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RESEARCH ARTICLE

SOCIO-DEMOGRAPHIC PROFILE AND BODY MASS INDEX OF PATIENTS WITH PULMONARY TUBERCULOSIS AND THEIR TREATMENT OUTCOME IN A TERTIARY CARE CENTRE KERALA

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SES, BMI, DM, Sputum Smear Conversion, CXR Shadows

Abstract

Introduction: Tuberculosis (TB) is a communicable disease that is a major cause of ill health and one of the leading causes of death worldwide. Several socio-demographic factors contributing towards the increasing incidence and development of TB are age, gender, socioeconomic status, smoking, alcoholism, drug addiction, living conditions, literacy, family history, overcrowding, poor sanitation, poor ventilation, malnutrition, occupation.

Primary Objectives: To evaluate the socio-demographic profile and body mass index (BMI) of patients with pulmonary tuberculosis and their treatment outcome.

Secondary Objectives: 1. To assess the relationship between low SES and new smear positive PTB. 2. To assess malnutrition among diagnosed PTB patients. 3. To know how malnutrition and low SES affect the treatment outcome 4. To assess nutritional status of patients before and after treatment 5. To evaluate the relationship between co morbidity and treatment outcome.

Methods: This is a prospective study done in 360 new sputum-positive pulmonary tuberculosis patients attending the department of respiratory medicine, GMC Kannur over 1 year. After full filling the inclusion and exclusion criteria data was collected and the results were organized and analyzed statistically.

Results: The total sample size was 360. 29.2%, belonging to 41-50 years with the male preponderance of male: female ratio = 1.7:1. Regarding the socio-demographic profile, 93.3% were natives, and 72.2% were married. 81.9% belonged to the lower caste, 94.7% had nuclear families, with small-sized families of percentage 70, and most of them, 87.2% resided in pucca houses. The majority of cases had a primary level of education and the literacy rate was only 1.9%. 43.3% of Sputum-positive patients were from low SES. Malnutrition (BMI<18.5Kg/m2) was seen in 58% of patients and there was a significant increase in BMI (p< 0.001) after treatment completion. The majority of patients had DM (38.9%).There was statistically significant clearance in CXR after treatment completion (p <0.001). It was found that DM, smoking and CXR shadows can lead to reduced sputum smear conversion and it was statistically significant with statistical significance as follows: DM –OR=0.367,95%CI of OR is 0.181-0.742, p-value- .004, CXR shadows: OR=0.190,95% CI of OR- 0.079-0.460, p value-0.001, current smokers: p value-0.006.

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Conclusion: In the current study, the majority of patients was having undernutrition (BMI<18.5Kg/m2) and low SES. The nutritional status was improved after treatment completion. Sputum smear conversion at the end of 2 months, which is a key indicator of infectivity, was affected by patients smoking status, DM, and CXR shadow. Hence, education, awareness, smoking cessation, adequate nutritional support, DM control are necessary for control of TB and for achieving the national target.

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Introduction:-

Tuberculosis (TB) is a communicable disease that is a major cause of ill health and one of the leading causes of death worldwide. TB is caused by the bacillus Mycobacterium tuberculosis. The disease typically affects the lungs (pulmonary TB) but can affect other sites. Most people (about 90%) who develop the disease are adults, with more cases among men than women. About a quarter of the world's population has been infected with M. tuberculosis[1].As per the Global TB Report 2021, the estimated incidence of all forms of TB in India for the year 2020 was 188 per 100,000 Population(129-257 per 100,000 population). The estimated mortality rate among all forms of TB is 37 per 100,000 population(34-40 per 100,000 population) in 2020, as per the Global TB Report 2021. There has been a slight increase in the mortality rate due to all forms of TB between 2019 and 2020 by 11% in the country [2].

Several socio-demographic factors contributing to the incidence and development of TB are age, gender, socioeconomic status, smoking, alcoholism, drug addiction, living conditions, literacy, family history, overcrowding, poor sanitation, poor ventilation, malnutrition, occupational factors like exposure to silica and those working in proximity to persons suffering from pulmonary tuberculosis, increased stress and strain of life, etc[3].Over 80% of cases and deaths are in low- and middle-income countries. Alcohol use disorder and tobacco smoking increase the risk of TB. In 2021, 0.74 million new TB cases worldwide were attributable to alcohol use disorder and 0.69 million were attributable to smoking [4]. The relationship between TB and nutrition is bidirectional, **i.e.** having active TB leads to loss of weight, and being underweight is considered a risk factor for developing TB, whether through reactivation of latent TB or developing progressive primary disease upon infection [5]. Under nutrition also leads to worse treatment outcomes once TB has developed.

Lack of awareness about the cause, risk factors, treatment, and prevention of pulmonary TB particularly among people living in rural areas is a major challenge to be addressed to reduce disease transmission. Therefore, much importance must be given to sensitization of the community about tuberculosis and the services offered through the program to end the disease [6].Several medical conditions like diabetes, malnutrition, HIV, tobacco smoking, and alcohol use are risk factors for TB and poor TB treatment results. Therefore, it is important to identify these co-morbidities in people diagnosed with TB to ensure early diagnosis and improve management. When these conditions are highly prevalent in the general population they can be important contributors to the TB burden. Consequently, reducing the prevalence of these conditions can help prevent TB [7].

The National Strategic Plan (NSP) 2017–2025 for TB elimination in India proposes bold strategies with commensurate resources to rapidly decline TB incidence and mortality in India by 2025, five years ahead of the global End TB targets and Sustainable Development Goals to attain the vision of a TB-free India. VISION is TB-Free India with zero deaths, disease, and poverty due to TB and the GOAL is to achieve a rapid decline in the burden of TB, morbidity, and mortality while working towards the elimination of TB in India by 2025[8]. Despite many comprehensive methods to end TB, there are many lacunae and there is still a long way to go.

Materials & Methods:-

Study Design

Prospective study

Study Setting

Department of Respiratory Medicine,Government medical college, Kannur

Study Population
The study population consist of patients having age >18 years, new sputum smear positive with pulmonary TB, registered for treatment in department of Respiratory medicine, Government medical college,Kannur.

Study Period
The study was conducted for a period of 1year from May 2021 to May 2022.

Sample Size
Minimum sample size for the study was calculated as 360 according to the formula
Sample size n =
$(Z_1-\frac{\alpha}{2}+ Z_1-\beta)^2 \div d\times pq$
= 359.04
~360
Where,
$Z_1-\frac{\alpha}{2}$ = 1.96, corresponding to 5%level of significance
$Z_1-\beta$ = 0.84, corresponding to 80% power

p = p1 + p2 ÷ 2 = 66%
q = 100-p = 34%
d = p1 – p2= 7%

Sampling Method
Consecutive sampling

Inclusioncriteria
1. Patients having age > 18 years
2. New sputum smear positive for pulmonary TB
3. Drug sensitive PTB cases

Exclusion Criteria
1. Extra pulmonary tuberculosis
2. Smear negative pulmonary tuberculosis cases
3. Drug resistant PTB and EPTB cases
4. HIV
5. Thyroid dysfunctions
6. Malignancy

Methodology:-
Subjects were selected according to the inclusion and exclusion criteria. A written informed consent was obtained from them. Using a structured questionnaire, information about socio-demographic data including age, sex, marital status, education, occupation, caste, family type, family size, socio-economic status, addictions, co-morbidities (DM, HTN ,CAD), past history of PTB and EPTB, knowledge and attitude towards TB was collected. Detailed history was taken which was proceeded with physical and clinical examination. The nutritional status of patients is assessed by a metric system using Body Mass Index (BMI) .The height(m) of the patients was measured while standing erect against a wall without shoes and their weight(Kg) measured on a digital standing scale with minimal clothing on. BMI was calculated by formula weight ÷ height (Kg/m2). The same instruments were used to take measurements of all patients and calibrated each morning to ensure the validity of the results. With height assumed to be unchanged, the weights of the patients were measured again at the end of the treatment. The nutritional status was then categorized according to the BMI calculated using latest WHO guidelines and entered into the table. Data on chest X-rays of patients before treatment and after treatment completion, details of sputum conversion are collected and entered on the table.

Variables Studied
Age, sex, co-morbidities, addictions, marital status, education, occupation, caste, family type, family size, socio-economic status, clinical features, sputum conversion, chest xray findings.

Data Analysis

Frequency and percentage will be used for analysis of categorical variable. Inferential statistical methods like chi square test and students t test will be used. P value of < 0.05 will be taken as significant. All statistical analysis were done using IBM SPSS statistics version 26.

Results:-

Age Distribution

Table 1:- Age distribution.

	AGE	Valid Percent
18-30	13	3.6
31-40	33	9.2
41-50	105	29.2
51-60	87	24.2
61-70	91	25.3
71-80	21	5.8
81-90	10	2.8
Total	360	100

Out of 360, 13 cases (3.6%) are in the age group 18-30 years, 33 cases (9.2%) comes under the age group 31-40 years, 105 cases (29.2%) in the age group 41-50 years, 87 cases (24.2%) in the age group 51-60 years, 91cases (25.3%) in the age group 61-70 years, 21cases (5.8%) in the age group 71-80 years and 10 cases (2.8%) in the age group 81-90 years.

Sex Distribution

Table 2:- Sex distribution.

In total 360 cases, 63% were males and 37% female.

	SEX	Valid Percent
Male	227	63.1
Female	133	36.9
Total	360	100

Table 3:- Distribution of sex according to the age group

Age group		Sex		Total
		Male	Female	
18-30 yrs	No.	10	3	13
	Row %	76.9%	23.1%	100.0%
	Col.%	4.4%	2.3%	3.6%
31-40 yrs	No.	20	13	33
	Row %	60.6%	39.4%	100.0%
	Col.%	8.8%	9.8%	9.2%
41-50 yrs	No.	59	46	105
	Row %	56.2%	43.8%	100.0%
	Col.%	26.0%	34.6%	29.2%
51-60 yrs	No.	54	33	87
	Row %	62.1%	37.9%	100.0%
	Col.%	23.8%	24.8%	24.2%
61-70 yrs	No.	63	28	91
	Row %	69.2%	30.8%	100.0%
	Col.%	27.8%	21.1%	25.3%
71-80 yrs	No.	16	5	21
	Row %	76.2%	23.8%	100.0%
	Col.%	7.0%	3.8%	5.8%
81-90 yrs	No.	5	5	10

	Row %	50.0%	50.0%	100.0%
	Col.%	2.2%	3.8%	2.8%
Total	No.	227	133	360
	Row %	63.1%	36.9%	100.0%
	Col.%	100.0%	100.0%	100.0%

The majority of males are included in the age groups 18-30 years (76.9%) and in the age groups 71-80 years (76.2%). The majority of females were included in the age group of 81-90 years. In the male population, major cases are found in the middle age groups, like 41-50 years (26.0%),51-60 years (23.8%) and 61-70 years (27.8%) and in the female population, 43.8%, 37.9% and 30.8% respectively

Residence

Table 4:- Distribution of cases according to their residence.

	RESIDENCE	**Valid Percent**
Native	336	93.3
Migrant	24	6.7
Total	360	100

Out of the total population, 93.3%(336 cases) were native and the migrants were only 6.7%(24 cases) .

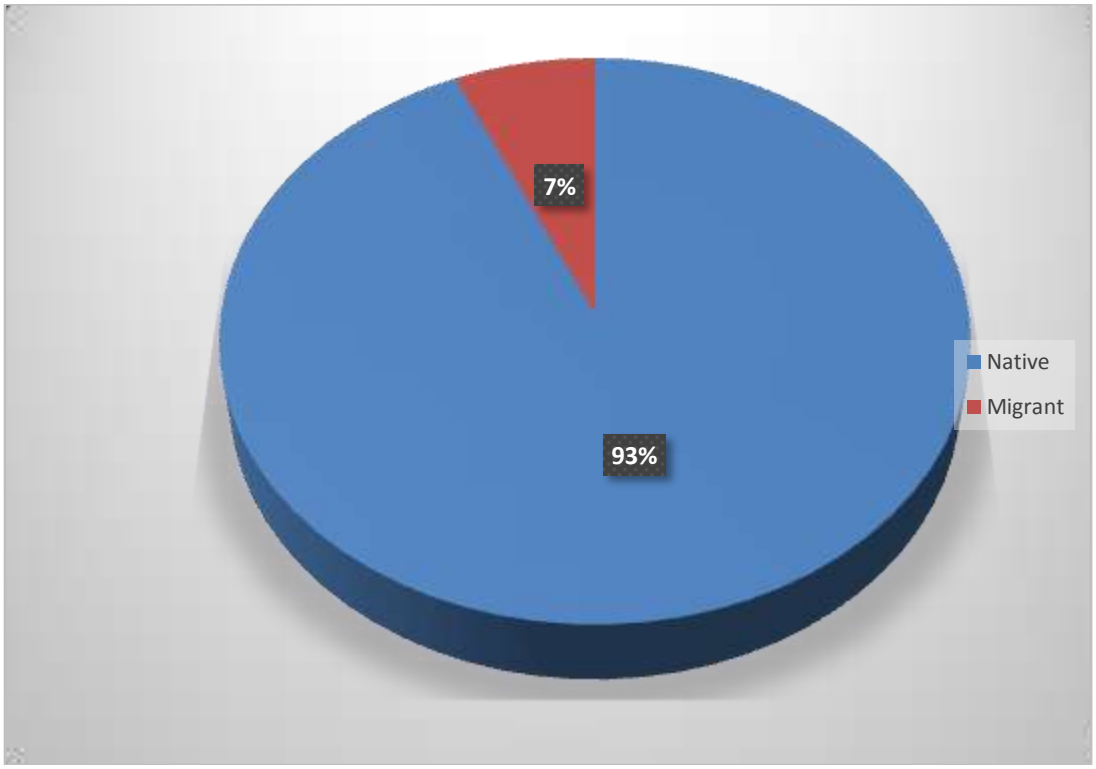

Figure 1:- Pie chart showing distribution of residence.

Socio Demographic Profile

Table 5:- Distribution of cases according to various socio-demographic profile.

Parameters		**No. of cases n= 360**	%
Marital Status	Married	260	72.2
	Single	62	17.2
	Widow/Widower	38	10.6
Caste	Dominant	5	1.8
	Prestige	28	7.7
	Agriculture caste	15	4.1

	Artisan Caste	17	4.7
	Lower Caste	295	81.9
Family Type	Nuclear	341	94.7
	Joint	19	5.3
Family Size	Small	252	70.0
	Medium	95	26.4
	Large	13	3.6
Education	Illiterate	7	1.9
	Can read only	57	15.8
	Can read and write	75	20.8
	Primary	210	58.3
	Middle	2	0.6
	High school	5	1.4
	Graduate and above	4	1.1
Occupation	No work	84	23.3
	labourer	156	43.3
	caste occupation	1	0.3
	business	68	18.9
	independent profession	18	5.0
	cultivation	17	4.7
	service	16	4.4

Table 5 illustrates. Out of 360 cases, 260 cases (72.2%) are married, 62 cases (17.2%) are single and 38(10.6%) cases are widow/widower. 295 cases (81.9%) were belonging to a lower caste. It was observed that 94.7% of the study population belonged to nuclear families and 70% had small-sized families. Majority are labourers (43.3 %), 18.9% were doing business and 23.3% had no work.

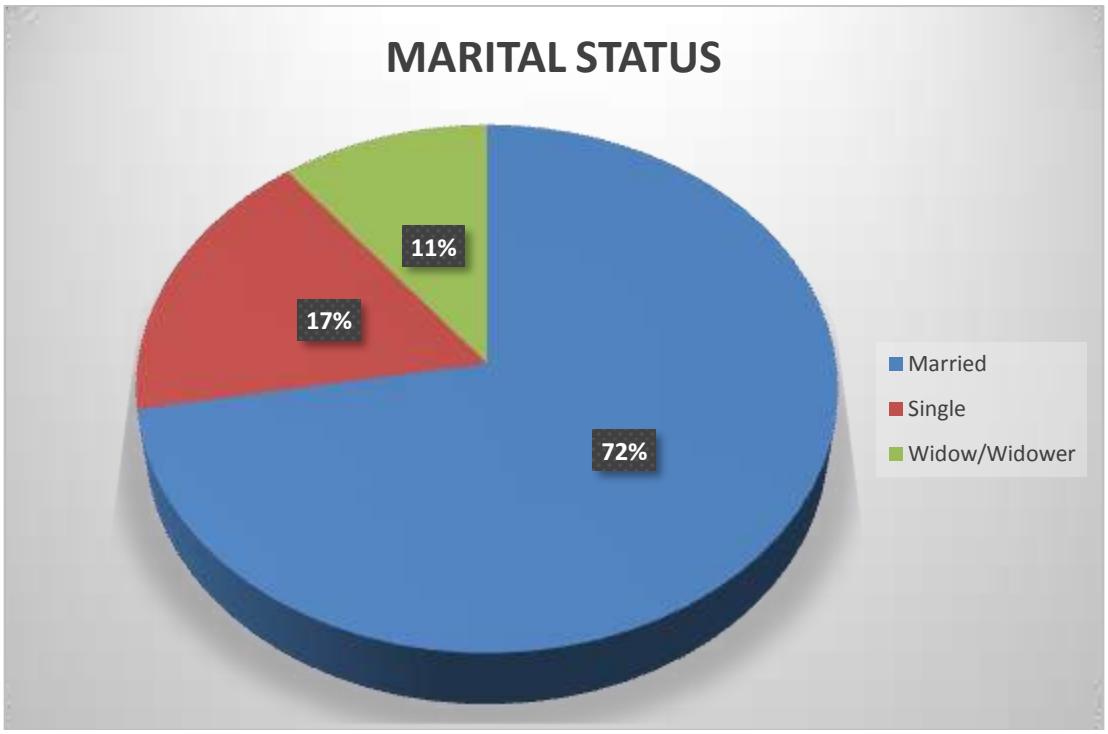

Figure 2:-Distribution of marital status.

Table 6:- Distribution of cases according to house type.

Parameters		**No.**	**%**
House Type	Kucha house	15	4.2

	Mixed house	31	8.6
	Pucca house	314	87.2
	Total	360	100.0

Table-6 depicts that, Out of the total 360 cases 87.2% of cases resided in pucca houses, 4.2% had Kucha house and 8.6% had mixed house.

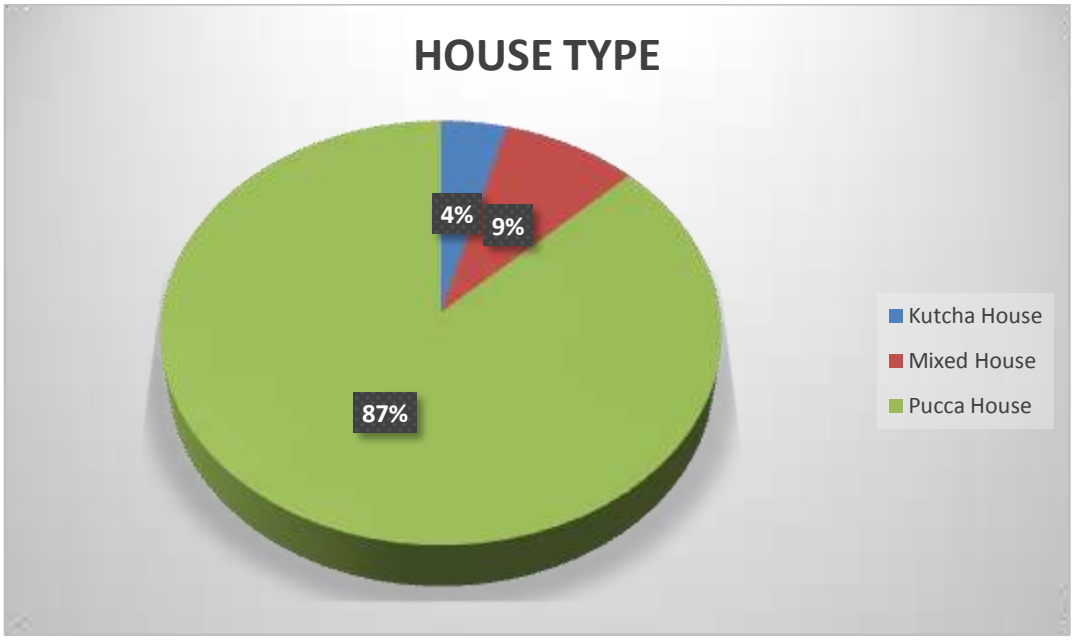

Figure 3:- Pie chart showing distribution of house type.

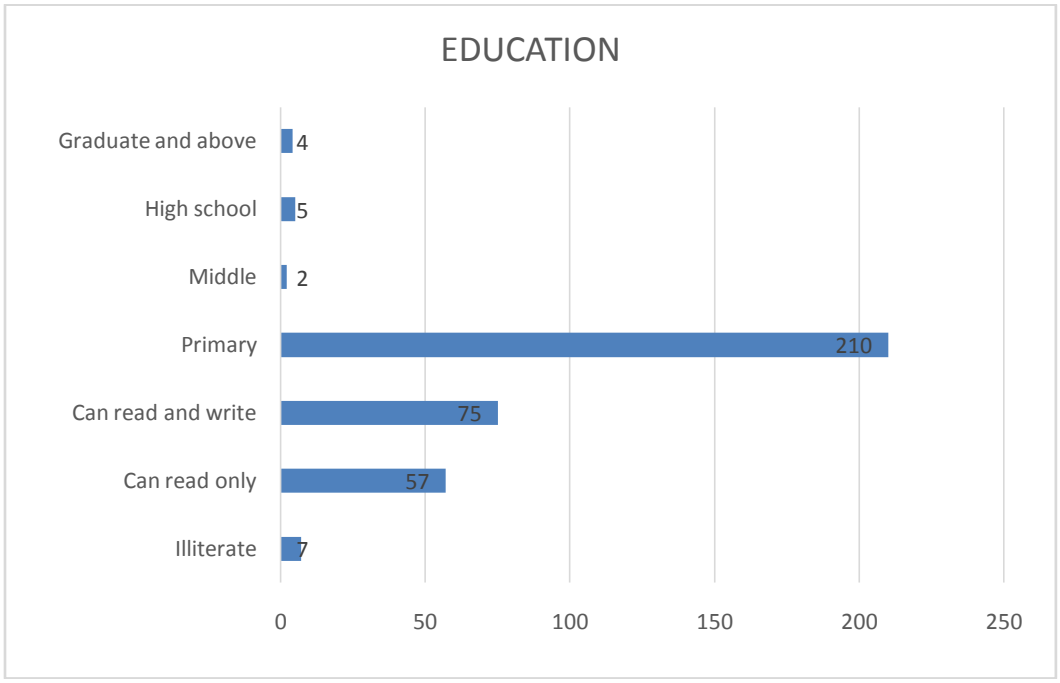

Figure 4:- Distribution of cases according to the education.

The majority of cases, ie, 58.3% (210 out of 360 cases) have a primary level of education. 20.8 % (75 cases) can read and write .15.8% (57 cases) can read only and 1.9% (7 cases) are illiterate.

Socio-Economic Status

Table 7:- Distribution of cases according to Socio-economic status.

	SES (using modified udai pareekh's scale)	**Valid Percent**
Upper class	16	4.4
Upper Middle Class	28	7.8
Middle Class	37	10.3
Lower Middle Class	123	34.2
Lower Class	156	43.3
Total	360	100

Table 7 shows that more than half of the sputum positive cases were belonging to lower class (43.3%)and lower middle class (34.2%). Only 10.3% cases from middle class, 7.8% from upper middle class and 4.4% belonging to upper class.

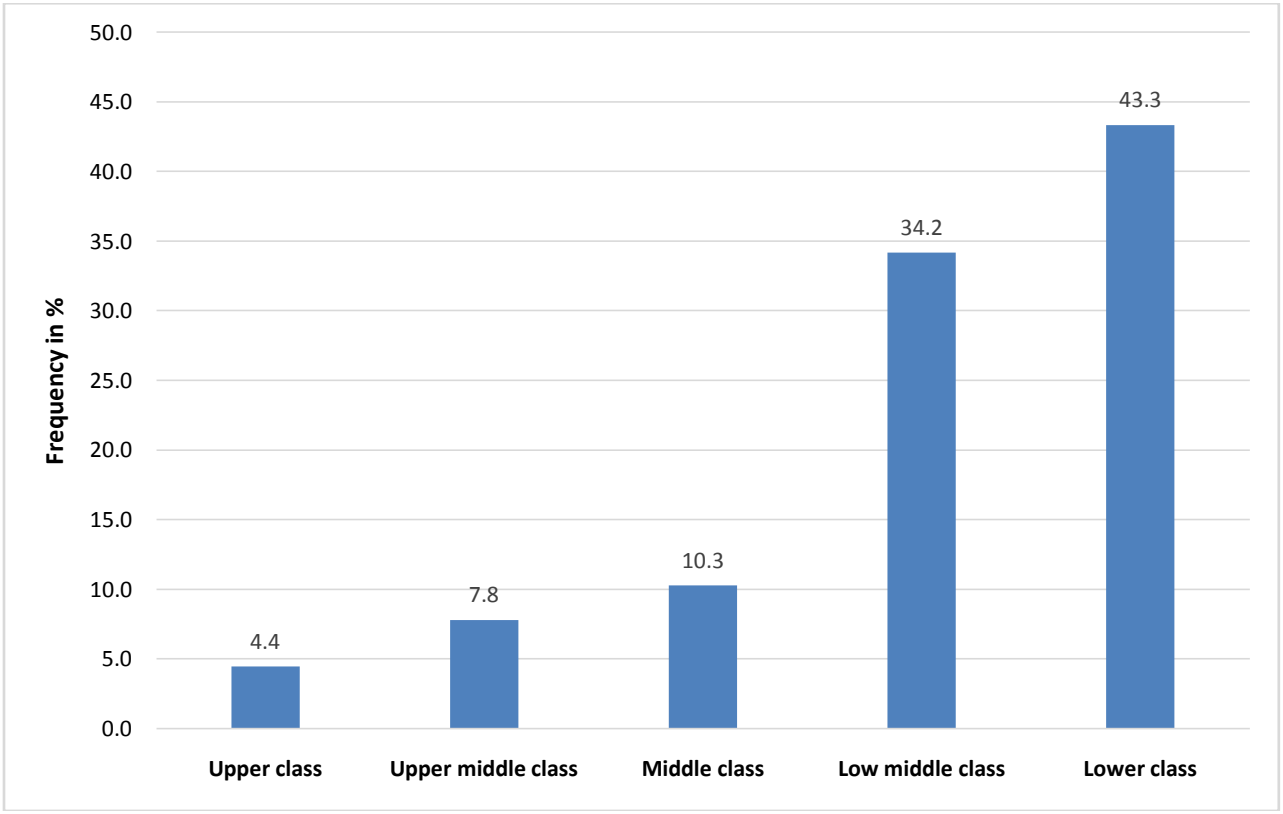

Figure 5:- Percentage distribution of cases according to Socio-economic status.

Symptoms And Addictions

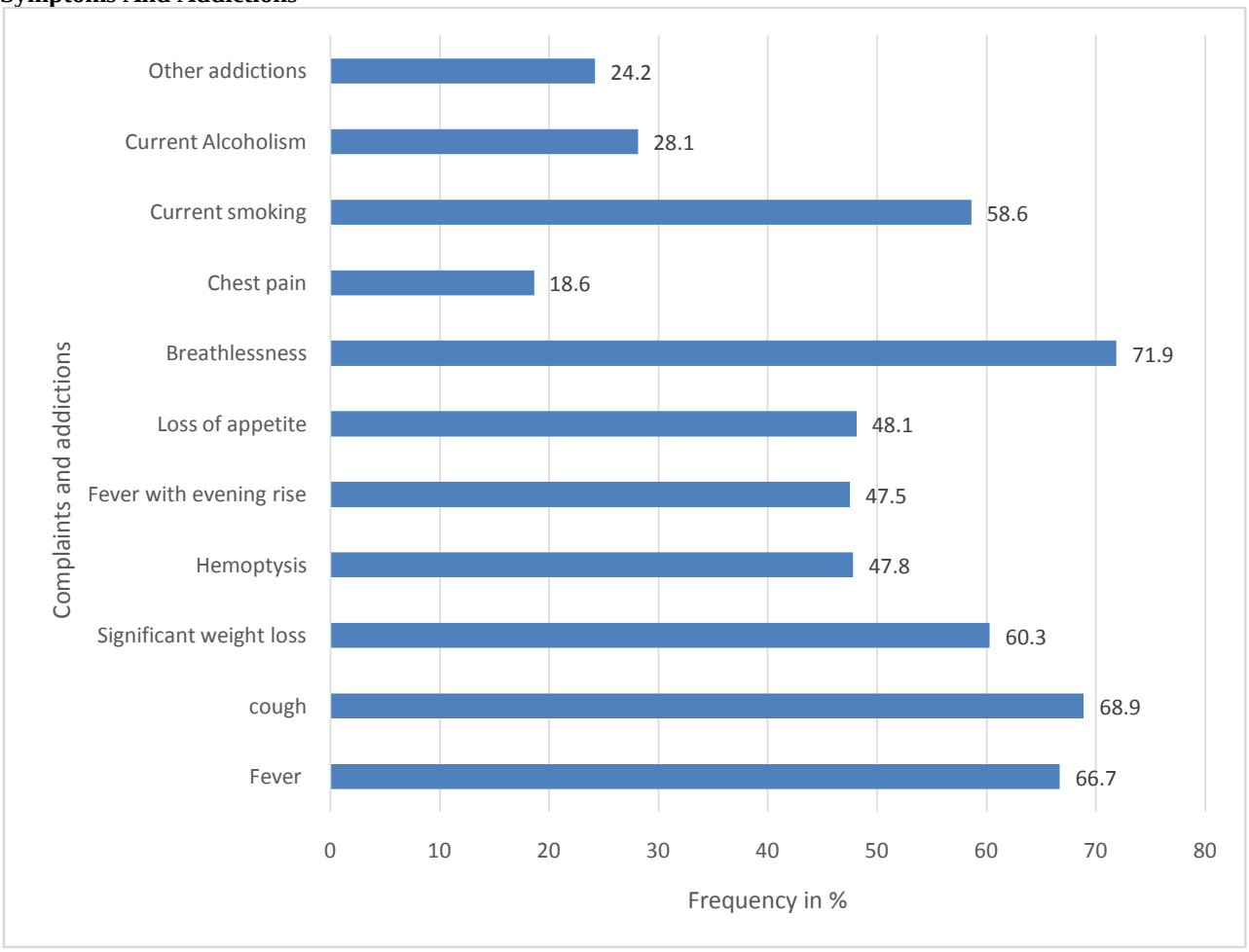

Figure 6:- Bar diagram showing the distribution of cases according to the complaints & addictions.

Above Figure 17 illustrates that out of 360 cases 269 cases was having breathlessness (71.9 %), followed by cough which was seen in 248 cases(68.9%), fever for more than 2 weeks in 240 cases (66.7 %). 217 cases(60.3%) have significant weight loss. 172 cases (47.8%) have Hemoptysis,171 cases(47.5%) have fever with evening rise,187 cases (51.9%) have loss of appetite, 67cases (18.6%) have chest pain.

Table 8:- Distribution of cases according to addictions.

	CURRENT SMOKING	Valid Percent
No	149	41.4
Yes	211	58.6
Total	360	100
	CURRENT ALCOHOLISM	Valid Percent
No	259	71.9
Yes	101	28.1
Total	360	100
	OTHER ADDICTIONS	Valid Percent
Nil	273	75.8
Tobacco	72	20
Betal/Areca Nuts	15	4.2
Total	360	100

Out of 360 cases, 58.6% have current smoking, 28.1 % have alcohol consumption and 24.2% have other addictions.

CO-Morbidities

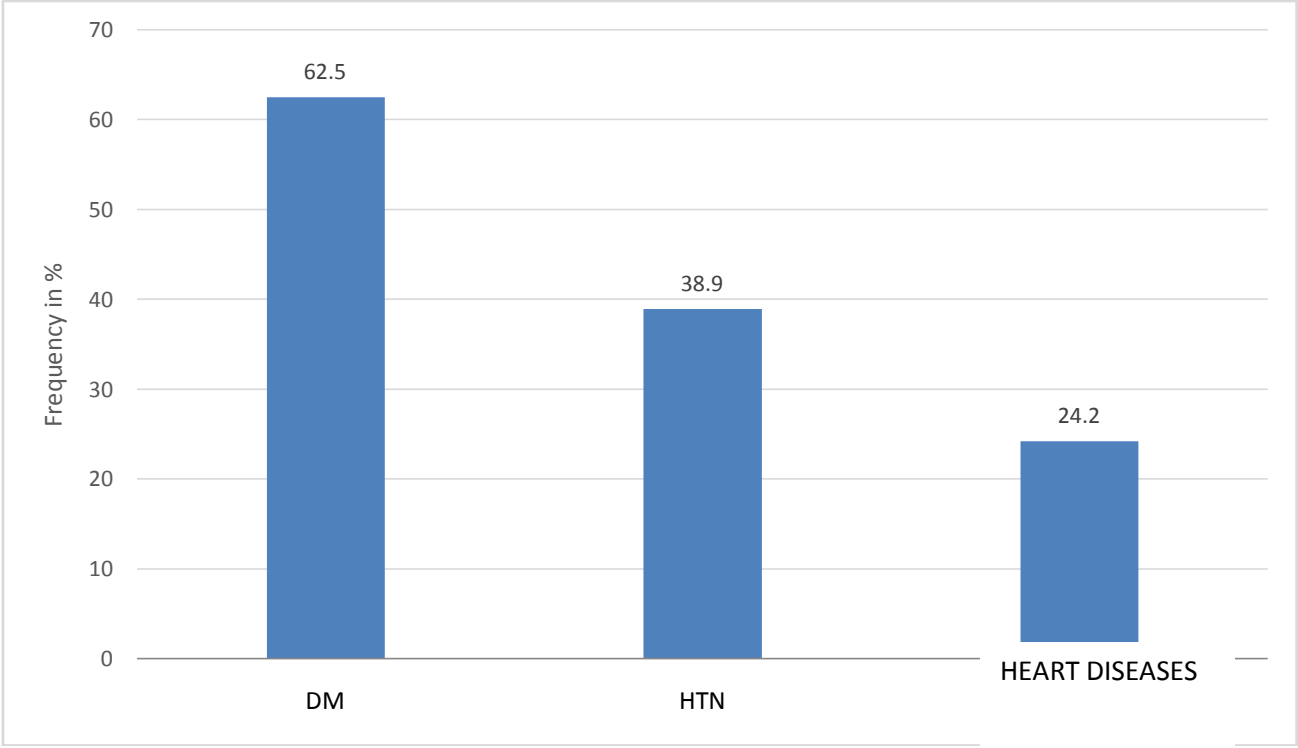

Figure 7:- Bar diagram showing distribution of co-morbidities among cases.

Figure 7 depict 62.5% cases were having DM, 38.9% have HTN and 24.2% have heart disease

Knowledge About Tb Among The Cases

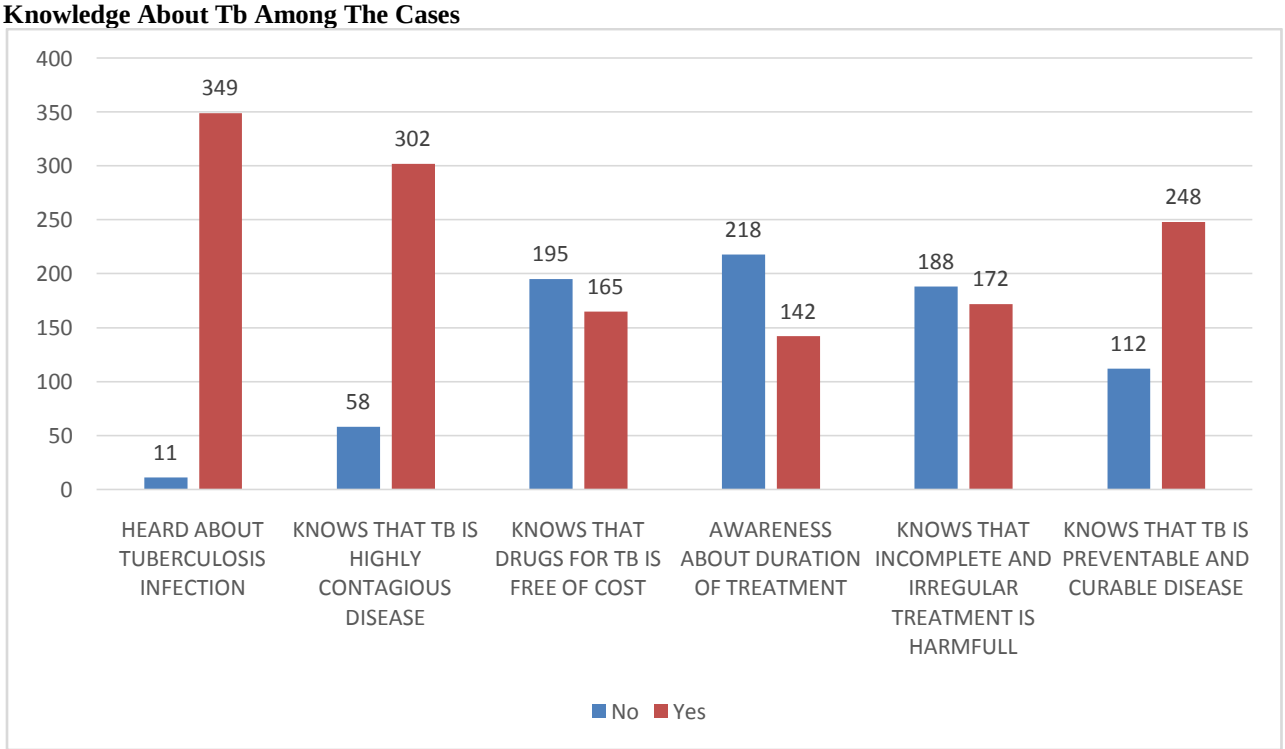

Figure 8:- Bar chart showing distribution of cases according to their knowledge on TB.

Figure 19 depicts that out of 360 cases, 349 patients (96.9%) have heard about tuberculosis infection. 302 patients (83.9%) know that TB is a highly contagious disease. Only 165 patients (45.8%) and 142 patients (39.4%) knows that drugs for TB are free of cost and had awareness about the duration of treatment, respectively. Also, only 172 cases (47.8%) know that incomplete and irregular treatment is harmful and 248 cases (68.9 %) know that TB is a preventable and curable disease.

Bmi Before And After Treatment

Table 9:Distribution of cases according to the BMI before and after treatment

Body Mass Index(Kg/m$^{2)}$ (WHO)	Description	Before Treatment		After Treatment	
		No.	%	No.	%
<18.5	Underweight	209	58	115	32
18.5-24.99	Normal	121	33.6	164	45.6
25-29.99	Over weight	20	5.6	43	11.9
>30	Obese	10	2.8	7	1.9
Lost follow up/ transferred out/ died		-	-	31	8.6
Total		360	100.0	360	100.0

As summarized in Table 9, it was observed that before treatment, 209 cases out of a total of 360 cases (58%) had a BMI <18.5 Kg/m2. ie, 58% of cases were underweight. But after treatment, only 115 cases came to be underweight. Before treatment, 121 cases(33.6 %) had BMI between 18.5-24.99 kg/m2. After treatment, 164 cases (45.6%) came under normal BMI. 20 cases(5.6%) were found to be over weight(BMI- 25-29.99kg/m2) before treatment. After treatment, there was an increase in overweight category cases to 43 (11.9%). Under the obesity category before treatment (BMI>30kg/m2), 10 cases were seen, but it was seem to be reduced to 7 after treatment. In 31 cases, which included subjects who died, lost to follow-up, transferred out, or migrated out of the area without information, weight measurements could not be recorded at the end of treatment.

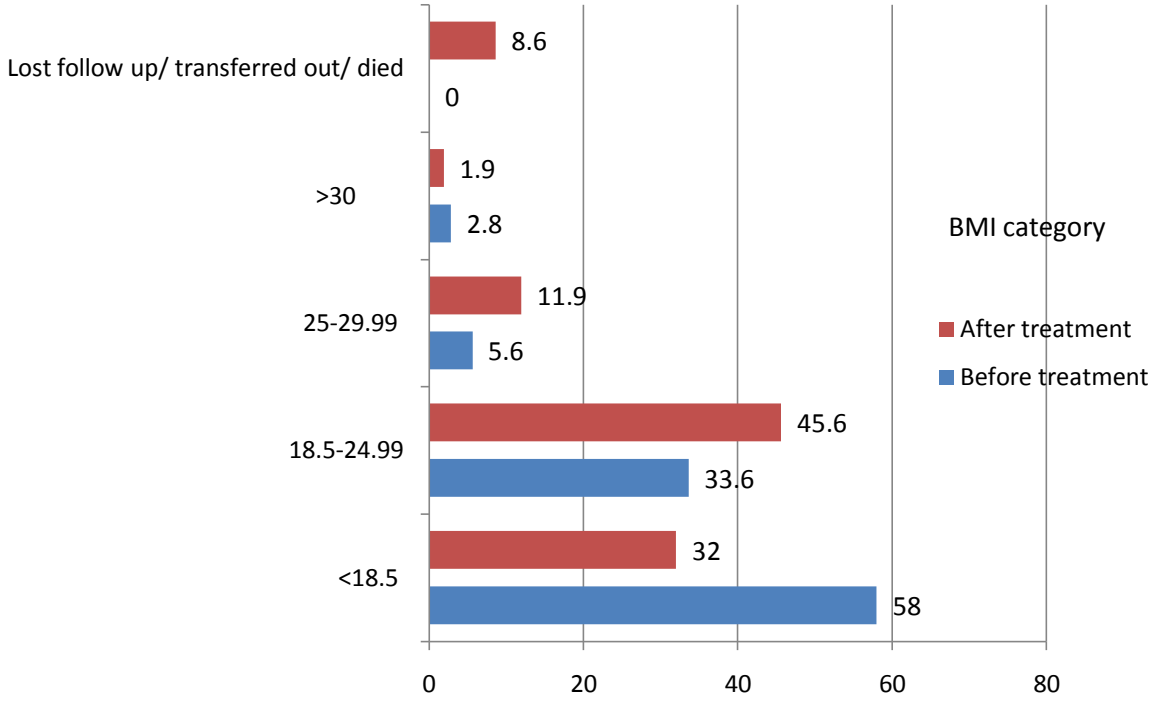

Figure 9:- Multiple bar diagram showing the Distribution of cases according to BMI in between before and after treatment.

Table 10:- Cross tab –BMI before treatment and BMI after treatment.

Chi-Square Tests			
	Value	df	Asymptotic significance(2-sided)
McNemar-Bowker Test	60.892	3	**0.000 (P value <0.001)**
N of Valid Cases	329		

Table 11:-Chi-square tests to measure the association between BMI before and after treatment.

BMI BEFORE TREATMENT		BMI AFTER TREATMENT				
		<18.5	18.5-24.99	>=25	Total	p- value
<18.5	No.	94	90	9	193	<0.001
	%	28.6%	27.4%	2.7%	58.7%	
18.5-24.99	No.	21	69	20	110	
	%	6.4%	21.0%	6.1%	33.4%	
>=25	No.	0	5	21	26	
	%	0.0%	1.5%	6.4%	7.9%	
Total	No.	115	164	50	329	
	%	35.0%	49.8%	15.2%	100.0	

Table 11 illustrates. Before treatment, 58.7% of cases were underweight, 33.4% were normal and 7.9% were overweight. After treatment, there were found to be 35.0% underweight, 49.8% were normal and 15.2% were overweight. However, **the malnutrition (underweight) was significantly reduced after treatment (p-value <0.001).**

Chest Xray

Chest Xray Finding Before Treatment

Normal	122	33.9
Right Upper Zone Shadows	100	27.8
Right Mid Zone Shadows	65	18.1
Right Lower Zone Shadows	31	8.6
Left Upper Zone Shadows	24	6.7
Left Mid Zone Shadows	6	1.7
Left Lower Zone Shadows	5	1.4
Right Multilobar Pneumonia	4	1.1
Bilateral Pneumonia	3	0.8
Total	360	100

Table 12:-CXR shadows before and after treatment.

From table 12, before treatment, the majority of cases ie, 33.9% have normal CXR, 27.8 % of cases show right upper zone shadows, 18.1% show right mid zone shadows, 8.6% show right lower zone shadows, 6.7% cases left upper zone shadows, 1.7% cases show left mid zone shadows, 1.4% cases shows left lower zone shadows, 1.1% cases shows right multilobar pneumonia and 0.8% cases shows bilateral pneumonia.

Comparison Of Cxr Before And After Treatment

Table 13:- CXR shadows before and after treatment.

Chest X-ray shadow			%
Before Treatment (No of cases n= 360)	Absent	123	34.1
	Present	237	65.8
After Treatment (No of cases n= 237)	Not Reduced	58	24.5
	Reduced	179	75.5

Table 13 depicts that before treatment, CXR shadows was seen in 237 cases of the total 360 cases (65.8%). Among the 237 cases, 179 cases shows reduction in CXR shadow (75.5%).

Table 14:- Comparison between CXR before and after treatment.

Chi-Square Tests			
	Value	df	P value (<0.05 is significant)
Pearson Chi-Square	53.061	7	**<0.001**

Crosstab					
			CXR after treatment completion		Total
			No Clearance	Clearance	
CXR Before Treatment	Right Upper Zone Shadows	Count	8	92	100
		% within CXR after treatment completion	13.8%	51.4%	42.2%
	Right Mid Zone Shadows	Count	11	54	65
		% within CXR after treatment completion	19.0%	30.2%	27.4%
	Right Lower Zone Shadows	Count	14	16	30
		% within CXR after treatment completion	24.1%	8.9%	12.7%
	Left Upper Zone Shadows	Count	14	10	24
		% within CXR after treatment completion	24.1%	5.6%	10.1%
	Left Mid Zone Shadows	Count	4	2	6
		% within CXR after treatment completion	6.9%	1.1%	2.5%
	Left Lower Zone Shadows	Count	3	2	5
		% within CXR after treatment completion	5.2%	1.1%	
	Right Multilobar Pneumonia	Count	2	2	4
		% within CXR after treatment completion	3.4%	1.1%	1.7%
	Bilateral Pneumonia	Count	2	1	3
		% within CXR after treatment completion	3.4%	0.6%	1.3%
Total		Count	58	179	237
		% withinCXR after treatment completion	100.0%	100.0%	100.0%

Table 15:- Chi-square test on comparison between CXR before and aftertreatment.

After treatment, there was **51.4%** CXR clearance for the right upper zone shadow. And there is only 13.8% of non clearance. Hence **there is reduction in CXR shadow after treatment which is statistically significant with P value <0.001**.

Sputum Smear Conversion After 2 Months OF IP

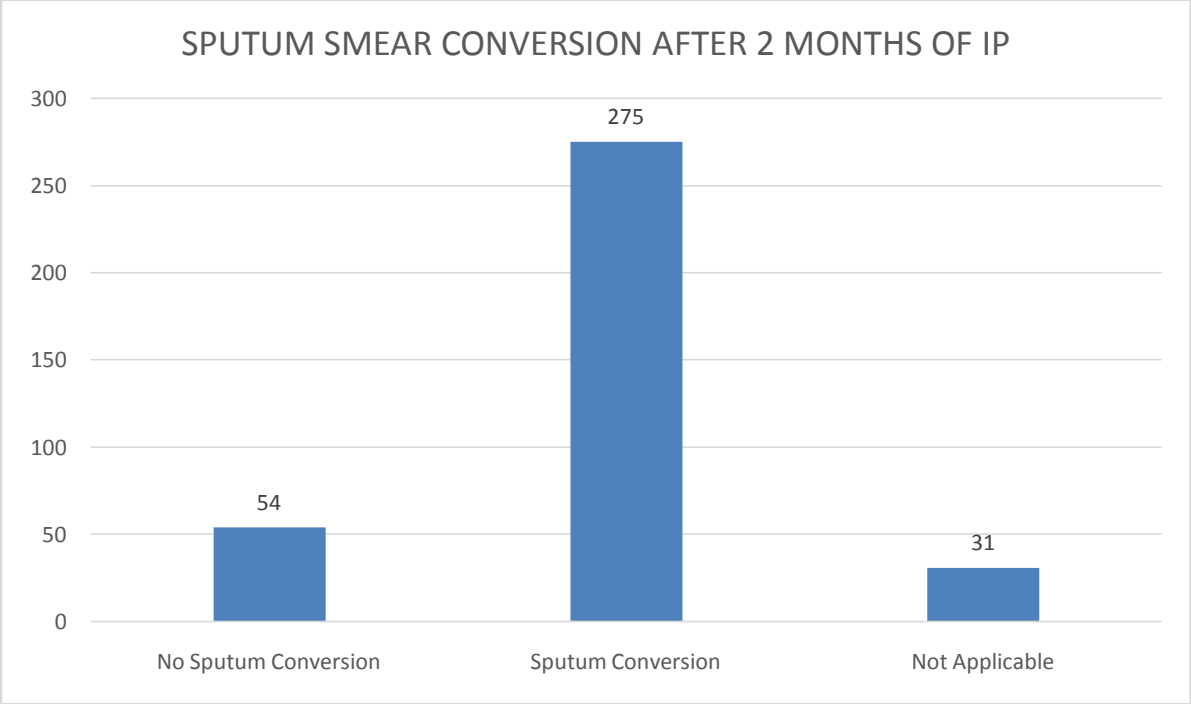

Figure 10:- Distribution of cases according to sputum conversion after IP.

Among the total 360cases, 76.4% have sputum smear conversion present, 15.0% have no sputum smear conversion, and 8.6% cases are not applicable(excluding the drop outs).

Comparison Of Sputum Smear Conversion In Dm And Non-Dm Patients

Table 16:- ODD ratio and p value showing association of sputum conversion in Diabetic and Non-diabetic patients.

VARIABLES	CATEGORY	NO	SPUTUM SMEAR CONVERSION		OR(95% CI OF OR)	P VALUE
			NO:	%		
DM	ABSENT	124	113	91.1	0.367(0.181- 0.742)	0.004
	PRESENT	205	162	79		

Among patients without DM 91.1% showed sputum smear conversion at the end of 2 months and among patients with DM 79.0% cases shows sputum smear conversion. As compared to cases without DM, cases with DM (OR=0.367, 95% CI of OR is 0.181 – 0.742 and p-value 0.004) shows less likely to have sputum smear converion.

Comparison Of Sputum Smear Conversion In Patients With Cxr Shadow And Without Cxr Shadow

Table 17:- ODD ratio and p value showing association of sputum conversion in patients with CXR shadows and those without CXR shadows.

Variable	Category	Num	Sputum smear conversion		Or(95% ci of or)	P value
			Num	%		
Chest x ray shadow	No	115	109	94.8	-	<0.001
	Yes	214	166	77.6	0.190 (0.079-0.460)	

In cases without chest X ray shadow 94.8% have sputum smear conversion at end of IP, and in cases with chest X ray shadow 77.6% have sputum smear conversion. As compare to cases without chest X ray shadow , with chest x ray shadow shows (OR=0.190, 95% CI of OR is 0.079– 0.460 and p-value <0.001) less likely to have sputum smear conversion and its shows a statistical significant association.

Comparison Of Sputum Smear Conversion In Current Smokers And Non-Smokers.
Cross
Tab 18:- Comparison of sputum smear conversion among current smokers and non smokers.

Crosstab					
			Sputum smear conversion after 2 months of IP		Total
			No Sputum Conversion	Sputum Conversion	
CURRENT SMOKING	No	Count	14	127	141
		% within sputum conversion after 2 months of IP	25.9%	46.2%	42.9%
	Yes	Count	40	148	188
		% within sputum conversion after 2 months of IP	74.1%	53.8%	57.1%
Total		Count	54	275	329
		% within sputum conversion after 2 months of IP	100.0%	100.0%	100.0%

Table 19:- Chi-square tests for comparing sputum smear conversion in smokers and non smokers.

Chi-Square Tests			
	Value	df	P value (<0.05 is significant)
Pearson Chi-Square	7.562	1	**.006**

As depicted in table 19, among the current smoker 74.1% was not having sputum smear conversion when compared with others. As P value calculated was 0.006 , the relation was found to be significant (P<0.05).**Hence, sputum smear conversion was found to be reduced in current smoker and it is statistically significant.**

Treatment Outcome

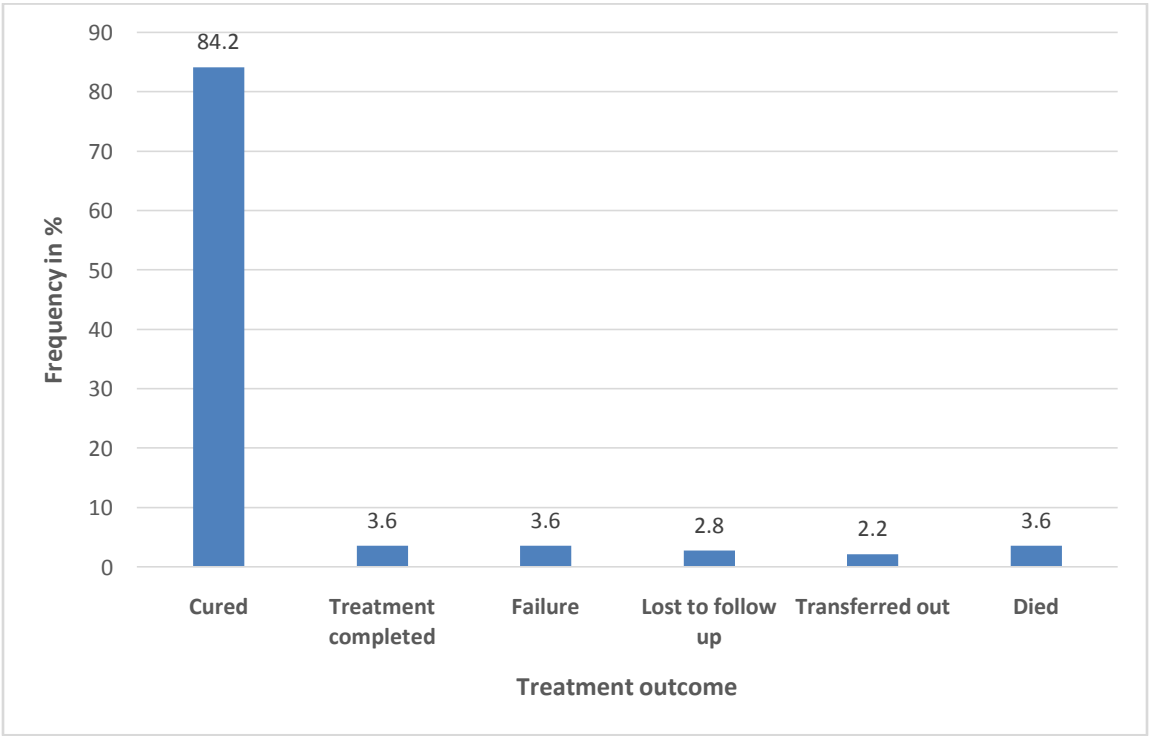

Figure 12:- Distribution of cases according to the treatment outcome.

Figure 12 illustrates that among the total 360 cases under study, 84.2% were cured and 3.6% completed treatment. Failure rate was 3.6%, 2.8% cases lost to follow up, 2.2% transferred out and 3.6% died during the treatment.

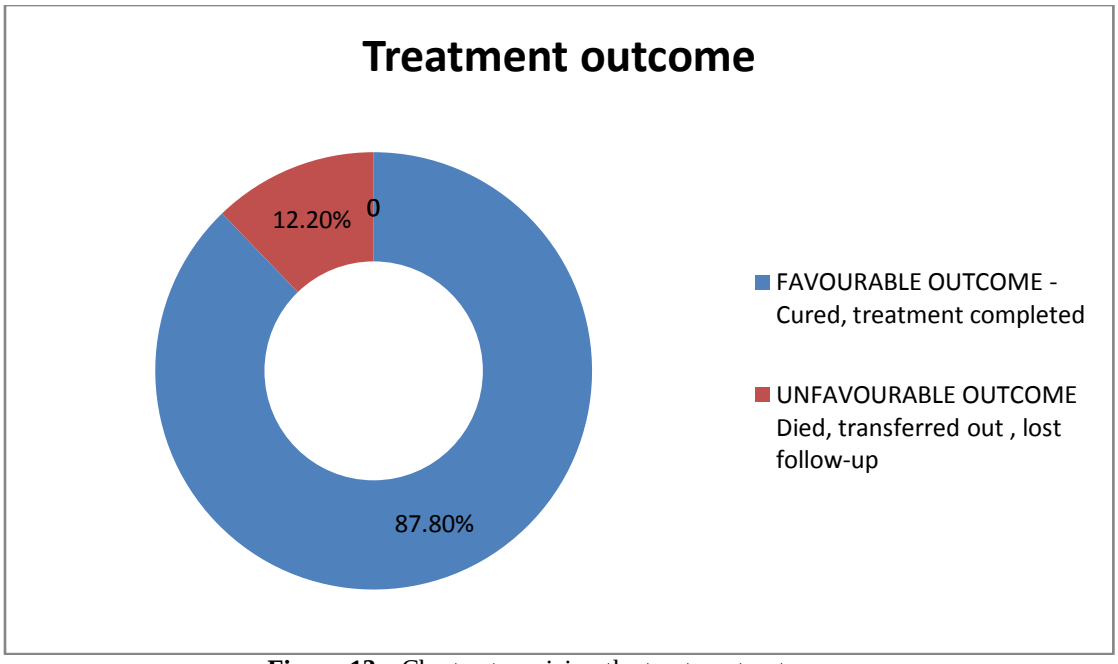

Figure 13:- Chart categorizing the treatment outcome.

For statistical analysis, outcomes was divided in two categories: FavourableOutcome (F.O.): include cured and treatment completed Unfavourable Outcome (U.O.): includes failure, loss to follow up, transferred out and died. In the study there were 87.80% ofFavourable outcome and 12.20 % of unfavourable outcome.

Effect Of Ses And Malnutrition On Treatment Outcome

Table 20:- Effect of malnutrition on treatment outcome.

BMI AFTER TREATMENT		Outcome		Total	p- value
		FAVOURABLE	UN FAVOURABLE		
<18.5	No.	111	4	115	0.95
	%	96.5%	3.5%	100.0%	
18.5-24.99	No.	157	7	164	
	%	95.7%	4.3%	100.0%	
>=25	No.	48	2	50	
	%	96.0%	4.0%	100.0%	

Table 20 depict among under weight , 96.5% of cases are cured after treatment of TB, among Normal patients 95.7% were cured after treatment of TB and among overweight/obese 96.0% of cases were cured after treatment. There is no statistically significant association between BMI and treatment outcome (p-value 0.95).

Table 21:- Effect of SES on treatment outcome.

SES		Outcome		Total	p-value
		Favourable	Un favourable		
Upper class	No.	41	3	44	0.06
	%	93.2%	6.8%	100.0%	
Middle class	No.	36	1	37	
	%	97.3%	2.7%	100.0%	
Lower class	No.	239	40	279	
	%	85.7%	14.3%	100.0%	

Table 21 shows among upper class family, 93.2% of cases are cured after treatment of TB, among middle class family 97.3% of patients were cured after treatment of TB and among lower class family85.7% of cases were cured

after treatment of TB. There is no statistically significant association between socio economic status and treatment outcome (p-value 0.06).

Discussion:-

The present study conducted at department of respiratory medicine, GMC kannur assessed the socio-demographic profile and BMI of patients with pulmonary TB and their treatment outcome, 360 cases of new sputum positive pulmonary TB, who satisfied the inclusion criteria, were studied from may 2021 to may 2022.

In our study, the majority of sputum positive cases fell in the age group of 41-50 years (29.2%).Similar finding was seen in a study conducted by sadia et al(2022)[9] , in which 31.45% belong to age group 41-50 years bearing the 2nd majority group (20.14%) 51-60 years. It implies that age is an important risk factor in the development of TB, probably due to decrease immunity along with the ageing process.

There was a male preponderance with male to female ratio of 1.7: 1 in which 56.3%male and 43.75 female. This findings were consistent with the study of Pakasi et al (2009) in Indonesia reflecting that among 121 TB patients, 56.3% were males and 43.7% were females[10]. The finding probably reflects the 'male-dominance' character of our society and also that being the bread-earner, male is made to report the health facility earlier than female counterpart in the family.

Regarding socio-demographic profile of the cases, it was observed that majority of the cases were natives (93.3.%) and married (72.2%), whereas in the study conducted by Gupta S et al (2007)[11] 45.77% of patients were natives and 145 (72.14%) were married. The present study shows that more than three fourth of the cases (81.9%) belonged to lower caste. Similar findings were reported by Mohrana et al (2009) in their study at a tertiary level heath facility in Orissa that majority of cases belonged to backward caste/SC/ST[12] .May be due to living conditions, ignorance and lack of health advice seeking behaviour among this class made them more chance of aquring TB infection.

In this study, it was observed that more than half among the males i.e. 43.3 % were labourers .A study on risk factors of TB by Hill et al (2006) in Gambia reported that the risk of TB decreases in those in a professional occupation[13].It was observed that 94.7% of study popuation belonged to nuclear families, 70% had small sized families and 87.2% of cases resided in pucca houses.

Education is an important factor in the prevention of TB as it can create awareness among people regarding its transmission and importance of treatment continuation. The majority of cases, ie, 58.3% have a primary level of education and only 1.9% (7 cases) are illiterate. In a study conducted by pandit and choudhary[14] where 50% of patients were educated up to primary school and 23% were illiterate. When comparing with other studies, the illiteracy rate is low in the current study, which is helpful for creating awareness and educating the people.

According to modified udai parikh classification on SES, more than half of the sputum positive cases were belonging to lower class (43.3%) and lower middle class (34.2%). The review of studies at the Tuberculosis Research Centre, Chennai showed that 64% of TB patients registered under RNTCP were poor and had low Standard of Living Index,reflecting low SES remains as a major risk factor for development of TB [15]. Reflecting low SES is still remaining as a risk factor in development of TB.

A review of studies by WHO, Stop TB Department, Geneva, Switzerland showed a log-linear inverse relationship between TB incidence and BMI. In other words, across all these studies TB incidence increased exponentially as BMI decreased[16]. In this study also it was observed that 58% cases were under weight(BMI<18.5 Kg /m^2) .

A successful TB treatment should result in weight gain among underweight individuals through restoring muscle and fat mass, depending on the nutritional intake[17]. In the present study also, it was observed that there was a significant drop of under nourished patients from 58% to 35% (p-value <0.001). In an another study conducted by N.C kajal et al there was a significant change in mean BMI in cured cases from 18.48±2.87 in the beginning to 18.99±2.91 at the end of treatment (p = <0.000) showing significant weight gain in cured cases[18]. Also in a study conducted by Vasantha et al (2009) in Tiruvallur district, Tamil Nadu, India, it was observed that the average gain in weight was 3.22kg among smear positive cases registered under DOTS. It was concluded that there is an association between gain in weight with DOT and cure of the patients[19].

Improving patient knowledge of TB is an important component of enhancing patient-centric care and is a major goal of the End TB strategy. In current study, regarding knowledge about the disease, 96.9% had heard about tuberculosis infection. 83.9% know that TB is a highly contagious disease. 68.9 % know that TB is preventable and curable disease .45.8% and 39.4% knows that drugs for TB are free of cost and had awareness about the duration of treatment, respectively. 47.8% know that incomplete and irregular treatment is harmful . A study done by Fatiregun et al (2009) in Nigeria showed that patients with a poor knowledge of tuberculosis had a higher risk of having a poor treatment outcome compared to those with a good knowledge[20]. Here in this study patients was having good knowledge about TB but the awareness need to be strengthened.

Smoking and DM increases the risk of contracting tuberculosis (TB), increases the risk of recurrent TB and impairs the response to treatment of the disease . In our study, 58.6% were current smokers and 62.5% cases were having DM. A systematic review of 13 observational studies found that DM increases the risk of TB by three-fold (relative risk 3.11; 95% CI 2.27-4.26)[21].

Chest xray is the most common modality for diagnosis of Pulmonary TB. Patchy, poorly defined areas of heterogeneous consolidation involving primarily in the apical and posterior segments of the upper lobes[22]. The majority of cases were having CXR shadows predominantly right upper zone (27.8 %) . After treatment, there was statistically significant CXR clearance (p value<0.001) in the right upper zone shadow . In a study conducted by balakrishnan et al there was 40.36% of residual x-ray lesions in tuberculosis and Complete radiological resolution of 59.64% [23].

Sputum smear conversion is a key indicator of treatment response and reduced infectivity among bacteriologically confirmed pulmonary tuberculosis (PTB) patients. Lifestyle and clinical characteristics associated with delayed sputum–smear conversion were smoking, diabetes mellitus.

Cigarette smoking is associated with delayed sputum conversion suggesting that smoking is an important factor in TB elimination[24]. It our study , 74.1% of current smokers showed a statistically significant reduction in sputum smear-conversion when compared with non smokers (P value -0.006).In an another study there was a significant delay in sputum smear conversion time, when smokers and non-smokers were compared at the end of the 2nd (53% vs. 10%, p<0.001)[24].

In the study sputum-smear conversion among patients with DM and non-DM were 79.0% and 91.1% respectively (OR=0.367, 95% CI of OR is 0.181 – 0.742 and p-value 0.004)and it was statistically significant. In a similar study done by Noorzusana muhd sheriff et al on sputum smear positivity after 2 months of intensive treatment: diabetes mellitus (**p** = .013, odds ratio [OR] = 2.59, 95% confidence interval [CI] 1.27–5.33)[25].

Sputum smear conversion in patients with CXR shadow was only 77.6% when compared with those without shadow [94.%] (OR=0.190, 95% CI of OR is 0.079– 0.460 and p-value <0.001) . It showed a statistical significant association.In a study by singla et al from New Delhi in (2003) concluded that patients with multiple cavitary disease was having persistent sputum positivity at the end of 2 months of treatment (P< 0.0001)[26].

Among the total 360 cases under study, 84.2% were cured and 3.6% completed treatment. Failure rate was 3.6%, 2.8% cases lost to follow up, 2.2% transferred out and 3.6% died during the treatment. The findings are in accordance with the study conducted by Chennaveerappa et al (2011) at Hassan, Karnataka showing that among 58 NSP patients treatment 49 patients (84%) got cured, (6%) patients died, (5%) patients were defaulters and 2 patients were treatment failures[27]. The effect of BMI and SES on treatment outcome was studied, but the statistical significance count be proven

Limitation

An important limitation of the study is small sample size. Also, the result couldn't be generalised as it is a single centered study conducted in a tertiary care centre.

Conclusion:-

Study concluded that most of the patients were middle aged with male preponderace and came from low SES. Malnutrion were found in majority of cases and there was a significant improvement in BMI after treatment completion. Among co-morbidities and addiction, DM and smoking was found commonly. Majority of patient had

CXR shadows commonly right upper zone, and among patients with shadow there was significant reduction in CXR shadows after treatment completion.Sputum conversion,which is considered as the sign of reduced infectivity was compared in patients with DM, current smokers and those with CXR shadows.Delayed sputum–smear conversion was significantly associated with smoking, DM, and in patients with CXR shadow.

Majority of patient was having favourable treatment outcome. Effect of Malnutrition and SES on treatment outcome was assessed it was found that patients with under-nutrition and low SES showed relatively low cure percentage, but both were not statistically significant.Government of India is making lot of efforts to bring down the problems associated with TB through revised plans and their implementation across the country. In spite of this, there is a long way to go to achieve significant reduction in high incidence and prevalence of TB in India. Factors like lack of awareness and resources, poor infrastructure, increasing drug resistant cases (MDR TB and XDR TB), poor notification and overall negligence are the major challenges.

As corollary to the preposition, the corrective measures to be undertaken shall include imparting adequate nutrition, spread of education, awareness and information among the masses. Smokers with smear-positive pulmonary TB should be managed thoroughly, and stop-smoking clinic services should be made accessible. Also DM should be controlled as the concurrence of both diseases potentially carries a risk of global spreading, with serious implications for TB control.

The current National Strategic Plan for TB Elimination (NSP 2017–25) has been worked out to provide nutrition support and reduce out of pocket expenditure of the patients and is aimed at ending TB by 2025 should be strengthened.

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