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Corresponding Author
Shirish Patil,
Department of Community Medicine, D Y Patil University School of Medicine, Navi Mumbai, 400706, Maharashtra, India
shirish.patil@dypatil.edu

Author Designation
[1,4]3rd Year PG Resident
[2]Professor
[3]Professor and Head

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A Cross Sectional Study to Determine the Prevalence of Metabolic Syndrome in Urban Population In Navi Mumbai

[1]Pratyush Jha, [2]Shirish Patil, [3]Sumedha Joshi and [4]Soham Khan

[1-4]Department of Community Medicine, D Y Patil University School of Medicine, Navi Mumbai, 400706, Maharashtra, India

ABSTRACT

Since metabolic syndrome is a lifestyle condition, understanding the causes behind the recent changing patterns in the prevalence of metabolic syndrome may be helpful in addressing the growing burden of Type 2 diabetes mellitus and cardiovascular disease. The NCEP ATP III is one of the most widely used criteria of metabolic syndrome. To assess, establish and compare the prevalence of metabolic syndrome in urban population in Navi Mumbai using modified NCEP ATP III criteria. A cross sectional study on 204 subjects of either sex between the age group of 20-85 years of urban area of Navi Mumbai was done at urban field practice area from August 2023 to Janauary 2024. The Modified NCEP ATP III criteria was used to calculate the prevalence of metabolic syndrome. The data were collected in structured Proforma and it was analyzed with relevant statistical methods. Maximum 91 (44.61%) were in the age group of 40-60 and only 1 (0.49%) female was above 80 years. Mean age of was 56+12.96 years. Sex distribution was male 73 (35.78%) and female 131 (64.22%). 110 (53.92%) subjects were from the income group of Rs. 10000-50000. 54 (26.47%) were graduates and only 19 (9.31%) were illiterate. As per BMI classification 83 (40.69%) were overweight i.e. in the range of 25-29.9 kg/m^2 and 16 (7.84%) were were obese i.e. above 30 BMI. Furthermore, each patient with metabolic syndrome who interacts with the clinical echelons must be identified and informed in order to lower their lifestyle risk factors and if necessary, receive targeted therapy.

INTRODUCTION

Since metabolic syndrome is a lifestyle condition, understanding the causes behind the recent changing patterns in the prevalence of metabolic syndrome may be helpful in addressing the growing burden of Type 2 diabetes mellitus and cardiovascular disease.

Metabolic syndrome is generally characterized as a clustering of the abnormal levels of blood lipids (low HDL and high triglycerides), impaired fasting glucose, elevated blood pressure and excess abdominal obesity[1]. Economic and nutritional transition has made a severe impact on human health by changing dietary habits and life style with decrease the physical activity, resulting in rising prevalence of overweight and obesity[2]. The upward trend of urbanization, high caloric dietuptake and central obesity compounded with a sedentary lifestyle are assigned as the influential underlying factors contributing to the epidemic upsurge of metabolic syndrome[3].

Obesity, insulin resistance, physical inactivity, advanced age and hormonal imbalance have been suggested as the underlying risk factors for the development of metabolic syndrome[4]. Visceral obesity and insulin resistance are recognized as the major intrinsic risk factors for metabolic syndrome[5]. Metabolic syndrome and cardiovascular risk in Asian Indians/South Asians are also heightened by their relative increase in body fat mass, truncal subcutaneous fatmass, intra-abdominal fat mass and also in ectopic fatdeposition. Cardiovascular risk cluster also manifests at a lower level of adiposity and abdominal obesity[6].

Metabolic syndrome is a complex web of metabolic factors that are associatedwith a 2-fold risk of cardiovascular disease and a 5-fold risk of diabetes. Individuals with metabolic syndrome have a 30-40% probability of developing diabetes and/or cardiovascular disease within 20 years, depending onthe number of components present[7] as well as a risk factor for all cause mortality[8]. Moreover, an individual with metabolic syndrome is two to four times more susceptible to developing stroke and at a three- tofour-fold risk of progressing myocardial infarction[9]. The redundant adipose tissue-induced low-grade persistent inflammatory condition was found to be involved in the progression of diseases related to metabolic syndrome such as atherosclerosis, atherogenic dyslipidemia, hypertension, pro-thrombotic status and impaired glucose tolerance[10].

Individuals with metabolic syndrome should be identified early so that their cardiovascular risk factors can be reduced[11].

Diagnostic Criteria: The National Cholesterol Education Program Adult Treatment Panel (NCEP: ATP III) released its new criteria for metabolic syndrome. According to the modified NCEP criteria[12], the presence of any three of the following five factors is required for a diagnosis of Metabolic Syndrome:

- Abdominal obesity :Waist circumference (> 80 cm)
- Hypertriglyceridaemia (triglycerides ≥ 1.7 mmol/L)
- Low HDL cholesterol (HDL cholesterol ≤ 1.03 mmol/L for men and ≤ 1.29 mmol/L for women)
- Elevated blood pressure (systolic blood pressure ≥ 130 mmHg and/or diastolic blood pressure ≥ 85 mmHg or current use of antihypertensive drugs)
- Impaired fasting glucose (fasting plasma glucose ≥ 5.6 mmol/L)

In addition, existing drug treatment for dyslipidemia / dysglycemia / raised blood pressure would also be qualifying criteria.

The NCEP ATP III definition is one of the most widely used criteria of metabolic syndrome. It incorporates the key features of hyperglycemia/insulin resistance, visceral obesity, atherogenic dyslipidemia and hypertension. It uses measurements and laboratory results that are readily available to physicians, facilitating its clinical and epidemiological application. It is also simple and easy to remember. Importantly, it does not require that any specific criterion be met; only that at least three of five criteria are met. Thus, the definition does not build in any preconceived notion of the underlying cause of metabolic syndrome, whether it is insulin resistance or obesity[13].

The recognition that patients with the metabolic syndrome should be provided intensified lipid modification therapy.

Objectives:

- To assessand establish the prevalence of metabolic syndrome in urban population in Navi Mumbai
- To compare the prevalence of metabolic syndrome using modified NCEP ATP III criteria.
- To compare the prevalence of metabolic syndrome in women and men.
- To look for age specific prevalence of metabolic syndrome

MATERIALS AND METHODS

A cross sectional study was done at urban field practice area from August 2023to January 2024.

The study population consisted of 204 subjects of either sex between the age group of 20-85 years of urban area of Navi Mumbai. The population below 20 years and of rural area were excluded. Each participant was interviewed and completed a standardized questionnaire containing information on demographics, anthropometric profile, past medical

history and biochemical parameters. All participants gave their written informed consent to participate in the study. After obtaining informed consent from the subjects, fasting blood sugar and fasting lipid profile were measured in all subjects. Waist circumference was measured as the smallest horizontal girth between the costal margins and iliac crests at minimal respiration. Blood pressure was recorded in sitting position, in the right arm, using the mercury sphygmomanometer. Prevalence of diabetes and hypertension was ascertained based on self-report of the physician's diagnosis and/or use of prescription medications along with medical records of therapeutics. Modified NCEP ATP III criteria was used to calculate the prevalence of metabolic syndrome.

Blood pressure was measured in each arm using standard adult arm cuff of a mercury sphygmomanometer with the subject's arm supported and at least 10 minutes after rest in sitting position. The average of three measurements of the systolic and diastolic blood pressure was considered. Measurement of height was done using a stadiometer and waist circumference (WC) was measured in a horizontal plane midway between the inferior margin of the ribs and the superior border of the iliac crest using a nonstretchable tape. The average of two measurements taken after inspiration and expiration at nearest half centimetre was calculated. Two-dimensional echocardiography and fundoscopy for each subjects was performed. Blood glucose was measured using GOD/POD method which is considered as gold standard for glucose estimation[14]. Lipid profile was measured using an auto analyzer and lipoprotein fractions were measured enzymatically[15].

The data were collected in structured Proforma and it was analyzed with relevant statistical methods. Results were expressed as Mean±SD. $p<0.05$ was considered significant.

RESULTS AND DISCUSSIONS

Table 1 shows the different variables in our study. Maximum 91 (44.61%)were in the age group of 40-60 and only 1 (0.49%) female was above 80 years. Mean age of was 56+12.96 years, Not significant ($p = 0.1559$) Sex distribution was male 73 (35.78%) and female 131 (64.22%), Highly significant $P<0.0001$. 110 (53.92%) subjects were from the income group of Rs. 10000-50000. 54 (26.47%) were graduates and only 19 (9.31%) were illiterate. As per BMI classification 83 (40.69%) were overweight i.e. in the range of 25-29.9 kg/m^2 and 16 (7.84%) were obese i.e. above 30 BMI. BMI was higher in females than in females, not significant ($p = 0.2229$).

Metabolic syndrome has been diagnosed using revised ATP-III criteria. Mean values of Waist circumference (>80 cm) in our study in male was 80.50+9.19 cm and in female was 83.97+10.97 cm. Mean values of triglycerides (>1.7 mmol/L) in our study in male was 1.46+1.13 mmol/L and in female was 1.63+1.24 mmol/L and mean values of fasting blood glucose (<5.6 mmol/L) in our study in male was 5.38+0.79 mmol/L and in female was 5.47+0.86 mmol/L (Table 2).

Table 1: Baseline characteristics of the study population

Baseline Characteristics	Male [73 (35.78%)] [n (%)]	Female [131 (64.22%)] [n (%)]	Total [204 (100%)] [n (%)]
Age Group (Years)			
20-40	5 (2.45%)	22 (10.78%)	27 (13.24%)
41-60	35 (17.16%)	56 (27.45%)	91 (44.61%)
61-80	33 (16.18%)	52 (25.49%)	85 (41.67%)
80 and Above	0	1 (0.49%)	1 (0.49%)
Income Distribution (Rs.)			
<10000	22 (10.78%)	35 (17.16%)	57 (27.94%)
>50000	14 (6.86%)	23 (11.27%)	37 (18.14%)
10000-50000	37 (18.14%)	73 (35.78%)	110 (53.92%)
Educational Status			
Illiterate	7 (3.43%)	12 (5.88%)	19 (9.31%)
Primary	23 (11.27%)	27 (13.24%)	50 (24.51%)
Secondary	13 (6.37%)	32 (15.69%)	45 (22.06%)
Higher Secondary	12 (5.88%)	24 (11.76%)	36 (17.65%)
Graduate	18 (8.82%)	36 (17.65%)	54 (26.47%)
BMI (kg/m^2)			
Below 18.5	1 (0.49%)	3 (1.47%)	4 (1.96%)
18.5-24.9	35 (17.16%)	66 (32.35%)	101 (49.51%)
25-29.9	32 (15.69%)	51 (25%)	83 (40.69%)
30.0 and above	5 (2.45%)	11 (5.39%)	16 (7.84%)

Table 2: Gender Wise Mean Values (modified ATP III criteria)

Parameters	Male	Female
Waist Circumference (> 80 cm)	80.50±9.19	83.97±10.79
Triglycerides (TG) (triglycerides ≥1.7 mmol/L)	1.46±1.13	1.63±1.24
High Density Lipoprotein C (HDL_C) (HDL cholesterol ≤1.03 mmol/L)	1.22±0.29	1.15±0.33
Systolic Blood Pressure (≥130 mmHg)	104.36±27.46	99.71±23.81
Diastolic Blood Pressure (≥85 mmHg)	63.44±15.19	63.89±14.69
Fasting Blood Glucose (≥5.6 mmol/L)	5.38±0.79	5.47±0.86

Table 3: Age and Gender Wise Specific Prevalence of Individual Components of Metabolic Syndrome

Age Group (Years)	Abdominal Obesity	Hypertension	Hyperglycemia	Triglyceride	HDL
Male (N = 71)					
20-40	0 (0%)	0 (0%)	1 (1.41%)	1 (1.41%)	4 (5.63%)
41-60	11 (15.49%)	10 (14.08%)	10 (14.08%)	12 (16.90%)	18 (25.35%)
61-80	12 (16.90%)	16 (22.54%)	13 (18.31%)	9 (12.68%)	13 (18.31%)
Total	23 (32.39%)	26 (36.62%)	24 (33.80%)	22 (30.99%)	35 (49.31%)
Female (n = 131)					
20-40	3 (2.29%)	0 (0%)	5 (3.82%)	5 (3.82%)	14 (10.69%)
41-60	24 (18.32%)	17 (12.98%)	21 (16.03%)	28 (21.37%)	33 (25.19%)
61-80	20 (15.27%)	24 (18.32%)	19 (14.50%)	20 (15.27%)	26 (19.85%)
80 and Above	1 (0.76%)	1 (0.76%)	0 (0%)	1 (0.76%)	1 (0.76%)
Total	48 (36.64%)	42 (32.06%)	45 (34.35%)	54 (41.22%)	74 (56.49%)

Table 4: Metabolic Syndrome (as per Modified ATP III Criteria)

ATP III Score	Sum of Total ATP (Male n=73) [n(%)]	Sum of Total ATP (Female n =131) [n(%)]	Sum of Total ATP [n(%)]
0-2	51 (25%)	82 (40.20%)	133 (65.20%)
3-5	22 (10.78%)	49 (24.02%)	71 (34.80%)
Total	73 (35.78%)	131 (64.22%)	204 (100%)

Comparing age wise, prevalence of male and female in our study, abdominal obesity in male was higher 12 (16.90%) cases in 61-80 age group cases, Hypertension was higher also higher 16 (22.54%) cases in the age group of 61-80 years and HDL in 18 (25.35%) cases of 41-60 age group. Abdominal obesity in female was higher 24 (18.32%) cases in 41-60 age group cases, Hypertension was higher also higher 24 (18.32%) cases in the age group of 61-80 years and HDL in 33 (25.19%) cases of 41-60 age group (Table 3).

Metabolic syndrome has been diagnosed using revised ATP-III criteria. Metabolic syndrome (ATP Score >3)was found in 71 (34.80%)cases out of which 22 (10.78%) were male and 49 (24.20%) were female (Table 4).

A growing proportion of the adolescent population with overweight and obesity sets the stage for a potential increase in metabolic syndrome as global research indicates a connection between the two[16]. Since metabolic syndrome and obesity track into adulthood, these clinical entities need to be recognized early in the life-course for effective prevention of type 2 diabetes mellitus and cardiovascular disease[17].

Maximum 91 (44.61%)were in the age group of 40-60 and only 1 (0.49%) female was above 80 years. Mean age of was 56+12.96 years [not significant (p = 0.1559)]. Sex distribution was male 73 (35.78%) and female 131 (64.22%) [highly significant (p<0.0001)]. 54 (26.47%) were graduates and only 19 (9.31%) were illiterate. Similarly in the study of Sawant *et al*.[18] maximum 149 (47.91%) were in age group of 40-60 years. In the study of Bashir et al.[19] sex distribution was male 82 (35.78%) and female 68 (64.22%). As per BMI classification 83 (40.69%) were overweight i.e. in the range of 25-29.9 kg/m^2 and 16 (7.84%) were obese i.e. above 30 kg/m^{2}BMI. In the study of Prasad *et al*.[20] 263 (39.3%) were graduates and only 73 (10.3%) were illiterateand BMI classification 248 (45.26%) were overweight i.e. in the range of 25-29.9 kg/m^2 and 185 (33.76%) were were obese i.e. above 30 BMI.

Metabolic syndrome has been diagnosed using revised ATP-III criteria. Mean values of Waist circumference (>80 cm) in our study in male was 80.50+9.19 cm and in female was 83.97+10.97 cm. Mean values of triglycerides (>1.7 mmol/L) in our study in male was 1.46+1.13 mmol/L and in female was 1.63+1.24 mmol/L and mean values of fasting blood glucose (<5.6 mmol/L) in our study in male was 5.38+0.79 mmol/L and in female was 5.47+0.86 mmol/L. While in the study of Deedwania *et al.*[21] greater prevalence in women vs. men was observed for high waist circumference and high triglycerides (31.5 vs. 41.2%) is greater in men.

Comparing age wise, prevalence of male and female in our study, abdominal obesity in male was higher 12 (16.90%) cases in 61-80 age group cases, Hypertension was higher also higher 16 (22.54%) cases in the age group of 61-80 years and HDL in 18 (25.35%) cases of 41-60 age group. Abdominal obesity in female was higher 24 (18.32%) cases in 41-60 age group cases, Hypertension was higher also higher 24 (18.32%) cases in the age group of 61-80 years and HDL in 33 (25.19%) cases of 41-60 age group. Similarly in the study of Sawant *et al*.[18] the prevalence in metabolic syndrome was 25.16% than females 12.6% (HS, p = 0.08). The age wise distribution was found to be 20.61% in 20-40 and 20.76% in 41-60 groups.

Metabolic syndrome (ATP Score >3)was found in 71 (34.80%) cases out of which 22 (10.78%) were male and 49 (24.20%) were female.Similarly in the study of Sawant[18] the overall prevalence of metabolic syndrome having >3 component was 19.52%.

This study shows a moderately high prevalence of metabolic syndrome in urban population. The prevalence is greater in women as compared to men. Men and women with better educational and earning

profile, greater fat intake, lower physical activity and higher body mass index have significantly greater prevalence of the metabolic syndrome.

CONCLUSION

The metabolic syndrome is characterized by hyperglycemia/insulin resistance, dyslipidemia and obesity. It's important for a number of reasons. The first step is determining who is most at risk for type 2 diabetes and atherosclerotic cardiovascular disease. Second, by studying the relationships between the components of metabolic syndrome, we may be able to better understand the pathophysiology linking them to one other and to the increased risk of cardiovascular disease. Thirdly, it facilitates clinical and epidemiological studies on lifestyle, preventative care and pharmaceutical products.

There is an urgent need to take serious action on this issue from the clinical and public health domains. From the perspective of public health, concentrated efforts must be made to encourage general population lifestyle changes that will lower obesity and enhance physical activity. Furthermore, each patient with metabolic syndrome who interacts with the clinical echelons must be identified and informed in order to lower their lifestyle risk factors and if necessary, receive targeted therapy.

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