumru <i>et al.</i> (1995)
2	South Greenland	0.5 - 1.0	Brown <i>et al</i> (1983)
3	USA	0.01 - 652	Cothorn <i>et al</i> (1983)
4	Kuwait	0.02 - 2.48	Bou-Rabee <i>et al</i> (1995)
5	Jordan	0.04 - 1400	Smith <i>et al</i> (2000)
6	Central Australia	>20	Hostetler <i>et al</i> (1998)
7	Cochin, India	0.34 - 2.54	Prabhu R.S. <i>et al</i> (2008)
8	Cuddalore district, India	0.1 ppb 24.67 ppb	Present Study

**Table 1.4:-** Comparison of uranium concentration in drinking water in different countries

S.No	Conc. Range (ppb)	Percentage of "U "
1	<1.0	66.70%
2	1 - 2	11.82%
3	2 -3	5.40%
4	3 - 4	4.30%
5	4 - 5	3.22%
6	5 - 6	2.15%
7	6 -7	2.15%
8	9 - 10	1.07%
9	>10	2.15%

**Fig. 4:-** Vertical proportion of uranium percentage in groundwater in the cuddalore region during pre-monsoon.

The above chart is representing the concentration of uranium ion presence of cuddalore area denotes the visual observation of higher range of 66.70% of samples in fall <1.0 ppb, medium level of 1-2 ppb in 11.82%, rest of the samples are falls in 2-3 ppb in 5.4%, and other samples were found in 3-4 ppb to >10.0 ppb in minor distribution for this study area.

### Conclusion:-

The present study is conclude that majority of the samples were indicate the not affected in uranium contaminant, only few samples were found in higher concentration. Then, it is calculating by their spatial volume of uranium content. The obtained results shows the following order of dominance of ion  $\text{Cl}^- > \text{H}_4\text{SiO}_4 > \text{HCO}_3^- > \text{NO}_3^- > \text{Na}^+ > \text{Ca}^{2+} > \text{Mg}^{2+} > \text{K}^+ > \text{SO}_4^{2-} > \text{F}^- > \text{PO}_4^{3-}$ . It is inferred that most of the samples are fresh to slightly saline in nature. The Uranium spatial map was studied to estimate the volume and their saturation points were found. These distributions of samples are covered in Majority samples were fall in South side and Eastern part and rest of them is Western part of study area. In which, overall water geochemistry results reflects to support the human utility. The graphical value indicates the each location proportion of uranium ion individual rating of study status. The area denotes the visual observation of higher range of 66.70% of samples in fall <1.0 ppb, medium level of 1-2 ppb in 11.82%, rest of

the samples are falls in 2-3 ppb in 5.4% , and other samples were found in 3-4 ppb to >10.0 ppb in minor distribution. Hence, the statistical approach insist correlate uranium ion with other geochemical parameters denotes the agricultural and artificial activities additionally mining manmade factors are influenced by to enrich the uranium distribution of groundwater in the Cuddalore region.

### References:-

1. AERB, Directive for Limit on Uranium in Drinking Water, India. Mumbai: Atomic Energy Regulatory Board, 2004.
2. Anandan K.S, Sahay S.N, Karthikeyan (2010b) Delineation of recharge area and artificial recharge studies in the Neyveli Hydrogeological Basin. *Mine Water Environment* 29: 14- 22.
3. Anandhan K.S, Sahay S.N, Ramabadrnan T.K, Shiv Prasad S (2010a) Groundwater control techniques for safe exploitation of the Neyveli Lignite deposit, Cuddalore District, Tamilnadu, India. *Mine Water Environment* 29: 3-13.
4. Balvinder Singh V. K. Garg, Poonam Yadav, Nawal Kishore ,Vandana Pulhani (2014) Uranium in groundwater from Western Haryana, India, *Journal of Radioanalytical and Nuclear Chemistry*, Volume 301, Issue 2, pp 427–433.
5. Brown, A. Steenfelt, H. Kunzzenorf (1983) Uranium districts defined by reconnaissance geochemistry in South Greenland, *Journal of Geochemical Exploration*, 19 (1983), pp. 127–145
6. Chidambaram S., Ramanathan A.L., Prasanna M.V., Karmegam U., Dheivanayagi V., Ramesh R., Johnsonbabu G., Premchander B. and Manikandan S. (2010). Study on the hydrogeochemical characteristics in groundwater, post-and pre-tsunami scenario, from Portnova to Pumpuhar, southeast coast of India. *Environ Monit Assess* 169, 553–568.
7. Chidambaram, S. Hydrogeochemical studies of groundwater in Periyar district, Tamilnadu, India, unpublished Ph.D thesis, Department of Geology, Annamalai University. 2000
8. Chidambaram, S., Ramanathan, A.L., Prasanna, M.V., Loganathan, D., Badrinarayanan, T. S., Srinivasamoorthy, K., and Anandhan, P. (2008) Study on the impact of tsunami on shallow groundwater from portnova to pumpuhar, using geoelectrical technique – south east coast of India. *Indian Journal of Marine Sciences*, 37(2), pp.121-131.
9. Cothorn, C. R.; Lappenbusch, W. L. Occurrence of uranium in drinking water in the United States. *Health Phys.* 1983, 45 (1), 89–99.
10. F. Bou-Rabee (1995) Estimating the concentration of uranium in some environmental samples in Kuwait after the 1991 Gulf War, *Applied Radiat Isotopes*, 46 (1995), pp. 217–220.
11. Hostetler S, Wischusen J, Jacobson G (1998). Groundwater quality in the Papunya–Kintore region, Northern Territory. Australian Geological Survey Organisation, Canberra.
12. Kumru, M.N., (1995) Distribution of radionuclides in sediments and soils along the Buyuk Menderes River. *Proc. Pakistan Acad. Sci.*, 32, p 51-56
13. Lenin Kalyana Sundaram V., (2008) Vulnerability Assessment of Seawater Intrusion and Effect of Artificial Recharge in Pondicherry Coastal Region using GIS. *Indian Journal of Science and Technology*. 1 (7) 1-7.
14. Prasanna M.V., Chidambaram S., Senthil Kumar G., Ramanathan A.L., and Nainwal H.C. (2011) Hydrogeochemical assessment of groundwater in Neyveli Basin, Cuddalore District, South India [J]. *Arabian Journal of Geosciences*. 4, 319–330.
15. R. S. Prabhu, R. Sathyapriya, S. K. Sahoo and S. Mahapatra, “Ingestion Dose Due to Natural Uranium to the Public through Drinking Water Pathways in Two Districts of Keral,” *Proceedings of 16th National Symposium on Environment*, Hisar, 2008, pp. 551-555.
16. Ramesh, R., and Anbu, M. (1996). Chemical methods for environmental analysis- water and sediments, pp.161.
17. Ramola, R. C., Singh, S., & Virk, H. S. (1988). Uranium and radon estimation in some water samples from Himalayas. Part D. Nuclear Tracks and Radiation Measurements, 15(1e4), 791-793.
18. Ravi Kumar V, Sahay S.N, Periasamy, Shiv Prasad, Karthikeyan S (2010) Groundwater basin management at the Neyveli Lignite Mines. *Mine Water Environment* 29: 23-28.
19. Sahoo, S. K., Mohapatra, S., Chakrabarty, A., Sumesh, C. G., Jha, V. N., Tripathi, R. M., & Puranik, V. D. (2009). Distribution of uranium in drinking water and associated age-dependent radiation dose in India. *Radiation protection dosimetry*, 136(2), 108-113.
20. Sarin M M, Krishnaswami S, Sharma K K and Trivedi J R (1992) Uranium isotopes and radium in the Bhagirathi– Alaknanda river system: Evidence for high uranium mobilization in the Himalaya; *Curr. Sci.* 62(12) 801–805.

21. Simeonov V, Stratis JA, Samara C, Zachariadis G, Voutsas D, Anthemidis A, Sofoniou M, Kouimtzis T (2003) Assessment of surface water quality in northern Greece. *Water Res* 37:4119–4124
22. Singh J, Singh H, Singh S, Bajwa BS.(2008) Estimation of uranium and radon concentration in some drinking water samples. *Radiat. Meas* 43(Supplement 1):523–526.
23. Singh J, Singh L and Singh G (1995) High U-contents observed in some drinking waters of Punjab, India; *J. Environ. Radioact.* 26 217–222.
24. Singh R V, Sinha R M, Bisht B S and Banerjee D C (2002) Hydrogeochemical exploration for unconformity related uranium mineralization: Example from Palnadu sub-basin Cuddapah Basin, Andhra Pradesh, India; *J. Geochem. Explor.* 76 71–92.
25. Singh, N. F., Singh, M., Singh, S., & Virk, H. S. (1984). Uranium and radon estimation in water and plants using SSNTD. *Nuclear Tracks and Radiation Measurements*, 8(1-4), 483-486.
26. Singh, S., Malhotra, R., Kumar, J., Singh, B., & Singh, L.(2001). Uranium analysis of geological samples, water and plants from Kulu Area, Himachal Pradesh, India. *Radiation Measurements*, 34, 427-431.
27. Smith B, Powell AE, Milodowski AE, Hards VL, Hutchins MG, Amro A, Gedeon R, Kilani S, Scrivens SM, Galt V (2000). Identification, investigation and remediation of ground water containing elevated levels of uranium-series radionuclides: a case study from the Eastern Mediterranean. In: Panayides L, Xenophontos C, Malpas J, (Eds.), *Proceedings of the Third International Conference on the Geology of the Eastern Mediterranean*, Nicosia, Cyprus. World Health Organization, Geneva (WHO/SDE/PHE/01.01).
28. World Health Organization, 2004. *Guidelines for Drinking-water Quality: Summary Statement*, 3rd ed., Geneva, WHO.

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### RESEARCH ARTICLE

#### PHENOTYPIC DETECTION OF BIOFILMS IN CANDIDA SPECIES ISOLATED FROM VARIOUS CLINICAL SPECIMEN

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##### Key words:-

Biofilm, Antifungal efficacy, Non albicans Candida

#### Abstract

Candida is one of the most frequently encountered opportunistic fungi that cause severe infection in humans because of its virulence factor. The ability of *Candida albicans* to form biofilms and adhere to host tissues and biomaterial surfaces is an important factor in its pathogenesis. One of the main characteristics of biofilms is their resistant to broad spectrum anti-microbial drugs. The aim of the study was to know the biofilm formation by various Candida species isolated from various clinical specimens. The study was carried out over a period of 1 year from January 2016 to December 2016 at the Department of Microbiology, Government Medical College and Hospital, Jammu. A total 120 Candida spp. were isolated from various clinical specimens. Speciation of Candida was done by standard yeast identification protocol and Candida CHROMagar. Biofilm formation was detected by Congo Red Agar, Tube method and microtitre plate method. Out of total 120 Candida spp. studied, biofilm production was seen in 63/100 (52.55%) isolates. While comparing all the three methods tube method proved more reliable, easy and more efficient. Antifungal efficacy of Coconut oil and Eucalyptus oil was also tested in this study against all Candida isolates. Eucalyptus oil was observed to be a better antifungal agent than Coconut oil in the present study. When coconut oil was tested against all *Candida albicans* isolates, the sensitivity of biofilm non producers was higher in comparison to biofilm producers.

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#### Introduction:-

A biofilm is a polysaccharide matrix that acts as a protective structural layer for the microorganism. By producing a biofilm, the micro-organism creates a shield to protect itself. (Sachin C Deorukhkar & Santosh Saini, 2013) Formation of a biofilm is a virulence factor of a microorganism. Biofilm is produced by both fungi and bacteria. In mycology, Candida spp. forms most common fungal biofilm which is extremely difficult to treat. (Nimet Yigit et.al., 2011). Candida spp. has an ability to adhere to the surface of commonly used medical devices. Candida spp. is the fourth most common cause of bloodstream infection (BSI) and the third most common cause of urinary tract infection (UTI). (Saroj Golia et.al, 2012) Formation of Biofilm exhibits increased resistance to commonly available antifungal therapies; these infections are very hard to treat. Most often, treatment of biofilm infections involves the removal of the infected medical devices (Pahwa N et.al., 2014). The majority of medically important Candida spp.

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has now been shown to develop biofilm including *C. albicans* and Non albicans Candida which includes *C. krusei*, *C. glabrata*, *C. tropicalis*, *C. dubliniensis* and *C. parapsilosis* (Serafino, A et.al.,2008 & Chander J.,2009). The Biofilms of Candida spp exhibits resistance to all available commonly used antifungal drug classes including the azoles (itraconazole, fluconazole, , voriconazole,), the echinocandins (caspofungin, micafungin, anidulafungin), the amphotericin B and flucytosine (Konopka K et.al., 2010). The formation of Candida biofilms carries important clinical repercussions because of their increased resistance to commonly available antifungal therapies and the ability of biofilms to withstand with host immune defences.( Khan MS et.al.,2012) Candida biofilms shows antagonistic impact on the health of the patients. The detection of biofilm becomes very necessary for the treatment of infection.( Ogbolu, D.O et.al., 2007) Various Phenotypic methods are used for the routine detection of Biofilms are - Microtiter Plate Method, Congo Red Agar and Tube adherence method. Fungal infections are treated with antifungal medications called antimycotics or antifungals. While antifungal are effective for many, some may experience side effects and rebound infection. To avoid side effects, one can use naturally occurring antifungals. (Ogbolu, D.O et.al., 2009) New studies shows that eucalyptus oil and coconut oil has powerful anti-fungal properties and it may be an effective treatment for biofilm. This antifungal efficacy of eucalyptus oil and coconut oil on the clinical Candida isolates was also tested in this study. The present study focused on-

1. Isolation and Identification of Candida spp. from various clinical specimens.
2. Detection of biofilm forming capacity of these isolates by various phenotypic methods.
3. Assessment of antifungal efficacy of plant oils on pathogenic Candida isolates.

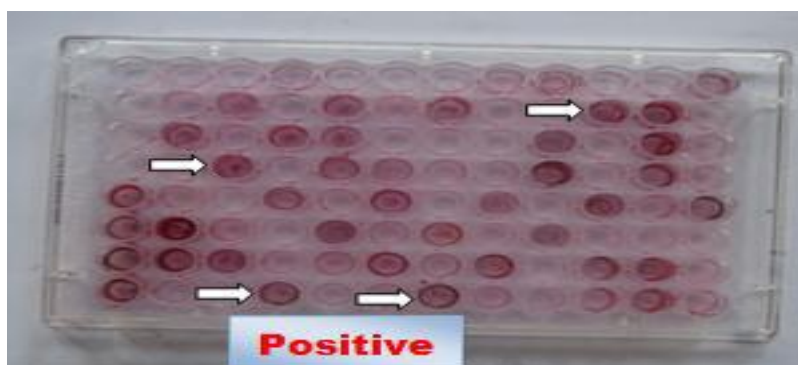
### Materials and Methods:-

The present study was conducted over a period of one year (January 2016 to December 2016) in the Department of Microbiology, Government Medical College & Hospital, Jammu, (J&K). The clinical isolates recovered from both outdoor and indoor patients and were identified by using standard microbiological protocols. Total 4150 clinical specimens were processed out of which 120 Candida species were recovered. Clinical specimens like Blood, Urine and Pus were included in the study. Samples were screened for budding yeast like cells with the help of Gram stain, and then inoculated on Sabourad's Dextrose Agar with Chloramphenicol at 37 °C for 24 hours. For initial speciation, Germ tube test was done followed by formation of Chlamyospore formation on Corn meal agar. Simultaneously Candida Spp. were inoculated on Candida CHROM agar and incubated at 37 °C for 24 hrs and the species were identified by colour of the colonies on CHROMagar media as per manufacturer's instructions (TM Media).

Biofilm Formation- Biofilm formation was detected by three methods as described below.

#### Microtitre plate method;-

Biofilm formation was determined by using 96-well pre-sterilized polystyrene microplates (HiMedia) For each isolate, a suspension from an overnight culture on SDA was prepared in sterile distilled water and adjusted to 1 McFarland. Each well of the microplate was filled with 180 µl of Sabouraud dextrose broth (Himedia, India) supplement with 8% glucose and then 20 µl of the standard suspension of tested isolates was inoculated. Microplates were covered and incubated at 37°C for 24 hours. The medium in wells was removed and washed three times with sterile phosphate buffer solution (PBS). Microtitre plates were stained with 1% Safranin for 5 minutes and then percentage transmittance (%T) was read at 630 nm by an ELISA reader. All tests were done in triplicates and mean were calculated. Finally, adherent biofilm layers were scored as either negative; weak (+) (percentage transmittance (%T ≤ 20)); moderate, (++) (%T = 20-35); strong (+++) (%T =36-50) and very strong (++++) (%T ≥ 50).



**Fig 1:-** Biofilm formation by Candida species (Microtitre plate method)

**Congo red Agar Method:-**

Congo Red Agar (CRA) is a simple and qualitative method for detecting biofilm production described by Freeman et al using Congo Red Agar medium. CRA medium was prepared with brain heart infusion broth 37 g/L, sucrose 50 g/L, agar No. 1 10 g/L and Congo Red indicator 8 g/L. Firstly Congo red stain was prepared as a concentrated aqueous solution separately from the other medium constituents and autoclaved at (121°C for 15 minutes) and then added to the autoclaved brain heart infusion agar with sucrose which is cooled at 55 °C. CRA plates were inoculated with test organisms and incubated at 37 °C for 24 hr aerobically. Black colonies with a dry crystalline consistency will indicate biofilm production. The experiment was performed in triplicate and repeated three times.



**Fig 2:-** Biofilm formation by Candida species (Congo Red Agar)

**Tube Method:-**

A loopful of organisms from the surface of SDA plate was inoculated into tube containing 10ml of Sabouraud Dextrose Broth supplemented with glucose. The tubes were incubated at 35°C for 48 hours. After incubation, the culture supernatants were decanted and the tubes were washed with phosphate buffer saline (pH 7.3) and the dried tubes were stained with 1% Safranin. Excess stain was removed by washing with de-ionized water. Tubes were then dried by positioning them invertedly. Tubes were then observed for biofilm formation. Biofilm formation was considered positive when a visible film lined the wall of the test tube.



**Fig 3:-** Biofilm formation by Candida species (Tube method)

**Antifungal Efficacy Testing of Eucalyptus Oil and Coconut Oil:-****Preparation of Impregnated Paper Discs**

The commercially available extracts of Eucalyptus oil and coconut oil were used. A 0.04 ml of 100% concentration of the Eucalyptus oil and coconut oil extracts was impregnated into the discs. The impregnated discs were left to dry



for 24 hours in the incubator at 37°C. After drying, the discs were transferred back into the sterile container and stored.

#### Antimicrobial Sensitivity Test:-

Antimicrobial experiments on *Candida* species were carried out on SDA plates. The test strain were streaked on the plates using sterile wire loop and allowed to dry for 15 minutes. Sterile impregnated discs were applied onto the inoculated plates. The plates were then incubated at 37°C for 24–48 hours. Zones of inhibition were assessed after the period of incubation.

#### Result:-

Out of 4150 samples, only 120 (2.89%) were culture positive for *Candida* spp. Out of 120 *Candida* spp. isolated, 58 (48.33%) were identified as *Candida albicans* and 62 (51.66%) were identified as Non-*albicans* *Candida* species. All isolates were studied for biofilm production. Out of total 120 *Candida* species studied, biofilm production was seen in 63/120 (52.55%) isolates.

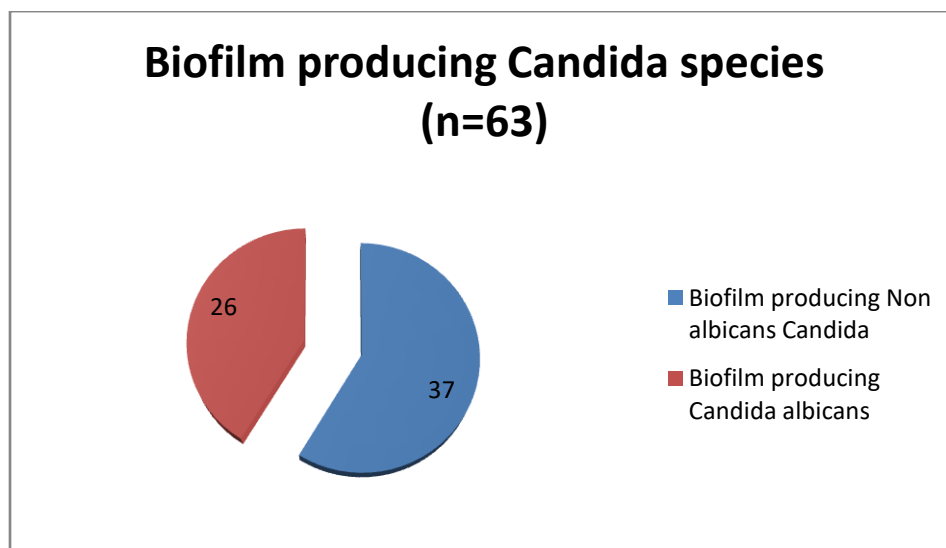


Fig 4:- Biofilm producing Candida species

Table 1:- Incidence of *Candida* spp. in Clinical Samples

S.No.	Specimen (n=120)	No. of <i>C. albicans</i> isolates (n=58)	No. of Non albicans <i>Candida</i> isolates (n=62)
1.	Blood(n=59)	27	32
2.	Urine(n=36)	12	24
3.	Pus(n=25)	19	6

Table 2:- Biofilm producers in *Candida albicans*

Specimen (n=120)	No. of <i>Candida albicans</i> isolates	Biofilm (+)	Biofilm (+)%	Biofilm (-)	Biofilm (-)%
120	58	26	44.82%	32	55.17%

Table 3:- Biofilm producers in Non albicans *Candida*

Specimen (n=120)	No. of Non albicans <i>Candida</i> isolates	Biofilm (+)	Biofilm (+)%	Biofilm (-)	Biofilm (-)%
120	62	37	59.67%	25	40.32%

**Table 4:-** Effect of Coconut Oil on *Candida albicans*

Specimen (n=58) <i>Candida albicans</i>	Sensitive to Coconut Oil	Sensitive	Resistant to Coconut Oil	Resistant
Biofilm producers (n=26)	7	26.92%	19	73.07%
Biofilm non producers (n=32)	12	37.5%	20	62.5%

**Table 5:-** Effect of Eucalyptus Oil on *Candida albicans*

Specimen (n=58) <i>Candida albicans</i>	Sensitive to Eucalyptus Oil	Sensitive	Resistant to Eucalyptus Oil	Resistant
Biofilm producers (n=26)	14	53.84%	12	46.15%
Biofilm non producers (n=32)	23	71.87%	09	28.12%

**Table 6:-** Effect of Coconut Oil on Non albicans *Candida*

Specimen (n=62) Non albicans <i>Candida</i>	Sensitive to Coconut Oil	Sensitive	Resistant to Coconut Oil	Resistant
Biofilm producers (n=37)	08	21.62%	29	78.37%
Biofilm non producers (n=25)	11	44%	14	56%

**Table 7:-** Effect of Eucalyptus Oil on Non albicans *Candida*

Specimen (n=62) Non albicans <i>Candida</i>	Sensitive to Eucalyptus Oil	Sensitive	Resistant to Eucalyptus Oil	Resistant
Biofilm producers (n=37)	12	32.43%	25	67.56%
Biofilm non producers (n=25)	17	68%	8	32%

## Discussion:-

The present research work was conducted with aim to study the biofilm production by various *Candida* spp. isolated from various clinical samples at Government Medical College and Hospital, Jammu, India. It is increasingly obvious that infections caused by *Candida* spp. are an escalating clinical problem, and with a limited arsenal of antifungal and a growing menace of biofilms, a lot has to be done for proper disease management. In the present study, biofilm production was found to occur most frequently in Non-albicans *Candida* than *C. albicans*. This finding is in contrast to an earlier report that suggested that pathogenic Non-albicans *Candida* were more likely to produce virulence factor biofilm than *C. albicans*. (Calderone RA et.al.,2001) In the present study, Out of 4150 samples, only 120 (2.89%) were culture positive for *Candida* spp. Out of 120 *Candida* spp. isolated, 58 (48.33%) were identified as *Candida albicans* and 62 (51.66%) were identified as Non-albicans *Candida* species. All isolates were studied for biofilm production. Out of total 120 *Candida* species studied, biofilm production was seen in 63/120 (52.55%) which is in agreement to the findings of the studies conducted by Mythreyl SR. et al.( Mythreyi Shekar Rishpana et.al., 2015) In our study we found 44.82% of *C. albicans* were biofilm producers which correlate well with the findings of Melek Inci et al. (Melek Inci et.al., 2012) and Saurabh M et al. (Saurabh M et al., 2012) Similarly, 59.67% of Non-albicans *Candida* were biofilm producers which is agreement to the findings of S. Golia et al. (Golia, S. et.al.) and Sahar Ali M et al.( Sahar Ali M et al., 2013) In our study we found that Non albicans *Candida* was more biofilm produces as compared to *C. albicans*.

Since Biofilms have been bethinking as a virulence factor bestowing the Candidal infection, a reliable method for their diagnosis is necessary. Three different methods were used for the evaluation of biofilm i.e. Congo red agar,

Microtitre plate method and Test tube adherence method. Out of these three different methods, Test tube method is fast, simple, reliable, and reproducible method. Tube method was commonly used for early detection of Biofilm production in routine use. The findings of present study showed that it is the most sensitive method for detection of biofilms which is in concordant with the study conducted by Oliveira and Cunha et.al.( Oliveira et.al.,2011 ) Biofilms have great impact on public health because biofilm-associated *Candida* exhibit dramatically plummet susceptibility to antimicrobial agents. This susceptibility may be intrinsic (as a natural outcome of growth in the biofilm) or acquired (due to transfer of extra chromosomal elements to susceptible organisms in the biofilm). It is likely that biofilms evade anti microbial challenges by multiple mechanisms. Some researches indicate that plants oils are used as antifungals because of their broad spectrum antifungal activity. (Nisha VJ.et.al., 2015)

Plant oils are increasingly claimed to Antifungal. Efficacy of Coconut oil and Eucalyptus oil was also tested in this study against all *Candida* isolates. Selected oils have been suggested to have potent antimicrobial activity.

The disc diffusion assay is a standard method widely used for the rapid screening of natural products for antifungal activity. Plant oils were screened using this very convenient assay method. The results indicate that caution is needed, since different oils have different diffusion rates on agar plates. This may contribute to variations in the size of the inhibitory zones, leading to erroneous conclusions regarding their antifungal activity. Hence this assay was run in triplicate and the average zone size was considered for interpretation. Both the oils were effective and showed anti-*Candida* activity at low concentrations; however Eucalyptus oil showed better antifungal activity as compared to coconut oil.( Epka, O.D.,et.al., 1996)

When coconut oil was tested against *Candida albicans* isolates, sensitivity of 26.92% was of biofilm producers *Candida albicans* whereas 37.5% biofilm non producers *Candida albicans*. Biofilm producers *Candida albicans* showed 53.84% sensitivity to Eucalyptus oil whereas non biofilm producers *C.albicans* showed 71.87% .When coconut oil was tested against all Non albicans *Candida* isolates, the sensitivity of biofilm producers was 21.62% and biofilm non producers was 44%. Whereas in the case of Eucalyptus oil 32.43% sensitivity was obtained against biofilm producers and 68% of biofilm non producers Non albicans *Candida* which was in concordant with the study conducted by M. Bansal et.al.( M. Bansal, et.al.,2016) This shows that Biofilm producers *Candida* spp. resist the antifungal activity of plant oils. This can be due to failure of oil to penetrate the full depth of the Biofilm.

The results presented in this study clearly demonstrate the antifungal potential of the selected plant oils. Eucalyptus oil may be used as anti-biofilm agent at low concentrations. However, before they are considered for use as topical preparations, a careful exploration of their undesirable effects needs to be undertaken.

### Conclusion:-

Biofilm is one of the known virulence factors of *Candida* spp. Early detection of Biofilm production may be useful and apply for clinical decision because of its suggestive property for potential pathogenic capacity of *Candida* isolates. The results of the present study emphasize the role of biofilm in *Candida albicans* as well as non-albicans *Candida* as a virulence factor. It also encourages the need for further examination of the efficacy of plant oils against other forms of systemic and superficial fungal infections.

### Acknowledgement:-

Words cannot express how thankful I am to Mr. Rakesh Gandotra and Mrs. Sheetal Gandotra for their continuous encouragement, support and blessings. Your prayer for me was what sustained me thus far. I have to express my appreciation to my beloved husband Dr. Vishal Sharma, for sharing his pearls of wisdom and subserve successful completion of this research article.

**References:-**

1. Sachin C Deorukhkar & Santosh Saini. Non-albicans candida species: its isolation pattern, Species distribution, virulence factors and Antifungal susceptibility profile. International journal of medical science and public health. 2013; 2 (3): 533-538.
2. Nimet Yigit, Esin Aktas, Saadettin Dagistan, Ahmet Ayyildiz. Investigating Biofilm Production, Coagulase and Hemolytic Activity in Candida Species Isolated From Denture Stomatitis Patients. EAJM 2011; 43: 27-32.
3. Saroj Golia, Vivek Hittinahalli, Sangeetha K. T, Vasudha C. L. Study of biofilm formation as a virulence marker in Candida species isolated from various clinical specimens. Journal of Evolution of Medical and Dental Sciences/Volume 1/Issue 6/December-2012 Page-1238-1246.
4. Pahwa N, Kumar R, Nirkhiwale S, Bandi A, "Speciesdistribution and drug susceptibility of Candida in clinical isolates from a tertiary care centre at Indore," Indian JMed Microbiol,32(1), 44–8, 2014.
5. Serafino, A., Vallebona, S., Andreola, P.S., Zonfrillo, F., Mercuri, M., Federici, L., Rasi, M., Garaci, G., Pierimarchi, E.P. 2008. Stimulatory effect of Eucalyptus essential oil on innate cell-mediated immune response. BMC Immunol., 9: 17.
6. Chander J. Textbook of Medical Mycology. 3th edition, Ch.20, Candidiasis. Mehta Publishers. New Delhi, 266-83, 2009.
7. Konopka K, Dorocka-Bobkowska B, Gebremedhin S, Duzgunes N. Susceptibility of Candida biofilms to histatin 5 and fluconazole. Antonie Van Leeuwenhoek. 2010;97(4):413-7.
8. Khan MS, Ahmad I. Antibiofilm activity of certain phytocompounds and their synergy with fluconazole against Candida albicans biofilms. J Antimicrob Chemother. 2012;67(3):618–21.
9. Ogbolu, D.O., Oni, A.A., Daini, O.A., Oloko, A.P. 2007. In vitro antimicrobial properties of coconut oil on Candida species in Ibadan, Nigeria. J. Med. Food., 10(2): 384–7.
10. Ogbolu, D.O., Oni, A.A., Daini, O.A., Oloko, A.P. 2009. Susceptibility of Candida isolates to virgin coconut oil and fluconazole. J. Med. Food., 10(2).
11. Calderone RA, Fonzi WA. Virulence factors of Candida albicans. Trends Microbiol. 2001;9(7):327–35.
12. Mythreyi Shekar Rishpana, Jyoti S Kabbin. Candiduria in Catheter Associated Urinary Tract Infection with Special Reference to Biofilm Production. Journal of Clinical and Diagnostic Research. 2015 Oct, Vol-9(10): DC11-DC13.
13. Melek Inci, Suleyman Durmaz et al. Investigating virulence factors of clinical Candida isolates in relation to atmospheric conditions and genotype. Turk J Med Sci 2012; 42 ((Sup.2): 1476-1483.
14. Saurabh Muni, Sarala Menon, Chhaya Chande, Aruna Gohil, Abhay Chowdhary, Ameeta Joshi. Candida biofilm. Bombay Hospital Journal, Vol. 54, No. 1, 2012.
15. Golia, S., Hittinahalli, V., Sangeetha, K. T., Vasudha, C.L. Study of biofilm formation as a virulence marker in Candida species isolated from various clinical specimens.
16. Sahar Ali Mohamed and Ziaab Zakey Al-Ahmadey. Biofilm Formation and Antifungal Susceptibility of Candida Isolates from Various Clinical Specimens. British Microbiology Research Journal 3(4): 590-601, 2013.
17. Silva S, Negri M, Henriques M, Oliveira R, Williams DW, Azeredo J. Adherence and biofilm formation of non-Candida albicans Candida species. Trends Microbiol. 2011; 19(5):241–7.
18. Nisha VJ, Mudhigeti N, Asir J, Chandrakesan SD. Detection of virulence factors and phenotypic characterization of Candida isolates from clinical specimens. J Curr Res Sci Med 2015; 1:27-31.
19. Epka, O.D., Ebana, R.U.B. 1996. Comparative studies of Mmanyanga, Palm and Coconut oils; Anti-microbial Effects of the oils and their metallic soaps on some bacteria and fungi. Global J. Pure Appl. Sci., 1(2): 155–163.
20. M. Bansal, S.A. Samant, S. Singh. Phenotypic Detection of Biofilms in Candida Species Isolated from Various Clinical Samples. Int.J.Curr.Microbiol.App.Sci (2016) 5(3): 47-56.



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### RESEARCH ARTICLE

#### INFLAMMATORY BOWEL DISEASES (IBD): A CASE REPORT

Dr. Sima Mohammad Al-Assaf and Dr. Saja Mohammad Al-Assaf

#### Manuscript Info

##### Manuscript History

Received: 29 November 2016  
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 Published: January 2017

#### Abstract

**Case Description:-** 28years old male Saudi medically free, coming through the ER complain of abdominal pain for about 3wks, associated with vomiting. There is loss of weight about (14kg) over 3 -2 month.

There is no (Diarrhea or change bowel habit). Also, the general systemic review is unremarkable. The patient is a smoker. The family history is negative (there is no similar condition and there is no medical disease).

**Physical Exam:-** The patient looks unwell. No (pale, jaundice or cyanosed)

Chest : clear

Cvs : normal, S1 + S2 + , No added sound

Abdomine = lower quadrant tenderness (only)

Vital Sign : temp =36.8/RR=20/pulse=82) PB= 64/115

Hight : 1.00 weight : 1.00 Spo .99 : BM1:4.06 R.B.S: 0

**Discussion:-** Yet it is largely a hidden disease, and one that causes stigma, fear and isolation - it's thought that many people with the condition go undiagnosed and suffer in silence. It doesn't have to be like this. Crohn's disease and ulcerative colitis are chronic (ongoing and life-long) conditions in which symptoms vary from person to person and will range ....

Treatment for Crohn's disease and ulcerative colitis depends on how severe

the symptoms are, and how much of the gut is affected.

##### Conclusion:-

1. It is idiopathic disease caused by a dysregulated immune response to host intestinal microflora.
2. IBD complication: hemorrhage, perforation, fistula

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#### Introduction:-

##### Definition:-

It is idiopathic disease caused by a dysregulated immune response to host intestinal microflora.

##### Types:-

A) ulcerative colitis (uc) which is limited to colon

B) Crohn disease (Cd) which can affect any segment all see the gastrointestinal tract.

#### **The etiology of IBD:-**

- 1) genetic predisposing.
- 2) an altered dysregulated immune response.
- 3) an altered response to gut.

#### **Complication:-**

Hemorrhage, perforation, fistules, toxic mega colon, cholangio carcinoma

**The annual incidence** of Crohn disease was 5.0 per 100,000 person years in Asia and Middle East, where the incidence rate of UC were 24.3 per 100,000 person years in Asia and Middle East

#### **Case Description:-**

##### **Case Description:-**

28 years old male Saudi medically free, coming through the ER complain of abdominal pain for about 3 wks, associated with vomiting. There is loss of weight about (14kg) over 3-2 months. There is no (diarrhea or change bowel habit). Also, the general systemic review is unremarkable. The patient is a smoker. The family history is negative (there is no similar condition and there is no medical disease).

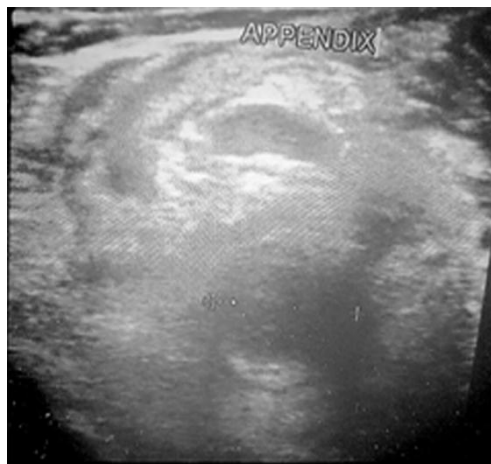
#### **Physical Examination:-**

The patient looks unwell. No (pale, jaundice or cyanosed)  
 Chest : clear  
 Cvs : normal, S1 + S2 + , No added sound  
 Abdomine = lower quadrant tenderness (only)  
 Vital Sign : temp = 36.8 / RR = 20 / pulse = 82 / PB = 64 / 115  
 Height : 1.00 weight : 1.00  
 Spo .99 : BMI : 4.06  
 R.B.S : 0

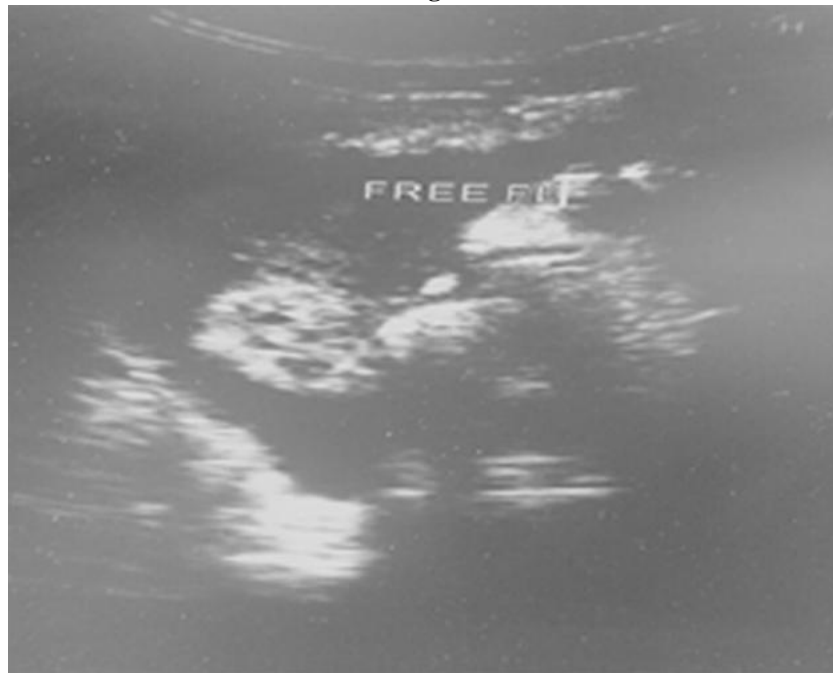
#### **Images 1:-**

##### **On Abdominal Ultrasound:-**

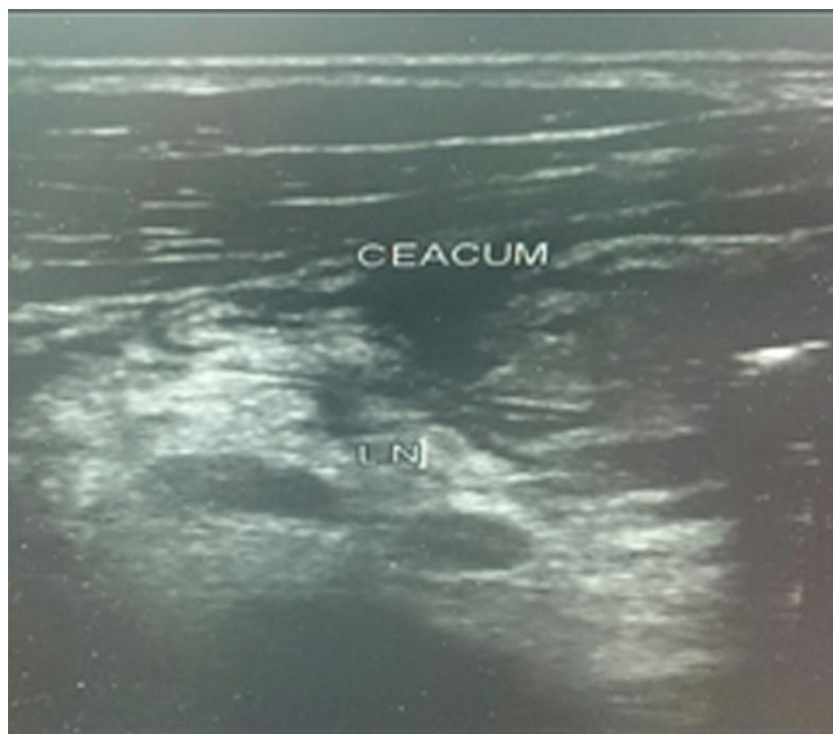
There is prominent thickening of the wall of caecum and distal ileum and appendix with prominent regional lymph nodes. Minimal intra-abdominal free fluid is seen



**Images 2:-**



**Images 3:-**



**Management :**

crohn's disease is an immune system disease, it cannot be cured by medication or surgery.

Treatment initially involves the use of medications to eliminate infections, generally antibiotics, and reduce inflammation, generally aminosalicylate, ant- inflammatory drugs and corticosteroids. Surgery may be required for complications such as obstructions or abscesses,

**Discussion:-**

Yet it is largely a hidden disease, and one that causes stigma, fear and isolation - it's thought that many people with the condition go undiagnosed and suffer in silence. It doesn't have to be like this.

Crohn's disease and ulcerative colitis are chronic (ongoing and life-long) conditions in which symptoms vary from person to person and will range ....

Treatment for Crohn's disease and ulcerative colitis depends on how severe the symptoms are, and how much of the gut is affected.

### Conclusion:-

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### References:-

1. <sup>A a b</sup> Baumgart DC, Carding SR (2007). "Inflammatory bowel disease: cause and immunobiology." *The Lancet*. **369** (9573): 1627–40. doi:10.1016/S0140-6736(07)60750-8. PMID 17499605.
2. <sup>A a b</sup> Baumgart DC, Sandborn WJ (May 2007). "Inflammatory bowel disease: clinical aspects and established and evolving therapies." *The Lancet*. **369** (9573): 1641–57. doi:10.1016/S0140-6736(07)60751-X. PMID 17499606. Retrieved 2009-11-04.



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### RESEARCH ARTICLE

#### SPECIES DIVERSITY AND DISTRIBUTION OF MOLLUSCAN FAUNA FROM ESTUARY AND MANGROVES (CORINGA WILDLIFE SANCTUARY) OF EAST GODAVARI ESTUARINE ECOSYSTEM, ANDHRA PRADESH, INDIA.

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##### Key words:-

Mangrove, estuarine, Species richness, abundance, Coringa.

#### Abstract

Study on the diversity of molluscan fauna was carried out in different locations in the mangrove areas and estuary region of the East Godavari estuary ecosystem. This study determined the abundance and diversity of molluscs in the East Godavari estuarine ecosystem. A total of 14 Gastropods and 8 bivalves were reported from the mangrove areas and estuary region were documented. Onchidium Sp. which is considered to be the shell-less terrestrial gastropod mollusc was also recorded from this mangrove area.

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#### Introduction:-

Phylum Mollusca with more than 100000 recognized species (Feldkamp, 2002) play an important role in ecosystem function for forage of predators in their habitats. The term molluscs refer to an ecological group of invertebrates that belong to many lesser known creatures (Mardiastuti, 2001).

The term molluscs are relatively know compared to other components of the mangrove habitats (Kober, 2004; Mardiastuti, 2001; Smith & Nol, 2000). The Gastropoda with an estimated 75000 to 150000 species are the most diverse class of molluscs in the marine habitats (Strong et al. 2008) such as mangroves (Vermeij, 1973) and terrestrial habitats (Barker, 2001). It has been shown that gastropod assemblages massively contribute to feeding resources of waders within the mangrove ecosystem (Al-Sayed et al., 2008). Although classically the role of mangrove gastropods in nutrient dynamics has been largely overlooked, studies have demonstrated their central ecological role (Fratini et al. 2008).

Mangroves are intertidal vegetation along tropical and subtropical shorelines (Zhang et al. 2007), which have special physiological adaptations to frequently inundate by the tides (Lewis Iii, 2005). These unique ecosystems provide a large number of biological, ecological, economic, scientific, environmental, aesthetic and ethical values (Mitsch, 2005) including controlling tide level (Varnell et al. 2003) reducing effects of wave and wind energy against shorelines (Miththapala, 2008), stabilizing shorelines (Lee & Shih, 2004). Thus mangroves protect inland structures (Lewis Iii, 2005), support coastal fisheries (Walters et al., 2008), provide diverse habitat to support wildlife communities including a large number of waterbirds, especially waders (Lewis Iii, 2005), and so many other direct and indirect benefits (Gustavson et al. 2009; Zhou et al. 2010).

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Molluscs support economically in the fishery sector and the ambience of our coastal communities are frequently overlooked with diversity of these marine organisms. Molluscan populations as a source of food, ornamental purposes and commercial uses have brought under the shade of endangered species Shanmugam and Vairamani (2005).

Marine invertebrates are considered an important link between the initial detritus at the bases of the food web and the terminal consumers (Coull et al . 1995). The information regarding the role of invertebrates in the mangrove ecosystem are quite scanty, however, molluscs and crustaceans are important components of the ecosystem (Jiang and Li, 1995; Wells, 1983, 1990; Milward, 1982; Redfield, 1982).

In the Phylum, Mollusc, about 3270 species have been reported from India belonging to 220 families and 591 genera. Among them the Bivalves are the most diverse (1100 species) followed by Gastropods (190 species). In India, about 215 species of mollusc were reported from mangrove areas of east and west coasts (Boominathan et al. 2012). In Andhra Pradesh a total of 120 molluscs have been reported. In the present study 22 molluscs species were recorded. East Godavari estuary ecosystem of east coast of India is an estuarine mangrove complex and supports a wide variety of biological species.

## Materials and Methods:-

### Study area:-

Coringa Wildlife Sanctuary is located between 16°44' to 16° 53' N and 082° 14' to 082° 22' E and at the confluence of the river Godavari with the Bay of Bengal in the East Godavari District of Andhra Pradesh. The sanctuary is a part of the Godavari Estuary and has extensive mangrove cover. The total area is 235.7 sq.km. The average temperature of the region is 17°C to 40°C. Average Rainfall is greater than 1,000 mm. The Northern part of sanctuary is covered by the back waters of the Kakinada Bay and covers an area of about 100 sq. km.

Due to seasonal distribution of rainfall, East Godavari estuary ecosystem experiences seasonal flooding which introduces a lot of detritus and pollutants from the land.

The estuary region presently serves as a major drainage channel receiving domestic wastes as well as industrial effluents from the industrial area of Kakinada.

Visits to the sampling sites were made during 2015 to 2016. Four sites were thoroughly visited for molluscan diversity and their distribution pattern. Two sampling points were taken from the estuary region and two sites were taken from the mangrove area. Each sampling site was recorded using a Garmin etrex 10 GPS receiver. Photographs were taken at the sampling area and some of the samples were collected and were preserved in 70% alcohol for identification in the field station.



## Results and Discussions:-

The aim of the study was to assess the molluscan faunal biodiversity in the mangroves and estuary regions of East Godavari estuary ecosystem. During the study period 14 Gastropods and 8 bivalves from the mangrove areas and estuary region were documented (**Table- 1**). *Onchidium* Sp. which is considered to be the shell-less terrestrial gastropod mollusc was also recorded from this mangrove area.

In the present study, the recorded specimens were found to occur on mud banks, mud flats, mangrove forest, sandy muddy area swamps and hard substratum. Gastropods and bivalves are generally benthos organisms, they consider to be used as bio indicators of aquatic healthy. Gastropods and bivalves can produce a billion of larvae in the form of planktons that sustains the biotic population and they have a role in food chain. The observation of Gastropods and bivalves populations in mangrove ecosystem is important to evaluate their condition Dewiyanti and Karina(2012).

*Clithon oualaniense*, *Murex trapa*, *Pirenella cingulata*, *Placuna placenta*, *Nassarius dorsatus* and *Fusinus colus* are found in the estuary region, *Crassostrea bilineata* were densely found on the trunks, pneumatophores and stilt roots of mangrove plants are found at the adjacent mangrove areas.

**Table 1:-** List of Molluscan species observed during the study period.

S.No	Species	Authority
	<b>Gastropods</b>	
1	<i>Assimineia brevicula</i>	(Pfeiffer, 1855)
2	<i>Cassidula nucleus</i>	(Gmelin, 1791)
3	<i>Cerithidea obtusa</i>	(Lamarck, 1822)
4	<i>Littoraria melanostoma</i>	(Gray, 1839)
5	<i>Neripteron violaceum</i>	(Gmelin, 1791)
6	<i>Pythia plicata</i>	(Ferussac, 1821)
7	<i>Telescopium telescopium</i>	(Linnaeus, 1758)
8	<i>Terebralia palustris</i>	(Linnaeus, 1767)
	<b>Bivalves</b>	
9	<i>Crassostrea bilineata</i>	(Roding, 1798)
10	<i>Brachidontes exustus</i>	(Linnaeus, 1758)
11	<i>Perna viridis</i>	(Linnaeus, 1758)
12	<i>Teredo navalis</i>	Linnaeus, 1758
13	<i>Tegillarca granosa</i>	(Linnaeus, 1758)
14	<i>Tegillarca rhombea</i>	(Born, 1778)
15	<i>Meretrix meretrix</i>	(Linnaeus, 1758)
	<b>Estuarine</b>	
16	<i>Clithon oualaniense</i>	(Lesson, 1831)
17	<i>Murex trapa</i>	Roding, 1798
18	<i>Pirenella cingulata</i>	(Gmelin, 1791)
19	<i>Placuna placenta</i>	(Linnaeus, 1758)
20	<i>Nassarius dorsatus</i>	(Röding, 1798)
21	<i>Fusinus colus</i>	(Linnaeus, 1758)
22	<i>Onchidium</i> Sp. (Slug)	

Narasimham (1973) Radhakrishna and Ganapati (1967) observed that *Anadara granosa* and *Placuna placenta* were restricted in distribution along the western and southern side of the bay. Similar observations were made in the estuarine region of the Coringa Wildlife Sanctuary where the *Placuna placenta* and *Anadara granosa* were harvested by the shell collectors from the estuary region. Rajendar kumar (2016) has reported 10 gastropods and 5 species of bivalves recorded in the Coringa mangroves. Present study reported the molluscan fauna from both mangrove areas and estuarine regions.

*Telescopium telescopium* were found in the two sites of the mangrove areas which were abundant along the fish bone canals which were dug for facilitating water to the regeneration of the mangrove plantation by the forest department.

*Cassidula nucleus*, *Pythia plicata* and *Cerithidea obtusa* has been observed to be on the same trunk of a tree during the high tide.

**Molluscan fauna (Gastropods) recorded during the study in the Mangrove areas and estuarine regions in East Godavari estuarine ecosystem**

### Gastropods



*Assiminea brevicula* (Pfeiffer, 1855)



*Cassidula nucleus* (Gmelin, 1791)



*Cerithidea obtusa* (Lamarck, 1822)



*Littoraria melanostoma* (Gray, 1839)



*Neripteron violaceum* (Gmelin, 1791)



*Pythia plicata* (Ferussac, 1821)



*Telescopium telescopium* (Linnaeus, 1758)



*Terebralia palustris* (Linnaeus, 1767)



## Gastropods



*Clithon ovalaniense* (Lesson, 1831)



*Murex trapa* (Roding, 1798)



*Pirenella cingulata* (Gmelin, 1791)



*Nassarius dorsatus* (Röding, 1798)



*Fusinus colus* (Linnaeus, 1758)



*Onchidium Sp.*

Species richness and number of individuals were determined and calculated the species diversity by Shannon-Wiener Index, Table -2. The results shows that the species diversity at Creek A is 1.718 and Creek B is 1.870, the species richness was same for the two creeks and the estuary region. *Telescopium telescopium* and *Cerithidea obtuse* are found to be in abundant all over the mangrove areas. During the survey at the time of high tide *Cerithidea obtuse* tends to avoid the water by crawling on to the trees to a height of 30cm to 50cm. These findings were done during the subsequent surveys for the small carnivores monitoring in the Coringa Wildlife Sanctuary.

Molluscan fauna (Bivalves) recorded during the study in the Mangrove areas and estuarine regions in East Godavari estuarine ecosystem

### Bivalves



*Crassostrea bilineata* (Roding, 1798)



*Brachidontes exustus* (Linnaeus, 1758)



*Perna viridis* (Linnaeus, 1758)



*Teredo navalis* (Linnaeus, 1758)



*Tegillarca granosa* (Linnaeus, 1758)



*Tegillarca rhombea* (Born, 1778)



*Meretrix meretrix* (Linnaeus, 1758)



*Placuna placenta* (Linnaeus, 1758)

Species	Creek A		Creek B		Estuary A		Estuary B	
	Abundance	Relative abundance	Abundance	Relative abundance	Abundance	Relative abundance	Abundance	Relative abundance
<i>Assiminea brevicula</i>	24	0.088	12	0.056	18	0.085	42	0.197
<i>Fusinus colus</i>	0	0.000	0	0.000	0	0.000	0	0.000
<i>Nassarius dorsatus</i>	0	0.000	0	0.000	0	0.000	0	0.000
<i>Pirenella cingulata</i>	0	0.000	0	0.000	0	0.000	0	0.000
<i>Neripteron violaceum</i>	30	0.109	21	0.099	18	0.085	25	0.117
<i>Pythia plicata</i>	19	0.069	18	0.085	6	0.028	12	0.056
<i>Telescopium telescopium</i>	68	0.248	42	0.197	30	0.141	20	0.094
<i>Terebralia palustris</i>	12	0.044	8	0.038	1	0.005	3	0.014
<i>Clithon oualaniense</i>	0	0.000	0	0.000	0	0.000	0	0.000
<i>Murex trapa</i>	0	0.000	0	0.000	0	0.000	0	0.000
<i>Littoraria melanostoma</i>	2	0.007	25	0.117	0	0.000	0	0.000
<i>Cerithidea obtusa</i>	54	0.197	22	0.103	0	0.000	0	0.000
<i>Cassidula nucleus</i>	47	0.172	38	0.178	39	0.183	8	0.038
<i>Onchidium Sp.</i>	18	0.066	27	0.127	0	0.000	0	0.000
Species Richness (S):	9		9		6		6	
Number of Individuals (N):	274		213		112		110	
Shannon-Wiener Index of Diversity (H'):	1.718		1.870		0.921		0.888	
Species Evenness (H'/ln(S)):	0.782		0.851		0.514		0.495	

### Recommendations:-

It was evident from the observations that unsustainable harvesting of the shells may cause decline in the populations of some molluscan species in this region. Hence, awareness programmes should be conducted on the sustainable methods of harvest of the shells to the shell collectors in this region.

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### References:-

1. **Al-Sayed, H., Naser H. and Al-Wedaei K. (2008).** Observations on macrobenthic invertebrates and wader bird assemblages in a protected marine mudflat in Bahrain. *Aquatic Ecosystem Health & Management*, 11(4): 450-456.
2. **Barker, G. (2001).** *The biology of terrestrial molluscs*: CABI publishing, Wallingford, UK, 404 p.
3. **Boominathan, M., Ravikumar, G., Subash Chandran. M. D and Ramachandra T.V. (2012).** Mangrove Associated Molluscs of India. National Conference on Conservation and Management of Wetland Ecosystems, School of Environmental Sciences, Mahatma Gandhi University, Kottayam, Kerala, 11Pp.
4. **Coull BC, Greenwood JG, Fielder DR, Coull BA (1995).** Subtropical Australian juvenile fish eat meio fauna : experiments with winter whiting *Sillago maculata* and observations on other species. *Marine Ecology Progress Series*, 125, 13-19.
5. **Dewiyanti Irma and Karina Sofuatuddin (2012).** Diversity of Gastropods and Bivalves in mangrove ecosystem rehabilitation areas in Aceh Besar and Banda Aceh districts, Indonesia. *Aquaculture, Aquarium, Conservation & Legislation International Journal of the Bioflux Society*.

6. **Feldkamp, S. (2002).** Modern Biology. Austin: Holt, Rinehart and Winston. ISBN 0030565413. Retrieved 12 April, 2010, from [www.textaddons.com](http://www.textaddons.com)
7. **Fratini, S., Vannini, M. and Cannicci, S. (2008).** Feeding preferences and food searching strategies mediated by air-and water-borne cues in the mud whelk *Terebralia palustris* (Potamididae: Gastropoda). *Journal of Experimental Marine Biology and Ecology*, 362(1): 26-31.
8. **Gustavson, K., Kroeker, Z., Walmsley, J. And Juma, S. (2009).** A process framework for coastal zone management in Tanzania. *Ocean & Coastal Management*, 52(2): 78-88.
9. **Jiang JX, Li RG (1995).** An ecological study on the mollusca in mangrove areas in the estuary of the Jiulong River. *Hydrobiologia*, 295, 213-220.
10. **Kober, K. (2004).** Foraging ecology and habitat use of wading birds and shorebirds in the mangrove ecosystem of the Caeté Bay, Northeast Pará, Brazil. 178p.
11. **Lee, H.Y. and Shih, S.S. (2004).** Impacts of vegetation changes on the hydraulic and sediment transport characteristics in Guandu mangrove wetland. *Ecological Engineering*, 23(2): 85-94.
12. **Lewis Iii, R.R. (2005).** Ecological engineering for successful management and restoration of mangrove forests. *Ecological Engineering*, 24(4): 403-418.
13. **Mardiastuti, A. (2001).** Ecology of Avian community of Pulau Rambut: population, nest site distribution and foraging sites. 53 p.
14. **Milward NE (1982).** Mangrove dependent biota. In mangrove ecosystem Australia. (ed. B. Clough). Canberra: Australian National University, 121- 39.
15. **Miththapala, S. (2008).** Mangroves. Coastal Ecosystems Series: by: Ecosystems and Livelihoods Groups Asia, IUCN. 28 p.
16. **Mitsch, W. (2005).** Wetland creation, restoration, and conservation: a wetland invitational at the Olentangy River wetland research park. *Ecological Engineering*, 24(4): 243-251.
17. **Narasimham, K. A. 1973.** On the moluscan fisheries of the Kakinada Bay. *Indian J.Fish.*, 20: 209-214.
18. **Radhakrishna, Y. and P .N .Ganapati.(1967).** Fauna of the Kakinada Bay. *Bull. Nat. Inst. Soi. India*. 38:689-699.
19. **Redfield J (1982).** Trophic relationships in mangrove communities. In mangrove ecosystem in Australia. (ed. B. Clough) Canberra: Australian National University, 259-62.
20. **Shanmugam A. And Vairamani S. (2005).** Molluscs in Mangroves: A Case study, Centre of Advanced Study in Marine Biology, Annamalai University. P. 371.
21. **Smith, A. and Nol, E. (2000).** Winter foraging behavior and prey selection of the Semipalmated Plover in coastal Venezuela. *The Wilson Bulletin*, 112(4): 467-472.
22. **Strong, E., Gargominy, O., Ponder, W. And Bouchet, P. (2008).** Global diversity of gastropods (Gastropoda; Mollusca) in freshwater. *Hydrobiologia*, 595(1): 149-166.
23. **Varnell, L., Evans, D. and Havens, K. (2003).** A geomorphological model of intertidal cove marshes with application to wetlands management. *Ecological Engineering*, 19(5): 339-347.
24. **Vermeij, G. (1973).** Molluscs in mangrove swamps: physiognomy, diversity, and regional differences. *Systematic Biology*, 22(4): 609.
25. **Walters, B.B., Rönnbäck, P., Kovacs, J.M., Crona, B., Hussain, S.A. and Badola, R. (2008).** Ethnobiology, socio-economics and management of mangrove forests: A review. *Aquatic Botany*, 89(2): 220-236.
26. **Wells FE (1983).** An analysis of marine invertebrates distribution in a mangrove swamp in northwestern Australia. *Bulletin of Marine Science*, 33, 736-44.
27. **Wells FE (1990).** Distribution of marine invertebrates in Hong Kong Mangroves, with emphasis on Molluscs. Proceedings of the second international Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong, 1986. (ed. B. Morton) Hong Kong. Hong Kong University Press: 783-793.
28. **Zhang, C.G., Leung, I.K.K., Wong, Y.S. and TAM, N.F. Y. (2007).** Germination, growth and physiological responses of mangrove plant (*Bruguiera gymnorrhiza*) to lubricating oil pollution. *Environmental and Experimental Botany*, 60: 127-136.
29. **Zhou, Y., Zhao, B., Peng, Y. and Chen, G. (2010).** Influence of mangrove reforestation on heavy metal accumulation and speciation in intertidal sediments. *Marine Pollution Bulletin*, 60(8): 1319-1324.





### RESEARCH ARTICLE

#### IS TIME MANAGEMENT RELATED TO BETTER ACADEMIC PERFORMANCE AND PERCEIVED ACADEMIC SATISFACTION AMONG MEDICAL STUDENTS? A CROSS- SECTIONAL SURVEY IN SAUDI ARABIA.

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#### Abstract

**Background:** Time management skill is considered very important for academic success and better quality of life. We aimed to investigate time management in Saudi medical students, and to explore relationship between these skills and socio-demographic features of participants and parameters of academic performance.

**Methods:** This cross-sectional survey was conducted in January 2017 using a self-administered questionnaire. Data were entered and analyzed using IBM-SPSS-20. Data were summarized and analyzed by using frequencies and percentages. Chi-square was used to test associations between time management and socio-demographic features. Pearson correlation was used to measure correlations between time management and parameters of academic performance.

**Results:** A total of 89 participants (37.1% males, 62.9% females) aged  $23 \pm 2.44$  (19-29) years participated in this study. Adequate and inadequate time management was found in 46% and 54% of the participants, respectively. There was no significant difference of time management in participants on the basis of their gender, study in private or government colleges, residence, rural or urban background, and educational qualification of their parents. More pre-clinical students had adequate time management than clinical students ( $p=0.019$ ). Significant positive correlations were observed between time management and total percentage of marks in last exam ( $r=0.331$ ,  $p=0.019$ ), and perceived academic satisfaction ( $r=0.356$ ,  $p=0.001$ ).

**Conclusions:** More than half participants had inadequate time management. There was no difference of time management on the basis of most of the socio-demographic features. Pre-clinical students seemed to manage their time better than clinical students. Time management is positively correlated with total percentage of marks in last exam, and perceived academic satisfaction. Students should increase their time management skills by reading books on this topic and attending relevant trainings and counseling sessions.

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**Introduction:-**

Time management has been referred to as set of principles, practices and skills which enable a person to get things done by working smarter but not harder. Effective time management techniques help us to judiciously organize and plan time which we spend on various activities with the aim to increase productivity and quality of life, even when time is less and pressures are high (MindTools.com, 2017). Time management is an acquired skill which can be developed at any age to perform actions efficiently. It has been observed that there are some people who find that they have enough time for their daily activities, but some people struggle as they rush from one task to another without finishing anything. It is not because former type of people have more time but because they know how to use their time effectively by practicing good time management skills (SkillsYouNeed, 2017).

Time management is actually self-management. Time management cannot increase the amount of time we have in a day but it can bring a better life for us by making us more organized (Misra and McKean, 2000). One can enjoy his life by sparing and devoting more time for himself, for his family, relatives and friends; effective time management can enable us to do so (Efil I., 2007).

Currently, time management is considered a very important element for personal and corporate success especially in the professional environment (Koch, 1998). A study by Khatib (2014) has explored that effective time management is associated with higher academic performance, while poor time management in students is associated with higher perceived stress. Being unable to plan and use time properly and doing last-minute study for exams are some factors that can increase stress among students leading to poor academic performance (Britton and Tesser, 1991).

Sometimes, time wasting factors in schools can be external issues which suddenly come up e.g. unplanned events, strikes, accidents, emergencies. These issues can affect students' studies adversely. Students usually have less control on these unforeseen issues (Achunine and Irondi, 1998). However, the internal time wasting factors of students can be even more important than the external factors. Some of these factors are lack of prioritization, procrastination and distractions. Some students may be overwhelmed by the task and they put it off till later dates. This procrastination is due to habitual laziness. It does not let us complete the task rather it brings more tension. Procrastination and lack of prioritization are two most important problems among students. Lack of time management skills can lead to procrastination especially when students don't meet the deadlines. Distractions, while studying, can also waste students' time. Some students may be distracted as they wrongly feel that some unrelated and unimportant things need their urgent attention (King, 2002). This may happen when students have heaps of work to be done and they are lazily looking for an appropriate time to study.

It has been observed that medical students have vast curriculum. It may be difficult for some of them to manage their study and leisure time which may lead to stress (Stecker, 2004; Yousafzai *et al.*, 2009; Waghachavare *et al.*, 2013; Oboko *et al.*, 2015). This further increases the importance of time management skills for medical students. There seem to be dearth of evidence on time management skills, academic performance and perceived academic satisfaction among Saudi medical students. Therefore, this study was conducted to: a) assess time management skills of Saudi medical students, b) investigate association between socio-demographic features of the participants and their time management skills, and c) explore correlation between total time management score and various parameters of academic performance of the participants.

**Methodology:-**

This study was a cross-sectional survey conducted in January 2017 among male and female medical students enrolled in various medical colleges of Saudi Arabia. The participants were aged  $\geq 19$  years and were studying in various years of MBBS from year 1 through 6. An online structured questionnaire was prepared for this survey using Google Forms. This self-administered questionnaire contained two sections. Section 1 consisted of information on socio-demographic features (age, gender, residence, parent's highest qualification etc.), academic performance and perceived academic satisfaction of the participants. Information was obtained on the following parameters of *academic performance*: GPA of last year, total percentage of marks in last exam, total number of A/A+ grades in last exam, total number of supplementary/failures in last exam, cumulative percentage of attendance during last year/semester, and total number of workshops/seminars/conferences attended during last one year. Information on parameters of academic performance was self-reported by the participants and was not confirmed from academic

records of the medical colleges. Students were requested to describe their perceived *academic satisfaction* on a scale of 1-10 with 10 being the most positive. Section 2 comprised of 25 standard questions to collect information on time management skills of the participants; this section was taken from the website of Wayne State University(2013).

Information on participants' age, gender, year of study during MBBS, type of medical college whether government or private, residence during study, permanent residence, highest qualification of father and mother were obtained. Students of 1-3 and 4-6 years of MBBS were considered in *pre-clinical* and *clinical years*, respectively. Each participant was supposed to answer each of the 25 standard questions of time management questionnaire. Participants' were to respond each question as 'always' or 'sometimes' or 'never'. 'Always' carried 2 scores, 'sometimes' carried 1 score and 'never' carried 0 score. For each participant, scores of all 25 questions were added up. Maximum scores that a participant could have achieved for 25 questions on time management were 50. A participant with a score of  $\leq 29$  was considered to have *inadequate time management* skills. A total score of  $\geq 30$  meant that the participant had *adequate time management* skills.

We informed all the participants about the purpose and scope of this survey before their voluntarily participation. We ensured anonymity and confidentiality of all the data. Furthermore, we considered various ethical aspects in line with Helsinki Declaration.

Data of only those participants (n=89) who filled the questionnaire properly were subject to analysis. Data on socio-demographic features of the participants, and their responses to all 25 standard questions on time management were entered and analyzed using IBM Statistical Package for Social Sciences (SPSS) version 20. The data were cross checked to ensure accuracy. Categorical data were summarized as frequencies and percentages. Chi-square test was used to measure association between each of the socio-demographic features of participants and their time management skills. Pearson correlation was used to test correlation between total time management score of the participants and other academic parameters (e.g. GPA, grades, supplementary/failures, academic satisfaction etc.). A *p*-value of  $\leq 0.05$  was considered statistically significant.

## Results:-

A total of 89 participants (37.1% males, 62.9% females) with age of  $23 \pm 2.44$  (19-29) years participated in this study. More than half (61.8%) of participants were students of clinical (4-6) years and the rest (38.2%) were students of pre-clinical (1-3) years of MBBS. Majority (86.5%) of the students were studying in government medical colleges. Most (85.4%) of the students were living in their homes (day scholars) and the rest of the students were living in hostels. Permanent residence of almost three-fourths of participants was in urban areas. Highest qualification of father and mother was at least secondary school education for 89.9% and 77.5% of total participants, respectively (Table 1).

Cumulative responses of the participants to each question of the time management questionnaire are given in Table 2. Most of the participants had less scores for questions No. 4, 13, 18, 20 and 21 of the questionnaire. However, participant got generally good scores for questions No. 1, 3, 6, 7, 17, 23 and 24. Mean time management score was  $27.91 \pm 8.56$  (range: 9-50).

Adequate time management skills (score  $\geq 30$ ) were found in 46% of the participants while inadequate time management (score  $\leq 29$ ) was observed in 54% of the participants (Figure).

Association between socio-demographic characteristics and time management skills of the participants is presented in Table 3. There was no significant difference of time management skills between male and female participants, students of private and government medical colleges, students living in hostels and homes, and rural versus urban students. Moreover, there was no statistically significant difference of time management skills between participants when we compared them on the basis of highest educational qualification of their parents. Adequate time management skills were present in 61.8% of pre-clinical students as compared to 36.4% of clinical students. Moreover, time management skills were inadequate in 38.2% of pre-clinical students as compared to 63.6% of clinical students. In a nutshell, pre-clinical students had significantly higher time management skills as compared to clinical students ( $p=0.019$ ).

Pearson correlation between total time management score and parameters of academic performance are given in Table 4. Significant positive correlations were observed between total time management score and total percentage

of the marks of last exam ( $r = 0.331$ ,  $p=0.019$ ), and perceived academic satisfaction ( $r = 0.356$ ,  $p=0.001$ ). Moreover, we found significant positive correlations between academic satisfaction and GPA of the last year/semester ( $r = 0.290$ ,  $p=0.016$ ), total percentage of the result of last exam ( $r = 0.390$ ,  $p=0.006$ ), and total number of A/A+ grades in last exam ( $r = 0.340$ ,  $p=0.002$ ). No significant correlation was observed between total time management score and other academic parameters of the participants.

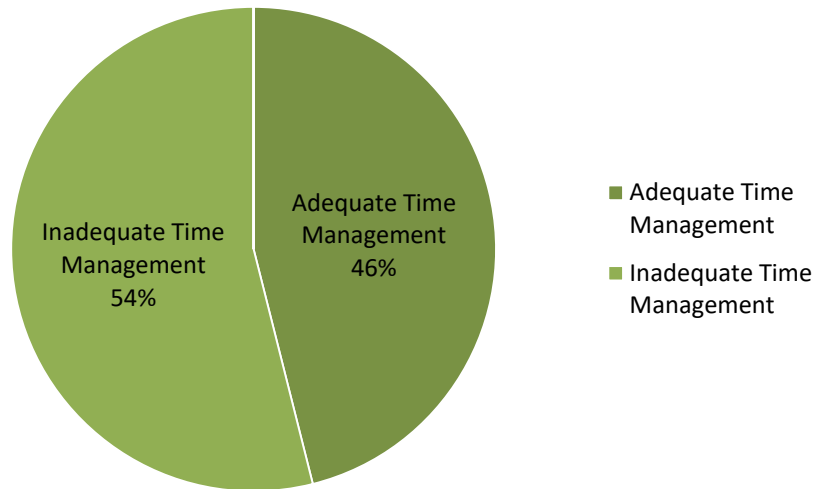
**Table 1:-**Socio-demographic characteristics of the participants (n = 89)

Socio-demographic Characteristics	Frequency (%)
Age: Mean $\pm$ SD (Range)	23 $\pm$ 2.44 (19-29) years
Gender	
Female	56 (62.9%)
Male	33 (37.1%)
Year of study during MBBS	
1	4 (4.5%)
2	9 (10.1%)
3	21 (23.6%)
4	12 (13.5%)
5	12 (13.5%)
6	31 (34.8%)
Pre-clinical or clinical students	
Students of pre-clinical (1-3) years	34 (38.2%)
Students of clinical (4-6) years	55 (61.8%)
Type of medical college	
Private	12 (13.5%)
Government	77 (86.5%)
Residence during study	
Living in the hostel	13 (14.6%)
Living in your own home (day scholar)	76 (85.4%)
Permanent Residence	
Rural area	25 (28.7%)
Urban area	62 (71.3%)
Highest qualification of Father	
Primary	9 (10.1%)
Secondary	11 (12.4%)
Tertiary	69 (77.5%)
Highest qualification of Mother	
Primary	20 (22.5%)
Secondary	8 (9.0%)
Tertiary	61 (68.5%)

**Table 2:-** Participants' cumulative responses to each question of the time management questionnaire

Questions	Participants' Responses n (%)			Total responses from the participants
	Never	Sometimes	Always	
1. I do things in order of priority.	5 (5.6%)	44 (49.4%)	40 (44.9%)	89
2. I accomplish what needs to be done during the day.	6 (6.7%)	61 (68.5%)	22 (24.7%)	89
3. I always get assignments done on time.	3 (3.4%)	37 (41.6%)	49 (55.1%)	89

4. I feel I use my time effectively.	29 (32.6%)	49 (55.1%)	11 (12.4%)	89
5. I tackle difficult or unpleasant tasks without procrastinating (delaying)	15 (16.9%)	57 (64.0%)	17 (19.1%)	89
6. I force myself to make time for planning.	7 (7.9%)	42 (47.2%)	40 (44.9%)	89
7. I am spending enough time planning.	11 (12.4%)	37 (41.6%)	41 (46.1%)	89
8. I prepare a daily or weekly "to-do" list.	17 (19.1%)	40 (44.9%)	32 (36.0%)	89
9. I prioritize my list in order of importance, not urgency.	14 (15.9%)	44 (50.0%)	30 (34.1%)	88
10. I am able to meet deadlines without rushing at the last minute.	21 (24.1%)	45 (51.7%)	21 (24.1%)	87
11. I keep up-to-date on my reading and homework assignments.	14 (16.1%)	48 (55.2%)	25 (28.7%)	87
12. I prevent interruptions from distracting me from high priority tasks.	14 (15.9%)	53 (60.2%)	21 (23.9%)	88
13. I avoid spending too much time on trivial/small matters.	15 (17.0%)	59 (67.0%)	14 (15.9%)	88
14. I am spending enough time on academic matters.	14 (16.1%)	41 (47.1%)	32 (36.8%)	87
15. I plan time to relax and be with friends in my weekly schedule.	21 (24.1%)	32 (36.8%)	34 (39.1%)	87
16. I have a weekly schedule on which I record fixed commitments such as classes and work hours.	26 (29.5%)	42 (47.7%)	20 (22.7%)	88
17. I try to do the most important tasks during my most energetic periods of the day.	9 (10.2%)	43 (48.9%)	36 (40.9%)	88
18. I make constructive use of my commuting (travelling) time.	18 (20.5%)	59 (67.0%)	11 (12.5%)	88
19. I periodically re-assess my activities in relation to my goals.	12 (13.8%)	47 (54.0%)	28 (32.2%)	87
20. I have discontinued any wasteful or unprofitable activities or routines.	18 (20.5%)	56 (63.6%)	14 (15.9%)	88
21. I screen and group my telephone calls to allow for control over telephone interruptions.	36 (40.9%)	41 (46.6%)	11 (12.5%)	88
22. I judge myself by accomplishment of tasks rather than by amount of activity or "busy-ness".	12 (13.6%)	51 (58.0%)	25 (28.4%)	88
23. My actions are determined primarily by me, not by circumstances or by other people's priorities.	8 (9.1%)	42 (47.7%)	38 (43.2%)	88
24. I have a clear idea of what I want to accomplish during the coming semester.	11(12.5%)	41 (46.6%)	36 (40.9%)	88
25. I am satisfied with the way I use my time.	33(37.5%)	33 (37.5%)	22 (25.0%)	88

**Figure: Percentage of the total participants showing adequate and inadequate time management****Table 3:- Association between socio-demographic characteristics and time management skills of the participants**

Socio-demographic characteristics		Participants' time management skills		p-value
		Adequate time management Frequency (%)	Inadequate time management Frequency (%)	
Gender (n=89)	Female (n=56)	24 (42.9%)	32 (57.1%)	0.429
	Male (n=33)	17 (51.5%)	16 (48.5%)	
Type of medical college (n=89)	Private (n=12)	6 (50%)	6 (50%)	0.769
	Government (n=77)	35 (45.5%)	42 (54.5%)	
Residence during study (n=89)	Living in the hostel (n=13)	5 (38.4%)	8 (61.6%)	0.552
	Living in your own home (day scholar) (n=76)	36 (47.4%)	40 (52.6%)	
Permanent Residence (n=87)	Rural area (n=25)	13 (52%)	12 (48%)	0.474
	Urban area (n=62)	27 (43.5%)	35 (56.5%)	
Highest qualification of Father (n=89)	Primary (n=9)	3 (33.3%)	6 (66.7%)	0.635
	Secondary (n=11)	6 (54.5%)	5 (45.5%)	
	Tertiary (n=69)	32 (46.4%)	37 (53.6%)	
Highest qualification of Mother (n=89)	Primary (n=20)	10 (50%)	10 (50%)	0.881
	Secondary (n=8)	4 (50%)	4 (50%)	
	Tertiary (n=61)	27 (44.3%)	34 (55.7%)	
Year of Study: Pre-clinical or Clinical (n=89)	Pre-Clinical (n=34)	21 (61.8%)	13 (38.2%)	0.019*
	Clinical (n=55)	20 (36.4%)	35 (63.6%)	

\*  $p \leq 0.05$  was considered statistically significant

**Table 4:-**Correlation between total time management scores and parameters of academic performance

Parameters of academic performance	Pearson correlation coefficient(r)	p-value
GPA of the last year/semester (n=69)	0.224	0.064
Total percentage of the marks of last exam (n=50)	0.331	0.019*
Total number of A/A+ grades in last exam (n=83)	0.203	0.066
Total number of supplementary/failures in last exam (n=87)	0.006	0.955
Cumulative Percentage of attendance in last year/semester of study (n=67)	0.052	0.678
Total number of workshops/seminars/conferences attended during last one year (n=84)	0.016	0.883
Perceived academic satisfaction (n=88)	0.356	0.001*

\*  $p \leq 0.05$  was considered statistically significant

### Discussion:-

Findings from this study suggest that more than half (54%) of the Saudi medical students have inadequate time management skills. We also found that there is no significant difference of time management skills in the participants on the basis of their gender, their study in private or government medical colleges, their residence in hostels or homes, their rural or urban background, and the educational qualification of their parents. Furthermore, we found that pre-clinical students are more likely to have adequate time management skills as compared to clinical students. We also observed significant positive correlation between total time management scores and total percentage of the marks of last exam, and perceived academic satisfaction among the participants.

We have observed that 54% of the medical students in Saudi Arabia have inadequate skills to manage their time effectively. This means that almost every one out of two medical students in Saudi Arabia seem not using his/her time smartly. This also means that time management is one of the self-management skills that some students are better at than others. In another study carried out by Eid *et al.* (2015) on nursing students in Egypt, it was explored that 85.5% of the nursing students have good time management skills while 14.5% have inadequate time management skills. This difference in findings of the two studies may be due to use of different questionnaires for assessing time management skills. Moreover, the participants in our study were medical students while in the Egyptian study were nursing students. An implication of poor time management among nearly half medical students in our study is that they are at risk of psychological stress and poor academic achievement as is mentioned by Khatib (2014).

In our study, there is no significant difference between males and females on the basis of their time management skills which is similar to the findings of some other studies (Jahanseir, *et al.*, 2008; Saketi and Taheri, 2010; Pehlivan, 2013; Adebayo, 2015). This means that both males and females may behave similarly to manage their time and similar importance should be given to both the genders during trainings on time management skills. However, in contrast to our findings, another study (Liu *et al.*, 2009) has demonstrated that females have better time management skills than males. While some studies (Guoging and Yongxin, 2000; Macan *et al.*, 2010) have reported that males have better time management than females.

Furthermore, we have observed that there is no significant difference in time management skills in our participants whether they are studying in private or government medical colleges, living in hostels or their homes, coming from rural or urban background, and having different educational qualifications of their parents. Its implication for academic counselors may be that, during teaching and training students on time management skills, equal importance should be given to all the students irrespective of their socio-demographic differences.

We found that pre-clinical (year 1-3) students are better than clinical (year 4-6) students on the basis of their time management skills. One possible explanation for this can be that medical students are at risk of psychological stress during their transition from pre-clinical years to clinical years (Oboko *et al.*, 2015). This increase in stress may be due to relatively more burden of studies during clinical years and may also affect the time management behavior of the students.

We have observed significant positive correlations between total time management scores and total percentage of the marks of last exam, and perceived academic satisfaction among the participant. It means that the students who can better manage their time might also get better results and may be more satisfied than their counterparts who are poor at time management. Moreover, no significant correlation was observed between total time management scores and GPA of the last year/semester. This finding is similar to the results of some other studies (Pehlivan, 2013; Eid *et al.*, 2015). In contrast to our finding, some other studies (Proctor *et al.*, 2006; Anand, 2007; Indreica *et al.*, 2011; Khatib, 2014) have reported significant positive correlation between time management skills and GPA. This difference may be due to difference in sample size and also because students in all these studies were enrolled in dissimilar programs.

Moreover, we have found significant positive correlations between academic satisfaction and GPA of the last year/semester, total percentage of the marks of the last exam, and total number of A/A+ grades in the last exam. This means that the medical students who get a higher GPA, better percentage of result, and more A/A+ grades can be more satisfied than the students who are performing poorly in all of these parameters of academic performance.

One of the strengths of this study is that we have investigated association between time management skills and various socio-demographic features of the participants by using a standardized time management questionnaire developed by Wayne State University (2013). Furthermore, we have also studied correlations between total time management scores and various parameters of academic performance of the participants. One of the limitations may be relatively small sample size (n=89) as compared to other similar studies. Caution must be taken to generalize the findings of this study due to its cross-sectional nature. We have used a self-administered questionnaire that may lead to some possibility of reporting bias.

### Conclusions:-

This study has shown that more than half medical students of Saudi Arabia have inadequate time management skills. There is no difference of time management skills among the participants on the basis of most of their socio-demographic features. Pre-clinical students seem to manage their time better than clinical students. Time management is positively correlated with total percentage of marks in the last exam and perceived academic satisfaction.

Since, a big proportion of medical students has reported inadequate time management and later is also correlated with some parameters of academic performance, we recommend some implications of this study for students, teachers and academic counselors. Students should increase their time management skills by reading books and other literature on this topic, and by attending relevant seminars and workshops. Teachers should act as role model to encourage students' participation in such activities. Academic counselors and psychologists should help the students by providing counseling sessions on time management and by organizing trainings on time management skills. It is also recommended to include the topic of time management in the courses of higher secondary education and university education so that by learning and using these skills student may improve their academic performance and quality of their life.

Further studies are recommended to investigate relation between time management skills of the students and psychological stress. Moreover, prospective studies may also be conducted to assess long-term effects of time management skills on various parameters of academic performance of students.

### References:-

1. Achunine, R.N. and Irondi, E. (1998) Management Administration of secondary education in Nigeria. Lagos: Totan Publishers Limited.
2. Adebayo, F. A. (2015). Time Management and Students Academic Performance in Higher Institutions, Nigeria — A Case Study of Ekiti State. *International Research in Education*, 3(2): 1–12. doi: 10.5296/ire.v3i2.7126.



3. Anand, V. (2007). A study of time management: The correlation between video game usage and academic performance markers. *Cyberpsychology & Behavior*, 10(4): 552–559.
4. Britton, B. K. and Tesser, A. (1991). Effects of time-management practices on college grades. *Journal of Educational Psychology*. American Psychological Association, 83(3): 405–410. doi: 10.1037/0022-0663.83.3.405.
5. Efil, I. (2007). Time management. In: L. Kucukahmet (Ed.): *Classroom Management*. Ankara: Nobel Publications.
6. Eid, N. M., Safan, S. M. and Diab, G. M. (2015). The Effect of Time Management Skills and Self Esteem of Students on Their Grade Point Averages (GPA). *IOSR Journal of Nursing and Health Science Ver. I*, 4(1): 82–88. doi: 10.9790/1959-04118288.
7. Guoging, Y. and Yongxin, Z. (2000). Gender Differences of china's Managers in Time Management. *Woman in Management Review*, 15(1): 33–40.
8. Indreica, E.S., Cazan, A.M. and Truța, C. (2011). Effects of learning styles and time management on academic achievement. *Procedia - Social and Behavioral Sciences*, 30(2011):1096–1102. doi: 10.1016/j.sbspro.2011.10.214.
9. Jahanseir, K., Salehzadeh, K., Vesagi, H. and Mosavifar, A. (2008). A Study of the Effect of Time Management on Academic Achievement of Students of Islamic Azad university Maragheh Branch. *Research in curriculum planning*. 2008; 1 (16) :97-114
10. Khatib, A.S.A. (2014). Time Management and Its Relation to Students' Stress, Gender and Academic Achievement among Sample of Students at Al Ain University of Science and Technology, UAE. *International Journal of Business and Social Research*, 4(5): 47–57.
11. King, J. M. C. (2002). *The procrastination syndrome, signs, symptoms, and treatment cultural studies and analysis*. Philadelphia: stoke publisher.
12. Koch, R. (1998). *The 80/20 Principle: The Secret of Achieving More with Less*. New York: Bantam Doubleday Dell Publishing Group.
13. Liu, O. L., Rijmen, F., MacCann, C. and Roberts, R. (2009). The assessment of time management in middle-school students. *Personality and Individual Differences*, 47(3): 174–179. doi: 10.1016/j.paid.2009.02.018.
14. Macan, T., Gibson, J. M. and Cunningham, J. (2010). Will you remember to read this article later when you have time? The relationship between prospective memory and time management. *Personality and Individual Differences*. 48(6):725–730. doi: 10.1016/j.paid.2010.01.015.
15. MindTools.com (2017) What Is Time Management? Time Management Skills From MindTools.com. Available at: [https://www.mindtools.com/pages/article/newHTE\\_00.htm](https://www.mindtools.com/pages/article/newHTE_00.htm) (Accessed: 23 January 2017).
16. Misra, R. and McKean, M. (2000). College students' academic stress and its relation to their anxiety, time management, and leisure satisfaction. *American Journal of Health Studies*, 16(1): 41–51.
17. Oboko, O.A., Theodora, O.E., Oboko, O.O., and Monday, I.B. (2015). Prevalence of stress, stressors and coping strategies among medical students in a Nigerian medical school. *African Journal of Medical and Health Sciences*, 14(1): 29-34. doi: 10.4103/2384-5589.153384.
18. Pehlivan, A. (2013). The Effect of the Time Management Skills of Students Taking a Financial Accounting Course on their Course Grades and Grade Point Averages. *International Journal of Business and Social Science*. 4(5): 196–203.
19. Proctor, B. E., Prevatt, F. F. and Adams, K. S. (2006). Study Skills Profiles of Normal-Achieving and Academically-Struggling College Students. *Journal of College Student Development*. 47(1): 37–51. doi: 10.1353/csd.2006.0011.
20. Saketi, P. and Taheri, A. (2010). The Relationship between Time Management and Academic Achievements Among Bachelor and Master Students of Shiraz University and Shiraz University of Medical Sciences. *Iranian Journal of Medical Education*. 10(3): 293–300.
21. SkillsYouNeed (2017). *Time Management Skills / SkillsYouNeed*. Available at: <http://www.skillsyouneed.com/ps/time-management.html> (Accessed: 23 January 2017).
22. Stecker, T. (2004). Well-being in an academic environment. *Medical Education*, 38(5): 465–478. doi: 10.1046/j.1365-2929.2004.01812.x.
23. Wayne State University. (2013). *Advising-Time Management Questionnaire*. Available at: <http://advising.wayne.edu/hndbk/time.php> (Accessed: 24 January 2017).
24. Waghachavare, V. B., Dhumale, G. B., Kadam, Y. R. and Gore, A. D. (2013). A study of stress among students of professional colleges from an urban area in India. *Sultan Qaboos University Medical Journal*, 13(3): 422–429.
25. Yousafzai, A. W., Ahmer, S., Syed, E., Bhutto, N., Iqbal, S., Siddiqi, M. N. and Zaman, M. (2009). Well-being of medical students and their awareness on substance misuse: a cross-sectional survey in Pakistan. *Annals of general psychiatry*, 8, p. 8. doi: 10.1186/1744-859X-8-8.



## RESEARCH ARTICLE

### ACUTE HEPATITIS A VIRUS INFECTION PRESENTING WITH MULTIORGAN DYSFUNCTION: A CASE REPORT.

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#### Abstract

**Introduction:** Acute hepatitis due to hepatitis a virus is usually a benign self-limiting disease conferring lifelong immunity. However, few cases have been reported in literature with fulminant hepatitis. We report this extremely rare case with multiorgan dysfunction including liver failure, hepatic encephalopathy, renal failure, pleural effusion, pericardial effusion and hematologic dysfunction as a sequale of this infection in an otherwise healthy male at the age of 18.

**Case presentation:** An 18 years old Pakistani male presented with two days history of fever, cough, headache and vomiting. His condition gradually deteriorated and on day 7 developed multiorgan dysfunction. Initially Immunoglobulin M anti hepatitis a virus was borderline 1.40 but repeated titers one week later confirmed the diagnosis of acute hepatitis a virus infection.

**Conclusion:** This original case report highlights the importance of focusing first uncommon manifestations of common illnesses while diagnosing difficult cases. Moreover this case also adds knowledge to the limited available data regarding complications and predictors of prognosis.

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#### Introduction:-

Hepatitis A virus has plagued mankind for centuries by causing acute hepatitis associated with significant morbidity and occasional mortality. HAV is a 7.5-kb positive-strand RNA virus of the Picornaviridae family and the only member of the genus Hepatovirus [1]. All four genotypes belong to a single serotype. HAV is spread via the fecal-oral route. The incubation period averages 30 days (range 15 to 49 days). The prevalence of HAV infection varies among countries in Asia [2]. Countries with high endemicity for HAV infection include Pakistan, India, China, Nepal, Bangladesh, Myanmar and the Philippines. Most people in these countries are exposed during childhood. HAV infection usually results in an acute, self-limiting illness and only rarely leads to fulminant hepatic failure [3]. In young children, the disease is often asymptomatic, whereas in older children and adults there might be a range of clinical manifestations from mild, anicteric infection to fulminant hepatic failure. The risk of fulminant hepatitis is high in patients having an underlying chronic liver disease and are aged more than 40 years [4]. This case report describes a young person from a highly HAV endemic area with serologically confirmed acute HAV infection with multiorgan involvement.

**Case Presentation:-**

An 18 years old Pakistani male presented with about two days history of intermittent fever with chills, nonproductive cough, generalized headache, nausea and nonbilious vomiting. He vomited thrice on day 1 and five times on the next day. Vomitus contained food particles and was devoid of blood. Clinical examination was unremarkable except raised temperature ranging from 37.22°C (310.4 kelvin) to 39.44°C (312.6 kelvin) with relative bradycardia (pulse ranging from 56/minute to 84/minute). Initial investigations revealed raised serum alanine aminotransferase (2043u/l), low normal platelet count ( $165 \times 10^9/l$ ) and total white cell count ( $4.2 \times 10^9/l$ ) with normal differential count and morphology. Other investigations including haemoglobin, malarial parasite slides, bilirubin, alkaline phosphatase, aspartate aminotransferase, albumin, urea, creatinine, electrolytes, plasma glucose, widal test, DIC screening, urinalysis and chest radiograph were within normal limits. He was provisionally diagnosed as a case of anicteric hepatitis with differential diagnoses of malaria and enteric fever due to their high prevalence in the area. He was managed with antimalarial (artemether), third generation cephalosporin (Ceftriaxone) and supportive parenteral fluids. Samples for blood cultures, viral (including hepatitis and dengue) screening, typhi dot, serology for brucella, leptospira, rickettsia and toxoplasma were sent to laboratory.

On day 3, he developed dizziness and unsteadiness of gait and asterixis while fever with relative bradycardia, headache and vomiting continued. CT scan head revealed no abnormality. IgM anti HAV was borderline 1.40 (cut off 1.20). Repeated investigations showed rising serum alanine aminotransferase 3690u/l, prothrombin time 30 seconds (control 12 seconds), PTTK 46 seconds (control 32 seconds), fibrinogen 130 mg/dl, D-dimers >200<400, serum albumin 28 g/l, urea 13 mmol/l, creatinine 266 umol/l, sodium 133 mmol/l potassium 4.8 mmol/l, creatinine kinase 1112 u/l with CK-MB 6.1%, LDH 6130 u/l, AST 66 u/l, haemoglobin 12.8 g/l, total white cell count  $11 \times 10^9/l$ , platelets  $116 \times 10^9/l$ , pus cells(8-10/HPF) & red blood cells (5-7/HPF) seen on urinalysis. Other investigations including ECG, bilirubin, alkaline phosphatase, hepatitis B surface antigen, serology for hepatitis E, C, dengue, brucella, leptospira, rickettsia, toxoplasma and typhoid were normal. Antimalarial (artemether) was stopped when repeated malarial parasite slides were found negative. Vitamin K was added to treatment but his clinical and laboratory parameters continued to deteriorate.

On day 7, fever settled but his blood pressure rose to 170/110 mmHg and became oliguric with 24 hour urinary output falling to 150 ml while investigations revealed urea 14.1 mmol/l, creatinine 1204 umol/l, sodium 127 mmol/l, potassium 4.4 mmol/l, serum alanine aminotransferase 2149 u/l, bilirubin 77 umol/l, alkaline phosphatase 367u/l, prothrombin time 16 seconds, PTTK 39 seconds and fibrinogen 180 mg/dl. Ultrasonography showed bilateral pleural effusion (mild) and renal parenchymal disease with increased echogenicity  $\times$  normal sized kidneys (Right 11.2 cm, Left 11.6 cm).

Echocardiography showed minimal amount of pericardial effusion with no evidence of tamponade. He was managed with frusemide and haemodialyzed thrice on day 7,8 and 10 via dual lumen catheter in right subclavian vein.

On day 10, he started showing signs of improvement with better control of blood pressure, urinary output improving to 900 ml/24 hours and significant improvement in the levels of serum urea/creatinine as well as the liver function tests etc. Repeated IgM anti hepatitis A virus was positive, while rest of the investigations including blood cultures, serum cryoglobulins, aldolase, rheumatoid factor, complement levels, autoimmune and vasculitic screening revealed no abnormality. Dual lumen catheter was removed post dialysis on day 10.

On day 16, investigations revealed normal serum albumin, coagulation profile, cardiac enzymes, electrolytes and blood counts while levels of serum urea 11.2 mmol/l, creatinine 246 umol/l, alanine aminotransferase 127 u/l, bilirubin 38 mmol/l, alkaline phosphatase 594 u/l were showing gradual improvement.

Follow up on day 23 revealed completely normal clinical and laboratory parameters including renal, hepatic, cardiac, pleural and hematological functions. Monthly follow up during last five months has not shown any evidence of relapse.

**Discussion:-**

HAV infection usually results in an acute, self-limiting illness conferring lifelong immunity and only rarely leads to fulminant hepatic failure. Fulminant hepatic failure occurs more commonly in patients with underlying liver disease; particularly chronic hepatitis B and C infection, advanced age and addiction of intravenous drugs [3]-[6]. This case is very unusual as there was no pre-existing hepatic or non hepatic illness or other risk factors.

Few cases of acute renal failure and nephrotic syndrome have been reported in the literature in association with HAV infection [7]-[10]. Acute tubular necrosis was the most common form of renal injury in such patients while in others renal biopsy was suggestive of interstitial nephritis, immune complex mesangial glomerulonephritis [7], and IgA dominant glomerulonephritis. Only once IgA dominant glomerulonephritis was accompanied with cutaneous cryoglobulinemic vasculitis.

This is a truly rare event in which a young patient at the age of 18, experienced multiorgan dysfunction secondary to hepatitis A virus infection comprising of fulminant liver failure, hepatic encephalopathy, acute renal failure, pleural effusion, pericardial effusion and hematological dysfunction within short span of time and without preexisting underlying liver disease.

**Conclusion:-**

This emphasizes the importance of focusing on common illnesses with their uncommon manifestations while searching for solution of various clinical diagnostic mysteries even in the absence of poor prognostic markers.

**Consent:-**

Written informed consent was obtained from the patient for publication of this case report and accompanying images

**Abbreviations:-****AST:-**

Aspartate transaminase

**CK-MB:-**

Myocardial fraction of creatinine kinase

**DIC:-**

Disseminated intravascular coagulation

**ECG:-**

Electrocardiogram

**HAV:-**

Hepatitis A virus

**HPF:-**

High power field

**Ig:-**

Immunoglobulin

**LDH:-**

Lactate dehydrogenase

**PTTK:-**

Partial thromboplastin time with kaolin

**RNA:-**

Ribonucleic acid.

Declarations

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**Competing Interests:-**

The authors declare that they have no competing interests.

**Authors' contributions**

None..

**References:-**

1. Robertson BH, Jansen RW, Khanna B, Totsuka A, Nainan OV, Siegl G, Widell A, Margolis HS, Isomura S, Ito K, Ishizu T, Moritsugu Y, Lemon SM: Genetic relatedness of hepatitis A virus strains recovered from different geographic regions. *J Gen Virol.* 1992, 73: 1365-1377. 10.1099/0022-1317-73-6-1365.**View ArticlePubMedGoogle Scholar**
2. Gust ID: Epidemiological patterns of hepatitis A in different parts of the world. *Vaccine.* 1992, 10 (1): S56-58. 10.1016/0264-410X(92)90544-T.**View ArticlePubMedGoogle Scholar**
3. Vento S, Garofano T, Renzini C, Cainelli F, Casali F, Ghironzi G, Ferraro T, Concia E: Fulminant hepatitis associated with hepatitis A virus superinfection in patients with chronic hepatitis C. *N Engl J Med.* 1998, 338: 286-290. 10.1056/NEJM199801293380503.**View ArticlePubMedGoogle Scholar**
4. Keefe EB: Is hepatitis A more severe in patients with chronic hepatitis B and other chronic liver diseases. *Am. J. Gastroenterol.* 1995, 90: 201-205.**PubMedGoogle Scholar**
5. Brown GR, Persley K: Hepatitis A epidemic in the elderly. *South Med J.* 2002, 95: 826-833.**View ArticlePubMedGoogle Scholar**
6. Akriviadis EA, Redeker AG: Fulminant hepatitis a in intravenous drug users with chronic liver disease. *Ann Intern Med.* 1989, 10: 838-839.**View ArticleGoogle Scholar**
7. Kim SE, Kim SJ, Kim HS, Kim HS, Nam ES, Lee SK, Shin SR, Kim HY: Two cases of acute renal failure associated with non-fulminant acute hepatitis A. *Korean J Gastroenterol.* 2006, 48: 421-426.**PubMedGoogle Scholar**
8. Vaboe AL, Leh S, Forslund T: Interstitial nephritis, acute renal failure in a patient with non-fulminant hepatitis A infection. *Clin Nephrol.* 2002, 57: 149-153.**View ArticlePubMedGoogle Scholar**
9. Zikos D, Grewal KS, Craig K, Cheng JC, Peterson DR, Fisher KA: Nephrotic syndrome and acute renal failure associated with hepatitis A virus infection. *Am J Gastroenterol.* 1995, 90: 295-298.**PubMedGoogle Scholar**
10. Cheema SR, Arif F, Charney D, Meisels IS: IgA-dominant glomerulonephritis associated with hepatitis A. *Clin Nephrol.* 2004, 62: 138-143.**View ArticlePubMedGoogle Scholar**

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### RESEARCH ARTICLE

## PHYSICAL ACTIVITI AMONG MEDICAL STUDENTS OF IMAM UNIVERSISTY AND ITS EFFECT ON THEIR ACADEMIC PERFORMANCE

**Algarni Ali and Aldughaytheir Mohammed.**

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#### Key words:-

Physical activity, GPA , Academic performance, medical students.

### Abstract

**Introduction:**Physical activity is defined as any bodily movement produced by the skeletal muscles that results in energy expenditure above the basal level, it is an important factor in improving the quality of life and preventing some medical condition. Many studies have shown that a regular physical activity increases thinking and learning skills

**Objectives:**The purpose of this study is to determine the percentage of students who are physically active and to find out whether physical activity has a beneficial effect on their academic performance or not.

**Materials & methods:**a cross-sectional surveydistributed to all the medical students of Imam university. We used the GPA and duration of daily studying to access the academic performance. Type and duration of physical activity were used to access the level of physical activity of the participants. We received 87 complete survey with a response rate of 18.5 %.

**Results:**29 students out of all participant were physically active, most of the student who were physically active had a GPA of 3.00 to 3.99 ( 18 students) followed by the students who scored a GPA of 4.00 to 5.00 ( 7 students ). Most of the students who were physically active spent more than 180 minutes of physical activity weekly (37.9%).We found that there was an association between physical activity and academic performance with a statistical trend toward significance ( p value = 0.09 ).

**Conclusions:**We found that students with a higher GPA tend to be more physically active than students with lower GPA. We recommend doing a similar study on a larger scale to determine the effect of physical activity on academic performance in the Kingdom of Saudi Arabia.

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### Introduction:-

Physical activity is an important factor in improving the quality of life and preventing some medical conditions, it increases the strength of bones and muscle, reduces the cardiovascular risk and its associated with lower risk of developing diabetes mellitus type 2 and metabolic syndromes. [1, 2] Physical activity is defined as any bodily movement produced by the skeletal muscles that results in energy expenditure above the basal level. physical activity can be categorized into light, moderate, or heavy intensity as well as weekday and weekend activity, plus

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2024

several other categories. [3] Many studies have shown that a regular physical activity increases thinking and learning skills. [1, 2] Several hypothesis have described the mechanism of which physical activity could improve academic performance including increasing the blood and oxygen flow to the brain, increasing the levels of norepinephrine and endorphins, reduction of stress and improvement of mood [4, 5, 6].

### **Objectives:-**

The purpose of this study is to determine the percentage of students who are physically active and to find out whether physical activity has a beneficial effect on their academic performance or not.

### **Literature Review:-**

Dawn Podulka Coe et al discussed the Effect of Physical Education and Activity Levels on Academic Achievement in Children. They enrolled 214 Participants who were sixth-grade students and randomly assigned to physical education during either first or second semesters. Academic achievement was assessed using grades from four core academic classes and standardized test scores. They found that Students who either performed some vigorous activity had significantly higher grades ( $P < 0.05$ ) than students who performed no vigorous activity in both semesters. [7]

Sigfúsdóttir ID, Kristjánsson AL .et al dicussed Health behaviour and academic achievement in Icelandic school children, a cross-sectional survey data from 5810 Icelandic school children. They found that the correlation between physical activity and grades is positive and significant ( $P < 0.01$ ) and findings are consistent with previous work and affirm the complexity of the relationship of health to academic achievement. [8]

Pei-An Liao<sup>1</sup>, Hung-Hao Chang et al. discussed Physical fitness and academic performance: empirical evidence from the National Administrative Senior High School Student Data in Taiwan. They used a dataset of 149 240 university-bound senior high school students from 2009 to 2011 was constructed by merging two nationwide administrative datasets of physical fitness test performance and the university entrance exam scores. Using a Hierarchical linear regression models the study revealed An increase of 1 SD on students' overall physical fitness from the first to third school year is associated with an increase in the university entrance exam scores by 0.007 and 0.010 SD for male and female students, respectively. [9]

### **Material & Method:-**

We distributed the questionnaire to all first, second, third and fourth year medical students of Imam university. We used the GPA and duration of daily studying to access the academic performance and we used the type of physical activity and the duration these activities are to access the status of physical activity of each student. We collected back 103 questionnaires, 87 of them were complete and we excluded the 16 questionnaires that were incomplete. response rate was 18.5%. we analyzed the data using SPSS.

### **Result and Discussion:-**

Out of the 87 participant 48 student had a GPA of 3.00 to 3.99 which makes it the most common rang of GPA, followed by a GPA of 2.00 to 2.99 ( 20 students ). 17 student had a GPA between 4.00 to 5.00 (19.5%) and only 2 student had a GPA of <2.00.[Table 1] [ chart 1]

29 students out of all participant were physically active, most of the student who were physically active had a GPA of 3.00 to 3.99 ( 62.1 %) followed by the students who scored a GPA of 4.00 to 5.00 (24.1%). Then a GPA of 2.00 to 2.99 (13.8%). None of the student who had a GPA of <2.00 were physically active.[Table 1] [ chart 2]

Cardiovascular-gym exercise and walking were the two most commonly performed type of physical activity ( 33.5% each ). Sports were the third most common physical activity (27.6%). Only one student was performing weight lifting (3.4%).[Table 1]

(75.0%) of the physically active student with a GPA of 2.00 to 2.99 were walking, while only (25.0%) performed cardiovascular-gym exercise. Among the physically active group of students who scored a GPA of 3.00 to 3.99, thirty eight percent were performing sports, while (27.8%) performed cardiovascular-gym exercise, 5 out of the 28 student who scored a GPA of 3.00 to 3.99 were walking (27.8%). While only (14.3%) of the physically active

student with a GPA of 4.00 to 5.00 performed sports, (57.1%) were performing cardiovascular-gym exercise and (28.6%) were walking.[Table 1]

(50.0%) of the physically active student who had a GPA of 2.00 to 2.99 spent more than 180 minutes/week in physical activity. Most of the physically active student with a GPA of 3.00-3.99 performed activity for more than 180 minutes weekly (38.9%) and only (11.1%) spent less than 60 minutes weekly. 60 to 120 minutes weekly physical activity was the most common duration among the physically active student with a GPA of 4.00 to 5.00 (42.9%), followed by more than 180 minutes per week (28.5%). Among all student with different GPA more than 180 minutes of physical activity was the most common duration (37.9%) and less than 60 minutes was the least (10.3%).[Table 1]

All student with a GPA of less than 2.00 spent less than 60 minutes of daily studying. (90.0%) of the students with a GPA of 2.00 to 2.99 studied for less than 60 minutes daily and only (10.0%) studied for 60 to 120 minutes per day. Most of the students with a GPA of 3.00 to 3.99 spent 60 to 120 minutes studying daily (66.6%), (29.2%) studied for less than 60 minutes daily and only 1 student studied for more than 180 minutes per day. 60 to 120 minutes and 120 to 180 minutes of daily studying were the two most common duration that was spent by students who has a GPA of 4.00 to 5.00 (41.2% each) followed by less than 60 minutes studying per day (11.7%), and only (5.9%) studied for more than 180 minutes daily. Among all the students 60 to 120 minutes was the most common duration of studying (49.4%) followed by less than 60 minutes of studying daily (39.0%). Nine percent of the students studied for 120 to 180 minutes, and only (2.3%) studied for more than 180 minutes daily.[Table 1]

We found that there was an association between physical activity and academic performance with a statistical trend toward significance (p value = 0.09).

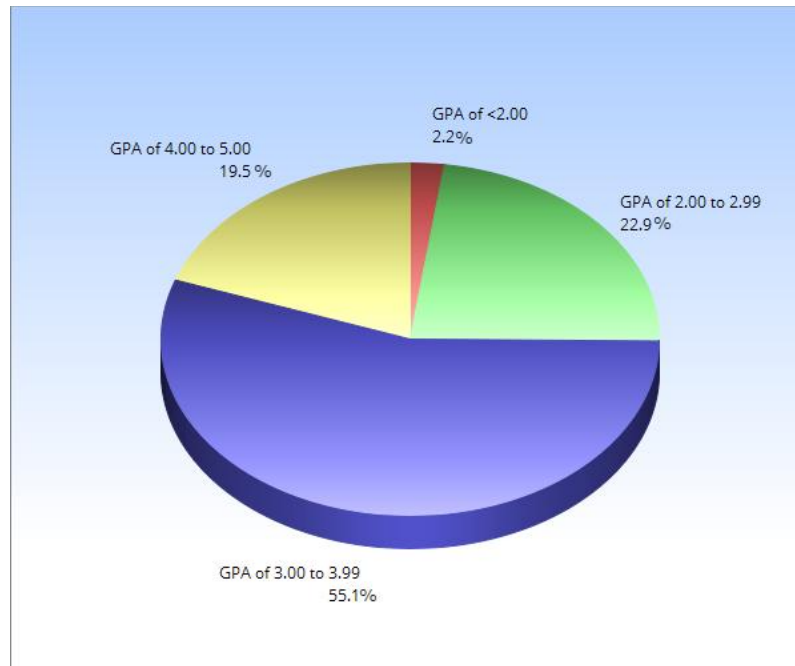
**Table 1:-** Characteristics of medical students of Imam university

		GPA				
		<2.00	2.00 – 2.99	3.00-3.99	4.0 – 5.0	total
<b>Number of participant</b>		2	20	48	17	87
<b>Physically active</b>		0	4 (13.8%)	18 (62.0%)	7 (24.1%)	29
<b>Non- Physically active</b>		2 (3.4%)	16 (27.5%)	30 (51.7%)	10 (17.2%)	58
<b>Type of activity</b>	<b>Cardiovascular-Gym exercise *</b>	0	1 (10.0%)	5 (50.0%)	4 (40.0%)	10
	<b>Walking</b>	0	3 (30.0%)	5 (50.0%)	2 (20.0%)	10
	<b>Sports**</b>	0	0	7 (87.5%)	1 (12.5%)	8
	<b>Weight lifting</b>	0	0	1 (100.0%)	0	1
<b>Duration of activity</b>	<b>&lt;60 minutes/week</b>	0	1 (33.3%)	2 (66.6%)	1 (33.3%)	4
	<b>60-120 minutes/week</b>	0	0	5 (62.5%)	3 (37.5%)	8
	<b>120-180 minutes/week</b>	0	1 (16.6%)	4 (66.6%)	1 (16.6%)	6
	<b>&gt;180 minutes/week</b>	0	2 (18.1%)	7 (63.6%)	2 (18.1%)	11
<b>Duration of studying</b>	<b>&lt; 60 minutes/day</b>	2 (5.9%)	18 (52.9%)	14 (41.1%)	2 (5.9%)	36
	<b>60-120 minutes/day</b>	0	2 (4.8%)	32 (78.0%)	7 (17.0%)	41
	<b>120-180 minutes/day</b>	0	0	1 (12.5%)	7 (87.5%)	8
	<b>&gt;180 minutes/day</b>	0	0	1 (50.0%)	1 (50.0%)	2

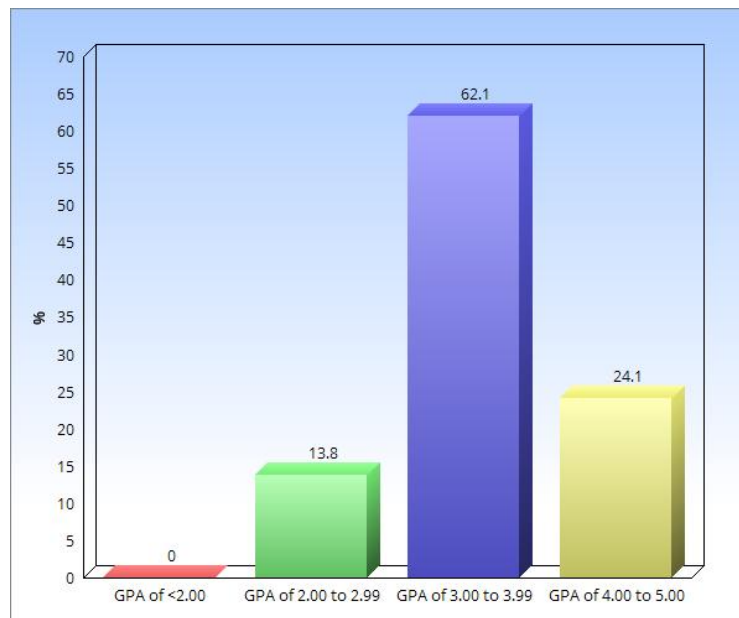


(\*) for example : Elliptical, Treadmill, Stationary Bike ... etc.

(\*\*) for example : Football, basketball, volleyball... etc.



**Chart 1:-** GPAs of medical students of Imam university.



**Chart 2:-** GPAs of physically active medical students of imam university( percentage )

### Conclusion:-

In this study we found a difference in the GPA of the students of Imam university according to their physical activity status with a statistical trend toward significance ( p value = 0.09 ). We recommend doing a similar study on a larger scale to determine the effect of physical activity on academic performance in the Kingdom of Saudi Arabia.

### Acknowledgement:-

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**References:-**

1. Centers for Disease Control and Prevention. Physical Activity and Health Web Sites, at: <http://www.cdc.gov/physicalactivity/everyone/health/index.html>. Accessed: 10 March 2013.
2. United States Surgeon General's report on physical activity and health. From the Centers for Disease Control and Prevention. 1996.
3. Caspersen C, Powell K, Christenson G. Physical activity, exercise and physical fitness: Definitions and distinctions for health-related research. *Public Health Rep.* 1985;100:126–31.
4. Penedo FJ, Dahn JR. Exercise and well-being: a review of mental and physical health benefits associated with physical activity. *Curr Opin Psychiatry.* 2005;18(2):189-193.
5. Hillman CH, Erickson KI, Kramer AF. Be smart, exercise your heart: exercise effects on brain and cognition. *Nat Rev Neurosci.* 2008;9(1):58-65.
6. Jorgensen LG, Nowak M, Ide K, Secher NH. Cerebral blood flow and metabolism. In: Saltin B, Boushel R, Secher N, Mitchell J, eds. *Exercise and Circulation in Health and Disease*. Champaign, IL: Human Kinetics Publishers; 2000:113-236.
7. Dawn Podulka Coe et al. the Effect of Physical Education and Activity Levels on Academic Achievement in Children. *MedSci Sports Exerc.* 2006 Aug;38(8):1515-9.
8. Sigfúsdóttir ID, Kristjánsson AL et al. Health behaviour and academic achievement in Icelandic school children. *Health Educ Res.* 2007 Feb;22(1):70-80. Epub 2006 Jun 9.
9. Pei-An Liao<sup>1</sup>, Hung-Hao Chang et al. Physical fitness and academic performance: empirical evidence from the National Administrative Senior High School Student Data in Taiwan. *Health Educ. Res.* (2013) doi: 10.1093/her/cyt041

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### RESEARCH ARTICLE

#### NEW IDENTIFYING SECURITY FEATURES OF INDIAN CURRENCIES

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banknote recognition, counterfeit  
currency, VSC

#### **Abstract**

By its definition, "currency" alludes to a concurred medium for trade, a country's cash is the formal medium authorized by the chose representing element. All through history, guarantors have confronted one basic danger: falsifying. Regardless of innovative progressions, conquering fake creation remains a far off future. Logical assurance of legitimacy requires a profound comprehension of the crude materials, assembling forms included and the security forms applied. Objective of this paper is to make layman's familiar with the security features added to new 2000 and 500 currency notes so that they can differentiate between forged and genuine currency notes with simple examinations.

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#### **Introduction:-**

To fake intends to wrongfully make an impersonation of something with the purpose to exploit the prevalent estimation of the imitated item. Fake cash alludes to money that nearly look like the first money of a nation yet that is delivered without the legitimate authorize of the administration. Fake cash is unsafe to a country. Fake notes increment cash dissemination, conceivably prompting to swelling (1-3). Likewise, the general trust in the cash diminishes. Moreover, people who honestly secure fake cash are deceived. There are generally no administration approaches to repay them for fake notes that are seized. Then again, the people who deliver fake money can make huge benefits and back a variety of exercises, large portions of which may be against the national premium. Fakes are made in an assortment of ways-The least demanding and most regular path is to utilize a high determination scanner to catch both sides of a certified money note. The filtered pictures are then printed utilizing a shading inkjet or laser printer. This strategy functions admirably for little group takes note of that are normally not examined. Be that as it may, it is anything but difficult to recognize such fake notes in view of the nature of the paper that is utilized (4). A more refined strategy begins with a low group note, blanches or washes out the ink and after that prints a higher esteem note. Nonetheless, the generation of an excellent fake requires a substance to utilize a similar crude materials and printing process that are utilized to create honest to goodness cash. This out of the span of individual forgers because of the high cost and trouble in delivering the crude materials and types of gear. Security elements are frequently implanted in money notes to recognize veritable notes. Regular security highlights incorporate watermarks, security strings, inert pictures, smaller scale lettering, intaglio (raised print), optically factor ink and fluorescence (5). Notwithstanding confirming that a money note is real, the security highlights dissuade forging. Duplicating the security highlights expands the cost of forging, making it less productive. This paper concentrates on fantastic fake Indian fake notes. While the effective distinguishing proof of such notes more often than not requires master examination, it is a generally straightforward issue on the grounds that exclusive the honesty of the security highlights must be researched. A more troublesome assignment is to recognize the wellspring of a fake note. This requires point by point examination by legal researchers utilizing costly instruments. Likewise, no programmed technique exists to interface a fake note to source press. Indian money notes are printed at

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committed government printing presses. The quantity of presses is restricted and extraordinary care is taken amid its printing. This paper essentially concentrates on the remarkable elements of money notes made for security reason and can help the layman to comprehend that straightforward mindfulness identified with notable elements of new monetary forms can help them to anticipate themselves of being casualties to forgers. In a noteworthy stride to check undeclared dark cash, the Government of India on the 8 November, 2016 declared demonetization of Rs. 500 and 1000 banknotes with impact from that day's midnight making these notes invalid. The Indian 2000 rupee banknote is of the most noteworthy division of Indian money. It was initially presented by Reserve Bank of India in November 2016. Indeed, even as Rs 2,000 notes printed by the Reserve Bank of India (RBI) are yet to achieve banks all over the place, a fake note of this section has surfaced many places of India. The fake notes found in different parts of the nation were photocopied adaptations, this note had highlights including the Gandhi watermark alongside the national image and a fake security string (6-7). Below some of the salient features of ₹ 2000 and ₹ 500 are mentioned which can help common people to differentiate between fake and genuine currencies.

### Material and Methods:-

Present study has been undertaken to study spectral examination of various security features in New Indian paper currency prescribed by Reserve Bank of India. New Currency note of Mahatma Gandhi series of denomination 2000 and 500 was selected for present study. The absorption spectral characteristics were examined by video spectral comparator (model 40). Various types of features were examined on paper currency note using different lights ranges (UV-365, 312, 254nm, Ultra Violet transmitted 365nm), by using different magnification ranges and spot light, various filters. In these ranges various security features were analyzed.

#### 1) New Security Features of Rs. 2000 notes (Figure 1a and b):

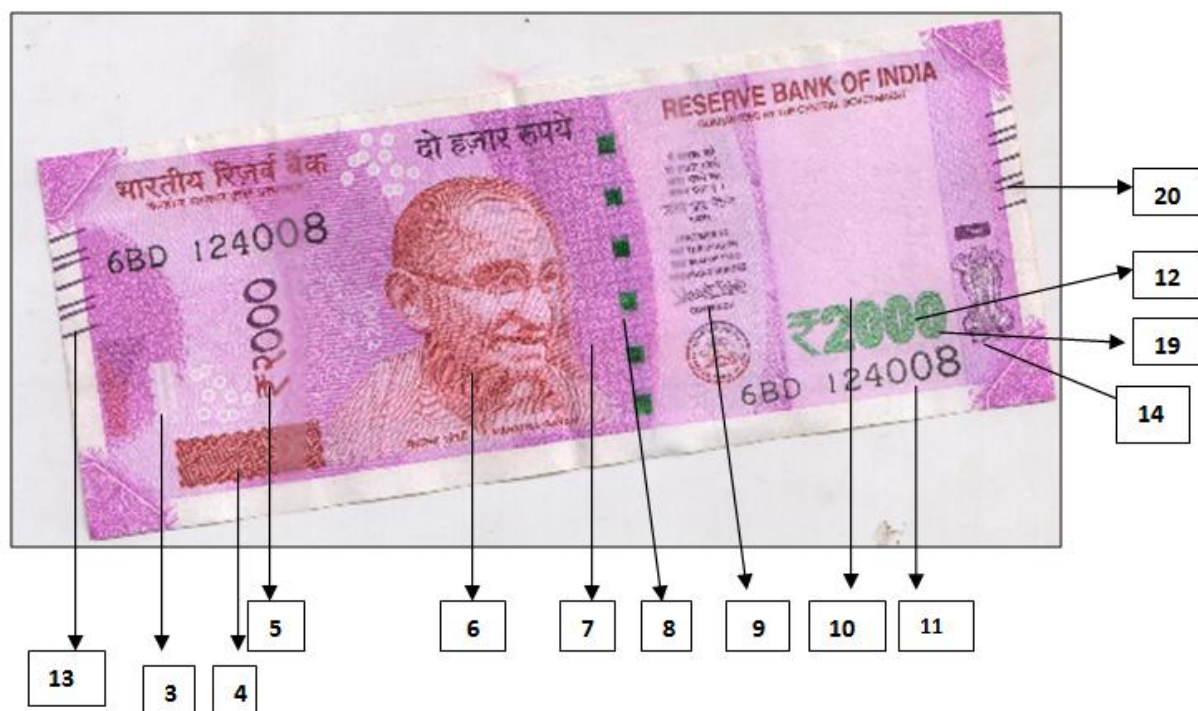
The Reserve Bank of India will issue ₹ 2,000 denomination banknotes in the Mahatma Gandhi (New) Series, without the inset letter.

#### Front side features:-

1. Size: 66mm x 166mm, smaller than the old notes,
2. Colour: Rs 2,000 note's paper will be available in a magenta base color.
3. Registered denominational numeral 2000 is seen.
4. Latent image with denominational numeral 2000 is observed.
5. Denominational numeral २००० in Devnagari is observed.
6. At the centre Portrait of Mahatma Gandhi is seen.
7. On the left side of the banknote Micro letters 'RBI' and '2000' observed.
8. On banknotes windowed security threads with inscriptions 'भारत', RBI and 2000 with color shift are observed. Thread Color changes from green to blue when the note is tilted.
9. Towards right side guarantee clause, governor's signature with promise clause and RBI emblem.
10. Watermarks of electrotypes and Mahatma Gandhi portrait (2000).
11. On the top left side and bottom right side number panel with numerals growing from small to big.
12. On bottom right denominational numeral with Rupee Symbol, ₹2000 in changing color ink (green to blue).
13. On left and right side raised print of seven angular bleed lines are present.
14. Emblem of Ashoka Pillar on the right.

#### Reverse side features:-

15. On the left of the note year of printing is seen.
16. Swachh Bharat logo with slogan is added as a new feature.
17. Language panel towards the centre on the reverse side.
18. Motif of Mangalyaan is added as a new feature.  
The notes are also meant to have some special features that have been designed keeping the visually-impaired individuals in mind.  
Intaglio or raised printings of Mahatma Gandhi portrait, Ashoka Pillar emblem, bleed lines and identity mark.
19. Raised print of ₹2000 horizontal rectangle form observed on the right.
20. On left and right side seven angular raised print bleed lines observed.



**Figure1a:-** Showing identifying features of Rs. 2000 currency of front side under VSC.



**Figure1b:-** Showing identifying features of Rs. 2000 currency of reverse side under VSC.

#### New Security Features of Rs. 500 notes (Figure2a and b):-

The RBI will issue ☐ 500 denomination banknotes in Mahatma Gandhi (New) Series with inset letter 'E' in both the number panels.

1. Size: The new Rs 500 note at 63mm x 150mm is smaller in size than previous one.



2. Color: Color is stone grey with Red Fort and Mahatma Gandhi's image on each side.
3. Registered denominational numeral 500 is seen.
4. The denomination numeral in latent image.
5. Denomination numeral in Devnagari script.
6. Mahatma Gandhi's portrait orientation changed.
7. When note is tilted windowed security thread changes from green to blue.
8. RBI emblem, Guarantee clause, Governor's signature shifted towards right.
9. Portrait of Mahatma Gandhi and electrottype watermarks.
10. Number panel with numerals growing from small to big on top left and bottom right sides.
11. On the bottom right denomination numerals with rupee symbol in colour changing ink from green to red.
12. Ashoka pillar emblem can be seen on the right side.

For Visually Impaired Mahatma Gandhi portrait, Ashoka Pillar emblem and identification mark in raised print.

13. 500 in raised print on the right with circle.
14. On the left and right five bleed lines in raised print.

### Reverse Side

15. Printed year on the left side.
16. Logo of Swachh Bharat with slogan.
17. Language panel towards centre.
18. Red fort image with Indian flag.
19. Numeral of denomination in Devanagari on the right.

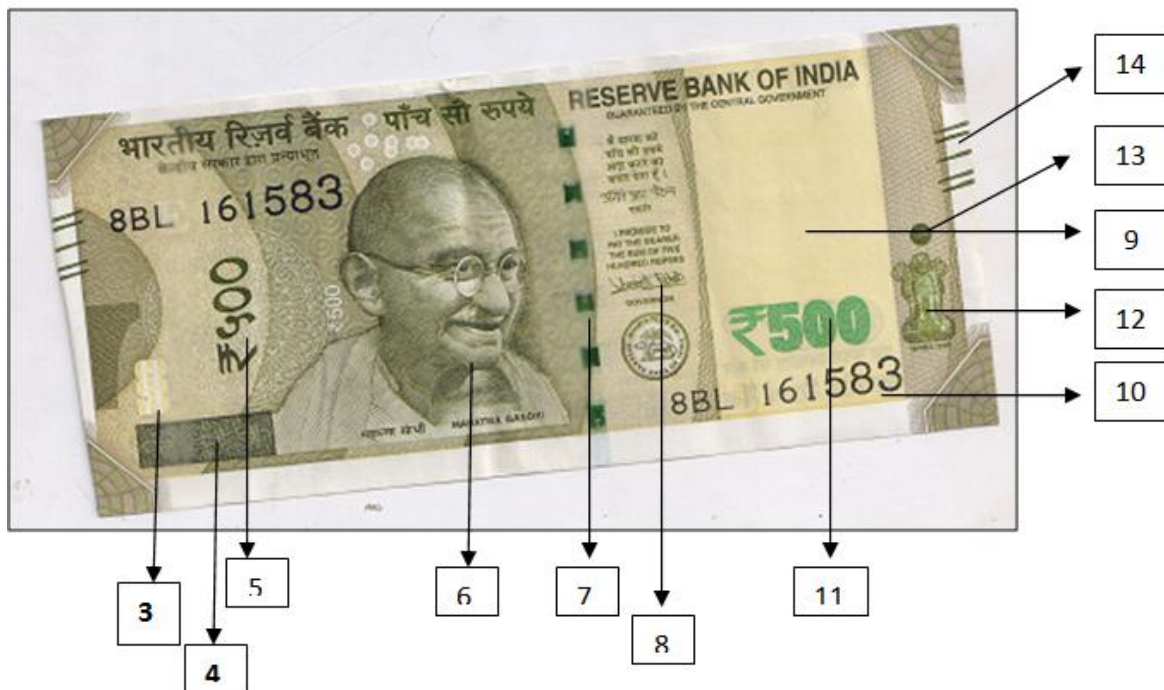
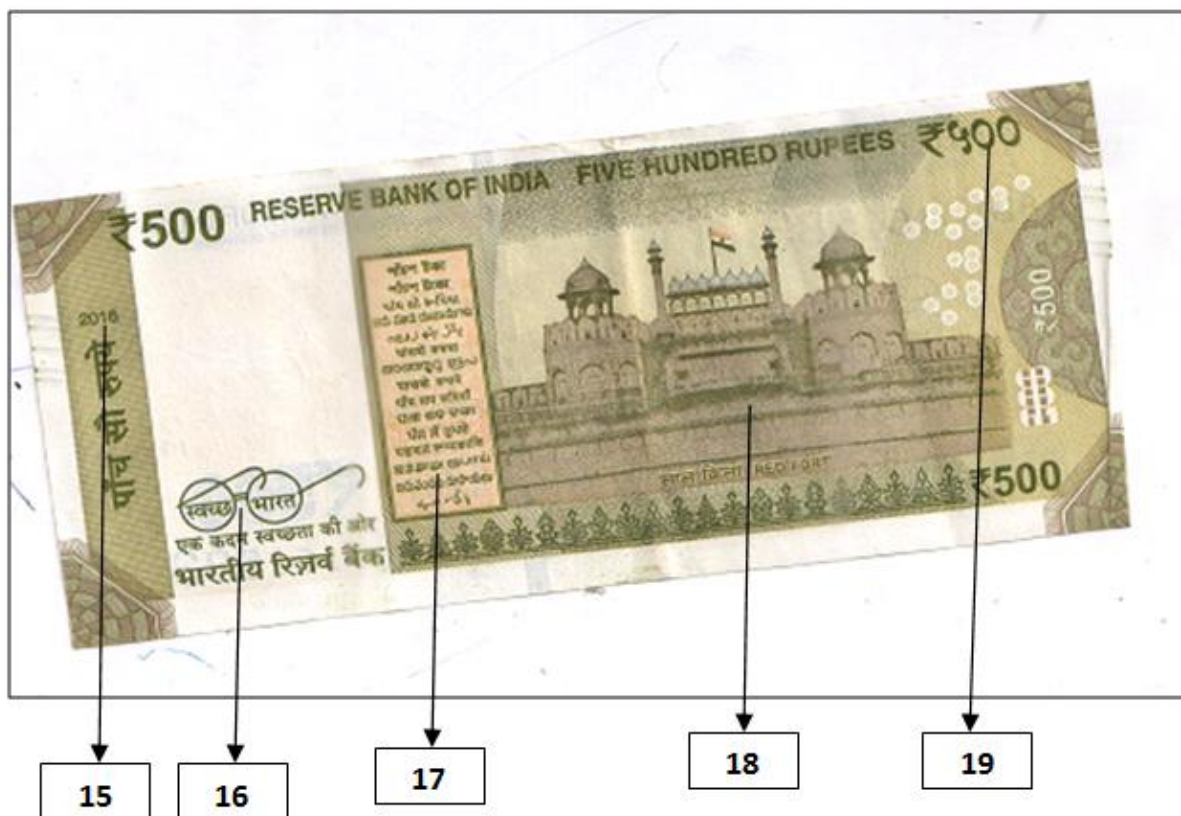


Figure 2a:- Showing identifying



**Figure 2b:-** Showing identifying features of Rs. 500 currency of front side under VSC.

### Conclusion:-

Exhibit study was done to dissect the different real elements of Indian cash of division 2000 and 500 utilizing Video Spectral comparator-40 (Freeman-Foster) to concentrate different certifiable components according to the rules of RBI. Exhibit study can be exceptionally useful in recognizing bona fide and fake Indian cash notes. The technique received is very advantageous and bona fide which can be increasingly embraced by bank authorities, security offices, cash exchangers and legal specialists. The methodology is exceedingly fitting, speedy and easy to use without much of a stretch be dissected and easily explained in report.

### References:-

1. Sharma B. K. "Counterfeiting of Indian Currency", CBI bulletin vol. VIII NO.11 NOV., pp. 4-7 (Special issue on counterfeiting of currency), 2000.
2. Oliver J., Chen J. "Use of Signature Analysis to Discriminate Digital Printing Technologies", in Proc. of the Int. Conf. on Digital Printing Technologies, pp. 218-222, San Diego, California, 2002.
3. Mittal S. C., Arora N. "Forgery of rupees Five Hundred Denomination Notes-Methods of Detection", CBI Bulletin, II, pp.4-20, 2003.
4. Mittal S. C. "Recent trends in forgery of Rs. 500 denomination Bank Notes of Mahatma Gandhi Series & their detection", CBI Bulletin, 12, pp. 8, 2004.
5. Mittal S. C., Arora N. "Recent Trends in the Counterfeiting of Rupees 1000 Denomination Currency Notes-Methods of Detection", NCRB Gazette, XVII (3), pp. 29-47, 2005.
6. Li C. K., Chan W.C., Cheng Y. S., Leung S. C. "The Differentiation of Color Laser Printers," Journal of the American Society of Questioned Document Examiners, Vol.7 (2), pp. 105-109, 2004.
7. Pal A., H. K. Pratihari. "Spectral Studies on Original and Fake Rupees 1000 Denomination Note" ISSN0974-3111 volume 4(2), 91-96, 2012.



## RESEARCH ARTICLE

### ASURVEY AND COMPARISON ON SYNCHRONIZATION METHODS OF CHAOTIC SYSTEMS

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Chaos, chaos synchronization, observer-based, Active control, Adaptive Control, Rösslersystem

#### Abstract

In this paper, several methods for synchronization of chaotic systems are explained and compared. The idea is based on drive-response systems synchronization. The methods include: active control, recursive control, adaptive control, and partial linearization method which are implemented and applied to a Lorenz chaotic system. The partial linearization method is used to synchronize a subset of states of the system to synchronize other states as well. Active control and rebound control methods are used when the system parameters are known while adaptive control method is used when some of the parameters of the system are unknown. In these methods, synchronization is based on Lyapunov stability theory. Three methods, namely, adaptive, active and recursive and are implemented on a T system successfully. A new matrix method has been presented for synchronization based on the theory of Lyapunov-Krasovskiy theory and linear matrix inequality (LMI). This method has been implemented to a Rössler system with delay. Comparing to classical methods used to synchronize chaotic system the matrix method seems the best because of easy design of input, suitable for synchronization of chaotic systems with delay, simple calculations, no need to find a Lyapunov function for stability.

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#### Introduction:-

Over the years, scientists have tried to invent with different methods, in order to make complex control systems stable and efficient. In this regard, one of the best methods has been proposed by scientists and Russian mathematician, Lyapunov. Lyapunov introduced a quasi-energy function model for nonlinear systems and then concluded that, if the system energy is constantly reducing, energy finally will finish and the system will be stable.

In this paper, we have investigated the synchronization of chaotic systems. Several methods for synchronization of chaotic systems, namely active control, recursive control, and adaptive control are reviewed and a special matrix method is proposed for design of chaotic system synchronization observer.

The remaining parts of this paper consist of four sections as follows: Inspection 2, an overview of the phenomenon of chaos in the systems is presented with some practical examples of chaotic systems. In section 3, the synchronization of chaotic systems is expressed. Conclusions are expressed in section 4.

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**Chaos phenomenon:-**

Chaos literally means anarchy, confusion and disorder. In chaotic systems, long-term behavior is not possible to predict. This characteristic is the result of high sensitivity of these systems to their initial condition. Chaotic behavior is not random behavior; it is deterministic.[1] But from the view of an observer unaware of the structure and function of chaotic system, the signal cannot be distinguished from a random signal using statistical tests. Since the signal can be measured only with limited precision, even if the chaotic signal generator is completely known, because of uncertainty in initial conditions, the output precision is constantly decreased[1]. Therefore, the future of signal, especially in the long-term cannot be predicted and thus, the behavior of signal seems random. Due to sensitivity to initial conditions, a small uncertainty in initial conditions will lead to huge amounts of uncertainty in long term, therefore the system is unpredictable [2]. Examples of the chaotic systems include: Burning a neon lamp, the point of incidence and magnitude of earthquakes, the trajectory of the fluid in a tube, population growth organisms, lightning in the sky, and the chain of random numbers generated by computer. [1, 2, 3]. The chaotic systems are studied in several fields of science such as mathematics, astronomy, physics, medicine, meteorology, engineering, mechanics, construction, pharmaceutical and aerospace and even in the fields of psychology, sociology, and management [2, 3].

The study of chaos has a lot of applications including:

- Ability to explain many events and natural phenomena, ability to predict disasters and avoid risks of accidents and reduce injuries
  - Control of behavior of the systems in the desired direction
  - Understanding the process leading to chaos in certain areas and under controlled conditions to achieve optimal conditions[2]
  - Developing algorithms and logic of measurement, computing, administrative and operational
  - Diagnose the cause of some irregularities, the correction of the laws of science and discovery of new laws[2]
- Due to the complex and unstable dynamics control, chaos control seems impossible but chaotic systems are capable of self-control and various control objectives are introduced as below:
- Remove chaotic behavior and sustainability point of balance
  - stabilization of unstable alternate routes (creation of sustainable Limit Cycle)
  - synchronization of two chaotic systems
  - iPod control chaos (chaos-chaotic anti-control off)
  - Control of bifurcation

**Synchronization:-**

In this paper synchronization of two chaotic systems is examined as follows. It is synchronization of changes in two systems so that they show the same behavior. For example, data transmission in telecommunication systems, both client and transmitter have access to a carrier signal for synchronization. In 1990, Pecorrat, Carroll showed that in specific circumstances two chaotic systems can become synchronized by applying error signal to systems [1]. Assume two identical copies of the dynamical system[2]

$$\dot{X} = f(x), \quad x \in \mathbb{R}^n \quad (1)$$

For example, two identical oscillators with different initial conditions. One of these systems is called drive and another one is called response.

$$\text{Drive System: } \begin{cases} \dot{Z}_d = Z(Z_d, y_d) \\ \dot{Y}_d = Z(Z_d, y_d) \end{cases} \quad (2)$$

$$\text{Response System: } \begin{cases} \dot{Z}_r = Z(Z_r, y_r) \\ \dot{Y}_r = Z(Z_r, y_r) \end{cases} \quad (3)$$

In equations (2) and (3),  $Z_d$  and  $Y_d$  are drive system's state variables and  $Z_r, y_r$  are state variables is the answer system.

Synchronization condition is defined as follows:

$$\lim_{t \rightarrow \infty} |Z_d(t) - Z_r(t)| \rightarrow 0 \quad (4)$$

$$\lim_{t \rightarrow \infty} |y_d(t) - y_r(t)| \rightarrow 0 \quad (5)$$

**Dynamic equations of error signal will be:-**

$$\begin{cases} \dot{e}_z = f_0(e_z, t) \\ \dot{e}_y = f_1(e_z, e_y, t) \end{cases} \quad (6)$$

Where  $e_z = z_d - z_r$  and  $e_y = y_d - y_r$ .

**Theorem [4]:** Suppose for every initial conditions  $z_d(0)$  and  $z_r(0)$  and  $y_d(0)$ , responses  $z_d(t)$  and  $y_d(t)$  in the interval are extremely large and equilibrium point  $e_z = 0$  in  $\dot{e}_z = f_0(e_z, t)$  is asymptotically stable in general and uniform. [3]  
 $\dot{e}_y = f_1(e_z, e_y, t)$  is stable. The purpose of synchronization is met then for any initial condition. There are other methods for synchronization, including synchronization with the passive-based, ActiveX control, recursion, adaptive control, partial linearization, and particular matrix methods. [1]

**ActiveX control Methods:-**

This method is used to synchronize two systems which are identical (T) in parameters. A system (T) in general is as follows: [5]

$$\text{T system: } \begin{cases} \dot{x} = a(y - x) \\ \dot{y} = (c - a)x - axz \\ \dot{z} = -bz + xy \end{cases} \quad (7)$$

When the coefficients  $a = 2.1$  and  $b = 0.6$  and chaotic system is  $c = 30$  is selected. Synchronization process is as follows. Consider the drive and response systems:

$$\text{Drive system: } \begin{cases} \dot{x}_1 = a(y_1 - x_1) \\ \dot{y}_1 = (c - a)x_1 - ax_1z_1 \\ \dot{z}_1 = -bz_1 + x_1y_1 \end{cases} \quad (8)$$

$$\text{Response system: } \begin{cases} \dot{x}_2 = a(y_2 - x_2) + u_1(t) \\ \dot{y}_2 = (c - a)x_2 - ax_2z_2 + u_2(t) \\ \dot{z}_2 = -bz_2 + x_2y_2 + u_3(t) \end{cases} \quad (9)$$

The error for the systems is define as:

$$e_1 = x_2 - x_1, e_2 = y_2 - y_1, e_3 = z_2 - z_1 \quad (10)$$

**The error dynamic equations are obtained as:-**

$$\begin{cases} \dot{e}_1 = a(e_2 - e_1) + u_1(t) \\ \dot{e}_2 = (c - a)e_1 - a(x_2z_2 - x_1z_1) + u_2(t) \\ \dot{e}_3 = -be_3 + x_2y_2 - x_1y_1 + u_3(t) \end{cases} \quad (11)$$

Then  $u_1$  and  $u_2$  and  $u_3$  are defined control functions for active control like below, error in the dynamic, non-linear segments are eliminated and will be only a function of  $e$ .

$$\begin{cases} u_1(t) = v_1(t) \\ u_2(t) = a(x_2z_2 - x_1z_1) + v_2(t) \\ u_3(t) = -x_2y_2 + x_1y_1 + v_3(t) \end{cases} \quad (12)$$

$$\begin{cases} \dot{e}_1 = a(e_2 - e_1) + v_1(t) \\ \dot{e}_2 = (c - a)e_1 + v_2(t) \\ \dot{e}_3 = -be_3 + v_3(t) \end{cases} \rightarrow \begin{bmatrix} \dot{e}_1 \\ \dot{e}_2 \\ \dot{e}_3 \end{bmatrix} = \begin{bmatrix} -a & a & 0 \\ c - a & 0 & 0 \\ 0 & 0 & -b \end{bmatrix} \begin{bmatrix} e_1 \\ e_2 \\ e_3 \end{bmatrix} + \begin{bmatrix} v_1 \\ v_2 \\ v_3 \end{bmatrix} \quad (13)$$

Now, it is sufficient to calculate the control vector  $\mathbf{v}$ , depending on the state variables so that the error is diminished. That is  $\dot{e} = -e$  the response of the equation is  $e^{-t}$ . That is the errors approach zero when  $t \rightarrow \infty$  [16]

The matrix  $A$  is chosen so that the eigenvalues of matrix  $A$  are  $-1$ .

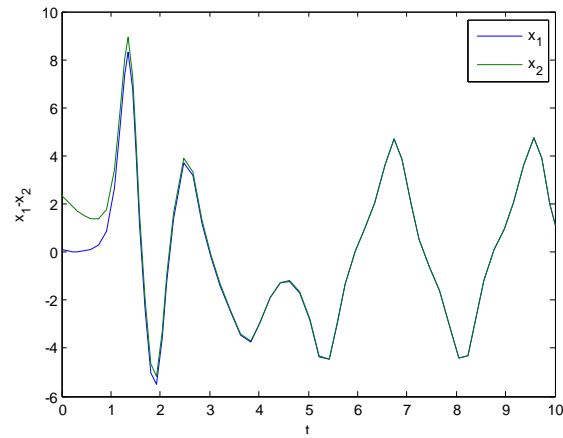
$$\begin{bmatrix} v_1 \\ v_2 \\ v_3 \end{bmatrix} = A \begin{bmatrix} e_1 \\ e_2 \\ e_3 \end{bmatrix} \rightarrow A = \begin{bmatrix} a - 1 & -a & 0 \\ a - c & -1 & 0 \\ 0 & 0 & b - 1 \end{bmatrix} \quad (14)$$

$$\begin{cases} \dot{e}_1 = -e_1 & e_1(t) = c_1 e^{-t} \\ \dot{e}_2 = -e_2 & e_2(t) = c_2 e^{-t} \\ \dot{e}_3 = -e_3 & e_3(t) = c_3 e^{-t} \end{cases} \quad (15)$$

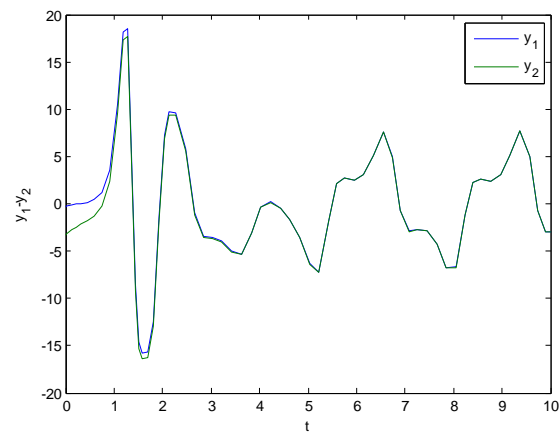
**The initial values for the simulation are:-**

$$x_1(0) = 0.1, x_2(0) = 2.4, y_1(0) = -0.3, y_2(0) = -3.3, z_1(0) = 0.2, z_2(0) = 14.5$$

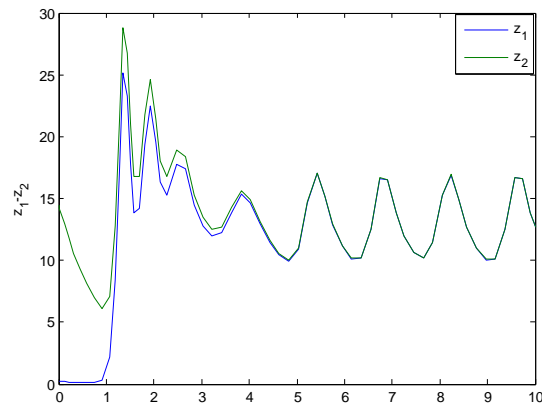
Figure (1) shows the changes of  $x_1$  and  $x_2$  where Figures (2) and (3) show  $y_1$  and  $y_2$  and  $z_1$  and  $z_2$  respectively. Figure (4) presents  $e_1, e_2$  and  $e_3$  versus time [7].



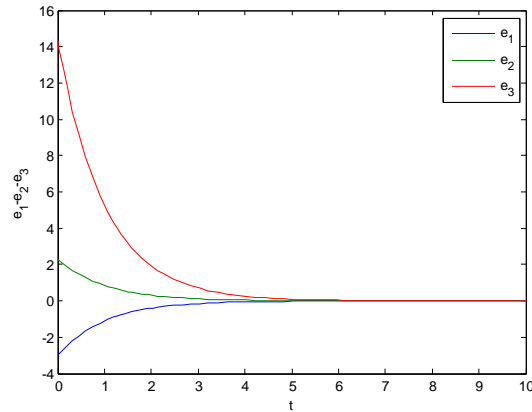
**Figure 1:-signals  $x_2$  and  $x_1$ .**



**Figure 2:-Signals  $y_1$  and  $y_2$**



**Figure 3:- Signals  $z_1$  and  $z_2$**



**Figure 4:-** signal  $e_1, e_2$  and  $e_3$

Synchronization by adaptive control

In particular situations, some parameters of the system are unknown. [9]

Once again there where the dynamic equations error as follows: [10]

$$\begin{cases} \dot{e}_1 = a(e_2 - e_1) + u_1(t) \\ \dot{e}_2 = (c - a)e_1 - a(x_2z_2 - x_1z_1) + u_2(t) \\ \dot{e}_3 = -be_3 + x_2y_2 - x_1y_1 + u_3(t) \end{cases} \quad (16)$$

**A positive definite Lyapunov function is defined as:-**

$$v(e_1, e_2, e_3, \tilde{a}, \tilde{b}, \tilde{c}) = \left(\frac{1}{2}\right)(e_1^2 + e_2^2 + e_3^2 + \tilde{a}^2 + \tilde{b}^2 + \tilde{c}^2) \quad (17)$$

Where  $\tilde{a} = a - a_1$ ,  $\tilde{b} = b - b_1$ ,  $\tilde{c} = c - c_1$  and  $a_1, b_1, c_1$  are the estimated values of the unknown parameters  $a, b, c$ . we assume control functions as:

$$\begin{cases} u_1(t) = -a_1(e_2 - e_1) \\ u_2(t) = -(c_1 - a_1)e_1 + a_1(x_2z_2 - x_1z_1) \\ u_3(t) = (b_1 - 1)e_3 - x_2y_2 - x_1y_1 \end{cases} \quad (18)$$

**The updating rules Are:-**

$$\begin{cases} \dot{a}_1 = -e_1^2 - e_2(x_2z_2 - x_1z_1) \\ \dot{b}_1 = -e_3^2 \\ \dot{c}_1 = e_1e_2 \end{cases} \quad (19)$$

**Then, the derivative of the Function v:-**

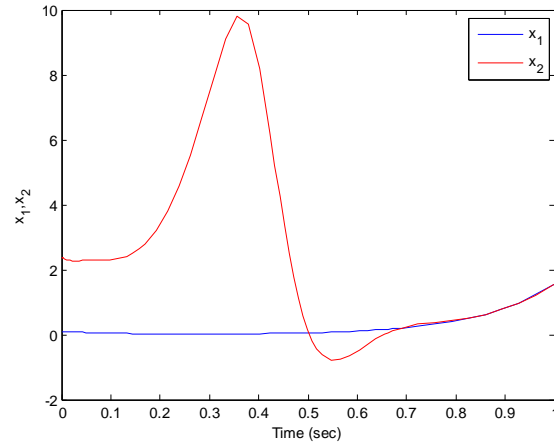
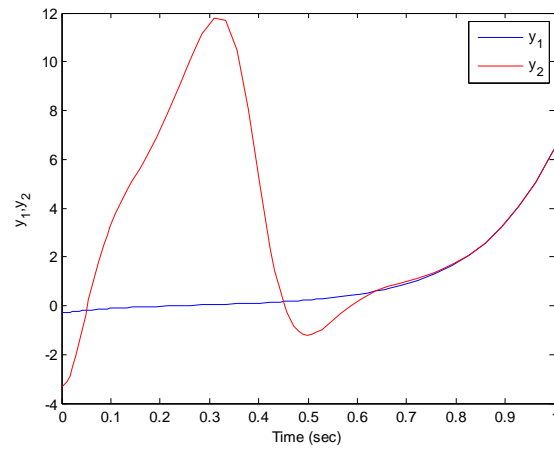
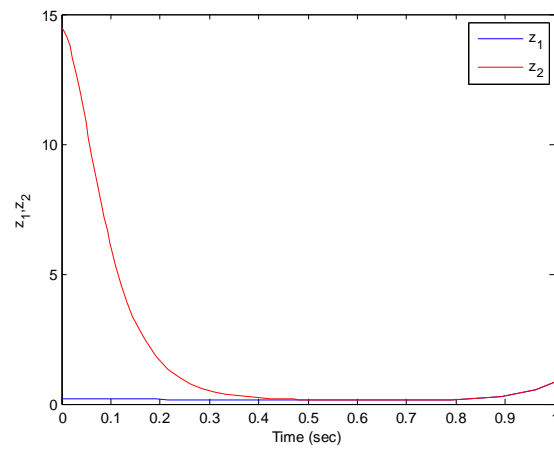
$$v(e_1, e_2, e_3, \tilde{a}, \tilde{b}, \tilde{c}) = e_1^2 - e_1^2 - e_1^2 < 0 \quad (20)$$

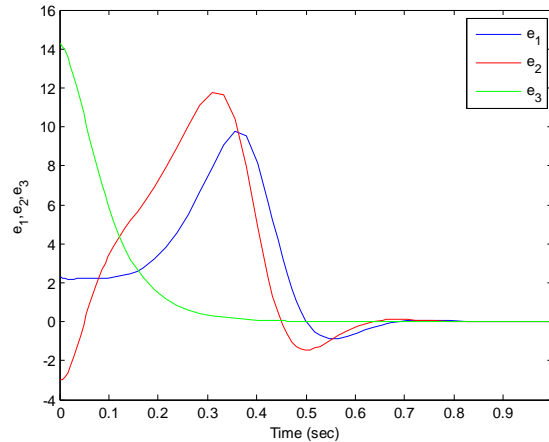
The signals  $x_2$  and  $y_2$  and  $z_2$  are from response system, while  $x_1$  and  $y_1$  and  $z_1$  are synchronized drive system variables. [10]

**The initial values for the simulation are as follows:-**

$$x_1(0) = 0.1, x_2(0) = 2.4, y_1(0) = -0.3, y_2(0) = -3.3, z_1(0) = 0.2, z_2(0) = 14.5, a_1(0) = b_1(0) = c_1(0) = 0.1$$

Figure (5) shows  $x_1 - x_2$ , Figure (6) shows  $y_1 - y_2$ , Figure (7) shows  $z_1 - z_2$ , and Figure (8) shows  $e_1$  and  $e_2$  and  $e_3$  versus time.

**Figure 5:-** .for  $x_1 - x_2$ **Figure 6:-** . $y_1 - y_2$ **Figure 7:-** . $z_1 - z_2$

Figure 8:-  $e_1, e_2$  and  $e_3$ **Synchronization by backstopping:-**

This method is efficient for up to two parameters in the design of the system (T) [11]. The dynamical equation of system error is:

$$\begin{cases} \dot{e}_1 = a(e_2 - e_1) + u_1(t) \\ \dot{e}_2 = (c - a)e_1 - a(e_1 e_3 + x_1 e_3 + e_1 z_1) + u_2(t) \\ \dot{e}_3 = -be_3 + e_1 e_2 + e_1 y_1 + e_2 x_1 + u_3(t) \end{cases} \quad (21)$$

There are three stages in backstopping, in the first step we define  $z_1 = e_1$ , then:

$$\dot{z}_1 = a e_2 - a z_1 + u_1(t) \quad (22)$$

Considering  $e_2 = \alpha_1(z_1)$  as a virtual controller. where  $\alpha_1(z_1)$  is designed to stabilize the  $z_1$  in (22), Then  $v_1$  is chosen as a Lyapunov function:

$$v_1 = \frac{z_1^2}{2} \quad (23)$$

$$\dot{v}_1 = z_1 \dot{z}_1 = -a z_1^2 + a z_1 \alpha_1 + u_1(t) z_1 \quad (24)$$

If  $u_1(t) = 0$  and  $\alpha_1 = z_1 - \frac{z_1}{a}$  then  $\dot{v}_1$  will be negative.

$\alpha_1(z_1)$  is a virtual control function.  $z_2$  is defined as:

$$z_2 = e_2 - \alpha_1 \quad (25)$$

$$\begin{cases} \dot{z}_1 = a z_2 - z_1 \\ \dot{z}_2 = (c - a) z_1 - a(z_1 e_3 + x_1 e_3 + z_1^2) - \left(1 - \frac{1}{a}\right) (a z_2 - z_1) + u_2(t) \end{cases} \quad (26)$$

In the next step, the second Lyapunov function is defined:

$$v_2 = v_1 + \frac{z_2^2}{2} \quad (27)$$

The derivation to of  $v_2$  will be:

$$\dot{v}_2 = -z_1^2 - z_2^2 < 0 \quad (28)$$

The functions are chosen as  $\alpha_2(z_1, z_2) = 0$  and  $u_2 = -z_2 - c z_1 + a z_1^2 + \left(1 - \frac{1}{a}\right) (a z_2 - z_1)$  then:

$$\begin{cases} \dot{z}_1 = a z_2 - z_1 \\ \dot{z}_2 = -a z_1 - z_2 - a(z_1 + x_1) z_3 \\ \dot{z}_3 = -b z_3 + z_1 y_1 + (z_1 + x_1) \left(z_2 + z_1 - \frac{z_1}{a}\right) + u_3(t) \end{cases} \quad (29)$$

To third Lyapunov function is  $v_3$ :

$$v_3 = v_2 + \frac{z_3^2}{2} \quad (30)$$

The derivative of  $v_3$  will be:

$$\dot{v}_3 = -z_1^2 - z_2^2 - a(z_1 + x_1)z_2z_3 + z_3m \quad (31)$$

Where

$$m = \left[ -bz_3 + z_1y_1 + (z_1 + x_1) \left( z_2 + z_1 + \frac{z_1}{a} \right) + u_3(t) \right] \quad (32)$$

If  $u_3(t) = (b-a)z_3 - z_1y_1 + (z_1 + x_1) \left( (a+1)z_2 + z_1 - \frac{z_1}{a} \right)$  and  $\alpha_2 = 0$ , then  $\dot{v}_3 < 0$  hence the equilibrium point  $(0,0,0)$  is asymptotically stable. By taking  $z_1 = e_1$ ,  $z_2 = e_2 - \alpha_1$ ,  $z_3 = e_3 - \alpha_2(z_1, z_2)$  it is observed that  $e_1$ ,  $e_2$  and  $e_3$  asymptotically approach zero, that means the synchronization between the systems. The initial values for the simulation are as follows:

$$x_1(0) = 0.1, x_2(0) = 2.4, y_1(0) = -0.3, y_2(0) = -3.3, z_1(0) = 0.2, z_2(0) = 14.5$$

Figures (9) to (12) show the variables  $x_1$ - $x_2$ ,  $y_1$ - $y_2$ ,  $z_1$ - $z_2$  and errors  $e_1$ ,  $e_2$  and  $e_3$  respectively [6,7,11].

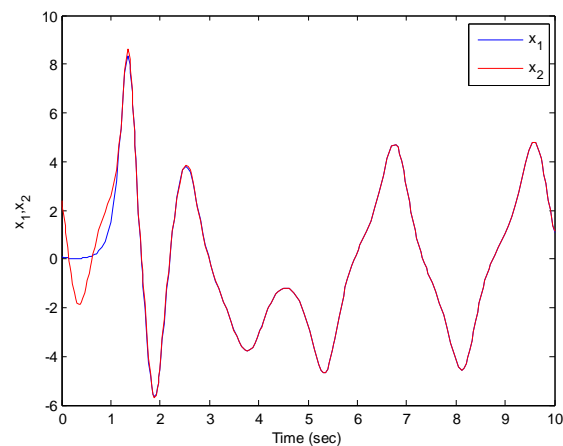


Figure 9:-  $x_1$ -  $x_2$

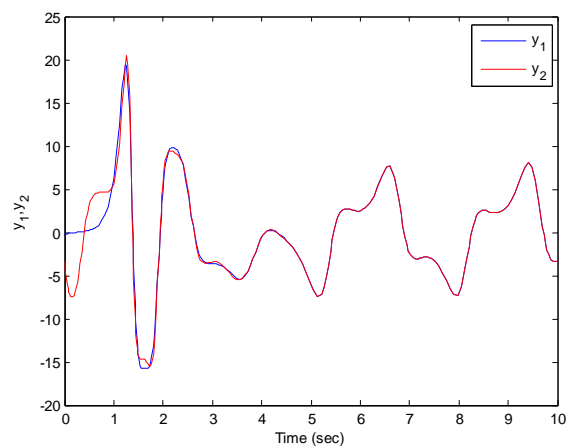
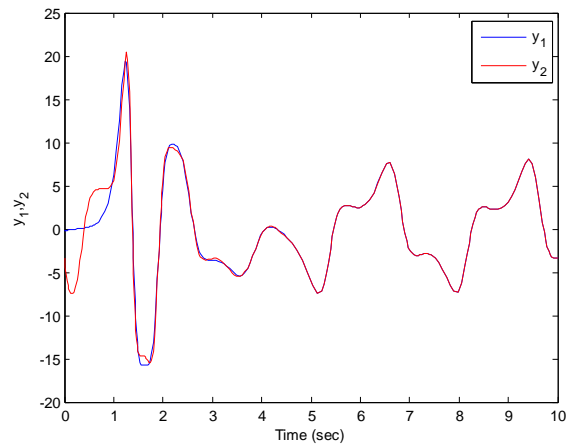
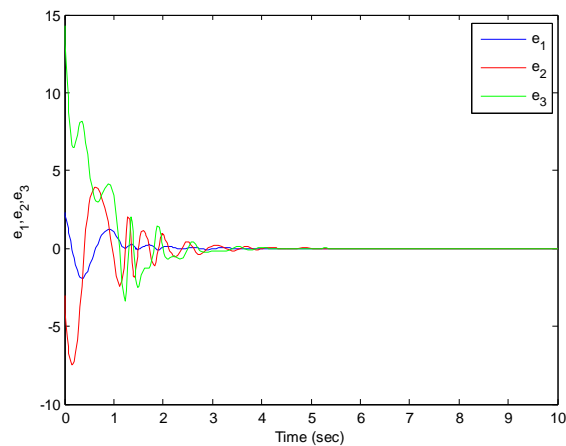


Figure 10:-  $y_1$  -  $y_2$

Figure 11:-  $z_1-z_2$ Figure 12:- errors  $e_1$  and  $e_2$  and  $e_3$ **Synchronization using the particular matrix:-**

This method assumes unknown delay [14]. The equations are as follows for drive and response systems:

$$\begin{cases} \dot{x}_1(t) = -x_1(t) - x_2(t) + a_1[x_1(t - \tau_1)] + a_2[x_2(t - \tau_2)] \\ \dot{x}_2(t) = x_1(t) + \beta_1 x_2(t) \\ \dot{x}_3(t) = (x_1(t) - \gamma)x_3(t) + x_1(t)x_3(t) + \beta_2 \end{cases} \quad (33)$$

$$\begin{cases} \dot{y}_1(t) = -y_1(t) - y_2(t) + a_1[y_1(t - \tau_1)] + a_2[y_2(t - \tau_2)] - u_1(t) \\ \dot{y}_2(t) = y_1(t) + \beta_1 y_2(t) - u_2(t) \\ \dot{y}_3(t) = (y_1(t) - \gamma)y_3(t) + y_1(t)x_3(t) - \beta_2 u_3(t) \end{cases} \quad (34)$$

The equations in the form of a matrix can be written as follows:-

$$\begin{bmatrix} \dot{x}_1(t) \\ \dot{x}_2(t) \\ \dot{x}_3(t) \end{bmatrix} = \begin{bmatrix} 0 & -1 & -1 \\ 1 & \beta_1 & 0 \\ x_3 & 0 & x_1(t) - \gamma \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \\ x_3(t) \end{bmatrix} + \begin{bmatrix} a_1 & a_2 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} x_1(t - \tau_1) \\ x_2(t - \tau_2) \\ x_3(t - \tau_2) \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ \beta_2 \end{bmatrix} \quad (35)$$

$$\begin{bmatrix} \dot{y}_1(t) \\ \dot{y}_2(t) \\ \dot{y}_3(t) \end{bmatrix} = \begin{bmatrix} 0 & -1 & -1 \\ 1 & \beta_1 & 0 \\ y_3(t) & 0 & y_1(t) - \gamma \end{bmatrix} \begin{bmatrix} y_1(t) \\ y_2(t) \\ y_3(t) \end{bmatrix} + \begin{bmatrix} a_1 & a_2 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} y_1(t - \tau_1) \\ y_2(t - \tau_2) \\ y_3(t - \tau_2) \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ \beta_2 \end{bmatrix} - \begin{bmatrix} u_1(t) \\ u_2(t) \\ u_3(t) \end{bmatrix} \quad (36)$$

The values  $\tau_1$ ,  $\tau_2$  and  $\tau_3$  are delay parameters of the system.



According to data provided by the design of the control input Theorem 1 in [13], obtained control values as follows:-

$$u(t) = \begin{bmatrix} \zeta_1 & 0 & -1 + x_3(t) \\ 0 & \zeta_2 & 0 \\ 0 & 0 & \zeta_3 \end{bmatrix} \begin{bmatrix} e_1(t) \\ e_2(t) \\ e_3(t) \end{bmatrix} \quad (37)$$

The system error equation is obtained as follows:-

$$\begin{bmatrix} \dot{e}_1(t) \\ \dot{e}_2(t) \\ \dot{e}_3(t) \end{bmatrix} = \begin{bmatrix} \zeta_1 & -1 & -x_3(t) \\ 1 & \beta_1 - \zeta_2 & 0 \\ x_3(t) & 0 & y_1(t) - \zeta_3 - \gamma \end{bmatrix} \begin{bmatrix} e_1(t) \\ e_2(t) \\ e_3(t) \end{bmatrix} + \begin{bmatrix} a_1 & a_2 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} e_1(t - \tau_1) \\ e_2(t - \tau_2) \\ e_3(t - \tau_2) \end{bmatrix} \quad (38)$$

According to Theorem 1 in [14] system error dynamic equations for asymptotic stability will be making the following conditions.

$$\begin{cases} -\zeta_1 + 2|a_1| + |a_2| < 0 \\ \beta_1 - \zeta_2 + |a_2| < 0 \\ y_1(t) - \gamma - \zeta_3 < 0 \end{cases} \quad (39)$$

The initial values for the simulation are as follows:-

$$a_1 = 0.2, a_2 = 0.5, \beta_1 = 0.2, \beta_2 = 0.2, \gamma = 5.7, \tau_1 = 0.2, \tau_2 = 0.1, \zeta_1 = 1, \zeta_2 = 1, \zeta_3 = y_1(t) \\ [x_1(0) \ x_2(0) \ x_3(0)] = [-2 \ -4 \ 10], [y_1(0) \ y_2(0) \ y_3(0)] = [1 \ 2 \ 1]$$

Figures (13) to (16) show  $x_1$ -  $y_1$ ,  $x_2$ -  $y_2$ ,  $x_3$ -  $y_3$  and error  $e_1, e_2$  and  $e_3$  respectively [15].

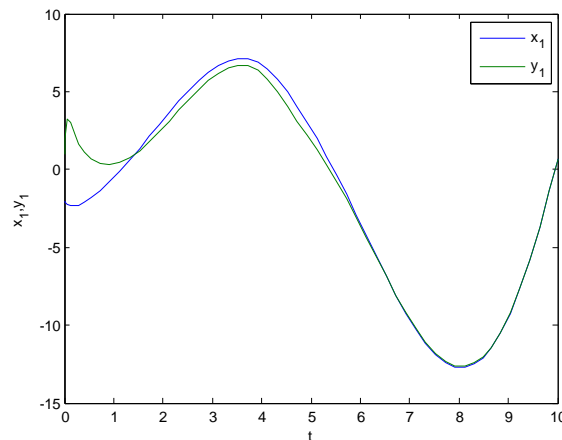


Figure 13:-  $x_1$ -  $y_1$

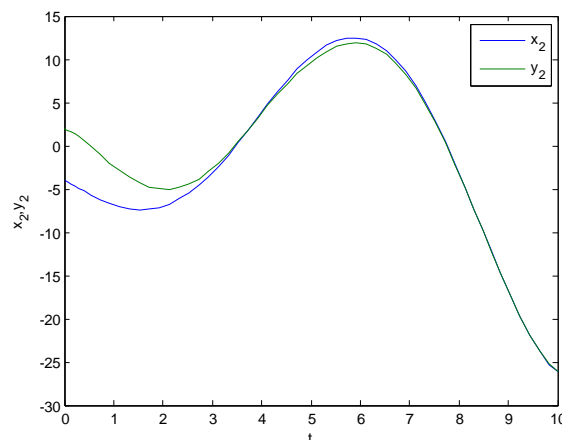
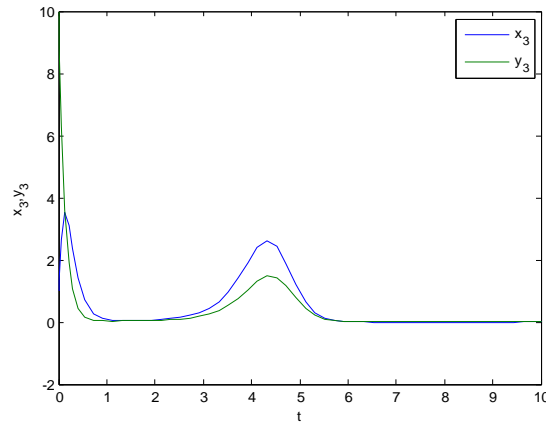
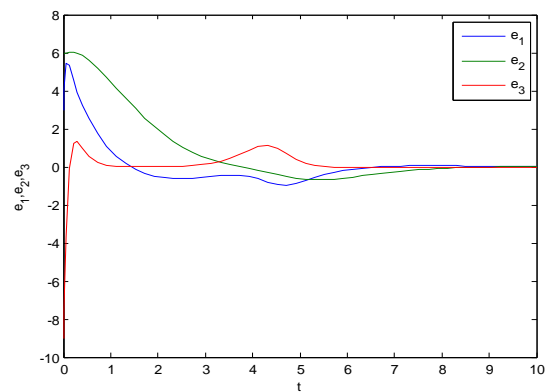


Figure 14:-  $x_2$ -  $y_2$

Figure 15:- $x_3$ -  $y_3$ Figure 16:- errors  $e_1$  and  $e_2$  and  $e_3$ **linear method Details:-**

In this method, the synchronization of one state concludes synchronization of all other states. Integrated system is considered with the following equations:

$$\begin{cases} \dot{x}_1 = (25\theta + 10)(y_1 - x_1) \\ \dot{y}_1 = (28 - 35\theta)x_1 - x_1z_1 + (29\theta - 1)y_1 \\ \dot{z}_1 = x_1y_1 - \frac{8+\theta}{3}z_1 \end{cases} \quad (40)$$

The system will be up for  $\theta = 0$ ,  $\theta = 0.8$  and  $\theta = 1$ , respectively Lorenz chaotic system, Lu and Chen.

Considering the equation (40) as the actuator and the equation (41) as the system's response:

$$\begin{cases} \dot{x}_2 = (25\theta + 10)(y_2 - x_2) \\ \dot{y}_2 = (28 - 35\theta)x_2 - x_2z_2 + (29\theta - 1)y_2 + u \\ \dot{z}_2 = x_2y_2 - \frac{8+\theta}{3}z_2 \end{cases} \quad (41)$$

The error for the system is defined:

$$e_1 = x_2 - x_1, e_2 = y_2 - y_1, e_3 = z_2 - z_1 \quad (42)$$

Error dynamic equations will be obtained as follows:

$$\begin{cases} \dot{e}_1 = (25\theta + 10)(e_2 - e_1) \\ \dot{e}_2 = (28 - 35\theta)e_1 + (29\theta - 1)e_2 - e_1e_3 - z_1e_1 - x_1e_3 + u \\ \dot{e}_3 = e_1e_2 + x_1e_2 + y_1e_1 - \frac{8+\theta}{3}e_3 \end{cases} \quad (43)$$

So that the control vector  $u$  we is chosen as a linear Relationship:-

$$u = (35\theta - 28)e_1 - 29\theta e_2 + e_1 e_3 + z_1 e_1 + x_1 e_3 \quad (44)$$

$$\dot{e}_2 = e_2 \quad (45)$$

According to Theorem 1 in [13]. Implementation wishes to simulate this technique to the Lorenz system as follows:-

$$\begin{cases} \dot{e}_1 = 10(e_2 - e_1) \\ \dot{e}_2 = 28e_1 - 1e_2 - e_1 e_3 - z_1 e_1 - x_1 e_3 + u \\ \dot{e}_3 = e_1 e_2 + x_1 e_2 + y_1 e_1 - \frac{8}{3}e_3 \end{cases} \quad (46)$$

$$u = -28e_1 + e_1 e_3 + z_1 e_1 + x_1 e_3 \quad (47)$$

The initial values for the simulation are as Follows:-

$$\begin{aligned} [x_1(0) \quad y_1(0) \quad z_1(0)] &= [10 \quad 10 \quad 10] \\ [e_1(0) \quad e_2(0) \quad e_3(0)] &= [-5 \quad -10 \quad 10] \end{aligned}$$

Figure (17) to (20) show  $x_1 - x_2$ ,  $y_1 - y_2$ ,  $z_1 - z_2$  and errors  $e_1$ ,  $e_2$  and  $e_3$  respectively [15].

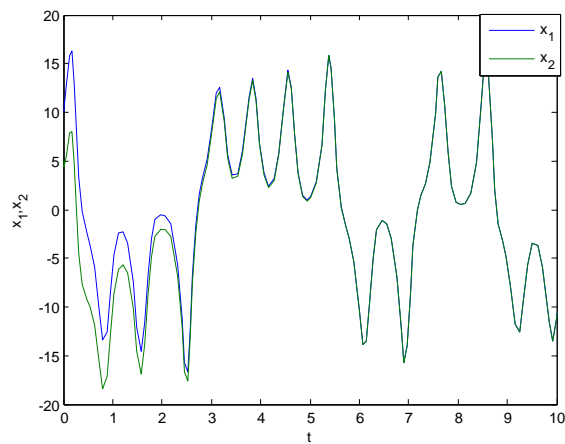


Figure 17:- for  $x_1 - x_2$

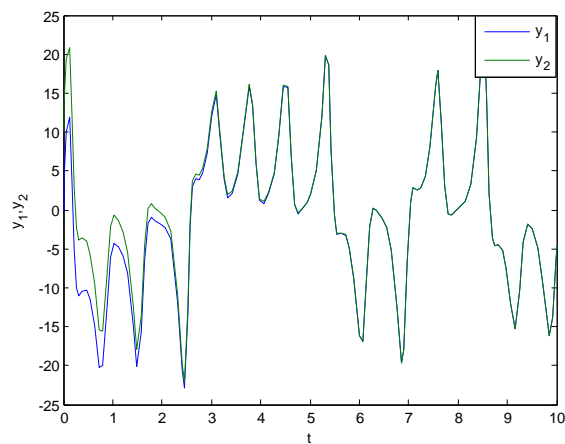
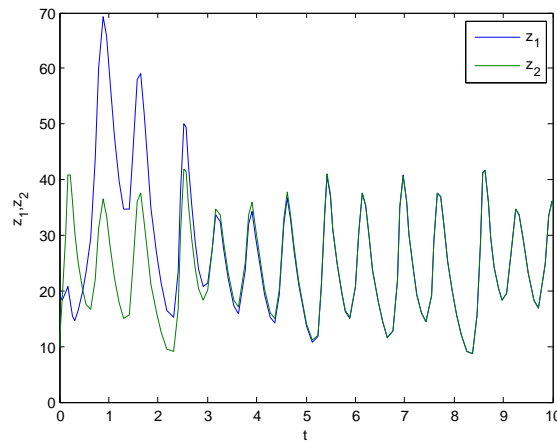
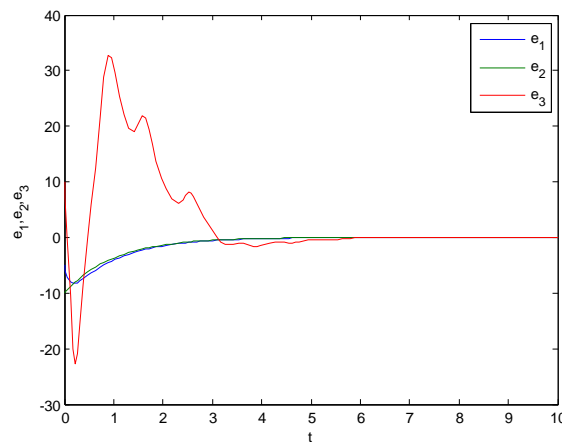


Figure 18:-  $y_1 - y_2$

Figure 19:- $z_1-z_2$ Figure 20:- errors  $e_1$  and  $e_2$  and  $e_3$ 

### Conclusion:-

In this paper we dealt with the history of chaos, chaos theory and synchronization of chaotic systems. Synchronization methods used in this paper are Active control, backstopping control, adaptive control, partial linearization matrix method, which is based on synchronization systems with a delay. All these methods are based on Lyapunov theory.

SIMULINK environment of MATLAB software has been utilized for simulation of synchronization of chaos systems. The methods designed for easy synchronization of chaotic systems introduce suitable methods for synchronization of delayed chaotic systems, with simple calculations, and no need to calculations of Lyapunov function for stability in contrast to the classical methods.

### References:-

1. S Wiggins, [BOOK] Introduction to applied nonlinear dynamical systems and chaos, 2003
2. Wilfrid Perruquetti, Jean-Pierre barbot [Book] Chaos in Automatic Control, 2005
3. Herve Dedieu, peter kennedy, martin hasler, Chaos shift Keying; Modulation and Demodulation of a Chaotic Carrier Using Self-synchronizing Chua's Circuits, IEEE Transactions on Circuits and Systems (1993) 634–643.
4. T.L. Carroll, L.M. Pecora, Synchronizing chaotic circuits, IEEE Transactions on Circuits and Systems 38 (4) (1991) 453–456.
5. G. Grassi, S. Mascolo, Nonlinear observer design to synchronize hyperchaotic systems via a scalar signal, IEEE Transactions on Circuits and Systems Fundamental Theory and Applications 44 (10) (1997) 1011–1014.
6. Alligood Kathleen T, Sauer Tim D and Yorke James A, (1996) "Chaos : An Introduction to Dynamical System", p.359-362.

7. Yue Wu, Xiaobing Zhou, Jia Chen, BeiHui, "Chaos synchronization of a new 3D chaotic system", *Chaos, Solitons and Fractals* 42 (2009) 1812–1819.
8. Sahab, A.R. and M. Haddad Zarif, *Chaos Control in Nonlinear Systems Using the Generalized Backstepping Method*, *American J. of Engineering and Applied Sciences* 1 (4): 378-383, 2008.
9. Wenjuan Wu, Zengqiang Chen, Zhuzhi Yuan, The evolution of a novel four-dimensional autonomous system: Among 3-torus, limit cycle, 2-torus, chaos and hyperchaos, *Chaos, Solitons and Fractals* 39 (2009) 2340–2356.
10. Giuseppe Grassi , Damon A. Miller , "Synchronizing chaotic systems up to an arbitrary scaling matrix via a single signal", *Applied Mathematics and Computation* 218 (2012) 6118–6124
11. Ling-Dong Zhao a,b, Jian-Bing Hu b,n, Jian-An Fang a, Wen-Xia Cui a, Yu-Long Xu a, Xin Wang a, "Adaptive synchronization and parameter identification of chaotic system with unknown parameters and mixed delays based on a special matrix structure" ,*ISA Transactions* 52 (2013) 738–743.
12. Ali Reza Sahab and Mohammad Haddad Zarif, *Improve Backstepping Method to GBM*, *World Applied Sciences Journal* 6 (10): 1399-1403, 2009.
13. Chun-Lai Li , Jian-Bin Xiong,, Wen Li, "A new hyperchaotic system and its generalized synchronization" ,*Optik* 125 (2014) 575– 579.
14. Jianbing Hu, Lingdong Zhao, ZhenguangXie, "Control and synchronizing nonlinear systems with delay based on a special matrix structure", *Commun Nonlinear SciNumerSimulat* 19 (2014) 1072–1078.
15. Yongguang Yu, Han-Xiong Li, JianDuan, "Chaos synchronization of a unified chaotic system via partial linearization", *Chaos, Solitons and Fractals* 41 (2009) 457–463.
16. Hu JB, Han Y, Zhao LD. Synchronizing chaotic systems using control based on a special matrix structure and extending to fractional chaotic systems *Commun Nonlinear SciNumerSimul* 2010;15:115–23.

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### REVIEW ARTICLE

#### A BRIEF REVIEW ON SAFETY SIGNAL MANAGEMENT PROCESS

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#### Abstract

The field of pharmacovigilance (or drug safety surveillance) has evolved significantly over the last few years. Important utility of pharmacovigilance is detection and dissemination of signal. It has power to prevent the epidemics of serious adverse drug reaction before damage to community. The historical medical calamities (e.g. thalidomide tragedy) could have been prevented if process like signal detection and pharmacovigilance would have been practiced since that time. Post-marketing detection and surveillance of potential safety hazards are crucial tasks in pharmacovigilance. To disclose such safety risks, a wide set of techniques has been developed for spontaneous reporting data and, more recently, for longitudinal data. This paper gives a broad overview of the signal detection process and introduces some types of data sources mostly used.

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#### Introduction:

All drugs are capable of producing side effect or adverse effect. Benefit risk profile of drug is made before releasing drug into the market and on the basis of this profile it is decided whether to use or not to use drug in patient. All adverse effects are not disclosed during clinical trials as there are some limitations like limited number of patients, subjects having single disease, specific population (children, elderly and pregnant women being excluded), small sample size (detection of rare adverse effect is difficult), shorter duration of a trial (limits the detection of long term adverse effects), inability to detect ADRs under real life situations (drug interaction, drug food interactions etc.). These drawbacks are overcome by post marketing surveillance. Pharmacovigilance is mainly the phase 4 of the clinical trials.<sup>1</sup> The thalidomide tragedy marked a turning point in toxicity testing, as it prompted United States and international regulatory agencies to develop systematic toxicity testing protocols and give rise to a development of a system for early detection of unknown adverse events of medicines.<sup>2</sup> The World Health Organization (WHO) defines Pharmacovigilance as a science related to the detection, assessment, understanding and prevention of adverse reactions towards a medicinal product or any other medicine related problems in human beings.<sup>3</sup> The main aim of pharmacovigilance is continuous review of all reported drug-drug related events which are serious or unexpected.<sup>4</sup> In accordance with data of European Commission (EC), adverse drug reaction (ADRs) are responsible for 5% of all hospital admissions, 5% of all patients in hospital experience an ADR and lastly ADRs cause minimum of 1.91 extra days of hospitalization. In United States (US), more than 100,000 deaths annually are because of ADRs. Hence, this scenario itself makes clear the importance of pharmacovigilance (PV).<sup>5</sup> Pharmacovigilance – an umbrella term used to describe the processes for monitoring and evaluating ADRs – is a key component of effective drug regulation systems, clinical practice and public health programmes.<sup>6</sup>

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**What is safety signal?**

One of the most important activities of pharmacovigilance is signal detection. Taken together, adverse drug reactions (ADRs) impose an enormous burden on society, causing hundreds of thousands of deaths annually at a cost of several billion \$US.<sup>7,8</sup> A signal in pharmacovigilance is not only a statistical association. It consists of a hypothesis together with data and arguments, which may be in favour or against these arguments. These relate to numbers of cases, statistics, clinical medicine, pharmacology (kinetics, actions, previous knowledge) and epidemiology, and may also refer to findings with an experimental character. Council for International Organizations of Medical Sciences (CIOMS), defines a safety signal as “information that arises from one or multiple sources (including observations or experiments), which suggests a new, potentially causal association, or a new aspect of a known association between an intervention [e.g., administration of a medicine] and an event or set of related events, either adverse or beneficial, that is judged to be of sufficient likelihood to justify verificatory action.” The information must be suggestive of something new so that after further investigation it can suggest that the association may or may not be confirmed. An example of a “new aspect of a known association” would be refinement of an existing safety signal by identifying subgroups of individuals who may be at greater risk. It can be explained by an example. An oncology drug associated with a characteristic cardiomyopathy identified by small number of spontaneous reports. To gather more information ongoing surveillance initiated which gives the information that risk is especially high in pediatric patients or patient’s previously treated with radiation to the chest region.<sup>9</sup> A signal in pharmacovigilance is more than just a statistical association. It consists of a hypothesis together with data and arguments, arguments in favor and against the hypothesis. These relate to numbers of cases, statistics, clinical medicine, pharmacology (kinetics, actions, previous knowledge) and epidemiology, and may also refer to findings with an experimental character.<sup>10</sup> In simple terms we can say signal is an important navigator of the consequences of the medicinal products. Signal not always be a safety concern sometimes it could be a probable beneficial effect of drug.

**Need for signal detection:**

- Provide early warning for new serious adverse events of new drugs. The detection of a previously unknown safety issue can have great impact on the overall benefit–risk balance of a drug as evidenced for example by the market withdrawal of Rofecoxib upon the detection of its increased myocardial infarction risk.
- To update the risk management system and monitor pharmacovigilance data to determine whether there are new risks or whether risks have changed or whether there are changes to the benefit-risk balance of medicinal products and then reduces risks of costly failures by early detection of ADRs.
- It is a regulatory requirement for all Marketing Authorization Holders.
- Regulatory actions

**Signal management process:**

The signal management process can be defined as the set of activities performed to determine whether, based on an examination of individual case safety reports (ICSRs), aggregated data from active surveillance systems or studies, literature information or other data sources, there are new risks associated with an active substance or a medicinal product or whether risks have changed.<sup>10</sup>

The steps involved in this process are signal detection, signal validation, signal prioritization, signal assessment and recommendation for action.

**Signal detection:**

Signal detection is a process of identifying a signal from different data sources.

**Potential Sources of Data for Signal Management<sup>11</sup>**

- Regulatory Authority reports (e.g. Anonymised Single Patient Reports)
- Clinical Trials Serious adverse events
- Post-marketing reports (to MAH)
- clinical trials, post-authorization studies, registries, post-authorization named-patient use programmes, other patient support and disease management programmes, surveys of patients or healthcare providers
- Medical and scientific literature
- Non-interventional studies e.g. marketing projects
- Post-authorization safety studies
- Medical and scientific literature

- Product quality complaints associated with adverse events
- Medical enquiries
- Periodic Safety Update Reports (PSURs)
- Regulatory databases (e.g FDA AERS, MHRA drug analysis prints [DAPs] / product analysis prints [PAPs])
- Other databases (e.g WHO Vigibase)

**Databases that can be used for signal detection in post-authorization drug safety surveillance:<sup>12</sup>**

- Yellow Card scheme in the UK
- Eudravigilance (EMA)
- Adverse Event Reporting System (AERS /FAERS) used by the Food and Drug Administration (FDA) in the USA,
- World Health Organization (WHO) International Database maintained at Uppsala Monitoring Center (UMC) in Uppsala, Sweden.
- Italian spontaneous reporting database
- Dutch spontaneous reporting to the Lareb PV centre in the Netherlands
- Drug Safety Research Unit (UK)
- Intensive Medicines Monitoring Program (New Zealand)
- Other programmes:
- Vaccine Safety Datalink (VSD)
- Sentinel Initiative
- Observational Medical Outcomes Partnership (OMOP)
- IMI-PROTECT Project

**Methods for signal Detection:**

**Traditional method:** This method also known as qualitative method and involve review of ICSRs. This method is generally applies when data set is small.

**Data mining techniques:** This method is also known as quantitative method. It is generally based on statistical analysis. These methods are usually applied to a broad range of combinations of drug exposures and subsequent adverse events, often without limiting the search to pre-defined drug classes or specific medical conditions. They can be regarded as a broad search over the whole spectrum of drug-event combinations (DECs) in the underlying dataset.<sup>13</sup>

**Surveillance method:** Surveillance techniques have been developed to consolidate knowledge on these already suspected DECs and are often applied after the first data-mining step.<sup>14</sup>

**Statistical methods:<sup>14</sup>****Bayesian approach.**

- Multi-item Gamma Poisson Shrinker (MGPS)
- Bayesian Confidence Propagation Neural network

**Frequentist Approach:**

- Reporting Odds Ratio (ROR)
- Proportional Reporting Ratio (PRR)

Frequentist or classical methods are particularly appealing and therefore widely used due to the fact that they are relatively easy to understand, interpret and compute as they are based on the same principles of calculation using the 2x2 table. (Table 1)



**Table 1:-** Formal 2x2 contingency table

	Drug of interest	All other drug in the database	Total
Adverse drug reaction of interest	A	B	A+B
All other adverse drug reaction	C	D	C+D
Total	A+C	B+D	A+B+C+D

A= number of reports containing both the suspect drug and the suspect adverse drug reaction

B= number of reports containing the suspect adverse drug reaction with other medications (except the drug of interest)

C= number of reports containing the suspect drug with other adverse drug reactions (except the event of interest)

D= number of reports containing other medications and other adverse drug reactions

### Signal Validation:<sup>15</sup>

Signal validation is the process of evaluating the data supporting the detected signal in order to verify that the available documentation contains sufficient evidence demonstrating the existence of a new potentially causal association or a new aspect of a known association, and therefore justifies further analysis.

Following factors are considered during validation of signal:

- Clinical relevance including: strength of evidence for a causal effect (e.g. number of reports, exposure, temporal association, plausible mechanism, de/re-challenge, alternative explanation/confounders), seriousness and severity of the reaction and its outcome, novelty of the reaction (e.g. new and serious adverse reactions); drug-drug interactions; reactions occurring in special populations.
- Previous awareness: the extent to which information is already included in the summary of product characteristics (SmPC) or patient leaflet; whether the association has already been assessed in a PSUR or RMP, or was discussed at the level of a scientific committee or has been subject to a regulatory procedure.

### Signal Prioritization:<sup>15</sup>

#### Two methods for signal Prioritization:

##### WHO-Triage:

The aim of this adjudication process is the identification of those signals that are likely to indicate a yet-unidentified safety hazard, and the elimination of false-positives from the results (are already known and well documented; (b) occur very seldom or (c) are highly implausible from a medical perspective and thus can be regarded as artificial false-positive signals.).

After having reduced the number of potential signals by mere technical restrictions, the remainders need to be assessed on a qualitative level. A common step is to exclude—automatically if possible—all known and well-documented risks and to focus on the unknown or unexpected identified signals. The exact layout of this part of the triage highly depends on a number of factors, including the underlying data structure, the signal detection method used and personnel resources, as in-depth medical and pharmacological knowledge is necessary.

Once the triage is completed, the safety risk of every remaining signal needs to be rated to decide whether (a) impact analyses and subsequent confirmatory analyses need to be induced; (b) the signal should be monitored to sharpen the risk profile or (c) the signal can be discarded because of low potential risk.

### MHRA-Impact analysis:<sup>16</sup>

A new method of prioritizing signals of potential adverse drug reactions (ADRs) detected from spontaneous reports that is called impact analysis. This is an interim step between signal detection and detailed signal evaluation. Using mathematical screening tools, large numbers of signals may now be detected from spontaneous ADR databases. Regulatory authorities need to rapidly priorities them and focus on those that are most likely to require significant action. Using two scores ranging from 1 to 100, each with three input variables, signals may be categorized in terms of the strength of evidence (E) and the potential public health impact (P). In a two-by-two figure with empirically derived cut-off points of ten (the logarithmic mean) for each score, signals are placed in one of four categories (A-D) that are ranked according to their priority (A being the highest and D the lowest). A sensitivity analysis is then performed that tests the robustness of the categorization in relation to each of the six input variables.

**Signal Assessment:**<sup>14</sup>

The assessment of signals is done in terms of various factors. First, the data in the report(s) need to be of good quality when a signal of a new adverse drug reaction is considered. There should be sufficient data to fully assess the relationship of the drug to the event.

The subjective assessment of the quality of the reports is mainly based on the patient and drug information. Patient information includes completeness of information with- patient initials, age, sex, date of birth (DOB), weight, diagnosis for which the medications were being taken, relevant history, adverse event description, adequate description of the event, when did the event occur? When did the event subside? How the event was managed? What was the outcome? Whether the event abated on stopping the drug or reducing the dose of the drug? Whether the event reappeared on reintroduction? Any supportive laboratory data? Drug information includes suspected medication with their brand name and/or generic name, labeled strength, manufacture, dose used, frequency of use, route used and therapy dates, concomitant medications including self medication and herbal remedies etc.

**Cause and Effect Analysis:**

The most commonly used methods are WHO-UMC causality categories and Naranjo's Probability Scale.

This method gives guidance to the general arguments which should be used to select one category over another as shown in Table 2.

**Table 2:- WHO-UMC causality categories**<sup>17</sup>

Categories	Time sequence	Other drug/Disease ruled out	Dechallenge	Rechallenge
Certain	Yes	Yes	Yes	Yes
Probable	Yes	Yes	Yes	No
Possible	Yes	No	No	No
Unlikely	No	No	No	No

**Naranjo's Probability Scale:**<sup>17</sup>

Naranjo's probability scale is the most commonly used causality assessment method, which has gained popularity among clinicians because of its simplicity. It is a structured, transparent, consistent and easy to apply assessment method. The Naranjo's criteria classifies the probability that an adverse event is related to the drug therapy based on a list of weighted questions, which examine factors such as the temporal association of drug administration and event occurrence, alternative causes for the event, drug levels, dose – response relationships and previous patient experience with the medication. The ADR is assigned to a probability category from the total score as follows: definite if the overall score is 9 or greater, probable for a score of 5-8, possible for 1-4 and doubtful if the score is 0.

Drugs are evaluated individually for causality, and points are deducted if another factor may have resulted in the adverse event, thereby weakening the causal association.<sup>18</sup>

**Recommendation for action:**<sup>15</sup>

The recommendation for action may include a request for:

- Immediate measures including the possibility of suspending the marketing authorization of the medicinal product;
- Additional information to be provided by the marketing authorization holder, e.g. in order to confirm if a conclusion is valid for all indications and patient groups;
- Periodic review of the signal, for example through PSURs
- Additional investigations or risk minimization activities;
- An update of the product information through a regulatory procedure;
- Conduct of a post-authorization safety study

**Conclusion:**

Pharmacovigilance is not only restricted to collecting the ADR data but also to extract the signal to prevent the investible medical disaster and harm to patients. The proper signal detection and their assessment is the most important aspect in pharmacovigilance. Various methods are used for the detection of signals. Signals in

pharmacovigilance have a variety of sources. Pharmacovigilance may not rely upon one single method, but needs a strategy of complementary activities. Further development of statistical methods and technological solutions to analyze large amounts of data to detect signals for potential safety issues, while minimizing noise, would enhance the efficiency and effectiveness of pharmacovigilance activities.

### References:-

1. Edwards IR (2000). The accelerating need for pharmacovigilance. *J R Coll Physicians Lond*; 34 (1): 48-51.
2. Meyboom RH, Egbert AC, Edward R, Hekster YA, Koning FH and Gribnau FWJ (1997). Principle of signal detection in pharmacovigilance. *Drug safety*. 16 (6): 355-365.
3. World Health Organization (2002). The Importance of Pharmacovigilance: Safety Monitoring of Medicinal Products. Geneva: WHO.
4. Pandey SK, Rastogi R and Gamperl HJ (2014). Comparative study of Pharmacovigilance Guidelines of European union and Asia pacific. *Asian journal of Pharmacology and toxicology*, 2015; 03 (11),: 1-6.
5. Khurana A, Rastogi R and Gamperl HJ A new era of drug safety – new eu pharmacovigilance (pv) legislation and comparison of pv in eu, us and india. 6 (7): 15-21.
6. Bihan A, Pandey R, Srivastava A, Joshi J, Rastogi R, Gamperl HJ (2014). Challenges in drug safety: a review. *IJPRD*.6(07): 6-12
7. Lazarou J, Pomeranz BH, Corey PN (1998). Incidence of adverse drug reactions in hospitalized patients: a meta- analysis of prospective studies. *J Am Med Assoc*. 279(15):1200–5.
8. Pirmohamed M, James S, Meakin S, Green C, Scott AK, Walley TJ, et al (2004). Adverse drug reactions as cause of admission to hospital: prospective analysis of 18,820 patients. *Br Med J*. 329(7456):15–9.
9. What is safety signal. Pfizer Inc 2011.
10. Meyboom RH, Hekster YA, Egberts AC, Gribnau FW, Edwards IR (1997). Causal or casual? The role of causality assessment in pharmacovigilance. *Drug Safety*. 1997; 17: 374-389.
11. PIPA Guidelines for Signal Management for Small and Medium Sized Pharmaceutical Companies. 2012.
12. Atsuko Shibata and Manfred Hauben (2011). Pharmacovigilance, Signal Detection and Signal Intelligence Overview. 14th International Conference on Information Fusion Chicago, Illinois, USA, July 5-8, 2011
13. Chandel S, Jain Nidhi, Joshi A, Sonawane R, Sharma A (2014). Signal Detection - An Imperative Activity of Pharmacovigilance. *Int. J. Pharm. Sci. Rev. Res*. 28(2): 95-100.
14. Suling M and Pigeot I (2012). Signal Detection and Monitoring Based on Longitudinal Healthcare Data. *Pharmaceutics*. 4: 607-640.
15. Agency EM (2012). Guideline on good pharmacovigilance practices (GVP).
16. Waller P, Heeley E, Moseley J (2005). Impact Analysis of Signals Detected from Spontaneous Adverse Drug Reaction Reporting Data. *Drug Safety*. 28(10): 843-850.
17. Hire RC. , Kinage PJ, Gaikwad NN (2013). Causality Assessment in Pharmacovigilance: A Step Towards Quality Care. *Sch. J. App. Med. Sci*.1(5):386-392
18. Honig PK (2013). Advancing the science of pharmacovigilance. *Clin Pharmacol Ther*. 93: 474-75.



## RESEARCH ARTICLE

### DESIGNING AN INTERACTIVE EDUCATIONAL WEBSITE USING ASP.NET.

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#### Abstract

The present work describes a website designed for remote teaching, it enables the students to view the lessons and also test themselves after each lesson they view, they can get benefit from the useful articles uploaded to the page also can ask question and get answers. Distance learning is beneficial for eliminating time and money spent related to student travel and allowed Outreach College students access to adept instructors regardless of physical locale.

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#### Introduction:-

A dramatic increase in the development of technology-based teaching and learning has been witnessed in the past decade. Many universities and corporations started rethinking the design and implementation of the learning systems [1]. To take advantage from the emergence of the Internet, it provides an inexpensive and flexible infrastructure that can greatly enhance the communication among distance learning system and students. The rapidly increasing expansion of the Internet has brought dramatic impact to one's life and education alike. Distance learning differentiates from the traditional learning in its ability to train anyone, anytime, and anywhere attributed to the openness of the Internet. Without the temporal and spatial limitation, one can have an independent and individual learning space.

Recent advances in the Web have rapidly changed our life in various ways. These advances provide new ways for people to communicate on a global scale and assess vast amounts of information. The Web provides educators with opportunities to implement a range of new teaching and learning practices, which redefine classroom- learning experiences. The Web enables a so-called WBI (Web-Based Instruction) system as a teaching aid. The WBI system, which integrates a hypertext information network with communication and collaborative tools, presents two important innovative features: first, it provides specific tools to manipulate the multimedia information contents of the Web pages; second, authorized users can modify the information network in the system [2],[3],[4]. In the end, education projects are developed because of the learner. Projects are developed because we want participants to gain specific knowledge and skills. Education projects are developed to promote public safety and the development of environmental and scientific literacy.

Each student has different cognitive abilities [5]. In [6]; [7]; [8]; [9]; [10] those problems can be overcome with the use of adaptive learning system. Many studies have been conducted on adaptive learning. Among them, studies that provide the most universal method of adaptability offer courseware by considering learner styles [11]; [12]; [13]; [14]; [15]; [16]; [17]. However, there are also theories that assert that a learning strategy created according to either a task or content is much more effective than the learning style [18]; [19]; [20]. It is thus necessary to provide adaptability according to the learning content along with the learning style [21].

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Careful attention to the design and implementation of an education project will be reflected in learner outcomes [22]. As a result of rapid improvements in both computer and Internet technologies, features and functions of e-learning systems have been improved. It has also become easier to access online lesson content and interactive, electronic applications or tools from any-where, at anytime. At this point, internet and the related technologies have an important role to play in all of these improvements and changes [23]

## Methods And Techniques:-

### Design Structure of the Educational Web Page:-

In this project the educational website designed using ASP.NET. ASP.NET (Active Server Page) is an open source web framework for building modern web applications and services [24]. With ASP.NET you can quickly create web sites based on HTML, CSS and JavaScript etc., scale them to millions of users and easily add more complex capabilities like Web APIs, forms over data or real time communications [25]. In this project the web page system corresponds to web interfaces and tools that are included in the system and provided to administrators, teachers, or student according to their role in connection with the system. There are three different types of user: administrators, students, and teachers. In order to log into the system, all of these users must make their registrations and type their usernames and passwords on the login page of the system. In order to save information the database very important for the web page here we used SQL server. Database contains administrators, teachers and students information and also consists of all materials related to education in addition to dates and results of quizzes and exams which the students submitted.

### Role of Each Group:-

As we mentioned before three kinds of user groups will use this website, administrator, teachers, and student. The administrator the only user who can view and control the overall the page as well as can make changes for example add or remove lessons delete unwanted contacts and also control the blog and give permission to view or not view the messages.

The teachers can view the students progress reports these reports contain the information of the lessons the students had viewed and can see how long they viewed the lessons, teachers also can view the quiz results that the students had submit.

The users under the student category can make their registration and view the lessons submit to quizzes and exams and also can view the results of all the quizzes that they had.

There will be a communication among these groups by sending mail messages to each other by this way the students can ask questions and get answers besides there is a discussion forum where the users can discuss any case about the subjects and lessons so that they can get benefit and knowledge from each other's experience.

### Database Tables Design:-

A database is a collection of information that is organized so that it can easily be accessed, managed, and updated [26]. This educational web based system registration, member's information, lessons, quiz and exams marks, useful documents and other effective tables have been created, the design and the use of these tables explained as follow:

### Lessons Table:-

This table contains the lesson name and a brief explanation of the subject so that if the student wanted to watch the lesson is going to just click on the lesson names that have been choose.


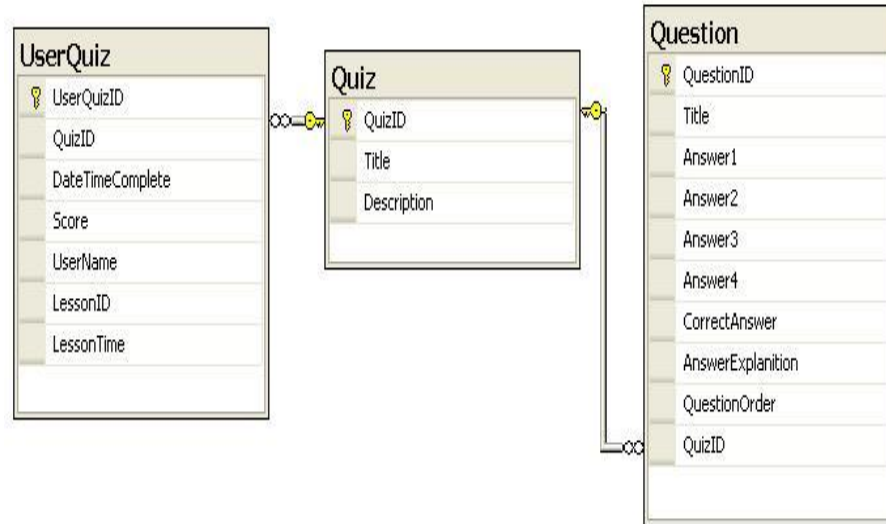
Lesson	
	LessonID
	Title
	Description

Fig.1:- Lesson Table

**Questions ,Quiz, and User Quiz Tables:-**

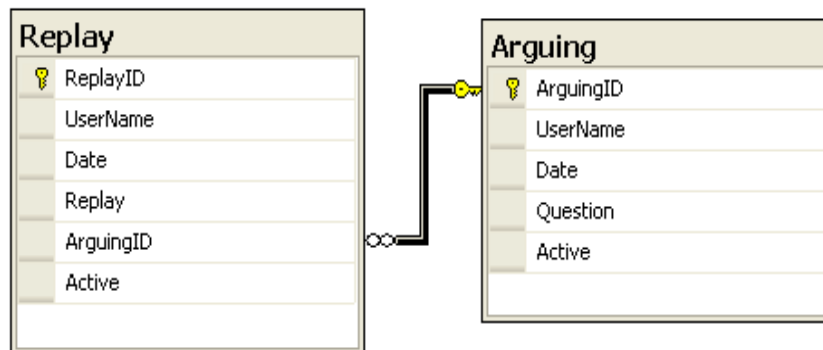
The students whom watching the lessons their performance and success evaluation is required for this purpose some exams and tests performed to serve this case, and all these data saves in the database as well as the information concerning the exam questions and answers and also the date that submitted is saved in these tables.



**Fig.2:-** Questions ,quiz, and UseQuiz tables

**Forum Tables:-**

This section contains two groups of tables. Arguing and replying table, these tables register all information about the questions, Answers, the name of the person who asked or answered the question and their date. The forum section is controlled by the administrator all questions and answers in any discussion waits for confirmation from the administrator of the page, the administrator will put 1 to activate or 0 to discard any unwanted question or answer, the table is shown in fig.3



**Fig.3:-** Arguing and Reply Tables

**Announcement Table:-**

In this table the announcement and it's date is saved, also this table is controlled by the administrator who can show the announcement by making the active field 1 or to hide the announcement by making it 0 . This table shown in Fig.5


Announcement	
	ID
	Detail
	Active
	Date

Fig.5:- Announcement Table

**Useful Materials, Navigation and Documents Tables:-**

Useful links and documents such as books, papers ...etc can be added to the web page by the administrator and will be saved in the database, these tables shown in Fig.6 and Fig.7.


Documanet	
	ID
	Title
	Description

Fig 6:- Navigation Table


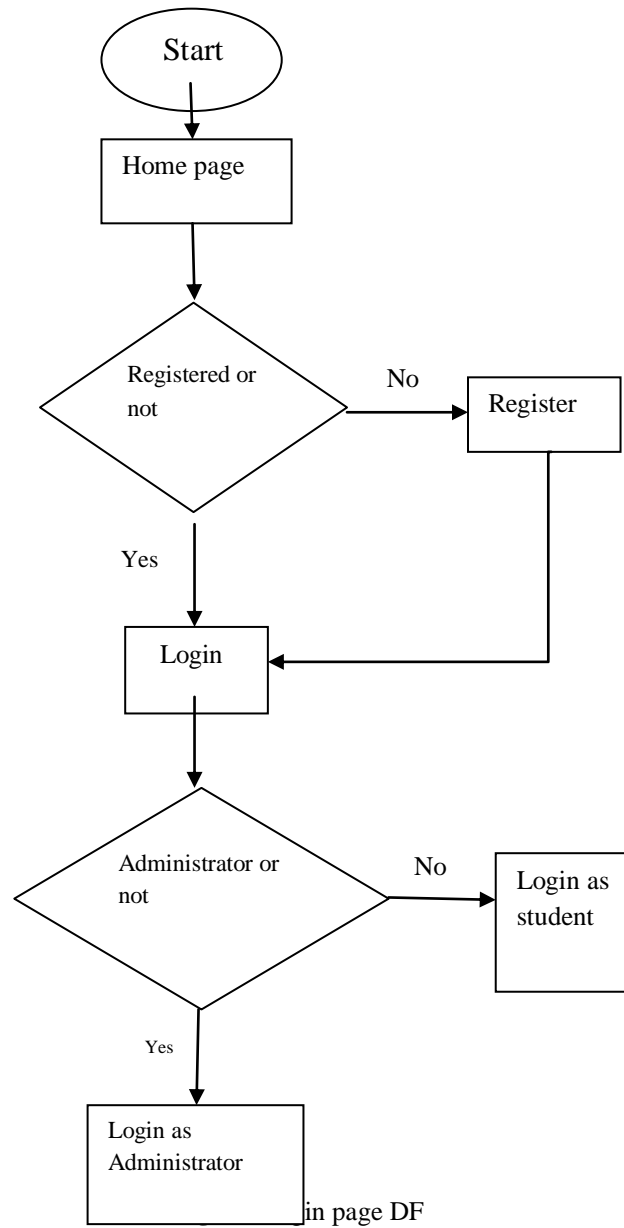
Navigation	
	ID
	Title
	Description

Fig.7:- Document Table

**The Dataflow Diagram of The Designed Website:-****Login Page Dataflow Diagram:-**

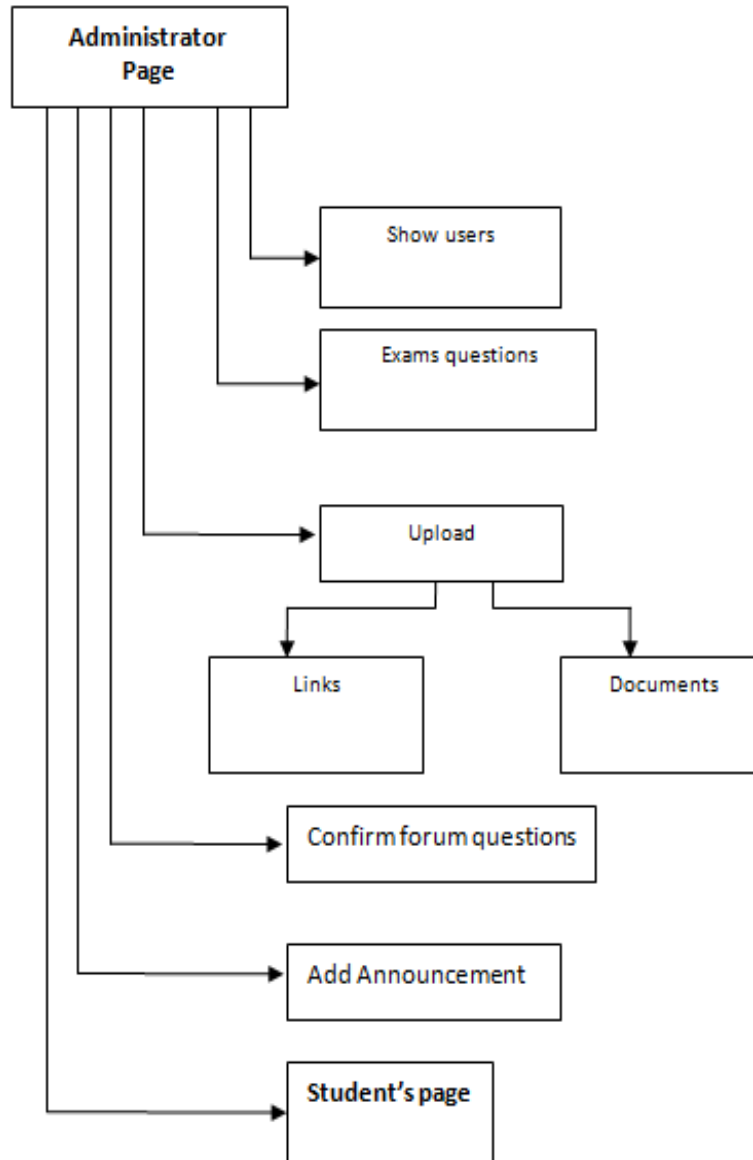
Any use wants to use this web page must register first, if the user was administrator so the website will show the administrator page, for the students the student page will be shown. Fig.8 shows this action.



#### Administrator Page Dataflow Diagram:-

After the administrator login process, the system automatically directs administrators the Admin user interface. The Admin page has been developed similar to the design of other management interface that is used by teachers. But it includes more options. Fig.9 shows the dataflow diagram of the administrator page.

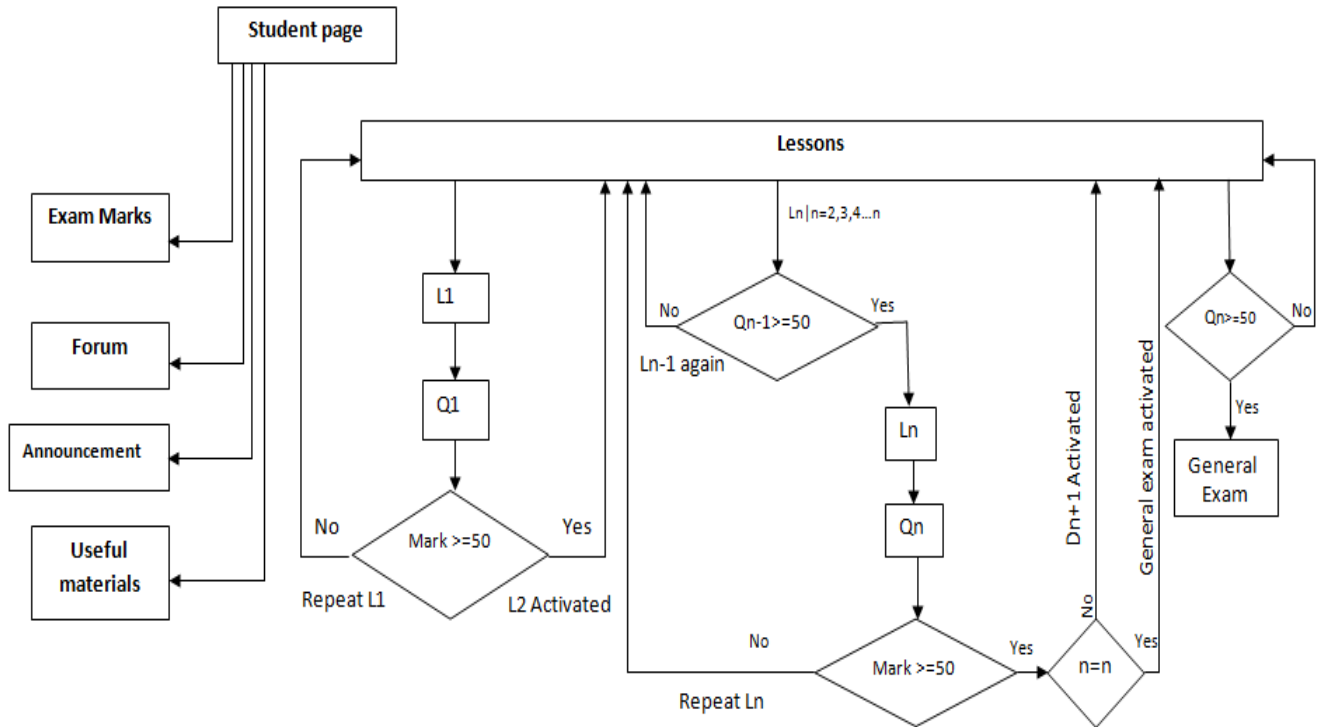




**Fig 9:-** Administrator page DFD

#### **Student Page:-**

The most important part is the student part here the student can see the course lessons title. Only first lesson contents will be active and can be viewed easily by clicking on the link provided by the system, the other lessons will be not activated unless the student pass the first lesson's quiz at that time the next lesson will be active and so on if the student didn't pass that quiz the next lesson will not be active, after the student passes all the quizzes the general exam will be activated so that the student can submit an exam contain questions about all the lessons that the student watched, beside the lessons the student can view past submitted exam marks, can enter the forum, see the announcements, and can get benefit from the useful materials part. The dataflow of the student page shown in Fig.10.



**Fig.10:-** Student Page DFD

#### User Communication Tools:-

In this system there are two different communication tools that can be used to communicate among system users. These communication tools used to improve the quality of the education activities by ensuring effective socialization processes among students and teachers.

The first communication tool is a forum, which is used to send messages or write comments on existing ones. The discussion subjects provided for users may be defined by teachers or other users via the management interface. The administrator can delete any illegal message or comment from the forum even can block the user account if the user insists on sending unacceptable messages.

The second communication tool of the system is an internal messaging tool, which allows students and teachers to send private messages each other.

#### Results and Future Work:-

There are some reasons that let us use asp.net as graphical user interface, web application exists in compiled form on the server so the execution speed is faster as compared to the interpreted scripts [27]. asp.net is not limited to script languages, it allows you to make use of .net languages like c#, j#, VB, etc. asp.net is a very valuable tool for programmers and developers as it allows them to build dynamic, rich web sites and web applications using compiled languages like VB and c#. the main advantage of this language is high security; code cannot be viewed from the browser. asp.net offers built-in security features through windows authentication or other authentication methods[28],[29].

One of the most important result we achieved in this project by activation constrains, that activation of the next lecture is depend on the student quiz result of the previous lecture so that the student must study hard to pass the quiz to activate the next lecture.

Besides the teacher can view the time that the student spent viewing and studying each lecture this done by timer starts when the student click to view the lecture and ends when clicking on quiz at the end of lecture so the lecture viewing time can be calculated the benefit of method is to give information if the student passed the lecture and

submit the quiz and may he or she can pass the quiz by chance; this information can help the teacher when assessment the students.

In the future this project can be developed by adding private chat between the users so that they can communicate privately get benefit from each other's experience, video conferencing also very important to share information between the users beside that can be virtual class so the students can attend any lecture the teacher demonstrate without any constrains all what they need is an internet connection.

### Conclusion:-

Today's economy is based on a global perspective. We need to compete and collaborate with the world. Thus education must be catered along these lines. We have seen that this is possible with the use of technology, technology is a necessity in today's world and we must be ready for it. Computers can provide universal success by dividing lessons into segments to the extent needed to make sure that everyone can accomplish something. They deliver results accurately and quickly, the closer the connection between the action and reward, the more valuable and more effective is the reward. With computers and technology, learning can be a 24/7 process. Teaching will not be bound by time constraints. Technology is a versatile and valuable tool for teaching and learning and becoming a way of life. The most important thing is that teachers need to be prepared to use these technologies effectively.

### References:-

1. Elvis Wai Chung Leung, City University of Hong Kong, Media-Based Presentation with Personalization in a Web-Based eLearning System, Advances in Computer Science – ASIAN 2005. Data Management on the Web Volume 3818 -pp 160-171
2. Seryn, W. & John, E. (1997), A case Study of communication technology within the elementary school, Australian Journal of Educational Technology, 13(2), 144-164
3. Giovanni, F. & Rosella, C. (1999), A Web-Based Instruction System to support design activities in Architecture, Paper presented to AusWeb 99, Fifth Australian World Wide Web Conference.
4. Mason, R. (1991), Moderating Educational Computer Conferencing in DEOSNEWS Vol. 1 No. 19
5. Hernawati. K., "E-Learning Adaptif Berbasis Karakteristik Peserta Didik", Prosiding Seminar Nasional Penelitian, Pendidikan dan Penerapan MIPA, Fakultas MIPA, Universitas Negeri Yogyakarta, 14 Mei 2011, ISBN: 978-979-99314-5-0, 2011.
6. Sfenrianto, "A Model Of Adaptive E-Learning SystemBased On Student's Motivation", Proceedings International Conference on Creative Communication and Inovative Technology (ICCIT), 8 Agustus 2009, Tangerang-Indonesia , ISSN 1978-8282, 2009.
7. Surjono. H. D, "Pemanfaatan Teknologi E-Learning Adaptif untuk Mengatasi Keragaman Gaya Belajar", Jurnal Penelitian Saintek, Vol 8, No 1, April 2013.
8. Dantes. G. R, Suarni. N. K and Sujaya. I. G, "Model Dynamic Intellectual Learning (DIL): Pergeseran Paradigma E-Learning Menuju Adaptive Learning", Konferensi Nasional Sistem dan Informatika 2010; Bali, November 13, 2010
9. Esichaikul. V, Lamnoi. S and Bechter. C, "Student Modelling in Adaptive E-Learning Systems", Knowledge Management & E-Learning: An International Journal, Vol.3, No.3, 2011.
10. Wirawan. I. M. A and Wahyuni. D. S, "Adaptive Mobile Learning Concept", Proceedings of the International Mobile Learning Festival, Bali - Indonesia June 2 – 4, 2014.
11. C. A. Carver, R. A. Howard and E. Lavelle, "Enhancing student learning by incorporating learning styles into adaptive hypermedia", Proceedings of ED-MEDIA '96 World Conf. on Educational Multimedia and Hypermedia, (1996) June, 17-22, Boston, USA.
12. J. E. Gilbert and C. Y. Han, "Adapting instruction in search of a significant difference", Journal of Network and Computer Applications, vol. 22, (1999), pp. 1-12.
13. M. Stern and P. Woolf, "Adaptive content in an online lecture system", Proceedings of the International Conference on Adaptive Hypermedia and Adaptive Web based System, (2000) August 28-30, Trento, Italy, pp. 29 1-300.
14. M. Grigoriadou, K. Papanikolaou, H. Kornilakis and G. Magoulas, "INSPIRE: An intelligent system for personalized instruction in a remote environment", Proceedings of 3rd Workshop on Adaptive Hypertext and Hypermedia, (2001) July 13-17, Sonthofen, Germany, pp. 13-24.

15. P. Paredes, and P. Rodrigues, "Considering sensing-intuitive dimension to exposition-exemplification in adaptive sequencing", Proceedings of AH2002 Workshop, Second International Conference on Adaptive Hypermedia and Adaptive Web-based Systems, (2002) May 29-31, Malaga, Spain, pp. 556-559.
16. N. Stash, A. Cristea and P. D. Bra, "Authoring of learning styles in adaptive hypermedia: problems and solutions", Proceedings of the WWW 2004 Conference, (2004) May 17-22, New York, USA, pp. 114-123.
17. J. Lee, "Adaptive Courseware Using Kolb's Learning Style", International Magazine on Advances in Computer Science and Telecommunication, vol. 3, no. 1, (2012), pp. 45-59.
18. G. K. Tallmadge and J. W. Shearer, "Study of Training Equipment and Individual Differences: the Effects of Subject Matter Variables", Supplementary Report, American Institutes for Research, (1968).
19. D. C. Berliner and L. S. Cahen, "Trait-Treatment Interaction and Learning", Review of Research in Education, vol. 1, (1973), pp. 58-94.
20. D. H. Jonassen, "Aptitude-versus content-treatment interactions, implication for instructional designs", Journal of Instructional Development, vol. 5, no. 4, (1982), pp. 15-27.
21. I Made Agus Wirawan, Made Sento Gitakarna, "Development of adaptive mobile learning (AML) On information system courses", International Journal of Advanced Computer Science and Applications, vol.6, No.12, 2015.
22. National Oceanic and Atmospheric Administration U.S. Department of Commerce , Designing Education Projects, Second Edition, APRIL 2009
23. Deperlioglu, O., & Kose, U. (2010). The effectiveness and experiences of blended learning approaches to computer programming education. Computer Applications in Engineering Education [in Early View]. DOI: 10.1002/cae.20476
24. The Asp.net website in <http://www.asp.net/>
25. [https://msdn.microsoft.com/en-us/library/aa711425\(v=vs.71\).aspx](https://msdn.microsoft.com/en-us/library/aa711425(v=vs.71).aspx)
26. Search sql server website, in <http://searchsqlserver.techtarget.com/definition/database>
27. Inside ASP.Net Web Matrix: Alex Homer and Dave Sussman - <http://www.asp.net/Tools/redir.aspx?path=webmatrixbook>
28. <http://www.careerride.com/ASP-NET-Advantages.aspx>
29. <http://www.pixelstech.net/article/1453714400-Why-to-Build-Modern-Web-Apps-with-ASP-NET>

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### RESEARCH ARTICLE

#### “COMPARISON OF SMOKERS AND NON-SMOKERS KNOWLEDGE AND AWARENESS OF SMOKING EFFECTS ON GENERAL and ORAL HEALTH

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#### Abstract

**Introduction:** Tobacco inhalation is inhalation of smoke from burned leaves of tobacco plant, most often in the form of cigarettes. Smokeless tobacco refers to chewing of tobacco. People may smoke casually for pleasure, habitually to satisfy an addiction, due to social pressure, etc. There is overwhelming evidence that tobacco usage produce harmful effects in the mouth.

**Aim:** The objective of this was to assess the differences in knowledge and awareness of dental patient to the effects of smoking on oral and general health between smokers and non-smokers.

**Materials and Methods:** A cross sectional analytic study using a self-administered questionnaire was be given to the patients in the dental clinics of the College of Dentistry at Taibah University.

**Results:** A total of 418 respondents responded to be enrolled in the study. Out of the 418 respondents, 51.9% were smokers and 48.1% were not. The comparison between smoker and non-smoker with age group, the smokers group was higher between (31-50) 57.1%, also in comparison between smokers and non-smokers in avoid reading about the hazards of smoking in newspapers, magazines and Emails smokers who totally agree was totally agree 64.5%

**Conclusion:** The dental patients had good knowledge about the oral and general effects of smoking. Smokers exhibited a willingness to follow the dentists' advice about quitting smoking.

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#### Introduction:-

Tobacco inhalation is inhalation of smoke from burned leaves of tobacco plant, most often in the form of cigarettes. Smokeless tobacco refers to chewing of tobacco. People may smoke casually for pleasure, habitually to satisfy an addiction, due to social pressure. There is overwhelming evidence that tobacco usage produce harmful effects in the mouth.<sup>1</sup>

WHO has reported that tobacco smoking has killed 100 million people worldwide in 20th century and warned that it could kill 1 billion people globally in the 21st century.

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Smoking has been established as a risk factor for death from several systemic diseases, including lung cancer, respiratory diseases, and cardiovascular disease.<sup>1,2</sup>

Smoking has also been demonstrated to affect the oral health of smokers in a variety of way ranging from cosmetic effects, such a teeth staining or discoloration, to potentially harmful life-threatening conditions such as oral cancer.<sup>1,3</sup>

Some of the reported effects of smoking on oral health include increased susceptibility to periodontal disease, reduced response to both surgical and nonsurgical periodontal therapies,<sup>4,5</sup>.Also there is an increased risk of dental implant failure<sup>6</sup> and a higher risk for cancer and precancerous lesions.<sup>7,8</sup>

In susceptible patients, the clinical effects of smoking depends on number of cigarettes smoked daily and the duration of habit.<sup>9</sup>

Passive smoking includes inhalation of smoke from smoker's cigarette to anther individual and it can cause increased allergic reaction against specific allergens, reduced lung function and increased asthmatic attacks in patient with asthma. Despite the above established adverse effects of smoking on oral health, few studies examining dental patient's knowledge and awareness of such effects are available.<sup>10,11</sup>

Moreover, the available studies have focused mainly on oral cancer and only a very few have examined the awareness regarding other oral health aspects, affected due to smoking. The aim of this study is to assess the awareness of smoking's effects on oral and general health among smoker and non-smoker dental patients.

#### **Study objectives:-**

To assess the differences in knowledge and awareness of dental patient to the effects of smoking on oral and general health between smokers and non-smokers.

#### **Study design:-**

A cross-sectional analytic study using a self-administered questionnaire was given to patients attending the dental clinics in College of Dentistry at Taibah University.

#### **Sample size:-**

The new patients attending the dental clinics in College of Dentistry during 2015 were 11,303. Using the Roasoft sample size calculator<sup>1</sup>. with a marginal error expected of 5%, 95% confidence level and a response distribution of 50%.Itwas calculated that the sample size would be 372 with an additional 10% expected drop out the total sample size was calculatedas 418 participants.

#### **Patient selection:-**

Systemic random sample, a list patient in ascending manner in three days a week for two months and will be chosen patient number (1-3-5-7....)

#### **Inclusion criteria:-**

Smoker and non-smoker attending to dental clinics in College of Dentistry at Taibah University

#### **Exclusion criteria:-**

1. Children (Local law defines children as anyone under age 18).
2. Students.
3. Cognitively impaired or mentally challenged subjects.

#### **Ethical clearance form:-**

1. Ethical clearance was be sought before the start of the study from the Taibah University College of Dentistry Research Ethics Committee (TUCD REC).

2. Data will be collected coded and locked in a password-protected computer at the principal investigator office to ensure confidentiality and privacy of patient data.

### Statistical Analysis:-

Data entry and analyzes of results will be done using the Statistical Package for Social Sciences (SPSS) ver 21 for Windows software<sup>2</sup>. Descriptive statistics such as mean and standard deviation (SD) for continuous variables and frequency and percentage for categorical variables will be determined. Inferential statistics will then be followed using parametric and non-parametric test for univariate analysis followed by multivariate analysis using logistic regression. The level of significance is set at  $p < 0.05$ .

### Results:-

The present study was a cross-sectional descriptive study conducted to assess perception of dental patients visiting Dental College and Hospital about comparison of smokers and non-smokers awareness of smoking effects on oral health as a part of oral health care delivery. All 418 subjects completed the questionnaire, with response rate of 100%. of 418 subjects, 51.9% were smoker, 48.1% were non-smoker.

A cross-sectional analytic study using an online anonymous self-administered participant filled in the appropriate responses. The study was conducted among patients attending the Dental clinics at Taibah University in Al-Medina Al-Munawarah.

A total of 418 respondents responded to be enrolled in the survey. Out of the 418 respondents, 51.9% were smokers and 48.1% were not (Table 1).

The comparison between smoker and non-smoker with age group, the smokers group was higher between (31-50) 57.1%, also as compared between smokers and non-smokers in avoid reading about the hazards of smoking in newspapers, magazines and Email smokers who totally agree was totally agree 64.5% (Table 2).

The difference in knowledge between participants about the background on the diseases that may result from smoking. 82.4% of smokers stated yes while 63.5% of non-smokers stated yes (Table 3).

The difference in knowledge between participants about the smoking causes lung cancer. 88.4% of smokers stated yes while 94% of non-smokers stated yes (Table 3).

The difference in knowledge between participants about the smoking causes heart disease. 90.7% of smokers stated yes while 89.5% of non-smokers stated yes (Table 3).

The difference in knowledge between participants about the smoking causes discoloration of the teeth. 89.8% of smokers stated yes while 94% of non-smokers stated yes (Table 4).

The difference in knowledge between participants about the smoking causes a foul odour of the mouth. 67.8% of smokers stated yes while 94.5% of non-smokers stated yes (Table 4).

The difference in knowledge between participants about the smoking causes tooth decay. 52.1% of smokers stated yes while 69.7% of non-smokers stated yes (Table 4).

The difference in knowledge between participants about the smoking causes gum disease. 47% of smokers stated yes while 91% non-smokers stated yes (Table 4).

The difference in knowledge between participants about the smoking causes cancer diseases, including oral cancer. 63.9% of smokers stated yes while 90% of non-smokers stated yes (Table 4).

<sup>1</sup> IBM SPSS Statistics IBM North America, 590 Madison Avenue, New York, NY 10022. United States, E-mail: www.ibm.com

**Table 1:-** Percent of smokers and non-smokers

	Frequency	Percent
Yes	217	51.9
No	201	48.1

**Table 2:-** Age groups

Age							
Do you smoke?		18-24	25-31	31-50	Greater than 51	X <sup>1</sup>	P-value
	Yes	47 21.7%	36 16.6%	124 57.1%	10 4.6%	104.34	0.000
	No	138 68.7%	28 13.9%	30 14.9%	5 2.5%		
Smoker avoid reading about the hazards of smoking in newspapers, magazines, and Emails							
Do you smoke?		Agree	Disagree	Sometimes	I totally agree	X <sup>1</sup>	P-value
	Yes	19 8.8%	25 11.5%	33 15.2%	140 64.5%	80.44	0.000
	No	41 20.4%	72 35.8%	43 21.4%	45 22.4%		

**Table 3:-** Knowledge of participants regarding general health about smoking

Do you have a background on the diseases that may result from smoking						
Do you smoke?		Yes	No	Basic knowledge	X <sup>1</sup>	P-value
	Yes	178 82.4%	4 1.9%	34 15.7%	19.12	0.000
	No	127 63.5%	6 3%	67 33.5%		
Do you think that smoking causes lung cancer						
Do you smoke?		Yes	No	I do not know	X <sup>1</sup>	P-value
	Yes	190 88.4%	15 7%	10 4.7%	7.53	0.023
	No	188 94%	3 1.5%	9 4.5%		
Do you think that smoking causes heart disease						
Do you smoke?		Yes	No	I do not know	X <sup>1</sup>	P-value
	Yes	196 90.7%	13 6%	7 3.2%	9.1	0.011
	No	179 89.5%	4 2%	17 8.5%		

**Table 4: Knowledge of participants regarding oral health about smoking**

Do you think that smoking causes discoloration of the teeth						
Do you smoke?		Yes	No	I do not know	X <sup>1</sup>	P-value
	Yes	193 89.8%	13 6.0%	9 4.2%	7.69	0.021
	No	189 94%	2 1.0%	10 5.0%		
Do you think that smoking causes a foul odor of the mouth						
		Yes	No	I do not know	X <sup>1</sup>	P-value
	Yes	145	8	61	48.66	0.000



Do you smoke?		67.8%	3.7%	28.5%		
	No	190	3	8		
		94.5%	1.5%	4.0%		
Do you think that smoking causes tooth decay						
Do you smoke?		Yes	No	I do not know	X <sup>1</sup> 14.70	P-value 0.002
	Yes	113 52.1%	28 12.9%	75 34.6%		
	No	140 69.7%	13 6.5%	48 23.9%		
Do you think that smoking causes gum disease						
Do you smoke ?		Yes	No	I do not know	X <sup>1</sup> 95.07	P-value 0.000
	Yes	101 47%	40 18.6%	74 34.4%		
	No	183 91%	2 1.0%	16 8.0%		
Do you think that smoking causes cancer diseases, including oral cancer						
Do you smoke ?		Yes	No	I do not know	X <sup>1</sup> 55.21	P-value 0.000
	Yes	138 63.9%	55 25.5%	23 10.6%		
	No	181 90%	2 1.0%	18 9.0%		

### Discussion:-

In Saudi Arabia, the use of tobacco is a common in the form of cigarettes and shisha. Cigarettes smoking affects oral health in a variety of ways ranging from staining to various serious conditions like oral cancer. Between these two extremities, there are various effects of smoking on oral health which thought not as a severe oral cancer still present potential for significant oral health morbidity and tooth mortality<sup>(1)</sup>.

In the current study, the awareness among patients about the difference in knowledge between participants about the smoking causes lung cancer. 88.4% of smokers stated yes while 94% of non-smokers stated yes. Was good in comparison with the study of Poonam Sood, Ridhi Narang, 82.8% of smokers stated yes, and 91.4% of non-smokers stated yes. However less compared with M. Terrades, 97.2% of smokers stated yes, and 99.2% of non-smokers stated yes <sup>(2),(3)</sup>.

The knowledge about relationship of smoking and heart diseases, 90.7% of smokers stated yes, and 89.5 of non-smokers stated yes. Was also higher in comparison with the study of Poonam Sood, Ridhi Narang, 71.7% of smokers stated yes, and 73.6 of non-smokers stated yes. However less compared with M. Terrades, 92.3% of smokers stated yes, and 95% of non-smokers stated yes <sup>(2),(3)</sup>.

The higher knowledge may be because many campaigns and advertisements have focused on smoking causative factors for lung cancer and heart diseases

The difference in knowledge between participants about the smoking causes discoloration of the teeth. 89.8 of smokers stated yes while 94% of non-smokers stated yes. Was good in comparison with the study of Poonam Sood, Ridhi Narang, 80.8% of smokers stated yes, and 84.16% of non-smokers stated yes. However less compared with M. Terrades, 93,1% of smokers stated yes and 99.2% of non-smokers stated yes <sup>(2),(3)</sup>.

The difference in knowledge between participants about the smoking causes a foul odor of the mouth. 67.8% of smokers stated yes, while 94.5% of non-smokers stated yes. Was less in comparison with the study of Poonam Sood, Ridhi Narang, 89.8% of smokers stated yes, and 95% of non-smokers stated yes . also less compared with M. Terrades, 87.5% of smokers stated yes, and 99.2% of non-smokers stated yes <sup>(2),(3)</sup>.

The difference in knowledge between participants about the smoking causes tooth decay. 52.1% of smokers stated yes while 69.7% of non-smokers stated yes. When this association has never been proved. Only 29.4% correctly

answered that there is no such association. It was good in comparison with M. Terrades, only 10.5% correctly responded that there is no such association<sup>(2),(3)</sup>.

The difference in knowledge between participants about the smoking causes gum disease. 47% of smokers stated yes while 91% non-smokers stated yes. It was good in comparison of non-smokers with M. Terrades, 85.1% stated yes and the study of Poonam Sood, Ridhi Narang 67.7% stated yes. While less in comparison of smokers with M. Terrades, 74.6% stated yes and the study of Poonam Sood, Ridhi Narang 58.5% stated yes <sup>(2),(3)</sup>.

The difference in knowledge between participants about the smoking causes cancer diseases, including oral cancer. 63.9% of smokers stated yes while 90% of non-smokers stated yes. It was good in comparison of non-smokers with M. Terrades, 89.3% stated yes and the study of Poonam Sood, Ridhi Narang 82.5% stated yes. While less in comparison of smokers with M. Terrades, 78.9% stated yes and the study of Poonam Sood, Ridhi Narang 67.6% stated yes <sup>(2),(3)</sup>.

This study suggests that smoking cessation should be stressed upon to improve periodontal health and reduce tooth loss among smokers. Dental health campaigns must run awareness programs on the well-proved association of smoking and periodontal diseases Reference. Moreover, dental practitioners should play a crucial role regarding advising and supporting the patients in quitting during regular dentist visits.

The dental team could identify the patients willing to stop smoking and guide them to specialist smoking cessation advice centers. It is recommended to conduct further surveys among the general population covering different age groups and comparative studies in other populations to determine the validity of these results.

#### **Limitations:-**

The present study reflects the perceptions of patients attending a dental hospital, so the results should be interpreted carefully as it may not reflect the perceptions of the general populations. Also, hospital setups encourage one to respond favorably. The presence of friends and relatives can have an effect on responses. The patients may not admit their actual smoking status in the presence of relative or friends  
The favorable responses may social desirability bias.

#### **Conclusion:-**

It can be concluded from this study that

1. The dental patients had a sound knowledge about the general and oral effects of smoking.
2. Smokers exhibited a willingness to follow the dentists' advice about quitting smoking.

#### **Recommendations:-**

1. It is recommended to conduct such surveys among general population covering different age groups.
2. Dentist should inform their patients about the effects of smoking and strongly advice and help them in quitting and take up a more active role in such activities.

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**References:-**

1. Johnson NW, Bain CA. Tobacco and oral disease. EU-working group on tobacco and oral health. Br Dent J 2000;189:200-06.m
2. Doll R, Peto R. Mortality in relation to smoking: 20 years observations on male. Br Med J 1976;2:7525-36.
3. Reibel J Tobacco and oral diseases. Update on the evidence, with recommendations. Med PrincPract 2003;12(Suppl 1):22-32.
4. Preber H, Berstrom J. Effect of nonsurgical treatment on gingival bleeding in smoker and nonsmoker. ActaOdontolScand1986;44:85-89.
5. Tonetti MS, Pini Prato G, Cortellini P. Effect of cigarette smoking on periodontal healing following GTR in infrabony defects. A preliminary retrospective study. J Clin Periodontal 1995;22:229-34.
6. Bain CJ, Moy PK. The association between the failure of dental implants and cigarette smoking. J Oral Maxillofac Implants 1993;8:609-15.
7. Blot WJ, McLaughter JK, Winn DM, Austin DF, Greenberg RS, Preston-Martin S, et al. Smoking and drinking in relation to oral and pharyngeal cancer. Cancer Res 1988;48:3282-87.
8. McCoy GD, Hecht SS, Whynder EL. The role of tobacco, alcohol, and diet in the etiology of upper alimentary and respiratory tract cancer. Prev Med 1980;9:622-29.
9. Calsina G, Ramon JJ. Effects of smoking on periodontal tissues Clin Periodontology 2002;29:771-76.
10. Buma JC, Whilliams LN Jr. A survey to determine the knowledge of military members about the hazards of tobacco use, and a resulting tobacco hazard education project. J Cancer Educ1995;10:37-40.
11. Telivuo M, Kallio P, Berg MA, Korbonen HJ, Muromca H. Smoking and oral health: A population survey in Finland. J Public Health Dent 1995;55:138-38.
12. BraimohOmoigberaiBashiru, UmanahAyamma Udo.Cigarette smoking and Awareness of Oral Health Problems of Tobacco use among Students at the University of Port Harcourt, South-South Nigeria. 10.5005/jp-journals-10015-1291.
13. Poonam Sood<sup>1</sup>, Ridhi Narang<sup>1</sup>, V. Swathi<sup>2</sup>, Litik Mittal<sup>1</sup>, Kunal Jha<sup>3</sup>, Anamika Gupta<sup>1</sup>. Dental patient's knowledge and perceptions about the effects of smoking and role of dentists in smoking cessation activities. Sunday, January 24, 2016, IP: 51.36.113.91]
14. M. Terrades, W. A. Coulter, H. Clarke, B. H. Mullally& M. Stevenson. Patients' knowledge and views about the effects of smoking on their mouths and the involvement of their dentists in smoking cessation activities. British Dental Journal 207, E22, 12 December 2009, doi:10.1038/sj.bdj.2009.1135.



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### RESEARCH ARTICLE

#### THE INCIDENCE OF CHOLELITHIASIS AFTER CORRECTIVE WEIGHT LOSS SURGERY

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##### Key words:-

Cholelithiasis, sleeve gastrectomy, Roux en Y gastric bypass.

#### Abstract

**Introduction:** Morbid obesity is a worldwide health problem; cholelithiasis considered the third most common disease between obese patients. Of 30 – 40 % of patients undergone corrective weight loss surgery developed cholelithiasis shortly after the surgery.

**Aim of the study:** to detect the relation and incidence of cholelithiasis those necessitate cholecystectomy after corrective weight loss surgery (sleeve gastrectomy and roux en Y gastric bypass) during a one year follow up and the necessary of prior cholecystectomy for those patients.

**Patients and methods:** Morbid obesity patients underwent corrective weight loss surgery (sleeve gastrectomy and roux en Y gastric bypass) in the period from June 2014 till June 2016, patients with unremarkable study at abdominal ultrasound before the surgery and patient with one year follow up after the surgery included in the study. Two comparative groups of patients were done: group A who underwent laparoscopic sleeve gastrectomy and group B who had laparoscopic roux en Y gastric bypass. The primary outcome measure was gallstones or mud formation with or without complications.

**Results:** 204 patients were included in the study, 163 patients had sleeve gastrectomy (group A) and 41 patients had bypass (group B), the mean age was 35.4 years for group A and 114 (69.9 %) of the patients were women, and it was 40.6 years for group B and 28 (68.2%) of patients were women, Gallstones requiring cholecystectomy after corrective weight loss surgery detected in 18 (11%) of 163 patients had sleeve gastrectomy and 4 (9.7 %) of 41 patients had roux en Y gastric bypass, group A patients developed gallstone after 8 months median time, while for group B it was 7 months. No significant difference found between the two groups of patients regarding the symptomatic gall bladder disease.

**Conclusions:** the incidence of cholelithiasis after corrective weight loss surgery was not so high for these patients and it is not recommended to do prophylactic cholecystectomy.

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**Introduction:-**

The prevalence of obesity (BMI > 30) in Europe reached around 20 % and in United States became around 30 % that became an epidemic condition with other co-morbidities of metabolic disorders and so was accompanied by life expectancy reduction (1). Corrective weight loss surgery (Bariatric surgery) reduces the body weight and so ameliorates the co-morbidities, while weight reduction conservative management gives less satisfactory results (2), so surgery was recommended for morbid obesity treatment by NIH consensus conference (3).

Laparoscopic sleeve gastrectomy is one of the corrective weight loss surgeries that include removal of the fundus and most of the antrum of the stomach, creating a gastric tube or sleeve which reduces the oral intake (4). This procedure initially introduced as a part of duodenal switch operation, but now become a popular stand-alone procedure for weight loss surgery (5).

About 30% of the patients who are candidates for bariatric surgery either have undergone a prior cholecystectomy or are found to present gallstones at time of surgery, Gallstone represent the third most common disease observed among obese patients (6). Newly formed gallstones may be diagnosed in 27% to 43% of patients who have undergone bariatric surgery within a very short period of time (7), and it was found that the risk of developing gallstones can be as high as 52.8% in patients undergoing Roux-en-Y gastric bypass who are followed up for 1 year afterwards (8).

Patients with a rapid weight loss, following bariatric surgery, experience increased cholesterol saturation in the bile and also present increased concentrations of mucin in the gallbladder which is the most important pro-nucleating factors (9).

**Patients and Methods:-**

This study involved 286 patients followed prospectively were suffering from morbid obesity and underwent laparoscopic sleeve gastrectomy (LSG) and laparoscopic Roux-en-Y Gastric Bypass (LRYGB) in the period from June 2014 till June 2016, data collection began before the operation and continued forward until the latest visit after the operation. *Inclusion criteria:* Patients with negative abdominal ultrasound preoperatively, patient with at least one year follow up after surgery were included in this study, *exclusion criteria:* included: patients with gallstone disease preoperatively, history of cholecystectomy, presence of gallbladder polyp on preoperative ultrasound, patients who were lost to follow up after surgery and patients with a previous weight reduction procedure such as intra gastric balloon or gastric band, 82 patients were excluded from the study and 204 patients were included, All patients were discussed concerning the options of LSG and LRYGB and the possible risks of surgery were explained, a written and informed consent taken from all patient preoperatively, Preoperative abdominal ultrasound was performed for all patients to rule out gallstones, sludge or gallbladder polyp. Those with positive findings on ultrasound were discussed for concomitant laparoscopic cholecystectomy. Patients were followed up regularly, every 2-3 months; those with symptoms suggestive of cholelithiasis or its complications underwent further imaging with abdominal ultrasound or magnetic resonance imaging of the abdomen. The patients were divided into two groups for comparison. Group A patients who had (LSG), and group B included the patients who underwent (LRYGB). The primary outcome measure was the formation of symptomatic gallstones or sludge with or without complications. Positive findings according to the ultrasound, or MRI reports were recorded. Symptoms were considered attributable to gallstones or sludge if not clinically explainable by other causes. Patients who had complications such as acute cholecystitis, deranged liver function, acute cholangitis, or biliary pancreatitis at first presentation also were considered as symptomatic in the analysis.

Statistical analysis: Data were collected using Excel for Windows, and analysis was performed with the Scientific Package of the Social Sciences version 22 (SPSS). The chi- square test or Fisher's exact test was used for nominal variables as appropriate. The t-test was used to compare continuous variables. A p value less than 0.05 was considered significant.

**Results:-**

During the period from June 2014 till June 2016, 224 patients underwent LSG and 62 patients had LRYGB, after exclusion from the study, 163 group A patients and 41 group B patients were included in the study (table 1). Preoperative cholelithiasis was found in 16(7.1 %) of patients in group A and 5 (8 %) of patients in group B, all patients with gallstone disease that diagnosed preoperatively underwent concomitant cholecystectomy, 7 patients

(3.1 %) in group A had previous weight reduction procedures (a previous gastric band and a previous intragastric balloon placement), while in group B, 4 (6.4 %) patients had a previous intragastric balloon and all these patients were excluded from the study.

**Table 1:-** the incidence of cholelithiasis before surgery and exclusions of the patients.

	Group A LSG	Group B LRYGB
Total number of patients	224	62
Exclusion number (%)	61 (27.2 %)	21 (33.8%)
Cholelithiasis on preoperative US	16 (7.1%)	5 (8 %)
GB polyp on US	3 (1.3 %)	1 (1.6 %)
Previous cholecystectomy	13 (5.8 %)	4 (6.4 %)
Previous weight reduction procedures	7 (3.1 %)	4 (6.4 %)
Lost to follow up	22 (9.8 %)	7 (11.2 %)
Number of patients included in the study	163	41

The demographics of the patients in the study in both groups are shown in (table 2) the mean age of was 35.4 (18 – 49 years) for group A, 114 (69.9 %) of the patients were women and 49 (30.1 %) of the patients were men , whereas it was 40.6 (26 – 54 years) for group B and, 28 (68.2%) of the patients were women and 13 (31.8%) of the patient were men, the Preoperative mean BMI was  $50.3 \pm 6.9$  (range from 34.6-64.2) in group A patients, and  $52.8 \pm 7.4$  (range from 41.7 -65.6) in group B patients. The median follow up period was 12 month (range 10 - 14 months) for sleeve group and 16 months (range 12-24 months) in gastric bypass group.

**Table 2:-** the patient demographics in the study.

	Group A (n = 163)	Group B (n = 41)
Mean age : years (Range)	35.4 (18 – 49)	40.6 (26 – 54)
Gender	Male	13 (31.8%)
	Female	28 (68.2%)
Preoperative BMI* (Kg/m <sup>2</sup> )	$50.3 \pm 6.9$	$52.8 \pm 7.4$
Median follow up (months)	12	16

\*BMI= body mass index

Symptomatic gallstones requiring cholecystectomy occurred in 18 (11 %) of 163 patients had LSG, and in 4 (9.7 %) of 41 patients had LRYGB, and this difference was statistically not significant (p. Value > 0.05), group A patients developed gallstone after 8 months median time, while for group B it was 7 months and this difference was statistically not significant( p.value > 0.05). Mean BMI at the time of cholecystectomy was  $30.5 \pm 6.8$ kg in group A (range from 19.5- 47.6kg/m<sup>2</sup>) and  $35.3 \pm 5.1$  kg/ m<sup>2</sup> (range 26.2-42.8 kg/m<sup>2</sup>) in group B (p. Value 0.07) table 3.

**Table 3:-** the comparison of the patients who developed gallstone in group A and B.

	Group A	Group B
Number of patients	18 (11 %)	4 (9.7 %)
Gender	Male	1 (25 %)
	Female	3 (75 %)
BMI at the time of Bariatric surgery (Kg/m <sup>2</sup> )	$50.3 \pm 6.9$	$52.8 \pm 7.4$
BMI at the time of cholecystectomy (Kg/m <sup>2</sup> )	$30.5 \pm 6.8$ kg	$35.3 \pm 5.1$
Interval (months)	$8 \pm 3.4$	$12 \pm 7.2$

All patients who developed symptomatic cholelithiasis underwent laparoscopic cholecystectomy. No patient developed complications requiring re-admission or reoperation after cholecystectomy. No mortality occurred in our patients after cholecystectomy.

**Discussion:-**

Laparoscopic cholecystectomy in the morbidly obese may be associated with increased operative difficulty and morbidity compared with non-obese patients (10). However, the role of prophylactic cholecystectomy at the time of bariatric surgery remains controversial. The fact that pathological evidence of gallbladder diseases has been found in more than 75% of routinely resected specimens supports those who advocate prophylactic cholecystectomy (11).

On the other hand, the fact that only 7 to 16% of patients will develop symptomatic gallstones (12, 13), and that less than 10% of patients with negative ultrasound exams require subsequent cholecystectomy (14) does not support performing a prophylactic cholecystectomy. Of our LRYGB group, 9.7 % developed symptomatic cholelithiasis and underwent laparoscopic cholecystectomy, this result is the same in many studies done by Nagem et al (15) and Li et al (16) which reported a rate ranged from 6.7 to 11.8%, theoretically, cholelithiasis is less common after laparoscopic sleeve gastrectomy, because the procedure does not alter the gastrointestinal pathway (16,17).

In our LSG patients, 11% developed symptomatic gallstones, and this rate was not statistically significant ( $p$  Value  $>0.05$ ) from that of LRYGB patients, Li et al (16) also reported no significant difference in the rate for symptomatic and complicated cholelithiasis between LRYGB and LSG group of patients. Although rapid weight loss after bariatric surgery is a risk factor for forming gallstones, we should not neglect that a high number of patients already had gallstone disease or previous cholecystectomy before Bariatric procedure possibly because of obesity factor. In our study we found 5.8 % of sleeve patients and 6.4 % of LRYGB patients, already had their gallbladder removed or had gallstone disease before the operation. This result is similar to that of other studies (16, 18). Portenier et al (14) argued that the incidence of delayed cholecystectomy for symptoms or complications of gallstone formation was much lower than the  $\geq 30\%$  reported to develop gallstones and suggested an expectant approach of the asymptomatic cholelithiasis in LRYGB patients. We agree on the point that the percentage of patients developing gallstones is not as high as it was perceived to be.

However, routine preoperative ultrasound screening for gallstones and/or prophylactic cholecystectomy may still be beneficial in LRYGB patients, because access to the biliary tract after LRYGB is challenging (18). In addition, positive gallstones in workups may interfere with diagnosing other reasons when the symptoms are not specific.

These study findings had two important implications. First, because symptomatic cholelithiasis showed no statistical significant compared with gastric bypass; routine prophylactic cholecystectomy is not indicated for these patients. Second, from an etiologic point of view, the traditional belief that hormonal changes and left vagal hepatic branch denervation after gastric bypass result in gallstone formation may no longer hold true because patients who had food going through the usual gastrointestinal transit without duodenal exclusion did not have a lower risk for symptomatic gallstone formation (19,20).

The speed and the degree of weight loss after surgery may be solely related to symptomatic cholelithiasis rather than the choice of the procedure itself (20).

**Conclusion:-**

Cholelithiasis was common in our patients before weight reduction surgery. The rate for symptomatic gallstones after surgery was not so high. No significant difference in symptomatic gallstone disease was found between the patients who underwent laparoscopic gastric bypass and those who had sleeve gastrectomy. Routine prophylactic cholecystectomy should not be recommended for these patients.

**References:-**

1. H. Mustone, J. Pietila, N. Jaser, et al, preoperative transabdominal ultrasonography prior to laparoscopic Roux-en-Y Gastric Bypass and laparoscopic sleeve gastrectomy in the first 100 operations. Was it beneficial and reliable during the learning curve? *Obes Surg*, 2012; 416 – 421.
2. A. Maggard, L. Shugarman, M. Suttorp, et al, Meta-analysis: surgical treatment of obesity, *Annals of internal medicine*, 2005, 142(7):547-561.
3. NIH conference, gastrointestinal surgery for severe obesity, *annals of internal Medicine*, 1991; 115:956-961.
4. E. Durmush, G. Ermerak and D. Durmush, short-term outcomes of sleeve gastrectomy for morbid obesity: dose staple line reinforcement matter? *Obes Surg*, 2014; 24:1109-1116.

5. S. Aggarwal, A. Prakash, and N. Ramaswamy, outcome of laparoscopic sleeve gastrectomy with and without staple line oversewing in morbidly obese patients: A randomized study, *Journal of laparoscopic and advanced surgical techniques*, 2013; 23(11):895-899.
6. M. Bastouly, C. Arasaki, J. Ferreira et al, Early changes in postprandial gallbladder emptying in morbidly obese patients undergoing Roux-en-Y gastric bypass: correlation with occurrence of biliary sludge and gallstones, *Obes Surg*, 2009;19:22-28.
7. C. Oliveira, E. Chaim, B. da Silva, Impact of rapid weight reduction on risk of cholelithiasis after bariatric surgery, *Obes Surg*, 2003;13(4):625-8.
8. L. Wudel, J. Wright, J. Debelak, et al, Prevention of gallstone formation in morbidly obese patients undergoing rapid weight loss: results of a randomized controlled pilot study, *J Surg Res*, 2002;102(1):50-56.
9. E. Sioka, D. Zacharoulis, E. Zachari, et al, complicated gallstones after laparoscopic sleeve gastrectomy, *Journal of obesity*, 2014; 2014:1-5.
10. B. Ammori, A. Vezakis, D. Davides, et al, laparoscopic cholecystectomy in morbidly obese patients, *Surg Endosc*, 2001;15:1136-1139.
11. M. Fobi, H. Lee, D. Igwe, et al, prophylactic cholecystectomy with gastric bypass operation: incidence of gallbladder disease, *Obes Surg*, 2002; 12:350-353.
12. L. Villegas, B. Schneider, D. Provost, et al, Is routine cholecystectomy required during laparoscopic gastric bypass? *Obes Surg*, 2004; 14:206-211.
13. A. Dhabuwala, R. Cannan, and R. Stubbs, improvement in comorbidities following weight loss from gastric bypass surgery, *Obes Surg*, 2000; 10:428-435.
14. D. Portenier, J. Grant, H. Blackwood, et al, expected management of the asymptomatic gallbladder at Roux-en-Y Gastric bypass, *Surg Obes Relat Dis*, 2007;3:476-479.
15. R. Nagem and A. Da-Silva, Cholecystolithiasis after Gastric Bypass: A Clinical, Biochemical, and Ultrasonographic 3-year Follow-up Study, *Obes Surg*, 2012; 22:1594-1599.
16. V. Li, N. Pulido, P. Suartez, et al, symptomatic gallstones after sleeve gastrectomy, *Surg Endosc*, 2009; 23:2488-2492.
17. R. Kiewiet, M. Durian, M. Leesum, et al, gallstone formation after weight loss following gastric banding in morbidly obese Dutch patients, *Obes Surg*, 2006;16:592-596.
18. M. Falcao, M. Campos, M. Galvato, et al, transgastric endoscopic retrograde cholangiopancreatography for the management of biliary tract disease after Roux-en-Y gastric bypass treatment for obesity, *Obes Surg*, 2012;22:872-876.
19. I. Samuel, E. Mason, K. Renquist, et al, An 18 year report from the international bariatric surgery registry, *Am J Surg*, 2006; 192:657-662.
20. V. Li, N. Pulido, P. Fajwaks, et al, Predictors of gallstone formation after bariatric surgery: a multivariate analysis of risk factors comparing gastric bypass, gastric banding, and sleeve gastrectomy, *Surg Endosc*, 2009;23: 1640-1644.





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### RESEARCH ARTICLE

## INTEGRATION OF BEEF CATTLE BREEDING WITH CROP FARMING AT SUSTAINABLE RICEFIELD IN JEMBER REGENCY, EAST JAVA

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### Abstract

The objective of this research was to analyze the sustainability status of the dimensions of economy, ecology, technology, and society, as well as organization in the integrated system of beef cattle breeding and crop farming in Jember Regency of East Java. Some analyses were included in this research, such as Analysis of Cost and Income, Analysis of Linear Programming, Analysis of Averagely Differential Rate (t-test), and Analysis of Sustainability. Result of research showed several findings. (1) The contribution of beef cattle breeding to the income of farmers/breeders was 8.18% but it was still smaller than the contribution of soybean farming with 31.13%, corn with 27.59%, and rice with 33.10%. In average, the cost for cattle feed was spent for Rp.2,575,000.- Workers who must look for greens, provide drinks to the cattle, clean the stall, and others, were valued as Rp.1,350,000.-. The biggest component of the cost in breeding work was the price of the calf that averagely reached Rp.8,000,000.-. The sale price of the harvested calf could attain Rp.16,250,000.-. The income rate of breeding work was then around Rp.3,482,000.-. (2) Integration between beef cattle breeding and crop farming at research area could be made into optimum under several conditions. Soybean was planted at 5.381 Ha land. Both corn and rice were planted at 6.667 Ha land. The maintained cattle should be 21 heads. The use of crop seed must be reduced, precisely 269 kg for soybean, 269 kg for corn, and 333 kg for rice. The use of Urea and organic fertilizers during Rainy Season I could be suppressed into the range between 1,849 kg and 3,333 kg. In other hand, the capital that needed to prepare for each planting season might be reduced to Rp.83,373,340.- ; Rp.109,840,000.- dan Rp.87,426,666.-. (3) If the optimum condition could be attained by farmers/breeders, then farmers' income in the research area would improve to Rp.531,085,000.- per year. This increment was very significant if compared to the actual condition of farmers' income, that reaching at Rp.486,553,100.-. Therefore, the implementation of optimal condition scenario was very recommended to be applied at research area. (4) The model of the optimization and sustainability of agribusiness with the integration system between beef cattle breeding and crop farming was important as cornerstone in formulating the policies for the favor of breeders. The policies kept breeders to apply

sustainable integration system. The combination of five dimensions of sustainability was used to measure the sustainability of agribusiness that involved the integration system between beef cattle breeding and crop farming. In whole, based on five dimensions of sustainability, then the agribusiness work with integration system between beef cattle breeding and crop farming at research area had the sustainability index rate of 42.40. This index showed that agribusiness work was less sustainable. Dimension with the worst sustainability index, and must be seriously attended, included the dimension of technology and infrastructure, and also the dimension of law and organization.

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## Introduction:-

Lower income of the farmers was caused by many factors. Among others were (1) limited ownership of farming land per farming household (RTP), with a width less than 0.50 ha, which should be not economically profitable for farming; (2) the declining land productivity due to strictly land intensification without land conservation; and (3) the relatively low price of farming product, especially during great harvest. Dealing with problems, then the integrated farming system comprising of rice, palawija, and beef cattle breeding, should be very relevant alternative to the existing problem-solving. Theoretically, integrated farming system could be functioned to conserve land fertility and to improve farming efficiency by utilizing the production input from inside the work (internal input). Rice farming might utilize the dung as the substitution to the synthetic fertilizers. Beef cattle breeding could use straw and other byproducts as the feed. Therefore, integrated farming system between rice and cattle would reduce the use outside input (low external output) which kept the system more efficient.

## Study Method:-

### Sample of Research:-

The population of research was farmers who applied one-year planting pattern involving soybean, corn and rice. These farmers also owned and bred beef cattle.

### Method of Data Analysis:-

Some analysis methods were used. Each was described as following.

#### (1) Analysis of Cost and Income

$$\pi = TR - TC \quad \text{or}$$

$$\pi = \sum_{i=1}^n QiPi - \sum_{j=1}^m XjPj$$

### Note:-

$\pi$	=	Profit obtained from the integration of crop farming + beef cattle breeding
TR	=	Earning derived from the integration of crop farming + beef cattle breeding
TC	=	Expense required in the integration of crop farming + beef cattle breeding
P	=	The price of input and output in the integration of crop farming + beef cattle breeding
Q	=	Output produced from the integration of crop farming + beef cattle breeding
n	=	Total of output; There were many kinds of output. These were:
i	=	1,2,3.....n (number and kind of output to receive)
j	=	1,2,3,.....m (number and kind of input to use)

1. Earning from crop farming
  2. Earning from the difference of cattle purchase and sale prices
  3. Earning from the sale price of organic fertilizers
- |   |   |  |
|---|---|--|
| X | = | Input used in the integration of crop farming + beef cattle breeding |
| M | = | Type and number of input to be used                                  |

Several costs were needed in crop farming, such as the cost for:-

- 1) Seeds: rice, corn, soybean, and peanut.
- 2) Workers.
- 3) Inorganic fertilizers.
- 4) Organic fertilizers.

**Several costs in beef cattle breeding were those for:-**

- 1) Cattle origins.
- 2) Workers for preparing the feed and maintaining cattle.
- 3) Greens, straws and others.
- 4) Concentrates.
- 5) Analysis of Linear Programming

**Maximizing the function of goal;-**

$$Max.Z = \sum_{i=1}^3 \sum_{j=1}^3 y_{ij} X_i + y X_4 - \sum_{i=1}^3 w_i X_{4+i} - w X_8$$

**Function of constraint:**

**Land**

$$\sum_{i=1}^3 a_{ij} X_i \leq A_j$$

**Seed Availability**

$$\sum_{i=1}^3 b_{ij} X_i \leq B_{ij}$$

**Fertilizer**

$$\sum_{i=1}^3 \sum_{k=1}^4 c_{kij} X_i \leq C_{kj}$$

**Cattle feed**

$$\sum_{i=1}^3 -d_{ij} X_i + d X_4 \leq 0$$

**Workers**

$$\sum_{j=1}^3 e_{ij} X_i + e_j X_4 - X_{4+j} - X_8 \leq E_j$$

**Working Capital**

$$\sum_{j=1}^3 f_{ij} X_i + e_j X_4 \leq F_j$$

**Note:-**

- |                 |   |  |
|-----------------|---|--|
| i               | = | crop species (soybean, corn, rice)                               |
| j               | = | planting season (MK I, MK II, MH I)                              |
| k               | = | fertilizer type (Urea, SP-36, Phoska, Organic)                   |
| y <sub>ij</sub> | = | gross earning of crop i at planting season j (thousand rupiahs)  |
| y               | = | gross earning of beef cattle breeding (thousand rupiahs)         |
| w <sub>i</sub>  | = | wage of workers for each crop farming (thousand rupiahs / HOK)   |
| w               | = | wage of workers in beef cattle breeding (thousand rupiahs / HOK) |

$X_i$	=	land width planted with crop i (i=1,2,3) in unit of Ha
$X_4$	=	number of cattle (head)
$X_{4+i}$	=	number of workers for crop i (HOK)
$a_{ij}$	=	land average width for crop i at planting season j (Ha)
$A_j$	=	land availability at planting season j (Ha)
$b_{ij}$	=	the average number of seed of crop i at planting season j (kg/Ha)
$B_{ij}$	=	the availability of seed of crop i at planting season j (kg/Ha)
$c_{kij}$	=	the average quantity of fertilizer type k used for crop i at planting season j (kg/Ha)
$C_{kj}$	=	the availability of fertilizer type k at planting season j (kg/Ha)
$d$	=	the quantity of greens (kg)
$d_{ij}$	=	the availability of greens at planting season j (kg)
$e_{ij}$	=	the average number of workers used for crop i at planting season j (HOK)
$e_j$	=	the average number of workers used to maintain cattle (HOK)
$E_j$	=	the availability of workers at planting season j (HOK)
$f_{ij}$	=	the average rate of capital used for crop i at planting season j (thousand rupiahs)
$f_j$	=	the average rate of capital used for maintaining the cattle (thousand rupiahs)
$F_j$	=	the availability of capital at planting season j (thousand rupiahs)

Based on the equation above, the analysis was done using Program Operational Management (POM). Result of analysis reflected the contribution of crop farming and beef cattle breeding to the earning of farmers.

**Analysis of Averagely Differential Rate (t-test):-**

$$H_0 : X_1 = X_2$$

$$H_A : X_1 > X_2$$

Note :  $X_1$  = earning of farmers after optimization.

$X_2$  = earning of farmers before optimization.

Statistic equation of t-test was described as following.

$$t - \text{hit} = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2} \left[ \frac{1}{n_1} + \frac{1}{n_2} \right]}}$$

**Note :-**

**Analysis of Sustainability:-**

The analysis technique was Multi Dimensional Scaling (MDS). All attributes in each dimension were assigned into an application program of Microsoft Excel, and then, these were analyzed with MDS using an application Excel for Rapfish.

**Table1:-**The Category of Sustainability Status

No.	Dimension Index	Category	Note
1	00.00 - 24.99	Poor	Less sustainable
2	25.00 – 49.99	Less	Less sustainable
3	50.00 – 74.99	Adequate	Quite sustainable
4	75.00 – 100.00	Good	Sustainable

Source : Pitcher (1999) and Kavanagh and Pitcher (2004).

**Result And Discussion:-****Beef Cattle Breeding:-****Table 2:-**Beef Cattle Breeding (Fattening) per Head per Year.

No	Component	Beef Cattle Breeding	Note
A	Average Cost (Rp)	13,425,000	Including stall costs.
B	Average Earning (Rp) :		
	(a) Principal (Cattle)	16,250,000	
	(b) Waste (Dung)	657,000	Dung was well done.
	Total	16,907,000	
C	Average Income (B-A)	3,482,000	
	R/C	1,26	

Earning obtained from the sale of 1 cattle was Rp. 16,250,000.-. This price was greatly determined by the quality of cattle during one-year fattening process. The heavier the cattle was the more expensive its price would be. This price was obtained from the average sale price of 1 cattle owned by respondent. Earning was also collected from the well-done dung of the cattle because it was useful for organic fertilizer with meaningful economic value. In the reality, farmers utilized dung/organic fertilizers to their crop farming. If the remaining existed, it would be sold to the needed farmers for the price Rp. 200.- per Kg. Economically, the income of farmers from breeding 1 cattle with one-year fattening process was Rp. 3,482,000.-. This income was low for farmers because beef cattle breeding was only side job for additional income to their primary work, precisely crop farming.

**Table 3:-**Crop Farming Per Year with Soybean-Corn-Price Planting Pattern

No	Component	Soybean Farming	Corn Farming	Rice Farming
A	Average Cost (Rp)	5,320,000	3,970,000	4,294,500
B	Average Earning (Rp) :			
	(c) Principal (Crop)	14,700,000	9,750,000	14,245,000
	(d) Waste (Barks/Cuts/Straws)	3,879,000	5,982,000	4,145,000
	Total: A+B	18,579,000	15,732,000	18,390,000
C	Average Income (B-A)	13,259,000	11,752,000	14,095,500
	R/C	3.49	3.95	4.28

Source : Primary Data were Processed, 2015

**The Contribution of Beef Cattle Breeding to Household Farming****Table 3:-**The Contribution of the Income from Beef Cattle Breeding to the Income of Household Farming in One-Year Period

No	Component	Principal	Waste	Total	Income (Rp)	Contribution (%)
A	Beef Cattle Breeding	16,250,000	657,000	16,907,000	3,482,000	8.18
B	Soybean Farming	14,700,000	3,879,000	18,579,000	13,259,000	31.13
C	Corn Farming	9,750,000	5,982,000	15,732,000	11,752,000	27.59
D	Rice Farming	14,245,000	4,145,000	18,390,000	14,095,500	33.10
		54,945,000	14,663,000	69,608,000	42,588,500	100

**Table 4:-**The Integration Rate of Beef Cattle Breeding and Farming

No	Component	Waste			Contribution (%)
		Physic (Kg)	Price (Rp)	Value (Rp)	
A	Beef Cattle Breeding	3,285	200	657,000	4.48
B	Soybean Farming	8,620	450	3,879,000	26.45
C	Corn Farming	9,970	600	5,982,000	40.79
D	Rice Farming	8,290	500	4,145,000	28.28
	<b>Total</b>			<b>14,663,000</b>	<b>100.00</b>

**The Optimization of Farming and Breeding:-****Table 5:-**Primary Activity in the Optimum Integration between Farming and Breeding

No.	Activity	Unit	Optimum Rate
1	Planting the soybean at dry season MK I	Ha	5.381
2	Planting the corn at dry season MK II	Ha	6.667
3	Planting the rice at rainy season MH I	Ha	6.667
4	Maintaining the cattle	Head	21

In addition to the planting, to achieve the optimum farming pattern, it would need resources to support farming activity. These resources were also useful in farming and breeding, such as land, seed, fertilizers (Urea, SP-36, Phoska and Organic), workers, and capital.

**Table 6:-**The Use of Land Resource at the Optimum Farming Pattern

No.	Activity	Unit	Optimum Rate
1	Soybean	Ha	5.381
2	Corn	Ha	6.667
3	Rice	Ha	6.667

**Table 7:-**The Use of Worker Resource at the Optimum Farming Pattern

No.	Workers (HOK)	MK I	MK II	MH I
1	Available	6,100	6,100	6,100
2	Used	559	298	298
3	Remaining	5,541	5,802	5,802

**Post-Optimum Analysis:-**

If the optimum pattern of farming and breeding was successfully achieved by farmers at research area, then their income would be greater. It was said so because the reallocation of resources was more efficient. The income obtained from the optimum pattern scenario was estimated to Rp.531,085,000.- per year. Actual income rate was Rp. 486,553,100.- per year. Or, in other words, if optimum pattern was achieved, then the increment of income would be 9.15% of actual income. To ensure whether there was actual difference between income in optimum pattern and actual income, t-test was conducted on the average difference of two populations. By considering optimum condition and actual condition as two different populations. Result of t-test could be seen in the following table.

**Table 8:-**Result of t-test on Income Difference from Optimum Condition and Actual Condition

Explanation	Income (Rp 000)	Differential	t-count	t-table
Optimum Condition ( $\mu_{Opt}$ )	531,085	44,531.9	<b>4,453</b>	<b>2,042</b>
Actual Condition ( $\mu_{Akt}$ )	486,553.1			

**The hypotheses tested in this analysis were:-**

$$H_0 : \mu_{Opt} \leq \mu_{Akt}$$

$$H_0 : \mu_{Opt} > \mu_{Akt}$$

Criteria of Decision :  $H_0$  was rejected if  $t\text{-count} > t\text{-table}$

As the table showed, it was known that  $t\text{-count} = 4.453$  and  $t\text{-table} = 2.042$  or, in other words,  $t\text{-count} > t\text{-table}$ , which thus, the decision was that  $H_0$  was rejected. Therefore, it was concluded that statistically, the income at optimum condition was greater than actual income of the farmers. The implementation of optimum condition scenario was very recommended to be applied at research area.

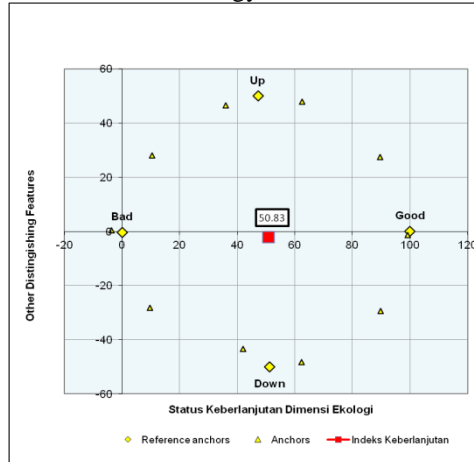
**Analysis of Sustainability:-****Table 9:-**Summary of Result of Analysis on MDS-Rapfish

Dimensions	Stress (S)	R-Square (R)
Ecology	0.1569	0.9347
Economy	0.1596	0.9335
Socio-culture	0.1459	0.9429

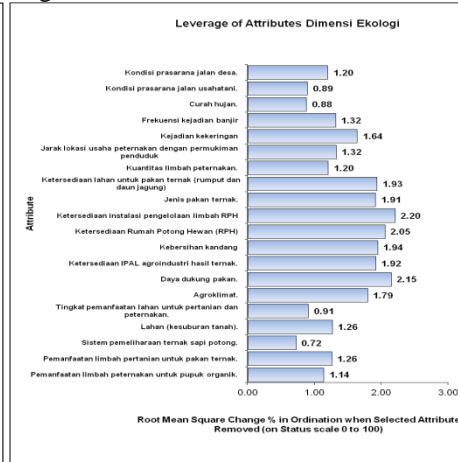
Technology and Infrastructure	0.1584	0.9316
Law and Organization	0.1652	0.9412

### Dimension of Ecology:-

Result of MDS analysis on sustainability status in ecology dimension was plotted in Figure 1, while sensitivity (leverage) of each atribut in ecology dimension was shown in Figure 2.



**Figure 1:-**Sustainability Status of Ecology Dimension.

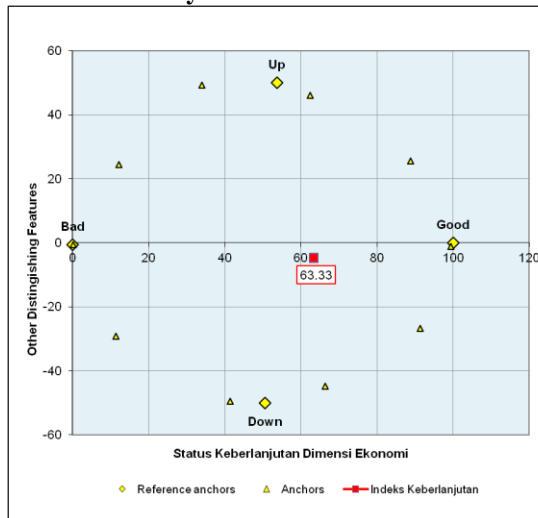


**Figure2:-**Sensitivity of Attributes in Ecology

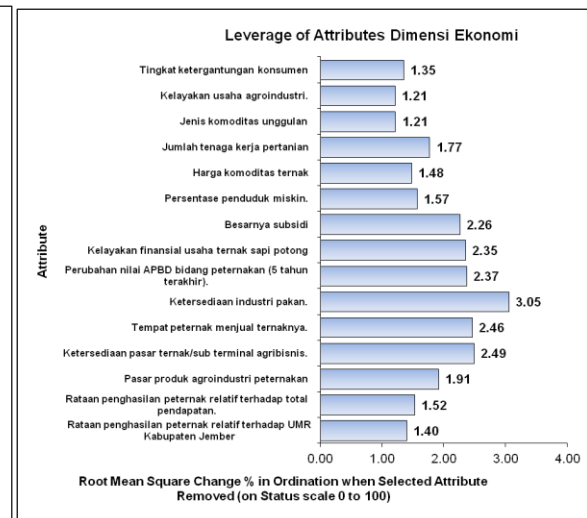
Figure 1 indicated that sustainability status index of ecology dimension was 50.83. This rate remained at the range 50–74.99 which meant as adequately sustainable. In other words, the ecology condition in research area was quite supportive to the sustainability of agribusiness with the integration system between cattle and crop.

As shown in Figure 2, some attributes of ecology dimension were quite influential to the sustainability of the dimension, among others were the availability of processing site for RPH waste, the availability of RPH, and the supporting capacity of the feed. It was said so because the leverage rate of three attributes was greater than other attributes. It could be also said that to improve the sustainability of ecology dimension, then the abattoir must be available, nearby, and managed well, with easier access to the feed source.

### Dimension of Economy:-



**Figure 3:-** Sustainability Status of Economy Dimension.

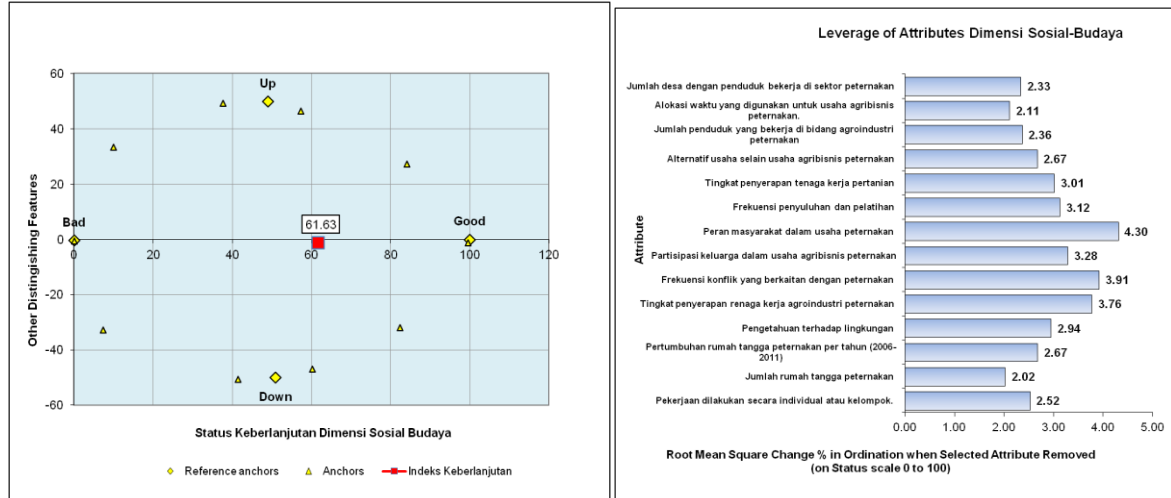


**Figure 4:-** Sensitivity of Attributes in Economy

Figure 3 displayed that sustainability status index of economy dimension was 63.33 which put this rate at the range 50 – 74.99. In other words, the sustainability was adequate. It was also meant that the agribusiness work with the integration system between cattle and crop at research area was quite profitable in term of economy. Although beef cattle breeding and crop farming quite economically meaningful, to preserve this position or improving it, some attributes must be given great attention because it gave great impact on economy dimension. As noted in Figure 4, some attributes that influenced the sustainability of economy dimension were the availability of feed industry, and the availability of livestock market or agribusiness sub-terminal as the place for breeders to sell the livestock.

#### Dimension of Socio-culture:-

Result of MDS analysis on the sustainability status of socio-culture dimension was indicated in Figure 5, while sensitivity (leverage) of each atribut in socio-culture dimension was shown in Figure 6.



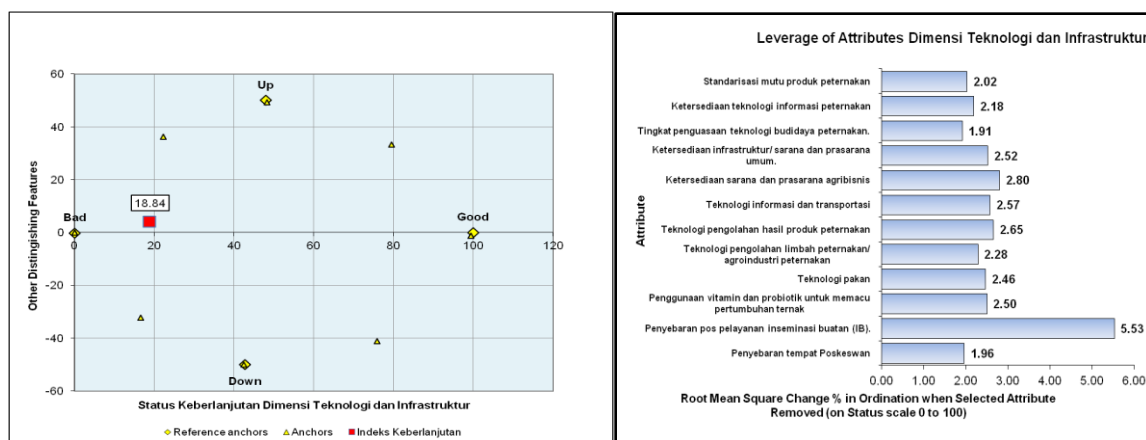
**Figure 5:-**Sustainability Status of Socioculture Dimension. **Figure 6:-** Sensitivity of Attributes in Socioculture Dimension

Figure 5 indicated that the sustainability status of socio-culture dimension was 61.63. This index stood at the range of 50-74.99 meaning that this dimension was adequately sustainable. In other words, the social and cultural conditions of research area were adequately supportive to the existence of agribusiness work involving the integration system between cattle and crop. This work was the legacy inherited by generations. Most lands were owned by farmers/breeders as the legacy. Figure 6 showed that the attributes with great influence on the sustainability of socio-culture dimension included the participation of community into breeding work, the frequency of conflict, and the worker absorbance rate. This result of the analysis meant that although breeding and farming were greatly supported in research area, but this work did not sufficiently absorp workers. If such condition was neglected, the long-term sustainability of breeding/farming would be on the risk.

#### Dimension of Technology and Infrastructure:-

Output of MDS Analysis on sustainability status of technology and infrastructure dimension was displayed in Figure 7, whereas sensitivity (leverage) of each atribute in technology and infrastructure dimension was shown in Figure 8.



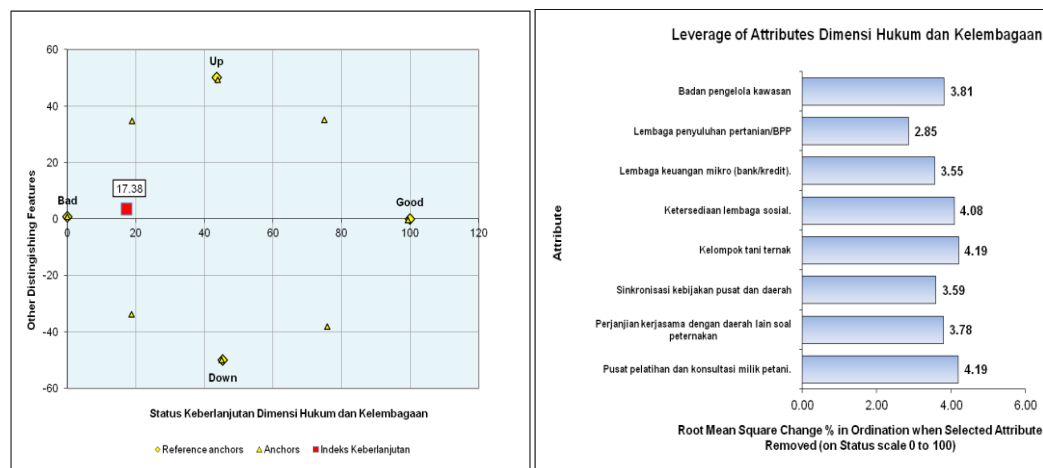


**Figure 7:- Sustainability Status****Figure 8:-Sensitivity of Attribute**

As shown in Figure 7, the sustainability status index was 18.84. This index was positioned at the range of 0.00-19.99 meaning as not sustainable. It occurred because in general, breeders/farmers still used traditional method to manage their work. Result of analysis also showed that if this condition was not improved or just keeping obstinate to use traditional method, then the agribusiness involving the integration system between cattle and crop would be hardly developed because it might be less competitive due to the lack of the availability of technology and infrastructure. As displayed in Figure 8, some attributes were very influential to the sustainability of technology and infrastructure dimension, and these were the distribution of artificial-insemination service post, the availability of agribusiness structure and infrastructure, and the availability of livestock product processing technology (post-production). In other words, the improvement of sustainability status of technology and infrastructure dimension could be focused on the provisioning of artificial-insemination service post, and by making available the structure and infrastructure that supported breeding activity, such as livestock extension house and others. Also, post-production technology for breeding could also improve the agribusiness that involved the cattle-crop integration system.

#### Dimension of Law and Organization:-

Result of MDS analysis on the sustainability status of law and organization dimension was plotted at Figure 9.



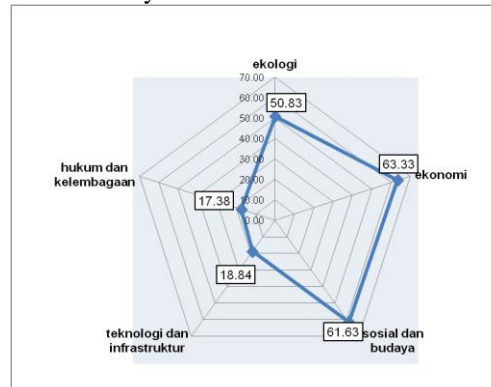
**Figure 9:- Sustainability Status of Law and Organization Dimension**

**Figure 8:- Sensitivity of Attribute of**

Figure 9 had shown that sustainability status index of law and organization dimension was 17.38. It remained at the range of 0.00-19.99, meaning that the dimension was not sustainable. It could be said that the support of government and immediate agencies to the agribusiness with cattle-crop integration system was still lacking. Attributes influencing greatly to the sustainability of this dimension was presented in Figure 10. As shown by this figure, there were eight attributes to measure law and organization dimension. In general, its leverage rate was almost similar or

considered as balancing. There were eight attributes that must be attended to improve the sustainability of law and organization dimension. Those with the highest leverage were the presence of breeder group, the presence of training and consultation center, and the presence of relevant social agency.

The combination of all five dimensions would be useful in measuring the sustainability of agribusiness involving cattle-crop integration system. This sustainability rate of this combination was shown in Figure 11.



**Figure 11:-Kite Diagram of Sustainability Status of The Model of Agribusiness with Cattle-Crop Integration System**

In average, the sustainability index rate of the agribusiness involving cattle-crop integration system in research area was 42.40, or in the range of 25.00-49.99 (less sustainable). As shown in kite diagram, if the index went out the diagram or approached to 100, it meant that sustainability status was better. Conversely, when it stayed inside diagram or went to the proximity of 0, the sustainability status would be worse. Of five dimensions explained, the dimension with the worst sustainability status was the dimension of technology and infrastructure, and the dimension of law and organization, with each sustainability status of 18.84 and 17.38 (meaning as not sustainable).

## Conclusion And Suggestion:-

### Conclusion:-

Based on the result of research and discussion, it was concluded in the following:

1. Result of analysis on sustainability status was described:
  - a. In term of dimension of ecology, the agribusiness with cattle-crop integration system was quite sustainable with the sustainability index of 50.83. The important attributes included the processing of RPH waste, the availability of RPH, and the supporting capacity of the feed. The economy dimension was also quite sustainable with the index of 63.33, where the sensitive attributes were the availability of feed industry, the availability of livestock market, and the availability of place to sell the livestock.
  - b. Socio-culture dimension had sustainability index of 61.63 which meant as quite sustainable. The influential attributes were the role of community in livestock business, the frequency of conflict, and the worker absorbance rate.
  - c. Technology and infrastructure dimension was not sustainable with sustainability index of 18.84. The sensitive attributes included the presence of artificial-insemination service post, the availability of agribusiness structure and infrastructure, and the availability of livestock product processing technology (post-production).
  - d. Law and organization dimension had sustainability index of 17.38. The influential attributes were the presence of breeder group, the presence of training and consultation center, and the presence of relevant social agency.
2. The model of optimization and sustainability of the agribusiness with cattle-crop integration system would be helpful in the formulation of policies for the interest of breeders because it allowed breeders to apply sustainable integration system. The combination of five dimensions of sustainability was used to measure the sustainability of agribusiness work with cattle-crop integration system. In whole, based on these five dimensions of sustainability, the agribusiness work with cattle-crop integration system at research area had the sustainability index rate of 42.40. This index justified the fact that agribusiness work was less sustainable. Dimension with the worst sustainability index, and must be seriously attended, included the dimension of technology and infrastructure and also the dimension of law and organization.

**Suggestion:-**

1. Beef cattle breeding contributed to the income of farmers at relatively smaller degree if compared to the farming activities. Based on the result of Linear Programming Analysis, and in order to achieve the optimum condition, the people of Tegalwangi Village was suggested to bred beef cattle in number of 21 cattles. The number on breeder was more than this suggested number. Therefore, to improve the contribution to farmers' income, then breeders could be educated to manage their breeding in more efficient and effective ways. It should be done to keep cattles providing better input or income.
2. It was also suggested that educating farmers in relative to their breeding method must be important, at least to achieve the optimum condition as shown by the result of analysis of Linear Programming. The increase of farmers' income from beef cattle breeding was also significant.
3. More attentions should be given to the improvement and the availability of technology, infrastructure and organization in research area, which would keep cattle-crop integration system more sustainable.

**References:-**

1. Adnyana. 2003. **Pengkajian dan Sintesis Kebijakan Pengembangan Peningkatan Produktivitas Padi dan Ternak (P3T) ke Depan**. Laporan Teknis Pusat Penelitian dan Pengembangan Tanaman Pangan, Litbang Pertanian, Bogor.
2. Agung, I Gusti Ngurah. 2006. **Statistika Penerapan Model Rerata Sel Multivariat dan Model Ekonometri dengan SPSS**. Jakarta : Yayasan SAD Satria Bhakti.

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### RESEARCH ARTICLE

## FRACTURE DISLOCATION OF PROXIMAL HUMERUS WITH INTRATHORACIC DISPLACEMENT OF THE HUMERAL HEAD. A RARE PRESENTATION.

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### Manuscript Info

#### Manuscript History

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#### Key words:-

Fracture dislocation proximal humerus ,  
Intrathoracic migration, Neers  
Prosthesis.

### Abstract

High velocity trauma results in fracture dislocation of the proximal humerus. Dislocated fragments of the proximal humerus fracture very rarely migrate into ipsilateral hemithorax. The dislocation adds an extra level of difficulty to the treatment of complex multipart proximal humeral fractures with higher risk of osteonecrosis. Classified as 11B3 by OTA classification. To our knowledge this is among the very few cases reported till date of intrathoracic humeral head migration.

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### Introduction:-

Fracture –dislocation of the humeral head into the thoracic cavity is a rare injury and there is no consensus on its treatment. We report the presentation and management of this injury in a 50-year female in developing country.

### Case report:

A 50 year old female had a road traffic accident with the vehicle falling over the bridge. The patient was brought to the emergency department with pain and swelling of left shoulder and inability to move shoulder joint. The general examination was unremarkable. On local examination patient had tenderness over shoulder and left side of chest without any neurovascular deficit distally in the limb. All movements of shoulder joint were restricted. Radiological examination with x ray shoulder revealed comminuted fracture proximal humerus with ipsilateral intrathoracic dislocation of humeral head. NCCT shoulder and chest was done with 3-D images showing posterolateral migration of head into ribcage. Usg chest showed haemothorax. Patient was posted in **emergency** for **thoracotomy** for removal of humeral head. Under general anesthesia in right lateral position a lateral incision was taken on 4 th intercostal space, dissected layer by layer to expose the rib. The rib was cut and pleural space was entered. The humeral head without any soft tissue attachment was found posterolaterally in pleural space. An ICD was kept and incision closed in layers. Patient was allowed to stabilise after thoracotomy and later posted after 2 weeks for **SHOULDER HEMIARTHROPLASTY**. Under general anesthesia and in supine position a deltopectoral approach was used for exposure of proximal humerus. The greater tuberosity and lesser tuberosity fragments with attached muscles were identified which helped for clinical judgement. The humerus cannal was prepared and cemented Neers prosthesis of size 35mm was inserted. The prosthesis was reduced in glenoid cavity having good stability. The rotator cuff was repaired along with the reduction of greater and lesser tuberosity. Wound was given, drain kept and incision closed in layers. Physical therapy and rehabilitation programme followed with good range of motion.

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**Results and Discussion:-**

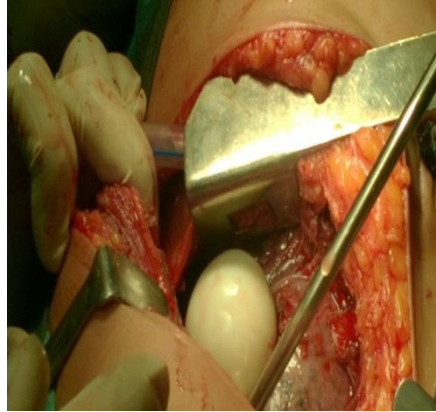
Fractures of the proximal humerus are sometimes associated with dislocation of the proximal fracture fragment , occurring more commonly anteriorly than posteriorly [7]. Rarely the dislocated fragment migrates into the ipsilateral hemithorax and may be associated with single or multiple rib fractures[1-6]. Associated pneumothorax or haemothorax occurred in some cases[2-4]. One case was managed nonoperatively with humeral head left within the thoracic cavity without apparent sequale[3]. Regarding the mechanism of ipsilateral intrathoracic dislocation one study suggested that a sudden abduction force was sufficient to both fracture the humerus and drive the dislocated humeral head between the ribs[3]. Another study suggested that a force along the humeral shaft could force the dislocated head into the thoracic cavity[4]. Needs carefull and vigilant x ray evaluation in emergency followed by CT scan. As the humeral head has no muscular or capsular attachment left so blood supply to head is disrupted , hence head osteonecrosis is inevitable so total shoulder arthorplasty or hemiarthroplasty is the surgery of choice.

**Legends:-**

**Fig 1:-** X-ray shoulder in emergency department



**Fig 2:-** 3D CT showing intrathoracic humeral head



**Fig 3:-** Humeral head found postero-laterally in pleural space



**Fig 4:-** Cemented Neers prosthesis reduced onto glenoid



**Fig 4:-** Postoperative X-ray with Neers prosthesis

### References:-

1. West EF. Intrathoracic dislocation of the humerus. *J Bone Joint Surg Br* **1949**;31-B:61-62
2. Glessner JR. Intrathoracic dislocation of the humeral head. *J Bone Joint Surg Am* **1961**;43-A:428-430
3. Patel MR, Pardee ML, Singerman RC. Intrathoracic dislocation of the head of the humerus. *J Bone Joint Surg AM* **1963**;45-A:1712-1714
4. Hardcastle PH, Fisher TR. Intrathoracic displacement of the humeral head with fracture of the surgical neck. *Injury* **1981**;12:313-315
5. Kaar TK, Rice JJ, Mullan GB. Fracture dislocation of the shoulder with intrathoracic displacement of the humeral head. *Injury* **1955**;26:638-639
6. Brogdon BG, Crotty JM, MacFeely L, McCann SB, Fitzgerald M. Intrathoracic fracture dislocation of the humerus. *Skeletal Radiol* **1995**;24:383-385
7. Rogers LF. *Radiology of skeletal trauma*, 2<sup>nd</sup> ed. New York: Churchill-Livingstone, **1992**:696-804





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### RESEARCH ARTICLE

#### PREVALENCE AND IMPACT ON JOB PERFORMANCE OF PRIMARY HEADACHE AMONG MEDICAL AND PARAMEDICAL STAFF IN THE EMERGENCY DEPARTMENTS OF TAIF HOSPITALS - SAUDI ARABIA

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#### Manuscript Info

##### Manuscript History

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#### Abstract

**Objectives:** The headache is one of the most common neurological disorders and was ranked the third cause of years lost due to disability. So This study conducted to identify the prevalence of headache and its impact on job performance in emergency department medical and paramedical staff.

**Methods:** A cross-sectional study using self-administered questionnaire. The sample of 308 medical and paramedical staff were selected randomly from emergency departments of Taif hospitals during the period from December 2016 - January 2017.

**Results:** Three hundred eight staff participated in the study. 158 (51.3%) Male and 150 (48.7%) Female. 132 (42.9%) Medical and 176 (57.1%) Paramedical. The last Three months prevalence of headache among participants was 272 (88.3%) and having statistical significant differences with Physical Activities ( $p=0.008$ ) and Smoking ( $p=0.020$ ). Regarding the Impact of headache, 86 (31.6%) Little to no impact and the others have severe impact 74 (27.2%), Remarkable impact 40 (14.7%) and Some impact 72 (26.5%). There were statistical significant differences ( $p \leq 0.05$ ) between Headache impact test and age, marital status, specialty, BMI, Physical activities, smoking, headache duration, specialist consultation, Medication use and frequency of absenteeism.

**Conclusion:** The primary headache prevalence is very high among medical and paramedical staff in emergency departments. Its characteristics are almost meeting the diagnostic criteria of the tension type headache. The impact of headache on job performance is little in the most of the staff, but there is significant percent of those with severe impact.

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#### Introduction:-

The headache is one of the most common neurological disorders. It is been in the form of pain and disability that occur in primary headache disorders called cluster, migraine, tension-type headache. The headache can occur due to

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secondary causes such as medication-overuse headache.<sup>[1]</sup> So the headache is classified regarding the causes to Primary headache that is daily, benign and not caused by underlying disorders and Secondary headache is caused by underlying problems such as Head injuries and space occupying lesions (e.g. bleeding, tumors ...etc.).<sup>[2]</sup>

According to Global Burden of Disease Study 2013, Headache was ranked the third cause of years lost due to disability (YLD).<sup>[3]</sup>

The Most common type of headaches is primary headache (More Than 90%), and mostly episodic tension-type headache. Roughly everyone is suffered from this type of headache at least once in his life. In Saudi Arabia, the headache prevalence is 63% affecting mainly females and younger age. The tension-type headache has had the highest type prevalence (32%) and is considered as the common cause of the physician visits and work absenteeism. It is followed by the migraine headache that was (2.6 - 5%).<sup>[4-5]</sup>

The medical and paramedical staff are exposed to high work stress, that can let them suffering from psychosomatic symptoms such as Primary headache. The Headache disabilities have an actual effect on job performance, costs and outcomes. Some studies found that the 31% of Migraine headache sufferers were losing one workday in a period of 3 months, and absent an ordinary of 10.7 days/year for the sake of headache symptoms. The absenteeism due to migraine headache costs annually \$13 Billion Dollars and \$1,165 Dollars for each individual in the United States of America (USA).<sup>[6-8]</sup>

There is still a lack of sufficient studies to investigate the primary headache prevalence and its impact on the job performance of medical and paramedical staff in the Emergency departments. The goals of conducting this study are to determine the prevalence and impact on the job performance of primary headache among medical and paramedical staff in the Emergency departments of Taif city hospitals - Saudi Arabia.

#### Methods:-

A cross-sectional study was designed to assess the prevalence of Headache in the Emergency Department Health Related Staff and its effect on job performance, using self-administered questionnaire. It includes 3 parts: **The First Part** collects the sociodemographic data (Age, gender, marital status, specialty, Body Mass Index (BMI), physical activity, smoking, income and Family History) and determines the participant suffering from headache in the last 3 months. All those participants answered this question with "yes", they asked to continue the rest of the questionnaire. **The second part** included questions about the characteristics of headache. **The Third part** assessed the impact of headache on job performance by using Headache Impact Test (HIT-6)<sup>[9]</sup>. The score of (HIT-6) shows the burden of headache on normal daily life and job performance as the following:

- **Score 60 or More:** The headache have very severe impact on the life and job.
- **Score 56 – 59:** The headache have a remarkable impact on life and job.
- **Score 50 – 55:** The headache have some impact on life and job.
- **Score 49 or Less:** The headache have a little to no impact on life and job.

The sample of 308 medical and paramedical staff was selected randomly from emergency departments of Taif hospitals (King Abdul Aziz Specialist Hospital, King Faisal Hospital, Prince Mansour Military Hospital, Al-Hada Military Hospital and Al-Ameen Hospital), during the period from December 2016 - January 2017.

All medical and paramedical staff those work in emergency department, over 18 years old and either male or female were included in the study. The health care providers those suffered from headache due to secondary causes were excluded. All participants were informed about the nature of the study and oral consent obtained from those who agreed to participate in the study. All participants were informed that their participation in the study is voluntary. The data was coded and entered using Microsoft Excel 2010, and then analyzed using SPSS program version 0.21.

#### Results:-

##### Sociodemographic Data:-

Three hundred eight medical and paramedical emergency department staff participated in the study. Most of the participants were Male (51.3%), Age group ranged from (25 - 39) with 57.1%, Single (51.9%), Paramedical (57.1%), Body Mass Index (BMI) Mean and Standard Deviation (SD) (24 ±5), Not performing ≥ 30 min. of physical activities (48.1%), Non-Smoker and 5000-10,000SR Income/Month, (79.9%) and (55.8%), respectively. (**Table 1**)



**Table 1:-** Socio-demographic data of the study sample (N=308)

		<b>N</b>	<b>%</b>
<b>Age</b>	18 - 24	80	26%
	25 - 39	176	57.1%
	40 - 59	52	16.9%
	<b>Total</b>	<b>308</b>	<b>100%</b>
<b>Gender</b>	Male	158	51.3%
	Female	150	48.7%
	<b>Total</b>	<b>308</b>	<b>100%</b>
<b>Marital status</b>	Single	160	51.9%
	Married	144	46.8%
	Divorced/Widow	4	1.3%
	<b>Total</b>	<b>308</b>	<b>100%</b>
<b>Specialty</b>	Medical	132	42.9%
	Paramedical	176	57.1%
	<b>Total</b>	<b>308</b>	<b>100%</b>
<b>Body Mass Index (BMI)</b>	Underweight	36	11.7%
	Normal	148	48.1%
	Overweight	80	26%
	Obese	44	14.3%
	<b>Total</b>	<b>308</b>	<b>100%</b>
<b>BMI Mean and SD</b>		24 ± 5	
<b>Physical Activities ≥ 30 mins./Week</b>	Never	148	48.1%
	1	56	17.5%
	1 - 3	70	22.7%
	+3	36	11.7%
	<b>Total</b>	<b>308</b>	<b>100%</b>
<b>Smoking</b>	Yes	62	20.1%
	No	246	79.9%
	<b>Total</b>	<b>308</b>	<b>100%</b>
<b>Income</b>	5000-10,000 SR	172	55.8%
	10,000 – 15,000 SR	88	28.6%
	+ 15000 SR	48	15.6%
	<b>Total</b>	<b>308</b>	<b>100%</b>
<b>Family history</b>	Yes	122	39.6%
	No	186	60.4%
	<b>Total</b>	<b>308</b>	<b>100%</b>
<b>Headache last three months</b>	Yes	272	88.3%
	No	36	11.7%
	<b>Total</b>	<b>308</b>	<b>100%</b>

**Prevalence of Headache:-**

The last Three months prevalence of headache among participants was 88.3%. It was common in The age group ranging from 40-59 (96.2.1%), Male (89.9.2%), Divorced (100%), Paramedical (88.1%), Obese (95.5%), Those performing physical activities ≥ 30 min more than 3 times per week (94.4%), Smokers (96.8%), those with monthly income between 5000-10,000SR (90.7%) and those with positive family history of headache (90.2%).

There were statistical significant differences between headache occurrence in the last 3 months and Physical Activities ≥ 30 mins./Week ( $p=0.008$ ) and Smoking ( $p=0.020$ ). (**Table 2**)

**Table 2:-** Association between sociodemographic data and Headache occurrence in the last 3 months

		Headache occurrence in the last 3 months				X <sup>2</sup>	P. Value
		Yes		No			
		N	%	N	%		
Age	18 - 24	72	(23.4%) 90%	8	(76.6%) 10%	4.94	0.09
	25 - 39	150	(48.7%) 85.2%	26	(51.3%) 14.8%		
	40 - 59	50	(16.2%) 96.2%	2	(83.8%) 3.8%		
Gender	Male	142	89.9%	16	10.1%	0.77	0.38
	Female	130	86.7%	20	13.3%		
Marital status	Single	136	85%	24	15%	3.8	0.15
	Married	132	91.7%	12	8.3%		
	Divorced/Widow	4	100%	0	0%		
Specialty	Medical	116	87.9%	16	12.1%	0.04	0.84
	Paramedical	156	88.6%	20	11.4%		
Body Mass Index (BMI)	Underweight	30	83.3%	6	16.7%	3.74	0.29
	Normal	128	86.5%	20	13.5%		
	Overweight	72	90%	8	10%		
	Obese	42	95.5%	2	4.5%		
Physical Activities ≥ 30 mins./Week	Never	138	93.2%	10	6.8%	11.92	0.008 <sup>††</sup>
	1	44	81.5%	10	18.5%		
	1 - 3	56	80%	14	20%		
	+3	34	94.4%	2	5.6%		
Smoking	Yes	60	96.8%	2	3.2%	5.39	0.020 <sup>††</sup>
	No	212	86.2%	34	13.8%		
Income	5000-10,000 SR	156	90.7%	16	9.3%	2.43	0.30
	10,000 – 15,000 SR	76	86.4%	12	13.6%		
	+ 15000 SR	40	83.3%	8	16.7%		
Family history	Yes	110	90.2%	12	9.8%	0.67	0.41
	No	162	87.1%	24	12.9%		

†† Statistically significant difference

(nn.n%) Column percent (of all sample)

**Headache Characteristics:-**

The characteristics of headache are represented in **(Table 3)**. 58.8% of the participants suffering from headache for less than three years. The headache is happening often weekly in 51.5% of participants. It is almost Bilateral (56.6%), Dull/pressing (52.9%) in character, Gradually (42.6%) in onset, Moderate in intensity (58.1%), not increasing in frequency (58.8%), occurring in the evening (53.7%), relieving in hours with medications (50%) and without medications (64%), worsening by physical activities (57.4%) and Not associated with nausea (66.9%), vomiting (85.3%), sensitivity to light (52.9%) and neurological deficiencies (83.8%), but associated with sensitivity to noise (53.7%).

There is 73.5% of participants didn't seek a consultation with specialist and didn't absent from work due to headache. 49.3% didn't use medications for their headache complaint.

**Table 3:-** Headache characteristics (N= 272)

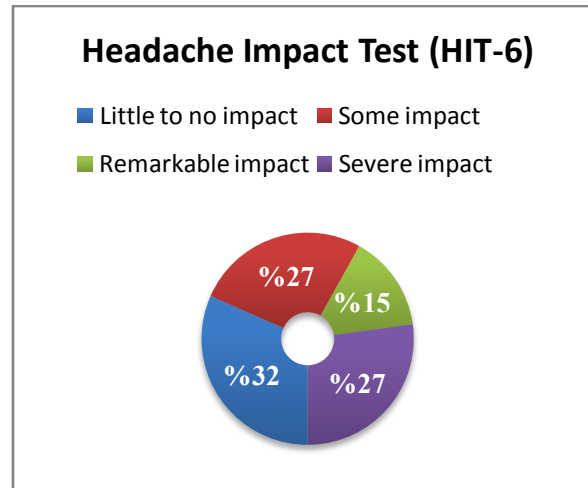
		N	%
<b>Headache duration (years)</b>	1 - 3 Years	160	58.8%
	3 - 5 Years	44	16.2%
	+ 5 Years	68	25%
<b>Headache frequency</b>	Daily	34	12.5%
	Weekly	140	51.5%
	Monthly	98	36%
<b>Headache site</b>	Bilateral	154	56.6%
	One-sided	118	43.4%
<b>Headache character</b>	Pulsating / throbbing	128	47.1%
	Dull/pressing	144	52.9%
<b>Headache onset</b>	Gradually	116	42.6%
	Suddenly	78	28.7%
	Varies	78	28.7%
<b>Headache intensity</b>	Mild	74	27.2%
	Moderate	158	58.1%
	Sever	40	14.7%
<b>Headaches increasing in frequency</b>	Yes	112	41.2%
	No	160	58.8%
<b>Headache time</b>	Morning	68	25%
	Evening	146	53.7%
	Night	58	21.3%
<b>Headache relieving (With Medications)</b>	Minutes	44	16.2%
	Hours	136	50%
	Days	18	6.6%
	No Medication Use	74	27.2%
<b>Headache relieving (Without Medications)</b>	Minutes	46	16.9%
	Hours	174	64%
	Days	52	19.1%
<b>Headache worsened by physical activities</b>	Yes	156	57.4%
	No	116	42.6%
<b>Headaches associated with nausea</b>	Yes	90	33.1%
	No	182	66.9%
<b>Headaches associated with vomiting</b>	Yes	40	14.7%
	No	232	85.3%
<b>Sensitivity to light</b>	Yes	128	47.1%
	No	144	52.9%
<b>Sensitivity to noise</b>	Yes	146	53.7%
	No	126	46.3%
<b>Neurological deficiencies</b>	Yes	44	16.2%
	No	228	83.8%
<b>Specialist consultation</b>	General practitioner	24	8.8%
	Family Physician	18	6.6%
	Neurologist	30	11%
	None	200	73.5%
<b>Medication use</b>	No medication	134	49.3%
	Prescription	46	16.9%
	Over the counter	92	33.8%
<b>Frequency of Absenteeism</b>	1 - 5 days	46	16.9%
	5 - 10 days	20	7.4%
	+10 days	6	2.2%
	None	200	73.5%

**Headache Impact Test (HIT-6):-**

More than one-fourth of participants have Little to no impact(31.6%) and the others have severe impact(27.2%), Remarkable impact(14.7%) and Some impact(26.5%).(**Figure 1**)

There were statistical significant differences ( $p \leq 0.05$ ) between Headache impact test (HIT-6) and age, marital status, specialty, BMI, Physical activities, smoking, headache duration, specialist consultation, Medication use and frequency of absenteeism. There weren't (HIT-6) and gender and income.

The severe impact of headache was almost affecting those people aging from 40-59 (48%), Married(33.3%), Medical (39.7%), Obese (100%), have headache more than 3 years (33.6%), consulting neurologist (60%), on over the counter medications (32.6%) and absented 5-10 days per year (60%). (**Table 4**)



**Figure 1:-**Headache Impact Test (HIT-6)

**Table 4:-** Headache Impact Test (HIT-6) (N= 272)

		Headache impact test (HIT-6)								X <sup>2</sup>	P. Value
		Severe impact		Remarkable impact		Some impact		Little to no impact			
		N	%	N	%	N	%	N	%		
Age	18 - 24	18	25%	10	13.9%	20	27.8%	24	33.3%	15.9	0.01 <sup>††</sup>
	25 - 39	32	21.3%	22	14.7%	42	28%	54	36%		
	40 - 59	24	48%	8	16%	10	20%	8	16%		
Marital status	Single	30	22.1%	10	7.4%	44	32.4%	52	38.2%	25.2	0.00 <sup>††</sup>
	Married	44	33.3%	28	21.2%	28	21.2%	32	24.2%		
	Divorced/Widow	0	0%	2	50%	0	0%	2	50%		
Specialty	Medical	46	39.7%	16	13.8%	30	25.9%	24	20.7%	19.3	0.00 <sup>††</sup>
	Paramedical	28	17.9%	24	15.4%	42	26.9%	62	39.7%		
Body Mass Index (BMI)	Underweight	0	0%	0	0%	0	0%	30	100%	411.1	0.00 <sup>††</sup>
	Normal	0	0%	0	0%	72	56.3%	56	43.8%		
	Overweight	3	44.4%	40	55.6%	0	0%	0	0%		

		2	%		%						
	Obese	4	100%	0	0%	0	0%	0	0%		
		2									
<b>Physical Activities <math>\geq</math> 30 mins./Week</b>	Never	3	24.6%	20	14.5%	4	30.4%	4	30.4%	<b>18</b>	<b>0.04<sup>††</sup></b>
		4	%		%	2	%	2	%		
	1	1	36.4%	4	9.1%	6	13.6%	1	40.9%		
		6	%				%	8	%		
	1 - 3	1	17.9%	14	25%	1	28.6%	1	28.6%		
		0	%			6	%	6	%		
	+3	1	41.2%	2	5.9%	8	23.5%	1	29.4%		
		4	%				%	0	%		
<b>Smoking</b>	Yes	1	20%	24	40%	8	13.3%	1	26.7%	<b>40.6</b>	<b>0.00<sup>††</sup></b>
		2					%	6	%		
	No	6	29.2%	16	7.5%	6	30.2%	7	33%		
		2	%			4	%	0			
<b>Headache duration (years)</b>	1 - 3 Years	3	22.5%	18	11.3%	4	30%	5	36.3%	<b>29.3</b>	<b>0.00<sup>††</sup></b>
		6	%		%	8		8	%		
	3 - 5 Years	1	36.4%	16	36.4%	6	13.6%	6	13.6%		
		6	%		%		%		%		
	+ 5 Years	2	32.4%	6	8.8%	1	26.5%	2	32.4%		
		2	%			8	%	2	%		
<b>Specialist consultation</b>	General practitioner	2	8.3%	2	8.3%	1	66.7%	4	16.7%	<b>50.8</b>	<b>0.00<sup>††</sup></b>
						6	%		%		
	Family Physician	6	33.3%	4	22.2%	2	11.1%	6	33.3%		
			%		%		%		%		
	Neurologist	1	60%	8	26.7%	2	6.7%	2	6.7%		
		8			%						
	None	4	24%	26	13%	5	26%	7	37%		
		8				2		4			
<b>Medication use</b>	No medication	2	19.4%	16	11.9%	3	23.9%	6	44.8%	<b>34.2</b>	<b>0.00<sup>††</sup></b>
		6	%		%	2	%	0	%		
	Prescription	1	39.1%	4	8.7%	2	43.5%	4	8.7%		
		8	%			0	%				
	Over the counter	3	32.6%	20	21.7%	2	21.7%	2	23.9%		
		0	%		%	0	%	2	%		
<b>Frequency of Absenteeism</b>	1 - 5 days	2	56.5%	2	4.3%	1	21.7%	8	17.4%	<b>46.3</b>	<b>0.00<sup>††</sup></b>
		6	%			0	%		%		
	5 - 10 days	1	60%	4	20%	2	10%	2	10%		
		2									
	+10 days	2	33.3%	0	0%	2	33.3%	2	33.3%		
			%				%		%		
	None	3	17%	34	17%	5	29%	7	37%		
		4				8		4			

†† Statistically significant difference

### Discussion:-

The Headache is the most common of neurological disorders that cause disabilities and have an impact on job performance among population. [6, 8] Multiple studies have reported the prevalence of headache in the health workers. But the studies denoted the headache and its impact among emergency department staff are rare. To date, this study is the first one that assess the prevalence of headache and its impact on job performance among medical and paramedical staff in the emergency departments in the hospitals of Saudi Arabia.

The health care works need a concentration, hard work and effort. Absence or weariness of one of the emergency department staff for one day or some time can affect the health care process. [10] So the headache needs evaluating and managing among medical and paramedical staff as all and specifically those working in the emergency departments.

In our study, we found the last three months prevalence of headache among medical and paramedical emergency department staff is 88.3% (**Table 1**), 87.9% of medical and 88.6% of paramedical (**Table 2**). This prevalence is much higher than the mean of global headache prevalence 46% as well as the general population prevalence in Saudi Arabia 63%.<sup>[5,11]</sup> And the other studies among various Health Care Workers (HCWs) that conducted in Switzerland, Nigeria, Taiwan and North China offer 61%, 39.3%, 49.6% and 45.3%, respectively.<sup>[12-15]</sup> These stringent results refer to the burden of stress that affecting health care professionals and exactly the emergency department staff.<sup>[16]</sup>

The statistical significant difference is shown in (**Table 2**) between headache prevalence in the last 3 months and doing physical activities  $\geq 30$  min. more than thrice a week ( $p=0.008$ ), because the headache is triggered by physical activities in 57.4% of the participant and this is supported by Zivadinov and colleagues study, that suggested the physical activity is one of the most triggers of headache.<sup>[17]</sup> As well as the Smoking have an association with headache prevalence ( $p=0.020$ ), represented in the smokers have a higher prevalence of headache (96.8%) than non-smokers (86.2%). This implies that the smoking have a negative effect on the headache occurrence as in Qi Gan and colleagues study (2016).<sup>[18]</sup> But this issue is conflicting according to Taylor, F. R. (2015).<sup>[19]</sup>

The headache characteristics among the study sample were weekly in 51.5% (**Table 3**). It is almost Bilateral (56.6%), Dull/pressing (52.9%) in character, Gradually (42.6%) in onset, Moderate in intensity (58.1%), not increasing in frequency (58.8%), occurring in the evening (53.7%), relieving in hours with medications (50%) and without medications (64%), worsening by physical activities (57.4%) and Not associated with nausea (66.9%), vomiting (85.3%), sensitivity to light (52.9%) and neurological deficiencies (83.8%), but associated with sensitivity to noise (53.7%). Most of these characteristics are meeting the diagnostic criteria of the tension type headache of the headache disorders classification, 3<sup>rd</sup> edition - beta version (ICHD-3 beta) by International Headache society, except the triggering of headache by physical activities and the sensitivity to noise (phonophobia).<sup>[20]</sup> Regarding to the worsening of headache by the physical activities, it is one of the migraine criteria, according to the International Headache society (ICHD-3 beta). As for phonophobia, If it is occurring not more than once, It may be considered as tension type headache. Overall, these characteristics may suggest that the tension type headache is the most type of primary headache affecting the medical and paramedical staff in emergency department, and it is supported by Sokolovic et al (2013).<sup>[12]</sup>

Unfortunately, The headache have a severe impact on the life and job performance of 27.2% of the emergency department staff. (**Figure 1**) Also, 36.4% of them were absenting from work due to the headache for 5 to 10 days in the past year (2016). Hence, This causes work productivity decline and defect in the health care providing process.<sup>[10]</sup> These results can illustrate the high percent (60%) of seeking a consultation from a neurologist rather than other specialists and using a prescribed medications (39.1%). (**Table 4**) But when we discerned these sufferer staff, we found them almost have a risk factors of developing headache, such as: Obesity and over the counter medications use.<sup>[21]</sup> So the risk factors, mainly modifiable, have to be taken into account beside the life and work stress impact. The most age group were severely affected by primary headache is that between 40 - 59 years old, and that affected little to no impact were 25 - 39 years old. This is antithesis of many studies which assume the primary headache is decreasing during the aging.<sup>[22,23]</sup> Fortunately still there is 31.6% of participants have a little and even no impact by headache on their life and jobs, and they represent most of the medical and paramedical emergency department staff in Saudi Arabia.

Finally, we recommend conducting further studies to assess the prevalence of headache and its impact on life and job performance in the health care field employee as all. Also, the documentation of the headache suffering employee is important, to take into account their conditions and so help them to overcome it and improve their life quality. Subsequently, This will increase the work productivity and decrease the burden of headache.

## Conclusion:-

The primary headache prevalence is very high among medical and paramedical staff in emergency departments. Its characteristics are almost meeting the diagnostic criteria of the tension type headache. The impact of headache on job performance is little in the most of the staff, but there is significant percent of those with severe impact.

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## References:-

1. WHO : Headache disorders Fact sheet Updated April 2016.
2. Goadsby PJ, Raskin NH. Chapter 14. Headache. In: Longo DL, Fauci AS, Kasper DL, Hauser SL, Jameson J, Loscalzo J. eds. *Harrison's Principles of Internal Medicine*, 18e. New York, NY: McGraw-Hill; 2012.
3. Global Burden of Disease Study 2013 Collaborators (2015) Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* (published online June 8, 2015 at [http://dx.doi.org/10.1016/S0140-6736\(15\)60692-4](http://dx.doi.org/10.1016/S0140-6736(15)60692-4))
4. Kunkel, Robert S. (2010-08-01). "Headache". *Disease Management Project: Publications*. Cleveland Clinic. Retrieved 2010-08-06.
5. Al Jumah, M., Al Khathaami, A., Kojan, S., Hussein, M., Stovner, L., Steiner, T., & Al saleh, L. (n.d.). The Burden of Primary Headache Disorders in Saudi Arabia. *Neurology journals*. Retrieved from [http://www.neurology.org/content/80/7\\_Supplement/P03.112.short](http://www.neurology.org/content/80/7_Supplement/P03.112.short)
6. Lin, K. C., et al. (2007). "Association between stress at work and primary headache among nursing staff in Taiwan." *Headache*
7. Kessler RC, Shahly V, Stang PE, Lane MC. The associations of migraines and other headaches with work performance: Results from the National Comorbidity Survey Replication (NCS-R). *Cephalalgia*. 2010;30(6):722–734. doi: 10.1177/0333102410363766.
8. Lipton RB, Stewart WF, Diamond S, Diamond ML, Reed M. Prevalence and burden of migraine in the United States: data from the American Migraine Study II. *Headache*. 2001;41(7):646–657.
9. Yang M, Rendas-Baum R, Varon SF, Kosinski M. Validation of the Headache Impact Test (HIT-6™) across episodic and chronic migraine. *Cephalalgia*. 2011;31(3):357–367. doi:10.1177/0333102410379890.
10. Aluko OO, Adebayo AE, Adebisi TF, Ewegbemi MK, Abidoye AT, Popoola BF. Knowledge, attitudes and perceptions of occupational hazards and safety practices in Nigerian healthcare workers. *BMC Research Notes*. 2016;9:71. doi:10.1186/s13104-016-1880-2.
11. Stovner, L., Hagen, K., Jensen, R., Katsarava, Z., Lipton, R., Scher, A., Steiner, T. and Zwart, J.-A. (2007), The global burden of headache: a documentation of headache prevalence and disability worldwide. *Cephalalgia*, 27: 193–210. doi:10.1111/j.1468-2982.2007.01288.x
12. Sokolovic et al.: Self-reported headache among the employees of a Swiss university hospital: prevalence, disability, current treatment, and economic impact. *The Journal of Headache and Pain* 2013 14:29.
13. Olajumoke Oshinaike, Oluwadamilola Ojo, Njideka Okubadejo, Olaitan Ojelabi, and Akinola Dada, "Primary Headache Disorders at a Tertiary Health Facility in Lagos, Nigeria: Prevalence and Consultation Patterns," *BioMed Research International*, vol. 2014, Article ID 782915, 5 pages, 2014. doi:10.1155/2014/782915
14. Lin KC, Huang CC, Wu CC. Association between stress at work and primary headache among nursing staff in Taiwan. *Headache*. 2007;47:576–584. doi: 10.1111/j.1526-4610.2007.00759.x.
15. ang Y, Xie J, Yang F, Wu S, Wang H, Zhang X, Liu H, Deng X, Yu S. The prevalence of primary headache disorders and their associated factors among nursing staff in North China. *J Headache Pain*. 2015;16:4. doi:10.1186/1129-2377-164.
16. Patrick KS. Burnout: Job hazard for health workers. *Hospitals*. 1979;16:87-90.
17. Zivadinov R, Willheim K, Sepic-Grahovac D, Jurjevic A, Bucuk M, Brnabic-Razmilic O, Relja G, Zorzon M (2003) Migraine and tension type headache in Croatia: a population-based survey of precipitating factors. *Cephalalgia* 23(5):336–343
18. Qi Gan, W., Estus, S. and Smith, J. H. (2016), Association Between Overall and Mentholated Cigarette Smoking With Headache in a Nationally Representative Sample. *Headache*, 56: 511–518. doi:10.1111/head.12778
19. Taylor, F. R. (2015), Tobacco, Nicotine, and Headache. *Headache: The Journal of Head and Face Pain*, 55: 1028–1044. doi:10.1111/head.12620
20. Headache Classification Subcommittee of the International Headache Society. The international classification of headache disorders, 3<sup>rd</sup> edn. *Cephalalgia* 33, 629–808 (2013).
21. Garza I, et al. Overview of chronic daily headache. <http://www.uptodate.com/home>. Accessed Jan. 6, 2015.
22. Armstrong, Carol L., and Lisa Morrow. *Handbook of Medical Neuropsychology: Applications of Cognitive Neuroscience*. New York: Springer, 2010. Print.
23. Bravo, T.P. *Curr Neurol Neurosci Rep* (2015) 15: 30. doi:10.1007/s11910-015-0552-2



### RESEARCH ARTICLE

## ALGERIAN DAIRY INDUSTRY; CAN IT CONTROL BACTERIAL CONTAMINANT INDICATORS OF HYGIENIC QUALITY DEFECTS IN THE PRODUCTION CHAIN OF RAW AND PASTEURIZED MILK?

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### Abstract

This study is a contribution to the adaptation of a quality control system of food products namely HACCP plan (*Hazard Analysis Critical Control Point*) to hazards microbiological control of pasteurized milk and acidified milk manufacturing, following an investigation to establish a HACCP plan with the determination of critical control points (CCP). Microbiological control of contaminant germs has been performed in duplicate test for pasteurized milk; acidified milk; milk powder and ferment that was used to prepare acidified milk; and finally rinse water and consumption water.

Analyzed microbiological parameters of pasteurized milk and rinse water showed that pasteurization process, quality of cleaning and disinfecting operation was effective. However, the quality of ferment and then acidified milk product were unsatisfactory. These results were attributed to indirect inoculation operation after preparing the ferment due not only to a lack of hygiene, but also to the defailance of cleaning and disinfecting operation of the fermentation tank.

A HACCP plan gathered the key information of the study which revealed seven critical points at different stages of the manufacturing process which need to be controlled through preventive and corrective measures that the industry must undertake to prevent the frequency of microbiological hazard occurrence, probably at the origin of consumers' food borne-infection.

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### Introduction:-

For many years, the quality control was to verify the safety of the finished product, which means their microbiological and chemical compliance with legislation. The dangers of food safety can occur at any stage of the food chain, and therefore require strict control over the entire chain (Leyral and Vierling, 2007).

Also, Food safety becomes a shared responsibility between all actors in the food chain, and food-borne diseases have direct impact not only on the consumers' health but also on the economical development. Therefore,

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intensification of building capacity in food safety is essential for most countries, particularly in developing countries.

By its biochemical composition rich on carbohydrate, fat, vitamins and minerals (Aggad *et al.*, 2009; Ahmed *et al.*, 2010), milk is considered as a favorable environment to the proliferation of microorganisms, especially pathogen germs (Ahmed *et al.*, 2010). These products have always been considered one of the main causes of food poisoning (Gran *et al.*, 2002).

For this purpose, the present study was undertaken, to establish a quality control system namely HACCP plan, with the determination of critical control points. A quality control operation of pasteurization step, cleaning and disinfecting operations was also studied.

#### **Status of milk in Algeria; a product of mass Consumption:-**

In Algeria, milk has an important place in the diet of everyone, whatever their incomes because, firstly, as a product rich in nutrients, milk can substitute for other expensive products like meat and, secondly, it's supported by the Algerian state (Amellal, 1995). The price support attributed by the state to the dairy offices was 43700 Dollar (USD) in 1982, which has grown to 2,3 million Dollar (USD) in 1992. In the space of a decade, the state has paid instead of consumers: 121 million Dollar (USD).

This high consumption is favored by the pricing policy of Algerian state, which encourages consumption compared to production status. Coupled with an extremely large population, this policy has led to an increase in demand, with more than two thirds of dairy consumption is covered by imports (Bourbouse *et al.*, 1989; Yakhlef, 1989; Mezani, 2000).

Milk intake per capita has improved during the same period as it was raised from 34 to 130 liters per year. While lower than the ration in European countries, where it's an average of 400 liters per year, it remains much higher than the average in Tunisia (87 liters) and Morocco (50 liters) (Boumghar, 2000).

#### **Insufficient rate coverage of needs on milk and dairy products:-**

The dairy industry is currently covering less than 40% of milk and dairy products requirements. Indeed, for a global demand estimated to 2,6 billion liters of milk equivalent in 1992, the production of dairy units was only 1,1 billion liters of milk equivalent.

The production deficit is compensated by importing milk. Between 1982 and 1992, the imports milk have attained 1,6 million tons and this costs the government 2,4 billion Dollars, either one-tenth the amount of the debt (Amellal, 1995).

#### **Material and Methods:-**

Sampling was performed at SUDLAIT Dairy industry in southwest of Algeria where the physicochemical and microbiological analyzes were performed in duplicate test during 2016 and involved the following samples "milk powder, pasteurized milk, acidified milk, ferment, rinse water and consumption water". Our purpose was firstly, to evaluate the hygienic quality of the analyzed products, secondly, identify the critical points and develop a plan or a standard quality manual for five Dairy industries visited in Algerian West.

#### **Physicochemical Analysis:-**

The physicochemical parameters studied were: temperature, titratable acidity, density, total dry matter, fat-free dry matter and fat content.

The titratable acidity was determined by measurement of lactic acid with sodium hydroxide in the presence of phenolphthalein at 1% as a color indicator according to (NA 678, 1994), The density of milk was measured by using a calibrated thermo-lactodensometer (AFNOR, 1993) The fat content was measured by the butyrometric of Gerber method according to (NF V 04-210, 1990).

Total dry matter is determined after drying in an oven at  $103^{\circ}\text{C} \pm 2$  (Drying method) according to (NA 679, 1994) and fat-free dry matter of milk was calculated by taking the difference between total dry matter and fat content of milk.

### Microbiological Analysis:-

Sampling was carried according to Algerian standard (NA 676, 1994; ISO 707, 1994). Microbiological analysis included after preparing decimal dilutions according to (ISO 8261, 2001), the detection and enumeration of bacterial indicators of fecal contamination; enumeration of total aerobic mesophilic flora incubated at 30°C for 72hours according to (NF V 04-016, 1985) on Plate Count Agar (PCA) (Fluka, Spain), detection and enumeration of total and fecal coliforms incubated at 37 and 44°C respectively for 24 to 48hours according to (ISO 4832, 1978) on the middle Violet Red Bile Lactose Agar (VRBL) (Biochem, Canada), search and enumeration in a liquid medium Rothe (Scharlau, Spain) for fecal Streptococci incubated at 37°C for 48hours following the method described by (Afif *et al.*, 2008) and finally, enumeration of fungal flora on Sabouraud 4% glucose agar (Fluka, India) according to (NA 5911, 1996).

Enumeration of Petri dishes having microorganisms was based on the standard set by legislation (AFNOR, 1980). The criteria of microbiological quality employed were in accordance with the publication on dairy products (**OJAR** 35, 1998), which is based on a 3-class plan following the specifications; n, c, m and M.

### Elaboration of HACCP plan:-

Two approaches are used throughout the world to ensure food safety: mean while the USA's way principally to control the sterilization step. The European Union 'EU' emphasizes quality management and security throughout production chains. Given the situation observed in the south countries and obtained results in Europe, it seems appropriate to use this approach to ensure dairy products safety in developing countries (Faye and Loiseau, 2000). The quality management by risks' analysis or potential hazards associated with a product or a process (HACCP approach) must be applied to the entire chain from the cow to the consumer (Leyral and Vierling, 2007). Hazard identification was based on 5M method (Medium, workforce, materials, methods and equipment) following the "cause-effect diagram" (Gouri Djaaboub, 2010; Blanc, 2007).

### Results:-

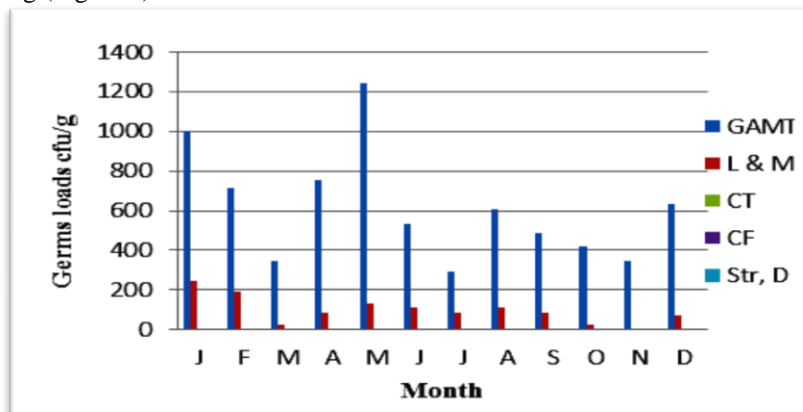
#### Physicochemical Analysis:-

The physicochemical analysis results of the samples do not reflect any abnormality and they were consistent to Official Journal of Algerian Republic (**OJAR** 87, 1999; **OJAR** 80, 1999; **OJAR** 94, 1998) and to the international standard (CODEX STAND 207, 1999).

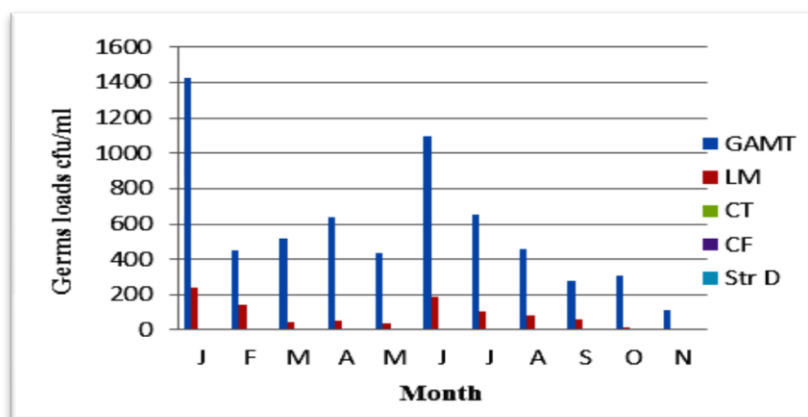
The density values obtained were between 1,030 and 1,034. The samples analyzed of pasteurized milk had a fat contents ranging from a minimum value of 1,5% and a maximum of 2%. The value of titratable acidity was between 1,5 and 1,7% for pasteurized milk. The average values of total dry matter and fat-free dry matter were 99 and 84g/l respectively. The temperature of the product at the exit of the industry does not exceed + 8,5°C.

#### Microbiological Analysis:-

Examined milk powders showed a variable load of aerobic germs ranging from  $0,3 \times 10^3$  to  $1,2 \times 10^3$  cfu/g. The analysis also showed that the total and fecal coliforms were absent, while the average value of fungal flora was  $0,3 \times 10^3$  to  $1,2 \times 10^3$  cfu/g (Figure 1).



Milk powder:-



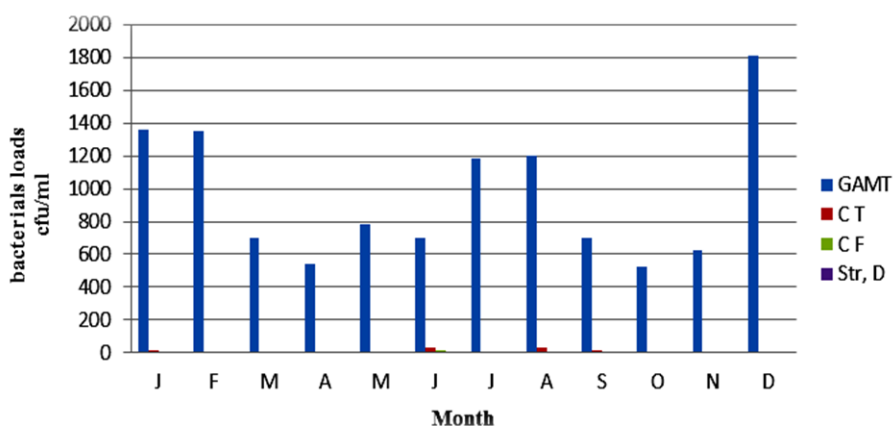
#### Consumption water:-

**Figure 1:-** Microbiological analysis of raw materials.

**GAMT:-** Total aerobic mesophilic flora, **LM:** fungal flora, **CT :** Total coliforms, **CF :** Fecal coliforms, **Str. D:** fecal streptococci.

The consumption water used in reconstituted milk production has also been tested; the results found were consistent with the Algerian standard.

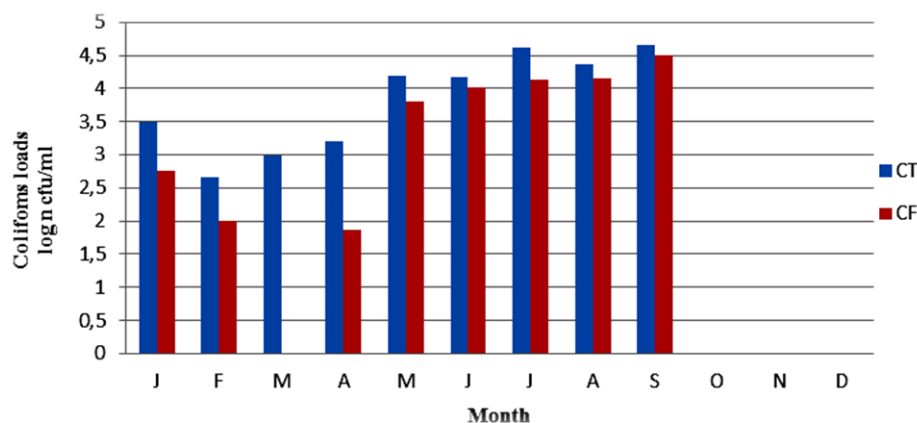
The average loads of different bacteriological parameters determined for partly skimmed pasteurized milk are summarized in Figure 2. The aerobic bacteria of all analyzed samples showed levels that are located in the standards and varying between  $0,7 \times 10^3$  and  $1,8 \times 10^3$  cfu/ml. The origins of fecal contaminants "total and fecal coliforms" were almost negligible.



**Figure 2:-** Microbiological analysis of pasteurized milk packaged in bags.

**GAMT:-** total aerobic mesophilic flora, **LM:** fungal flora, **CT :** total coliforms, **CF :** fecal coliforms, **Str. D:** fecal streptococci.

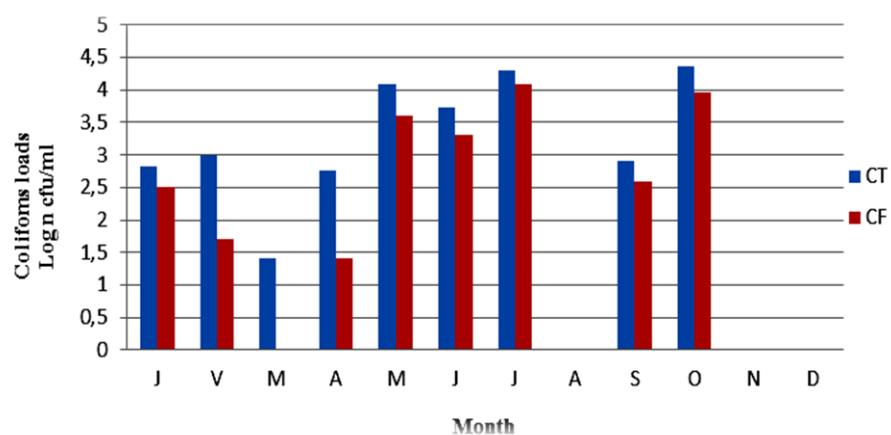
Bacteriological analysis of acidified milk shows high contamination by a significant load of fecal coliforms, which had an average of  $1,53 \times 10^4$  cfu/ml during the period when the temperature is higher from the months of May to September (Figure 3), and for the month of January, the contamination was moderate but remains above the norm and had an average of  $5,6 \times 10^2$  cfu/ml fecal coliforms. While for the months from February to April, the load of total and fecal coliforms was consistent with the Algerian standard.



**Figure 3:-** Microbiological analysis of acidified milk.

**CT:-** total coliforms, **CF :** fecal coliforms.

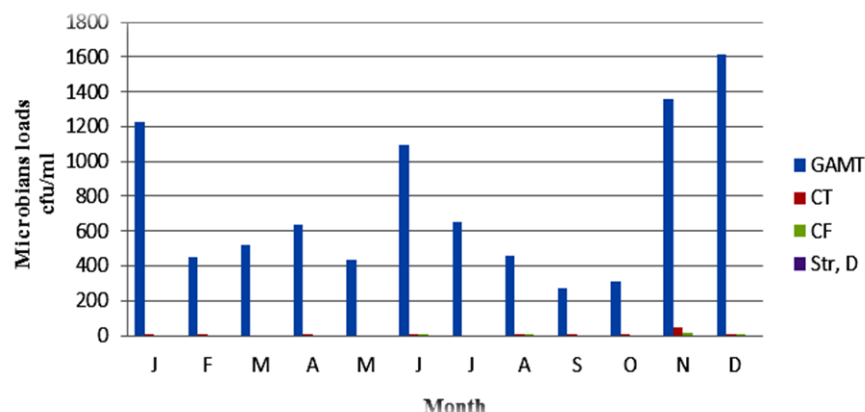
In parallel, the analysis of the ferment used for the preparation of acidified milk also had a significant load of fecal coliforms in the same period of May to September (Figure 4), while for the months from February to April, the load of total and fecal coliforms was consistent with the standard's set.



**Figure 4:-** Microbiological analysis of ferment.

**CT:-** total coliforms, **CF :** fecal coliforms.

The rinse water showed a significant load of aerobic germs with an average of  $0,75 \times 10^3$  cfu/ml, a minor contamination by total and fecal coliforms was detected with an average load that is less than  $0,54 \times 10^3$  cfu/ml (Figure 5).



**Figure 5:** Microbiological analysis of rinse water.

**GAMT:-** total aerobic mesophilic flora, **CT :** total coliforms, **CF :** fecal coliforms, **Str. D:** fecal streptococci.

Analyzed bacteriological parameters for the reconstituted pasteurized milk and rinse water showed that the thermal treatment applied (pasteurization step) and quality of cleaning and disinfecting operation were effective, and also respected by the industry. A correlation was significant between the milk powder, pasteurized milk and the quality of cleaning and disinfecting operation for the searched microbiological parameters, because of a possible contamination of milk during manufacturing probably also present in the rinse water, and bad cleaning/ disinfecting operation of tubing 'closed circuit' may contaminate the product.

However the ferment quality and subsequently the acidified milk product were unsatisfactory. A correlation was significant for both products.

#### Assurance safety and hazard identification "HACCP approach"

The following table (Table 1) provides an illustration of a hazard identification approach, CCP and control measuring in the production process based on the interactive decision tree for dairy subsidiaries in west of Algeria - Raw milk, partly skimmed pasteurized milk packaged in bags and acidified milk.

**Table 1:-** Control measuring in the process production of reconstituted milk, pasteurized raw milk packaged in bags, and acidified milk.

Steps		Control measuring
<b>The raw material:</b> -Receipt of local raw milk -Milk powder		-Check and control the health program and maintenance of premises and separation zones, personal hygiene "uniform clothes + body and hand hygiene" -Managing the storage conditions of raw material, raw milk must be refrigerated no later than 2 hours after milking at 4°C maximum. -Systematical control of microbiological parameters especially physicochemical ones at the arrival of milk. -Strict compliance with hygiene "rule of 5M," sampling conditions of raw milk "healthy collection».
	<b>Pasteurization step</b>	-Check pasteurization scales (time/temperature) -Regular maintenance pasteurizer
	<b>Cleaning and disinfecting operation</b>	-To check the status, validity and the dose of used disinfectant. -To check the correct operation of CIP

Acidified milk	<b>Semi-direct /direct inoculation</b>	<ul style="list-style-type: none"> <li>-Use of selected cultures in sufficient load adapted to the production conditions (direct inoculation is recommended).</li> <li>-Create a sterile area during direct or semi-direct inoculation</li> <li>-Cleaning and disinfecting of the equipment</li> <li>-Respect the time of lactic fermentation, it should be sufficient</li> <li>-A good cleaning of tanks before and after preparation of acidified milk.</li> <li>- Compliance with strict hygiene rules 'GHP'.</li> <li>-Ensure closing of tank covert after inoculation process.</li> <li>- Control of titratable acidity of acidified milk, do not exceed 85°D (&lt; 8,5g/l lactic acid).</li> <li>-Keep tank cover closed after cleaning step.</li> <li>-Walk forward.</li> </ul>
	<b>Thermisation/cooling</b>	<ul style="list-style-type: none"> <li>-Check temperature of product at cooling exit before being packaged</li> <li>-Temperature of the product should be 4 to +6°C.</li> <li>- Titratable acidity should be below 85°D.</li> </ul>
	<b>Conditioning</b>	<ul style="list-style-type: none"> <li>-Sterile packaging; hermetic.</li> <li>-Keep the polystyrene packaging in a clean place</li> </ul>
	<b>Storage/marketing</b>	<ul style="list-style-type: none"> <li>-Cold preservation during the storage, transport and distribution especially temperature.</li> <li>-Respect the consumption deadline of the product</li> <li>-Extended loading and unloading of dairy products should be avoided.</li> <li>-Separation of dairy products in the storage location.</li> </ul>

### Discussion:-

The good physicochemical quality of samples reflects mastery and continuous control for replenishment and pre-pasteurization operations, which satisfy the physicochemical standards.

Microbiological analysis results of raw materials (milk powder and water for reconstitution) indicate the excellent microbiological quality of milk powder (low level of total aerobic microflora and no coliforms). These results fully meet the recommended standards by International Dairy Federation (IDF, 1974).

Getting the good hygienic quality of reconstituted milk is firstly the result of raw material quality, the stage of pasteurization and observation of the rules and hygiene measures at the local manufacturing involving maintaining continuous optimal cleanliness conditions, respect of individual hygiene of manipulators and prevention of exogenous re-contamination, as well as the effectiveness of the cleaning and disinfecting operation through CIP "Clean in place" before and after pasteurized milk manufacturing. These results were consistent with the study of Ould Moustapha *et al.*, (2012) which present the operational and technological origins to have a good hygienic quality of milk.

The presence of coliforms is generally used as an indicator of poor hygienic practices in the handling of milk (Elzyney *et al.*, 2007; Chye *et al.*, 2004). Enumeration of this flora for samples showed that there is a significant fecal contamination of the ferment and the acidified milk during periods when the temperature is high. That results from indirect inoculation operation after preparing the ferment due to a lack of hygiene, bad cleaning and disinfecting operation of fermentation tank, knowing that the high temperature promotes the growth of contaminating microorganisms.

Rigorous respect of general hygiene at the production and processing, eliminate the massive consequences of microbial contamination and gives a finished product that meets the microbiological standards of current regulations (Hamama *et al.*, 1995), we also must educate producers by setting up a training program with good manufacturing practices (Katinan *et al.*, 2012). A HACCP plan gathered the key information of the study revealed seven critical points at different stages of the manufacturing process (Milking at the farm, collection and transportation, receipt and storage of raw materials "raw milk", pasteurization, inoculation and maturation of acidified milk, refrigeration and storage of finished product, cleaning and disinfecting operation), that are imperative to be controlled through preventive and corrective measures that the industry must undertake to prevent the frequency of microbiological risks occurrence, probably at the origin of consumers' food borne-infection.

### Conclusion:-

The physicochemical analysis of pasteurized milk taken at the state of dairy industry showed no abnormalities, and for microbiological analysis, there is a low level of total and fecal coliforms, and no other contaminants such as fecal streptococci.

The consumption of acidified milk could be a risk to public health, especially in the summer season when the warm climate promotes the microbial growth. The lack of good hygiene practices, bad cleaning and disinfecting operations of fermentation tanks, the high values of the titratable acidity recorded explain the proliferation of fecal contaminants observed in the acidified milk product.

The imperative control of raw materials, finished products and control of the manufacturing process including pasteurization step, good hygiene practices and rapid cooling of the packaged product could help to provide consumers with high microbiological quality of dairy products. Thus, we must establish a quality policy "HACCP plan" as an accurate methodological tool in the searching for relevant control means adapted to the risk, with popularization of good manufacturing and hygiene practices 'GHP, GMP'.

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### References:-

1. Afif, A. Faïd, M. and Najimi, M. 2008. Qualité microbiologique du lait cru produit dans la région de Tadla au Maroc. Rev Biol Biotech 7(1): 2-7.
2. AFNOR. 1980. Milk and dairy products, analysis methods, French Standards Association.
3. AFNOR. 1993. Quality control of food products: milk and dairy products: physicochemical analyzes. Defense, Paris.
4. Aggad, H. Mahouz, F. Ammar, YA. and Kihal, M. 2009. Évaluation de la qualité hygiénique du lait dans l'Ouest Algérien. Rev Méd Vét 160(12): 590-595.
5. Ahmed, AI. Mohammed, AA. Faye, B. Blanchard, L. and Bakheit, SA. 2010. Assessment of quality of camel milk and gariss, north Kordofan State, Sudan. Res J Anim Vet Sci 5(1): 18-22.
6. Amellal, R. 1995. La filière lait en Algérie : Entre l'objectif de la sécurité alimentaire et la réalité de la dépendance. In: Les agricultures maghrébines à l'aube de l'an 2000. Opt Méd Série B 14 : 229-238.
7. Blanc, D. 2007. ISO 22000, HACCP et sécurité des aliments. Recommandation outils, FAQ et retours de terrain. AFNOR-11-rue Francis de pressensé – 93571 la plaine saint –Denis cedex, pp : 20-30.
8. Boumghar, MY. 2000. La filière lait en Algérie: une production largement insuffisante. Agroligne 3 : 8-9.
9. Bourbouse, A. Chouchen, A. Eddebbagh, A. Pluvineau, J. and Yakhlef, H. 1989. Analyse comparée de l'effet des politiques laitières sur les structures de production et de collecte dans les pays du Maghreb. In: Le lait dans la région méditerranéenne. Opt Méd Série A 6 : 247-258.
10. Chye, FY. Abdullah, A. and Ayob, MK. 2004. Bacteriological quality and safety of raw milk in Malaysia. Food Microbiol 21: 535-541.
11. Codex Standard 207. 1999. Norme codex pour les laits en poudre et la crème en poudre.
12. El-Ziney, MG. and AL-Turky, AI. 2007. Microbiological quality and safety assessment of camel milk (*Camelus dromedaries*) in Saud Arabia (*Qassim region*). Appl Biol Environ Res 5(2): 115-122.
13. Faye, B. and Loiseau, G. 2000. Sources de contamination dans les filières laitières et exemples de démarches qualité. In : Hanak E, Boutrif E, Fabre P, Pineiro M, Gestion de la sécurité des aliments dans les pays en développement. Actes de l'atelier international, CIRAD-FAO, 11-13 décembre 2000, Montpellier, France, CIRAD-FAO. Cédérom du CIRAD, Montpellier, France.
14. Fédération Internationale de Laiterie FIL. 1974. Lait et produits laitiers : Dénombrement de la microflore totale. Norme Internationale: FIL - IDF 73.
15. Gouri Djaaboub, S. 2010. Application du système HACCP dans la minoterie ELARDJA sise à Béchar : prévention et contrôle des mycotoxine. Mémoire de Magister. Faculté des Sciences et Technologie, Université Tahri Mohammed de Béchar, pp : 41-45.
16. Gran, HM. Mutukumina, AN. Wethlesen, A. and Narvhus, JA. 2002. Smallholder dairy processing in Zimbabwe: the production of fermented milk products with particular emphasis on sanitation and microbiological quality. Food control, 13: 161-168.

17. Leyral, G. and Vierling, E. 2007. Microbiologie et toxicologie des aliments : hygiène et sécurité alimentaires. 4ème Ed. Rueil-Malmaison : Doin ; Bordeaux : CRDP d'Aquitaine, Bioseneces et techniques, Sciences des aliments, 290p.
18. Hamama, A. Zahar, M. El Marrakchi, A. Aboulala, F. and Bent Mohamed Abderrahman, M. 1995. Préparation du fromage frais à partir du lait recombinaé. Actes Inst Agron Vet (Maroc) 15(4): 21-26.
19. ISO 4832. 1978. Microbiologie-Directives générales pour dénombrement des coliformes-Méthodes par comptage de colonies obtenues à 30°C, Organisation Internationale de Normalisation.
20. ISO 8261. 2001. Lait et produits laitiers-lignes directrices générales pour la préparation des échantillons pour essai, de la suspension mère et des dilutions décimales en vue de l'examen microbiologique. Organisation Internationale de Normalisation.
21. ISO 707. 1994. Lait et produits laitiers-Lignes directrices pour l'échantillonnage. Organisation International de Normalisation.
22. Katinan, CR. Sadat, AW. Chatigre, KO. Bohoussou, KM. and Nogbou Emmanuel Assidjo, NE. 2012. Évaluation de la qualité des laits caillés artisanaux produits et consommés dans Yamoussoukro. J Appl Biosci 55: 4020-4027.
23. Labioui, H. Elmoualdi, L. Benzakour, A. El yachoui, M. Berny, Elh. and Ouhssine, M. 2009. Etude physicochimique et microbiologique de laits crus. Bull Soc Pharm (Bordeaux) 148: 7-16.
24. Mezani, H. 2000. Le lait: Une politique dévastatrice. Agroligne 3 : 10-11.
25. NF V 04-016. 1985. Lait, Dénombrement des microorganismes, Technique par comptage des colonies à 30°C, Norme Française.
26. NA 676. 1994. Lait et produits laitiers-Méthode d'échantillonnage. Norme Algérienne. NA 678 (1994). Lait – Détermination de l'acidité titrable. Norme Algérienne.
27. NA 679. 1994. Lait –Détermination de la teneur en matière sèche. Norme Algérienne.
28. NA 5911. 1996. Lait et produit laitiers-Dénombrement des unités formant colonie de levure et/ou moisissures- Comptage des colonies à 25°C. Norme Algérienne.
29. NF V 04-210. 1990. Lait-Détermination de la teneur en matière grasse, Méthode acido-butyrométrique. Norme Française.
30. OJAR 35. 1998. Ministère du Commerce. Arrêté du 27 mai 1998, Norme relatif aux critères microbiologiques des laits et des produits laitiers ; Technique de prise d'essai et Interprétation des résultats d'analyses microbiologiques JORA, n°35, 1998.
31. OJAR 94. 1998. Ministère du Commerce. Arrêté du 16 Décembre 1998, Norme relatif aux taux d'humidité et d'acidité des laits. JORA, n° 94, 1998.
32. OJAR 87. 1999. Ministère du Commerce. Arrêté du 08 Décembre 1999, Norme relatif aux températures des denrées alimentaires réfrigérées. JORA, n° 87, 1999.
33. OJAR 80. 1999. Ministère du Commerce. Arrêté du 14 Novembre 1999, Norme relatif aux spécification du lait en poudre industriel et aux conditions et modalités de sa présentation, sa détention, son utilisation et sa commercialisation. JORA, n°80, 1999.
34. Ould Moustapha, A. N'Diaye, AD. and Ould Koray, MB. 2012. Etude de la qualité du lait pasteurisé des industries laitières situées à Nouakchott (Mauritanie). ScienceLib 4: 1-11.
35. Yakhlef, H. 1989. La production extensive de lait en Algérie. Opt Méd 6 : 135-139.





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### RESEARCH ARTICLE

#### EFFECT OF FRICTION STIR PROCESSING PARAMETERS ON THE TENSILE STRENGTH OF SURFACE COMPOSITE ALUMINUM ALLOY.

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FSP, Surface, Composite, tensile, strength, processing

#### Abstract

In the current study, the surface composite sheet of AA2024/al203 has been fabricated using friction stir processing technique. The processing parameters during fabrication process; such as rotation speed, travel speed and number of passes have been investigated. The number of passes has a significant effect on the mechanical properties through tensile test. The results revealed that tensile strength improved with increasing passes number.

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#### Introduction:-

Increasing demand for improving the properties of surfaces in order to meet with design and functional requirements. Friction stir processing (FSP) is one of the techniques for fabricating surface composites and modifying microstructural features, furthermore the improvement of mechanical properties. Process parameters are the key art of Friction Stir Processing. The stirring conditions (rotational and translational speeds) are important issues in FSP to obtain the desired mechanical properties.

Many researchers were discussed the relation between the process parameters and the quality of welded or processed metals according to [1,2,3,4]. The Tensile strength is found to be increased with increasing the rotational speed up to specified limit for AA6351 Al alloys as reported by [5]. The tensile properties and fracture locations have been investigated by many authors [6,7,8] they are fabricated metal sheets alloy using FSP. The results are revealed that the rotational speed has a significant influence on the tensile strength as a result of improving grain refinement of the material. The mechanisms of particle refinement during FSP of pure Al, and the effect of various processing parameters on the particle refinement have been studied by [9]. The investigators reported, that amount of heat generation during FSP was increased when rotational speed increase and decrease when transverse speed increase. Fabricating AA1050/SiC surface composite using FSP technique has been investigated by [10] the author concluded that, the formation of defects are causing at higher tool rotational speeds. The surface composite sheets are investigated by [11,12,13,14,15,16], they are concluded that tool rotation speed has a major effect on the mechanical properties and microstructure refinement.

The effect of multi-pass FSP on the, microstructure, micro hardness and tensile strength on the metal alloy and composites have been studied by [17,18,19,20,21,22]. Multi pass FSP not only improve the mechanical properties, but also get defect-free weld through adjusting the Welding parameters, including tool rotation rate, traverse speed, spindle tilt angle, and target depth [23]. multi-pass with even step (2, 4 up to 8-pass) FSP with 100% overlap was performed by [24]. The results reported that multi-pass FSP were improved tensile properties of composites including UTS, yield strength (YS) and elongation. The authors were reasoned this improvement because of reduced

porosity contents. CNT/2009Al is fabricated by combination of Powder Metallurgy and FSP by [25]. It was observed that as the FSP passes increased, there was good dispersion for CNT in the matrix, and the maximum tensile strength increased with increasing the passes number.

In the current investigation the aim of this work is to fabricate a surface composite sheet from AA2024 aluminum sheet and alumina nanoparticles, in order to enhance the tensile properties though overlap multi pass friction stir processing.

#### Experimental work:-

The wrought alloy sheets of AA2024 has been prepared and the Annealing is done at 410 °C for 2 hours, followed by slow cooling in the furnace to relief the remaining residuals stresses after cold and hot sheet metal working and improve ductility and dimensional stability. A rectangle slotted grooves are machined in each plate. The alumina nanoparticles are filled the grooves, then the friction stir processing has been carried out to fabricate the desired surface composite. The chemical composition for AA2024 wrought alloy is given in (Table 1). An automatic milling machine is used to perform FSP at different combination of processing parameters. The tool rotation speed was vary at different four rotation speed 900, 1100, 1500, 1800 rpm. Processing travel speed was chosen at three speeds (10, 15, and 20) mm/min, the last factor that effect on the process is the number of passes, and it is design to be processed at three overlap level.

**Table 1:-** Chemical composition of the as received AA2024 alloy (weight %)

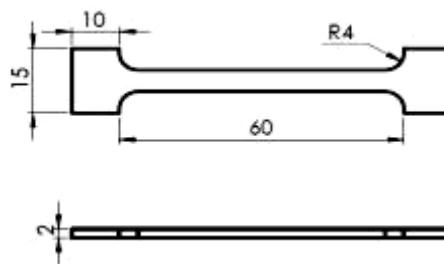
Element	Cu	Mg	Mn	Zn	Fe	Si	Pb	Al
%	4.89	1.45	0.616	0.156	0.11	0.107	0.0193	Remain

#### Tensile Test:-

Tension test has been performed by MTS machine as shown in "Fig. 1". According to ASTM B557 with standard specimens along the processing zone as shown in "Fig. 2". The samples are tested in order to evaluate the tensile properties such as young's modulus, ultimate tensile strength (UTS) and yield stress (YS).



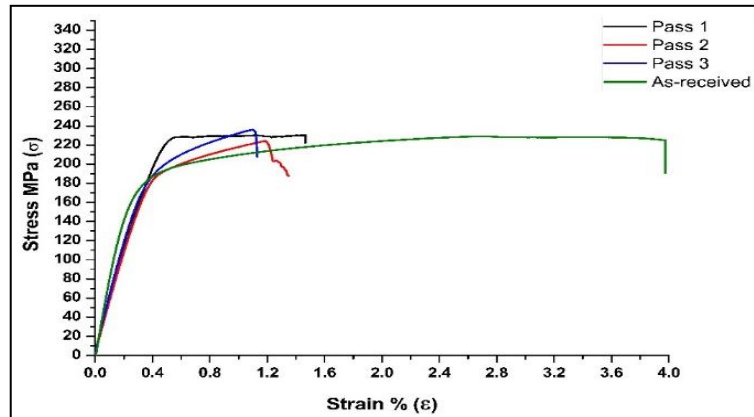
**Fig 1:-** Universal tension test machine



**Fig 2:-** Schematic drawing for standard tension test sample

#### Results and Discussions:-

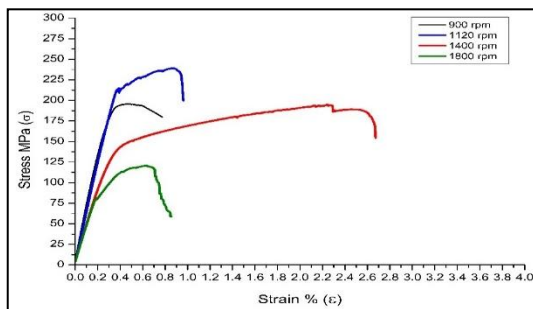
The mechanical properties and material flow pattern are influenced with the Processing parameters such as tool rotation speed, longitudinal traverse speed and number of passes. The tool rotation speed effect on the tensile stress, but the ductility is decreased by 50% with respect to the base metal as shown in "Fig.3". As-received alloy has the highest elongation. The results reveal that, although the addition of Al<sub>2</sub>O<sub>3</sub> Nano powder increases the strength, it decreases the ductility which it was congruent with [26].



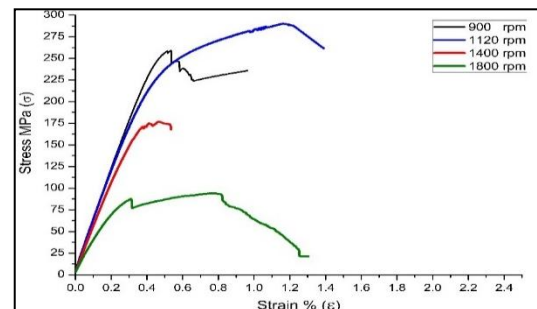
**Fig 3:-** Tensile strength samples tested at 900 rpm with 10 mm/min travel speed

Higher tool rotation speed increases the heat produced during friction stirring action, the high temperature in this metal matrix causes defects during processing specially in the first pass. The rotation speed 1500rpm and 1800 rpm resulting poor surface composite. The tensile strength curves show preference of low rotation speed rather than using higher speeds as shown in "Fig.4" and "Fig.5". The first pass noticed that, it is insufficient to improve the mechanical properties because some voids or defects are remained in the matrix. These results are in accordance to the previous results [27, 28, 29, 30].

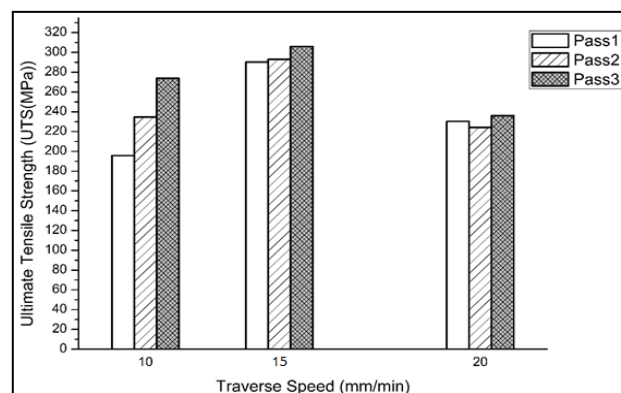
Enhanced results for these metal matrixes composite are obtained at relatively low speeds with 10 mm/min and 15 mm/min traverse speed as shown in "Fig. 6". The improvement in the surface tensile properties is explained due to provide the sufficient heat during stirring process.



**Fig 4:-** Effect of rotational speed on tensile strength at 10 mm/min travel speed for the 1<sup>st</sup> pass.

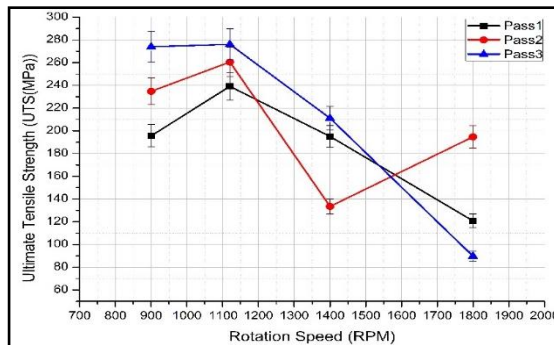


**Fig 5:-** Effect of rotational speed on tensile strength at 15 mm/min travel speed for the 1<sup>st</sup> pass

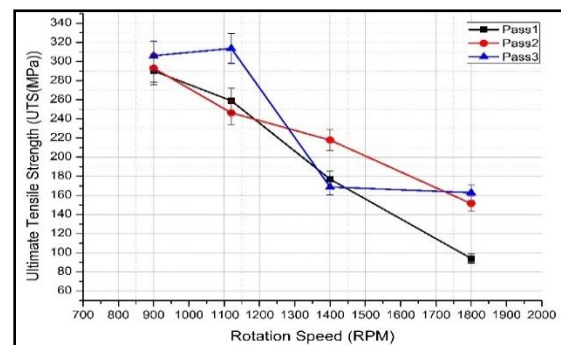


**Fig 6:-** Effect of traverse speed on the ultimate tensile strength at constant rotation speed 900 rpm.

Ultimate tensile strength (UTS) results are represented in the comparison curves which, illustrates the effect of rotation speed on the ultimate tensile strength throughout different passes number as shown in "Fig.7" and "Fig. 8". Tool rotations speed performed at 900-rpm and 1100-rpm have a higher ultimate tensile strength than other speed specially when processed at 10 mm/min and 15 mm/min traverse speeds. Third pass causes an improvement in the tensile strength which, the maximum value for UTS is improved by 27 % rather than base metal. Tool rotation speed at 1800-rpm remarked that, having a lower UTS.



**Fig 7:-** Effect of rotational speed on UTS at 10 mm/min travel.



**Fig 8:-** Effect of rotational speed on UTS at 15 mm/min travel.

### Conclusion:-

This paper present the effect of processing parameters on the tensile properties of surface composite alloy fabricated by friction stir process. The results are concluded that:

- The average tensile strength of friction stirring processed specimen are improved by 10% as compared to the base metal
- The ductility of resultant metal matrix composite was decreased by 50% due to presence of alumina particles in the matrix.
- The superior tensile strength is achieved at low rotational speeds of 900-rpm and 1100 -rpm with medium travel speed 15 mm/min.
- Increasing the number of FSP passes lead to refinement the grain, furthermore good distribution of alumina nanoparticles in the composite matrix.

### References:-

1. K. Hussain and S. A. P. Quadri, "Evaluation of parameters of friction stir welding for aluminum AA6351 alloy," *International Journal of Engineering Science and Technology*, vol. 2(10), pp. 5977-5984, 2010.
2. M. JAYARAMAN and V. BALASUBRAMANIAN, "Effect of process parameters on tensile strength of friction stir welded cast A356 aluminium alloy joints," *Transaction of Nonferrous Metal scociety of china*, vol. 23, p. 605–615, 2013. S.
3. Rajakumar and V. Balasubramanian, "Establishing relationships between mechanical properties of aluminium alloys," *Materials and Design*, vol. 40, p. 17–35, 2012.
4. Devaraju , A. Kumar and A. Kumaraswamy, "Influence of reinforcements (SiC and Al<sub>2</sub>O<sub>3</sub>) and rotational speed on wear and mechanical properties of aluminum alloy 6061-T6 based surface hybrid composites produced via friction stir processing," *Materials and Design*, vol. 51, p. 331–341, 2013.
5. S. N. S. Y.J. Kwon, "Mechanical properties of fine-grained aluminum alloy produced by friction stir process," *Scripta Materialia*, vol. 49, p. 785–789, 2003.
6. M. G. G.Venkateswarlu, "Effect of Rotational Speed on Microstructure and Mechanical Properties of Friction Stir Processed Mg AZ31B Alloy," *International Conference On Advances In Engineering, Science And Management*, pp. 323- 327, 2012.
7. O. S. Salih, H. Ou , W. Sun and D. G. McCartn, "A review of friction stir welding of aluminium matrix composites," *Materials and Design*, vol. 86, p. 61–71, 2015.

8. H. J. LIU, "Friction stir welding characteristics of 2017-T351 aluminum alloy sheet," *JOURNAL OF MATERIALS SCIENCE*, vol. 40, p. 3297 – 3299, 2005.
9. R. Moshwan , F. Yusof and M. A. Hass, "Effect of tool rotational speed on force generation, microstructure and mechanical properties of friction stir welded Al–Mg–Cr–Mn (AA 5052-O) alloy," *Materials and Design*, vol. 66, p. 118–128, 2015.
10. M. H. Wais, J. . M. Salman and A. . O. Al-Roubaiy, "Effect Of Friction Stir Processing On Mechanical Properties And Microstructure Of The Cast Pure Aluminum," *International Journal Of Scientific & Technology Research*, vol. 2, no. 12, pp. 154-163, 2013.
11. E. R. Mahmoud, K. Ikeuchi and M. Takahashi, "Fabrication of SiC particle reinforced composite on aluminium surface by friction stir processing," *Science and Technology of Welding and Joining*, vol. 13, no. 7, pp. 607-608, 2008.
12. D. K. Lim, T. Shibayanagi and A. P. Gerlich, "Synthesis of multi-walled CNT reinforced aluminium alloy composite via friction stir processing," *Materials Science and Engineering A*, vol. 507, p. 194–199, 2009.
13. P. Asadi, M. K. Besharati Givi, K. Abrinia, M. Taherishargh and R. Salekrostam, "Effects of SiC Particle Size and Process Parameters on the Microstructure and Hardness of AZ91/SiC Composite Layer Fabricated by FSP," *Journal of Materials Engineering and Performance*, vol. 20, no. 9, p. 1554–1562, 2011.
14. Thangarasu, N. Murugan, I. Dinaharan and S. J. Vijay, "Effect of tool rotational speed on microstructure and microhardness of AA6082/TiC surface composites using friction stir processing," *Applied Mechanics and Materials*, Vols. 592-594, pp. 234-239, 2014.
15. Kurta, I. Uygurb and E. Cetec, "Surface modification of aluminium by friction stir processing," *Journal of Materials Processing Technology*, vol. 211, no. 3, p. 313–317, 2011.
16. M. Azizieh, A. H. Kokabi and P. Abachi, "Effect of rotational speed and probe profile on microstructure and hardness of AZ31/Al<sub>2</sub>O<sub>3</sub> nanocomposites fabricated by friction stir processing," *Materials and Design*, vol. 32, p. 2034–2041, 2011.
17. R. Sathiskumar, . I. Dinaharan, N. Murugan and S. J. VIJAY, "Influence of tool rotational speed on microstructure and sliding wear behavior of Cu/B<sub>4</sub>C surface composite synthesized by friction stir processing," *Transaction of Nonferrous Metal scocity of china*, vol. 24, p. 95–102, 2014.
18. W. T. A. R. Rebecca Brown, "Multi-pass friction stir welding in alloy 7050-T7451: Effects on weld response variables and on weld properties," *Materials Science and Engineering A*, Vols. 513-514, p. 115–121, 2007.
19. H. ., M. ., A. S. Sahraeinejad, "Fabrication of metal matrix composites by friction stir processing with different Particles and processing parameters," *Materials Science & Engineering A*, vol. 626, p. 505–513, 2015.
20. M. SarkariKhorrami, M. N. Kazeminezhad and A. H. Kokabi, "The effect of SiC nanoparticles on the friction stir processing of severely," *Materials Science & Engineering A*, vol. 602, p. 110–118, 2014.
21. S. Panigrahaia, K. Kumara and W. Yuana, "Transition of deformation behavior in an ultrafine grained magnesium alloy," *Materials Science and Engineering A*, vol. 549, p. 123– 127, 2012.
22. W. Yuan, S. Panigrahi and R. Mishra, "Influence of grain size and texture on Hall–Petch relationship for a magnesium alloy," *Scripta Materialia*, vol. 65, p. 994–997, 2011.
23. Mishra, Rajiv Sharan, Partha Sarathi and N. Kumar, *Friction Stir Welding and Processing*, Switzerland: Springer International Publishing, 2014.
24. M. Barmouz and M. Kazem Besharati Givi, "Fabrication of in situ Cu/SiC composites using multi-pass friction stir processing: Evaluation of microstructural, porosity, mechanical and electrical behavior," *Composites: Part A*, vol. 42, p. 1445–1453, 2011.
25. X. W. W. ., Z. M. Z.Y. Liu, "Analysis of carbon nanotube shortening and composite strengthening in carbon nanotube/aluminum composites fabricated by multi-pass friction stir processing," *carbon*, vol. 69, p. 2 6 4 –2 7 4, 2014.
26. L. Johannes and R. Mishra, "Multiple passes of friction stir processing for the creation of superplastic 7075 aluminum," *Materials Science and Engineering A*, vol. 464, p. 255–260, 20017.
27. Z. Z. Y. Z. G. C. Y. G. M. L. J. Z. Rui Yang, "Effect of multi-pass friction stir processing on microstructure and mechanical properties of Al<sub>3</sub>Ti/A356 composites," *Materials Characterization*, vol. 106, p. 62–69, 2015.
28. Z. Da-Tong, X. Feng and Z. Wei-Wen, "Superplasticity of AZ31 magnesium alloy prepared by friction stir processing," *Trans. Nonferrous Met. Soc. China*, vol. 21, p. 1911–1916, 2011.
29. P. Cavaliere and P. De Marco, "Superplastic behaviour of friction stir processed AZ91 magnesium alloy produced by high pressure die cast," *Journal of Materials Processing Technology*, vol. 184, p. 77–83, 2007.
30. S. Tutunchilar, M. Besharati Givi and M. Haghp, "Eutectic Al–Si piston alloy surface transformed to modified hypereutectic alloy via FSP," *Materials Science and Engineering A*, vol. 534, p. 557– 567, 2012.





## RESEARCH ARTICLE

### ASSOCIATION BETWEEN PRIMARY SITE OF MELANOMA AND SURVIVAL OF U.S. ADULT PATIENTS

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Melanoma, Melanocyte, Primary site, Prognosis, Survival.

#### Abstract

**Introduction:** Melanoma is the most dangerous form of skin cancer. The National Cancer Institute estimated that there would be 76,100 new invasive melanoma cases and 9,710 deaths from melanoma in the US in 2014. Anatomic location was identified as a significant prognostic factor in patients with primary cutaneous melanoma (CM) by several investigators.

**Objectives:** The aim of this study is to assess the relationship between primary site of melanoma and survival in a large US adult population.

**Materials & methods:** We analyzed 227,509 US melanoma patients from the SEER (Surveillance, Epidemiology, and End Results Program Registry) from 1973 to 2011. We excluded duplicate cases. We compared the primary site and survival by using Kaplan-Meier curves. Hazard ratio (HR) were determined by unadjusted and adjusted Cox-regression model.

**Results:** In the unadjusted model, the primary anatomical site was significantly associated with survival. Melanoma patients who had a primary site as an overlapping lesion of skin (the tumor overlaps the boundaries of two or more adjacent anatomical sites) were 10 times more likely to die within 5 years of diagnosis compared to patients with non-overlapping lesions located on the head or neck (HR= 10.7, 95%CI=10.3 - 11.1). After we adjusted for age at diagnosis, gender, race, ethnicity and stage at diagnosis, patients with overlapping lesion of skin still had lower chance of surviving more than 5 years as compared to patients with non-overlapping head and neck lesions, followed by trunk (HR= 3.5, 95%CI= 3.3 - 3.6 and HR=1.2, 95%CI= 1.2 - 1.3, respectively).

**Conclusions:** Overlapping lesion of skin had the worst prognosis followed by trunk lesions, while lesions located at upper limbs & shoulders had better prognosis. Clinical correlation and timely diagnosis of primary melanoma sites might improve survival and prognosis in this population

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## Introduction:-

Melanoma is the most dangerous form of skin cancer that represents 4.6% of all new cancer cases in the United States. The National Cancer Institute estimated that there would be 76,100 new invasive melanoma cases and 9,710 deaths from melanoma in the United States in 2014 [1,2]. Anatomic location was identified as a significant prognostic factor in patients with primary cutaneous melanoma (CM) by several investigators [3,4,5,6]. Understanding the role of anatomic site in melanoma survival is important for public health messages on skin awareness and sun protection. Moreover, because the role of screening in melanoma is considered important for early detection [7,8]. The location often has been classified into four anatomic regions: head and neck, trunk, and the upper and lower extremities [9,10,11,12]. But some authors have tried to subdivide anatomic location into higher and lower risk sites according to recurrence or survival rates [5,13,14,15]. Cutaneous head and neck melanomas (CHNM) constitute 12-21% of melanomas diagnosed annually [16,17]. CHNM have poorer outcomes relative to melanomas of other sites (MOS) [18,19,20]. Extremity lesions have generally been associated with a more favourable prognosis than trunk and head and neck lesions, even when adjusted for tumour type and thickness [21,22]. Other authors have confirmed that the anatomical location is a prognostic factor, but have demonstrated a poor prognosis in association with other areas, such as the BANS region (upper back, posterior arm, neck and posterior scalp) [23].

## Objectives:-

The aim of this study is to assess the relationship between primary site of melanoma and survival in a large US adult population.

## Literature Review:-

Warren H. Tseng et al argued that Tumor Location Predicts Survival in Cutaneous Head and Neck Melanoma. An analysis of the Surveillance Epidemiology and End Results (SEER) database of the National Cancer Institute of all patients with CHNM diagnosed from 1988 to 2006. Kaplan-Meier survival curves depicting overall survival (OS) and melanoma specific survival (MSS) dependent on location of tumor. Result shown that ten-year overall survival was 55.1% for all patients with cutaneous head and neck melanoma. For tumors of the scalp/neck, 10-year rates of overall survival was 57.2%. 10-year overall for cutaneous head and neck melanoma (CHNM) at sites other than the scalp/neck was 55.6%. the author concluded that Patients with melanomas of the scalp/ neck have poorer OS and MSS and those with lip melanomas have poorer MSS. These anatomic areas should not be overlooked when performing skin examinations [24].

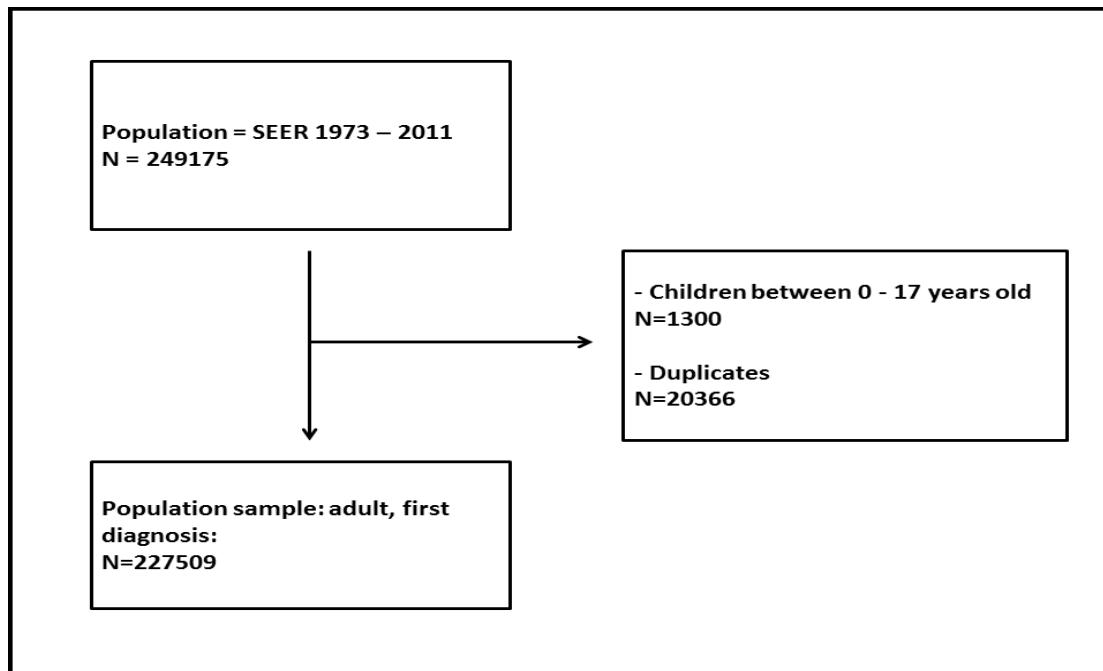
Claus Garbe, et al discussed Prognostic Classification of Anatomic Location of Primary Cutaneous Melanoma. In a series of 5093 patients with invasive primary cutaneous melanoma followed from 1970 to 1988 at four university centers in Germany who were investigated using the multivariate Cox proportional hazard model to analyze the importance of anatomic location for survival probability. The back and breast (thorax), upper arm, neck, and scalp (TANS regions) were identified as high risk sites as the univariate 10-year survival rates for primary CM showed significant site-related differences ranging from 63.4% (scalp), 68% (back) to 87.7% (lower arm), 82.4% (lower leg). The author concluded that the Anatomic location was confirmed as an independent prognostic factor for patients with primary cutaneous melanoma. The TANS regions were identified as high risk sites, and the lower trunk, thigh, lower leg, foot, lower arms, hands, and face were identified as intermediate sites [25].

H. M. SHAW, et al discussed Influence of Site of Lesion and Age of Patient in the Female Superiority in Survival. Statistical analyses of differences between survival rates were carried out by the Logrank method. Observed and expected differences were analyzed for significance by the chi-square test with one degree of freedom. final group comprised 753 patients (362 men and 391 women). Result showed that Melanoma of extremities had better prognosis than axial melanoma with 5-yr survival (<1.5mm thick) of 85.7% in men and 96.8 % in women. as opposed to axial melanoma 5-yr survival (<1.5mm thick) of 75.7% in men and 84.3% in women. The author concluded that The association between decline in prognosis with increasing age and decline in proportion of thin lesions with increasing age was much closer in men than women. In men and women matched by age, site, and thickness of primary lesions, women with very thick tumors still survived longer [26].

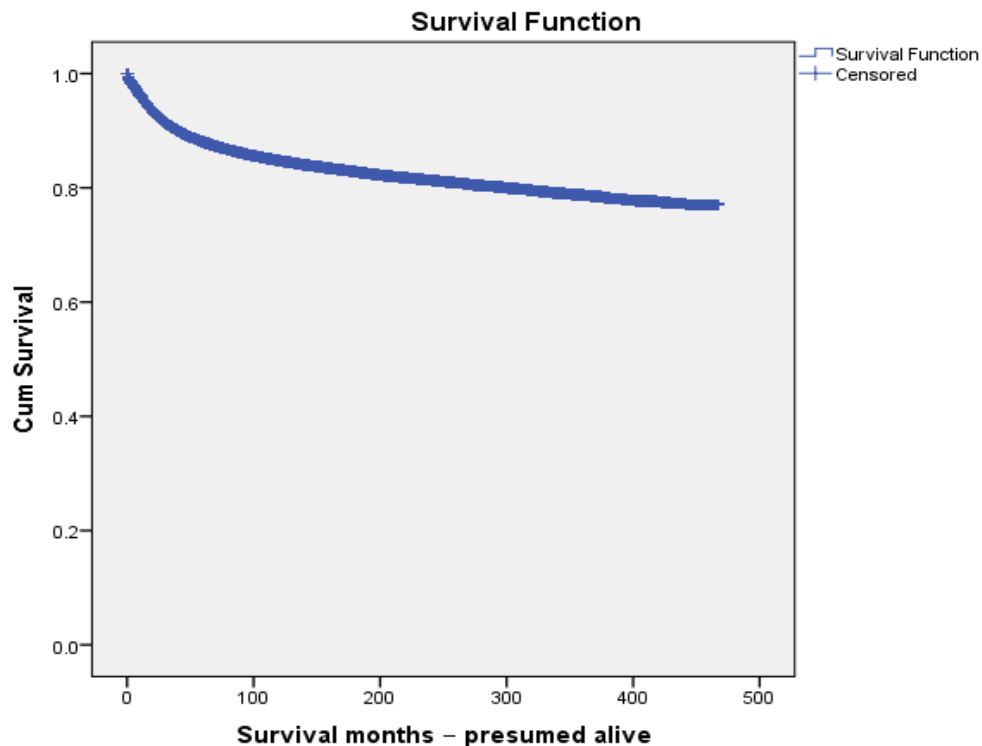
## Material & Method:-

In this study our population was 249175 US melanoma patients from the SEER (Surveillance, Epidemiology, and End Results Program Registry) during the 1973 to 2011 period. We excluded 20366 patients as duplicated cases and

1300 patients younger than 18 years old. The final group was 227509 US melanoma patients, we analyzed them using SPSS [Figure 1]. We used Kaplan-Meier curves to compare primary sites and survival with 5 years interval [Figure 2]. Hazard ratio (HR) were determined by unadjusted and adjusted Cox-regression model.



**Figure 1:-** Selection of melanoma patient from SEER database 1973 - 2011



**Figure 2:-** Kaplan Meier curve of survival time for adult melanoma patients in US (1973-2011)



### Result and Discussion:-

Patients with primary lesions located at trunk contributed the highest number of patients by 64457 followed by head and neck by 58138 Patients. Patients with Overlapping lesions were 14948 as the smallest group.[Figure 3]

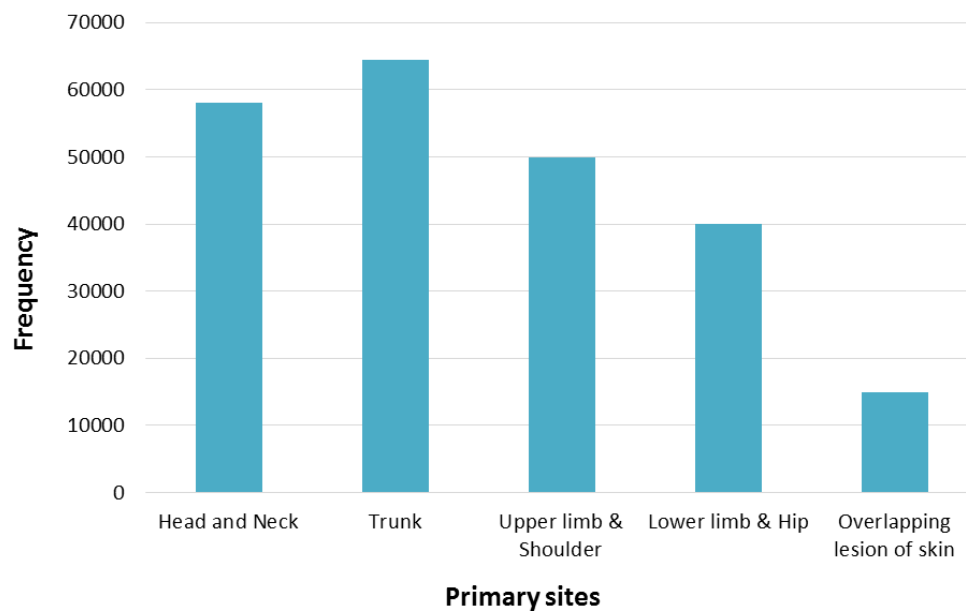
The Mean Age of patients with primary site at Head & neck lesion are older (65.5) which is higher than other lesion. Men have higher percentage of overlapping lesion of skin and skin NOS (81.7%) while women contribute higher percentage of lower limb & hip lesion (70.4%). Most of melanoma patients are white (97.1%). Most of the melanoma patients are Non- Spanish-Hispanic-Latino (97.7%).Patients with overlapping lesion and Skin NOS diagnosed at late stage in contrast to other lesions. [Table 1]

Patients who survived 5 years or less are older (61.3) compare to those who survived more than 5 years. Patient with primary sites of melanoma located at lower limb/hip and trunk have higher percentage in more than 5 year category (63.9% and 63.5% respectively). While patients with primary site defined as overlapping lesion of skin and skin NOS have the lower percentage (26.5%) of surviving more than 5 years. Women diagnosed with melanoma have better higher percentage of surviving after 5 years compared with men (64.8% and 53.8% respectively). Patients diagnosed at early stage (63.7%) have more probability of surviving 5 years or more than those at late stage (36.3%). [Table 2]

In our unadjusted model the primary site was significantly associated with the survival. Melanoma patients whose primary site was overlapping lesion of skin/skin NOS are 10 times more likely to die due to melanoma compared to patients with lesions at head/neck (HR= 0.772). Women are 60% less likely to die from melanoma compared with men. Patients diagnosed at late stage are have worse prognosis in comparison to those diagnosed at early stage (HR= 11.229).

After we adjusted for age and stage at diagnosis, gender, race and ethnicity, overlapping lesion of skin/skin NOS and lower limb/hip were highly associated with unfavorable prognosis of melanoma compared to head/neck (HR= 3.500 and HR=1.900 respectively). Women are still less likely to die from melanoma compared with men (H=0.600). Patients who have the worst prognosis for melanoma are those diagnosed at late stage (HR=8.900) and white patients (HR=1.200). [Table 3]

Less than 10% of overlapping lesions patients survived 60 months. Around 43% of trunk and lower limbs and hip patients survived 60 months.Upper limb and shoulder and head and neck patients had the highest percentage of surviving 60 months by more than 50%. [Figure 4]



**Figure 3:-** Number of patients per primary sites

**Table1:** Characteristics of melanoma patients I by primary site in US, (SEER 1973-2011)

Characteristics	Head & neck	Trunk	Primary Site Upper limb & Shoulder	Lower limb & Hip	Overlapping lesion of skin & skin NOS <sup>c</sup>	Sig <sup>a</sup>
	N (%)	N (%)	N (%)	N (%)	N (%)	
<b>Age at diagnosis in years (mean, SD)<sup>b</sup></b>	(65.5, ±16.1)	(53.9, ±16.3)	(57.4, ±16.5)	(52.7, ±17.0)	(48.7, ±17.3)	<0.001
<b>Gender</b>						<0.001
Male	39237 (67.5)	41242 (64.0)	24847 (49.7)	11819 (29.6)	12209 (81.7)	
Female	18901 (32.5)	23215 (36.0)	25135 (50.3)	28165 (70.4)	2739 (18.3)	
<b>Race</b>						<0.001
White	55826 (98.2)	61330 (97.9)	47689 (98.3)	37194 (95.5)	13251 (89.9)	
Black	375 (0.7)	630 (1.0)	404 (0.8)	1070 (2.7)	1132 (7.7)	
Other <sup>d</sup>	638 (1.1)	664 (1.1)	483 (0.9)	676 (1.7)	362 (2.5)	
<b>Ethnicity</b>						<0.001
Non-Spanish-Hispanic-Latino	57029 (98.1)	63329 (98.2)	49076 (98.2)	38732 (96.9)	14002 (93.7)	
Spanish-Hispanic-Latino	1109 (1.9)	1128 (1.8)	906 (1.8)	1252 (3.1)	5341 (2.3)	
<b>Stages<sup>e</sup></b>						<0.001
Early	50601 (91.3)	56228 (91.0)	44099 (92.5)	32301 (89.5)	1378 (26.0)	
Late	4832 (8.7)	5558 (9.0)	3552 (7.5)	3771 (10.5)	3912 (74.0)	
<b>Mortality</b>						<0.001
Alive or dead of other cause	43788 (90.2)	51522 (89.0)	40660 (91.8)	32094 (88.2)	5099 (36.7)	
Dead	4778 (9.8)	6378 (11.0)	3642 (8.2)	4286 (11.8)	8797 (63.3)	

<sup>a</sup> P-value was calculated based on Chi-square unless otherwise specified<sup>b</sup> Significant of age was calculated based on ANOVA test<sup>c</sup> NOS: not otherwise specified<sup>d</sup> Other (Race): American Indian/AK Native, Asian/Pacific Islander<sup>e</sup> Satge has 9.4% missing**Table 2:** Association between Survival and Age, Gender , Race, Ethnicity, Stage and mortality in melanoma patients

Characteristics	Survival (years)			
	≤ 5 years	> 5 years		p-value <sup>a</sup>
	N (%)	N (%)		
<b>Age at diagnosis in years (mean,SD) <sup>b</sup></b>	(61.3 , ± 17.8)	(54.1 , ± 16.3)		< 0.001
<b>Primary site</b>				< 0.001
Head & Neck	26287 (45.2)	31851 (54.8)		
Trunk	23554 (36.5)	40903 (63.5)		
Upper limb & shoulder	19045 (38.1)	30937 (61.9)		
Lower limb & Hip	14425 (36.1)	25559(63.9)		
Overlapping lesion of skin and skin NOS <sup>c</sup>	10983(73.5)	3965(26.5)		
<b>Gender</b>				< 0.001

Male	59767 (46.2)	69587 (53.8)		
Female	34527 (35.2)	63628 (64.8)		
<b>Race</b>			< 0.001	
White	88527 (41.1)	126763 (58.8)		
Black	2088 (57.8)	1523 (42.2)		
Other <sup>d</sup>	1268 (45.6)	1510 (54.4)		
<b>Ethnicity</b>			< 0.001	
Non-Spanish-Hispanic-Latino	91662 (41.3)	130505 (58.7)		
Spanish-Hispanic-Latino	2632 (49.3)	2709 (50.7)		
<b>Stages</b>			< 0.001	
Early	67086 (36.3)	117521 (63.7)		
Late	13770 (63.7)	7855 (36.3)		
<b>Mortality</b>			< 0.001	
Alive or dead of other cause	58171 (33.6)	114992 (66.4)		
Dead	21164 (75.9)	6717 (24.1)		

<sup>d</sup> Other (Race): American Indian/AK Native, Asian/Pacific Islander

<sup>a</sup> P-value was calculated based on Chi-square unless otherwise specified

<sup>b</sup> Significant of age was calculated based on T test

<sup>c</sup> NOS: not otherwise specified

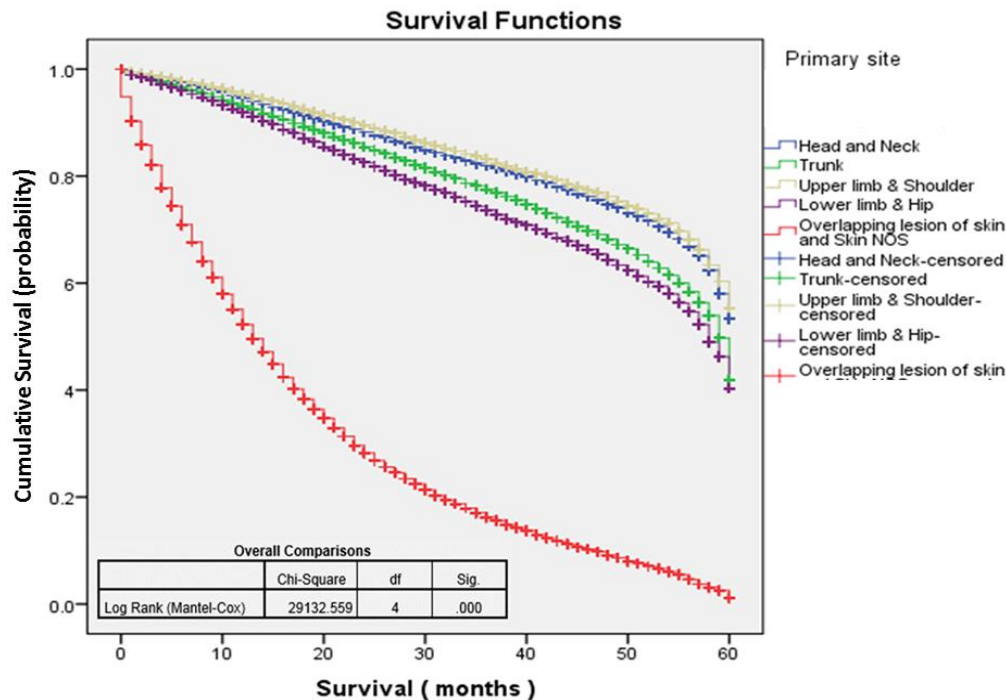
**Table 3:** Unadjusted and Adjusted associations between hazard ratio and characteristics of melanoma patients

Characteristics	Survival (months)			
	Unadjusted		Adjusted	
	HR (95% CI)	p-value	HR <sup>a</sup> (95% CI)	p-value
<b>Primary site</b>				
Head & Neck	Ref		Ref	
Trunk	1.017 (0.979 - 1.056)	0.391	1.245 (1.193-1.298)	<0.001
Upper limb & shoulder	0.772 (0.739 - 0.806)	<0.001	0.906 (0.863-0.951)	<0.001
Lower limb & Hip	1.081 (1.037 - 1.126)	<0.001	1.196 (1.138-1.257)	<0.001
Overlapping lesion of skin and skin NOS <sup>b</sup>	10.723 (10.347 - 11.112)	<0.001	3.507 (3.325-3.698)	<0.001
<b>Age at diagnosis in years</b>	0.999 (0.998 - 1.000)	0.02	1.022 (1.021-1.023)	<0.001
<b>Gender</b>				
Male	Ref		Ref	
Female	0.369 (0.386 - 0.407)	<0.001	0.671 (0.650-0.693)	<0.001
<b>Race</b>				
White	0.274 (0.259 - 0.289)	<0.001	1.265 (1.108-1.445)	<0.001
Black	Ref		Ref	
Other <sup>c</sup>	0.452 (0.408 - 0.500)	<0.001	1.100 (0.918-1.304)	0.315
<b>Ethnicity</b>				
Non-Spanish-Hispanic-Latino	0.517 (0.487 - 0.548)	<0.001	0.952 (0.861-1.053)	0.339
Spanish-Hispanic-Latino	Ref		Ref	
<b>Stages</b>				
Early	Ref		Ref	
Late	11.229 (10.902 - 11.566)	<0.001	8.968 (8.687-9.258)	<0.001

<sup>a</sup>HR: Hazard Ratio

<sup>b</sup>NOS: not otherwise specified

<sup>c</sup> Other (Race): American Indian/AK Native, Asian/Pacific Islander



**Figure 4:-**Survival curve of primary sites (N=94294)

### Conclusions:-

This study have shown a very obvious difference in survival between the primary sites. Overlapping lesion of skin had the worst prognosis followed by trunk lesions while upper limb & shoulder lesions have a better prognosis. Timely diagnosis of primary melanoma sites will improve survival and prognosis of this population.

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### References:-

1. <http://www.skincancer.org/skin-cancer-information/melanoma>(accessed March 21,2015).
2. <http://www.seer.cancer.gov/statfacts/html/melan.html> (accessed March 29,2015)
3. Balch CM, Soong SJ, Murad TM, Ingalls AL, Maddox WA, HalpernNB. A multifactorial analysis of melanoma: prognostic histopathologicalfeatures comparing Clark's and Breslow's stagingmethods. *Ann Surg* 1978; 188:732-42.
4. Ringborg U, Afzelius LE, Lagerlof B, Adami HO, AugustssonI,Blomqvist E, et al. Cutaneous malignant melanoma of the headAnd neck. *Cancer* 1993;71:751-8.
5. Clark WH Jr., Elder DE, Guerry D, Braitman LE, TrockBJ,Schultz D, et al. Model predicting survival in stage I melanomabased on tumor progression. *J Natl Cancer Znst*1989;81:1893-904.
6. Blois MS, Sagebiel RW, Tuttle MS, Caldwell TM, Taylor HW.Judging prognosis in malignant melanoma of the skin: a problemof inference over small data sets. *Ann Surg*1983; 198:ZOO-6.
7. Geller AC, Miller DR, Swetter SM, Demierre MF, Gilchrest BA. A call for the developmentand implementation of a targeted national melanoma screening program.*ArchDermatol.* 2006;142(4):504-507.
8. Koh HK. Melanoma screening: focusing the public health journey. *Arch Dermatol.*2007;143(1):101-103.
9. Sondergaard K, Schou G. Survival with primary cutaneous malignantmelanoma, evaluated from 2012 cases. *Virchows ArchPatholAnat*1985;406:179-95.
10. Vossaert KA, Silverman MK, Kopf AW, Bart RS, Rigel DS, FriedmanRJ, et al. Influence of gender on survival in patients withstageI malignant melanoma. *J Am AcadDermatol*1992;26:429-40.

11. Balch CM, Soong SJ, Shaw HM, Milton GW. An analysis of prognostic factors in 8500 patients with cutaneous melanoma. In: Balch CM, Houghton AN, Milton GW, Sober AJ, Soong S-J, editors. Cutaneous melanoma: clinical management and treatment results worldwide. Philadelphia: JB Lippincott, 1992: 165-87.
12. O'Doherty CJ, Prescott RJ, White H, McIntire M, Hunter JAA. Sex differences in presentation of cutaneous malignant melanoma and in survival from stage I disease. *Cancer* 1986;58:788-92.
13. Day CL Jr., Mihm MC Jr., Sober AJ, Harris MN, Kopf AW, Fitzpatrick TB, et al. Prognostic factors for melanoma patients with lesions 0.76-1.69 mm in thickness: an appraisal of "thin" level IV lesions. *Ann Surg* 1982; 195:30-4.
14. Rogers GS, Kopf AW, Rigel DS, Friedman RJ, Levine JL, Levenstein ML, et al. Effect of anatomical location on prognosis in patients with clinical stage I melanoma. *Arch Dermatol* 1983; 119:644-9.
15. Luria LW, Proper SA, Burnett SM, Williams CC, Fenske N. An anatomical basis for prognosis of malignant melanoma. *Plast Reconstr Surg* 1992;90:2639.
16. Golger A, Young DS, Ghazarian D, Neligan PC. Epidemiological features and prognostic factors of cutaneous head and neck melanoma: a population-based study. *Arch Otolaryngol Head Neck Surg*. 2007; 133(5):442-7. [PubMed: 17515502]
17. Hoersch B, Leiter U, Garbe C. Is head and neck melanoma a distinct entity? A clinical registry-based comparative study in 5702 patients with melanoma. *Br J Dermatol*. 2006; 155(4):771-7. [PubMed: 16965427]
18. Gillgren P, Mansson-Brahme E, Frisell J, Johansson H, Larsson O, Ringborg U. A prospective population-based study of cutaneous malignant melanoma of the head and neck. *Laryngoscope*. 2000; 110(9):1498-504. [PubMed: 10983950]
19. Lachiewicz AM, Berwick M, Wiggins CL, Thomas NE. Survival differences between patients with scalp or neck melanoma and those with melanoma of other sites in the Surveillance, Epidemiology, and End Results (SEER) program. *Arch Dermatol*. 2008; 144(4):515-21. [PubMed: 18427046]
20. Balch CM, Soong SJ, Milton GW, et al. A comparison of prognostic factors and surgical results in 1,786 patients with localized (stage I) melanoma treated in Alabama, USA, and New South Wales, Australia. *Ann Surg*. 1982;196(6):677-84. [PubMed: 7149819]
21. Blois MS, Sagebiel RW, Abarbanel RM, Caldwell TM, Tuttle MS. Malignant melanoma of the skin. I. The association of tumor depth and type, and patient sex, age, and site with survival. *Cancer* 1983; 52:1330-1341.
22. Day CL Jr, Mihm MC, Jr, Lew RA, Harris MN, Kopf AW, Fitzpatrick TB, et al. A multivariate analysis of prognostic factors for melanoma patients with lesions > 3.65 mm in thickness. The importance of revealing alternative Cox models. *Ann Surg* 1982; 195:44-49.
23. Day CL, Mihm MC, Sober AJ, Lew RA, Harris MN, Kopf AW, et al. Prognostic factors for melanoma patients with lesions 0.76-1.69 mm in thickness. An appraisal of 'thin' level IV lesions. *Ann Surg* 1982;195:30-34.
24. Warren H, Tseng, et al. Tumor Location Predicts Survival in Cutaneous Head and Neck Melanoma. *J Surg Res*. 2011;167:192-8.
25. Claus Garbe, et al. Primary Cutaneous Melanoma Prognostic Classification of Anatomic Location. *Cancer*. 1995;75:2492-8.
26. H.M. SHAW, et al. Malignant Melanoma: Influence of Site of Lesion and Age of Patient in the Female Superiority in Survival. *Cancer*. 1980;46:2731-5.

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## RESEARCH ARTICLE

### EFFECT OF LIGHT ON VENOM OF *BUNGARUSCAERULEUS* (INDIAN COMMON KRAIT)

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#### Manuscript Info

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##### Key words:-

Radiation, proteins, ionising, non-ionising, toxicity, immunogenic

#### Abstract

In case of snake envenomation the only therapy available is antiserum inoculation. The antiserum is raised in horses. The toxicity of the venom reduces the life of a horse. Moreover when a horse is given a dose of venom with adjuvant, it brings a lot of discomfort to the horse with local necrosis at the site. Because the proteins are integral part of snake venom an effort has been made in the present study to see the effect of electromagnetic spectrum on venom of *Bungaruscaeruleus* Indian common krait. Proteins are in general sensitive to radiation. After irradiation there is change in a number of physical and chemical properties of the proteins. It may further produce rearrangement of the protein. It decreases antigenicity of the proteins as is shown in present study where we can observe the loss of immunogenic components when exposed to UV, infra-red rays and to direct sunlight.

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#### Introduction:-

The common four species of snakes responsible for casualties due to envenomation belong to two families of snakes: elapidae and viperidae. The venom of elapidae is neurotoxic and that of viperidae is cardiotoxic. The Indian common krait and cobra belong to elapidae family. The proteins are integral part of the snake venom. It is a mixture of thousands of different peptides, proteins, enzymes and chemicals. Most common snake venom enzymes include acetylcholinesterases, L-amino acid oxidases, serine proteases, metalloproteinases, and phospholipases-A<sub>2</sub>. These enzymes are necessary for a venom to be toxic. Higher catalytic efficiency, thermal stability, and resistance to proteolysis make these enzymes attractive models for every researcher (Kang et al., 2011).

Visible light, ionizing and non-ionizing radiations are part of electromagnetic radiations and are used vastly in medical, diagnostic and research fields (Angela Newing, 1999). These electromagnetic waves carry energy. Our eyes can perceive only a small portion of the electromagnetic spectrum which we know as visible light. Ultraviolet (UV) light is the portion of the electromagnetic spectrum between visible light and x-rays, with a wavelength of 100 to 400 nm. The red end of the electromagnetic spectrum is low frequency, low energy and long wavelength, whereas the blue end is high frequency, high energy and short wavelength. The visible light is in the middle of the electromagnetic spectrum. Infra-red rays are also present in electromagnetic spectrum felt in everyday life by human beings as heat. It is invisible like UV rays and is of longer wave length as compared to the visible light starting from the red edge of the visible spectrum at 700 nm to 1000000 nm. The UV light is used to expose the venom. It is generally with a wavelength of 100 to 400 nm. It is the portion of electromagnetic spectrum lying in between visible light and x-rays. Sources of UV radiation are sun as a natural source, lasers, and number of medical and research instruments like dental polymerising equipment. Shorter the wave length more damage caused by it to the substrate (Akram&Rubock 2005).

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Since ionizing radiations are efficient in altering structure and properties of proteins and enzymes, they have been used to attenuate toxins of animal origin. The results are favourable as there is decrease in toxicity of the toxin under experiment (Esmat, 2003).

Gamma radiation is a potential tool used to detoxify a venom. It either slows down or stops enzymatic activities of venom. Gamma radiations work directly on the biomolecules or indirectly when the venom is in solution form.

These radiations act on the biomolecules in venom solution directly or indirectly. The direct process where radiations act directly on the enzymatic proteins and indirectly when the venom is in solution. In indirect way water radiolysis products too help in interaction and affect the action of radiations on protein biomolecules. In the present study also the venom has been used in solution form to observe the effect of radiation.

#### Aim and Objective:-

- The present study is an attempt to observe the effect of visible and invisible light on the toxicity and immunogenicity of the venom of *Bungarus caeruleus* (Indian common krait).
- This may further help to select the wave length of light suitable to reduce the toxicity of venom, to inoculate in horses or other experimental animals, for raising antivenom sera.
- This will further help in reducing local discomfort to the animal.

#### Materials and Methods:-

##### Material:-

1. Venom: the common krait or *B. caeruleus* venom used in this study was obtained from Central Research Institute Kasauli & the normal toxicity of this venom was checked before starting these experiments.
2. Slides- Glass slides of 20 × 5 cm were used for immunodiffusion tests.

##### Methodology:-

Experimental method was used in the present study. Throughout experiments, the toxicity was checked by inoculating aliquotes intravenously in mice and LD<sub>50</sub> was calculated. For immunodiffusion test, gel diffusion was used, followed by staining of slides.

Effects of light were observed by keeping equal quantities of venom in liquid state in different conditions like complete darkness, in day-light, sun-light, UV light and in infra-red rays. In all the above mentioned experiments the toxicity tests were observed after every 7 days interval for 28 days and immunological components by immunodiffusion tests.

#### Results:-

The venom showed reduction in toxicity by storing the venom in complete darkness after 28 days. The reduction in toxicity in day light is still marked. The venom was rendered more or less non-toxic by exposing the solution to direct sun light for three hours/day for 28 days. Immunodiffusion test also proved that 2 components of venom were lost in day light as compared to control venom. In case of complete darkness one component was lost.

The effect of invisible light i.e. UV rays, infrared rays was studied here. The results indicated that there is marked reduction of toxicity of Indian krait venom when the venom solution is exposed to U.V light. The toxicity is also reduced on exposure to infra-red rays. The effect of invisible light on krait venom's toxicity was confirmed by immunodiffusion test which showed that there was loss of 2 components of venom in both the situations.

**Table 1:-** Effect of visible light on venom of *Bungarus caeruleus* (Indian common Krait)

Interval after start (days)	Visible change if any	Venom control solution in N.S	LD <sub>50</sub> of solution of venom exposed to		
			Complete darkness	Day light	Sunlight
0	No change	1.6384	1.6384	1.6384	1.6384
7	No change	1.6384	1.6384	2.048	64
14	Turbidity sun light	1.7660	2.585	4	100

21	Turbidity sun light	1.7810	3.710	9.571	121.8
28	Turbidity in all	1.8130	4.595	10.24	312.5
No. of immunogenic components after 28 days		7	6	4	4

**Table 2:-** Effect of invisible light on venom of *Bungaruscaeruleus* (Indian common Krait)

Venom exposed to	LD <sub>50</sub> of venom exposed				Immunogenicity(no. of components)
	I	II	III	Mean	
Unexposed (control venom)	1.6384	1.7810	1.8130	1.7441	7
UV rays	180.0	198.2	198.4	192.2	5
Infrared rays	183.3	185.1	185.1	184.8	5

**Table 3:-** Effect of light on toxicity and immunogenicity on venom of *Bungarus caeruleus* (Indian common Krait)

Property	Venom Exposed to						
	Unexposed		UV Rays	Infra-red Rays	Complete darkness	Day light	Sunlight
Toxicity %	R	100	0.90	0.94	100	66.67	66.67
	L	0	99.10	99.06	0	33.33	33.33
Immunogenicity %	R	100	57.14	57.14	100	44.87	1.47
	L	0	42.86	42.86	0	55.13	98.53

Abbreviations: R – Retained, L – Lost



**Figure:-** Effect of light on immunogenicity on venom of *Bungaruscaeruleus*

- 1- Untreated venom  
2-- Venom exposed to UV light  
3 - Venom exposed to Sun light  
4-- Venom exposed to Day light  
5- Venom kept in dark  
6- Venom exposed to Infra-red light

The results of venom kept for 7 days did not produce any visible change in the venom kept in darkness, day light or sunlight. After 14 days some turbidity appeared in vial kept in sunlight. After 28 days the turbidity appeared in all the venom vials kept in dark, day light and sunlight.

The toxicity also showed fall in the case of day light and sun light. The venom became non-toxic when kept in sun light and lethal dose was calculated as 312.5 microgram in mice by intravenous route of inoculation. Daylight reduced the lethality of venom when kept for 28 days, and the LD<sub>50</sub> was calculated as 10.24 microgram. Complete darkness condition had effect on the LD<sub>50</sub> and it was calculated as 4.595 micrograms. The venom lost one immunogenic component in complete darkness and 2 components were lost in day light and sunlight condition after 28 days.

The venom exposure to infra-red rays and UV rays showed that the toxicity was lost upto 99.10% in infra-red while it was lost up to 99.06% in venom solution exposed to ultra-violet. Loss in toxicity was 33.33% in day light as well as sun light, but immunogenicity was lost up to 55.13% in day light and 98.53% in case of sun light.



**Discussion:-**

UV radiation and infra-red radiations are widely used in research labs, medical labs, antisera labsto control the bacterial and viral infection to avoid contamination and to keep the inoculating area completely free of microbes (Pauland Christina, 2006). The day light has capacity to kill partially the micoorganisms, whereas the sunlight makes the area exposed totally sterilised. This knowledge is used in hospitals and homes to sterilise the woollens and beddings along with other fomites. It is because of the bacteriostatic or bactericidal property of light on the protein content of the microbes.

In the present study the knowledge of action of light on the proteins has been used to observe the effect of light on the venom from *Bungaruscaeruleus*. This is done to try to turn venom into the venom/toxoid so as to reduce the toxicity of venom while retaining immunogenicity. This process can also make the venom less toxic to the animals in which antivenom is to be raised. The results of the present study indicated that venom is almost denatured by the action of day light, sunlight, UV rays and infra-red rays. The venom kept in darkness showed slight fall in toxicity with retention of 6 immunogenic components.

In the present study ionizing radiations like UV rays and non-ionizing radiations like infra-red rays have been used to observe the effect on Indian common krait venom along with visible part of the electromagnetic spectrum. The basic difference between these two types is the amount of energy they possess. Ionizing radiation has higher energy and has the ability to break chemical bonds, causing ionization of atoms and production of free radicals that can result in biological damage. Non-ionizing radiation doesn't have enough energy to cause ionization but disperses energy through heat and increased molecular movement (Zaider and Rossi, 1985; Hall, 2000).

The venom has been used in aqueous solution because irradiation of aqueous solutions induces chemical and structural alterations in proteins and peptides related to an attenuation or abolishment of biological activity and interferences in immunological properties. When the venom was subjected to visible and invisible spectrum of light it showed decrease in toxicity and immunogenicity. Whether the wave length of light was small as in UV light, large as in infra-red case or the middle spectrum that is direct sun light, it denatured the proteins and the immunogenicity was lost along with toxicity. The study also served to characterise the venom of *Bungaruscaeruleus* but further study is needed.

Proteins are in general sensitive to radiation and that is why the effect is so enhanced on venom when exposed to UV, infra-red rays and to direct sunlight. After irradiation there is change in a number of physical and chemical properties of the proteins. It may further produce rearrangement of the protein (Antoni, 1973). It decreases antigenicity of the proteins as is shown in present study, where we can observe the loss of immunogenic components when exposed to UV, infra-red rays and to direct sunlight. Generally as the wave length of radiation decreases the energy emitted by it increases that means the UV rays which have shorter wavelength as compared to infra-red are more lethal for the proteins but both types of rays are showing same result in the present study. Toxicity and immunogenicity are affected equally by these radiations.

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**References:-**

1. Kang TS, Georgieva D, Genov N, et al (2011). Enzymatic toxins from snake venom: structural characterization and mechanism of catalysis. FEBS J, 278, pp.4544-76.
2. Angela Newing (1999). Treatment with ionizing radiation. Light, visible and invisible, and its Medical applications, World Scientific, pp. 57-89. (Internet citation on 14 Nov, 2016). <https://books.google.com>books>about>
3. Akram M and Rubock P. (2015). Environmental Health& Safety. Working Safely with Ultraviolet Radiation. Policy and Procedures, 2015, Journal of Emerging Investigators. Columbia University Health Sciences Division
4. Esmat A. Shaban (2003). Influence of ionizing radiation on Cobra (*Najahaje*) and *Cerastes cerastes* venoms: Toxicological and Immunological aspects. The Egyptian Journal of Hospital medicine Vol.13, pp. 99-111.
5. Paul J. Meehan<sup>1</sup> and Christina Wilson<sup>1</sup> (2006), Use of Ultraviolet Lights in Biological Safety Cabinets: A Contrarian View. Applied Biosafety, 11(4) pp. 222-227
6. Zaider, M. and Rossi, H.H., (1985). Dual radiation action and the initial slope of survival curves. Radiat. Res. Suppl., 8, pp. 568 - 576.
7. Hall, E.J., (2000): A radiation biological looks to the future. Int. J. Radiat Oncol., Biol. Phys., 46, 1 - 2.
8. Antoni, F., (1973). The effect of ionizing radiation on some molecules of biological importance. Manual on Radiation Sterilization of Medical and Biological Material. Tech. Rep. Series, No. 149, 13 - 21.



## RESEARCH ARTICLE

### SUBJECTIVE RESPONSE TO RESPIRATOR USE: COMPARISON N95, SURGICAL MASK AND FACE COVER.

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#### Abstract

Cancer is a genome disease, initiated by mutations in genes that usually control cell growth and division. Matrix metalloproteinases (MMPs) have important roles in both of tumor invasion and spread. The present study was conducted to evaluate the effect of ionizing radiation (in the level of treatment doses of  $\gamma$ -rays). The action of collagenase gene was examined *in vivo* by using a model of solid tumor carcinoma (EAC). Eighty male mice were used for this experiment; it is divided into 8 groups, 10 mice / each; which were Normal and beside three groups of normal and like them of tumor transplanted mice each of them exposed to the following accumulated doses (6, 9 and 12 Gy). Whole body mice were exposed to gamma radiation from Cobalt-60 (<sup>60</sup>Co) twice a week with different doses after 12 days of injected EAC in the right thigh region. The different doses of ionizing radiation exposure resulting in different changes (Mutations) on the sequence of collagenase gene in normal and malignant implanted groups and the level of these mutations were height in the malignant groups.

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#### Introduction:-

Health care workers (HCW) are at risk of serious infectious diseases. Respiratory protective devices can reduce the risk. This project investigates how they tolerate them to determine if that affects proper use.

#### Objectives:-

To estimate the subjective effects upon users of respirators during activities comparable to healthcare work and to assess the effects of combining face covering and respirators among female health workers.

#### Materials & Methods:-

This study is controlled experimental design with two factors: respirator type and activity type.

Measures of effects were based upon a rating instrument (questionnaire) designed by the Saudi Arabia Medical Students (SAMS) team. Ratings were based on ordinal 6 point scale. The following factors were measured: breathing difficulty, clarity of speech, heat and sweating, level of concentration, vision and comfortability.

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Tasks were designed to be comparable to common health care work. These included: walking outdoor, climbing stairs carrying an object, reading out loud (comparable to patient interviewing) and level of concentration (comparable to attending meetings).

The tasks were designed to range from mild activities such as level of concentration (attending a meeting) and reading to strenuous ones such as walking and climbing stairs (carrying an object).

The activities have been pilot tested before the conduction. Factors such as (walking distance, pace, duration, temperature, voice level and object's weight) have been standardized.

Mask conditions were: N95 Respirator (3M Model 1860), Basic surgical mask (Walgreens Model Model # 023185056204), Face cover + N95 combination and No mask.

#### **Sampling Technique:-**

The order of tasks and mask type was assigned randomly among participants. Sixteen tasks sets of measures have been completed by each participant (4 mask conditions x 4 tasks). The whole process of questionnaires administration and collection took about one week.

Participants for the phase `1 pilot trial: Seven female medical students had volunteered to participate, their age group was between (23-26 year-old), and they were all healthy.

Data collection methods, instruments used, measurements: Types of masks have been used are; respirators (N95) and basic surgical mask along with the well recognized face cover that is commonly used (Niqab).

#### **Results:-**

There were statistically significant effects of both respirator type and activity level (Mixed linear model, SAS Proc Mixed). Wearing a respirator (N95) combined with face cover by (Niqab) shows the highest score in the interference with breathing and the level of comfortability in an average of 2.01 and 2.45, respectively. These differences were seen at all levels of exertion, not just the heaviest.

#### **Conclusions:-**

Better controlled studies are required to delineate whether such findings could be extended to those who are of different age groups, different sex such as bearded males and individuals with acute or chronic diseases in the Kingdom of Saudi Arabia.

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#### **References:-**

1. Harber, P., Bansal, S., Santiago, S., Liu, D., Yun, D., Ng, D., ... & Wu, S. (2009). Multidomain subjective response to respirator use during simulated work. *Journal of Occupational and Environmental Medicine*, 51(1), 38-45.
2. For more information visit Wellington-Dufferin-Guelph Public Health, <http://www.wdgphealth.ca/sites/default/files/wdgphefiles/Fact%20Sheet%20-%20Guide%20to%20Using%20N95%20Masks.pdf> - Retrieved November, 2012.
3. Johnson, D. F., Druce, J. D., Birch, C., & Grayson, M. L. (2009). A quantitative assessment of the efficacy of surgical and N95 masks to filter influenza virus in patients with acute influenza infection. *Clinical Infectious Diseases*, 49(2), 275-277.
4. For more information visit 3M Occupational Health and Environmental Safety Division, <http://multimedia.3m.com/mws/mediawebserver?LLLLLLuS1X&Leo4Lyo4LLlvv3wH kkkkJ-> - Retrieved October, 2009.
5. Occupational Safety and Health Administration. (2007). Pandemic influenza preparedness and response guidance for healthcare workers and healthcare employers. Retrieved March, 14, 2008.



## RESEARCH ARTICLE

### MICROBIAL DNA EXTRACTION FROM INFECTED SEED POTATO FOR MOLECULAR DIAGNOSTIC APPLICATIONS

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DNA extraction, Infected Potato, Protocols

#### Abstract

Transmission of tuber borne diseases is a major cause of yield reduction in potato cultivation. Molecular level diagnosis of the microbial pathogens is a challenge to obtain a sufficient quantity of DNA from infected potato tubers. Therefore, this study focused to find a simple protocol to extract microbial DNA from the infected seed potato. Three different DNA extraction protocols were performed and the extracted DNA was tested for the quantity and quality of DNA using agarose gel electrophoresis. Next Generation Sequencing of 16S rDNA and ITS1 region based amplification was used for the detection of bacterial and fungal pathogens in infected samples using Ion Torrent sequencing platform. Both the enrichment and the culture independent boiling methods of extraction yielded sufficient amount of total genomic DNA from the infected tuber samples. In each method, DNA yield varied depending on the type and severity of infection. The extracted DNA matched with the stringent quality control standards for sequencing on Ion Torrent PGM and amplified both 16S rDNA and ITS1 regions with clear distinctive and reproducible banding patterns in agarose gels. Both bacterial and fungal pathogens were detected with these modified extraction protocols. However, enrichment method was found to be suitable in detecting pathogens even in latent infections. In conclusion, these DNA extraction protocols provided simple, inexpensive and effective methodology in detecting microbial diversity in infected potato tubers.

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#### Introduction:-

One of the most remarkable events in the field of microbial ecology in the past decade has been the advent and development of meta-genomics which is defined as "The direct genetic analysis of genomes contained within an environmental sample" (Thomas *et al*, 2012). Application of meta-genomic approaches on microbial diversity identifications has achieved a considerable progress during the past few years. Culture independent direct DNA extraction is the most crucial step in meta-genomic analysis (Jiang *et al*, 2015). However, many technical challenges regarding efficient DNA extraction protocols from various tissue samples are still remain unanswered.

Potato is a major crop of the world and a number of microorganisms thrive on the nutrients that can be found in potato (Follenweider, 2009). The potato plant is susceptible to many bacterial and fungal diseases which consistently

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cause yield losses in potato production. The presence of microbial populations in infected seed tubers including latent infections are difficult to detect and enumerate with accuracy due to lot of methodological limitations in DNA extraction. Therefore, direct microbial DNA extraction from potato tubers often yields only very small amounts of DNA insufficient for detection purposes. Like many plant tissues, potato tubers contain acidic polysaccharides (Yusuphetal, 2003; Noda *et al*, 2004) and various polyphenolics (Friedman, 1997) that are known to inhibit total nucleic acid extraction. Obviously, such inhibitors are likely to distort PCR and Next Generation Sequence analysis. However, detection of microorganisms present within infected plant tissues is indispensable in phytopathology as they are responsible for many important diseases. Therefore, a broad array of research efforts are directed towards revealing successful DNA extraction protocols. New research findings on culture independent direct microbial DNA extraction methodologies are required in various research areas.

The development of molecular approaches to community analysis have circumvented the need for cultivation because phylogenetically informative DNA sequences can be directly screened from the environment (Laurel *et al*, 2003). The method describes in the present study illustrates a suitable DNA extraction protocol which could be used in meta-genomic analysis for microbial detection.

## **Materials and Methods:-**

### **Seed Potato Sample Collection:-**

Both infected and uninfected seed potato tubers randomly sampled from the imported seed potato consignments at the entry ports of Sri Lanka were collected from the pathology division of National Plant Quarantine Service–Katunayake, Sri Lanka. The collected seed tubers were separately stored in a cold room under 4 °C at the National Plant Quarantine Service until taken for DNA extraction.

### **DNA Extraction:-**

#### **Enrichment Method:-**

Seed potato tubers were first washed in tap water and then in distilled water. Surface sterilization was done by washing with 10% NaOCl (Chlorox) for 1 min. Small pieces of seed potato tubers especially from the infected samples, stem end and eyes were crushed and incubated in 15 ml of liquid LB. The mixture was shaken for 12 hrs. under 120 rpm. The liquid culture was centrifuged for 10 min. at 12 400 g under 4 °C. The pellet was washed twice using a wash buffer (50 mM TrisHCl & 5 mM EDTA of pH 8.0) and re-suspended in lysis buffer (100 mM TrisHCl & 100 mM EDTA of pH 8.0, 1.5 M NaCl). The suspension was centrifuged for 15 min. at 12 400 g at 4 °C. Then NaOAc and 500 µl of ice-cold isopropanol were added to the supernatant and centrifuged for precipitating the DNA. The pellet was washed with 70% ethanol and re-centrifuged at 12 400 g for 10 min at 4 °C. Ethanol was completely removed by air drying. The DNA was re-suspended in de-ionized water.

#### **Lysis Method:-**

Seed potato tubers were washed with tap water and distilled water. Surface sterilization was carried out by shaking with 10% NaOCl for 1 min. and washed thoroughly with autoclaved distilled water. Seed potato tuber was crushed and filtered using a sterile gauze and 50 ml of the filtrate was centrifuged for 5 min. at 750 g. The supernatant was centrifuged again under 10500 g for 10 min at 4 °C. The cell pellet was re-suspended in 300 µl of TE Buffer. Then 2 µl of lysozyme solution and 1 µl of RNase A were added to the cell suspension. It was mixed by vortexing and incubated at 37 °C for 30 min. Further, 300 µl of lysis solution (2X) and 1 µl of proteinase K were added. The mixture was incubated at 65 °C for 15 min and cooled to room temperature and placed on ice for 3-5 min. Phenol Chloroform mixture of 700 µl was added and mixed vigorously for 10 sec. The debris was removed by centrifugation for 10 min. at 10 500 g at 4 °C. Ice cold isopropanol was added to the supernatant and mixed by inverting the tube several times. DNA was pelleted by centrifugation for 10 min. at 10,500 g at 4 °C and washed with 70% ethanol and air-dried at room temperature.

#### **Boiling Method:-**

Surface sterilization was carried out by washing the infected seed tubers with running water for 5 min. and shaking with 10 % NaOCl (Chlorox) for 1 min. The tuber was washed thrice with autoclaved distilled water and ground manually using a sterile motor and pestle. Then, 10 ml of autoclaved deionized water was added to the crushed potato paste and transferred whole content to an autoclaved container. The mixture was kept for 30-45 min. and filtered using a sterile gauze. The extract was collected and boiled for 5 min. in a water bath adjusted to 95-100 °C. The mixture was then vortexed for 30 sec. and centrifuged under 12400 g for 10 min. The pellet was washed with 3 ml of wash buffer (50 mM TrisHCl & 5 mM EDTA of pH 8.0) under 12400 g for 10 min. Then, 3 ml of lysis

buffer (100 mM TrisHCl & 100 mM EDTA of pH 8.0, 1.5 M NaCl) was added and kept for 30-45 min. with proper mixing in each 10 min. intervals. The homogenized mixture was centrifuged at 12400 g for 15 min. The resulting supernatant was then centrifuged under 12400 g for 15 min. with 150 µl of NaOAC and 1:1 ice-cold isopropanol added along the wall of the tube. The pellet was washed with 70% ethanol and re-centrifuged at 12400g for 10 min. Ethanol was completely removed by air drying. The DNA was re-suspended in de-ionized water.

#### DNA Quantity and Quality Assessment:-

The quality and quantity of DNA from each extraction was verified by 0.8% (w/v) agarose gel electrophoresis looking for no evidence of substantial band shearing or contamination either with RNA or polysaccharide. The concentration of amplified 16s rDNA and ITS1 fragments were tested prior sequencing using a Qubit fluorometric quantitation at Credence Genomics Pvt. Ltd. Colombo, Sri Lanka.

#### Next Generation Sequencing:-

Based on the results of amplification of 16s rDNA and ITS1 regions by PCR, the extracted DNA was submitted to Credence Genomics Pvt. Ltd. Colombo-Sri Lanka for meta-genomic library preparation and sequencing on Ion Torrent PGM platform to confirm the protocol yielded both bacterial and fungal DNA.

#### Results:-

In this study three different DNA extraction methods (Enrichment method, Lysis method and Boiling method) were assessed in order to determine the best method to extract microbial DNA from infected and uninfected seed potato tubers. The enrichment method was capable of yielding DNA from both infected and asymptomatic potato tubers with latent infections. The DNA extracted by enrichment method was found to have higher concentration of approximately 200 ng/ µl (Figure 1).

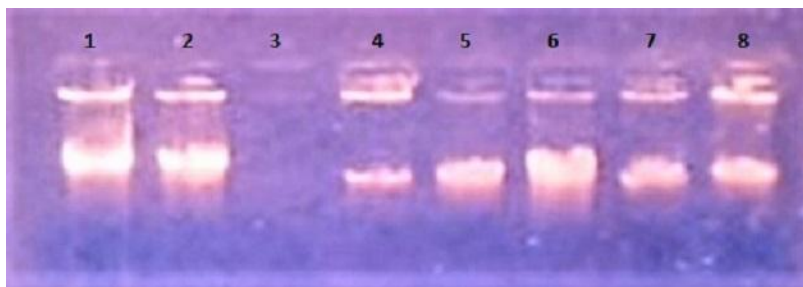
The culture independent boiling method for meta-genomic DNA extraction was quite efficient in yielding DNA from only infected potato tubers (Figure 2). Quality and quantity of the DNA were found better in both boiling and enrichment methods. Both enrichment and the rapid lysis methods revealed single, high molecular weight DNA bands with little evidence of shearing and less RNA or polysaccharide contamination. The relative band intensities were varied depending on the sample. However, 1 µl of sample resolved on the agarose gel with the 50 ng lambda DNA standard, consistently yielded approximately 5 ng of DNA per gram of potato tissue (Data not shown). Altogether 3 hrs. were needed for DNA extraction from boiling method whereas, enrichment DNA extraction method required approximately 16 hrs. The ratio of absorbance at 260 nm and 280 nm ( $A_{260}/A_{280}$ ) was 1.75. However, the lysis method for DNA extraction was unable to extract DNA properly for producing DNA bands on agarose gel. During the crushing of potato tubers, browning of the solution was observed due to phenolic compound available on the peel. The intensity of browning varied depending on the variety of potato. Upon DNA precipitation, despite the observation of a small brown pellet, the agarose gel failed to reveal any DNA.

PCR amplification of 16s rRNA gene (Figure 3) and ITS1 (Figure 4) regions confirmed the amplification availability of both bacterial and fungal DNA (Table 1). The DNA was sufficient for high throughput sequencing and passed the quality control measures of Credence Genomics Pvt. Ltd. Sri Lanka for Ion Torrent Next Generation Sequencing.

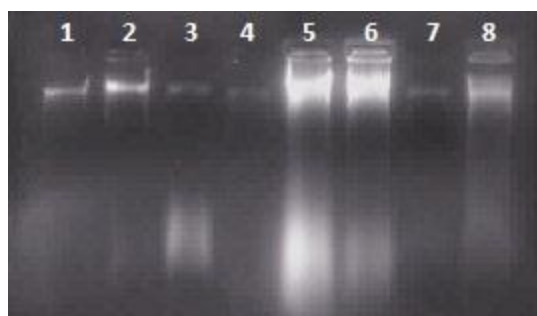
**Table 1:-** Concentration of PCR amplified fragments of four DNA samples extracted from Enrichment method

Sample No.	Concentration after PCR ng/µl	
	16s Rdna	ITS1
1.	0.224	0.059
2.	0.137	0.780
3.	0.211	0.214
4.	1.430	0.564

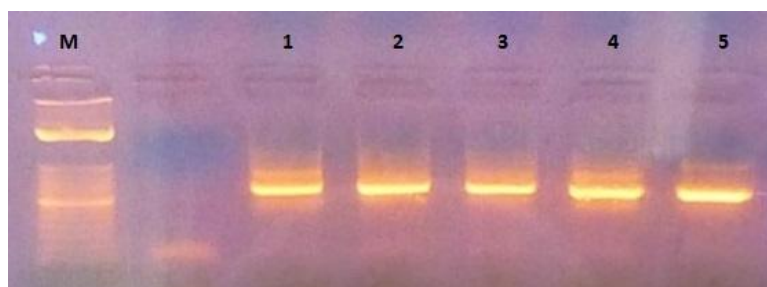
In conclusion the enrichment method extracted a higher value of DNA concentration and the extracted DNA was of high molecular weight for all extracted seed tuber samples. From this study it was suggested that the enrichment method might be a suitable choice for extracting DNA from both infected and uninfected potato tubers because it is capable of yielding DNA from both infected and asymptomatic tubers with latent infections.



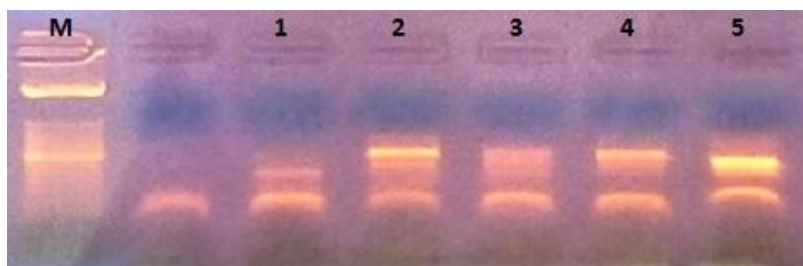
**Figure 1:-**Enrichment method for genomic DNA extraction from four seed potato samples. Lane 1 & 2: Sample 1; Lane 3 & 4: Sample 2; Lane 5 & 6: Sample 3; Lane 7 & 8: Sample 4



**Figure 2:-**Boiling method for meta-genomic DNA extraction from four infected seed potato samples - Lane 1 & 2: Sample 1; Lane 3 & 4: Sample 2; Lane 5 & 6: Sample 3; Lane 7 & 8: Sample 4



**Figure 3:-** Amplification of bacterial 16S rDNA from extracted genomic DNA from the samples to confirm the availability of bacterial DNA within the extractions. M -100 bpMarker; Lane 1, 2, 3, 4 : Seed potato DNA Samples. Lane 5: Positive control.



**Figure 4 :-**Amplification of fungal ITS1 region from extracted genomic DNA to confirm the availability of fungal DNA within the extracted samples. M - 100 bp Marker; Lane 1, 2,3, 4 : Seed potato DNA Samples. Lane 5: Positive control.



Additional comparative studies are necessary to ensure that potato DNA extraction techniques are optimized for other plant materials. Following the results of this study, we recommend boiling method as a method of choice for meta-genomic DNA extraction from infected potato tubers based on the processing time, easiness of use and DNA extraction efficiency.

### Discussion:-

Polymerase chain reaction (PCR) and Next Generation Sequencing (NGS) based applications in molecular diagnostics for plant pathogens require good quality DNA for reliable and reproducible results. Imported seed potato tuber lots carry various important diseases therefore tissues from potato tubers are often used for DNA extraction to identify the pathogenic bacteria and fungi. The extraction of DNA from potato tubers often requires tedious protocols. Therefore, it was essential to develop a method reducing the number of handling steps, eliminating the need for long incubations or supplementation with expensive commercial based kits and reagents.

Culture independent boiling method for DNA extraction was efficient only with infected potato tubers where the symptoms are observable. The method is based on direct cell lysis with heat and a lysis buffer followed by precipitation with isopropanol. This method was unable to yield any DNA from uninfected tubers which may be due to low abundance of bacteria available. It was observed that the DNA yield will strongly depend on the amount of tissue taken for extraction and the severity of infection of potato tuber.

In latent infection, the bacteria may be found in all parts of tissues however, their density is usually low. When the pathogen populations are low, they need to be enriched above detection level. In enrichment method for DNA extraction, initial incubation of crushed potato with liquid LB acts as a common enrichment medium for bacteria available within the potato tissues and increased the bacterial cell number. This enrichment medium creates conditions that stimulate growth and multiplication of bacteria possibly facilitating the detection of all available pathogens within the sample which may include pathogens as well as the endophytes. That is similarly important as microbial endophytes that colonize potato tissue are widespread and some of the non-pathogenic endophytes could also turn into phytopathogens that are able to induce infection symptoms (Koiv *et al.*, 2015). Therefore, developed enrichment method allows multiplication of available pathogens which possibly enables isolation of most of the bacteria in the samples. Most sequencing technologies essentially require high nanograms or microgram amounts of DNA (Torsten Thomas, 2012). Therefore, enrichment media is one option employed to increase DNA yields. This method can multiply the number of available microorganisms and thus enrichment methods are widely used in microbial research. But there are potential problems associated with culture based methods.

Culture-based methods are important in investigating the microbial communities but they were identified as extremely biased in their evaluation of microbial genetic diversity by selecting a particular population of microorganisms (Rastogi *et al.*, 2011). The inability to culture many microorganisms in the provided media produce a major problem where the reports indicated that only 1-4% of the microbes can be cultivated under standard laboratory conditions (Chaudhuri *et al.*, 2006). The enrichment media used in culturing microorganisms under laboratory conditions are selective and only a subpopulation of the microbes in an environmental sample are grown in any given medium (Schneegurt *et al.*, 2003). The analysis using indirect methods such as incubation was also detected as producing artificial changes in the microbial community structure and metabolic activity. Other limitations to culturing include the inability to predict the proper culture medium to select unknown organisms, and the propensity of fast-growing organisms to outgrow and overshadow the more relevant organisms that grow more slowly. These issues can have significant impact on subsequent microbial community analysis. These several important reasons have led to the development of culture independent rapid lysis method for microbial DNA extraction for unbiased detection of microbial pathogens associated with infected seed potato tubers.

However, several limitations are associated with the culture independent microbial DNA extraction from potato tubers. Polysaccharides and polyphenols including flavonoids and other secondary metabolites interfere with the extraction of pure genomic DNA (Sahu *et al.*, 2012). Potatoes are a great source of phenolic compounds and they are present both in the peel and the flesh of potato tubers (Akyol *et al.*, 2016). In DNA extraction, brownish pellet indicates the contamination of phenolic compounds (Sahu *et al.*, 2012). In all tested DNA extraction protocols, browning of solution was observed which has been attributed to the oxidation of phenolic secondary metabolites in potato tubers. Certain protocols add Polyvinylpyrrolidone (PVP) into extracts to absorb such phenolics preventing their oxidation that renders DNA unusable for downstream applications (Young *et al.*, 1993). In many other protocols, an antioxidant such as DIECA (diethyldithiocarbamic acid) is used in very low concentrations (0.05%)

during enrichment to protect bacteria cells from oxidative stress due to the release of the plant compounds (Czajkowski *et al*, 2015). However, any chemical was not applied in these extraction protocols to remove the phenolic contaminants. Several centrifugation and pelleting steps of unlysed tuber materials was effective for removal of polysaccharide and phenolics continuously leeching in to the solution. Also, unlysed tissues settle in the bottom of the falcon tube were removed during the second step. Early removal of debris has also improved the clarity. Mechanical, thermal, and chemical processes that are used to refine DNA may damage DNA through endogenous enzyme hydrolysis, shearing, depurination, cross-linking, acid hydrolysis, and oxidation (Smith *et al*, 2005). These damaged or fragmented template DNA may severely reduce amplification efficiency in PCR or may render target sequences undetectable.

In boiling and enrichment methods for DNA extraction; DNA precipitation included the addition of NaOAc high salt solution before DNA was precipitated with IsoPropanol. Polysaccharides have a similar solubility to DNA and co-precipitate in either iso-propanol or ethanol inhibiting downstream molecular applications (Healey *et al*, 2014). The addition of a high salt buffer increases their solubility in ethanol, allowing their removal once the DNA has been precipitated and pelleted.

To better determine how well the extraction methods performed each of the methods were analyzed separately. The DNA was successful in NGS which may be due to either a lesser degree of inhibitors or a lower degree of damage to the template DNA during extraction. There was no significant difference between the DNA quality recovered by the enrichment method and rapid lysis methods which produced the most consistent, highest quality template.

The extensive research on meta-genomic DNA extraction targeting different substrates highlights the need to ensure that, extraction procedures are well benchmarked, and that multiple methods are compared to ensure representative extraction of DNA (Thomas *et al*, 2012). This research was basically focusing on development of culture independent meta-genomic DNA extraction method from potato tubers. The applied boiling method extracted the sufficient amount of DNA yields from the tuber material. For most of the analyzed tuber samples, this method recovered the highest levels of amplifiable DNA yields however the yield varies from one sample to another depending on the disease intensity which indicated that overall yield had greater influence over intensity of infection or the level of disease spreading.

### Conclusion:-

The optimized enrichment and boiling methods for DNA extraction are simple and rapid therefore, suitable for routine diagnosis assays from potato. The methods yielded sufficient quantities of DNA from the pathogenic microbes associated with the seed tubers. DNA was suitable for the detection of bacterial and fungal pathogens using PCR and NGS based analysis.

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### References:-

1. Akyol H., Riciputi Y., Capanoglu E., Caboni M.F. and Verardo V. (2016). Review Phenolic Compounds in the Potato and Its Byproducts: An Overview. *International Journal of Molecular Sciences*. Vol.17, 835
2. Chaudhuri S. R., Pattanayak A. K. and Thakur A. R. (2006). Microbial DNA Extraction from Samples of Varied Origin. *Current Science*, Vol. 91, No. 12, p 1697-1700
3. Czajkowski R, Perombelon M.C.M., Jafra S., Lojkowska E., Potrykus M., Van der Wolf J.M. and Sledz W. (2015). Detection, Identification and Differentiation of *Pectobacterium* and *Dickeya* Species Causing Potato Blackleg and Tuber Soft Rot: A Review. *Annals of Applied Biology* 166. p 18-38 ISSN 0003-4746
4. Follenweider S. (2009). Potato Microbiology. The English High School & Lars Dietrich, PhD; Department of Biology, Massachusetts institute of Technology. Available online <https://biology.mit.edu/sites/default/files/PotatoMicrobiology.pdf>
5. Friedman M. (1997). Chemistry, Biochemistry, and Dietary Role of Potato Polyphenols. A Review. *Journal of Agricultural and Food Chemistry*. Vol. 45: p 1523–1540.
6. Healey A., Furtado A., Cooper T and Henry R.J. (2014). Protocol: A Simple Method for Extracting Next-Generation Sequencing Quality Genomic DNA from Recalcitrant Plant Species. *Plant Methods*. Vol. 10:21.

7. Jiang W., Peng Liang, Buying Wang, Jianhuo Fang, JidongLang, GengTian, Jingkun Jiang and Ting F Zhu (2015). Optimized DNA Extraction and Meta-genomic Sequencing of Airborne Microbial Communities. *Nature Protocols*. Vol.10 No.5. p 768-779
8. Koiv V., Mart Roosaare, Eve Vedler, Paula Ann Kivistik, KristelToppi, David W. Schryer, MairoRemm, TanelTenson and Andres Mäe (2015). Microbial Population Dynamics in Response to *Pectobacteriumatrosepticum* Infection in Potato Tubers. *Scientific Reports*.
9. Laurel D. Crosby andCraig S. Criddle. (2003). Understanding Bias in Microbial Community Analysis Techniques due to rrn Operon Copy Number Heterogeneity. *BioTechniques* Vol. 34: p 790-802
10. Mendel Friedman (1997). Potato Polyphenols: Role in the Plant and in the Diet. *Antinutrients and Phytochemicals in Food*.ACS Symposium Series, Vol. 662. Chapter 5, pp 61–93. ISBN13: 9780841234987eISBN: 9780841216150
11. NodaT, Tsuda S., Mori M., Takigawa S., Matsuura-Endo C., Saito K., Mangalika W.H.A., Hanaoka A., Suzuki Y. and Yamauchi H. (2004). The Effect of Harvest Dates on The Starch Properties of Various Potato Cultivars. *Food Chemistry*. Vol. 86, Issue 1, June 2004, p 119–125
12. Rastogi G. andSani R.K. (2011). Molecular Techniques to Assess Microbial Community Structure, Function, and Dynamics in the Environment. *Microbes and Microbial Technology: Agricultural and Environmental Applications*, p 29-57 DOI 10.1007/978-1-4419-7931-5\_2,
13. Smith D.S,Maxwell P.W. and De Boer S.H. (2005). Comparison of Several Methods for the Extraction of DNA from Potatoes and Potato Derived Products. *Journal of Agricultural and Food Chemistry*. Vol. 53. p 9848–9859
14. Sahu S.K., Thangaraj M. and Kathiresan K. (2012). DNA Extraction Protocol for Plants with High Levels of Secondary Metabolites and Polysaccharides without Using Liquid Nitrogen and Phenol. *ISRN Molecular Biology*. Vol. 2012, Article ID 205049.
15. Schneegurt M.A., Dore S.Y., Kulpa C.F. and Jr. (2003). Direct Extraction of DNA from Soils for Studies in Microbial Ecology. *Curr. Issues Mol. Biol*. Vol. 5: p 1-8.
16. Thomas T., Gilbert J. and Meyer F. (2012). *Metagenomics - A Guide from Sampling to Data Analysis*.Microbial Informatics and Experimentation. Vol. 2:3 <http://www.microbialinformaticsj.com/content/2/1/3>
17. Young, C.C., Burghoff R.L., Keim L.G., Minak-Bernero V., Lute J.R. and Hinton S.M. (1993). Polyvinylpyrrolidone-Agarose Gel Electrophoresis Purification of Polymerase Chain Reaction-Amplifiable DNA from Soils. *Applied and Environmental Microbiology*. Vol. 59, No. 6. p. 1972-1974
18. Yusuph M., Tester R.F., Ansell R. and Snape C.E. (2003). Composition and Properties of Starches Extracted from Tubers of Different Potato Varieties Grown Under the Same Environmental Conditions.*Food Chemistry*. Volume 82, Issue 2, p 283–289

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## CASE REPORT

### AGGRESSIVE BREAST CARCINOMA IN A 26 YEARS-OLD LADY: A YOUNG AGE AT DIAGNOSIS

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#### Abstract

The incidence of breast cancer is directly related to the age as it increases with it. The diagnosis of breast cancer at an age below 40 is relatively uncommon with the majority being diagnosed at the age of 50 or older. Breast cancer accounts for less than 1.8% in females younger than 30 years of age. In this paper, we report a case of a 26-year-old lady who presented with a picture of cholestatic hepatic disease and then later found to have invasive ductal carcinoma with hepatic metastasis confirmed by histopathology.

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#### Introduction:-

Worldwide, breast cancer is the most common cancer in females, accounting for 22% of all newly diagnosed cancers in this group of patients.<sup>[1-4]</sup> According to cancer incidence report of Saudi Arabia 2009, breast cancer ranked first among females accounting for 25.1% of all newly diagnosed female cancers.<sup>[1]</sup> The median age at diagnosis of breast cancer was reported to be 48 years compared to a median age in USA of 62 years at diagnosis.<sup>[2,3]</sup>

Breast cancer is uncommon in women younger than 30 years of age; the percentage of the new cases below the age of 30 is less than 0.65%.<sup>[4,5]</sup>

Breast carcinoma is not only uncommon in young female, but at a younger age it often tends to be more aggressive with poor survival as the survival rate in 20 years is less than 30% compared to older patients with the same tumor and stage.<sup>[5]</sup>

#### Case Report:-

A 26-year-old Saudi single female, presented to us complaining of an abdominal pain associated with nausea, anorexia, abdominal distension and weight loss of one-month duration. The patient has no previous medical or family history contributing to the present illness.

Physical examination revealed jaundiced sclera, distended abdomen consistent with ascites and hepatomegaly. The liver span was 16 cm. The other parts of physical examination were normal.

Liver function test, PTT, PT, and tumor markers are shown in [Table 1].

Tri-phasic CT scan revealed infiltrative hepatic lesion as shown in [Figure.1].

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Transcutaneous biopsy was taken from the right hepatic lobe and the findings were consistent with diffuse and glandular invasive carcinoma as shown in [Figure.2].

Immuno-histochemical staining showed tumor cells that are strongly positive for estrogen receptors and CK19. However, progesterone receptors and HER2 are negative [Figure 3 and 4].

Based on these findings, breast carcinoma was suspected, and indeed, breast examination showed left breast mass, measuring 3x3 cm that was fixed to the skin with no nipple discharge, along with cervical lymphadenopathy.

Our patients passed away within less than 4 weeks of her presentation due to disseminated intravascular coagulopathy secondary to hepatic metastasis from breast carcinoma and hepatic failure.

Because of the quick deterioration of the health state of the patient and death, it was not possible to perform a mammography or initiate any kind of interventional or palliative therapy.

**Table 1:- Rapid liver function deterioration within 4 weeks till patient death**

Investigation	On day of admission 15/1/2016	On day of death 9/2/2016
PTT (25-35s)	42s	56s
PT (11-14s)	17s	24s
LFT	T.Bili= 5 (0.3-1.9 mg/dl) D.Bili= 4.6 (0-0.3 mg/dl) T.Protein= 8 (6-8.3 gm/dl) Albumin= 2 (3.3-5.5 gm/dl) ALP=828 (45-115 U/L) SGOT=645 (8-48 U/L) SGPT=115 (7-55 U/L) LDH=768 (140-280 U/L) GGTP=1184 (3-28.7 IU/L)	T.bili= 10 D.Bili= 8 T.Protein= 6 Albumin= 3 ALP= 173 SGOT=697 SGPT=91 LDH = 790 GGTP=301

### Discussion:-

Invasive breast carcinoma is uncommon in women younger than 40 years old. It accounts for less than 1.8% in females with breast cancer younger than 30 years of age. <sup>[4]</sup>As far as we know, the youngest reported age of woman with breast cancer in the literature was 21. <sup>[6]</sup>

In Saudi Arabia, the median age at diagnosis of breast cancer is 48, a decade younger than the reported median age in the developed countries, where the median age at diagnosis is 61 and 58 years old for white and black women, respectively. <sup>[2,3]</sup> In general, it's been noticed in the literature that a higher proportion of patients were diagnosed with breast cancer at an age less than 40 in Africa and the Middle East; and the researches to reveal whether environmental factors or genetic differences contribute to this early occurrence, are ongoing. <sup>[7]</sup>

Several, however, uncommon factors contribute to the prognosis and the aggressive nature that might lead to an unfortunate ending in breast cancer patients, including young age at diagnosis as previously discussed, hormone receptor status, elevated tumor marker levels, hepatic metastasis as well as family history of familial syndromes of breast cancer; and our patient had many of these factors.

Breast cancer in young patients tends to be more invasive and aggressive clinically, biologically, and in term of its histological aspects leading to poor prognosis. <sup>[5,8]</sup> Younger patients often tend to have lower ER positivity and higher HER2 positivity; our patient showed the contrary. <sup>[7]</sup>

Young patients presenting with breast cancer may have abnormal single genes mutation transmitted as autosomal dominant such as BRCA1 and BRCA2, or genes as TP53 and CHEK2 which are transmitted as autosomal recessive genes that may play a fundamental role in developing breast cancer in patients younger than 40 years

of age.<sup>[3,7,9]</sup> However, our patient did not mention positive family history of breast cancer, ovarian cancer, prostate cancer or colon cancer that support familial risk of her breast cancer.

Investigations of our patient showed an isolated extensive liver metastasis with infiltrative pattern.

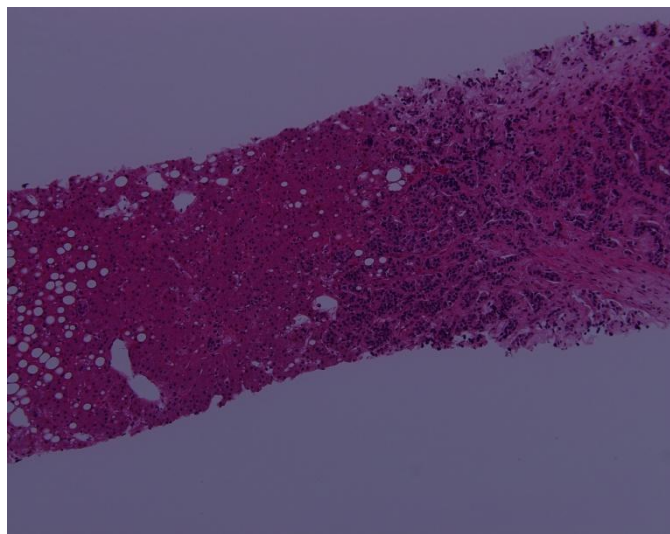
Some studies showed that isolated hepatic breast cancer metastasis ranges from 2% to 26% with a median survival of only a few months.<sup>[10]</sup> The liver function test of our patient showed bilirubin of 5 mg/dl and albumin level of 2 gm/dl indicating liver failure. Studies have shown that patients with breast cancer and marked impaired hepatic function secondary to breast carcinoma had poor prognosis and some patients died at the first cycle of chemotherapy. Just like our patient, the range of survival of such patients varies from only two weeks up till 6 weeks.<sup>[10]</sup> Features indicating very poor prognosis of patients with hepatic metastasis of breast cancer include extensive invasion of the liver, low albumin, less than 2gm/dl and high bilirubin, more than 5 mg/dl.<sup>[10]</sup> All in all, our patient had deleterious progressive hepatic metastasis and she passed away within less than 4 weeks from her admission. It was not possible to provide any active therapy such as palliative chemotherapy since the patient performance status at admission was 3 (based on ECOG) and presented with marked impaired liver function secondary to hepatic failure from the metastasis.

### Conclusion:-

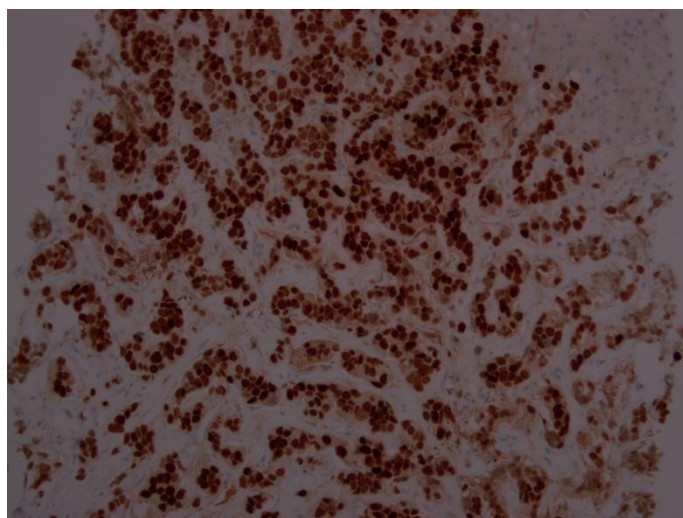
Breast cancer in young females < 40 years of age is relatively uncommon hence, young age at diagnosis is considered as a poor prognostic factor. It often follows an aggressive and invasive course with poor outcomes as what happened with our patient whose symptoms were sudden and progressive with liver failure that lead to her death in less than 4 weeks.



**Figure1:-**Liver metastases; Characteristic appearance of liver metastases on a contrast-enhanced axial CT scan.

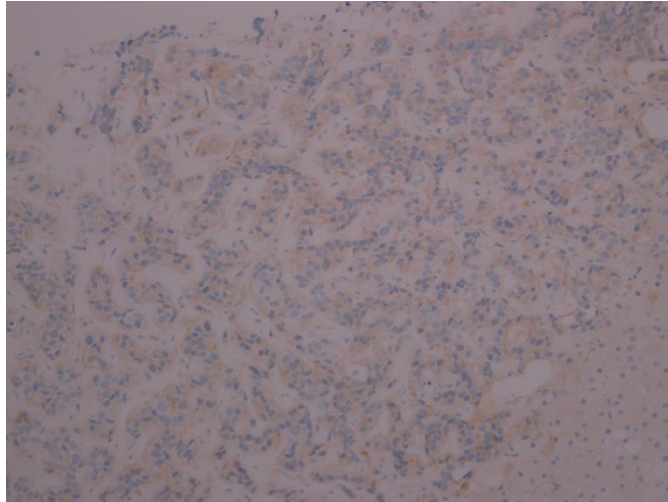


**Figure 2:-**Light microscopy showing a diffuse infiltration of hepatic tissue by malignant cells arranged predominantly as glands.



**Figure3:-**Diffuse infiltration of hepatic tissue by malignant cells with immune-histochemical staining positive for estrogen receptors.





**Figure4:-**Diffuse infiltration of hepatic tissue by malignant cells with immune-histochemical staining negative for HER2neu receptor.

#### References:-

1. Kingdom of Saudi Arabia, Ministry of Health, National Cancer Registry. Cancer Incidence Report. 1999-2010, 2014.
2. McPherson K, Steel CM, Dixon JM. Breast cancer—epidemiology, risk factors, and genetics. *British Medical Journal*. 2000; 321(7261): 624-8.
3. Saggu S, Rehman H, Abbas ZK, Ansari AA. Recent incidence and descriptive epidemiological survey of breast cancer in Saudi Arabia. *Saudi Medical Journal*. 2015; 36(10): 1176-80.
4. Assi HA, Khoury KE, Dbouk H, Khalil LE, Mouhieddine TH, El Saghier NS. Epidemiology and prognosis of breast cancer in young women. *J Thorac Dis*. 2013; 5 (1):2-8.
5. Batori M, Ruggieri M, Chatelou E, et al. Breast cancer in young women: case report and a review. *Eur Rev Med Pharmacol Sci*. 2006;10(2):51–2.
6. West JG, Kapoor NS, Liao SY, Chen JW, Bailey L, Nagourney RA. Multifocal breast cancer in young women with prolonged contact between their breasts and their cellular phones. *Case Rep Med*. 2013; 2013: 1-5.
7. Azim H, Partridge A. Biology of breast cancer in young women. *Breast Cancer Res*. 2014; 16 (4): 427-35
8. Yao S, Xu B, Ma F, Liao Y, Fan Y. Breast cancer in women younger than 25: clinic-pathological features and prognostic factors. *Annals of Oncology*. 2008;20(2):387-9.
9. Petrucelli N, Daly MB, Feldman GL. Hereditary breast and ovarian cancer due to mutations in BRCA1 and BRCA2. *Genet Med*. 2010;12(5):245-59.
10. Wyld L, Gutteridge E, Pinder SE, James JJ, Chan SY, Cheung KL, Robertson JF, Evans AJ. Prognostic factors for patients with hepatic metastases from breast cancer. *Br J Cancer*. 2003;89(2):284-90.



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### RESEARCH ARTICLE

## POTATO PEEL - A COST EFFECTIVE SUBSTRATE FOR PROTEIN ENRICHMENT AND WASTE MINIMIZATION.

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Protein enrichment, Potato peel, *Saccharomyces cerevisiae*, Chemical analysis, Fermentation.

#### Abstract

Disposal of kitchen waste is universal and likewise the need for food to the growing human population is inevitable, a sure solution is immediately needed. The bioconversion of potato peel into certain valuable products like single cell protein (SCP) has the ability to solve the worldwide food protein deficiency by obtaining an economical product for food and feed. The aim of using kitchen waste as substrate for the production of high nutritious food product may decrease environmental pollution due to utilization of kitchen waste as a substrate, up to some extent. However, using flour prepared from dried potato peels were inoculated with pure culture of *Saccharomyces cerevisiae* and then left for four days. Chemical analysis of the fermented potato peel mash revealed a significant ( $p < 0.05$ ) increase in the protein content of the potato peel mash when compared with unfermented potato peel. This result also shows that fermentation increased significantly the protein of the fermented potato peel mash, while a decrease in carbohydrate was observed. Moisture content of 125%, temperature of 30<sup>0</sup> and pH of 5.5 were maintained for growth of *S. Cerevisiae* on the mash. Therefore fermented peels could be a good source of protein enriched feed.

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#### Introduction:-

Various forms of organic waste such as cellulose hemicelluloses, hydrocarbon and different types of agricultural waste were used in the production of protein enrich food<sup>1</sup>. Lignocelluloses wastes (LCW) refer to plant biomass wastes that are composed of cellulose, hemicellulose, and lignin. Potato (*Solanum tuberosum* L.) is one of the major world crops with world annual production of 180million tons on 2009 according to the Food and Agriculture Organization (FAO)<sup>2</sup>. The Potato peels are rich in phytonutrients, carbohydrates, high in starch (8-28%) but with only 1-4% protein. Anon reported that potato starch is a large grained starch containing 25% amylose and 73% amylopectin and high phosphate content<sup>3</sup>. A large amount of potato peels are discarded during processing for chips by many industries. Protein enrichment of potato peels through inexpensive means is therefore desirable<sup>4</sup>. Solid state bio processing (SSB), an aerobic microbial transformation, has been successfully exploited for enzyme and food production, phenolic enhancement, fruity aroma production as well as many other uses. Culture conditions of bioprocessing are more similar to the natural habitat of filamentous fungi, which leads, in many cases, to higher efficiency, as well as lower generation of liquid waste<sup>5</sup>. The materials that make up wastes should normally be recycled back into the ecosystem, e.g.:- straw, bagasse, citric acid, olive, and date waste, whey, molasses, animal

manures and sewage. The amount of these wastes can be very high and may contribute to a significant level of pollution in watercourses<sup>6</sup>. A variety of microorganisms and substrate are used to produce protein rich food. Yeast is suitable for production because of its superior nutritional quality. The supplementation of cereals especially with yeast, make them a good source of protein for animal. The necessary factor considered for its production is the demonstration of toxic and carcinogenic compounds originated from substrates, biosynthesized by microorganisms or formed during processing. *Saccharomyces cerevisiae* and *Candida* has been used to bio convert agro-industrial waste into valuable protein sources. Of all the essential plant nutrients, Nitrogen is the most often limiting to potato production on sandy soils. Nitrogen fertilizer recommendations for irrigated soils are based on crop yield goal and previous crop. Nitrogen supplementation of the raw substrate with ammonium sulphate in solid state bio processing may stimulate growth or improve process efficiency<sup>5</sup>. The objective of the present investigation were to study the protein enrichment of potato peel by the process of solid-state bio processing using *Saccharomyces cerevisiae* and its addition as a protein supplement to the diet of animals.

### **Material and Methods:-**

**Requirements:-** Lyophilized culture, inoculating loop, incubator shaker, laminar Air Flow, Erlenmeyer flask (250ml), measuring cylinder, distilled water, autoclave, ethanol (70%), cotton, refrigerator, centrifuge, colorimeter, etc.

### **Preparation of YEPD media:-**

**Medium components:** Pure culture of yeast (*Saccharomyces cerevisiae*) used was MTCC 170. It was revived on YEPD<sup>5</sup> (Yeast Extract 3.0g; Peptone 10.0g; Dextrose 20.0g; Agar 15.0g; distilled water 1.0 L) at 30<sup>0</sup> C for 48hrs and was stored at 4<sup>0</sup> C.

### **Procedure:-**

- YEPD medium (50ml) was prepared in Erlenmeyer flask (250ml) and autoclaved at 15psi for 15min.
- Inoculum (2ml) developed was transferred to the 50ml YEPD medium prepared in a flask and kept for 30<sup>0</sup>C for four days on rotatory shaker.
- Chemical analysis of the culture was done after every 24hrs of incubation for four days.

### **Culture revival of *Saccharomyces cerevisiae* (MTCC no. : 170):-**

**Medium components:-** Pure culture of yeast (*Saccharomyces cerevisiae*) used was MTCC 170. It was revived on YEPD<sup>5</sup> (Yeast Extract 3.0g; Peptone 10.0g; Dextrose 20.0g; Agar 15.0g; distilled water 1.0 L) at 30<sup>0</sup> C for 48 hrs and was stored at 4<sup>0</sup> C.

### **Procedure:-**

- Pure culture was obtained in lyophilized form from MTCC (microbial type culture collection), IMTECH.
- Culture was revived in Yeast extract potato dextrose (YEPD) broth medium consists of Yeast extract 3.0g; Peptone 10.0g; Dextrose 20.0g; Agar 15.0g; Distilled water 1.0L.
- Culture was spread to the YEPDA medium plates using spreader under sterile conditions and incubated at 30<sup>0</sup>C for 24hrs. Optical density of the culture was checked in colorimeter at 680nm.
- Sub culturing was done to maintain culture for further use.

### **Preparation of YEPD media supplemented with ammonium sulphate:-**

**Medium components:-** YEPD medium for *Saccharomyces cerevisiae* production was prepared<sup>5</sup>. It consists of (g/l): Yeast extract 3.0g; Peptone 10.0g; Dextrose 20.0g, ammonium sulphate 2.5%, distilled water 1.0L.

### **Procedure:-**

- YEPD medium (50ml) was prepared in Erlenmeyer flask (250ml), and ammonium sulphate (1.25g/50ml) was added and autoclaved at 15psi for 15min.
- Inoculum (2ml) developed was transferred to the 50ml YEPD medium prepared in a flask and kept at 30<sup>0</sup>C for four days on rotatory shaker.
- Chemical analysis of the culture was done after every 24hrs of incubation for four days.

**Substrate:-**

The potato peels used in this study was obtained from nearby fast food facilities. The peels were washed thoroughly with sterile distilled water, cut into tiny bits and dried in an oven at 60°C for 48 hrs. The dried peels were powdered by using Pestle and Mortar, subsequently sieved with 0.5mm screen mesh<sup>4</sup>.

**Preparation of potato peel media in YEPD broth:-****Medium components:-**

Dried potato peel powder (10g), specific medium for *Saccharomyces cerevisiae* production was prepared<sup>5</sup>. It consists of (g/l): Yeast extract 3.0g; Peptone 10.0g; Dextrose 20.0g, distilled water 1.0L.

**Procedure:-**

- YEPD medium (50ml) was prepared in Erlenmeyer flask (250ml) and autoclaved at 15psi for 15min. Inoculum (2ml) developed was transferred to the above prepared medium in a flask and kept at 30°C for 17-18hrs. Dried potato peels were weighed (10g). Moisture level (125% (v/w)) was adjusted and autoclaved at 121°C for 15min.
- Under aseptic conditions, YEPD growth media was transferred to flask containing dried potato peels which was then kept for fermentation at 30°C on rotatory shaker (150rpm) for four days.
- Chemical analysis of the culture was done after every 24hrs of incubation for four days.

**Preparation of potato peel media in YEPD broth supplemented with ammonium sulphate:-****Medium components:-**

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**Procedure:-**

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- Dried potato peels were weighed (10g). Moisture level (125% (v/w)) was adjusted. Ammonium sulphate was added (2.5%) in the flask containing dried potato peels and autoclaved at 121°C for 15min.
- Under aseptic conditions, YEPD growth media was transferred to flask containing dried potato peels which was then kept for fermentation at 30°C on rotatory shaker (150rpm) for four days.
- Chemical analysis of the culture was done after every 24hrs of incubation for four days.

**Solid State Bio processing:-**

Solid state bioprocessing was carried out in 250ml Erlenmeyer flasks containing potato peel (10g). Flasks were aseptically inoculated with inoculum suspension of *Saccharomyces cerevisiae* ( $2 \times 10^8$  CFU/ml). Flasks were covered with sterilized gauze covers and statically incubated at 30°C in a laboratory incubator for 4 days with intermittent manual shaking. Samples, as whole flasks in duplicate were withdrawn after each 24hrs. The time necessary to reach the peak of protein concentration was evaluated<sup>5</sup>.

**Result:-****Chemical analysis of fermented potato residue:-****Moisture content:-**

Fermented potato residue was dried at 60°C until its weight remained constant. The weight difference after drying was considered the moisture content.

**Moisture Content:-**

Item	Moisture content (%)
Unfermented potato peel	71.7%
Fermented potato peel	85.51%

**Water holding capacity:-**

Potato peel residue was soaked in water at 4°C for 24hrs and centrifuged at 14000 rpm for 1hr, the supernatant was discarded, and the amount of moisture of the residual pellet was determined as water-holding capacity.

**Water holding Capacity:-**

Item	Water holding capacity (%)
Unfermented potato peel	85.02%

**Determining pH level:-**

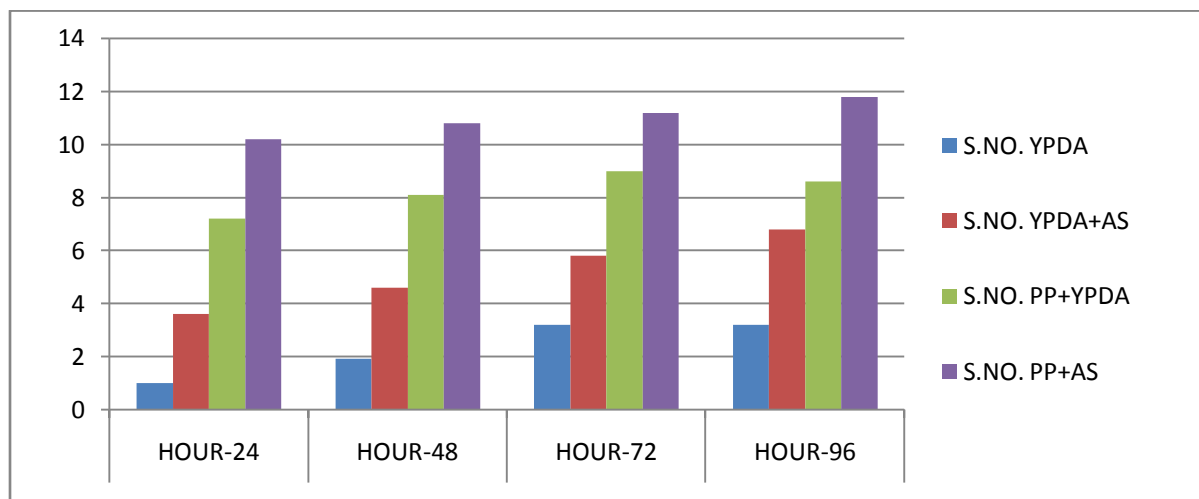
PH level were estimated in a suspension of sample (0.5g) in distilled water (10ml). Statistical analysis of data was determined by Analysis of Variance (ANOVA) and Tukey test was applied with accepted significance of  $p < 0.05$ . PH level was kept constant at 5.5 throughout the fermentation.

**Protein content in wet biomass:-**

Protein content was calculated by Folin Lowry method.

**Table1:-**Protein content of wet biomass of different media during fermentation.

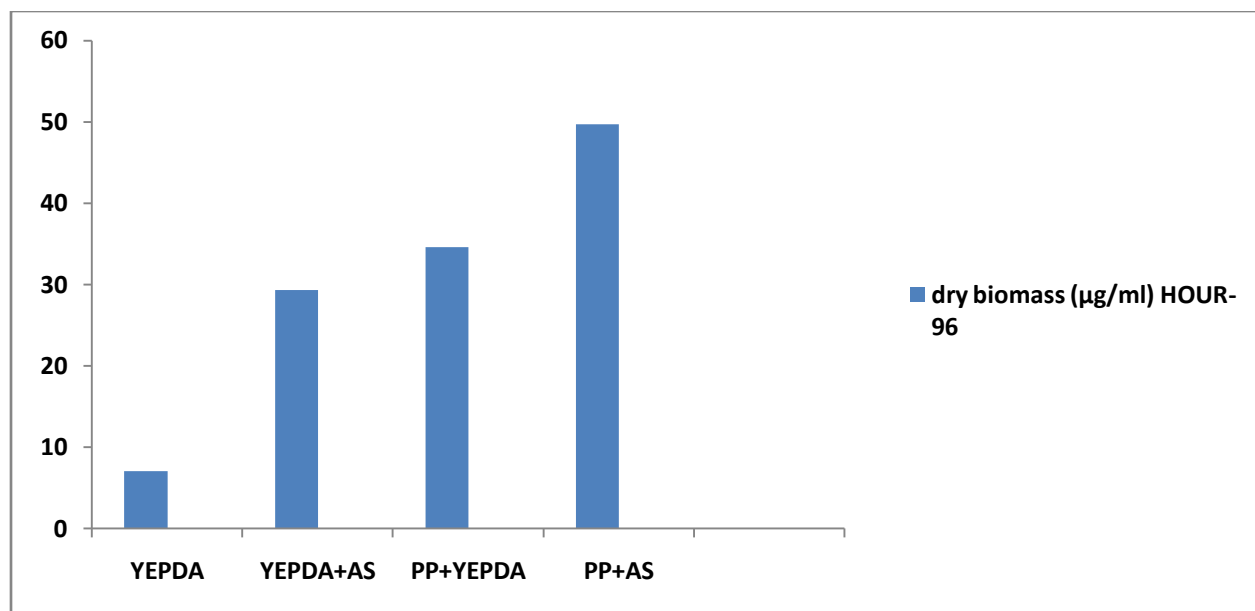
Media	24 Hours ( $\mu\text{g/ml}$ )	48 Hours ( $\mu\text{g/ml}$ )	72 Hours ( $\mu\text{g/ml}$ )	96 Hours ( $\mu\text{g/ml}$ )
YEPD	2.2	3.5	6.2	6.2
YEPD+AS	14.2	17.7	24	26.6
YEPD+PP	21.3	23.1	27.55	30.2
PP+AS	28.4	34.6	40.8	45.3

**Fig 1:-**Conc Of protein in wet biomass (ug/ml)

The protein content of YEPDA was lower than the protein content in the substrate supplemented with ammonium sulphate during solid state fermentation for four days by *Saccharomyces cerevisiae*. But there was constant increase of protein content in the potato peel supplemented with and without ammonium sulphate as compared to synthetic media. With low concentration ( $2.2\mu\text{g/ml}$ ) of protein in synthetic media during first 24hr of fermentation, effect of nitrogen supplementation was examined as shown in fig-1. Supplementation with 2.5% of ammonium sulphate, results in the enrichment of protein level ( $45.3\mu\text{g/ml}$ ) of potato peel as compared to concentration ( $21.3\mu\text{g/ml}$ ) of potato peel without ammonium sulphate during solid state fermentation by *Saccharomyces cerevisiae*. This shows that ammonium sulphate have been utilized as a source of nitrogen which results in the increase in protein content of the potato peel during fermentation.

**Protein content in dry biomass:-****Table2:-**Protein content in dry biomass of different media after fermentation

Media	96 Hours ( $\mu\text{g/g}$ )
YEPD	7.1
YEPD+AS	29.3
YEPD+PP	34.6
PP+AS	49.7



**Fig 2:-**Conc of protein in dry biomass (96-hrs) (ug/ml)

The final dried biomass of substrate after 96hrs of fermentation results in the overall increase in the protein content as compared to wet biomass. Protein content in the final bioprocessed product reached 49.7µg/ml when supplemented with ammonium sulphate. Without supplementation of ammonium sulphate, bio processed sample reached around 34.6µg/ml in the dried biomass. This shows that *Saccharomyces cerevisiae* have utilized ammonium sulphate, source of nitrogen for protein enrichment.

### Discussion:-

The results obtained from this study revealed that fermentation can bring about desirable changes in the nutrient composition of potato peels. From this study, yeast showed potential to increase the protein content of the potato peel mash. The yeast *S. cerevisiae* demonstrated the best ability to enrich the peel mash in four days. The peels when fermented with *S. cerevisiae* had an improvement to 18.62%. This implied that yeast had significant ( $P < 0.05$ ) effect on the protein content. The increase in the crude protein observed could be attributed to the additional crude protein (extracellular enzymes) such as amylases production from the fungal mycelia<sup>9-12</sup> and thus secreted into the supernatant of fermenting mash in order to make use of the starches as a carbon source<sup>13</sup>. Furthermore, increase in the growth of the microorganisms in the fermenting potato peel mash may possibly account for increase in the protein content of the fermented peel mash as reported by some other workers<sup>14,15</sup>. Similar results using sweet potato have been reported by<sup>8, 16</sup>. An optimum temperature and pH range of 25°C and 5.5 respectively supported the highest crude protein formation when *S. cerevisiae* was grown on the potato peel mashes. This finding is in agreement with that of<sup>17</sup> who reported a temperature range between 25°C and 30°C to be favorable for the growth of most yeast. Similar findings were also reported by<sup>14</sup>. This observation further confirms that the increase in crude proteins observed is as a result of an increase in cell mass generated by the organism. Therefore, the commercial utility of protein enrichment of potato peel residue with *Saccharomyces cerevisiae* by solid state fermentation for animal feed appears to be promising as described by<sup>18</sup>. The water holding capacity of potato peel residue was 85.02%. The moisture content of the unfermented potato peel substrate was 71.7% which was lower than the water holding capacity. Whereas, the moisture content of fermented potato peel was (85.51%) lower than the moisture content in potato peel supplemented (86.89%) with ammonium sulphate. Similar findings were also reported by<sup>7</sup>.

### Conclusion:-

The results obtained in the study have shown that growing of yeast on potato peel mash can enrich its protein content. This could be attributed to the ability of *Saccharomyces cerevisiae* to utilize ammonium sulphate as a source of nitrogen in protein enrichment, apart from this, to make use of potato peel carbohydrate as a source of carbon. The increase in the microbial biomass in the potato peel supplemented with ammonium sulphate account for the increase in the protein content by yeast during fermentation.

**References:-**

1. Adedayo, M.R., Ajiboye, E.A., Akintunde, J.K., Odaibo, A. (2011): SCP: As nutritional Enhancer. J. Microbiology., 2(5): 396-409.
2. Weshahy A.I., Rao V.A. (2012): Potato peels as a source of important phytochemical antioxidant nutraceuticals and their role in human health- A Review. In Tech, pp278.
3. Anon (1985): International potato centre. Annual report, Lima, Peru,;23.
4. Akintomide, Antai M.J., S.P. (2012): Protein enrichment of Irish potato (*Solanumtuberosium*) peels through solid substrate fermentation by *Saccharomyces cerevisiae*. IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT). Volume 1, Issue 5, PP 15-19.
5. Roberta correa, Margarida Magalhaes and GoreteMacedo (2006): Protein enrichment of pineapple waste with *Saccharomyces cerevisiae* by solid state bio processing. Journal of scientific and industrial research.vol.66, pp259-262.
6. Srividya R., Vishnuvarthan V.J., Murugappan M., Dahake P.G. (2013): Single cell protein-A Review. International journal for pharmaceutical research scholars. 2(4), 472-485.
7. Yang S.S. (1987): Protein Enrichment of Sweet Potato Residue with Amylolytic Yeasts by Solid-State Fermentation. Biotechnology and bioengineering, vol. 32.
8. Abu O.A. (1997): Biochemical characteristics and utilization of processed sweet potato Legume batata (L) LAM for rabbit feeding, doctoral diss. University of Ibadan Ibadan, Nigeria.
9. Leninger A.L. (1987): Bioenergetics and Metabolism. Principles of Biochemistry. New Delhi: CBS Publisher and Distributors. 313-356.
10. Okafor N., Ejiofor A.O. (1990): Rapid detoxification of cassava mash by yeast simultaneously producing linamarase and amylase. Process Biochemistry. 25(3), 82-86.
11. Akindahunsi A.A., Oboh G., Oshodi A.A. (1999): Effect of fermenting cassava with *Rhizopusoryzae* on the chemical composition of its flour and garri. RivistaItalianaDelleSostanze Grasse, 76(10), 437- 440.
12. Oboh G., Elusiyan C.A. (2007): Changes in the nutrient and anti-nutrient content of micro-fungi fermented cassava flour produced from low- and medium-cyanide variety of cassava tubers. African Journal of Biotechnology, 6(18), 2150-2157.
13. Raimbault M. (1998): General and microbiological aspects of solid state fermentation. Electronic Journal of Biotechnology, 1(3), 34.
14. Antai S.P., Mbongo P.M. (1994): Utilization of cassava peels as substrates for crude protein formation. Plant Foods for Human Nutrition, 46(4), 345-351.
15. Oboh G., Akindahunsi A.A., Oshodi A.A. (2002): Nutrient and anti-nutrients content of *Aspergillus Niger* fermented cassava products (flour and garri). Journal of Food Compound and Analysis, 15(5), 617 – 622.
16. Abu O.A., Oguntimein G.B., Tewe O.O. (1998): Protein enrichment of sweet potato by solid state fermentation using four monoculture fungi. Nigerian Journal of Biotechnology, 9(1), 1- 4.
17. Campbell I., Duffus J.H. (1988): Culture, storage, isolation and identification of yeasts, in I. Campbell, and J.H. Duffus (Ed.). Yeasts: A practical approach. Oxford, England; Washington, DC, IRL Press, 1-15.
18. Thongkratok R., Sutisakhempaka, WittawatMolee. (2010): Protein enrichment of cassava pulp using microorganisms' fermentation techniques for use as an alternative animal feedstuff. Journal of animal and veterinary advances 9(22): 2859-2862.

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## RESEARCH ARTICLE

### METHEMOGLOBINEMIA DUE TO BIOLOGICAL POISONING – CASE REPORT

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#### Abstract

Acquired methemoglobinemia is a dyshaemoglobinemia which results from exposure to various oxidizing agents, results in impaired oxygen delivery to the tissues and can be potentially fatal if untreated. Deliberate ingestion of certain herbicides, insecticides, and pesticides may produce this condition. We report 2 cases of methemoglobinemia due to intentional ingestion of pesticides which were marketed to be safe and contain only biological extracts and fillers. Methylene blue, ascorbic acid, blood transfusion and exchange transfusion are the various modalities of treatment.

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#### Introduction:-

Methemoglobin (MetHb) is a dyshemoglobin, represents the oxidized form of hemoglobin (Hb), the ferrous ( $\text{Fe}^{2+}$ ) state of iron is transformed into ferric ( $\text{Fe}^{3+}$ ) state, which makes it incapable of binding to oxygen. Acquired methemoglobinemia is more common than inherited and results from exposure to various oxidizing agents such as nitrates, nitrites, aniline, dapsone, local anaesthetics, herbicides and pesticides. We report 2 cases of methemoglobinemia induced by ingestion of pesticides with suicidal intent.

#### Case presentations:-

##### Case 1:-

A 25-year-old woman presented to emergency with alleged history of poisoning with pesticide within 40 minutes after consumption. She was found unresponsive and was intubated and mechanically ventilated. At presentation, she was cyanotic with pulse rate, 90 beats/min; respiratory rate, 28 breaths/min; and blood pressure, 130/80 mmHg. Bilateral breath sounds were clear. Bilateral pin point pupils with sluggish reaction to light were noted. Within 3 hours after admission, she became hemodynamically unstable and developed generalized tonic clonic seizures. Oxygen saturation measured by pulse oximetry ( $\text{SpO}_2$ ) was 67 % at ambient air and 88% with 100% oxygen. Her blood samples appeared chocolate brown. Arterial blood gas (ABG) analysis with CO-oximetry (SIEMENS Rapid point 500) showed a partial pressure of  $\text{O}_2$  ( $\text{pao}_2$ ) 467.5 mmHg, arterial  $\text{O}_2$  saturation of 99% ( $\text{SaO}_2$ ) and MetHb of 78%. She was treated with 1% methylene blue, ascorbic acid, exchange transfusion, antiepileptics, and inotropic support but despite of treatment, she expired on day 3.

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**Case 2:-**

A 25-year-old man was brought to emergency with alleged history of poisoning with about 100ml of pesticide within 90 minutes of ingestion. At presentation, he was conscious, coherent and cyanotic. His vital signs were as follows: pulse rate, 120/min; blood pressure, 130/80mmHg and respiratory rate, 26 breaths/min. SpO<sub>2</sub> was 70% at ambient air and 86% with oxygen supplementation of 6L/min. Bilateral breath sounds were clear. Bilateral pin point pupils with sluggish reaction to light were noted. Within 30min. of hospitalization, he became unconscious for which he was intubated and mechanically ventilated. ABG analysis with CO-oximetry showed pO<sub>2</sub>, 621mmHg, SaO<sub>2</sub>, 99% and MetHb, 80%. Patient had troponin I&T positive and urine for myoglobin was positive.

He was administered 1% methylene blue (1mg/kg). CO-oximetry after 1 hour showed MetHb of 50 %. A single volume of exchange transfusion was done. He gained consciousness and became oriented. Two doses of 1% methylene blue were repeated with an interval of 12 hours to prevent rebound methemoglobinemia and MetHb was 6.2% after 3<sup>rd</sup> dose. In addition, he received inj. vitamin C 500mg in 5% dextrose once daily. He was extubated on 4<sup>th</sup> day and discharged after 7 days of admission, MetHb was 2% at the time of discharge without any neurological deficit.

**Discussion:-**

Methemoglobinemia (MetHb > 2%) is an altered state of hemoglobin which results when there is an overwhelming oxidative stress exceeding the normal protective mechanisms. Acquired methemoglobinemia is induced by exposure to various oxidizing agents, most commonly due to nitrates and nitrites (1, 2).

The clinical manifestations (Table I) of methemoglobinemia are due to impaired oxygen delivery to the tissues and hence correlate with severity of methemoglobinemia.

Table I: Levels of methemoglobin and associated clinical features (3)

Methemoglobin %	Signs and symptoms
< 15%	Asymptomatic
20-30%	Cyanosis, headache, fatigue, mental status changes, syncope, dizziness, and exercise intolerance
30-50%	Shortness of breath and headache
50-70%	Lethargy, stupor, dysrhythmias, seizure, coma
>70%	Death

The onset of signs and symptoms in our cases was 30-60 minutes after pesticide ingestion. We observed bilateral pin point pupils in two cases and positive troponin and myoglobin in one case but this finding was not seen with similar poisoning described by George et al (4).

Common insecticides that induce methemoglobinemia include indoxacarb, aluminium phosphide, and paraquat. The pesticide consumed in our case reports contains biological extracts, stabilizers and fillers which was marketed to be safe and no mention of an antidote. We found only one case report (4) of toxicity with the similar pesticide in the literature. Biological extracts are rich in nitrogenous products and hence can potentially cause methemoglobinemia (4).





Figure 1:-

Methemoglobinemia should be suspected clinically by the presence of cyanosis in the presence of a normal PaO<sub>2</sub> and chocolate-brown colored blood (Figure1). The presence of methemoglobinemia can be suspected when the SpO<sub>2</sub> is significantly different from the SaO<sub>2</sub> ("saturation gap"). This saturation gap between SaO<sub>2</sub> and SpO<sub>2</sub> greater than 5% is a diagnostic clue to the presence of MetHb(5). To confirm methemoglobinemia, carbon monoxide (CO)-oximetry is required. Even CO-oximeters cannot distinguish between MetHb and sulfhemoglobin due to similar absorbance peaks at 630 nm (6). MetHb was detected by absorption spectrophotometry after addition of sodium cyanide in the clinical biochemistry laboratory.



Figure 2:-

Management of acute methemoglobinemia begins with discontinuation of the offending agent. Methylene blue (MB) is the first line antidotal therapy which provides an artificial electron transporter for the reduction of MetHb via the NADPH dependent methemoglobinreductase system. Methylene blue is indicated when MetHb exceeds 25-30% in asymptomatic patient or when the patient exhibits symptoms of oxygen deficiency, such as dyspnea and alteration of

consciousness (7). The recommended dose of 1% methylene blue for adults is 1-2mg/kg diluted in 100ml of isotonic saline, infused intravenously over 5 minutes. The response is usually rapid within 30 minutes; the dose may be repeated in one hour if the level of methemoglobin is still high one hour after the initial infusion (8). Dextrose containing fluids should be co-administered in order to increase NADPH formation. Injection ascorbic acid (300 to 1000 mg/day) may be useful which activates alternate minor pathway. Serial measurements of methemoglobin levels should be performed following treatment with MB as rebound methemoglobinemia may occur up to 18 hours after MB administration. The dose can be repeated hourly up to a maximum of 7mg/kg over 24 hours (9). As observed in one of our patients, symptoms of dyspnea and depressed mental status improved within 30 minutes of MB injection. Caution should be exercised to avoid over dosage (>7 mg/kg) because cumulative doses of MB can cause dyspnea, chest pain, hemolysis and paradoxical methemoglobinemia in some susceptible subjects. Methylene blue should not be administered to patients with known glucose 6-phosphate dehydrogenase (G6PD) deficiency.

Severe methemoglobinemia (MetHb>70%) is usually fatal, as evidenced in our first case though survival has been reported with a MetHb level of 80% in our case 2 and previous reports (4, 10).

In case of unresponsive methemoglobinemia with MB, exchange transfusion or hyperbaric oxygen may be beneficial (5).

Fig 1 : ABG suggestive of methemoglobinemia (met Hb :80.17%)

Fig 2 : Chocolate brown colored blood due to methemoglobinemia on the left

### Conclusion:-

We conclude that every physician should be cautious in cases of poisoning with unknown chemical composition which may potentially cause fatal complications like methemoglobinemia. A high index of clinical suspicion of methemoglobinemia is required in all cases of unexplained cyanosis.

### Consent:-

Written informed consent was obtained from the patient's guardian/parent for the publication of this report.

**Conflicts of interest:** None

### References:-

1. Dewan A, Patel AB, Saiyed HN. Acute methemoglobinemia- A common occupational hazard in an industrial city in western India. *Journal of Occupational Health*. 2001; 43(3): 168-171.
2. Donovan JW: **Nitrates, nitrites and other sources of methemoglobinemia**. In *Clinical management of poisoning and drug overdose*. Edited by Haddad LM, Winchester JF. W.B. Saunders Company, Philadelphia; 1990:1419-1431.
3. Ash-Bernal R, Wise R, Wright SM. Acquired methemoglobinemia: a retrospective series of 138 cases at 2 teaching hospitals. *Medicine*. 2004 Sep; 83(5):265-73.
4. George T, Shaikh AI, Thomas L, Kundavaram AP.
5. Severe methemoglobinemia due to insecticide poisoning. *Indian J Crit Care Med* 2014; 18:113-4
6. Abu-Laban RB, Zed PJ, Purssell RA, Evans KG. Severe methemoglobinemia from topical anesthetic spray: Case report, discussion and qualitative systematic review. *CJEM* 2001; 3:51-6.
7. Gharahbaghian L, Massoudian B, Dimassa G. Methemoglobinemia and sulfhemoglobinemia in two pediatric patients after ingestion of hydroxylamine sulfate. *West J Emerg Med* 2009; 10:197-201.
8. Chongtham DS, Phurailatpam J, Singh MM, Singh TR: Methaemoglobinemia in nitrobenzene poisoning. *J PostgradMed* 1997, 43(3):73-4.
9. Rees SM, Nelson LS: **Dyshemoglobinemias**. In *Emergency medicine - a comprehensive study guide*. 6th edition. Edited by Tintinalli JE, Kelen GD, Stapczynski JS. McGraw-Hill, New York; 2004:1169-1171.
10. doNascimento TS, Pereira RO, de Mello HL, Costa J. Methemoglobinemia: From diagnosis to treatment. *Rev Bras Anesthesiol* 2008; 58:651-64
11. Perera M, Shihana F, Kularathne K, Dissanayake D, Dawson A. Acute methaemoglobinaemia after massive nitrobenzene ingestion, *BMJ Case Rep* 2009;2009.



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### RESEARCH ARTICLE

#### A COMPARISON STUDY OF DECISION SUPPORT SYSTEM USING CO-EVOLUTIONARY ALGORITHMS.

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Decision Support Systems Co-evolutionary Algorithms Matching Suppliers Maximize Profit.

#### Abstract

This study is proposed for a small and medium-sized steel construction company to answer their problem in choosing suppliers on a project. A steel construction company's project usually works with a same basic material for many types of item such as steel. Furthermore, the price for each item from the supplier is not based on the item type but its volumes. This study will perform a simulation of decision support system to help the company in decision making about which supplier will supply the item to gain the maximize profit. In this study, a co-evolutionary algorithm is used as the basic foundation for the application to optimize the profit by matching the right supplier for each item. The objective of doing this simulation is to proof that there is a rise in profit of the company by doing a matching the right supplier for the company. In this study will consider two kind of scenarios: (i) without considering discount (ii) with considering discount and divided into 2 cases in each scenario: First case is when the company use the same type of goods which make the price from each supplier is only based on their volumes. The second case, is when the company use different type of goods which make the price from each supplier become more variety. These scenarios are proposed see how co-evolutionary algorithms perform in making a decision when the parameters become more varieties and developed by using Java Net Beans.

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#### Introduction:-

Generally, the optimal solution for effective purchasing is the buyer was free to choose from a range of different sources. Mostly, all companies choose the supplier who providing the lowest price. There is a strong trend in many companies towards reducing the total numbers of suppliers as well as concentrating more on developing the relationships with the remaining ones that the company is dealing directly with. This can be achieved by forming systems of suppliers, with the right suppliers for each item in the company.

The main issue in this study is doing this simulation of decision support system to help the company to proof that there is a rise in profit of the company by doing a matching supplier with using co-evolutionary algorithm. In this study, the numerical example based on the steel-construction company (SCC) case, which in this case SCC can receive multiple project from a single company. Before doing the project, SCC will make a contract first with the

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related company. The contract is established by submitting a proposal about project timeline, budgeting, resources, etc. After the proposal is submitted and approved by the related company, SCC will start doing the project. Usually, the company will check the total cost and the duration needed to finish the project on the proposal and the proposals have the lowest cost and duration will be approved. In order to maximize the profit, SCC will choose the most expensive item from many suppliers so SCC can maximize the profit since SCC is a service company. Choosing the best supplier isn't that simple because of the variant item needed in a project and many suppliers can supply the same item with higher cost. Therefore, in this study proposes a solution by demonstrating a decision support system using co-evolutionary algorithms in matching suppliers. Decision support system is an interactive computer-based system to support user in assessing and deciding an option [6]. The applicability and efficiency of solution procedure is demonstrated through numerical example and a co-evolutionary algorithms and genetic algorithm (GA) is proposed as a solution method [7]

### Background and Related Works:-

A study of coevolutionary algorithm and genetic algorithm for multiobjective optimization is performed used in the previous research by [3]. In their study, they were comparing coevolutionary algorithm (CGA) with 7 other algorithm in optimizing multiobjective function. The other algorithm is: random search (RAND), Fonseca and Fleming's multiobjective GA (FFGA), the Niched Pareto GA (NPGA), Hajela and Lin's weighted sum approach (HLGA), the Vector Evaluated GA (VEGA), the Nondominated Sorting GA (NSGA), a single-objective EA using weighted-sum aggregation (SOEA), and the Strength Pareto GA (SPEA). The used test function provide a range of difficulties for multiobjective optimization (e.g., multimodality, deception, isolated optima). In each optimization, it is desired to minimize the objective vector by finding its Pareto-optimal front. The result show that the CGA performed very well compared to the other evolutional algorithm and random search. It could be argued that the CGA qualitatively performed on par with or outperformed the other algorithms based on four of the six functions.

Based on previous research [4], genetic algorithm works well in searching and optimizing a solution. Genetic algorithm have a simple and understandable principles but it is complex to design the chromosome and implement it. These principles is rather similiar with the problem that coevolutionary algorithm had.

The study of using coevolutionary algorithm and genetic algorithm to collaborate between 2 company already performed by [1]. Their study proposed a collaboration between 2 delivery service company in 3 different region based on the terminal status and the service center location. A coevolutionary algorithm and genetic algorithm is applied in the proses and the result was satisfying. After that, they extend the study with proposes a sustainable alliance model, which deals with selecting service centers in each merging region with low demand in express delivery services by using a co-evolutionary genetic algorithm based heuristic is developed for network design, which may be implemented under a distributed decision-making scenario assumed in collaboration system by [2].

This study will develop the solution model of decision support system to matching suppliers with using co-evolutionary algorithm. The objective in this study is to maximize the profit of the company by doing a matching supplier in steel-construction company (SCC) with two kind of scenarios: without considering discount and with considering discount and also in each scenario considering for each item are made with same or different raw materials.

### Problem Definition :-

The main problem in this study is how to maximize the profit by matching the right supplier for each item. This study considers a small to medium steel-construction company (SCC) in choosing supplier in a single project. Matching or choosing the right supplier become difficult as the types of item and the decision parameter increased. The more item used in a project, the more difficult it is for SCC to decide which supplier will supply the item. In this study will consider two kind of scenarios: (i) without considering discount (ii) with considering discount and based on the required problem, the problem is divided into 2 cases in each scenario:

#### a) Case 1

Assumptions:

There are  $m$  companies whose distribute the raw materials that needed for make items.

There are  $n$  items. All of these items are made with the same raw materials.

Labor works for each raw materials are same for each company.

Let  $i$  denoted the order of company that being used for supplying raw materials where  $i$  denote the set of possible companies.  $\therefore i \in I$ . Therefore,  $\max\{i\} = m$ .

Let  $j$  denoted the item that made from raw materials where  $j$  denote the set of possible items.  $\therefore j \in J$ . Therefore,  $\max\{j\} = n$ .

The goal of the problem is to maximize the profit whereas the profit function for the  $i$ -th company computed as follows:

$$g(i) = p(x_i + h_i) * \sum_{j=1}^n q_j \quad (1)$$

The problem become maximization problem with the statement

$$\text{Max}\{g(x_i)\} \quad (2)$$

The notations are defined as follows:

Let  $p$  be the desired profit as a fraction of the total cost.

Let  $x_i$  be the cost in Rupiah of the raw material for the  $i$  th company for each kilogram.

Let  $h_i$  be the cost in Rupiah of the labor works for the  $i$  th company for each kilogram.

Let  $q_j$  be the quantity in kilogram of raw material being used in for the  $j$  th item.

Let  $g(i, j)$  be the profit function for  $j$  th item that supplied by the  $i$  th company.

## b) Case 2

Assumptions:

There are  $m$  companies whose distributed the raw materials that needed for make items.

There are  $n$  items. For each item are made with different raw materials.

Labor works for each raw materials are same for each company.

Let  $i$  denoted the order of company that being used for supplying raw materials where  $i$  denote the set of possible companies.  $\therefore i \in I$ . Therefore,  $\max\{i\} = m$ .

Let  $j$  denoted the item that made from raw materials where  $j$  denote the set of possible items.  $\therefore j \in J$ . Therefore,  $\max\{j\} = n$ .

The goal of the problem is to maximize the profit whereas the profit function for the  $i$  th company of the  $j$  th item computed as follows:

$$g(i, j) = p(x_{ij} + h_i) * q_j \quad (3)$$

Since for each item we only need to find 1 company that maximizes the profit, the problem become maximization problem with statement

$$\forall_{j \in J}, \max_{i \in I} \{g(i, j)\} \quad (4)$$

The notations are defined as follows:

Let  $p$  be the desired profit as a fraction of the total cost.

Let  $x_{ij}$  be the cost in Rupiah of the raw material for the  $i$  th company of the  $j$  th item for each kilogram.

Let  $h_i$  be the cost in Rupiah of the labor works for the  $i$  th company for each kilogram.

Let  $q_j$  be the quantity in kilogram of raw material being used in for the  $j$  th item.

Let  $g(i, j)$  be the profit function for  $j$  th item that supplied by the  $i$  th company.

Let  $i_j^*$  be the company that supply the  $j$  th item which makes  $g(i, j)$  maximum as  $i^* \in I$  and  $j \in J$ .

It is easier to find the maximum profit through finding the company that maximizes profit for each item ( $i_j^*$ ). Therefore, the equations can be divided into several parts based on the item.

$$\begin{cases} g(i, 1) = 0.2(x_{i1} + h_i) * q_1 \\ g(i, 2) = 0.2(x_{i2} + h_i) * q_2 \\ \vdots \\ g(i, n-1) = 0.2(x_{in-1} + h_i) * q_{n-1} \\ g(i, n) = 0.2(x_{in} + h_i) * q_n \end{cases} \quad (5)$$

### Research Method and Algorithm Development:-

In this study, a heuristic algorithm based on co-evolutionary algorithm and genetic algorithm is proposed. The solution procedure is implemented using a genetic algorithm (GA), which is a stochastic solution search procedure proven to be useful for solving combinatorial problems by adopting the concept of evolution [5]. In order to do this, the first step is design the suitable chromosome for each supplier. As shown in Fig1, a chromosome consists of 13 genes. Each gene represents the status of each item purchased. Each gene only has 2 type of value, "0" or "1". 0 means the item will not be purchased from the specified supplier, while 1 means the item will be purchased from the specified supplier. To evaluate the fitness values for each supplier, the co-evolutionary algorithm is performed, in which GA is also applied.

I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13
1	0	1	1	1	0	0	1	0	1	1	1	0

**Fig1.** Chromosome design for each supplier

According to Fig 2, the chromosome is composed of three parts based on the supplier. The first one, ranging from the first gene to the thirteenth gene, denotes the type of item that will be supplied by the first supplier. The second part, ranging from the fourteenth gene to the twenty-sixth gene, indicates the type of item that will be supplied from the second supplier. The third part, ranging from the twenty-seventh gene to the thirty-ninth gene indicates the type of item that will be supplied by the third supplier.

Supplier A													Supplier B													Supplier C													
1	0	0	1	1	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	0

**Fig 2.** Chromosome design for calculating fitness value

The procedure of the co-evolutionary algorithm can be summarized as follow steps:

1. Generate the population randomly for each supplier as shown in Fig 1.
2. Matching process for each chromosome from each supplier as shown in Fig 2.
3. Verify each chromosome as shown in Fig 5 with the following condition:
  - a. Each item can only be supplied by 1 supplier.
  - b. Each item must be supplied.
4. Calculate the fitness value for each chromosome based on the given equation (Depends on the scenarios: if considering discount then calculate the fitness function must be added the parameter which represents: If in a single supplier, SCC ordered more than 6 types of item, the SCC company will get a 2% discount).
5. Descending sort of the chromosome based on the fitness value.
6. Choose the top-ten best chromosome from each supplier and save all of them into a temporary variable.
7. A roulette wheel selection is doing to fill the other 90 chromosome which has been disposed from step 6.
8. In this study, the single-cut point crossover applied as the genetic operator based on the cross over rate. The process is shown in Fig 3. There are two processes in the crossover. First, generate a random number from 0-38 (e.g. 19) and the second is from the twentieth gene to thirty-ninth gene will be swapped with the same range of gene from the chromosome below.
9. Apply the binary mutation genetic operator. The process is shown in Fig 4. First, generate a random number from 0-38 (e.g. 5). The chosen gene value will be flipped from "0" to "1" and from "1" to "0".
10. Verify each chromosome with the same condition as step 3 describes in Fig 5.
11. Recalculate the fitness value.
12. Descending sort of the chromosome based on the fitness value to find best chromosome.
13. Repeat from step 1 through 13 until 100 generation is reached.

The genetic operators are used in the proposed GA: crossover, mutation, and selection. The single-cut point cross over method is used. The parameter values for GA are: the population size equals to 100; the maximum number of generation is 100; the mutation rate is set at 10%; the cross over rate is set 50%, Gen (2008).

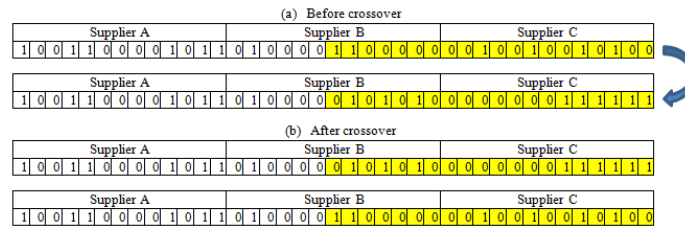


Fig 3: Crossover

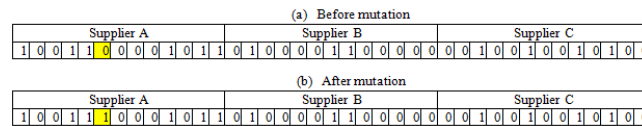


Fig 4. Mutation

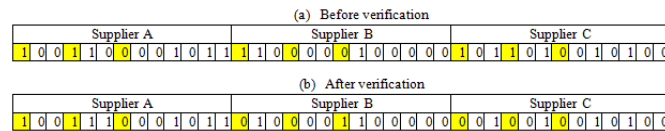


Fig 5. Verification

#### A Numerical Example And The Results:-

This study considers a single SCC using 13 type of item in a project with considering two kind of scenarios: without considering discount and with considering discount. There are three practicable suppliers that can supply those items with a different price for each item. For each item, only one supplier will be chosen (Supplier A, B and C).

Table1:-Price List

Item Code	QTY	Supplier A's Price/pcs	Supplier B's Price/pcs	Supplier C's Price/pcs
I1	10pcs	Rp.915.600,00	Rp.917.300,00	Rp.975.500,00
I2	10pcs	Rp.1.196.800,00	Rp.1.150.000,00	Rp.1.175.800,00
I3	5pcs	Rp.1.491.200,00	Rp.1.502.500,00	Rp.1.500.000,00
I4	10pcs	Rp.1.792.000,00	Rp.1.805.000,00	Rp.1.665.000,00
I5	50pcs	Rp.571.000,00	Rp.565.000,00	Rp.600.000,00
I6	20pcs	Rp.979.000,00	Rp.975.000,00	Rp.990.000,00
I7	30pcs	Rp.192.000,00	Rp.212.000,00	Rp.225.000,00
I8	50pcs	Rp.111.000,00	Rp.132.000,00	Rp.120.000,00
I9	32pcs	Rp.1.010.000,00	Rp.1.050.000,00	Rp.1.050.000,00
I10	22pcs	Rp.1.296.000,00	Rp.1.315.000,00	Rp.1.275.000,00
I11	13pcs	Rp.2.600.000,00	Rp.2.600.000,00	Rp.2.611.000,00
I12	9330Kg	Rp.1000,00	Rp.800,00	Rp.1100,00
I13	480pcs	Rp.4.500,00	Rp.4.800,00	Rp.4.500,00

Table 1 shows the price given by the supplier for each item. The types and quantity needed already given by the company issuing the project. The profit will be calculated based on the scenarios:

- First scenario: Multiplying the price with the quantity of each item. The result will be summed and multiplied by labor price and 20% for the profit.
- Second scenario: Multiplying the price with the quantity of each item. The result will be summed and multiplied by 5% for labor price and 20% for the profit. If in a single supplier, SCC ordered more than 6 types of item, the SCC company will get a 2% discount.



c)

The main issue in this study can be show as the comparison between the profit produced by each supplier's price list and the profit produced by co-evolutionary algorithm. Fig 6 shows the results of co-evolutionary algorithm and genetic algorithm implementation. The chromosome suggested the SCC to buy the item as shown in Table 2 for First scenario and Table 3 for Second scenario.

Supplier A												Supplier B												Supplier C											
0	1	0	0	0	1	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	1	0	0	1	0

Fig 6. Result of co-evolutionary algorithm

Table 2:-Suggested shopping list for first scenario

Item Code	Item Name	Supplier
I1	Iron Plate A36 6MMX4'X8' GRP	C
I2	Iron Plate A36 8MMX4'X8' GRP	A
I3	Iron Plate A36 10MMX4'X8' GRP	B
I4	Iron Plate A36 12MMX4'X8' GRP	B
I5	UNP Iron 150X75X6MMX6M KYF	C
I6	UNP Iron 200X75X8.5X11.5MMX6M KYF	C
I7	Angled Iron 65X65X6MMX6M STD-EQ	C
I8	Angled Iron 50X50X5MMX6M W2A	B
I9	Angled Iron 90X90X9MMX12M IBB	C
I10	Angled Iron 100X10X10MMX12M IBB	B
I11	Angled Iron 130X130X12MMX12M KS	C
I12	Zinchromate Paint	C
I13	Bolt HTB ½"	A

Table3:-Suggested shopping list for second scenario

Item Code	Item Name	Supplier
I1	Plat Besi A36 6MMX4'X8' GRP	C
I2	Plat Besi A36 8MMX4'X8' GRP	A
I3	Plat Besi A36 10MMX4'X8' GRP	C
I4	Plat Besi A36 12MMX4'X8' GRP	C
I5	UNP Besi 150X75X6MMX6M KYF	C
I6	UNP Besi 200X75X8.5X11.5MMX6M KYF	A
I7	Siku Besi 65X65X6MMX6M STD-EQ	A
I8	Siku Besi 50X50X5MMX6M W2A	A
I9	Siku Besi 90X90X9MMX12M IBB	C
I10	Siku Besi 100X10X10MMX12M IBB	A
I11	Siku Besi 130X130X12MMX12M KS	A
I12	Cat Zinchromate	C
I13	Baut HTB ½"	A

The profit gained from each supplier and co-evolutionary algorithm suggested shopping list for first and second scenario shows in Table 4 and Table 5 respectively. Based on the Table 4, the summarization of observation can be seen as follows: first, before using co-evolutionary algorithm, the maximum profit that can be gained is Rp. 47.570.380 by choosing supplier C for supplying the entire item. After using the co-evolutionary algorithm, the maximum profit that can be gained is increased by 1,49% (Rp. 48.279.000,00). Second, the company won't be needed to determine which supplier will supply each item since co-evolutionary algorithm already gave the suggested shopping list. From the Table5 can be summarize as follows: firstly, before using co-evolutionary algorithm, the maximum profit that can be gained is Rp. 49.948.899,00 by choosing supplier C for supplying all of the item. After using the co-evolutionary algorithm, the maximum profit that can be gained is increased by 12,16% (Rp. 56.020.692,00). Secondly, the company won't be needed to determine which supplier will supply each item since co-evolutionary algorithm already gave the suggested shopping list.



Based on these results we can conclude that the best matching supplier in this study is Supplier C by considering the discount or not. As we can see in Table 4 and Table 5, the profit still the highest by choosing Supplier C. This means, less time is needed to make the proposal. By doing this, not only the profit is increased, but the work duration of a project will be faster.

**Table4:-**Profit gained for first scenario

List	Profit
Supplier A	Rp. 46.653.640,00
Supplier B	Rp. 46.869.570,00
Supplier C	Rp. 47.570.380,00
Co-evolutionary algorithm	Rp. 48.279.000,00

**Table5:-**Profit gained for second scenario

List	Profit
Supplier A	Rp. 48.986.322,00
Supplier B	Rp. 49.213.049,00
Supplier C	Rp. 49.948.899,00
Co-evolutionary algorithm	Rp. 56.020.692,00

### Conclusion:-

This study develops the solution model to optimize the profit by doing matching suppliers with the company with using co-evolutionary. In order to reach a more suitable supplier for a single project, there are many things need to be learned first e.g. supplier's cost, delivery time, additional charge. The proposed model considers decision support system as an interactive computer-based system to support user in assessing and deciding an option. In this study, the scope of decision parameter is limited by gaining profit from three parameters which is item types, supplier's price list and discounts. The profit gained from coevolutionary algorithm is compared with each supplier's price list which is shown in Numerical Example. For future research, the decision parameter scope can be extended to reach a more complex issue and find better solution procedure.

### References:-

1. F.N.Ferdinand,C.S.Ko, K.H. Chung, K. H. Kim (2013): A collaborative network design model for strategic alliance in express delivery services,*Proc. of IJIE 2013*, Korea, pp.339-345.
2. F.N.Ferdinand,C.S.Ko (2016): A Cooperative Game-theoretical Method for Design of Sustainable Alliance Network in Express Delivery Services, *ICIC Express Letters:InternationalJournal of Research and Surveys*, vol.10, no.6, pp.1259-1263, SCOPUS indexed
3. J. Lohn, W. Kraus, G. Haith. (2002): Comparing a Coevolutionary Genetic Algorithm for Multiobjective Optimization. *Proceedings of the 2002 IEEE Congress on Evolutionary Computation*, pp. 1157-1162
4. Kristian Guillaumier. (2002): Generic Chromosome Representation and Evaluation for Genetic Algorithm. University of Malta, October 2002.
5. Mitsuo Gen. (2008): Network Model and Optimization. Springer.
6. R. Eko Indrajit. (2013): Decision Support System.
7. R. Paul Wiegand. (2003): An Analysis of Cooperative Coevolutionary Algorithms. George Mason University.

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### RESEARCH ARTICLE

#### SEX DIFFERENCES IN TRACE METALS AND DISEASE ACTIVITY IN PATIENTS WITH RHEUMATOID ARTHRITIS.

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#### Abstract

**Objectives:** Rheumatoid arthritis (RA) is chronic autoimmune disease marked by tissue inflammation and joint destruction. Sex differences and essential element derangement in the incidences of RA are well described. **Methods:** The present study aims to determine serum mineral level, superoxide dismutase (SOD) activity and disease activity score (DAS) in female and male RA subjects and association of minerals with disease activity in both the sexes.

**Results:** Female RA patients had significantly reduced serum Zn as compared to male RA subjects. Females had non significantly low values for copper, magnesium and phosphorous as compared to male RA subjects. SOD and DAS were significantly increased in female RA subjects. The RA subjects had higher levels of serum zinc, copper and lower levels of serum Mg when compared with reference values. However none of them were found to be associated with disease activity.

**Conclusions:** The results suggest derangement of minerals in RA where mineral evaluation and supplementation especially of magnesium in RA patients would be helpful.

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#### Introduction:-

Rheumatoid arthritis (RA) is chronic inflammatory autoimmune disorder of unknown etiology affecting various symmetric joints of the body. Like other autoimmune diseases RA is also more prevalent in females as compared to males<sup>1-4</sup>. Female to male ratio in RA is 3:1<sup>5</sup>. The differences in over occurrence and development of aggressive disease in females is not clear but genetic and hormonal factors are suggested to be involved<sup>6-11</sup>.

Several observational studies suggest that women with RA have worst disease as compared to men<sup>12-16</sup>. In recent studies RA seems to have derangement of mineral content like Mg, Zn, Cu and P. Their optimum concentration is required for normal functioning of the body. However alterations in level of these trace minerals as Mg<sup>17</sup>, Zn<sup>18</sup> and Cu (Copper) have been implicated in pathogenesis of RA as they are the co-factor of important enzymes involved in collagen and bone metabolism, the antioxidant defense system<sup>19</sup> and the immune system<sup>20</sup>. The development and progression of RA was suggested due to marginal deficiencies of Zn and Cu based on their

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serum levels<sup>21,22</sup>. Many of these trace elements are present in bones as iron, copper, zinc, manganese, fluoride, strontium and boron<sup>23</sup>. As the changes in the concentration of trace elements has been linked to inflammatory response therefore the present study was undertaken to analyze i) The concentration of Zn, Cu, Mg and P in female and male RA subjects along with activity of superoxide dismutase (SOD) and disease activity score (DAS-28-CRP). These may help in determination of possible roles of these in disease activity of female and male RA patients.

### Materials and Methods:-

The study was started after approval from Institutional Ethical Committee and written informed consent was obtained from all the participants. 46 samples (31 females, 15 males) were randomly collected from the OPD of Orthopaedics from different centers during the study period. Patients were recruited with active RA who fulfilled 4 or above criteria of American College of Rheumatology (ACR)<sup>24</sup>.

Clinically the patients presented symmetric arthritis with complaints of severe multiple joint pain along with morning stiffness (>1hr) of joint, presence of rheumatoid nodules along with radiographic changes like erosion, swelling (>3 joint especially phalanges), multiple joint involvement and deformity of peripheral joints (metacarpophalangeal (MCP) and proximal interphalangeal joint (PIP)) and decreased range of motion. The patients did not had any renal disease and were non hypertensive. Blood was drawn from overnight fasting patients for all the analysis.

### Laboratory Analysis:-

The laboratory analysis for minerals was done by commercial kits from Coral clinical system (The Tulip group, India). Serum level of magnesium were estimated by Calmagite Method by using the UV- 1800 SHIMADZU UV Spectrophotometer at the wavelength of 510nm. Serum level of the Copper and Zinc were measured by colorimetric method by using the UV- 1800 SHIMADZU UV Spectrophotometer at the wavelength of 580nm, 570nm respectively. Serum Phosphorous level by Molybdate UV Method by using the UV- 1800 SHIMADZU UV Spectrophotometer at the wavelength of 340nm. SOD estimation was done according to Mishra and Fridovich, 1972<sup>25</sup>. DAS-28 was measured according to counts of affected joint count and final value was calculated using CRP values.

### Statistical Analysis:-

The data was analyzed with Student's independent t- test. The correlation of change in biochemical parameters was done by Pearson correlation analysis. A two-tailed ( $\alpha=2$ )  $p<0.05$  was considered to be statistically significant. Graphpad Prism (version 3.0) and SPSS-15 were used for the analysis.

### Results:-

The study was done on 46 RA patients (31 females and 15 males). Their was no significant difference in the BMI of female and male patients. Female patients and male patients had significant difference in the mean age. They had reduced levels of serum zinc (131.48 $\mu$ mg/dl Vs 138.32 $\mu$ mg/dl  $p<0.05$ ), serum copper (153.65mg/dl Vs 157.06mg/dl), serum magnesium (1.006mEq/l Vs 1.106mEq/l) and serum phosphorous (6mg/dl Vs 6.166mg/dl) as compared to male participants (table 1). Both female and male RA subjects had reduced levels of serum magnesium as compared to reference values. The activity of super oxide dismutase (SOD) and disease activity score (DAS-28-CRP) were significantly high in female patients as compared to males (table 1).

Intercorrelation between different parameters studied showed no correlation of any of the essential minerals tested with DAS-28-CRP or SOD in neither females (Table 2) nor males (table 3). However female patients showed significant negative correlation ( $r=-0.434$ ;  $p<0.05$ ) between phosphorous and copper (table 2).

**Table 1:-** shows the parameters analyzed in female and male subjects. P-phosphorous; SOD-Superoxide dismutase; DAS-28-CRP-Disease activity score-28-C-reactive protein.

	Females N=31	Males N=15	Reference range
Age	33.60±1.817	43.53±2.74*	
BMI	21.98±0.76	22.96±0.72	
Zinc (*mg/dl)	131.48±1.91	138.32±1.96*	75-120*mg/dl
Copper(*mg/dl)	153.65±3.47	157.066±2.46	70-140*mg/dl
Mg (mEq/l)	1.006±0.686	1.71±0.051	1.3-2.5mEq/l
P (*mg/dl)	6.006±0.147	6.11±0.1002	2.5-50(*mg/dl)
SOD (u/mg protein)	1330.88±22.73	1024.60±53.91*	
DAS-28-CRP	5.131±0.216	4.73±0.119	

**Table 2:-** Interrelation between different parameters in female RA patients. SOD-Superoxide dismutase. DAS-28-CRP-Disease activity score-28-C-reactive protein. \* shows significant correlation (p<0.05).

	Zinc	Copper	Magnesium	Phosphorous	SOD	DAS-28-CRP
Zinc	1					
Copper	-0.021	1				
Magnesium	-0.117	-0.119	1			
Phosphorous	0.212	-0.434*	0.007	1		
SOD	-0.271	0.150	-0.029	-0.211	1	
DAS-28-CRP	0.098	0.256	0.077	-0.215	-0.139	1

\*Significant values have p<0.05.

**Table 3:-** Interrelation between different parameters in male RA patients. SOD-Superoxide dismutase.

	Zinc	Copper	Magnesium	Phosphorous	SOD	DAS-28-CRP
Zinc	1					
Copper	0.105	1				
Magnesium	-0.252	-0.252	1			
Phosphorous	0.260	-0.457	0.04	1		
SOD	0.232	0.105	0.138	0.422	1	
DAS-28-CRP	0.479	-0.044	0.336	0.001	0.011	1

DAS-28-CRP-Disease activity score-28-C-reactive protein

## Discussion:-

There was no significant difference in the BMI of female and male patients. Females have more aggressive and painful disease than males. As female patients in our study had less average age than males suggesting early onset of RA in them as compared to males. There are differences in functional capacity in female and male subjects with RA where females have more functional impairment than males<sup>26</sup>. In our study also DAS-28-CRP is higher in females as compared to males. These differences may be due to general strength of bones and muscles, bone mineral density (BMD), hormones etc. However the widely used measure of function, the health assessment questionnaire (HAQ), is cross-sectionally higher (worse) in women<sup>26</sup>.

In the present study, we found decreased level of serum magnesium in female and male RA subjects as compared to reference range, though no significant difference was observed between the two sexes in serum magnesium levels. Chronic inflammatory conditions in RA may alter the levels of magnesium and possible mechanism of reduced magnesium may be due to chronic inflammation and autoimmune injury<sup>17,27,28</sup>. Our results are in accordance with<sup>17,27-29</sup> suggesting that RA, is associated with serum magnesium disturbances<sup>28</sup>. Mg is one of the essential nutrient of the body and studies suggest its role in reducing chronic inflammation<sup>30</sup>. Decreased Mg level is considered as marker for RA<sup>17</sup>. Magnesium is an activator of sodium potassium ATPase, is antiarrhythmic and is associated with cardio vascular disease susceptibility<sup>31-32</sup>. Inflammation triggers its deficiency in animal models. In humans, low serum magnesium concentrations have been associated with high C-reactive protein (CRP) levels<sup>33</sup>.

The level of phosphorous and copper was non-significantly higher in male RA patients as compared to females. In female RA patients, phosphorous showed inverse correlation with copper ( $r = -0.434$ ;  $p < 0.05$ ). There is strong association between elevated phosphorous and Ca and phosphorous products and the development of calciphylaxis. Phosphorous influences a number of pathways involved in vascular calcification. It also has a role in induction of differentiation of vascular smooth muscle cells into osteoblast-like cells capable of extraskelatal mineralization which is important process in development of vascular calcifications. Thus phosphorous may have a role in augmenting inflammation.

Both female and male RA patients had higher serum copper levels as compared to reference values. RA patients are shown to have high levels of copper<sup>34,35</sup>. Their levels have been shown to increase in all inflammatory processes including RA. Ceruloplasmin, a copper containing enzyme is found to be significantly elevated in inflammatory conditions and has anti-inflammatory activity<sup>36-37</sup>. Our findings are consistent with Scudder et al 1978<sup>38</sup> and Tuncer et al 1999<sup>39</sup>. Hypercuperemia associated with inflammatory response may be due to oxidative stress<sup>40</sup> as positive correlations were found between serum Cu levels and inflammatory markers as serum CRP and ESR in RA patients<sup>41</sup>. Yang et al, 2016<sup>42</sup> have reported that RA patients living where farm soil has high copper had higher WBC count, ESR, DAS-28 and platelet count than people living in areas with low levels of copper. Cu is an environmental bioelement having key role in the cell's physiology. It is cofactor or component of the enzymes, participating in anti-oxidative processes, or in detoxification of oxygen free radicals. Cu complexes were effective in treating arthritis as Cu complexes have anti-inflammatory properties. Antiarthritic drugs in their active forms are complexed with copper<sup>35</sup>. The hypercuperemia was also suggested to be the outcome of dyslipidemia<sup>43</sup> or inflammation, as the cytokines have been reported to enhance the release of Cu thioneins during the oxidative burst of polymorphonuclear cells<sup>44</sup>. As many studies have reported higher levels of copper in active RA, therefore copper has been suggested to be used as an additional biochemical biomarker for RA<sup>45</sup>.

In our study the levels of zinc were significantly higher in males as compared to females. This clearly shows that RA patients are not deficient in Zinc or copper<sup>19</sup>. However, Zoli et al., 1998<sup>46</sup> reported lower zinc levels in RA patients. As zinc is considered anti-inflammatory with studies showing negative correlation between zinc and levels of IL-1 $\beta$  and TNF- $\alpha$ . Mierzecki et al, 2011<sup>18</sup> have reported nonsignificant but higher levels of zinc in serum of RA patients. Though zinc levels should have been lower considering the role of proinflammatory cytokines as IL-1 and TNF- $\alpha$  which inhibit albumin synthesis in liver and lower their zinc-binding capacity, which should in turn reduce the plasma zinc levels. However lower values of zinc in other studies may be due to pharmacological treatments or other effects which also need to be considered. Serum zinc levels have been shown to decrease during acute-phase response of inflammation and with treatment with NSAIDs<sup>44</sup>. Probably alterations in inflammation may have some role in the levels of essential minerals.

Inflammation may be the primary cause for systemic alterations in the levels of minerals and enzymes which further modulate acute phase plasma proteins<sup>47</sup>. The study Chavan et al. 2015 by<sup>29</sup> have shown negative correlation between serum magnesium with TC, triglycerides, LDL-c and positive correlation with HDL-c. Thus lower serum magnesium may be associated with worsened lipid profile and increased CVD risk of RA patients.

In our study SOD activity is significantly increased in female RA patients as compared to males. The treatment of Methotrexate (for control of RA) has been reported to increase Zn-SOD activity in rats<sup>48-49</sup>.

Increased activity of SOD<sup>50-51</sup> may also be due to increased O<sub>2</sub><sup>-</sup> production by hyperactive cells<sup>52-53</sup>. Higher SOD levels may be an after effect to nullify excessive free radical production. Post treatment the antioxidants are increased which lead to lower plasma MDA and increased total antioxidant capacity (TAC)<sup>54,55</sup>.

RA is associated with serum mineral disturbances and oxidative stress. Our results show that male and female patients of RA neither differ much in copper, phosphorous and zinc levels nor the minerals are associated with DAS. Serum magnesium was lower in both sexes in RA subjects. Serum magnesium and serum copper may be useful biomarker for RA.

#### **Compliance with Ethical Standards:-**

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Ethical Approval: The study was approved by Institutional ethical committee and written informed consent was obtained from all the subjects.

## References:-

1. Talal N: Sjögren's syndrome: historical overview and clinical spectrum of disease. *Rheum Dis Clin North Am* 1992, 18:507-515.
2. Linos A, Worthington JW, O'Fallon WM, Kurland LT: The epidemiology of rheumatoid arthritis in Rochester, Minnesota: a study of incidence, prevalence and mortality. *Am J Epidemiol* 1980, 111:87-98.
3. Steen V, Conte C, Santoro D, et al.: Twenty-year incidence survey of systemic sclerosis (scleroderma). *Arthritis Rheum* 1980, 23:581-590.
4. Will R, Edmunds L, Elswood J, Calin A: Is there sexual inequality in ankylosing spondylitis? A study of 498 women and 1202 men. *J Rheumatol* 1990, 17:1649-1652.
5. Wolfe AM, Kellgren JH, Masi AT: The epidemiology of rheumatoid arthritis: a review. II. Incidence and diagnostic criteria. *Bull Rheum Dis* 1968, 19:524-529.
6. Van Vollenhoven RF, McGuire JL: Estrogen, Progesterone, and Testosterone: Can they be used to treat Autoimmune Diseases? *Cleveland Clinic J Med* 1994, 61:276.
7. Cutolo M, Villaggio B, Serio B, Montagna P, Capellino S, Straub RH, Sulli A: Synovial fluid estrogens in rheumatoid arthritis. *Autoimmun Rev* 2004, 3:193-198.
8. Wilder RL: Hormones, pregnancy, and autoimmune diseases. *Ann N Y Acad Sci* 1998, 840:45-50.
9. Cutolo M, Sulli A, Capellino S, Villaggio B, Montagna P, Serio B, Straub RH: Sex hormones influence on the immune system: basic and clinical aspects in autoimmunity. *Lupus* 2004, 13:635-638.
10. Olsen NJ, Kovacs WJ: Hormones, pregnancy, and rheumatoid arthritis. *J Gend Specif Med* 2002, 5:28-37.
11. O'Brien SM, Fitzgerald P, Scully P, Landers A, Scott LV, Dinan TG: Impact of gender and menstrual cycle phase on plasma cytokine concentrations. *Neuroimmunomodulation* 2007, 14:84-90.
12. Forslind K, Hafstrom I, Ahlmen M, Svensson B: Sex: a major predictor of remission in early rheumatoid arthritis? *Ann Rheum Dis* 2007, 66:46-52.
13. Tengstrand B, Ahlmen M, Hafstrom I: The influence of sex on rheumatoid arthritis: a prospective study of onset and outcome after 2 years. *J Rheumatol* 2004, 31:214-222.
14. Symmons DP: Epidemiology of rheumatoid arthritis: determinants of onset, persistence and outcome. *Best Pract Res Clin Rheumatol* 2002, 16:707-722.
15. Kuiper S, van Gestel AM, Swinkels HL, de Boo TM, da Silva JA, van Riel PL: Influence of sex, age, and menopausal state on the course of early rheumatoid arthritis. *J Rheumatol* 2001, 28:1809-1816.
16. Da Silva JA, Hall GM: The effects of gender and sex hormones on outcome in rheumatoid arthritis. *Baillieres Clin Rheumatol* 1992, 6:196-219.
17. Lucia M, Isabela S, Minerva G: Changes of serum magnesium level in patients with rheumatoid arthritis stage I-II, before treatment. *Med Con* 2011; 6:9-16.
18. Mierzecki A, Strecker D, Radomska K: A pilot study on zinc levels in patients with Rheumatoid arthritis *Biol Trace Elem Res* 2011; 143:854-862.
19. Milanino R, Frigo A, Bambara LM et al. Copper and zinc status in rheumatoid arthritis: studies of plasma, erythrocytes and urine, and their relationship with disease activity markers and pharmacological treatment. *Clin Exp Rheumatol* 1993; 11: 271-81.
20. Stabel JR, Spears JW. Effect of copper on immune function and disease resistance. *Adv Exp Med Biol* 1989; 258:243-52.
21. Simkin PA. Oral zinc sulphate in rheumatoid arthritis. *Lancet* 1976;2:539-42.
22. Rainsford KD. Environment ion perturbations, especially as they affect copper status, are a factor in the etiology of arthritis conditions: an hypothesis. In: Sorenson JRJ, editor. *Inflammatory disease and copper*. Clifton, NJ, Humana Press; 1982. pp. 137-43.
23. Sandstead HH, Penland JG, Alcock NW, Dayal HH et al Effects of repletion with zinc and other micronutrients on neuropsychologic performance and growth of Chinese children. *Am J Clin Nutr* 1998; 68:470-55.
24. Arnett FC, Edworthy SM, Bloch DA, Mc Shane, DJ, Fries JF, Cooper NS et al. The American Rheumatism Association 1987 revised criteria for the classification of Rheumatoid arthritis. *Arthritis Rheum* 1988; 31:315-24.
25. Misra, H.P., and Fridovich, I. The role of superoxide anion in the autoxidation of epinephrine and a simple assay for superoxide dismutase. *J. Biol. Chem.* 1972; 247:188.
26. van Vollenhoven RF Sex differences in rheumatoid arthritis: more than meets the eye...*BMC Medicine* 2009, 7:12.
27. Amin RS, Adallah FR, Abdel-Hamid NM. Variations in some. Blood minerals related to bone remodeling and haematopoiesis in rheumatoid arthritis. Abstracts of The IXth International Convention of Polish Magnesium Society "Contemporary directions in researches on elements" Kazimierz Dolny upon Wisla, Poland 9<sup>th</sup> -12th September, 2004. *Magnesium Research*. 2005; 18(2):135-40. [Magnesium Research. 18(2); 135-40, June 2005, ABSTRACTS]

28. Cortes YE, Moses L. Magnesium disturbances in critically ill patients. *Compend Contin Educ Vet.* 2007;29(7):420-27.
29. Chavan VU, Ramavtaram DVSS, Patel PA, Rupani MP. Evaluation of serum magnesium, lipid profile and various biochemical parameters as risk factors of cardiovascular diseases in patients with rheumatoid arthritis. *J Clin Diag Res* 2015; 9: BC01-BC05.
30. Weisinger JR, Bellorin-Font E. Magnesium and phosphorus. *Lancet* 1998; 352:391-96.
31. Chiuve SE, Korngold EC, Januzzi Jr. JL, Gantzer ML, Albert CM. Plasma and dietary magnesium and risk of sudden cardiac death in women. *Am J Clin Nutr* 2011; 93:253-60.
32. Makhdoom A, Rahopoto MQ, Laghari MA, Qureshi Pir AL, Siddiqui KA. Bone mineral levels in rheumatoid arthritis. *Medical Channel* 2009; 15:99-102.
33. Rodríguez-Morán M, Guerrero-Romero F. Serum magnesium and C-reactive protein levels. *Arch Dis Child* 2008; 93:676-80.
34. Jacobson DM. Corinthian bronze and the gold of alchemists. *Gold Bulletin.* 2000;33(2):60-66.
35. Rainsford KD. Environment ion perturbations, especially as they affect copper status, are a factor in the etiology of arthritis conditions: an hypothesis. In: Sorenson JRJ, editor. *Inflammatory disease and copper.* Clifton, NJ, Humana Press 1982; pp. 137-43.
36. Milanino R, Marrella M, Gasperini R, Pasqualicchio M, Velo G. Cu and Zn body levels in inflammation: an overview of the data obtained from animal and human studies. *Agents Actions.* 1983;39:195-209.
37. Gubler CJ, Lahey ME, Cartwright GE, Wintrobe MM. Studies on copper metabolism. IX. Transportation of copper in blood. *Jour. Clin. Investigations.* 1953;32:405-14.
38. Scudder PR, Al-Timimi D, McMurray W, White AG, Zoob BC, Dormandy TL. Serum copper and related variables in rheumatoid arthritis. *Ann. Rheum. Dis* 1978; 37: 67-70.
39. Tuncer S, Kamanli A, Akcil E, Kavas GO, Seckin B, Atay MB. Trace element and magnesium levels and superoxide dismutase activity in rheumatoid arthritis. *Biol. Trace Element Res* 1999; 68:137-142.
40. Ford ES. Serum copper concentrations and coronary heart disease among US adults. *Am J Epidemiol* 2000; 151:1182-8.
41. Liuzzo G, Biasucci LM, Gallimore JR et al. The prognostic value of C-reactive protein and serum amyloid a protein in severe unstable angina. *N Engl J Med* 1994; 331: 417-24.
42. Yang TH, Yuan TH, Hwang YH, Lian LB, Meng M, Su CC Increased inflammation in rheumatoid arthritis patients living where farm soils contain high levels of copper. *J Formosan Med Ass* 2016; 115: 991-996.
43. Aaseth J, Munthe E, Forre O, Steinnes E. Trace elements in serum and urine of patients with rheumatoid arthritis. *Scand J Rheumatoid* 1978; 7: 237-40.
44. Balogh Z, El-Ghobarey AF, Fell GS, Brown DH, Dunlop J, Dick WC. Plasma zinc and its relationship to clinical symptoms and drug treatment in rheumatoid arthritis. *Ann Rheum Dis* 1980; 39:329 – 332.
45. Chakraborty M, Chutia H, Changkakati R. Serum Copper as a Marker of Disease Activity in Rheumatoid Arthritis *Journal of Clinical and Diagnostic Research.* 2015 Dec, Vol-9(12): BC09-BC11.
46. Zoli A, Altomonte L, Caricchio R et al. Serum zinc and copper in active rheumatoid arthritis: correlation with interleukin 1 $\beta$  and tumour necrosis factor  $\alpha$ . *Clin Rheumatol* 1998; 17:378-382.
47. Dean C. *The magnesium miracle.* 1st edn. New York: Ballantine Books (an imprint of the Random House Publishing Group. Inc.). 2007; pp. 1-400.
48. Armagan A, Uzar E, Uz E, Yilmaz HR, Kutluhan S, Koyuncuoglu HR, Soyupek S, Cam H, Serel TA Caffeic acid phenethyl ester modulates methotrexate-induced oxidative stress in testes of rat. *Hum Exp Toxicol* 2008; 27:547-552.
49. Al-Saleh E, Al-Harmi J, Nandakumaran M, Al-Shammari M, Al-Jassar W. Effect of methotrexate administration on status of some essential trace elements and antioxidant enzymes in pregnant rats in late gestation. *Gynecol Endocrinol* 2009; 25:816-822.
50. Vijayakumar D, Suresh K. Lipid peroxidation and antioxidant status in blood of rheumatoid .*Indian Journal of Clinical Biochemistry* 2006; 21 (1) 104-108.
51. Cimen MY, Cimen OB, Kaçmaz M, Oztürk HS, Yorgancıoğlu R, Durak I Oxidant/antioxidant status of the erythrocytes from patients with rheumatoid arthritis. *Clin Rheumatol* 2000; 19: 275-277.
52. Gregory E M, Fridovich I. Induction of superoxide dismutase by molecular oxygen. *J Bacteriol* 1973; 114: 543-8.
53. Hassan H M, Fridovich I. Regulation of the synthesis of superoxide dismutase in *Escherichia coli*: induction by methyl viologen. *J Biol Chem* 1977; 252: 7667-72.
54. Jaswal S, Mehta HC, Sood AK, Kaur J. Antioxidant status in rheumatoid arthritis and role of antioxidant therapy. *Clin Chim Acta.* 2003; 338:123-129.
55. Nourmohammadi I, Athari-Nikazm S, Vafa MR, Bidari A, Jazayeri S, Hoshyarrad A et al., Effect of antioxidant supplementations on oxidative stress in rheumatoid arthritis patients. *J Biol Scien* 2010; 10: 63-66.

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### RESEARCH ARTICLE

## WORK PARTICIPATION OF TRIBAL WOMEN IN GAJAPATI DISTRICT: A STATESTATICAL ANALYSIS OF ODISHA.

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### Abstract

This paper has been written on the basis of qualitative and quantitative data collected from secondary source and discussed work participation of tribal women in Gajapati district in a descriptive manner. The tribal women have been equal partners with tribal men in the contribution to household economy. Women do more physical labour in their agricultural fields and forest than that of the tribal men. Tribal women have usually enjoyed a higher social status in their own communities. The literacy rate among the tribal's and more so in case of tribal women is quite low and this is also associated with poor nutritional and health status among the tribal's. They are engaged in various traditional occupations like mixed farming, hunting, Jhoom cultivation and shifting cultivation to settled agriculture. A very negligible percent are engaged in non-agricultural activities. The Scheduled Tribes constitute 8.2% of India's total population. 9.2% of the country's scheduled tribe population is found in Odisha, which is third highest in the country and the scheduled tribes account for 50.78% population of the district.

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### Introduction:-

Agriculture is the most primitive occupation of the tribal people. The people had changed their cultivation pattern from traveller's cultivation to settled cultivation, but some of the practices have remained unchanged among many groups of farmers. They are engaged in various traditional occupations like mixed farming, hunting, Jhoom cultivation and shifting cultivation to settled agriculture. The tribal people are practices traditional agricultural wisdom for their livelihood.

Tribal people have traditionally lived in about 15% of the country's geographical areas, mainly forests, hills and undulating inaccessible terrain in plateau areas, rich in natural resources. They have lived as isolated entities for centuries, largely untouched by the society around them. This seclusion has been responsible for the slower growth, dissimilar pattern of their socio-economic and cultural development and inability to negotiate and cope with the consequences of their involuntary integration into mainstream society and economy. Tribals continue to be socio-economically backward. One of the most distinguishing features of the rural economy of Gajapati has been the growth in the number of agricultural workers, cultivators and agricultural labourers engaged in crop production. Agricultural labourers, especially in smaller villages away from towns and cities, are generally unskilled workers carrying on agricultural operation in the centuries old traditional wages. Agriculture is the back bone of many developing countries. Women account for more than half of the work force by participating in different activities, either directly or indirectly. The gender division of labour varies from one society and culture to another, and within

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each culture external circumstances influence the level of activity (Nigist, 2004). Women are the unavoidable part of any development programmes whether it is for developed or developing country (Raksha et al, 2016). Odisha is one of the poorest states in India, with an estimated 47% of its population living on less than a dollar a day (Haans & Dubey, 2003). A regional and social group-wise analysis of poverty in Odisha highlights the fact that the population in Scheduled Areas is comparatively much poorer than the population in non-Scheduled Areas, and that Scheduled Tribes are the poorest groups (Kumar, K., 2005). Women have played and continue to play a key role in the conservation of basic life support systems such as land, water, flora and fauna (Prasad C. et al, 1992). Women play a central role in the agriculture economy (Chauhan, J., et al, 2016).

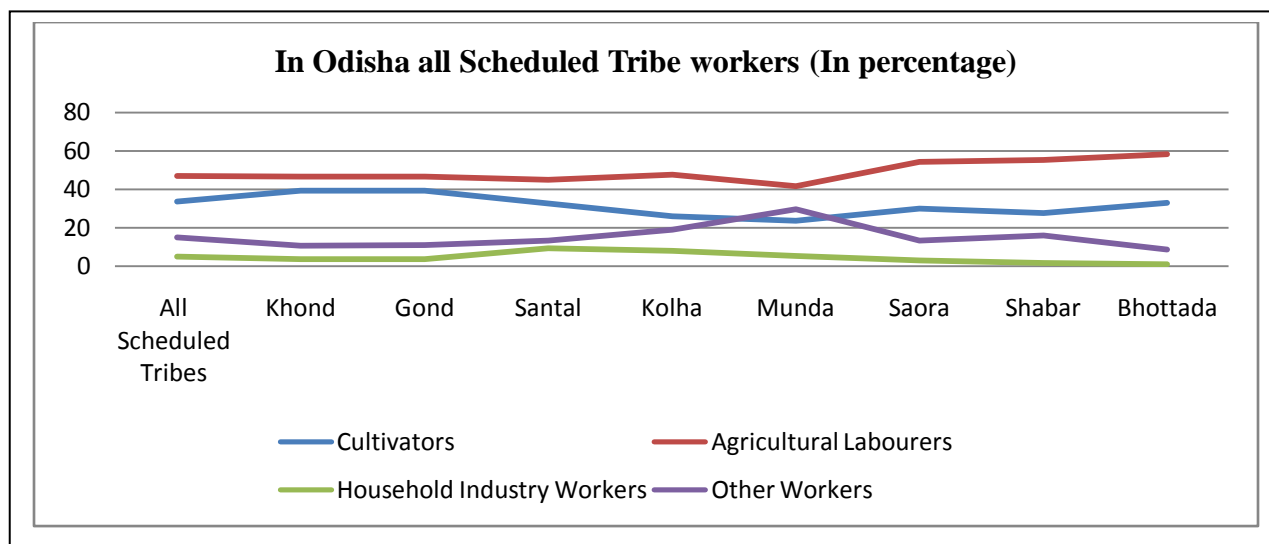
Women's work participation is considered as an important indicator of women's participation in economic activities of the State. Women's contribution though not recognized in all spheres of activity is significant. Despite their overall input to the economy they have limited access and control over the resources and productive assets. Wage gaps and discrimination against women in labour markets lower their participation. Women's work participation among the Scheduled Tribe in India fell marginally from 44.8% in 2001 to 43.5% in 2011. In Odisha Women's work participation rate increased from 42.2% in 2001 to 43.9% in 2011. In Gajapati district women's work participation rate decreased from 49.7% in 2001 to 46.8% in 2011. The economy of Schedule Tribe areas is primarily subsistence oriented and based upon a combination of agriculture, forestry and wage labour (Odisha review, 2014).

As per 2011 census, Out of sixty-two (62) scheduled tribe population of India is 84,326,240 constituting 8.2%, Odisha scheduled tribes (ST) population as 8,145,081 constituting 22.1% and Gajapati district scheduled population as 263,476 constituting 50.78%. district wise distribution of the individual scheduled tribe shows that khond have the highest proportion i.e. 93.3 percent in kandhamala district, followed by Nayagarh as 76.9 percent, Baudh 76.4 percent and Rayagada i.e. 71.1 percent of the district. Gond has the highest concentration in Nabarangapur districts followed by Nuapada district whereas Santal and Kolha are primarily concentrated in Mayurbhanj district. Other four scheduled tribes i.e. Munda, Saora, Shabar and Bhottada are primarily concentrated in Sundargarh, Bargarh, Gajapati and Nabarangapur district. The scheduled tribes account for 50.78 percent population of Gajapati district and khond as 14.86%, Saora 32.21% and Shabar 50.84% are the largest tribal groups in the district (Census 2011, Orissa review).

In Odisha all Scheduled Tribe workers (in percentage)

Economic category	All Scheduled Tribes	Khond	Gond	Santal	Kolha	Munda	Saora	Shabar	Bhottada
Cultivators	<b>33.3</b>	39.1	39.1	32.3	25.8	23.4	<b>29.6</b>	27.5	32.6
Agricultural Labourers	<b>46.9</b>	46.8	46.6	45.1	47.6	41.7	<b>54.3</b>	55.3	58.2
Household Industry Workers	<b>4.8</b>	3.6	3.3	9.3	7.9	5.3	<b>2.8</b>	1.4	0.7
Other Workers	<b>15</b>	10.5	11	13.3	18.8	29.5	<b>13.3</b>	15.8	8.6

\*Source: Data highlights- the scheduled tribes, Orissa, Census of India 2001.



The Work Participation Rate of the Scheduled Tribes population is 49 per cent, which is equal to that of all Scheduled Tribes at the national level (49.1 per cent). There has been a slight decline of 0.4 per cent in the Work Participation Rate of the tribes during 1991-2001. While there has been a decline in male Work Participation Rate from 58.9 to 54.8 per cent, female Work Participation Rate (43.2 per cent) has increased by 3.4 per cent during 1991-2001. Among the total workers, 57.4 per cent are main workers and this proportion is much below the national average recorded for all Scheduled Tribes (68.9 per cent).

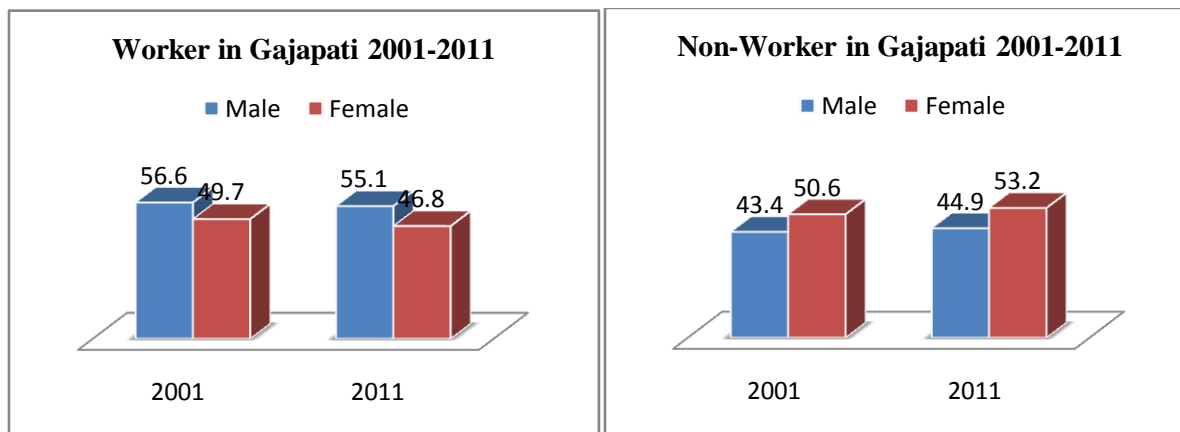
Among the major tribal groups i.e. Khond, Gond, Shabar, Saora and Bhattada have higher work participation rate than that of the State as well as national average for recorded for all scheduled tribes. Agricultural labourers constitute the highest proportion 46.9 percent among the total workers. Cultivators 33.3%, other workers 15% and Household Industry constitute between as 4.8%. These Soura populations contribute to the four Economic Categories i.e. Cultivators 29.6 percentage, Agricultural Labourer 54.3 percentage, Household Industry Workers 2.8 percentage only and Other Workers 13.3 percentage (see figure-1).

#### Worker and Non-Worker in Gajapati 2001-2011

	Worker and Non-Worker in Gajapati 2001		Worker and Non-Worker in Gajapati 2011	
	Worker	Non-Worker	Worker	Non-Worker
Male	56.6	43.4	55.1	44.9
Female	49.7	50.6	46.8	53.2

(Source: Census of India 2011 final data, Registrar General of India), Databook for PC: 4<sup>th</sup> Aug-2014. Census of India 2011, Primary Census Abstract Figure at a Glance and Data Highlight.

#### Worker and Non-Worker in Gajapati 2001-2011



In Gajapati district we find Women constitute 50% of the workforce where as men constitute 57% of the total workers. Among non-worker women are more (50.6) in comparison to men (43.4). This is trending all India, all Odisha level also. But same how 50% Women Work Participation Rate shows a significant highest of Women Work Participation Rate (WWPR) in Gajapati district. May be due to high concentration % of tribal population are engaged as marginal worker for their own survival. This is a marginal status of tribal women in Gajapati district. Which will be further clarified while stratify women engaged in Agrarian sector (see figure-2).

**Agricultural related activities** are picking and threshing of paddy crops followed by harvesting, winnowing, storage, making threshing yard, bagging/packing and marketing of agricultural produce. The roles of tribal farmwomen in all these operations were observed up to the highest importance level (*Chayal and Dhaka, 2010*). Agriculture production is dependent on rainfall (*Hans Asha, 2014*)



Agricultural pattern in our study area is primarily based on hill cropping pattern. Mostly people go for the cultivation of Ragi, Corn, Janna as main crop in year. And for secondary crop almost all families go for Jhudunga, Kandula and Kulata. Mostly people go for kharif cultivation and very few people go for rabbi cultivation where these are mostly found in wet land area (joba khiari). There is no irrigation facility in our study area of Gajapati district, though the river Mahendra Tanaya is flowing in this district. The perusal of the data in regards to participation of tribal farm women in sowing operation revealed that the highest participation of tribal farmwomen was observed in sowing, transplanting followed by stubble collection, clod crushing and seedbed preparation (*Chauhan, N. M. & Thakor, R, 2006*).

Our study area among men 77 per cent are agricultural farmers and 23 per cent are wage labourers. From among our women respondents 97 per cent are daily worker and 3% are housewives. But these daily wage workers among women also constitute agricultural workers.

Our study area are reflects that very few families are doing multi crop cultivation i.e. around 13%. Nearly 87% are depending on their single crop cultivation which is a very poor source of earning. Cash cropping in our study area are such as Mango, Banana, Cashew, Lemon, Orange, Jackfruit and Pineapple cash crop. The cash crops in the area are mainly citrus fruits, Cashew, Mango and Orange etc.

One of the most distinguishing features of the rural economy of India has been the growth in the number of agricultural workers, cultivators and agricultural labourers engaged in crop production. The phenomena of under-employment, under-development and surplus population are simultaneously manifested in the daily lives and living of the agricultural labourers. They usually get low wages, conditions of work put an excessive which they get is extremely irregular.

Agricultural workers constitute the most neglected class in Indian rural structure. Their income is low and employment irregular. Since, they possess no skill or training, they have no alternative employment opportunities either. Socially, a large number of agricultural workers belong to scheduled castes and scheduled tribes. Therefore, they are a suppressed class. They are not organized and they cannot fight for their rights. Because of all these reasons their economic lot has failed to improve even after four decades of planning.

### Summary:-

This paper focuses attention to the practices of the resources poor tribal farmers that makes use of low cost renewable inputs, family and community labour for solving the food crises through their traditional wisdom which need documentation to make the future agriculture a sustainable one. The study on the farmer's traditional wisdom on agriculture was initiated through non-random selection of respondents from Lanjia Saora tribe of Gumma & Rayagada block of the district. A typical tribal village is situated a little away from the main road and mostly inside the forest. Generally, the houses are constructed on the both side of a wide village road. The cowsheds are constructed on the middle of the road earlier. Now they are having a cowshed in their house in front side or in the end of house row. This system has changed due to reduced number of wild animals and effective forest. Most of the houses have some backyard and they raise a kitchen garden. Gradually, this kitchen garden extends to the field which again merges with the forest. The village has been set up where there was plain land and a stream. This selection of their dwelling place shows their intelligence and foresight. The villagers are used cow-dung like a fertilizer in their own cultivators land. Mostly of the house have same backyard and they raise a kitchen garden. Gradually, this kitchen extends to the field which again merges with the forest. In other hand women are engaged in other agricultural occupations like dairy, farming, horticulture, raising of live-stock, bees and poultry.

Today much of tribal people are loss of livelihood is an indication of displacement, migration and human distress. Scheduled tribe women in search of work in the last few years have been trafficked for work in different parts of the country. The migrant tribal women and girls faced a number of problems immediately after their migration to cities which included difficulty of communication in local language, residential accommodation, employment, education of children, local contacts, adjustment with city life and environment. Women migrants especially from tribal areas to urban areas are highly traumatized.

### Reference:-

1. Census of India (2001) Office of the Registrar General, India, Data Highlights: The Scheduled Tribes Census of India 2001, **Orissa**.
2. Census of India (2011) final data, Registrar General of India, Data book for PC: 4<sup>TH</sup> Aug-2014. Census of India 2011, Primary Census Abstract Figure at a Glance India.
3. Chauhan, N. M., & Thakor, R. (2006). Participation of the tribal farm women in decision making Gujarat J. *Ext. Edu.*, Anand, 16, 55-57.
4. Chayal, K., & Dhaka, B. L. (2016). Analysis of role performance of women in farm activities. *Indian Research Journal of Extension Education*, 10(2), 109-112.
5. Haan and Dubey (2003), 'Poverty in Orissa: Divergent Trends? With Some Thoughts on Measurement Issues', Mimeo, Paper presented at the Workshop on 'Monitoring of Poverty in Orissa', 26-27 February, Nabakrushna Choudhury Center for Development Studies, Bhubaneswar.
6. Hans Asha, (2014), "Scheduled Tribe Women of Odisha", *Odisha review*, November-14, pp. 26-32, 27-40 pdf.
7. [Htt://censusindia.gov.in/Tables\\_/published/A-Series\\_links/t\\_00\\_005.aspx.11/23/2016](http://censusindia.gov.in/Tables_/published/A-Series_links/t_00_005.aspx.11/23/2016)
8. [Htt://www.stcodisha.gov.in/About.asp?GL=abt&PL=1.11/23/2016](http://www.stcodisha.gov.in/About.asp?GL=abt&PL=1.11/23/2016)
9. Kumar, K. (2006). Dispossessed and displaced: A brief paper on tribal issues in Orissa. *Co-Acting Monthly Review of the state and people*, 1(1).
10. Nigist, S., (2004). Gender Main streamlining world vision.
11. Padhi Kuamani (2017) Agriculture labour in India-A close look, Orissa reviews.
12. Prasad, C., & Singh, R. P. (1992). Farm women: "A Precious Resources" in Women in Agriculture, Vol. 2. *Education, Training and Development edited by RK Punia*.
13. Raksha, J. C. (2016). Women: Seeds of Change in Agriculture. *Indian Research Journal of Extension Education*, 15(3), 72-79.
14. Raksha, J. C. (2016). Women: Seeds of Change in Agriculture. *Indian Research Journal of Extension Education*, 15(3), 72-79.
15. Source: Data highlights- the scheduled tribes, Orissa, Census of India 2001.



## RESEARCH ARTICLE

### THE EFFECT OF VIRECHANA KARMA AND SHIROBASTI IN SCALP PSORIASIS – A CASE REPORT.

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#### Manuscript Info

##### Manuscript History

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##### Key words:-

Kitibha kushta, Scalp psoriasis, Shodhan, Virechan, Shirobasti, Shaman.

#### Abstract

Scalp Psoriasis is a chronic dermatosis characterized by an unpredictable course of remission and relapse. It is characterized by well defined dried, erythematous plaques with silvery scale which have a predilection for scalp. The disease not only affects the patient physically but also disturbs mental and social health of the patient. According to W.H.O., it is one of the most common dermatological disease affecting upto 2.5% of the World's population and in India, prevalence of Psoriasis varies from 0.44 to 2.88%. Kitibha Kushta is described as Vata-Kaphaj disease. Kitibha Kushta has signs and symptoms :Shyava, Krushna / aruna varna kina (Erythrema)Khara/Parushata of the Kina (Dryness and scaling)Srava (flow of exudates in early stage)Vrutta (Rounded plaques), Ghana (Stable plaque) Ugra Kandu (Severe Itching)Vartate cha samutpannam (Flare up of psoriasis)Which can be compared with psoriasis. The intrinsic nature of psoriasis posed an ultimate challenge to the skill and humanity of the medicinal world. Ayurveda provides maximum relief to such disease with Panchakarma. In this case study first Rukshana-Pachana, Virechana Karma as shodhan chikitsa, shirobasti as bahi parimarjan chikitsa and shaman oushadhi were given. At the end of 60-days treatment in virechana, shrobasti and shamana oushadhi showed good results in scalp psoriasis as the overall effect of therapy.

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#### Introduction:-

Scalp psoriasis is a chronic and one of the most common dermatological disease affected to 2.5% of the World's population. In India, prevalence of psoriasis varies from 0.44 to 2.88%.

In Ayurveda, all skin diseases are described under the umbrella of kushta <sup>1</sup>Kitibha Kushta – is one of the Kshudra Kushta described in Ayurvedic text. <sup>2</sup>Kitibha Kushta is described as vata-kaphaja disease. <sup>3</sup>Kitibha Kushta has signs and symptoms shyava, Kina, Khara, Parush, Sparsha, Srava, Vrutta, Ghana, ugra kandu, vartate che Samutpannam etc. which can be compared with symptoms of scalp psoriasis. <sup>4</sup>Psoriasis is common chronic, immune mediated, inflammatory, proliferative, non contagious disease of the skin. <sup>5</sup>Scalp psoriasis consist of itching, erythematous, silvery scaly patches on scalp. <sup>6</sup>Affected person faces a lot of problem in the society which hampers their social as well as psychological condition which creates social stigma.Till yet satisfactory treatment has not been established.

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Modern science treat this condition with PUVA and cortico steroids but these drugs having local and systemic side effects. The intrinsic nature of psoriasis posed an ultimate challenge to the skill and humanly of the medicinal world.

In this condition, Ayurveda provides maximum relief through Panchakarma. The main line of treatment for Kushta, considering the elimination of vitiated dosha shodhan chikitsa (Virechan karma), Bahi parimarjan chikitsa(shirobasti) and shaman oushadhi to bring samyavastha (balanced condition) showed good results in this case study.

### Case Report:

A 27 yr. old male patient came to Panchakarma OPD of Government Ayurved College, Nanded, Maharashtra, India presented with dried, rounded well defined, silvery plaque with thick scaly (Since 6 months) itchy lesions on scalp (since 6 months) with constipation (since 6 months) and hair fall (since 3 month) and weight gain (since 1 year).

Patient was diagnosed as Scalp psoriasis by dermatologist 6 years back. Patient had taken allopathic treatment before coming to our hospital but not relieved.

Patient was thoroughly examined and detailed history was taken. Patient was bank manager by occupation. Patient did not have history of any other major illness.

### On examination:-

General condition – moderate, afebrile

Pulse rate - 74 / min, Regular

Patient had H/o scalp psoriasis since 6 years No pallor.

### Routine Investigation:-

Such as complete blood count, random blood sugar, urine routine and microscopic were in normal range.

Patient has – 72 kg weight

1. O/E Patient has dry scaling (Parushta and rukshata)
2. Itching (Kandu)
3. Erythrema (Krushna and shyava varna)
4. Thickened skin (ghanata) are found in present study as the leading symptoms.
5. weight gain and
6. hair fall as associated symptoms.

### Sign and Symptoms:-

- |                       |   |          |
|-----------------------|---|----------|
| 1. Itching            | - | present  |
| 2. Erythrema          | - | present  |
| 3. Scaling(dry)       | - | present  |
| 4. Thickness          | - | present  |
| 5. Candle grease sign | - | present  |
| 6. Auspitz sign       | - | present. |

**Diagnosis -** Kitibha Kushta (Scalp psoriasis)

### Assesment Criteria:-

#### Subjective criteria

- |              |   |   |                                    |
|--------------|---|---|------------------------------------|
| a) Itching   | 0 | - | No itching                         |
|              | 1 | - | Mild or occasional                 |
|              | 2 | - | Moderate (Tolerable) Frequent      |
|              | 3 | - | Severe itching, frequent.          |
|              | 4 | - | Very severe with disturbing sleep. |
| b) Erythrema | 0 | - | No erythrema                       |
|              | 1 | - | Minimally percentile               |
|              | 2 | - | Marked but no edema                |
|              | 3 | - | Fiery with edema                   |

c)	Scaling	4	-	Fiery with edema and blistering.
		0	-	No scaling
		1	-	Mild scaling from some lesions.
		2	-	Moderate from some lesions
		3	-	severe scaling from some lesions.
		4	-	very severe scaling from all lesions
4.	Thickness	0	-	No thickness
		1	-	Mild thickness
		2	-	Moderate thickness
		3	-	Very thick
		4	-	Very thick with induration.
5.	Candle grase sign			

When a psoriatic lesion is scratched with the point of a dissecting forceps, a candle grease like scale can be repeatedly produced.

		0	-	Absent
		1	-	improved
		2	-	present
5.	Auspitz sign. : On complete removal of the scales, ared, moist surface is seen. On further scarping, punctute bleeding points are seen.			
		0	-	Absent
		1	-	present
		2	-	improved

### Treatment Given:-

- 1) Rukshan/Pachan : given with triphala (*Terminalia chebula*, *Emblia officinalis* and *terminalia belirica*) + Musta (*Cyperus rotundus*) and Shunti (*Zingiber officinale* -> Kwatha (Decoction) given – 40ml BID before meal for 5 days, prepared as per procedure mentioned in Sharangdhar samhita and Nirama Lakshanas observed.
- 2) Snehapana with guggulu tiktaka ghrita given for 5 – days with increasing quantity every day with kosha Jala (luke warm) water as Anupana.

Day	Quantity	Time given	Time of Appetite
1 <sup>st</sup>	30 ml	9.00 a.m.	12.00 noon
2 <sup>nd</sup>	60 ml	7.30 a.m.	12.30 noon
3 <sup>rd</sup>	90 ml	7.30 a.m.	2.00 p.m.
4 <sup>th</sup>	120 ml	8.00 a.m.	5.30 p.m.
5 <sup>th</sup>	150 ml	8.00 a.m.	7.30 p.m.

After 5 days samyak snigdha lakshanas observed.

- 3) 3 days sarvang Abhyanga (with murchita tilataila) and Peti sweda (Bashpa) was given. Samyak singdha and samyak swinna lakshanas observed. .
- 4) Virechana : On 3<sup>rd</sup> day at 9.30 a.m. in the morning after snehana and swedana.
- 5) Virechana with Nimbamritadi castor oil – 100 ml with Triphala Kwatha – 50 ml was given. After 1 hour, virechana vega started. Total – 11 vega passed in 12 hours. Pulse rate and blood pressure are within normal limits.
- 6) In Paschat Karma – Samsarjana Krama with Peyadi Krama advised for 5 days.
- 7) Shirobasti – with Ksheerabala taila and Brahmi taila for 25 min to 30 minutes given at 11.00 a.m. for 7 days.
- 8) Shaman Oushadhi : Combination of Arogya vardhini Rasa (20 gm) + Guduchi satwa 2 gm + Rasamanikya rasa – 200 mg + shataputi abhrak bhasma + Raktapachak – 100 mg + chopachini churna (*Smilax china*) + Avipittakar choorna – 20 gm was given twice a day after meal and khadirarishta m 15 ml BID was given for 30 days and Nimba taila was used for external application for 30 days With above mentioned line of treatment patient got relief from the symptoms of psoriasis.



Signs and symptoms	BT	AT
Itching	4	0
Erythrema	3	0
Scaling	4	0
Thickness	2	0
Constipation	3	0
Hair fall	Present	Absent
Weight	75 kg	69 kg

Prakruti - Kapha vataja Diet - Non-vegetarian  
 Bala - Madhyama Rasa-Satmyata - Avara

<b>Roga Prakruti</b>	Samprapti Ghataka	Samprapti Vighatana
<b>Dosha</b>	Kapha Vataja	Virechana
<b>Dushya</b>	Rasa,Rakta,Mamsa, Meda,Twak	Virechana and Shirobasti
<b>Agni</b>	Manda	PachanaDeopan
<b>Srotas</b>	Raktavahaq	Virechana
<b>Uddhbhavasthana</b>	Amashaya	Virechana
<b>Vyakristhana</b>	Shiras & Keshas	Shirobasti
<b>Roga</b>	Kitibha Kushta] (Scalp Psoriasis)	Kushta Chikitsa Medavritta Rukshana Snehapana with GTG Virechana and shaman
<b>Upadrava</b>	Rasavaha Indigestion Rakta vaha Psoriatic lesions Purishava Constipation	Manovaha depression Madovaha Obesity

Photograph BT



During Treatment



Photograph AT



### Discussion:-

In above case study, patient was suffering with scalp psoriasis i.e. Kitibha Kushta at Shiras. Considering Kapha-vataja Prakruti and medopradoshaja vikara (Sthoulya), Rukshana Kwatha was selected and Snehapana was planned with Guggulu tiktaka ghrita

Considering lesions on scalp i.e. shiras and hair fall, shirobasti was selected from masthishyaka / Bahi parimarjan chikitsa. Kitiba Kushta is raktapradoshaja vikara and patient was suffering with constipation so – virechan karma was selected as shodhana.

Shama oushadhi has kushtaghna as well as Rasayana effect on skin.

By overall effect of therapy, patient got complete relief from the symptoms of Kitibha Kushtas i.e. scalp psoriasis and patients weight was reduced by 6 kgs and hair were found differ in texture were found and long hairs are found.



**Conclusion:-**

In this case study, we got good results of Panchkarma and Shaman oushadhi.

The treatment given for Kitibha Kushta (Scalp psoriasis) was Rukshani Pachana, Shodhan i.e. virechana, shirobasti and shaman oushadhi helped for removing sanga and sroto vishodhana, amapachana and removal of vitiated doshas to bring equilibrium i.e. balanced condition of doshas. So above treatment helped to relieve symptoms of disease and an attempt was made to provide safe and effective treatment to the patient.

**References:-**

1. Acharya Agnivesha , Charak samhita –2009 edition edited by Brahmanand Tripathi, Chaukhamba Surbharati Prakashan Varanasi (Ch.Chi.7)
2. Acharya Agnivesha , Charak samhita– 2009 edition edited by Brahmanand Tripathi, Chaukhamba Surbharati Prakashan Varanasi (Ch.Chi.7/21,27 page no 305)
3. Acharya Agnivesha , Charak samhita – 2009 edition edited by Brahmanand Tripathi, Chaukhamba Surbharati Prakashan Varanasi (Ch.Chi.7/29 P. 306)
4. Acharya Sushruta, Sushruta Samhita edited by Vaidya Yadavaji Trikamji Acharya, Chaukhamba Orientalia, Varanasi 2010 - 8<sup>th</sup> edition.
5. Acharya Laghu Vagbhatta, Astanga Hrudaya edited by Kaviraj Atrideva Gupta, Varanasi -2008 edition Chaukhamba Prakashan.
6. Sharangadhara, Sharangadhara Samhita edited by Pandit.Parushuram Shastri Vidyasagar 1983 – 3<sup>rd</sup> edition Chaukhamba Orientalia
7. [www.jaad.org](http://www.jaad.org)>article>abstract.
8. <https://www.researchgate.net/post/wh>
9. [www.ijdv.com](http://www.ijdv.com)/article.asp.issn-0378-6323, 2010 Y.P.Munjhal (editor in chief) API Text book of Medicine 2015 edition volume 1 page no 678

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### RESEARCH ARTICLE

## INCIDENCE OF NOSOCOMIAL BLOOD STREAM INFECTION, PNEUMONIA AND URINARY TRACT INFECTION IN PEDIATRIC WARD AT KING ABDULAZIZ UNIVERSITY HOSPITAL, JEDDAH, SAUDI ARABIA 2015- 2016.

Osama Y. Safder, Mohammed S. Alzahrani, Wafaa F. Alharbi, Hassan K. Balubaid, Mohammed F. Bukhari, Bashaer S. Alshomrany, Barah A. Malibari, Nada J. Alata, Manayer G. ALmutairi and AbeerAlnajjar.

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##### Manuscript History

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#### Abstract

**Background:** Nosocomial infections (NI): “defined as those occurring within 48 hours of hospital admission, 3 days of discharge or 30 days of an operation”. NI is Major complication in pediatric patients at different hospital wards. NI is associated with significant morbidity and mortality. Studies had shown that NI are associated with prolonged hospital stay and increase economic burden on the health care system.

**Objectives:** -Identify the commonest organism which causes nosocomial BSI, pneumonia or UTI among pediatric patients at KAUH, 2015-2016. To know the prevalence of nosocomial BSI, pneumonia and UTI among pediatric patients at KAUH, 2015-2016. -Identify the commonest predisposing factors which lead to nosocomial BSI, pneumonia and UTI among pediatric patients at KAUH, 2015-2016.

**Methods:** This is a retrospective study done at King Abdulaziz University Hospital Jeddah Saudi Arabia 2015-2016. This include all pediatric patients who developed fever after 48 hours of hospital admission, 3 days of discharge or 30 days of an operation in pediatric ward 2015-2016.

**Results:** The number of patients who admitted was 1502 patients, 111 patients got NI. Infants are more reliable to have NI by (62.2%). Patient who had cardiovascular disease (18.9%) is more susceptible to have NI. The commonest type of infections were UTI (25.2%), BSI (21.6%) and pneumonia (19.8%). Gram negative were the dominant (48.9%). The commonest pathogen was Coagulase negative staphylococci (25.3%). The most predisposing factors were Immunosuppressive medications (22.5%), Central venous catheter (22.5%) and Nasogastric tube (19.8%).

**Conclusions:** Infant patients are more reliable to get NI. The UTI is the commonest type of infection. Gram negative are the commonest but, the Coagulase negative staphylococci is the common organism. Immunosuppressive medications, Central venous catheter and Nasogastric tube are the most predisposing factors.

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### Introduction:-

Nosocomial infections (NI): “defined as those occurring within 48 hours of hospital admission, 3 days of discharge or 30 days of an operation” (1). NI are a Major complication in pediatric patients at different hospital wards. NI are associated with significant morbidity and mortality. Studies had shown that nosocomial infection is strongly associated with prolonged hospital stay and increase the economic burden on the health care system (2). Many studies had shown that the most common organisms are gram-negative bacteria as *Klebsiella pneumoniae*, *E.coli*, and *Pseudomonas aeruginosa*, followed by gram positive bacteria as *Staphylococcus aureus*, and enterococci (3). The most common type of infections are blood stream infection, followed by pneumonia, and UTI(4). There are multiple risk factors that precipitate NI as prolonged hospital stay, and patients who are admitted to ICU are more prone to have NI (5). Patients who are on mechanical ventilation device, central venous line, or urinary catheter are at higher risk to develop NI. (6) In Tunisia, a prospective cohort study was done and showed over all incidence of NI is (6.5%), mostly caused by Gram-negative bacteria (68%) with *Klebsiella pneumoniae* accounting (22.7%), the commonest type is BSI (7). On the other hand, in a multicenter European prospective study showed that the overall incidence of NI is (2.5%), mostly caused by bacteria accounting for (68%). Most of these bacteria are gram negative bacilli but, that coagulase negative *Staphylococcus* is the main pathogen. The same study showed that antibiotic resistant was highest in PICU compared to the general pediatric unit. (8) Locally, at Al-Hada Armed Forces Hospital in Taif, Saudi Arabia during the year 2004. A prospective study was for all patients admitted there. The most common site of infection was pneumonia (32.3%), followed by urinary tract infection (UTI) (25.7%) and blood stream infections (BSI) (18.6%). The most common organism was Gram negative (66.2%). *E.coli* was the most common organism (22.3%) (9).

### Research objectives:-

1. Identify the most common organism which causes nosocomial blood stream infection, pneumonia or Urinary tract infection among pediatric patients at KAUH,2015-2016.
2. To know the prevalence of nosocomial blood stream infection, pneumonia and Urinary tract infection among pediatric patients at KAUH,2015-2016.
3. Identify the most common predisposing factors which lead to nosocomial blood stream infection, pneumonia and Urinary tract infection among pediatric patients at KAUH,2015-2016.

### Research Methodology:-

This is a retrospective observational study done at KAUH, Jeddah, Saudi Arabia 2015-2016.

This include all pediatric patient who admitted to the pediatric ward between 15 February 2015 to 16 February 2016

Inclusion criteria: “infection than occurring within 48 hours of hospital admission, 3 days of discharge or 30 days of an operation” (1).

Statistical analysis: In the present study, statistical analysis using "IBM SPSS statistics ver. 20.0" was applied to evaluate and test the hypothesis.

Descriptive statistics, charts (Frequencies and percentage) .

study tools: a data gathered by hospital system using a data sheet with include demographics, date of admission, date of discharge, comorbidity, diagnosis, length of stay, investigation (on admission, with infection, after infection)

imaging, medication, risk factor(blood transfusion, immunosuppressant medication, stress ulcer prophylaxis ,central line, PICC line, NGT, TPN, urinary catheter, ventilator, tracheostomy ), outcome.

### Results:-

The total number of patients who admitted between 15 February 2015 to 16 February 2016 was 1502 patients, 111 patients got a nosocomial infection.

Among the different age groups, the Infants are more reliable to have a nosocomial infection by (62.2%).The patient who had an underlying cardiovascular disease (18.9%) are more susceptible to has a nosocomial infection, followed

by a neurological disease (16.2%) and gastrointestinal disease (16.2%). The most common type of infections in this study was UTI (25.2%) followed by blood stream infection (21.6%), pneumonia (19.8%).

Gram-negative organisms were the dominant by (48.9%). gram positive caused (43.3%) , fungi caused (7.8%) .

The most common pathogen was Coagulase-negative staphylococci (25.3%), followed by pseudomonas aeruginosa (14.5%) and Enterococcus faecalis (7.2%).

The three most potential predisposing factors were Immunosuppressive medications ( 22.5%), Central venous catheter (22.5%) and Nasogastric tube (19.8%). This study also showed that increase length of stay may increase the chance to get a nosocomial infection.

The majority of patients recovered within one week (57.7%). the mortality were only (3.6%).

**Table 1:-** Distribution of pediatric age groups

	Age	
	Frequency	Percent
Infant	69	62.2
Up to 10 years	30	27.0
Above 10 years	12	10.8
Total	111	100.0

**Table 2:-** Underlying disease of all Pediatric patients who developed NI

	Yes		No	
	Count	Table N %	Count	Table N %
Cardiovascular diseases	21	18.9%	90	81.1%
Neurology diseases	18	16.2%	93	83.8%
GI diseases	18	16.2%	93	83.8%
Respiratory diseases	14	12.6%	97	87.4%
Hematology diseases	10	9.0%	101	91.0%
Oncology diseases	10	9.0%	101	91.0%
Renal diseases	8	7.2%	103	92.8%
Genetics diseases	7	6.3%	104	93.7%
Endocrine diseases	6	5.4%	105	94.6%
Infectious diseases	5	4.5%	106	95.5%

**Table 3:-** Results of all cultures done for all Pediatric patients who developed NI

Urine Culture		
	Frequency	Percent
Positive	28	25.2
Negative	47	42.3
No culture	36	32.4
Total	111	100.0
Blood culture		
	Frequency	Percent
Positive	24	19.8
Negative	67	60.4
No culture	22	19.8
Total	111	100.0
Respiratory culture		
	Frequency	Percent
Positive	22	19.8
Negative	20	18
No culture	69	62.2
Total	111	100.0

**Table 4:-** Result of Positive cultures

	Frequency	Percent
Gram negative	44	48.9
Gram positive	39	43.3
Fungus	7	7.8
Total	90	100

**Table 5:-** Causative bacterial Organisms

Organism		Frequency	Percent
	coagulase negative staph	21	25.3
	pseudomonasaeruginosa	12	14.5
	Enterococcus faecalis	6	7.2
	Enterobacter cloacae	5	6.0
	ESBL positive e.coli	5	6.0
	acinetobacterbaumannii	4	4.8
	E.coli	4	4.8
	stenotrophomonasmaltophilia	3	3.6
	streptococcus viridans	3	3.6
	ESBL positive klebsiella pneumonia	3	3.6
	Klebsiella pneumonia	3	3.6
	Enterococcus faecium van a vre	2	2.4
	MRSA	2	2.4
	Gram negative bacilli	2	2.4
	Staphylococcus hominis	1	1.2
	serratiamacescens	1	1.2
	dermacoccusnishinomiyaensis	1	1.2
	citrobacteramalonaticus	1	1.2
	Staphylococcus epidermidis	1	1.2
	Citrobacterkoseri	1	1.2
	streptococcus pnemoniae	1	1.2
	Streptococcus salivaris	1	1.2
	Total	83	100.0

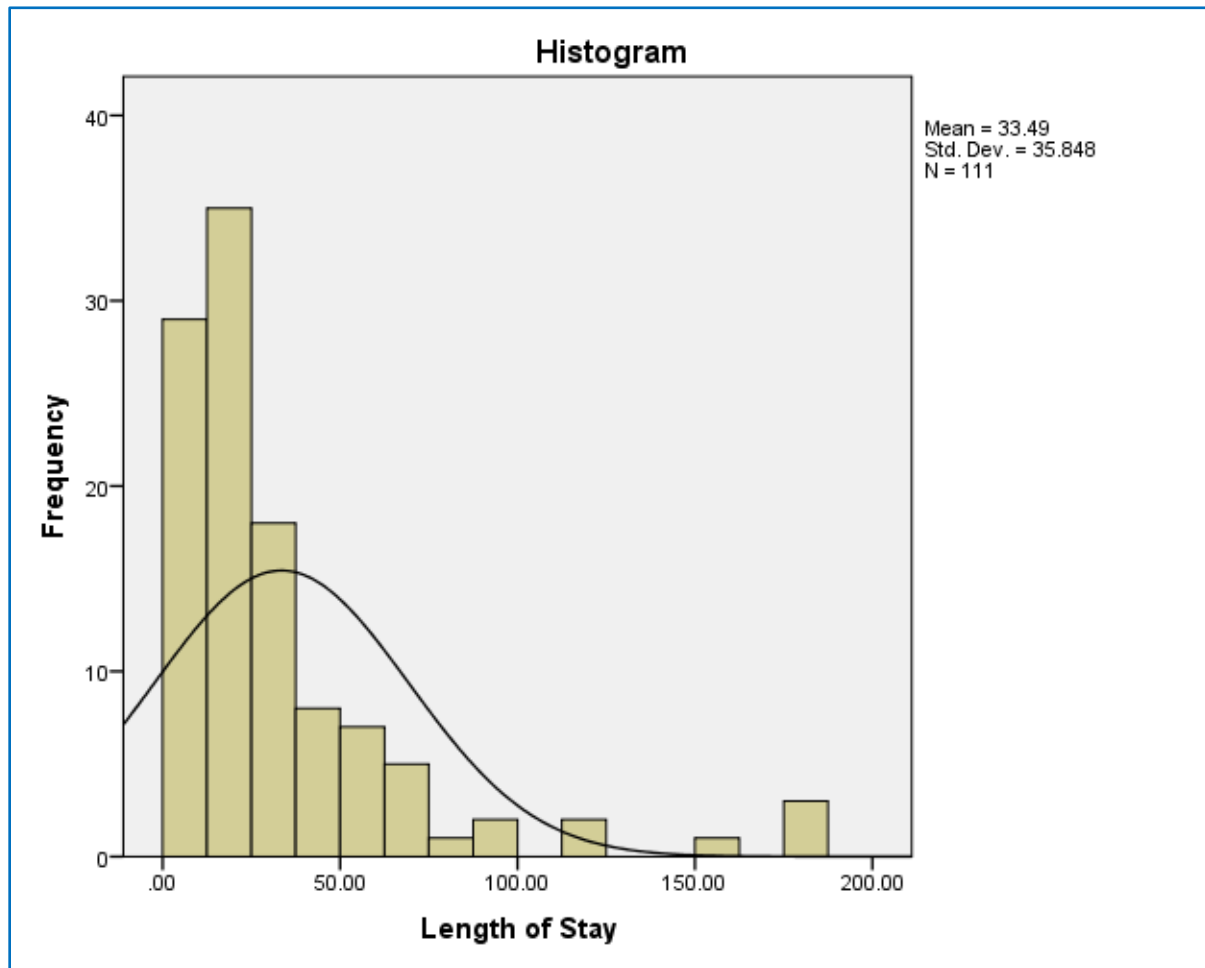
**Table 6:-** Foreign bodies associated with NI

Central venous catheter			
		Frequency	Percent
	Yes	25	22.5
	No	86	77.5
	Total	111	100.0
Peripherally inserted catheter			
		Frequency	Percent
	Yes	18	16.2
	No	93	83.8
	Total	111	100.0
Nasogastric tube			
		Frequency	Percent
	Yes	22	19.8
	No	89	80.2
	Total	111	100.0
Tracheostomy			
		Frequency	Percent
	Yes	8	7.2

	No	103	92.8
	Total	111	100.0
<b>Mechanical ventilator</b>			
		Frequency	Percent
	Yes	14	12.6
	No	97	87.4
	Total	111	100.0
<b>Foley Catheter</b>			
		Frequency	Percent
	Yes	11	9.9
	No	100	90.1
	Total	111	100.0
<b>Parenteral Nutrition</b>			
		Frequency	Percent
	Yes	16	14.4
	No	95	85.6
	Total	111	100.0

**Table 7:-** treatment associated with NI

<b>Immunosuppressive medications</b>			
		Frequency	Percent
	Yes	25	22.5
	No	86	77.5
	Total	111	100.0
<b>Stress ulcer prophylaxis</b>			
		Frequency	Percent
	Yes	20	18.0
	No	91	82.0
	Total	111	100.0
<b>Blood Transfusion</b>			
		Frequency	Percent
	Yes	24	21.6
	No	87	78.4
	Total	111	100.0



**Figure 1:-**The length of stay ranged from 3 minimum to 180 maximum days with a mean of (34 +or- 36) days. The length of stay was not normally distributed as seen from the graph, therefore, main patients stayed between 0 and 70 days with the median of 21 days.

**Table 8:-** The outcomes.

Outcome			
		Frequency	Percent
	Recovery within 1 week	64	57.7
	Recovery > 1 week	38	34.2
	Recovery with comorbidities	5	4.5
	Mortality	4	3.6
	Total	111	100.0

### Discussion:-

The goals of the study were to know the most common organism that cause nosocomial infection, most common site of infection and the risk factors. Coagulase-negative staphylococci was the most common infection which present (25.3%) of our samples.

Coagulase-negative staphylococci are part of normal flora of the human skin, and it can be transmitted throw any invasive devises to the blood and cause infection, that's why it's the most common infection in hospitals.

A study of 24,179 cases of nosocomial in 49 hospitals across the United States suggest that (31%) of sample were coagulase negative staphylococci (11).

But on the other hand, a study of 841 patients done in tertiary care teaching hospital showed that klebsiella pneumonia was predominant (12).

The data indicate that the UTI is the most common site of infection.

A study done in United States, 110709 pediatric patients with 6290 nosocomial infections suggest that the blood stream infection is more frequently than UTI (13).

Prolonged hospital stay and frequently used of invasive devices with poor hygiene can cause hospital acquired infection and may cause complication such as sepsis and maybe death .

Immunosuppressive medication, central venous catheter and nasogastric tube are most common predisposing factors. Study of 911 cases was performed at St Louis Children's Hospital, showed that patients with bloodstream infection were more likely to have multiple central venous catheters (14). On the other hand, in Egypt, there is a study conducted in devices associated infection, they found that the Patients who are on mechanical ventilation device, central venous line, or urinary catheter are at higher risk to develop NI (6). But in our study we found that Patients who are on central venous line, peripherally inserted catheter and Nasogastric tube are at higher risk to develop NI.

### Conclusion:-

Infant patients are more reliable to get a Nosocomial infection than the other pediatric age groups. In this study, the UTI is the commonest type of infection. Gram negative organisms are the most common to cause an NI but, the Coagulase-negative staphylococci is the common organism. Immunosuppressive medications, Central venous catheter and Nasogastric tube are the three most potential predisposing factors. The majority of patients recovered within one week.

### Perspectives:-

We believe that we need further similar studies with multicenter and larger sample size. Also, a control group that involves patients with a non-nosocomial fever might help to understand the possible risk factors for the development of nosocomial infection.

### References:-

1. Inweregbu K, Dave J, Pittard A. Nosocomial infections. *Contin Educ Anaesth Crit Care Pain*. 2005;5(1):14-17.
2. Urrea M, Rives S, Cruz O, Navarro A, José García J, Estella J. Nosocomial infections among pediatric hematology/oncology patients: Results of a prospective incidence study. *American Journal of Infection Control*. 2004;32(4):205-208.
3. Singhi S, Ray P, Mathew J, Jayashree M, Dhanalakshmi. Nosocomial bloodstream infection in a pediatric intensive care unit. *Indian J Pediatr*. 2008;75(1):25-30.
4. Tantracheewathorn T, Vititpatarak N, Phumisantiphong U. Epidemiologic study of nosocomial bacterial infection of pediatric patients at BMA Medical College and Vajira Hospital. *Journal of the Medical Association of Thailand, Chotmaihetthangphaet [Internet]*. 2007 [cited 3 March 2016];90(2):258-65.
5. Becerra M, Tantalean J, Suarez V, Alvarado M, Candela J, Urcia F. Epidemiologic surveillance of nosocomial infections in a pediatric intensive care unit of a developing country. *BMC Pediatrics*. 2010;10(1):66.
6. Rasslan O, Seliem Z, Ghazi I, El Sabour M, ElKholy A, Sadeq F et al. Device-associated infection rates in adult and pediatric intensive care units of hospitals in Egypt. *International Nosocomial Infection Control Consortium (INICC) findings. Journal of Infection and Public Health*. 2012;5(6):394-402.
7. Ben Jaballah N, Bouziri A, Kchaou W, Hamdi A, Mnif K, Belhadj S et al. Épidémiologie des infections bactériennes nosocomiales dans une unité de réanimation néonatale et pédiatrique tunisienne. *Médecine et Maladies Infectieuses*. 2006;36(7):379-385.
8. Raymond JA, Ujard Y. Nosocomial Infections in Pediatric Patients: A European, Multicenter Prospective Study . *Infection Control and Hospital Epidemiology*. 2000;21(4):260-263.
9. Abdel-Fattah M. Surveillance of Nosocomial Infections at a Saudi Arabian Military Hospital for a One-Year Period. *International Journal of Infectious Diseases*. 2005;12:e369-e370.



10. Jackowska T, Pawlik K. Prevention of nosocomial infections in the pediatric ward - own experiences. - PubMed - NCBI [Internet]. Ncbi.nlm.nih.gov. 2015 [cited 6 June 2016]. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/26384127>
11. Wisplinghoff H, Bischoff T, Tallent S, Seifert H, Wenzel R, Edmond M. Nosocomial Bloodstream Infections in US Hospitals: Analysis of 24,179 Cases from a Prospective Nationwide Surveillance Study. 2004.
12. Singhi, Ray, Mathew, Jayashree, Dhanalakshmi. Nosocomial bloodstream infection in a pediatric intensive care unit. - PubMed - NCBI [Internet]. Ncbi.nlm.nih.gov. 2008 [cited 19 December 2016]. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/18245931>
13. Richards M, Edwards J, Culver D, Gaynes R, System t. Nosocomial Infections in Pediatric Intensive Care Units in the United States [Internet]. Pediatrics.aappublications.org. 1999 [cited 19 December 2016]. Available from: <http://pediatrics.aappublications.org/content/103/4/e39.short>
14. Yogaraj J, Elward A, Fraser V. Rate, Risk Factors, and Outcomes of Nosocomial Primary Bloodstream Infection in Pediatric Intensive Care Unit Patients. 2002.



### RESEARCH ARTICLE

## DEVELOPMENT OF CHAPPATI, A LOW COST TRADITIONAL INDIAN FOOD, USING COMMON INGREDIENTS IN DIFFERENT COMPOSITION -A COMPARATIVE STUDY.

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Low cost supplementary ingredients,  
Chappati, Malnutrition, Sensory  
evaluation

### Abstract

**Background:** Chappati, a low cost supplementary traditional food in India, is often used as a supplementary food. However, its nutritional quality depends on the composition of ingredients. Therefore, a study to be conducted to develop a low cost nutritionally rich and acceptable *chappati*, for use of the common people.

**Objective:** To develop *chappati* with same ingredients of different composition in order to make the most nutritionally rich chappati at low cost and acceptable for consumption.

**Design:** An experimental study (a comparative nutritional analysis).  
**Setting:** Laboratory based on Viharilal College of Home Science.

**Subjects & Methods:** Chappati was prepared by mixing low cost ingredients such as- Bajra (pearl millet) Flour, Soya bean Flour, Sesame seeds, Groundnut Flour, Rice Flour in three different proportions and marked as 1, 2, and 3. Nutrient contents (carbohydrate, protein, fat and iron) of these products and the raw samples were analyzed. Sensory evaluations of the products are carried out for determining the acceptability. Protein quality of these products was evaluated.

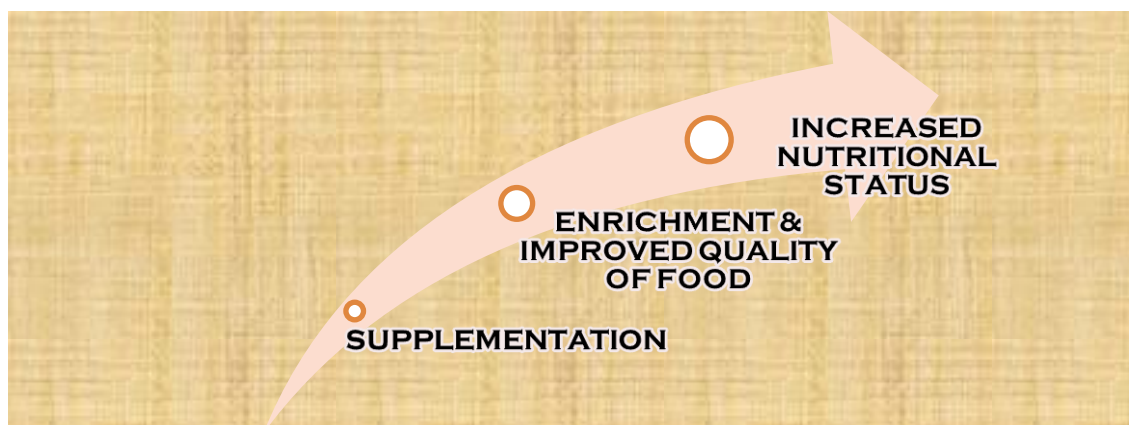
**Results:** Nutritional analysis indicated that all the products were rich in carbohydrate and protein. But comparison showed that product-3 was rich in protein and iron. Protein quality of product-3 found to be highest.

**Conclusion:** Product Sample-3 (proportion-3) was found to be nutritionally richest in terms of the nutrients analyzed. It may be used to provide adequate nutrients and can be used as a protein supplement.

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### Introduction:-

The word "Supplementation" is derived from the word "Supplement" which means something or any nutrient is added to the food to improve the quality of food and the process of making up for a deficiency, especially any nutrient deficiency [1].



The food which are low in cost and rich in nutrients in adequate amounts as compared to the high cost nutrient rich food. Impact of low cost food supplementation on the child growth, merits careful evaluation, in the view of reliance of many States and non-governmental organizations on this intervention to improve child health in Low & Middle Income Countries(LMIC)[2].

*Bajra*,Soyabean,Sesame seed, Groundnut,Rice –All the low cost ingredients are rich in adequate amount of carbohydrate, protein, fat, vitamins & minerals(specially iron)[3].

Previous study reported that,two type of ready to eat supplementary food formulations were developed by roller drying based on wheat, soy protein concentrate, whey protein concentrate, and green gram flour and was fortified with vitamins and minerals to meet the one third of the recommended daily allowance (RDA). However, the formulations were nutritionally better than only cereal based supplementary food formulations available commercially. The product could be served in the form of porridge with water/milk or in the form of small *chappati*[4].

Another study reported that, onfortified spreads peanut can be used as supplementary foods instead; these are energy-dense, lipid-based pastes with added powdered micronutrients [5].

#### Objectives:-

- ✚ To compare the nutritive value among the three proportions taken as sample.
- ✚ To compare the nutritive value of raw & cooked product of the sample ingredients of three proportions.
- ✚ To evaluate the acceptability rate of three products made by three proportions among the community.
- ✚ To evaluate the quality of protein among three proportions.
- ✚ To develop *chappati* with same ingredients of different composition in order to make the most nutritionally rich *chappati* at low cost and acceptable for consumption.

#### Materials & Methods:-

At first, all the raw materials were grounded into powdered form. These were mixed in three different proportions are as follows-

INGREDIENTS	PROPORTION-1	PROPORTION-2	PROPORTION-3
Bajra	20 gram	30 gram	10 gram
Soya bean	20 gram	30 gram	30 gram
Sesame	20 gram	20 gram	40 gram
Groundnut	20 gram	10 gram	10 gram
Rice	20 gram	10 gram	10 gram

Then *chappatis* were prepared from these three proportions according to conventional method.

#### Carbohydrate Estimation Method:-

**Anthrone Method**-100 mg sample was weighed into a boiling tube. It was hydrolyzed by keeping it on boiling water bath for three hours with 5 ml of 2.5 N HCL and cooled to room temperature. After that it was neutralized with sodium carbonate until the effervescence ceased. The volume was made up to 200 ml with distilled water and

centrifuged at 3000R.P.M for 15 minutes. Then supernatant was collected and 1 ml aliquot was taken for analysis. Then 4 ml of anthrone reagent was added and heated for eight minutes in a boiling water bath, cooled rapidly and green colour appeared. The reading was taken at 630nm in spectrophotometer (Parkin Elmer lambda 25) [6].

**Protein Estimation Method:-**

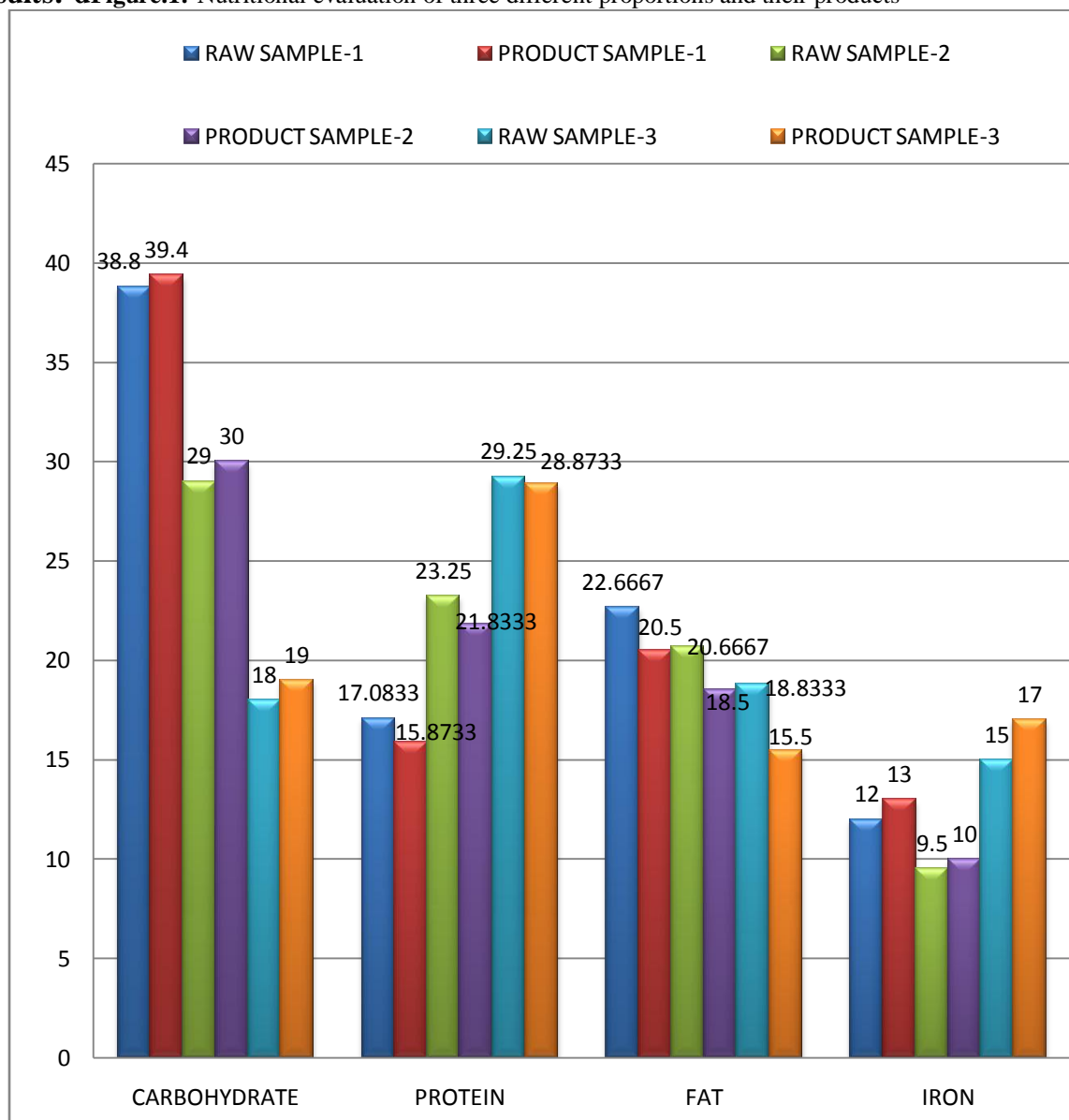
**Lowry Method-** 0.4 gm (400 mg) sample was taken in 20 ml buffer solution (Measured the pH at 7.6). Then it was homogenized & kept overnight for extracting protein. Then cold centrifuged for 20 minutes at 5000 R.P.M (Rate per Minute). Then 1ml supernatant was collected. After that 5ml of Lowry reagent was added & allowed to stand for 10 minutes. Then 0.5ml Folin's reagent was added & kept it for 30 minutes. The reading was taken at 630nm in spectrophotometer (Parkin Elmer lambda 25) [7]. And protein quality also measured by using NDP calorie%.

**Fat Estimation Method:-**

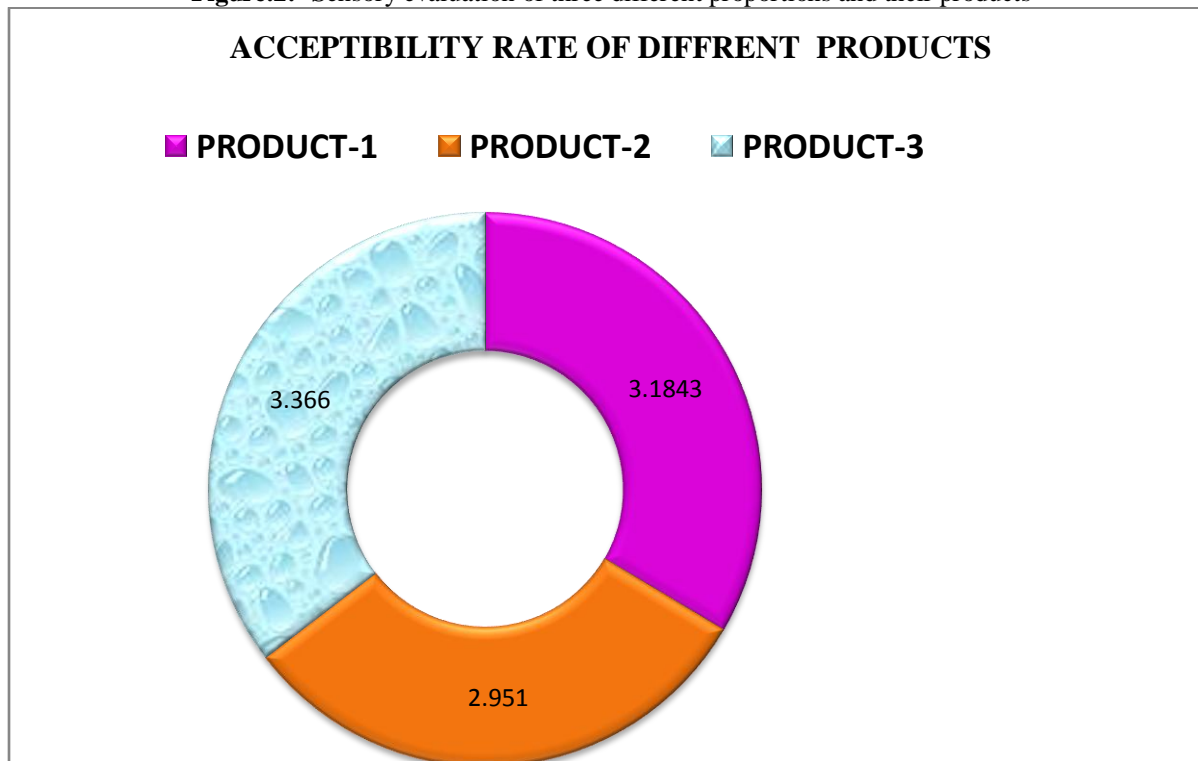
**Soxhlet Extractor Method-** At first, 5 gm dried sample was taken. Covered it tightly by the filter paper & wrapped by string. 100ml petroleum ether was taken in a round bottom flask. The sample was placed in the extractor of the soxhlet apparatus and it was run for at least 16 hours. After complete extraction of fat from the sample, the solvent was poured into a weighed Petridish and the ether was evaporated. Then the final weight of fat containing Petridis was taken. Thus the amount of fat was estimated [8].

**Iron Estimation Method:-**

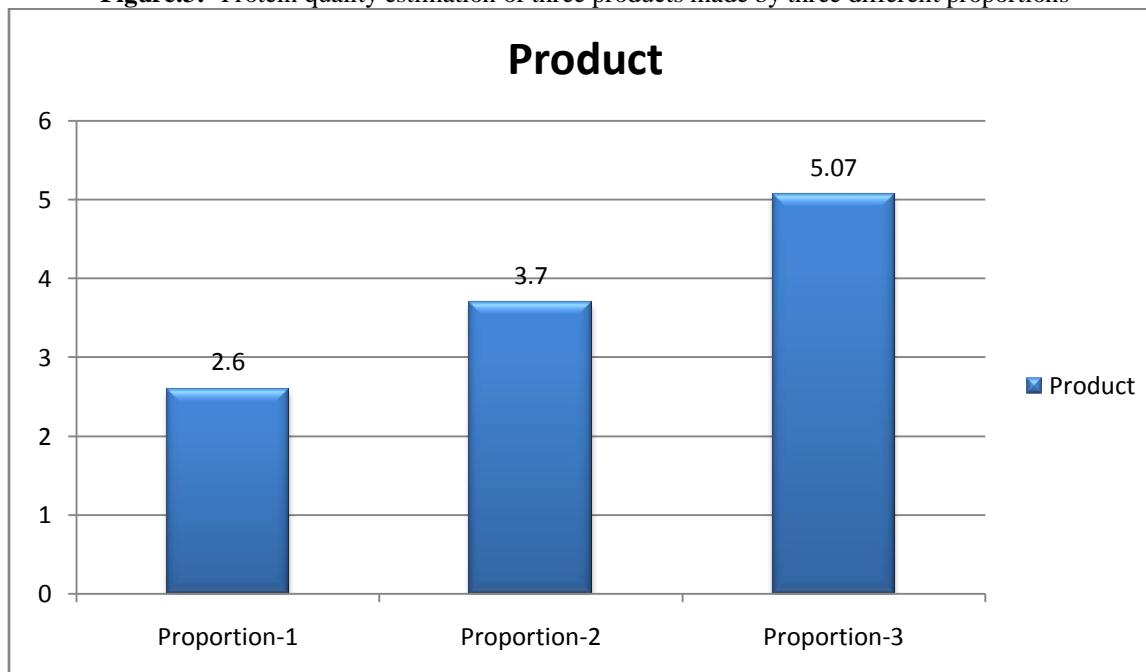
At first 500mg sample was taken in a 25ml volumetric flask. Then 10ml nitric acid was added & kept for overnight. Then it was heated for 6 hours. Then 2ml per-chloric acid was added & again heated for until the sample became transparent liquid. Then the volume make up with the double distilled water and filtered. Then reading was taken by atomic absorption spectrophotometer [9].

**Results:-dFigure.1:-Nutritional evaluation of three different proportions and their products**

According to figure, in 100g sample, carbohydrate content of raw sample-1,2,3 were 38.8%,29%,18%.Carbohydrate content of product sample-1,2,3 were 39.4%,30%,19%.Protein content of raw sample-1,2,3 were 17.08%,23.25%,29.25%.Protein content of product sample-1,2,3 were 15.87%,21.83%,28.87%.Fat content of raw sample-1,2,3 were 22.66%,20.66%,18.83%.Fat content of product sample-1,2,3 were 20.5%,18.5%,15.5%.Iron content of raw sample-1,2,3 were 12%,9.5%15%.Iron content of product sample-1,2,3 were 13%,10%,17%.

**Figure.2:-** Sensory evaluation of three different proportions and their products

According to figure, acceptability rate of product-1,2,3 were 3.18%,2.95%,3.36%.

**Figure.3:-** Protein quality estimation of three products made by three different proportions

According to figure, protein quality of product-1,2,3 were 2.6%,3.7%,5.07%.

### Discussion:-

**Fig-1** shows that the carbohydrate content of three mixes were slightly increased after cooking. Protein content of three mixes were decreased after cooking. Fat content of all the mixes were decreased after cooking, but among them fat content of **raw sample-3** is highly decreased. Iron content of all the mixed are increased after cooking.

**Fig -2** shows that acceptability rate of **product sample-3** is highest among the three different mixed.

**Fig -3** shows that protein quality of product-3 was highest among three products.

Studies have shown that, for adults, diets with an NDP Cal% of 5% would be adequate to maintain health. According to this study while the quantity of all the three products were comparable, product-3 was most suitable for adults in terms of protein quality.

### Conclusion:-

The study was based on nutritional evaluation of the low cost food (*chappati*) that can be used as supplementary food.

Among all the three products developed, protein and iron contents were found to be highest in one of the products. Moreover, quality of the protein in this product also was found to be highest.

Therefore, this particular product (*chappati*) is most suitable as a supplementary food among the three products developed.

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**Financial Support:** None.

**Conflict of Interest:** None declared.

### Reference:-

1. B. Srilakshmi (2010). *Title of work: Food science*. Location: New Age International (p) Ltd., New Delhi-110002
2. **Manning, Katie, Ruth Pelling, Tom Higham, Jean-Luc Schwenniger and Dorian Q Fuller.** 4500-year-old domesticated pearl millet (*Pennisetum glaucum*) from the Tilemsi Valley, Mali: new insights into an alternative cereal domestication pathway. *Journal of Archaeological Science*. 2010; 38 (2): 312-322
3. B. Srilakshmi (2010). *Title of work: Food science*. Location: New Age International (p) Ltd., New Delhi-110002
4. **Haas, J. D., & Brownlie, T.** Iron deficiency and reduced work capacity: a critical review of the research to determine a causal relationship. *The Journal of nutrition*. 2001; 131(2), 676S-690S.
5. **Hinton, P. S., Giordano, C., Brownlie, T., & Haas, J. D.** Iron supplementation improves endurance after training in iron-depleted, nonanemic women. *Journal of Applied Physiology*. 2000; 88(3), 1103-1111.
6. **Strom, B. L.; Schinnar, R; Ziegler, EE; Barnhart, KT; Sammel, MD; MacOnes, GA; Stallings, VA; Drulis, JM; et al.** Anthrone method. *JAMA: the Journal of the American Medical Association (American Medical Association)*. 2001; 286 (7): 807-814.
7. **Tarnopolsky, M.** Lowry method: a critical experiment. *Journal of biochemical method*. 1998; 8(4), 286-297.
8. **Sohani, Mehdi.** Soxhlet extractor for fat. 2013; (2): 239-247. Retrieved February 2, 2014.
9. **Oplinger, T.M.; Oelke, E.A.; Kelling, K.A.; Doll, J.D.** iron estimation method, New Center, Purdue University. 1991. Retrieved 26 September 2015.

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## RESEARCH ARTICLE

### PATTERN OF THYROID DISEASE IN ALKHARJ PROVINCE, SAUDI ARABIA.

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Pattern, thyroid diseases, Alkhraj, Saudi Arabia.

#### Abstract

Background: Thyroid gland is one of the important organ in human body and the burden of thyroid diseases in the general population is enormous specially in females. In Saudi Arabia its pattern is differ from area to area. Aim of the study: The present work was conducted to study the pattern of thyroid disorders among patients attended to the endocrinology clinics in Prince Sattam bin Abdul-Aziz University hospital and King Khalid hospital, Alkhraj Province, Saudi Arabia. Results: The patients complaining of different thyroid disorders were 203 (12.93%) cases. 113 (55.7%) was found to have hypothyroidism and 90 (44.3%) had hyperthyroidism. Iodine deficiency was associated with hypothyroidism in females but it was common in males with hyperthyroidism. The etiology and risk factors of hypothyroidism were stress, malignant tumors and diabetes in males while the were bad nutrition, Iodine deficiency, goiter, benign thyroid tumor and family history in females. Diabetes, graves, disease, benign and malignant tumors were common in males but bad nutrition, iodine deficiency, goiter and family history were the more frequent in females suffered from hyperthyroidism. Total cases with goiter were 68 most of them were with male (61.76%). The palpable goiter was more common than visible type (66.67%) in hypothyroidism and (64.29%) in hyperthyroidism. Malignant thyroid were found mainly in males (61.29%) with papillary type of cancer (41.94%) and the common presenting manifestation was hyperthyroidism (70.97%). Conclusion: Thyroid disorders are common in Alkhraj Province especially in females. The pattern is more or less similar to that detected in other Saudi cities. Goiter and malignant thyroid are more common in males. Recommendation: More studies should be carried out in Alkhraj Province to stress on the individual thyroid disorder so as more comprehensive studies could be obtained.

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#### Introduction:-

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Thyroid gland is one of the imperative organ in human body and the encumbrance of thyroid disorders in the community is tremendous exceptionally in females . Thyroid diseases make numerous issues, even though most of them undergo medical or surgical management. Thyroid disorders are in general grouped and showed into two major classifications which are either because of diminished activity of the gland (hypothyroidism) or due to its over action (hyperthyroidism). The previous one is more common in older people (La Franchi, 1994& Griffith et al 1999).

The epidemiology of thyroid disorders in iodine- sufficient areas deals mainly with thyroid autoimmune diseases and sporadic goiter (Elahi et al 2005). However in iodine deficient areas, other type of thyroid tumors and goiters are more common . The rate of Multi-nodular goiter is different as per the countries and seems to be generally dependant on the iodine status( Abu-Eshy et al 1994)

The types of thyroid disease incorporate nontoxic goiter, Graves 'malady, Hashimoto's thyroiditis and thyroid neoplasm (Rallison et al.1991). There are two basic important thyroid gland autoimmune diseases which are Hashimoto thyroiditis and Graves disease. The first one is the most widely recognized reason for hypothyroidism, whilst the last one is the leading cause for hyperthyroidism (Rossi et al., 1985 There is a notable geographical reliance in thyroid disorders due to the various quantities of trophic iodine ingestion that happen in various geographic areas (Knudsen et al., 2000).The number of individuals in the community who have microscopic nodules, palpable goiter , and occult papillary carcinoma must be considered .

Risk factors of thyroid disorders include: Gender (thyroid disease are higher in women than in men), Diet rich in goitrogens or lacking in iodine , Family history, Pregnancy , Radiation to the neck and Smoking (Abdul Rahman et al 1997 )

The frequency and types of thyroid disorders were studied in Saudi Arabia by a few specialists (Al-Tameem, 1987; Koriesh et al., 1988; Abu-Eshy et al., 1994; Al-Zahrani et al., 2005). However little is thought about thyroid disorders studies in Alkharj province, so the present review was attempted study the types and causes of the disease among patients presented to the outpatient clinics of the University Hospital , Alkharj province, Saudi Arabia.

### **Patients and Methods:-**

This is retrospective study included 203 patients with thyroid disorders presented to the outpatient clinics of Prince Sattam bin Abdul-Aziz University Hospital , and king Khalid hospital in Alkharj Saudi Arabia during the year 2014. They were diagnosed clinically to have thyroid dysfunction disease . That was reflected either by manifestation of hypothyroidism ,hyperthyroidism or enlargement of thyroid gland. Data was collected from admissions and outpatient medical records. The data contained causes risk factors ,social-demographic data and clinical presentation, The results had been noted and analyzed.

### **Results:-**

The total number of patients presented to the endocrinology clinics in Prince Sattam bin Abdul-Aziz University Hospital and King Khalid Hospital was 1569.The patients complaining of different thyroid diseases were 203 (12.93%)

**Table (1):-** Represented the age distribution of the subjects according to thyroid dysfunction. The mean age of the patients was 44 years.

**Table (2):-** The results of present study showed that among the 203 patients, 90 cases (34 male and 56 female) was found to have hyperthyroidism and 113 (37 male and 76 female) have hypothyroidism.

**Table (3):-** Concerning **hyperthyroidism**: The stress (8.45%) , DM (21.13%) and iodine deficiency (12.68%) were the common risk factors, And graves' disease (14.08%) , Benign neoplasm (16.90%) and malignant neoplasm (8.45%) were the more frequent etiology in males. Furthermore the bad nutrition (29.55%) was the most risk factor , And the goiter (21.97%) and family history (15.15%) were the more frequent etiology in females.

**Table (4):-** Regarding to **hypothyroidism**: Stress (72.70%) , DM (76.10%) were the common risk factors, And graves' disease (66.70%) , , Malignant neoplasm (80.00% ) were the more frequent etiology in males.

While Mal-nutrition (86.70%) , Iodine deficiency (25.00%) were the common risk factors, And Goiter (88.90%) , Benign neoplasm (73.70%) , Family history (86.60%) were the more frequent etiology in females.

**Table (5):-** Revealed that palpable goiter was more common 66.7% in patients with hypothyroidism than visible type and it was more common (35.7%) in patient with hyperthyroidism. And the total cases with goiter was (68).

**Table (6):-** Total cases with goiter was (68), Males were more frequent (42) than females (26).

Subjects with thyroid goiter ( 68 cases) in the current study were demonstrated either by diffuse type ( 39 cases) or solitary nodular type ( 29 cases).

The histopathological studies obtained from the patients files revealed that ( 18 cases) out of the ( 29 case) with solitary nodules were benign.

**Tables (7):-** As regarding thyroid cancer, patients with thyroid cancer in the current study were mainly males (61.29%)

**Tables (8):-** Pattern of thyroid carcinoma among patients with thyroid malignancies, the papillary type was the most common (42%)

**Tables (9):-** And the common presenting manifestation of thyroid carcinoma was with hyperthyroidism (71%).

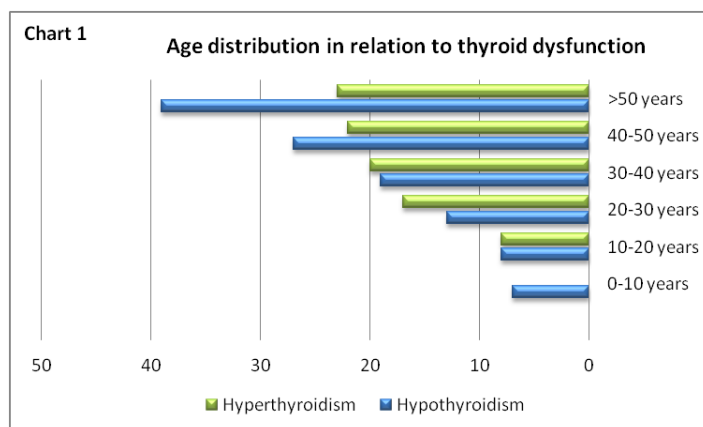
**Table (10):-** The most common manifestation in Patients complaining of **hyperthyroidism** in the present work was palpitation ((45.6%).

Each patient of total ( 90) has more than one of these clinical manifestations.

**Table (11):-** The most common manifestation in Patients complaining of **hypothyroidism** in the present work was obesity (59.29%).

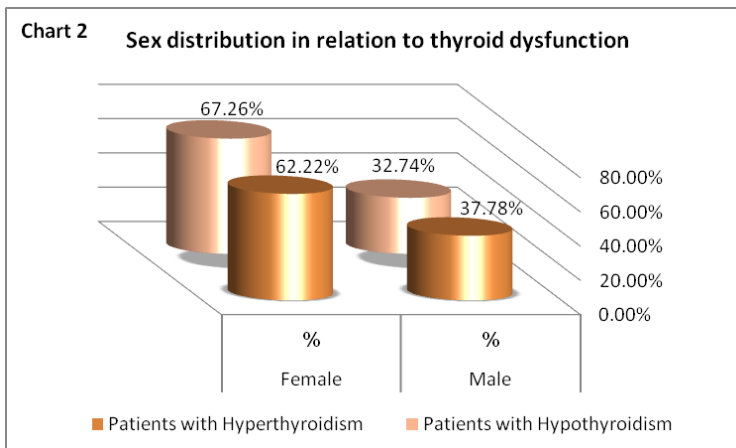
Each patient of total ( 113) has more than one of these clinical manifestations.

<b>Table 1: Age distribution in relation to thyroid dysfunction</b> among patients with thyroid disorders in Prince Sattam bin Abdul-Aziz University hospital and King Khalid hospital, Alkharij Province , Saudi Arabia during the year of 2014.					
Age categories	Hypothyroidism		Hyperthyroidism		Total cases
	Number	%	Number	%	
0-10 years	7	6%	0	0%	7
10-20 years	8	7%	8	9%	16
20-30 years	13	12%	17	19%	30
30-40 years	19	17%	20	22%	39
40-50 years	27	24%	22	24%	49
>50 years	39	35%	23	26%	62
Total	113	100%	90	100%	203



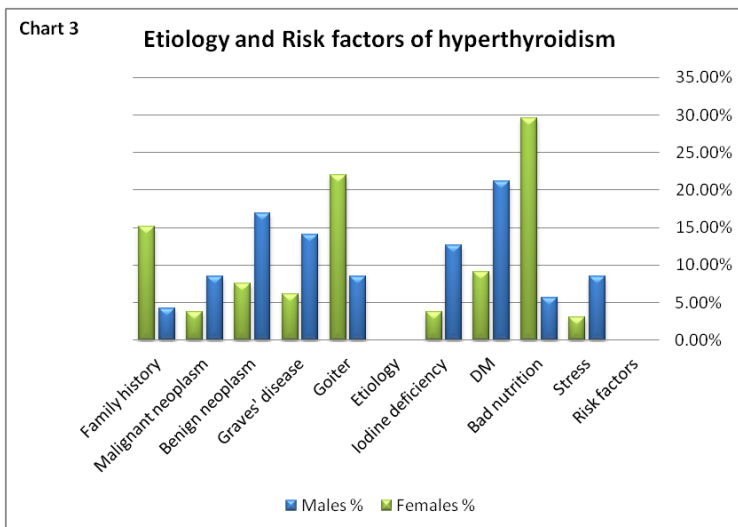
**Table 2: Sex distribution in relation to thyroid dysfunction** among patients with thyroid disorders in Prince Sattam bin Abdul-Aziz University hospital and King Khalid hospital, Alkharij Province, Saudi Arabia during the year of 2014.

Disorder	Male		Female		Total
	Number	%	Number	%	
Patients with Hyperthyroidism	34	37.78%	56	62.22%	90
Patients with Hypothyroidism	37	32.74%	76	67.26%	113



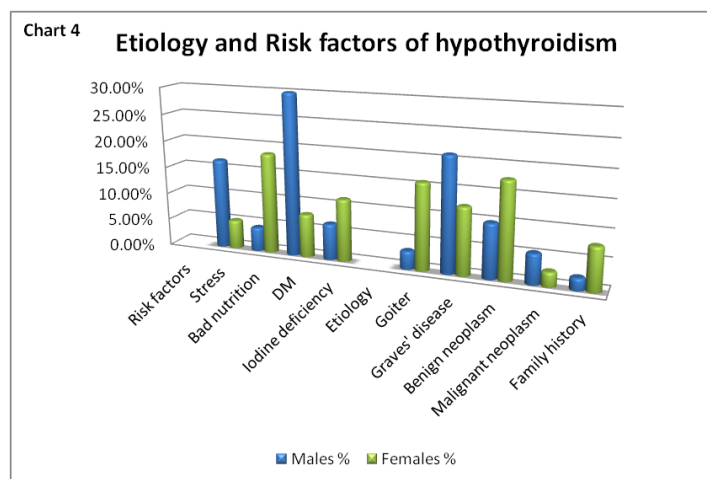
**Table 3: Etiology and risk factors of hyperthyroidism** among patients with thyroid disorders in Prince Sattam bin Abdul-Aziz University hospital and King Khalid hospital, Alkharij Province, Saudi Arabia during the year of 2014.

	Males		Females		Total
	Number	%	Number	%	
Risk factors					
Stress	6	8.45%	4	3.03%	10
Bad nutrition	4	5.63%	39	29.55%	43
DM	15	21.13%	12	9.09%	27
Iodine deficiency	9	12.68%	5	3.79%	14
Etiology					
Goiter	6	8.45%	29	21.97%	35
Graves' disease	10	14.08%	8	6.06%	18
Benign neoplasm	12	16.90%	10	7.58%	22
Malignant neoplasm	6	8.45%	5	3.79%	11
Family history	3	4.23%	20	15.15%	23
Total	71	100.00%	132	100.00%	203



**Table 4: Etiology and risk factors of hypothyroidism** among patients with thyroid disorders in Prince Sattam bin Abdul-Aziz University hospital and King Khalid hospital, Alkharij Province , Saudi Arabia during the year of 2014.

	Males		Females		Total
	Number	%	Number	%	
Risk factors					
Stress	15	16.67%	6	5.31%	21
Bad nutrition	4	4.44%	21	18.58%	25
DM	27	30.00%	9	7.96%	36
Iodine deficiency	6	6.67%	13	11.50%	19
Etiology					
Goiter	3	3.33%	18	15.93%	21
Graves' disease	19	21.11%	14	12.39%	33
Benign neoplasm	9	10.00%	20	17.70%	29
Malignant neoplasm	5	5.56%	3	2.65%	8
Family history	2	2.22%	9	7.96%	11
Total	90	100.00%	113	100.00%	203

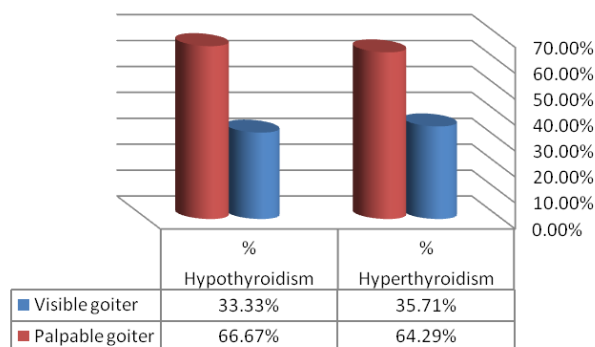


**Table 5:** Classification of goiter in relation to **thyroid dysfunction** among patients with thyroid disorders in Prince Sattam bin Abdul-Aziz University hospital and King Khalid hospital, Alkharij Province , Saudi Arabia during the year of 2014.

Goiter	Hyperthyroidism		Hypothyroidism		Number of patient with Goiter
	Number	%	Number	%	
Visible goiter	5	35.71%	18	33.33%	23
Palpable goiter	9	64.29%	36	66.67%	45
Total	14	100.00%	54	100.00%	68

Chart 5

Goiter in relation to thyroid dysfunction

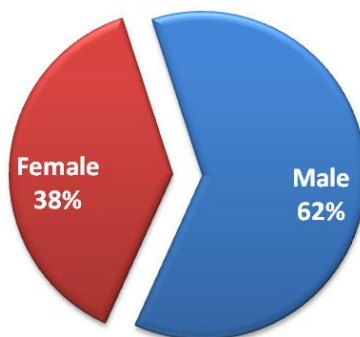


**Table 6:** Classification of **goiter in relation to sex** among patients with thyroid disorders in Prince Sattam bin Abdul-Aziz University hospital and King Khalid hospital, Alkharij Province , Saudi Arabia during the year of 2014.

Goiter in relation to sex	Patient Number	%
Male	42	61.76%
Female	26	38.24%
Total	68	100.00%

Chart 6

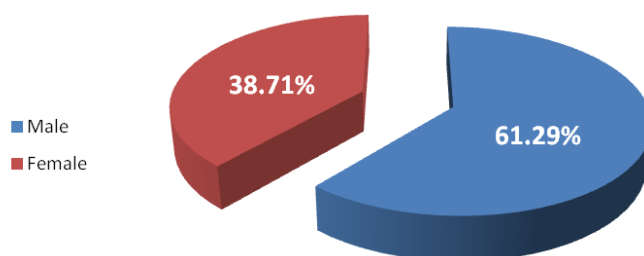
Goiter in relation to sex



**Table 7:** Pattern of **thyroid carcinoma** in relation to **sex** among patients with thyroid disease in Prince Sattam bin Abdul-Aziz University hospital and King Khalid hospital, Alkharj Province , Saudi Arabia during the year of 2014.

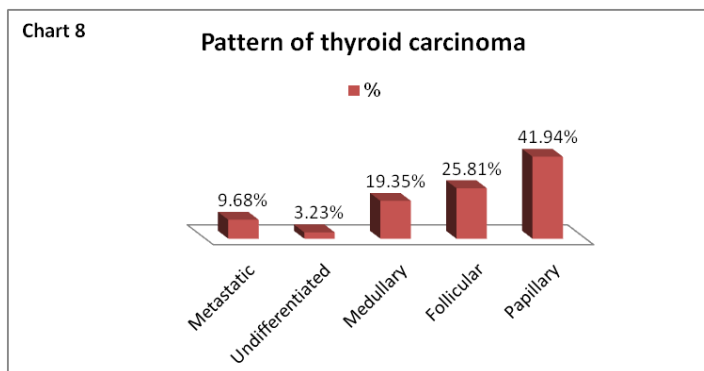
Carcinoma in relation to sex	Patient Number	%
Male	19	61.29%
Female	12	38.71%
Total	31	100%

Chart 7 Pattern of thyroid carcinoma in relation to sex



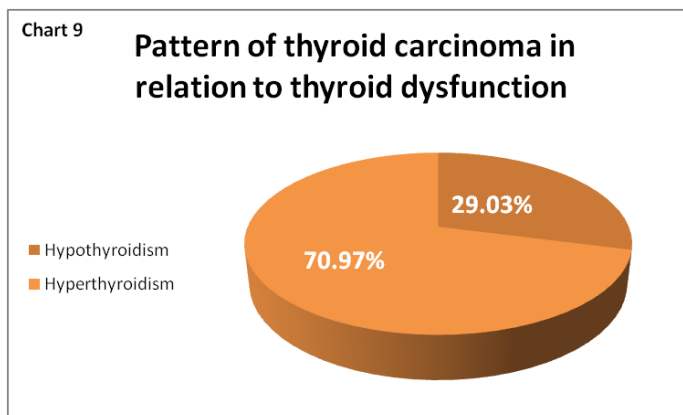
**Table 8:** Pattern of **thyroid carcinoma** among patients with **thyroid cancer** in Prince Sattam bin Abdul-Aziz University hospital and King Khalid hospital, Alkharj Province , Saudi Arabia during the year of 2014.

Pattern of thyroid carcinoma	Patients Number	%
Papillary	13	41.94%
Follicular	8	25.81%
Medullary	6	19.35%
Undifferentiated	1	3.23%
Metastatic	3	9.68%
Total	31	100%



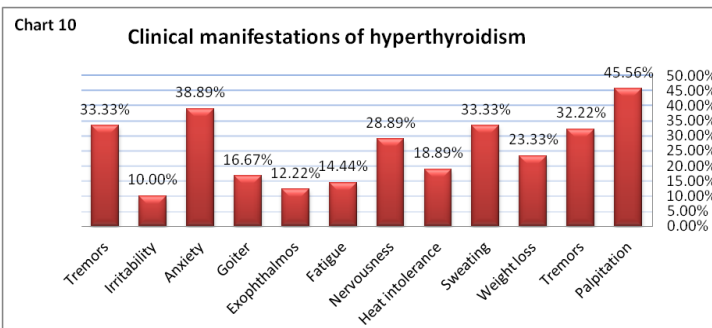
**Table 9:** Pattern of **thyroid carcinoma** in relation to **thyroid dysfunction** among patients with thyroid in Prince Sattam bin Abdul-Aziz University hospital and King Khalid hospital, Alkharj Province , Saudi Arabia during the year of 2014.

Pattern of carcinoma	Patients Number	%
Hypothyroidism	9	29.03%
Hyperthyroidism	22	70.97%
Total	31	100.00%



**Table 10:** Clinical manifestation of **hyperthyroidism** among patients with thyroid disorders in Prince Sattam bin Abdul-Aziz University hospital and King Khalid hospital, Alkharj Province , Saudi Arabia during the year of 2014.

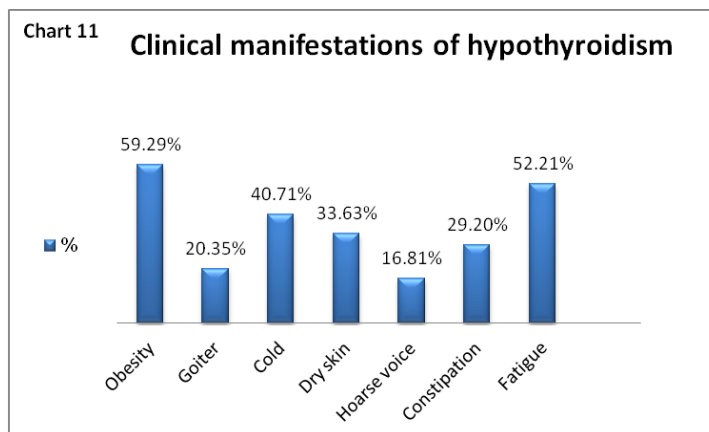
Clinical manifestation	Patient Number	%
Palpitation	41	45.56%
Tremors	29	32.22%
Weight loss	21	23.33%
Sweating	30	33.33%
Heat intolerance	17	18.89%
Nervousness	26	28.89%
Fatigue	13	14.44%
Exophthalmos	11	12.22%
Goiter	15	16.67%
Anxiety	35	38.89%
Irritability	9	10.00%
Tremors	30	33.33%



**Table 11:** Clinical manifestation of **hypothyroidism** among patients with thyroid disorders in Prince Sattam bin Abdul-Aziz University hospital and King Khalid hospital, Alkharj Province , Saudi Arabia during the year of 2014.

Clinical manifestation	Patient Number	%
Fatigue	59	52.21%
Constipation	33	29.20%
Hoarse voice	19	16.81%
Dry skin	38	33.63%
Cold	46	40.71%
Goiter	23	20.35%
Obesity	67	59.29%





Diseases of the thyroid are of great importance because most are amenable to medical or surgical management. Patients with thyroid diseases usually presented by conditions associated with excessive release of thyroid hormones (hyperthyroidism), deficiency of the hormone hypothyroidism), and mass lesions of the thyroid (**Maitra et al ;2008**)

Risk factors of thyroid disease include: Gender, Diet rich in goitrogens or deficient in iodine , Pregnancy , Radiation to the neck , Family history and Smoking (**Marita et al , 2008**)

Hypothyroidism results from deficient production of the thyroid hormone or defects in thyroid hormone receptor activity. The disorder may be acquired or congenital manifested at birth or delayed as a result of a variety of congenital defects. Congenital causes of hypothyroidism may be sporadic or familial (**Ordoorkhani et al., 2005**).

The current study revealed that out of 175 patients , 98 cases ( 27 male and 71 female ) was found to have hypothyroidism and 57 (26 male and 31 female) had hyperthyroidism. likewise , it was documented by many authors that hypothyroidism is more common in females while hyperthyroidism is more common in males ( **Martin ; 2013.**) In addition stress (59.4%) , malignant tumors ( 75% ), Hashimootothyroidiis, and DM as risk factors of hypothyroidism were more prevalent in males than females. While the common risk factors in females were bad nutrition, iodine deficiency, goiter , benign thyroid tumor and family history were more prevalent in females with hypothyroidism comparable with males (**Wang et al ;1997 & Morganti et al ; 2005**). Similarly, Flynn et al; 2004 reported that conditions such as bad nutrition and poorly controlled diabetes were among causes of hypothyroidism in females. Our results on the contrarily revealed that the uncontrolled DM was found as a risk factor in males .**Akbar et al. 2006** as well as our study reported that family history of hypothyroidism is associated with an increase risk and the role of familial susceptibility to thyroid disorders was highly related . Congenital hypothyroidism in the current work increased significantly in males (18 %) than in females (9 %) which is in consistent with the study of Wintergerst et al (**Wintergerst et al ;2014**)

Concerning hyperthyroidism, stress, DM, graves disease, benign and malignant tumors were common in males. Moreover, bad nutrition, iodine deficiency, goiter, family history and radiation were the more frequent in females. Likewise same results were obtained by Abdul Shakoor et al while other authors didn't find relation with family history to thyroid diseases (**Abdul Shakoor et al 2014**)

Iodine deficiency was associated with hypothyroidism in females but it was common in males with hyperthyroidism. likewise high iodine deficiency was recorded in hypothyroidism females and hyperthyroidism males. Epidemiological studies has shown that pattern of thyroid dysfunction in a community is largely determined by iodine intake level (**Knudsen et al. 2000**). Kutras (2001) reported that iodine deficiency, thyroid autoimmunity, infection and previous irradiation are the common etiological factors of thyroid disorders In iodine deficient communities incidence of hypothyroidism is low while nontoxic goiter and hyperthyroidism due to toxic nodular goiter is common and increases with age. Like the results of the present study , high incidence of Hashimoto thyroiditis was recorded in hypothyroidism males. Hanna and **LaFranchi** (2002) reported that thyroid autoimmune diseases like Graves' disease and Hashimoto's thyroiditis are common

reason of thyroid diseases. **Takasu et al.** (1990) described eight cases of autoimmune thyroid disease with an alternating pattern of thyroid function.

Goiter in the present study was found to be higher in males (60.7%) than in females (39.3%) . On the other hands **Elhai et al** (2005) reported an incidence of 60.6% in females. This may be due to the kind of their patients which were referred from a centre for nuclear medicine . On the contrarily one again, **Al-Bouq et al.** (2006) reported that the incidence of goiter was much less than that of ours (19.6%) in Medinah Munawarah, Saudi Arabia. A high incidence of goiter was also recorded in Gizan, Saudi Arabia (**Sulimani et al. 1995**), Bombay, India (**Dodd and Samul ,1993**) and Tunisia (**El-May et al.1997**). The appearance of goiter depends on many factors like sex, family history, iodine intake and thyroid autoimmunity. Low iodine intake enhances the TSH sensitivity and positive influence of growth factors involved in the physiological regulation of thyroid growth.

In Saudi Arabia thyroid cancer is the fourth most common cancer in all age and the second most common cancer in female ( **National Cancer Registry ;1997**).

The number of cases with malignant thyroid in the current study among cases admitted to the endocrinology clinic was 28 (12.9 % and 9.2 % in hypothyroidism and hyperthyroidism, respectively. It was reported that incidence of malignant thyroid varies from one geographical area to the other. It was recorded as 13% in Asir , (**Abu-Eshy et al ; 1994**) and 21% in Riyadh (**Al-Tameem , 1987**) There are different causal factors of malignant thyroid such as prolonged high level of TSH and iodine deficiency (Belfiore et al.1992).

Papillary carcinoma in the present work was the most common histological subtype (64.3%) followed by medullary carcinoma (14.3%), then follicular variant (10.7%) .The least was the undifferentiated (7.1%). In a retrospective study done by Hussain et al ; 2013 during the year of 2000-2010 to investigate the Incidence of thyroid cancer in the Kingdom of Saudi Arabia, Similar pattern was recognized ( **Hussain et al 2013** ) This figure is lower than that found in The Republic of Yemen (21%). (**Al-Hureibi et al; 2004**) Our finding further coincides with the study carried out in Riyadh ( **Alghamdi. Et al ; 2014**)

Thyroid nodule presenting as either a solitary nodule or a multinodular goiter (**Mazzafferri; 2004**). Most of thyroid nodules are more common in women. One or more palpable thyroid nodules affect 4% of the adult population; most of these nodules are benign (**Rossi; 2006**). Majority of solitary nodules of the thyroid proved to be localized, non-neoplastic conditions (**Mazzafferri; 2004**). Likewise, our results confirmed this fact as most of our patients with solitary nodules were found negative for malignancy.

In the present study, it was found that the cancer was more more frequent in males (75%) than females (25%). Similar results were obtained by (Hussein et al 2013). Considerable geographical variations were present in thyroid cancer incidence in Saudi Arabia.(**Bazarbashi et al ; 2008**).

In the present study, most of the patients with hyperthyroidism were complaining of palpitation (87.7%) and tremors (63.2%)

About half of the case ( 49.1% ) had weight loss and (35.1%) had sweating .Others had exophthalmos , goiter , exophthalmos and irritability .Similarly symptoms recorded by (**Michelageli et al ,200** ) were palpitation, tremors and weight loss each were over 50%. Other symptoms recorded included excessive sweating (45%), heat intolerance (31%), and nervousness (27%). On the hand, exophthalmos, tremors, and tachycardia ranked top on the list of clinical signs representing over 40% for each. However they added clinical manifestation that not included in the present work which were Proximal myopathy ( 8% ) and atrial fibrillation (4%) of patients. Graves' ophthalmopathy in their study was noted in 54% of their patients.

### Conclusion:-

Thyroid disorders are common in Alkharj province especially in females .The pattern is more or less similar to that detected in other Saudi cities. Goiter and malignant thyroid are more common in males .

**Recommendation:-**

More studies should be carried out in Alkharj province to stress on the individual thyroid disorder so as more comprehensive studies could be obtained.

**Limitation of the Study:-**

This hospital-based retrospective study, included those attended the university hospital only . To represent Alkharj province as a whole, the study should extend to cover more areas of Alkharj province especially the remote villages.

**Acknowledgment:-**

We would like to thank doctor Mohamed Abdelrazik, the assistant professor of general surgery for his continuous help and support to get the patients' files and registries .

**References:-**

1. Abdul Rahman Al-Nuaim, MB, FRCP(C), FACP; Yagob Al-Mazrou, MB, PhD, FRCGP; Mohammed Kamel, MB, MD Omer Al-Attas, PhD; Nasser Al- Daghari, MSc; Riyadh Sulimani, MB, FRCP(C), FAC IODINE DEFICIENCY IN SAUDI ARABIA Ann Saudi Med 1997;17(3):293-297.
2. Abdul Shakoor SA1, Hawkins R, Kua SY, Ching ME, Dalan R. Natural history and comorbidities of subjects with subclinical hyperthyroidism: analysis at a tertiary hospital setting. Ann Acad Med Singapore. 2014 Oct;43(10):506-10.
3. Abu-Eshy, S.A., Al-Shehri, M.Y., Khan, A., Khan, G.M., Al- Humidi, M.A., Maltani, T.S. (1994): Causes of goiter in the Asir region: a histopathological analysis of 361 cases. Ann Saudi Med. 11:285-288.
4. AL Bouq, Y., Fazili, F.M., Gaffar, H.A. (2006): The Current Pattern of Surgically treated Thyroid diseases in the Medinah region of Saudi Arabia. JK-Practitioner, 13(1):9-14 Ozean Journal of Applied Sciences 1(1), 2008.
5. Akbar DH, Ahmed MM, Al-Mughles J. Thyroid dysfunction and thyroid autoimmunity in Saudi type 2 diabetics. Acta Diabetol 2006;43:14e8.
6. Alghamdi IG1, Hussain II, Alghamdi MS, Dohal AA, Almalki SS, El-Sheemy MAJ Immigr Minor Health. The Incidence Rate of Thyroid Cancer Among Women in Saudi Arabia: An Observational Descriptive Epidemiological Analysis of Data from Saudi Cancer Registry 2001-2008. 2014 May 25. [Epub ahead of print].
7. Al-Hureibi KA, Abdulmughni YA, AlHureibi MA, Al- Hureibi YA, Ghafoor MA. The epidemiology, pathology, and management of thyroid cancer in Yemen. Ann Saudi Med 2004 March;24(2):119-.
8. Al-Tameem MM. (1987): The pattern of surgically treated thyroid disease in two general hospitals in Riyadh. Saudi Med J, 8:61-66.
9. Alzahrani, A.S., Aldasouqi, S., Abdel Salam, S., Sultan, A. (2005): Autoimmune thyroid disease with fluctuating thyroid function. PLOS Med. 2:401-403
10. Bazarbashi S. Saudi Cancer Registry. Cancer Incidence Report 2004. Riyadh (KSA): Saudi Cancer Registry; 2008. p. 1-98.
11. Belfiore A, LaRosa GL, LaPorta GA, (1992): Cancer risk in patients with cold thyroid nodules: relevance of iodine intake, sex, age, and multinodularity. Am J Med .93:363-369.
12. Dodd NS and Samuel AM. (1993): Iodine deficiency in adolescents from Bombay slums. Natl Med J India, 6(3):110-113.
13. Elahi S, Manzoor-ul-Hassan A, Syed Z, Nazeer L, Nagra SA and Hyder SW (2005): A study of goiter among female adolescents referred to centre for nuclear medicine, Lahore. Pak J Med Sci. 21(1): 56- 62.
14. El-May MV, Bourdoux P, Ben SF, Ben AM, Mtimet S. (1997): Fairly elevated incidence of goiters with marginally low urinary iodine in adolescents living in the northwestern part of Tunisia. Eur J Epidemiol, 13(3):363-365.
15. Flynn R. W. V., T. M. MacDonald, A. D. Morris, R. T. Jung, and G. P. Leese, "The thyroid epidemiology, audit, and research study: thyroid dysfunction in the general population," Journal of Clinical Endocrinology and Metabolism, vol. 89, no. 8, pp. 3879-3884, 2004. View at Publisher • View at Google Scholar • View at Scopus.
16. Griffith, R.W. (1999): Thyroid conditions in older patients. Practitioner, 243: 214-221. Nasr HA. (1983): Surgically treated goiter at King Abdulaziz University Hospital, Jeddah , Saudi Arabia ,8th Saudi Medical Conference, 1983 (Abstracts). King Khalid Academy, Riyadh, P.78.
17. Hanna CE and LaFranchi SH. (2002): Adolescent thyroid disorders. Adolesc Med , 13:13-35.

19. Hussain F1, Iqbal S, Mehmood A, Bazarbashi S, ElHassan T, Chaudhri N. Hematol Oncol Stem Cell Ther. Incidence of thyroid cancer in the Kingdom of Saudi Arabia, 2000-2010. 2013 Jun;6(2):58-64. doi: 10.1016/j.hemonc.2013.05.004. Epub 2013 Jun 10.
20. Knudsen N, Bulow I, Jorgensen T, Laurberg P, Ovesen L and Perrild H. (2000): Comparative study of thyroid function and types of thyroid dysfunction in two areas in Denmark with slightly different iodine status. Eur J Endocrinol, 143: 485-491.
22. Koriech OM, Al Kuhaymi R. (1988) :Thyroid cancer: clinicopathological study of 113 cases In Saudi Arabia. Saudi Med J;9:188-193.
23. Koutras DA. (2001): Thyroid nodules in children and adolescents: consequences in adult life. J Pediatr Endocrinol Metab, 14 (Suppl 5):1283-1287.
24. LaFranchi S. (1994): Adolescent thyroid disorders. Adolesc Med, 5(1):65-86. Memonab, A. (2004): Family history of benign thyroid disease and cancer and risk of thyroid cancer. Eur. J. Cancer 40:754-760.
25. Maitra A, Abbas AK. The endocrine system. In, Kumar V, Abbas AK, Fausto N. Robbins and Cotran, Pathologic basis of disease. 7th ed Elsevier Saunders 2005. ch:24, 1155 -1226. 2008.
26. Martin I Surks, MD Clinical manifestations of hypothyroidism Aug 13, 2013.
27. Mazzaferri; 2004 Thyroid Cancer in Thyroid Nodules: Finding a Needle in the Haystack," The American Journal of Medicine, Vol. 93, No. 4, 1992, pp. 359-362. doi:10.1016/0002-9343(92)90163-6.
28. Michelageli VP, Pawape G, Sinha A, Ongugu K, Linge D, Sengupta SH, et al. Clinical features and pathogenesis of thyrotoxicosis in adult Melanesians in Papua New Guinea. Clin Endocrinol (Oxf) 2000; 52: 261-6.
29. Morganti S, Ceda GP, Sacconi M et al Thyroid disease in the elderly: sex-related differences in clinical expression. J Endocrinol Invest 2005;28(11 Suppl Proceedings):101-4.
30. National Cancer Registry. Cancer incidence report Saudi Arabia 1997-1998. National Cancer Registry 2001: 28-9
31. Ordoorkhani A, Mirmiran P, Najafi R, Hedayati M, Azizi F. (2003): Congenital hypothyroidism in Iran. Indian J Pediatr.; 70(8):625-628.
32. Rallison ML, Dobyns BM, Meikle AW, Bishop M, Lyon JL, Stevens W. (1991): Natural history of thyroid abnormalities: prevalence, incidence and regression of thyroid diseases in adolescents and young adults. Am J Med, 91(4):363-370.
33. Rossi ED, Raffaelli M, Mule, A et al Simultaneous immunohistochemical expression of HBME-1 and galectin-3 differentiates papillary carcinomas from hyperfunctioning thyroid nodule of the thyroid. Histopathology 2006 June;48(7):795-800.
34. Rossi RL, Nieroda C, Cady B, Wool MS. (1985): Malignancies of the thyroid gland in the Lahey Clinic experience. Surg Clin N Am ;65:211-229.
35. Sulimani RA, Al-Attas OS, Ali ME, El-Desouki M, Al- Nuaim AA, Al-Sekait MA. (1995): The prevalence of endemic goiters among schoolchildren and adolescents in Gizan, Saudi Arabia. Saudi Med J., 16(4):291-293.
36. Takasu N, Yamada T, Sato A, Nakagawa M, Komiya I. (1990): Graves' disease following hypothyroidism due to Hashimoto's disease: Studies of eight cases. Clin Endocrinol (Oxf) 33: 687-698
37. Wintergerst K, Gembel G, Kreipe T, Zeller P, Eugster E, Young B, Andruszewski K, Kleyn M, Cunningham T, Fawbush S, Vanderburg N, Sockalosky J, Menon R, Linard S, Hoffman G, Gorman L Congenital Hypothyroidism Long-Term Follow-up Project: Navigating the Rough Waters of a Multi-Center, Multi-State Public Health Project. J Genet Couns. 2014 Nov 18.



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### RESEARCH ARTICLE

## EVALUATION TOOL FOR THE FORCASTING INITIAL EVALUATION OF SCHOOL ENVIRONMENTAL PROJECTS: A CASE STUDY.

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### Abstract

Evaluation is an integral part of teaching and learning process focusing on actual teaching practice, deeply transformative force in society, offering feedback and optimization to the teaching activities. The carried out research was a qualitative approach to the initial primary, forecasting, diagnostic evaluation of school environmental projects, focusing to the needs of stakeholders and participants, the recording of objectives, type and model, schedule and budget of evaluation giving emphasis to the service or not of requirements and expectations of the project stakeholders, the used methodology and the materialized activities that matches the objectives. An Evaluation Tool for the forecasting evaluation of school projects of Environmental Education developed to serve the needs of the research.

The design of evaluation, especially the forecasting initial evaluation, is extremely neglected in Greek SPEEs which submitted for approval of implementation in Secondary Education of Crete, also in the rest regions of Greece as bibliographic research appealed, mainly attributed to the type of the used Application Form which needs upgrade, also to the lack of the proper teachers' training. In order to design educational interventions in the Greek schools of the 21st century with aims-centered characteristics, innovative, sustainable, integration and digital, the School Projects of Environmental Education, need to be materialized in more comprehensive framework with detailed templates of Application Form and Final Report by well-educated teachers.

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### Introduction:-

Evaluation and inspection systems can provide valuable feedback to the schools, to build upon the didactic and pedagogical achievements and meet the educational changing needs. Evaluation is treated as an integral part of the teaching and learning process and focuses on actual teaching practice, deeply transformative force in society, offering feedback and optimization of processes. European Parliament and Council set up, in 2001, the framework of school evaluation processes with the recommendation to the Member States to establish transparent quality assurance systems and encourage school communities to create a balanced framework of school self-assessments, and any external evaluations. Next years must be involved stakeholders in all processes which can disseminate good practices and achievements of knowledge and experience (EC, 2007).

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The success of a school project of Education for the Sustainable Development (ESD) attributed to many factors, among them are good and decentralized project management, interdisciplinary approach, team work, attainable outcomes, professional core tasks, analytical definition of the project, appropriate indicators of success, initial well defining of the problem, working with real problems, capacity building of participants who will work as facilitators rather than teachers, initial training change agents, understanding sustainability of the school and local community, develop visions and alternative ideas for a sustainable future (Hesselink et al, 2000). Obviously, like any project, an ESD project needs to be organized and managed in a professional way in order to obtain the expected results. But considering that ESD projects are often very complex in nature, because many actors and interests are mostly involved, professional project management becomes even more essential for achieving goals, and this type of management needs very well organized primary and forecasting evaluation in the design phase.

Several studies are internationally referred to theoretical approaches, types, methods, techniques and evaluation plans of Environmental Education (EE) with indicators/criteria, that most have been used in the educational evaluation, mainly concern the performance of students. Design and planning criteria of school educational projects are developing rapidly in recent years, specializing in criteria of framework or input, process, outcome, divided into general and particular, depending on the reference range on the faces of the evaluating objects. High care is required in the entire evaluation in terms of validity, reliability, persuasiveness, acceptance, use and ultimately usefulness of the selecting criteria, depends primarily on their accuracy and appropriateness (Dimitropoulos, 1999).

Since students have a strong natural interest about the environment, helping them to conduct research on environmental issues, and following up on the research with action as responsible citizens, is an effective way to create broader environmental knowledge. By investigating and evaluating environmental issues and actions, they improve science learning and teaching in conjunction with current school curriculum, and develop tools to investigate and evaluate environmental issues of environmental education quality standards (Hungerford et al, 1996). EE needs equipped teachers with skills of mentoring, discussion and dialogue, cooperation and work in groups, to encourage students to participate in discussions and connect the lesson with prior knowledge and experiences, with the school curricula, supporting them to construct critical and creative thinking, bring them in reflection processes and self-evaluation (EC, 2007).

Due to educational research, our concepts of learning continue to evolve, but there is still a long way until the lessons from research are fully assimilated in the teaching methods and the school organization (EC, 2007). Forecasting evaluation, as initial assessment of school educational projects has to be carried out in the startup phase of the projects to estimate variables and resources related to the design and structuring, to the human and economic resources, to the ways of cultivating values and behaviors for the personal development of the participants and the progress of the school and local community. It allows the evaluator to focus on specific characteristics, parameters and procedures in order to recognize interactions and problems from the beginning, in the planning phase of project (Koutouzis & Chatziefstratiou, 1999). The forecasting evaluation can be carried out in the school forum, at a school conference, with an open discussion of all those who intend to participate in the project, or by a committee of students and teachers. They may set specific criteria or simply the evaluation questions about the topic, the content, the aims, the methodology and the actions that will be developed in the SPEE. Some questions that can be set from the outset of the design in the construction phase of the project can be: why is the topic interesting for me, to school? How the decision was made for dealing with this issue? How to check whether the project objectives can be achieved and to what extent? Is there correspondence to the project goals and actions to the school curricula? What will be the new knowledge I'll acquire? How this knowledge will be useful to me personally, to my peers, at school, in society at local, national and global level? Is there anything that would change in the design of the project and what is that? Will be the project method useful and appropriate for approaching this issue-Why? (NTUA, 2007; EKDDA, 2012).

In Greek secondary schools, EE is applied, volunteered, beyond the obligatory timetable, guided by the Greek Ministry of Education (Circular YPEPTH Doc. Ref. 117 302 / C7 / 19.10.2007) and the local Educational Administrations. Regarding the materialized SPEEs every school year, the most of them are not evaluated at all, relies on teachers good disposition, since the evaluation is proposed-not imposed (Mavrikaki, 2001). The evaluation, as part of the project, is not included in the Application Form of SPEEs (AF-B), not even mentioned in the designing of the projects. Generally, in SPEEs, the greater weight is given to the activities and the implementation procedure and not to the primary, formative or final evaluation (Zygouri, 2005; Mavrikaki, 2001; Kalathaki & Sfakianaki,

2008). In this research, SPEEs of Heraklion (Crete, Greece) were checked if initial evaluation, as forecasting, had been taken place in the planning and structuring phase.

### Method:-

The describing research is a qualitative approach of the evaluation design the primary phase of SPEEs planning. In the research, SPEEs that materialized in school year 2005-2006 in Heraklion (Crete) Secondary Education, were checked on the prediction of evaluation in their planning and structuring phase, if they had incorporated a forecasting evaluation as assessment of important factors with sequent effectiveness and reflection to the participants, stakeholders, aims and actions of SPEEs.

The research sub-queries concern the prediction of the process and techniques of the projects' evaluation, more specifically the analysis of needs, the recording of the objectives matched to the planned activities, the selection of type and model, the educational schedule and budget. Greek Centre of Public Administration and Local Government (EKDDA, 2012) has established indicators for assessment programs, following some of them are gleaned those are relevant to the initial/forecasting evaluation of SPEEs. These indicators help in the creation of research questions and sub-queries about the existence or not of the initial/diagnostic evaluation in SPEEs, oriented to: a. satisfaction of personal interest and objectives of the school curricula and strategic objectives, b. completeness, communicability, organization, activation interest, cooperation, educational materials, training methods for teachers, c. open to participation with timely information on participation, support the implementation by management of the school, cooperation and support by the school-the program is hypothesis of the whole school community, d. infrastructure for implementation, visual aids, access to resources and materials.

Twelve specific criteria were developed in the applied Tool (Table 1) for the initial evaluation of SPEEs, with four research objects, regarding the evaluation design and planning in order to reveal if they are aims-centered, innovative, sustainable, participative and digital, if they have designed in accordance to the principles of EE and ESD. The Tool is suitable for qualitative approaches of primary/forecasting/diagnostic evaluation of SPEEs, focusing to the needs of stakeholders and participants, the recording of objectives, type and model, schedule and budget of evaluation. In the construction of the evaluation Tool, were took into consideration the principles for design and evaluation of SPEEs from Greek literacy of EE (Flogaiti, 1993; Zygouri, 2005; Flogaiti, 2006; NTUA, 2007; Aegean, 2004), the objectives and methodology as expressed in the Tbilisi conference (1977) and Thessaloniki (1997) (UNESCO, 2004) and quality indicators developed by UNESE experts (UNECE, 2006) and Frangoulis (2006), also the Evaluation Tool of the environmental teachers' training projects regarding the determination of requirements for the SPEEs implementation (Kalathaki, 2015).

**Table 1:-**Evaluation tool for the forecasting evaluation of school environmental education projects (SPEES)

<b>1 PRACTICAL ISSUES OF APPLYING THE FORECASTING EVALUATION</b>
a. who will carry out the forecasting evaluation procedure (school forum, open discussion, committee of students and teachers)
b. establishing monitoring and evaluation indicators and criteria (input, process, outcome, attainable outcomes, professional core tasks, transparent and balanced framework )
c. timing of the project's actions
<b>2. SERVICE OF REQUIREMENTS AND EXPECTATIONS OF THE STAKEHOLDERS</b>
a. of the operator of the project implementation (school, educational directorate)
b. of the participants to the project (students, teachers, local authorities, bodies, scientists, organizations, universities, enterprises, etc.)
c. of the recipients of the project results and evaluation report (school and local community, educational authorities, acceptance, use and ultimately usefulness)
<b>3. METHODOLOGY OF THE FORECASTING EVALUATION</b>
a. the selection of the type and model of evaluation (primitive, formative, final, self-assessment)
b. the links to the school curricula (divided into general and particular, interdisciplinary, modern characteristics, ICTs)
c. valuation of the project objectives (knowledge, skills, values, principles of Education for the Sustainable Development), setting evaluation's objectives
d. efficiency of available resources (educators, economical support, infrastructure)
<b>4. RELEVANCE OF OBJECTIVES AND ACTIVITIES</b>
a. educational activities,

## b. social and environmental interpretive actions.

The Tool applied in the archival material of 22 SPEEs, printed and digital, of the Application Forms (AF) and Final Reports (FR) for content analysis (Cohen & Manion, 1994; Bell, 1997; Iosifidis, 2003). The AFs were of two types A and B, because 8 of the studied SPEEs were funded, also, by Aegean University which required specific type of Application Form (AF-A), more analytical. The AF-B is the demanding type by the Greek Ministry of Education.

The applied research criteria of the Tool are referred to the stakeholders and participants of the project, the educational objectives and actions, the requirements and usefulness of the project, the type and model of the evaluation, concerning the beginning of the project: 1. Practical Issues of applying the Forecasting evaluation: a. who will carry out the forecasting evaluation procedure, b. establishing monitoring and evaluation indicators and criteria, c. timing of the project's actions, 2. Service of requirements and expectations of the stakeholders: a. the operator of the project implementation, b. the participants to the project and c. the recipients of the project results and evaluation report. 3. Methodology of the forecasting evaluation regarding: a. the selection of the type and model of evaluation, b. the links to the school curricula, c. valuation of the project objectives, 4. Relevance of objectives and activities: a. educational activities, b. social and environmental interpretive actions.

### **Results and Findings:-**

As the research revealed, there is not planned evaluation process in the initial design of the studied SPEEs. Greek Ministry of Education does not request in the AFs-B explanations on who, why and what in SPEEs' evaluation.

### **Practical issues of applying the forecasting evaluation:-**

#### **Who will carry out the forecasting evaluation procedure?**

The forecasting evaluation can be carried out in the school forum, at a school conference, with an open discussion of all those who intend to participate in the project, or by a committee of students and teachers. The asked evaluation in the AF-Bs is only indicative, (circular YPEPTH, 2007), where requested to complete the question "Who will do the evaluation of SPEE? (From A. Students/Self-assessment, B. Teachers). In the studied SPEEs, teachers had to select the type of planning evaluation in the project by clicking only the option, they had nothing to describe and explain about. The proposed AFs-A template by Aegean University was more detailed and demanding than the Greek Ministry of Education AF-B, it was more thorough fulfilling about the project evaluation. It asked the type of Evaluation a. primitive/forecasting, b. formative c. final and possible uses of the project evaluation findings (Aegean, 2004).

Similarly, in FRs, which have not a template as AFs had, teachers did not make systematic evaluation, they express particularly evaluative judgments, in relation to what they experienced themselves and gained their students, mainly in the final phase of SPEEs. Also, there were not any data from SPEEs' archives justifying the need of their evaluation. Lack of systematic evaluation in SPEEs of Secondary Education of Lasithi prefecture of Crete pointed also Drakonaki (2006), where only 5% of SPEEs had evaluation and that was on final evaluation. In 70% of SPEEs, the teachers did rudimentary judgments, since most of them had not thought to evaluate their project. Generally, evaluation in SPEEs which are materialized in Secondary Education in Greece, where it carried out, is empirical and inadequate, with no evidence whether the projects are effective or not (Zygouri, 2005).

#### **Establishing monitoring and evaluation indicators and criteria:-**

The indicator framework for educational projects should facilitate clear and transparent reporting, also effective communication about the objectives and achievements of each stage of implementation. UN (2015) established thematic Indicators to Monitor the Education 2030 Agenda by the Technical Advisory Group Proposal, October 2015, of ESD and global citizenship education (GCE), new territories, and with differences in approach, for developing comparable indicators. Among the indicators, at the level of measuring inputs, it could be measured the extent to which elements of ESD/GCE are found in curricula as subjects and approaches to learning. At the level of measuring knowledge, there is consensus that progress in the acquisition of knowledge and skills related to SD and global citizenship needs to be monitored, even if it is not linked to changes in attitudes and behaviors, linked to the age group.



**Timing of the project's actions:-**

The evaluation will answer when and whether the expected outcomes of the project have been realized also when and whether the expectations of the schools and the participants have been met. There was no evidence for the alignment control of the assessment timing with the project completion deadlines.

**Service of Requirements and Expectations of Stakeholders:-**

The project proposal must include adequate activities to evaluate the outcomes of the individuals and the project as a whole. So, the project plan ought to provide information on the impact expected on the students, teachers and others, and on the school overall. Also it has to make suggestions to how the school will integrate the competences and experiences that will be acquired through the project materialization (Erasmus, 2014).

**Forecasting Evaluation concerning the Operator of Implementation:-**

Public dialogue increasingly revolves around the request of schools' cooperation with other bodies and organizations. Evaluation and inspection systems can provide valuable feedback to school to build upon, not only its achievements but also the benefits of the total school community, and meet changing needs. Unfortunately, parents, students and other members of school and local communities are involved less and less often in the school projects and evaluations than teachers and school councils (EC, 2007).

Needs and expectations of the project operator, that is the school and school community, and wider the Educational Administration of Crete, were not recorded in any of the researched SPEEs. Also, there were no relevant evidence, indicating ways thought the implemented SPEEs to response to the requirements of the award and funding bodies, or even the evaluation's, recipients which are, among the others, the collaborative institutions, organizations, bodies and citizens. In no project sought persons available to engage in the evaluation process, even the comfortable periods for applying evaluation. No data was about the efficiency of educators and human resources in connection with the use of infrastructure and other available resources. Also, no explanation had been on how the school will integrate the competences and experiences acquired by the project in its strategic development in the future (Erasmus, 2016).

**Forecasting Evaluation concerning the Participants:-**

Primarily, it has to be answered the number of people will be affected by the outcomes of the project and how will be achieved this number. The proposal is good to identifies and addresses clearly the specified needs of the applicant school in terms of educational development of students and teachers. It also has to be described how the project will be aligned with the profile of the students and teachers who will materialize the project (Erasmus, 2014). Teachers, by investigating and evaluating environmental issues and actions, get students to think for themselves and to analyze their own ideas and teach the learners how, not only what, to think (Hungerford et al, 1996).

Given the empirically proved importance of the teacher education, educator in the inspiration and formation of the teacher, in teacher education, the educator is an extremely marginalized part of research (cf. Van der Walt et al., 2011). The reality of increasingly multicultural society's worldwide necessitates the inclusion of multicultural and intercultural education in teacher education programs. This entails not only a knowledge of other cultures and their cultural heritage, but is also a matter of attitude of creating intercultural sensitivity (Wolhuter, 2011). There is also the issue of making teacher education accessible to members of the entire spectrum of cultural groups. Some intellectuals of the EE area believe that ESD should not just focus on school audiences, but also and perhaps foremost on situations where informal and non-formal education takes places, i.e., the workplace, recreation areas, people's homes, etc., as well as in policy and decision making processes. Some even prefer to speak of learning rather than of education. Since, in their eyes, education has strong connotations with in-school and formal learning whereas, the 'broader' concept of learning refers to learning taking place at all levels in all situations formal, informal and non-formal (Hesselink et al, 2000). Having this point of view for SPEEs, teachers need suitable education and training to receive before they undertake the implementation of a SPEE. There were no evidence in the researched archival material about training and education of teachers and whom they would consult and support professionally on designing and implementing the project and especially the evaluation. In a metacognitive approach of the evaluation applied in the studied SPEEs, about the same archival material, Kalathaki and Sfakianaki (2008) remarked to have a substantial positive impact on the participants' competences and future professional practice.

In the studied archival material, it was not mentioned needs and expectations of students and teachers who participated in the project on their specified investigation of needs of the target populations. The survey of Aggelidou & Kritikou (2006) reported data on the non-satisfaction of the teachers' expectations who participated in

the SPEEs materialized in Secondary Education of Attica and who, in the following years, did not participate in new. They related their attitude, mainly, to difficulties and adversities of the school environment, generally in inadequate support of the projects by the school directors, the colleagues and the Educational Administration which could have been avoided with a better initial/forecasting evaluation of the implemented SPEEs.

#### **Initial Evaluation concerning the Recipients of the Evaluation Results:-**

Identification of the recipients of results and conclusions of the project's evaluation is important element of the project. It was requested to be recorded in the AFs-A, not in the simpler AFs-B. In this criterion, analogies found to the recordings of the recipients of the project results, even it was not given concrete recipients' description and categorizations of the conclusions in AFs and FRs, not even their fitted profile to the project (Ioannidou et al, 2005).

The objectives of the evaluation does not necessarily coincide with the educational objectives of the project. In forecasting evaluation as primary assessment, usually carried out an initial investigation of the level of the aims' satisfaction and the results may lead to a redefinition of the objectives, methods, partners, even of the project scope. Regarding the service of the purpose and objectives of SPEEs evaluation, no recordings of evaluation targets were detected in the AFs-B and FRs of the studied projects. In the AFs-A there is a special field on the utilization of the findings of the evaluation, with widespread references of joint drafting and/or general information on the projects' objectives, the used educational techniques to achieve these goals, but without clear assignments of the initial evaluation of these objectives and the methodological tools. In all AFs-A becomes clear definition of additional knowledge, but not participants' skills that each SPEE aimed to provide, with clarity in the wording of cognitive and psychomotor objectives and how to evaluate them during all phases of project materialization.

In educational projects' design, must be also assessed the structuring and the project development, so the findings of the evaluation to be useful in the future to redesign the educational process, when repeated (Koutouzis&Chatziefstratiou, 1999). Below are some excerpts from the AF-As of two projects. The program A7 had aims, among the others, *"identifying processes to bridge the gaps and reconstruction of distortion of the practical-experiential knowledge, exchange of information, processing and synthesis of materials, further facilitate planning, control, comparison of views, proposals configuration authority"*. In the program A8 was written *"The exploitation of the program will be done first by the school environmental team, as group experience. Also can be used by other teachers and schools"*.

#### **Methodology of the Forecasting Evaluation:-**

UNESCO (2012) proposes teaching with multiple perspective approach. Eight complementary and specifically approaches are selected, as of high importance, for understanding the complexity of the world today, for understanding long-standing global inequities and problems, and for their appropriateness for secondary students. They are scientific, historical, geographic, human rights, gender equality, values, cultural diversity and sustainability perspectives.

#### **Selection of the type and the model of evaluation:-**

There were not retrieved data from the AFs-B and the FRs to answer this criterion of selection the type and the model of evaluation (Vergidis&Karalis, 1999). Only the 8 AFs-A approved for funding by the Aegean University had descriptions in special field about initial, formative and final evaluation of SPEEs, to report and analyze the type, means and utilization of project evaluation. It was the same teachers who completed the two types of AFs, but, because it was not requested in the AF-B, they had not made any reference on this matter. In the FRs of the SPEEs, fragmentary evaluation elements were noticed. Only one program, A5, proposed in AF-A to materialize external evaluation: *"Evaluation by third parties with a questionnaire during the presentation of the project"*. In the AF-A of the project A1 designed *"Monitoring of the change, if any, to the knowledge, attitudes and behaviors of students"*. In the AF-A of the project A3, during the initial evaluation planned to be done *"Detection of particular inclinations and skills of the students to take into account of the division of labor ("students as painters, actors, lyricists")*.

The self-evaluation, from the beginning to the end of the SPEE, does not aim to control, but improving quality of educational work. It motivates all school factors, engages many people in joint determined actions, commits towards predetermined designs, builds collaborative behaviors, concrete problems and suggests areas for self-education and training (Papaioannou, 2013). No self-evaluation references were detected in the studied SPEEs.

**Project's links to the school curricula:-**

All school projects' results ought to be incorporated in the management and pedagogical, curricular framework and practice of the school. Applying in SPEEs the characteristics of new curriculums of the 2010 Greek educational reforming of Greek schools called 'New School', the projects, as all educational activities, must be aims-centered, innovative, sustainable, integration and digital. More analytically, a. the aims-centered projects propose objectives relating not only to building knowledge, but also to develop skills and desirable attitudes, b. the innovative projects put the focus of learning process on the students and their contribution to the initiation in research procedures and processes that promote scientific way of working and thinking ("young scientists" or "young investigators"), has a proper evaluation, etc., c. the sustainable projects help people to become sensitive to environmental issues and stakeholders for the sustainable development, d. the integration projects adopt collaborative teaching and learning processes by fostering responsibility, honesty, mutual aid, self-confidence and acceptance of the other, of the different, e. the digital projects adequately integrate ICTs to achieve specific learning objectives (PI, 2011). As Information and Communication Technologies (ICTs) have an enormous potential to support autonomous learning, the collaborative construction of knowledge and skills development, they must be exploited, in the higher possible degree, in all educational projects (EC, 2007). There were no references on the assessment of the researched archival material regarding the above characteristics in the projects' design. Of course the projects had some or all the above characteristics, indications immersed from the describing materialized activities, but hadn't not expressly referred in the AFs or elsewhere as initial/forecasting valuation approach.

**Evaluation of the project objectives:-**

In EE are evaluated/assessed individuals, resources and procedures. Evaluation items of SPEEs (Dimitriou, 2007) may be the knowledge, skills for the recognition of environmental issues and the mesh of relationships that create them (values, attitudes, physical, social, economic, cultural factors), skills to investigate environmental problems (data collection from various sources of information, data synthesis for investigating problems, recognition alternatives), attitudes, values, participation and possibility to take action to protect the environment. The targets of the projects should be clear, concrete and realistic because lack of clarity of objectives is one of the major causes of ESD projects going astray (Hesselink et al, 2000).

The SD agenda calls for an explicit focus on equity, including equity-specific goals on gender equity and reductions in inequalities. In response, education indicators should aim to capture variation across different sections of the population defined by group and individual characteristics, such as sex, wealth, location, ethnicity, language or disability, and combinations of these characteristics (UNESCO 2012; UN, 2015). 'The Future We Want' Conference's outcome document emphasizes the importance of greater international cooperation to improve access to Education including through building and strengthening education infrastructure, increasing investment in Education, particularly to improve the quality of Education for all in developing countries (Rio+20, 2012). It encourages international education exchanges and partnerships, including the creation of fellowships and scholarships to help achieve global education goals.

Where evidence retrieved about the type of SPEEs evaluation, revealed that the evaluation is independent from the project objectives, is not systematic and written only the positive outcomes that experienced students and teachers. In the FR of the project A3, teacher says that *"The environmental team having put high goals, I think, that has managed to achieve them"*. According to Mager (in Aegean/spee, 2004), when didactic aims formulated, they must respond to the questions of what the participants must be able to do (activity), under what conditions they can do it (conditions) and how well has to do it (criteria).

**Efficiency of available resources:-**

Forecasting evaluation of the efficiency and efficacy of the available resources for the project materialization, such as educators, economical support, infrastructure is fundamental for SPEEs implementation because the planned educational actions are usually much demanded and uncommon to the used school methodology of lessons and educational projects. All AFs had forecasting budget for the economic needs of the studied SPEEs. The AFs-A had analytical budget records and some explanations on the monitoring mechanism of the economic potential of the project with the estimated materials of type, quantity, cost, transportation on how many and who, publications, and in a few of them about the forecasting revenue. The AF-B had records about the total amount and, in some cases partial needs. In FRs there were no references about the way they work in order to support economically the project actions which constitutes part of forecasting evaluation.

### **Relevance of Objectives and Activities:-**

Specifying the relevance of objectives and activities, the educational activities ought to match the objectives. Programing of activities has to be clearly defined, comprehensive and realistic, matched to the capacity of the participating organizations (Erasmus, 2016). The planned activities must versus needs with a prediction about what will be future activities matching the identifying needs and objectives. With the educational activities and actions in social and environmental interventions, in the school and the society, communication becomes a broader concept in dissemination and exploitation of the project results, with the information and promotion activities to raise awareness and enhance the visibility of the project's activities (Erasmus, 2016).

When objectives set out at the levels of ecological foundation, at the level of conceptual education for environmental consciousness and shaping environmental attitudes, at the level of life and action skills with eco-management level greatly assist the selection of appropriate activities to achieve effectively them (Zachariou, 2007).

In order more effectively to be achieved the objectives of SPEEs, would be selected appropriate pedagogical, teaching methods and instructional materials, especially active participatory methods in interdisciplinary, multidisciplinary and holistic approach of the issue. To this contribute, also, the clear definition of the objectives and the determination of the type, model, methods and assessment techniques which will be applied from the beginning of the process.

### **Educational activities:-**

The subject content of ESD needs proper understanding, taught with learner-centered methods, communication at a mutually agreed time between the teacher and the environmental team, benefiting effectively of issues involved in the renewal of a common world (Ojedokun, 2012). The educational activities must negotiate issues at a more detailed level than simple information, such may be visits, magazine publishing, seminars, educational projects on television, educational videos, etc. (Aegean, 2004).

The educational software applications, which are frequently used to cultivate knowledge and skills in various issues of SPEEs, is special software with clear learning and teaching purposes in various forms of multimedia applications and robotics, applets or general software, mostly web2.0 technologies and applications. The study of FRs showed that all the phases of the projects had been properly developed, with many actions and activities, in order to achieve their objectives.

Over and above the dissemination of project results, the transfer of competences acquired during themobility and actively involvement of the participants are also of high educational importance for the project benefits.

### **Social and environmental interpretive actions:-**

Interpretative activities and actions serve the reveal of the physical processes to the learners with the presentation of complex and simpler issues at an understandable level to the general public, without the use of specified terminology. They include exhibitions, brochures, tours, pathways, lectures, presentations, voluntary environmental activities, etc. (Aegean, 2004; Katsikis, 2000). Useful tools in the design and implementation of such activities are the multimedia and Internet sites become a very flexible and powerful tool for disseminating educational activities. According to the annual Circular of Ministry of Education for Environmental Education, the basic principles to be designed the SPEEs' activities, are the interdisciplinary approach, the experiential approach, the opening of school to society, the development of democratic dialogue and the cultivation of critical thinking. As teacher El said, "Was an attempt to bring the school closer to the community, get to know the students the principles and institutions of public administration to manage growth, to learn about the management practices developed in areas of great ecological and cultural interest of the site and elsewhere." "The program aim (AF) was" to make students aware of the geophysical and cultural identity of the regions with different biodiversity than that of their place".

Democracy in schools also has a practical reason to exist as an effective way for creating a climate of confidence and responsibility within schools. The contribution of school staff, including teachers is key to the success of each school (EC, 2007).

### Conclusion:-

In SPEEs, evaluation is organic part of the project and assigned to weighty significance, since it is an inquiry educational process. In Greek Secondary Education, the evaluation in the educational process is limited and in this general climate, happens the inexistent initial evaluation of SPEEs. The carried out research was a qualitative approach to the initial, forecasting, diagnostic evaluation of school environmental projects, focusing to the needs of stakeholders and participants, the recording of objectives, type and model, schedule and budget of evaluation. As concluded from the research, the design of the evaluation is extremely neglected in SPEEs submitted for approval of implementation in Secondary Education, as none of the type of Application Forms (AFs) and Final Reports (FRs) had recordings about evaluation objectives, timetable and required financing when SPEEs were designed. This lack is, mainly, attributed to not requirement in the completion and submission of the AF-B to the local educational Administrations. The studied SPEEs not provide forecasting assessment of the expecting results in terms of the students themselves and the usually involved school and local community. Actually, this would be concomitant to the recording of students' and stakeholders' expectations from the educational project, if it carried out a primary research, at the beginning of the project designing, to reveal the needs and expectations of the school and local community, as it happens in Adult Education projects. Due to educational research, our concepts of learning continue to be evolved, but remains a long way until the outcomes from the international researches to be fully assimilated in teaching methods and school organization of Greek SPEEs.

### Recommendations:-

According to the research results and reported highlights of other researchers, it is required previously specialization and training of teachers in the design and implementation of evaluation process, particularly in setting the objectives, the choice of form and type, to select appropriate activities that match more effectively to the SPEEs' targets and the way they will be evaluated in the initial, formative and final level. The requested by the Greek Ministry of Education template of AF-B is substandard and needs upgrade, taken into consideration the Application Form (AF-A) suggested by Aegean University. In order to design aims-centered, innovative, sustainable, integration and digital environmental educational interventions in the Greek schools of the 21st century, need to prepare comprehensive frameworks with detailed project templates, by well-educated teachers. By evaluating and reflecting thoroughly the past we can looking more hopefully at the future.

### References:-

1. Aegean (2004) Project Management Guide "School Programs of Environmental Education", 2002-2006, Aegean University, available [www.Aegean/ee.gr](http://www.Aegean/ee.gr)
2. Aggelidou E. & Kritikou E. (2006) How is shaped the profile of teachers of Secondary Education of East Attica who permanently or temporarily stopped the implementation of environmental education programs, 2nd Congress of School Programs IP Athens 15-17 December 2006
3. Bell J. (1997) Methodological Design of Pedagogical and Social Research, Publications Gutenberg, Athens
4. Circular YPEPTH Doc. Ref. 117 302 / C7 / 19.10.2007, entitled: Design and implementation of School Activities program: Career Education, Environmental Education, Health Education, Cultural issues, Comenius-Leonardo da Vinci and eTwinning, Integrated Administrative Affairs Sector Studies, Education and Innovation, D / Directorate of Advisory Vocational Guidance and Educational Activities, section B of Environmental Education, Athens
5. Cohen, L. and Manion, L. (1994) Research Methods in Education (4th edn), London: Routledge
6. Dimitriou A. (2007) Evaluation of School Programs of Environmental Education, University Notes in the Postgraduate Program of Environmental Education, University of the Aegean, TEPAES, Rhodes
7. Dimitropoulos E. (1999) Evaluation of Education and Training Programs, the evaluator Guide, Gregory Publications, Athens
8. Drakonaki Ch. (2006) Environmental education in schools of Secondary Education of Lasithi, 2nd Congress of School Programs of Environmental Education, Athens 15-17 December 2006
9. EC (2007) Schools for the 21st Century, Working Paper of the European Commission Services, Brussels, 11.07.2007, SEC (2007) 1009, Available 23-09-2010 [http://ec.europa.eu/education/school21/consultdoc\\_el.pdf](http://ec.europa.eu/education/school21/consultdoc_el.pdf) and 29-01-2016 [http://e-learning.sch.gr/pluginfile.php/7824/mod\\_resource/content/0/GENIKO\\_MEROS/ENOTHTA\\_1/MATHIMA\\_1/SCHOOLS\\_FOR\\_THE\\_20TH\\_CENTURY.pdf](http://e-learning.sch.gr/pluginfile.php/7824/mod_resource/content/0/GENIKO_MEROS/ENOTHTA_1/MATHIMA_1/SCHOOLS_FOR_THE_20TH_CENTURY.pdf)
10. EKDDA (2012) Indicators for Programs' evaluation INEP, <http://www.ekdd.gr/ekdda/index.php/gr/2012-06-19-08-31-50/48-2012-06-29-12-10-45/118-2013-01-04-09-27-47>

11. Erasmus+ (2014) Guide for Experts on Quality Assessment, Actions managed by National Agencies, European Commission, Version 1: 26/02/2014, available 220416  
[http://jaunatne.gov.lv/sites/default/files/web/ErasmusPlus/2014/dokumenti/expert-guide\\_en\\_youth.pdf](http://jaunatne.gov.lv/sites/default/files/web/ErasmusPlus/2014/dokumenti/expert-guide_en_youth.pdf)
12. Erasmus (2016) Erasmus+ Programme Guide, Version 2 (2016),  
[https://eacea.ec.europa.eu/documents/eforms\\_en](https://eacea.ec.europa.eu/documents/eforms_en)
13. Flogaiti E. (1993) Environmental Education, Greek University Press
14. Flogaiti E. (2006) Education for Environment and Sustainability, publications Greek Letters, 2nd edition
15. Frangoulis I. (2006) Design and development of Quality Indicators for Evaluating Local History's Programs in Primary Education, 5th National Conference of Greek Pedagogical Society, Thessaloniki 24-26 November 2006
16. Hesselink F., Kempen P., and Wals A. (Editors), (2000) ESDebate: International debate on education for sustainable development, Commission on Education and Communication of IUCN - The World Conservation Union, IUCN Publications Services Unit, Switzerland
17. Hungerford H., Litherland R., Peyton R., Ramsey J. & Volk T. (1996), Investigating & Evaluating Environmental Issues & Actions, available 5-4-2007 on  
[http://www.classroomearth.org/classroomearth/programs/investigate\\_and\\_evaluate.cfm](http://www.classroomearth.org/classroomearth/programs/investigate_and_evaluate.cfm)
18. Ioannidou E., Kourou M., Tzelve-Anesti S. (2005), The Contribution of environmental education programs in the effectiveness of the school, 1st Conference of School Programs of Environmental Education, Corinthia 23-25 September 2005
19. Iosifidis Th. (2003) Qualitative Data Analysis in the Social Sciences, Kritiki Publications, Athens
20. Kalathaki M. & Sfakianaki M. (2008). Metacognitive approach of an evaluation inquiry of school projects of environmental education in prefecture of Heraklion, Proceedings of 4th Panhellenic Conference of PEEKPE under the auspices of the Ministry of Education, "Towards Sustainable Development, Natural Resources, Society, Environmental Education", Nafplio 12-14/12/2008, in electronic format on CD-ROM and on the website, <http://kpe-kastor.kas.sch.gr/peekpe4/proceedings/synedria11/kalathaki.pdf>
21. Kalathaki M (2015) Evaluation Tool for Teachers' Training Projects of Environmental Education, International Journal of Education, Macrothink Institute, ISSN 1948-5476, 2015, Vol. 7, No. 1, <http://www.macrothink.org/journal/index.php/ije/article/view/6927/5719>
22. Katsikis A., (2000), Environmental Education: Findings and configured orientations. Environmental Education in the Context of the 21st Century Education: Perspectives and Possibilities. Larisa: Primary Education UTH, pp. 101-110.
23. Koutouzis M., Chatziefstratiou I., (1999) Evaluation of the Educational Unit, in Administration of Educational Units-Social and European Dimension of Educational Administration, Volume III, Greek Open University, Patras, 1999
24. Mavrikaki E. (2001) The problem of the evaluation of school environmental education programs-Models, evaluation processes and proposals, Congress School Knowledge and Teaching in Primary Education, Ioannina
25. NTUA (2007) Educational material for Teachers and Executives Training Seminar of Environmental Education, EPEAEK II Writing Group with scientific responsible Professor Koutsopoulos K., National Technical University of Athens
26. Ojedokun E. O. (2012) Diffusing Education for Sustainability Into Teacher Education Programme in Nigeria: A Theory in Use, World Journal of Education, Vol. 2, No. 2; April 2012 doi:10.5430/wje.v2n2p109 URL: <http://dx.doi.org/10.5430/wje.v2n2p109>
27. Papaioannou (2013) Evaluation in Education, Management Proficiency Certificate National Centre for Public Administration and Decentralization (EKDDA)
28. PI (2011) Major Training Program, Basic Training Material, Volume A: General Part, Pedagogical Institute, Athens, available on <http://www.epimorfosi.edu.gr/>
29. Rio+20 (2012) "The Future We Want", Conference outcome document, Rio+20 United Nations Conference on Sustainable Development, Rio de Janeiro, 20-22 June 2012 <http://www.hellenicaid.gr/diethnes-plaisio/diethnes-plaisio/pagkosmia-diaskepse-gia-te-biosime-anaptuxe-ton-ee-rio-20.html>
30. UN (2015) Education 2030 Incheon Declaration and Framework for Action Towards inclusive and equitable quality education and lifelong learning for all, available [http://www.unesco.org/new/fileadmin/multimedia/HQ/ED/ED\\_new/pdf/FFA-ENG-27Oct15.pdf](http://www.unesco.org/new/fileadmin/multimedia/HQ/ED/ED_new/pdf/FFA-ENG-27Oct15.pdf)
31. UNESCO (2004) Draft UNECE Strategy for Education for Sustainable Development, Addendum, Background, 2nd Regional Meeting on Education for Sustainable Development, Rome, 15-16 July 2004, [cep.ac.13/2004/8/add.1](http://cep.ac.13/2004/8/add.1), 18May 2004, Economic Commission for Europe Committee on Environmental Policy
32. UNESCO (2012) Exploring Sustainable Development: A Multiple-Perspective Approach, Education for Sustainable Development in Action, Learning & Training Tools N°3 – 2012, UNESCO Education Sector,

- United Nations Decade of Education for Sustainable Development (2005-2014)  
<http://unesdoc.unesco.org/images/0021/002154/215431E.pdf>
33. UNECE (2006) Expert group on Indicators for Education for Sustainable Development, Fourth meeting, The Hague (the Netherlands), 10-12 May, Available 070208 on <http://www.unece.org/env/esd/inf.meeting.docs/EGonInd/Guidance.for.reporting.final.e.pdf>.
  34. Vergidis D. & Karalis Th. (1999) Adult Education: planning, organization and evaluation of programs, EAP, Patras, 1999
  35. Wolhuter C.C. (2011) Teacher Education to Meet Twenty-First Century Society, chapter in book 'Teacher Education in Modern Era, Trends and Issues' by Anastasiadis P et al, University of Crete, Pedagogical Institute, Athens
  36. Zachariou A (2007) Interdisciplinary in Environmental Education and Education for the Sustainable Development, University Notes in the Postgraduate Program of Environmental Education, University of the Aegean, TEPAES, Rhodes
  37. Zygouri E., (2005), Evaluation of environmental education programs: Theory and Practice, Athens: Typothito



## RESEARCH ARTICLE

### Etiological profile of gastric outlet obstruction and its treatment: a hospital based prospective study in a tertiary care center, north-east India.

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##### Key words:

Gastric outlet obstruction, duodenal ulcer, antral carcinoma, gastric bazoar, pseudo pancreatic cyst, carcinoma head of the pancreas.

##### Key message:

Etiology of GOO is changing from benign to malignant pathology in present era.

#### Abstract

**Background:** Gastric outlet obstruction (GOO) also known as pyloric obstruction is the clinical & patho-physiological consequence of any disease process that produces a mechanical impediment to gastric emptying.

**Aims & Objectives:** To identify the causes, review the modes of clinical presentation and evaluate diagnostic methods & management strategies of GOO in adults.

**Material & Methods:** A prospective observational study conducted in 70 patients attending dept. of surgery, Silchar Medical College and hospital, a tertiary care center during the period of July 2014 to December 2016 of G.O.O. were included in this study. Causes of functional non-mechanical cause of G.O.O were excluded. Only patients of 20 years & above were included in this study. Saline load test, upper gastro-intestinal endoscopy and routine laboratory investigations were done in all cases while Barium meal study was done in few cases to make the diagnosis.

**Results:** Age group of 50-59 was maximum sufferers 40%, followed by age group 40-49 with 30% sufferers. Male-Female ratio was 1.9:1. Antral carcinoma (60%) followed by cicatrized duodenal ulcer seen in 34% of the cases; two case was due to gastric bazoar (3%), one case was due to pseudo-pancreatic cyst and one case was due to carcinoma head of the pancreas.

**Conclusion:** In vast majority of cases, GOO diagnosis can be established clinically. Males are more sufferers and antral carcinoma is main cause of G.O.O. After proper diagnosis, relief can be given to patients by surgical treatment. The type of procedure depends on underlying cause.

##### Abbreviations:

GOO-Gastric outlet obstruction, VGP-Visible gastric peristalsis, DU-Duodenal ulcer, CA-Carcinoma.



## Introduction:-

Gastric outlet obstruction (GOO, also known as pyloric obstruction) is the clinical and patho-physiological consequence of any disease process that produces a mechanical impediment to gastric emptying. Clinical entities that can result in GOO are generally categorized into 2 groups - benign and malignant. This classification facilitates discussion of investigations and treatment. Until the late 1970s, benign disease was responsible for the majority of cases of GOO in adults, while malignancy accounted for only 10 to 39 percent of cases [1, 2]. By contrast, in recent decades, 50 to 80 percent cases have been attributable to malignancy [2, 3, 4].

GOO can be a diagnostic and treatment dilemma. As part of the initial workup, the possibility of functional causes of obstruction, such as gastroparesis due to diabetes or paralytic ileus due to any metabolic cause should be excluded. Once a mechanical obstruction is confirmed, definitive treatment is based on recognition of the specific underlying cause i.e. benign and malignant. Diagnosis and treatment should be done as early as possible, as delay may result in further compromise of the patient's nutritional status and also increase the oedematous tissue, which complicate surgical intervention.

Cicatrised DU was the most common cause of GOO [1] but due to wider usage of H2 blockers and PPIs, better health care facilities with new investigating equipments & techniques, its incidence is on decline and is replaced by carcinoma stomach which is detected early by new investigating modalities.

The lack of uniformity in criteria in accepting a case of GOO lead to differences in incidences and clinical features in different centres, still, any one of the following can be used to diagnose gastric outlet obstruction.

1. Projectile vomiting of undigested food consumed previous day.
2. Visible gastric peristalsis (VGP).
3. Gastric succussion splash 3-4 hours after the last meal.
4. Palpable hypertrophied stomach.
5. Delayed emptying of stomach on barium meal studies.
6. A gastric residue of more than 500 ml in an adult.
7. An aspirate of more than 250 ml on saline load test.

## Aims & objectives:-

1. To identify the causes of GOO in adults.
2. To review the changes in presentation of GOO in view of changing trends in the management because of new drugs and investigatory modalities.
3. To evaluate diagnostic methods and management strategies of GOO in adults.

## Material and Methods:-

This is a clinical observational study comprising of 70 consecutive cases of GOO in adults due to various causes. Patients for the study were selected from the surgical units of *Silchar Medical College and hospital, Silchar during the period of July 2014 to December 2016.*

The pre-requisites for selecting a patient in this study were as follows:

1. One or more of the following clinical features; projectile vomiting, especially persistent vomiting of undigested food; gastric succussion splash heard 3-4 hours after the last meal; visible gastric peristalsis or presence of a palpably distended and hypertrophied stomach.
2. Fasting overnight gastric aspirate more than 200ml.
3. Saline load test of Goldstein: The volume of saline remaining half an hour after instillation of 600 ml of 0.9% NS solution. Any volume more than 250 ml. was considered significant.
4. Upper Gastro intestinal endoscopy demonstration / Radiological demonstration of gastric outlet obstruction.
5. Demonstration at operation of gross narrowing of the gastric outlet.

The cases that were willing to undergo surgery, 20 years or more in age, irrespective of sex were included in this study while patient having functional cause of obstruction were excluded. After admission of the patient a detailed clinical history was taken. Physical examination was carried out in detail, noting the state of hydration and

nutritional status. Particular attention was paid to abdominal examination for the presence of VGP, tenderness, palpable masses and succussion splash.

On the basis of the history and physical findings, a diagnosis of GOO was made and the patient investigated. Saline load test performed bedside in every patients.

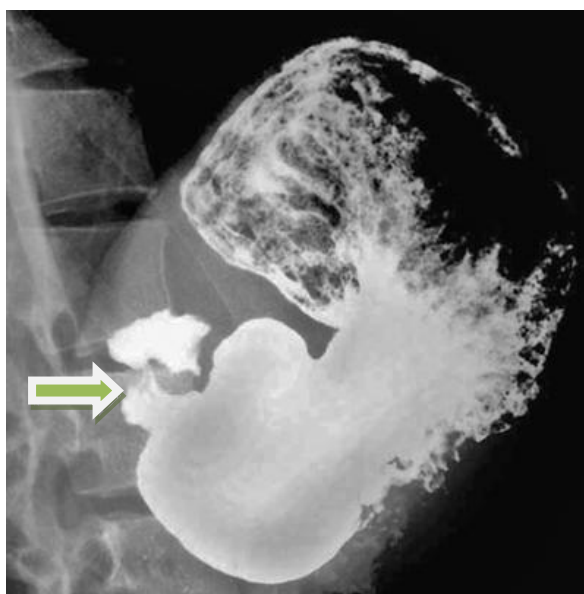
### Results and Observations:-

The clinical material for this study consists of 70 adult patients with gastric outlet obstruction. All these patients were selected from the general surgical units of Silchar Medical College & Hospital, Silchar. A thorough study of these cases was made regarding the history, clinical examination, investigations, operative findings, treatment, post-operative management and tables & figures are depicting clinical parameters is also presented.

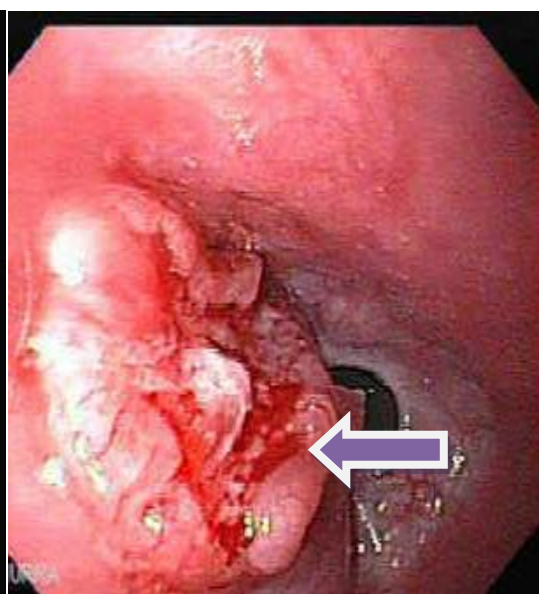
Out of 70 cases, 42(60%) cases had malignant growth in the gastric antrum as shown in figure 2, 24(34%) cases had cicatrized duodenal ulcer as shown in figure 1, 2(3%) had gastric trichobezoar, 1(1.5%) had pseudo pancreatic cyst and 1(1.5%) had carcinoma head of the pancreas as the cause of gastric outlet obstruction. Distribution according pathology is shown in Table 1.

**Table 1. Distribution according to pathology.**

Sl. No.	Cause	Male	Female	Total no. Of cases	Percentage
1	Cicatrized duodenal ulcer	14	10	24	34%
2	Antral carcinoma	30	12	42	60%
3	Gastric trichobezoar	01	01	02	03%
4	Pseudo pancreatic cyst	00	01	01	1.5%
5	carcinoma head of the pancreas	01	00	01	1.5%

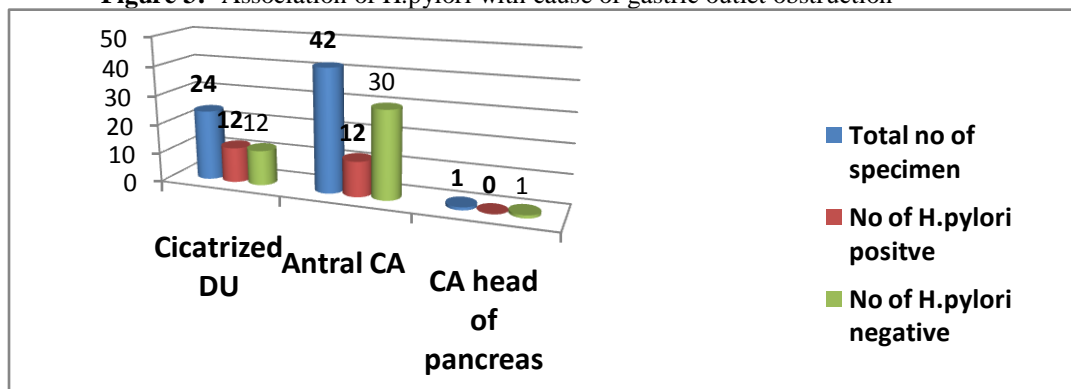


**Figure 1:-** Barium meal X-ray showing GOO pyloric stenosis due to chronic DU.



**Figure 2:-** Endoscopy showing GOO due to antral carcinoma.

The endoscopic biopsy specimen from gastric mucosa was taken from 67(95.7%) cases, except for GOO due to gastric trichobezoar and pseudo pancreatic cyst. 50% of cicatrised duodenal ulcer cases were H.pylori positive. H.pylori quick test results are shown in figure 3.

**Figure 3:-** Association of H.pylori with cause of gastric outlet obstruction

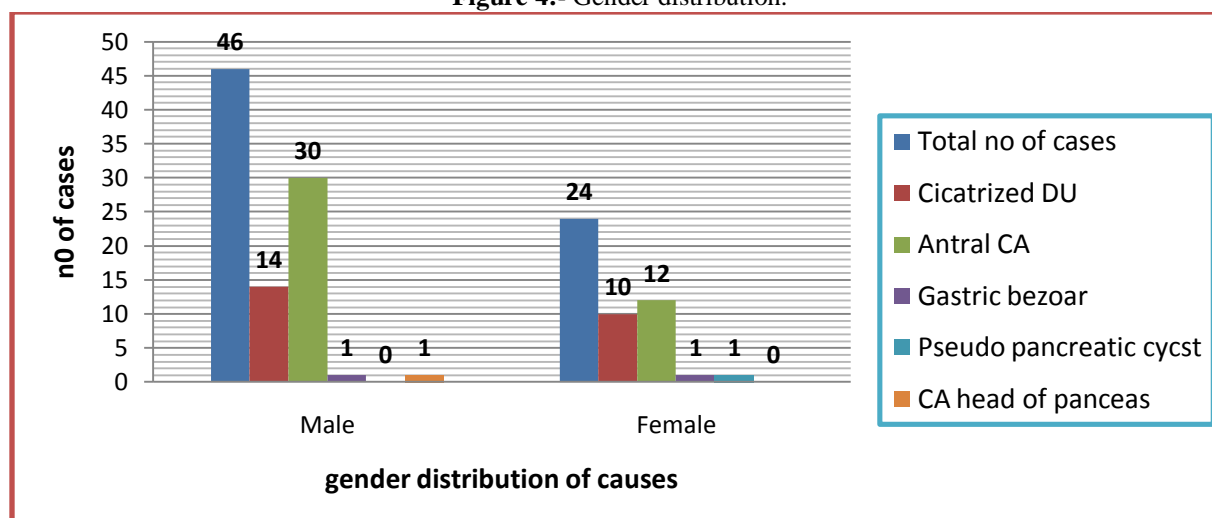
The maximum incidence (40%) of GOO was seen in 50-59 years of age of which 28.5% was due to antral carcinoma, while 40-49 years age group incidence was 30% of which 20% was due to cicatrized DU, one case of pseudo pancreatic cyst was seen in 30-39 years of age group, one case of carcinoma head of the pancreas was seen in 60-69 years age group. and two cases of gastric Trichobezoar was seen as a cause of G.O.O. Distribution according to underlying pathology is shown in table 2.

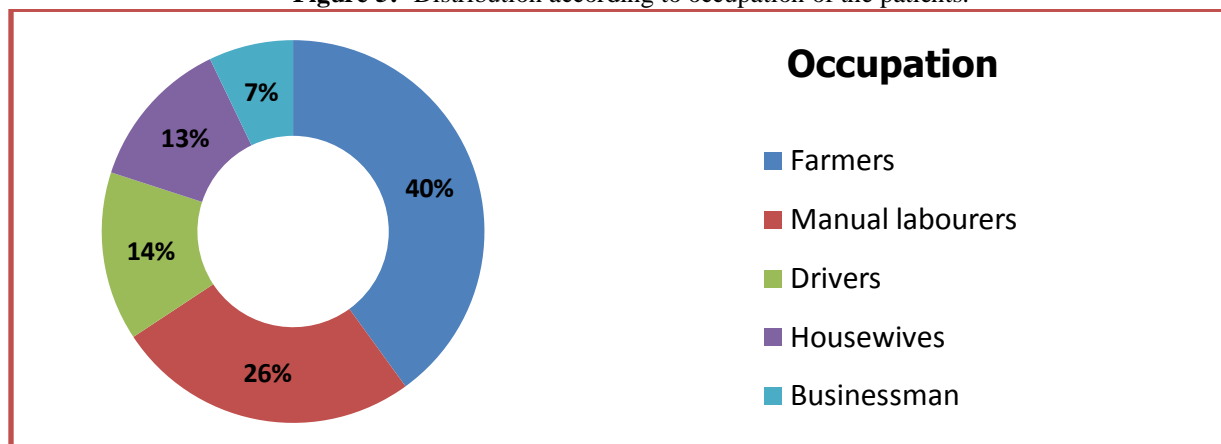
**Table 2:-** Age Distribution with underlying pathology.

Age	Cicatrized DU(%)	Antral CA(%)	Gastric bezoars(%)	Pseudo pancreatic cyst (%)	CA head of pancreas(%)	Total(%)
20-29	-	-	01(1.5%)	-	-	01(1.5%)
30-39	03(4%)	01(1.5%)	-	01(1.5%)	-	05(07%)
40-49	14(20)	07(10%)	-	-	-	21(30%)
50-59	7(10%)	20(28.5%)	01(1.5%)	-	-	28(40%)
60-69	-	14(20%)	-	-	01(1.5%)	15(21.5%)
Total	24	42	02	01	01	40

In this series 46(65.7%) patients were males and 13 (34.3%) patients were female. Male to female ratio (M:F) was 1.9:1 as seen in figure 4.

In this series, 28 patients (40%) were farmers, 18(26%) patients were manual labourers, 10 (14%) patients were Drivers, 9 (13%) patients were housewives and 5 (7%) patients were businessman as seen in figure no 5.

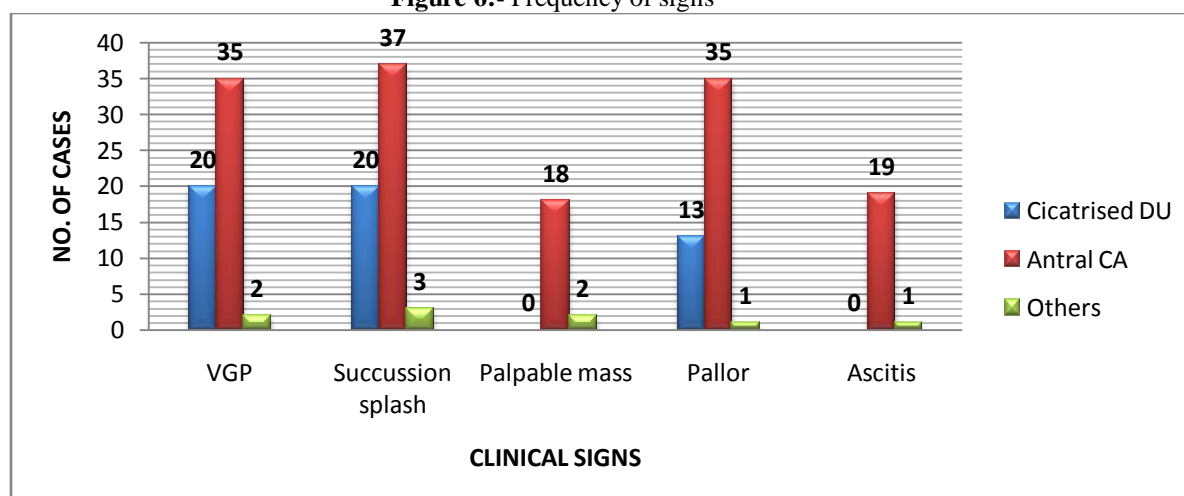
**Figure 4:-** Gender distribution.

**Figure 5:-** Distribution according to occupation of the patients.

Pain abdomen and vomiting were found in most of the cases as shown in table 3.

**Table no 3:-** Distribution of symptoms with their frequency.

Symptom	No. Of cases	Cicatrized DU	Antral CA	Gastric bezoars	Pseudo pancreatic cyst	CA head of pancreas
Pain abdomen	64	24	28	01	01	00
Vomiting	70	24	42	02	01	01
Lump abdomen	21	00	19	00	01	01
Appetite loss	54	11	42	00	00	01
Weight loss	43	08	34	00	00	01
Post-prandial fullness	55	15	37	01	01	01
Melena	25	03	21	00	00	01
Jaundice	02	00	00	00	01	01

**Figure 6:-** Frequency of signs

Almost 70% to 80% patients with Cicatrised DU and Antral cancer had VGP & succussion splash. More than 45% antral cancer patients had palpable mass, pallor & Ascitis as in figure 6.

Most common surgical operation done was Truncal vagotomy with posterior gastro-jejunostomy for cicatrized duodenal ulcers followed by Billroth II gastrectomy for antral carcinoma, Gastric Trichobezoar were removed by gastrotomy in two cases and pseudo pancreatic cyst was drained by Jurasz Cysto-gastrostomy as shown in table 4.

**Table no 4:-** Types of surgical procedures done in the study

Cause	Surgical Procedure done	No. of cases	Percentage
Cicatrized DU	Truncal vagotomy with posterior gastro-jejunostomy	24	34%
Antral CA	Billroth II gastrectomy	21	30%
	Anterior gastro-jejunostomy	14	20%
	Palliative feeding jejunostomy	07	10%
Gastric bezoars	Gastrotomy and removal of bezoar	02	03%
Pseudo pancreatic cyst	Jurasz operation(Cysto-gastrostomy)	01	1.5%
CA head of the pancreas	Anterior gastro-jejunostomy with T-tube biliary drainage	01	1.5%

Six patients of antral carcinoma died in post-operative period, four with electrolyte imbalance and the other two because of severe lower respiratory tract infection and septicaemia. Post-operative hospitalization ranged from 8 to 21 days with an average of 14 days. Sutures were removed between 7th and 10th post-operative day.

### Follow up:-

All the 64 cases were followed up post operatively for the period of 6 months. All the antral carcinoma patients received chemotherapy post operatively, of 34 patients 15 who underwent Billroth II resection received cisplatin and 5 FU regimen and rest with unresectable disease received epirubicin, cisplatin and 5 fluorouracil (5FU) regimen for 6 cycles at an interval of 21 days. Before every cycle complete blood count, liver and renal functions were assessed and 8 patients lost the follow up after 3 months. All 24 cases of duodenal ulcer were symptom free; Patients with gastric bezoar followed up and were symptom free; also patient with pseudo pancreatic cyst was followed up and he had recurrent attacks of dull aching pain in epigastrium, dyspepsia and was given oral opioid analgesics along with proton pump inhibitor (PPI) and pancreatic enzyme supplementation. On follow up of patient with CA head of pancreas he is found to be jaundice free and receiving adjuvant chemotherapy as in table 5.

**Table 5:-** follow ups of patients after surgery.

Follow ups	1 month	3 months	6 months	remarks
Cicatrized DU	24	24	-	Symptom free
CA Antrum	34	34	26	All received adjuvant chemotherapy & 8 patients lost follow up after 3months
Gastric bazoar	2	2	-	Symptom free
Pseudo pancreatic cyst	1	1	1	Had recurrent attacks of pain on treatment
CA head of the pancreas	1	1	-	Jaundice free & receiving adjuvant chemotherapy

### Discussion:-

The commonest cause of GOO was antral carcinoma & the next common cause was cicatrized duodenal ulcer in our study. These observations were similar to that of McQuaid [5] and Dullas N shone [6] studies.

Until the late 1970's benign disease was responsible for a majority of cases of GOO in adults, while malignancies accounted for only 10 to 39 % of cases. Contrasting to this, in the recent decades due to the discovery of *Helicobacter pylori* and proton pump inhibitors, 50 to 80 percent cases have been attributed to malignancy [7]. Similar findings were observed in McQuaid et al study in 2010 [5]. In Dallas N shone et al study in 2008 [6], cause of G.O.O in 61% (n=20) cases was malignancy and in 39% (n=31) cases was duodenal ulcer.

Most patients were in the fifth & sixth decade in this study. In antral carcinoma cases the maximum incidence seen in the age group of 50-59 years. Life span was 20 to 69 years. In series of Fisher et al [8] the average age was 54 yrs with a span from 20-89 yrs & men outnumbered women by 2:1. Men outnumbered women by 1.9:1 in our study as

compared to 5.5:1 observed by Yogiram Chaudary [9]. This higher incidence in males, worldwide can be explained as because of more consumption of gastric irritants by males compared to females.

In our series 40% of the patients were farmers, 26% manual labourers and 14% were drivers who gave history of irregular diet habits, which seems to contribute to disease process. The series of Donald D Kozoll & Karl A Meyer [10] also showed the same pattern with non-skilled day labourer group listed most frequently with obstruction.

All the cases were subjected to serum electrolyte estimation in our study. Out of them 18 cases (25.7%) showed electrolyte imbalance. In series of Maichel L Schwartz [11] electrolyte imbalance was present in 30%.

Common symptoms and signs in our study were vomiting, pain abdomen & dyspepsia and succussion splash, VGP & pallor respectively.

Upper GI endoscopy was done in all 70 cases (100%). 42 (60%) cases had carcinoma stomach in which 31 cases showed antral growth and other 11 cases showed Prepyloric growth. 24(34%) had cicatrized duodenal ulcer, 2(3%) had gastric bezoar, 1 (1.5%) had pseudo pancreatic cyst and 1 (1.5%) had CA head of pancreas. It is similar as found by Misra SP in 1998 [12]. 50% of cicatrized DU's in this study were H. pylori positive.

### Conclusions:-

The present study is a clinical observational study of gastric outlet obstruction. Since the study has been based on a small number of cases with a limited follow up, it will be rather difficult to come to definite conclusions. However some of the conclusions which can be drawn from this study are as follows:-

1. The commonest cause of G.O.O in adults was ca antrum (60%), followed by cicatrized duodenal ulcer (34%).
2. Males are commonly affected with G.O.O in adults.
3. Vomiting and succussion splash are the most common and constant symptom and sign of G.O.O.
4. In the vast majority of cases, the diagnosis can be established clinically. .
5. The saline load test was found to be an effective bed side investigative procedure to assess the degree of G.O.O.
6. Upper gastro intestinal endoscopy should be advised in all suspected cases of G.O.O. It can diagnose the cause of obstruction very effectively than any other investigative modality.
7. Surgical procedure for antral carcinoma depends on stage of disease, operability and resectability of tumour. Majority of patients with duodenal ulcer can be treated with Truncal vagotomy with posterior gastrojejunostomy.

### References:-

1. Johnson CD. GOO malignant until proved otherwise. Am J Gastroenterol 1995;90:1740.
2. Johnson CD, Ellis H. GOO now predicts malignancy. Br J Surg 1990;77:1023-4.
3. Chowdhury A, Dhali GK, Banerjee PK. Etiology of gastric outlet obstruction. Am J Gastroenterol 1996;91:1679.
4. Kshitiz R, Ruchita J, Ankur J. GOO in adults: A prospective study in tertiary care hospital of Karnataka. J Pharm Biomed Sci 2013;32:1282-6.
5. McQuaid KR. Gastrointestinal disorders. In: McPhee SJ, Papadakis MA, Editors. Current medical diagnosis and treatment, 49<sup>th</sup> vol. United States of America: The McGraw-Hill Companies; 2010. P.1546.
6. Shone DN, Nikoomanesh P, Smith-Meek MM, Bender JS. Malignancy is the most common cause of GOO in the era of H2 blockers. Am J Gastroenterol 1995; 90:1769-70.
7. Naeem P, Khan RA, Rashid HB, Chaudhry M. GOO due to adenocarcinoma of the duodenum infiltrating the head of pancreas: a case report. Sci.Int.(Lahore) 2014; 26:1197-9.
8. Fisher Dr, Ebert PA, Zenidena GD. Obstructing peptic ulcers results of treatment. Arch. Surg. 1967;94:724-9.
9. Yogiram B, Chowdary NVS. Duodenal (ulcer) stenosis in Andhra Pradesh. A 10 year study. Ind. J. Surg. 1983;12-16.
10. Kozoll DD, Meyer KA. Obstructing gastroduodenal ulcers: Symptoms and signs. Arch. Surg. 1964;89:491-8.
11. Schwartz ML, Humphry WE, Dunn HD, Weiland Douglas. GOO in peptic ulcer disease, an indication for surgery. Am-J surgery 1982;143:90.
12. Misra SP, Dwivedi M, Misra V. Malignancy is the most common cause of GOO even in a developing country. Endoscopy 1998;30:484-6.



### RESEARCH ARTICLE

#### HOW MUCH DOES THE INTRA-ABDOMINAL PRESSURE VARY BY NASOGASTRIC DECOMPRESSION IN PATIENTS WITH INTESTINAL OBSTRUCTION???

Dr. DebabrataSingha, Dr. G. Sankamithra, Dr. Eden Sinha, Dr. Preetam Kumar Das, Dr. NareshPawar and Dr. Suvajyotichakraborty.

#### Manuscript Info

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##### Key words:-

IAP (Intra-abdominal pressure),  
nasogastric decompression, intestinal  
obstruction.

#### Abstract

**Introduction:** We follow the age-old teaching of inserting nasogastric tube to decompress the stomach and reduce intra-abdominal pressure whenever a patient comes to us with intestinal obstruction. But how much does this decrease the raised intra-abdominal pressure is hardly known and evidence based. So in this study we attempt to find the difference in intra-abdominal pressure that occurs by insertion of nasogastric tube and decompression.

**Aims and objectives:** To find the difference in intra-abdominal pressure on insertion of nasogastric tube and decompression in patients with intestinal obstruction.

**Method of study:** Interventional study. 75 patients with intestinal obstruction who presented to emergency department of Silchar Medical College and Hospital were included in the study. Patient who had no vomiting in the last 2 hours before presentation were only included for this study. Intra-abdominal pressure was measured via Foley's catheter method before and after insertion of nasogastric tube and decompression. Results were obtained based on the difference in intra-abdominal pressure and percentage variation.

**Conclusion:** From this study we found that insertion of nasogastric tube in emergency department in patients with intestinal obstruction reduces the intra-abdominal pressure by 2.81mmHg (mean of 75 patients) in short time even when no other intervention has been carried to reduce the intra-abdominal pressure before operation. On an average there was 18.18% reduction of IAP after nasogastric decompression.

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#### Introduction:-

We follow the age-old teaching of inserting nasogastric tube to decompress the stomach and reduce intra-abdominal pressure whenever a patient comes to us with intestinal obstruction. But how much does this decrease the raised intra-abdominal pressure is hardly known and evidence based. So in this study we attempt to find the difference in intra-abdominal pressure that occurs by insertion of nasogastric tube and aspiration.

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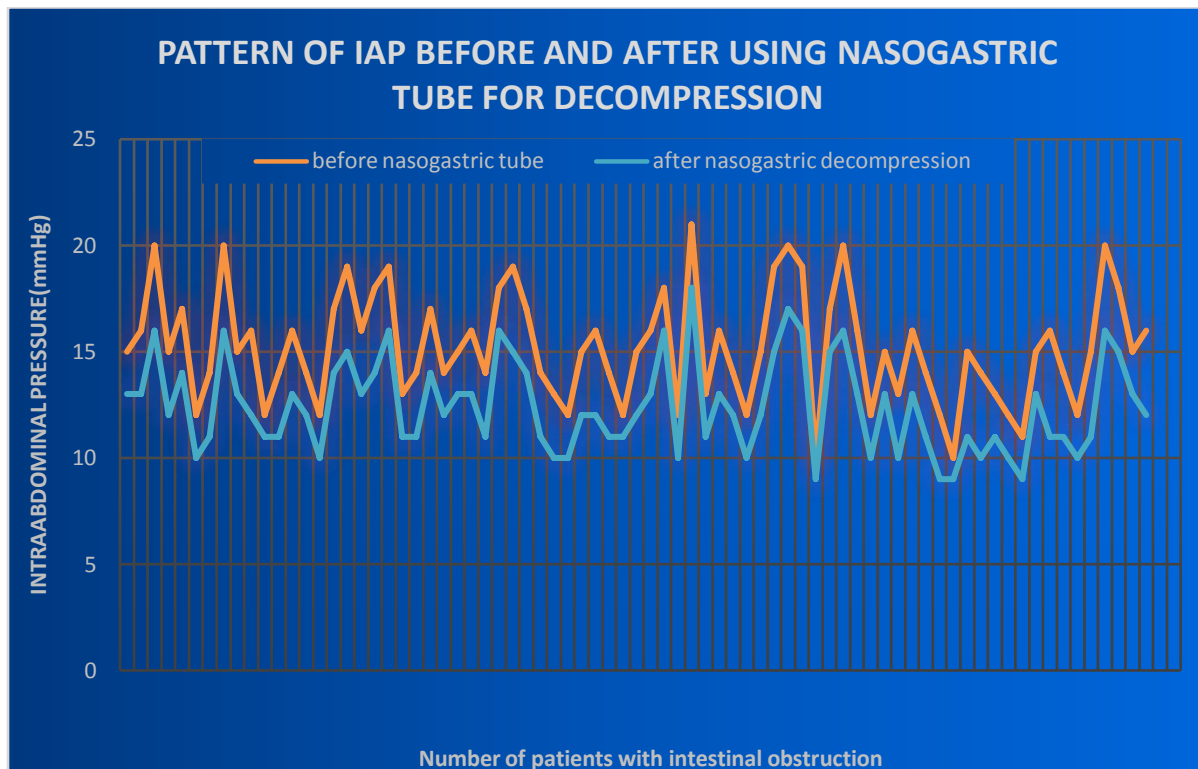
75 patients with intestinal obstruction who presented to emergency department of Silchar Medical College and Hospital were included in the study. Patient who had no vomiting in the last 2 hours before presentation were only included for this study. Intra-abdominal pressure was measured via Foley's catheter method before insertion of nasogastric tube.[1]

With the patient lying supine, 100 ml of sterile water were instilled via manometer tubing into the bladder following drainage of viscera. The mid-axillary line was used as the zero reference, and cavity pressure noted in centimeters of water (cmH<sub>2</sub>O) at end expiration.[2] The IAP was converted to mmHg by multiplying with 0.735

Then nasogastric tube of 16F size, was inserted till 55 cm marking and maximum decompression done. After ten minutes of decompression IAP was measured again. The difference in IAP was found in all cases. No other intervention that alters the IAP were done before taking these values. In all patients IAP was measured by same method in supine position. Pediatric patients and pregnant women were excluded.

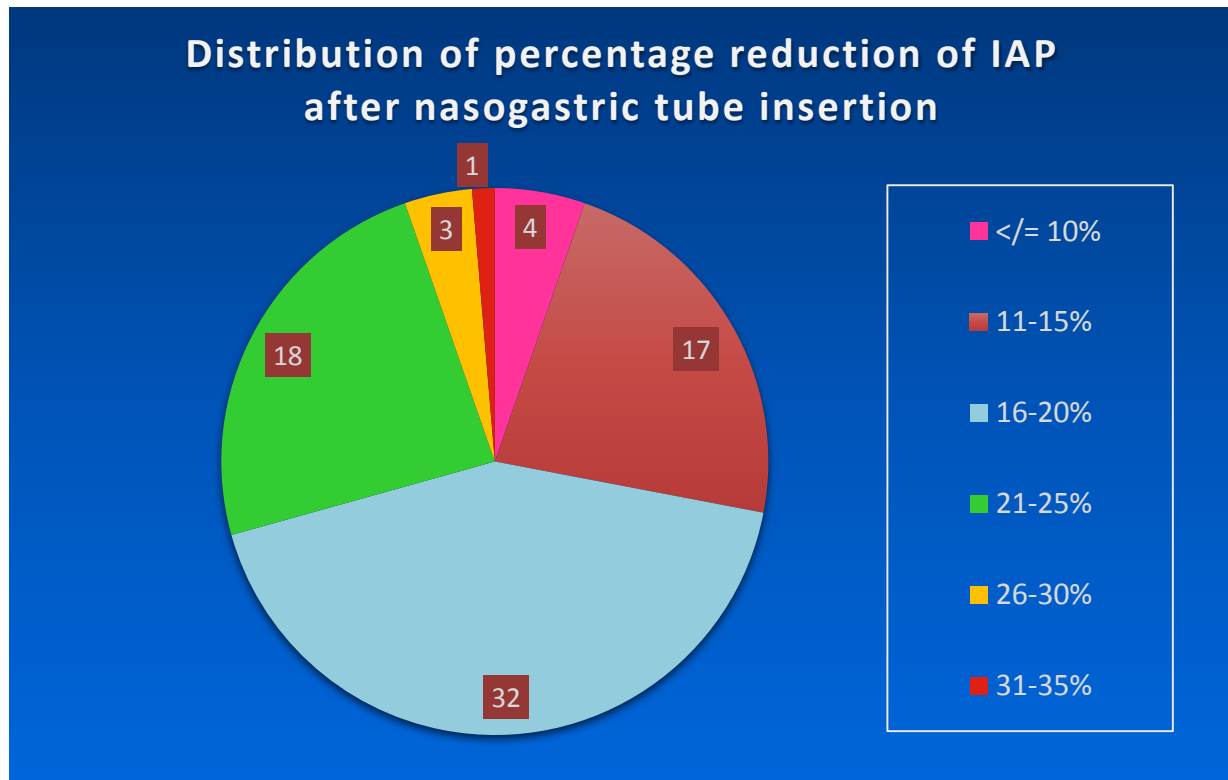
**Results and observations:-**

The recording of intra-abdominal pressure in all the patients with intestinal obstruction before and after nasogastric decompression is plotted in the form of graph below:



The maximum change in intra-abdominal pressure observed was 5 mmHg in one out of 75 patients. Minimum change in intra-abdominal pressure observed was 1 mmHg in 4 out of 75 patients. Among the patients who presented to us with intestinal obstruction the maximum intra-abdominal pressure noted was 21 mmHg and minimum IAP at presentation was 10mmHg. The difference in IAP of 2mmHg, 3mmHg and 4mmHg were noted in 24 patients, 32 patients and 14 patients respectively. So difference of 3mmHg was found in maximum number of patients in our study due to nasogastric decompression. Through this study we observed that maximum of 31.25% reduction of IAP occurred after nasogastric decompression and minimum of 8.3% reduction of IAP in two patients. 16-20% reduction of IAP occurred in maximum number of patients (32). Percentage reduction of IAP were divided into 6 categories and mentioned in diagram below.





### Discussion:-

Since the 1930s routine use of the nasogastric tube to achieve postoperative gastric decompression has enjoyed widespread acceptance, and for decades patients' complaints were not taken into consideration by anesthesiologists and surgeons. Nasogastric decompression facilitate exposure of operative field during surgeries for intestinal obstruction. It helps to drain the gastric remnant which can relieve nausea and abdominal distension. Besides, it may help decrease diaphragmatic splintage and hence decrease chance of chest infection when ileus occurs. Perceived importance in earlier years was well expressed by WJ Mayo: 'Would rather have a resident with a nasogastric tube in his pocket than a stethoscope.'[9]

However, nasogastric intubation could cause patient discomfort; also it has been shown that it would cause gastro-esophageal reflux which may be associated with chest complication. At one point or the other each surgeon would have experienced to see the patient who removed nasogastric tube himself due to discomfort. So it is highly essential to have evidence based establishment of influence of nasogastric decompression on Intra-abdominal pressure.

Since the abdomen and its contents can be considered as relatively non-compressive and primarily fluid in character, subject to Pascal's law, the IAP can be measured in nearly every part of the abdomen. In 1875, Oderbrecht measured IAP within the urinary bladder.[3] Different direct and indirect measurement methods have been reported. In this study we have used the intra-vesical method which is considered gold standard in most of the studies and cost effective as well.

Normal IAP ranges from sub-atmospheric to 0 mmHg. Normal IAP is approximately 5–7 mm Hg in critically ill patients. The World Society of the Abdominal Compartment Syndrome (<http://www.wsacs.org>), in its latest consensus statement [2], defined IAH as sustained or repeated IAP of  $\geq 12$  mmHg. Likewise, abdominal compartment syndrome (ACS) was defined as IAP  $> 20$  mmHg in combination with at least one new end-organ failure.

IAP increases with inspiration (diaphragmatic contraction) and decreases with expiration (diaphragmatic relaxation).[4] Thus all the measurement in our study was taken just after expiration of patient. It is also directly affected by the volume of the solid organs or hollow viscera (which may be either empty or filled with air, liquid or

fecal matter), the presence of ascites, blood or other space-occupying lesions (such as tumors or gravid uterus), and the presence of conditions that limit expansion of the abdominal wall (such as burn or third-space edema). But how much does the nasogastric decompression help in reducing IAP is the main interest of this study.

The potential contribution of body position in elevating IAP should be considered in patients with moderate to severe IAH or ACS. Other studies say Head of bed elevation can significantly increase IAP compared to supine position, especially at higher levels of IAH.[5] Such increases in IAP become clinically significant (increase >2 mmHg) when the patient's head of bed elevation exceeds 20°. To avoid error in measurement due to change in posture, all our readings were taken in supine position.

Abdominal Compartment Syndrome (ACS) and Intra-abdominal Hypertension (IAH) affect all body systems, most notably the cardiac, respiratory, renal, and neurologic systems. ACS/IAH affects blood flow to various organs and plays a significant role in the prognosis of the patients. Abdominal perfusion pressure is the difference in mean arterial pressure and the intra-abdominal pressure in mmHg. So for each mmHg of decrease in abdominal pressure there is chance for intra-abdominal perfusion to increase. Literature shows reduction of mesenteric blood flow and higher chance of gut mucosal ischemia and reduction in portal circulation with increase in IAP more than 10mmHg. There are studies showing reduction bowel tissue oxygenation with normal cutaneous oxygenation in patients with intra-abdominal hypertension. [6] In our study we observed that 15 out of 75 patients reached IAP of 10mmHg and below following nasogastric decompression.

For every mmHg rise in IAP there is incremental reduction in renal plasma flow which is irreversible by just fluid management[7], [8]. So reduction of IAH in the earliest can help renal system to recover its flow and function.

It has been established already that there is direct relationship between duration of increased IAP and morbidity of patient. In our study the mean difference found was 2.81mmHg of reduction in IAP just by nasogastric decompression in ten minutes interval. On an average there was 18.18% reduction of IAP after nasogastric decompression. Even when mean reduction in IAP of 2.81mmHg by nasogastric decompression appears to be smaller, it can highly contribute for reducing IAP apart from non-operative techniques like per rectal evacuation in patients with intestinal obstruction. This reduction of IAP will help to maintain perfusion of intra-abdominal organs during the time spent before operative intervention.

### Conclusion:-

From this study we found that insertion of nasogastric tube in emergency department in patients with intestinal obstruction reduces the intra-abdominal pressure by 2.81mmHg (mean of 75 patients) in short time even when no other intervention has been carried to reduce the intra-abdominal pressure before operation. If the study can be carried on large scale an evidence based value of difference in intra-abdominal pressure following nasogastric decompression by Ryle's tube can be firmly established.

**Conflict of interest:** none

### References:-

1. Fusco MA, Martin RS, Chang MC. Estimation of intra-abdominal pressure by bladder pressure measurement: validity and methodology. *J Trauma*. 2001;50(2):297–302. doi: 10.1097/00005373-200102000-00016.
2. Malbrain ML, Cheatham ML, Kirkpatrick A, Sugrue M, Parr M, De Waele J, Balogh Z, Leppaniemi A, Olvera C, Ivatury R, D'Amours S, Wendon J, Hillman K, Johansson K, Kolkman K, Wilmer A. Results from the International Conference of Experts on Intra-abdominal Hypertension and Abdominal Compartment Syndrome. I. Definitions. *Intensive Care Med*. 2006;32(11):1722–1732. doi: 10.1007/s00134-006-0349-5.
3. Odebrecht E. Aus der gynäkologischen Klinik des Herrn Prof. Hegar in Freiburg i.B. Beitrag zur Lehre von intraabdominellen Druck. *Berl. klin. Wochenschr*. 1875; 12: 175-8.
4. Hess D, Maclyntyre N, Galvin W, Mishoe S. *Respiratory care: Principles and practice*: Jones & Bartlett Learning; 3<sup>rd</sup> edn: 2015. ISBN-13: 9781284050004
5. Cheatham ML, De Waele J, De Laet I, De Keulenaer BL, Widder S, Kirkpatrick AW, Cresswell AB, Malbrain MLNG, Bodnar Z, Mejia-Mantilla JH, Reis R, Parr M, Schulze R, Puig S: The impact of body position on intra-abdominal pressure measurement: a multicenter analysis. *Crit Care Med* 2009, 37: 2187-2190. 10.1097/CCM.0b013e3181a021fa

6. Bongard F, Pianim N, Dubecz S, Klein SR. Adverse consequences of increased intra-abdominal pressure on bowel tissue oxygen. *J Trauma* . 1995;39:519–525.
7. Bradley SE, Bradley GP. The effect of increased abdominal pressure on renal function. *J Clin Invest*. 1947;26:1010–1015.
8. Harman PK, Kron IL, McLachlan HD, et al. Elevated intra-abdominal pressure and renal function. *Ann Surg*. 1982;196:594–597.
9. Tanguy, Michèle, Philippe Seguin, and Yannick Mallédant. “Bench-to-Bedside Review: Routine Postoperative Use of the Nasogastric Tube – Utility or Futility?” *Critical Care* 11.1 (2007): 201. PMC. Web. 25 Jan. 2017.

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## RESEARCH ARTICLE

### PREVALENCE OF CARIES IN ANTERIOR TEETH IN DAKSHINA KANNADA POPULATION

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##### Key words:-

Age, diet, tooth surface, location

#### Abstract

The aim of the survey was to determine the prevalence of caries in the anterior teeth in the Dakshina Kannada population. The basic research design included performance of dental examination based on WHO criteria and questionnaire survey on 4000 patients from the Dakshina Kannada district visiting the outpatient section of the Department of Conservative Dentistry and Endodontics and Rural Satellite Centres of A. B. Shetty Memorial Institute of Dental Sciences, Nitte University, Deralakatte, Mangaluru from 2014 to 2015. The data obtained were statistically analyzed. A significant correlation was deduced between gender, age, diet, oral hygiene habits and caries of the anterior teeth

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#### Introduction:-

Dental caries as old as humankind is a chronic, infectious disease caused by bacterial by-products that leads to the dissolution of the tooth surface.<sup>1</sup> Dynamic balance between demineralizing and remineralizing factors determines the eventual outcome of dental caries. Demineralizing factors include acidogenic bacteria, inhibited salivary function and frequency of ingestion of fermentable carbohydrates. Dental caries manifests as a continuum of disease states ranging from subclinical atomic level of demineralization to frank cavitation.<sup>2</sup> Caries is largely preventable by early diagnosis, identification of individual risk factors, patient counselling and education, and initiation of preventive care procedures. The progressive nature of dental disease can quickly diminish the general health and quality of life especially in the case of caries in anterior teeth. Failure to identify and prevent dental disease leads to consequential and long-term adverse effects. Untreated dental disease can compromise the patient's ability to eat, sleep and function well at home and the society. An aesthetic healthy smile in addition to being an important determinant of overall physical aesthetics has been observed to have a considerable bearing on social interaction, playing an important role in how an individual is felt and perceived by others. The unaesthetic nature of untreated anterior carious teeth can also compromise the individual's self-esteem and social development leading to intense psychological repercussions in certain instances. Despite significant achievements in public health programmes individuals still suffer from dental caries and are without basic dental care.<sup>3</sup> The infectious dental disease is reversible, if detected early enough. Establishment of a healthy lifestyle, good oral hygiene and nutrition, periodic oral health check-up is of paramount importance to prevent dental caries.

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An insight pertaining to the aetiology of dental caries may be provided from a patient's caries pattern. Hence adequate knowledge and information regarding the prevalence of caries will form the inherent basis for caries prevention programmes and treatment plans. This survey conducted aimed at determining the prevalence of caries in the anterior teeth based on gender, age, location, diet, frequency of oral hygiene measure practiced and surface of the tooth involved.

### Materials and Methodology:-

An epidemiological study was conducted on 4000 patients in the year 2014 and 2015 aged above 15 years randomly selected from the outpatient department of A. B. Shetty Memorial Institute of Dental Sciences and satellite rural centres of Nitte University. Subsequent to obtaining permission from the ethical clearance committee of the institute and written consent from the patients a standardized prepared questionnaire based on the WHO Oral Health Assessment form 2013 was filled by the clinical examiner prior to and after the clinical examination.

### Inclusion Criteria:-

Male and female patients aged above 15 years of age  
Anterior maxillary and mandibular teeth

### Exclusion Criteria:-

Patients with intellectual disability  
Patients undergoing orthodontic treatment  
Edentulous patients  
Maxillary and mandibular premolars and molars

Armamentarium used for the examination was sterile mouth mirror, probe, tweezer and cotton rolls.

The patients were examined for anterior caries on a dental chair under adequate illumination. The data collected were analyzed statistically.

### Results:-

**Table 1:-** Total prevalence of caries in anterior teeth

TOTAL PATIENTS		PATIENTS WITH ANTERIOR CARIES	
2014	2015	2014	2015
2000	2000	480 (24%)	402 (20.1%)

Out of the 4000 patients examined over a period of 2 years, caries in the anterior teeth was observed in 480 (24%) and 402 (20.1%) patients in the year 2014 and 2015 respectively.

**Table 2:-** Prevalence of caries in different age groups

AGE GROUP (IN YEARS)	TOTAL PATIENTS		PATIENTS WITH ANTERIOR CARIES	
	2014	2015	2014	2015
15-25	200	264	10 (02.08%)	9 (02.23%)
26-35	280	424	30 (06.25%)	42 (10.45%)
<b>36-45</b>	<b>440</b>	<b>509</b>	<b>170 (35.42%)</b>	<b>188 (46.77%)</b>
46-55	480	317	155 (32.29%)	96 (23.88%)
56-65	400	308	65 (13.54%)	43 (10.70%)
>65	200	178	50 (10.42%)	24 (05.97%)

Highest prevalence of caries was observed in the age group of 36 – 45 years 170 (35.2%) in the year 2014 and 188 (46.7%) in 2015 followed by 46 – 55 years.

**Table 3:-** Prevalence of caries based on gender

GENDER	TOTAL PATIENTS		PATIENTS WITH ANTERIOR CARIES	
	2014	2015	2014	2015
FEMALE	1200	919	200 (41.60%)	175 (43.53%)
<b>MALE</b>	<b>800</b>	<b>1081</b>	<b>280 (58.30%)</b>	<b>227 (56.46%)</b>

Males exhibited higher prevalence of caries in anterior teeth 280 (58.30%) and 227 (56.46%) when compared to the female gender

**Table 4:-** Prevalence of caries based on location

LOCATION	TOTAL PATIENTS		PATIENTS WITH ANTERIOR CARIES	
	2014	2015	2014	2015
RURAL	1247	1341	260 (54.17%)	180 (44.77%)
URBAN	753	659	220 (45.83%)	180 (44.77%)

The prevalence of caries in anterior teeth in the year 2014 was higher in the rural population 260 (54.17%) when compared to the urban population, whereas in the year 2015 the prevalence of caries was 44.7% in both the rural and urban population.

**Table 5:-** Prevalence of caries based on diet

DIET	TOTAL PATIENTS		PATIENTS WITH ANTERIOR CARIES	
	2014	2015	2014	2015
VEGETARIANS	480	370	150 (31.25%)	127 (31.59%)
MIXED DIET INCLUDING FISH	1220	1430	130 (27.08%)	75 (18.66%)
MIXED DIET EXCLUDING FISH	300	200	200 (41.66%)	200 (49.75%)

The prevalence of caries in anterior teeth was observed to be more in patients following mixed diet but devoid of fish 41.66% in 2014 and 49.75% in 2015.

**Table 6:-** Prevalence of caries based on brushing frequency

BRUSHING FREQUENCY	TOTAL PATIENTS		PATIENTS WITH ANTERIOR CARIES	
	2014	2015	2014	2015
1	1314	1343	249 (51.88%)	198 (49.25%)
2	712	622	107 (22.29%)	99 (24.63%)
>2	74	35	124 (25.83%)	103 (25.63%)

Prevalence of caries in anterior teeth was highest among patients brushing once daily 51.88% in 2014 and 49.25% in 2015.

**Table 7:-** Prevalence of caries based on specific anterior tooth

TOOTH NUMBER	NUMBER OF TEETH WITH CARIES	
	2014	2015
11	325 (33.44%)	302 (33.82%)
12	195 (20.07%)	170 (19.04%)
13	15 (01.54%)	17 (01.90%)
21	300 (30.86%)	280 (31.36%)
22	27 (02.77%)	17 (01.90%)
23	6 (00.62%)	7 (00.78%)
31	20 (02.05%)	17 (01.90%)
32	12 (01.24%)	14 (01.57%)
33	4 (00.41%)	6 (00.68%)
41	40 (04.11%)	38 (04.25%)
42	20 (02.06%)	21 (02.35%)
43	8 (00.83%)	4 (00.45%)

Maxillary right central exhibited the highest prevalence of caries 33.44% and 33.82% in 2014 and 2015 respectively.

**Table 8:-** Prevalence of caries based on the surface of the tooth involved

TOOTH SURFACES	SURFACES WITH CARIES	
	2014	2015
MESIAL	730 (67.97%)	688(66.47%)
DISTAL	285 (26.54%)	321(31.01%)
LABIAL	15 (1.40%)	13(1.25%)
LINGUAL	25 (2.33%)	19(1.83%)
INCISAL	19 (1.77%)	14(1.35%)

Prevalence of caries was most observed in the proximal surfaces, mesial 730 (67.97%), 688 (66.47%) and distal 285 (26.54%), 321 (31.01%) in 2014 and 2015 respectively.

### Discussion:-

This study concluded that the distribution of caries was slightly higher in males than females, but not of much significance in contrast with the research conducted by Hegde M N et al<sup>3</sup> and the research conducted by Lukacs J R et al<sup>4</sup>. The earlier studies attributed the higher prevalence of caries in anterior teeth in females to early eruption of teeth, longer exposure to cariogenic environment, easier access to food supplies and frequent snacking during food preparation.<sup>2</sup> The decrease in the prevalence of caries among the female population may be due to an increase in the awareness of oral health importance among the rural population. Exposure to various oral health awareness programmes conducted in schools, colleges and in rural satellite dental care centres may also be a contributory factor to the decreased prevalence.

The prevalence of caries in anterior teeth was assessed in various age groups. Out of the 4000 patients examined, prevalence of caries was more in the age group of 36 – 55 years of age. Similar results were recorded in studies conducted by Hegde M N et al<sup>3</sup> and Cleaton-Jones et al<sup>5</sup>.

The prevalence of caries in anterior teeth in the rural population was higher than that of the urban population in the year 2014 whereas in the year 2015 similar prevalence was observed. The higher prevalence of anterior caries in the earlier years corroborated by study conducted by Hegde M N et al may be due to various socio-economic factors, such as lack of knowledge and practice of oral hygiene practices, inadequate infrastructure and facilities available for oral health screening and treatment.<sup>6</sup> The decrease in the disparity in prevalence of caries in the anterior teeth among the rural and urban population is due to the increase in oral health awareness among the rural population contributed by various oral health awareness programmes conducted by rural satellite centres located in the areas.

A strong correlation was observed between prevalence of caries in anterior teeth, diet excluding fish and diet including fish. Fish is a common part of the diet in population of Dakshina Kannada located in west coast of Karnataka, India. The decreased prevalence of caries in anterior teeth may be attributed to the increased intake of fish which is rich in fluoride and proteins. Proteins in the diet increase the pH in the oral environment due to putrefaction. Hence the population may be protected from dental caries.<sup>7, 8, 9</sup>

This study showed that the prevalence of caries was dependent on the oral hygiene habits of the population. It was observed that lesser the frequency of brushing higher the prevalence of caries in anterior teeth. Similar results were reported in studies conducted by Hegde M. N. et al<sup>3</sup> and Tarsitani et al<sup>6</sup>.

Prevalence of caries was more in the maxillary anterior teeth than the mandibular anterior teeth. This finding may probably be due to the proximity of the mandibular teeth to the submandibular and sublingual salivary gland duct openings. Similar findings were reported by Hegde M. N. et al and Mustafa D. et al. The results of the present study show that the prevalence of caries was most common in maxillary right central incisor followed by the maxillary left central incisor and maxillary right lateral incisor.

Certain areas of the tooth are more susceptible to caries such as pit and fissures and proximal surfaces. Approximal surfaces of the anterior teeth showed the highest prevalence of caries in accordance with the study conducted by Hegde M. N. et al and Mustafa De merci et al.<sup>10</sup> Prevalence of caries was observed more in the mesial surface followed by the distal surface. This may be due to inadequate oral hygiene practices. Proximal surfaces of the anterior teeth are not self-cleansing hence may present as a retention area, thereby promoting caries

### Conclusion:-

According to the study conducted it can be concluded that prevalence of caries in the anterior teeth can be strongly correlated with age, location, diet, oral hygiene habits and the surface of the tooth. Association between gender and caries was not observed.

**References:-**

1. Fejerskov Ole, Kidd Edwina, NyvadBente, BaelumVibeke editor. Dental Caries: the Disease and its Clinical Management. 2nd ed.. Oxford: Blackwell Munksgaard; 2008
2. Featherstone JD. 2004. The continuum of dental caries: evidence for a dynamic disease process. J Dent Res 83:C39–C42.
3. Hedge MN, Hegde P, Bhat R, Rao LN, Dahiya R. Prevalence of dental caries in anterior teeth in South Canara population – a three year epidemiological study. Indian Journal of Applied Research. Vol:IV, Issue II, Feb-2014
4. Lukacs JR, Largaespada LL. Explaining sex differences in dental caries prevalence; saliva, hormones, and “life-history” etiologies. Am J Hum Bio. 2006 Jul-Aug;18(4):540-55
5. Cleaton-Jones Peter, Fattipaul. Dental caries trends in Africa. Community Dent Oral Epidemiol. 1999;27:316-320
6. Petti ,PanfiliPierluigi, SimonettiD'Arca Adele. Oral hygiene, sucrose consumption and dental caries prevalence in adolescent systemic fluoride non-users. Community Dent Oral Epidemiol. 1997;25:334–336
7. Tinanoff N, Palmer CA. Dietary determinants of dental caries and dietary recommendations for preschool children. J Public Health Dent. 2000;60:197–206 |
8. Bardow A, Moe D, Nyvad B, Nauntofte B. The buffer capacity and buffer systems of human whole saliva measured without loss of CO<sub>2</sub>. Arch Oral Biol. 2000;45:1–12
9. Mithra N. Hegde, Amit Malhotra, Nidarsh D. Hegde. Prevalence of caries in anterior teeth in adults of Dakshina Kannada Indian population – An epidemiological study
10. Mustafa D, Safa T, Ahmet AY. Prevalence of caries on individual tooth surfaces and its distribution by age and gender in university clinic patients. Eur J Dent. 2010;4(3):270-279.





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### RESEARCH ARTICLE

#### STUDY ON COOLING OF AUTOMOBILES USING AIRJET IMPINGEMENT.

Kiran Kumar Ventrapragada and Sai Nikhil Mudunuri.

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#### Abstract

Cooling has always been a difficulty faced in the automobile sector. High elevated temperatures have to be achieved and thus there is a requirement for high grade cooling in automobiles. In addition to that, other components in mechanical sector like, gas turbines, compressors, flywheels, etc all require an extensive cooling mechanism. The major contributing factor in any cooling system is the coolant fluid and the heat transfer surface area from which the heat is rejected. The general challenge when concerned with fabrication of any component is its surface finish. Not all surfaces have a smooth contour. Hence, in our project, we will be performing an experimental study on the cooling rate of a metallic component using air impingement cooling. Air impingement cooling is a procedure where, high pressure air is used as a coolant fluid over the whole surface to be cooled. Due to surface finish being a concern, the experiments will be carried out on a copper plate with a rough surface. The major advantage however with a rough surface is the increase in effective heat transfer surface area. The conventional cooling methods include-Air Cooling or Oil cooling at the domestic level. To improve on this, we would like to explore the more advanced process called Impingement cooling. Impingement cooling has the distinctive advantage of being more effective and provides with higher heat transfer rates. It is a common process that is used in the cooling of gas turbine blades and other high temperature, high precision components. Jet impingement is an attractive cooling mechanism due to the capability of achieving high heat transfer rates. This cooling method has been used in a wide range of industrial applications such as annealing of metals, cooling of gas turbine blades, cooling in grinding processes and cooling of photovoltaic cells. Jet impingement has also become a viable candidate for high-powered electronic and photonics thermal management solutions and numerous jet impingement studies have been aimed directly at electronics cooling. The set up includes a copper plate which acts as the metal body (Rough surface), an air compressor's blow off which serves as the Air impinger. The copper plate contains equal spaced holes which makes it a rough surface. This rough surface is then heated using the furnace. Then, the experiment is then conducted by using the Air compressor. At equal intervals of time, the temperature is measured. The experiment is repeated for natural convection too. The temperatures are measured using an IR gun (Infra Red gun).

Temperatures are seen for both Natural convective cooling and Impingement cooling and a graph is plotted. Then, the results are deducted.

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## ..... **Introduction:-**

This report presents a concise review of the Air Jet Impingement technique on flat surfaces. Impingement is an age old technique which was initially used on gas turbine blades in late twentieth century. This review is aimed at using the technique to a more sophisticated purpose.

**Cooling has been an age old technique. We know that there are three basic modes of heat transfer. They are:**

**Conduction:-**

**Convection:-**

**Radiation:-**

Phase change is a trending mode of heat transfer which is still in its developing stage. The project revolves around how convection is booming in the present world of Cooling. Convection is of 2 types viz. natural and forced.

## **Background:-**

Our project is based on a type of forced convection called as Impingement. Impingement is a new way of forced convection where the fluid is forced on to the hot surface at a very high force. This method is used in industries for various applications like annealing of metals, cooling of gas turbine blades, cooling in grinding processes and cooling of photovoltaic cells. Jet impingement has also become a viable candidate for high-powered electronic and photonics thermal management solutions and numerous jet impingement studies have been aimed directly at electronics cooling.

Impingement technique has been widely researched for its high value of heat removal rate and how it behaves. The jet flow characteristics are highly complex and consequently the heat transfer from a surface subject to such a flow is highly variable. Numerous jet configurations have been studied and numerous experimental parameters exist that influence both the fluid flow and the heat transfer.

Jet impingement's most sought after feature is its fluid flow characteristics. Comprehensive studies of the mean fluid flow characteristics of both a free and an axially symmetric impinging air jet have shown that Three zones can be identified in an impinging jet flow.

Firstly, there is the free jet zone, which is the region that is largely unaffected by the presence of the impingement surface; this exists beyond approximately 1.5 diameters from the impingement surface. A potential core exists within the free jet region, within which the jet exit velocity is conserved and the turbulence intensity level is relatively low. Beyond the potential core the shear layer has spread to the point where it has penetrated to the centreline of the jet. At this stage the centreline velocity decreases and the turbulence intensity increases. Second, a stagnation zone that extends to a radial location defined by the spread of the jet. The stagnation zone includes the stagnation point where the mean velocity is zero and within this zone the free jet is deflected into the wall jet flow. Finally, the wall jet zone extends beyond the radial limits of the stagnation zone.

In a jet flow, vortices initiate in the shear layer due to Kelvin Helmholtz instabilities. As the vortices move downstream of the jet nozzle each vortex can be wrapped and develop into a three dimensional structure due to secondary instabilities. A schematic of the breakdown process of toroidal vortices in an axially symmetric jet flow is presented in figure

Vortices, depending on their size and strength, affect the jet spread, the potential core length and the entrainment of ambient fluid. In certain cases jet vortices can pair, forming larger but weaker vortices. With distance from the jet nozzle the vortices break down into random small scale turbulence. In the vortex pairing case, the vortices initiate in the shear layer at a certain frequency. These vortices pass in the shear layer of the jet at the same frequency as the frequency at which they roll up. As the vortices pair off the passing frequency halves.

In this case instabilities in the boundary layer of the flow within the nozzle form vortices once the jet exhausts from

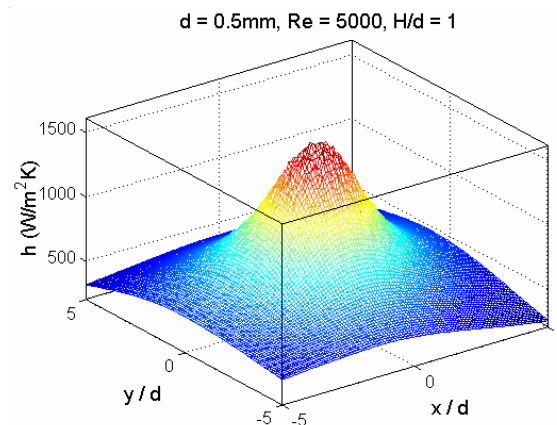
the nozzle. These vortices are typically small and initiate at high frequencies. The vortices grow and merge as they are convected downstream to form larger scale vortices in a process similar to the pairing mentioned previously.

It is known that fluids in motion can separate into regions of high and low temperature and this phenomenon is termed “energy separation”. Energy separation involves the re-distribution of total energy in a fluid flow without external work or heating. Energy separation can be initiated within the jet nozzle boundary layer flow and is enhanced later with the onset of vorticity. Because of this the naturally occurring vortex structures of an impinging jet have been the focus of much research. The maximum energy separation peaks at approximately  $H/D = 0.5$  where the strength of the vortex is a maximum. Beyond this, at about  $H/D = 1$  the maximum energy separation decreases until it is no longer discernible at  $H/D = 14$ .

#### Heat Transfer characteristics:-

The heat transfer distribution to an impinging jet varies significantly in shape and magnitude with the various test parameters. The first definition of the convective heat transfer coefficient can be used when the thermal boundary condition is one of uniform heat flux. At heights of the nozzle above the impingement surface that correspond to within the potential core length, the stagnation point heat transfer is relatively low and constant. Nusselt numbers increase with  $H/D$  for distances beyond the potential core length until it reaches a maximum at  $H/D = 8$ . This increase is attributed to the penetration of turbulence induced mixing from the shear layer to the centreline of the jet. The decrease beyond  $H/D = 8$  is due to the lower arrival velocity of the jet. Similar variation of the stagnation point Nusselt number has been reported by Lee et al. At heights of the nozzle above the impingement surface that correspond to within the potential core length, the stagnation point heat transfer is relatively low and constant. Increases with  $H/D$  for distances beyond the potential core length until it reaches a maximum at  $H/D = 8$ . This increase is attributed to the penetration of turbulence induced mixing from the shear layer to the centreline of the jet. The decrease beyond  $H/D = 8$  is due to the lower arrival velocity of the jet.

The surface finish of the impingement surface is another parameter for the enhancement of heat transfer to an impinging jet. An array of jets impinging on a dimpled surface was explored. In certain cases, it was found that the heat transfer could be enhanced by up to 50 %, depending on the cross-flow condition and on the height of the jets above the impingement surface.



**Fig 1.1:-** Heat Concentration on the plate with increasing enthalpy.

#### Research Objectives:-

The current research investigates the fluid flow and heat transfer for a submerged, un-confined axially symmetric impinging air jet, for a range of impingement parameters. Mean and fluctuating heat transfer distributions are compared with local velocity measurements. Of particular interest to the current investigation are the secondary peaks that occur in the mean heat transfer distribution when the jet nozzle is placed within 2 diameters of the impingement surface. An important objective of the current research is to reveal the convective heat transfer mechanisms that influence the magnitude and location of these peaks.

Control of the vortex development in the shear layer of the free jet and its influence on heat transfer has been a major

area of interest in this field in recent years. It has been shown that by exciting the jet, acoustically or otherwise, the vortex development can be controlled and this has a consequence for heat transfer. Another objective of this research is to understand the influence that various stages within the vortex development have on the convective heat transfer in the wall jet.

One important application of jet impingement is the cooling of a grinding process. To date this has been achieved using flood cooling with a traditional coolant such as an oil and water mixture. For both environmental and economic reasons, it would be preferable to cool the process using air. The final objective of this research is to investigate the convective heat transfer mechanisms that occur in an air cooled grinding process, with a view to determining an optimal jet set-up.

### **Literature Review:-**

This chapter presents previous research results and conclusions that are necessary in understanding the characteristic behavior of impinging jet flow. The first section explains the qualitative flow behavior of the jet before and during impingement. The second section presents experimental works that explain the effects of changing certain physical criteria such as nozzle-to-surface distance or jet Reynolds number; effects of different surface shapes, effects of multiple jets, as well as the effects of system rotation on the flow behavior. The third section presents simulation works in predicting jet impingement flow.

Convective heat transfer to an impinging air jet is known to yield high local and area averaged heat transfer coefficients. The current research is concerned with the measurement of heat transfer to an impinging air jet over a wide range of test parameters. mean and fluctuating surface heat transfer distributions up to 6 diameters from the geometric centre of the jet are reported. The time averaged heat transfer distributions are qualitatively compared to velocity flow fields. Simultaneous velocity and heat flux measurements are reported at various locations on the impingement surface to investigate the temporal nature of the convective heat transfer.

At low nozzle to impingement surface spacings the heat transfer distributions exhibit peaks at a radial location that varies with both Reynolds number and H/D. It is shown that fluctuations in the velocity normal to the impingement surface have a greater influence on the heat transfer than fluctuations parallel to the impingement surface. At certain test configurations vortices that initiate in the shear layer impinge on the surface and move along the wall jet before being broken down into smaller scale turbulence. The effects of these vortical flow structures on the heat transfer characteristics in an impinging jet flow are also presented. Specific stages of the vortex development are shown to enhance vertical fluctuations and hence increase heat transfer to the jet flow, resulting in secondary peaks in the radial distribution.

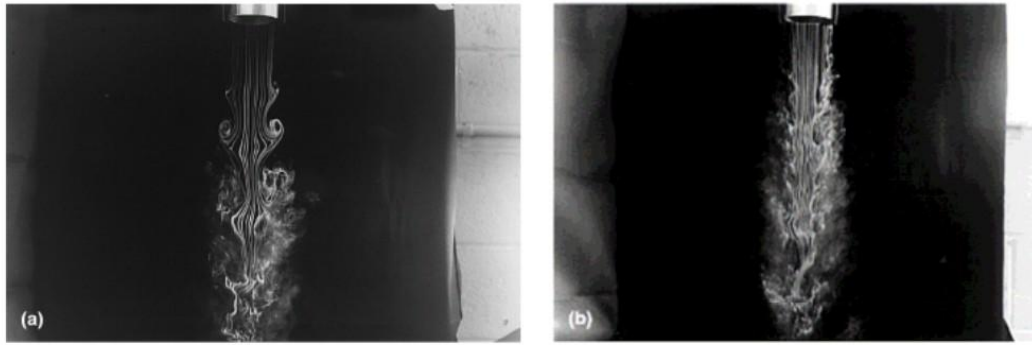
Air jet cooling of a grinding process has been investigated as large quantities of heat must be dissipated to avoid high temperatures that have an adverse effect on the workpiece and the grinding wheel itself. Convective heat transfer distributions

along the axis of cut are compared to local flow characteristics for a range of jet and grinding wheel configurations. It has been shown that the jet velocity must be significantly higher than the tangential velocity of the grinding wheel in order to penetrate the grinding wheel boundary layer and effectively cool the arc of cut.

### **Anatomy of Jets:-**

#### **Structure of Free jets:-**

The behavior of free jets and impinging jets on flat surfaces using a smoke wire visualization technique was investigated in the year 1999 and the following visuals were presented

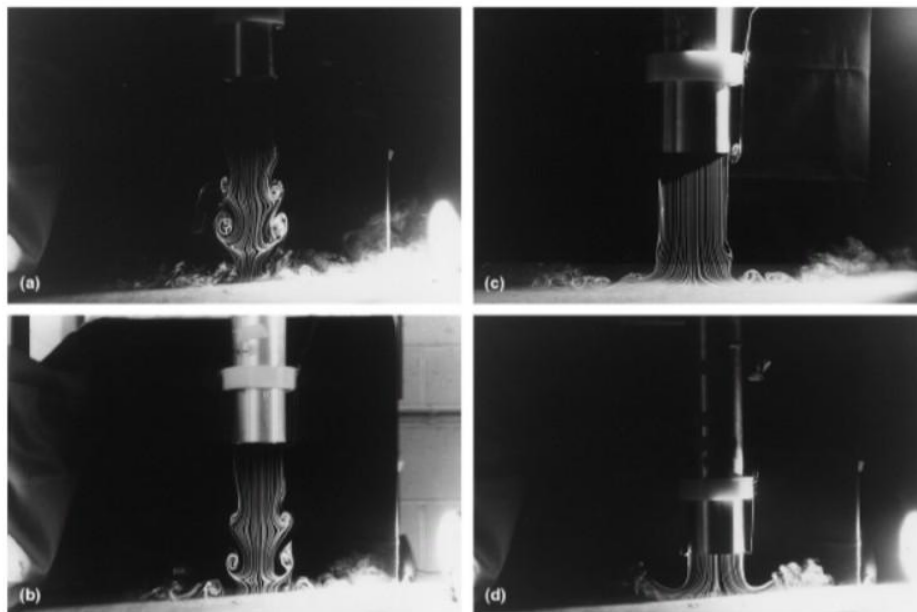


**Fig. 2.1:-** Visualization pictures showing effect of increasing Reynolds number  $Re = 6,000$  to (b)  $Re = 10,000$  on free flow structures

The above figure shows the visualization results of free jets issuing from a nozzle of diameter  $D = 47.2$  mm at two different Reynolds numbers of  $Re = 6,000$  and  $10,000$ . It is seen that at lower Reynolds number a large, well-defined, vortex structures were observed, which were no longer present at the higher Reynolds number. This was attributed to the increase in the turbulence intensity value at the nozzle edges from 9% to 14%. Thus, it was concluded that at lower Reynolds numbers, where the turbulence intensity level of the shear layer at the jet edge was less than 10%, large vortex structures would form, but no vortex structures would be present at higher Reynolds numbers, where the turbulence intensity level was greater than 14%. With low levels of turbulence intensity at the nozzle's edge, entrainment of surrounding fluid into the jet causes enough instability to create small disturbances in the flow, resulting in the formation of small vortices which roll up and grow in size as they are convected downstream and as more surrounding fluid is entrained into the jet. Eventually, these vortices grow big enough to reach the jet centreline at the end of the potential core, where the vortices will meet up before breaking down, creating high levels of turbulence. For the higher Reynolds number case, the higher levels of turbulence intensity resulted in an earlier transition to turbulent flow, which occurred closer to the jet exit nozzle than for the lower Reynolds number flow.

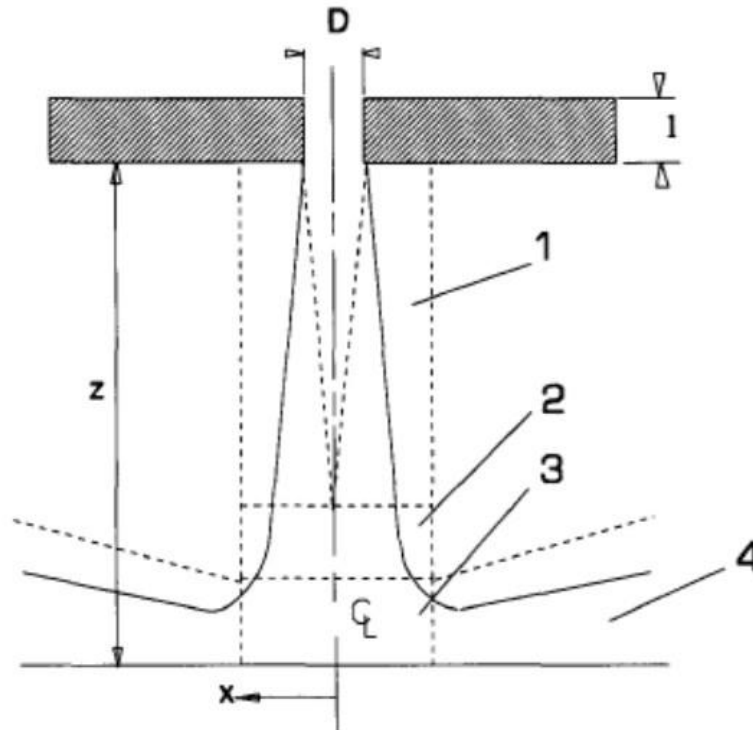
#### Structures of jets impinging on flat surfaces:-

In 1999, a few scientists obtained flow visualizations of jet impingement on a Flat Surface which is shown in the following figure.



**Fig. 2.2:-** Flow structures of a jet impinging on a flat surface (a)  $H/D = 4$  (b)  $H/D = 3$  (c)  $H/D = 2$  (d)  $H/D = 1$

At  $H/D = 4$  (Figure 2.2 (a)), the impingement occurs just at the end of the potential core resulting in the vortex structures breaking down at the impingement point. Because of this, no large vortex structures were observed radially along the flat surface after the impingement point. At  $H/D = 3$  (Figure 2.2 (b)), the vortex structures formed in the free jet continued radially along the flat surface after impingement because jet impingement occurs within the potential core region, and the transition to fully turbulent flow occurs further downstream from the stagnation point, resulting in the flow vortex structures retaining their form for a longer duration. At  $H/D = 2$  (Figure 2.2 (c)), no large vortex structures were observed along the jet because the structures have no time to form before impingement takes place, although small vortex structures did develop radially along the flat plate after the impingement. At  $H/D = 1$  (Figure 2.2 (d)), due to the close proximity of the jet nozzle to the surface, the strong axial flow resulted in a subsequent strong radial deflection with no large vortex structures forming at all, before or after impingement.



The Jet impingement flow structures are divided into four zones as shown in the figure below.

**Fig. 2.3:-** Flow zones of an impinging jet

In this figure, Zone 1 is the developing zone, which encompasses the jet nozzle exit up to the end of the potential core. The potential core is the region where the fluid velocity is almost equal to the nozzle exit velocity. It was suggested that the end of the potential core is reached when the axial velocity falls to 95% of the jet exit velocity. The reduction of the jet velocity is due to the entrainment of fluid into the jet forming a mixing or shear layer which surrounds the potential core.

Zone 2 is the established jet zone. If the nozzle-to-surface distance is sufficiently long, the flow will progress beyond the potential core length. This region will subsequently be fully turbulent and the centreline axial velocity will continually reduce as the flow moves away from the nozzle exit. the reduction of the centreline velocity is inversely proportional to the square root of the axial development distance for slot jets whilst for circular jets it is inversely proportional to the distance.

Zone 3 is the deflection zone. This region is also called the impingement zone or the stagnation zone. This is the region where there is a rapid decrease in axial velocity and an increase in static pressure. The extent of this zone is approximately nozzle diameters from the impingement surface. Zone 4 is the wall jet zone. The deflected flow from Zone 3 follows and spreads over the surface, creating a wall jet. The wall jet momentum will eventually decay due

to the effects of wall friction at the surface and the mixing with the surrounding fluid.

#### Experimental studies of impinging jets:-

##### Single Jet Impinging on Flat Surfaces:-

An early experimental work on impinging flows done by Gardon & Carbonpue (1962) investigated the effects of various nozzle-to-surface ( $H/D$ ) distances on the heat transfer rate. They found that the maximum stagnation heat transfer rate occurred at nozzle-to-surface distances of between 6 to 7 jet diameters.

The lateral variation of heat transfer coefficient at various Reynolds numbers for a nozzle-to-surface distance of  $H/D = 2$  is shown in the graph below. The profiles show that the overall heat transfer coefficient increases with an increase in Reynolds number. A number of heat transfer coefficient peaks were also observed. Two peaks were observed at Reynolds numbers between 14,000 to 28,000, at lateral positions of  $x/D = +0.5$  and  $+1.9$ . At Reynolds numbers between 2,800 and 10,000, up to three peaks were observed at lateral positions of  $x/D = +0.5$ ,  $+1.4$  and  $+2.5$ .

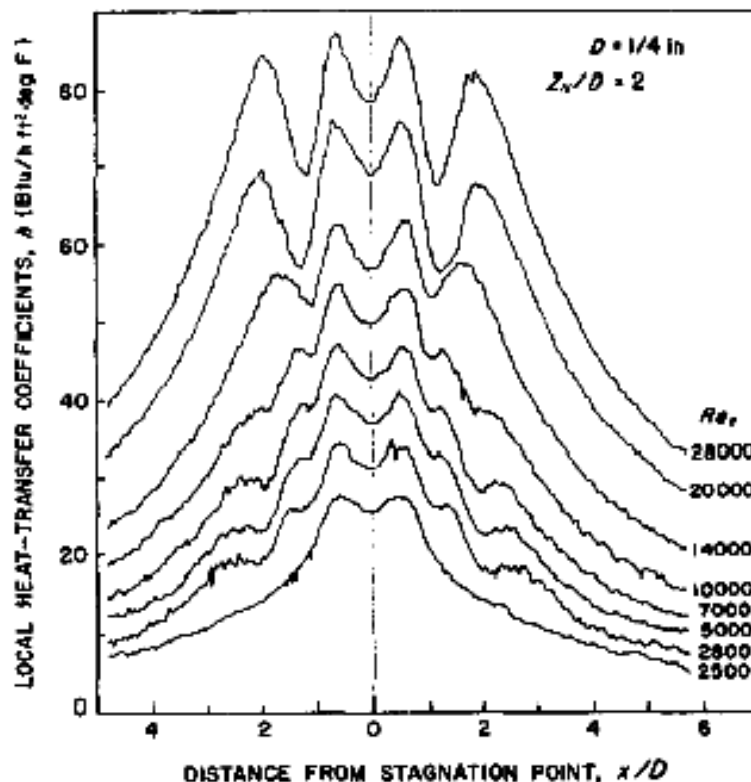


Fig. 2.4:- Lateral variations of local heat transfer coefficients

The conclusions said that the first peak is not caused by the effects of turbulence but by the mechanism of the axisymmetric impinging jet flow, regardless of whether the flow is laminar or turbulent. Also, the first peak is caused by the rapid increase in lateral velocity as the flow accelerates in the deflection region. Next, the second peak, at  $x/D = +1.9$ , is caused by the transition from laminar to turbulent boundary layer flow. Then, the third peak at  $x/D = +2.5$  for flows between  $Re = 2,800$  and  $10,000$  is caused by the toroidal vortices as observed. The local heat transfer coefficients exhibit local minimum values at the stagnation point.

#### Computational studies of Impinging jets:-

##### Modelling of impinging jets:-

Many of the widely used turbulence models for predicting momentum and heat transfer have been developed by reference to flows parallel to walls, such as simple boundary-layer flows. To use these models in complex flows, it is important that they can perform accurately regardless of the flow orientation relative to the bounding surfaces. In particular, for impinging jets, the models should be able to predict correctly both flows parallel to and normal to the walls. There are a number of significant differences between shear and impinging flow characteristics, which the

models must be able to reproduce.

Due to these differences in the flow behaviour, many turbulence models such as linear k- $\epsilon$  models, and even some stress transport models, give incorrect predictions of impinging flows. An advanced low Reynolds number second moment closure model with reasonable success on impinging jet flow and flow through ribbed passages. However, second moment closure models use a lot of computational resources because of their complexity.

Further development of the eddy viscosity approach has resulted in non-linear eddy viscosity models (NLEVM) which introduce additional non-linear terms into the stress-strain relation. A cubic stress-strain relationship into the two-equation k- $\epsilon$  eddy viscosity model tested over a range of applications including flow in a curved channel, through a rotating pipe, transitional flow over a flat plate, impinging flow and flow around a turbine blade. In each of these cases, the model produced a significant improvement in results compared with the linear model, requiring only 10% more computing time. Particularly in the case of flat plate impinging jet simulations

**Table 2.1:-** Differences between impinging flow and shear flow

<b>Impinging Flow</b>	<b>Shear Flow</b>
Turbulence energy is dominated by normal straining near the impingement region.	Turbulence energy is generated by the shear effects.
RMS fluctuating velocity normal to the wall is larger than that parallel to the wall at the impingement zone.	Stress component normal to the wall is small compared with other components.
Turbulence length-scales near the wall are strongly affected by those of the incoming jet.	Turbulence length-scales are determined by the distance from the wall.
Convective transport of turbulence energy is important near the stagnation point.	Convective effects are negligible whilst the generation and dissipation processes are roughly balanced.

#### **Research Methods:-**

Current research in improving impingement jet performance and predicting jet behavior falls into two categories, experimental and numerical. Where possible, researchers use experimental results to assist in the development and validation of numerical tools for predicting flow and heat transfer behavior.

Impingement heat transfer experiments focus on measuring the flow field characteristics and the surface heat transfer coefficients. In an experiment a single jet or jet array is constructed and positioned above a solid target such as a plate or cylindrical surface. A pump or blower forces fluid onto the target plate while instrumentation collects information about fluid properties and target surface properties. Most impinging jet industrial applications involve turbulent flow in the whole domain downstream of the nozzle, and modeling turbulent flow presents the greatest challenge in the effort to rapidly and accurately predict the behavior of turbulent jets. Numerical modeling of impinging jet flows and heat transfer is employed widely for prediction, sensitivity analysis, and device design. Finite element, finite difference, and finite volume computational fluid dynamics (CFD) models of impinging jets have succeeded in making rough predictions of heat transfer coefficients and velocity fields. The difficulties in accurately predicting velocities and transfer coefficients stem primarily from modeling of turbulence and the interaction of the turbulent flow field with the wall.

The computation grid must resolve both the upstream and downstream flow around the nozzles or orifices and must extend sufficiently far to the side of a single jet or array (typically eight to ten diameters) to provide realistic exit conditions. Zero-gradient and constant-static-pressure conditions have been used at the far-field model boundaries. Successful, stable modeling using both of these conditions can depend on properly shaping the boundary at the edge of the model domain.

Turbulent impinging jet CFD the variety of numerical models has grown and computational research has taken on a larger importance in predicting the physical behavior of impinging jets. The continuing increase in computing power has enabled more rapid computation including optimization by parametric variation. An inexpensive desktop computer may solve precise, high-resolution two-dimensional models within a day. Three-dimensional models and unsteady models are now possible without the use of super-computers, and have execution times ranging from several days to several weeks. The examples in the following review are primarily from impinging jet numerical



modeling conducted since the original review by Polat et al.

Useful as a theoretically simple approach, the direct numerical simulation (DNS) method is the most complete and physically exact numerical method employed to predict the impinging jet flow field and transfer rates. This method solves the full Navier–Stokes, continuity, and energy/mass diffusion equations using discrete units of time and space, but requires an extremely small grid to fully resolve all the turbulent flow properties, because the microscopic turbulent length scales involved in jet impingement are far smaller than the macroscopic lengths involved (e.g.  $D_0$  or  $H$ ). The consequently long computation time practically limits the use of DNS to Reynolds numbers much lower than those in the gas turbine impingement heat transfer application. Since the DNS computational time to resolve turbulent eddies grows with the local turbulent Reynolds number ( $Re_t$ ) to the third power, this modeling method may be of academic interest for laminar flows but will remain impractical for turbulent jets for the foreseen future. Typical DNS CFD studies, using supercomputers, were limited to Reynolds numbers of the order of 10,000. To represent practical application successfully, the majority of DNS computations were limited to  $Re_{0.1,000}$ , with even lower limits for highly complex flows.

In an attempt to remedy this situation, some CFD models use Large Eddy Simulation (LES). The time-variant LES approach tracks flow properties with the full equations down to some user-defined length scale (typically the grid spacing), and then uses additional sub-grid-scale equations to describe turbulent flow behavior at smaller scales. The LES method has shown encouraging results and clarified the understanding of formation, propagation, and effects of flow eddies upon the velocity fields and jet transfer characteristics, but it requires high resolution in space for accuracy, may require high resolution in time for stability and accuracy, and therefore still needs a great amount of computing power or time to produce satisfactory solutions for the transitional and turbulent flows of interest here.

### Summary:-

An investigation of documented research results has been performed regarding jet impingement cooling on flat surfaces. Both experimental and numerical studies have been surveyed, as well as situations with multiple jets and rotation effects, in addition to impingement on both concave and convex surfaces. Based on the investigation, an understanding of the flow behavior and characteristics has been achieved.

Through visualization results of low Reynolds number jet flows, it was found that large vortices develop within the surrounding mixing layer of the jet before impingement and these vortices are translated to the impinging surface, resulting in increased turbulence and heat transfer levels. The vortices will eventually disperse downstream due to momentum loss. For curved surfaces, the centrifugal forces created by the surfaces act to destabilize the flow for a boundary layer developing on a concave surface and stabilize the flow for the corresponding convex surface case. In both cases, experimental results suggest that the heat transfer rate is increased compared with that of flat plate impingement.

Generally, increasing the Reynolds number,  $Re$ , will increase the heat transfer rate at the impinged surface. The main peak in the heat transfer profile is caused by the deflection of the flow near the stagnation point resulting in a rapid lateral velocity where the flow follows the impinging surface. Increasing the nozzle-to-surface distance  $H/D$  to a position just beyond the jet's potential core will generally increase the heat transfer rate because at that relative high  $H/D$ , the flow reaching the surface is already fully turbulent. At lower  $H/D$ , secondary peaks are observed in the heat transfer profiles caused by the transition of the wall jet from laminar to turbulent flow. In some cases, a minima is observed at the stagnation point because, due to the low  $H/D$ , the flow reaching the surface is within the non-turbulent potential core region.

Predictions using the two-equation  $k-\epsilon$  linear eddy viscosity model have proved to be inaccurate for simulations involving flat plate jet impingement and rotating flows. This is because the linear  $k-\epsilon$  model fails to capture correctly the normal stress anisotropy in impingement flow and the effects of Coriolis forces in rotational flow. However, for jet impingement on a concave surface, the  $k-\epsilon$  linear model did show reasonable correlation with experimental results. For flat plate impingement and rotating flow, predictions using two-equation  $k-\epsilon$  non-linear cubic eddy viscosity models can give reasonably good results due to the inclusion of additional non-linear terms in the stress-strain relation. Second moment closure models generally gave better predictions for jet impingement and rotating flows but at the cost of higher computational time and resources due to their complexity.

**Jet Impingement:-**

Impinging jets have attracted much research from the viewpoint of the fluid flow characteristics and their influence on heat transfer. The jet flow characteristics are highly complex and consequently the heat transfer from a surface subject to such a flow is highly variable. Numerous jet configurations have been studied and numerous experimental parameters exist that influence both the fluid flow and the heat transfer. The overall objective of the current research is to conduct a fundamental investigation of the heat transfer mechanisms for an impinging air jet. Much of the research presented in this chapter has been conducted as independent investigations into jet impingement fluid flow and impinging jet heat transfer.

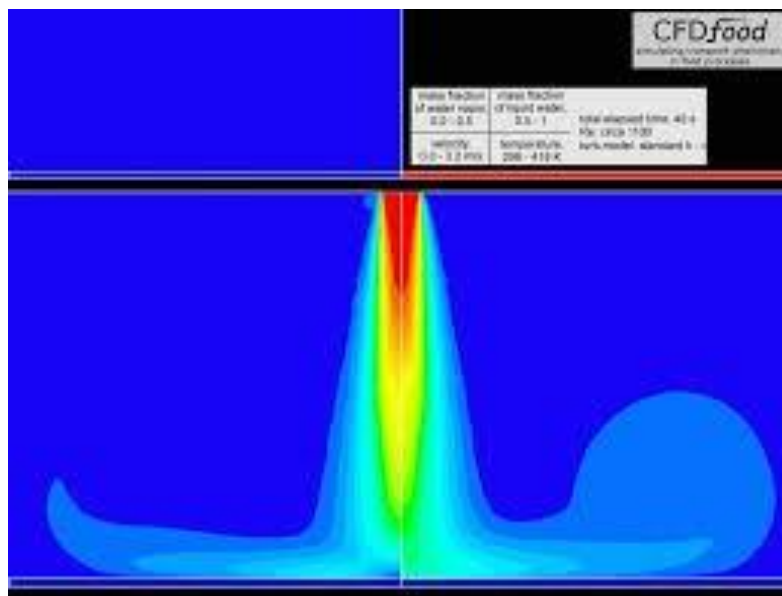
This chapter is divided into 3 parts. The first showing the jet fluid flow characteristics which includes all the aspects of the flow that have been shown to influence the heat transfer. Second section describes the various parameters which influence the heat transfer. Third part shows some novel techniques that enhance Heat transfer to an impinging air jet.

**Fluid Flow Characteristics:-**

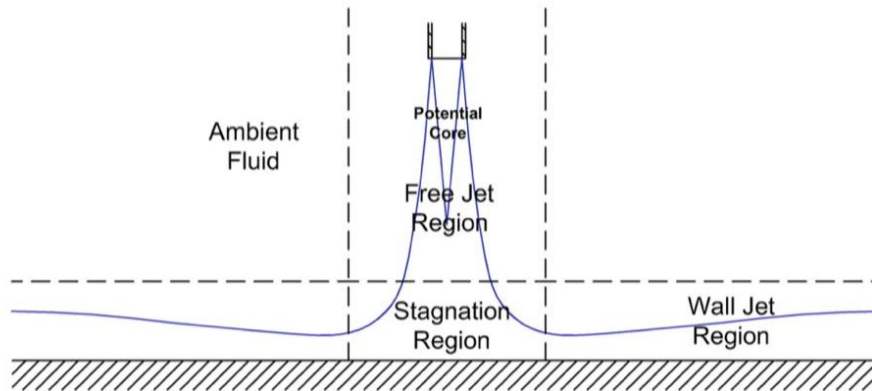
This section presents some of the latest research on impinging jet fluid flows that has a consequence for heat transfer and has not been presented in the previous reviews of mean characteristics of jet flow.

**Jet Flow Characteristics:-**

Three zones can be identified in an impinging jet flow. Firstly, there is the free jet zone, which is the region that is largely unaffected by the presence of the impingement surface; this exists beyond approximately 1.5 diameters from the impingement surface. A potential core exists within the free jet region, within which the jet exit velocity is conserved and the turbulence intensity level is relatively low. A shear layer exists between the potential core and the ambient fluid where the turbulence is relatively high and the mean velocity is lower than the jet exit velocity. The shear layer entrains ambient fluid and causes the jet to spread radially. Beyond the potential core the shear layer has spread to the point where it has penetrated to the centreline of the jet. At this stage the centreline velocity decreases and the turbulence intensity increases. The stagnation zone includes the stagnation point where the mean velocity is zero and within this zone the free jet is deflected into the wall jet flow. Finally, the wall jet zone extends beyond the radial limits of the stagnation zone.



**Fig. 3.1:-** Jet flow characteristics.



**Fig. 3.2:-** Impinging Jet zones.

The jet emerges from a nozzle or opening with a velocity and temperature profile and turbulence characteristics dependent upon the upstream flow. For a pipe-shaped nozzle, also called a tube nozzle or cylindrical nozzle, the flow develops into the parabolic velocity profile common to pipe flow plus a moderate amount of turbulence developed upstream. In contrast, a flow delivered by application of differential pressure across a thin, flat orifice will create an initial flow with a fairly flat velocity profile, less turbulence, and a downstream flow contraction (vena contracta). Typical jet nozzle designs use either a round jet with an axisymmetric flow profile or a slot jet, a long, thin jet with a two-dimensional flow profile.

After it exits the nozzle, the emerging jet may pass through a region where it is sufficiently far from the impingement surface to behave as a free submerged jet. Here, the velocity gradients in the jet create a shearing at the edges of the jet which transfers momentum laterally outward, pulling additional fluid along with the jet and raising the jet mass flow.

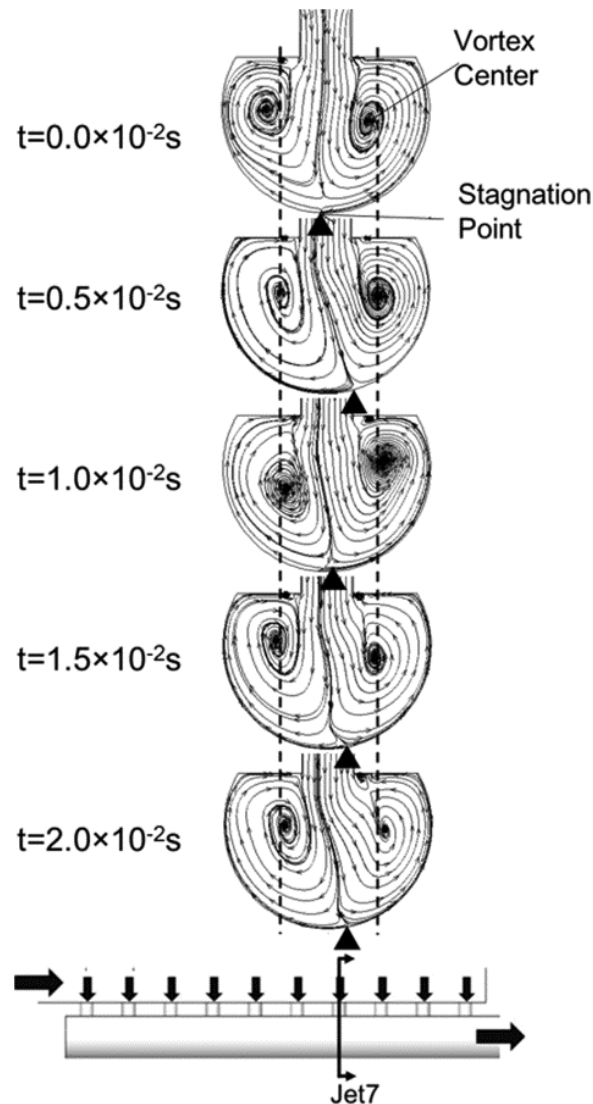
In the process, the jet loses energy and the velocity profile is widened in spatial extent and decreased in magnitude along the sides of the jet. Flow interior to the progressively widening shearing layer remains unaffected by this momentum transfer and forms a core region with a higher total pressure, though it may experience a drop in velocity and pressure decay resulting from velocity gradients present at the nozzle exit. A free jet region may not exist if the nozzle lies within a distance of two diameters ( $2D$ ) from the target. In such cases, the nozzle is close enough to the elevated static pressure in the stagnation region for this pressure to influence the flow immediately at the nozzle exit.

As the flow approaches the wall, it loses axial velocity and turns. This region is labeled the stagnation region or deceleration region. The flow builds up a higher static pressure on and above the wall, transmitting the effect of the wall upstream. The non-uniform turning flow experiences high normal and shear stresses in the deceleration region, which greatly influence local transport properties. The resulting flow pattern stretches vortices in the flow and increases the turbulence. The stagnation region typically extends 1.2 nozzle diameters above the wall for round jets

After turning, the flow enters a wall jet region where the flow moves laterally outward parallel to the wall. The wall jet has a minimum thickness within 0.75–3 diameters from the jet axis, and then continually thickens moving farther away from the nozzle. This thickness may be evaluated by measuring the height at which wall-parallel flow speed drops to some fraction (e.g. 5%) of the maximum speed in the wall jet at that radial position. The boundary layer within the wall jet begins in the stagnation region, where it has a typical thickness of no more than 1% of the jet diameter. The wall jet has a shearing layer influenced by both the velocity gradient with respect to the stationary fluid at the wall (no-slip condition) and the velocity gradient with respect to the fluid outside the wall jet. As the wall jet progresses, it entrains flow and grows in thickness, and its average flow speed decreases as the location of highest flow speed shifts progressively farther from the wall. Due to conservation of momentum, the core of the wall jet may accelerate after the flow turns and as the wall boundary layer develops. For a round jet, mass conservation results in additional deceleration as the jet spreads radially outward

**Vortex Development:-**

In a jet flow, vortices initiate in the shear layer due to Kelvin Helmholtz instabilities. As the vortices move downstream of the jet nozzle each vortex can be wrapped and develop into a three dimensional structure due to secondary instabilities.



**Fig. 3.3:-** Vortex development

Vortices, depending on their size and strength, affect the jet spread, the potential core length and the entrainment of ambient fluid. In certain cases jet vortices can pair, forming larger but weaker vortices. With distance from the jet nozzle the vortices break down into random small scale turbulence. In the vortex pairing case, the vortices initiate in the shear layer at a certain frequency. These vortices pass in the shear layer of the jet at the same frequency as the frequency at which they roll up. As the vortices pair off the passing frequency halves. In general, turbulent jets have a fundamental frequency at which the pairing process stabilizes and this is determined by the turbulence level of the jet.



**Fig. 3.4:-** Vortex Separation

In this case instabilities in the boundary layer of the flow within the nozzle form vortices once the jet exhausts from the nozzle. These vortices are typically small and initiate at high frequencies. The vortices grow and merge as they are convected downstream to form larger scale vortices in a process similar to the pairing mentioned previously.

#### **Energy separation:-**

It is known that fluids in motion can separate into regions of high and low temperature and this phenomenon is termed “energy separation”. Energy separation involves the re-distribution of total energy in a fluid flow without external work or heating. Energy separation can be initiated within the jet nozzle boundary layer flow and is enhanced later with the onset of vorticity. Because of this the naturally occurring vortex structures of an impinging jet have been the focus of much research. Heat transfer Characteristics The heat transfer distribution to an impinging jet varies significantly in shape and magnitude with the various test parameters. This section focuses primarily on differences between various investigations available in the literature. This includes the effects of some parameters that have not been considered in the current research. In general, the heat transfer distribution is presented as the variation of the local Nusselt number with radial position.

#### **Enhancement techniques:-**

Several techniques have been investigated with a view to enhancing the heat transfer to an impinging air jet. These include increasing the turbulence in the jet, the addition of swirl or artificially exciting the jet. This section identifies some of these techniques, explains the principles behind them and then briefly describes some of the findings of the various research conducted.

#### **Nozzle geometry:-**

The jet nozzle geometry is believed to have a significant effect on the heat transfer to the impinging air jet. Several studies attribute inconsistencies between reported data and their own research to slight differences in the nozzle geometries. For this reason, the effect of nozzle geometry on heat transfer has attracted much research. One of the most important aspects of the nozzle geometry is confinement. A long pipe nozzle issuing a jet into a open space is considered to be unconfined, however in many cases, a nozzle is machined into a plate. This situation is considered to be semi-confined.

#### **Nozzle Shape:-**

The effect of nozzle inlet chamfering, with a view to enhancing the ratio of area averaged heat transfer coefficient to the pressure drop across the jet nozzle. This was done by finding the optimum inlet chamfering angle. It was concluded that while the inlet chamfer angle has a large effect on the pressure drop across the nozzle; the effect on the heat transfer coefficient was not significant. A chamfer angle in the vicinity of approximately  $60^\circ$  was shown to be the optimum set-up as this removed a sharp corner at the inlet which reduced the effect of a vena contract within the nozzle. Both smaller and larger angles were more similar to a sharp edged orifice.

For a semi-confined jet orifice, the effect of jet exit chamfering on the heat transfer to the impinging air jet. It has been shown that for a sharp edged orifice the maximum turbulence intensity is greater than that with less chamfering or no chamfering (square edged). The nozzle exit chamfering has been shown to induce more jet expansion than the sharp edged orifice. Results reported in their investigation were also compared to previous investigations that employed both contoured nozzles and fully developed flow from long pipe jets. All the data presented by Lee and Lee [62] have shown enhancements in the heat transfer by 25

° 55 % and 50 ° 70 % with respect to the fully developed pipe jet and the contoured nozzle respectively, at low  $H/D = 2$ . This enhancement is attributed to the higher turbulence intensity of the orifice jets. The nozzles investigated included a semi- confined hyperbolic shaped nozzle, a semi-confined orifice and an unconfined jet. In general, the pressure distribution along the impingement surface decreases from a maximum at the geometric centre with increasing radial distance. However, at low  $H/D < 2$  the pressure is reported to be sub-atmospheric between  $0.6 < r/D < 2.2$ .

### **Jet Excitation:-**

Jet excitation has been shown to have the potential to significantly influence heat transfer to an impinging jet. A jet has a natural frequency at which vortices form and develop and it is thought that this naturally occurring frequency has an effect on the heat transfer distribution. Artificial excitation can control the development of vortices in the jet flow and therefore has the potential to enhance the heat transfer from the surface. This is the most recent enhancement technique investigated by researchers.

The impinging air jet acoustically and reported on the resulting flow and heat transfer distributions. It has been shown that, depending on the frequency of excitation, the area averaged heat transfer can be enhanced or reduced at low nozzle to impingement surface spacings. In the case where the jet is excited at a sub harmonic of the natural frequency of the jet, the heat transfer is reduced. This frequency has the effect of strengthening the coherence of the naturally occurring frequency. It is thought that the energy separation due to a more coherent flow structure has an adverse affect on the heat transfer to the jet. The jet was also excited at a frequency higher than that of the natural jet frequency. In this case the excitation had the effect of producing intermittent vortex pairing. This results in a break down of the naturally occurring vortex. Consequently, the effects of energy separation are reduced and transition to small scale turbulence effectively increases the heat transfer to the impinging air jet.

Acoustic excitation was applied to the shear layer of the jet also. Two naturally occurring frequencies were identified in the spectrum of the velocity data acquired in the free jet. The larger occurred at approximately 1kHz and this corresponds to the fundamental frequency of vortex generation. A subharmonic of this frequency at 500Hz is present and is due to the frequency of vortex pairing. Three shear layer excitation frequencies were applied to the jet, (1950,2440,3250Hz). When the jet is excited at a multiple of the natural jet frequency, the vortex is maintained at larger distances downstream. This is because the excitation frequency suppresses the effects of vortex pairing. Results have shown that while the frequency of the jet flow is affected strongly by the acoustic excitation of the jet it has a less significant effect on the vortex frequency. At higher excitation frequencies, the vortex frequency is increased marginally. In general, the excitation frequency has the potential to change the potential core length, depending on whether the excitation frequency encourages or discourages vortex pairing. Therefore, the heat transfer rate can be affected by changing the location of the impingement surface relative to the jet development stages without changing its location relative to the nozzle exit. When the excitation frequency was equal to, or close to being equal to, a harmonic of the natural frequency of the jet, vortex pairing was suppressed. This elongated the potential core of the jet. Otherwise the jet excitation facilitated vortex pairing and reduced the potential core length.

The difference between main- stream jet excitation and shear layer excitation was investigated. Essentially no significant difference was noted between the two excitation techniques. Results were presented for a range of Strouhal numbers and for two different excitation power levels from 80dB to 100dB. Only slight differences in the jet structure are noticed to vary with excitation technique. When the main flow was excited the potential core is reported to be slightly shorter and the turbulence intensity to be elevated slightly. It has been shown that a significant excitation power level (approx. 90dB) is required to have an appreciable effect on the jet velocity or turbulence intensity. Once again however, the power level is a factor that amplifies the effect that a particular excitation has. Finally, for a heated plane jet that when the excitation frequency is within 4.5Hz of the natural frequency of the jet, the vortices are strengthened by the excitation.

**Other techniques:-**

Several other techniques have been employed with a view to enhancing the overall heat transfer to an impinging jet flow. Some of these techniques are:

**Intermittency:-**

An intermittent jet flow has been used to provide enhancement of the convective heat transfer to a free surface water jet. Depending on the location on the impingement surface the heat transfer could be enhanced by up to 100 %. This is explained on the basis that the intermittent flow forces renewal of the hydrodynamic and thermal boundary layers that form along the wall jet. An investigation presented results for another self-oscillating jet. Results were presented for oscillation frequencies from 20Hz to 100Hz. A significant enhancement in the heat transfer to the jet of up to 70 % was reported for the specific range of heights ( $H/D \geq 24$ ) and Reynolds number of 14000. In another investigation, different sort of nozzle geometry, that of a precessing jet effectively the precessed jet motion is that of self-sustained unsteadiness. It was found that for the range of parameters studied, however, the heat transfer to the jet was reduced. Effectively there are two main competing effects. The first is that the interaction of the jet with the ambient flow increases the mixing and turbulence of the flow along the plate. However, this interaction has the consequence of reducing the arrival velocity of the impinging jet. It is thought that the heat transfer is highly sensitive to the amplitude and frequency of the oscillations and therefore the enhancement

**Turbulence Promoters:-**

In an attempt to enhance the heat transfer by increasing the turbulence in the jet flow, installed mesh screens across the nozzle exit with various mesh solidity. The mesh screen has the effect of increasing turbulence in the stagnation zone. It also reduced the pressure in this zone and this resulted in enhancement of the heat transfer coefficients by up to 4 % at low  $H/D$  and a mesh screen solidity of 0.83.

**Surface Finish:-**

The surface finish of the impingement surface is another parameter for the enhancement of heat transfer to an impinging jet. In an investigation] an array of jets impinging on a dimpled surface was explored. In certain cases, it was found that the heat transfer could be enhanced by up to 50 %, depending on the cross- flow condition and on the height of the jets above the impingement surface.

The literature to date has shown that the heat transfer to an impinging air jet is highly sensitive to each of the many experimental parameters that exist. The shape of the heat transfer distribution in particular varies considerably with height of the jet nozzle above the impingement surface. While abrupt increases in turbulence in the wall jet are used to explain the location and magnitude of secondary peaks in heat transfer the literature fails to provide an in depth explanation of the heat transfer mechanism that causes this increased heat transfer.

In more recent years, attention has been focused on the potential of vortices within an impinging jet flow to enhance the heat transfer. It has been revealed that vortices serve to enhance energy separation within the flow. Research has also shown that the development of a vortex can be influenced by artificial excitation of the jet flow and that, depending on the excitation frequency, the time averaged heat transfer can be enhanced. An understanding of the heat transfer mechanisms at various stages within the vortices' development is not available however.

Finally, it is apparent that the jet nozzle has a significant effect on the overall heat transfer. Discrepancies between studies have been attributed to slight differences between nozzle geometries. The jet exit flow condition is dependent on the nozzle shape and therefore each investigation is nozzle specific. The current investigation presents data for the most common nozzle type found in the literature, i.e. a hydro- dynamically fully developed jet that issues from a long pipe.

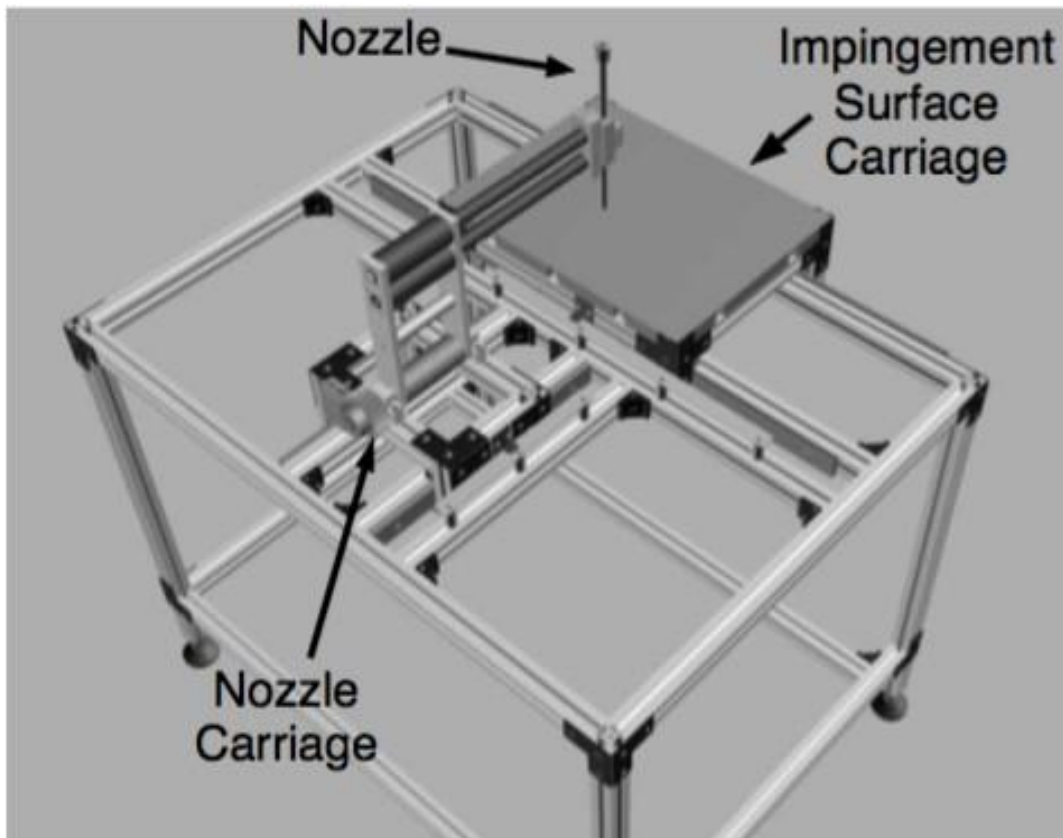
**Experimental Set up and measurement techniques:-**

In this chapter, we describe the experimental rig design and the measurement techniques employed. The experimental rig has been designed to allow for the variation of parameters beyond the scope of this project and these are detailed in this chapter. The specifics of the fluid flow and heat transfer measurement techniques used are also detailed in this chapter. Finally, the acquisition hardware and software are described.



**Experimental rig:-**

The experimental rig is to be used for both the impinging air jet and for the study of air jet cooling. The rig consists of an Air Compressor connected to a shower which acts as an impinger, Copper plate which acts as a rough surface and a table fan to measure the fundamental investigation.



**Fig. 4.1:-** Schematic diagram of set-up

**Experimental Equipment:-**

The experiment consists of the following equipment.

**Shower:-**

**Fig. 4.2:-** Stainless Steel Shower

The Stainless steel Shower is used for impingement cooling of the plates. The Shower is connected to the flexible pipe and the other end of the flexible pipe to the outlet of the air compressor. The shower is placed right above the



Heated plates and air impacts the hot plates at right angles.

**Copper Plates:-**



**Fig. 4.3:-** Copper plate of thickness 0.1in



**Fig. 4.4:-** Copper plate of thickness 0.5in

The above are the copper plates on which the experiment is conducted. There are two copper plates which are used. One of thickness 0.1in and the other of thickness 0.5in.

**Air Compressor:-**



**Fig. 4.5:-** Air Compressor.

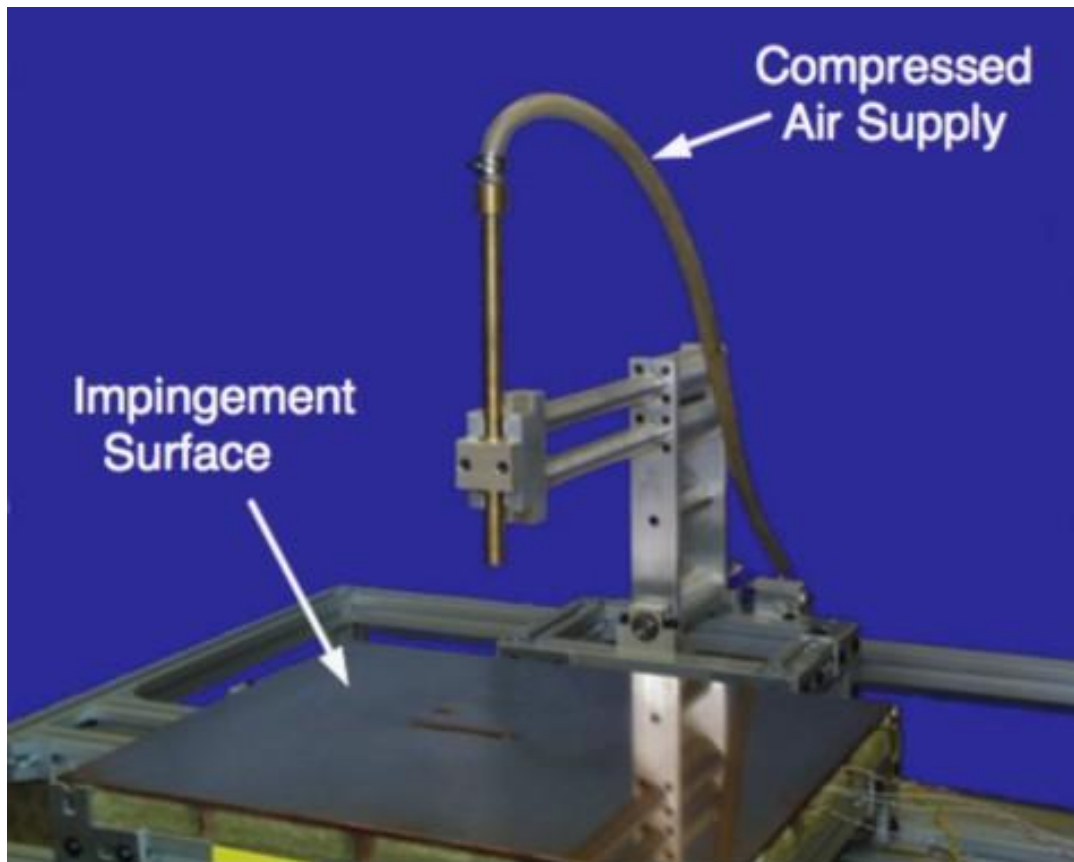
**Infra Red Thermometer:-**

**Fig. 4.6:-** Infra Red Thermometer.

**The Infra Red Thermometer uses Infra Red waves to detect temperature. When the laser light is incident on the plate, the infra red waves reads the temperature and displays the temperature.**

**Set-up for Fundamental investigation:-**

The main elements of the experimental rig are a nozzle and an impingement surface. Both are mounted on independent carriages that travel on orthogonal tracks. The flat impingement surface is instrumented with two single point heat flux sensors and the ability of the carriages to move in this way enables the jet to be positioned relative to the sensors at any location in a two dimensional plane.



**Fig. 4.7:-** Actual set up.

**Measurement Technique:-**

There are 3 experiments being conducted. First by natural convection, second by forced convection and finally by impingement. Each of the experiment has a separate measurement mode. They are listed below:

**For Natural Convection:-**

The copper plate is heated by using the furnace to a temperature of about  $450^{\circ}\text{C}$ . The temperature is measured using an Infra Red gun. This metal plate is then carefully taken from the furnace and kept in the open to undergo natural convection. The temperature is noted down at every 15 minutes and the experiment is repeated with the second metal plate.

**For Forced Convection:-**

The copper plate is heated by using the furnace to a temperature of about  $450^{\circ}\text{C}$ . The temperature is measured using an Infra Red gun. This metal plate is then carefully taken from the furnace and kept under a table fan for forced convection to occur. The temperature of the plate is checked at every 15 minutes and the experiment is repeated with the second metal plate.

**For impingement:-**

The copper plate is heated by using the furnace to a temperature of about  $450^{\circ}\text{C}$ . The temperature is measured using an Infra Red gun. This metal plate is then carefully taken from the furnace and kept under the shower of the air compressor for impingement to occur. The temperature of the plate is checked at every 15 minutes and the experiment is repeated with the second metal plate.

**Tables of Data.****On Copper plate of thickness 0.5in.****Natural Convection.****Table 5.1:-** Temperature-Time values for Natural Convection.

Time (Minutes)	Temperature ( $^{\circ}$ C)
0	454
15	446
30	431
45	416
60	408
75	396
90	381
105	364
120	350
135	331
150	306
165	297
180	271
195	255
210	231
225	212
240	198
255	177
270	142
285	120
300	103
315	93
330	80
345	71
360	47
375	44

**Forced Convection:-****Table 5.2:-** Temperature-Time values for Forced Convection

Time (minutes)	Temperature ( $^{\circ}$ C)
0	448
15	418
30	391
45	360
60	339
75	307
90	288
105	267
120	243
135	219
150	193
165	172
180	140
195	122
210	98
225	78
240	54
255	48



**Impingement cooling:-****Table 5.3:-** Temperature-Time values for Impingement cooling

Time (minutes)	Temperature ( $^{\circ}$ C)
0	459
5	390
10	328
15	241
20	178
25	119
30	98
35	73
40	42

**On Copper plate of thickness 0.1in****Natural convection****Table 5.4:-** Temperature-Time values for Natural Convection.

Time (minutes)	Temperature ( $^{\circ}$ C)
0	453
15	442
30	429
45	411
60	401
75	391
90	376
105	359
120	343
135	327
150	306
165	291
180	269
195	241
210	219
225	198
240	171
255	140
270	119
285	98
300	76
315	54
330	51

**Forced Convection:-****Table 5.5:-** Temperature-Time values for Forced Convection

Time (minutes)	Temperature ( $^{\circ}$ C)
0	455
15	418
30	387
45	351
60	332
75	301
90	279
105	251
120	229

135	201
150	175
165	143
180	122
195	95
210	56
225	52

Impingement cooling:-

**Table 5.6:-** Temperature-Time values for Impingement cooling.

Time (minutes)	Temperature ( $^{\circ}$ C)
0	452
5	381
10	311
15	233
20	151
25	95
30	48

### Conclusions:-

The main objective of this thesis is to explore the technique of Air Jet Impingement as a technique for cooling automobiles. With it's existing uses it has been seen that Impingement cooling can be a method to cool Automobile Engines at a very fast rate.

However, before the experiment was conducted, simpler computational domains were taken into account. Such as, Flat plate with uniform roughness was used. Also, copper plates were used due to it's high conductivity. The temperature of the plates were not allowed to go beyond  $450^{\circ}$  C and the pressure from the Air compressor was maintained at a constant pressure.

A comparison of the types of present cooling techniques viz. Natural Convection, Forced Convection and Impingement cooling is done and the best method is identified.

The following conclusions can be derived from these numerical investigations involving both the copper flat plates.

1. The ambient temperature of the environment had a major role to play in cooling the surfaces. Temperature during the experiment was around  $46^{\circ}$  C, hence the higher time for cooling during cooling.
2. For the conditions investigated the RMS velocity or turbulence intensity is a maximum in the wedge made between the grinding wheel and the grinding surface.
3. The Angle of incidence on to the plate had a major role to play.
4. It has been seen that a high speed jet effectively penetrates the boundary layer flow around the grinding wheel providing good cooling of the grinding zone.
5. Vortices that roll-up naturally in the shear layer of the free jet, close to the nozzle exit, have been shown to merge forming larger yet weaker vortices, before being broken down into smaller scale random turbulence. Stages within the merging processes have been identified to occur at various distances from the jet nozzle.
6. The effect that the actual vortex structure has on surface heat transfer has attracted little attention. It has been shown here that axial velocity fluctuations close to the impingement surface have a far greater influence on the heat transfer than fluctuations parallel to the surface. Vortices that impinge upon the surface determine the magnitude and frequency of the fluctuations in both directions. Because of this, the various stages of the vortex merging process influence the mean and RMS Nusselt number distributions at low H/D.
7. Vortices that impinge at later stages in their development are weaker and therefore as they breakup in the wall jet, the magnitude of the velocity fluctuations normal to the surface is reduced. This does not enhance the heat transfer in the wall jet, to the same degree as stronger vortices do. In general, the breakdown of strong vortices (in the early stages of the vortex development), has a favorable effect on the heat transfer in the near wall jet. Enhancement of the heat transfer in this region could be achieved by exciting the jet so that strong coherent vortices impact on the heated surface.

**Further Work:-**

The current research on impinging jet flow has been concerned with the effect of vortices at different stages in their development on the surface heat transfer. Recent studies have shown that jet excitation has the potential to control the development of vortices in a jet flow. With the knowledge gained from the current research, further work would include the artificial excitation of the impinging jet flow. This would facilitate an in depth investigation of the effect of the vortical jet flow on the surface heat transfer, for a wider range of parameters to include the vortex strength, passing frequency, etc.

Also. With impingement on the rise, it would be of a great intensity if it enters the Automobile Industry to cool the Automobile Engines as that would lead it to Higher vehicle life, higher engine usage, low cost of maintenance and higher profit rates.

**Acknowledgement:-**

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**References:-**

1. Donaldson, C. D., and Snedeker, R. S., 1971, "A study of free jet impingement, part i mean properties of free impinging jets," *Journal of Fluid Mechanics*, 45, pp. 281 – 319.
2. Maurel, S. and Sollicec, C. A turbulent plane jet impinging nearby and far from a flat plate. *Exp. Fluids* 31, 687–696. Goldstein, R. J., Behbahani, A. I., and Heppelmann, K. K. (1986). Streamwise distribution of the recovery factor and the local heat transfer coefficient to an impinging circular air jet. *Int. J. Heat Mass Transfer* 29, 1227–1235.
3. Baughn, J. W., and Shimizu, S. S., (1989), "Heat transfer measurements from a surface with uniform heat flux and a fully developed impinging jet", *J. Heat Transfer*, Vol.111.
4. Jambunathan, K., Lai, E., Moss, M. A., and Button, B. L. (1992). A review of heat transfer data for single circular jet impingement. *Int. J. Heat Fluid Flow* 13, 106–115. Donaldson, C. D. and Snedeker, R. S. (1971). A study of free jet impingement. Part 1. Mean properties of free and impinging jets,. *J. Fluid Mech.* 45, 281–319.
5. Baughn, J. W., Yan, X. J., and Mesbah, M., (1992), "The effect of Reynolds number on the heat transfer distribution from a flat plate to a turbulent impinging jet", *Proc. ASME Winter Annual Meeting*, November 1992.
6. Hollworth, B. R., and Durbin, M., 1992, "Impingement cooling of electronics," *ASME Journal of Heat Transfer*, 114, pp. 607 – 613.
7. Viskanta, R. (1993). Heat transfer to impinging isothermal gas and flame jets. *Exp. Thermal Fluid Sci.* 6, 111–134. Zuckerman, N. and Lior, N. (2005). Impingement heat transfer: Correlations and numerical modeling. *J. Heat Transfer* 127, 544–552.
8. Han, J.-C., Dutta, S., and Ekkad, S. (2000). "Gas Turbine Heat Transfer and Cooling Technology". Taylor & Francis, New York. Taniguchi, H., Miyamae, S., Arai, N., and Lior, N. (2000). Power generation analysis for high temperature gas turbine in thermodynamic process. *AIAA J. Propul. Power* 16, 557–561.
9. Kim, B. G., Yu, M. S., Cho, Y. I., and Cho, H. H. (2002). Distributions of recovery temperature on flat plate by under expanded supersonic impinging jet. *J. Thermophys. Heat Transfer* 16, 425–431. Lee, J. and Lee, S. (2000). The effect of nozzle configuration on stagnation region heat transfer enhancement of axisymmetric jet impingement. *Int. J. Heat Mass Transfer* 43, 3497–3509.
10. Hollworth, B. R., and Durbin, M., 1992, "Impingement cooling of electronics," *ASME Journal of Heat Transfer*, 114, pp. 607 – 613.
11. Babic, D. M., Murray, D. B., and Torrance, A. A., 2005, "Mist jet cooling of grinding processes," *International Journal of Machine Tools and Manufacture*, 45, pp. 1171 – 1177.
12. Sparrow, E. M., and Lovell, B. J., 1980, "Heat transfer characteristics of an obliquely impinging circular jet," *ASME Journal of Heat Transfer*, 102, pp. 202 – 209.
13. Lee, J., and Lee, S., 2000, "The effect of nozzle configuration on stagnation region heat transfer enhancement of axisymmetric jet impingement," *International Journal of Heat and Mass Transfer*, 43, pp. 3497 – 3509.
14. Lee, D. H., Won, S. Y., Kim, Y. T., and Chung, Y. S., 2002, "Turbulent heat transfer from a flat surface to a



- swirling round impinging jet,” *International Journal of Heat and Mass Transfer*, 45, pp. 223 – 227.
15. Wen, M. Y., and Jang, K. J., 2003, “An impingement cooling on a flat surface by using circular jet with longitudinal swirling strips,” *International Journal of Heat and Mass Transfer*, 46, pp. 4657 – 4667.
  16. Gao, N., Sun, H., and Ewing, D., 2003, “Heat transfer to impinging round jets with triangular tabs,” *International Journal of Heat and Mass Transfer*, 46, pp. 2557-2569.
  17. Yu, M. H., Lin, T. K., and Hsieh, Y. Y., 2001, “Influence of acoustic forcing on the near field development of a heated plane jet,” *Experimental Thermal and Fluid Science*, 25, pp. 13 – 22.
  18. Zumbrennen, D. A., and Aziz, M., 1993, “Convective heat transfer enhancement due to intermittency in an impinging jet,” *ASME Journal of Heat Transfer*, 115, pp. 91 – 98.
  19. Camci, C., and Herr, F., 2002, “Forced convection heat transfer enhancement using a self-oscillating impinging planar jet,” *ASME Journal of Heat Transfer*, 124, pp. 770 – 782.
  20. Göppert, S., Gürtler, T., Mocikat, H., and Herwig, H., 2004, “Heat transfer under a precessing jet: effects of unsteady jet impingement,” *International Journal of Heat and Mass Transfer*, 47, pp. 2795 – 2806.
  21. Kanokjaruvijit, K., and Martinez-botas, R. F., 2005, “Jet impingement on a dimpled surface with different crossflow schemes,” *International Journal of Heat and Mass Transfer*, 48, pp. 161 – 170.



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### RESEARCH ARTICLE

#### THE MODEL OF BEEF CATTLE BREEDING DEVELOPMENT WITH HOUSEHOLD ECONOMIC APPROACH IN JEMBER REGENCY.

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Household, policy, breeding

#### Abstract

The analysis in specific aims was using *Gaduhan Model* that was considered as suitable to the existing conditions in Jember Regency. Some analyses would be used in this research, and these included Analysis of Regression, Individually Coefficient Test (t-test), Simultaneously Coefficient Test (F-test), and Classical Assumption Test. Result of research had given some results. (1) Household economic model could explain the behavior of deciding the production of farming and breeding. This decision was influential to the income of farmer household. This decision was numerous, including that about grass-collection worker, on-family breeding worker, concentrate cost, green feed cost, off-family rice-field farming worker, on-family rice-field farming worker, rice-field fertilizer cost, income from rice-field farming, off-family garden farming worker, on-family garden farming worker, income from garden farming, income from beef cattle breeding, income of the family, income from garden field, total cost of rice-field farming, and income from rice-field farming. (2) Income from beef cattle breeding was influenced by the number of beef cattle bred and the number of grass-collection worker. The cost of concentrate was influenced by the purchasing cost for livestock feed greens (HMT). Therefore, HMT cost would be influenced by the number of beef cattle bred. (3) If governmental policy was designated to improve the income of farmer household, then the most effective policy scenario would be the scenario of providing financial aid for rice-field farming at rate of Rp 1,000,000.-. The allocation for each decision was set at percentage point, such as: Grass-collection worker (0.04%); On-family breeding worker (0.24%); Concentrate cost (0.00%); Green feed cost (0.00%); Off-family rice-field farming worker (439.00%); On-family rice-field farming worker (45.31%); Rice-field fertilizer cost (4.42%); Income from rice-field farming (7.25%); Off-family garden farming worker (34.07%); On-family garden farming worker (0.00%); Income from garden farming (1.593%); Income from beef cattle breeding (0.00%); Income of the family (30.33%); Income from garden field (1.76%); Total cost of rice-field farming (44.40%); Income from rice-field farming (25.85%); and Garden farming worker (5.94%). (4) If the government could select

the proper policy, then policy goal would be conforming to the result of this research, respectively the improvement of household income.

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### Introduction:-

Beef was animal-based protein source. It stood as one of *agents of development* that determined the competitiveness of human resource at certain nation. The consumption of animal protein by Indonesia community was still lower compared to other ASEAN countries. Beef consumption was still driven on demand, and the fulfillment was always problematic. A gap between consumption demand for local beef and its production occurred annually. The possible cause was the growth of the middle-to-upper class population. This increasing demand was reflected in the increased beef consumption from 1.95 kg per capita on 2007 to 2 kg per capita on 2008. This rate was still ascending to 2.24 kg per capita on 2009. This consumption increase might impact on the increasing demand for beef and internals, precisely from 455,755 tones on 2008 to 516,603 tons on 2009. Such beef demand was equivalent to the number of 2.432 millions beef cattle bred on 2008 and 2.746 millions beef cattle on 2009. Fulfilling this demand, the imported beef and internals were also advancing toward 110.246 tones. The imported origin cattle (calf) also upsurged to the rate of 768,133 calves on 2009. Import measure was taken because local beef cattle only supplied 49% beef demand of national beef demand on 2009.

### Study Method:-

#### Research Sample:-

The sample of farmer was selected based on some conditions. Farmer must have minimally one beef cattle to breed. Beef cattle must be prime or adult, and had been grown at least one year. The breeder must have experience minimally at least three years in breeding.

#### Data Analysis Method:-

Some analyses methods were used in this research.

#### Analysis of Regression:-

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + e$$

#### Where:-

Y	:	Number of beef cattle bred
B	:	Coefficient of regression
X <sub>1</sub>	:	Age of breeder
X <sub>2</sub>	:	Breeding experience of breeder
X <sub>3</sub>	:	Education background of breeder
X <sub>4</sub>	:	Land width occupied for beef cattle breeding
X <sub>5</sub>	:	Income of beef cattle breeder
X <sub>6</sub>	:	Price of the origin calf
X <sub>7</sub>	:	Price of the concentrate
X <sub>8</sub>	:	Feed consumption
X <sub>9</sub>	:	Non-feed consumption
X <sub>10</sub>	:	Development pattern (0 = Fattening, 1 = Origin calf)
e	:	Disturbance term

#### Individually Coefficient Test (t-test)

$$H_0 : b_i = 0 \quad (i=1,2,\dots,10)$$

$$H_a : b_i \neq 0$$

By determining degree of confidence at 95% ( $\alpha = 0,05$ ), and also degree of freedom at  $(Df) = n-k-1$ , then t-table could be set and used as the reflection of region that accepted or rejected hypothesis. The t-count rate could be obtained using the following equation:

$$t = \frac{b_i}{Sb_i}$$

where :

$b_i$  = coefficient of regression of independent variable  $i$ .

$Sb_i$  = standard error of coefficient of regression  $b_i$

Opportunity value (p-value) that was obtained from t-test was then compared with  $\alpha$  by using the following criteria:

- If  $p\text{-value} > \alpha$ , then  $H_0$  was accepted, meaning that there was a significant effect from independent variable on dependent variable.
- If  $p\text{-value} < \alpha$ , then  $H_0$  was rejected, meaning that there was no significant effect from independent variable on dependent variable.

Simultaneously Coefficient Test (F-test)

$H_0 : \beta_1 = \beta_2 = \dots = \beta_{10} = 0$

$H_a$  : there must be minimally one  $i$  where  $\beta_i \neq 0$  ( $i=1,2,\dots,10$ )

By setting the degree of confidence at 95% ( $\alpha = 0,05$ ) and degree of freedom at  $(Df) = k/(n - k - 1)$ , then F-table could be measured to be used as the reflection of region that accepted or rejected hypothesis. The F-count rate was derived from the following equation:

$$F = \frac{R^2 / (k)}{(1 - R^2) / (n - k - 1)}$$

Opportunity value (p-value) from F-test was compared with  $\alpha$  through some criteria as following:

- If  $p\text{-value} > \alpha$ , then  $H_0$  was accepted, meaning that there was no significant and simultaneous effect of all independent variables on dependent variable.
- If  $p\text{-value} < \alpha$ , then  $H_0$  was rejected, meaning that there was significant and simultaneous effect of all independent variables on dependent variable.

### Classical Assumption Test:-

Classical assumption test helped determining whether an estimation had the required characteristics, such as *unbiasedness*, *consistency*, *sufficiency*, and others. Therefore, the estimated coefficient of regression would be the best linear estimator due to its unbiasedness (*Best Linear Unbiased Estimator* = BLUE) but if it could meet some classical assumptions. In reality, classical assumptions were failed to be met and therefore, further test was conducted to examine how far these classical assumptions could be fulfilled.

According to Gujarati (2001), multiple linear regression model with OLS method could be used as unbiased estimator if it met BLUE requirements, such as:

- *Best* = It gave the best coefficient of regression.
- *Linear* = Independent variables were linearly related with dependent variable.
- *Unbiased* = The expectancy rate of coefficient of regression was similar to its actual rate ( $b_i$ ).
- *Efficient estimator* = The obtained regression model had minimum variance.

### Normality Test:-

It was conducted by comparing opportunity rate (p-value) from *Anderson Darling* Test with  $\alpha$  on several conditions:

- If  $p\text{-value} > \alpha$  then  $H_0$  was accepted.
- If  $p\text{-value} < \alpha$  then  $H_0$  was rejected.

Where  $H_0$  = normally dispersed data

$H_a$  = abnormally dispersed data

**Multicollinearity Test:-**

**Whether multicollinearity test did exist or not was detected by the following methods:-**

1. Coefficient of determination (R<sup>2</sup>) was high, and t-value from the estimated regression of all variables was significant.
2. If R<sup>2</sup> must be very high (more than 0.8), and no coefficient of regression was statistically significant, then there would be multicollinearity symptom.
3. Variance Inflation Factor (VIF) was examined, where if VIF stood below 10, it meant that multicollinearity symptom did not exist.

**Heteroscedasticity Test:-**

Heteroscedasticity occurred because the variance of the residual was not similar across each observation. It was tested using Glejser Test. If the significance rate of Glejser score was lower than 0.05 (5%), then the regression equation contained heteroscedasticity. Converse result would be no indication of heteroscedasticity or homoscedasticity.

**Auto-correlation Test:-**

Detecting whether there was auto-correlation was using *Durbin Watson* Model. It was explained as following:

1. OLS Regression was operated to obtain residual  $e_i$ .
2. Term  $d$  was counted with the following formula:

$$d = \frac{\sum_{t=2}^{t=N} (e_1 - e_{t-1})^2}{\sum_{t=1}^{t=N} e_t^2}$$

3. For certain sample size, with many explanatory variables, critical rates of  $dL$  dan  $dU$  were estimated
4. If  $d$  remained between  $dU$  and  $4-dU$ , then non-auto-correlation assumption was met. If  $d$  stood between 0 and  $dL$ , then there would be positive auto-correlation, while if  $d$  existed between  $4-dL$  and 4, then there must be negative auto-correlation.
5. The assumption of no occurrence of auto-correlation was met if Durbin-Watson statistic rate was found between  $dU$  and  $4-dU$ .

**Simultaneous Equation System Model:-**

Simultaneous Equation System Model was used as the second analysis technique to answer the second goal from the model of simulation for the policy of beef cattle breeding development, that in this case must be made compatible to the existing condition. The specification of this model included several items:

**The use of worker at farming work;-**

Worker who was used at farming work was divided into three groups, such as: breeding worker, rice-field farming worker, and garden farming worker. The use of on-family breeding worker (TKSPDKL) was estimated to be influenced by household member (ARTP), number of beef cattle (JSP), and family income (INCKL). The structural equation covering all these items was written as:

$$TKSPDKL = B0 + B1*ARTP + B2*JSP + B3*INCKL + B4*D;$$

Worker for rice-field farming was assigned into two groups, off-family rice-field farming worker (TKUTLKL) and on-family rice-field farming worker (TKUDKL). Off-family rice-field farming worker was estimated to be influenced by occupied land width (LHN), income from rice-field farming (KUT), and family income (INCKL). On-family rice-field farming worker (TKUDKL) was estimated under influence of occupied land width (LHN) and income from rice-field farming (KUT). The structural equation was described as following:

$$TKUTLKL = F0 + F1*LHN + F2*KUT + F3*INCKL + F4*D ;$$

$$TUTDKL = G0 + G1*LHN + G2*KUT + G3*D ;$$

Worker for garden farming (TKBUN) was also separated into two, respectively off-family garden farming worker (TKBUNLKL) and on-family garden farming worker (TKBUNDKL). Off-family garden farming worker (TKBUNLKL) was estimated to be influenced by occupied land width (LHN) and off-family rice-field farming

worker (TKUTLKL). On-family garden farming worker was estimated under influence of occupied land width (LHN). Structural equation was written as:

$$TKBUN = TKBUNDKL + TKBUNLKL;$$

$$TKBUNLKL = J0 + J1*LHN + J2*TKUTLKL + J3*D$$

$$KBUNDKL = K0 + K1*LHN + K2*D ;$$

#### Cost for Beef Cattle Breeding:-

Total cost of beef cattle breeding (TBSP) was comprised of variable cost and fixed cost. Variable cost included the cost for beef cattle concentrate (BKONSP), the cost for beef cattle medicine (BOBTSP), the cost for green feed (BHMT), the cost for origin calf (HABIT) and the cost for other structure and infrastructure (BSPL). The equation was arranged as:

$$TBSP = BKONSP + BOBTSP + BHMT + HABIT + BSPL$$

#### Income From Beef Cattle Breeding:-

Annual income from beef cattle breeding (KSP) was obtained from the summation of all incomes that related with beef cattle breeding (RESP), and then, it was subtracted with the total cost of beef cattle breeding (TBSP). Monthly income from beef cattle breeding was derived by dividing the profit of beef cattle breeding in a year (KSP) with the number of months in a year. Therefore, the equation was written as:

$$KSP = RESP - TBSP;$$

$$KSPBLN = KSP/12;$$

Incomes that related with beef cattle breeding (RESP) was estimated to be influenced by the number of beef cattle bred (JSP), the quantity of concentrate (JKON), and the grass-collection worker for beef cattle (TKSPRMP). The structural equation was written as following:

$$RESP = E0 + E1*JSP + E2*JKON + E3*TKSPRMP + E4*D ;$$

#### Identification of Model in the Simultaneous Equation System:-

Model must be identified before making an estimation. The aim was to facilitate the determination of estimation method. There were three types of model identification, such as (1) *under identified* or *unidentified*, (2) *exactly identified*, and (3) *over identified*. If a certain equation system was said as *under identified*, there would no statistical models be used to estimate all parameters in simultaneous equation model. If the equation was considered *exactly identified*, the most proper technique was *indirect least squares* (ILS). If simultaneous equation was called as *over identified*, then various techniques could be used such as *Two stage least square* (2SLS), *Three stage least square* (3SLS), *Limited Information Maximum Likelihood* (LIML), or *Full Information Maximum Likelihood* (FIML). Indeed, 2SLS method was the most frequently used because it was compatible with software SAS.

Identification was conducted in two methods. First was testing the structural model (*order condition*), while the second was testing against model in *reduced form* (*rank condition*). Because first method was more simple and more easier, then the study of dissertation preferred to use first method. The condition to say certain equation as *identified* was that the number of variable excluded from the equation, but included within other equation, must be minimally equal to the number of equation in the simultaneous equation model after being subtracted with one. It was written as following (Gujarati, 2000).

The equation would be *identified* if  $(K-M) \geq (G-1)$

**where:**

G : number of equation (endogenous variable)

K : number of variable in the model (endogenous and predetermined)

M : number of variable (endogenous dan exogenous) in the *identified* equation

The conditions of the equation could be exposed into the details as following:

1. If  $(K-M) < (G-1)$  then the equation was considered as under identified
2. If  $(K-M) = (G-1)$  then the equation was considered as exactly identified
3. If  $(K-M) > (G-1)$  then the equation was considered as over identified

**Identification of Model in the Simultaneous Equation System:-**

Model identification was conducted before making an estimation. This process was aimed to facilitate the determination of estimation method. There were three types of model identification: (1) *under identified* or *unidentified*, (2) *exactly identified*, and (3) *over identified*.

**Model Validation:-**

Model validation was carried out to understand whether endogenous variable in the simultaneous equation model could be used to describe the information that was not different from actual rate.

**Policy Simulation:-**

Recent governmental policy was designated to provide working capital aid to the breeders through the direct loan aid to the community (BPLM). This aid was given to the breeder group who was seriously attended by policy maker. To ensure the benefit of this governmental policy, this research attempted to simulate household economic policy, involving some policies such as: (1) feed consumption, (2) non-feed consumption, (3) production cost for beef cattle breeding, (4) production cost for rice-field farming. Household economic model of beef cattle breeders was made from simultaneous equation system.

**Result:-****Income That Related with Beef Cattle Breeding (RESP):-**

The sign of explanatory variable in the equation of all incomes that related with beef cattle breeding at Gaduhan Pattern (RESP) was compatible with the expectancy and economical behavior from the worker who maintain the number of beef cattle bred (JSP) and also from the grass-collection worker (TKSPRM). Therefore, the income of beef cattle breeding at Gaduhan Pattern (RESP) was influenced by the number of beef cattle bred and the number of grass-collection worker. The greater number of beef cattle bred, the greater also be obtained the incomes from beef cattle breeding at Gaduhan Pattern in Jember Regency. The higher ownership rate for beef cattle was closely related with not too high production input cost. It conflicted with the finding in the ownership scale below five beef cattles. Great number of beef cattle bred would minimize the loss due to unreliable production input. Grass-collection worker was one determinant in this situation. Greater number of grass-collection worker at Gaduhan Pattern would reduce the income of beef cattle breeding at Gaduhan Pattern because production input cost was not efficient, possibly due to the excessively high cost to expend in production input. It definitely decreased farmer income.

Result of regression against the income from beef cattle breeding was shown in the table. The equation of regression was written as:

$$\text{RESP} = 480.804 + 15961.7\text{JSP} + 0.146 \text{BKONSP} - 1719.25\text{TKSPRM} + 33.461 \text{D}$$

**Table:-** Result of Regression Analysis on The Income from Beef Cattle Breeding

Variable	Parameter Estimation	Standard Error	t-value	Pr >  t
JSP	15961.700	598.074	26.690	<.0001
BKONSP	0.146	0.171	0.850	0.402
TKSPRMP	-1719.250	748.817	-2.300	0.030
D	33.461	436.044	0.080	0.939
F-value = 771.83 Pr > F = <0.0001 R <sup>2</sup> = 0.99133				

Source: Analysis on Primary Data, 2016

The above table showed that parameters were tested partially (t-value) and simultaneously (F-value). Simultaneous test obtained F-value=771.83 with Pr > F = <0.0001 (<0.10). Therefore, in simultaneous manner, number of beef cattle bred, concentrate cost, number of grass-collection worker, and beef cattle development pattern, were obviously influential to the income of beef cattle breeding.

Coefficient of determination (R<sup>2</sup>) of the model was 0.99133, meaning that 99.133% diversities of beef cattle breeding income were explained by number of beef cattle bred, concentrate cost, number of grass-collection

worker, and beef cattle development pattern, while the remaining 0.867% were explained by other variable out of the model, and these were vulnerable to error.

The number of beef cattle bred was obviously and positively influencing the income of beef cattle breeding as shown by  $Pr > |t| = <0.0001$  ( $<0.10$ ). It proved that greater number of beef cattle bred, the higher the income that was obtained from beef cattle breeding.

In other hand, number of grass-collection worker had obvious but negative effect on beef cattle breeding income as shown by  $Pr > |t| = 0.030$  ( $<0.10$ ). Therefore, it could be said that the greater number of grass-collection worker, the lower the income derived from beef cattle breeding.

#### Model Validation:-

Model validation was aimed to determine model predictability. Result of model validation would describe how close was the predicted rate with the actual rate, based on endogenous variable observed. The explanation was given in the following table.

**Table:-** Result of Statistical Test against Model Predictability Rate

Variable	Label	Actual Mean	Predicted Mean	UM	US	UC
Grass-collection worker	TKSPRMP	1.4688	1.4677	0.00	0.13	0.87
On-family breeding worker	TKSPDKL	1.9063	1.9063	0.00	0.18	0.82
Concentrate cost	BKONSP	5554.7	5557.8	0.00	0.12	0.88
Off-family rice-field farming worker	TKUTLKL	0.1875	0.0418	0.16	0.26	0.58
On-family rice-field farming worker	TKUTDKL	1.5313	1.1016	0.21	0.24	0.55
Rice-field fertilizer cost	PPKUT	156110	156112	0.00	0.22	0.78
Income from rice-field farming	REUT	7871263	7442892	0.04	0.47	0.49
Off-family garden farming worker	TKBUNLKL	0.3438	0.2706	0.02	0.25	0.73
On-family garden farming worker	TKBUNDKL	1.2813	1.2812	0.00	0.33	0.67
Income from garden farming	REBUN	2696151	2662506	0.00	0.11	0.89
Income from breeding	RESP	24218.8	24220.5	0.00	0.00	1.00
Family income	REKL	11384108	9313169	0.34	0.20	0.46
Income from garden field	KBUN	2953125	2405533	0.19	0.16	0.65
Total cost of rice-field farming	TBUT	547487	547489	0.00	0.00	1.00
Income from rice-field	KUT	8418750	6895404	0.30	0.37	0.33
Garden farming worker	TKBUN	1.625	1.5518	0.01	0.23	0.76

Source: Analysis on Primary Data, 2016

Note:

UM = biased proportion

US = variance proportion

UC = covariance proportion

Based on test statistic, predictability criteria included UM, US and UC scores. As shown in the table, most UM scores tended to approach zero, and therefore, the model did not experience systematic bias. In addition, US scores also approached zero, meaning that its predicted rate always followed the fluctuation of actual rate. In other side, model validation showed that most UC scores were approaching to one. In other words, model error was negligent and irregular, but it dispersed to all observation data. From these results of model validation, it could be said that the resultant model was valid to be used as *simulation tool*.

#### Analysis on The Change of Input to Beef Cattle Breeding:-

The simulation of the policy for beef cattle breeding involved various policies. These concerned with feed and non-feed consumption, the production cost for beef cattle breeding, and the cost of rice-field farming.



### Simulation of the Policy for Feed and Non-Feed Consumption

The policy that was used in the simulation was to provide the financial aid for feed and non-feed consumption which the aid was counted for Rp 1,000,000.00. This aid was directly influential to the income of breeder household. Result of the simulated policy was displayed in the table.

**Table:-**Simulation of the Policy for Feed and Non-Feed Consumption with Financial Aid of Rp. 1,000,000.00

Variable	Base Simulation	Simulation Scenario	Change
Grass-collection worker	1.4677	1.4683	0.04%
On-family breeding worker	1.9063	1.9109	0.24%
Concentrate cost	5557.8	5557.8	0.00%
Green feed cost	8414.1	8414.1	0.00%
Off-family rice-field farming worker	0.0418	0.063	50.72%
On-family rice-field farming worker	1.1016	1.1171	1.41%
Rice-field fertilizer cost	156112	163018	4.42%
Income from rice-field farming	7442892	7505239	0.84%
Off-family garden farming worker	0.2706	0.2813	3.95%
On-family garden farming worker	1.2812	1.2812	0.00%
Income from garden farming	2662506	2667406	0.18%
Income from breeding	24220.5	24219.6	0.00%
Family income	9313169	9373510	0.65%
Income from garden field	2405533	2410432	0.20%
Total cost of rice-field farming	547489	554395	1.26%
Income from rice-field	6895404	6950845	0.80%
Garden farming worker	1.5518	1.5625	0.69%

Source: Analysis on Primary Data, 2016

Table above explained that the aid would reduce feed and non-feed consumption but it increased off-family rice-field farming worker to 50.72%, rice-field fertilizer cost to 4.42%, off-family garden farming worker to 3.95% and total cost of rice-field farming to 1.26%. The income of rice-field farming increased to 0.84%, so did garden farming worker and income from rice-field, which each increased to 0.69% and 0.80%. Other variable with value less than 0.50% was subjected to the change. Based on this simulation, there was subsidy given to feed and non-feed consumption to encourage breeders to use off-family worker. Family member might be put in the other job that was more productive, or that was focusing more in education background rather than merely helping the farming and breeding works.

### Simulation of the Policy for Beef Cattle Breeding Cost:-

In addition to the simulated policy for feed and non-feed consumption, other simulation was to provide financial aid of Rp 1,000,000.00 to reduce beef cattle breeding cost, especially for concentrate cost and green feed cost. Result of simulation was displayed in the table.

**Table:-**Simulation of the Policy for Beef Cattle Breeding Cost with Financial Aid of Rp. 1,000,000.00

Variable	Base Simulation	Simulation Scenario	Change
Grass-collection worker	1.4677	1.4683	0.04%
On-family breeding worker	1.9063	1.9109	0.24%
Concentrate cost	5557.8	4075.8	-26.67%
Green feed cost	8414.1	7414.1	-11.88%
Off-family rice-field farming worker	0.0418	0.063	50.72%
On-family rice-field farming worker	1.1016	1.1171	1.41%
Rice-field fertilizer cost	156112	163018	4.42%
Income from rice-field farming	7442892	7505239	0.84%
Off-family garden farming worker	0.2706	0.2813	3.95%
On-family garden farming worker	1.2812	1.2812	0.00%
Income from garden farming	2662506	2667406	0.18%
Income from breeding	24220.5	24190.4	-0.12%

Family income	9313169	9373510	0.65%
Income from garden field	2405533	2410432	0.20%
Total cost of rice-field farming	547489	554395	1.26%
Income from rice-field	6895404	6950845	0.80%
Garden farming worker	1.5518	1.5625	0.69%

Source: Analysis on Primary Data, 2016

Table above illustrated that the financial aid for beef cattle breeding at Rp1,000,000.00 would decrease average concentrate cost for 26.67% and also reduce green feed cost for 11.88%. This aid did not improve breeder income because income from breeding had declined by 0.12%. Such condition was caused by a tendency of breeders to use off-family worker after receiving the financial aid for beef cattle breeding cost. Therefore, average income from the breeding decreased. In other hand, income from other farming (rice-field farming and garden farming) increased for 1.26% and 0.20%. General income of the family also improved by 0.65%.

#### Simulation of the Policy for Rice-Field Farming Cost:-

Other simulation done in this research was financial aid of Rp 1,000,000.00. Result of this policy simulation could be seen in the table.

**Table:-** Simulation of the Policy for Rice-Field Farming Cost with Financial Aid of Rp. 1,000,000.00

Variable	Base Simulation	Simulation Scenario	Change
Grass-collection worker	1.4677	1.4683	0.04%
On-family breeding worker	1.9063	1.9109	0.24%
Concentrate cost	5557.8	5557.8	0.00%
Green feed cost	8414.1	8414.1	0.00%
Off-family rice-field farming worker	0.0418	0.2253	439.00%
On-family rice-field farming worker	1.1016	1.6007	45.31%
Rice-field fertilizer cost	156112	163018	4.42%
Income from rice-field farming	7442892	7982464	7.25%
Off-family garden farming worker	0.2706	0.3628	34.07%
On-family garden farming worker	1.2812	1.2812	0.00%
Income from garden farming	2662506	2704907	1.593%
Income from breeding	24220.5	24219.6	0.00%
Family income	9313169	12138236	30.33%
Income from garden field	2405533	2447933	1.76%
Total cost of rice-field farming	547489	304395	-44.40%
Income from rice-field	6895404	8678069	25.85%
Garden farming worker	1.5518	1.644	5.94%

Source: Analysis on Primary Data, 2016

As noted in table above, financial aid of Rp 1,000,000.00 that was given to rice-field farming cost was contributive to the reduction of total cost of rice-field farming for 44.40%. The aid also improved the earning from rice-field by 7.25%, income from rice-field by 25.85%, income from garden farming for 1.76%, and family income by 30.33%. Significant increase was also found in the off-family rice-field farming worker by rate of 439% and on-family rice-field farming worker at rate of 45.31%.

#### Contribution to the Research:-

##### Theoretical Contribution:-

The review on the results of some previous researches had found a surprising fact. The use of simultaneous equation model to understand household economic was still lacking of research. Research about alternative policy to develop household economic in the beef cattle breeding was also not yet delivered.

Chayanov developed a household economic model to help the farmer to allocate production factors owned by the farming household. The decision about production and consumption in the farming household was inseparable. Household economic model of the farmers that was formulated by Chayanov was operated by maximizing the utility

of three items, including: (1) Function of production, (2) Minimally accepted income rate, and (3) Maximum work-day at farmer household.

'Research on household economic in the beef cattle breeding attempted to develop Chayanov's theory of household economic model by involving some simultaneous equations and by making connection between these equations and the alternative policies that related with work development. These policies included those about input improvement, process improvement, output management, and consumption change, in order to increase the income of beef cattle breeders.

One of distinctive character from household economic model of farmers was the relationship between decision on production and decision on consumption. In simultaneous equation model, the analysis was done through simulation by experimenting the change of input and output prices. Policy simulation could be operated by exploiting some policy variables (simultaneously) which could impact on farmer household. The benefit of simulation analysis was that it could resolve the problem in non-linear equation in the model where farmer household might have different exogenous variable. Elasticity analysis could help determining the variance of farmer household size (Smith and Strouss, 1986). The analysis against the impact of price change could be also conducted with a combination of more than one policy variable.

#### **Practical Contribution:-**

Simultaneous equation model was useful to simulate few policy alternatives to increase household economic welfare of beef cattle breeders. Result of single simulation indicated that the policy that could increase household income was financial aid of Rp 1,000,000.00 to support rice-field farming cost.

#### **Conclusion And Suggestion:-**

##### **Conclusion:-**

By taking account all the results of research and discussion, it was concluded that:

1. Household economic model that was formulated in this research could explain the behavior in deciding about farming and breeding productions, and this decision was strongly influential to the income of farming household. Some decisions must be made, such as about grass-collection worker, on-family breeding worker, concentrate cost, green feed cost, off-family rice-field farming worker, on-family rice-field farming worker, rice-field fertilizer cost, income from rice-field farming, off-family garden farming worker, on-family garden farming worker, income from garden farming, income from beef cattle breeding, income of the family, income from garden field, total cost of rice-field farming, and income from rice-field farming.
2. Income from beef cattle breeding was influenced by the number of beef cattle bred and the number of grass-collection worker. Concentrate cost remained under influence of the cost to purchase livestock feed greens (HMT). HMT cost itself was influenced by the number of beef cattle bred.
3. If governmental policy was indeed aimed to improve the income of farmer household, then the most effective policy scenario would be the scenario of providing financial aid of Rp 1,000,000.00 for rice-field farming. This aid was allocated to some decisions, which were described at percentage point, such as: Grass-collection worker (0.04%); On-family breeding worker (0.24%); Cconcentrate cost (0.00%); Green feed cost (0.00%); Off-family rice-field farming worker (439.00%); On-family rice-field farming worker (45.31%); Rice-field fertilizer cost (4.42%); Income from rice-field farming (7.25%); Off-family garden farming worker (34.07%); On-family garden farming worker (0.00%); Income from garden farming (1.593%); Income from beef cattle breeding (0.00%); Income of the family (30.33%); Income from garden field (1.76%); Total cost of rice-field farming (44.40%); Income from rice-field farming (25.85%); and Garden farming worker (5.94%).
4. If the government could select the proper policy, then policy goal would be matching with the result of this research, respectively the improvement of household income.

##### **Suggestions:-**

There were many policies to be made about food. The recommended food policies for farming-breeding works would be those about the occupied land width, the increase of production through the utilization of production input, the on-family and off-family based employment, and the earning and income of farming-breeding works, and the income of household that would be spent on consumption and investment.

**References:-**

1. Gujarati,D.N. 2001. Basic Econometrics, Third Edition. McGraw Hill. Singapore.
2. Suryana. 2009. Pengembangan Usaha Ternak Sapi Potong Berorientasi Agribisnis Dengan Pola Kemitraan Balai pengkajian Teknologi Pertanian Kalimantan Selatan Jurnal Litbang Pertanian, 28 (1) 2009.
3. Tarmizi H.B dan Safarudin. 2012. Pengaruh Sistem Integrasi Padi Ternak (SIPT) Terhadap Peningkatan Pendapatan Petani Dan Dampaknya Terhadap Pengembangan Wilayah Di Kabupaten Serdang. Jurnal Ekonom 15 (4), Oktober 2012.



## RESEARCH ARTICLE

### HYPOTHALAMIC CAVERNOMA IN A 28 YEARS OLD SAUDI LADY: CASE REPORT

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#### Manuscript Info

##### Manuscript History

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##### Key words:-

Vascular malformation, cavernoma, angioma, haemangioma.

#### Abstract

**Background:** Cerebral vascular malformations occur in 0.1-4% of the general population. Cavernoma is a subtype of these malformations with 0.4% incidence rate. Symptoms vary from absence to various neurological sequelae. We believe it's important to report this case because it strongly emphasizes that patients should not be profiled, and chronic complaints may need reassessment.

**Case Presentation:** We report a case of 28-years old Saudi lady with cerebral cavernoma. She is complaining of chronic headache for five years with recurrent attacks of severe headache for the last two years.

**Conclusion:** Cavernoma is the least common vascular malformation in central nervous system which may cause serious complications. Decision about management depends on whether it is symptomatic or not. Hence, patients should be evaluated carefully and chronic complaints should always be revisited.

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#### Introduction:-

Cavernous malformations are also referred to as cavernous angiomas, cavernous haemangiomas or cavernomas. It occurs sporadically or in a familial pattern.<sup>(1)</sup> It is the least common cerebral vascular malformation with an incidence rate 0.4% of the general population.<sup>(2,3)</sup> Symptoms are related to its site, size, venous drainage and association with other malformations. We present a patient with history of chronic headache. She presented to our emergency department with worsening of that headache for three days and was found to have a leaking cerebral cavernoma. This case asserts that chronic complaints may need reassessment.

#### Case Presentation:-

The patient is a 28-year old Saudi lady presented with an attack of severe headache, associated with nausea, vomiting and blurring of vision for three days. It is occipital, of thunderclap nature and occurs in several episodes daily. Each lasts for minutes and associated with symptoms of meningism.

These attacks started two years back with a frequency of one every 4-5 months. Frequency and severity were increasing recently.

She has five years history of chronic headache which was diagnosed as migraine and cerebral venous thrombosis (received anticoagulant for a year).

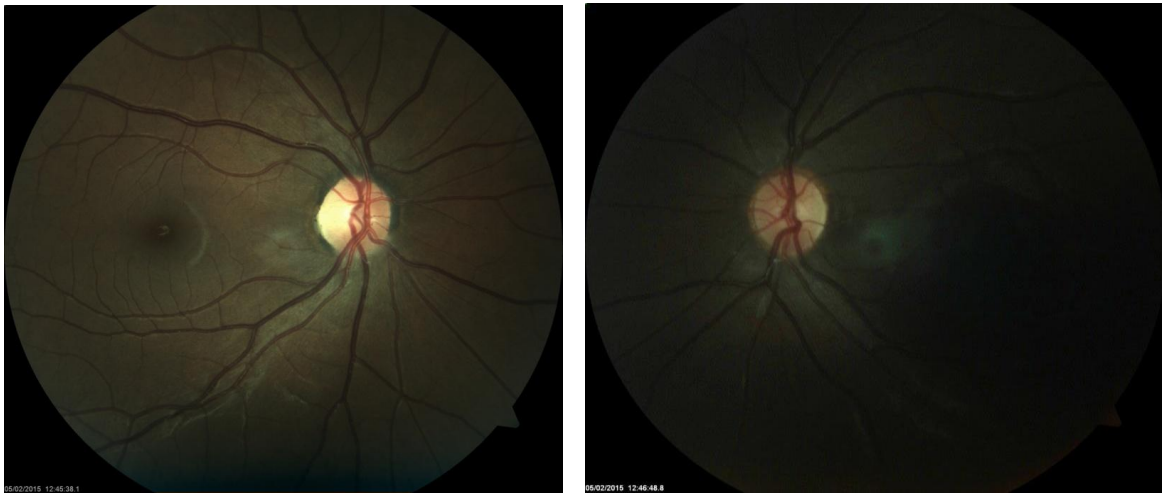
There are no other neurological symptoms and she has no other medical problems or receiving any regular medications. Family history is positive for epilepsy (maternal aunt and uncle). She is married with three kids and has no special habits.

On examination, the patient had an average built, general and systemic examination were normal.

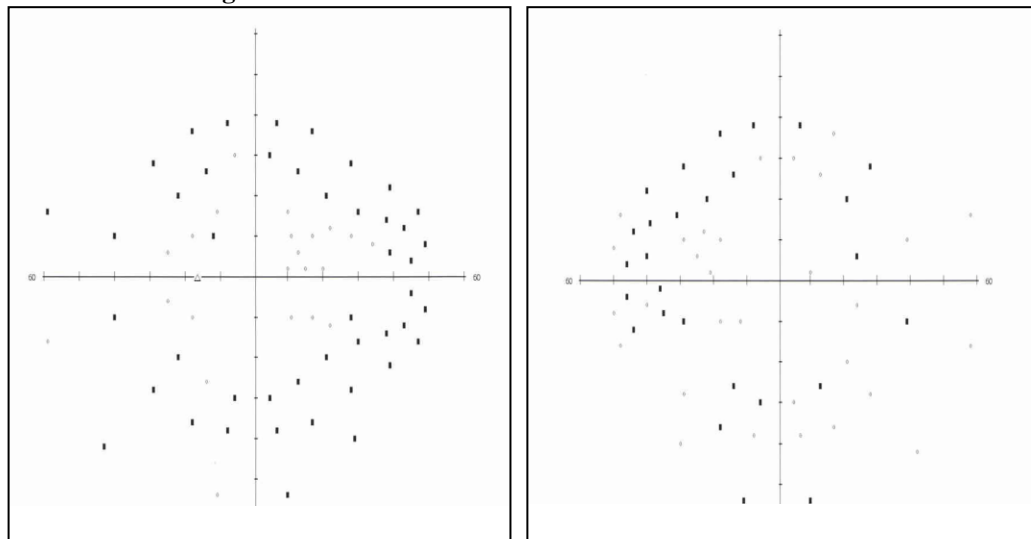
Full neurological examination came normal apart from ophthalmological exam which showed:

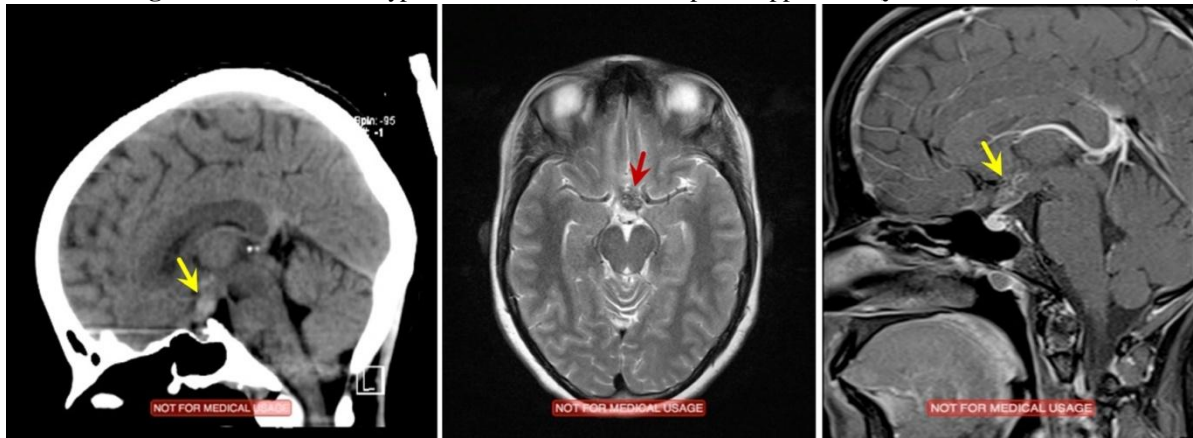
- Pupils: equal and reactive with relative afferent pupillary defect (RAPD) more in left eye.
- Visual acuity: Right eye: 20/25, Left eye: 20/30.
- Extra ocular movements (EOMs): normal eye movements in all directions.
- Fundi: Bitemporal optic atrophy. (**Figure 1**)
- Visual fields: Binasal hemianopia. (**Figure 2**)
- Her blood tests were normal.
- Magnetic Resonance Image (MRI) (**Figure 3**), Magnetic Resonance Venography (MRV) and Magnetic Resonance Angiography (MRA) brain are done.

**Figure 1:-** Fundus examination showing bitemporal optic atrophy.



**Figure 2:-** Visual fields show loss of nasal fields.



**Figure 3:-MRI shows Hypothalamic Cavernoma, Popcorn apperance (yellow and red arrows)****Discussion:-**

Cerebral vascular malformations occur in 0.1 to 4.0 percent of the general population. Four general subtypes of congenital malformations have been described: developmental venous anomalies, capillary telangiectasias, cavernous malformations and arteriovenous malformations.<sup>(2,3)</sup>

Three genetic loci (CCM1, CCM2, and CCM3) responsible for familial cavernous malformations (CMs) have been reported.<sup>(4-6)</sup>

The cerebrum is the most common location for CMs (70-90%).<sup>(7)</sup> They have been reported throughout the supratentorial compartment, but most commonly are subcortical and inclined to the rolandic and temporal areas. Posterior fossa lesions involve approximately 25 percent of CMs in most large series, with the majority located in the pons and cerebellar hemispheres. There have been just 36 cases of spinal cord cavernous malformations announced in the literature.<sup>(8)</sup>

Supratentorial CMs commonly present with hemorrhage, seizures, and progressive neurologic deficits. This may be the result of mass effect and secondary compromise of the microcirculation, or of microhemorrhages with local hemosiderin deposition irritating cortical or subcortical tissue. Annual bleeding rates of 0.25 to 1.1 percent have been reported.<sup>(9,10)</sup>

Infratentorial CMs commonly present with hemorrhage and progressive neurologic deficits. The lesions of brainstem are worse than that in other areas. The annual bleeding rate for brainstem lesions is 2 to 3 percent per year, with recurrent hemorrhage rates approaching 17 to 21 percent.<sup>(11)</sup> Progressive neurologic decline is observed in 39 percent.

The natural history of asymptomatic lesions is significantly different from CMs presenting with clinical sequelae. 50% of 122 patients (age ranged from 4 - 82 years and mean 37 years).<sup>(12)</sup> on follow up mean of 34 months, the hemorrhage rate in the asymptomatic patients was 0.6% and 4.5% in the symptomatic patients. In another cohort, five year rates of hemorrhage were 2.4 percent for a first hemorrhage and 29 percent for a recurrent hemorrhage.<sup>(13)</sup> The risk of recurrent hemorrhage declines over time.<sup>(13,14)</sup> While prior hemorrhage is a consistent risk factor for subsequent hemorrhage, studies have found inconsistent results as to other risk factors for hemorrhage and neurologic disability, including gender, lesion size, location, and multiplicity.<sup>(12-15)</sup>

CMs blood flow is low. Therefore, they usually are indicated to as "angiographically occult", due to may not be seen on angiography. MRI usually establishes the diagnosis. Characteristic findings on T-1 and T-2 weighted images include a "popcorn" pattern of variable image intensities consistent with evolving blood products. A dark hemosiderin ring, best seen on T2 or gradient echo sequences at the periphery of the lesion, is suggestive of remote hemorrhage.<sup>(16)</sup>

Computed tomography usually demonstrates a nonspecific, irregular, hyperdense mass with variable degrees of calcification. Angiography demonstrates a capillary blush or early draining vein in approximately 10 percent of patients. Digital subtraction angiography appears to be much more sensitive than MRI for detecting the presence of CM-associated atypical venous drainage.<sup>(17)</sup>

Asymptomatic CMs are observed, irrespective of location. Surgical resection indications of accessible symptomatic lesions of cerebral and cerebellum include progressive neurologic deficit, intractable epilepsy, and recurrent hemorrhage.<sup>(18-19)</sup> Patients with symptomatic CMs entirely surrounded by eloquent tissue (e.g., rolandic cortex, brainstem, thalamus/basal ganglia) are usually observed despite the poor natural history associated with untreated brainstem and thalamic lesions.

In our case, first MRI, MRV done five years ago showed the suprasellar lesion. However, her normal variant hypoplastic transverse sinus made her diagnosed as cerebral venous thrombosis in presence of headache and bilateral papilledema. She continued on anticoagulant for one year. Since that time she has chronic headache which is considered migraine and treated for migraine headache.

During one of her attacks of severe headache She presented to our emergency department and was associated with nausea, blurring of vision and symptoms of meningism. On examination, we found her discs abnormality which is confirmed by fundus photography and visual fields. We revised her images again and new one is done (**Figure 3**). We conclude that she has never cerebral venous thrombosis and this is a normal variant of hypoplastic transverse sinus. Moreover, she has progressive neurological deficit which is bilateral optic atrophy due to compression of the optic chiasma by the lesion. Leaking from the cavernoma is the cause of her intractable headache due to meningeal irritation. CSF xanthochromia was checked and confirm the leaking. Accordingly, we referred the patient to the neurosurgery team.

### Conclusion:-

Cavernous malformations are the least common vascular anomaly of central nervous system. It may be asymptomatic or cause various neurological deficits.

Surgical intervention is recommended only if it is symptomatic.

This case reminds us how serious diseases can masquerade in old complaints. Patients should never be profiled and chronic complaints should always be revisited.

### References:-

1. Rigamonti D, Hardley MN, Drayer BP, et al. Cerebral cavernous malformations. Incidence and familial occurrence. *N Engl J Med* 1988;319:343.
2. McCormick, WF. Pathology of vascular malformations of the brain. In: *Intracranial Arteriovenous Malformations*, Wilson, CB, Stein, BM (Eds), William & Wilkins, Baltimore, MD 1984. p.44.
3. Russell, DS, Rubinstein, LJ. Pathology of Tumours of the Nervous System. 5<sup>th</sup> ed. William & Wilkins, Baltimore, MD 1989. p.727.
4. Dubovsky J, Zabramski JM, Kurth J, et al. A gene responsible for cavernous malformations of the brain maps to chromosome 79. *Hum Mol Genet* 1995; 4:453.
5. Laberge-Le Couteux S, Jung HH, Labauge P, et al. Truncating mutations in CCM1, encoding KRIT1, cause hereditary cavernous angiomas. *Nat Genet* 1999; 23:189.
6. Verlaan DJ, Davenport WJ, Stefan H, et al. Cerebral cavernous malformations: mutations in Krit1. *Neurology* 2002; 58:853.
7. McCormick, PC, Michelson, WJ. Management of intracranial cavernous and venous malformations. In: *Intracranial vascular malformations*, Barrow, DL (Ed), American Association of Neurological Surgeons. Park Ridge, IL 1990. P.197.
8. Tew, JM, Sathi, S. Cavernous Malformations. In: *Primer on Cerebrovascular Diseases*, Welch, KM, Caplan, LR, Reis, DJ, et al. (Eds), Academic Press. San Diego, CA 1997. P.550.
9. Robinson JR, Awad IA, Little JR. Natural history of the cavernous angioma. *J Neurosurg* 1991; 75:709.
10. Aiba T, Tanaka R, Koike T, et al. Natural history of intracranial cavernous malformations. *J Neurosurg* 1995; 83:56.



11. Fritschi JA, Reulen HJ, Spetzler RF, Zabramski JM. Cavernous malformations of the brain stem. A review of 139 cases. *Acta Neurochir(Wien)* 1994;130:35.
12. Kondziolka D, Lunsford LD, Kestle JR. The natural history of cerebral cavernous malformations. *J Neurosurg* 1995;83:820.
13. AL-Shahi Salman R, Hall JM, Home MA, et al. Untreated clinical course of cerebral cavernous malformations: a prospective, population-based cohort study. *Lancet Neurol* 2012;11:217.
14. Flemming KD, Link MJ, Christianson TJ, Brown RD Jr. Prospective haemorrhage risk of intracerebral cavernous malformations. *Neurology* 2012;78:632.
15. Robinson JR jr, Awad IA, Magdinec M, Parandhi L. Factors predisposing to clinical disability in patients with cavernous malformations of the brain. *Neurosurgery* 1993; 32:730.
16. Rigamonti D, Hadley MN, Drayer BP, et al. Cerebral cavernous malformations. Incidence and familial occurrence. *N Engl J Med* 1988; 319:343.
17. Kamezawa T, Hamada J, Niino M, et al. Clinical implications of associated venous drainage in patients with cavernous malformations. *J Neurosurg* 2005; 102:24.
18. Baumann CR, Acciarri N, Bertalanffy H, et al. Seizure outcome after resection of supratentorial cavernous malformations: a study of 168 patients. *Epilepsia* 2007; 48:559.
19. Cohen DS, Zubay GP, Goodman RR. Seizure outcome after lesionectomy for cavernous malformations. *J Neurosurg* 1995; 83:237.



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### RESEARCH ARTICLE

#### EXPLORING PREVALENCE OF LONG TERM DIABETES MELLITUS VASCULAR COMPLICATIONS IN KING FAHAD GENERAL HOSPITAL

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#### Manuscript Info

##### Manuscript History

Received: 03 November 2016  
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 Published: January 2017

#### Abstract

##### Study objective(s):-

##### Primary objective:-

To assess the cumulative and individual prevalence of microvascular and macrovascular complications among study population.

##### Secondary objective(s)

- To Map Cardiovascular Risk Factors among study population.
- Correlate diabetic complication prevalence with level of diabetes control (A1C target level)

##### Study Design &Duration:-

A retrospective cross sectional study design will be used. Patients' files will be used as source of data collection in a brief case report form. To avoid duplication unique patient file number will be used as subject number preceded by investigator number. A random data source verification of 20% of the case report forms as quality control of collected data. Patients will be enrolled inn 1 month

##### Study population:-

##### Inclusion criteria

- Male or Female patients of all age groups.
- Established diagnosis of DM for more than 10 years.
- Patients presented to the outpatient clinic during the last three months.

##### Exclusion criteria

- Incomplete patient's file

**Expected number of patients:** 375 patients attending to King Fahad General Hospital, Jeddah, Saudi Arabia.

Expected number of investigators: **3 investigators.**

##### Recruitment modalities:-

##### Selection of patients

In order to allow extrapolation of the results to the broadest possible population, all consecutive patients who meet the eligibility criteria and agree to participate upon a signed consent form will be included in the study. Each physician should recruit about 125 consecutive DM patients.

**Endpoint(s):-****Primary endpoints**

- Number of Micro/Macrovascular complications
- Proportion of patients having micro/macro complications
- Frequency of micro/macrovascular complications per patients
- Proportion of individual micro/macrovascular complication among study population.

**Secondary endpoints**

- Proportion of Cardiovascular risk factors among study population and its correlation to DM vascular complications

**Difference in prevalence of micro/macrovascular and individual complications in patients with target A1C < 8 % or > 8% at the time of diagnosis****MAIN DATA COLLECTED:-**

Data will be collected during a single visit in an individual case report form (CRF). No tests will be specifically done for this study.

**The following data will be collected:**

- **Date of last visit,**
- **Inclusion/exclusion criteria check,**
- **Patient profile:**
  - Demographic characteristics (age, gender, marital status, etc.),
  - Lifestyle habits (smoking status, physical activity),
  - Vital signs, weight, waist circumference, body mass index, blood pressure).
  - Family History of DM and Cardiovascular disease
  - Relevant history of risk factors for DM
- **Characteristics of diabetes:**
  - Type of Diabetes
  - Duration of diabetes,
- **Cardiovascular Risk Factors**
- **Microvascular Complications**
  - Retinopathy (Date of Diagnosis, A1C level)
  - Nephropathy (Date of Diagnosis, A1C level)
  - Neuropathy (Date of Diagnosis, A1C level)
- **Macrovascular Complications**
  - Ischemic heart Disease (Type, Date of Diagnosis, A1C level)
  - Cerebrovascular Disease (Type, Date of Diagnosis, A1C level)
  - Peripheral vascular Disease (Type, Date of Diagnosis, A1C level)

**Statistical considerations:-****Sample size calculation**

Number of subjects: N= 375

**Sample size:**

Distribution by country or region: Limited to one center as pilot study

**Statistical power and sample size justification:-**

According to Litwak et al. 2013;<sup>14</sup> the prevalence of microvascular and macrovascular complications among diabetic patients in Middle East/Gulf area including Saudi Arabia was 65.8% and 28.7% respectively; accordingly:

Sample size for Microvascular complications: In our study; it is hypothesized that the prevalence of microvascular complications among diabetic patients would be 60% with a precision of  $\pm 5\%$ . A sample size of 369 individuals will allow for a confidence level of 95% considering a 2-tailed test.

Sample size for Macrovascular complications: In our study; it is hypothesized that the prevalence of macrovascular complications among diabetic patients would be 25% with a precision of  $\pm 5\%$ . A

sample size of 288 individuals will allow for a confidence level of 95% considering a 2-tailed test.

**Statistical Analysis Plan:-**

Statistical analysis will be based on all patients enrolled in the registry. Descriptive analysis will be performed. Patient 's characteristics (demographic data, risk profile, treatment, etc.) will be described for all the included patients.

Quantitative data will be summarized using mean, median, standard deviation and range for continuous parameters and counts and percentages for categorical parameters. All statistical tests will be performed using two-tailed tests at a 5% level of significance. Moreover, statistical test will be performed on comparing different groups. Chi square test will be used to compare between categorical parameters. The results will be calculated at 95% CI and 5% level of significance. For parametric data; two-tailed paired t-test and repeated measures ANOVA will be used when comparing between repeated measurements while independent t-test and one way ANOVA when comparing between study groups. Non-parametric tests of significance would be used with data not normally distributed. Logistic Regression analysis would be performed to detect positive and negative predictors of microvascular and macrovascular complications.

**Estimated duration of the study:-**

**Estimated enrollment duration:** 1 month

**Estimated dates:**

- FPI: 1 JAN 2017
- LPI: 31 JAN 2017
- LPO: 31 JAN 2017
- Database lock date: 28 FEB 2017

Report date: 31 MAR 2017

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**List of Abbreviations:-**

ADR	Adverse Drug Reaction
AE	Adverse Event
CI	Confidence Interval
CRF	Case Report Form
CRO	Contract Research Organization
DM	Diabetes Mellitus
GCP	Good Clinical Practice
A1c	Glycated hemoglobin
ICH	International Conference on Harmonization
IEC	Independent Ethics Committee
IRB	Institutional Review Board
SAP	Statistical Analysis Plan
SFDA	Saudi Food and Drug Authority

**Introduction and Rationale:-**

**Background:-**

Diabetes is one of the largest global health emergencies of the 21st century. Each year more and more people live with this condition, which can result in life-changing complications. In addition to the 415 million adults who are estimated to currently have diabetes, there are 318 million adults with impaired glucose tolerance, which puts them at high risk of developing the disease in the future. Nearly each 6 seconds a patient would die because of diabetes and its complications reaching up to 5 million deaths a year ahead of cancer, tuberculosis and Malaria mortalities.<sup>1</sup>

The number of people with type 2 diabetes is growing rapidly worldwide. This rise is associated with ageing populations, economic development, increasing urbanization, less healthy diets and reduced physical activity.<sup>2</sup> Over the past three decades, major social and economic changes have transformed many of the countries in the Middle East and North Africa (MENA) region. Some Gulf States have undergone rapid economic growth and urbanization, associated with reduced infant mortality and increasing life expectancy.<sup>3</sup>

The age adjusted comparative prevalence rate of Diabetes Mellitus across the MENA region is estimated to be 10.7% with 35.4 million patients suffering from diabetes with 17.1 billion USD health expenditure for Diabetes and costlier 342 thousand deaths a year. The age adjusted prevalence of impaired glucose tolerance account for 8.6% adding another 30.2 million progressing to overt Diabetes Mellitus. Even Type 1 DM which is the by far less common compared to T2 DM the prevalence is 60.1 Thousand patients.<sup>3</sup>

Saudi Arabia has the highest prevalence across the MENA region in Type II DM reaching >20% of adult population aged 20-79 years old. Saudi Arabia also have some of the world's highest annual incidence rates of type 1 diabetes in children, with 31.4 new cases per 100,000 population, hence, Saudi Arabia has 16,100 children with type I diabetes, by far the highest number in the region, and over a quarter of the region's total of 60,700.<sup>3,4</sup>

Moreover, the diabetic population consumes a disproportionate share of health care resources because of both micro-vascular and macro-vascular complications. Strategies to lessen the disease burden in these patients include hygienic measures (diet and exercise) as well as rigorous treatment of hypertension, dyslipidemia and hyperglycemia.<sup>5</sup>

Diabetic patients are at high risks of developing microvascular complications of small blood vessels or macrovascular complications affecting larger blood vessels.<sup>6</sup> Microvascular complications are long-term complications and can be classified into diabetic retinopathy nephropathy or neuropathy.<sup>7</sup> The narrowing of arteries leads to decreased blood flow to the heart, or to the brain, or to the limbs leading to several macrovascular complications.<sup>8</sup>

There are a large number of epidemiological studies or national registers which have been conducted worldwide, particularly in the westernized countries, in order to assess the quality of care in diabetic patients, or to check compliance with national treatment guidelines and national program for improvement of quality of care of these patients. There has also been an international collaboration of different registries from various countries aiming to better understand global pattern of the diabetic disease.<sup>9,10</sup>

### **Rationale:-**

Local data available from Saudi Arabia are derived from 2 studies conducted in Eastern and central regions. One published in 2000 by Khan *et al* conducted in Al-Hasa area estimated the prevalence of retinopathy by 13.6%.<sup>11</sup> The most recently published study by Aboud FA *et al* in 2016 is again single center study including Type 2 DM patients attending Al-Wazarat Healthcare Center in the central region. Out of the 748 participants, 111 (14.8%) had retinopathy, 112 (15%) had nephropathy, and 5.6% had neuropathy. Approximately 63 (8.7%) had myocardial infarction (MI), 49 (6.6%) had cerebrovascular accident (CVA). The prevalence of both micro- and macro- vascular changes in the same patient were 42 (5.6%).<sup>12</sup> Overall, the prevalence of microvascular and macrovascular complications of Diabetes Mellitus seem to be lower than reported in international studies such as the United Kingdom Prospective Diabetes Study (UKPDS).<sup>13</sup>

This situation highlights the need to consistently assess the current prevalence of microvascular and macrovascular diabetic complications in the western region of Saudi Arabia and to put in place some actions in order to improve the quality of care of these patients.

The aim of this study is to explore the prevalence of microvascular and macrovascular complications among male and female patients having diabetes for more than 10 years at King Fahad General Hospital, Jeddah Saudi Arabia.

**Study objectives:-****Primary:-**

To assess the cumulative and individual prevalence of microvascular and macrovascular complications among study population.

**Secondary:-**

To Map Cardiovascular Risk Factors among study population.

Correlate diabetic complication prevalence with level of diabetes control (A1C target level)

**Study Design:-****Description of the study design:-**

A retrospective cross sectional study design will be used. Patients' files will be used as source of data collection in a brief case report form. To avoid duplication unique patient file number will be used as subject number preceded by investigator number. A random data source verification of 20% of the case report forms as quality control of collected data.

**Duration of study participation:-**

Data will be collected as one single visit. Patients will be enrolled over a period of one month.

**Evaluation Criteria:-****Primary evaluation criteria:-**

Number of Micro/Macrovascular complications

Proportion of patients having micro/macro complications

Frequency of micro/macrovascular complications per patients

Proportion of individual micro/macrovascular complication among study population.

**Secondary evaluation Criteria:-**

Proportion of Cardiovascular risk factors among study population and its correlation to DM vascular complications.

Difference in prevalence of micro/macrovascular and individual complications in patients with target A1C < 8 % or > 8% at the time of diagnosis.

**Selection of Patients:-****Sample Size:-**

It is planned the 3 investigators to recruit 375 patients in King Fahad General Hospital, Jeddah, Saudi Arabia.

**Inclusion Criteria:-**

Male or Female patients of all age groups.

Established diagnosis of DM for more than 10 years.

Patients presented to the outpatient clinic during the last three months.

**Exclusion Criteria:-**

Incomplete patient file

Modalities of recruitment

To allow extrapolation of the results to the broadest possible population, all consecutive patients who meet the eligibility criteria will enrolled in the study. Each selected investigator will include about 125 consecutive patients' files that meet eligibility criteria. This consecutive recruitment will limit biases of patient selection. The total recruitment period will be 1 month.

**Data Collection:-****Data Collection Schedule:-**

All data will be collected during one single visit (see Section 2.2 Study Flow Chart) in an individual Case Report Form (CRF).

**Data Collected:-**

Data will be collected from the medical chart. No tests will be specifically done for this study.

**Patient Data:-****The Following Data Will Be Collected:**

- Date of last visit,
- Inclusion/exclusion criteria check,
- **Patient profile:-**
  - ❖ Demographic characteristics (age, gender, , marital status, e),
  - ❖ Lifestyle habits (smoking status, , physical activity),
  - ❖ Vital signs, weight, waist circumference, body mass index, blood pressure).
  - ❖ Family History of DM and Cardiovascular disease
  - ❖ Relevant history of risk factors for DM
- **Characteristics of Diabetes:-**
  - ❖ Type of Diabetes
  - ❖ Duration of diabetes,
- **Cardiovascular Risk Factors:-**
- **Microvascular Complications:-**
  - ❖ Retinopathy (Date of Diagnosis, A1C level)
  - ❖ Nephropathy (Date of Diagnosis, A1C level)
  - ❖ Neuropathy (Date of Diagnosis, A1C level)
- **Macrovascular Complications:-**
  - ❖ Ischemic heart Disease (Type, Date of Diagnosis, A1C level)
  - ❖ Cerebrovascular Disease (Type, Date of Diagnosis, A1C level)
  - ❖ Peripheral vascular Disease (Type, Date of Diagnosis, A1C level)

**Site/ Investigator questionnaire:-**

Not applicable.

**Patient/Subject tracking log:-**

Not applicable:-

**Logistic Aspects:-**

Not applicable.

**Management of data:-****Data Collection, Validation and data quality control at mandated CRO LEVEL:-**

Data will be collected using paper CRFs. Patient profile and medical history will be collected from clinical records which are considered as source documents.

The computerized handling of the data by the mandated Contract Research Organization (CRO) may generate additional requests to which the participating investigator is obliged to respond by confirming or modifying the data questioned. The requests with their responses will be appended to the CRFs held by the Investigators.

**Data collection and validation procedures will be detailed in appropriate operational Documents:-****Monitoring And Site data quality control:-**

Data quality control will be performed at site level, where each investigator will randomly select and review 10% of CRF filled by his/her colleague against the patient file. That means 20% of the the CRFs will be cross checked.

Data quality control must be performed by qualified designated personnel. The methodology of data quality control and appropriate consecutive corrective actions will be detailed in the study manual.

**Pharmacovigilance:-**

The investigator should ensure that no product names / brand names are collected through the CRF. For this disease observational study, there will be no systematic collection of safety data.

However, all adverse drug reactions (ADRs) to any product that occurred during the course of the study must be recorded and transmitted to SFDA within 24 hours e.g. ADRs that are discovered at the time of a reviewing patents' files, data source verification and cross checking by another investigator or ADRs discovered during data entry into the database.

According to the International Conference on Harmonization (ICH) E2D guideline, ADRs are noxious and unintended responses to a medicinal product (the phrase 'responses to a medicinal product' means that a causal relationship between a medicinal product and an AE is at least a reasonable possibility).

According to local regulation, investigators must comply with Saudi Arabian regulations for the spontaneous reporting of ADRs as described in local regulatory requirements issued by Drug Sector/Saudi Food and Drug Authority (SFDA) which relate to Good Pharmacovigilance Practice Guidelines dated 01-SEP-2015, which describe the responsibility of the investigators and sponsor in reporting ADRs to SFDA / National Pharmacovigilance Center.

Per the ICH E2A guideline, a serious ADR is any untoward medical occurrence that at any dose:

- results in death,
- is life threatening (a reaction in which the patient was at risk of death at the time of the reaction e.g. allergic reaction: angioedema of the larynx would be life-threatening),
- requires inpatient hospitalization or results in prolongation of existing hospitalization,
- results in persistent or significant disability / incapacity e.g. loss of visual acuity, fractured neck of femur, convulsions with neurologic sequelae,
- is a congenital anomaly / birth defect, during pregnancy or after birth or any anomaly that results in fetal loss?
- is a medically important reaction (reactions that may not be immediately life-threatening or result in death or hospitalization but may jeopardize the patient or require intervention to prevent one of the other outcomes listed in the definition of seriousness). NB: it is the responsibility of the investigator to assess these events as medically important.

The investigators are responsible within 24 hours from his/her awareness of the ADR with special care to follow up serious cases until final outcome/resolution.

**SFDA requires the investigators to report the following special cases:-**

- Drug exposure via parent, with or without ADR,
- Lack of efficacy,
- Overdose (intentional or unintentional) with or without ADR,
- Drug misuse, with or without ADR,
- Drug abuse,
- Unintended beneficial effects,
- Medication errors, with or without ADR,
- Suspected transmission of infectious agents.

SFDA ADR form is attached in **Annex I**.

**Safety Observations:-**

- The Investigator should take all appropriate measures to ensure the safety of the patients, notably he/she should follow up the outcome of any ADR related to any product (clinical signs, laboratory values or other, etc.) until the return to normal or consolidation of the patient's condition;
- In case of any serious ADR related to any product, the patient must be followed up until clinical recovery is complete and laboratory results have returned to normal, or until progression has been stabilized. This may imply that follow-up will continue after the patient has left the study;
- According to the American Diabetes Association, hypoglycemia is a condition characterized by abnormally low blood glucose levels, usually falling below 70 mg/dL.
- The Investigator will assess the severity of all AEs/SAEs (including hypoglycemia) as Mild, Moderate, or Severe, based on the following definitions (developed from Clinical Data Interchange Standards Consortium CDISC Study Data Tabulation Model standard terminology v3.1.1):



- **Mild:** A type of AE that is usually transient and may require only minimal treatment or therapeutic intervention. The event does not generally interfere with usual activities of daily living.
- **Moderate:** A type of AE that is usually alleviated with additional specific therapeutic intervention. The event interferes with usual activities of daily living, causing discomfort, but poses no significant or permanent risk of harm to the research participant.
- **Severe:** A type of AE that interrupts usual activities of daily living, or significantly affects clinical status, or may require intensive therapeutic intervention.

**Statistical Considerations:-****Determination of Sample Size:-**

**Sample size:** 375 patients

**Statistical power and sample size justification:-**

According to Litwak et al. 2013; the prevalence of microvascular and macrovascular complications among diabetic patients in Middle East/Gulf area including Saudi Arabia was 65.8% and 28.7% respectively; accordingly:

Sample size for Microvascular complications: In our study; it is hypothesised that the prevalence of microvascular complications among diabetic patients would be 60% with a precision of  $\pm 5\%$ . A sample size of 369 individuals will allow for a confidence level of 95% considering a 2-tailed test.

Sample size for Macrovascular complications: In our study; it is hypothesised that the prevalence of macrovascular complications among diabetic patients would be 25% with a precision of  $\pm 5\%$ . A sample size of 288 individuals will allow for a confidence level of 95% considering a 2-tailed test.

Adopting the higher sample size rounded to 375 subject would be required.

**Distribution by country or region:-**

Limited to one center as pilot study

**Disposition of patients:-**

No tracking log will be used in the study. However, all investigators and patients included in the study will be accounted for. The study enrollment period (dates of first and last patients recruited, duration of recruitment period) and the number of patients per investigator will be given.

**Analysis Populations:-**

Two populations of patients will be defined:

- The **enrolled population:** all patients included in the study,
- The **analysis population:** all patients with DM included in the study who fulfilled eligibility criteria.

**Statistical Methods:-**

This section provides specifications for preparation of a final Statistical Analysis Plan (SAP), which will be issued prior to database lock. Any differences compared to this statistical section should be identified and documented in the final SAP. Statistical analysis will be based on all patients enrolled in the registry. Descriptive analysis will be performed. Patients' characteristics (demographic data, risk profile, treatment, etc.) will be described for all the included patients.

Quantitative data will be summarized using mean, median, standard deviation and range for continuous parameters and counts and percentages for categorical parameters. All statistical tests will be performed using two-tailed tests at a 5% level of significance. Moreover, statistical test will be performed on comparing different groups. Chi square test will be used to compare between categorical parameters. The results will be calculated at 95% CI and 5% level of significance.

For parametric data; two-tailed paired t-test and repeated measures ANOVA will be used when comparing between repeated measurements while independent t-test and one way ANOVA when comparing between study groups. Non-parametric tests of significance would be used with data not normally distributed. Logistic Regression analysis would be performed to detect positive and negative predictors of microvascular and macrovascular complications

**Analyses Variables:-**

Information about the patients will be collected through the CRF. All data collected during the registry will be analyzed in the appropriate descriptive analysis. Statistical analysis will be performed by a statistical programmer using SAS software, release 9.4 or higher (SAS institute, Cary, NC, U.S.A).

**Interim Analysis:-**

No interim analysis is planned for this registry.

**Responsibilities:-****Study Committees:-**

The chairperson will be responsible for coordinating the conduct of this study. She/He was involved in the preparation and approval of the protocol and its amendment(s), will assess the progress of the study at site level and is given full authority for presentation/publication of the results.

**Responsibilities of the Investigators:-**

The Investigator will perform the study in accordance with this protocol, applicable local regulations and international guidelines.

**It is the Investigator's responsibility to:-**

- Fill in the CRF and record all data pertinent to the study. She/he will ensure that the information reported in the CRF is precise and accurate.

The ICF and the Information Sheet used by the Investigator for obtaining the Patient's Informed Consent must be reviewed and approved by the Sponsor prior to submission to the appropriate Ethics Committee (IRB/IEC) for approval / favorable opinion.

The Investigators are responsible for taking all reasonable steps and providing adequate resources to ensure the proper conduct of the study.

**Investigators are responsible for:**

- Local submission(s) complying with data protection rules,
- Any other local submission(s).

**Ethical and Regulatory Standards:-****Ethical Principles:-**

This study will be conducted in accordance with the principles laid by the 18<sup>th</sup> World Medical Assembly (Helsinki, 1964) and all subsequent amendments.

**Laws and Regulations:-**

This study will be conducted in accordance with the guidelines for Good Epidemiology Practice [US (14) & European(16)].

The Investigators should locally ensure all necessary regulatory submissions (e.g. IRB/IEC) are performed in accordance with local regulations including local data protection regulations.

**Administrative Expectations:-****Record Retention:-**

The Investigator shall arrange for the retention of study documentation until the end of the study. In addition the Investigator will comply with specific local regulations/ recommendations with regards to patient record retention.

It is recommended that the Investigator retains the study documents at least 5 years (5) after the completion or discontinuation of the study.

However, applicable regulatory requirements should be taken into account in the event that a longer period is required.

**Confidentiality:-**

All material, information (oral or written) and unpublished documentation provided by the Investigator, including the present protocol and the CRF, are exclusive property of the investigator.

These materials or information (both global and partial) cannot be given or disclosed by the Investigators or by any person of her/his group to unauthorized persons without the prior formal written consent of Investigators.

The Investigator shall consider as confidential all the information received, acquired or deduced during the study and will take all necessary steps to ensure that there is no break of confidentiality, other than for information to be disclosed by law.

**Data protection:-**

The patients' personal data and the Investigators' personal data which may be included in the study database shall be treated in compliance with all local applicable laws and regulations.

When archiving or processing personal data pertaining to the Investigator and/or to the patients, The investigators and delegated CRO shall take all appropriate measures to safeguard and prevent access to this data by any unauthorized third party.

**Insurance:-**

Not applicable.

**Premature discontinuation of the study:-**

The investigators can decide at any time and for any reason to prematurely stop or to interrupt the study; the decision will be communicated in writing to If appropriate, according to Saudi regulations, Ethic Committee(s) (IRB/IEC) and SFDA should be informed.

**Ownership and use of data and Study Results:-**

No use of the data will be possible without the authorisation of the Investigators conducting the study.

**Publications:-**

All study Investigators will have full authority of primary presentation and/or primary publication of results. No other publication is allowed before the primary publication. Any subsequent presentation or publication by a study participant (including for substudies) must be approved by the investigators and make reference to the study and the primary publication.

**Protocol Amendments:-**

Any change to the protocol will be recorded in a written amendment, which will be signed by the Investigator. Amendment to the protocol may require regulatory submissions (e.g. IRB/IEC) in accordance with Saudi regulations.

**Bibliographic References:-**

1. IDF atlas 7<sup>th</sup> edition <http://www.idf.org/atlasmap/atlasmap>. Chapter 1
2. WHO Study Group on Prevention of Diabetes Mellitus, editor. Prevention of diabetes mellitus. Geneva: World Health Organization; 1994.
3. IDF atlas 7<sup>th</sup> edition <http://www.idf.org/atlasmap/atlasmap>, Chapter 4, Pages 78-81
4. Irfan M. Diabetes among Saudis a major issue. Published on Arab News (<http://arabnews.com>) on November 13<sup>th</sup>, 2012.
5. Nataniel Winer MD, James R, Sowers MD. Epidemiology of Diabetes. J Clin Pharmacol, 2004; 44(4):397-405.
6. Dormandy JA, Charbonnel B, Eckland DJ, Erdmann E, Massi-Benedetti M, Moules IK, et al. Secondary prevention of macrovascular events in patients with type 2 diabetes in the PROactive Study (PROspective pioglitAzone Clinical Trial In Macro Vascular Events): a randomized controlled trial. Lancet 2005; 366: 1279-1289.
7. Aiello LP, Gardner TW, King GL, Blankenship G, Cavallerano JD, Ferris FL, 3rd, et al. Diabetic retinopathy. Diabetes care 1998; 21: 143-156.

8. Diabetes.co.uk. Diabetes complications. [Updated 2015; Accessed 2015 May 24/]. Available from: <http://www.diabetes.co.uk/diabetes-complications/diabetes-complications.html>
9. Mottur-Pilson C, Snow V, Bartlett K. Physician Explanations for failing to comply with “best practices”. *Eff Clin Pract*, 2001; 4:207-213.
10. Cabana MD, Rand CS, Powe NR, Wu AW, Wilson MH, Abboud PA C, Rubin HR. Why don't physicians follow clinical practices guidelines? A framework of improvement. *JAMA*, 1999; 282(15):1458-1465.
11. Khan AR, Wiseberg JA, Lateef ZAA, Khan SA. Prevalence and Determinants of Diabetic Retinopathy in Al Hasa Region of Saudi Arabia: Primary Health Care Centre Based Cross-Sectional Survey, 2007-2009. *Middle East Afr J Ophthalmol* 2010; 17: 257-263.
12. Alaboud AF, Tourkmani AM, Alharbi TJ, Alobikan AH, Abdelhay O, Al Batal SM, et al. Microvascular and macrovascular complications of type 2 diabetic mellitus in Central, Kingdom of Saudi Arabia. *Saudi Med J* 2016; Vol. 37 (12): 1408-1411.
13. Stratton IM, Adler AI, Neil HAW, Matthews DR, Manley SE, Cull CA, et al. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes s (UKPDS 35): prospective observational study. *BMJ* 405-412.
14. Litwak L, Goh SY, Hussein Z, Malek R, Prusty V, Khamseh ME. Prevalence of diabetes complications in people with type 2 diabetes mellitus and its association with baseline characteristics in the multinational Alchieve study. *Diabetol Metab Syndr*. 2013 Oct 24;5(1):57
15. International Society for Pharmacoepidemiology, April 2007. ‘Guidelines for Good Pharmacoepidemiology Practices’.
16. Good Epidemiological Practice (GEP) proper conduct in epidemiology research – IEA European Federation (April 2007).

**Annex I:-** SFDA Adverse drug reaction form

This study is an epidemiological survey and is not intended to collect safety data about medication used in management of diabetes Mellitus. If the investigator discovered Adverse Drug Reactions during review of patient file, he/she will report it to Saudi National Pharmacovigilance Center by online submission using the electronic form in the below link: <https://ade.sfda.gov.sa/ADR1.aspx>

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### RESEARCH ARTICLE

#### A REVIEW: COMPARISON OF LINE CLIPPING ALGORITHMS IN 3D SPACE.

**Nisha.**

#### **Manuscript Info**

##### **Manuscript History**

Received: 29 November 2016  
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##### **Key words:-**

3D geometry, Line Clipping, Computer Graphics, 2D geometry.

#### **Abstract**

In computer graphics there are many line clipping algorithms which can be extended to 3D space. This paper is a review on Cohen-Sutherland and Liang-Barsky line clipping algorithms. Mostly all of the 3D line clipping algorithms involves basic three steps to check either a line segment lies completely inside the clipping volume or lies completely outside the clipping volume or crossing calculations when it is not entirely inside or outside. [1]

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#### **Introduction:-**

In context of computer graphics, it is very essential to clip an area or a volume of interest which is to be displayed on the computer monitor. This division of interest is normally a rectangle or a general polygon in 2-Dimension and known as the clipping window. When it comes to 3-Dimensional clipping, a volume is used to extract a part from a 3-Dimensional scenario. Broadly the lines are clipped by clipping volume and it is known as polyhedron. And these Cuboids are extensively used as the clipping volume. 3-Dimensional clipping is one of the most essential processes such as video games, medical applications, computer aided design and many various applications. Occasionally it is important to dispose the data that is not within the visible range to avert the overflow of the internal registers of the display device.

Moreover, less memory consumption can be acquired by loading only a certain part of a scenario to the memory by clipping unnecessary parts. Therefore, bettering the performance of the clipping algorithm has a better impact on performance of the comprehensive graphics system.

Cohen-Sutherland line clipping algorithm, Liang-Barsky line clipping algorithm, Cyrus-Beck line clipping algorithm and Nicholl-Lee-Nicholl line clipping algorithm are the traditional line clipping algorithms. The Cohen-Sutherland and the Liang-Barsky algorithms can be continued to 3-Dimensional clipping. Nicholl-Lee-Nicholl algorithm achieves lesser comparisons and divisions which makes it faster than others. Nevertheless, it is difficult to expand for 3-Dimensional clipping. [1]

#### **Cohen-Sutherland Line Clipping Algorithm in 3D Space:-**

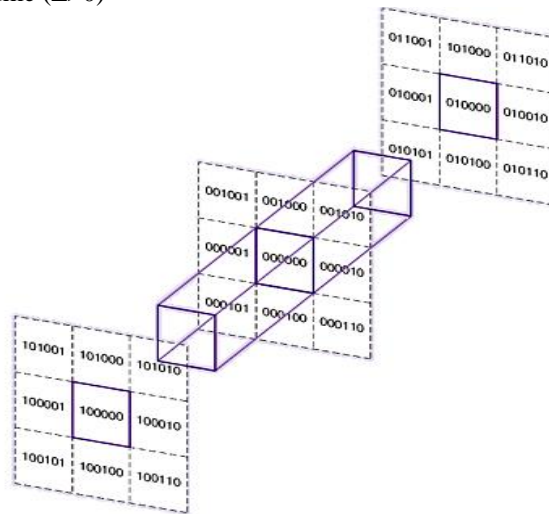
Cohen-Sutherland algorithm is one of the elementary and widely used clipping algorithms in computer graphics. This algorithm works very quickly in situations like the line segment is completely inside or outside of the clipping window. When the line segment is not lies inside or outside, this algorithm becomes ineffective due to repeated calculations. This algorithm can be easily extended to 3-Dimensional clipping, but space is required to divide into 27 mutually exclusive volumes, when the clipping volume is a cube or a cuboids. Again each volume is assigned a region code. Throughout the clipping process those region codes should be reserved in the memory. So in terms of

space and time complexity Cohen – Sutherland algorithm lacks results for complex problems. According to Hearn and Baker [3] all most all the 3D line clipping algorithms involve three steps:

1. For a given line sector check if it lies entirely inside the clipping volume.
2. If it does not fall between check whether it lies completely outside the clipping volume.
3. Diversely, perform intersection calculations with one or more clipping planes.

**The Cohen-Sutherland algorithm extends to 3D very simply. The outcode for 3D clipping is a 6-bit code. For a parallel canonical view volume the bits represent:**

- bit 1 - point above view volume ( $Y > 1$ )
- bit 2 - point below view volume ( $Y < -1$ )
- bit 3 - point to the right of view volume ( $X > 1$ )
- bit 4 - point to the left of view volume ( $X < -1$ )
- bit 5 - point behind view volume ( $Z < -1$ )
- bit 6 - point in front of view volume ( $Z > 0$ )



Nine line clipping regions of Cohen-Sutherland in 3D space

As in the 2D case, the line may be trivially accepted (both outcodes=000000), or trivially rejected ((code 1 AND code 2) not 000000). Otherwise line subdivision is used again. The points of intersection with the clipping edges are found using a parametric representation of the line being clipped. Consider the general line from P0 ( $x_0, y_0, z_0$ ) to P1 ( $x_1, y_1, z_1$ ). Its parametric representation is:

$$x = x_0 + t(x_1 - x_0) \quad (1)$$

$$y = y_0 + t(y_1 - y_0) \quad (2)$$

$$z = z_0 + t(z_1 - z_0) \quad (3)$$

$$0 \leq t \leq 1$$

As  $t$  varies from 0 to 1 these equations give the coordinates of all the points on the line between P0 and P1.

EXAMPLE: To calculate the intersection of a line with the  $y=1$  plane,  $y=1$  is substituted into equation (2). Rearranging this gives:

$$t = \frac{1 - y_0}{y_1 - y_0} \quad (4)$$

Substituting (4) into (1) and (3) yields:

$$x = x_0 + \frac{(1 - y_0)(x_1 - x_0)}{y_1 - y_0} \quad (5)$$

$$z = z_0 + \frac{(1 - y_0)(z_1 - z_0)}{y_1 - y_0} \quad (6)$$

As all the values in equations (5) and (6) are known, these two equations can be solved to find the x and z coordinates of the point of intersection. Using this information the line can be divided in two. [6]

### Liang-Barsky Line Clipping Algorithm in 3D space:-

Consider the parametric definition of a line:-

- $x = x_1 + u\Delta x$
- $y = y_1 + u\Delta y$
- $\Delta x = (x_2 - x_1), \Delta y = (y_2 - y_1), 0 \leq (u, v) \leq 1$

Mathematically, this means

- $x_{\min} \leq x_1 + u\Delta x \leq x_{\max}$
- $y_{\min} \leq y_1 + u\Delta y \leq y_{\max}$

Rearranging, we get

- $-u\Delta x \leq (x_1 - x_{\min})$
- $u\Delta x \leq (x_{\max} - x_1)$
- $-v\Delta y \leq (y_1 - y_{\min})$
- $v\Delta y \leq (y_{\max} - y_1)$

In general:  $u * p_k \leq q_k$ . There are many cases, if  $p_k = 0$  then line is parallel to boundaries and if for the same k,  $q_k < 0$ , reject the line otherwise accept the line. If  $p_k < 0$  then line starts outside this boundary and  $r_k = q_k / p_k$ ,  $u_1 = \max(0, r_k, u_1)$ . If  $p_k > 0$  then line starts outside this boundary and  $r_k = q_k / p_k$ ,  $u_2 = \min(1, r_k, u_2)$ . And if  $u_1 > u_2$ , the line is completely outside. It can easily extend to 3D by adding equation for  $z = z_1 + u\Delta z$  and 2 more p's and q's. [5]

### Conclusion:-

In this paper I defined Cohen-Sutherland and Liang-Barsky line clipping algorithms in 3-Dimensional space. Three-dimensional objects are clipped against a bounding volume as opposed to a clipping rectangle. Specifically, when clipping in 3D space we need to consider the intersections of lines and planes or polygons and planes as opposed to the clipping of lines against lines, which is the case with 2D space. A simple technique often employed to reject objects completely outside the clipping volume and to accept objects entirely inside it is to create a bounding sphere for the object and to subsequently test its edges against that of the view volume. A bounding volume, or bounding box, is simply a volume containing a geometric object. Cohen-Sutherland is the simplest line clipping algorithm but the Liang-Barsky algorithm is more efficient, since intersection calculations are reduced. [2]

### References:-

1. R. Kodituwakku, K. R. Wijeweera, M. A. P. Chamikara, "An Efficient Line Clipping Algorithm for 3D Space", International Journal of Advanced Research in Computer Science and Software Engineering Volume 2, Issue 5, May 2012.
2. Abhishek Pandey<sup>1</sup>, Swati Jain<sup>2</sup>, "Comparison of Various Line Clipping Algorithms for Improvement", International Journal of Modern Engineering Research (IJMER) Vol.3, Issue.1, Jan-Feb. 2013.
3. Donald Hearn, and M. Pauline Baker, "Computer Graphics, C Version", 3 edition, pp. 226-230, December 2004
4. Rogers DF. "Procedural elements for computer graphics". New York: McGraw-Hill, 1985. P.111-87.
5. [https://en.wikipedia.org/wiki/Liang%E2%80%93Barsky\\_algorithm](https://en.wikipedia.org/wiki/Liang%E2%80%93Barsky_algorithm)
6. <https://www.cs.helsinki.fi/group/goa/viewing/leikkaus/lineClip.html>

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### RESEARCH ARTICLE

## CORRELATION BETWEEN SERUM ZINC AND GLYCOSYLATED HEMOGLOBIN LEVELS IN TYPE II DIABETES MELLITUS.

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#### Manuscript Info

##### Manuscript History

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#### Abstract

Correlation between serum zinc and glycosylated hemoglobin levels in type II diabetes mellitus.

#### Key words:-

serum zinc, glycosylated hemoglobin,  
type II Diabetes mellitus.

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#### Introduction:-

Diabetes mellitus (DM) is one of the major emerging health problem in developing countries resulting in morbidity and mortality of an individual and reducing the longevity of life. Although elaborate research works have been carried out to elucidate the multivarous aspects of this disease, many associated factors which will help to achieve better glycemic control are yet to be explored.[1] Universally there is a marked rise in type II DM cases and associated hypertension, stroke and renal problems and in turn they have become major contributors to morbidity and mortality. India being the second largest populated country in the world is also having 61.2 million cases in 2011 and is estimated to have 101.2 million type 2diabetic people by 2030.

Diabetes mellitus (DM) is a metabolic disorder with hyperglycemia and its related complications due to abnormality in insulin release, action or both. Insulin resistance plays a key role leading to all metabolic dysfunctions. Insulin resistance leads to increased visceral fat, dyslipidemia, hypertension, ,vasculopathy, increased platelet aggregation, endothelial dysfunction and accelerated atherosclerosis.[2] The altered metabolism of various minerals and trace elements has been implicated in diabetes mellitus and these elements may play a vital role in the itiopathogenesis and progression of the disease. Of these trace elements- magnesium, zinc and copper are important for various physiologic functions.[3] Oxidative stress caused by reactive oxygen species is the basis of pathogenesis of many diseases including DM. Trace elements play a role in production of oxygen free radicals.[4,5] .Zinc is a cofactor in the enzymatic pathways of production, storage and release of insulin. Zinc is also responsible for the structural stability of insulin, alteration of which leads to insulin resistance. Since glycosylated hemoglobin is an indicator of long-term glycemic control, HbA1c was measured and compared with serum zinc level.

#### Aim:-

To correlate between serum zinc and glycosylated hemoglobin levels in type II Diabetes Mellitus.

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### Materials and Methodology:-

The present study was undertaken in the Institute of Physiology, Madurai Medical College, Madurai. After obtaining Institutional Ethical clearance, 60 males in the age group of 40-60 yrs, newly diagnosed with type 2 DM were selected based on history, examination, and relevant investigations. 60 age- and sex-matched volunteers without diabetes mellitus were taken as controls. Persons on micronutrient supplementation, drugs which interfere with zinc metabolism, oral hypoglycemic agents, insulin therapy, pregnant women or chronic diseases were excluded from the study.

Patients were classified as diabetic based on the American Diabetic Association 2010 criteria for diagnosis of DM.[8]. After getting prior informed written consent, with strict universal precautions 5 mL of venous blood was collected from antecubital vein by venepuncture using a sterile disposable syringe. Serum Zinc was estimated by colorimetric method,[9,10], glycated haemoglobin by ion exchange resin method,[7,11,12], blood glucose (fasting and postprandial) by Glucose oxidase/Peroxidase method,[13,14]. Statistical analysis of the data was performed by using SPSS software. 'p' value of less than or equal to 0.05 was considered significant. Correlation was found out in SPSS by using regression equation.

### Results and Discussion:-

Age distribution of cases and controls was not statistically significant with  $p > 0.05$ . The mean fasting and postprandial blood glucose in newly diagnosed type 2 DM cases were found to be statistically significant than that of the controls with  $P < 0.001$ . Mean serum zinc was lower in cases ( $69.65 \pm 5.6 \mu\text{g/dl}$ ) vs controls ( $86.54 \pm 9.3 \mu\text{g/dl}$ ) with  $p < 0.001^*$ . Mean HbA<sub>1c</sub> was higher in cases ( $7.03 \pm 0.67\%$ ) than controls ( $5 \pm 0.29\%$ ), with  $p < 0.001^*$ . Williams *et al.*, [21] reported DM to be a condition most frequently associated with hypozincemia, where they observed 17% decrease in serum zinc concentration in diabetics, compared with controls.

**Table 1:-**

S.No	Cases	Controls	'p' value	Pearson's correlation coefficient
Mean S.Zinc	$69.65 \pm 5.6 \mu\text{g/dl}$	$86.54 \pm 9.3 \mu\text{g/dl}$	.001*	<b>Negative Correlation - 0.826</b>
Mean HbA <sub>1c</sub>	$7.03 \pm 0.67\%$	$5 \pm 0.29\%$	<0.001*	

Correlation between glycated hemoglobin (HbA<sub>1c</sub>)% and serum zinc concentration in cases reveal a negative correlation between s.zinc and HbA<sub>1c</sub> with Pearson's correlation coefficient - **0.826**.

The findings of the present study are consistent with Reefat *et al.*, [28] who showed negative correlation between serum zinc concentration and baseline HbA<sub>1c</sub>% value in cases. Marchesini *et al.*, [29] explained hypozincemia in diabetic population due to the low gastrointestinal absorption and high urinary excretion of zinc.

### Discussion:-

Diabetes mellitus is a multifactorial disease. The metabolic derangements in diabetes causes pathophysiologic changes in multiple organ systems due to micro vasculopathy.

Present study revealed significant decrease in serum zinc levels in diabetic patients. Zinc plays a key role in various enzyme systems in the body.[13] Zinc is a potent antioxidant. Chronic zinc deprivation may lead to increased oxidative damage. Pujar S *et al.*, [13] in their study also showed significant decrease in serum zinc levels in type 2 diabetic patients. The reason for decreased serum zinc in diabetics may be due to impaired absorption, increased urinary excretion due to altered renal function, or genetic factors or during infections in which zinc plays a role in defence.[26]

Hence it may be concluded that there is significant reduction of serum zinc in type 2 DM patients. Alterations in Zn homeostasis has adverse effect on carbohydrate metabolism. High renal tubular load of glucose in diabetics interfere with tubular reabsorption of zinc causing hyperzincuria. Zn also increases insulin sensitivity by increasing the

sensitivity of insulin binding to its receptors.[2].Disordered metabolism of zinc may interfere with achievement of glycemic control in DM and in turn leads to development of complications.

#### **Conclusion:-**

Present study revealed inverse relationship between serum zinc and glycemic control. Hence micronutrient supplementation with emphasis on zinc may pave the way for good glycemic control in Type II diabetes mellitus and reduce morbidity and mortality.

#### **Conclusion:-**

Our study shows a decrease in levels of serum zinc among the type 2 DM patients. This causes poor glycemic control in type 2 DM by the involvement of zinc in oxidative stress and increase. Increased levels of copper and decreased level of magnesium and zinc are associated with increased values of HbA1c. This shows that the impaired metabolism of these minerals may have a contributory role in the progression of DM and later development of complications. However further studies are needed to be carried out to determine the molecular role of zinc, magnesium and copper in the development of diabetic complications.

#### **References:-**

1. Zimmet P, Alberti KG, Shaw J. Global and Societal Implication of the Diabetes Epidemic. *Nature*.2001;414:782–7. [PubMed]
2. Chausmer AB. Zinc, insulin and diabetes. *J Am Coll Nutr*. 1998;17:109–115. [PubMed]
3. Rai V, Iyer U, Mani I, Mani UV. Serum Biochemical changes in Insulin Dependent and Noninsulin Dependent Diabetes Mellitus and their role in the Development of Secondary Complications. *Int J Diabetes Dev Ctries*. 1997;17:33–7.
4. Tripathy S, Sumathi S, Bhupal Raj G. Minerals Nutritional Status of Type 2 Diabetic Subjects. *Int J Diabetes Dev Ctries*. 2004;24:27–8.
5. Hyun-Mee Oh, Jin-Sook Yoon. Glycemic control of type 2 diabetic patients after short-term zinc supplementation. *Nutrition Research and Practice*. 2008;2:283–8. [PMC free article] [PubMed]
6. Diabetes Control and Complications Trial Research Group. ‘The relationship of glycemic exposure (HbA<sub>1c</sub>) to the risk of development and progression of retinopathy in the diabetes control and complications trial’ *Diabetes*. 1995;44:968. [PubMed]
7. Nathan DM, Singer DE, Hurxthal K, Goodson JD. The clinical information value of the glycosylated hemoglobin assay. *N Engl J Med*. 1984;310:341–6. [PubMed]
8. American Diabetes Association: Standards of medical care in diabetes. *Diabetes Care*. 2010;33(Suppl 1):S13. [PMC free article] [PubMed]
9. Akita Abe, Yiamashita S. *Clin Chem*. 1989;35(4):552–4. [PubMed]
10. Tetsuo Makino. *Clin Chem Acta*. 1991;197:209–20.
11. Trivelli LA, Ranney HM, Lai HT. Hemoglobin components in patients with diabetes mellitus. *N Engl J Med*. 1971;284:353–7. [PubMed]
12. Bunn HF. Evaluation of glycosylated hemoglobin in diabetic patients. *Diabetes*. 1981;30:613–17.[PubMed]
13. Trinder P. Glucose oxidase-peroxidase method. *Ann Clin Biochem*. 1964;6:24.
14. Raabo E, Terkildsen TC. On the enzymatic determination of blood glucose. *Scand J Clin Lab Invest*.1960;12:402–07. [PubMed]
15. Berthelot MP. Berthelot's reaction mechanism. *Report Chim Appl*. 1859:2884.
16. Fawcett JK, Scott JE. *J Chim Pathol*. 1960;13:156. [PMC free article] [PubMed]
17. Bosnes RW, Taussay HH. On the colorimetric determination of creatinine by the Jaffe reaction. *J Biol Chem*. 1945;158:581–91.
18. Toro G, Ackermann PG. Boston: Little Brown and Co; 1975. *Practical Clinical Chemistry*; p. 154.
19. Kinlaw WB, Levine S, Morley J, Silvis S, McClain C. Abnormal Zn metabolism in type II diabetes mellitus. *Am J Med*. 1983;75:273–7. [PubMed]
20. Zalewski P, Millard S, Forbes I, Kapaniris O, Slavotinek S, Betts W, Ward A, et al. Video image analysis of labile Zn in viable pancreatic islet cells using specific fluorescent probe for Zn. *J Histochem Cytochem*.1994;42:877–84. [PubMed]
21. Williams NR, Rajput-Williams J, West J, Nigdikar S, Foote J, Howard A. Plasma, granulocyte and mononuclear cell copper and zinc in patients with diabetes mellitus. *Analyst*. 1995;120:887–90. [PubMed]

22. McNair P, Kiilerich S, Christiansen C, Christiansen M, Madsbad S, Transbol I. Hyperzincuria in insulin treated diabetes mellitus-its relation to glucose homeostasis and insulin administration. *Clinica Chimica Acta*.1981;112:343–8. [PubMed]
23. Garg V, Gupta R, Goal R. Hypozincemia in diabetes mellitus. *J Assoc Physicians India*. 1994;42:720–1.[PubMed]
24. The Diabetes Control and Complications Trial Research Group. *N Engl J Med*. 1993;329:977–86.[PubMed]
25. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. *BMJ*. 1998;317:703. [PMC free article] [PubMed]
26. Khaw KT. Glycated haemoglobin, diabetes, and mortality in men in Norfolk cohort of European Prospective Investigation of Cancer and nutrition (EPIC-Norfolk) *BMJ*. 2001;322:15–18. [PMC free article][PubMed]
27. Verma Effect of Increasing Duration of Diabetes Mellitus Type 2 on Glycated Hemoglobin And Insulin Sensitivity, Indian. *J Clin Biochem*. 2006;21:142–6. [PMC free article] [PubMed]
28. Refaat A, Al-Marroof, Shatha S, Al-Sharbatti Serum zinc levels in diabetic patients and effect of zinc supplementation on glycemic control of type 2 diabetics. *Saudi Med J*. 2006;27:344–50. [PubMed]
29. Marchesini G, Bugianesi E, Ronchi M, Flaminia R, Thomaseth K, Pacini G. Zinc supplementation improves glucose disposal in patients with cirrhosis. *Metabolism*. 1998;47:792–8. [PubMed]



### RESEARCH ARTICLE

#### THE OCCURRENCE AND ASSESSMENT OF AWARENESS ABOUT INTERVENTIONAL COSMETICS AMONG STUDENTS OF COLLEGE OF APPLIED SCIENCES AND COMMUNITY SERVICES IN THE UNIVERSITY OF DAMMAM SAUDI ARABIA.

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#### Abstract

Seeing how the number of teenagers undergoing cosmetic surgeries is on the rise, and how most people undergoing cosmetic interventions are unaware of their consequences.

**Objectives:** This study assessed the awareness and estimated the occurrence of cosmetic surgeries among 530 female students from the University of Dammam's College of Applied Sciences and Community Service. It also aimed at assessing the association between age and future cosmetic surgeries, as well as determining the prevailing body image, BMI, and attitude, and their relationship with cosmetic surgeries among these students.

**Methodology:** A stratified random sampling method with proportionate allocation was conducted.

**Results:** About 40% of the females above 15 years old reported had undergoing a cosmetic surgical intervention, with hair removal by laser being the most frequently preformed. Also, 59% of the students had a body mass index within the normal range. In addition, mean total knowledge score for those who "did not perform surgery" is 11.22. While, mean total knowledge score for those who "performed surgery" is 12.18.

**Conclusion:** In general, there was an increased awareness about cosmetic interventions. The study also found that previous conductance of cosmetic surgery substantially affected the level of knowledge about these procedures. Further studies are required to determine the reasons behind seeking these cosmetic interventions.

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Cosmetic surgery is usually performed to correct a physical abnormality or to enhance an otherwise normal physical feature and, therefore, improve a person's appearance. In the not so distant past, it was confined only to surgery that was absolutely necessary to the health and well-being of the patient, such as skin-grafting for serious burn injuries, repairing a broken nose or jaw, or treating an unseemly birthmark across the face. Cosmetic surgery was first used regularly after World War I, when treatment and reconstruction of war injuries gave hope to young soldiers <sup>[1]</sup>. Cosmetic surgery has increased dramatically in popularity over the past 10 years <sup>[2]</sup>, and it is constantly on the rise, seeing how more and more people are turning to cosmetic surgeries in their search for physical perfection.

According to the International Society of Aesthetic Plastic Surgery (ISAPS), two studies were conducted in 2010 and 2011 to determine the top 25 countries by total number of cosmetic procedures showed that Saudi Arabia ranked as 23<sup>rd</sup>, 22<sup>nd</sup> top country worldwide respectively, by total number of 45,398 procedures in 2010 and 46,962 procedures in 2011 <sup>[3,4]</sup>.

In Saudi Arabia and worldwide, Lipoplasty was the most prevalent cosmetic surgery; 19.9% of all cosmetic surgeries worldwide in 2011 were lipoplasties, and 9,601 of them were preformed in Saudi Arabia. The second most prevalent surgery was breast augmentation, comprising 18.6% of cosmetic surgeries worldwide, with 6,424 surgeries preformed in Saudi Arabia in 2011. Rhinoplasty was the third most prevalent cosmetic surgery in Saudi Arabia, with 5,630 procedures preformed in 2011. There were also, 4,984 blepharoplasties and 3,652 abdominoplasties performed in Saudi Arabia in 2011 <sup>[4]</sup>.

Almost all plastic surgeries have risks, and these risks vary in their severity and their duration. For instance, temporary numbness or loss of feeling at the site of the incision is fairly common in face-lifts and tummy tucks, though it's rarely permanent. Numbness after breast surgeries of any type is the most common. Loss of sensation in the nipple in particular occurs anywhere from 10% to 70% of the time, depending on the type of procedure. Another example is a seroma, which is a collection of watery body fluids that occurs most often in tummy tucks. It's common enough that many surgeons take preventative measures by inserting a drain during surgery. Tissue necrosis due to surgical manipulation is inevitable after any procedure, though risks increase dramatically if the patient is a smoker. Infections are rare in plastic surgery patients, since most patients are healthy to begin with. However, when they do happen, they can spread quickly and must be stopped immediately <sup>[5]</sup>.

The number of plastic surgeries is on the rise, and many of the people undergoing these procedures are unaware of their risks. Many doctors and institutions are taking advantage of these people and treating this sector as a booming business. This resulted in the percentage of teenagers undergoing these procedures to rise to a total of 2% of all procedures, adding up to about 230,617 procedures per year, including laser hair removal (69,434 procedures), rhinoplasty (33,892), and Botox injections (16,160). There are also about 8,892 teenage girls having breast implants <sup>[6]</sup>.

Moreover, in the field of cosmetic plastic surgery, common deaths are related to anesthesia with the highest probability of occurrence being 1 out of 13,000 and lowest 1 out of 300,000. Liposuction related surgery deaths are estimated to happen in every 5,000 cases due to the usage of general anesthesia. Tummy tucks accounted for 1 out of every 500 cases. For the elderly that undergo face-lift procedures, their risks are 1 in every 600 cases <sup>[7]</sup>.

Based on all of what we mentioned above, we decided to conduct this study among the University of Dammam female students to assess their awareness of cosmetic surgeries and to estimate the occurrence of cosmetic surgeries among them.

#### **Objectives:-**

General objectives: to assess the awareness of university students on cosmetic interventions, and estimate the occurrence of cosmetic surgeries among university students.

Specific objectives: To assess the association between age and future cosmetic surgeries among university students. Also, to determine the prevailing body image, BMI, attitude and their relationship with cosmetic surgeries.

#### **Methodology:-**

##### **Setting:-**

This cross-sectional study aimed to estimate the occurrence of cosmetic interventions and to assess the level of awareness about them among female students of the college of applied sciences, University of Dammam, Khobar, Saudi Arabia. This college was selected because of its accessibility and proximity to the survey conductors.

Research was conducted in a 2 weeks period. Started on 24/11/2013 and ended on 5/12/2013.

#### **Participants:-**

The target population consisted of 530 female students from the College Of Applied sciences, from 1st level to 8th level. The participants' ages fall in the range of 17 to 25 year old. Almost all the participants were Saudi nationals.

#### **Procedure:-**

Survey conductors followed a random stratified sampling method while distributing the questionnaires among the students of the college of applied sciences. All students anonymously completed a self-admitted questionnaire developed to assess the knowledge and rate of occurrence of interventional cosmetic surgeries. The questionnaire contained questions inquiring about the procedures they or any of their female relative had undergone. The participants were also asked whether they wanted to undergo cosmetic surgery or not, and which specific procedure they would like to have. Participants' attitude about cosmetic surgeries was assessed by a 1-4 scale, 1 being "strongly disagree", and 4 being "strongly agree". The rest of the questionnaire consisted of multiple-choice questions regarding various types of cosmetic surgeries and their procedure and subsequent side affect. These multiple-choice questions were aiming to estimate the total knowledge of university students concerning cosmetic surgeries. After collecting the questionnaires, the students were accompanied by the survey collectors to a scale where their weights and heights were accurately measured.

#### **Ethical Consideration:-**

An approval letter was addressed to the Dean of each college included in the research. Brief explanation of the study was conducted to each participated student and answering the questionnaire implied the consent. Confidentiality and anonymity was assured for all the information gathered. Participation in the research was voluntary.

#### **Statistical Design:-**

The statistical analysis was done using SPSS-Ver.20 statistical software package. All data collected was entered to SPSS. It was analyzed and categorized by medical students involved in research. We calculated the total knowledge score by adding the score of correct answers, yielding a maximum score of 30 and categorized into: 1= poor knowledge (<15), 2= average knowledge (15-23) and 3= good knowledge (> 23). Body Mass Index was calculated by the equation:  $\text{weight (kg)} / (\text{height (m)})^2$  and categorized into 1=underweight (<18.5), 2=normal (18.5-24.9), 3= overweight (25-29.9), 4=obese (30-39.9), and 5= morbidly obese ( $\geq 40$ ).

Data was represented by using descriptive statistics in the form of numbers and percentages for qualitative variables (Categorized BMI, Body Image, Past surgery Conductance, Attitude, Family Monthly Income, Age Groups and Future Surgery Conductance). Mean  $\pm$  standard deviation (SD) was applied for quantitative variables (Total Knowledge Score, Correct Answers and occurrence for each surgery). Frequency tables and cross tables were used. Also, statistical tests were used like: t-test and chi-square test. T-test was used for associating one qualitative variable and a quantitative variable, for example, the distribution of the mean total knowledge score (quantitative, dependent variable) by surgery conductance (Independent variable). Furthermore, the chi-square test was used for finding the relationship between two qualitative variables as between body image and BMI). Finally, the significance of all statistical tests was set at a P-value of 0.05 .

#### **Results:-**

Table 1 discusses the demographic characteristics of the data collected from the 530 students. Variable chosen where: level, age, marital status, family monthly income, and the educational level of the mother and the father. First, the percentage of students who were 25 year old was the lowest (1%), on the other hand, the percentage of students who were 20 year old was the highest (22.4%). Second, 86.6% of students were unmarried, while 13.4% were married showing that the majority of the students are not married. Third, 60.6% has a family monthly income greater than 15000 SR. This represents the highest percentage. This is followed by those who have a family monthly income ranges between 5000-15000 SR, representing 36.3%. In addition, the percentage of parents who had an educational level of "university and above" was 49.8%. This represents the highest proportion out of the 4 levels of education. Finally, the association between the educational level of the mother and the father with knowledge score showed no significance.

Table 2 shows the association between body image and body mass index. In general, the university students are aware of their current weight. 59% of the students had a body mass index within the normal range. Furthermore, 21.1% of the students were overweight, and this is considered to be slightly elevated. Only 0.8% of students were morbidly obese. Finally, 83.5% of the students who fall within the normal range of BMI considered themselves normal, and they were the most accurate.

Table 3 shows association between conductance of surgery-attitude and monthly income. First, concerning the attitude the following was found. 77.79% of the students accepted undergoing surgeries for medical reasons. Among them, 49% have already undergone surgery. In addition, 34.9% of those who believe that undergoing cosmetic surgeries is “Totally unaccepted” performed surgery. They might done hair removal by laser or skin peeling which they didn’t consider it a cosmetic intervention to change the appearance. Second, concerning the monthly income the following was found. About 65.5% of students who had undergone cosmetic surgeries had a monthly family income of 15000 SR or more, followed by 33.3% for whom who had a monthly family income falling between 5000-15000 SR. As a result, this strongly suggests the substantial role of general financial state on conductance of surgery.

Table 4 shows the distribution of the mean total knowledge score by conductance of surgery. The mean total knowledge score of those who had undergone surgery = 12.8, SD=3.172, this means that about 68% of total knowledge scores of those who had undergone surgery are between (9.6-15.97). On the other hand, the mean total knowledge score of those who had not undergone surgery = 11.22, SD=3.207, this means that about 68% of total knowledge scores of those who had not undergone surgery are between (8.01-14.43). Also, T-Test P-value 0.001 highly significant. As a result, past experience of cosmetic surgery plays a role in the knowledge about cosmetic interventions.

Table 5 shows the assessment of correct answers (Questions 34 – 63) by frequency and valid percentage. Question about “Indications of skin abrasion” was the most common correctly answered question by 70.9% of students. Next, the question concerning “Effective duration of Botox” was correctly answered by 65.8% of the students. Finally, the question with the third highest correct answer was about “Indications of plastic nose surgery” constituting 64.3% of the students. In contrast, question regarding “Function of Botox injections for facial wrinkles” was the least question answered correctly, only by 11.1% of student. (Low frequency of correct answer might be due requirement of pure medical knowledge in order to answer the question, since the answer was: the Botox exerts its effect chemically by inhibiting the postganglionic synapse innervating the muscles of facial expression). In addition, by categorizing the questions according to the cosmetic intervention they assess, and calculating the average of both the frequency and the valid percent, the following results were found to be: Questions assessing the knowledge about skin peeling, skin abrasion, and the hair removal by laser got the highest average valid percentage (62.1%, 46.7%, and 45.2%) respectively.

Table 6 shows the total Occurrence of each Cosmetic Intervention Among Females above 15 years old. 40.5% of the total females had undergone a cosmetic intervention. “Hair removal by laser” is the most common cosmetic intervention done among the total female population of the sample with the highest percentage of 22.8%. Moreover, the second common cosmetic intervention was “Skin abrasion”, conducted by 4.24% of students. Finally, the third common cosmetic intervention was “Skin care with laser”, conducted by 3.66% students.

Table 7 shows the association between age group and future surgery. The percentage of students who wish to undergo future cosmetic surgery increases with age, being 41.7% in students aged from 23-25 year old.

**Table 1:-**Demographic characteristics of data collected from 530 female students in the University of Dammam - College of Applied Studies and Community Services

Demographic characteristics		No. of females=530	Percentage
Year	1 <sup>st</sup> year	149	28.1%
	2 <sup>nd</sup> year	146	27.5%
	3 <sup>rd</sup> year	113	21.3%
	4 <sup>th</sup> year	122	23.0%
	Total	530	100%
Age	17	8	1.5%

	18	75	14.3%
	19	114	21.7%
	20	118	22.4%
	21	103	19.6%
	22	66	12.5%
	23	30	5.7%
	24	7	1.3%
	25	5	1.0%
	Total	526*	100%
Marital status	Married	71	13.4%
	Not married	459	86.6%
	Total	530	100%
Monthly income	Less than 5000	16	3.0%
	5000-15000	191	36.3%
	More than 15000	319	60.6%
	Total	526*	100%
Educational level of the mother	University or above	222	42.0%
	Secondary	173	32.7%
	Middle	71	13.4%
	Primary or below	63	11.9%
	Total	529*	100%
Educational level of the father	University or above	304	57.6%
	Secondary	148	28.0%
	Middle	49	9.3%
	Primary or below	27	5.1%
	Total	528*	100%

\*There are missing data (Total sample size=530)

**Table 2:- Association Between Body Image and Body Mass Index (BMI)**

Body Image: Do you Consider yourself of normal weight?		BMI Category					Total (n=522)*	Chi-square (P) value .000
		Underweight ( $<18.5$ )	Normal (18.5- 24.9)	Overweight (25-29.9)	Obesity (30- 39.9)	Morbid Obesity ( $\geq 40$ )		
Underweight	No.	37	23	0	0	0	60	
	%	61.7%	38.3%	0%	0%	0%	100%	
Normal	No.	19	212	21	1	1	254	
	%	7.5%	83.5%	8.3%	0.4%	0.4%	100%	
Overweight	No.	0	70	85	26	0	181	
	%	0	38.7%	47%	14.4%	0%	100%	
Obese	No.	0	3	4	17	3	27	
	%	0%	11.1%	14.8	63%	11.1%	100%	
Total	No.	56	308	110	44	4	522*	
	%	10.7%	59%	21.1%	8.4%	0.8%	100%	

\*There are missing data. (Total sample size= 530 students)

**Table 3:-Association Between Conductance of surgery-attitude and monthly income**

Attitude	Surgery conductance	Chi-square
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		Perform surgery	Did not perform surgery	Total (n=527)	(p) value
Totally unaccepted	No.	15	28	43	.023
	%	34.9%	65.1%	100%	
Accepted for medical reasons	No.	201	209	410	
	%	49 %	51 %	100%	
Accepted for cosmetic reasons	No.	45	26	71	
	%	63.4%	36.6%	100%	
Accepted for changing features to look like celebrities	No.	1	2	3	
	%	33.3%	66.7%	100%	
Total	No.	262	265	527*	
	%	49.7%	50.3%	100%	
Monthly Income		Surgery Conductance			Chi-square (P) value
		Perform surgery	Did not perform surgery	Total (n=523)	
Less than 5000	No.	3	13	16	.008
	%	18.8%	81.2%	100%	
5000-15000	No.	87	103	190	
	%	45.8%	54.2%	100%	
More than 15000	No.	171	146	317	
	%	53.9%	46.1%	100%	
Total	No.	261	262	523*	
	%	49.9%	50.1%	100%	

\*There are missing data (Total sample size= 530)

**Table 4:-**The Distribution of the Mean Total Knowledge Score by Conductance of Surgery

	Surgery Conductance	n=527*	Mean (Total Score = 30)	St. Deviation	T-Test P value
Knowledge score	No surgery	265	11.22	3.207	0.001
	Perform surgery	262	12.18	3.172	

\* There are missing data. (Total sample= 530)

**Table 5:-**Assessment of Correct Answers (Questions 34 – 63) by Frequency and Valid Percentage

Categorizing Questions according to Knowledge they Access	Question	Frequency	Valid Percent
Botox and Fillers	34-Function of Botox injections for facial wrinkles	<b>59</b>	<b>11.1%</b>
	35-Effective duration of Botox	<b>349</b>	<b>65.8%</b>
	36-Indications of fillers	<b>310</b>	<b>58.5%</b>
	37-Complications of fillers	<b>76</b>	<b>14.4%</b>
	Average	<b>198.5</b>	<b>37.5%</b>
Hair removal by laser	38-Best candidate for hair removal by laser	<b>322</b>	<b>60.8%</b>
	39-Side effects of hair removal by laser	<b>156</b>	<b>29.5%</b>
	Average	<b>239</b>	<b>45.2%</b>
Skin care by laser	40-Indications of laser for skin care	<b>175</b>	<b>33.1%</b>
	Average	<b>175</b>	<b>33.1%</b>
Skin abrasion	41-Indications of skin abrasion	<b>375</b>	<b>70.9%</b>
	42-Complications of skin abrasion	<b>119</b>	<b>22.5%</b>
	Average	<b>247</b>	<b>46.7%</b>
Skin peeling	43-Instructions for chemical face skin peeling	<b>323</b>	<b>60.9%</b>

	44-Instructions for chemical face skin peeling	334	63.3%
	Average	328.5	62.1%
Bariatric Surgeries	45-Indication of bariatric surgeries for weight management	198	37.4%
	46-Contraindications of bariatric surgery	88	16.6%
	47-Medical preparation for bariatric surgery	260	49.1%
	48-Bariatric surgery suitable for sweet lovers	92	17.4%
	49-Risk factor during bariatric surgery	331	62.5%
	50-Bariatric surgery causing malabsorption	183	34.6%
	51-Regular type of food intake after gastric bypass	223	42.2%
	Average	196.4	37.1%
Breast augmentation	52-Contraindications of breast augmentation	106	20.0%
	53-Complications of breast augmentation	131	24.7%
	Average	118.5	22.4%
Liposuction	54-Indications of liposuction	120	22.6%
	55-Complications of liposuction	281	53.0%
	Average	200.5	37.8%
Abdominoplasty	56-Indications of abdominoplasty	273	51.5%
	57-Complications of abdominoplasty	114	21.5%
	Average	193.5	36.5%
Nose surgery	58-Nose surgery considered as cosmetic	97	18.3%
	59-Indications of plastic nose surgery	341	64.3%
	Average	219	41.3%
Blepharoplasty	60-Main reason for blepharoplasty	316	59.6%
	61-Contraindication of blepharoplasty	91	17.2%
	Average	203.5	38.4%
Breast lift	62-Instructions for patients after breast lift	296	56.0%
	63-Procedure of breast lift	85	16.0%
	Average	190.5	36%

	Female above 15 years conducted surgery (n=2099)
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Cosmetic Intervention	Total Number of Females	Percentage
Breast augmentation	7	0.3%
Breast lift	3	0.14%
Liposuction	12	0.57%
Abdominoplasty	8	0.38%
Rhinoplasty	17	0.8%
Blepharoplasty	5	0.23%
Gastric banding	6	0.28%
Sleeve gastrectomy	6	0.28%
Gastric bypass	8	0.38%
Botox	33	1.57%
Hair removal with laser	479	22.8%
Skin care with laser	77	3.66%
Skin abrasion	89	4.24%
Chemical skin peeling	53	2.52%
Fillers	33	1.57%
Other cosmetic surgeries	16	0.76%
Total	852	40.5%

**Table 6:-**Total Occurrence of each Cosmetic Intervention Among Females above 1**Table 7:-**Association Between Age Groups and Future Surgery

Age Groups	Future Surgery		Total (n=511)	Chi-Square (P-value)
	no wish	wish		
17-19 year old girls	Count	161	32	193
	% within age groups	83.4%	16.6%	100.0%
20-22 year old girls	Count	225	57	282
	% within age groups	79.8%	20.2%	100.0%
23-25 year old girls	Count	21	15	36
	% within age groups	58.3%	41.7%	100.0%
Total	Count	407	104	511
	% within age groups	79.6%	20.4%	100.0%

**Conclusion:-**

This study was conducted to assess university female students awareness about cosmetic interventions, carries quite interesting findings regarding this concern. About 40% of participants reported undergoing a surgical cosmetic intervention, with hair removal by laser being the most common procedure conducted among collage girls. The study results show an increasing awareness about cosmetic interventions. Interestingly, previous conductance of cosmetic surgery substantially affects the level of knowledge about these procedures. There is a need for further studies deeply assessing the level of knowledge about cosmetic interventions and inquiring the reasons for seeking out these procedures.

**Recommendations:-**

It is highly recommended to conduct further studies and researches to collect more data and to ensure results. Furthermore, health care providers are recommended to increase public awareness about cosmetic plastic surgeries especially its complication. Finally, higher authorities should set strict laws and penalties to prevent malpractice.

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### References:-

1. wiseGEEK. What is cosmetic surgery?.[Online]. available from: <http://www.wisegeek.org/what-is-cosmetic-surgery.htm> . [Accessed 3rd December 2013].
2. Cleveland clinic .cosmetic surgery: Today and in the future . [Online]. available from:[http://my.clevelandclinic.org/services/Cosmetic\\_Surgery/hic\\_Cosmetic\\_Surgery\\_Today\\_and\\_in\\_the\\_Future.aspx](http://my.clevelandclinic.org/services/Cosmetic_Surgery/hic_Cosmetic_Surgery_Today_and_in_the_Future.aspx) . [Accessed 3rd December 2013].
3. International Society of Aesthetic Plastic Surgery . ISAPS International Survey on Aesthetic/Cosmetic Procedures Performed in 2010. [Online]. available from: <http://www.isaps.org/Media/Default/global-statistics/ISAPS-Results-Procedures-2010.pdf> [Accessed 3rd December 2013].
4. International Society of Aesthetic Plastic Surgery . ISAPS International Survey on Aesthetic/Cosmetic Procedures Performed in 2011. [Online]. available from: <http://www.isaps.org/Media/Default/global-statistics/ISAPS-Results-Procedures-2011.pdf> [Accessed 3rd December 2013].
5. Marcus M. Forbes. Ten Plastic Surgery Risks You Need To Know. [Online] 2007. Available from:[http://www.forbes.com/2007/10/09/health-surgery-risks-forbeslife-cx\\_mlm\\_1010health.html](http://www.forbes.com/2007/10/09/health-surgery-risks-forbeslife-cx_mlm_1010health.html) [Accessed 28th November 2013].
6. The Guardian. US Plastic Surgery Statistics. [Online] 2011. Available From: <http://www.theguardian.com/news/datablog/2011/jul/22/plastic-surgery-medicine> [Accessed 28th November 2013].
7. Mark A. Kaire .Cosmetic Plastic Surgery Death Statistics. [Online]. available from: <http://floridamedicalmalpracticelaws.com/cosmetic-plastic-surgery-death-statistics/> . [Accessed 3rd December 2013].



## REVIEW ARTICLE

### SITE SPECIFIC DELIVERY OF ANTI-ARTHRITIC DRUG BY GELATIN SURFACE MODIFIED BOVINE SERUM ALBUMIN MICROSPHERES

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#### Abstract

Non-steroidal anti-inflammatory drugs are the most commonly used and widely prescribed drugs all over the world. With the wide advantages, they are also associated with severe Gastro-Intestinal side effects. Developments of novel drug delivery systems have always been a challenge to formulation scientists because of their high instability and economic factor compared to the conventional dosage forms. Thus, the main objective of this review is to present an alternative way of developing NSAIDs as microspheres specifically using albumin polymers, which are playing an increasing role as drug carriers in the clinical setting. Hence, there is a prolonged release of the drug along with minimized side effects. A brief overview of the methods developed for the preparation of albumin microspheres and the most suitable techniques for optimum entrapment of drug have been emphasized. The in-vitro evaluations are also explained. In order to appreciate the medical application possibilities of albumin microspheres in novel drug delivery, some fundamental aspects are also briefly discussed.

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#### Introduction:-

Rheumatoid arthritis (RA) is an autoimmune disease in which there is joint inflammation, synovial proliferation and destruction of articular cartilage. Immune complexes composed of IgM activate complement and release cytokines which are chemotactic for neutrophils. These inflammatory cells secrete lysosomal enzyme which damage cartilage and erode bone, while PGs produced in the process cause vasodilation and pain. It is a chronic disorder for which there is no known cure.

Aceclofenac is a non-steroidal anti-inflammatory drug (NSAID) used extensively in the treatment of rheumatoid arthritis, osteoarthritis and ankylosing spondylitis. Aceclofenac is a newer derivative of diclofenac having less gastrointestinal complication. The usual therapeutic dose and dosing frequency of conventional aceclofenac tablets is high (100 mg twice daily), because of the short biological half-life of the drug (3-4 h), it is an ideal candidate for modified release dosage forms. To reduce the frequency of administrations and to improve patient compliances, once daily sustained release dosage forms of aceclofenac is desirable. (Chandiran *et al.*, 2010)

NSAIDs are usually indicated for the treatment of acute or chronic conditions where pain and inflammation are present. Research continues into their potential for prevention of colorectal cancer, and treatment of other

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conditions, such as cancer and cardiovascular disease. NSAIDs are generally indicated for the symptomatic relief of the following conditions:

- Rheumatoid arthritis
- Osteoarthritis
- Inflammatory arthropathies (e.g ankylosing spondylitis, psoriatic arthritis, Reiter's syndrome)
- Acute gout
- Dysmenorrhoea (menstrual pain)
- Metastatic bone pain
- Headache and migraine
- Postoperative pain
- Mild-to-moderate pain due to inflammation and tissue injury
- Pyrexia (fever)
- Ileus
- Renal colic
- They are also given to neonate infants whose ductus arteriosus is not closed within 24 hours of birth.

Aspirin, the only NSAID able to irreversibly inhibit COX-1, is also indicated for inhibition of platelet aggregation. This is useful in the management of arterial thrombosis and prevention of adverse cardiovascular events. Aspirin inhibits platelet aggregation by inhibiting the action of thromboxane -A. In 2001, NSAIDs accounted for 70,000,000 prescriptions and 30 billion over-the-counter doses sold annually in the United States. (Green *et al.*, 2001)

Gastric residence time (GRT) is an important parameter which may affect drug bioavailability of dosage forms. Many Drug Suffer from low bioavailability because of short gastric emptying time. Gastro retentive systems are the current approach to overcome the above problem of GRT. Among the number of approaches, mucoadhesive drug delivery system (FDDS) is one of the promising delivery system which adheres to the mucous layer of the stomach and thus remains in the stomach for long period of time.

In one such research study carried out by Chaturvedi *et al.*, efforts were directed to reduce the side effects of Aceclofenac and to extend the release time using synthetic polymers. Different microsphere formulations loaded by Aceclofenac were obtained and fully characterized for morphology, size, encapsulation efficiency and release rate of Aceclofenac. (Chaturvedi *et al.*, 2012).

### **Microspheres:-**

**Microspheres** are small spherical particles, with diameters in the micrometer range (typically 1  $\mu\text{m}$  to 1000  $\mu\text{m}$ ). Microspheres are sometimes referred to as microparticles. (Kataria *et al.*, 2010).

Microspheres are homogeneous, monolithic particles which improve the treatment by providing localization of the drug at the site of action and by prolonging the drug release. The objective of the present study was to formulate sustained release microspheres of aceclofenac using egg albumin as release retarding agent. (Rajamanickam *et al.*, 2010).

### **What is albumin and why albumin microspheres?**

Albumin is a major plasma protein constituent, accounting for ~55% of the total protein in human plasma. Since they were first described by Kramer, albumin microspheres have been extensively investigated in controlled release systems as vehicles for the delivery of therapeutic agents to local sites. The exploitable features of albumin include its reported biodegradation into natural products, its lack of toxicity, and its non-antigenicity.

Albumin microspheres are metabolized in the body, and the size of particles, degree of stabilization, and site of metabolism are the main factors influencing the extent of metabolism. Drug release from the microspheres can be widely modulated by the extent and nature of cross-linking, size, the position of the drug, and its incorporation level in the microspheres. Colloidal forms of albumin have been considered as potential carriers of drugs for their site-specific localization or their local application to anatomically discrete sites. Albumin has been used as a carrier for targeting drugs to tumors, and since the synovium of the rheumatoid arthritis patients shares various features observed in tumors, albumin-based delivery systems can be used to target drugs to the inflamed joint. Intravenous administration of the drugs coupled with albumin has been reported to improve the targeting efficiency of the drug to arthritic regions. (Hilpert *et al.*, 1989). The circulation half-lives of the drugs have been reported to dramatically

increase when the drug is conjugated with albumin. Increasing the circulation half-life of the formulation by reducing its uptake by the reticuloendothelial system has been shown to improve the targeting efficiency of the formulation to the arthritic paws of rats. There are several reports on the use of long circulating liposomes to target the drugs to the arthritic joints. However, there are only a few reports on the use of microspheres for targeting the drugs to the arthritic joints. (Thakkar *et al.*, 2005).

#### **Advantage and disadvantage of NSAID loaded albumin microsphere**

The following advantages make them a promising means for the delivery of NSAIDs.

- Albumin Microspheres provide constant and prolonged therapeutic effect.
- Reduces the dosing frequency and thereby improve the patient compliance.
- They could be injected into the body due to the spherical shape and smaller size.
- Better drug utilization will improve the bioavailability and reduce the incidence or intensity of adverse effects.
- Albumin microsphere morphology allows a controllable variability in degradation and drug release.
- Reduces GI toxic effects.
- Albumin has non-antigenic property and ability to control the physicochemical characteristics of the microspheres produced, depending on the cross-linking methods and characteristics of cross-linking agent. (Jeevana *et al.*, 2009).

#### **Some of the Disadvantages were found to be as follows:-**

- The modified release from the formulations.
- The release rate of the controlled release dosage form may vary from a variety of factors like food and the rate of transit through gut.
- Differences in the release rate from one dose to another.
- Controlled release formulations generally contain a higher drug load and thus any loss of integrity of the release characteristics of the dosage form may lead to potential toxicity.
- Dosage forms of this kind should not be crushed or chewed.
- Larger size of extended release products may cause difficulties in ingestion or transit through the gut.
- Possibility of distal intestinal toxicological manifestations because of sustained release and enteric coated NSAID formulations. (Kataria *et al.*, 2011).

#### **Methodology:-**

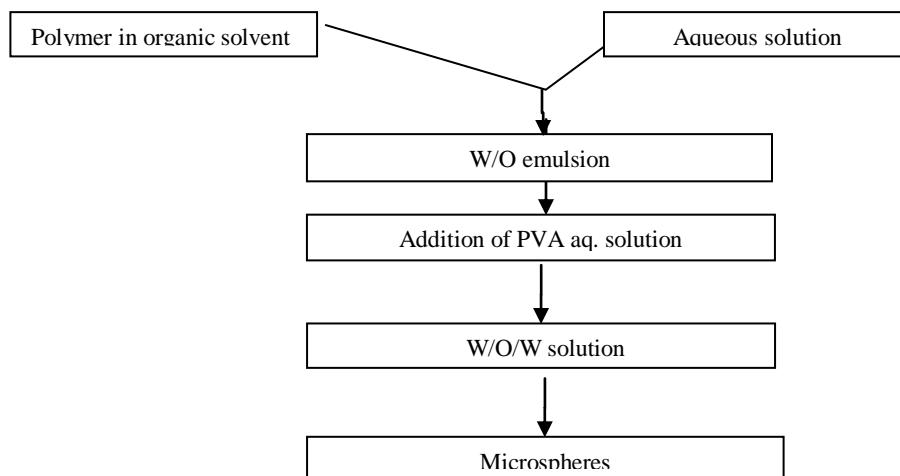
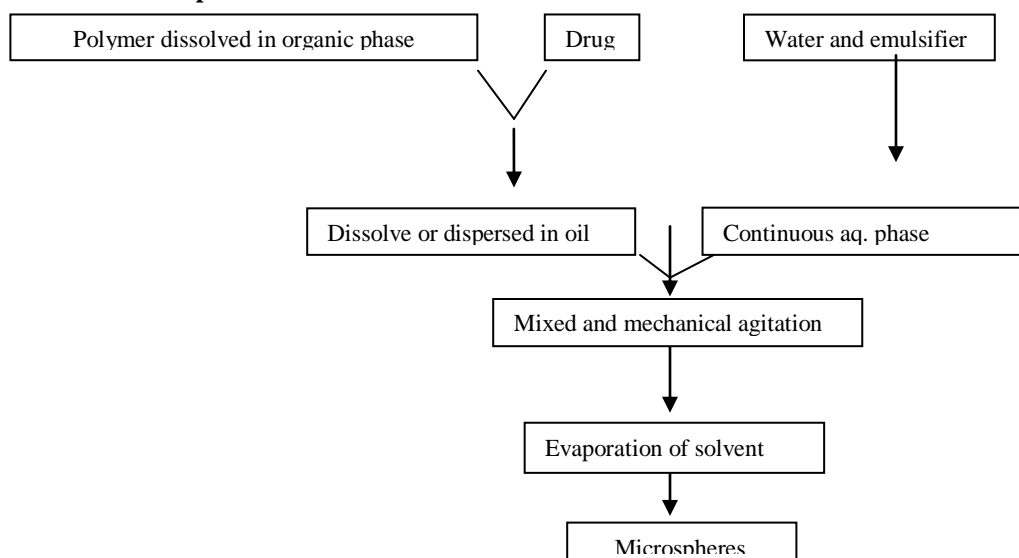
##### **Technologies used for prepare albumin microspheres:-**

The preparation of microsphere from natural polymers involves three steps:-

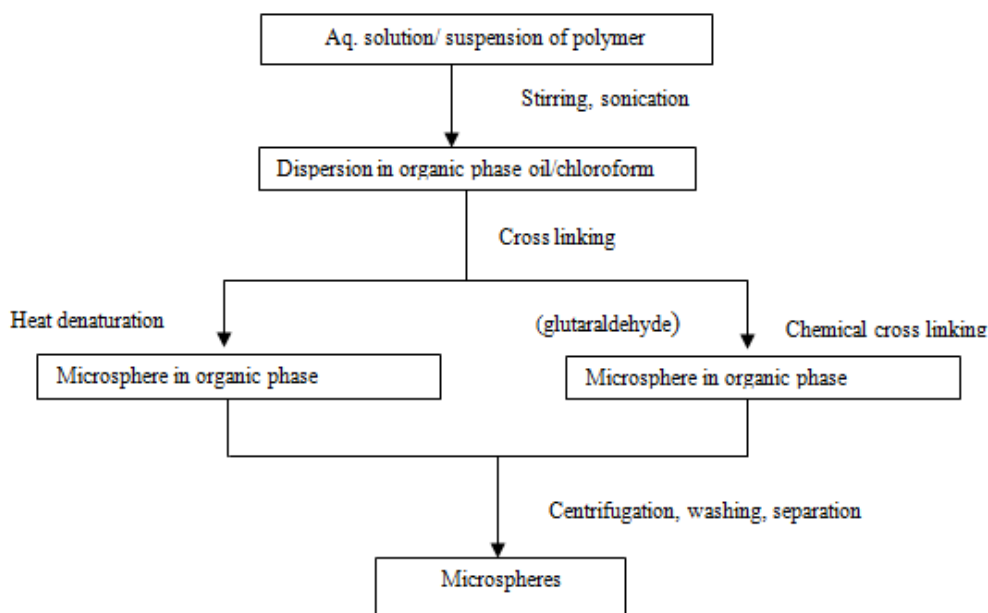
1. The solution of the polymer is dispersed in a continuous medium such as vegetable oil or an organic solvent using a suitable cross- linking agent.
2. It involves separation of the solid microsphere formed, by filtration, centrifugation or freeze-drying.
3. Purification (to remove the residual solvents, surfactant and other additives) and drying (air dried, vacuum dried, freeze dried). (Liggins *et al.*, 2004).

##### **Single emulsion technique:-**

The micro particulate carriers of natural polymers of natural polymers i.e. those of proteins and carbohydrates are prepared by single emulsion technique. The natural polymers are dissolved or dispersed in aqueous medium followed by dispersion in non-aqueous medium like oil. Next cross linking of the dispersed globule is carried out. The cross linking can be achieved either by means of heat or by using the chemical cross linkers. The chemical cross linking agents used are glutaraldehyde, formaldehyde, acid chloride etc. (Linda *et al.*, 2009). Heat denaturation is not suitable for thermolabile substances. Chemical cross linking suffers the disadvantage of excessive exposure of active ingredient to chemicals if added at the time of preparation and then subjected to centrifugation, washing, separation<sup>3</sup> The nature of the surfactants used to stabilize the emulsion phases can greatly influence the size, size distribution, surface morphology, loading, drug release, and bio performance of the final multiparticulate product. (Kataria *et al.*, 2010).

**Multiple emulsion / Double emulsion method :-****Figure 1:-** Multiple emulsion / Double emulsion method**Emulsion solvent evaporation:-****Figure 2:-** Emulsion solvent evaporation



**Emulsion cross-linking method:-****Figure 3:-** Emulsion cross-linking method**Spray drying and spray congealing technique:-**

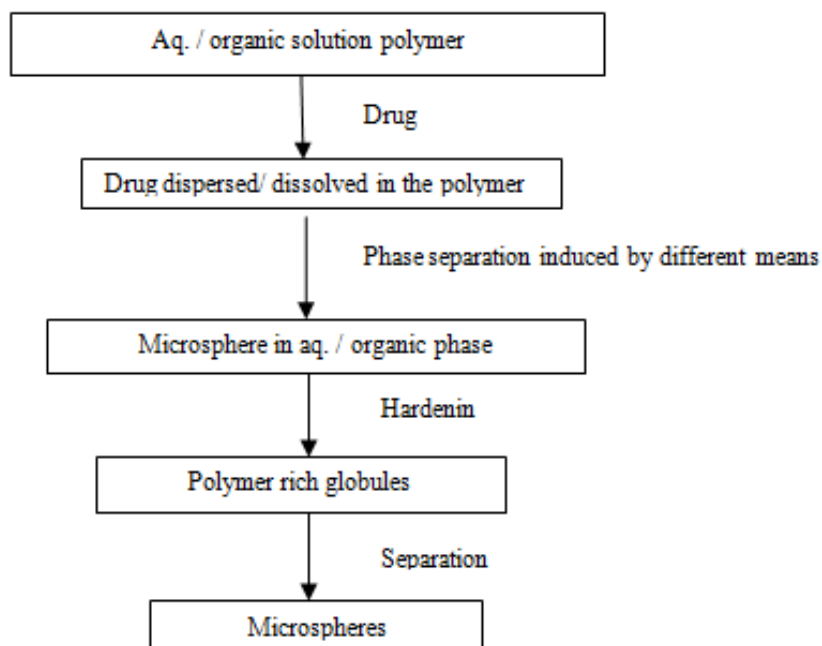
Spray drying and spray congealing method are based on the drying of the mist of the polymer and drug in the air. Depending upon the removal of the solvent or the cooling of the solution the two processes are named spray drying and the spray congealing respectively (Ying *et al.*, 2007). Spray drying technique involves dispersing the core material in a liquefied coating material and spraying the core-coating mixture in to the environment to effect solidification of coating. Solidification is accomplished by rapid evaporation of the solvent in which coating material is solubilized. The process control variables in this technique are feed material properties, feed rate, method of atomization and drying rate. Spray drying method is rapid, reproducible and easy to scale up. But due to the fast drying process the polymer may lose its crystallinity and leads to the formation of porous microparticles. (Mathew *et al.*, 2007).

**Coacervation method:-**

This method is simple and utilizes aqueous system for the preparation. This process consists of three steps under continuous stirring.

**The formation of three phases:-**

- Core material
  - Dispersing a core material in a solution of coating polymer
  - Immiscible polymer in liquid state (Coating material phase)
1. Coating is accomplished by controlled physical mixing of coating solution and core material in liquid manufacturing vehicle phase. (Muvaffak *et al.*, 2004)
  2. Rigidisation could be achieved by thermal, chemical cross-linking or desolvation techniques.



**Figure 4:-** Coacervation phase separation method. (Ghosh *et al.*, 2008).

#### **Emulsification-heat stabilization technique:-**

Emulsification-heat stabilization technique was carried out the preparation and characterization of albumin microspheres encapsulated with propranolol HCl by emulsion-heat stabilization technique. Bovine serum albumin microspheres (BSA) containing propranolol HCl were prepared by emulsification-heat stabilization technique. Briefly, a 5% solution of BSA containing 0.1% Tween80 was made, to which 4% propranolol HCl was added and used as the aqueous phase. The oil phase composed of 30 ml maize oil and 10 ml petroleum ether with 1% Span 80 as emulsifier were mixed together and allowed to stir for 10 min at 1000 rpm. The aqueous phase was added drop wise to the oil phase and stirred on a magnet stirrer at 1000 rpm for 30 min to form the initial emulsion. (Eroglu *et al.*, 2000). This emulsion was then added to 40 ml of maize oil preheated to 120° C and stirred at 1000 rpm for 15 min to allow the formation and solidification of microspheres. The microsphere suspension was centrifuged at 3500 rpm for 30 min and the settled microspheres were washed three times with ether to remove traces of oil on microsphere surfaces. (Rathod *et al.*, 2008). The microspheres were vacuum dried in a desiccator overnight and stored at 4°C in dark. The microspheres had mean diameters between 1-25 µm of which more than 50 percent were below 5 µm. The encapsulated drug was found to be about 9% w/w of that initially added to microspheres and the superficial drug was 25% of the total amount of the encapsulated drug. Also albumin microspheres were noted to possess good bio-adhesion in such a way that about 70% of microspheres remained adherent on the surface mucosa of rat jejunum. The total amount of drug released from microspheres after 12h was 70%. (Sayyed *et al.*, 2003).

#### **Sonication technique:-**

As the technique name itself is self-explanatory, it just involves a simple sonication for certain period of time till a desired size of albumin microspheres is obtained. The albumin solution of desired concentration is taken which is sonicated. To this add the drug which will then form intrachain cross-link with cysteine residues of albumin chains (Cheng *et al.*, 2004).

#### **Evaluation of microspheres:-**

Some of the evaluation characteristics considered for albumin microspheres are as follows:

#### **Drug Polymer Interaction Studies:-**

##### **IR spectroscopic studies:-**

The IR spectra of the free drug and the microspheres were recorded. The identical peaks corresponding to the functional groups and albumin (BSA, Egg albumin, Human serum albumin) features confirm that neither the polymer nor the method of preparation has affected the drug stability. (Deepa *et al.*, 2012).

**Particle size:-**

Average particle size of microspheres was measured by optical microscopy. (Prasad *et al.*, 2011).

**Percentage yield:-**

Prepared microspheres were weighed after drying, and percent yield was calculated by help of this formula. The yield was calculated as the weight of the microspheres recovered from each batch divided by total weight of drug and polymer used to prepare that batch multiplied by 100. (Patel *et al.*, 2013).

$$\% \text{ yield} = Y_p / Y_t \times 100$$

Where,  $Y_p$  = Practical yield,

$Y_t$  = Theoretical yield.

**Drug entrapment capacity:-**

The capture efficiency of the microspheres or the percent entrapment can be determined by allowing washed microspheres to lyse. The lysate is then subjected to the determination of active constituents as per monograph requirement. The percent encapsulation efficiency is calculated using following equation-

$$PDE = \text{Practical drug content} / \text{theoretical drug content} \times 100 \text{ (Nikam } et al., 2012)$$

**Morphology/Electron microscopy:-**

The morphological study of microspheres was done by scanning electron microscopy (SEM.). (Tuncay *et al.*, 2000).

**In vitro release studies:-**

In-vitro release studies can be performed according to USP XXII type I dissolution apparatus at suitable pH conditions. The temperature should be maintained at  $37 \pm 0.5^\circ\text{C}$  and the rotation speed of 100 rpm. Then 5 ml of sample should be withdrawn at various time intervals and replenished with an equal volume of fresh dissolution media. The drug content in the sample can be analyzed spectrophotometrically at specific wavelength (nm). (Jayaprakash, *et al.*, 2009).

**Conclusion:-**

It has been observed that microspheres are better choice of drug delivery system than many other types of drug delivery system because it is having the advantage of target specificity and better patient compliance. Its applications are enormous as they are not only used for delivering drugs but also for imaging tumours, detecting biomolecular interaction etc. So in future microspheres will have an important role to play in the advancement of medicinal field.

**References:-**

1. Chandiran SI, Sivakumar T, Kumar BP. (2010): Preparation and evaluation of aceclofenac loaded biodegradable Microspheres. International Journal of Pharmaceutical and Biomedical Research., 2(4): 19-23.
2. Chaturvedi S, Sharma PK, Visht S, Tyagi S. (2012): Comparison of emulsification and Ionic Gelatin method of Preparation of mucoadhesive Microsphere. The Pharma Innovation., 1(5): 1-9.
3. Deepa B, Satinder K, Ramandeep S, Ujjwal N. (2012): Magnetic microspheres as a targeted drug delivery system. Journal of Acute Disease., 1(2): 1-17.
4. Eroglu H, Suheyla K, Oner L, Sargon M, Hincal AA. (2000): Preparation of Bovine Serum Albumin Microspheres Containing Dexamethasone Sodium Phosphate and the in Vitro Evaluation. Turk J Med Sci., 30: 125-128.
5. Ghosh A, Nayak UK, Rout P, Nag T, Roy P. (2008): Preparation, Evaluation and in vitro- in vivo Correlation (IVIVC) study of Lamivudine Loaded Microspheres. Research J. Pharm. and Tech., 1(4): 353-356.
6. Green GA. (2001): Understanding of NSAIDs from aspirin to COX-2. Clin Cornerstone., 3(5): 50-60.
7. Hilpert LP, Mattrey RF, Mitten RM, Peterson T. (1989): IV injection of air filled Human albumin microspheres to enhance arterial Doppler signal: A preliminary study in rabbits. AJR., 153: 613-616.
8. Jayaprakash S, Mohamed SH, Mohamed PUF, Kulaturanpiallai A, Nagarjan M. (2009): Preparation and evaluation of biodegradable microspheres of methotrexate. Asian J Pharm., 3: 26-29.
9. Jeevana JB, Sunitha G. (2009): Development and evaluation of Gelatin microspheres of Tramadol Hydrochloride. J Young Pharma., 1(1): 24-27.
10. Kataria S, Middha A, Sandhu P, Bilandi A and Kapoor B. (2011): Microsphere: a review. International Journal of Research in Pharmacy and Chemistry, 1(4): 1184-1197.

11. Liggins RT, Burt HM. (2004). Paclitaxel loaded poly L-Lactic acid microsphere properties of microsphere made with low molecular weight polymer. *Int. J. Pharm.*, 222(1): 19-33.
12. Linda SL, Paul TS, Hard AD. (2009): Burt HM. Intra-articular treatment of inflammatory arthritis with microspheres formulations of methotrexate: pharmacokinetics and efficacy determination in antigen- induced rabbits. *Inflammation research*, 58: 445-456.
13. Mathew TS, Gayathri DS, Sandhya KV. (2007): Formulation and Evaluation of Ketorolac Tromethamine-loaded Albumin Microspheres for Potential Intramuscular Administration. *AAPS Pharm Sci Tech.*, 8(1): 1-9.
14. Muvaffak A, Gurhan I, Hasirci N. (2004): Prolonged cytotoxic effect of colchicine released from biodegradable microspheres. *J Biomed Mater Res Part B: Appl Biomater.* 71: 295-304.
15. Nikam KV, Gudsoorkar VR, Hiremath SN, Dolas RT, and Kashid VA. (2012): Microspheres - A Novel Drug Delivery system. *International journal of pharmaceutical and chemical sciences*, 1: 113-128.
16. Patel S, Chand T and Maulik T. (2013): Formulation Development and Evaluation of Microsphere Containing Duloxetine Hydrochloride. *International Journal of Research in Pharmaceutical and Biomedical sciences*, 4: 568-572.
17. Prasad BS, Giri, Setty C.M., Gupta V.R.M., Devanna D., and M. Devi Rama. (2011): Aceclofenac-Loaded Alginate Microspheres Prepared By Ionotropic Gelation Method: Effect of Formulation Variables on Encapsulation Efficiency, Morphology and Release Characteristics, 3(2): 10-24.
18. Rajamanickam D, Rajappan M, Varadhran M, Srinivasan B. (2010): Formulation evaluation of albumin microspheres containing Aceclofenac. *International Journal of Pharmaceutical Sciences Review and Research*, 4: 112-117.
19. Rathod S, Deshpande SG. (2008): Albumin microspheres as an ocular delivery system for pilocarpine nitrate. *Indian J. Pharm. Sci.*, 70 (2): 193-197.
20. Sayyed B, Sajadi T, Naheed R. (2003): Preparation and characterization of albumin microspheres encapsulated with propranolol Hcl. *DARU.*, 11(4):137- 141.
21. Thakkar H, Sharma RK, Chuttani K, Murthy RR. (2005): Albumin Microspheres as carrier for Antiarthritic drug celecoxib. *AAPS Pharm Sci Tech.*, 6(1): 65-73.
22. Tuncay M, Calis S, Kas HS, Ercan MT, Peksoy L, Hincal A. (2000): Diclofenac sodium incorporated PLGA (50:50) microspheres formulation considerations and in-vitro/in-vivo evaluation. *Int J Pharm.*, 195:179-188.
23. Ying LU, Zhang G, Sun D, Zhong Y. (2007): Preparation and evaluation of biodegradable flubiprofen gelatin microspheres or intra-articulate administration. *Journal of microencapsulation*, 24(6): 515-524.



## RESEARCH ARTICLE

### INTEGRATING IMAGING TECHNIQUES IN DEEP INFERIOR EPIGASTRIC PERFORATOR BREAST RECONSTRUCTION.

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#### Abstract

**Introduction:** The definition of a deep inferior epigastric perforator (DIEP) flap is breast reconstruction for a female who had previous surgical procedure due to any certain illness. It's usually an autologous breast reconstruction flap to minimize the scar of the breast at the site of operation.

**Method:** We used these significant techniques to evaluate the flap, making sure sufficient blood flow is achieved and assessing the flap's binding capacity. It must be successfully done with radiological Multidetector Doppler ultra sound and CT Angiography (MDCTA). All of them used to evaluate and demarcate the flap tissue to diminish flap rejection. Our goal was to aesthetically normalize the anomaly, correct the patient's own self image and how she perceives it.

##### Conclusion:

The predictability and efficiency of DIEP flap in breast reconstruction is high. Multidetector Doppler ultra sound and CT Angiography (MDCTA) are a great asset especially in the rather expansive technology-driven, and they are perfectly attributed to integrated imaging technologies, as well as they have particular advantage which reduce operative time and stress.

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#### Background:-

The deep inferior epigastric perforator (DIEP) flap has become the gold standard for autologous breast reconstruction owing to the reduced donor site morbidity and inconspicuous scar, abundance and reliability of transferred tissue as well as texture and contour emulation to the female breast.<sup>1,2</sup> The vascular anatomy of the DIEP and its perforators greatly varies not only among patients but also from one hemi-abdomen to the other in the same individual. Because of numerous congenital and acquired anatomical variations of the DIEP branching pattern, thorough knowledge of the perforators topography and perforator dominance is essential for accurate preoperative planning.<sup>3-8</sup>

The evolution of imaging technology has significantly contributed to the enhancement of predictability and reproducibility of DIEP breast reconstruction outcomes. Meticulous pre-operative imaging of the perforator flap and

mapping of the vessels facilitates precise flap design and harvest, reduces operative time and intraoperative complications while it improves outcomes and efficiency.<sup>4,9-11</sup>

The selected dominant perforator is usually medially located, bares a short intramuscular course and a diameter >1 mm, with an extended vascular distribution within the flap adipose tissue to match the flap and to allow preservation of muscle innervation.<sup>2,12</sup>

The pre-operative vascular mapping includes imaging modalities ranging from Color Doppler<sup>13</sup> to sophisticated stereotactic vascular representation systems.<sup>11,14</sup> The ideal imaging technique should have no risk to the patient, attain exceptional quality and highly informative images, and be fast and comfortable to the patient.<sup>11,12</sup> Pre-requirement for the reliability of each of the imaging techniques is a standardized protocol for accurate identification of DIEA perforators.<sup>13</sup>

This review presents current imaging methods integrated in DIEP mapping for breast reconstruction, emphasizing on ultrasonography and computed tomographic angiography.

### **Doppler ultrasonography:-**

Doppler flowmetry for planning the DIEP flap was first described by Blondeel et al in 1998 and can access the flow velocity, patency, location, and caliber of the perforator arteries and venus tributaries.<sup>15</sup>

Color Doppler Ultrasonography (CDU) exhibits 96% sensitivity nearly 100% positive predictive value.<sup>16,17</sup> It can identify perforators > 0.5mm in diameter and can be used in pre-operative planning, intraoperative decision-making, and post-operative follow-up.<sup>16-18</sup>

CDU is performed the day before or the morning before the operation with the patient in supine position, as in surgery, and allows for direct visualization of the perforator as it emerges from the deep fascia of the rectus abdominis.

Following the course of the DIEA from its origin to the umbilicus, CDU scans the entire flap at a radius of approximately 10 cm above and laterally to the umbilicus. The penetration point of the superficial fascia of the rectus abdominis to the flap skin is exactly located and marked accurately on the skin.

CDU is a low-cost, non-ionizing, bedside examination. Although a reliable method in estimating the vessel caliber, specificity and sensitivity of CDU may vary. Expertise is required while there is interobserver variability.<sup>11,12</sup> Subcutaneous vessels that are not perforators may be visualized resulting in false positives, while in overweight patients sensitivity further decreases. Moreover, the duration of the examination is 45-60 minutes, rendering the technique uncomfortable for the patient, who has to remain in the same position during the procedure.<sup>11,12</sup>

It is noteworthy that CDU does not provide information on the anatomic relationship between the deep inferior epigastric system and other structures, such as the superior inferior epigastric (SIE) system. In addition, as CDU is a real-time technique, further post examination analysis of data is not possible.<sup>11</sup>

### **CT angiography (CTA):-**

The introduction of CTA in preoperative vascular mapping has significantly improved DIEP flap dissection and survival, as it provides highly accurate information concerning the arterial as well as the venous anatomy of the DIEP flap and can display DIEA's course, branching patterns, number, size, intramuscular trajectory and location of perforators.<sup>19-23</sup> CTA has a sensitivity of 96%, a positive predictive value of 95% and may identify perforators as small as 0.3 mm. Moreover, CTA may reveal the structure and competence of the abdominal wall fascial layers.<sup>11,12,23</sup>

The rate and timing of the injection and the patient's cardiac output and body habitus determine the degree of enhancement. Careful optimization of single phase CTA prevents low opacification due to early scan as well as venous contamination due to late arterial phase. In multiphase CTA examination on the other hand, each phase should be independently validated and the radiation dose is multiple compared to single phase CTA.<sup>24</sup>

Kim et al.<sup>25</sup> reported the use of CTA to evaluate flap and recipient vessels, scanning the area from the clavicle to the pubic symphysis. They assessed the intercostal space, the internal mammary artery and vein, and the internal

mammary artery perforator to determine which intercostal space was most appropriate. The authors also used CTA for volumetric estimation of the contralateral breast and the abdominal flap.

The use of multidetector CT increases accuracy and may provide further data on the number of perforators, their distribution and axially to the flap subcutaneous tissue.<sup>12,16,17</sup> This information is highly beneficial in patients with lower abdominal scars, as it facilitates selection of the best perfused region of abdominal tissue supplied by the dominant perforator.<sup>12,26,27</sup>

CTA is a three-dimensional, non-invasive, operator- independent method, highly reproducible, requiring a short scanning time of 5 minutes<sup>11,12</sup>. Apart from the high spatial resolution,<sup>28-30</sup> there is availability of free software for post processing 3D digital reconstruction for detailed mapping of the vascular anatomy.<sup>11,31</sup> Also 4D reconstruction adds temporal resolution enabling dynamic analysis of perforator anatomy and may be used to delineate the perforasomes in lower abdomen.<sup>6,11,17,32</sup>

Among drawbacks, is the high cost of the investigation, which may be counterbalanced by the reduction in operative time and intraoperative complications, resulting from thorough and accurate preoperative mapping.<sup>11,12,32</sup> Another limitation is the exposure of the patient to ionizing radiation and the use of intravenous contrast medium, that is nephrotoxic and allergenic.

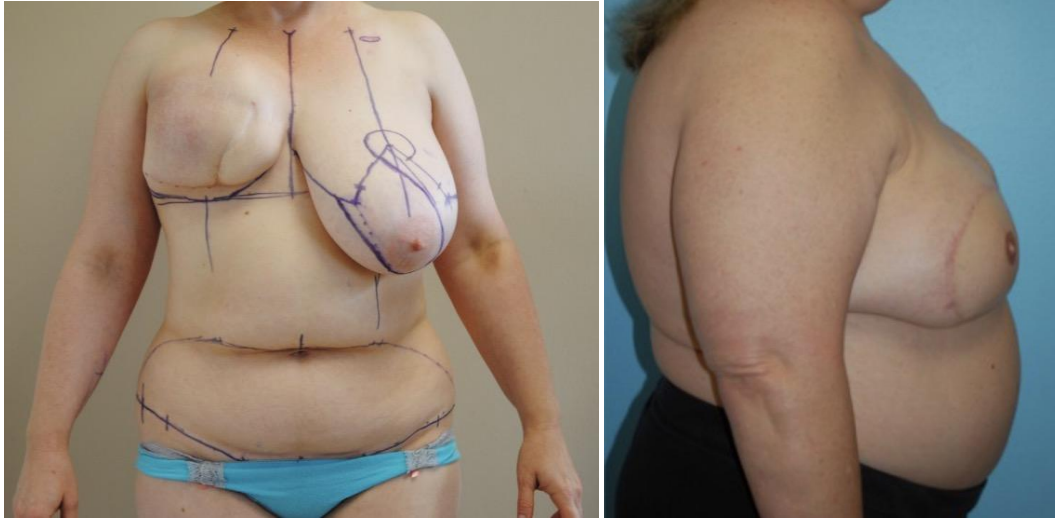
Compared to CDU, both methods provide reliable information about the size, localization, and course of DIE perforators. CTA is a more accurate method in detecting the course and location of perforators compared to CDU<sup>11,16</sup> but CDU is superior to a standalone CTA examination for measuring perforator diameters.<sup>33-35</sup> and for hemodynamic evaluation of both arterial and venous conduits of the perforator-complex.<sup>36</sup>

In order to increase the accuracy of preoperative mapping, CDU may be used in addition to CTA.



In this CTA showing the inferior epigastric artery which showing the perforator to determine for seorgone the mark line for the patient before the operation 14.





For this patient pre-operative once we compare for the left pic. Showing the scar and deformity of the breast. All this depend on the reconstruction of the breast and the prognosis.

#### **Perforator artery or perforator complex?**

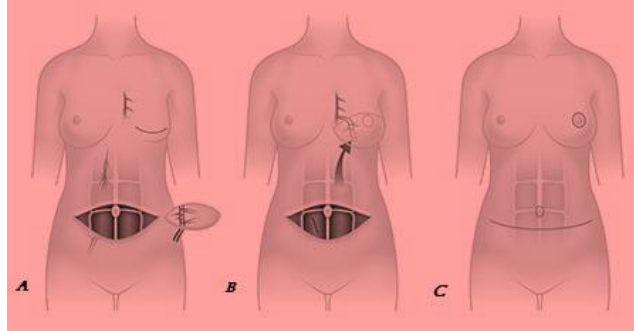
Despite the fact that the majority of DIEP flaps are compromised due to venous congestion and rarely arterial insufficiency,<sup>37</sup> all techniques were until recently spotlighting on the dominant arterial-perforator, downsizing the importance of the accompanying venous – tributaries.<sup>36,38</sup>

It is well-perceived that, although any medially located arterial perforator >1 mm in diameter can perfuse any flap, not every associated vein can drain every flap.<sup>36</sup> Lately the concept of the perforator complex, which includes the triad of an arterial perforator, venous tributaries and nerve in any combination, has been brought in, suggesting that selection of the dominant perforator-complex based on dominant veins ensures optimal flap microcirculation, while diminishing intraoperative incidents and postoperative healing complications.

Figus et al.<sup>38</sup> demonstrated that if a dominant vein is identified first, the probability of detecting a suitable perforator- complex increases to 93.5%, while significantly decreases to 69.8% when a dominant artery is identified first.<sup>38</sup>

Our team introduced the perforator- complex imaging protocol termed as “CTA-guided CDU examination”,<sup>36</sup> which combines the use of CTA and CDU in the decision-making process of choosing the best suitable perforator-complex. The CTA results are used as a guide to conduct a CDU examination to investigate the size and patency of the accompanying venous tributaries. Selection of the suitable perforator complex based on the size and patency of the dominant vein resulted in better flap revascularization ( $p < 0.05$ ) and decreased postoperative complications ( $p < 0.05$ ) compared to dominant artery based selected complexes. Our preliminary results indicated that this protocol may identify more optimal perforator-complexes based on venous mapping and thus, further improve the pre-operative microsurgical planning.<sup>36</sup>





This figure. A. showing the vascular arteries and vein is determined, B. tissue is transfer from right side and anastomosed to the left breast. C. healing is done after the reconstruction and the both breast are similar.<sup>24</sup>

### Magnetic Resonance Angiography:-

There is little evidence associating preoperative Magnetic resonance angiography (MRA) with improved clinical outcomes.<sup>39-42</sup> Contrast enhanced MRA delineates accurately the intramuscular trajectory of the perforators and can identify vessels >0.8mm in diameter.<sup>11,40-42</sup>

Rozen et al. suggested that despite high sensitivity (100%) MRA was inferior to preoperative CTA due to low specificity (50%),<sup>43</sup> while Chernyak et al. reported a 97% concordance of MRA imaging with intraoperative findings in DIEP flap breast reconstruction.<sup>44</sup>

Despite its higher cost, MRA has certain advantages over CTA, namely elimination of exposure to ionizing radiation and safer required contrast medium. Nevertheless, gadolinium may also be nephrotoxic for patients with renal insufficiency.<sup>11,12,40-44</sup>

Masia et al. demonstrated that non-contrast magnetic resonance imaging was associated with high specificity and provided reliable information on the perforator branching within the subcutaneous abdominal tissue and the vascular connections between the superficial and the deep inferior epigastric vessels.<sup>45</sup>

Nevertheless, a serious limitation of MRA is possible patient discomfort, as it requires breath-hold for 10-20 seconds to avoid motion artifacts. Distress levels may increase in claustrophobic patients, while the technique is contraindicated in severely obese and patients with metallic implants.<sup>11,39,45</sup>

### Other methods:-

The use of dynamic infrared thermography (DIRT) for perforator mapping in DIEP flaps was first described in 1993.<sup>46</sup> DIRT has been used in the preoperative planning, intraoperative and postoperative monitoring of flap perfusion. Thermal images are captured with an infrared camera before, during and after exposure to a cold challenge provided by a fan blowing air for 2 min over the abdomen. After a recovery period of 3 min, the first appearing hot spots correlate with reliable perforator location.<sup>17,47</sup> Although a simple, low cost and patient safe method it can obviously provide only 2D perforator mapping, while there is no evidence supporting its accuracy.

Laser-assisted indocyanine green fluorescence angiography (LA-ICGFA)<sup>48</sup> involves peripheral injection of indocyanine green and capture of the cutaneous vascularity with the use of infrared energy. Images are recorded and software analysis data on flap perfusion and patency of anastomosis are collected. Apparently, the method, of anyway limited use, may be useful for intraoperative assessment and less for preoperative and postoperative monitoring.<sup>17</sup>

### Conclusions:-

Recent improvements in the predictability and efficiency of DIEP flap in breast reconstruction are to a great extent technology-driven and attributed to integrated imaging technologies. Advances in accurate preoperative perforator imaging have resulted in significantly reduced operative time and stress, increased flap survival and consequently patient satisfaction.

The choice of imaging technique depends on patient history, equipment availability and radiologic expertise. Standardization of protocols may further increase precision in vascular anatomy imaging and patient comfort and safety.

### References:-

1. Granzow JW, Levine JL, Chiu ES, Allen RJ. Breast reconstruction using perforator flaps. *J Surg Oncol* 2006;94(6):441–54
2. Allen RJ, Treece P. Deep inferior epigastric perforator flap for breast reconstruction. *Ann Plast Surg* 1994;32(1):32–8.
3. Moon HK, Taylor GI. The vascular anatomy of rectus abdominis musculocutaneous flaps based on the deep superior epigastric system. *Plast Reconstr Surg* 1988;82(5):815–32.
4. Casey 3rd WJ, Chew RT, Rebecca AM, Smith AA, Collins JM, Pockaj BA. Advantages of preoperative computed tomography in deep inferior epigastric artery perforator flap breast reconstruction. *Plast Reconstr Surg* 2009;123(4):1148–55.
5. Ghattaura A, Henton J, Jallali N, Rajapakse Y, Savidge C, Allen S, et al. One hundred cases of abdominal-based free flaps in breast reconstruction. The impact of preoperative computed tomographic angiography. *J Plast Reconstr Aesthet Surg* 2010;63(10):1597–601.
6. Wong C, Saint-Cyr M, Mojallal A, Schaub T, Bailey SH, Myers S, et al. Perforasomes of the DIEP flap: vascular anatomy of the lateral versus medial row perforators and clinical implications. *Plast Reconstr Surg* 2010;125(3):772–82.
7. Canizares O, Mayo J, Soto E, Allen RJ, Sadeghi A. Optimizing Efficiency in Deep Inferior Epigastric Perforator Flap Breast Reconstruction. *Ann Plast Surg* 2015 Aug;75(2):186-92.
8. Rozen WM, Palmer KP, Suami H, Pan WR, Ashton MW, Corlett RJ, et al. The DIEA branching pattern and its relationship to perforators: the importance of preoperative computed tomographic angiography for DIEA perforator flaps. *Plast Reconstr Surg* .2008;121(2):367–73.
9. Keys KA, Louie O, Said HK, Neligan PC, Mathes DW. Clinical utility of CT angiography in DIEP breast reconstruction. *J Plast Reconstr Aesthet Surg* 2013 Mar;66(3):e61-5
10. Malhotra A(1), Chhaya N, Nsiah-Sarbeng P, Mosahebi A. CT-guided deep inferior epigastric perforator (DIEP) flap localization -- better for the patient, the surgeon, and the hospital. *Clin Radiol* 2013 Feb;68(2):131-8.
11. Aubry S, Pauchot J, Kastler A, Laurent O, Tropet Y, Runge M. Preoperative imaging in the planning of deep inferior epigastric artery perforator flap surgery. *Skeletal Radiol* 2013 Mar;42(3):319-27
12. Masia J, Clavero JA, Larranaga JR, Alomar X, Pons G, Serret P. Multidetector-row computed tomography in the planning of abdominal perforator flaps. *J Plast Reconstr Aesthet Surg* 2006;59(6):594–9.
13. Giunta RE, Geisweid A, Feller AM. The value of preoperative Doppler sonography for planning free perforator flaps. *Plast Reconstr Surg* 2000;105(7):2381–6.
14. Rozen WM, Ashton MW, Stella DL, Phillips TJ, Taylor GI. Stereotactic image-guided navigation in the preoperative imaging of perforators for DIEP flap breast reconstruction. *Microsurgery* 2008;28(6):417-23
15. Blondeel PN, Beyens G, Verhaeghe R, Van Landuyt K, Tonnard P, Monstrey SJ, et al. Doppler flowmetry in the planning of perforator flaps. *Br J Plast Surg* 1998;51(3):202–9.
16. Cina A, Salgarello M, Barone-Adesi L, Rinaldi P, Bonomo L. Planning breast reconstruction with deep inferior epigastric artery perforating vessels: multidetector CT angiography versus color Doppler US. *Radiology*. 2010;255(3):979–87.
17. Mohan AT, Saint-Cyr M. Advances in imaging technologies for planning breast Reconstruction. *Gland Surg* 2016;5(2):242-254
18. Heitland AS, Markowicz M, Koellensperger E, Schoth F, Feller AM, Pallua N. Duplex ultrasound imaging in free transverse rectus abdominis muscle, deep inferior epigastric artery perforator, and superior gluteal artery perforator flaps: early and long-term comparison of perfusion changes in free flaps following breast reconstruction. *Ann Plast Surg* 2005 Aug;55(2):117-21
19. Rozen WM, Anavekar NS, Ashton MW, Stella DL, Grinsell D, Bloom RJ, et al. Does the preoperative imaging of perforators with CT angiography improve operative outcomes in breast reconstruction? *Microsurgery* 2008;28(7):516–23.
20. Phillips TJ, Stella DL, Rozen WM, Ashton M, Taylor GI. Abdominal wall CT angiography: a detailed account of a newly established preoperative imaging technique. *Radiology* 2008;249(1):32–44.
21. Alonso-Burgos A, Garcia-Tutor E, Bastarrika G, Cano D, Martinez-Cuesta A, Pina LJ. Preoperative planning of deep inferior epigastric artery perforator flap reconstruction with multislice-CT angiography: imaging findings and initial experience. *J Plast Reconstr Aesthet Surg* 2006;59(6):585–93.

22. Rozen WM, Ashton MW, Stella DL, Phillips TJ, Taylor GI. The accuracy of computed tomographic angiography for mapping the perforators of the DIEA: a cadaveric study. *Plast Reconstr Surg* 2008;122(2):363–9.
23. Rozen WM, Chubb D, Ashton MW, Webster HR. Mapping the vascular anatomy of free transplanted soft tissue flaps with computed tomographic angiography. *Surg Radiol Anat* 2011.
24. Pellegrin A, Stocca T, Belgrano M, Bertolotto M, Pozzi-Mucelli F, Marij Arnež Z, Cova MA. Preoperative vascular mapping with multislice CT of deep inferior epigastric artery perforators in planning breast reconstruction after mastectomy. *Radiol Med* 2013 Aug;118(5):732-43.
25. Kim H, Lim SY, Pyon JK, Bang SI, Oh KS, Mun GH. Preoperative computed tomographic angiography of both donor and recipient sites for microsurgical breast reconstruction. *Plast Reconstr Surg*. 2012 Jul;130(1):11e-20e
26. De Frene B, Van Landuyt K, Hamdi M, Blondeel P, Roche N, Voet D, Monstrey S. Free DIEAP and SGAP flap breast reconstruction after abdominal/gluteal liposuction. *J Plast Reconstr Aesthet Surg* 2006;59(10):1031-6.
27. Hamdi M, Larsen M, Craggs B, Vanmierlo B, Zeltzer A. Harvesting free abdominal perforator flaps in the presence of previous upper abdominal scars. *J Plast Reconstr Aesthet Surg* 2014 Feb;67(2):219-2
28. Teoh R, Johnson RF, Nishino TK, Ethridge RT. Evaluation of three-dimensional computed tomography processing for deep inferior epigastric perforator flap breast reconstruction. *Can J Plast Surg* 2007;15(4):196-8.
29. Laungani AT, Van Alphen N, Christner JA, Lachman N, Pawlina W, Ballman KV, Saint-Cyr M. Three-dimensional CT angiography assessment of the impact of the dermis and the subdermal plexus in DIEP flap perfusion. *J Plast Reconstr Aesthet Surg* 2015 Apr;68(4):525-30
30. Hummelink S, Hameeteman M, Hoogeveen Y, Slump CH, Ulrich DJ, Schultze Kool LJ. Preliminary results using a newly developed projection method to visualize vascular anatomy prior to DIEP flap breast reconstruction. *J Plast Reconstr Aesthet Surg* 2015 Mar;68(3):390-4.
31. Chae MP, Hunter-Smith DJ, Rozen WM. Comparative study of software techniques for 3D mapping of perforators in deep inferior epigastric artery perforator flap planning. *Gland Surg* 2016 Apr;5(2):99-106
32. Rozen WM, Garcia-Tutor E, Alonso-Burgos A, Acosta R, Stillaert F, Zubieta JL, et al. Planning and optimising DIEP flaps with virtual surgery: the Navarra experience. *J Plast Reconstr Aesthet Surg* 2010;63(2):289–97.
33. Klasson S, Svensson H, Malm K, Wassélius J, Velander P. Preoperative CT angiography versus Doppler ultrasound mapping of abdominal perforator in DIEP breast reconstructions: A randomized prospective study. *J Plast Reconstr Aesthet Surg* 2015 Jun;68(6):782-6.
34. Rozen WM, Phillips TJ, Ashton MW, Stella DL, Gibson RN, Taylor GI. Preoperative imaging for DIEA perforator flaps: a comparative study of computed tomographic angiography and doppler ultrasound. *Plast Reconstr Surg* 2008;121(1 Suppl):1–8.
35. Vandevort M, Vranckx JJ, Fabre G. Perforator topography of the deep inferior epigastric perforator flap in 100 cases of breast reconstruction. *Plast Reconstr Surg* 2002;109(6):1912–8.
36. Gravvanis A1, Tsoutsos D, Papanikolaou G, Diab A, Lambropoulou P, Karakitsos D Refining perforator selection for deep inferior epigastric perforator flap: the impact of the dominant venous perforator. *Microsurgery* 2014 Mar;34(3):169-76.
37. Blondeel PN, Arnstein M, Verstraete K, Depuydt K, Van Landuyt KH, Monstrey SJ, et al. Venous congestion and blood flow in free transverse rectus abdominis myocutaneous and deep inferior epigastric perforator flaps. *Plast Reconstr Surg* 2000;106(6):1295–9.
38. Figus A, Wade RG, Gorton L, Rubino C, Griffiths MG, Ramakrishnan VV.
39. Venous perforators in DIEAP flaps: an observational anatomical study using duplex ultrasonography. *J Plast Reconstr Aesthet Surg* 2012 Aug;65(8):1051-9.
40. Schaverien MV, Ludman CN, Neil-Dwyer J, Perks GB, Akhtar N, Rodrigues JN, Benetatos K, Raurell A, Rasheed T, McCulley SJ. Contrast-enhanced magnetic resonance angiography for preoperative imaging in DIEP flap breast reconstruction. *Plast Reconstr Surg* 2011 Jul;128(1):56-62
41. Newman TM, Vasile J, Levine JL, Greenspun DT, Allen RJ, Chao MT, et al. Perforator flap magnetic resonance angiography for reconstructive breast surgery: a review of 25 deep inferior epigastric and gluteal perforator artery flap patients. *J Magn Reson Imaging* 2010;31(5):1176–84
42. Vasile JV, Levine JL. Magnetic resonance angiography in perforator flap breast reconstruction. *Gland Surg* 2016 Apr;5(2):197-211
43. Neil-Dwyer JG, Ludman CN, Schaverien M, McCulley SJ, Perks AG. Magnetic resonance angiography in preoperative planning of deep inferior epigastric artery perforator flaps. *J Plast Reconstr Aesthet Surg* 2009;62(12):1661–5.
44. Rozen WM, Stella DL, Bowden J, Taylor GI, Ashton MW. Advances in the pre-operative planning of deep inferior epigastric artery perforator flaps: magnetic resonance angiography. *Microsurgery* 2009;

- 29(2):119–231 .45
46. Chernyak V, Rozenblit AM, Greenspun DT, Levine JL, MilikowDL, Chia FA, et al. Breast reconstruction with deep inferior epigastric artery perforator flap: 3.0-T gadolinium-enhanced MR imaging for preoperative localization of abdominal wall perforators. *Radiology* 2009;250(2):417–24.
  47. Masia J, Kosuotic D, Cervelli D, Clavero JA, Monill JM, Pons G. In search of the ideal method in perforator mapping: non contrast magnetic resonance imaging. *J Reconstr Microsurg* 2010 Jan;26(1):29-35.
  48. Itoh Y, Arai K. Use of recovery-enhanced thermography to localize cutaneous perforators. *Ann Plast Surg* 1995;34:507-11.
  49. Weum S, Mercer JB, de Weerd L. Evaluation of dynamic infrared thermography as an alternative to CT angiography for perforator mapping in breast reconstruction: a clinical study. *BMC Med Imaging* 2016 Jul 15;16(1):43
  50. Liu DZ, Mathes DW, Zenn MR, et al. The application of indocyanine green fluorescence angiography in plastic surgery. *J Reconstr Microsurg* 2011;27:355-64.



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### RESEARCH ARTICLE

## MAGNITUDES OF VARIABILITY IN EARLY INBREEDING GENERATIONS ( $S_1$ AND $S_2$ ) FOR GRAIN YIELD AND ITS COMPONENTS IN MAIZE.

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### Abstract

Study was conducted to assess the magnitude of heterosis and combining ability in the line  $\times$  tester cross material involved 100 hybrids generated by crossing 25 lines with four testers and 3 commercial hybrid check (900 M, DMH-2 and Prabha) in maize at Agricultural Research Station, Arabhavi. The analysis of variance indicated significant amount of variability among the genotypes for yield and yield contributing traits. Among the hybrids, ARYP-24  $\times$  CM-111 and ARYP-15  $\times$  CM-111 were found to be the best cross combinations for grain yield and its components.

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### Introduction:-

Maize (*Zeamays* L.;  $2n = 20$ ) is an important cereal crop with high yield potential. The total production at world level has surpassed both sorghum and pearl millet gaining a third place after wheat and rice. The demand for maize grain is increasing every year due to its diversified use in poultry, piggery and industry. During the year 2005-06, the total area in the country under maize cultivation was 7.58 mha. and the total production was 14.70 mt. as compared to 14.17 mt. during 2004-05. The increased production from Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Orissa and Tamil Nadu was due to the availability and adaptation of recently released hybrids (Anon., 2005).

Maize is mainly grown in the warmer parts of temperate regions and in humid-subtropical climate. The highest production is in areas with the warmest month isotherms from  $21^0$  to  $27^0$ C and a frost-free season of 120 to 180 days duration. Today, maize has become an all season crop in India.

Maize has more than 1000 industrial uses and mainly used for production of starch due to its high starch content (66.2 to 77%). Maize seed oil contains highest polyunsaturated fatty acid (PUFA), linoleic acid (61.9%) and it remains as liquid at fairly low temperatures which is helpful in combating heart diseases. Maize seed oil is also low in linolenic acid (0.7%) and contains a high level of natural flavour. Maize is used primarily as food for humans in Africa and Asian sub-continent. A number of genotypes viz., single cross, three way cross, double top cross, double cross hybrids, composites, synthetic population are being cultivated by farmers.

Beal (1880) was the first to conduct experiment on various hybridizations in maize. The inbreeding experiments were first reported by Darwin (1877) which continued for only one generation with limited impact on the future of maize breeding. East (1908) and Shull (1908, 1909) were first to report the results of their experiments on

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inbreeding and restoration of vigour upon crossing. Shull (1909) published "A pure line method of corn breeding", which outlined the three essential steps a) large scale inbreeding to obtain many homozygous or near homozygous lines, (b) testing the selected pure lines in all possible crosses and (c) utilizing the best cross for practical corn production. In early days when relatively few lines were available, it was common to evaluate inbreds in all possible cross combinations.

The efficiency and success of hybrid maize breeding depends on the contribution of heterotic effects from the superior inbred lines. The superior cross combination may be exploited as commercial single cross. Usually, the hybrid development programme in maize involves development of inbred lines, evaluation of inbred lines, crossing of selected inbreds and production of hybrids. In this context, a programme on development of inbred lines was initiated by using inbreeding system utilizing yellow pool as the base population. Yellow pool is a blend of 50 elite lines received from Directorate of Maize Research (DMR), New Delhi and inter mated for four cycles at Agricultural Research Station, Arabhavi. The  $S_2$  lines derived from this population were evaluated by line  $\times$  tester analysis involving four diverse testers to know their performance, combining ability and nature of inheritance of different quantitative traits. The line  $\times$  tester ( $L \times T$ ) design is basically an extension of top cross analysis involving more than one tester (Kempthorne, 1957). Thus, keeping these views in background, the proposed work was undertaken to develop hybrids suitable for *kharif* season in Karnataka.

**\*Part of the Ph.D thesis submitted to the University of Agricultural Sciences, Dharwad**

### **Material and Methods:-**

Fifty elite breeding lines (Table 1) were received from Directorate of Maize Research (DMR), IARI, New Delhi for development of full season heterotic yellow pool. These lines were raised and allowed to open pollinate for four generations (intermating) without exercising any selection. In each generation, the plants were raised in half-sib family method and at the end of fourth generation, the seeds were collected and grown as base population at College of Agriculture, Dharwad in isolation and allowed to open pollinate. Sufficient care was taken to maintain more than 10 thousand plant population. Out of this population, 150 plants were tagged in each grid by dividing entire population into 10 grids of 150 sq. mt. at the time of tassel emergence, based on vigour, standing ability, silk and tassel traits and free from disease incidence, 800 cobs were selected based on grain yield (*per se*) performance and this material formed basis for further inbreeding and isolation of inbred lines.

The experiments were laid out at Agricultural Research Station, Arabhavi and the experimental details are mentioned below under.

After thorough land preparation, hand dibbling was done with two seeds per hill and thinned out to maintain single plant per hill during second week after sowing (10-15 days after sowing). The crop was applied with recommended dose of fertilizers as per the package of practices.

### **Observations on quantitative traits:-**

In these investigations, data were collected in respect of quantitative traits. Observations on quantitatively inherited traits were recorded on five competitive randomly selected plants. The average was taken as the mean of the treatment. The way in which observations were recorded is described below.

#### **Plant height at 60 days after sowing (cm):-**

Plant height was expressed in centimetres by measuring the plant stalk from the ground level to the base of the last leaf sheath of the plant.

#### **Ear height at 60 days after sowing (cm):-**

This observation was recorded at the same time as plant height (at harvest), measured as the height of the plant from the ground level to the uppermost ear bearing node and expressed in centimetre.

#### **Leaf area at 60 days after sowing (cm<sup>2</sup>):-**

The average of five leaves from five different plants at 60 days after sowing was calculated by using formula  $L \times B \times 0.75$  and expressed in square centimetre (Montgomery, 1911).

**Ear weight (g):-**

Five ears were sun dried and weight in grams was recorded at stable moisture content.

**Ear length (cm):-**

Length of the ear was measured and recorded in centimetres at the time of harvest as its total length (from the base to the tip of the ear).

**Ear circumference (cm):-**

Ear circumference at one-third length from the base of the ear was measured and recorded in centimetre.

**Number of kernel rows per cob:-**

Number of kernel rows in each ear was counted for five cobs and mean was worked out.

**Number of kernels per row:-**

The number of kernels in any one of the row in each ear was counted and mean was worked out.

**Number of kernels per ear:-**

Total number of kernels in each ear of the selected plants was recorded.

**Hundred grain weight (g):-**

One hundred randomly selected grains per cob were weighed and weight was recorded in grams.

**Shelling percentage:-**

The ratio of grain weight to the ear weight was expressed in percentage.

$$\text{Shelling percentage} = \frac{\text{Grain weight}}{\text{Cob weight}} \times 100$$

**Pith / shank / heart weight (g):-**

The total pith / shank / heart weight from each ear was recorded and the average heart weight was expressed as heart weight per plant in grams.

**Kernel yield per plant (g) :-**

At the time of harvesting, fresh ear weight was recorded in grams per plant. Moisture determinations were made from shelled samples from five random ears of each plot with the help of electronic moisture meter. The fresh ear weight data was used to work out the dry weight at 15 per cent moisture grain yield in grams per plant.

**Kernel yield per plot (kg/plot):-**

At the time of harvest, fresh ear weight was recorded in kilograms for each plot. This fresh ear weight was adjusted to zero per cent grain moisture and recorded as grain yield per plot. Moisture percentage was determined on universal moisture tested in a grain sample obtained from two rows of each of five ears selected at random at the time of harvest were used for genetical analysis following Combstock (1948) and Robinson (1968).

$$\text{Yield per plot (kg/plot)} = \frac{\text{Fresh ear weight} \times (100 - \text{AVM})}{\text{Final stand}} \times K$$

Where,

$$K = \frac{\text{Average stand/plot of the trial} \times \text{plot area} \times 0.9412}{100 \times \text{plot area}}$$

AVM = Average moisture

#### Kernel / grain yield per hectare (q/ha):-

Fresh dehusked ear weight per plot was recorded at the time of harvest. Moisture content of 100 grams of fresh kernels was recorded by moisture meter of each entry and the moisture percentage was calculated by using moisture conversion charts. Kernel yield per hectare was calculated using the formula given below:

$$\text{Yield (q/ha)} = \frac{\text{Fresh ear weight} \times 100 - \text{AVM}}{\text{Final stand harvest}} \times K$$

Where,

$$K = \frac{\text{Final stand harvest}}{\frac{\text{Average stand of the trial} \times \text{Area (ha)} \times 0.9412}{100 \times \text{plot area}}}$$

AVM – Average moisture

#### Statistical analysis:-

##### Analysis of variance:-

The data were subjected to statistical analysis for randomised block design (RBD) as described by Panse and Sukhatme (1962). The mean values of the entries in each replication were used for analysis of variance (ANOVA). The significant difference among genotypes was tested by 'F' test at one per cent and five per cent levels of probability.

#### Results:-

##### Performance of yellow pool base population:-

##### Mean and range values for ten quantitative traits among selected:- progenies in yellow pool base population:-

The yellow pool base population comprising of 10,000 plants was raised during *kharif* season. A total of 1500 plants were initially tagged based on plant morphological traits and finally 800 cobs were selected based on plant morphology and cob characters. The cobs harvested from such selected plants were assessed for following ten quantitative traits whose results are presented below.

##### Cob weight (g):-

The cob weight among 800 progenies ranged from 91.90 to 375.00 g. and the mean cob weight was 160.35g (Table 2). However, the median value (155.31g) was comparatively lower than mean value, while the mode value (170.00g) was relatively higher than the mean cob weight. The skewness of the results indicated the negative distribution in the base population. The kurtosis (1.57) and skewness (0.89) values supported the deviation from normal distribution. The cob weight trait recorded higher co-efficient of variance (23.49%) with coefficient range value of 0.61.

##### Cob length (cm):-

The cob length ranged from 9.00 to 23.00 cm (Table 2). The median (15.00 cm) and mode (15.00cm) values were comparable with the mean value (15.08 cm). The mode value (15.00cm) was equal to the mean value indicating a positively skewed distribution in the base population and a marginal deviation from the normal distribution. The cob length recorded higher coefficient of variance (13.89%) with a coefficient range of 0.44. As many as 312 progenies (39%) recorded cob length ranging from 15.08 to 17.17 cm (Table 2).



**Cob girth (cm) :-**

The cob girth in population ranged from 10.00 to 18.00 cm with a mean of 13.08cm (Table 2). The magnitude of median (13.00) and mode (13.00) were comparable with mean value. This indicated the positive skewness and narrow deviation from the normal distribution. The cob girth recorded relatively lower coefficient of variation (9.25) with a coefficient range of 0.29.

**Number of kernel rows per cob:-**

The number of kernel rows per cob ranged between 8.00 to 20.00 rows per cob (Table 2). The magnitude of median (14.00) and mode (14.00) were comparable with the mean number of kernel rows per cob (13.79). The magnitude of kurtosis indicated negative distribution (-0.19) while the skewness indicated positive distribution (+0.19). The data indicated negatively skewed distribution with narrow deviation from the normal distribution. The coefficient of variance with respect to number of kernel rows per cob was 14.69 with a coefficient range value of 0.43.

**Number of kernels per row:-**

The number of kernels per row ranged from 18.00 to 48.00 with a mean value of 30.90 (Table 2). The magnitude of median (31.00) was comparable with the mean value, while the mode value (28.00) was relatively lower than mean value. The skewness recorded positive distribution (0.30), while the kurtosis (-0.40) recorded negative distribution indicating the deviation from normal distribution. The coefficient of variation was 18.38 per cent with a co-efficient range of 0.45.

**Number of kernels per cob:-**

The number of grains per cob ranged from 200.00 to 774.00 with a mean of 428.09 (Table 2). The magnitude of median (420.00) and mode (336.00) were relatively lower than mean value. This indicated negatively skewed distribution from the normal distribution. The kurtosis was negative (-0.02) while skewness (0.58) had positive. The number of grains per cob recorded higher coefficient of variation value (25.64%) with a coefficient of range of 0.60.

**Hundred seed weight (g):-**

The range of 100-seed weight was between 16.53 to 46.53 g with a mean value of 29.55g (Table 2). The median value (29.21) and mode value (29.28) were relatively lower than the mean (29.55 g). This indicated negatively skewed distribution and deviation from the normal distribution in the base population. However, the kurtosis (0.42) and skewness (0.42) indicated relatively lesser deviation. The 100-seed weight recorded coefficient of variation of 16.88 per cent with a coefficient range of 0.48.

**Shelling percentage (%):-**

The shelling per cent in the base population ranged between 74.71 to 95.60 per cent (Table 2). The mean shelling percentage was 86.05. The magnitude of median (86.24) and mode (86.65) were comparable with the mean value (86.05) indicating negatively skewed distribution. The kurtosis value of 0.76 and skewness of -0.43 were recorded for the shelling percentage. The shelling percentage recorded minimum coefficient of variation (3.14) with a coefficient of range of 0.12.

**Grain yield per plant (g):-**

The grain yield per plant ranged between 72.73 to 318.18g, with a mean value of 138.15 g (Table 2). The median (133.93) was lesser than the mean value (138.15), while the mode value (151.91) was relatively higher than mean value. This indicated both negative and positive skewed distribution in the base population. The kurtosis (1.45) and skewness (0.90) were appreciably deviated from the normal distribution. The grain yield per plant recorded coefficient of variation of 24.27 per cent with a coefficient of range of 0.63.

**Distribution of progenies for various qualitative traits in base population:-**

The distribution for qualitative traits of the progenies in yellow pool base population were studied for grain colour, grain size, grain texture pith colour and tip filling and the same is presented here under.

**Grain colour:-**

Out of 800 progenies in the base population, 369 progenies were with yellow colour followed by 309 with orange yellow and 122 progenies had yellow orange grain colour (Table 3). The frequency of yellow population was relatively high (46.13%) followed by orange yellow (38.63%). The frequency of yellow orange progenies was minimum with per cent value of 15.25.

**Grain size:-**

Among the 800 progenies, 546 had medium grain size accounting for 68.25 per cent of the population followed by 219 progenies with bolder grain size (27.37%) (Table 3). Thirty four progenies recorded smaller grain size, while only one progeny recorded very bold grain size. Highest number of progenies (95.6%) recorded grain size which ranged between bold to medium grain size.

**Grain texture:-**

Out of the 800 progenies, 713 possessed flint grain texture accounting to 89.13 per cent of the population (Table 3). The other progenies exhibited grain texture such as dent (8 progenies), semident (26 progenies) and semi-flint (53 progenies) accounting to 10.87 per cent of the base population.

**Tip filling:-**

Moderate tip filling was recorded by 437 progenies accounting to 54.63 per cent, while 326 lines exhibited no tip filling accounting to 40.75 per cent of the base population (Table 3). Only 37 progenies recorded complete tip filling accounting for 4.63 per cent of the base population.

**Discussions:-****Characterization of yellow pool base population based on Quantitative traits:-**

The proportion of superior inbred lines is determined by the proportion of the superior genotypes in the base population and the effectiveness of selection during the inbreeding. Hence, selection of proper germplasm source is an essential part of breeding programme. The breeding methods, efficiency of selection and final success are highly dependent on the base population chosen. Tannar and Smith (1987) studied various maize population derived from synthetics using two methods of recurrent selection and population derived from open pollinated variety based on the changes in grain yield, grain moisture and lodging. The study indicated the importance of effective population size and selection during  $S_1$  or  $S_2$  was more effective in eliminating unfavourable allele in the population.

In an another attempt, made to establishing inbreeding tolerant base population, Choudhary and Choudhari (2001) using DH-8644 and Jogia local as a base population indicated the possibilities of establishing inbreeding tolerant base population by selecting crosses which showed non-significant inbreeding depression with better yield performance.

Out of ten quantitative characters recorded in 800 selected progenies on cob characters, the progenies exhibited very high coefficient of variation for cob weight, pith weight, number of kernels per cob and grain yield per plant coupled with relatively high estimates of coefficient of range values indicating the presence of high variability in the base population. Further the median and mode values indicated positive skewed distribution for pith weight with high mode value suggesting the greater scope for selection of progenies for lower pith weight there by shelling percentage can be improved. It is interesting to note that out of the traits which recorded high estimates of coefficient of variability, cob weight and the grain yield per plant revealed platykurtic distribution with a high mode value than their respective mean values indicating the presence of relatively high proportion of superior progenies with higher mean values for both the characters in base population. Carlone and Russell (1989) selected 247 progenies from BSSS population and advanced to  $S_2$  generation. Similarly, Venkatesh *et al.* (2001) selected 500 progenies from CMIP2-7 population and selfed it for two generation to obtain  $S_2$  generation. The results on the *per se* performance of line, crosses vis-à-vis revealed that high yielding sister line crosses (SLCs) recorded high values for various yield related traits.

Cob girth and shelling percentage exhibited lower coefficient of variability with a 0.29 and 0.12 coefficients of range values, respectively with a platykurtic distribution in both the cases. However, shelling percentage had the greater mode value than the mean indicating the presence of superior progenies with a high shelling percentage in the base population comparatively with cob girth. It is interesting to note that cob length, number of kernels per cob, number of kernels per row and 100-seed weight had more or less a similar coefficient of range value varying from 0.43 to 0.48 revealing the presence of moderate variability for these traits in the selected progenies in base population. Wide range of cluster mean, for various traits were observed by Saxena and Sandhu (1989) in a divergence study involving 140 genotypes belonging to diverse geographic region.

Selected 800 progenies were grouped into different classes based on their superiority over the mean (Table 4). When superior progenies were scored based on greater values than mean + two standard deviation ( $>M + 2 SD$ ) for ten

quantitative traits, two traits namely number of kernels per cob and number of kernel rows per cob had high frequency of progenies *i.e.*, 6.25 per cent for number of kernels per cob and 5.50 per cent for number of kernel rows per cob followed by 100-seed weight and grain yield per plot. However, there were no superior progenies for shelling percentage under this class. Similar results were quoted by earlier workers. Marker and Joshi (2005) reported genetic gain for two traits *vis-à-vis* 100-grain weight and ear diameter through full sib family selection.

In a similar frequency classification made considering the class value of  $M + SD$  to  $M + 2 SD$ , high frequency of superior progenies were scored for number of kernels per cob (33.50%) and number of kernel rows per cob (20.88%). These two traits also had similar trend in the higher class value. However, as many as 49.00 per cent progenies had shelling percentage between  $M$  to  $M + 2 SD$  followed by cob length with 39.00 per cent of the progenies. Out of ten traits under study, the base population had maximum number of superior progenies in higher class values for number of kernel rows per cob and number of kernels per cob which are important components of a grain yield, revealing the importance of the Yellow pool population for isolation of productive inbred lines at later generations.

These were also scored for grain colour, grain size, grain texture, pith colour and tip filling characters. As many as 713 (89%) progenies were flint type, 546 (68.25%) with medium grain size and 437 (54.60%) with a medium tip filling traits. However, there were only 37 (4.60%) plants with a complete tip filling and 122 progenies with a yellow orange grain colour. Majority of the progenies (87.40%) had the white pith colour.

The grouping made on the basis of qualitative cob character clearly revealed the presence of desirable alleles for grain texture, grain size and tip filling in the Yellow pool population.

## References:-

1. Anonymous, 2005, XXXXVIII Annual Progress Report, All India Co-ordinated Maize Improvement Project, Directorate of Maize Research Pusa Campus, New Delhi – 110012.
2. Beal, W. J., 1880, Indian corn, *Report Michigan State Board. Agric.*, 19 :279- 289 (Cf. Lonnquist and Gardner, 1961).
3. Carlone, M. R. Jr., and Rusell, W. A., 1989, Evaluation of  $S_2$  maize lines reproduced for several Generations by random mating with lines. II.
4. Comparisons for test cross performance of original and Advanced  $S_2$  and  $S_8$  lines. *Crop Science*, 29 : 899-903.
5. 4. Choudhary, A. K. and Choudhari, L. B., 2001, An approach to establish inbreeding tolerant base population in maize (*Zea mays* L.). *Indian Journal of Genetics*, 61(1) : 31-33.
6. Comstock, R. E. and Robinson, H. F., 1948, The components of genetic variance in populations of biparental progenies and their use in estimating average degree of dominance. *Biometrics*, 4 : 254-266.
7. Darwin, C. 1877, The effect of crosses and self fertilization in the vegetable kingdom. D. Appleton and Co., New York, p. 482.
8. East, E. M., 1908, Hybridization methods in inbreeding. *Report of African Breeders Association*, 6 : 63-72.
9. Kempthorne, O., 1957, *An Introduction to Genetic Statistics*. John Willey and Sons, New York.
10. Marker, S. and Joshi, V. N., 2005, Estimation of genetic variance from full sib and half sib families in a maize (*Zea mays* L.) composite. *Indian Journal of Genetics*, 65(3) : 180-183.
11. 10.Montgomery, E. G., 1911, Correlation studies in corn. Nebr. Agriculture Experimental Station, *Annual Report*, 24 : 108-159.
12. 11.Panse, V. G. and Sukhatme, P. V., 1962, *Statistical Methods for Agricultural Workers*, ICAR Publication, New Delhi, p. 145.
13. 12.Robinson, N. G., 1968, Genetic variance estimates from different mating systems in a variety of corn (*Zea mays* L) *Diss. Abstr.*, 28 : 2214B-2215B.
14. 13.Saxena, V. K. and Sandhu, A. S., 1989, Divergence analysis in maize. *Crop Improvement*, 16(2) : 154-158.
15. 14.Shull, G. H., 1908, The composition of a field maize. *American Breeders Association Republic*, 4 :296-301.
16. 15.Shull, G. H., 1909, A pure line method of corn breeding. *American Breeders Association Republic*, 5 :51-59.
17. 16.Tanner, A. H. AND SMITH, O. S., 1987, Comparison of half sib and  $S_1$  recurrent selection in the krug yellow dent maize populations. *Crop Science*, 27 : 509-513.
18. 17.Venkatesh, S., Singh, N. N., and Gupta, N. P., 2001, Early generation identification and utilization of potential inbred lines in modified single cross hybrids of maize (*Zea mays* L.) *Indian Journal of Genetics*, 61(3) : 213- 217.



## RESEARCH ARTICLE

### L'IDE AU MAROC : EFFETS ECONOMIQUES ET ATTRACTIVITE DU TERRITOIRE (ESSAI DE VALIDATION EMPIRIQUE POUR LA PERIODE 1970-2011)

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#### Abstract

L'objet de ce travail est d'évaluer les effets économiques de l'IDE sur la croissance économique, cas du Maroc, en relation avec le concept de l'attractivité du territoire. L'importance de l'IDE trouve sa justification dans sa capacité de générer des externalités positives « effets de Spillover », exercées sur l'ensemble des variables économiques (le capital humain, l'investissement domestique, les exportations, les différents secteurs d'activité et le tissu industriel) et par conséquent, sur la croissance économique du pays. Ainsi, la question fondamentale est de vérifier si le territoire marocain est suffisamment attractif pour générer ces effets économiques positifs théoriquement attendus et politiquement prétendus.

Cette étude examine la relation entre les investissements directs étrangers (IDE) et la croissance économique pour le cas du Maroc tout au long de la période de 1970 à 2011. Les résultats économétriques obtenus par un modèle à équations simultanées ont suggéré un effet d'entraînement avec l'investissement domestique, un effet de complémentarité en présence de la variable des exportations et un effet négatif du capital humain.

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#### Introduction:-

Depuis les années 80, de nombreux pays en voie de développement ont opté pour le choix libéral et ont adopté des politiques d'attractivité, choix et politiques théoriquement justifiés par un certain nombre de vertus et effets positifs attendus de l'IDE par le biais de certains facteurs :

- un facteur capital où l'IDE est conçu comme source de financement non génératrice de service de dette.
- un facteur travail où l'IDE contribue à la création d'emploi, à la qualification de la main d'œuvre par le transfert de technologies, de connaissances, de compétences managériales et organisationnelles aussi bien que de nouveaux procédés et méthodes de production et de fabrication.
- des exportations où l'IDE contribue à l'augmentation du volume des exportations du pays d'accueil.
- un tissu industriel où l'IDE améliore la compétitivité entre firme multinationale et entreprise nationale.
- un environnement économique où l'IDE incite aux réformes d'assainissement et d'amélioration des performances globales de l'environnement macro-économique, ce qui est de nature à influencer toutes les autres variables.

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Par ailleurs, à côté des effets positifs, il existe des effets négatifs sinon neutres à prendre en compte : un *effet d'éviction* à côté d'un *effet d'entraînement* pour l'investissement domestique et le tissu industriel, un *effet de substituabilité* à côté de celui de *complémentarité* pour les exportations et d'*effet de seuil* pour le capital humain.

Or, l'enseignement majeur que l'on peut tirer à la fois de la revue de la littérature des travaux théoriques et empiriques, c'est qu'il existe une " certaine interaction ", des " *effets mutuels* ", des " *relations causales bilatérales* " entre l'IDE et la croissance " : les flux d'IDE et l'implantation d'une firme dans " un territoire " mesurée entre autres par le niveau de la croissance économique alors que celle-ci est déterminée en retour par l'IDE. La relation d'interaction bilatérale ou le lien circulaire devient de plus en plus complexe si on introduit le " concept " de l'attractivité du territoire<sup>1</sup>. Il s'agit donc d'étudier l'interaction entre deux systèmes, le *système productif* et le *système attractif*, par le biais des *effets économiques*. De même, ce qui ressort de la revue de la littérature en matière de déterminants de croissance et déterminants de l'IDE, c'est que les premiers sont en grande partie les déterminants de l'IDE et que les seconds sont aussi les déterminants de la croissance. En termes de politiques économiques, ces mêmes déterminants constituent aussi bien les objectifs des politiques économiques (croissance) que ceux des politiques d'attractivité.

De ce qui précède, toute étude des effets de l'IDE sur la croissance doit tenir compte de l'attractivité du territoire. C'est dans cet esprit que nous formulerons cette relation en une seule question centrale qui constituera notre problématique; et qui guidera notre réflexion tout au long de notre travail :

**" Le territoire marocain est-il suffisamment attractif pour générer les effets économiques attendus ? "**

**Questions secondaires:-**

La meilleure façon de répondre à cette question consiste à s'en poser d'autres. C'en est là une question qui interpelle d'autres partant de sa première composante qu'est le diagnostic du système attractif au sens large du terme et de sa deuxième qui porte sur l'évaluation des effets dudit système attractif sur le système productif. Il serait donc possible de se demander :

**Question 1:-** si les " politiques d'attractivité " auxquelles le Maroc s'est engagé depuis les années quatre-vingt ont-elles atteint les objectifs escomptés en terme d'attractivité ? Cette question cherche à examiner l'efficacité du système attractif au sens large du terme (attractivité et politiques d'attractivité) pour expliquer l'écart existant entre l'attractivité effective et l'attractivité potentielle du territoire marocain.

**Question 2:-** si le territoire marocain, ou le système productif a-t-il les pré-conditions nécessaires et les performances globales requises pour tirer profit de la présence de l'IDE. ?

**Question 3:-** Quels sont les effets économiques de l'IDE sur la croissance économiques pour le cas du Maroc? C'est-à-dire comment pouvant nous évaluer la relation IDE-croissance et le lien entre le système attractif et le système productif ?

**Objectifs de l'étude:-**

Répondre à la fois aux questions découlant de notre problématique et à la nécessité méthodologique mentionnée dans les approches méthodologiques adoptées (référence et repérage), exige cinq objectifs de l'étude :

- Présenter une revue de la littérature sélective aussi bien théorique qu'empirique sur la relation IDE-croissance (question 1)
- Évaluer les effets dans le cadre d'une analyse économétrique entre (1970-2011) (.question 2 et 3)

**Effets de l'IDE à la lumière des travaux empiriques:-**

La revue de la littérature empirique distingue deux types d'effets sur la croissance, directs et indirects.

**Effets directs :-**

Les travaux empiriques qui se sont attachés à l'étude des effets de l'IDE sur la croissance dans les pays en voie de développement ont mis en évidence l'effet positif qu'exerce l'IDE sur la croissance économique et ce, à la fois par un effet d'entraînement sur l'investissement domestique, sur l'amélioration de la qualité de la main d'œuvre, la création des externalités positives qui améliorent la productivité totale des facteurs et l'efficacité économique du pays

<sup>1</sup>Au sens large du terme cela signifie à la fois les politiques d'attractivité et l'attractivité du territoire proprement dite

d'accueil. Nous citons à cet égard les travaux les plus reconnus ; Blomström(1986) et (1989) et Kokko(1994), Aitken, Hanson, et Harrison(1997) pour le cas de la Mexique, Blomstöm (1989) et Kokko,Tansini, Zejan (1994) pour le cas de l'Uruguay , Sjöholm(1999) et Blalock(2001) pour " l'industrie ", Batra et Tan(2002) pour la Malaisie, Djankov et Heckman(2000) sur les firmes " tchèques " et Javorcik(2004) sur les industries manufacturières lituanienne.

#### **Effets indirects:-**

Il sera question ici de présenter les effets de l'IDE sur le capital humain, sur l'investissement domestique, sur les exportations ainsi que sur le tissu industriel.

#### **IDE-capital humain:-**

Il est très bien utile de noter qu'un niveau de qualification de la main d'œuvre qui dépend lui aussi de la politique éducative . Le niveau de qualification du capital humain semble être un mécanisme déterminant de la génération ou non des effets de l'IDE.Même si l'IDE requiert un niveau et un seuil minimum de qualification du capital, après leurs installations, les FMN développent ce capital humain via l'amélioration des capacités organisationnelles des entreprises locales. (Blomstrom et Kokko (1988)). En revanche, les FMN dont l'activité est orientée vers le marché extérieur, investissent davantage dans la formation pour rendre le capital humain plus qualifié (Kumar(1996)). La capacité d'absorption dépend essentiellement de la capacité " d'apprentissage " (reading by doing).

Selon Blomström et kokko(2003a), les FMN n'affectent pas directement l'enseignement primaire et secondaire, mais elles permettent d'agir indirectement sur l'enseignement supérieur . Un capital humain qualifié permet facilement le transfert technologique, un secteur ou un pays détenant un niveau technologique avancé permet de tirer profit des retombées positives au niveau du capital humain (OCDE, 2002). En cas d'absence de transfert, les FMN sont dans une situation de monopole des FMN. Un effet d'éviction est exercé sur les entreprises locales (Haitit et Hammoudi H. (2005)). La « transférabilité » dépend également du type de formation (Alsan et al. (2006)).

#### **IDE-investissement domestique:-**

Les études portant sur la relation IDE-ID essaient de répondre à la question suivante : « Y a-t-il un effet d'entraînement ou d'éviction entre l'IDE et l'investissement domestique ? » Borenstein est considéré comme l'un des premiers auteurs qui ont largement étudié cette relation. Ces études ont montré également l'existence possible d'un effet de complémentarité (Rodriguez-Clare (1996); Markusen et Venables(1999)).Malgré la non significativité obtenues des coefficients, DE Gregorio et Lee (1998), Soya et Oneal (1999) ont trouvé un effet d'entraînement de l'IDE et non un effet d'éviction.

De même, Argosin et Mayer(2000) ont montré que l'IDE exerce un effet d'entraînement (Crowding in) sur l'IDE. Par contre, il exerce un effet d'éviction (crowding out) en Amérique latine. Au niveau théorique, de nombreux travaux se sont attachés à l'étude de la relation IDE et investissement domestique ( Markusen, et Venables(1999), travaux qui, ont mis l'accent sur le fait que " l'effet d'entraînement " est conditionné par la forme et la nature des stratégies des firmes multinationales.

#### **IDE-Commerce extérieur:-**

L'IDE a des effets à la fois directs ou indirects sur les deux composantes du commerce extérieur (Importations et exportations). Par exemple, au niveau des exportations, l'effet direct de l'IDE sur le commerce extérieur peut être réalisé au cas où la production des FMN se consacrerait soit à la " réexportations " vers le pays d'origine de la firme multinationale soit vers des marchés tiers. Le pays d'accueil est alors considéré comme " plate-forme de réexportation ".Mucchielli J-L (2002) confirme que la nature complémentaire ou substituable de l'IDE avec les importations affecte la balance commerciale. En s'implantant dans l'économie du pays d'accueil, une FMN peut voir sa production se substituer à l'importation du pays d'origine de la FMN. Or, ce dernier peut se substituer à l'investissement domestique (effet d'éviction).

L'IDE a en dernier lieu des effets dynamiques et à long terme sur la spécialisation internationale et au transfert des avantages compétitifs spécifiques des FMN (Henner (1997)). Moran(1998) confirme qu'une politique d'ouverture permet aux FMN d'accéder aux sources d'approvisionnement et de s'intégrer aux marchés internationaux. Lee , Ricci et Rigobon (2004), Rodriguez (2000) soutiennent que le débat sur la relation IDE-ouverture n'est pas encore tranché. L'IDE peut exercer un effet sur la croissance bien qu'il soit minime (Jansen(1995)) .

**Données et spécification du modèle d'analyse:-**

Notre analyse économétrique porte sur des données statistiques inhérentes à l'économie marocaine pour la période 1970 - 2011. La méthode empirique utilisée est basée sur un modèle à équations simultanées dans le cadre duquel on distingue deux types de variables : les variables endogènes et les variables exogènes, variables dont la définition sera explicitée une fois que sera présentée la forme générale dudit modèle.

**Présentation générale d'un modèle à équations simultanées:-**

Afin de tenir compte des insuffisances économétriques précédemment évoquées dans la revue de la littérature, nous entendons construire un modèle structurel composé de plusieurs équations simultanées. Le but recherché ici est de relier la croissance économique aux IDE et aux autres facteurs tels que les exportations, le capital humain, l'emploi, les infrastructures, etc. La forme générale du système peut s'écrire de la manière suivante :

$$f(Y_T X, \beta)_t = \varepsilon(t)$$

où  $y$  est le vecteur des variables endogènes,  $x$  le vecteur des variables exogènes et  $t$  est le vecteur des résidus possiblement corrélé ; le but de l'estimation étant de trouver le vecteur des paramètres  $\beta$ .

La structure du modèle est représentée par un système de huit équations simultanées qui se présente comme suit :

$$Y_t = A + \beta X_T + \varepsilon(t)$$

$Y_t$  : Vecteur des variables endogènes

$X_t$  : Vecteur des variables exogènes

$A$  : Vecteur des termes constants

$\varepsilon(t)$  : Vecteur des termes de l'erreur.

**Forme fonctionnelle :-**

Soit le système général de 5 (cinq) équation structurelles liant cinq variables endogènes à 12 variables exogènes :

En s'inspirant de travaux de Van den Berg et Ghosh Roy (2006), et Bende et Al(2000), nous adoptons un modèle de cinq équations simultanées qui se représente comme suit:

$$Cr_t = f(IDE_t, KH_t, EXPORT_t, ID_t) \quad [\text{eq.1}]$$

$$ID_t = f(Cr_t, IDE_t, CREDIT_t, INTERET_t) \quad [\text{eq.2}]$$

$$EXPORT_t = f(IDE_t, TXCHANGE_t, LIBER_t) \quad [\text{eq.3}]$$

$$KH_t = f(IDE_t, Depeduca_t, URBAN_t, SANTPIB_t) \quad [\text{eq.4}]$$

$$IDE_t = f(Cr_t, KH_t, IDE_{t-1}, OUVERT_t, INFLAT_t, INFRPIB_t, M2_t) \quad [\text{eq.5}]$$

**Forme structurelle:-**

Comme Van den Berg et Ghosh Roy (2006), Bende et al(2000), nous supposons dans le cadre de cette analyse une relation linéaire entre les différentes variables du modèle. Ain la forme structurelle de notre modèle se présente comme suit:

**Equation 1:-**

$$Cr_t = \alpha_0 + \alpha_1 IDE_t + \alpha_2 KH_t + \alpha_3 EXPORT_t + \alpha_4 ID_t + \varepsilon_{1t}$$

**Equation 2:-**

$$IDE_t = \gamma_0 + \gamma_1 Cr_t + \gamma_2 KH_t + \gamma_3 IDE_{t-1} + \gamma_4 OUVERT_t + \gamma_5 INFLAT_t + \gamma_6 INFRPIB_t + \gamma_7 M2_t + \varepsilon_{2t}$$

**Equation 3:-**

$$KH_t = \phi_0 + \phi_1 IDE_t + \phi_2 Depeduca_t + \phi_3 URBAN_t + \phi_4 SANTPIB_t + \varepsilon_{4t}$$

**Equation 4 :**

$$EXPORT_t = \delta_0 + \delta_1 IDE_t + \delta_2 TXCHANGE_t + \delta_3 LIBER_t + \varepsilon_{3t}$$

**Equation 5 :**

$$ID_t = \beta_0 + \beta_1 Cr_t + \beta_2 IDE_t + \beta_3 CREDIT_t + \beta_4 INTERET_t + \varepsilon_{2t}$$

**Définition des variables:-**

Il s'agit des variables endogènes et exogènes spécifiques au cas du Maroc pris comme cas d'étude pour la période susmentionnée.

(Voir en annexe 6 la définition de l'ensemble des variables)

#### Les variables endogènes:-

Les variables endogènes sont la croissance du PIB/tête ( Cr ) ; les flux nets d'investissement direct étranger en pourcentage du PIB ( IDE ) . Le capital humain est approximé par le taux de scolarisation brut au niveau secondaire ( KH )  
2

, la part de l'investissement domestique dans le PIB (FBCF en pourcentage du PIB ) , ( ID ), et les exportations des biens et services en pourcentage du PIB ( EXPORT ) .

#### Les variables exogènes:-

Ces variables sont le crédit accordé au secteur privé par rapport au PIB , qui indique la disponibilité et l'efficacité des intermédiaires financiers ainsi que la facilité d'accéder aux crédits ( CREDIT ) , les dépenses d'éducation en pourcentage du PIB ( Depeduca ) , le taux d'inflation annuel ( INFLATION ) , le coût du capital mesuré par le taux d'intérêt réel ( INTERET ) , la masse monétaire au sens de M2 ( M2 = Monnaie + quasi monnaie) comme approximation du niveau de développement financier ( M2 ) , l'ouverture économique (exportations et importations sur le PIB ) ( OUVERT ) , le taux de change du dollar en monnaie locale ( TXCHANGE ) , le degré d'urbanisation et de développement des institutions urbaines, permettant un accès plus facile aux différentes institutions (sociales, culturelles, sanitaires, sportives, etc.) est approximé par la population urbaine en pourcentage de la population totale ( URBAN ) ,Les dépenses de santé en pourcentage du PIB ( SANTPIB ) et les dépenses en infrastructure ( IFRAPIB ) . Les flux d'investissements décalés en pourcentage du PIB ( ID E ( t-1 ) ) ,la variable indicatrice de l'adoption d'une politique d'ouverture qui prend 1 depuis 1983 et 0 autrement ( LIBER ) .

#### Signes attendus:-

Sur la base des travaux à la fois théoriques et empiriques nous présentons dans le tableau ci-après les signes attendus des variables aussi bien endogènes qu'exogènes. Les variables endogènes sont représentées en caractère gra

**Table 1:-** Signes attendus des variables [pour la lecture du tableau :  $y = f(x)$ ]

$\begin{matrix} y \\ x \end{matrix}$	Cr	ID E	KH	ID	EXPORT
<b>Cr</b>		+		+	
<b>IDE</b>	+		+	+/-	+
<b>KH</b>	+	+			
<b>ID</b>	+				
<b>EXPORT</b>	+				
IDE(t-1)		+			
CREDIT				+	
Depeduc			+		
INFLAT		-			
INTERET				-	
M2		+			
OUVERT		+			
TXCHAN					-
GE					
URBAN			+		
SANTPIB					
INFRPIB		+			
LIBER					+

#### Tests de stationnarité des variables:-

Voir en annexe le tableau récapitulatif des tests de stationnarité de l'ensemble des variables étudiées (Annexe 6);



**Conditions d'ordre et de rang:-**

Les conditions d'identification peuvent faire l'objet d'un développement complexe, nous nous bornons ici à édicter des règles simples qui sont dans la pratique, appliquées en premier lieu. Soit :

- $g$  est le nombre de variables endogènes du modèle (ou encore nombre d'équations du modèle)
- $k$  est le nombre de variables exogène du modèle
- $g'$  est le nombre de variables endogènes figurant dans une équation
- $k'$  est le nombre de variables exogènes figurant dans une équation ;

Lorsque les restrictions ne sont pas des restrictions d'exclusion, les conditions nécessaires d'identifiabilité s'énoncent ainsi :

- $g-1 > g' + k - r \rightarrow$  L'équation est sous-identifiée;
- $g-1 = g' + k - k' \rightarrow$  L'équation est juste identifiée;
- $g-1 > g' + k - k' \rightarrow$  L'équation est sur-identifiée;

Ce qui peut se résumer ainsi : pour qu'une équation ne soit pas sous-identifiée, le nombre de variables exclues de l'équation doit être au moins au nombre d'équation du modèle <sup>1</sup>. Ces conditions nécessaires sont appelées conditions d'ordres d'identifiabilité.<sup>2</sup>

<sup>3</sup>

**Table 2:-** Les conditions d'ordre et de rang

	$g$	$g'$	$k$	$k'$	$r$	$(g-g')+(k-k')+r$	$g-1$	Conclusion
Cr	5	0	12	0	0	17	4	L'équation est sur-identifiée.
IDE	5	2	12	5	0	10	4	L'équation est sur-identifiée
KH	5	1	12	3	0	13	4	L'équation est sur-identifiée
EXPORT	5	1	12	2	0	14	4	L'équation est sur-identifiée
ID	5	2	12	2	0	13	4	L'équation est sur-identifiée

**Résultats d'estimations et éléments d'interprétations:-**

Dans le cadre de l'analyse économétrique de notre problématique qui met en relation l'étude de la problématique d'attractivité du territoire marocain à celle des effets économiques, nous présentons les résultats d'évaluation des effets indirects à l'aide du modèle à équations simultanées

<sup>4</sup>

**Déterminants de l'IDE:-**

Méthode d'estimation: 2MCO/Modèle:	
Variable dépendante : IDE	Période : 1970 – 2008
Constant	-3,80
	(-,316)
Cr	-0,981
	0,225
KH	0,058
	(0,225)
M2	,009133
	(,052)*
IFLAT	-,032143
	-,121

<sup>2</sup>Lorsque nous avons  $r$  restrictions, autres que celles d'exclusion, concernant les paramètres d'une équation (égalité de deux coefficients, par les conditions précédentes deviennent :

- $g-1 > g' + k - k' + r \rightarrow$  L'équation est sous-identifiée;
- $g-1 = g' + k - k' + r \rightarrow$  L'équation est juste identifiée;
- $g-1 > g' + k - k' + r \rightarrow$  L'équation est sur-identifiée;

IFRPIB	,824925
	,283
IDE(1-t)	,017896
	,014
OUVERT	,052637
	,144
$R^2 = 0,20861$	
$F = 0,194$	
IDE : investissement direct étranger, C: constante,Cr: croissance du PIB/Tête, KH : capital humain, M2: production d'énergie, OUVERT : l'ouverture économique, INFLATION : taux d'inflation. IFRPIB : IDE(1-t) : OUVERT/ ***, ** et * indiquent respectivement un niveau de significativité de 1%, 5% et 10%. ( ) : Les chiffres entre parenthèses sont les t de Student.	

Les résultats de la régression (équation 12) suggèrent que toutes les variables explicatives ( OUVERT , INFLAT , INFRPIB , IDE( t-1 ) ) ont le signe attendu théoriquement (exception faite de la variable de la croissance économique(Cr)), signe non significatif. Les variables monétaires ( INFLAT , M2 ) , le niveau d'infrastructure( INFRPIB ) et le degré d'ouverture ( OUVERT ) ainsi que la variable retardée de l'IDE semblent avoir un pouvoir explicatif de l'attractivité de l'IDE.

Cela pourrait être expliqué par l'hypothèse suivante : le pays a fourni depuis les années quatre-vingt des efforts soutenus et s'est engagé dans le processus de libéralisation et de l'ouverture de son économie et de l'encouragement du secteur privé. La série des réformes mises en place afin de rendre les pré-conditions macro-économiques de plus en plus propices aussi bien pour l'investissement domestique que pour l'investissement direct étranger ( IDE ). En outre, des mesures spécifiques ont été mises en faveur l'IDE. Le pays a fourni des efforts aussi bien au niveau de la politique d'ouverture ( OUVERT , IDE ( t-1 ) ), qu'en matière des réformes visant à créer les pré-conditions macro-économiques ( M2 , INFLAT , Cr , KH ). Le signe inattendu de la croissance économique peut être dû soit à la mesure de celle-ci soit au fait que le taux de croissance marocain n'est pas aussi suffisant pour attirer l'IDE. Son caractère volatil et sa dépendance aux aléas climatiques en témoignent.

La non significativité de l'ensemble des coefficients suggèrent que les politiques, les réformes et les mesures générales et spécifiques ne sont pas aussi suffisantes pour tirer profit des avantages de l'IDE.

Le Maroc doit s'ouvrir davantage sur l'extérieur et poursuivre les chantiers de réformes déjà entamés. La réforme du système éducatif, monétaire et financier, l'amélioration des infrastructures. Les chantiers ne sont entamés que récemment.

IL est encore tôt donc de juger leurs effets sur l'attractivité (tous les plans menés sont très récents et couvrent la période 2005-2011). Car il ne suffit pas de mettre en place des politiques d'attractivité, mais d'opérer un suivi rigoureux en vue d'atteindre les objectifs escomptés.

### 3. L'effet de l'IDE sur les exportations :

Méthode d'estimation: 2MCO/Modèle:	
Variable dépendante : EXPORT	Période : 1970 – 2008
Constant	19,345998
	2,115
IDE	3,910870
	4,315
TXCHANGE	-,008160
	-,102
LIBER	4,341362
	2,446
$R^2 = ,60116$	
$F = 17,08244$	
IDE : investissement direct étranger, C: constante,TXCHANGE: capital humain, EXPORT: production d'énergie,	

**LIBER :**

\*\*\*, \*\* et \* indiquent respectivement un niveau de significativité de 1%, 5% et 10%. ( ) : Les chiffres entre parenthèses sont les t de Student.

Les résultats de la spécification de l'équation 13 indiquent que toutes les variables ont le signe théoriquement attendu. Tous les signes sont statistiquement significatifs. Le processus de libéralisation des échanges extérieurs, et le nombre d'accords de libre-échange signés par le pays depuis l'adoption du programme d'ajustement structurel (PAS) favorisera l'expansion et l'évolution des exportations. L'ouverture économique et l'abolition progressive des restrictions aux exportations ont favorisé l'évolution de celles-ci. De même, l'adoption de la politique de la dévaluation par l'autorité monétaire améliore la compétitivité-prix à l'échelle internationale, le volume des exportations évolue par conséquent. Ce résultat est bel et bien satisfaisant, mais des obstacles aux exportations subsistent ; des goulots d'étranglement, des coûts de transaction engendrés par la lourdeur administrative et la bureaucratie rigide influencent les délais d'attente et constituent une entrave réelle à l'expansion du volume des exportations. Des efforts en la matière doivent être déployés pour les atténuer ou du moins les abolir.

On peut donc prononcer avec beaucoup de prudence, selon les résultats économiques obtenus qu'il y a lieu de citer " un effet de complémentarité " entre l'IDE et les exportations pour le cas du Maroc au cours de la période d'étude (1970-2011). Cela peut être expliqué par la nature et le mode des stratégies adoptées par les firmes multinationales implantées au Maroc. Les dites firmes adoptent le plus souvent une stratégie dite " verticale " ; c'est-à-dire qu'elles exploitent les avantages comparatifs du pays (ressources naturelles, main d'œuvre bon marché) afin de réexporter leurs produits vers leurs pays d'origine ou leurs sociétés mères. Ce qui contribue effectivement à l'évolution simultanée des deux variables et par voie de conséquence à la génération de " l'effet de complémentarité ". La politique de change vient renforcer cette complémentarité. Donc en terme de synthèse, les politiques économiques d'attractivité (génériques, spécifiques et différenciée) améliorent les avantages comparatifs du pays (prix bas des matières premières, main d'œuvre bon marché, procédure administrative allégée, etc.) ce qui incite et améliore l'attractivité et l'implantation des firmes multinationales à " stratégie verticale " à s'implanter d'abord et réexporter par la suite. Cette attractivité se trouve de plus en plus renforcée par l'accouplement de la politique d'attractivité à la politique commerciale (libre-échange et politique de change). Donc, l'amélioration à la fois des " avantages comparatifs " et de " la compétitivité " du territoire agit favorablement sur l'attractivité des firmes multinationales à stratégie verticale.

### 3. L'effet de l'IDE sur le capital humain :

<b>Méthode d'estimation: 2MCO/Modèle:</b>	
<b>Variable dépendante : KH</b>	<b>Période : 1970 – 2008</b>
Constant	14,021535
	2,368
IDE	6,829861
	3,784
URABN	1,484767
	6,549
Depeduca	1,079128
	,610
SANTPIB	,215835
	,040
$R^2 = ,87003$	
$F = 55,22416$	
IDE : investissement direct étranger, C: constante, KH : capital humain, URABN: production d'énergie, Depeduca: l'ouverture économique, SANTPIB: taux d'inflation.	
***, ** et * indiquent respectivement un niveau de significativité de 1%, 5% et 10%. ( ) : Les chiffres entre parenthèses sont les t de Student.	

Les résultats de la régression de l'équation 14 suggèrent que l'ensemble des variables explicatives ont le signe théoriquement attendu. L'IDE et l'urbanisation ont un effet positif significatif tandis que les dépenses d'éducatives et les dépenses de santé rapportée au PIB ont un effet positif non significatif.

Un tel résultat peut être expliqué ainsi : Il est d'abord utile de rappeler que cela rejoint les résultats obtenus par plusieurs travaux empiriques. Ce résultat se trouve conforté par plusieurs études empiriques : " les retombées de l'IDE par la formation de la main d'œuvre locale peuvent être plus importante que celles générées par l'enseignement public " (Cave, 1996). (Voir tableau récapitulatif de la revue de la littérature sélective de l'IDE).

L'IDE permet le transfert des compétences managériales et organisationnelles, de savoir-faire et de technologies, aux entreprises domestiques et au facteur travail national. De même, cela peut être attribué à l'existence des activités intensives en travail peu qualifié. Ce dernier facteur est jugé très explicatif et ne contredit pas l'interprétation de l'équation 12 des déterminants de l'IDE qui confirme que l'IDE exige un " seuil " quantitatif et qualitatif du capital humain pour qu'une firme multinationale puisse s'implanter.

Le capital humain : (KH) Quel que soit le sens de la relation entre le capital humain et l'IDE, le Maroc se trouve dans l'obligation ardente de mener une politique éducative apte à assimiler et approprier les technologies incorporées et transférées par l'IDE. Plusieurs raisons peuvent être avancées pour expliquer le fait que l'impact du capital humain (KH), mesuré ici par le taux de scolarisation secondaire, une variable " proxy ", se montre peu significatif (malgré le signe attendu ) sur le taux de croissance économique marocain tout au long de la période d'étude . On peut invoquer à propos deux raisons explicatives : l'inefficacité interne et l'inefficacité externe du système éducatif (voir chapitre 2 contextuel, section consacrée à du facteur travail). L'inefficacité interne du système éducatif signifie son incapacité de faire acquérir des compétences et des qualifications) en raison de la prépondérance de l'enseignement théorique au détriment de l'enseignement pratique.

L'inefficacité externe porte à son tour sur les changements et les déséquilibres intervenus sur le marché du travail (Sekkat (2004)). Un déséquilibre aussi bien quantitatif que qualitatif entre l'output du système éducatif (l'offre) et les besoins formulés par le système productif (demande). Ce phénomène se pose avec plus d'acuité au niveau de l'enseignement secondaire et du supérieur qui sont directement en prise avec le marché du travail. De plus, la plupart des diplômés de l'enseignement supérieur s'engagent dans la fonction publique, emploi jugé et considéré comme étant " non productif " Les deux sortes d'inefficacité (internes et externes) sont liées. Les deux systèmes, éducatif et productif se développent, évoluent et expriment leurs besoins indépendamment l'un de l'autre. Une réforme du système éducatif s'impose en tenant compte des besoins et des attentes du système productif. De même la spécialisation du système productif ainsi que les secteurs prioritaires productifs doivent être fixés en prenant en considérations la capacité du système éducatif à couvrir ses besoins.

#### 4. L'effet de l'IDE sur l'investissement domestique :

<b>Méthode d'estimation: 2MCO/Modèle:</b>	
<b>Variable dépendante : ID</b>	<b>Période : 1970 – 2008</b>
Constant	14,021535
	2,368
Cr	1,690662
	,919
IDE	2,055132
	,670
CREDIT	,284945
	1,245
INTERET	-,842588
	-1,411
$R^2 = ,02348$	
$F = ,19834$	
IDE : investissement direct étranger, C: constante, Cr: croissance du PIB/Tête, KH : capital humain, CREDIT: production d'énergie, INTERET: l'ouverture économique	
***, ** et * indiquent respectivement un niveau de significativité de 1%, 5% et 10%. ( ) : Les chiffres entre parenthèses sont les t de Student.	

Le taux de croissance, le crédit accordé au secteur privé, le taux d'intérêt et l'IDE ont tous le signe approprié et attendu théoriquement. Il y a lieu de citer un " effet d'entraînement " entre l'IDE et l'investissement domestique (équation 15). Cela pourrait être expliqué par les opérations de fusion-acquisition qui représentent 29,5% des flux d'IDE à destination au Maroc. Le signe positif mais non significatif signifie un " effet d'entraînement " faible. Cet

effet peut également s'améliorer en orientant l'IDE vers les secteurs ou les branches d'activités complémentaires à celles recherchées par les firmes multinationales, soit en aval, soit en amont. Les deux types d'investissement doivent se compléter. Pour ce qui est du taux d'intérêt, il représente le coût du capital son effet est négatif sur l'investissement domestique. Les firmes multinationales sont plus compétitives que les firmes domestiques ; leur pouvoir de marché, en termes d'avantages technologiques, de marque ainsi que des techniques avancées de marketing inhibent le déclenchement de l'effet d'entraînement de manière significative.

#### 5. L'effet de l'IDE sur la croissance économique :

<b>Méthode d'estimation: 2MCO/Modèle:</b>	
<b>Variable dépendante : Cr</b>	<b>Période : 1970 – 2008</b>
Constant	-3,886191
	-,544
KH	-,102469
	-,662
IDE	,101812
	(,074 )
ID	,143280
	(,661 )*
EXPORT	,258425
	,753
$R^2 = 0,20861$	
$F = 0,194$	
IDE : investissement direct étranger, C: constante, Cr: croissance du PIB/Tête, KH : capital humain, ID: production d'énergie, EXPORT: l'ouverture économique, ***, ** et * indiquent respectivement un niveau de significativité de 1%, 5% et 10%. ( ) : Les chiffres entre parenthèses sont les t de Student.	

Les résultats de l'ajustement de l'équation montrent que toutes les variables explicatives ont le signe attendu théorique, exception faite du capital humain. Ils décèlent le rôle prépondérant des déterminants classiques de la croissance économique (ID, EXPORT). L'IDE semble agir positivement sur la croissance économique mais de manière statistiquement non significative.

#### L'effet significatif de complémentarité pour les exportations:-

Les multinationales horizontales se réalisent en fonction de l'arbitrage du coût de l'échange. Ce coût affecte et détermine la décision ou non de s'implanter à l'étranger. Si ce coût est bas, la firme préfère produire localement et servir les marchés étrangers par le biais des exportations. Si ce coût est élevé, la firme a intérêt de se multinationaliser afin de détourner les barrières douanières et servir la demande étrangère pour l'unité délocalisée.) (note de bas de page) La majorité des IDE attirés par les pays en voie de développement (PVD), en l'occurrence le Maroc, sont des investissements de nature verticale. C'est ce qui justifie que l'origine des IDE drainés vers les pays en voie de développement sont d'origine des pays développés (l'Union européenne, les États-Unis, etc.)<sup>3</sup>

#### L'effet négatif non significatif du capital humain:-

Le signe attendu non significatif pour le seuil de signification de 5% semble imputé en partie au choix même de l'indicateur, même si pour le cas du Maroc, et pour d'autres pays en voie de développement (PVD), on constate qu'il y a une inadéquation entre les besoins des structures productives et le système d'enseignement, ce qui donne lieu à la fois à une faible productivité des nouveaux travailleurs et des effets d'apprentissage insuffisants pour générer des gains de productivité significatifs lors des transferts de nouvelle technologie. Cette absence de complémentarité entre la technologie et le niveau d'éducation requis aggrave le problème de l'assimilation et de la maîtrise des nouvelles technologies pour le cas du Maroc. Parallèlement, la formation de la main d'œuvre révèle des lacunes du système éducatif marocain et influence par voie de conséquence la productivité du facteur travail. Ces lacunes trouvent leurs explications en grande partie dans l'absence d'une vision claire des choix politiques en matière de la gestion des priorités éducationnelles et des objectifs stratégiques de développement. Les choix

<sup>3</sup>Pour le cas du Maroc, les IDE dirigés vers les pays en provenance de l'Union Européenne présente 50%.

politiques impliquent une baisse de la qualité de la formation de la main d'œuvre de moins en moins adaptée au marché du travail et au niveau de développement du pays <sup>4</sup>

De plus, le capital humain se trouve affecté significativement par la variable présentant le degré de l'urbanisation. L'appartenance aux zones urbaines contribue effectivement à l'amélioration de la qualité du capital humain. Les économies d'agglomération favorisent l'accès aux différents services et institutions sociales, culturelles, sanitaires et politiques. L'ensemble de ces facteurs améliorent la qualité du capital humain (formation, santé, éducation et loisirs). Les effets positifs et non significatifs des dépenses d'éducation et de santé rapportées au PIB peuvent s'expliquer par le niveau faible de ces dépenses par rapport aux attentes de la population qui ne cesse d'évoluer et de s'agglomérer dans le milieu urbain à cause de l'exode rurale.

#### **IDE-croissance:-**

Les caractéristiques de l'IDE peuvent expliquer en grande partie l'effet non significatif de l'IDE : sa volatilité, sa dépendance aux opérations de privatisation, sa faiblesse par rapport à l'attractivité potentielle et par rapport aux pays ayant des économies similaires et l'absence de réinvestissement des revenus générés des premiers investissements sont les principaux facteurs explicatifs de la non significativité de l'IDE sur la croissance économique. Quant aux investissements directs étrangers, le test économétrique soulève un effet positif non significatif. Parallèlement, les IDE se concentrent dans des industries peu porteuses en terme de transfert technologique. Les activités de concentration entre les branches sont limitées.

S'ajoutant à ceci, la concentration de l'IDE dans des secteurs où la contribution des nouvelles technologies est moins importante (Textile par exemple). L'IDE n'est pas pour autant significatif, bien qu'il soit de signe positif. Un tel constat pourrait être justifié par la concentration de l'IDE dans le secteur de l'industrie, dans le secteur de l'énergie surtout " certains types d'IDE, ceux qui forment des enclaves dans les ressources naturelles et le pétrole, devraient avoir une contribution relativement plus faible sur la croissance économique " (LTM, 2007). Ainsi la contribution à la croissance peut se limiter à la réalisation des revenus.

L'ensemble des résultats obtenus permettent de conclure avec beaucoup de prudence et de recul que l'effet de l'IDE sur la croissance est positif, à condition qu'il existe un minimum nécessaire de conditions économiques préalables, qui aident l'IDE à exercer ses effets économiques attendus.

Mais, pour le cas du Maroc, nous avons enregistré un effet négatif non significatif du capital humain sur la croissance économique, effets dûs aux problèmes du système éducatif du pays, et ayant un lien fort et étroit avec les effets attendus de l'IDE. Les retombées technologiques sont limitées. On peut de même expliquer la faiblesse des IDE par un certain nombre de facteurs structurels : l'instabilité politique, lourdeurs administratives, corruption, etc. C'est ce que nous chercherons à évaluer dans le cadre du modèle à effets indirects;

#### **Conclusion:-**

Sur la base des résultats obtenus, un certain nombre de recommandations peuvent être formulées à l'issue de cette conclusion:

- La politique d'attractivité doit être au centre des préoccupations des politiques économiques de croissance et de développement. Des efforts doivent être résolument engagés afin de moderniser les services de l'administration publique, simplifier et alléger les procédures administratives, investir davantage dans les infrastructures routières, ferroviaires et portuaires.
- Elle doit de même procéder à une réforme et une refonte du système judiciaire chargé de la sanction du non respect des engagements, veiller à ce que les droits de propriété soient pleinement respectés et assurés.

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<sup>4</sup>En outre, le système éducatif et d'enseignement au Maroc se caractérise par l'instabilité des programmes et du mode de formation qui privilégie la répétition plutôt que la réflexion sur les aptitudes innovatrices de la main d'œuvre. De même, on peut souligner les problèmes posés par le programme d'ajustement structurel, qui par leur objectif budgétaire, fige le système éducatif et limite les possibilités de réformes et de modernisation nécessaires. La difficulté de gestion du système éducatif peut être surmontée pour peu que nous ajustions les moyens financiers destinés au système et aux besoins. En fait, le taux de scolarisation et le nombre des enseignants ne cesseront d'augmenter devant les ressources allouées au système. Il en résulte un manque de motivation et une baisse de la qualité de la formation de ce dernier.

- Les effets de l'IDE sur la croissance économiques doivent être étudiés en présence de la problématique de l'attractivité et dans le cadre d'une approche systémique exhaustive et multidimensionnelle.
- L'investissement domestique doit cohabiter avec l'IDE en générant "un effet d'entraînement". La mise à niveau des entreprises locales et l'encouragement/renforcement du secteur privé est de nature à améliorer leur compétitivité face à celle des multinationales.
- La diversification des exportations doit être poursuivie en ciblant les investissements orientés vers les exportations à fortes valeurs ajoutées.
- Une politique proactive en matière du système éducatif et de la formation professionnelle doit être envisagée compte tenu du fait que l'IDE ne peut générer ses effets escomptés sans l'existence préalable d'un seuil quantitatif et de qualification d'un capital humain capable de s'approprier et imiter la technologie transférée et incorporée.

## Annexes :-

**Table 3:-** Classification des variables

Dime nsions	Vari ables	Signification	Source
Econ omique	Cr	Croissance du PIB/tête	WDI (2012)
	IDE	IDE en pourcentage du PIB	WDI (2012)
	KH	Taux de scolarisation brut au niveau secondaire	WDI (2012), UNESCO Statistical Yearbooks
	IDE	FBCF en pourcentage du PIB	WDI (2012)
	EXP	Exportations en pourcentage du PIB	WDI (2012)
	ORT		
	CRE	Crédit accordé au secteur privé en pourcentage du PIB	WDI (2012)
	DIT		
	ENE	Production d'énergie exprimée en 1000 T.E.P	WDI (2012)
	RGIE		
	EPA	Epargne domestique en pourcentage du PIB	WDI (2012)
	RGNE		
	INF	Taux d'inflation annuel	WDI (2012)
	LATION		
	INT	Taux d'intérêt réel	WDI (2012)
	ERET		
	M2	Masse monétaire au sens de M2	WDI (2012)
	OU	Ouverture économique	WDI (2012)
	VERT		
	TX	Taux de change du dollar en monnaie local	WDI (2012)
	CHANGE		
	Libe	Variable indicatrice qui mesure l'ouverture	-
	r		
Socio culturelle	Déd ucation :	Dépenses d'éducation en pourcentage du PIB	WDI (2012)
	UR BAN	Population urbaine en % de la population totale	WDI (2012)

**Table 4:-** Test de stationnarité de l'ensemble des variables

Variables	Test de Dickey-Fuller augmenté		Test de Phillips-Perron		L'ordre d'intégration
	En niveau	En différence 1ère	En niveau	En différence 1ère	
<b>Cr</b>	-2.723	-3.770 **	-9.544 *	-21.668 *	I(1)
( -3.542 )	( -3.546 )	( -3.5312 )	( -3.534 )		
<b>IDE</b>	-1.529	-4.215 **	-3.833 **	-11.294 *	I(1)
(3.538)	( -3.542 )	( -3.531 )	( -3.5348 )		
<b>Export</b>	-2.723	-5.354 **	-9.544 *	-21.668 *	I(1)
( -3.542 )	( -3.5468 )	( -3.5312 )	( -3.534 )		

<b>KH</b>	-1.778996	-2.670595	-1.573071	-5.25360 0 *	I(2)
( -3.5426 )	( -3.5468 )	( -3.5312 )	( -3.5348 )		
<b>ID</b>	-2.429	-3.33 9 ***	-2.177084	-4.56969 4 **	I(1)
( -3.542 )	( -3.205 )	( -3.5312 )	( -3.5348 )		
<b>CREDIT</b>	-1.855446	-2.850991	-1.485814	-7.03657 8 *	I(2)
( -3.5426 )	( -3.5468 )	( -3.5312 )	( -4.2242 )		
<b>ENERGIE</b>	-2.883716	-3.79191 6 **	-2.395346	-5.29159 1 *	I(1)
( -3.5426 )	( -3.5468 )	( -3.5312 )	( -4.2242 )		
<b>Déduction</b>	-2.750389	-3.94634 6 **	-4.077784	-9.61936 0 *	I(1)
( -3.5426 )	( -3.5468 )	( -4.2165 )	( -3.5348 )		
<b>OUVER</b>	-1.857193	-3.84151 3 **	-1.870799	-6.65316 7 *	I(1)
( -3.5456 )	( -3.5478 )	( -3.5312 )	( -4.2242 )		
<b>INTERET</b>	-2.274688	-3.70748 8 **	-3.074952	-10.0246 1 *	I(1)
( -3.2426 )	( -3.5368 )	( -3.4312 )	( -3.5348 )		
<b>EPARGNE</b>	-1.726447	-4.56805 3 **	-2.497602	-8.16488 0 *	I(1)
( -3.5348 )	( -3.5386 )	( -3.5312 )	( -3.5348 )		
<b>M2</b>	0.034674	-2.209016	0.104596	-7.94756 1 *	I(2)
( -3.5426 )	( -3.5468 )	( -3.5312 )	( -3.5348 )		
<b>TEL</b>	-1.024354	-1.871326	-0.280732	-3.8272 8 **	I(2)
( -3.5348 )	( -3.5386 )	( -3.5312 )	( -3.5348 )		
<b>TXCHANGE</b>	-2.251037	-3.92728 8 **	-2.455455	-6.67221 5 *	I(1)
( -3.5348 )	( -3.5386 )	( -3.5312 )	( -4.2242 )		
<b>INFLATION</b>	-6.43151 5 *	-	-4.2165	-	I(0)
( -4.2242 )	( -4.2165 )				
<b>URBAN</b>	-1.067992	-2.098571	1.222275	-1.988916	I(2)
( -3.5426 )	( -3.5468 )	( -3.5312 )	( -3.5348 )		
<b>DUM</b>	-1.749627	-3.5426	-3.5312	-3.5348	I(2)
( -3.5426 )	( -3.5468 )	( -3.5312 )	( -3.5348 )		
<b>DUM</b>	-1.749627	-3.5426	-3.5312	-3.5348	I(2)
( -3.5426 )	( -3.5468 )	( -3.5312 )	( -3.5348 )		
<b>SANTPIB</b>	-1.989	-3.98332 9 **	-4.05681 5 **	-	I(1)
( -3.5426 )	( -3.5468 )	( -3.5312 )			
<b>INFRPIB</b>	-2.283677	-3.39850 8 **	-5.264 3 **	-	I(1)
( -3.5426 )	( -3.5468 )	( -3.534 )			

## References:-

1. Andreff ., W(1996), *Les Multinationales Globales*, Edition la Découverte.
2. Andreff ., W(1996), “La déterritorialisation des multinationales : firmes globales et firmes-réseaux ”, *Cultures et Conflits*, n°21/22..
3. Agosin, M. & Mayer, R., (2000), “Foreign Direct Investment In Developing Countries : Does it Crowd in Domestic Investment ?” *UNCTAD Discussion paper*, n° 146.
4. Aitken, B. Harrison, A. and Lipsey, E. R., (1996), “Wages and Foreign Ownership : A Comparative Study of Mexico, Venezuela, and the United States”, *Journal of International Economics*, Vol. 40, p. 343-371.
5. Aliber R-H.,(1970), “A Theory of Direct Foreign investment”, In C-P. Kindleberger, Chapter 1, p.17-34.
6. ANIMA(2010), *Investissement directs étrangers et partenariats vers les pays MED en 2009*.
7. Arestis, Philip, and Panicos Demetriades.,(1997),“ Financial Development and Economic Growth : Assessing the Evidence ”, *The Economic Journal*, 107, May, p.783-99.
8. Assiedu, E., (2002), “ On the determinants of foreign direct investment to Developing countries: Is Africa Different?” , *World Development*, 30, p.107-19.



9. Assiedu, E., (2003 a), " Foreign Direct investment to Africa: The Role of Government Policy, Governance and Political Instability". Working Paper, University of Kansas.
10. Asiedu, E., (2003 b), " Policy Reform and Foreign Direct Investment to Africa: Absolute Progress but Relative Decline", mimeo, Department of Economics, University of Kansas, United States.
11. Auray B. , Bailly A. , P-H. Derycke , J-M Huriot., (1994) , *Encyclopédie d'économie spatiale* , Economica, Paris , p.19. .
12. Banque Mondiale, (2006), "Promouvoir la croissance et l'emploi par la diversification productive et la Compétitivité ", 14 mars 2006 . - CNUCED (2005), "Le Développement Economique en Afrique : Repenser le Rôle de l'investissement étranger direct ", Nations Unies, New York et Genève.
13. Barro J. Robert ., (1997), *Determinants of Economic Growth*, MIT Press, Cambridge. .
14. Blomström M., (1989), "Foreign direct investment and spillovers : A case study of technology transfer to Mexico", London, Routledge
15. Blomstrom M. et Kokko A., (1998), "Multinational corporations and spillovers", *Journal of Economic Surveys*, Vol. 12, n° 3, p.247-277
16. Blomström M. et Wang J.Y., (1992), "Foreign investment and technology transfer : A simple model ", *European Economic Review*, n° 36, p.137-155
17. Borensztein E., De Gregorio J. et Lee J-W., (1998), "How does foreign direct investment affect economic growth", *Journal of International Economics*, Vol. 43, n° 45, p.115-135
18. Borensztein E. and De Gregorio J., (1995), "How Does Foreign Direct Investment Affect Economic Growth", *NBER Working Paper*, n°5057 .
19. Buckley (P-J), (1993), "Contemporary Theories of International Direct Investment ", *Revue économique*, Vol. 44, n°4, juillet .
20. Bye . M ., (1957), "L'autofinancement de grande unité territoriale, et les dimensions temporelles de son plan ", *Revue d'Economie Politique*, n° 67, mai-juin . D'après Jacquemont P. , *la firme multinationale : une introduction économique* , Economica, 1990, p. 117.
21. Caves R.E., (1982), "Multinational enterprise and economic analysis", *Cambridge University Press*, Cambridge, 61p.
22. CNUCED (2005), "Les sociétés transnationales et l'internationalisation de la recherche et développement", *World Investment Report*, Unites Nations Publication, New York et Genève
23. CNUCED (2008), "Sociétés transnationales et leurs rôles dans infrastructures", *World Investment Report*, Unites Nations Publication, New York et Genève.
24. Coase (R-H), (1987), "The nature of the firm", *Revue française d'Economica* .
25. Courlet C ., (1989), *Territoires et régions, les grandes oubliées du développement économique* , L'Harmattan, p.34.
26. Crabbé, Philippe ., (1997). *Le développement durable : concepts, mesures et d'efficacités des marchés et des politiques au niveau de l'économie ouverte, de l'industrie et de l'entreprise*, Document
27. Dabla-Norris, Honda, Lahreche, Verdier (FMI) (2010), "FDI Flows to Low-Income Countries: Global Drivers and Growth Implications".
28. Dunning, J. H., (1995), "The Eclectic Paradigm in an Age of Alliance Capitalism ", *Journal of Business Studies*, p.463.
29. Dunning, J. H., (2001), "The Eclectic (OLI) Paradigm of International Production: Past, Present and Future ", *International Journal of Economics of Business*, Vol. 8, n° 2.
30. Dunning, J. H., (1998), "Multinationals, Technology and Competitiveness", Unwin Hyman.
31. *Economie Internationale*, n°71, 3° trimestre, p. 135-167
32. Fontagné Lionel, Gurérin Jean-Louis et (1997), "L'ouverture catalyseur de la croissance ", *Economie Internationale*, n°71, 3° trimestre, p. 135-167.
33. Gannagé E., (1985), "Théories de l'investissement direct étranger", *Economica* .
34. Görg and Greenaway ., (2001), "Foreign Direct Investment GEP ", *Research Paper*, n°37, Leverhulme Centre.
35. Guellec Dominique et Pierre Ralle., (1995), *les nouvelles théories de la croissance, la Découverte*, 123p.
36. Harrison A. and McMillan M., (2002) "Does direct foreign investment affect domestic firms credit constraints?" , *University of California, Berkeley*.
37. Henner H.F., (1997), *Commerce international* , 3ème Edition, Montchrestien.
38. Jansen K., (1995), "The macroeconomic effects of direct foreign investment: The case of Thailand", *World Development*, Vol. 23, n° 2, p. 193-210.
39. Jean Arrous., (1999) , *Les Théories de la croissance*, Le seuil, livre "savant" mais remarquablement clair.
40. J-L-Mucchielli ., (1985), *Les FMN mutations et nouvelles perspectives* , Economica .

41. K.Kojima ., (1978), *Direct foreign investment a model of multinational business Operations* , croom Helm.
42. L-Dunning., (1981) , *International Production and the Multinational Entreprise* ,Londres G.Allen and Unwin .
43. Lucas E.Robert .,(1988), “On the mechanics of economic development,” *Journal of Monetary Economics*, 22, p.3-42.
44. Lutz, Matthias .,(2001), “Globalisation, Convergence and the case for openness in Developping Countries : What Do We Learn From Open Economy Growth Theory and Empirics ” , *CSGR working paper*, 72/01, May. .
45. M.Bellet .,(1992), “Technologie et territoire : L'organisation comme objet de recherche ” , *Revue Française d'Economie* vol 7, n°1, hiver , p.86. A47
46. M.Storper, définit le territoire comme : « Un stock d'actifs relationnels » cité par A-L.Saives 1996 op,cit , p. 58.
47. Malinvaud, E., (1991), *Voies de la recherche macro-économique*, Ed. Odile Jacob Patric .
48. Mallampally P., K. and Sauvart .,(1999), “Foreign Direct Investment in Developing Countries”, *Finance and Development*, Vol.36, n°1.
49. Markusen, J.R and Venables, A.J., (1999), “Foreign Direct Investment as a Catalyst for Industrial Development”, *European Economic Review*, vol. 43, p.335-356.
50. Marouane ALAYA (2006), “ L’investissements directs étrangers et croissance économique : une estimation à partir d’un modèle structurel pour les pays de la rive sud de la méditerranée ”, 7èmes journées scientifiques du réseau « Analyse Economique et Développement de l’AUF », Université Montesquieu-Bordeaux IV.
51. Michalet(C-A).,(1985), *Le capitalisme mondial*, 2ème édition .
52. Michalet(C-A).,(1994), “Globalisation et gouvernance : les rapports des Etats-Nations et des transnationales”, *Mondes en Développement*, Tome 22, n° 88.
53. Michalet (C-A).,(2005), “L’impact en Europe des délocalisations vers les pays de la méditerranée”, Notes et Etudes ANIMA, n°8 .
54. Morisset J. et Lumenga N.O., (2002),“Administrative barriers to foreign investment in developing countries”, *Transnational corporations*, Vol.11, n°2, UNCAD/ITE/IIT/31, August.
55. Morisset, J., (2000),“Foreign Direct Investment in Africa: Policies Also Matter”, *Policy Research Working Paper*, n° 2481.
56. Mucchielli J.L. et Sollogoub M., (1980), *L'échange international, fondements théoriques et analyses empiriques*, Economica, Paris.
57. Mucchielli J-L., (2002), “IDE et exportations : Compléments ou substituts ”, *Economie Internationale*, n° 2751, 6 Mars, p.25-286-457.
58. Mucchielli J-L., (2003),“Les déterminants et les impacts de la multinationalisation des entreprises”, *Archives audiovisuelles de la rcherche en sciences humaines et sociales*.
59. Mucchielli J-L., (2005), *Relations économiques internationales*, Ed Hachette, Paris, 159 p.
60. Mundell (R-A).,(1957), “International Trade and factor mobility”,*The American Economic Review* ,Vol.47.
61. Muchielli J.L., (1991),“De nouvelles formes de multinationalisation : les alliances stratégiques”, *Problèmes économiques*, n° 2234, Juillet, p. 25-32.
62. Muchielli J-L. et Mayer T., (1997).,“Les déterminants des investissements directs à l'étranger : les choix ide/exportations et les choix de localisation dans les modèles récents”, in B. Lassudrie-Duchêne (ed) *Connaissances économiques*, Economica, Paris, p.307-324, 357p.
63. Muchielli J-L. et Mayer T., (2005), *Economie internationale*, Ed Dalloz, Paris, 496.p
64. OCDE ., (2002), L'investissement direct étranger au service du développement: optimiser les avantages minimiser les coûts, Paris.
65. Perroux F.,(1961), *L'économie du XX siècle*, Paris, PUF, 3 éd. 1969, dans Oeuvres complètes,tome V, Grenoble, PUG, 1991.
66. Pissarides A. Christopher., (1997) , “ Learning by trading and the returns to human capital un developing countries ”, *The World Bank Economic Review*, vol.11, p.17-32.
67. P-J Buckley., (1993) ,*Contemporary Theories of International Direct Investment* , Revue économique, Volume 44 n°4, juillet , p.731-732.
68. R-A-Mundell ., (1990) ,“International Trade and factor, mobility ”, *the American Economic Review* ; vol 47,1957.D'après P-Jacquemont , *la firme multinationale : une introduction économique*, Economica .
69. Rebelo, Sergio ., (1998),“Long Run Policy Analysis and Long Run Growth”, *Journal of Political Economy*, vol. 99, p. 500-521. .
70. Rivera-Batiz, Luis A. et Paul M. Romer.,(1991), “Economic Integration and Endogenous Growth”, *Quarterly Journal of Economics*, vol. 106, p. 531-556.
71. Rodriguez-Clare .,(1996),“Multinationals, Linkages, and Economic Development”, *American Economic Review* , vol86 (4), p852-873.

72. Romer, Paul .,(1986), “Increasing returns and long-run growth”, *Journal of Political Economy*, Vol 94 n°5 p.1002-1037
73. Romer, M.Paul .,(1990), “Endogenous Technological Change ”, *Journal of Political Economy*, Vol 98, n°5, Part 2 , p.71-102
74. Sachwald, Perrin (Institut français des relations internationales /Agence française de développement) (2003), “ Multinationales et développement : le rôle des politiques nationales ”.
75. Sekkat K. et Véganzonès-Varoudakis M.A., (2004),“Trade and Foreign Exchange Liberalization, Investment Climate, and FDI in the MENA countries”, *Working Paper Series* n° 39, p.1-27. 463
76. Stiglitz, J.,(2002) , *Globalisations an its Discontents*, Allen Lane, London.
77. Y. Aboutaib(2004), “ Les IDE et la compétitivité des entreprises et de l’économie marocaine ”, Séminaire Doctoral, Université de Nice Sophia Antipolis.
78. Zia, Rizvi (Institute of Business Managt., Pakistan) (2009), “ The Impact of Foreign Direct Investment on Employment Opportunities”.

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### RESEARCH ARTICLE

#### PULMONARY INTERSTITIAL EMPHYSEMA PRESENTING IN A WOMAN ON THE INTENSIVE CARE UNIT: CASE REPORT AND REVIEW OF LITERATURE

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#### Abstract

**Introduction:** Pulmonary interstitial emphysema is a life-threatening form of ventilator-induced lung injury. We present one of the few reported adult cases of pulmonary interstitial emphysema in a woman with respiratory failure admitted to our intensive care unit.

**Case presentation:** An 87-year-old Caucasian woman with a diagnosis of community-acquired pneumonia was admitted to our intensive care unit requiring invasive ventilation. The combination of a poor oxygenation index and bilateral alveolar/interstitial infiltrates on a chest radiograph fulfilled the criteria for adult respiratory distress syndrome; the cause was thought to be a combination of the direct pneumonic pulmonary injury and extrapulmonary severe sepsis. By day seven, the fraction of inspired oxygen, peak airway and positive end expiratory pressures weaned sufficiently to allow an uncomplicated percutaneous tracheostomy. On day 10, problems with ventilation necessitated recruitment maneuvers with a Mapleson C circuit, after which dramatic surgical emphysema was noted. An upper airway bronchoscopy showed no obvious tracheal wall injury, and computed tomography of her chest showed extensive surgical emphysema, perivascular emphysema and peribronchial emphysema, which were consistent with a diagnosis of pulmonary interstitial emphysema. Over the following days, despite protective ventilatory strategies and intercostal tube thoracostomy, lung compliance along with oxygenation deteriorated and our patient died on day 14.

**Conclusion:** The development of pulmonary interstitial emphysema is a rare but real risk when caring for patients with worsening lung compliance on the intensive care unit. Improved awareness of the condition, early protective ventilation strategies and timely treatment of any of the lethal complications will hopefully result in improved survival from the condition in adults.

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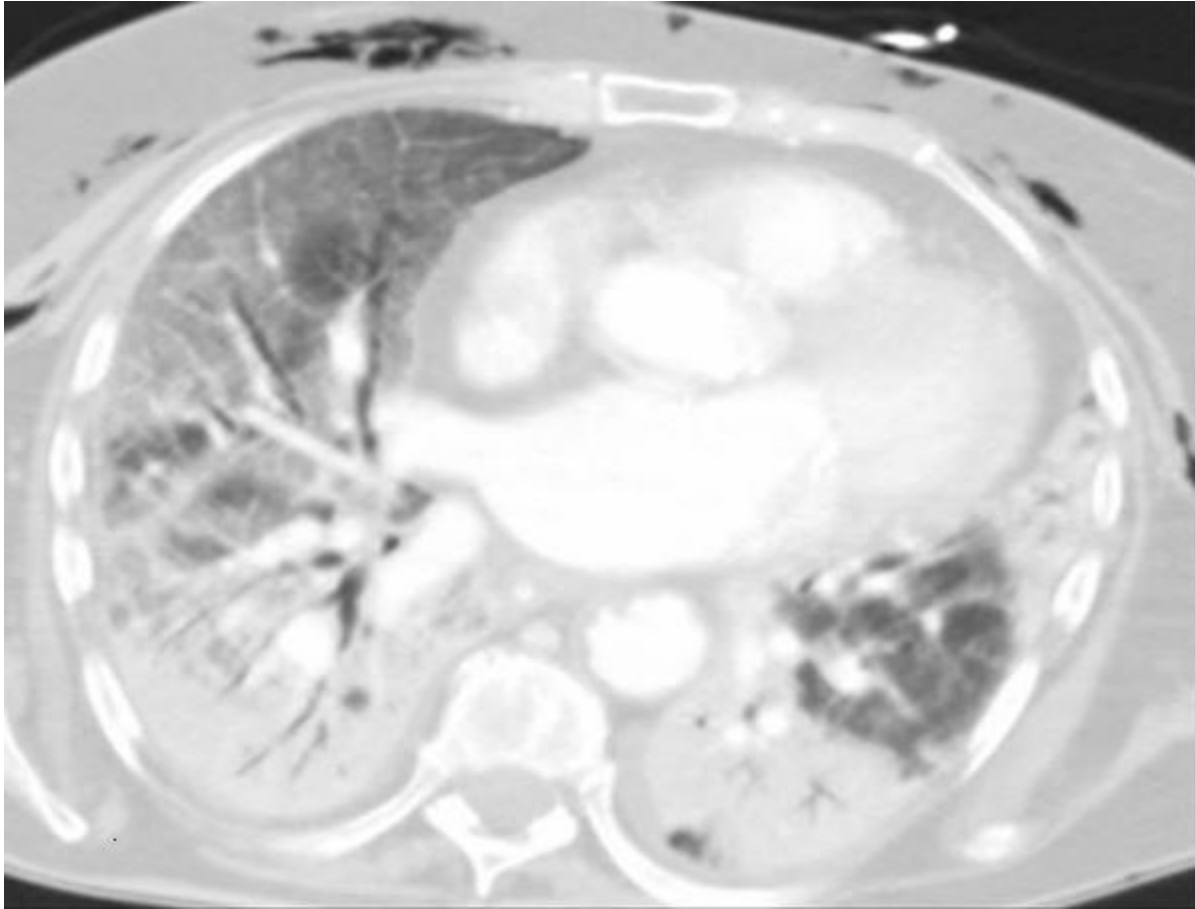
#### Introduction:-

Pulmonary interstitial emphysema (PIE) is a barotrauma-related life-threatening condition, not uncommon to the neonatologist caring for pre-term babies. For the intensivist, despite being confronted by significant compliance

issues resulting from the fibroproliferative phase of adult respiratory distress syndrome (ARDS) on a daily basis, PIE in the critically ill adult is an extremely rare occurrence. The infrequency of PIE on the intensive care unit means that recognition of the condition, knowledge of its clinical sequelae, and its management among physicians is poor. We present the case of a woman admitted to our unit, who developed PIE, and died. We believe this to be one of the only few reported adult cases of barotrauma-related PIE.

### **Case Presentation:-**

An 87-year-old Caucasian British woman presented to our emergency department with a three-day history of shortness of breath, pyrexia and non-productive cough. Her only significant past medical history was well controlled hypertension. She was independent in her daily activities, did not smoke cigarettes and reported a good cardiorespiratory reserve prior to the onset of symptoms. The diagnosis of community-acquired multilobar pneumonia was made with a CURB-65 score of three. She was admitted to the high dependency unit with type 1 respiratory failure and a high alveolar-arterial oxygen gradient. She received intravenous antibiotics (piperacillin/tazobactam and erythromycin) and non-invasive high-flow continuous positive airway pressure (CPAP). By the fourth day, our patient had deteriorated, with a chest radiograph showing bilateral alveolar and interstitial infiltrates and a ratio of partial pressure of arterial oxygen to the fraction of inspired oxygen ( $\text{PaO}_2/\text{FiO}_2$ ) of  $< 26.6$  kPa, which required invasive ventilation. The criteria for ARDS were met and the cause was thought to be a combination of the direct pneumonic pulmonary injury and extrapulmonary severe sepsis. With protective lung ventilation, low dose methylprednisolone, antibiotic therapy and a negative fluid balance, gradual improvement was made; over the following five days respiratory parameters weaned sufficiently to allow an uncomplicated percutaneous tracheostomy to be performed. On day 10, a period of desaturation required recruitment maneuvers with a Mapleson C circuit that resulted in notable surgical emphysema. The cause was thought to be a tracheal injury sustained at the time of tracheostomy insertion. An adjustable flange tube was positioned under bronchoscopic guidance just proximal to the carina in an attempt to limit any further tracking of air through the potential tracheal defect. Despite these measures, a high alveolar-arterial oxygen gradient and peak airway pressures persisted. A chest radiograph showed more homogenous central pulmonary alveolar shadowing. An upper airway bronchoscopy showed no obvious tracheal wall injury and computed tomography (CT) of her chest showed extensive surgical emphysema and a small anterior left sided pneumothorax. On further review of the CT scan, it was felt that the perivascular and peribronchial emphysema was consistent with a diagnosis of pulmonary interstitial emphysema (Figure 1). Over the following days, despite protective ventilatory strategies and intercostal tube thoracostomy, lung compliance along with oxygenation deteriorated. By day 13, the deteriorating respiratory parameters along with inotropic requirements resulted in a decision to limit therapy and the patient died on day 14.



**Figure 1:-**

**Axial CT chest scan:-**

**Discussion:-**

In a large retrospective study, Greenough *et al.* found the incidence of PIE in pre-term infants requiring ventilation for respiratory distress syndrome to be around 19.5%, with a mortality rate of 24% [1]. These figures are known to be falling with the growing use of new ventilation strategies and availability of high frequency oscillatory ventilation. PIE almost exclusively occurs as a result of intermittent positive pressure ventilation (IPPV) with peak airway pressures exceeding 30 cm H<sub>2</sub>O [2]. When high airway pressures and dramatic shearing forces are applied to a non-compliant lung unit, the result is alveolar duct rupture, usually at the terminal bronchiole/alveolar junction [3]. This allows air to escape into the connective tissue of the peribronchovascular sheaths, interlobular septa and visceral pleura, occasionally migrating into the lymphatic and venous circulation [3]. The emphysema can be localized, unilateral or, as in our case, bilateral and diffuse. Pre-term babies are particularly prone to PIE, because of the high shearing forces and airway pressures required to re-recruit lung units with collapsing pressure exceeding their functional residual capacity, secondary to reduced surfactant levels [3]. Other postulated risks for PIE include increased amount of pulmonary connective tissue or a sudden reduction in extravascular lung water, which may offer a degree of protection against tracking interstitial emphysema. Poor lung compliance was pivotal in our case, but a reduction in extravascular lung water also perhaps had a role to play in the development of PIE.

Interstitial emphysema has a number of potentially detrimental sequelae [1, 4]. These include: compression atelectasis of adjacent healthy lung and resulting intrapulmonary shunt which is worsened by recruitment maneuvers; compression of surrounding pulmonary vasculature; and decompression of interstitial blebs into surrounding spaces, potentially resulting in pneumomediastinum, pneumothorax, pneumopericardium, pneumoperitoneum and surgical emphysema.

Although all the above can be very difficult to manage in a critically ill patient, the addition of a pneumothorax to PIE alone doubles the mortality [1].

PIE is generally felt to be a radiographic and pathologic diagnosis, although the presence of recurrent pneumothoraces and large persistent alveolar-arterial gradient in the presence of high peak airway pressures should at least arouse a suspicion of its presence.

Chest radiograph findings are often very subtle, and identification, given the frequent presence of overlying dense alveolar shadowing as a result of the lung injury and exudative processes, make the diagnosis difficult. However, the following findings may sometimes be distinguishable [4, 5, 6]: parenchymal stippling; lucent mottling and streaking extending to the mediastinum; perivascular halos (from perivascular air collections); subpleural cysts; lucent bands; and parenchymal cysts or bullae.

CT is a more sensitive tool for delineating the pathology, and the classic findings of tracking perivascular and peribronchial emphysema [7] were both demonstrated in our case (Figure 1).

The chosen treatment will, to an extent, depend on the distribution of the disease along with the severity and complications. The mainstay of treatment is to achieve adequate oxygenation with lower mean and peak airway pressures, hence minimizing interstitial leak through the defects [8]. This technique of protective lung ventilation and permissive hypercapnia is a familiar one to intensivists trying to avoid the many ramifications of volutrauma and barotrauma. There are a number of other therapeutic options that may be considered. Lateral decubitus positioning with the affected lung in the dependent position can be tried as an early conservative approach, encouraging plugging of the dependent lung. This is only of benefit when the disease is localized. Selective main bronchial intubation and occlusion can be useful, although only for unilateral disease. High-frequency ventilation (high frequency jet ventilation or high frequency oscillatory ventilation) can also be effective. Finally, extracorporeal membrane oxygenation can be used [1, 2, 3, 8].

Beyond these mainstays of treatment, there have been some case reports and series regarding the use of steroids and surgical resection for persistent localized disease, but such therapies have not established a good evidence base as yet.

Once the diagnosis of PIE is established, a high degree of vigilance must be maintained for any potentially serious complications, coupled with prompt and appropriate interventions.

### **Conclusion:-**

The meticulous employment of protective lung strategies throughout intensive care units has been a vital step towards avoiding volutrauma and/or and improving outcomes and survival in acute lung injury (ALI) and ARDS [9]. However, despite these measures, development of the fibroproliferative and fibrotic phases of ALI and ARDS are commonplace. The associated reduction in lung compliance produces a new range of challenges, which is distinct from the exudative and/or hypoxia phase faced in the early disease.

Recruitment maneuvers are commonly undertaken on the intensive care unit. They are vital for increasing the functional residual capacity above the closing capacity, and therefore providing improved lung compliance and oxygenation. When undertaking recruitment maneuvers and interpreting peak airway pressures, it is important to remember the differential lung time constants encountered throughout the diseased lungs. These variations result in an uneven distribution of pressure across the alveoli, and areas of lung with long time constants are at high risk of barotrauma. It is these areas that are at particular risk of developing PIE when exposed to the shearing forces experienced during IPPV.

The development of PIE is a rare but real risk when caring for patients with worsening lung compliance. Improved awareness of the condition, early protective ventilation strategies and timely treatment of any lethal complications will hopefully result in improved survival from the condition in adults.

### **Consent:-**

Written informed assent was obtained from the patient's next of kin for publication of this case report and accompanying images.

**Declarations:-****Authors' original submitted files for images**

Below are the links to the authors' original submitted files for images.

13256\_2010\_1592\_MOESM1\_ESM.bmp Authors' original file for figure 1

**Competing interests:-**

The authors declare that they have no competing interests.

**Authors' contributions:-**

TJ was involved in the care of the patient. PS and TJ analyzed the case history and CT scans. PS and TJ were involved in drafting the manuscript and both authors read and approved the final manuscript.

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**References:-**

1. Greenough A, Dixon AK, Robertson NRC: Pulmonary Interstitial Emphysema. Arch Dis Child. 1984, 59 (11): 1046-1051. 10.1136/adc.59.11.1046.**View ArticlePubMedPubMed CentralGoogle Scholar**
2. Woodring JH: Pulmonary interstitial emphysema in the adult respiratory distress syndrome. Crit Care Med. 1985, 13 (10): 786-791. 10.1097/00003246-198510000-00003.**View ArticlePubMedGoogle Scholar**
3. Plenat F, Vert P, Didier F, Andre M: Pulmonary interstitial emphysema. Clin Perinatol. 1978, 5 (2): 351-75.**PubMedGoogle Scholar**
4. Kemper AC, Steinberg KP, Stern EJ: Pulmonary interstitial emphysema: CT findings. AJR. 1999, 172 (6): 1642-**View ArticlePubMedGoogle Scholar**
5. Unger JM, England DM, Bogust JA: Interstitial emphysema in adults: recognition and prognostic implications. J Thorac Imaging. 1989, 4 (1): 86-94. 10.1097/00005382-198901000-00015.**View ArticlePubMedGoogle Scholar**
6. Westcott JL, Cole SR: Interstitial pulmonary emphysema in children and adults: roentgenographic features. Radiology. 1974, 111 (2): 367-378.**View ArticlePubMedGoogle Scholar**
7. Satoh K, Kobayashi T, Kawase Y, Mitani M, Nakano S, Takahashi K, Takashima H, Ohkawa M, Tanabe M, Kojima K: CT appearance of interstitial pulmonary emphysema. J Thorac Imaging. 1995, 11 (2): 153-154.**View ArticleGoogle Scholar**
8. Frantz ID, Stark AR, Westhammer J: Improvement in pulmonary interstitial emphysema with high frequency ventilation. Pediatr Res. 1981, 15: 719-**View ArticleGoogle Scholar**
9. The Acute Respiratory Distress Syndrome Network: Ventilation with Lower Tidal Volumes as Compared with Traditional Tidal Volumes for Acute Lung Injury and the Acute Respiratory Distress Syndrome. N Engl J Med. 2000, 342 (18): 1301-1308.**View ArticleGoogle Scholar**



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## RESEARCH ARTICLE

### ORAL PEMPHIGUS: CASE REPORT & TREATMENT STRATEGIES

Prof (Dr.) Muralee Mohan, Prof (Dr.) B Rajendra Prasad, Dr. Pratiksha Shetty and Dr. Neha Sharma.

#### Manuscript Info

#### Abstract

#### Manuscript History

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#### Introduction:-

Pemphigus is a potentially fatal skin disease characterized by the appearance of vesicles and bullae. Pemphigus comes from the word *pemphix* which in Greek means a bubble or a blister. Originally coined by Wichman in 1971, Pemphigus includes a group of autoimmune blistering diseases of skin and mucous membrane. Intradermal blisters are its pathognomonic clinical feature and histologically characterized by IgG antibodies directed against the cell surface of keratinocytes. There are three primary subtypes of the disease that is, Pemphigus vulgaris, Pemphigus foliaceus, and Paraneoplastic pemphigus. Out of these most commonly seen variant is pemphigus vulgaris.

This disease has a very strong immunogenetic predisposition. Blisters are associated with the binding of antibodies to keratinocytes, desmosomes & desmosome free areas resulting in loss of cell adhesion. Disease activity can be linked to antibody titer. It affects all races with an equal gender predisposition. Mean age of onset is 50 to 60 years; however it may affect the younger and older individuals as well. The bullous lesions contain thin, watery fluid shortly after appearance but may soon become purulent or sanguineous. On rupturing a raw eroded surface can be seen. The loss of epithelium caused by rubbing apparently unaffected skin is known as NIKOLSKY's SIGN. It occurs due to prevesicular edema that weakens the dermal-epidermal junction. Mucosal lesions often precede the lesions on the skin and other parts of the body. Patients may have irregularly shaped gingival, buccal or palatine erosions<sup>1</sup>. Affected individuals are unable to eat or drink due to the associated pain. It is characterized microscopically by suprabasilar split, acantholysis which causes clumps of cells to be suspended free within the vesicular space known as *Tzanck cells*<sup>1</sup>. Direct Immunofluorescent testing (DIF) seems to be the mainstay in diagnosing this lesion.

#### Case Report:-

A 34 year old patient reported to the department of Oral Medicine in AB Shetty Memorial Institute of Dental Sciences with the chief complaint of severe pain and burning sensation in the mouth with a resultant inability to eat and drink since the last three days. The ulcers first presented three months back on the tongue and the buccal mucosa and appeared like a white plaque, when the patient attempted rubbing it off it lead to bleeding and fluid discharge. Following this he took admission in a local hospital and was treated symptomatically. Remission occurred but within two weeks recurrence of ulcers was seen. Following this the patient also took homeopathic medication but the condition worsened and led to the present state. The patient had no history of tobacco consumption or any other addiction. No history of long-term treatment for any chronic illness, continuous drug intake or any significant family history. There was no significant finding on general examination. On intraoral examination multiple erosive lesions

were found with erythematous halo surrounding them, affecting bilateral buccal mucosa, tongue, floor of the mouth & lower lip with sloughing. Tenderness was present on palpation & Nikolsky's sign was positive. The clinical presentation of recurrent oral ulcers and positive Nikolsky's sign in this case led to provisional diagnosis of vesiculo-bullous lesion affecting the oral cavity. Differential diagnosis included aphthous stomatitis, chemical burns, pemphigus vulgaris, dermatitis herpetiformis, erythema multiforme bullosum, epidermolysis bullosa, erosive lichen planus, bullous pemphigoid & Para neoplastic pemphigus.

A smear was prepared and studied which on H & E staining showed epithelial & inflammatory cells. In a few areas clumps of rounded epithelial cells with enlarged & hyperchromatic nuclei were visible suggestive of Tzanck cells. Incisional biopsy was taken from a representative site, the microscopic features demonstrated stratified squamous parakeratinized epithelium with certain areas showing suprabasilar cleft and acantholytic cells. Underlying connective tissue showed dense chronic inflammatory cell infiltrate comprising of plasma & lymphocytes. The diagnosis of Pemphigus was given based on the histologic findings and to further confirm the diagnosis DIF test was performed. DIF demonstrated in vivo deposits of IgG (IgG1, IgG4) on the surface of keratinocytes, thereby confirming the diagnosis.

The treatment plan comprised oral prednisolone 60 mg/day along with multi-vitamin supplementation and analgesic in the form of a lidocaine gel for local application. After six days of steroid therapy, the patient was symptomatically better and clinically reduced sloughing and erythema was seen. The patient was discharged since he was relatively comfortable and could consume oral diet. Patient was reviewed after one week, there was complete resolution of sloughing and a few erythematous zones were noted. Due to the remission of symptoms the dose of prednisolone was reduced to 40mg. Again after ten days the patient was reviewed and was completely asymptomatic, therefore we reduced the dose of prednisolone to 20mg tapering it over a period of one week and then stopping the medication.

### Discussion:-

Generally in Pemphigus vulgaris small asymptomatic blisters are seen, they are really thin walled & tend to rupture, thereby causing pain and hemorrhagic erosions. Lesions can be found in any place in the oral cavity but the sites most vulnerable are the ones subjected to constant friction<sup>2</sup>. Due to the presenting features the disease tends to be misdiagnosed as aphthous stomatitis, gingivostomatitis, or erosive lichen planus. As was the case with our patient, who in his earlier visit to a doctor was misdiagnosed as a case of aphthous stomatitis. Therefore we will stress on the importance of an early correct diagnosis, which enables the use of lower dosage of medications over a shorter period of time.

Since our patient reported to us with an aggressive lesion, with acute symptoms, we conducted a smear test, biopsy and DIF simultaneously. Also, culture sensitivity of the lesional exudates along with a complete blood profile of the patient was done. Till the diagnosis was confirmed supportive therapy in the form IV fluids and local care was provided. The culture sensitivity was negative and all the blood profile was completely normally, however the smear, biopsy and DIF suggested the presence of pemphigus vulgaris.

Once the diagnosis has been confirmed the treatment should be started as soon as possible with systemic corticosteroids that remain the treatment of choice for this lesion<sup>3</sup>. Corticosteroids do cause rapid remission but also lead to various adverse effects like peptic ulcers, weight gain, hypertension, diabetes & osteoporosis<sup>3</sup>. Therefore when steroids have to be used for longer periods of time adjuvants such as Azathioprine or Cyclophosphamide are added to the regimen<sup>4</sup>. Even in our patient ant acids were prescribed to prevent gastritis.

Emerging therapies include plasmapheresis, intravenous immunoglobulins, immunoadsorption, cholinergic agonists, tumor necrosis factor-alpha antagonists (infliximab & etanercept) & cholinergic agonists<sup>3</sup>. Out of all these therapies plasmapheresis is the one that is being extensively studied and its use questioned for the treatment of pemphigus vulgaris. In a study by Matthew S. Turner, BS the use of plasmapheresis in conjunction with immunosuppression has been studied. They have suggested a series of five plasma exchanges within a period of eight days followed by administration of immunosuppressive drugs to prevent a rebound flare of the disease. They have concluded that this line on treatment should be employed for patients who do not respond to the conventional treatment or for patients with a severe form of the disease<sup>5</sup>.

**Conclusion:-**

In this article we illustrated the common oral presentation of pemphigus vulgaris, the importance of cinching the correct diagnosis and preventing it from being misdiagnosed as some of the other oral lesions with similar presentation. It should be considered as a differential diagnosis whenever a patient presents with a history of multiple, chronic, non-healing ulcerations that begin as a blister or bullae. Definitive diagnosis can be achieved by histological inspection and DIF. Once diagnosis is confirmed we stressed on the importance of administration of systemic corticosteroids to reach a disease free state & also the use of some new treatment modalities for a more severe form of the disease.

**References:-**

1. Rajendran, R., Sivapathasundharam, B. and Shafer, W. (n.d.). *Shafer's textbook of oral pathology*.
2. Dagistan, S., Goregen, M., Miloglu, O. and Aakur, B. (2008). Oral pemphigus vulgaris: a case report with review of the literature. *J Oral Sci*, [online] 50(3), pp.359-362. Available at: <http://dx.doi.org/10.2334/josnurd.50.359> [Accessed 4 Aug. 2016].
3. Kapoor, S., Kaur, G. and Sikka, P. (2013). Pemphigus vulgaris of oral cavity: A case report with its treatment strategies. *International Journal of Nutrition, Pharmacology, Neurological Diseases*, [online] 3(2), p.146. Available at: <http://dx.doi.org/10.4103/2231-0738.112842> [Accessed 4 Aug. 2016].
4. Rai, A., Arora, M., Naikmasur, V., Sattur, A. and Malhotra, V. (2015). Oral Pemphigus Vulgaris: Case Report. *Ethiop J Health Sci*, [online] 25(4), p.637. Available at: <http://dx.doi.org/10.4314/ejhs.v25i4.11> [Accessed 4 Aug. 2016].
5. Turner, M., Sutton, D. and Sauder, D. (2000). The use of plasmapheresis and immunosuppression in the treatment of pemphigus vulgaris. *Journal of the American Academy of Dermatology*, [online] 43(6), pp.1058-1064. Available at: <http://dx.doi.org/10.1067/mjd.2000.109297> [Accessed 4 Aug. 2016].

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### RESEARCH ARTICLE

#### THE EFFECT OF ELECTRONIC STORIES ON CLOTHING BEHAVIOR FOR TEENAGE GIRLS.

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Electronic Stories, Clothing Behavior,  
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#### Abstract

The purpose of this study is to investigate effects of electronic stories on clothing behavior for teenage girls. The study's samples consisted of 40 teenage girls from the third Medium School in Afif province in Saudi Arabia. The experimental method was used by applying the questionnaire before using electronic stories and after using electronic stories to know teenage girls clothing behavior, then used an SPSS program to do statistical analysis. The results showed the effectiveness of using electronic stories on the clothing behavior of teenage girls in aspects of The Self -Esteem, Modesty, Fashion, Attract Attention, Accommodation, Economic Level and father Education Level, depending on the results of the study the researchers set a number of recommendations.

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#### Introduction:-

The clothing plays an important role in the person lives, its effect on their business and in their relationships with others, clothing is key to personality, the reliability on the importance of clothing notes in the reality that the eye sees the clothes before the ear listening to the language, before the mind even understands the culture and civilizations (Eyed, El-Sayed, 2003). The selection of clothing important and complex process, everyone can choose clothes that fit him in, not only that, but must feel the beauty in his clothes because this pushes the individual to improve his attitude, so the appearance affects an individual's confidence in himself, accepted socially and its compatibility with the community in which lives. The proper clothing behavior, it is the behavior which was compatible with the community and the environment to which they belong, as well as customs, values and Traditions in this community (Eyed and others, 2000).

Behavior for teenage girls is only a translation of attitudes and values acquired through socialization factors, stemming from the values and standards of the community to which they belong, is affected by parental attitudes towards choosing clothes and accessories (Abboud, 1997). The big problems will appear obvious in adolescence, according to somatic changes, emotional and mental, which make teenager in puzzled chose to childish fashion, or feminine fashion, which will Exposing to criticism from community members. Tiggeman, Pickering (1996) said musical image passages strongly affects of teenage girls than any kind of TV programs when showing how women must be in form and behavior.

The development of the era and the advent of the Internet has made techniques more interactive and social, which led to the proliferation of electronic media and the spread and development of electronic digital devices which obsess the minds of members of society in General and become The preoccupation of adolescents and youth. So the

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researchers tried to take advantage of these devices, and to exploit the time, which spend with these devices in listen and watch electronic- stories related to clothing behavior to give them the opportunity to take advantage of them in clothing behavior, because the teenage girls often begin to have psychological changes and love imitating others that may affect their behavior, and Learn if there were importance of the electronic stories in the field of clothes, and Know if there is effect of the use electronic stores in clothing behavior (self-modesty, fashion, attracting Attention) among teenage girls.

## **Review of Literature:**

### **Electronic-stories:-**

Stories are produced and archived and published using digital media, It is brilliantly from the novel revolves around an event or person or place-could be real or fictional, and rehire sound and music and sound effects, text, images, graphics and video for specific purposes (Shehata, 2014).

The Type of Electronic Stories were as flowing (Abdel Basset, 2014):-

1. **Photographic Stories:** are collections of static images and text, to prepare these kind of stories are enough to know how to take pictures and how to develop slides from the power point program and put images in it.
2. **Video Words:** a set of words or phrases and images to produce a short film and simple, and teacher can do some pictures and ask the learners comment on it.
3. **Presentations:** a collection of texts and images to provide a specific subject, and one of the most common story industry operations.
4. **Drama:** which does not focus on the facts, but showing emotions, events and statements in the context of applying the granulation.
5. **Video clips:** merge images, texts, music and record conversations together to do a show about a particular topic.
6. **Anecdotal Painting:** a series of simple visualizations (like paste shapes, pictures, or drawing) specified in single frames, which offers a representation of the digital story content, containing all the events contained within the text catalog in a number of paintings that represent each one of the visible events, describe each image that we want to use.

### **Factors Affecting on the Clothes Selection:-**

There are several factors affecting selection of appropriate clothing, these factors (Aldirdeiry, 2002):

1. **Environmental factors:** climate, weather and geographical environment and history.
2. **Social factors:** regarding customs and traditions and community style and community formations.
3. **Cultural factors:** ideas and philosophies, religions and historical heritage and identity.
4. **Psychological factors:** personal characteristics, attitudes, values and behavior, motivations and desires and tendencies as well as the tradition.
5. **Economic factors:** economic level relates to the individual in terms of income and price for clothing.
6. **Technical factors:** regarding the importance of aesthetics in clothing.

### **Distinctive trends in Clothing behavior in Arab community:-**

There is a tendency for the Arab community and affects on the clothing behavior, this trend is modesty in clothing, it covered the whole body except the face and hands and loosely not describes size or shape of the body, and the dress itself not attractive and not transparent, should not resemble the dress of men (Altanikhi, 1982). This trend or mainstream shows authentic values, customs and traditions in Arabic communities and affected by the Islamic religion.

### **Teenage Girls:-**

The period between childhood and maturity, the period of time between 13-20 years, characterized by physical and psychological changes, which may occur and some behavioral and mental disorders. (Lohal, 1985) Said: teens are looking for economic autonomy and integration into a society in which no family-centered, thus showing the teen as a crucial transition seeking psychological autonomy and freedom from dependency sledge, which leads to changes on a personal level, especially the dialectical relationship between the self and the others.

**Self-esteem:-**

Individual expression of itself directly or indirectly and reach the maximum achievable potential and capabilities to satisfy, and re-equilibrium that allow him to use those capabilities and capacities in the service of the individual and society and the roles, responsibilities and usual duties (Arafat, 2001).

**Modesty:-**

It is a human social value the individual's commitment to ethics and religious teachings and societal customs and traditions, modesty in clothing means wearing clothes that cover the body and the details do not appear.

**Fashion:-**

The concept of fashion is a common method in the given time, and fashion style of expression in any art, clearly show in equilibrium or font or color. Fashion can also be a yardstick the people, classify the garments worn by the people are more or less in line with fashion, they have clothes and colors and textures that fit with it. (Al-fuhaid, 2015).

**Attract Attention:-**

Main in the clothing behavior as an attempt to attract the attention of others by using clothing.

**Accommodation:-**

An individual's place of residence in the countryside or in the city.

**Afif Third Medium School Girls:-**

Middle School for girls in Afif Province in Saudi Arabia.

**Hypothesis 1:-** There Are effect of electronic stories about the teenage girls clothing behavior in aspects of the self -modesty, fashion and attract attention.

**Hypothesis 1a:-** There Are effect of electronic stories about the teenage girls clothing behavior for accommodating variable.

**Hypothesis 1b:-** There Are effect of electronic stories about the teenage girls clothing behavior back to the family economic level.

**Hypothesis 1c:-** There Are effect of electronic stories about the teenage girls clothing behavior refer to The father education level.

**Hypothesis 1d:-** There Are effect of electronic stories about the teenage girls clothing behavior refer to The mother's education level.

**Methodology:-****Sample:-**

Consist of fourteen students teenage girls have been selected from junior high girls students from third middle school students on Afif province in Saudi Arabia academic year 2015-2016, and The description of the Study sample were as shown in (Table1).

**Table 1:-** Sample Description

No.Of sample	Variable		Frequency	Percentage %
( 40) students from the teenage girls	Accommodation,	Countryside	17	42.5
		City	23	57.5
	Economic Level	Low	6	15.0
		Medium	26	65.0
		High	8	20.0
	The Level of Education of the head of family	Just Right and Read	9	22,5
		Medium Certificate	9	22.5
		Bachelor	15	37.5
		Graduate	7	17.5

**Measure:-**

The Questionnaire consists of four subsections for each one of the clothing behavior aspects (self-modesty-fashion-attract attention) then formulated to the initial scale which consists of (27) variable. Then the questionnaire, view on a group of professor of Home Economics, College clothes professors and Faculty of education and Psychology faculty of education to voice their opinions and judge the suitability of scale for measuring the samples, and after the viewing added three variable matches the nature of society in the axis of decency, the scale reached (90%) agreement on the vocabulary. Then the final form of The questionnaire was designed.

**Validity and Reliability of The Tool:-**

To achieve stability and validity of the tool, the Alpha Crunbach method was used to, and the result found that the Reliability Coefficient equal 0.85 and the Self honesty Factor equal 0.92.

**Data Collection:-**

The experimental method was used according to the following steps:

1. The questionnaire was applied before using Electronic-stories which interest in personal, social and moral terms of clothes on a sample which consist of fourteen girls in teenage and enrolled in third middle school girls at the beginning of the second semester of the academic year 2015-2016
2. Visited the school twice a week and view some electronic stories which consist of electronic text stories, photo stories and educational videos in family education.
3. Been conducting The questionnaire after applying electronic stories at the end of the second semester of the academic year 2015/2016 on the same girls sample.
4. Scheduling and make appropriate data statistic analysis by use SPSS software to identify the study results.

**Result:-**

To find if there are statistically significant differences between the average grades of the experimental group students before and after applying electronic stories in aspects (self-modesty, fashion, attracting attention), The arithmetic mean, standard deviations and T test value was calculated as shown in (Table 2).

**Table 2:-** T Test Results of The Experimental Group

Variable		Members Number	Mean	Standard Deviation	Freedom Degrees	T value	Interpretation
Self Esteem	After Experimentation	40	37.9000	5.10806	39	7.359	Function 0.01
	Before Experimentation	40	42.2750	3.63027			
Modesty	After Experimentation	40	23.3000	4.53024	39	4.556	Function 0.01
	Before Experimentation	40	26.9500	4.90395			
Fashion	After Experimentation	40	23.0000	4.48930	39	4.564	Function 0.01
	Before Experimentation	40	24.7000	3.43586			
Attract Attention	After Experimentation	40	17.1750	3.74089	39	2.306	Function 0.05
	Before Experimentation	40	17.7750	2.98275			
The Scale as a Whole	After Experimentation	40	101.3750	13.49774	39	6.838	Function 0.01
	Before Experimentation	40	111.7000	10.26870			

To find if there are statistically significant differences between the average grades for the experimental group students before and after applying electronic stories refer to variable accommodation (countryside, city), the researchers used one way analysis of variance (ANOVA) calculates the F - value as shown in (Table 3).

**Table 3:-** ANOVA Results of The Experimental Group in The Accommodation Variable

Variable		Sum of Squares	Def	Mean Square	F	Interpretation
Self -Esteem	Between Groups	.204	1	.204	.015	Not Function
	Within Groups	513.771	38	13.520		
	Total	513.975	39			
Modesty	Between Groups	101.400	1	101.400	4.606	Function 0.05
	Within Groups	836.500	38	22.013		
	Total	937.900	39			
Fashion	Between Groups	13.067	1	13.067	1.110	Not Function
	Within Groups	447.333	38	11.772		
	Total	460.400	39			
Attract Attention	Between Groups	3.038	1	3.038	.336	Not Function
	Within Groups	343.938	38	9.051		
	Total	346.975	39			
The Scale as a Whole	Between Groups	252.150	1	252.150	2.482	Not Function
	Within Groups	3860.250	38	101.586		
	Total	4112.400	39			

To know if there are statistically significant differences between the average grades of the experimental group students before and after applying electronic stories refer to variable economic level (low, medium, high), the researchers used one way analysis of variance (ANOVA) to calculate the F - value as shown in (Table 4). And to determine the direction of Significant statistical differences the Scheff's test was used, as explains in (Table 5).

**Table 4:-** ANOVA Results of The Experimental Group in The Economic Level Variable

Variable	Measurement	Sum of Squares	Def	Mean Square	F	Interpretation
Self -Esteem	Between Groups	129.257	2	64.629	6.216	Function .005
	Within Groups	384.718	37	10.398		
	Total	513.975	39			
Modesty	Between Groups	199.063	2	99.532	4.984	Function .012
	Within Groups	738.837	37	19.969		
	Total	937.900	39			
Fashion	Between Groups	16.451	2	8.226	.686	Not Function
	Within Groups	443.949	37	11.999		
	Total	460.400	39			
Attract Attention	Between Groups	3.821	2	1.911	.206	Not Function
	Within Groups	343.154	37	9.274		
	Total	346.975	39			
The Scale as a Whole	Between Groups	785.846	2	392.923	4.370	Function .020
	Within Groups	3326.554	37	89.907		
	Total	4112.400	39			

**Table 5:-** The Scheff's Test Result for Economic Level

Economic Level	N	Mean
Low	6	119.875
Medium	26	110.576
High	8	105.667

To know if there are statistically significant differences between the average grades of the experimental group students before and after applying electronic stories refer to variable The Level of Education of father (just right and read, medium certificate, bachelor, graduate). The researchers used one way analysis of variance (ANOVA) to



calculate the F - value as shown in (Table 6).And to determine the direction of Significant statistical differences the Scheff's test was used, as explains in (Table 7).

**Table 6:-** ANOVA Results of The Experimental Group in The Father Education Level Variable

Variable		Sum of Squares	Def	Mean Square	F	Interpretation
Self -Esteem	Between Groups	170.718	3	56.906	5.968	Function .00
	Within Groups	343.257	36	9.535		
	Total	513.975	39			
Modesty	Between Groups	243.341	3	81.114	4.204	Function .01
	Within Groups	694.559	36	19.293		
	Total	937.900	39			
Fashion	Between Groups	96.032	3	32.011	3.163	Function .04
	Within Groups	364.368	36	10.121		
	Total	460.400	39			
Attract Attention	Between Groups	11.273	3	3.758	.403	Not Function
	Within Groups	335.702	36	9.325		
	Total	346.975	39			
The Scale as a Whole	Between Groups	1308.844	3	436.281	5.602	Function .00
	Within Groups	2803.556	36	77.877		
	Total	4112.400	39			

**Table 7:-** The Scheff's Test Result for The Father Education Level Variable

The Level of Education of the head of family	N	Mean
Graduate	7	122.00
Bachelor	15	105.66
High	9	113.00
Just Right and Read	9	112,00

To find if there are statistically significant differences between the average grades of the experimental group students before and after applying electronic stories refer to variable the mother's education level (just right and read, medium certificate, bachelor, graduate), the researchers used one way analysis of variance (ANOVA) to calculate the F - value as shown in (Table 8).

**Table 8:-** ANOVA Results of The Experimental Group The Mother Education Level Variable

Variable		Sum of Squares	Def	Mean Square	F	Interpretation
Self -Esteem	Between Groups	30.737	3	10.246	.763	Not Function
	Within Groups	483.238	36	13.423		
	Total	513.975	39			
Modesty	Between Groups	167.005	3	55.668	2.600	Not Function .
	Within Groups	770.895	36	21.414		
	Total	937.900	39			
Fashion	Between Groups	12.094	3	4.031	.324	Not Function
	Within Groups	448.306	36	12.453		
	Total	460.400	39			
Attract Attention	Between Groups	43.377	3	14.459	1.714	Not Function
	Within Groups	303.598	36	8.433		
	Total	346.975	39			
The Scale as a Whole	Between Groups	136.249	3	45.416	.411	Not Function
	Within Groups	3976.151	36	110.449		
	Total	4112.400	39			

### Discussion:-

It is clear from (Table 2) that the arithmetic mean of the experimenter group girls grades after applied experimentation is greater than the arithmetic mean of their grades in the measurement before applied experimentation in all axes on the scale. The T-value is function in aspects of (self-modesty, fashion, the scale as a whole) on level (0.01), and at (0, 50) at the attract attention, and that's indicates statistical differences between the measurement before and after experimentation. This may be due to the electronic stories method of interesting and attractive for students in a change in clothing behavior due to their dependence on the interaction of personalities that reflect the reality of life the student in addition to blending images, music and events that help to acquire information and different behaviors and it turns out the difference in clothing behavior especially in two aspects self-esteem and modesty by fairly large. Because electronic stories which are used drew the attention of the students to know clothing is the language to Expressed yourself and personality reflects.

From (Table 3) it clear that there aren't statistically significant differences exist between the average score for the experimental group in clothing behavior back to the accommodation variable. There are no significant differences in aspects of self-esteem, fashion and attract attention, but there is a significant difference in the aspect of modesty (f-value 4.606), and this may be back to difference in alive between the city and countryside in constant to the traditional. From Table 4 f-value in self-esteem aspect is (6.218) which function at (0.05) level. And f-value in modesty aspect is (4.984) and it is functioning at the level (0.01). These mean there are significant statistic differences in aspects of self-esteem and modesty refer to the economic level variable while there are no significant statistic difference in scale of clothing in aspects of the fashion and attract attention. And f-value of the measurement as a whole is (4.370) and it is functionally at (0.05) level, these mean there are significant statistic differences in the clothing behavior refer to the economic level variable and social habit.

From (Table 4) f-value in self-esteem aspect is (6.218) which function at (0.05) level. And f-value in modesty aspect is (4.984) and it is functioning at the level (0.01). These mean there are significant statistic different clothing behavior in aspects of self-esteem and modesty refer to the economic level variable while there are no significant statistic differences in aspects of the fashion and attract attention. And the f-value of the measurement as whole is (4.370) and it is functionally at (0.05) level, these mean there are significant statistic differences in the clothing behavior refer to economic level variables.

(Table 5) found differences refer to a higher economic level, then medium and finally was low economic level, due to the high economic level owners attention to clothes and preservation, and have a different ways to clothes care, and clothes appropriate for each different events to achieve their self-esteem and modesty.

(Table 6) shows the value (f) in aspect of self-esteem modesty and fashion is a statistical function at a level (0.01) shows statistically significant differences between degrees of teenage girls in the aspects (self-modesty, fashion) while shows no differences in aspect (attract attention), because the value (f) is a statistic not functioning. The value (f) (5.602) for general is considering a statistical function value at (0.01) level, which shows statistically significant differences between degrees of teenage girls. Due to the level of education of the father.

It is clear from (Table7) differences refer to graduate level education first and then followed by the intermediate certificate then just write and reads. This may be due to the fact that most respondents were a daughter of some universities employee, which may cause statistical differences in the aspects (self-modesty, fashion) where the level of education of the father help in educating their children about appropriate purchasing methods with social status and the customs of the society with encourages to trendiness fashion.

(Table 8) Shown that the value (f) in all the aspect (self-modesty, fashion, attracting attention) of the questionnaire non-statistically function which indicating a lack of statistically significant differences refer to the mother's level of education variable (just reads and writes, medium certificate, bachelor, graduate), this may be due to the nature of the age for teen girls and what was the girl's behavior at that point where seeking independence from her mother's opinion trying to bring itself.

### Recommendations:-

From the above results the researchers recommends :

1. Encourage teenage girls to exploit times they spend online to watch the stories useful electronic and related to patterns of family and social life.
2. Teenage students should be encouraged to take advantage of family education curricula, and utilized in real working life, nor in cognitive side only.
3. Use the Lectures and cultural seminars in various social institutions and schools about how to choose and wear and how to improve clothing behavior.
4. The need to employ modern technology and activate electronic stories related curriculum life skills relating to teenage girls.

### References:-

1. Abboud , Mona Abdel-Rahman. (1997) . The relationship between the trends of parental and the adolescent schoolgirls towards choosing clothes . Unpublished Master thesis, Helwan University: Faculty of home economics.
2. Abdeen , Alia . (2002) . Studies in the psychology of clothes . Cairo: Dar al-fikr al-Arab. Abdel Basset , Mohamed Ahmed . (2014) . Educational technology: digital stories in teaching courses. Retrieved from [http://www.eductice.com/2014/10/blog-post\\_97.html#.VEPJUOpbfzU.twitter](http://www.eductice.com/2014/10/blog-post_97.html#.VEPJUOpbfzU.twitter)
3. Abdel Hafiz. , Zainab . (2002). Youth trends of The clothing , first edition. Cairo :Dar al-fikr al-Arab .
4. Aldirdeiry, Inas ALsaid . (2003). A study of the relationship between behavior and social revival", *research journal of home economics*. University of Menoufia: Home Economics College Volume 13, issue (3, 4) .
5. Aldirdeiry. , Inas ALsaid . (1999) .The role of design in improving taste in fashion. Unpublished PhD thesis. Menoufia University :Faculty of home economics.
6. Al-fuhaid , Hisa Saud . (2015). Fashion and its effect factors. Retrieved from [http://mynew-fashion.blogspot.com/2015/11/blog-post\\_19.html](http://mynew-fashion.blogspot.com/2015/11/blog-post_19.html)
7. Aldirdeiry. , Inas ALsaid . (2002) .The cultural level and its impact on clothing behavior of children. *research journal of home economics*, University of Menoufia: Home Economics College, volume 14, issue (1, 4).
8. Altanikhi , Malka of Mahmoud . (1982) . The clothing behavior and its relationship to the Concept of self and some values in Egyptian society . Unpublished PhD thesis. Helwan University :Faculty of home economics.
9. Arafat , Fadila . (2001). self -esteem necessary for community . Retrieved from <http://www.alnoor.se/article.asp?id=46215>
10. Chowdhary, U. (1993) . Self, perceived some to types and clothing, related behavior of older men and women . Perceptual ,and motor ,skills , Vol. 77 (1) .
11. Eyed ,Rushdie Ali. El-Sayed, Mohamed . (2003). Study realization for university students choose their clothes . Fifth Egyptian domestic economy Conference, Menoufia University: Faculty of home economics.
12. Hwang, J. (1997) .Relationship between body cathexis, clothing benefits sought, and clothing behavior and effects of importance of meeting the ideal body image and clothing attitude . PhD, Virginia: Polytechnic Institute, State University.
13. Le hall, H. (1985). Adolescent psychology. University Press of France (PUF), PARIS 1<sup>st</sup> Edition, P13.
14. Lo-castro, A. M. (1996) . Aspects of physical appearance and clothing behavior . MA. University of South Africa.
15. Park , Latifa Mohammed . (2000) .The study of clothing behavior for teenage girls in Jeddah . *Home economics research journal*. : Menoufia University :Faculty of home economics folder (10), (4).
16. Pasha , Samiha Ali . (1990) . The clothing behavior for female teachers in the basic education in Egypt and its relation to some demographic variables. unpublished Master thesis, Helwan University: Faculty of home economics,.
17. Shehata ,Nashwa Rifat .(2014).digital stories . Retrieved from [http://el-gradu.blogspot.com/2014/01/blog-post\\_10.html](http://el-gradu.blogspot.com/2014/01/blog-post_10.html)
18. Shim, S. (1990) . Short, average, height, tall, and big men: body, cathexis, clothing and retail satisfactions, and clothing behavior. Perceptual – and - Motor Skills, vol. 70. (1).
19. Tiggemann, M., & Pickering, A. S. (1996). Role of television in adolescent women's body satisfaction and drive for thinness. *International Journal of Eating Disorders*, 20, 199– 203.



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### RESEARCH ARTICLE

#### RELATIONSHIP BETWEEN SUDDEN INFANT DEATH SYNDROME AND MOTHER SMOKING.

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Sids, children, passive smoking.

#### Abstract

There is substantial evidence to conclude that maternal smoking caused a marked increase in SIDS. There have been almost 16 SIDS children and 76 death children as control group that have examined this relationship and all indicate an increased risk. Passive smoking during pregnancy has a certain relationship to preterm birth and spontaneous abortion. Complications are exposed women with insufficient health care and an increased incidence of other pathological conditions.

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#### Introduction:-

Cigarette smoking is one of the most significant preventable causes of death and illness in the world. It accounts for some 400 000 deaths per year in the USA, approximately 100 000 in the UK and 4.9 million worldwide. Due to smoking tobacco being among the leading causes of many diseases such as lung cancer, heart attacks, COPD, erectile dysfunction, and birth defects. Among the diseases that can be caused by smoking are vascular stenosis, lung cancer, heart attacks and chronic obstructive pulmonary disease. Smoking during pregnancy may cause ADHD to a fetus. Male and female smokers lose an average of 13.2 and 14.5 years of life, respectively. At least half of all lifelong smokers die earlier as a result of smoking. The corresponding estimates for lifelong nonsmokers are a 1.1% probability of dying from lung cancer before age 85 for a man of European descent, and a 0.8% probability for a woman.

Tobacco smoke is a complex mixture of over 5,000 identified chemicals, of which 98 are known to have specific toxicological properties. The most important chemicals causing cancer are those that produce DNA damage since such damage appears to be the primary underlying cause of cancer.

**Table 1:-** The most genotoxic cancer causing chemicals in cigarette smoke

Compound	Microgram per cigarette	Effect on DNA
Isoprene	952.0	Single and double strand breaks in DNA.
Formaldehyde	60.5	DNA-protein crosslinks causing chromosome deletions and re-arrangements.
Ethylene oxide	7.0	Hydroxyethyl DNA adducts with adenine and guanine.
Acrylonitrile	29.3	Oxidative stress causing increased 8-oxo-2'-deoxyguanosine.
Acrolein	122.4	Reacts with deoxyguanine and forms

		DNA crosslinks, DNA-protein crosslinks and DNA adducts.
Acetaldehyde	1448.0	Reacts with deoxyguanine to form DNA adducts.
1,3-butadiene	105.0	Global loss of DNA methylation (an epigenetic effect) as well as DNA adducts.

### Sudden death infant syndrome :

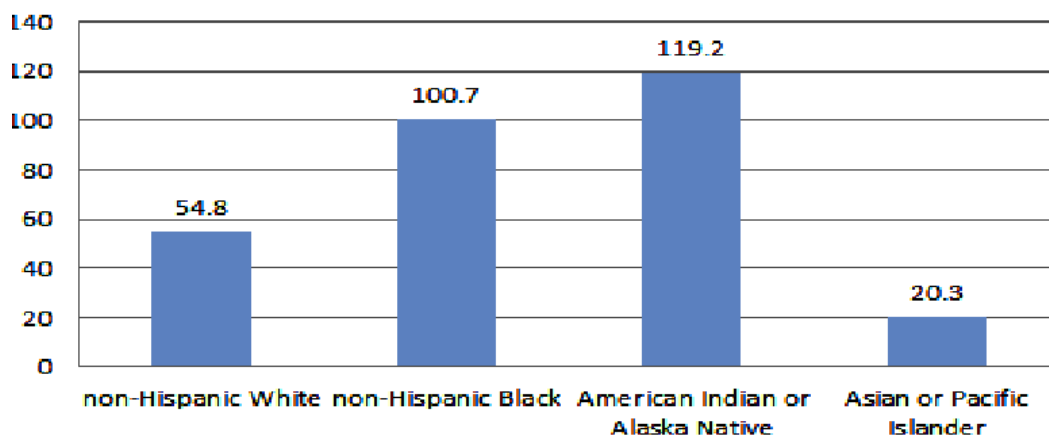
Sudden infant death syndrome (SIDS), also known as cot death or crib death, is the sudden unexplained death of a child less than one year of age. Diagnosis requires that the death remains unexplained even after a thorough autopsy and detailed death scene investigation.

Globally SIDS resulted in about 22,000 deaths as of 2010, down from 30,000 deaths in 1990. Rates vary significantly by population from 0.05 per 1000 in Hong Kong to 6.7 per 1000 in American Indians. SIDS was responsible for 0.54 deaths per 1,000 live births in the US in 2005. SIDS deaths in the US decreased from 4,895 in 1992 to 2,247 in 2004. But, during a similar time period, 1989 to 2004, SIDS being listed as the cause of death for sudden infant death (SID) decreased from 80% to 55%. According to John Kattwinkel, chairman of the Centers for Disease Control and Prevention (CDC) Special Task Force on SIDS "A lot of us are concerned that the rate (of SIDS) isn't decreasing significantly, but that a lot of it is just code shifting".

In 2013, there are persistent disparities in SIDS deaths among racial and ethnic groups in the U.S. In 2009, the rates of death range from 20.3 for Asian/Pacific Islander to 119.2 for American Indians/Alaska Native. African American infants have a 24% greater risk of having a SIDS related death and experience a 2.5 greater incidence of SIDS than in Caucasian infants.

**Graf1:- SIDS death rates per 100,000 live birth by race/ethnicity 2009**

### **SIDS death rates per 100,000 live births by race/ethnicity, 2009 (CDC, 2013)**



### Risk factors:

The frequency of SIDS does appear to be influenced by social, economic, and cultural factors, such as maternal education, race or ethnicity, and poverty. SIDS is believed to occur when an infant with an underlying biological vulnerability, who is at a critical development age, is exposed to an external trigger.

SIDS rates are higher for infants of mothers who smoke during pregnancy. SIDS correlates with levels of nicotine and derivatives in the infant. Nicotine and derivatives cause significant alterations in fetal neurodevelopment.

Placing an infant to sleep while lying on the stomach or the side increases the risk. Especially at two to three months of age. Sharing bed with parents especially during first 3 months of life is one of the risk factors of SIDS. Elevated or reduced room temperature also increases the risk, as does excessive bedding, clothing, soft sleep surfaces, and stuffed animals. Bumper pads may increase the risk and, as there is little evidence of benefit from their use, they are not recommended.

SIDS rates decrease with increasing maternal age; with teenage mothers at greatest risk. Low birth weight is a significant risk factor. In the United States from 1995 to 1998, the SIDS death rate for infants weighing 1000–1499 g was 2.89/1000, while for a birth weight of 3500–3999 g, it was only 0.51/1000. Premature birth increases the risk of SIDS death roughly fourfold. From 1995 to 1998, the U.S. SIDS rate for births at 37–39 weeks of gestation was 0.73/1000, while the SIDS rate for births at 28–31 weeks of gestation was 2.39/1000.

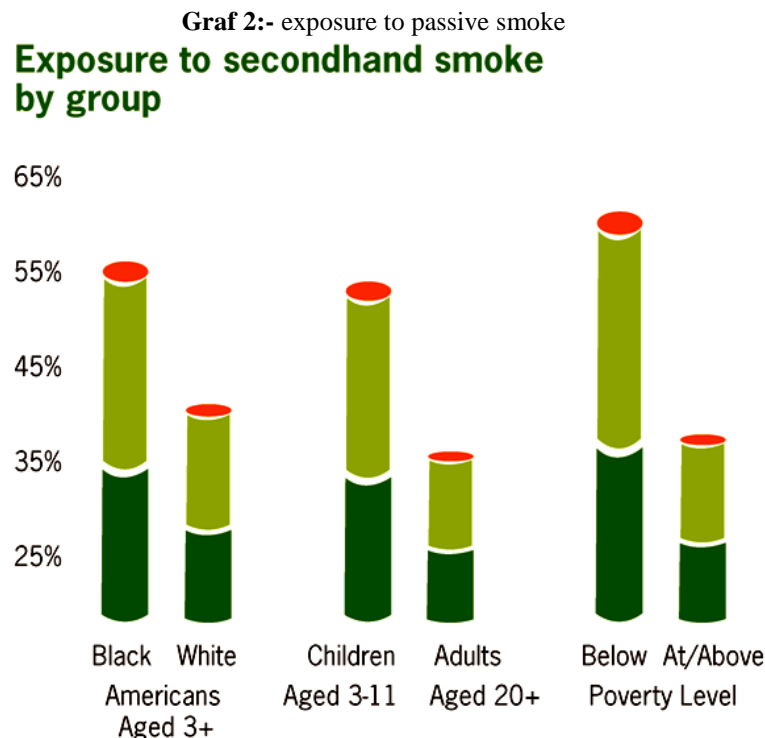
Genetics plays a role, as SIDS is more prevalent in males. There is a consistent 50% male excess in SIDS per 1000 live births of each sex. Given a 5% male excess birth rate, there appears to be 3.15 male SIDS cases per 2 female, for a male fraction of 0.61. About 10 to 20% of SIDS cases are believed to be due to channelopathies, which are inherited defects in the ion channels which play an important role in the contraction of the heart.

Drinking of alcohol by parents is linked to SIDS. A particular study found a positive correlation between the two during New Year's celebrations and weekends.

#### Passive smoking:-

Passive smoking is the inhalation of smoke, called second-hand smoke (SHS), or environmental tobacco smoke (ETS), by persons other than the intended "active" smoker.

In 2006 report, the US Surgeon General concludes: "The evidence is sufficient to infer a causal relationship between exposure to secondhand smoke and sudden infant death syndrome." Secondhand smoking has been estimated to be associated with 430 SIDS deaths in the United States annually. Nicotine crosses the placenta and is found in the breast milk of mothers who smoke as well as mothers who inhale passive smoke. Maternal passive smoking increases the risk of non-syndromic orofacial clefts by 50% among their children. Maternal exposure to secondhand smoke exposure during pregnancy is associated with an increased risk of neural tube defects. A 2014 meta-analysis found that maternal secondhand smoke exposure increased the risk of miscarriage by 11%.



### Results:-

Significant negative impact is also complex effect on the total weight of newborns of smoking mothers. the gap reaches 250-300 g in our study was the average of 142 g, which is significantly difference  $p < 0.01$  of new experimental work implies that the parts sidestream "cigarette smoke after 5 - weeks Exhibitions are able to increase the excitability of C fibers in the lungs thus indirectly influence the reflective enhance the effect of substance P in NC. Solitary tract and cause as well as prolonged apnea. This may passively smoking involved in the eventual emergence of SIDS, and the occurrence of apnea, bronchoconstriction and mucus hypersecretion. it has also been found that children of smoking mothers during pregnancy died later and longer under hypoxic test than children nonsmoking mothers Children smokers have more frequent and longer lasting obstructive apnea During smoking expectant mothers Nicotine probably due to direct vasoconstrictor Fetal Hypoxia Nicotine was detected in the placenta, the amniotic fluid and fetal blood of smoking mothers during pregnancy In this context, interesting finding of pulmonary neuroendocrine cell hyperplasia in SIDS children who smoked during pregnancy. Their dysfunction (with vasoconstriction and bronchoconstriction effect) may contribute to the pathophysiology of SIDS and from our previous observations suggest the children Passive smoking significant risk factor for SIDS.

**Table 2:-** The share of smokers in families with occurrences SIDS

Household members	Smoking	Counts		Statistical significance
Mother	no	SIDS (16) 6	Inspection (76) 66	$P < 0.01$ $P < 0.01$
Mother	Yes Only during pregnant Postpartum	9 10	8 10	$P < 0.01$ $P < 0.01$
Father	No Yes	3 13	47 29	$P < 0.01$ $P < 0.05$
Other members	Yes	9	11	$P < 0.01$

Passive smoking during pregnancy has a certain relationship to preterm birth and spontaneously abortion. Concert complications are exposed women with insufficient health care and an increased incidence of other pathological conditions (anemia, malnutrition, drug addiction etc.)

Based on the work in this area and to describe their own experience called fetal tobacco syndrome, which is actually proportional fetal growth retardation, associated with smoking at least five cigarettes per day during pregnancy and expectant mothers. On the other hand, the major finding of maternal smoking during pregnancy is a separate major factor in the development of obesity in school-age children. Here is manifested by a significant factor, intrauterine exposure to cigarette smoke on obesity as one of the major contributing factor "lifestyle diseases" and their adverse consequences.

### Discussion:-

According to American academy of pediatrics recommended both maternal smoking during pregnancy and smoke in the infant's environment after birth are major risk factors for SIDS.

Mothers should not smoke during pregnancy or after the infant's birth.

There should be no smoking near pregnant women or infants. Encourage families to set strict rules for smoke-free homes and cars and to eliminate secondhand tobacco smoke from all places in which children and other nonsmokers spend time.

The risk of SIDS is particularly high when the infant bed-shares with an adult smoker, even when the adult does not smoke in bed.

## Conclusion:-

Sudden infant death syndrome is unknown causes but some risk factor could be increase the mortality rate such as smoking , passive smoking bed share , young mother , Apparently life threatening event and ther is some factors could decrease the mortality such as breastfeeding and family education.

## Reference:-

1. West, Robert; Shiffman, Saul (2007). Fast Facts: Smoking Cessation. Health Press Ltd. p. 28. ISBN 978-1-903734-98-8.
2. <http://www.who.int/tobacco/media/en/mitchell.pdf>
3. "Tobacco Fact sheet N°339". May 2014. Retrieved 13 May 2015.
4. Centers for Disease Control and Prevention (CDC) (2002). "Annual smoking-attributable mortality, years of potential life lost, and economic costs--United States, 1995-1999". *MMWR Morb. Mortal. Wkly. Rep.* 51 (14): 300-3. PMID 12002168.
5. Centers for Disease Control and Prevention (CDC) (2002). "Annual smoking-attributable mortality, years of potential life lost, and economic costs--United States, 1995-1999". *MMWR Morb. Mortal. Wkly. Rep.* 51 (14): 300-3. PMID 12002168.
6. Thun MJ, Day-Lally CA, Calle EE, Flanders WD, Heath CW; Day-Lally; Calle; Flanders; Heath Jr (1995). "Excess mortality among cigarette smokers: changes in a 20-year interval". *Am J Public Health.* 85 (9): 1223-30. doi:10.2105/ajph.85.9.1223. PMC 1615570. PMID 7661229.
7. Thun MJ, Hannan LM, Adams-Campbell LL, Boffetta P, Buring JE, Feskanich D, Flanders WD, Jee SH, Katanoda K, Kolonel LN, Lee IM, Marugame T, Palmer JR, Riboli E, Sobue T, Avila-Tang E, Wilkens LR, Samet JM; Hannan; Adams-Campbell; Boffetta; Buring; Feskanich; Flanders; Jee; Katanoda; Kolonel; Lee; Marugame; Palmer; Riboli; Sobue; Avila-Tang; Wilkens; Samet (2008). "Lung cancer occurrence in never-smokers: An analysis of 13 cohorts and 22 cancer registry studies". *PLoS Med.* 5 (9): e185. Doi: 10.1371/journal.pmed.0050185. PMC 2531137. PMID 18788891
8. American Legacy Foundation factsheet on lung cancer; their cited source is: CDC (Centers for Disease Control) The Health Consequences of Smoking: A Report of the Surgeon General. 2004. Archived September 27, 2007, at the Wayback Machine
9. <sup>[SEP]</sup> Nyboe J, Jensen G, Appleyard M, Schnohr P; Jensen; Appleyard; Schnohr (1989). "Risk factors for acute myocardial infarction in Copenhagen. I: Hereditary, educational and socioeconomic factors. Copenhagen City Heart Study". *Eur Heart J.* 10 (10): 910-6. PMID 2598948.
10. <sup>[SEP]</sup> Devereux G (2006). "ABC of chronic obstructive pulmonary disease. Definition, epidemiology, and risk factors". *BMJ.* 332 (7550): 1142-1144. Doi: 10.1136/bmj.332.7550.1142. PMC 1459603. PMID 16690673.
11. Talhout R, Schulz T, Florek E, van Benthem J, Wester P, Opperhuizen A (2011). "Hazardous compounds in tobacco smoke". *Int J Environ Res Public Health.* 8 (2): 613-28. Doi: 10.3390/ijerph8020613. PMC 3084482. PMID 21556207.
12. Kastan MB (2008). "DNA damage responses: mechanisms and roles in human disease: 2007 G.H.A. Clowes Memorial Award Lecture". *Mol. Cancer Res.* 6 (4): 517-24. Doi: 10.1158/1541-7786.MCR-08-0020. PMID 18403632.
13. Braun JM, Kahn RS, Froehlich T, Auinger P, Lanphear BP; Kahn; Froehlich; Auinger; Lanphear (2006). "Exposures to environmental toxicants and attention deficit hyperactivity disorder in U.S. children". *Environ. Health Perspect.* 114 (12): 1904-9. Doi: 10.1289/ehp.10274. PMC 1764142. PMID 17185283.
14. Liu XY, Zhu MX, Xie JP (2010). "Mutagenicity of acrolein and acrolein-induced DNA adducts". *Toxicol. Mech. Methods.* 20 (1): 36-44. Doi: 10.3109/15376510903530845. PMID 20158384.
15. <sup>[SEP]</sup> Speit G, Merk O (2002). "Evaluation of mutagenic effects of formaldehyde in vitro: detection of crosslinks and mutations in mouse lymphoma cells". *Mutagenesis.* 17 (3): 183-7. Doi: 10.1093/mutage/17.3.183. PMID 11971987.
16. <sup>[SEP]</sup> Pu X, Kamendulis LM, Klaunig JE (2009). "Acrylonitrile-induced oxidative stress and oxidative DNA damage in male Sprague-Dawley rats". *Toxicol. Sci.* 111 (1): 64-71. Doi: 10.1093/toxsci/kfp133. PMC 2726299. PMID 19546159 Koturbash I, Scherhag A, Sorrentino J, Sexton K, Bodnar W, Swenberg JA, Beland FA, Pardo-Manuel Devillena F, Rusyn I, Pogribny IP (2011). "Epigenetic mechanisms of mouse interstrain variability in genotoxicity of the environmental toxicant 1,3-butadiene". *Toxicol. Sci.* 122 (2): 448-56.
17. Garcia CC, Angeli JP, Freitas FP, Gomes OF, de Oliveira TF, Loureiro AP, Di Mascio P, Medeiros MH (2011). "[13C2]-Acetaldehyde promotes unequivocal formation of 1,N2-propano-2'-deoxyguanosine in human cells". *J.*



- Am. Chem. Soc. 133 (24): 9140–3. Doi: 10.1021/ja2004686. PMID 21604744.
18. Tompkins EM, McLuckie KI, Jones DJ, Farmer PB, Brown K (2009). "Mutagenicity of DNA adducts derived from ethylene oxide exposure in the pSP189 shuttle vector replicated in human Ad293 cells". *Mutat. Res.* 678 (2): 129–37. doi:10.1016/j.mrgentox.2009.05.011. PMID 19477295.
  19. Fabiani R, Rosignoli P, De Bartolomeo A, Fuccelli R, Morozzi G (2007). "DNA-damaging ability of isoprene and isoprene mono-epoxide (EPOX I) in human cells evaluated with the comet assay". *Mutat. Res.* 629 (1): 7–13. Doi: 10.1016/j.mrgentox.2006.12.007. PMID 17317274.
  20. National Institute of Child Health and Human Development. 27 June 2013. Retrieved 9 March 2015.
  21. Centers for disease control and prevention, sudden infant death RETRIEVED MARCH 13, 2013
  22. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, Abraham J, Adair T, Aggarwal R, Ahn SY, et al. (Dec 15, 2012). "Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010." *Lancet.* 380 (9859): 2095–128. Doi: 10.1016/S0140-6736 (12) 61728-0. PMID 23245604.
  23. Sharma BR (March 2007). "Sudden infant death syndrome: a subject of medicolegal research." *The American Journal of Forensic Medicine and Pathology.* 28 (1): 69–72. Doi: 10.1097/01.paf.0000220934.18700.ef. PMID 17325469.
  24. "CDC Wonder". Centers for Disease Control and Prevention (CDC). 2010-02-24. Retrieved 2010-04-17.
  25. Bowman L, Hargrove T. Exposing Sudden Infant Death In America. Scripps Howard News Service. <http://dailycamera.com/news/2007/oct/08/saving-babies-exposing-sudden-infant-death-in/>
  26. Powers, D. A.; Song, S. (2009). "Absolute change in cause-specific infant mortality for blacks and whites in the US: 1983–2002". *tion Research and Policy Review.* 28 (6): 817–851. Doi: 10.1007/s11113-009-9130-0.
  27. <sup>[1]</sup><sup>[SEP]</sup> Pollack, H. A.; Frohna, J. G. (2001). "A competing risk model of sudden infant death syndrome incidence in two US birth cohorts". *The Journal of Pediatrics.* 138 (5): 661–667. Doi: 10.1067/mpd.2001.112248
  28. Kinney HC, Thach BT (2009). "The sudden infant death syndrome". *N. Engl. J. Med.* 361 (8): 795–805. Doi: 10.1056/NEJMr0803836. PMC 3268262. PMID 19692691
  29. Pickett, KE, Luo, Y, Lauderdale, DS. Widening Social Inequalities in Risk for Sudden Infant Death Syndrome. *Am J Public Health* 2005;94(11):1976–1981. Doi: 10.2105/AJPH.2004.059063
  30. Sullivan FM, Barlow SM (2001). "Review of risk factors for Sudden Infant Death Syndrome". *Paediatric Perinatal Epidemiology.* 15 (2): 144–200. Doi: 10.1046/j.1365-3016.2001.00330.x. PMID 11383580.
  31. Office of the Surgeon General of the United States Report on Involuntary Exposure to Tobacco Smoke
  32. <sup>[1]</sup><sup>[SEP]</sup> Bajanowski T.; Brinkmann B.; Mitchell E.; Vennemann M.; Leukel H.; Larsch K.; Beike J.; Gesid G. (2008). "Nicotine and cotinine in infants dying from sudden infant death syndrome". *International journal of legal medicine.* 122 (1): 23–28. Doi: 10.1007/s00414-007-0155-9. PMID 17285322.
  33. <sup>[1]</sup><sup>[SEP]</sup> Lavezzi AM, Corna MF, Matturri L (July 2010). "Ependymal alterations in sudden intrauterine unexplained death and sudden infant death syndrome: possible primary consequence of prenatal exposure to cigarette smoking". *Neural Dev.* 19 (5): 17. Doi: 10.1186/1749-8104-5-17. PMC 2919533. PMID 20642831.
  34. Moon RY, Fu L (July 2012). "Sudden infant death syndrome: an update." *Pediatrics in review / American Academy of Pediatrics.* 33 (7): 314–20. Doi: 10.1542/pir.33-7-314. PMID 22753789.
  35. Moon RY, Horne RS, Hauck FR (November 2007). "Sudden infant death syndrome". *Lancet.* 370 (9598): 1578–87. Doi: 10.1016/S0140-6736(07)61662-6. PMID 17980736.
  36. Fleming PJ, Levine MR, Azaz Y, Wigfield R, Stewart AJ (June 1993). "Interactions between thermoregulation and the control of respiration in infants: possible relationship to sudden infant death". *Acta Paediatr Suppl.* 82 (Suppl 389): 57–9. Doi: 10.1111/j.1651-2227.1993.tb12878.x. PMID 8374195
  37. McIntosh CG, Tonkin SL, Gunn AJ (2009). "What is the mechanism of sudden infant deaths associated with co-sleeping?" *N. Z. Med. J.* 122 (1307): 69–75. PMID 20148046
  38. Sullivan FM, Barlow SM (2001). "Review of risk factors for Sudden Infant Death Syndrome". *Paediatric Perinatal Epidemiology.* 15 (2): 144–200. Doi: 10.1046/j.1365-3016.2001.00330.x. PMID 11383580.
  39. Centers for Disease Control and Prevention (CDC). 2010-02-24. Retrieved 2010-04-17.
  40. Hunt CE (November 2007). "Small for gestational age infants and sudden infant death syndrome: a confluence of complex conditions". *Arch. Dis. Child. Fetal Neonatal Ed.* 92 (6): F428–9. Doi: 10.1136/adc.2006.112243. PMC 2675383. PMID 17951549.
  41. CDC WONDER online database and [http://www3.who.int/whosis/menu.cfm?Path=whosis, inds, mort&language=English](http://www3.who.int/whosis/menu.cfm?Path=whosis,inds,mort&language=English) for data on SIDS by gender in the US and throughout the world.
  42. Mage DT, Donner EM (September 2004). "The fifty percent male excess of infant respiratory mortality". *Acta Paediatr.* 93 (9): 1210–5. Doi: 10.1080/08035250410031305. PMID 15384886.
  43. Behere, SP; Weindling, SN (2014). "Inherited arrhythmias: The cardiac channelopathies." *Annals of Pediatric*

- Cardiology. 8 (3): 210–20. Doi: 10.4103/0974-2069.164695. PMC 4608198. PMID 26556967
44. Van Nguyen, JM; Abenhaim, HA (October 2013). "Sudden infant death syndrome: review for the obstetric care provider." *American journal of perinatology*. 30 (9): 703–14. Doi: 10.1055/s-0032-1331035. PMID 23292938.
  45. Phillips, DP; Brewer, KM; Wadensweiler, P (March 2011). "Alcohol as a risk factor for sudden infant death syndrome (SIDS)." *Addiction (Abingdon, England)*. 106 (3): 516–25. Doi: 10.1111/j.1360-0443.2010.03199.x. PMID 21059188.
  46. Surgeon General 2006, p. 194
  47. "Secondhand Smoke and Children Fact Sheet", American Lung Association August 2006.
  48. State health officer's report on E-cigarettes: A community health threat. California Department of Public Health, California Tobacco Control Program. January 2015
  49. Sabbagh, HJ; Hassan, MH; Innes, NP; Elkodary, HM; Little, J; Mossey, PA (2015). "Passive smoking in the etiology of non-syndromic orofacial clefts: a systematic review and meta-analysis." *PLOS ONE*. 10 (3): e0116963. Doi: 10.1371/journal.pone.0116963. PMC 4356514. PMID 25760440
  50. Wang, Meng; Wang, Zhi-Ping; Zhang, Meng; Zhao, Zhong-Tang (13 August 2013). "Maternal passive smoking during pregnancy and neural tube defects in offspring: a meta-analysis". *Archives of Gynecology and Obstetrics*. 289 (3): 513–521. Doi: 10.1007/s00404-013-2997-3.
  51. Pineles, B. L.; Park, E.; Samet, J. M. (10 February 2014). "Systematic Review and Meta-Analysis of Miscarriage and Maternal Exposure to Tobacco Smoke During Pregnancy". *American Journal of Epidemiology*. 179 (7): 807–823. Doi: 10.1093/aje/kwt334.
  52. Getahun D, Amre D, Rhoads GG, Demissie K. Maternal and obstetric risk factors for sudden infant death syndrome in the United States. *Obstet Gynecol*. 2004; 103(4): 646–652
  53. Kraus JF, Greenland S, Bulterys M. Risk factors for sudden infant death syndrome in the US Collaborative Perinatal Project. *Int J Epidemiol*. 1989; 18(1): 113–120 [SEP]
  54. Paris CA, Remler R, Daling JR. Risk factors for sudden infant death syndrome: changes associated with sleep position recommendations. *J Pediatr*. 2001; 139(6): 771–777 [SEP]
  55. Stewart AJ, Williams SM, Mitchell EA, Taylor BJ, Ford RP, Allen EM. Antenatal and intrapartum factors associated with sudden infant death syndrome in the New Zealand Cot Death Study. *J Paediatr Child Health*. 1995; 31(5): 473–478
  56. Farber HJ, Walley SC, Groner JA, Nelson KE; Section on Tobacco Control. Clinical practice policy to protect children from tobacco, nicotine, and tobacco smoke [policy statement]. *Pediatrics*. 2015; 136(5):1008–1017 [SEP]
  57. Farber HJ, Groner J, Walley S, Nelson K; Section on Tobacco Control. Protecting children from tobacco, nicotine, and tobacco smoke [technical report]. *Pediatrics*. 2015; 136(5). Available at: [www.pediatrics.org/cgi/content/full/136/5/e1439](http://www.pediatrics.org/cgi/content/full/136/5/e1439) [SEP]
  58. Blair PS, Fleming PJ, Smith IJ, et al; CESDI SUDI Research Group. Babies sleeping with parents: case-control study of factors influencing the risk of the sudden infant death syndrome. *BMJ*. 1999; 319(7223): 1457–1461
  59. Fleming PJ, Blair PS, Bacon C, et al; Confidential Enquiry into Stillbirths and Deaths Regional Coordinators and Researchers. Environment of infants during sleep and risk of the sudden infant death syndrome: results of 1993-5 case-control study for confidential inquiry into stillbirths and deaths in infancy. *BMJ*. 1996; 313(7051): 191–195
  60. Zhang K, Wang X. Maternal smoking and increased risk of sudden infant death syndrome: a meta-analysis. *Leg Med (Tokyo)*. 2013;15(3):115–121
  61. Vennemann MM, Hense HW, Bajanowski T, et al Bed sharing and the risk of sudden infant death syndrome: can we resolve the debate? *J Pediatr*. 2012; 160(1): 44–48, e42 [SEP]
  62. Arnstad M, Andersen M, Vege A, Rognum TO. Changes in the epidemiological pattern of sudden infant death syndrome in southeast Norway, 1984-1998: implications for future prevention and research. *Arch Dis Child*. 2001; 85(2): 108–115 [SEP]
  63. Scragg R, Mitchell EA, Taylor BJ, et al; New Zealand Cot Death Study Group. Bed sharing, smoking, and alcohol in the sudden infant death syndrome. *BMJ*. 1993; 307(6915): 1312–1318 [SEP]



### RESEARCH ARTICLE

#### EXTRACELLULAR L-ASPARGINASE PRODUCTION BY HALOTOLERANT STRAIN OF *ENTEROBACTER HORMAECHAEI* ISOLATED FROM MARINE FISHES.

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#### Abstract

Bacterial isolates from marine fishes were screened for L-Asparaginase production on M9 minimal agar medium. Eleven isolates were selected for the estimation of extracellular enzyme production by submerged fermentation. Highest enzyme activity observed was 39 IU/ml. Bacterial mass assessed as optical density using spectrophotometer showed strong correlation ( $p < 0.01$ ) with the extracellular enzyme production. In laboratory scale process optimization studies, conditions selected for L-asparaginase production were 40°C temperature, 7.0 pH and 3% sodium chloride concentration. The yield has been increased to 42 IU/ml upon fermentation with optimized process parameters. Taxonomic identity of the best extracellular enzyme producing bacterial isolate was studied by biochemical analysis, PCR amplification of a portion of 16S rDNA and comparative sequence analysis using NCBI tool. The isolate was identified as *Enterobacter hormaechei*. Halotolerance and sustained enzyme production at an elevated temperature might be advantages to exploit the bacterium on commercial scale for the production of extracellular L- asparaginase.

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#### Introduction:-

The enzyme L- asparaginase (L- asparaginase amidohydrolase, EC 3.5.1.1) is among the list of essential medicines for basic health system by World Health organization (Robertson *et al.*, 2015; Andrade *et al.*, 2014). L- asparaginase is widely accepted for its anti-neoplastic activity and is used for the treatment of acute lymphoblastic leukemia and lymph sarcoma (Neelam and Kuldeep, 2007). L-asparaginase, when administered to patients, catalyzes the hydrolysis of serum L-asparagine into L-aspartic acid and ammonia. Neoplastic cells depend on serum L-asparagine for their survival whereas normal cells can synthesize it. In presence of pharmacological concentrations L- asparaginase, neoplastic cells are eliminated by depriving the essential amino acid. The pharmaceutical enzymes have advantageous characteristics like biodegradability, non-toxic nature and ease of administration at the local sites. Besides the therapeutic value, L-asparaginase has also been used in food processing industries due to their capability to reduce acrylamide content in fried and baked foods.

Various sources of clinically important L-Asparaginase enzyme like bacteria, fungi and plants were reviewed by Dhananjayam and Kannan (2014) and Kumar and Verma (2012). Novel sources like marine actinomycetes (Shivasankari *et al.*, 2016) and genetically engineered microorganisms (Kishore *et al.*, 2015) were also studied for

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the enzyme production. Commercial bacterial producers are *Erwinia* spp., *E.coli* and *Pseudomonas* spp. (Peterson and Ciegler, 1969). On long term medication, the enzyme develops adverse immunological reactions (Burke 2014; Cortijo *et al.*, 2012). There is a continued demand for high quality L-asparaginase with more stable immunological properties for clinical applications. Enzymes from marine organisms, being halotolerant or halophilic in nature, might have more environmental adaptability and stable features. Most of the scientific reports were on cytoplasmic or periplasmic L-Asparaginases from bacteria. Considering the advantages of bacterial bioprocess, the present study envisages the screening for halotolerant bacterial strains with extracellular L-asparaginase production. The halophilic nature of the bacteria studied could be an added advantage to eliminate mesophilic contaminants during bioprocess.

## Materials and Methods:-

### 2.1 Sample preparation:

Samples of *Sardinella longiceps* (common name: Sardine) and *Rastrelliger kanagurta* (common name: Mackerel) were collected from retail outlets in and around Kochi, Kerala state in South India. A total of 24 samples of fishes were analyzed and each of the samples included a portion of the intestine, gills and skin with muscle.

### 2.2 Screening for L-asparaginase producing bacteria on M9 medium:

Screening for L- asparaginase production was carried out on M9 minimal medium (Gulati *et al.*, 1997). Ingredients per litre of the medium are  $\text{Na}_2\text{HPO}_4 \cdot 2\text{H}_2\text{O}$ , 6.0 g;  $\text{KH}_2\text{PO}_4$ , 3.0 g; NaCl, 0.5 g; L-asparagine, 5.0 g;  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ , 0.5g;  $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ , 0.15g; Glucose, 2g; bacteriological agar, 20.0 g. Phenol red (0.005%) is used as the pH indicator.

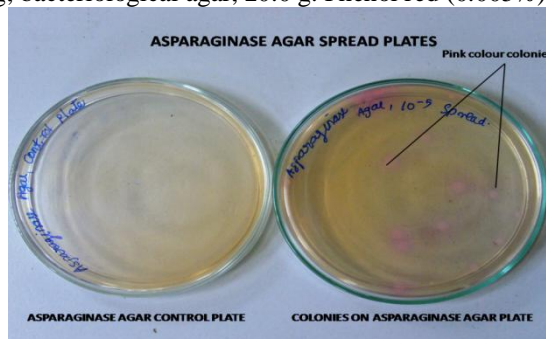


Fig 1:- L-Asparaginase producing colonies showing pink halo in the M9 medium

The M9 agar plates were surface plated with dilutions of the sample. The M9 medium contains L-asparagine as sole source of nitrogen. The pink coloration is due to the increase in pH around the colonies where ammonia is liberated by the hydrolysis of L-asparagine. Phenol red in the medium indicates the increase in pH as colour change from yellow to pink and thus suggestive of positive L-asparaginase production. The diameter of the pink zone represents the extent of enzyme production and was measured after 48 h incubation (Fig 1). Based on the zone diameter, 120 isolates were screened and categorized as 'excellent', 'good', 'medium' and 'poor' producers. The category 'excellent producers' had the diameter of pink halo above 14mm, 'good producers' has the halo between 13.9mm-10mm, 'medium producers' has 9.9mm-6mm and 'poor producers' has lesser than 5.9mm respectively.

### 2.3 Phenotypic characterization of the L- asparaginase producing isolates:

Phenotypic characterization was done by studying morphological and biochemical characteristics. Biochemical tests performed were IMViC tests, sugar fermentation test using glucose, sucrose and lactose, urease test, catalase test, hydrogen sulphide production, gelatin hydrolysis and starch hydrolysis test by standard procedures (Cappuccino and Sherman, 2011; <http://microbeonline.com/bacterial-identification-methods/>). Growth media used for biochemical studies were supplemented with 3% sodium chloride to maintain the halotolerant properties of the isolates.

### 2.4. Quantitative Assays on the Production of L-asparaginase:

Broth based assays were performed as an effort to screen the isolate that would produce highest yield of extracellular L-asparaginase. Eleven isolates which produced a conspicuous pink zone with more than 14mm diameter size was examined for enzyme activity by submerged fermentation in Tryptone glucose yeast extract (TGY) broth (Gulati *et al.*, 1997; Imada *et al.*, 1973). For enzyme production, a 250 ml volume of TGY broth in 500-ml Erlenmeyer flasks was inoculated 1ml of inoculum (0.2 OD at 600nm) of the bacterium to be tested. The broth is incubated in a shaker incubator at (180 rotations/min) at 37°C for 48h. After incubation, 0.1ml of

supernatant was tested with 0.9 ml of 0.1M Sodium borate buffer (pH 8.5) and 1 ml of 0.04M L-asparagine. The mixtures were incubated at 37°C for 15 minutes, and the reaction was stopped by the addition of 0.5 ml of 15% (w/v) trichloroacetic acid. Precipitated proteins were removed by centrifugation and the liberated ammonia was determined by using Nessler's reagent. Enzyme activity was calculated as international unit (IU) and one unit equals to the amount of enzyme which releases 1  $\mu$ mole of ammonia in 1 minute at 37°C (Wriston and Yellin, 1973).

## 2.5. Process optimization studies for L-Asparaginase production:

Among the eleven isolates, the strain which showed highest enzyme activity (Sp7) was selected for further process optimization. Consistent yield on M9 agar medium as well as TGY broth medium were considered for selecting the candidate strain. The production of the enzyme was evaluated at various pH ranging from 5 to 9. The TGY broth was adjusted to the test pH with 0.1N HCl and 0.1N NaOH. TGY broth was supplemented with 3% NaCl and the culture was incubated at 37°C in shaker incubator. At fixed intervals during incubation, growth at OD<sub>600</sub> and the enzyme estimation was done. Optimization of growth temperature was conducted in TGY broths at constant pH (7) and salt concentration (3%) at variable temperatures namely 30°C, 37°C, 40°C and 45°C. Similarly, the enzyme production and growth was evaluated at different sodium chloride concentrations like 1%, 3%, 5%, 7% and 9% in TGY broth at constant growth temperature (37°C) and pH (7).

## 2.6. Taxonomic characterization of the isolate by 16SrDNA:

Genomic DNA was isolated from 18h old cells by the method described by Wilson, 2001[16]. A 380bp stretch of 16S rDNA was amplified in a thermal cycler (Eppendorf, Germany) using specific forward primer, RW01 (5'-AAC TGG AGG AAG GTG GGG AT-3') and reverse primer, DG74 (5'-AGG AGG TGA TCC AAC CGC A-3'). Polymerase chain reaction (PCR) was carried out using conditions like initial denaturation at 95°C for 5 minutes followed by 30 cycles with 95°C for 25 seconds for denaturation, 55°C for 25 seconds for annealing and 72°C for 1 minute for extension and then at 72°C for 10 minutes final extension. The amplicons were separated in 1.2% agarose gel and viewed using gel documentation system (Vilber Lourmat, France). The band corresponding to ~380bp was purified and sequenced in both directions using Genetic Analyzer (Applied Biosystems, USA). The trimmed sequence was used as the query sequence to compare similar sequences using nucleotide BLAST tool from the website of National Centre for Biotechnology Information (NCBI).

## Results and Discussion:-

### 3.1 Phenotypic characterization of the L- asparaginase producing isolates:

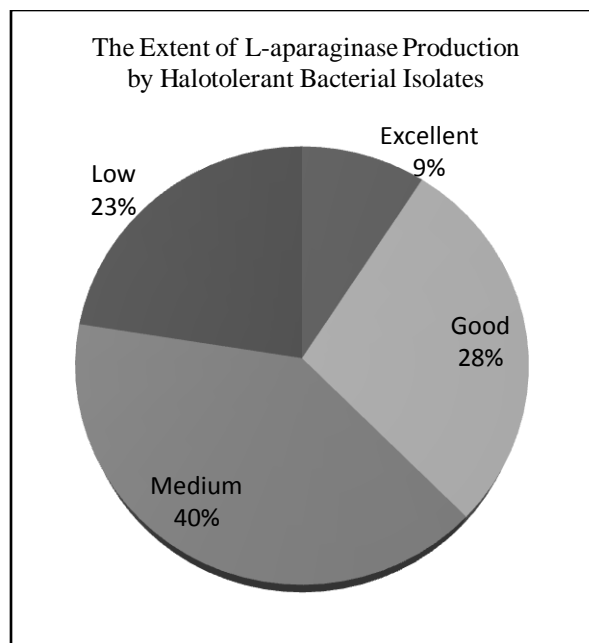
Results of the biochemical characterization of L-asparaginase producing bacterial isolates were presented in Table 1. A total of 98 isolates were assigned to different bacterial genera. The prevalence of the genera in the two fishes was *Aeromonas* (17.34%), *Arthrobacter* (4.08%), *Bacillus* (8.16%), *Enterobacter* (10.20%), *Erwinia* (8.16%) *Flavobacter* (10.20%), *Pseudomonas* (5.10%), *Serratia* (14.28%) and *Vibrio* (24.48%). Twenty two isolates could not be assigned to any genera and required further biochemical tests for the identifying the taxonomic status. A few of these bacterial genera are currently exploited for commercial production (Peterson and Ciegler, 1969). L-asparaginase is increasingly in demand due to its specific action and ease in combination therapy. However, on long term usage, the enzyme induces immunological responses like tolerance or hypersensitivity reactions. This warrants the need for novel enzyme with stable properties and fewer immunological effects. In the study, marine bacterial isolates were considered as their enzymes are adapted to specific growth conditions of elevated salt concentrations. Halophilic and halotolerant bacteria were reported to be exploited commercially for pharmaceutical enzyme production (Ebrahiminezhad *et al.*, 2011, Shirazian *et al.*, 2016).

L-Asparaginase is generally a cytoplasmic enzyme or would be secreted into the periplasmic space by the bacteria. Present study attempted to look for the extracellular enzyme production because of the economic benefits of easy downstream processing. Extracellular L-asparaginase production was reported earlier Murthy *et al.* (2015). The strain selected (Sp7) for the process optimization experiments was a halotolerant bacterium as it did not exhibit growth above 7% NaCl concentration in the growth medium. Unlike extreme halophilic bacteria, halotolerant bacteria would not accumulate ions in its cytoplasm for the osmotic balance (Nieto and Vargas, 2002; Brown, 1976). Thus the enzyme would be stable in general physiological conditions and the metabolic properties of the extracellular enzyme might be optimal for the pharmacological purposes.

### 3.2. Quantitative Assays on the Production of L-asparaginase

Out of the 120 enzyme producing isolates screened on M9 agar, 11 isolates were categorized as 'excellent producers' followed by 34, 48 and 27 as 'good producers', 'medium producers' and 'poor producers' respectively

(Fig 2). 'Excellent producers' were belonged to the genus *Bacillus*, *Psuedomonas*, *Aeromonas*, *Enterobacter*, *Serratia* and *Vibrio*.

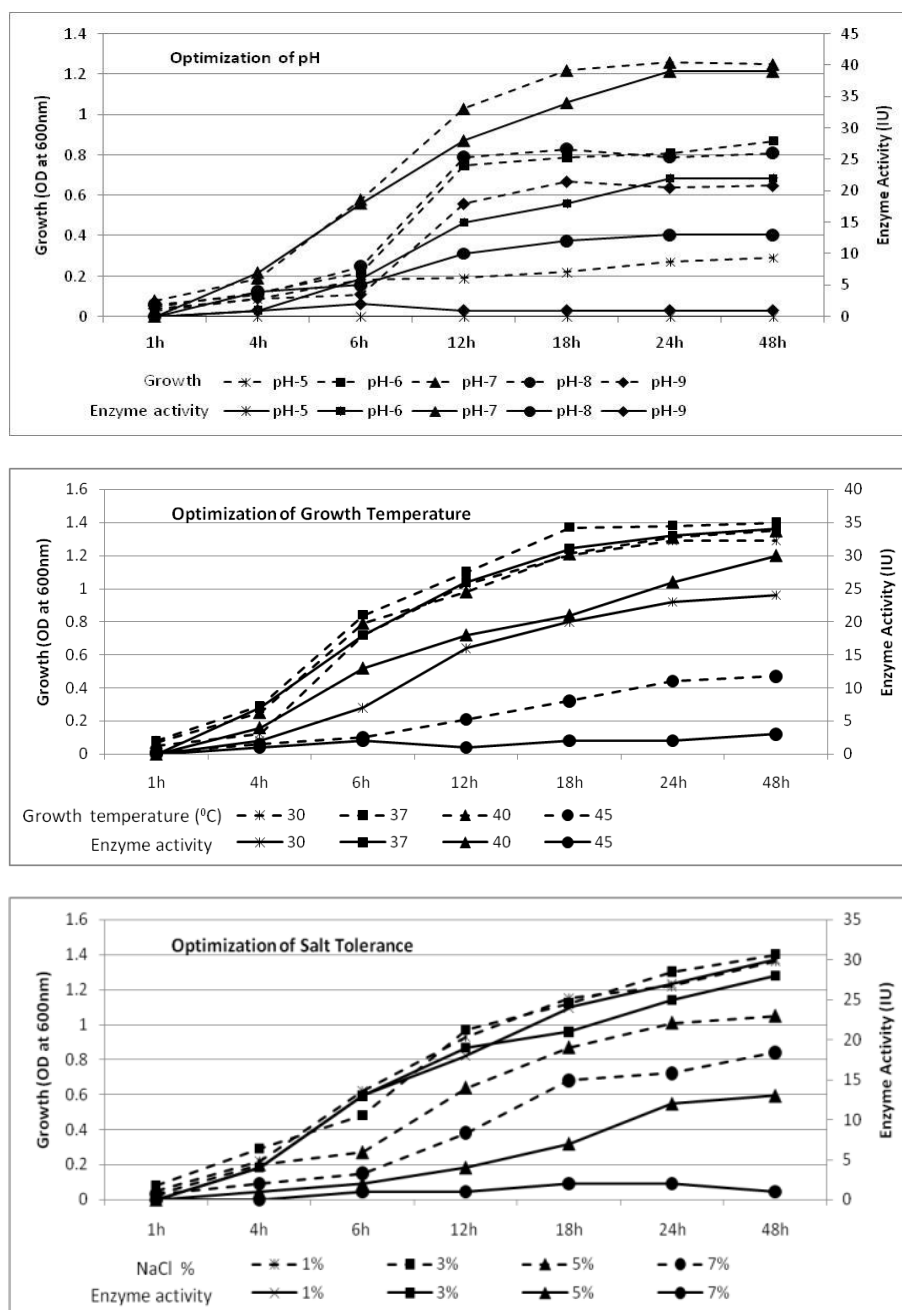


**Fig 2:0** L-Asparaginase production by halotolerant bacterial isolates from marine fishes

A total of eleven strains were assessed for their enzyme production in TGY medium by submerged fermentation. Growth conditions provided were 37°C temperature, 1% salt concentration and 7 pH. The active enzyme in the culture broth ranged from 11IU to 39IU per ml. The isolate, Sp7, showed the highest enzyme activity of 39IU/ml and was selected for further process optimization experiments. The Sp7 isolate showed 16mm pink halo on the M9 agar medium. The bacterium is Gram negative rods, non sporulating and showed positive reaction for biochemical tests like Vogues Proskauer test, Citrate utilization test, Urease test, Sugar fermentation test for lactose, sucrose and dextrose and Catalase test, and showed negative reactions for Indole test, Methyl red test, Starch hydrolysis test, Gelatin liquefaction test and H<sub>2</sub>S production test. Phenotypically, the isolate was identified as *Enterobacter* sp.

### 3.3. Process optimization studies:

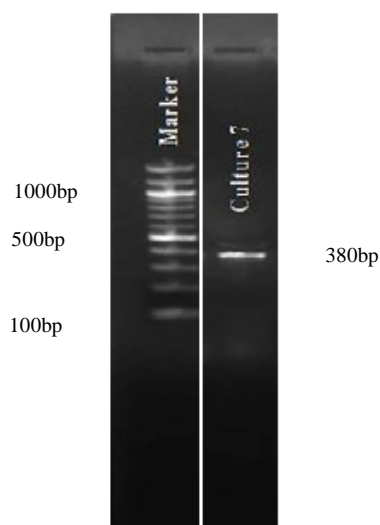
Result of the optimization assays for pH, temperature, and salinity tolerance was graphically represented in the fig 3. In all the experiments growth of the bacterium positively correlated with the extracellular enzyme production ( $p < 0.01$ ). The parameters selected were pH 7, temperature 40°C and salt concentrations 3% for the laboratory scale production. In optimal physicochemical conditions, the enzyme activity was increased to 42IU/ml. The increase in production is apparently small (1.6%) and further studies on substrate optimizations and effective strain improvement strategies are to be performed to increase the yield. Halotolerance and the elevated growth temperature of the isolate could be advantageous for reducing mesophilic contamination during the production process.



**Fig 3:-** Effect of pH, temperature, and salt tolerance on growth and L-asparaginase production by *Enterobacter* sp.(Sp7)

### 3.4. Taxonomical analysis of Sp7 isolate:

The taxonomic identity of the selected isolate, *Enterobacter* sp. (Sp7) was further confirmed by 16S rDNA characterization. The 16S rDNA based identification has advantageous over conventional biochemical method as it provide species level and phylogenetic information (Fredricks and Relman, 1996). Fig 3 shows the separated amplicon (~380bp) in 1.2% agarose gel. Trimmed sequence data of the partial 16S rDNA sequence was used as the query sequence to align similar sequences of the NCBI using nucleotide BLAST tool. The sequence showed 100% sequence identity with *Enterobacter hormaechei*.



**Fig 4:-** Partial 16S rDNA amplicon from *Enterobacter* sp. (Sp7)

*Enterobacter hormaechei* belong to the family *Enterobacteriaceae* which comprises generally mesophilic bacteria. The species is already exploited for industrial purpose as it produces rhamnolipid with biosurfactant properties (Mojard *et al.*, 2016). In another study by Sullam and his team (2012) on the formation of gut bacterial community on the fish, the halotolerant nature of the bacterium was reported. *Enterobacter hormaechei*'s competent survival efficiency, adaptability to grow in wide range growth parameters and extracellular nature of L-asparaginase production would make it a good candidate as an industrial strain with potential for commercial exploitation.

**Table.1:-** Biochemical characterization of L- asparaginase producing bacterial isolates from selected marine fishes.

Biochemical tests	<i>Sardinella longiceps</i> (No. of bacterial isolates= 68)		<i>Rastrelliger kanagurta</i> (No. of bacterial isolates = 52)	
	Positive	Negative	Positive	Negative
Gram reaction	14 (20.59%)	52 (79.41%)	13 (25.00%)	39 (75.00%)
Citrate utilization test	40 (58.82%)	28 (41.18%)	41 (78.84%)	11 (21.16%)
Indole production test	32 (47.05%)	36 (52.95%)	33 (63.46%)	19 (36.54%)
Methyl red test	24 (35.29%)	44 (64.71%)	21 (40.38%)	31 (59.62%)
Vogues Proskauer test	44 (64.70%)	24 (35.30%)	30 (57.69%)	22 (42.31%)
Urease test	41 (60.29%)	27 (39.71%)	13 (25.00%)	39 (75.00%)
Lactose fermentation test	31 (45.58%)	37 (54.42%)	34 (65.38%)	18 (34.62%)
Sucrose fermentation test	28 (41.17%)	40 (58.83%)	28 (53.84%)	24 (46.16%)
Dextrose fermentation test	35 (51.47%)	33 (48.53%)	32 (61.53%)	20 (38.47%)
Starch hydrolysis test	26 (38.23%)	42 (61.77%)	9 (17.30%)	42 (82.70%)
Gelatin liquefaction test	41 (60.29%)	27 (39.71%)	31 (59.61%)	21 (40.39%)
Hydrogen sulphide production	26 (38.23%)	42 (61.77%)	12 (23.07%)	40 (76.93%)
Catalase test	32 (47.05%)	36 (52.95%)	23 (44.23%)	29 (55.77%)

### Conclusion:-

A strain of halotolerant bacterium, *Enterobacter hormaechei*, isolated from marine fish was found to be suitable for extracellular L- Asparaginase production. The stability exhibited by the enzyme at wide physico-chemical conditions and tolerance up to 7% salt concentration would make it a suitable strain for L-asparaginase production with lesser mesophilic contamination.

### Declaration of Interest:

We, the three authors of this article, declare that there is no known conflict of interest associated with this publication.



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### References:-

1. Andrade, F.A, Borges, K.S. and Silveira, V.S. (2014): Update on the Use of L-Asparaginase in Infants and Adolescent Patients with Acute Lymphoblastic Leukemia. *Clinical Medicine Insights*, 8: 05-100.
2. Brown, A. (1976): Microbial water stress. *Bacteriological Reviews*, 40:803-46.
3. Burke, M.J. (2014): How to manage asparaginase hypersensitivity in acute lymphoblastic leukemia, *Future Oncol.*, 10:2615-2627.
4. Cappuccino, J.G., Sherman, N. (2011): (Editors) In *Microbiology: A Laboratory manual*. 9<sup>th</sup> Ed. Pearson publishers.
5. Cortijo, C.S., Jimenez-Cerezo, M.J., Tejada, H.A., (2012): Review of hypersensitivity reactions to antineoplastic agents. *Farm. Hosp.* 36:148-58.
6. Dhanam Jayam, G., Kannan, S., (2014): The various sources of L-asparaginase *International Journal of Recent Scientific Research.*, 5:342-346.
7. Ebrahiminezhad, A., Rasoul-Amini, S., Ghasemi, Y. (2011): L-Asparaginase production by moderate halophilic bacteria isolated from Maharloo Salt Lake. *Indian J. Microbiol.*, 51: 307-311.
8. Fredricks, D.N., Relman, D.A., (1996): Sequence-based identification of microbial pathogens: A reconsideration of Koch's postulates. *Clin. Microbiol. Rev.*, 9:18-33.
9. Gulati, R., Saxena, R.K., Gupta, R., (1997): A rapid plate assay for screening L-Asparaginase producing microorganisms. *Letters in Applied Microbiology*, 24:23-6.
10. <http://microbeonline.com/bacterial-identification-methods/> last accessed on 2.12.2016
11. Imada, A., Igarasi, S., Nakahama, K., Isono, M., (1973): Asparaginase and glutaminase activities of microorganisms. *J. Gen. Microbiol.*, 76:85-99.
12. Kishore, V., Nishita, K.P., Manonmani, H.K., (2015): Cloning, expression and characterization of L-asparaginase from *Pseudomonas fluorescens* for large scale production in *E. coli* *Biotech.*, 5:975.
13. Kumar, K., Verma, N., (2012): The various sources & application of L-Asparaginase. *Asian Journal of Biochemical and Pharmaceutical Research*, 2:197-2015.
14. Mojarad, M., Abbas, A., Golafarin, G., Mohammad, J., (2016): Kerosene biodegradation ability and characterization of bacteria isolated from oil-polluted soil and water. *Journal of Environmental Chemical Engineering.*, (accepted manuscript), <http://dx.doi.org/10.1016/j.jece.2016.09.035>
15. Moorthy, V., Aishwarya, R., Sumantha, A., Shankaranaya, R.T., (2010): Production, purification and characterization of extracellular L-asparaginase from a soil isolate of *Bacillus* sp. *African Journal of Microbiology Research.*, 4:1862-1867.
16. Nieto, J., Vargas, C., (2002): Synthesis of osmoprotectants by moderately halophilic bacteria: genetic and applied aspects. *Recent Research Development in Microbiology*, 6:403-18.
17. Peterson, R.E., and Ciegler, A., (1969): L-Asparaginase production by various bacteria. *Applied Microbiology*, 17:929-930.
18. Robertson, J., Magrini, N., Barr, R., Forte, G., and Ondari, C., (2015): Special report: Medicines for Cancers in Children: The WHO model for selection of essential medicines. *Pediatr. Blood Cancer*, 62:1689–1693.
19. Shirazian, P., Asad, S., Amoozegar, M.A., (2016): The potential of halophilic and halotolerant bacteria for the production of anti neoplastic enzymes: L-asparaginase and L-glutaminase. *EXCLI Journal*, 15:268-279.
20. Sivanshankari, T.R., Sudha, K., Bharathi, S., Karthikeyan, V., (2016): Efficacy of plasmid curing agent on *Streptomyces longsporesflavns*. *African Journal of Microbiology Research*, 10: 616-625. DOI: 10.5897/AJMR2015.7675.
21. Sullam, K.E., Essinger, S.D., Lozupone, C. A., O'Connor, M.P., Rosen, G.L., Knoght, R., et. al. (2012): Environmental and ecological factors that shape the gut bacterial communities of fish: a meta-analysis. *Molecular Ecology*, 21:3363-78.
22. Verma, N., Kumar, K., Kaur, G., Anand, S., (2007): L-asparaginase: a promising chemotherapeutic agent. *Crit Rev Biotechnol.*, 27:45-62.
23. Wilson, K., (2001): Preparation of Genomic DNA from Bacteria. In *Current Protocols in Molecular Biology*, 00:I:2.4.2.4.1–2.4.5.
24. Wriston, J.C., Yellin, T.O., (1973): L-Asparaginase: A Review. *Adv. Enzymol. Relat. Areas Mol. Biol.*, 39:185-248.



### RESEARCH ARTICLE

## THE USE OF THE MEMBRANE - REDOX POTENTIALS THREE - STATE LINE SYSTEM DEPENDENT - FULL 9 STEPPED CYCLE OF PROTON CONDUCTANCE - RELATED REGULATIONS IN THE ANTICANCER TREATMENT.

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#### Key words:-

The membrane - redox potentials three - state line system dependent - full 9 stepped cycle of proton conductance, the solid beta state, the fluid alpha state, the gamma state.

### Abstract

The essence of our new idea in relating to how to decrease the intensity of cancer cell growth by changing and establishing the right balance between glycolysis process and the process of proton, electron conductance in the membrane - redox potentials three - state line system dependent - full 9 stepped cycle, which functioned with using of oxygen is **follows:**

a. Maintaining of normal intensity of glycolysis process by stimulation the proton, electron conductance in the 2-th stage of the full 9 stepped cycle of proton conductance inside human body in the level of isocitrate dehydrogenase, alpha ketoglutarate dehydrogenase and succinate dehydrogenase.

b. Maintaining of normal intensity of glycolysis process by stimulation of the formation of oxaloacetate from malate under action of malate dehydrogenase in the 2-th stage of the full 9 stepped cycle of proton conductance inside human body in the level of isocitrate dehydrogenase, alpha ketoglutarate dehydrogenase and succinate dehydrogenase.

1-th stage of the full 9 stepped cycle of proton conductance inside human body is distinguished by release of proton, electron from food substrates (carbohydrate, amino acids, fatty acids), under the undirect action of oxygen released from membrane surroundings of erythrocyte in the 9 stage, from this stage started the proton conductance within cycle.

The maintaining of increased fluid alpha states, consisting of unsaturated fatty acids with high levels of oxy potentials conducting the flow of protons and electrons in this stage of cancer cells more useful to decrease the cancer cell growth.

If needed to decrease the cell division rates during cancer should be increased the alpha state with high oxidizing potentials in the reaction medium of "Donators + membrane - redox potentials three - state line system +  $O_2$  + ADP + Pi +  $H^+$  + nH + membrane space = (ATP + heat energy) +  $H_2O$  + nH + matrix +  $CO_2$ "

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### Introduction:-

Untill now we can not drive and regulate the intensity of metabolism reaction during cancer to more usefull needed direction because we do not know in which place of cells are existed driving point of regulations subjected to action of such kinds of manipulation and medicaments.

Revealed by us the membrane - redox potentials three - state line system is one of more important member of proposed by us the full 9 stepped cycle of proton conductance inside the human body and one of these places of cells, which easily subjected to action of manipulation and medicaments as driving point to conduct the usefull favorable direction of metabolism reactions during cancer, diabetes mellitus and hypercholesterinemia.

In such a case, membrane - redox potential's three - state line system serves the role of main driver.

We can create all the variants of useful reaction background forms of metabolism by changing the membrane - redox potentials three - state line system of the full 9 stepped cycle of proton conductance inside the human body.

If needed to decrease the cell division rates during cancer should be increased the alpha state with high oxidizing potentials in the reaction medium of "Donators + membrane - redox potentials three - state line system +  $O_2$  + ADP +  $Pi$  +  $H^+$  +  $nH$  + membrane space = (ATP + heat energy) +  $H_2O$  +  $nH$  + matrix +  $CO_2$ "

### Results and conclusion:-

We proposed that the biochemical characteristics of cancer cells more similar to Archea (prokaryotic) as if cancer cells acquired the some feature of Archea, as if normal cells made the evolutionary back steps to direction of the early evolution cells (as if Eukarya cells turn to Archaea- prokaryotic cells) with whom could be meet 4,4 billion years ago according to Woese classification .

The Archaea adapted to exist in extreme environments, niches devoid of oxygen and whose temperatures can be near or above the normal boiling point of water.

Archaea are prokaryotic cells which are typically characterized by solid membrane lipids that are branched hydrocarbon chains attached to glycerol by ether linkages. The presence of these ether linkages in Archaea adds to their ability to withstand extreme temperatures and highly acidic conditions.

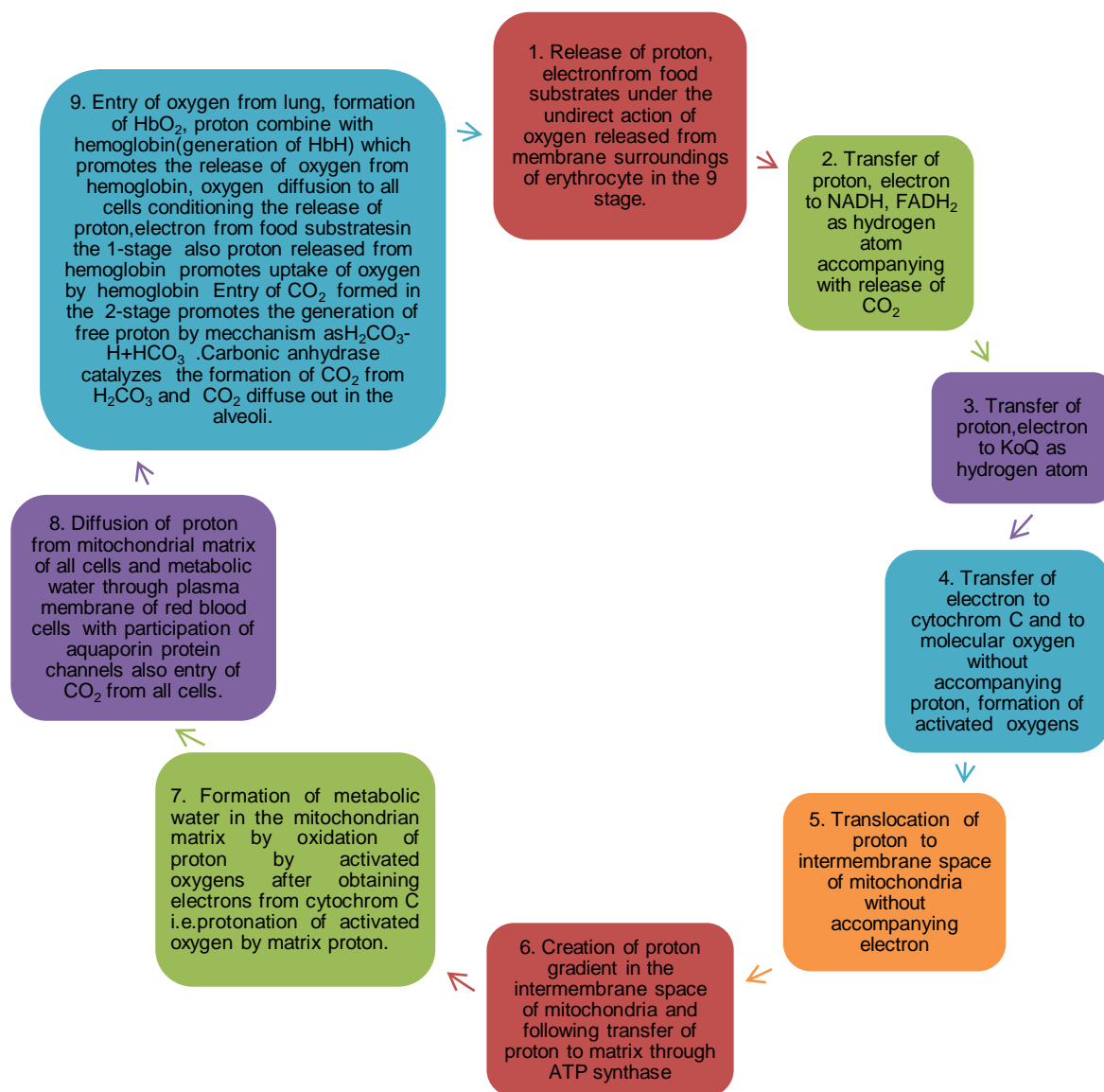
We can see abovementioned feature of Archea, possessing the solid beta state of membrane structures and their ability to withstand extreme temperatures and highly acidic conditions in example of cancer cells, behind these regulations may be existed the such lawfull process as rapidly growing tumor cells typically have glycolytic rates up to 200 times higher than those of their normal tissues of origin, this occurs even if oxygen is plentiful.

The Warburg effect is the observation that most cancer cells predominantly produce energy by a high rate of glycolysis .

Otto Warburg postulated this change in metabolism as glycolysis, is the fundamental cause of cancer.

Many substances have been developed which inhibit glycolysis, and such inhibitors are currently the subject of intense research as anticancer agents.

In this connection raised the questions that if most cancer cells produce energy by a high rate of glycolysis in the cytosol, what kinds of positive usefull changes should be induced in the membrane - redox potentials three - state line system dependent - full 9 stepped cycle of proton conductance because glycolysis followed by oxidation of donators in this cycle.



Also raised the questions how to use this positive useful changes in the anticancer treatment by causing the useful shift in the the membrane - redox potentials three - state line system dependent - full 9 stepped cycle of proton conductance such as from the solid beta state of membranes consisting of mainly saturated fatty acids conditioning a high levels of red potentials to the fluid alpha state of membranes, consisting of unsaturated fatty acids with high levels of oxy potentials, also from the gamma state of membranes consisting of decreased contents of saturated - unsaturated fatty acids, conditioning a decreased levels of redox potentials to the fluid alpha state of membranes with high levels of oxy potentials.

9-th stage of the the membrane - redox potentials three - state line system dependent - full 9 stepped cycle of proton conductance is distinguished by entry of oxygen from lung, formation of HbO<sub>2</sub>, proton combine with hemoglobin (generation of HbH) which promotes the release of oxygen from hemoglobin, oxygen diffusion to all cells conditioning the release of proton, electron from food substrates.

The abovementioned explanation shows that promotion of the release of oxygen from hemoglobin, oxygen diffusion to all cells conditioning the release of proton, electron from food substrates in the 9-th stage of the the membrane - redox potentials three - state line system dependent - full 9 stepped cycle of proton conductance by increasing the fluid alpha state of membranes, consisting of unsaturated fatty acids with high levels of oxy potentials in cancer cells may be used in the anticancer treatment.

**We proposed that:-**

The essence of our new idea in relating to how to decrease the intensity of cancer cell growth by changing and establishing the right balance between glycolysis process and the process of proton, electron conductance in the membrane - redox potentials three - state line system dependent - full 9 stepped cycle, which functioned with using of oxygen is follows:

a. Maintaining of normal intensity of glycolysis process by stimulation the proton, electron conductance in the 2-th stage of the full 9 stepped cycle of proton conductance inside human body in the level of isocitrate dehydrogenase, alpha ketoglutarate dehydrogenase and succinate dehydrogenase.

b. Maintaining of normal intensity of glycolysis process by stimulation of the formation of oxaloacetate from malate under action of malate dehydrogenase in the 2-th stage of the full 9 stepped cycle of proton conductance inside human body in the level of isocitrate dehydrogenase, alpha ketoglutarate dehydrogenase and succinate dehydrogenase.

1-th stage of the full 9 stepped cycle of proton conductance inside human body is distinguished by release of proton, electron from food substrates (carbohydrate, amino acids, fatty acids), under the undirect action of oxygen released from membrane surroundings of erythrocyte in the 9 stage, from this stage started the proton conductance within cycle.

The maintaining of increased fluid alpha states, consisting of unsaturated fatty acids with high levels of oxy potentials conducting the flow of protons and electrons in this stage of cancer cells more useful to decrease the cancer cell growth.

2-th stage of the full 9 stepped cycle of proton conductance inside human body is distinguished by transfer of proton, electron to NADH, FADH<sub>2</sub> as hydrogen atom accompanying with release of CO<sub>2</sub>, by which stage continued the proton conductance within cycle.

The maintaining of increased fluid alpha states, consisting of unsaturated fatty acids with high levels of oxy potentials conducting the flow of protons and electrons in this 2-th stage of cancer cells more useful to decrease the cancer cell growth.

4-th stage of the full 9 stepped cycle of proton conductance inside human body is distinguished by transfer of electron to cytochrom C without accompanying proton, which one is stages of continuity of the proton conductance within cycle and the increase of the fluid alpha state, consisting of unsaturated fatty acids with high levels of oxy potentials conducting the flow of protons and electrons.

The maintaining of increased fluid alpha states, consisting of unsaturated fatty acids with high levels of oxy potentials conducting the flow of protons and electrons in this 4-th stage of cancer cells more useful to decrease the cancer cell growth.

According to the full 9 stepped cycle of proton conductance inside human body proposed by Ambaga and Tumen-Ulzii (2015) 6- th stage of the full 9 stepped cycle of proton conductance inside human body is distinguished by creation of proton gradient in the intermembrane space of mitochondria and following transfer of proton to matrix through ATP synthase, which is played important role in continuity of the proton conductance within cycle.

The maintaining of increased fluid alpha states, consisting of unsaturated fatty acids with high levels of oxy potentials conducting the flow of protons and electrons in this 6- th stage of cancer cells more useful to decrease the cancer cell growth.

Also 7- th stage of the full 9 stepped cycle of proton conductance inside human body is distinguished by formation of metabolic water in the mitochondrian matrix by oxidation of proton by molecular oxygens i.e, by protonation of molecular oxygen by matrix proton, which is one of a previous stages of continuity of the proton conductance cycle and in this connection the increase of the fluid alpha state, consisting of unsaturated fatty acids with high levels of oxy potentials conducting the flow of protons and electrons in this 7- th stage of cancer cells more useful decrease the cancer cell growth.

9-th stage is distinguished by entry of oxygen from lung, formation of  $\text{HbO}_2$ , proton combine with hemoglobin (generation of  $\text{HbH}$ ) which promotes the release of oxygen from hemoglobin, oxygen diffusion to all cells conditioning the release of proton, electron from food substrates and the increase of the fluid alpha state, consisting of unsaturated fatty acids with high levels of oxy potentials conducting the flow of protons and electrons.

The maintaining of increased fluid alpha states, consisting of unsaturated fatty acids with high levels of oxy potentials conducting the flow of protons and electrons in this 9-th stage of cancer cells more useful to decrease the cancer cell growth.

### References:-

1. Ambaga M, Tumen-Ulzii A (2016). Integrated NCM medicine with s-NCM new knowledge, Lambert Academic Publishing
2. Ambaga M, Tumen-Ulzii A (2015). The life become dependent from the presence of electrons and protons, which were formed during events called big bang 15 billion years ago, electrons and protons sets the stage for formation of life in the universe
3. Ambaga M (2016). The Full Cycle of Proton and Electron Conductance inside the Human Body, Consisting of 9 Linked Stages. Acad. J. Sci. Res. 4(6): 127-131.
4. Ambaga M (2016). A new suggestion about existing of membrane - redox potential three state line system between donors and acceptors inside the living cells, Asian Journal of Science and technology, Vol.07, Issue, 07, pp.3157-3161.
5. Ambaga M (2016). The buffering capacity of erythrocyte membrane surroundings in relation to free protons, formed in the Full Cycle of Proton and Electron Conductance inside the Human Body. **International Journal of Development Research**, Vol 06, Issue, 07, pp. 8458-8461.
6. Ambaga M (2016). The Full Cycle of Proton and Electron Conductance inside the Human Body and triple Rlung, Mkhris, Badgan theory of Tibetan Traditional medicine, **International Journal of Current Research**, Vol 8, Issue 08, p.36391-36393.
7. Ambaga M (2016). The possibility to drive the membrane - redox potential, a three state line system dependent - full 9 stepped cycle of proton conductance inside human body to favorable direction during pathological situations., International Journal of Current Research, Vol, Issue,11, pp 42456-42459, November.
8. Nick Lane, and William F. Martin (2012), The origin of membrane bioenergetics J.cell, <http://dx.doi.org/10.1016/j.cell.2012.11.050>.
9. Víctor Sojo, Andrew Pomiankowski, Nick Lane (2014), A Bioenergetic Basis for Membrane Divergence in Archaea and Bacteria, Published: August 12, 2014, <http://dx.doi.org/10.1371/journal.pbio.1001926>
10. Filipa L. Sousa, Thorsten Thiergart, Giddy Landan, Shijulal Nelson-Sathi, Inês A. C. Pereira, John F. Allen, Nick Lane, William F. Martin (2013), Early bioenergetic evolution, Published 10 June 2013.DOI: 10.1098/rstb.2013.0088.



## RESEARCH ARTICLE

### QUALITY OF LIFE OF MEDICAL STUDENTS AT QASSIM UNIVERSITY.

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#### Abstract

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#### Introduction:-

Recently, Saudi students have been noticed to pursue their education in medical field more likely than before. Due to the fact that medicine is one of the specialities that is known for its long journey and continuous stress, the quality of life (QOL) of medical students has emerged as an issue that has to be assessed carefully. This current study is the first of its kind to focus on medical students' life in the central region of Saudi Arabia.

#### Methodology:-

A cross-sectional study was conducted among second and third year medical students at Qassim University using WHOQOL-BREF instrument for data collection. Different domains were pointed out within the questionnaire including degree of satisfaction about physical, psychological health, environment and social life. Moreover, influencing factors like age, income, marital status, habitat and academic performance were considered, too.

#### Results and discussion:-

Generally, the results showed a low QOL of medical students, nonetheless, they scored highest at Physical health (Mean  $\pm$ SD:73.4 $\pm$ 4.1) followed by environment (Mean:49.6). On the other hand, the lowest score was found to be social relationship (Mean: 23) followed by psychological health (Mean: 36.8). To some points, this was not surprising as medical training is one of the most stressful undergraduate training worldwide. Moreover, students who are 21 years or more, third year students, living with their family and have an excellent income reported a higher QOL.

#### Conclusion:-

As our study results have shown a low QOL, measures such as reevaluating the curriculum and improving students' lifestyle must be taken to bring about a change. Furthermore, other studies are warranted to meticulously evaluate the quality of life and ensure a better support system for our students.

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**References:-**

1. WHOQOL Group (1994) Development of the WHOQOL: Rationale and current status. *Int J Mental Health* 23: 24-56.
2. Aktekin M, Karaman T, Senol YY, Erdem S, Erengin H, et al. (2001) Anxiety, depression and stressful life events among medical students: A prospective study in Antalya, Turkey. *Med Educ* 35: 12-17.
3. Paro HB, Morales NM, Silva CH, Rezende CH, Pinto RM, et al. (2010) Health related quality of life of medical students. *Med Educ* 44: 227-235.
4. Moffat KJ, McConnachie A, Ross S, Morrison JM (2004) First year medical student stress and coping in a problem-based learning medical curriculum. *Med Educ* 38: 482- 491.





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### RESEARCH ARTICLE

#### A CASE REPORT OF BERNARD-SOULIER SYNDROME IN DIFFERENTIAL DIAGNOSIS OF IMMUNE THROMBOCYTOPENIC PURPURA.

Lujain faisal aletani, Housam Almadni, Basel Dahlawi, Weam Ahmed Murad, Dina Mohamed Hossameldin Ahmed, Ahmad Talal Alharbi, Abdulrahman Mohammed Alharbi, Ahmed Mashhour Al ghamdi, Ibrahem Hamad Alwashmi, Bushra Mukhtar Alhajjaji, Daniya Osama Abdouh, Abdul rahman Tareq Khizindar, Raghad Fareed Hakim and Ahmed Ali AlGhamdi.

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Bernard Soulier Syndrome, idiopathic thrombocytopenic purpura, thrombocytopenia, giant platelets, hereditary thrombocytopenia.

#### Abstract

Bernard-Soulier Syndrome (BSS) is a rare hereditary disorder. Platelets in patients with BSS are unable to adhere, leading to an increased bleeding tendency. BSS cases are often misdiagnosed as idiopathic thrombocytopenic purpura (ITP). We report here a seven years old girl diagnosed as Bernard-Soulier syndrome with homozygous deletion of 39 nucleotides in the exon 2 of GPIBA. Bernard-Soulier syndrome should be considered before the patient is diagnosed with immune thrombocytopenia.

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#### Introduction:-

Bernard-Soulier syndrome (BSS) was first known by two French hematologists – Jean Bernard and Pierre Soulier. They found out a patient from a consanguineous family with severe bleeding episodes, thrombocytopenia and very large platelets<sup>[1]</sup>. It is a rare hereditary disorder (1:1000000)<sup>[2]</sup>. Platelets in patients with BSS are unable to adhere, leading to an increased bleeding tendency<sup>[3]</sup>. BSS is a platelet function disorder, transmitted in an autosomal recessive manner. Caused by defects in the glycoprotein (GP)Ib/IX/V complex<sup>[4]</sup>. These genes stand for a group of linked proteins normally found on the surface of the platelets<sup>[5]</sup>. Composed of four subunits, GPIb $\alpha$  disulphide-linked to two GPIb $\alpha\beta$  subunits, GPIX and GPV in a ratio of 2:4:2:1, respectively<sup>[5]</sup>. The genes for each of these subunits have been cloned and are located in Chromosome (ch). 17p12 (GPIBA)<sup>[6]</sup>, ch.22q11.2 (GPIIB)<sup>[7]</sup>, ch3q21 (GP9)<sup>[8]</sup> and ch.3q29 (GP5)<sup>[9]</sup>. BSS cases are often misdiagnosed as idiopathic thrombocytopenic purpura (ITP)<sup>[5]</sup>. In this case report, we present one girl with causative mutations in GPIBA.

#### Case History:-

A seven years old Saudi girl previously healthy until the age of 5 years old when she presented on 15/1/2015 complaining of petechiae all over face, chest, arms, abdomen, and legs. Another systemic review was unremarkable. She was not on any medications. On examination she was conscious, alert, oriented, not distressed. No enlarged lymph nodes were palpable in any part of her body. Her abdomen was not distended, and her spleen and liver were not palpable. Other systemic examinations were unremarkable.

Laboratory findings were: CBC (HG: 11.7, RBC: 4.19, WBC: 11.2, PLATELET: 80).

Blood film: many large and giant platelets seen. Serologic examinations for Human Immunodeficiency Virus and hepatitis B and C were all negative. Also, ANA and direct coombs test were negative.

The patient diagnosed as idiopathic thrombocytopenia. Received IVIG and discharged in good condition. In addition, she had multiple admissions due to the same complain petechiae and low platelet count. She received IVIG many times, and she responded as platelet count increase at least by 30,000 but after two to four weeks platelets drop again even below 10,000. There was no response to steroids. She responded to anti-D once for four weeks. She received four doses of rituximab there was no response until 16 weeks. Bone marrow aspiration and biopsy were done on 30/3/2015 before receiving steroids; the result was cellular normal marrow. Normal megakaryocytes content on the marrow. No pathology on the marrow to explain the thrombocytopenia.

She was diagnosed as chronic ITP with frequent admission and poor response to treatment and due to hospital logistic issues platelets aggregation and flow cytometry not done. The doctor arranged an appointment for follow-up and genetic analysis for Bernard-Soulier syndrome. The result of Molecular genetic analysis of the genes GP1BA, GP1BB, GP9 showed a presence of a homozygous deletion of 39 nucleotides in the exon 2 of GP1BA. Finally, she diagnosed as Bernard-Soulier Syndrome (BSS).

### Discussion:-

Bernard-Soulier syndrome is an autosomal recessive disorder. Bernard-Soulier syndrome affects both males and females<sup>[10]</sup>. In Bernard-Soulier syndrome, thrombocytopenia is associated with morphologically abnormal large platelets and platelet dysfunction. The clinical manifestation is variable and includes purpura, epistaxis, gingival bleeding, menorrhagia, occasional gastrointestinal bleeding, hematoma, or hematuria. The diagnosis of platelet function disorders needs a detailed medical history and a series of laboratory tests.

In people with Bernard-Soulier syndrome:

- The bleeding time is difficult to perform in young children.
- The closure time is prolonged.
- Larger platelets.
- Platelets appear on the blood film.
- There are usually fewer platelets than normal.
- Platelets do not clump together normally in the presence of ristocetin.
- GPIb/IX/V is not detectable by flow cytometry<sup>[10]</sup>.

Reasons to suspect hereditary thrombocytopenia<sup>[11]</sup> (See Table 1)

Classification schemes for hereditary thrombocytopenia<sup>[11]</sup> (See Table 2)

On (Table 3 and 4) showed Mutations Identified and some diseases associated in Patients with Bernard-Soulier Syndrome, their ages ranged from 1 to 70 years. They had platelet counts from 22 to  $178 \times 10^9/L$ . The mean value of MPV was 12.6 fL, with a range from 10.4 to 17.2 fL<sup>[92]</sup>.

Mutation of the glycoprotein (GP) Ib/IX complex associated with Bernard-Soulier Syndrome (See Table 5)<sup>[92]</sup>

Idiopathic thrombocytopenic purpura, leukemia should be included in the differential diagnosis of patients with Bernard-Soulier syndrome. Patients with idiopathic thrombocytopenic may have detectable antiplatelet antibodies. In the past, Inherited thrombocytopenia were, considered very rare. Patients are subject to misdiagnosis of autoimmune thrombocytopenic instead of hereditary thrombocytopenia and inappropriate therapy, such as steroid treatment and splenectomy.<sup>[27-29]</sup>

Proposed definitions of ITP (Table 6)<sup>[30]</sup>

Proposed criteria for assessing response to ITP treatments (Table 7)<sup>[30]</sup>

Individual agents for treatment of ITP and the time to the first and peak responses if using the reported dose range (Table 8)<sup>[30]</sup>

Refractory ITP (Table 9)<sup>[30]</sup>

Here, we report one girl with Bernard-Soulier syndrome (BSS) who missed diagnosed as ITP. She demonstrated typical BSS features such as giant platelets and petechial rash. In Conclusion, Bernard-Soulier syndrome should be considered before the patient is diagnosed with immune thrombocytopenia.

**Table 1:-** Reasons to suspect hereditary thrombocytopenia. <sup>[11]</sup>

a) Lack of platelet response to therapies including steroids, IVIG, IV anti-D, and splenectomy and, rituximab.
b) A family history of thrombocytopenia.
c) Abnormal size of platelets on blood film.
d) Abnormal bleeding time in comparison with platelet count.
e) Onset at birth.
f) Associated features such as high tone hearing loss, absent radii, mental retardation, renal failure, cataracts, or the development of leukemia.

**Table 2:-** Classification schemes for hereditary thrombocytopenias. <sup>[11]</sup>

a) Thrombocytopenia due to poor production or accelerated destruction.
b) Mode of inheritance: X-linked (Wiskott-Aldrich syndrome) or autosomal dominant.
c) Platelet size on smear: very large, normal, or small (Wiskott-Aldrich Syndrome); other findings, e.g. Dohle-like bodies in neutrophils.
d) Associated features including clinical and laboratory findings: <ol style="list-style-type: none"> <li>findings on exam or by history, e.g., absent radii, renal failure, hearing loss (May Hegglin Anomaly)</li> <li>laboratory abnormalities, e.g., flow cytometry for platelet glycoprotein expression, platelet function testing, assessment of the von Willebrand factor multimer composition.</li> </ol>

**Table.3:-** Mutations Identified in Patients with BSS <sup>\*[92]</sup>

Gene mutation	Nucleotide substitutions	Amino acid Change	Genotype	Initial diagnosis	Splenectomy	References
<b>GPIB<math>\alpha</math> mutation</b>						
7F	deletion of 39 nucleotides in the exon 2		Homozygous	ITP	-	Our Patient
41F	3998-3999delTG	Premature termination	Homozygous	ITP	+	[12]
43M	4444insT	Premature termination	Compound heterozygous	ITP	+	[12]
	4464delA	Premature termination				
26F	4447C>A (TCA>TAA)	Ser444Stop	Homozygous	ITP	-	[13]
34F	4464delA	Premature termination	Homozygous	ITP	+	[14]
14F	4464delA	Premature termination	Homozygous	?	Oophorectomy	[15]
<b>GPIB<math>\beta</math> mutation</b>						
37F	777C>T (CGC>TGC)	Arg17Cys	Heterozygous	GPD	-	[16]
6F	949C>G (CCG>CGG)	Pro74Arg	Homozygous	BSS	-	[17]
37F	991A>G (TAC>TGC)	Tyr88Cys	Compound heterozygous	ITP	-	[18]
	1050G>C (GCC>CCC)	Ala10Pro				
20F	991A>G (TAC>TGC)	Tyr88Cys	Homozygous	BSS	-	[19]
37M	1096G>A (TGG>TAG)	Trp123Stop	Homozygous	ITP	+	S.K., et al, unpublished data
1moF	del 22q11.2	unknown	Compound heterozygous	BSS	-	[20]

7M			Homozygous	BSS	-	[62]
4M			Homozygous	BSS	-	[62]
<b>GPIX mutation</b>						
39F	1856T>C (TTT>TCT)	Phe55Ser	Homozygous	ITP	+	[21]
46F	1910G>A (TGT>TAT)	Cys73Tyr	Homozygous	BSS	-	[22]
31M	1910G>A (TGT>TAT)	Cys73Tyr	Homozygous	ITP	-	[22]
46M	1982G>A (TGT>TAT)	Cys97Tyr	Homozygous	ITP	+	[23]
30F	2076G>A(TGG>TG A)	Trp127Stop †	Homozygous	ITP	+	[14,40]
39F	2076G>A(TGG>TG A)	Trp127Stop	Homozygous	ITP	-	[24]
44F	2076G>A(TGG>TG A)	Trp127Stop	Homozygous	ITP	+	[24]

\*Nucleotide numbering for GPIb<sub>α</sub>, GPIb<sub>β</sub>, and GPIX is according to GenBank accession numbers M22403, U07983, and M80478, respectively. GP indicates glycoprotein; ITP, idiopathic thrombocytopenic purpura; GPD, giant platelet disorders; BSS, Bernard-Soulier syndrome.

†Originally reported as codon 126.

**Table 4:-** Bernard-Soulier Syndrome Associations

Association	Age	Gender	Reference
Angiodysplasia	39 years old	Female	[31]
	-	Female	[32]
	14 years old	Male	[33]
Angiodysplasia + breast cancer + Hepatitis C	48 years old	Female	[34]
Tuberculosis	14 years old	Female	[35]
Hepatitis	42 years old	Female	[36]
Coronary artery disease	68 years old	Male	[37]
Atherosclerosis and unstable angina	66 years old	Male	[38]
Pregnancy	Variable	Female	[39]
Aquagenicurticarial	18 years old	Male	[45]
Developmental dysplasia of her left hip (DDH)	40 years old	Female	[46]
Acute myeloid leukemia	21 years old	Female	[25]
Myocardial infarction	60 and 64 years old	Male	[26]

**Table 5:-** Mutation of the glycoprotein (GP) Ib/IX complex associated with Bernard-Soulier Syndrome<sup>[92]</sup>

Mutation	Nucleotide Substitution	Amino acid change	References
GPIb <sub>α</sub> Mutations	3172delA	Premature termination	[63]
	3233-3236delTGAG	Premature termination	[64]
	3285C>T	Leu57Phe	[65]
	3309T>C	Cys65Arg	[66]
	3343delT	Premature termination	[67]
	3502T>C	Leu129Pro	[68-69]
	3583C>T	Ala156Val	[70-71-72]
	3621-3656del	Premature termination	[72]
	3651-3653delCTC	del Leu179	[73]
	3741T>A	Cys209Ser	[74-75]
	3998-3999delTG	Premature termination	[12]
	4145G>A	Trp343stop	[76]
	4444insT	Premature termination	[12-14-75]

	4447C>A	Ser444stop	[13]
	4464delA	Premature termination	[12-14]
	4591-4592delAt	Premature termination	[77-78-79]
	4610G>A	Trp498stop	[66-80]
GPIIb Mutations	del 22q11.2	-	[81-82-83]
	220C>G	Loss of GATA1 site	[81]
	777C>T	Arg17Cys	[16]
	790G>A	Trp21stop	[85]
	945C>G	Pro74Arg	[17]
	963delC	Premature termination	[86]
	991A>G	Tyr88Cys	[18-19]
	1050G>C	Ala108Pro	[18]
	1096G>A	Trp123stop	S.K., et al., unpublished data
GPIX Mutations	1717T>C	Cys8Arg	[87]
	1757A>G	Asp21Gly	[88]
	1811T>C	Leu40Pro	[89]
	1826A>G	Asn45Ser	[88-90-91]
	1856T>C	Phe55Ser	[84-21]
	1910G>A	Cys73Tyr	[22]
	1982G>A	Cys97Tyr	[23]
	2076G>A	Trp127stop	[14-24]
*Nucleotide numbering for GPIIb, GPIIb $\beta$ , and GPIX is according to GenBank accession numbers M22403, U07983, and M80478, respectively.			

**Table 6:-** Proposed definitions of disease<sup>[30]</sup>

Primary idiopathic thrombocytopenic	<ul style="list-style-type: none"> <li>It is an autoimmune disorder characterized by isolated thrombocytopenia (peripheral blood platelet count &lt;100 x 10<sup>9</sup>/L) in the absence of other causes that may be associated with thrombocytopenia. No confirmed clinical or laboratory parameters are currently available to establish its diagnosis with accuracy.</li> </ul>
Secondary ITP	<ul style="list-style-type: none"> <li>All immune-mediated thrombocytopenia except primary ITP*</li> </ul>
Phases of the disease	<ul style="list-style-type: none"> <li>Newly diagnosed ITP: within three months from diagnosis</li> <li>Persistent ITP: between 3 to 12 months from diagnosis.</li> <li>Chronic ITP: More than 12 months.</li> <li>Severe ITP: Presence of bleeding symptoms at presentation need treatment, or occurrence of new bleeding symptoms requiring additional therapeutic intervention with a different platelet-enhancing agent or an increased dose.</li> </ul>

**Table 7:-** Proposed criteria for assessing response to ITP treatments<sup>[30]</sup>

<b>Quality of response</b>
<ul style="list-style-type: none"> <li>CR: platelet count &gt;100 x 10<sup>9</sup>/L and absence of bleeding.</li> <li>R: Platelet count &gt;30 x 10<sup>9</sup>/L and at least 2-fold increase the baseline count and absence of bleeding.</li> <li>Time to response: time from starting treatment to time of achievement of CR or R.</li> <li>NR: platelet count &lt;30 x 10<sup>9</sup>/L or less than 2-fold increase of baseline platelet count or bleeding</li> <li>Loss of CR or R: Platelet count &lt;100 x 10<sup>9</sup>/L or bleeding (from CR) or &lt;30 x 10<sup>9</sup>/L or less than 2-fold increase of baseline platelet count or bleeding (from R)</li> </ul>
<b>Timing of assessment of response to ITP treatments</b>
<ul style="list-style-type: none"> <li>Variable depends on the type of treatment (see Table 8).</li> </ul>
<b>Duration of response</b>
<ul style="list-style-type: none"> <li>Measured from the achievement of CR or R to loss of CR or R.</li> </ul>
For response criteria in refractory ITP, see Table 9.

**Table 8:-** Individual agents for treatment of ITP and the time to the first and peak responses if using the reported dose range<sup>[30]</sup>

Agent/treatment	Reported dose range	Time to initial response*	Time to peak response*
Prednisone <sup>[46,47]</sup>	1-4 mg/kg PO daily x 1-4 wk	4-14 d	7-28 d
Dexamethasone <sup>[48,49]</sup>	40 mg PO or IV daily x 4 d for 4-6 courses every 14-28 d	2-14 d	4-28 d
IVIg <sup>[50,51,52]</sup>	0.4-1 g/kg per dose IV (1-5 doses)	1-3 d	2-7 d
Anti-D <sup>[53,54]</sup>	75 ug/kg per dose IV	1-3 d	3-7 d
Rituximab <sup>[55,56,57]</sup>	375 mg/m <sup>2</sup> per dose IV (4 weekly doses)	7-56 d	14-180 d
Splenectomy <sup>[58]</sup>	Laparoscopic	1-56 d	7-56 d
Vincristine <sup>[46]</sup>	up to 2 mg/dose IV (4-6 weekly doses)	7-14 d	7-42 d
Vinblastine <sup>[46,59]</sup>	0.1 mg/kg per dose IV (6 weekly doses)	7-14 d	7-42 d
Danazol <sup>[46,60]</sup>	400-800 mg PO daily	14-90 d	28-180 d
Azathioprine <sup>[60]</sup>	2 mg/kg PO daily	30-90 d	30-180 d
AMG53 <sup>[61,41,42]</sup>	3-10 ug/kg weekly SC	5-14 d	14-60 d
Eltrombopag <sup>[43]</sup>	50-75 mg PO daily	7-28 d	14-90 d

In the times to the initial and peak responses, the first number of days is the first time that a response could be reasonably expected and the second number of days is the time after which a response to this particular agent becomes less likely when administered at the dose and schedule listed in the table. Dosages, where not given on kilogram/body weight basis, are intended for adults.  
PO indicates per oral administration; IV, intravenous infusion; and SC, subcutaneous infusion.

**Table 9:- Refractory ITP<sup>[30]</sup>**

<b>Definition (all should be met)</b>
Failure to achieve at least R or loss of R after splenectomy*
Need of treatment(s) (including, but not limited to, low dose of corticosteroids) to minimize the risk of clinically significant bleeding. † Need of on-demand or adjunctive therapy alone does not qualify the patient as refractory.
Primary ITP confirmed by excluding other supervened causes of thrombocytopenia.
<b>Definition of on-demand therapy</b>
Any therapy used to temporarily increase the platelet count sufficiently to safely perform invasive procedures or in case of major bleeding or trauma‡
<b>Definition of adjunctive therapy</b>
Any non-ITP specific therapy that may decrease bleeding (e.g., antifibrinolytic agents, hormonal agents, DDAVP, recombinant factor VIIa, fibrin sealants). Platelet transfusion is also included.
<b>Definition of response to therapy in refractory ITP</b>
Ability to maintain a platelet count sufficient to prevent clinically significant bleeding†§
Ability to decrease toxic therapy (e.g., corticosteroids) does not qualify for response but should be reported
<b>Definition of response to on-demand therapy</b>
Control of bleeding in the specific situation
Achievement of a platelet count sufficient to perform procedure or minimize bleeding from trauma
DDAVP indicates deamino arginine vasopressin. *May not be applicable in children or in patients with accessory spleen. †Bleeding symptoms measured by a validated scale whenever possible (requires further studies). ‡Specific platelet thresholds cannot be provided, but in most instances, a platelet count of 50-70 x 10 <sup>9</sup> /L would fulfill this criterion. §A strict definition of response in terms of predefined platelet count cannot be given and may not be appropriate

when considering the risk/benefit ratio in refractory ITP, because the trade off between efficacy of a specific treatment and its short- and long-term toxicity varies among patients.

### References:-

1. Pham A, Wang J. Bernard-Soulier Syndrome: An Inherited Platelet Disorder. Arch Pathol Lab Med. 2007;131:1834-6.
2. Sumitha E, Jayandharan GR, David S, Jacob RR, Devi GS, Bargavi B, et al. Molecular basis of Bernard-Soulier syndrome in 27 patients from India. J Thromb Haemost. 2011;9:1590-8.
3. Cattaneo M. Inherited platelet-based bleeding disorders. J Thromb Haemost 2003;1:1628-36.
4. Savoia A, Pastore A, De Rocco D, Civaschi E, Di Stazio M, Bottega R, et al. Clinical and genetic aspects of Bernard-Soulier syndrome: searching for genotype/phenotype correlations. Haematologica. 2011;96:417-23.
5. Berndt MC, Andrews RK. Bernard-Soulier syndrome. Haematologica. 2011;96:355.
6. Lopez JA, Chung DW, Fujikawa K, Hagen FS, Papayannopoulou T, Roth GJ. Cloning of the alpha chain of human platelet glycoprotein Ib: a transmembrane protein with homology to leucine-rich alpha 2-glycoprotein. Proc Natl Acad Sci U S A 1987; 84: 5615-9.
7. Yagi M, Edelhoff S, Disteché CM, Roth GJ. Structural characterization and chromosomal location of the gene encoding human platelet glycoprotein Ib beta. J Biol Chem 1994; 269: 17424-7.
8. Hickey MJ, Deaven LL, Roth GJ. Human platelet glycoprotein IX. Characterization of cDNA and localization of the gene to chromosome 3. FEBS Lett 1990; 274: 189-92.
9. Yagi M, Edelhoff S, Disteché CM, Roth GJ. Human platelet glycoproteins V and IX: mapping of two leucine-rich glycoprotein genes to chromosome 3 and analysis of structures. Biochemistry 1995;34:16132-7.
10. Bernard-Soulier syndrome - World Federation of Hemophilia [Internet]. Wfh.org. 2012 [cited 2016 Oct 5]. Available from: <http://www.wfh.org/en/page.aspx?pid=657>
11. Cines DB, Bussel JB, McMillan RB, Zehnder JL. Congenital and Acquired Thrombocytopenia. ASH Education Program Book. 2004;2004(1):390-406.
12. Kanaji T, Okamura T, Kurolwa M, et al. Molecular and genetic analysis of two patients with Bernard-Soulier syndrome: identification of new mutations in glycoprotein Ib gene. Thromb Haemost. 1997;77:1055-61.
13. Kunishima S, Miura H, Fukutani H, et al. Bernard-Soulier syndrome Kagoshima: Ser 444→stop mutation of glycoprotein (GP) Ib resulting in circulating truncated GPIb and surface expression of GPIb and GPIX. Blood. 1994;84:3356-62.
14. Mitsui T, Yokoyama S, Yazaki N, et al. Severe bleeding tendency in a patient with Bernard-Soulier syndrome associated with a homozygous single base pair deletion in the gene coding for the human platelet glycoprotein Ib. J Pediatr Hematol Oncol. 1998; 20:246-51.
15. Noda M, Fujimura K, Takafuta T, et al. Heterogeneous expression of glycoprotein Ib, IX and V in platelets from two patients with Bernard-Soulier syndrome caused by different genetic abnormalities. Thromb Haemost. 1995;74:1411-15.
16. Kunishima S, Naoe T, Kamiya T, Saito H. A novel heterozygous missense mutation in the platelet glycoprotein Ib gene associated with isolated giant platelet disorder. Am J Hematol. 2001;68: 249-55.
17. Kunishima S, Tomiyama Y, Honda S, et al. Homozygous Pro74→Arg mutation in the platelet glycoprotein Ib gene associated with Bernard-Soulier syndrome. Thromb Haemost. 2000;84:112-17.
18. Kunishima S, Lopez JA, Kobayashi S, et al. Missense mutations of the glycoprotein (GP) Ib gene impairing the GPIb / disulfide linkage in a family with giant platelet disorder. Blood. 1997;89: 2404-12.
19. Kurokawa Y, Ishida F, Kamijo T, et al. A missense mutation (Tyr88 to Cys) in the platelet membrane glycoprotein Ib gene affects GPIb/IX complex expression: Bernard-Soulier syndrome in the homozygous form and giant platelets in the heterozygous form. Thromb Haemost. 2001;86:1249-56.
20. Nakagawa M, Okuno M, Okamoto N, Fujino H, Kato H. Bernard-Soulier syndrome associated with 22q11.2 microdeletion. Am J Med Genet. 2001;99:286-288.
21. Suzuki K, Hayashi T, Yahagi A, et al. Novel point mutation in the leucine-rich motif of the platelet glycoprotein IX associated with Bernard-Soulier syndrome. Br J Haematol. 1997;99:794-800.
22. Noda M, Fujimura K, Takafuta T, et al. A point mutation in glycoprotein IX coding sequence (Cys73 (TGT) to Tyr (TAT)) causes impaired surface expression of GPIb/IX/V complex in two families with Bernard-Soulier syndrome. Thromb Haemost. 1996;76: 874-8.
23. Kunishima S, Tomiyama Y, Honda S, et al. Cys97→Tyr mutation in the glycoprotein IX gene associated with Bernard-Soulier syndrome. Br J Haematol. 1999;107:539-45.
24. Iwanaga M, Kunishima S, Ikeda S, Tomonaga M, Naoe T. Vulnerable mutation Trp126→stop of glycoprotein IX in Japanese Bernard-Soulier syndrome. Eur J Haematol. 1998;60:264-6.

25. Adlekha S, Chadha T. Bernard Soulier Syndrome associated with acute myeloid leukemia. *Indian J Med Sci.* 2013;67:145-7.
26. Girolami A, Vettore S, Vianello F, Berti de Marinis G, Fabris F. Myocardial infarction in two cousins heterozygous for ASN41HIS autosomal dominant variant of Bernard-Soulier syndrome. *J Thromb Thrombolysis.* 2012;34:513-7.
27. Kurtjens R, Bolt C, Vossen M, Haanen C. Familial thrombopathic thrombocytopenia. *Br J Haematol.* 1968;15:305-17.
28. Nayan Y, Lecompte T. Genetic thrombocytopenia with autosomal dominant transmission: a review of 54 cases. *Br J Haematol.* 1990;74:203-8
29. Noris P, Spedini P, Belletti S, Magrini U, Balduini CL. Thrombocytopenia, giant platelets, and leukocyte inclusion bodies (May-Hegglin anomaly): clinical and laboratory findings. *Am J Med.* 1998;104:355-60.
30. Rodeghiero F, Stasi R, Gernsheimer T, Michel M, Provan D, Arnold DM, et al. Standardization of terminology, definitions and outcome criteria in immune thrombocytopenic purpura of adults and children: report from an international working group. *Blood.* 2009;113:2386-93.
31. Yuksel O, Koklu S, Ucar E, Sasmaz N, Sahin B. Severe recurrent gastrointestinal bleeding due to angiodysplasia in a Bernard-Soulier patient: an onerous medical concomitance. *Dig Dis Sci.* 2004;49:885-7.
32. Otrrock ZK, Degheili JA, Sibai H, Salem ZM. Recurrent jejunal bleeding due to angiodysplasia in a Bernard-Soulier patient. *Blood Coagul Fibrinolysis.* 2013;24:428-9.
33. Kaya Z, Gürsel T, Dalgic B, Aslan D. Gastric angiodysplasia in a child with Bernard-Soulier syndrome: efficacy of octreotide in long-term management. *Pediatr Hematol Oncol.* 2005;22:223-7.
34. Okita R, Hihara J, Konishi K, Osaki A, Yoshida K, Yamaguchi Y, et al. Intractable gastrointestinal bleeding from angiodysplasia in a patient of Bernard-Soulier syndrome--report of a case. *Hiroshima J Med Sci.* 2005;54:113-5.
35. Hasanazad M. Bernard-Soulier Syndrome (BSS) & tuberculosis: A case report. *Int J Mycobacteriol.* 2014;3:283-5.
36. Suzuki K, Hayashi T, Akiba J, Yoshino M, Tajima K, Satoh S, et al. Successful intravenous interferon-beta treatment of chronic hepatitis C in a patient with Bernard-Soulier syndrome. *Thromb Res.* 2000;100:149-52.
37. Bilal RH, Moideen I, Pyke L, Makahleh Z, Fernandez-Jimenez P, Hasan R. Off-pump coronary artery bypass grafting in a patient with Bernard-Soulier syndrome. *Ann Thorac Surg.* 2010;90:284-5.
38. Humphries JE, Yirinec BA, Hess CE. Atherosclerosis and unstable angina in Bernard-Soulier syndrome. *Am J Clin Pathol.* 1992;97:652-5.
39. Peitsidis P, Datta T, Pafilis I, Otomewo O, Tuddenham EG, Kadir RA. Bernard Soulier syndrome in pregnancy: a systematic review. *Haemophilia.* 2010;16:584-91.
40. Arai M, Yamamoto N, Akamatsu N, et al. Substantial expression of glycoproteins IX and V on the platelet surface from a patient with Bernard-Soulier syndrome. *Br J Haematol.* 1994;87:185-8.
41. Newland A, Caulier MT, Kappers-Klunne M, et al. An open-label, unit dose-finding study of AMG 531, a novel thrombopoiesis-stimulating peptibody, in patients with immune thrombocytopenic purpura. *Br J Haematol.* 2006;135:547-53.
42. Kuter DJ, Bussel JB, Lyons RM, et al. Efficacy of romiplostim in patients with chronic immune thrombocytopenic purpura: a double-blind randomized controlled trial. *Lancet.* 2008;371:395-403.
43. Bussel JB, Cheng G, Saleh MN, Psaila B, Kovaleva L, Meddeb B, et al. Eltrombopag for the Treatment of Chronic Idiopathic Thrombocytopenic Purpura. *N Engl J Med.* 2007;357:2237-47.
44. Kai AC, Flohr C. Aquagenic urticaria in twins. *World Allergy Organ J.* 2013;6:2.
45. Stuart Bisland and Frank Smith. Total Hip Arthroplasty in A Young Patient with Bernard-Soulier Syndrome. *J Orthop Case Rep.* 2014; 4: 38-41.
46. George JN, Woolf SH, Raskob GE, et al. Idiopathic thrombocytopenic purpura: a practice guideline developed by explicit methods of American Society of Hematology. *Blood.* 1996;88:3-40.
47. Bellucci S, Charpak Y, Chastang C, Tobelem G. Low doses v conventional doses of corticoids in immune thrombocytopenic purpura (ITP): results of a randomized clinical trial in 160 children, 223 adults. *Blood.* 1988;71:1165-9.
48. Andersen JC. Response of resistant idiopathic thrombocytopenic purpura to pulsed high-dose dexamethasone therapy. *N Engl J Med.* 1994; 330:1560-4.
49. Mazzucconi MG, Fazi P, Bernasconi S, et al. Therapy with high-dose dexamethasone (HDDXM) in previously untreated patients affected by idiopathic thrombocytopenic purpura: a GIMEMA experience. *Blood.* 2007;109:1401-7.



50. Godeau B, Chevret S, Varet B, et al. Intravenous immunoglobulin or high-dose methylprednisolone, with or without oral prednisone, for adults with untreated severe autoimmune thrombocytopenic purpura: a randomised, multicenter trial. *Lancet*. 2002;359:23-9.
51. Godeau B, Caulier MT, Decuyper L, Rose C, Schaeffer A, Bierling P. Intravenous immunoglobulin for adults with autoimmune thrombocytopenic purpura: results of a randomized trial comparing 0.5 and 1 g/kg b.w. *Br J Haematol*. 1999; 107:716-19.
52. Bussel JB, Pham LC, Aledort L, Nachman R. Maintenance treatment of adults with chronic refractory immune thrombocytopenic purpura using repeated intravenous infusions of gammaglobulin. *Blood*. 1988;72:121-7.
53. Newman GC, Novoa MV, Fodero EM, Lesser ML, Woloski BM, Bussel JB. A dose of 75 microg/kg/d of i.v. anti-D increases the platelet count more rapidly and for a longer period of time than 50 microg/kg/d in adults with immune thrombocytopenic purpura. *Br J Haematol*. 2001;112:1076-8.
54. Tarantino MD, Young G, Bertolone SJ, et al. Single dose of anti-D immune globulin at 75 microg/ kg is as effective as intravenous immune globulin at rapidly raising the platelet count in newly diagnosed immune thrombocytopenic purpura in children. *J Pediatr*. 2006;148:489-94.
55. Arnold D, Dentali F, Crowther MA, et al. Systematic review: efficacy and safety of rituximab for adults with idiopathic thrombocytopenic purpura. *Ann Intern Med*. 2007;146:25-33.
56. Godeau B, Porcher R, Fain O, et al. Rituximab efficacy and safety in adult splenectomy candidates with chronic immune thrombocytopenic purpura: results of a prospective multicenter phase 2 study. *Blood*. 2008;112:999-1004.
57. Cooper N, Stasi R, Cunningham-Rundles S, et al. The efficacy and safety of B-cell depletion with anti-CD20 monoclonal antibody in adults with chronic immune thrombocytopenic purpura. *Br J Haematol*. 2004;125:232-9.
58. Kojouri K, Vesely SK, Terrell D, George J. Splenectomy for adult patients with idiopathic thrombocytopenic purpura: a systematic review to assess long-term platelet count responses, prediction of response, and surgical complications. *Blood*. 2004;104:2623-34.
59. Facon T, Caulier MT, Wattel E, Jouet JP, Bauters F, Fenaux P. A randomized trial comparing vinblastine in slow infusion and by bolus i.v. injection in idiopathic thrombocytopenic purpura: a report on 42 patients. *Br J Haematol*. 1994;86:678-80.
60. Boruchov DM, Gururangan S, Driscoll MC, Bussel JB. Multiagent induction and maintenance therapy for patients with refractory immune thrombocytopenic purpura (ITP). *Blood*. 2007;110:3526-31.
61. Klaassen RJ, Blanchette VS, Barnard D, et al. Validity, reliability, and responsiveness of a new measure of health-related quality of life in children with immune thrombocytopenic purpura: the Kids' ITP Tools. *J Pediatr*. 2007;150:510-15.
62. Madani H, Nazer M, Alotibi W. Bernard-Soulier Syndrome; Case Study. *Int J Health Sci (Qassim)*. 2016;4:156-9.
63. Li C, Pasquale DN, Roth GJ. Bernard-Soulier syndrome with severe bleeding: absent platelet glycoprotein Ib due to a homozygous one-base deletion. *Thromb Haemost*. 1996;76:670-4.
64. Afshar-Kharghan V, Craig FE, Lopez JA. Bernard-Soulier syndrome in a patient doubly heterozygous for two frameshift mutations in the glycoprotein Ib gene. *Br J Haematol*. 2000;110: 919-24.
65. Miller JL, Lyle VA, Cunningham D. Mutation of leucine-57 to phenylalanine in a platelet glycoprotein Ib leucine tandem repeat occurring in patients with an autosomal dominant variant of Bernard-Soulier disease. *Blood*. 1992;79:439-46.
66. Kenny D, Jonsson OG, Morateck PA, Montgomery RR. Naturally occurring mutations in glycoprotein Ib that result in defective ligand binding and synthesis of a truncated protein. *Blood*. 1998;92: 175-83.
67. Simsek S, Admiraal LG, Modderman PW, van der Schoot CE, von dem Borne AE. Identification of a homozygous single base pair deletion in the gene coding for the human platelet glycoprotein Ib causing Bernard-Soulier syndrome. *Thromb Haemost*. 1994;72: 444-9.
68. Li C, Martin SE, Roth GJ. The genetic defect in two well-studied cases of Bernard-Soulier syndrome: a point mutation in the fifth leucine-rich repeat of platelet glycoprotein Ib. *Blood*. 1995;86: 3805-14.
69. Antonucci JV, Martin ES, Hulick PJ, Joseph A, Martin SE. Bernard-Soulier syndrome: common ancestry in two African American families with the GPIb Leu129Pro mutation. *Am J Hematol*. 2000;65:141-8.
70. Ware J, Russell SR, Marchese P, et al. Point mutation in a leucine-rich repeat of platelet glycoprotein Ib resulting in the Bernard-Soulier syndrome. *J Clin Invest*. 1993;92:1213-20.
71. Savoia A, Balduini CL, Savino M, et al. Autosomal dominant macrothrombocytopenia in Italy is most frequently a type of heterozygous Bernard-Soulier syndrome. *Blood*. 2001;97:1330-5.

72. Margaglione M, D'Andrea G, Grandone E, Brancaccio V, Amoriello A, Di Minno G. Compound heterozygosity (554-589 del, C515-T transition) in the platelet glycoprotein Ib alpha gene in a patient with a severe bleeding tendency. *Thromb Haemost.* 1999;81:486-92.
73. Salle C, Baas MJ, Lanza F, Schwartz A, Hanau D, Chevalier J, et al. A three-base deletion removing a leucine residue in a leucine-rich repeat of platelet glycoprotein Ib $\alpha$  associated with a variant of Bernard-Soulier syndrome (Nancy I). *Br J Haematol.* 1995;89:386-96.
74. Simsek S, Noris P, Lozano M, et al. Cys209 Ser mutation in the platelet membrane glycoprotein Ib gene is associated with Bernard-Soulier syndrome. *Br J Haematol.* 1994;88:839-44.
75. Gonzalez-Manchon C, Larrucea S, Pastor AL, et al. Compound heterozygosity of the GPIb gene associated with Bernard-Soulier syndrome. *Thromb Haemost.* 2001;86:1385-91.
76. Ware J, Russell SR, Vicente V, Scharf RE, Tomer A, McMillan R, et al. Nonsense mutation in the glycoprotein Ib alpha coding sequence associated with Bernard-Soulier syndrome. *Proc Natl Acad Sci U S A.* 1990;87:2026-30.
77. Koskela S, Partanen J, Salmi TT, Kekomaki R. Molecular characterization of two mutations in platelet glycoprotein (GP) Ib in two Finnish Bernard-Soulier syndrome families. *Eur J Haematol.* 1999;62:160-8.
78. Afshar-Kharghan V, Lopez JA. Bernard-Soulier syndrome caused by a dinucleotide deletion and reading frameshift in the region encoding the glycoprotein Ib transmembrane domain. *Blood.* 1997;90:2634-43.
79. Afshar-Kharghan V, Craig FE, Lopez JA. Bernard-Soulier syndrome in a patient doubly heterozygous for two frameshift mutations in the glycoprotein Ib gene. *Br J Haematol.* 2000;110: 919-24.
80. Holmberg L, Karpman D, Nilsson I, Olofsson T. Bernard-Soulier syndrome Karlstad: Trp 498 $\rightarrow$ Stop mutation resulting in a truncated glycoprotein Ib that contains part of the transmembranous domain. *Br J Haematol.* 1997;98:57-63.
81. Ludlow LB, Schick BP, Budarf ML, et al. Identification of a mutation in a GATA binding site of the platelet glycoprotein Ib promoter resulting in the Bernard-Soulier syndrome. *J Biol Chem.* 1996;271:22076-80.
82. Budarf ML, Konkle BA, Ludlow LB, et al. Identification of a patient with Bernard-Soulier syndrome and a deletion in the DiGeorge/velo-cardio-facial chromosomal region in 22q11.2. *Hum Mol Genet.* 1995;4:763-6.
83. Iascone MR, Sacchelli M, Vittorini S, Giusti S. Complex conotruncal heart defect, severe bleeding disorder and 22q11 deletion: a new case of Bernard-Soulier syndrome and of 22q11 deletion syndrome? *Ital Heart J.* 2001;2:475-7.
84. Noris P, Simsek S, Stibbe J, von dem Borne AE. A phenylalanine55 to serine amino-acid substitution in the human glycoprotein IX leucine-rich repeat is associated with Bernard-Soulier syndrome. *Br J Haematol.* 1997;97:312-20.
85. Moran N, Morateck PA, Deering A, Ryan M, Montgomery RR, Fitzgerald DJ, Kenny D. Surface expression of glycoprotein Ib $\alpha$  is dependent on glycoprotein Ib $\beta$ : evidence from a novel mutation causing Bernard-Soulier syndrome. *Blood.* 2000;96:532-9.
86. Kenny D, Morateck PA, Gill JC, Montgomery RR. The critical interaction of glycoprotein (GP) Ib with GPIX: a genetic cause of Bernard-Soulier syndrome. *Blood.* 1999;93:2968-75.
87. Rivera CE, Villagra J, Riordan M, Williams S, Lindstrom KJ, Rick ME. Identification of a new mutation in platelet glycoprotein IX (GPIX) in a patient with Bernard-Soulier syndrome. *Br J Haematol.* 2001;112:105-8.
88. Wright SD, Michaelides K, Johnson DJ, West NC, Tuddenham EG. Double heterozygosity for mutations in the platelet glycoprotein IX gene in three siblings with Bernard-Soulier syndrome. *Blood.* 1993 May 1;81(9):2339-47.
89. Noris P, Arbustini E, Spedini P, Belletti S, Balduini CL. A new variant of Bernard-Soulier syndrome characterized by dysfunctional glycoprotein (GP) Ib and severely reduced amounts of GPIX and GPV. *British journal of haematology.* 1998;103:1004-13.
90. Donner M, Karpman D, Kristoffersson AC, Winqvist I, Holmberg L. Recurrent mutation Asn45 $\rightarrow$ Ser of glycoprotein IX in Bernard-Soulier syndrome. *Eur J Haematol.* 1996;57:178-9.
91. Vanhoorelbeke K, Schlamadinger A, Delville JP, et al. Occurrence of the Asn45Ser mutation in the GPIX gene in a Belgian patient with Bernard Soulier syndrome. *Platelets.* 2001;12:114-20.
92. Kunishima S, Kamiya T, Saito H. Genetic abnormalities of Bernard-Soulier syndrome. *Int J Hematol.* 2002;76:319-27.



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## RESEARCH ARTICLE

### RECURRENT VISCERAL LEISHMANIASIS IN AN IMMUNOCOMPETENT PATIENT: A CASE REPORT.

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#### Abstract

**Introduction:-** Current treatment options for visceral leishmaniasis (pentavalent antimony, amphotericin B, liposomal amphotericin B and miltefosine) achieve long-term clinical cure in the majority of immunocompetent patients. Disease relapse is usually provoked by T-cell number or function impairment (corticosteroid or cytotoxic therapy, transplant recipients, advanced human immunodeficiency virus disease).

**Case presentation:-** We report a case of visceral leishmaniasis with multiple relapses in a 75-year-old Greek immunocompetent man. Visceral leishmaniasis relapses occurred despite appropriate treatment with liposomal amphotericin B 3mg/kg/day on days one to five, 14 and 21 (for the first episode and the first relapse) and miltefosine 150mg/day for 28 days (for the second relapse). The third relapse was treated with high-dose liposomal amphotericin B (10mg/kg for two consecutive days), followed by a secondary prophylaxis of 3mg/kg once per month, which prevented disease reappearance during one year of follow-up.

**Conclusion:-** An unusual case of recurrent visceral leishmaniasis in an older immunocompetent patient was treated with high-dose liposomal amphotericin B and a monthly prophylaxis with no evidence of a relapse after one year of follow-up.

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#### Introduction:-

Leishmaniasis is a globally widespread group of parasitic diseases caused by different species of parasites that belong to the genus *Leishmania*. It is a zoonosis and the parasite is transmitted by the bite of an infected female phlebotomine sand fly. Clinically, it is subdivided into visceral (kala-azar), cutaneous and mucocutaneous forms. Visceral leishmaniasis (VL), the most severe form, is a disseminated intracellular protozoan infection that targets tissue macrophages in the liver, spleen and bone marrow. *Leishmaniadonovani* and *Leishmaniainfantum* can both cause VL, but *L. infantum* is the predominant pathogen in Mediterranean countries [1, 2].

The outcome and clinical features of the disease depend on both parasite properties (infectivity, pathogenicity, virulence) and host factors (age, nutritional status, and efficacy of innate and cell-mediated immunity). With

appropriate treatment, long-term clinical cure is usually achieved; however, eradication of parasites is unlikely in most patients, as evidenced by the fact that, despite initial clinical cure, the disease can reactivate several years later and parasites can be persistently detected with application of sensitive assay methods like polymerase chain reaction [3]. Disease relapse occurs frequently in patients with T-cell number or function impairment (corticosteroid or cytotoxic therapy, transplant recipients, advanced human immunodeficiency virus disease). Rarely, spontaneous reactivation can occur in immunocompetent patients, attributed mainly to drug resistance or suboptimal treatment regimens [4, 5].

Here we report the case of an older immunocompetent patient who had multiple VL relapses, despite appropriate treatment with liposomal amphotericin B (L-AmB) and miltefosine. His relapsing disease course was attributed to advanced age-induced immunosuppression as no other cause was identified.

### Case presentation:-

A 75-year-old Greek man, resident in an urban area, presented to our hospital complaining of high fever with chills and rigors, night sweats, fatigue and weight loss of 3kg in one month. His previous medical history was unremarkable. A physical examination revealed a moderately enlarged spleen.

Laboratory investigation showed leukopenia (leukocytes: 2100/ $\mu$ L), normochromic-normocytic anemia (hemoglobin: 11.3g/dL) and moderate thrombocytopenia (platelets: 101,000/ $\mu$ L). A high erythrocyte sedimentation rate (ESR) (90mm/hour) and C-reactive protein (4mg/dL) were also noticed. The biochemical tests were normal except for elevated serum globulins (4.2g/dL). The serum protein electrophoresis revealed a polyclonal  $\gamma$ -globulin pattern without detection of a monoclonal component. His chest X-ray and urine analysis were normal. His blood and urine culture results were repeatedly negative. A transthoracic echocardiogram revealed no pathology and his tuberculin skin test result was negative. An abdominal computed tomography scan with contrast medium revealed the presence of a few hyperechogenic splenic lesions. Serology results for hepatitis A, B, and C, Coxsackie virus, enteric cytopathic human orphan virus, herpes simplex virus, Epstein-Barr virus, cytomegalovirus, human immunodeficiency virus, human T-lymphotropic virus type 1 and 2, toxoplasma, *Bartonellahenselae*, *Francisellatularensis*, *Coxiellaburnetii* and *Rickettsia conorii* were negative. Wright and rapid plasma reagin tests were also negative. A full immunological screening with rheumatoid factor, antinuclear antibodies, antibodies to double-stranded deoxyribonucleic acid (DNA), anti-Sm, anti-Ro/SSA, anti-La/SSB, anti-ribonucleoproteins, anti-Jo-1, anti-Scl-70, anti-histones, anti-mitochondrial antibodies, anti-smooth muscle antibodies, centrally accentuated antineutrophil cytoplasmic antibodies (c-ANCA), perinuclear antineutrophil cytoplasmic antibodies (p-ANCA), anti-cardiolipin, and lupus anticoagulant was negative. A bone marrow aspiration showed numerous protozoan parasites (Leishmanian spp.) within macrophages. Serum test results for leishmania antibodies and K39 antigen were positive.

After confirming the diagnosis of VL, the patient was treated with L-AmB 3mg/kg/day on days one to five, 14 and 21 intravenously. His tolerance of amphotericin was excellent with no significant changes in his kidney and liver functions. Treatment was completed uneventfully and was associated with prompt remission of the patient's symptoms in conjunction with a gradual recovery of leukocyte and platelet counts and hematocrit level.

Six months later, he reported intermittent fever and deterioration of his health. The laboratory tests showed leukopenia, anemia and thrombocytopenia again. The physical examination was normal. His blood and urine cultures were still negative and a new abdominal computed tomographic scan showed no pathological findings. A bone marrow smear revealed the presence of leishmania amastigotes, though in much lower numbers than those detected six months previously. The patient received another complete course of intravenous L-AmB at the same dose, which resulted in complete clinical and laboratory remission.

However, three months later, the patient had to be hospitalized again for a new episode for VL that was confirmed with a new bone marrow smear. The laboratory and serological findings were compatible with the previous results. A total lymphocyte count and CD4+ percentage, as well as their absolute count, were measured in order to evaluate the immune status of our patient. CD4+ cell percentage and absolute count were found to be relatively low (22% and 450/ $\mu$ m<sup>3</sup>, respectively). Miltefosine (Impavido® 50mg/Zentaris GmbH, Germany) was administered in a dosage of 150mg per day (three capsules once daily) for 28 days. Treatment was generally well tolerated; gastrointestinal symptoms such as vomiting and anorexia were controlled with a split of the daily dose into two doses, which were co-administered with food.

Three months later, the patient required another hospitalization for irregular fever, sweats and fatigue. The laboratory tests once again revealed pancytopenia. His test results for leishmania antibodies and K39 antigen were positive. The patient was reluctant to be subjected to an additional bone marrow biopsy. However, there was a strong clinical evidence for a new episode of VL, therefore a new course of L-AmB administration was decided in a dose of 10mg/kg on days one to two, in combination with oral miltefosine. Unfortunately, the tolerance of miltefosine was very poor this time because of vomiting; this led the patient to stop the drug three days after initiation. Nevertheless, the administration of high-dose L-AmB resulted in complete clinicolaboratory response. In order to prevent further disease relapses, a secondary prophylaxis with L-AmB once per month at a dose of 3mg/kg was scheduled. Currently, almost a year after the last VL episode, the patient remains in good health with normal hematological indices.

### Discussion:-

Leishmania organisms are flagellated protozoa that are usually transmitted by female phlebotomine sand flies to mammalian hosts, where they reproduce as obligate intracellular parasites in the mononuclear phagocytic system. The cardinal pathogenetic characteristics of leishmania infection are: (i) the parasite replicates intracellularly in resident tissue macrophages, (ii) the host immune-inflammatory response regulates the expression and outcome of the disease and (iii) tissue infection is usually persistent [6]. Dissemination depends on different factors such as parasite properties, host factors and host responses. Ideally, after promastigotes enter macrophages, the immunocompetent host develops nonspecific (innate) and cell-mediated immunity in order to eradicate the infection, leading to spontaneous healing and prevention of reactivation. Secretion of proinflammatory Th1-type cytokines such as interferon- $\gamma$ , interleukin-12 and tumor necrosis factor- $\alpha$  prevents parasitemia and development of chronic disease. On the contrary, in immunosuppressed patients, immune responses are ineffective and dissemination of disease occurs frequently [7].

Current therapies for VL, such as pentavalent antimony, amphotericin B, L-AmB and miltefosine, lead to clinical cure in the majority of immunocompetent patients. Recurrent infections occur within a period of six months, commonly in patients with impaired cellular immunity such as individuals with advanced human immunodeficiency virus disease or immunosuppressed transplant recipients [8].

In this article, we report on multiple episodes of relapsing VL in an older patient. Beyond the known decreased capacity of cytotoxic responses during senescence, no other immune-suppressing factor was identified in our case. CD4<sup>+</sup> cell percentage and absolute count measured in the second VL relapse were found to be relatively low (22% and 450/ $\mu\text{m}^3$ , respectively). However, even in human immunodeficiency virus cases with CD4<sup>+</sup> cell counts reaching 250 to 300/ $\mu\text{m}^3$  the risk of relapse seems to be low [9]. To the best of our knowledge, there are very few reports of relapsing VL in the immunocompetent in the literature [10].

Initially, our patient was treated with L-AmB and the same regimen was given in his first episode of relapse. L-AmB is considered a highly effective regimen for VL treatment even in immunosuppressed patients [11, 12]. However, this treatment option failed to succeed in chronic suppression of the disease. Miltefosine, an alkylphosphocholine with antileishmanial activity, was used as an alternative treatment in his second episode of relapse. Studies in immunocompromised patients (human immunodeficiency virus seropositive) have shown that the antileishmanial activity of this drug is retained in this special population, suggesting that miltefosine might be a useful option in preventing relapses of the disease [13]. Unfortunately, even after miltefosine therapy, our patient had a new episode of VL.

L-AmB shows a concentration-dependent activity against Leishmaniaspp, where higher doses of L-AmB result in a greater reduction of the parasite load and in a persistence of drug levels in the liver and spleen for a long period after cessation of therapy [11]. In order to eradicate the infection, we decided to administer the high dose and shorter duration scheme of L-AmB (10mg/kg for two consecutive days) with a subsequent secondary prophylaxis. Current evidence in acquired immune deficiency syndrome-related VL suggests that maintenance treatment with L-AmB at a dose of 3mg/kg once every three or four weeks may suppress recurrent infection, probably by inhibition of the reproduction of the remaining parasites, which represent an endogenous reservoir responsible for future relapses [14, 15]. Our patient showed an excellent tolerance to therapy with no renal or electrolyte disturbances and exhibited a complete clinical and laboratory response.

**Conclusions:-**

An unusual case of recurrent VL in an older immunocompetent patient was effectively treated with high-dose L-AmB and a monthly prophylaxis with no evidence of relapse after one year of follow-up. High-dose and shorter duration regimens of L-AmB seem to be a well-tolerated therapy in older patients, while maintenance therapy may be needed in some cases in order to prevent future VL relapses.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

**Abbreviations:-**

<b>ANCA:-</b>	Antineutrophil cytoplasmic antibody
<b>ESR:-</b>	Erythrocyte sedimentation rate
<b>HIV:-</b>	Human immunodeficiency virus
<b>L-AmB:-</b>	liposomal amphotericin B
<b>VL:-</b>	visceral leishmaniasis.

**Declarations:-****Competing interests:-**

The authors declare that they have no competing interests.

**Authors' Contributions:-**

All authors have read and approved the final version of this manuscript.

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**References:-**

1. Banuls AL, Hide M, Prugnolle F: Leishmania and the leishmaniasis: a parasite genetic update and advances in taxonomy, epidemiology and pathogenicity in humans. *AdvParasitol.* 2007, 64: 1-109.**View ArticlePubMedGoogle Scholar**
2. Herwaldt BL: Leishmaniasis. *Lancet.* 1999, 354: 1191-1199. 10.1016/S0140-6736(98)10178-2.**View ArticlePubMedGoogle Scholar**
3. Chappuis F, Sundar S, Hailu A, Ghalib H, Rijal S, Peeling RW, Alvar J, Boelaert M: Visceral leishmaniasis: what are the needs for diagnosis, treatment and control?. *Nat Rev Microbiol.* 2007, 5: 873-882.**View ArticlePubMedGoogle Scholar**
4. Weigle K, Saravia NG: Natural history, clinical evolution, and the host-parasite interaction in New World cutaneous leishmaniasis. *ClinDermatol.* 1996, 14: 433-450. 10.1016/0738-081X(96)00036-3.**View ArticlePubMedGoogle Scholar**
5. Desjeux P: The increase in risk factors for leishmaniasis worldwide. *Trans R Soc Trop Med Hyg.* 2001, 95: 239-243. 10.1016/S0035-9203(01)90223-8.**View ArticlePubMedGoogle Scholar**
6. Murray HW, Berman JD, Davies CR, Saravia NG: Advances in leishmaniasis. *Lancet.* 2005, 366: 1561-1577. 10.1016/S0140-6736(05)67629-5.**View ArticlePubMedGoogle Scholar**
7. Okwor I, Uzonna J: Persistent parasites and immunologic memory in cutaneous leishmaniasis: implications for vaccine designs and vaccination strategies. *Immunol Res.* 2008, 41: 123-136. 10.1007/s12026-008-8016-2.**View ArticlePubMedGoogle Scholar**
8. Simon I, Wissing KM, Del Marmol V, Antinori S, Rimmelink M, NiluferBroeders E, Nortier JL, Corbellino M, Abramowicz D, Cascio A: Recurrent leishmaniasis in kidney transplant recipients: report of 2 cases and systematic review of the literature. *Transpl Infect Dis.* 2011, 13: 397-406. 10.1111/j.1399-3062.2011.00598.x.**View ArticlePubMedGoogle Scholar**
9. Alvar J, Aparicio P, Aseffa A, Den Boer M, Canavate C, Dedet JP, Gradoni L, Ter Horst R, Lopez-Velez R, Moreno J: The relationship between leishmaniasis and AIDS: the second 10 years. *ClinMicrobiol Rev.* 2008, 21: 334-359. 10.1128/CMR.00061-07.**View ArticlePubMedPubMedCentralGoogle Scholar**

10. Colomba C, Scarlata F, Salsa L, FrascaPolara V, Titone L: [Mediterranean visceral leishmaniasis in immunocompetent children. Report of two cases relapsed after specific therapy]. *Infez Med.* 2004, 12: 139-143.**PubMedGoogle Scholar**
11. Bern C, Adler-Moore J, Berenguer J, Boelaert M, den Boer M, Davidson RN, Figueras C, Gradoni L, Kafetzis DA, Ritmeijer K, Rosenthal E, Royce C, Russo R, Sundar S, Alvar J: Liposomal amphotericin B for the treatment of visceral leishmaniasis. *Clin Infect Dis.* 2006, 43: 917-924. 10.1086/507530.**View ArticlePubMedGoogle Scholar**
12. Sinha PK, van Griensven J, Pandey K, Kumar N, Verma N, Mahajan R, Kumar P, Kumar R, Das P, Mitra G, Flevaud L, Ferreyra C, Remartinez D, Pece M, Palma PP: Liposomal amphotericin B for visceral leishmaniasis in human immunodeficiency virus-coinfected patients: 2-year treatment outcomes in Bihar, India. *Clin Infect Dis.* 2011, 53: e91-e98. 10.1093/cid/cir521.**View ArticlePubMedGoogle Scholar**
13. Sindermann H, Engel KR, Fischer C, Bommer W: Oral miltefosine for leishmaniasis in immunocompromised patients: compassionate use in 39 patients with HIV infection. *Clin Infect Dis.* 2004, 39: 1520-1523. 10.1086/425359.**View ArticlePubMedGoogle Scholar**
14. Lopez-Velez R, Videla S, Marquez M, Boix V, Jimenez-Mejias ME, Gorgolas M, Arribas JR, Salas A, Laguna F, Sust M, Canavate C, Alvar J: Amphotericin B lipid complex versus no treatment in the secondary prophylaxis of visceral leishmaniasis in HIV-infected patients. *J AntimicrobChemother.* 2004, 53: 540-543. 10.1093/jac/dkh084.**View ArticlePubMedGoogle Scholar**
15. Berenguer J, Cosin J, Miralles P, Lopez JC, Padilla B: Discontinuation of secondary anti-leishmania prophylaxis in HIV-infected patients who have responded to highly active antiretroviral therapy. *AIDS.* 2000, 14: 2946-2948. 10.1097/00002030-200012220-00020.**View ArticlePubMedGoogle Scholar**

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## RESEARCH ARTICLE

### METFORMIN AND ITS SIDE EFFECTS.

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Metformin, DM, Side effects

#### Abstract

**Metformin and its Side Effects:-** Objective: This research aims at investigating the effects of using metformin among Saudi patients in Riyadh.

**Methodology:** (67) males and (57) females have been selected randomly to participate in this research. Self-reported questionnaire has been given to participants. Continuous variables were expressed as mean  $\pm$  standard deviation and categorical variables were expressed as percentages. The t-test was used for continuous variables and chi square test was used for categorical variables. A p-value  $<0.05$  was considered statistically significant.

**Results:** many patients reported diarrhea and nausea as the main side effects of using this medication. However, 50% of participants have no complain. This project found no significant difference between two genders except age & using metformin.

**Conclusion:** metformin has been used widely among Saudi patients suffering from type 2 DM. Many patients complain from side effect of this medication.

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#### Introduction:-

Metformin, or otherwise known as Glucophage, is an oral first-line medication to treat Type-2 diabetes. Type 2 Diabetes or Diabetes mellitus type 2 is a condition where a relative lack of insulin, along with insulin resistance and high blood pressure is observed. Metformin, along with this chronic long-term diabetes, can also be used to treat polycystic ovary syndrome, common amongst the overweight young women.

In type 2 diabetes cases, Metformin increases insulin sensitivity and improves glycaemic control in the patient. The glucose production decreases in the liver so that insulin could work efficiently (1). Coupled with this, Metformin is also said to prevent cardiovascular diseases and cancer complications in a diabetic patient (2). This has also been stated by many studies where the use of Metformin may have lowered cancer risks far greater than other anti-

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diabetic drugs (3). In addition to that, in several clinical trials, antitumoral effects have been observed, especially in colon region and breasts (4). If taken with diet and exercise, Metformin works remarkably. It is repeatedly prescribed to the patients not to chew or crush the tablet. Instead, it is preferred to be swallowed as a whole.

Keeping its amazing benefits on one side, Metformin is said to cause some serious side effects as well. The common ones include nausea, vomiting, upset stomach with abdominal pains, or diarrhoea which are mostly characterized as gastrointestinal effects and will be discussed later on in Literature Review. Severe headaches and skin rashes are also very common. Apart from this, Metformin also rarely causes lactic acidosis, which is the excess building up of lactic acid in the body and can be fatal. This will also be elaborated in the literature review.

### **Literature Review:-**

Metformin should be avoided in cases when the patient experiences any sort of allergic reactions. For instance, hives, or difficulty in breathing, swelling up of facial organs such as tongue, lip or the entire face, or even throat swelling (5). These are the indications that Metformin dosage or the entire medication prescription needs to be consulted again with the doctor because of inadequate response of the patient towards the medicine.

Gastrointestinal effects of Metformin have repeatedly been studied and reviewed by physicians and scholars, and all of them state that these results, if not treated on time, can be fatal as well depends on the drug dosage. In a clinical trial, consisting of 286 subjects, all given Metformin, 141 or 53.2% of the respondents gave reports of diarrhoea while 25.5% of them said that they felt nauseous and even vomited (6). Gastrointestinal issues can cause serious discomfort, if not treated earlier. Most commonly, it is prominent when the dosage is increased or when Metformin is initially administered. To avoid this, either the dose should be decreased or if it's necessary to consume a larger dose, then it should be increased gradually so the body can get used to the daily consumption.

The most serious side effects of Metformin include Lactic Acidosis. It is also referred to as "metformin-associated lactic acidosis," or MALA. The few symptoms of Lactic Acidosis include severe drowsiness, muscle pain, tiredness, fast or difficult breathing, along with gastrointestinal symptoms as stated earlier, child or cold/blue skin, and others similar to these (7). Even though MALA is approximately 9 per 100,000 person-years (8), it can be fatal in many cases. A similar drug, called Phenformin, was called off from the market because of its high rates of causing lactic acidosis, around 40-64 per 100,000 patient-years (9). Metformin is relatively safer than Phenformin, and the risk of developing lactic acidosis is restricted to specific high-risk groups (9).

Along with all this, Metformin is also said to increase lactic acid production in the large intestine (10). Increased lactic acidosis is mostly common in the patients suffering from heart diseases, kidney issues, or even respiratory diseases (11).

Metformin does not usually cause hyperglycemia, but if it is used with other anti-diabetic drugs, low blood sugar can prevail. Coupled with this, if the patient is exercising too much, or not consuming enough energetic calories from his meals, or even drinking large amounts of alcohol, Metformin may lead to extremely lower levels of blood sugar, which is very dangerous for the patient.

The side effects of Metformin are usually more evident in older people, mostly above the age of 80 years. At that age, heart failures, strokes, liver or kidney diseases are more prevalent, and the doctor needs to be informed of them before Metformin is prescribed to the patient (12). Several studies, taking place in Texas between 2000 and 2006, stated the fact that ingest doses of 5000 mg caused more drastic effects in adults (13). Several other studies and data revealed the fact of some intentional overdose cases, resulting in the survival of the patient. The dose was as high as 63,000 mg, i.e. 63 grams of Metformin (14). This comparison shows that Metformin's side effects do not depend on its overdose. It majorly negatively harms the adult than the younger ones.

Metformin is said to be contraindicated in those people who have the diseases mentioned above, such as heart failures, kidney or liver diseases (defined as creatinine levels over 150  $\mu\text{mol/l}$  (1.7 mg/dl), or any respiratory or lung diseases (15). These may cause the patient to develop lactic acidosis at a much higher rate than otherwise. This has also been reinstated by several studies which link the high occurrence of lactic acidosis to the patient's infection of heart disease and his/her consuming of Metformin (16).

The effects of Metformin do not necessarily start right away. They depend on the body of the patient and vary accordingly. For some people, Metformin does not show any side effects such as the gastrointestinal ones for many days, or even months. On the other hand, for some, they begin on the very same day, or perhaps, two to three days later. There is no stringent rule for the occurrence of these side effects.

### Results and statistical Analysis:-

Data were analyzed using Statistical Package for Social Studies (SPSS 22; IBM Corp., New York, NY, USA). Continuous variables were expressed as mean  $\pm$  standard deviation and categorical variables were expressed as percentages. The t-test was used for continuous variables and chi square test was used for categorical variables. A p-value  $<0.05$  was considered statistically significant.

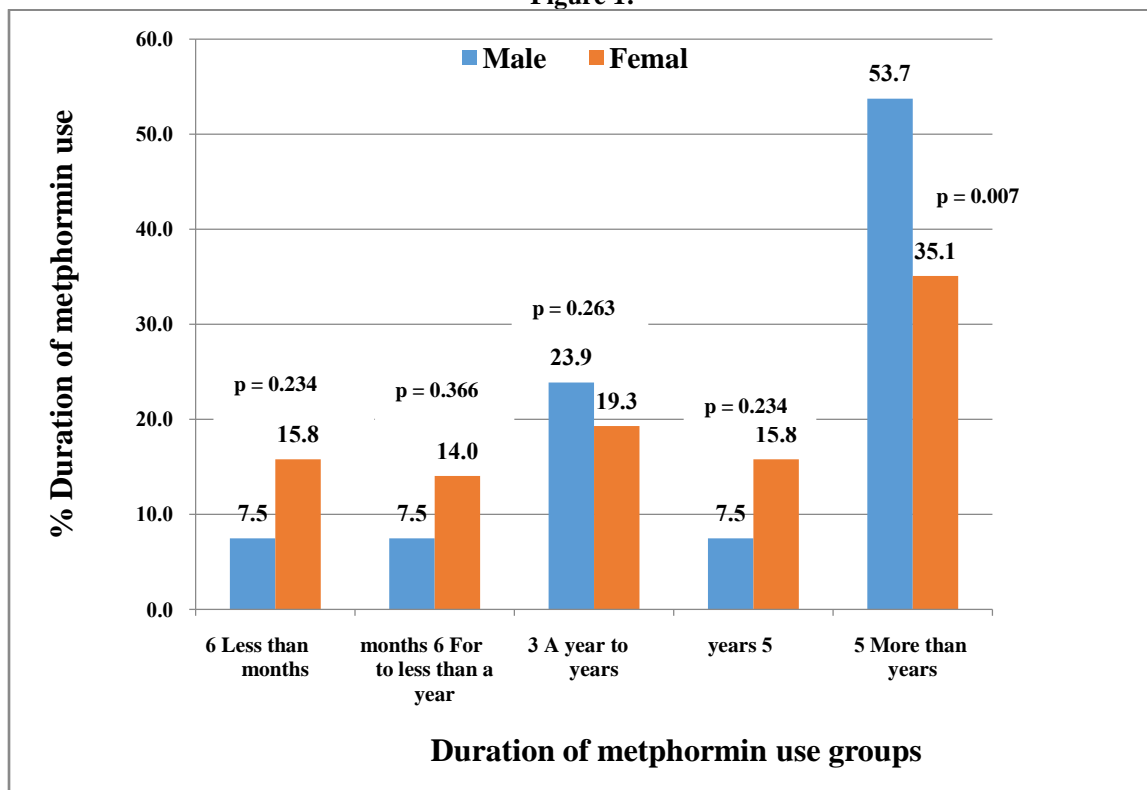
**Table 1:-** Comparison of using metformin by gender.

	ALL (124) N (%)	Male (67) N (%)	Female (57) N (%)	P value
Age (mean $\pm$ SD)	55.10 $\pm$ 11.73	59.00 $\pm$ 9.89	50.51 $\pm$ 12.13	$<0.001^*$
Dose(mean $\pm$ SD)	500 $\pm$ 0.00	500 $\pm$ 0.00	500 $\pm$ 0.00	
Using metformin				
for DM	79 (63.71%)	54 (80.60%)	25 (43.86%)	$<0.001^*$
for obesity	2 (1.61%)	1 (1.49%)	1 (1.75%)	
PCOS	17 (13.71%)	0 (0.00%)	17 (29.82%)	
DM&Obesity	24 (19.35%)	10 (14.93%)	14 (24.56%)	
Other medications	60 (48.39%)	36 (53.73%)	24 (42.11%)	0.252
Side effect of Metformin use				
Nausea	8 (6.45%)	5 (7.46%)	3 (5.26%)	0.536
Gases	2 (1.61%)	1 (1.49%)	1 (1.75%)	
Diarrhea	22 (17.74%)	14 (20.90%)	8 (14.04%)	
Headache	2 (1.61%)	0 (0.00%)	2 (3.51%)	
Nausea&Vomiting	1 (0.81%)	1 (1.49%)	0 (0.00%)	
Nausea&Diarrhea	11 (8.87%)	7 (10.45%)	4 (7.02%)	
Gases&Diarrhea	9 (7.26%)	5 (7.46%)	4 (7.02%)	
Gases&Headache	1 (0.81%)	0 (0.00%)	1 (1.75%)	
Diarrhea&Headache	3 (2.42%)	1 (1.49%)	2 (3.51%)	
Nausea&Vomiting&Gases	1 (0.81%)	1 (1.49%)	0 (0.00%)	
Nausea&Vomiting&Diarrhea	2 (1.61%)	2 (2.99%)	0 (0.00%)	
Nothing	62 (50.00%)	30 (44.78%)	32 (56.14%)	
Duration of symptoms				0.866
1 day	25 (20.16%)	11 (16.42%)	14 (24.56%)	
1 week	14 (11.29%)	7 (10.45%)	7 (12.28%)	
1 month	34 (27.42%)	22 (32.84%)	12 (21.05%)	
$\leq 6$ month	10 (8.06%)	5 (7.46%)	5 (8.77%)	
$\leq 1$ year	25 (20.16%)	15 (22.39%)	10 (17.54%)	
$\leq 3$ year	16 (12.90%)	7 (10.45%)	9 (15.79%)	
Start feeling symptoms				
During the 1 <sup>st</sup> hour after taking the medicine	27 (21.77%)	16 (23.88%)	11 (19.30%)	0.643
After the 1 <sup>st</sup> hour	97 (78.23%)	51 (76.12%)	46 (80.70%)	
Time of taking medicine				
Before eating	14 (11.29%)	8 (11.94%)	6 (10.53%)	0.813
During eating	7 (5.65%)	3 (4.48%)	4 (7.02%)	
After eating	103 (83.06%)	56 (83.58%)	47 (82.46%)	
Inform the physician about the symptoms	89 (71.77%)	48 (71.64%)	41 (71.93%)	0.608
Using medicines to relieve such symptoms	29 (23.39%)	12 (17.91%)	17 (29.82%)	0.555
There is no significant difference between two genders except age & using metformin				
* significant p value (level of significance $< 0.05$ )				

**Table 2:-** Comparison of using metformin by age group.

	Age < 45 years		Age 45-65years		Age>65 years		P value
	20		76		28		
	n(%)		n(%)		n(%)		
Gender							
Male	3	(15.00%)	42	(55.26%)	22	(78.57%)	<0.001*
Female	17	(85.00%)	34	(44.74%)	6	(21.43%)	
Dose	500±0.00		500±0.00		500±0.00		
Using metphormin							
for DM	4	(20.00%)	52	68.42%	25	(89.29%)	<0.001*
for obesity	0	(0.00%)	2	2.63%	0	(0.00%)	
PCOS	16	(80.00%)	1	1.32%	0	(0.00%)	
DM& Obesity	0	(0.00%)	21	27.63%	3	(10.71%)	
Other medications	3	(15.00%)	32	(42.10%)	25	(89.29%)	<0.001*
Side effect of Metformin use							
Nausea	0	(0.00%)	5	(6.58%)	3	(10.71%)	0.049*
Gases	0	(0.00%)	2	(2.63%)	0	(0.00%)	
Diarrhea	4	(20.00%)	15	(19.74%)	3	(10.71%)	
Headache	1	(5.00%)	1	(1.32%)	0	(0.00%)	
Nausea& Vomiting	0	(0.00%)	1	(1.32%)	0	(0.00%)	
Nausea& Diarrhea	1	(5.00%)	4	(5.26%)	6	(21.43%)	
Gases& Diarrhea	1	(5.00%)	5	(6.58%)	3	(10.71%)	
Gases& Headache	0	(0.00%)	1	(1.32%)	0	(0.00%)	
Diarrhea& Headache	2	(10.00%)	0	(0.00%)	1	(3.57%)	
Nausea& Vomiting& Gases	0	(0.00%)	0	(0.00%)	1	(3.57%)	
Nausea& Vomiting &Diarrhea	0	(0.00%)	0	(0.00%)	2	(7.14%)	
Nothing	11	(55.00%)	42	(55.26%)	9	(32.14%)	
Duration of symptoms							0.112
1 day	12	(60.00%)	13	(17.11%)	0	(0.00%)	
1 week	0	(0.00%)	11	(14.47%)	3	(10.71%)	
1 month	5	(25.00%)	22	(28.95%)	7	(25.00%)	
<=6 month	3	(15.00%)	6	(7.89%)	1	(3.57%)	
<=1year	0	(0.00%)	13	(17.11%)	12	(42.86%)	
<=3year	0	(0.00%)	11	(14.47%)	5	(17.86%)	
Start feeling symptoms							
During the 1 <sup>st</sup> hour after taking the medicine	7	(35.00%)	17	(22.37%)	3	(10.71%)	0.619
After the 1 <sup>st</sup> hour	13	(65.00%)	59	(77.63%)	25	(89.29%)	
Time of taking medicine							
Before eating	3	(15.00%)	7	(9.21%)	4	(14.29%)	0.218
During eating	3	(15.00%)	4	(5.26%)	0	(0.00%)	
After eating	14	(70.00%)	65	(85.53%)	24	(85.71%)	
Inform the physician about the symptoms	18	(90.00%)	47	(61.84%)	24	(85.71%)	0.125
Using medicines to relieve such symptoms	6	(30.00%)	16	(21.05%)	7	(25.00%)	0.589
There is significant difference among different groups of duration of metformin use for gender, other medications, using metformin and side effect of Metformin use.							
* significant p value (level of significance < 0.05)							

Figure 1:-



Duration of metformin use for two genders. The data are presented by percentage (%). P-value had been calculated between two genders. Duration of metformin use for female gender was significantly lower in duration group more than 5 years when compared with all other duration groups.

### Discussion:-

Metformin is used as a prescription to type 2 Diabetes mellitus. This project investigated the harms resulting in the use of such medication among Saudi patients. Many patients reported diarrhea and nausea as the main side effects of metformin. However, half of participants don't get the same suffering. This project found no significant difference between two genders except age & using metformin.

Similar findings have been reported in other publications. In a clinical trial, consisting of 286 subjects, all given Metformin, 141 or 53.2% of the respondents gave reports of diarrhoea while 25.5% of them said that they felt nauseous and even vomited (Drug Facts and Comparisons, 2005). Gastrointestinal issues can cause serious discomfort, if not treated earlier. Most commonly, it is prominent when the dosage is increased or when Metformin is initially administered.

In conclusion, metformin is widely used among diabetic Saudi patients. Side effects as result of using this medication should be expected. Health education can help to reduce the severity of these complains.

Qualitative study should be launched to give in details explanations regarding the side effect of the use of metformin among diabetic patients in all age groups.

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**References:-**

1. Kirpichnikov D, McFarlane SI and Sowers JR. (2002) 'American college of physicians,' *Annals of Internal Medicine*. 137(1):25–33.
2. Drugs.com. (2016). "Metformin hydrochloride". Available from <https://www.drugs.com/monograph/metformin-hydrochloride.html>.
3. Evans JMM, Donnelly LA, Emslie-Smith AM, Alessi DR and Morris AD (2005) 'Metformin and reduced risk of cancer in diabetic patients' *BMJ*. 330:7503.
4. Chong C and Chabner B. (2009) 'Mysterious metformin', *The oncologist*. 14(12):1178–81.
5. Drugs.com (2000). "Metformin: Uses, dosage, side effects". Available from: <https://www.drugs.com/metformin.html>.
6. Drug.com. (2005). "Facts and Comparisons". Available from <https://www.drugs.com/ppa/>
7. Scheen AJ, Paquot N. (2013) "Metformin revisited: a critical review of the benefit-risk balance in at-risk patients with type 2 diabetes". *Diabetes Metab*. 39(3):179-90.
8. Stang M, Wysowski DK and Butler-Jones D. (1999) "Incidence of lactic acidosis in metformin users", *Diabetes Care*. 22(6): 925–927.
9. Salpeter SR, Greyber E, Pasternak GA and Salpeter EE. (2003) "Risk of Fatal and Nonfatal Lactic Acidosis with Metformin use in type 2 diabetes Mellitus" *Archives of Internal Medicine*. 163(21):2594–2602. doi: 10.1001/archinte.163.21.2594.
10. Kirpichnikov D, McFarlane S and Sowers J. (2002) 'Metformin: An update' *Annals of internal medicine*. 137(1):25–33.
11. Williams L and Wilkins: "Pathophysiology", A Wolters Kluwer Company, Philadelphia, 2005.
12. MedlinePlus.(2016). *Metformin*. Available from <https://medlineplus.gov/druginfo/meds/a696005.html>
13. Forrester M. (2008) "Adult metformin ingestions reported to Texas poison control centers, 2000–2006", *Hum Exp Toxicol*. 27(7):575–583. doi: 10.1177/0960327108090589.
14. Gjedde S, Christiansen A, Pedersen SB and Rungby J. (2003) "Survival following a Metformin overdose of 63 g: A case report", *Pharmacology & Toxicology*. 93(2):98–99. doi: 10.1034/j.1600-0773.2003.930207.x.
15. Jones GC, Macklin JP and Alexander WD. (2003) "Contraindications to the use of metformin", *Editorial*. 326(7379):4–5. doi: 10.1136/bmj.326.7379.4.
16. Bristol-Myers Squibb Company. (no date). "GLUCOPHAGE®" Available at: [http://www.accessdata.fda.gov/drugsatfda\\_docs/label/2008/020357s031,021202s0161bl.pdf](http://www.accessdata.fda.gov/drugsatfda_docs/label/2008/020357s031,021202s0161bl.pdf) (Accessed: 11 November 2016).



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### RESEARCH ARTICLE

#### Do blind people have better hearing levels than normal population?

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##### Key words:-

hearing level; blindness; visual impairment; Saudi Arabia.

#### Abstract

**Objective:** To find out if there is a difference in hearing levels between normal and blind people. To answer the following questions, "Is the concept of losing one sense will improve the other senses right or wrong? If someone born blind, will he have better hearing abilities than those with a good vision?"

**Study design:** A cross sectional study

**Methods:** Forty male students aged between 13-22 years old from two special education schools were randomly selected to evaluate their hearing levels from Eastern district, Saudi Arabia at the period from February 2016 to April 2016. They were divided into two groups. The first group included the student with visual impairment (13 students) and total blindness (7 students) for more than 5 years. The second control group is of 20 students with normal vision. A questionnaire was answered by each one. Anyone with history of ear disease was excluded from the study. A pure tone average thresholds (PTAs) were obtained for left and right ears for the frequencies 0.125, 0.25, 0.5, 1, 2, 4, and 8 kHz. Data were statistically evaluated using SPSS version 20.

**Results:** Hearing levels were normal in most of the participants with mild hearing loss in 4 ears of 3 participants (5%). The difference at the hearing levels between pure tone average for both ears in the visually impaired plus totally blind subjects compared to the control group was non-significant, P value = 0.829 ( $> 0.05$ ). While, there was significant difference at the hearing levels between pure tone average for both ears in the three groups (visually impaired, totally blind and normally sighted group) using ANOVA test, P value = 0.04 ( $< 0.05$ ) with the lowest hearing level at the totally blind group.

**Conclusion:** Loss of one sense does not potentiate other senses as some people believe. Blind people have the same level of hearing as normal population.

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#### Introduction:-

Communication and people interactions in our daily life activities depend on hearing and vision [1]. Most blind people were not born blind, they become blind. This means that, having learned to rely on their sight in order to recognize and relate to the world, they must now radically revise their basic assumptions about that world [2-3].

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It is reported that 285 million people are estimated to be visually impaired worldwide. Thirty nine million are blind and 246 million have low vision [4]. In Kingdom of Saudi Arabia (KSA) there was study conducted on 14,577 people representing the settled population of KSA. The survey revealed that 1.5% of the population are blind and another 7.8% are visually impaired according to the World Health Organization definition [5].

Hearing is one of the important senses by which we can understand & communicate with surroundings. Hearing thresholds of 25 dB or bigger in any ear is said to have hearing loss (HL). HL may be mild, moderate, severe or profound. It is reported as well that about 360 million people worldwide have disabling hearing loss [6].

Loss of one sense will affect other senses. Music experts often cite blind musicians Stevie Wonder and Ray Charles as examples of how a lack of sight can heighten or enhance hearing. Therefore loss of vision can result in changes in auditory perceptual abilities and in the way sounds are processed within the brain [7]. A number of studies have reported that people who become blind at an early age can hear notes and localize sounds more precisely than those with sight or people who go blind later in life [7]. In a same conception, a recent review on visual abilities in the profoundly deaf suggests that enhanced visual performance in those group [8&9]. King in 2015 reported that blind persons are dependent on their hearing as they develop superior auditory skills, either as a result of plasticity within the auditory system or through the recruitment of functionally relevant occipital cortical areas that lack their normal visual inputs [7]. Improvements in hearing abilities following blindness may result from an increase in cortical territory devoted to auditory processing (10).

To find out if there is a difference in hearing levels between normal and blind people. To answer the following questions, "Is the concept of losing one sense will improve the other senses right or wrong? If someone born blind, will he have better hearing abilities than those with a good vision?"

### **Material and Methods:-**

The study was conducted with the help of the hearing and speech department in the special education center, Khalid bin Al-Walid middle school, and Al-Mubarraz high school, Eastern district, Saudi Arabia from February 2016 to April 2016. Forty male students aged between 13-22 years old from both schools were randomly selected to participate. The participants were divided into two groups, each group consisted of 20 students based on the visual acuity. The first group included the student with visual impairment (13 students) and total blindness (7 students) for more than 5 years. The second group had 20 students with normal vision, constituting the control group. An informed verbal consent for their participation in the study was obtained at the beginning with explanation of what the research is about to all the participants. A questionnaire was answered by each one of them about their history [Fig1]. It includes the history of chronic diseases, ear problems, the use of hearing aids, family history of ear problems, the use ototoxic drugs and past history of ear surgery. Anyone with history of ear disease was excluded from the study. A pure tone average thresholds (PTAs) were obtained for left and right ears for the frequencies 0.125, 0.25, 0.5, 1, 2, 4, and 8 kHz. Data were statistically evaluated using SPSS version 20.

Name \_\_\_\_\_

Age \_\_\_\_\_ Gender \_\_\_\_\_ Nationality \_\_\_\_\_

1) Are you suffering from any chronic disease/ diseases?  
       Yes        No     if no go to Q3

2) What is the disease/ diseases?  
       Diabetes Mellitus    Hypertension     Others \_\_\_\_\_

3) Do you have any ear problems?  
       Yes        No     if no go to Q6

4) What is the problems? (You can choose more than one answer)  
       Congenital anomaly    Decreased hearing ability    Pain  
       Buzz                      Excess ear wax                      Dizziness

5) Do you use any hearing aids?  
       Yes        No

6) Does any of your family members suffer from ear problems?  
       Yes, Relation (.....)                      No

7) Do you use any drug regularly?  
       Yes                No     if no go to Q9

8) If you answered yes to the seventh question, what is the name of this drug / these drugs?  
       ( .....)

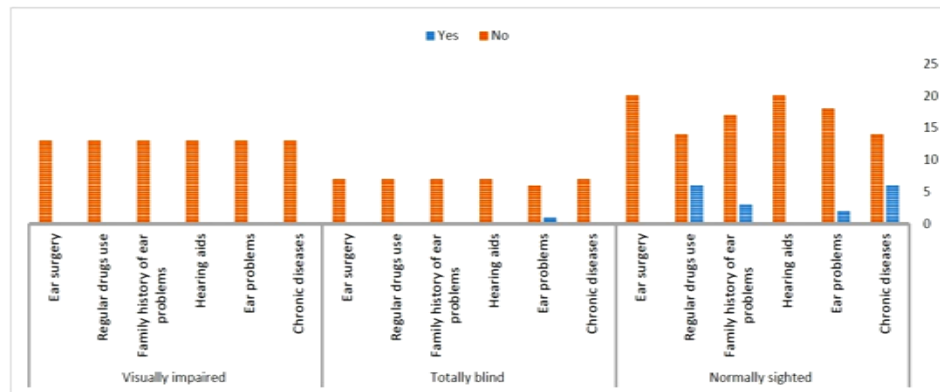
9) Did you perform any surgery in your ear in the past?  
       Yes, what was it? (.....)  
       No

Figure 1: Questionnaire



## Results:-

Our study included 40 participants. They all replied the questionnaire and the findings are shown in figure 2.



**Figure 2: questionnaire findings**

They were visually impaired subjects (13=32.5%), totally blind persons (7=17.5%) and normally sighted controls (20=50%). The average age of the visually impaired group was  $16 \pm 2.1$  years, the totally blind group was  $16.6 \pm 2.8$  years, and the normally sighted group was  $15.2 \pm 1.5$  years [table 1]. All the 40 participants were Saudi males.

**Table 1. Descriptive statistics regarding age of the study group**

	N	Mean	Minimum	Maximum	SD
Visually impaired	13	16	13	20	2.1
Totally blind	7	16.6	14	22	2.8
Normally sighted	20	15.2	13	17	1.5

Hearing levels were normal in most of the participants with mild hearing loss in 4 ears of 3 participants (5%) [table 2].

**Table 2. Pure tone averages in R and L ears**

Visually impaired		Totally blind		Normally sighted	
PTAs R ear (db)	PTAs L ear (db)	PTAs R ear (db)	PTAs L ear (db)	PTAs R ear (db)	PTAs L ear (db)
5	5	18	21	20	20
13	10	10	15	20	20
18	12	12	16	15	20
10	15	20	20	11	11
13	7	35	36	16	16
16	17	16	20	15	15
15	15	32	20	17	17
18	18			15	15
20	20			16	16
15	15			15	15
23	20			15	15
15	15			15	15
21	17			15	15
				25	25
				15	15
				15	15
				15	15
				15	15
				33	17

Pure tone average ranges from 5 to 23 dB for the visual impairment group (mean 14.9 dB), 10 to 36 dB for the total blindness group (mean = 20.8 dB), and 11 to 33 dB for the normal sighted group (mean = 16.6 dB). Using independent sample T-test SPSS version 20, there was non-significant difference at the hearing levels between pure tone average for both ears in the visually impaired plus totally blind subjects with the control group, P value = 0.829 ( $> 0.05$ ) [table 3].

**Table 3. Independent sample T-test results**

	N	mean	SD	t	df	P value
Visually impaired + Totally blind	20	16.97	6.33	0.217	38	0.829 ( $> 0.05$ )
Normally sighted	20	16.63	3.44			

While, there was significant difference at the hearing levels between pure tone average for both ears in the three groups (visually impaired, totally blind and normally sighted group) using ANOVA test, P value = 0.04 ( $< 0.05$ ) with the lowest hearing level at the totally blind group [table 4].

**Table 4. ANOVA test results**

	N	mean	SD	S error	F	P value
Visually impaired	13	14.9	4.4	1.2	3.505	0.04 ( $< 0.05$ )
Totally blind	7	20.8	7.8	2.9		
Normally sighted	20	16.6	3.4	0.7		

### Discussion:-

This study was planned based upon the hypothesis that sensory deprivation (e.g. blindness) may has some effect on the intact senses. Blind people depend more on their intact sensory modalities (e.g. hearing), making them sharper and perform better compared to normal performance in order to compensate the lack of visual inputs [6].

Our study showed that the mean pure tone average for both visually impaired and totally blind to be 14.9 dB and 20.8 dB respectively compared to 16.6 dB in normally sighted people. Which means that totally blind participants have significantly worse hearing abilities than sighted age matched controls, and that against our conception [11]. Participants with visual impairment didn't show significant difference from the sighted age matched controls, and that could be due to having some residual visual abilities.

Most of the previous studies which were similar to our study focused on the ability of a blind person to localize sounds in comparison with normally sighted person. Nilsson & Schenkman reported that due to sound being the only source of information used for sound localization for a long term, the blind has greater inter-aural time differences sensitivity and inter-aural level differences sensitivity compared to sight age-matched [12]. Another study by Kolarik et al. focused on the distance discrimination, suggesting that totally blind people have better sound distance discrimination than sight age-matched and no difference when comparing people with partial visual loss to sight age-matched [11].

### Limitations:-

Our study cannot be generalized to all the blind, since it was done only for a small number of blind people in a very limited area.

### Conclusion:-

Loss of one sense does not potentiate other senses as some people believe. Blind people have the same level of hearing as normal population.

**References-**

1. Vreeken HL, van Rens G, Knol DL, van Reijen NA, Kramer SE, Joost M Festen JM, and van Nispen R. Dual sensory loss: A major age-related increase of comorbid hearing loss and hearing aid ownership in visually impaired adults. *Geriatr Gerontol Int* 2014; **14**: 570–576
2. Fitzgerald RG, Parkes CM. Blindness and loss of other sensory and cognitive functions. *BMJ* 1998;316 (7138): 1160–1163.
3. Fitzgerald RG. Reactions to blindness: an exploratory study in adults with recent loss of sight. *Arch Gen Psychiatry* 1970; 22:370-379.
4. Visual impairment and blindness (Updated August 2014 at media centre of WHO web site in June 17, 2016). : <http://www.who.int/mediacentre/factsheets/fs282/en/>
5. Tabbara KF, Ross-Degnan D. Blindness in Saudi Arabia. *JAMA* 1986; 255(24):3378-3384
6. Deafness and hearing loss (Updated March 2015 at media centre of WHO web site in June 17, 2016). <http://www.who.int/mediacentre/factsheets/fs300/en/>
7. King AJ. Crossmodal plasticity and hearing capabilities following blindness. *Cell Tissue Res* 2015; 361:295–300
8. Bottaria D, Turatto M, Bonfiole F, Abbadessac C, Selmic S, Beltramec MA, Pavana F. Change blindness in profoundly deaf individuals and cochlear implant recipients. *Brain research* 2008;1242: 209-218
9. Bavelier D, Brozinsky C, Tomman A, Mitchell T, Neville H, Liu G. Impact of early deafness and early exposure to sign language on the cerebral organization for motion processing. *J Neurosci* 2001;21(22):8931-42
10. Lazzouni L, Lepore F. Compensatory plasticity: time matters. *Front Hum Neurosci* 2014; 8:340
11. Kolarik AJ, Cirstea S, Pardhan S. Evidence for enhanced discrimination of virtual auditory distance among blind listeners using level and direct-to-reverberant cues. *Exp Brain Res* 2013; 224:623–633
12. Nilsson ME, Schenkman BN. Blind people are more sensitive than sighted people to binaural sound-location cues, particularly inter-aural level differences. *Hearing Research* 2016; 332: 223-232