Original Research Article

Prevalence of metabolic syndrome in young adults: a study from North India

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ABSTRACT

Background: Metabolic syndrome is a cluster of risk factors for CVD and is on rise globally as well as in india.
Methods: This was a population based study conducted on 356 individuals of the age of 16-45 years, attending Medicine OPD for routine check-up at Sri guru ram das institute of medical sciences and research. Participants were subjected for anthropometric measurements, complete physical examination and evaluation of biochemical parameters in context of metabolic syndrome.
Results: On applying, NCEP-ATPIII criteria, the prevalence of MS was found to be 22.47%. The prevalence of MS was comparable in both genders, though MS was significantly higher in females of 36-45 years age group (25.64%). About 82% of the participants were either overweight or obese.
Conclusions: Since obesity was the most common entity prevalent and a major risk factor for MS and CVD, early detection and lifestyle modifications to prevent obesity and dyslipidemia should be promoted at all levels in community.

Keywords: Metabolic syndrome, North India

INTRODUCTION

Metabolic syndrome is being increasingly recognized as a worldwide epidemic and a major risk factor for CVD and other vascular events like stroke. Since last few decades, the global impact of infectious disease is decreasing while the global burden of chronic diseases (e.g. CVD and Diabetes) is on the rise.[1] The incidence and prevalence of cardiovascular diseases (CVD) is rapidly increasing in india and worldwide. By 2020, CVD will be the largest cause of disability and death in India.[2,3] The Metabolic syndrome is a constellation of risk factors for atherosclerotic cardiovascular disease (ASCVD). Insulin resistance has been postulated as the key factor along with adiposity for development of these major CVD.

Although different terms have been used for the insulin resistance syndrome or syndrome X, the term Metabolic syndrome was coined by Adult Treatment Panel III-National Cholesterol Education Program (ATP III-NCEP) to use a common definition in global context.[4]

NCEP: ATP III 2001 criteria for the metabolic syndrome

Three or more of the following

- *Central obesity:* waist circumference >102 cm (males), >88cm (females).
- *Hypertriglyceridemia:* triglyceride level ≥150mg/dl or specific medication.

- *Low HDL cholesterol:* <40mg/dl for men and <50 mg/dl for women or specific medication.
- *Hypertension:* blood pressure ≥130mmHg systolic or > 85mmHg diastolic or specific medication.
- *Fasting plasma glucose level*: ≥100 mg/dl or specific medication or previously diagnosed type 2 diabetes.

Metabolic syndrome increases the risk factor of developing diabetes and/or CVD by 30%-40% within 20 years, depending upon the number of risk factors present.[5] Various studies have shown high prevalence of Metabolic syndrome in South Asian children including India, probably due to high level of insulin resistance among them.[6] The aim of the present study was to determine the prevalence of metabolic syndrome in young adults in North India.

METHODS

This was a population based study. A total of 356 young adults of the age group of 16-45 years age group, who attended Medicine OPD at Sri Guru Ram Das Institute of Medical Sciences and research, Amritsar, India for routine check-up were randomly selected for the study. Among these 196 were males and 160 were females.

All participants were subjected to a detailed medical history and complete medical examination. A standard questionnaire containing information on demographic profile, past medical history and family history (associated with major risk factors of CVD), past treatment history was provided to all participants. A detailed history regarding previously diagnosed diabetes and hypertension or treatment for dyslipidemia was along with the medical record of the treatment was taken.

Thereafter, all participants were subjected for anthropometric examination and biochemical parameters analysis.

Anthropometric measurements

Body weight of all participants was measured on an electronic scale, with subjects wearing light clothes and no shoes or socks. Height was measured with non expandable measuring tape with the subject standing against the wall wearing no shoes or socks. Body mass index (BMI) was calculated using the formula.

$$BMI= \frac{Weight\ (kg)}{Height^2\ (m)}$$

Biochemical parameters

Fasting blood samples (after 12 hours overnight fasting) were collected from all participants.

Following biochemical parameters were measured after serum centrifugation

- Fasting blood glucose (FBS)
- Total cholesterol
- Serum triglycerides
- Serum HDL level

Prevalence of metabolic syndrome was assessed on the basis of NCEP: ATP III 2001 criteria, wherein the presence of any three of the following in the same individual would meet the defining criteria of metabolic syndrome

- *Central obesity:* waist circumference >102 cm (males), >88cm (females).
- *Hypertriglyceridemia:* triglyceride level ≥150mg/dl or specific medication.
- *Low HDL cholesterol:* <40mg/dl for men and <50 mg/dl for women or specific medication.
- *Hypertension:* blood pressure ≥130mmHg systolic or >85mmHg diastolic or specific medication.
- *Fasting plasma glucose level*: ≥100 mg/dl or specific medication or previously diagnosed type 2 diabetes

RESULTS

Demographic profile

Of the 356 participants, 196 were males (55%) and 160 females (45%). The age range of the subjects was from 16 to 45 years with mean age of 31.4 years in males and mean age of 32.27 in females. Among these 19.38% males and 16.25% females were in age group of 16-25 years, 48.98% males and 59.37% females in age group of 26-35 years while 31.63% males and 24.37% females were in the age group of 36-45 years (Table 1).

Table 1: Age and gender wise distribution of study group.

Age group (years)	Males (n=196)	Females (n=160)	Total (%)
16-25	38 (19.38%)	26 (16.25%)	64 (17.98%)
26-35	96 (48.98%)	95 (59.37%)	191 (53.65%)
36-45	62 (31.63%)	39 (24.37%)	101 (28.37%)

Our study showed that about 82.58% of the study population has been categorized as overweight or obese according to their BMI. The mean BMI of males has been found to be 26.73 and the mean BMI of females has been calculated to be 28.13.

The prevalence of overweight increased with increasing age. The prevalence of overweight in males and females is comparable (83.66% in male's vs 81.25% in females), while prevalence of obesity is higher in females than males (42.5% in females vs 35.20% in males (Table 2).

Table 2: Prevalence of obesity in study group.

BMI	Males n (%)	Females n (%)	Total n (%)
Normal (<24.9)	32 (16.32%)	30 (18.75%)	62 (17.41%)
Overweight (25-29.9)	95 (48.46%)	62 (38.75%)	15 (44.10%)
Obese (≥30)	69 (35.20%)	68 (42.5%)	137 (38.48%)

The prevalence of hypertension has been estimated to be 27.53% in our study group, prevalence being higher in males than females (30.1% in males versus 24.37% in females). The prevalence of hypertension was higher in 36-45 years age group in both gender groups (Table 3).

Table 3: Blood pressure profile of study group.

Blood pressure	Males n (%)	Females n (%)	Total n (%)
Normal	137 (69.89%)	121 (75.62%)	258 (72.47%)
Hypertension	59 (30.10%)	39 (24.37%)	98 (27.53%)

Biochemical analysis

Venous blood sample was collected from all the participants after overnight fasting for atleast 12 hours. The sample was subjected to centrifugation at 3000 rpm for 10 minutes to separate the serum. Serum glucose, total serum cholesterol, triglycerides and HDL cholesterol levels were measured from this sample. All tests were performed on automated clinical chemistry analyzer.

Fasting blood sugar was normal in 315 (88.48%) participants. 41 (11.52%) participants were detected to be having impaired glucose tolerance or diabetes. Prevalance of IGT/ Diabetes was almost similar in males and females (11.74% in males vs 11.25% in females). Prevalence was higher in 36-45 years age group in both males and females (Table 4). Hyertriglyceridemia was the most marked feature of the study group, being detected in

53.65% of the participants. Hyertriglyceridemia was more marked and more common in males than females (55.10% in male's vs 51.88% in females). The mean triglyceride level was 162.29 mg/dl in the study group. The mean triglyceride level was higher in males (169.57mg/dl) than females (153.38mg/dl). So, hyertriglyceridemia was more common and more marked in males than females (Table 5).

Table 4: Impaired glucose tolerance in study group.

Fasting blood sugar	Males n (%)	Females n (%)	Total
<100 mg/dl	173 (88.26%)	142 (88.75%)	315 (88.48%)
≥100 mg/dl	23 (11.74)	18 (11.25%)	41 (11.52%)

Table 5: Prevalence of hypertriglyceridemia in study group.

Serum triglyceride	Males n (%)	Females n (%)	Total
<150 mg/dl	88 (44.90%)	77 (48.12%)	165 (46.35%)
≥150 mg/dl	108 (55.10%)	83 (51.88%)	191 (53.65%)

50.56% of the study population has low serum HDL level (<40 mg/dl for men and <50 mg/dl or women). 47.45% of the males and 54.38% of the females in the study group has serum HDL lesser than normal standard value for their gender. The mean HDL level of males was 42.39 mg/dl while the mean HDL level of females was 46.59 mg/dl (Table 6).

Table 6: HDL profile of study group.

HDL cholesterol	Males n (%)	Females n (%)	Total
Normal	103 (52.55%)	73 (45.62%)	176 (49.44%)
Low	93 (47.45%)	87 (54.38%)	180 (50.56%)

Table 7: Age and gender wise prevalence of metabolic syndrome in study group.

Age group (in years)	Male		Female		Total	
	Total	MS	Total	MS	Total	MS
16-25	38	8 (21.05%)	26	5 (19.23%)	64	13 (20.13%)
26-35	96	21 (21.87%)	95	22 (23.15%)	191	43 (22.51%)
36-45	62	14 (22.58%)	39	10 (25.64%)	101	24 (23.76%)
Total	196	43 (21.93%)	160	37 (23.12%)	356	80 (22.47%)

Metabolic syndrome

The overall prevalence of metabolic syndrome according to NCE: ATP III CRITERIA was 22.47%. Out of the 196 males participating in the study, 43 males were detected to be suffering from Metabolic syndrome, while out of 160 female participants, Metabolic syndrome was diagnosed in 37 female participants. The prevalence of Metabolic syndrome in females was 23.12% while in males the prevalence of Metabolic syndrome was 21.93%. The prevalence of Metabolic syndrome was higher in 36-45 age group (23.76%), and more common in females than males (23.12% in females vs 21.93% in males). In males the pravalance of Metabolic syndrome shows linear increase with increase in age, though the increase is not highly significant. In females, the prevalence of Metabolic syndrome showed significant rise with age, prevalence being highest in females of 36-45 age group (25.64%) (Table 7).

DISCUSSION

Metabolic syndrome consists of cluster of risk factors for CVD. Higher the number of risk factors resent in an individual, higher is the risk of developing major CVD. Obesity and more importantly insulin resistance is the major etiological factor for development of diabetes, Metabolic syndrome and CVD. The prevalence of metabolic syndrome in Indians varies according to the region, gender and age group. About one third of the urban population in Indian major cities have MS.[7] Asian Indians are a high risk population for diabetes and CVD and the incidence and prevalence is on the rise.[8] The prevalence of MS in our study was slightly higher in females than males, while in other Indian studies, prevalence of MS was significantly higher in females than males.[9,10] In a study conducted by Chow et al, the prevalence of MS was found to be 26.9% in males and 18.4% in females in south india, which is disconcordant with the present study.[10] In the present study the prevalence of MS in males and females has been found to be 21.93% and 23.12% respectively. The prevalence of MS in females was 1.3 times higher in 36-45 years age group as compared to 16-25 years age group. Overweight and obesity remains the major factor in development of MS suggesting that early lifestyle modifications and dietary changes to prevent obesity can significantly reduce the prevalence of MS and eventually CVD.

CONCLUSION

Clinical diabetes and major CVD are preceded by a cluster of risk factors including obesity, insulin resistance and hypertension. Metabolic syndrome is becoming increasingly more prevalent globally and also in this part of the world. In the present study, the prevalance of MS has been found comparable in males and females but prevalence has been found to be increasing with age, suggesting that with age MS become more prevalent especially in females.

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