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Journal of Advanced Scientific Research

Available online through http://www.sciensage.info/jasr

ISSN
0976-9595
Research Article

METABOLIC SYNDROME AMONG RURAL WOMEN POPULATION IN TIRUVALLUR, TAMILNADU: A CROSS-SECTIONAL STUDY

Priyadarshini S*, Sheila John

Department of Home Science, Women's Christian College, Affiliated to University of Madras, Chennai, India

**Corresponding author: priyadarshinis02@gmail.com*

ABSTRACT

Metabolic syndrome (MetS) is an aggregation of several risk factors such as abdominal obesity, hyperglycemia, atherogenic dyslipidemia and hypertension. Metabolic syndrome is a strong predictor of coronary vascular disorder (CVD) and diabetes mellitus. A cross-sectional study was conducted among women (20 -60 years) in two rural area ofTiruvallur. Interview schedule, physical and clinical examination; and biochemical measurements were completed for 154 women. Metabolic syndrome was defined using Joint Interim Statement (JIS). Chi-square test was applied to test the association between MetS and various risk factors. p value < 0.05 was considered statistically significant. Over 51.9% of the study participants were diagnosed with Metabolic syndrome. Abdominal obesity (82.5 %), low High density lipoprotein cholesterol (74 %) and hyperglycemia (47.4 %) were the most prevalent components. Advancing age, being overweight/obese, physical inactivity, habit of chewing betel nut, non-vegetarian diet and higher frequency of sea foods intake were significantly associated with risk of MetS. The study emphasizes the need for community awareness and intervention program for prevention and control of MetS.

Keywords: Metabolic Syndrome, Abdominal Obesity, Women, Betel Nut, Sea Foods

1. INTRODUCTION

Metabolic syndrome (MetS) as defined by the National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III) is an aggregation of several risk factors such as abdominal obesity, hyperglycemia, atherogenic dyslipidemia and hypertension [1, 2]. Metabolic syndrome as well as individual metabolic syndrome components is predictive of prevalence and incidence of coronary heart diseases, ischemic stroke, carotid artery disease and diabetes [3]. Metabolic Syndrome confers a 5-fold increase in the risk of type 2 diabetes mellitus (T2DM) and 2-fold the risk of developing cardiovascular disease (CVD) over the next 5 to 10 years. Metabolic Syndrome is diagnosed if the individual has at least three of the following components: large waist circumference, elevated triglycerides, low High density lipoprotein (HDL) cholesterol, raised blood pressure, and elevated fasting blood glucose [4].

The global prevalence of MetS ranges from <10% to 84%, depending upon the region and composition (sex, age, race, and ethnicity) of the population studied, and the definition of the syndrome used [5, 6]. The epidemiology of metabolic syndrome is rising. Nolan et al. reported a prevalence rate of 4.8-7% among young adults [7]. About $1/5^{th}$ of the adult population in Asian pacific region are affected by MetS [8]. In India the prevalence of MetS varies among urban and rural population. The prevalence of MetS among urban Indians ranges from 19 % to 45.3 % [9-12] while among rural Indians the prevalence rate was found to be between 9.2 % and 26.6 % [13-15].

In many of the studies worldwide and in India, women had a higher prevalence of metabolic syndrome. Different cut-off points for waist circumference and HDL cholesterol employed for identifying MetS in women partly explain this gender variation. Additionally a higher prevalence of sedentary lifestyle among women due to cultural influences and increased predisposition in women to gain weight at various physiological transitions such as puberty, pregnancy and menopause might explain the increased prevalence of metabolic syndrome in women [9, 16]. There are few studies reporting prevalence of metabolic syndrome in this region. The objective of the study was to determine the presence and risk factors of MetS among women residing in rural area of Tiruvallur district.

2. MATERIAL AND METHODS

2.1. Study setting and subjects

The design of the study was cross sectional survey conducted among women residents of two rural panchayats of Tiruvallur district from Dec 2017 to May 2018. 154 women in the age group 20-60 years were selected based on their willingness to participate. The study protocol was approved by the Independent Institutional Ethics Committee of Women's Christian College, Chennai, India. Pregnant and lactating women were excluded from the study.

2.2. Data Collection

Data pertaining to socio-demographic characteristics such as age, education and income; personal history of non-communicable diseases, physical activity, betel nut consumption and diet was obtained using standardized questionnaire during the interview schedule. Bodyweight was measured using a portable digital weighing machine (Omron HBF-375) and height was measured using a portable stadiometer (Prime Surgicals Height Measuring Scale Precision Model). BMI was calculated using the formula BMI =weight (kg)/height $(m)^2$. Asian population cut off for overweight and obesity was used to classify BMI [17].Waist circumference was obtained by measuring the distance around the waist half inch above the umbilicus (navel) using a non- stretchable plastic measuring tape and was recorded to the nearest 0.1 cm. Automatic electronic Blood pressure device (OMRON HEM-7261) was used for measuring blood pressure.Two consecutive measurements were obtained 5-minutes apart and the average of the two readings was recorded.

2.3. Biochemical analysis

Blood samples were collected by vein puncture after 10 to 12 hours of overnight fasting. Estimation of biochemical parameters was carried out in a standard laboratory (Lister Metropolis). Fasting blood glucose, triglycerides and HDL cholesterol were estimated by enzymatic method using clinical automated analyser (Cobas 6000, Roche) on the same day of sample collection.

2.4. Definition of Metabolic syndrome

The Joint Interim Statement (JIS) of multi-organisations in 2009 was used to diagnose MetS [4]. Participants were classified as having MetS, if they had at least 3 of the following metabolic risk factor:

1. Waist circumference (≥80 cm in women)
2. Systolic BP ≥130 mmHg and/or Diastolic BP ≥85 mmHg or on medical treatment of previously diagnosed hypertension
3. Triglycerides ≥150 mg/dL
4. HDL- Cholesterol <50 mg/dL in women
5. Fasting glucose ≥100 mg/dL or a known diabetic on treatment.

2.5. Statistical Analysis

The statistical analysis was performed using SPSS (Statistical Package for Social Sciences). Continuous variables are presented as mean±standard deviation (SD) and categorical variables are presented as frequencies and percentage. Student's t-test for continuous variables was used to determine the differences between study subjects with MetS and without MetS. Chi-square test was applied to test the association between MetS and various risk factors. Significance level $p < 0.05$ was used.

3. RESULTS

Data was collected from 154 women residing in two rural panchayats of Tiruvallur district, Tamil Nadu. Majority of the studied subjects (32.5%) were in the age group 36 to 45 years. The mean age of the study population was 43.95±9.88. Annual income of family was used for determining the socioeconomic status of the subjects. According to the classification given by National Council of Applied Economics and Research [18] majority of the women belonged to aspirers category (Rs.90,000-2,00,000 annual income). With regard to educational qualification, 16 (10.39 %) of the women were illiterate, 15 (9.74%) had completed primary education, 94 (61.04 %) were educated up to senior secondary level and 29 (18.83%) of the women were graduates or above.

Among the 154 women MetS was identified among 80 (51.9%). Table 1 shows the number and percentage of subjects who met 0-5 MetS criteria according to JIS. The most common component among the women was abdominal obesity followed by reduced HDL cholesterol, hyperglycemia, hypertriglyceridemia and elevated blood pressure. The prevalence of individual components of MetS is shown in fig.1.

The mean anthropometric, clinical and biochemical parameters of women with and without MetS is shown in table 2. Women with MetS had significantly higher waist circumference, fasting glucose, triglycerides, blood pressure and lower levels of HDL cholesterol than women without MetS.

Table 1: Number of subjects who met 0 -5 criteria of MetS according to JIS, 2009

Number of criteria met	Frequency	Percentage
Met 5 criteria	8	5.2
Met 4 criteria	30	19.5
Met 3 criteria	42	27.3
Met 2 criteria	45	29.2
Met 1 criteria	24	15.6
Met 0 criteria	5	3.2

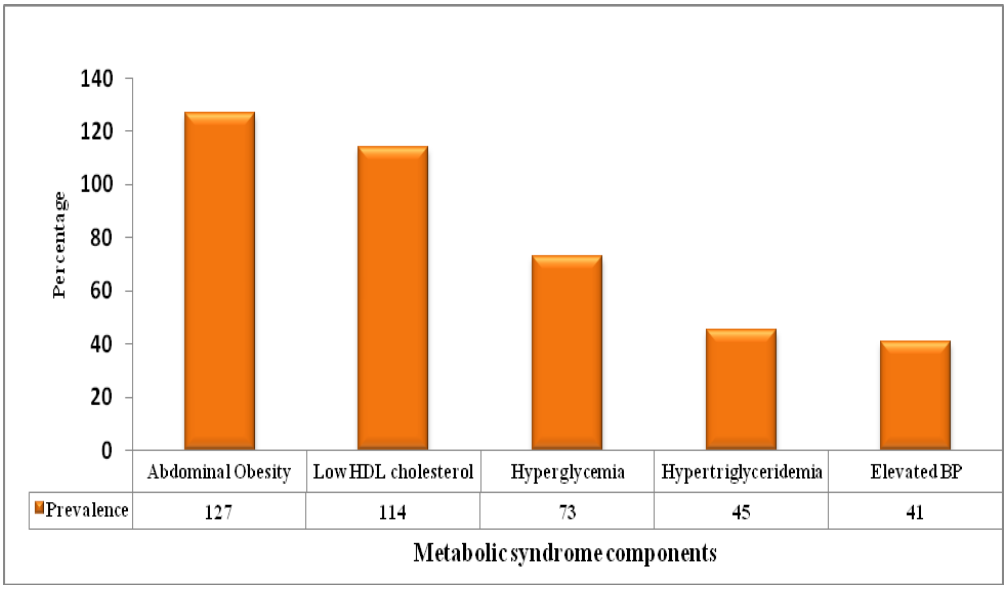

Fig. 1: Individual Components of Metabolic syndrome in studied population

Table 2: Anthropometric, blood pressure and biochemical parameters of women with and without metabolic syndrome

Variables	No MetS	MetS	Student's t test (p value)
Weight (Kg)	63.36±11.07	69.95±12.5	0.001*
BMI (Kg/m^2)	27.09±4.48	29.71±4.81	0.001*
Waist circumference (cm)	86.06±9.34	93.63±9.14	0.000*
Systolic Blood pressure (mmHg)	110.25±15.09	125.40±20.58	0.000*
Diastolic Blood pressure (mmHg)	71.36±9.47	79.98±11.72	0.000*
Fasting Blood Glucose (mg/dL)	96.58±32.46	140.86±65.87	0.000*
Total Cholesterol (mg/dL)	169.23±32.46	182.34±30.03	0.010*
Triglycerides (mg/dL)	91.82±35.75	148.28±57.18	0.000*
HDL Cholesterol (mg/dL)	49.36±10.79	40.03±7.01	0.000*

**Significant at p value <0.05*

Chi-square analysis was used to identify the sociodemographic and lifestyle factors associated with MetS. The result of Chi-square analysis is presented in table 3. Advancing age, being overweight/obese, physical inactivity, habit of chewing betel nut, non-vegetarian diet and higher frequency of sea foods intake were significantly associated with risk of MetS.

Table 3: Risk factors associated with Metabolic Syndrome

Risk factor	No MetS	MetS	Total	p value
Age (years)				
≤25	1	0	1	0.031*
26 – 35	21	14	35	
36 – 45	29	21	50	
46 – 55	16	30	46	
56 – 60	7	15	22	
Obesity				
Yes	58	73	131	0.025*
No	16	7	23	
Chewing betel nut				
Yes	1	8	9	0.022*
No	73	72	145	
Physical activity				
Yes	27	16	43	0.023*
No	47	64	111	
Type of diet				
Vegetarian	8	4	12	0.042*
Non vegetarian	60	75	135	
Ovo vegetarian	6	1	7	
Seafood Consumption				
Never	10	7	17	0.035*
Consumed rarely	5	3	8	
Once a month	10	4	14	
2-3 times a month	19	22	41	
Once a week	26	28	54	
2-3 times a week	3	16	19	
Once a day	1	0	1	

**Significant at p value <0.05*

4. DISCUSSION

The results of the study indicate alarmingly high rate of metabolic syndrome among rural women. MetS was identified in 51.9 % of women participants using the Harmonisation definition. Previous study on prevalence of metabolic syndrome among women conducted in the same region using Modified NCEP, ATP-III Criteria cited a prevalence rate of 36 % [19], which is a lesser prevalence percentage than the present study. While, in a comparative study among urban and rural women to assess metabolic syndrome risk using Modified NCEP, ATP-III Criteria a prevalence rate of 57.96% and 55.19% was reported respectively, which is similar to our finding [20].

The most common individual component of MetS among the studied women population was abdominal obesity (82.5 %), followed by low HDL cholesterol (74.5 %). Abdominal obesity, a surrogate marker for intra-abdominal adiposity is responsible for progression for multiple cardiometabolic risk factors independently of body mass index [21]. In a cross sectional study on middle aged women it was reported that central/abdominal obesity was positively related to the risk of hyperhomocysteinemia which has been identified as an independent risk factor for CVD [22]. The Framingham study identified that HDL cholesterol is a major risk factor for Coronary artery diseases (CAD) and that the association between the incidence of CAD and HDL cholesterol levels was stronger than for Low density lipoprotein (LDL) levels [23].

In our study the risk of metabolic syndrome was higher among older individuals and those with greater body mass index; similar finding has been reported by many studies [11, 12, 15]. Among the studied population, 85% women fell under overweight/obese category. According to recent systematic analysis 135 million Indians are affected by obesity [24]. A significant reduction in disease-free years was associated with mild and severely obese individuals in 40 to 75 years [25]. Findings of the study reveal that physical inactivity was associated with risk of metabolic syndrome. This finding is consistent with the results of previous studies [26, 27]. Salonen et al. in their study among Finnish young adults reported that longer time spent at the sedentary level of physical activity increased the risk of MetS [28]. Around 54.4 % Indians were found to be inactive according to ICMR-INDIAB study conducted in four regions of the country. The study also quoted that women were less physically active than men [29].

Results of the study showed that the habit of chewing betelnut was associated with increased risk of MetS. Betel nut, also known as areca nut and is often chewed wrapped inside betel leaves (paan) or with tobacco (betel quid), the composition of which varies in different populations and countries [30]. Areca nut is said to be the fourth most commonly used psychoactive substance in the world [31].Areca nut chewing was to be a significant risk factor for metabolic syndrome according to a systematic review. The risk of obstructive CAD (coronary heart disease) was 3.5 fold times higher in

those who chewed areca nut than those who did not have the habit of chewing areca nut [32].

The risk of MetS was higher among non-vegetarians than vegetarians and ovo-vegetarians in our study. The protective effect of vegetarian dietary pattern on the risk of NCD's is inconsistent. Vegetarian status was associated with lower risk for diabetes but it did not have a protective effect for metabolic syndrome and obesity among Asian Indians in US [33]. On the contrary Rizzo et al. reported that vegetarian dietary pattern was associated with significantly lower means for all Metabolic risk factors except HDL cholesterol (p for trend < 0.001 for those factors) and a lower risk of having MetS (OR 0.44, 95% CI 0.30–0.64, $p< 0.001$) when compared with a nonvegetarian dietary pattern [34]. Result of the Meta analysis of cross sectional studies to examine the effect of vegetarian diet on metabolic syndrome or its components demonstrated that vegetarian diet in comparison with omnivorous diet was not associated with a lower risk of MetS [35].

The present study showed an association between excess fish consumption and metabolic syndrome. Our finding has been supported by another study carried out by Cheng et al. which found that higher intake of fish/seafood correlated with increased numbers of altered MetS components in men [36]. Studies have been quoted that only lean fish not fatty fish consumption was associated with reduced risk of having MetS and consumption of fried fish was associated with a higher risk of Heart Failure [37, 38].

5. CONCLUSION

The study indicates the increasing burden of NCD's in rural area, as about half the female participants in the present study met the criteria for MetS. This is of concern as MetS is associated with 2-fold risk of CVD and 5-fold risk of Diabetes Mellitus. The study emphasizes the need for periodic screening to identify at risk individuals, community awareness and intervention program for prevention and control of MetS in rural area.

6. ACKNOWLEDGEMENT

The authors thank Dr. Niraimathi Anandan for her technical assistance in statistical analysis.

Conflict of Interest – NIL

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