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RESEARCH ARTICLE

A STUDY ON ASSESSMENT OF EFFECT OF SAMYOGA VIRUDDHA AHARA CONSUMPTION ON METABOLIC SYNDROME IN 35 - 50 YEAR OLD MEN AND WOMEN OF MUMBAI

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Abstract

Background: Metabolic Syndrome is now a growing epidemic spanning rapidly across the world. The increasing prevalence is observed in developing countries, developed countries as well as underdeveloped countries indicating, the weight of the current situation and the need for immediate worldwide action at governmental, public, community and clinical level. Ayurveda, one of the most ancient medical sciences emphasizes the importance of diet (Ahara), in determining an individual's health. It states that consumption of food in the wrong combination, dosage, sequence, quantity, method of cooking, processing results in disturbance at molecular level, which progresses into development of various diseases. In the present day scenario, due to modernisation we observe a change in the lifestyle of individuals and the prevalence of metabolic disorders like - diabetes and cardiovascular disorders has increased. The following study aimed at assessing the effect of Samyoga Viruddha Ahara Consumption on of Metabolic Syndrome in 35 – 50 year old men and women of Mumbai

Aim: To assess the effect of Samyoga Viruddha Ahara Consumption on Metabolic Syndrome in 35 – 50 year old men and women.

Materials and Methods: The study was a Cross sectional Observational Study carried out on 97 participants between age 35 -50 years, residing in Mumbai, selected with random sampling method. The participants were enrolled into health camps, where demographic, anthropometric, lifestyle, and dietary information was recorded using self-designed questionnaire. Biochemical analysis was carried out on venous blood sample drawn from each participant after a 12 Hour Fast and analysed for lipid profile (HDL-C and TG) and Fasting Plasma Glucose. After receiving blood reports indicating HDL-C and TG

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levels, participants were diagnosed for presence or absence of metabolic syndrome using the NCEP ATP III Criteria. All 97 participants were administered the Samyoga Viruddha Ahara Frequency Questionnaire and correlation between dietary patterns, Samyoga Viruddha Ahara Consumption Frequency and Prevalence of Metabolic Syndrome and its risk factors was established. Data was analysed using SPSS Version 25 for Windows. Statistical analysis was carried out using Mann Whitney U Test, Pearson's Correlation and Spearman's Correlation tests were carried out to analyse frequency and correlation between anthropometry, body composition, blood pressure, blood levels with nutrient intake. Rank Point Biserial Correlation was used to analyse correlation between prevalence of metabolic syndrome and Samyoga Viruddha Ahara Frequency.The p value of <0.05 was considered to be significant.

Results: Higher prevalence of MetS (52.6%) observed in participants compared to non-MetS (47.4%). Prevalence of Metabolic Syndrome was found to be higher in Males compared to females. ($p = 0.003$). Anthropometric parameters such as – Weight, BMI, Waist Circumference were observed higher in MetS compared to non-MetS ($p<0.05$). Average Systolic and Diastolic blood Pressure of participants with MetS was higher than non-MetS ($p<0.05$). Higher prevalence of Hypertensive and Prehypertensive individuals in MetS group compared to non-MetS. Higher levels of HDL-C found in non-MetS compared to MetS ($p<0.05$), whereas High TG observed in MetS compared to non-MetS ($p<0.05$). Significant positive correlation between caloric consumption with weight ($p = 0.031$), muscle mass ($p = 0.005$), systolic blood pressure ($p = 0.006$), diastolic Blood Pressure ($p = 0.015$). Significantly positive correlation between weight, BMI, Waist Circumference, Hip circumference, Waist to Hip Ratio, Body Fat Percentage, Muscle Mass, Blood Pressure (SBP and DBP), with Frequency of Consumption of Samyoga Viruddha Ahara found.

Conclusion: Prevalence of Metabolic Syndrome in study population was 52.6%, with higher prevalence observed in males than in females. Dietary patterns of participants as reflected by 24-Hour Dietary recall and Samyoga Viruddha Ahara Consumption Frequency Questionnaire showed higher consumption of Samyoga Viruddha Ahara in participants with Metabolic Syndrome and a positive correlation of higher consumption with increased Body weight, BMI, Waist Circumference, Waist Circumference, and Blood Pressure. Therefore reducing Consumption of Samyoga Viruddha Ahara (Incompatible Food Combinations), in diet may reduce prevalence of metabolic Syndrome and its Components like – obesity, dyslipidaemia, elevated Blood Pressure.

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Introduction:-

The term metabolic syndrome (MetS), first coined by Haller and Hanefeld in 1975 is a complex characterised by a combination of underlying risk factors that when occur together, result or culminate in adverse outcomes, which include development of Diabetes Mellitus (T2DM), cardiovascular Disease (CVD) and therefore resulting in an approximately 1.6 fold increase in all-cause mortality. (O'Neil S. et al 2014)Presence of metabolic syndrome increases chances of death from cardiovascular disease, type 2 diabetes, or stroke. Metabolic syndrome affects 20–25 percent of adults worldwide and 19.2 percent of children. (Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults, 2001) Several studies have shown the prevalence of metabolic syndrome to be higher in Urban South Asian/Asian Indian adults and children as well as economically disadvantaged individuals living in slum and rural areas. (Misra A., and Khurana L. 2009)

Obesity is one of the major risk factor and is defined as presence of excess fat and is measured through calculation of Body Mass Index (BMI) or by measurement of Waist Circumference (WC). The cut-off values for presence of obesity are set at a BMI of ≥25 Kg/sq.m and Waist Circumference of ≥102 in men and ≥88 cm in women (≥94 cm for men and ≥80 cm for women – considered overweight). The problem of obesity is reaching epidemic proportions across the world recently, with estimations of 1.4 billion obese individuals, with the number rising by the day.(O'Neil S. et al 2014) Other emerging risk factors that may contribute to progression of CVD after presence of metabolic syndrome in South Asians include – C-Reactive Protein – an inflammatory biomarker (CRP), Interleukin-6 (IL-6), adipokines, thrombotic factors such as fibrinogen and plasminogen activator inhibitor-1 (PAI-1). (Chambers J. C. et al. 1999)

Metabolic and lifestyle disorders such as hypertension, obesity, dyslipidaemia and diabetes mellitus are associated with important genetic components, however these are complex and identification of only a small fraction of genetic play is possible. (Firmann M., et all 2008) Genes identified to be involved in regulating lipolysis and thermogenesis are of prime importance in determining genetic predisposition. Although, epigenetics play a bigger role in promoting development of Metabolic Syndrome. Epidemiological studies have shown strong correlation between intrauterine nutrition and growth and development of metabolic syndrome in adults. (Saklayen M., 2018)

Ayurveda is one of the most ancient medical sciences which gives prime importance to Ahara (diet) and believe that food is responsible for the growth, development and enhancement of Ojas.(Raina T. 2018) Food, wholesome or unwholesome also plays a role in influencing state of mind and mood of an individual.(Raina T. 2018) Since, the well-being of an individual depends on the kind of food he consumes, consuming the right kind of diet which is balanced and nutritious is the most important factor supporting health, maintenance and growth.(Poya H. et al. 2017) Ayurveda offers a logical approach for determining an optimum diet based upon elements of an individual's constitution - vata, pitta and kapha.(Hajare P. 2020)

Food which is wrong in combination, has undergone wrong processing, consumed in incorrect dosage, and/or consumed at an incorrect time of the day or consumed in the wrong season can lead to incorrect metabolism.(Poya H. et al. 2017) This can inhibit the process of metabolism and exert an opposite property on dhatus.This effect of incorrect food combinations, incorrect time of consumption, incorrect processing, incorrect dosage, which interrupts the metabolism, which inhibits the process of formation of tissue and which have the opposite property to the tissue are called as Viruddha Ahara, or incompatible diet or unwholesome diet.(Poya H. et al 2017),(Sahu A. et al. 2020)

Samyoga Viruddha Ahara is incompatibility as a result of incorrect food combinations, which may lead to depletion of bodily tissues, improper metabolism and formation of toxins (Ama) in the body. The mode of action can be explained by the following proposed mechanism in Ayurvedic literature - frequent intake of combination of incompatible foods leading to toxin formation, which provokes all doshas and mixes with digestive juice and rasa dhatu is formed which then spreads from one dhatu to another. This Doshas spreads from Koshtha to Shakha, while travelling through the body, and gets lodged in places with presence of deformity (Sthaanavaigunya) and presents symptoms of disease. Recommended therapy for disease caused by consumption of incompatible diet is by ShodhanaChikitsa (Eliminative Therapy), ShamanaChikitsa (Palliative Therpay), and ApunarbhavaChikitsa (Avoidance Therapy). (Gorakhnath D., 2013)

The concept of incompatible foods is not given particular importance in modern dietetics, as is given in Ayurvedic principles. However, modern dietetics does pay importance to diet induced changes, drug nutrient interaction, drug activity, exacerbation of disease after consumption of certain foods. Certain arenas of modern dietetics tend to overlap with Ayurvedic principles. Some topics which may have similarities are –Agonist and antagonist, Free radicle formation, Food allergies, Food poisoning, Food additives (preservatives). Due to modernisation, urbanisation, and industrialisation, we observe a shift in the diet patterns in Indians toward high rate of Viruddha Ahara consumption. Such a diet imparts an untoward effect on the immune system, cellular metabolism, growth hormone and Dehydroepiandrosterone Sulphate (DHEAS). As defined in Ayurveda prolonged consumption of such a diet acts as poison which leads to aggravation of all doshas, the root cause for most diseases.(Zambare S. V., 2017)

Methodology:-

Study Design and Participants

The study was a cross-sectional Observational study was conducted on 160 participants aged 34 – 50 years and residing in Mumbai. Exclusion criteria was – pregnant women, lactating mothers, individuals who had undergone surgery in past 3 months, individuals with psychological disorders and critically ill or bed-ridden individuals. After screening for eligibility criteria and exclusion criteria97 participants were a part of the study (21 did not meet eligibility criteria, missing information for 3 participants, and 39 lost to follow-up).

Data Collection

Data collection took place through health camps conducted across the city of Mumbai at different locations including – Jogeshawari, Borivali, Colaba, and SVT College Campus in Juhu. Participant information was recorded through a self-designed questionnaire which included details of – Demography, anthropometry, medical and dietary history. Biochemical analysis was carried out on venous blood sample drawn from each participant after a 12 Hour Fast and analysed for lipid profile (HDL-C and TG) and Fasting Plasma Glucose. Anthropometric data included height (in cms), weight (in Kgs), BMI, Waist and Hip Circumference (in cms), Waist to Hip Ratio, Blood Pressure. Body Composition analysis was carried out using a portable bioelectrical impedance machine and recorded – Body Fat Percentage, Total Body Water, Muscle Mass Percentage, Basal Metabolic Rate and Bone Mass. Medical history of participants recorded presence of chronic diseases, and medication for same. Lifestyle history included – consumption of alcohol, tobacco and smoking. Dietary information was recorded through a 24-Hour Diet recall, and frequency of consumption of Samyoga Viruddha Ahara was recorded through an self-designed FFQ. After obtaining complete information, presence of Metabolic syndrome was defined using NCEP ATP III Criteria.

Statistical Analysis

Data was analysed using SPSS version 25 for Windows (version 25, 2017, IBM Corporation, Armonk, New York, United States). Data presented as Mean±SD, Median (minimum-maximum) or frequency (%). Normality of continuous data was assessed with Shapiro Wilk test. Anthropometry, body composition, blood pressure, blood levels and nutrient intake was compared in metabolic syndrome vs non- metabolic syndrome group using Intendent Sample T test. Frequency of food intake was compared by prevalence of metabolic syndrome using Mann Whitney U test. Pearson's correlation was used to analyse correlation between anthropometry, body composition, blood pressure, blood levels and nutrient intake. Spearman's correlation was used to analyse correlation of Frequency of food intake with anthropometry, body composition, blood pressure, blood levels and nutrient intake. Correlation of prevalence of metabolic syndrome with food frequency intake was done using Rank Point Biserial correlation. Cross tabulations were computed for categorical data and compared using Fisher's exact test/ chi-square test. P value of <0.05 was considered to be statistically significant.

Results:-

Table 1:- Basic Characteristics of participants.

DEMOGRAPHIC PARAMETER	CATEGORIES	FREQUENCY (n=97)	PERCENTAGE
Gender	Males	63	64.9
	Females	34	35.1
Occupation	Self Employed	57	58.8
	Not Employed	1	1
	Retired	6	6.2
	Housewife	20	20.6
	Other	13	13.4
Income	<6174	6	6.2
	6174-18496	21	21.6
	18497-30830	29	29.9
	30831-46128	12	12.4
	46129-61662	7	7.2
	61,663-123,321	1	1
	61663-123321	11	11.3
	>123322	10	10.3
Prevalence of MetS	Present	51	52.6

	Absent	46	47.4
BMI	Underweight	1	1
	Normal	34	35.1
	Overweight	51	52.6
	Obese	11	11.3
Waist to Hip Ratio	Ideal	37	38.1
	At Risk	60	61.9
Blood Pressure	Normal	33	34
	Pre Hypertension	59	60.8
	Stage I Hypertension	5	5.2
HDL-C Levels	Normal	37	38.1
	Low	60	61.9
Triglyceride Levels	Normal	43	44.3
	Out of Range	54	55.7

Table 1 gives demographic,anthropometric, and biochemical information of study participants. Out 97 participants, 63 were males (64.9%) and 34 (35.1%) were females. In terms of profession it was found that 57 participants (58.8%) were self-employed, 1 participant was not employed, 6 participants (6.2%) were retired, 20 participants (20.6) were homemakers/housewives and 13 participants (13.4%) in the other category. In terms of family income, the range and categories were decided in accordance to the Kuppuswamy Scale.

It also shows the prevalence of Metabolic Syndrome that was – 52.6% (n = 51), had Metabolic Syndrome and 47.4% (n = 46), did not have Metabolic Syndrome.

It was observed that out of all the participants, 34 participants (35%) had normal BMI, 51 participants (52.6%) were overweight, 11 participants (11.3%) were obese. 38% of the population had an ideal waist to hip ratio, whereas 62% of the population had a waist to hip ratio at risk.Prevalence of prehypertension (60.8%) was observed to be highest in the participants, whereas only 5% of the participantshad higher blood pressure indicating presence of Stage I Hypertension. 34% of participants (n=33) had normal Blood Pressure.

The prevalence of individuals with low HDL-C levels(n=60) was found to be higher compared to individuals with HDL-C levels within desirable range(n=37) (>50 mg/dL in women and >40mg/dL in men). Similarly Individuals with High TG levels (55.7%) were more prevalent than individuals with normal TG levels

Table 2:- Prevalence of Metabolic Syndrome in Male and Female Participants.

GENDER	**Non Metabolic Syndrome (n=46)**		**Metabolic Syndrome (n=51)**		**Total (n=97)**		**P value**
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**	
Males (n=63)	23	50	40	78.4	63	64.9	**0.003**
Females (n=34)	23	50	11	24.6	34	35.1	-

From Table 2, it was observed that significantly higher percentage of males were in the Metabolic Syndrome group as compared to non-Metabolic Syndrome Group.($p<0.05$).

Table 3:- Correlation of Anthropometry with dietary intake of Calories, Carbohydrates, Protein and Fat.

Diet Component	**Weight**		**BMI**		**Waist to Hip Ratio**		**Muscle Mass Percentage**		**Systolic Blood Pressure**		**Diastolic Blood Pressure**	
	R Value	**P Value**	**R Value**	**P Value**	**R Value**	**P Value**	**R Value**	**P Value**	**R Value**	**P Value**	**R Value**	**P Value**
Energy Consumptio	0.219	**0.031**	0.057	0.579	0.05	0.629	0.281	**0.005**	0.275	**0.006**	0.247	**0.015**

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CHO	0.216	**0.033**	-0.005	0.958	0.169	0.099	0.285	**0.005**	0.164	0.109	0.175	0.087
CHO Percentage	0.035	0.734	-0.172	0.092	0.298	**0.003**	0.057	0.577	-0.128	0.212	-0.082	0.425
Protein	0.208	**0.041**	0.039	0.707	0.114	0.265	0.307	**0.002**	0.350	**0.001**	0.277	**0.006**
Protein Percentage	0.061	0.551	-0.015	0.881	0.14	0.172	0.193	0.059	0.225	**0.026**	0.138	0.177
Fat Amount	0.132	0.196	0.11	0.283	-0.148	0.149	0.155	0.13	0.291	**0.004**	0.236	**0.02**
Fat Percentage	-0.056	0.586	0.166	0.105	-0.335	**0.001**	-0.106	0.3	0.072	0.484	0.048	0.639

Table 3 shows that Weight and Energy consumption as reflected by 24Hour Dietary Recall were significantly positively correlated. ($p = 0.031$). Significant positive correlation observed between weight and Carbohydrate consumption ($p = 0.033$) and, Protein Consumption ($p = 0.041$). No significant correlation observed between weight and Carbohydrate percentage, protein percentage, fat consumption and fat percentage. ($p>0.05$)

No significant correlation observed between BMI with Energy consumption, carbohydrate consumption, protein consumption and fat consumption. ($p>0.05$)

Significant positive correlation found between Waist to Hip Ratio with CHO Percentage consumption ($p = 0.003$) and Fat Percentage consumption ($p = 0.001$). No significant correlation found between waist to hip ratio with calorie, carbohydrate and fat consumption.

Muscle mass is significantly positively correlated with calorie consumption ($p = 0.005$), carbohydrate consumption ($p = 0.005$), and protein consumption ($p = 0.002$). No significant correlation found between muscle mass with carbohydrate percentage consumption, protein percentage, fat amount and percentage. ($p>0.05$)

It can be observed that Systolic Blood Pressure is positively significantly correlated with energy consumption ($p = 0.006$), protein consumption ($p = 0.001$), protein percentage consumption ($p = 0.026$) and fat consumption ($p = 0.04$). No significant correlation found between systolic blood pressure with carbohydrate consumption, and fat percentage consumption. ($p>0.05$)

Diastolic Blood pressure is significantly positively correlated with energy consumption ($p = 0.015$), protein consumption ($p = 0.006$), and fat consumption ($p = 0.02$). No significant correlation found between diastolic blood pressure with carbohydrate consumption, and protein and fat percentage consumption. ($p>0.05$)

Table 4:- Frequency of Samyoga Viruddha Ahara consumption in Metabolic and Non-Metabolic Syndrome Participants.

FOOD COMBINATION	Metabolic Syndrome (n=51)	Non Metabolic Syndrome (n=46)	p value
Fish + Milk	0.33±0.653	0.02±0.147	**0.002**
Fruits + Milk	1.92±1.521	1.85±1.725	0.879
Milk + Salt	0.14±0.348	0.11±0.315	0.671
Fish + Jaggery	0.02±0.14	0±0	0.342
Fish + Honey	0.1±0.3	0.02±0.147	0.121
Fish + Sesame Seeds	0.78±1.189	0.3±0.628	**0.03**
Fish + Black Gram	0.14±0.348	0.02±0.147	**0.04**
Curd + Chicken	3±1.249	2.39±1.291	**0.011**
Honey + Hot Water	1.14±1.709	0.61±1.164	0.105
Honey + Ghee	2.49±1.433	2.17±1.45	0.201
Radish + Milk	0.08±0.272	0.04±0.206	0.478
Sour Fruits + Milk	1.59±1.062	1.37±0.903	0.237

Mushroom + Milk	0.16±0.367	0.02±0.147	**0.023**
Tea + Milk	5.02±2.679	2.91±2.858	**0.001**
Tea + Garlic	0.29±0.61	0.2±0.5	0.408
Meat + Grains	3.39±0.75	2.3±0.916	**0.001**

From table 4 it can be interpreted that mean consumption of milk with fish was observed higher in Metabolic Syndrome participants (0.33±SD 0.653), compared to non-metabolic participants (0.02±SD 0.147). This difference was statistically significant. (p = 0.002)

Mean consumption of combination of fish with sesame seeds was observed to be higher in participants with metabolic syndrome (0.78±SD 1.189), compared to participants without metabolic syndrome (0.3±SD 0.628). This difference was statistically significant. (p = 0.03)

Mean consumption of combination of fish with black gram was observed higher in participants with metabolic syndrome (0.14±SD 0.348), compared to participants without metabolic syndrome (0.02± SD0.147). This difference was statistically significantly different. (p = 0.04)

Mean consumption of curd along with chicken in participants was observed higher in the metabolic group (3±SD 1.249), whereas in non-metabolic group it was observed to be lower (2.39±SD 1.291). This difference was statistically significantly different (p = 0.011)

Mean consumption of combination of mushroom with milk was found to be higher in participants with metabolic Syndrome (0.16±SD 0.367), compared with participants without metabolic syndrome (0.02±SD 0.147). This difference was noted to be statistically significantly different. (p = 0.023)

The mean consumption of combination of tea with milk was found to be higher in participants with metabolic syndrome (5.02±SD 2.679), compared with non-metabolic participants (2.91±2.858). This difference was found to be statistically significant. (p = 0.001)

Mean consumption of combination of meat and meat products with grain was found to be higher in participants with metabolic syndrome (3.39±SD 0.75), compared to participants without metabolic syndrome (2.3±SD 0.916). This difference was statistically significant. (p = 0.001)

Statistically significant difference observed in the consumption of – fish and milk (p = 0.002), fish and sesame seeds (p = 0.03), fish and black gram (p = 0.04), curd and chicken (p = 0.011), mushroom and milk (p = 0.023), tea and milk (p = 0.001) and, meat and grains (p = 0.001) when compared between participants with and without metabolic syndrome, with consumption of Samyoga Viruddha Ahara higher in participants with metabolic syndrome.

Table 5:- Correlation of Anthropometry and Blood Pressure of Participants with Samyoga Viruddha Ahara Consumption.

SAMYOGA VIRUDDHA AHARA	**Weight**		**BMI**		**Waist Circumference**		**Hip Circumference**		**Waist to Hip Ratio**		**Systolic Blood Pressure**		**Diastolic Blood Pressure**	
	RHO Value	**P Value**	**RHO Value**	**P Value**	**RHO Value**	**P Value**	**RHO Value**	**P Value**	**RHO Value**	**P Value**	**RHO Value**	**P Value**	**RHO Value**	**P Value**
Fish + milk	0.111	0.281	0.102	0.322	0.142	0.165	0.161	0.114	0.074	0.473	0.334	**0.001**	0.237	**0.019**
Fruits + Milk	-0.12	0.242	-0.056	0.583	-0.084	0.413	0.106	0.301	-0.228	**0.025**	-0.016	0.875	-0.05	0.629
Milk + Salt	-0.003	0.974	0.025	0.807	-0.007	0.944	-0.004	0.965	-0.037	0.72	0.098	0.338	0.072	0.482
Fish + Jaggery	0.035	0.736	0.091	0.375	0.077	0.456	-0.007	0.943	0.128	0.213	0.146	0.152	0.124	0.225
Fish +	-	0.344	-	0.088	-0.04	0.699	-0.136	0.184	0.031	0.766	0.206	**0.043**	0.148	0.149

Honey	0.097		0.174											
Fish + Sesame Seeds	0.044	0.667	0.056	0.583	0.077	0.454	0.078	0.184	0.06	0.561	0.175	0.086	0.161	0.115
Fish + Black Gram	0.06	0.562	0.059	0.567	0.079	0.442	0.046	0.653	0.064	0.536	0.166	0.104	0.052	0.61
Curd + Chicken	0.008	0.939	0.148	0.147	0.014	0.894	0.241	**0.035**	-0.123	0.232	0.227	**0.025**	0.206	**0.043**
Honey + Hot Water	-0.061	0.554	0.027	0.792	0.01	0.922	0.056	0.586	-0.054	0.598	0.153	0.134	0.047	0.65
Honey + Ghee	-0.027	0.794	-0.013	0.903	0.044	0.665	0.11	0.285	-0.001	0.995	0.113	0.27	0.074	0.472
Radish + Milk	0.039	0.705	0.052	0.613	-0.019	0.853	0.064	0.532	-0.093	0.364	0.111	0.278	0.114	0.268
Sour Fruits + Milk	0.196	0.055	0.133	0.194	0.192	0.059	0.13	0.204	0.178	0.081	0.182	0.075	0.260	**0.01**
Mushroom + Milk	0.034	0.739	0.061	0.553	0.049	0.634	-0.044	0.67	0.1	0.332	0.253	**0.012**	0.216	**0.033**
Tea + Milk	0.258	**0.011**	0.138	0.179	0.184	0.071	0.162	0.113	0.08	0.436	0.334	**0.001**	0.284	**0.005**
Tea + Garlic	0.227	**0.025**	0.055	0.59	0.289	**0.004**	0.155	0.129	0.236	**0.02**	0.104	0.313	0.105	0.308
Meat + Grains	0.219	**0.031**	0.278	**0.006**	0.274	**0.007**	0.219	**0.031**	0.171	0.095	0.577	**0.001**	0.416	**0.001**

From Table 5, it can be observed that Weight was statistically significantly positively correlated with consumption of combination of tea with milk ($p = 0.011$), tea with garlic ($p = 0.025$) and meat with grains ($p = 0.031$).

BMI was significantly positively correlated with consumption of meat with grains ($p = 0.006$).

Waist Circumference was positively significantly correlated with the consumption of combination of tea with milk ($p = 0.004$), and meat with grains ($p = 0.007$). No significant correlation found between waist circumference and consumption of other combinations of Samyoga Viruddha Ahara. ($p>0.05$)

Hip Circumference was found to be positively correlated with consumption of combination of meat with grains ($p = 0.031$). No significant correlation found between Hip circumference and consumption of other combinations of Samyoga Viruddha Ahara. ($p>0.05$)

Waist to Hip Ratio was found to be significantly positively correlated with consumption of combination of tea with garlic ($p = 0.02$). No significant correlation found between Waist to Hip Ratio and consumption of other combinations of Samyoga Viruddha Ahara. ($p>0.05$)

Systolic Blood Pressure was found to be significantly positively correlated with consumption of combination of fish with milk ($p = 0.001$), fish with honey ($p = 0.043$), curd with chicken ($p = 0.025$), mushroom with milk ($p = 0.012$), tea with milk ($p = 0.001$), and meat with grains ($p = 0.001$). No significant correlation found between consumption of other food combinations producing Samyoga Viruddha Ahara with systolic Blood Pressure. ($p>0.05$)

Diastolic Blood pressure was significantly positively correlated with consumption of combination of fish with milk ($p = 0.019$), curd with chicken ($p = 0.043$), sour fruits with milk ($p = 0.01$), mushroom with milk ($p = 0.033$), tea with milk ($p = 0.005$), and meat with grains ($p = 0.001$). No significant correlation found between consumption of other food combinations producing Samyoga Viruddha Ahara with diastolic Blood Pressure. ($p>0.05$)

Table 6:- Correlation of Body Composition and Blood Composition with Samyoga Viruddha Ahara Consumption in Participants.

SAMYOGA VIRUDDHA AHARA	Body Fat Percentage		Muscle Mass		Basal Metabolic Rate		Triglyceride		HDL-C	
	RHO Value	P Value	RHO Value	P Value	RHO Value	P Value	RHO Value	P Value	RHO Value	P Value
Fish + milk	-0.066	0.521	0.235	**0.02**	0.122	0.233	0.348	**0.001**	-0.063	0.541
Fruits + Milk	0.226	**0.026**	-0.138	0.178	-0.019	0.853	0.069	0.504	0.022	0.829
Milk + Salt	-0.051	0.617	-0.046	0.652	-0.031	0.761	0.027	0.79	-0.038	0.715
Fish + Jaggery	-0.077	0.456	0.057	0.583	0.051	0.62	0.175	0.086	-0.155	0.129
Fish + Honey	-0.124	0.227	-0.017	0.87	-0.017	0.87	0.172	0.092	-0.101	0.325
Fish + Sesame Seeds	-0.092	0.372	0.058	0.574	0.058	0.574	0.118	0.249	-0.065	0.53
Fish + Black Gram	0.018	0.861	0.157	0.124	0.157	0.124	0.159	0.121	0.105	0.308
Curd + Chicken	-0.006	0.953	0.008	0.942	-0.018	0.864	0.277	**0.006**	-0.16	0.118
Honey + Hot Water	0.217	**0.033**	0.053	0.607	-0.056	0.589	0.186	0.068	0.133	0.194
Honey + Ghee	-0.044	0.669	0.07	0.497	-0.146	0.154	0.164	0.109	-0.148	0.147
Radish + Milk	-0.041	0.694	0.152	0.137	0.06	0.562	0.087	0.396	-0.089	0.387
Sour Fruits + Milk	-0.047	0.649	0.195	0.056	0.029	0.775	0.169	0.099	-0.006	0.956
Mushroom + Milk	-0.063	0.541	0.088	0.394	0.117	0.255	0.193	0.058	-0.088	0.393
Tea + Milk	-0.152	0.137	0.267	**0.008**	0.247	**0.015**	0.323	**0.001**	-0.156	0.126
Tea + Garlic	-0.121	0.238	0.149	0.144	0.202	**0.047**	-0.017	0.865	0.039	0.703
Meat + Grains	-0.142	0.165	0.291	**0.004**	0.291	**0.004**	0.535	**0.001**	-0.445	**0.001**

Table 6 shows that, Body Fat percentage was found to be significantly positively correlated with consumption of combination of honey with hot water (p = 0.033), and fruits with milk 8p = 0.026). No significant correlation found between consumption of other combinations producing Samyoga Viruddha Ahara with Body Fat Percentage. (p>0.05)

Muscle Mass was found to be significantly positively correlated with consumption of combination of fish with milk (p = 0.02), tea with milk (p = 0.008), and meat with grains (p = 0.004). No significant correlation found between consumption of other combinations producing Samyoga Viruddha Ahara with Muscle Mass. (p>0.05)

Basal Metabolic Rate was found to be significantly positively correlated with consumption of combination of tea with milk (p = 0.015), tea with garlic (p = 0.047), and meat with grains (p = 0.004). No significant correlation found between consumption of other combinations producing Samyoga Viruddha Ahara with Basal Metabolic Rate. (p>0.05)

Triglyceride levels were found to be significantly positively correlated with consumption of combination of fish with milk (p= 0.001), curd with chicken (p = 0.006), tea with milk (p = 0.001), and meat with grains (p = 0.001). No significant correlation found between triglyceride levels and consumption of other food combinations producing Samyoga Viruddha Ahara. (p>0.05)

HDL-C levels were found to be significantly negatively correlated with consumption of combination of meat with grains (p = 0.001), indicating increase in HDL-C levels with decrease in consumption of meat with grains. No significant correlation found between HDL-C levels and consumption of other food combinations producing Samyoga Viruddha Ahara. (p>0.05)

Discussion:-

52.6% of the participants had metabolic syndrome (n = 51)Prevalence of Metabolic Syndrome was found to be higher in Males compared to females. (p = 0.003). In a cross-sectional study by Gupta et al. on 2051 participants in 2009 found the prevalence of metabolic syndrome in Indian population to be 41% according to NCEP ATP Criteria. (Gupta et al. 2009) In a cross-sectional study by Azizi F. in 2003 aimed at assessing prevalence of metabolic syndrome in an Urban population found the prevalence to be 30.1%, and found higher prevalence in women than in men. (Azizi F. 2003)

The average weight, BMI, Waist circumference, Hip circumference was statistically significantly higher in the Metabolic Syndrome Group as compared to Non-Metabolic Syndrome group (p<0.05), whereas difference in waist to hip ratio between the 2 groups was not statistically significant (p>0.05).

In a cross-sectional study conducted by Gupta et al. on 2051 participants in 2009 found prevalence of components of Metabolic Syndrome to be higher in females than in men (Azizi F., 2003). In a cross-sectional study conducted by Firmann et al. 2008 on 6,188 participants foundthe prevalence of components of metabolic syndrome like - obesity, hypertension, dyslipidaemia (elevated TG, low HDL-C) and diabetes higher in men compared to women. (Firmann et al. 2008)

Systolic Blood Pressure of participants with Metabolic Syndrome (131.2 mmHg) was found to be statistically significantly higher as compared to participants without MetS (120 mmHg). Similarly Diastolic Blood Pressure of MetS group (83.9 mmHg) was found to be statistically significantly higher compared to non-MetS group (80.2 mmHg) (p<0.05). Prevalence of Hypertensive and Prehypertensive individuals was found to be higher in Metabolic Syndrome Group as compared to non-MetS. (p<0.05)

HDL-C levels were found to be statistically significantly higher in participants without metabolic Syndrome, whereas TG levels were found to statistically significantly higher in participants with Metabolic Syndrome. (p<0.05)

In a cross-sectional study conducted by Sekgala M., D., on 624 adults aimed to investigate association between metabolic syndrome and lifestyle risk factors found higher mean values for waist circumference (WC), higher fasting glucose levels, higher total cholesterol levels, and higher Low density cholesterol levels in females compared to males. (Sekgala M., D., 2018)

Highest prevalence of Cardiovascular Disease (26.8%) observed in the participants, followed by Diabetes Mellitus (22.7%), Digestive Disorders (14.4%), Thyroid Disorders (5.2%), anaemia (5.2%), Dyslipidaemia (4.1%) and PCOD/PCOS (2.1%).

24 hour diet recall reflected a statistically significantly higher consumption of calories, carbohydrate percentage, and protein in participants with metabolic syndrome compared to participants without metabolic syndrome. (p<0.05)

Conclusion:-

From the study, it was concluded that Prevalence of Metabolic Syndrome was observed to be 52.6% in 35 – 50 year old men and women of Mumbai, with higher prevalence observed in males than in females. The average weight, BMI, Waist circumference, Hip circumference, Blood Pressure, Body Fat Percentage, TG levels was statistically significantly higher in the Metabolic Syndrome Group as compared to Non-Metabolic Syndrome group. Dietary patterns of participants as reflected by 24-Hour Dietary recall and Samyoga Viruddha Ahara Consumption Frequency Questionnaire showed higher consumption rates of Samyoga Viruddha Ahara in participants with Metabolic Syndrome and a positive correlation of higher consumption rates with increased Body weight, BMI, Waist Circumference, Waist Circumference, and Blood Pressure. Therefore reducing Consumption of Samyoga Viruddha Ahara (Incompatible Food Combinations), in diet may reduce prevalence of metabolic Syndrome and its Components like – obesity, dyslipidaemia, elevated Blood Pressure.

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