

Research Article

Study of association of metabolic syndrome and its components in premenopausal and postmenopausal Indian females

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ABSTRACT

Background: The metabolic syndrome (MS) consists of constellation of metabolic abnormalities that increases the risk of cardiovascular diseases (CVD) and diabetes mellitus. Studies show that CVD is one of the major causes of death in postmenopausal women. Our aim was to study the association of Metabolic Syndrome and its components in premenopausal and postmenopausal Indian females.

Methods: It was an Observational study. We enrolled 100 females who came to medical OPD. Out of 100 females enrolled, 49 were in premenopausal stage (Group I) and remaining 51 had attained menopause (Group II).

Results: Age of a woman ranged from 22 to 72 years with a mean age of 41.94 ± 11.33 years. According to IDF criteria, 76.5% of postmenopausal women had MS compared to 51.0% of premenopausal women ($P = 0.008$). Waist circumference ($P = 0.027$) as well as WHR was significantly higher in Group II. Regular physical activity was higher in Group I (38.8%) as compared to Group II (27.5%) but the difference was not significant statistically. Majority of women in both the groups were vegetarians, statistically there was no significant difference between groups with respect to dietary preference ($P = 0.139$). Mean total cholesterol levels, VLDL, triglyceride, LDL, Fasting blood sugar levels were higher in Group II, however, the difference was significant statistically with respect to total cholesterol and LDL only.

Conclusions: In our study, menopause, diet and exercise were found to be significantly associated with MS. Diet and exercises are the modifiable risk factors that can be modified by restricting calories and increasing physical activity.

Keywords: Metabolic syndrome, Premenopausal, Postmenopausal, Females, Physical activity

INTRODUCTION

The metabolic syndrome (MS) consists of constellation of metabolic abnormalities that increases the risk of cardiovascular diseases (CVD) and diabetes mellitus.^{1,2} The major features of MS include central obesity, hypertriglyceridemia, low high density lipoprotein cholesterol (HDL-c), hyperglycemia and hypertension. Studies show that MS and CVD are more common in women above 55 years of age^{3,4} and CVD is one of the major cause of death in postmenopausal women.⁵

Prevalence of MS has varied greatly in different populations. In one of the study from India, prevalence of MS in the premenopausal was 22.2% and in the postmenopausal was 32.42%.⁶

The current study was carried out to determine the association of MS and its components in premenopausal and postmenopausal Indian females (using IDF criteria). If this study comes out to be effective then it will be very fruitful for individuals with MS by modifying the factors that are responsible for MS.

METHODS

The present study was conducted in the department of Medicine. It was an observational study. We enrolled 100 females who came to medical outpatient department of Medicine. Out of 100 females enrolled in the study, 49 were in premenopausal stage and remaining 51 had attained menopause. Women who were still menstruating were considered as premenopausal women while postmenopausal women were women in whom menstruation had ceased for at least one year. The participation of the women was voluntary. Informed consent was obtained from each of them. Ethical approval was taken from Institutional Ethical Committee, Reference code: 70th ECM II- B/P 20.

Inclusion criteria

The study included females attending the medical outpatient department of age more than 18 years.

Exclusion criteria

It includes females of age less than 18 years; females with clinically confirmed pregnancy; females suffering from hypothyroidism; females not giving consent; those who have undergone hysterectomy.

Information on age, gender, dietary habits and physical activity status were obtained through questionnaire. 24 hour dietary recall was obtained. Physically active females were those who performed physical activity daily for ≥ 30 minutes for five days in a week.

Body weight to the nearest of 0.1 kg was measured with minimal clothing and without shoes, using the manual scale and standing height to nearest 1 cm was measured with a stadiometer. BMI was calculated by dividing weight (kg) by height squared (m). The waist circumference to the nearest 0.1 cm was measured using standard measuring tape at the level of midline between inferior border of ribs and superior border of iliac crest with the subject standing erect and breathing normally. Blood pressure was measured by trained physician after five minutes rest in the right arm with minimal clothing in sitting position with mercury sphygmomanometer.

Venous blood samples were collected from each participant after overnight fasting for glucose and lipid profile. Glucose levels were measured by Glucose oxidase and per oxidase method (GOD-POD). Lipid levels were measured using enzymatic method.

Diagnosis of metabolic syndrome was based on the IDF criteria. According to IDF criteria,⁷ for a person to be defined as having the MS they must have:

- Central Obesity (defined as waist circumference with ethnicity specific values).

- Europids, sub Saharan Africans, Eastern Mediterranean & Middle East populations - Male ≥ 94 cm. Female ≥ 80 cm.
- South Asians, Chinese, Japanese & Ethnic South and Central Americans - Male ≥ 90 cm. Female ≥ 80 cm.

In our study waist circumferences of South Asian females (≥ 80 cm.) were taken.

Plus any two of the following factors:

- Raised triglycerides (TG) - ≥ 150 mg/dl or specific treatment for this lipid abnormality.
- Reduced HDL cholesterol - < 40 mg/dl in males and < 50 mg/dl in females or specific treatment for this lipid abnormality.
- Raised blood pressure - Systolic B.P. ≥ 130 mmHg or diastolic B.P. ≥ 85 mmHg or treatment of previously diagnosed hypertension.
- Raised fasting plasma glucose - ≥ 100 mg/dl or previously diagnosed type 2 diabetes.

Statistical analysis

The data was analyzed using Statistical Package for Social Sciences, version 15.0. Data has been represented as frequencies and proportions (No. and %) and mean and standard deviation. Categorical comparisons have been made using chi-square test. Parametric evaluations were done using Independent samples "t"-test. Multivariate analysis was done using a binary logistic regression approach. Confidence level of the study was 95%; hence a "P" value less than 0.05 indicated a statistically significant association.

RESULTS

The present study was undertaken in the department of Medicine, to look for metabolic syndrome in premenopausal and post-menopausal females. 100 female subjects attending the medical OPD were included in the study and then evaluated for metabolic syndrome using IDF criteria. Age of women ranged from 22 to 72 years with a mean age of 41.94 ± 11.33 years. Mean age of women in Group I (premenopausal) was 33.14 ± 7.06 years and mean age of women in Group II (postmenopausal) was 50.39 ± 7.60 years.

Metabolic syndrome was more prevalent among Group II (postmenopausal) than among Group I (premenopausal). According to IDF criteria 76.5% of postmenopausal women had metabolic syndrome compared to 51.0% of premenopausal women, as shown in Table 1 ($X^2=7.025$; $df=1$; $P = 0.008$).

Table 1: Distribution of women in two groups with respect to metabolic syndrome (IDF criteria).

Metabolic syndrome	Group I ^a (n=49)		Group II ^b (n=51)	
	No.	%	No.	%
No	24	49.0	12	23.5
Yes	25	51.0	39	76.5

^aPremenopausal; ^bPostmenopausal

Mean Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) of Group II women were significantly

higher as compared to that of Group I. However, Waist Circumference (WC) as well as Waist Hip Ratio (WHR) was significantly higher in Group II as compared to Group I (Table 2).

Mean Total Cholesterol (TC) levels, VLDL-c, triglycerides, LDL-c, Fasting Blood Sugar (FBS) levels were higher in Group II as compared to Group I, however, the difference was significant statistically with respect to total cholesterol and LDL-c only. Mean HDL-c level was higher in Group II as compared to Group I which was not significant statistically (Table 2).

Table 2: Baseline characteristics of Group I and Group II women.

Variables	Group I (n=49)	Group II (n=51)	Significance of difference	
	Mean \pm SD	Mean \pm SD	"t"	P
Systolic B.P. (mmHg)	123.5 \pm 12.2	132.7 \pm 19.6	-2.801	0.006*
Diastolic B.P. (mmHg)	81.1 \pm 7.6	86.3 \pm 10.9	-2.742	0.007*
WC ^a (cm)	95.8 \pm 13.2	101.6 \pm 12.8	-2.239	0.027*
Waist hip ratio	0.9 \pm 0	1 \pm 0	-4.093	<0.001*
TC ^b (mg/dl)	176.1 \pm 29	191.5 \pm 39.3	-2.228	0.028*
VLDL ^c -c (mg/dl)	27.1 \pm 12.2	30.4 \pm 13.9	-1.237	0.219
Triglyceride (mg/dl)	137.8 \pm 59.5	163 \pm 73.2	-1.881	0.063
HDL ^d -c (mg/dl)	45.6 \pm 8.1	46.3 \pm 11.7	-0.362	0.718
LDL ^e -c (mg/dl)	102.2 \pm 31.5	117.8 \pm 37.9	-2.227	0.028*
FBS ^f (mg/dl)	93.8 \pm 23.5	104.3 \pm 31.2	-1.895	0.061

^aWaist circumference; ^bTotal cholesterol; ^cVery low density lipoprotein; ^dHigh density lipoprotein; ^eLow density lipoprotein; ^fFasting blood sugar; *Statistically significant

Regular physical activity was higher in Group I (38.8%) as compared to Group II (27.5%) but the difference was not significant statistically (P = 0.229). Majority of women in both the groups were vegetarians, statistically there was no significant difference between the groups with respect to dietary preference (P = 0.139) (Table 3).

Table 3: Distribution of women in two groups with respect to physical activity status and dietary preferences.

Variables	Group I (n=49)		Group II (n=51)		Significance of difference	
	No.	%	No.	%	χ^2	P
Physical exercise	19	38.8	14	27.5	1.449	0.229
Vegetarians	26	54.2	35	68.6	2.186	0.139

In the proposed model (Table 4), only three independent variables, menopause, vegetarian diet and lack of exercise were found to be significantly associated with outcome i.e. metabolic syndrome. It was found that among these three variables menopause and lack of exercise were positively associated with higher odds of metabolic

syndrome whereas vegetarian diet was associated with lower odds of metabolic syndrome.

Table 4: Multivariate logistic regression for metabolic syndrome.

Variables	B	S.E.	Wald	df ^a	Sig.	Exp (B)
Menopause	2.150	0.845	6.475	1	0.011	8.583
Vegetarian	-1.110	0.548	4.101	1	0.043	0.330
Exercise	1.627	0.618	6.944	1	0.008	5.091

^aDegrees of freedom

DISCUSSION

Asian Indians are high risk population with respect to diabetes and cardiovascular diseases and the numbers are consistently on the rise.^{8,9}

MS is a cluster of cardio metabolic risk factors like obesity, hyperglycaemia, hypertriglyceridemia, hypertension and low High Density Lipoprotein (HDL).¹⁰⁻¹² In one of the study from India, a prevalence of MS in the premenopausal was 22.2% and in the

postmenopausal group was 32.42%.⁶ In our study, the prevalence of MS in the postmenopausal group had increased significantly in comparison with the premenopausal group. 76.5% of postmenopausal women had metabolic syndrome compared to 51.0% of premenopausal women ($P = 0.008$).

The aetiology of the metabolic syndrome in postmenopausal females is not clearly known but may be because of increased abdominal obesity as a result of decrease in oestrogen production.¹³ During menopause, reduction in estrogen level causes decrease basal metabolism and this causes weight gain.^{14,15} Another factor responsible for the control of body weight are the estrogen receptors. These estrogen receptors, activated by estradiol, has inhibiting effect on the development of adipose tissue; therefore, there is an increase in adipose tissue during the menopause as a result of the deficiency of estrogen.¹⁶ Regular physical activity plays an important role in controlling obesity. Routine physical activity is thought to be of benefit for over several chronic conditions.¹⁷ Various chronic diseases have been associated with a physically inactive the lifestyle including coronary artery disease, stroke, hypertension, colon cancer, breast cancer, type 2 diabetes and osteoporosis.¹⁸⁻²⁰ In our study, regular physical activity status was higher in Group I (Premenopausal) as compared to Group II (Postmenopausal) but the difference was not significant statistically ($P = 0.229$). Lower activity status could be one of the factors responsible for metabolic syndrome in postmenopausal females.²¹

Diet also plays an important role in controlling obesity and MS. In our study, majority of women in both the groups were vegetarians. Number of studies has shown that most vegetarian diet, when compared with typical western diet, are not only nutritionally adequate but also prevent from various chronic diseases.²²

CONCLUSIONS

In our study the predominant components identified in postmenopausal females were central obesity, raised blood pressure, raised fasting blood glucose, raised triglycerides and LDL cholesterol.

The three independent variables menopause, diet and lack of exercise were found to be significantly associated with outcome i.e. metabolic syndrome. Among the three variables, diet and exercise were the modifiable risk factors that can be modified by caloric restriction and increased physical activity. Exercise and consumption of low caloric foods has shown the ability to reduce metabolic syndrome criteria.

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