ORIGINAL ARTICLE

High Prevalence of Metabolic Syndrome among Outpatients in a Tertiary Care Centre, Tamil Nadu, India

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Abstract:

Background: Metabolic Syndrome (MetS), a constellation of specific cardiometabolic risk factors increases the risk of diabetes and cardiovascular diseases. These risk factors can be largely reversed through lifestyle changes. To develop individualized lifestyle therapeutic interventions among patients attending non-communicable disease specialty departments, there is a need for identification of people with high risk of developing MetS. *Aim and Objectives:* To determine the prevalence of MetS, it's associated demographic and clinical characteristics among patients attending specialty Outpatient Department (OPD) in a tertiary care centre. *Material and Methods:* In this hospital-based cross-sectional study, randomly selected adults (aged 20 years or more) attending the diabetology or cardiology OPD were included. Using pretested interview tool, demographic details, height, weight and waist circumference were measured as per standard guidelines. Blood pressure, fasting blood sugar and fasting lipid profile were assessed. MetS was classified based on the modified Adult Treatment Panel (ATP-III) and International Diabetes Federation (IDF) criteria. *Results:* A total of 668 patients were included and the mean age was 50.1 ± 9.7 years. Of the total, 72.6% and 64.5% of patients had MetS. Patients aged 60 years or more had 1.8 times [Adjusted PR 95% CI: 1.05-3.16] higher prevalence of MetS compared to 20-30 years. Patients who were doing at least 30 minutes of regular moderate physical activity had 17% less occurrence of MetS [Adj PR: 0.71-0.96] compared to those who did less than 15 minutes of physical activity. Gender, literacy, type of diet and amount of visible fat intake were not significantly associated with MetS. *Conclusion:* MetS is highly prevalent among patients attending diabetology and cardiology OPD. Across several subgroups, around two-thirds had MetS and low high-density lipoprotein was the major contributing factor for MetS.

Keywords: Metabolic Syndrome, Cardiovascular Diseases, Epidemiology, Risk Assessment, Obesity

Introduction:

Metabolic Syndrome (MetS) is a cluster of medical conditions comprising of raised blood pressure, blood sugar, central obesity and abnormal lipid levels in the form of raised triglycerides and reduced high-density lipoprotein [1]. MetS independently increases the risk of cardiovascular diseases and stroke [2, 3]. It is well known that MetS is directly linked to insulin resistance [4]. As overall body fat among South Asians is more, they

are prone to cardiovascular diseases at lower BMI compared to others. Hence, the cut-offs to define waist circumference has been reduced for Asian Pacific adults. Based on consensus, waist circumference >80cm in women and >90 cm in men is considered as the cut-offs for Asia Pacific adults [5].

According to the recent report on causes of death released by the Sample Registration System, more than 50% of deaths occur due to cardiovascular diseases [6]. Also, MetS is found to be associated with poor quality of life [7]. In the last two decades, the prevalence of diabetes and hypertension has almost doubled [8]. Attributes of MetS not only predict the future occurrence of Cardiovascular Diseases (CVD); these attributes could be effectively prevented and reversed through lifestyle modifications. The major reduction in the progression of MetS through weight reduction and physical activity is extensively studied by The Coronary Artery Risk Development in Young Adults (CARDIA) study [9].

The widely used cardiovascular disease risk assessment is based on age-dependent Framingham risk score [10]. This age-dependent score completely ignores the increased risk of CVDs at the younger age of Asian Pacific adults compared to others. Identification of MetS in this population may fill this gap. A study conducted among patients diagnosed with recent coronary artery disease had explored the predictive value of MetS even among patients with a Framingham risk score <10% [10].

Previous studies have reported the varying prevalence of the MetS from 5-77% [11-16]. There is a significant difference in the prevalence of MetS in the community and hospital settings. Often, patients attending OPD of diabetology or cardiology would be more receptive for lifestyle modifications compared to others identified in the community settings. Identifying the people at higher risk for cardiovascular diseases through MetS can facilitate clinical decision making and emphasize the need for lifestyle modifications among these individuals. In this context, this study was planned to estimate the prevalence of MetS along with the sociodemographic and dietary factors associated with MetS among patients attending cardiology or diabetology OPD in tertiary care centre of Chennai city, South India.

Material and Methods:

Study design and population:

This is a cross-sectional analytical study conducted among patients seeking care from the outpatient department of cardiology or diabetology in tertiary care hospitals in the capital city of Tamil Nadu, India. Adults aged more than 20 years old attending to these hospitals from July to December 2015 were included in the study.

Study setting:

The study was conducted at the Outpatient Department (OPD) of The Tamil Nadu Government Multi Super Specialty Hospital (TNGMSSH), Chennai and OPD of the Institute of Diabetology functioning at Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai. TNGMSSH is a 400-bedded referral institute functioning with a multi-disciplinary team of specialists from cardiology, neurology, medical oncology, and nephrology along with five surgical departments, namely, cardiothoracic, neurosurgery, surgical oncology, vascular, hand and reconstructive microsurgery. Along with this, the following specialty departments are also functioning namely anaesthesiology, radiology, radiation oncology, pathology, biochemistry, microbiology, nuclear

medicine and customized dietary services. The Government General Hospital, one of the premier Government Institutions in the country has nine affiliated institutions with hospitals, each one of them recognized for excellence in Healthcare services. In 2009, the Diabetology Department of Madras Medical College was upgraded as Institute of Diabetology, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai.

OPD of cardiology and diabetology cater to an average attendance of more than 2000 OPD patients in a day. As part of routine care, patients attending this OPD were evaluated for diabetes, hypertension and dyslipidemia and other associated risk factors such as central obesity and raised Body Mass Index (BMI). To strengthen the health promotion behaviours among these high-risk individuals, a lifestyle clinic was established as a part of specialty departments. Services related to non-communicable diseases are provided through a multidisciplinary team of qualified healthcare professionals.

Sample size and sampling methods:

Sample size was estimated using the assumed prevalence and estimated error using Open Epi software. Assuming the prevalence of MetS as 77% among patient attending OPD of cardiology/ diabetology with 5% relative precision and 15% non-response rate, the estimated sample size was 640 [10,15]. On each out-patient service day, five patients were randomly selected for the study from the outpatient registers available from either diabetology or cardiology department.

Study variables and data collection tool:

Informed consent was obtained from eligible adults. Information on patient demographic characteristics such as age, gender, family type, family size, family income, education, type of diet consumed, and quantity and type of visible fat consumed by the family was collected using pre-tested structured interview schedule. Per capita, visible fat intake was calculated from total family oil consumption and a total number of family members. Clinical profile of the patients such as anthropometry, blood pressure, previous history of diabetes and hypertension was obtained from the patient or his clinical records. As a part of routine care under cardiovascular risk prediction, all patients were subjected to the following biochemical investigations: Fasting Blood Glucose (FBG) and lipid profile. These details were extracted from the individual case records if data available was more than a month old, the investigations of FBG; fasting serum Triglycerides (TG), High Density Lipoprotein-cholesterol (HDL-c) was repeated.

MetS was classified based on modified NCEP-ATP III as well as IDF 2005 [5]. In 2005, modified ATP III raised waist circumference was considered as optional criteria whereas under IDF 2005 criteria, raised waist circumference (region specific) was considered as mandatory one. Hence, as per ATP III guidelines, MetS was considered to be present if three or more of the following factors are present at the time of the study:

1. Raised waist circumference >80 cm among women and >90 cm among men or BMI >30 kg/m^2 irrespective of waist circumference
2. FBG >=100mg/dl or H/O diagnosed diabetes with or without treatment in the past
3. Systolic Blood Pressure (SBP) >=130 mmHg and/ diastolic blood pressure >=85mmHg or History (H/O) diagnosed hypertension with or without treatment in the past
4. Serum TG >=150mg/dl or H/o diagnosed dyslipidemia with or without treatment in the past

5. HDL-C <50 mg/dl in women or <40 mgs/dl in men or H/O diagnosed dyslipidemia with or without treatment in the past

Body weight and height were measured as per the standard guidelines with the least accuracy of 0.1kg, 1cm respectively. Waist circumference was measured using non-stretchable tape at the midway between the lowest rib and anterior superior iliac spine at the end of expiration. Blood pressure was measured twice over an interval of five minutes using an automated electronic device (OMRON) and the average was considered for analysis.

Blood samples were collected by vein puncture after an overnight fast for 12-14 h. Blood venous was collected in plain and fluoride bulbs for measurement of serum lipids, and glucose, respectively. The serum was separated after centrifugation at 3000 rpm for 5-10 min. The analysis was carried on an automated clinical chemistry analyzer, Beckman DXC 800. TG and HDL-C concentration were measured by International Federation of Clinical Chemistry (IFCC) approved enzymatic methods. Beckman reagents and calibrators were used for the analysis. Controls were included in each batch of samples analysed.

Statistical Analysis:

Data were entered in Microsoft Excel 2005 and analyzed using statistical software SPSS 17, USA. Patient demographic characteristics, the presence of various cardiometabolic risk factors are presented in the form of percentages.

Anthropometric characteristics and laboratory parameters were summarized in the form of Mean ± Standard Deviation (SD). MetS was classified based on the presence of three or more identified cardio-metabolic risk factors and summarized as percentages with 95% Confidence Intervals (CI). Factors associated with MetS were identified by performing chi-square test. Potential confounders were adjusted through multivariate regression techniques. Associations were presented in the form of adjusted Prevalence ratio with 95 % CI. Presence or absence of MetS was considered as the outcome variable and factors such as sex, literacy, family type, income categories, and visible fat intake were entered as an independent variable in the multivariable analysis. The p-value of less than 0.05 was considered for statistical significance.

Results:

A total of 668 patients were included in the study and 55% (366/668) were males. Around one fifth (19%) of the patients had a literacy level of less than primary education. Majority of the study participants were non-vegetarians (88%) and 87% belonged to nuclear families. About 65% of the patients had less than five family members and 62% had a monthly family income of fewer than 10000 rupees (INR). About one fourth (24.2%) of the patients reported that they performed a moderate physical activity for a minimum of 30 minutes on regular basis. Table 1 describes BMI, waist circumference, blood sugar, blood pressure and lipid profile in males and females. Prevalence of MetS as per modified NCEP-ATP III and IDF-2005 criteria was 72.6% (95% CI: 69.1-76) and 64.5% (95% CI: 60.8-68.1) respectively (Table 2). When MetS was classified based on IDF-2005 criteria, raised FBG and low level of HDL-c were common contributing factors for MetS followed by raised TG.

Table 1: Characteristics of Patients Attending Outpatient Specialty Department of Tertiary Care Centre Tamil Nadu, 2015

Parameter	Male (n=366) Mean ± SD	Female (n=302) Mean±SD
Age (years)	50.8 ± 9.2	49.3± 10.2
Weight (kg)	70.1 ± 13.2	67 ± 15.1
Height (cm)	163 ± 19.4	153 ± 7.8
Body Mass Index (BMI) (kg/m^2)	26.4 ± 5.1	28.4 ± 5.9
Waist circumference (cm)	93.6 ± 10.1	91.8 ± 11.5
Systolic blood pressure (mmHg)	126.8 ± 14.8	127.1 ± 14.8
Diastolic blood pressure (mmHg)	82.8 ± 9.6	83.4 ± 12
Fasting blood sugar (mg/dl)	124.9 ± 35.9	131.1 ± 52.2
Triglycerides (mg/dl)	168.3 ± 63.6	165.8 ± 70.6
High density lipoproteins (mg/dl)	39.2 ±7.7	42.8 ±10.1
Per capita visible fat intake/day (ml) [median(IQR)]	26 (16.6 – 33.3)	

SD-standard deviation, IQR-Interquartile range

Table 2: Components of MetS among Patients Attending the Outpatient Specialty Department of the Tertiary Care Centre, Tamil Nadu, 2015

Factor	Male (%) N=366	Female (%) N=302	Total (%) N=668
Raised waist circumference	256 (70)	262 (86.8)	518 (77.5)
BMI >30kg/m^2	59 (16.1)	94 (31.1)	153 (22.9)
Raised BP(mm Hg) (>130&/>85)	115 (31.4)	123 (40.7)	238 (35.6)
TG >150 mg/dl	229 (62.6)	162 (53.6)	391 (58.5)
HDL <40 mg/dl or <50 mg/dl	320 (87.4)	159 (52.7)	479 (71.7)
Fasting blood sugar>100mg/dl	275 (75.1)	227 (75.2)	502 (75.2)
MetS as per modified ATP III % (95% CI)	77.9 (73.3-82.0)	66.2 (60.6-71.5)	72.6 (69.1-76)
MetS as per IDF 2005	63.4 (58.2-68.3)	65.9 (60.2-71.2)	64.5 (60.8-68.1)

BMI-body mass index, TG-Triglycerides, HDL-high density lipoprotein, modified ATP-Adult treatment Panel, IDF-International diabetes federation, CI-confidence interval

Across several subgroups, around two-thirds of patients had MetS. However, patients more than 60 years had 1.8 times had a higher prevalence of MetS compared to less than 20 years of age (Table 3). Patients who followed regular physical activity for at least 30 minutes a day had 17% less occurrence of MetS compared to patients who did less than 15 minutes of physical activity in a day. Other socio-demographic factors and dietary-related factors were not found to be a statistically significant association with MetS. However, in the adjusted analysis, none of the factors were found to be significantly associated with MetS (Table 3).

Table 3: Factors Associated with MetS among Patients Attending the Outpatient Specialty Department of the Tertiary Care Centre, Tamil Nadu, 2015

Factor	Number	MetS %	Unadjusted PR	Adjusted PR
Sex				
Male	366	63.4	Ref	
Female	302	65.9	1.04 (0.93-1.16)	
Age groups (years)				
20-30	20	40	Ref	Ref
31-40	91	65.9	1.65 (0.94-2.88)	1.69 (0.96-3)
41-50	219	60.7	1.52 (0.88-2.62)	1.57 (0.90-2.75)
51-60	238	66	1.65 (0.96-2.84)	1.73 (0.99-3.01)
>60	100	73	1.8 (1.05-3.16)	1.86 (1.06-3.26)
Education				
Less than primary	128	61.7	Ref	
5-8th	219	66.2	1.07 (0.91-1.27)	
9-10th class	164	64.6	1.05 (0.88-1.25)	
More than 10th class	157	64.3	1.04 (0.87-1.25)	
Diet				
Vegetarian	78	65.4	Ref	
Non-Vegetarian	590	64.4	0.99 (0.83-1.17)	
Income (INR)				
<10,000	417	63.3	Ref	Ref
10,001-20000	154	63.6	1.01 (0.87-1.16)	0.99 (0.87-1.14)
>20,000	97	71.1	1.12 (0.97-1.30)	1.16 (0.99-1.34)

Type of Oil				
Palm oil	68	72.1	Ref	Ref
Refined oil	458	64.8	0.90 (0.76-1.06)	0.89 (0.76-1.04)
Both	142	60	0.83 (0.68-1.01)	0.85 (0.69-1.04)
Per capita oil consumption				
Q1	224	67.9	Ref	
Q2	227	60.8	0.90 (0.78-1.03)	-
Q3	118	61	0.90 (0.76-1.07)	
Q4	99	69.7	1.03 (0.88-1.20)	
Physical activity per day (mins)				
<15	397	68	Ref	Ref
15-30	109	64.2	0.94 (0.81-1.10)	0.95 (0.81-1.10)
>30	162	56.1	0.83 (0.71-0.96)	0.85 (0.73-0.99)

INR-Indian National Rupee, Q1-Q4-quartiles, PR-prevalence ratio

Discussion:

This study carried out among patients attending OPD of cardiology or diabetology in the tertiary care institutes had shown the prevalence of 72.6% as per modified NCEP-ATP III criteria. When the raised waist circumference was used as an essential criterion as per IDF criteria, the prevalence of MetS was found to be lower (64.5%). Previous studies where they had used both modified NCEP-ATP III and IDF criteria also reported this difference in prevalence estimates [2, 13, 17]. This explains the possible risk of missing MetS when essential criteria are being set compared to using the items as optional criteria.

The prevalence from the current study was about two times higher compared to other studies reported from India. Several community-based studies have reported the MetS prevalence in the range of 5-40% [7, 12, 17, 18]. The present study population age ranged (20-70) when compared to the previous studies with patients of younger age. Moreover, patients attending the cardiology or the diabetology specialty outpatient department of the tertiary care centres were attending the OPD for management of symptoms associated with obesity, dyslipidemia, poor glycemic control, or hypertension participated in the study, this may explain the higher prevalence of MetS in the present study.

Though the current study prevalence seems to be completely different from other studies, the burden of MetS is closely in line with studies where they assess the MetS among coronary artery disease [15, 16]. Apart from this, the different classification and different cut-offs to define the presence of various risk factors also could have contributed to the difference. Hence findings from facility-based studies and where MetS was defined based on modified NCEP-ATP III criteria

was considered for comparing the estimated prevalence. Studies from Uttar Pradesh and Chennai which estimated the MetS among CAD patients had shown the prevalence as 77% and 67.7% respectively [2, 10]. The study from Iranian adults who had undergone angiography also revealed the MetS prevalence to be 74.3% [16].

In the current study, a low level of high-density lipoprotein was identified to be the major contributing factor for MetS. A similar pattern was also observed in other studies [13, 16, 19]. However, in contrary to other studies, males had profound low high-density lipoprotein compared to females [18].

In our study, except for the extreme elderly age group and physical activity, none of the other demographic, clinical and dietary-related factors achieved statistical significance. However, some of the previous studies including the National Health and Nutrition Examination Survey (NHANES) [20] had shown the increased risk of MetS among females compared to males [12, 14, 16]. In the present study, though females had a slightly higher prevalence than that of males, it was not statistically significant. This could be explained by differential gender distribution of patients attending the tertiary care hospitals and their associated health-seeking behaviour. Also, studies from developed countries had shown the age-dependent increase and ethnic variations in the prevalence of MetS [20].

Since patients having MetS are 2-3 times more at risk of cardiovascular diseases; identifying the high-risk individuals using this simple approach and act upon the possible risk could avert many deaths due to cardiovascular diseases [2, 3]. The current cardiovascular risk assessment is based on multiple factors through an algorithmic approach which may not be used in all settings. Identification of MetS is based on a group of five specified risk factors and a score can be developed. Thus, this condition could be easily identified even by the allied health personnel in the peripheral health facilities. When the assessment of MetS is systematically captured in the form of the scorecard in the patient treatment chart for all chronic disease patients, this could be potentially used as a tool for health education or behaviour modification tool. This could easily increase the perceived severity among the high-risk patients and thereby their compliance with lifestyle modifications and adherence to the treatment protocol.

However, since this study was conducted in one of the tertiary care teaching institutes where clustering of various cardio-metabolic risk factors is expected to be more, the same prevalence cannot be generalized to other facility based or community-based settings. Though the condition of cardiovascular diseases can be predicted through MetS, it should not be used alone for risk assessment since this does not consider the other proven risk factors such as smoking, family history of diabetes mellitus or premature death. MetS could be used as an additive tool along with other risk factor assessment tools rather than an exclusive tool.

Conclusion:

MetS is highly prevalent (72.6% as per modified ATP III) among out-patients attending cardiology/diabetology OPD of tertiary care hospital. Low high-density lipoprotein was the most common contributing factor for MetS. Across several subgroups, about two-thirds of patients had MetS; however extreme age beyond 60 years and physical inactivity had a higher prevalence of MetS compared to others.

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