Screening for Cardiometabolic Risk Profile in Middle Aged Premenopausal Indian women

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ABSTRACT

Background: Prevalence of several cardio metabolic risk factors, especially central obesity and dyslipidemia, places women in high risk group for development of insulin resistance and atherosclerosis. Physiological and hormonal factor in women acts as an additional risk factor for such disease. The burden of cardio metabolic risk in middle aged pre-menopausal women need to be evaluated thoroughly. **Objective:** The study was designed to assess cardio metabolic risk profile and to evaluate association of traditional risk factors of metabolic syndrome with obesity and atherogenic markers in middle aged pre-menopausal Indian women. **Materials and Methods:** One hundred and thirty seven randomly selected female subjects (age 25-45 years) were evaluated for prevalence of various cardio metabolic risk factors. The parameters studied included body mass index (BMI), waist circumference (WC), waist-hip ratio (WHR), blood pressure, ECG, fasting blood glucose level and lipid profile of the subject. The association between various traditional risk factors of metabolic syndrome and the obesity and atherogenic markers of the subject was evaluated. **Results:** The overall prevalence rate of metabolic syndrome in middle aged pre-menopausal women was found to be 28.99%. The rate of incidence of metabolic syndrome increases with advancement of age. The most common individual component of metabolic syndrome in subject was central obesity followed by altered lipid profile. All the traditional risk factors of metabolic syndrome were found to vary with WC, WHR and TG/HDL-C ratio of the subject. **Conclusion:** The result of the present study suggested that central obesity followed by altered lipid profile are the main causative factors for development of metabolic syndrome in pre-menopausal middle aged Indian women. Obesity markers like waist circumference and waist–hip ratio and TG/HDL-C ratio can be used to predict metabolic syndrome in this group of subjects.

Key words: Metabolic syndrome, Premenopausal women, TG/HDL-C, WC, WHR.

BACKGROUND

Cardio metabolic risk profile includes hypertension, dyslipidemia, glucose intolerance, proinflammatory and prothrombotic states in a subject leading to various cardiac and metabolic disorders.[1] Several recent studies revealed that metabolic syndrome that predicts future cardiovascular and metabolic disorders has emerged as a major public health problem in different groups of population worldwide.[2,3] The extent of the problem varies according to region, life style patter, ethnicity, socioeconomic and cultural factors.[4-6] Obesity is one of the major contributors for cardio metabolic risk in subjects irrespective of their age, sex and ethnicity.[7] Obesity often

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leads to increased blood sugar level, altered lipid profile and change in inflammatory markers.[8,9] Women are particularly prone to obesity and associated metabolic complication.[10] They belong to the high risk group due to prevalence of various cardio metabolic risk factors including obesity, central adiposity, hyperglycemia and dyslipidemia.[11,12] In addition, physiological and hormonal parameters act as an additional risk factor for such disorders in women.[13] Burden of cardio metabolic risk in women are assessed from different corners of the world.[14-20] Most of the studies revealed that menopausal transition in women act as a causal factor for increased cardio metabolic risk in women due to change in hormonal milieu with declining oestrogen and alteration of its ratio with testosterone. Limited information is available on cardio-metabolic status of middle aged premenopausal Indian women. Moreover, the association among various obesity and atherogenic markers and traditional risk factors of metabolic syndrome is not evaluated in this group of women. Hence, the current study is designed to assess cardio metabolic risk profile in middle aged premenopausal Indian women and to evaluate association of traditional risk factors of metabolic syndrome with obesity and atherogenic markers.

MATERIALS AND METHODS

The study was conducted on one hundred and thirty seven (137) randomly selected pre menopausal women (age 25-45 years) from Agartala city of Tripura, belonging to mixed Indian population. All subjects were healthy, non-alcoholic and non smokers and are not users of any hormonal contraceptive. The exclusion criteria included presence of clinically confirmed pregnancy, known diabetics, hypertension, other heart disease, history of polycystic ovary, cancer or any psychiatric disorder. Ethical clearance of the study was obtained from Institutional Human Ethical Committee. Informed consent to participate was obtained from each subject after explaining the study protocol to them in local language. All participants filled a predesigned personal information form that included age, marital status, personal and family history, smoking, alcoholism and current medicine intake.

The study protocol included measurements of weight and height in light clothing. Body mass index (BMI) was calculated by dividing weight in kg by height in m^2. Waist circumferences (WC) were measured at the midpoint between the last rib and the iliac crest. Hip circumferences were measured at the widest level over the greater trochanters to the nearest centimetre by using a measuring tape. Waist to hip ratio (WHR) was calculated. Blood pressure was recorded by using an aneroid manometer in sitting posture. A 12 lead electrocardiogram (Cardiart 9108, BPL, India) was recorded for the entire participating subject. Venous blood sample was drawn after an overnight fast for plasma glucose and lipid estimation. All plasma samples were analysed in a semi-automatic biochemical analyser (Cora Lab 3000) using commercial kits. Atherogenic index was calculated as TG/HDL-C ratio.[21]

Metabolic syndrome was defined according to National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria.[22] Women were considered to have metabolic syndrome if they had any three or more of the following conditions according to NCEP ATP II criteria (Table 1).

All data are analysed using statistical software SPSS 16.0. Parameters are expressed as Mean ± SEM and percentage. Difference between two groups are examined by unpaired t-test, $p < 0.05$ is considered as significant.

RESULTS

The baseline characteristics of the subject with or without metabolic syndrome are presented in Table 2. Out of 137 women studied 39 were found to have metabolic syndrome according to NECP ATP II criteria. All the characteristics, except BMI, TC and LDL-C, were found to be significantly high in women with metabolic syndrome. Electrocardiogram of the subjects from either group did not show any abnormality.

Table 3 and Figure 1 represented percentage of subjects with metabolic syndrome in different age groups. The rate of prevalence increased with increase in the age of the subject. Prevalence of single component of metabolic syndrome represented in Table 4 and Figure 2 showed that central obesity was the most prevalent component in subjects with metabolic syndrome, followed by elevated blood pressure, altered lipid profile and hyperglycemia.

Table 5 represented influence of various obesity and atherogenic markers on traditional risk factors of metabolic syndrome in women. WC, WHR and TG/HDL-C ratio were found to vary significantly with almost all the traditional cardio metabolic risk factors in our study subjects.

DISCUSSION

In our study, the prevalence of metabolic syndrome among premenopausal Indian women in the age group of 25-45 years was found to be 28.46%. The results

Table 1: NECP ATP III criteria for metabolic syndrome in women (any three of the following)

Parameters	Criteria
Central obesity : waist circumference	≥ 88 cm.
Hypertriglyceridemia : serum TG level	≥ 150 mg /dl (1.7 mmol/L).
Serum HDL-C	< 50 mg/dl (1.29 mmol/L).
Elevated Blood Pressure	SBP ≥ 130 mmHg and/or DBP ≥ 85 mmHg or on treatment for hypertension.
Hyperglycemia : fasting blood glucose level	≥ 110 mg/dl (6.1 mmol/L) or on treatment for diabetes.

Table 4: Prevalence of Single component of Metabolic Syndrome (MetS) among women, number in the bracket indicates number of subjects

Component	% Prevalence	
	Subject with MetS (39)	Subject without MetS (98)
Central obesity	79.48 (31)	38.77 (38)
Elevated Blood Pressure	30.76 (12)	25.51 (25)
Elevated TG	56.41 (22)	28.57 (28)
Reduced HDL	43.58 (17)	12.24 (12)
Elevated Fasting Glucose	28.20 (11)	8.16 (8)

(Number in the bracket indicates number of subject in particular category).

Table 2: Baseline characteristics of Women (24-45 yrs) with and without Metabolic Syndrome (MetS). (Values are in Mean ± SE; *p<0.05)

Parameters	Total No. of Subjects (137)	Subjects without MetS (98)	Subject with MetS (39)
Age(yrs)	37.23 ± 4.51	35.67 ± 5.43	39.36 ± 4.35*
BMI(kg/m²)	24.11 ± 2.33	23.53 ± 1.57	26.86 ± 1.46
WC(cm)	86.41 ± 8.95	84.93 ± 10.89	92.85 ± 7.62*
WHR	0.88 ± 0.03	0.87 ± 0.01	0.91 ± 0.01*
SBP(mmHg)	123.54 ± 14.45	121. 17 ± 18.73	125.91 ± 18.80*
DBP(mmHg)	79.23 ± 8.92	77.06 ± 10.54	86.81 ± 11.33*
PP(mmHg)	42.74 ± 1.93	42.23 ± 0.76	46.38 ± 1.56*
TC(mg/dl)	216.18 ± 32.16	213.24 ± 39.20	218.83 ± 37.91
TG(mg/dl)	139.73 ± 89.94	126.92 ± 53.70	187.64 ± 96.10*
HDL(mg/dl)	47.26 ± 11.30	47.89 ± 12.62	56.35 ± 8.21*
LDL(mg/dl)	121.63 ± 26.37	122.94 ± 31.16	127.90 ± 28.37

BMI – Body mass index; WC- Waist circumference; WHR- Waist-hip ratio; SBP- Systolic blood pressure; DBP- Diastolic blood pressure; PP- Pulse pressure; TC- Total cholesterol; TG- Triglyceride; HDL - High density lipoprotein; LDL- Low density lipoprotein.

Table 3: Prevalence of Metabolic syndrome (MetS) in women according to Age group

Age Group (yrs)	Total No. Subject	No. of Subjects with MetS	No. of Subjects without MetS	% of Subjects with MetS
25-30	32	03	29	9.37
31-35	41	08	33	19.51
36-40	33	11	22	33.33
41-45	31	17	14	54.83
TOTAL	137	39	98	28.46

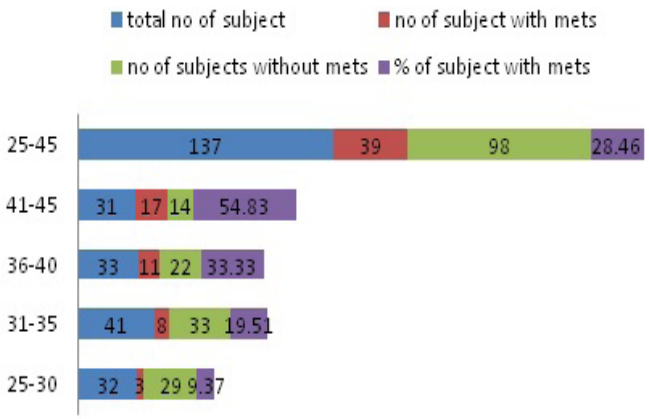

Figure 1: Prevelence of Metabolic syndrome in women according to age group

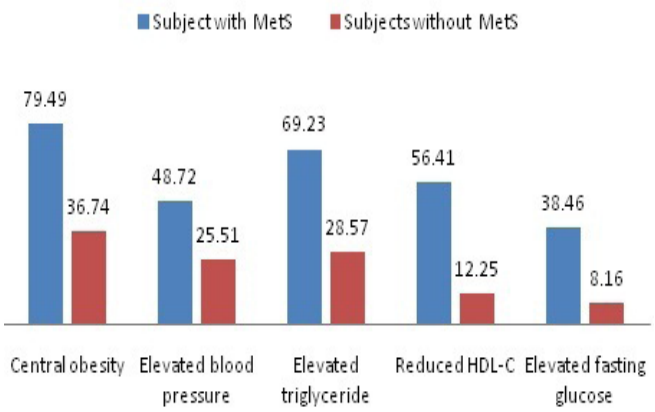

Figure 2: Prevelence of single component of metabolic syndrome (MetS) among women

Table 5: Correlation between Metabolic risk factors and Obesity/Atherogenic markers

Metabolic Risk Factor	Obesity / Atherogenic Markers							
	BMI		WC		WHR		TG/HDL-C	
	r	p	r	p	r	p	r	p
Systolic Blood Pressure (mmHg)	0.152	0.077	0.121	0.160	0.648**	0.000	-0.145	0.090
Diastolic Blood Pressure (mmHg)	0.173*	0.043	0.119	0.168	0.677**	0.000	-0.112	0.193
Triglyceride	0.352**	0.000	0.197*	0.021	-0.100	0.247	0.869**	0.000
High Density Lipoprotein	-0.204*	0.017	-0.198*	0.021	0.031	0.721	-0.574**	0.000
Fasting Blood Glucose	0.051	0.557	0.080	0.354	-0.233**	0.006	0.214*	0.012

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed). BMI – Body mass index; WC- Waist circumference; WHR- Waist-hip ratio; TG/HDL-C- triglyceride/high density lipoprotein- cholesterol.

are in agreement with different studies reported from different parts of world.[14-20,23] The overall prevalence of metabolic syndrome in women reported in these studies ranges from 13.8% in premenopausal to over 60% in post menopausal women. Saha in his study reported 19.2 % prevalence in premenopausal and 32.4% prevalence in post menopausal Indian women.[24] Selvaraj *et. al.* recently reported a prevalence of 30.7% among rural women from Tamilnadu, India, in the age group of 30-50 years using NCEP ATP III criteria.[25] Little less rate of prevalence found in our study may be due to difference in age range of the subjects included. Chaw *et. al.* reported overall 18.4% prevalence of metabolic syndrome among women from Andhra Pradesh, India.[26] Their study also included women less than 30 years of age.

The Asian Indians are reported to be prone to cardio metabolic risk at a younger age as compared to Western population.[27,28] In our study, we observed an increase in cardio metabolic risk in pre-menopausal women with advancement of age with 9.37% incidence among 25-30 years age range and 54.83% in 41-45 years age range. Similar observation on relationship between age and incidence of metabolic syndrome is reported by other workers.[20,21,23] The difference in prevalence of metabolic syndrome observed in different studies may be due to different criteria selected to identify the risk, socioeconomic and environmental differences, genetic factors and life style.[23]

Different obesity and atherogenic markers of metabolic syndrome were found to be significantly higher among premenopausal women with metabolic syndrome in comparison to those without syndrome. The most common individual component of metabolic syndrome, in our study, was found to be central obesity with a frequency of 79.48% in subject with metabolic syndrome as against 38.77% in subjects without metabolic syndrome. Several studies reported central obesity as the most important causative factor for development of metabolic syndrome in women.[29,30] Obesity increases cardio metabolic risk because it induces insulin resistance, increases blood pressure, triglyceride, low density lipoprotein cholesterol (LDL-C) and reduces high density lipoprotein cholesterol (HDL-C).[31] However, in our study, BMI did not vary significantly between subjects with and without metabolic syndrome. This might be due to the fact that normal weight persons might become metabolically obese due to abnormal distribution of body mass resulting into central obesity.[32] It is reported that substance released by intra-abdominal fat including inflammatory cytokines like tumour necrosis factor-alpha and interleukin-6, influences glucose metabolism as well as blood lipid profile producing insulin resistance.[33]

The second most prevalent cardio metabolic risk identified among premenopausal women, in our study, was altered lipid profile followed by elevated blood pressure and increased glucose level. Many studies from different parts of the world have reported altered lipid profile as the main risk factor for metabolic syndrome.[34-36] In our study, correlation between central obesity and altered lipid profile with prevalence of metabolic syndrome was observed in subjects from all age groups. The electrocardiographic record of all the subjects showed normal wave pattern in terms of voltage and duration with all the intervals and segments within the normal range.

Studies on association between obesity markers and traditional risk factors of metabolic syndrome revealed that both waist circumference and waist hip ratio varied with almost all the traditional risk factors of metabolic syndrome in premenopausal Indian women. From our study, it is observed that both central obesity and altered lipid profile can predict occurrence of metabolic syndrome in subjects. Jouyandech *et. al.* Also observed similar relationship between waist circumference and traditional metabolic syndrome components in women.[23] The traditional risk factor of metabolic syndrome is also found to very significantly with atherogenic marker TG/HDL-C ratio. Similar observation is reported by Aurther *et.al.* In their

study with Ghanaian women.[20]

CONCLUSION

In conclusion, the present study reveals that the overall prevalence of metabolic syndrome in premenopausal middle aged Indian women is 28.46%. And the rate of prevalence increases with advancement of age. The most important causative factor for metabolic syndrome is central obesity. All the traditional risk factors of metabolic syndrome are associated with WC, WHR and TG/HDL-C ratio of the subject. These factors might be utilized to predict metabolic syndrome in this group of women.

CONFLICT OF INTEREST

Authors declared there is no conflict of interest.

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