Research Article

Prevalence of metabolic syndrome in higher socioeconomic class of Ahmedabad, Gujarat, India

Navin R Patel[1], Harshid L Patel[2], Asha P Gunjalia[2]

[1]Department of Pathology, Gujarat Adani Institute of Medical Science, Bhuj-Kutch, Gujarat, India.

[2]Department of Pathology, GMERS Medical College, Dharpur-Patan, Gujarat, India.
Correspondence to: Harshid L Patel, E-mail: drhlp1975@gmail.com

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Abstract

Background: The metabolic syndrome (MetS) is a highly complex multifactorial endocrine disorder, which includes ectopic fat accumulation, impaired insulin sensitivity, and increased systemic inflammation. Globally, a rapid increase in the prevalence of MetS is observed as a result of persistent obesity. The MetS includes the features such as insulin resistance, dyslipidemia, hypertension, and a male, visceral distribution of adipose tissue; it is related to the high incidences of morbidity and mortality, which result from various commonly occurring diseases such as diabetes, cancers, myocardial infarction, and stroke.

Objective: To determine the prevalence of MetS, its components, and risk factors among a higher socioeconomic population in Ahmedabad, and to estimate the prevalence of MetS using the International Diabetes Federation (IDF) definition to compare it with the prevalence estimated using the definition of the National Cholesterol Education Program (NCEP).

Materials and Methods: This cross-sectional survey of a higher socioeconomic population was carried out in Ahmedabad, Gujarat, India, from April to December 2014. The subjects included were between the age group of 25 and 65 years. A total of 500 subjects were selected for this study. But, 22 subjects were discarded owing to insufficient blood samples.

Result: In this study, of the total 478 subjects, 213 (44.6%) male subjects and 265 (55.4%) female subjects were analyzed. About 264 (55.2%) of them were between 25 and 45 years, and 214 (44.8%) of them were between 46 and 65 years of age. About 95% of all the subjects were married. About 373 (78.0%) were nonsmokers and 105 (22.0%) were smokers; 372 (77.8%) were nonalcoholics and 106 (22.2%) were alcoholics; 154 (32.2%) showed normal weight, 218 (45.6%) overweight, and 106 (22.2%) obese. The female subjects were younger and showed higher values of BMI and WC and, thus, were more prone to overweight and obesity.

Conclusion: The global prevalence of the MetS was 26.2% and 42.6% by the NCEP adult treatment panel III (ATP III) and IDF criteria, respectively. Central obesity was the most prevalent determinant of MetS, followed by low levels of high-density lipoprotein (HDL), and then high blood pressure (BP). The triad of low HDL, high BP, and central obesity were largely responsible for MetS in this community.

KEY WORDS: Central obesity, IDF, metabolic syndrome, NCEP ATP III

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Introduction

Metabolic syndrome (MetS) is a highly complex multifactorial endocrine disorder, which shares not one but several common underlying mechanisms that include ectopic fat accumulation, impaired insulin sensitivity, and increased systemic inflammation.[1] MetS is caused by several factors such as inherited genes, intrauterine environment, irregular

patterns of fat deposits, and lack of physical exercises.[2] The MetS includes the features such as insulin resistance, dyslipidemia, hypertension, and a male, visceral distribution of adipose tissue; it is related to the high incidences of morbidity and mortality, which result from various commonly occurring diseases such as diseases, such as diabetes, cancers, myocardialinfarction, and stroke.[3]

In 1997, the WHO defined obesity as "a disease in which excess fat is accumulated to an extent that health may be adversely affected." Obesity has been listed as a disease in the International Classification of Disease by the WHO since 1979. The standard classification of obesity is expressed in terms of body mass index (BMI). Obesity is defined as a BMI ≥ 30 kg/m^2.[4] Extremely obese people are found to be the most rapidly growing segment in a population. It was estimated that doubled, quadrupled, and quintupled risks were present in those who showed a BMI ≥30, 40, and 50 kg/m^2, respectively, in the United States, in the period between 1986 and 2000.[5]

The effect of obesity in lowering the life span of an individual is immense. The life span of a 25-year-old obese man shows a 22% reduction in his expected remaining lifespan, when compared with normal individuals. The National Health and Nutrition Examination Survey III data reported that white women, aged 20–30 years, with a BMI ≥ 45 kg/m^2 will lose 8 years of life and the obese men will lose 13 years of their life.[6] In the United States, the prevalence of MetS is driven by the growing obesity "epidemic," which is occurring throughout Western society and is, particularly, notable in southeastern United States.[7] It has been reported that the incidence of MetS increases with the severity of obesity and has been observed in 50% of obese adolescents.[8] Type 2 diabetes is five to six times more common in obese people (BMI ≥ 30 kg/m^2) than in those of normal weight.[9]

Recent estimates in the United States are that about one-third of women are obese when they reach child-bearing age.[10] Owing to maternal obesity at conception, which poses health issues, the gestational metabolism is altered, which affects the placental, embryonic, and fetal growth and development.[11] Moreover, it is reported that an improper diet by the mother can affect the offspring resulting in the development of components of MetS in adult life.[12]

To classify the body weight in adults, BMI < 18.5 kg/m^2 will be underweight, BMI in the range of 18.5–24.9 kg/m^2 will be of normal weight, BMI in the range of 25–29.9 kg/m^2 will be overweight, BMI in the range of 30–34.9 kg/m^2 will be obese class-1, BMI in the range of 35–39.9 kg/m^2 will be obese class-2, BMI ≥ 40.0 kg/m^2 will be obese class-3 (severe/extreme obesity), BMI ≥ 50 kg/m^2 will be obese class-4, and BMI ≥ 60 kg/m^2 will be obese class-5.[13]

There have been several definitions of MetS, but the most commonly used criteria for definition at present are from the WHO,[14] the European group for the study of Insulin Resistance (EGIR),[15] the National Cholesterol Education Program Adult Treatment Panel (NCEP ATP) III[16] and International Diabetes Federation (IDF).[17]

Although each definition possesses common features, there are several parameters that differ. For example, the WHO and EGIR classifications require the measurement of insulin resistance (IR), which is determined by an oral glucose tolerance test and hyperinsulinemic–euglycemic clamp. The ATP III definitions were developed to be applicable in the outpatient clinic and, therefore, have remained a backbone for subsequent classifications, such as the IDF diagnostic criterion.[18]

Materials and Methods

This cross-sectional survey of a higher socioeconomic population was carried out in Ahmedabad, Gujarat, India, from April to December 2014. The subjects included were randomly walk-in patients, of private Pathology Laboratory, between the ages of 25 and 65 years. Pregnant women, hypertensive individuals, diabetic individuals, and persons not willing to participate in the study were excluded from the study. A total of 500 subjects were selected for this study. But, 22 subjects out of the 500 were eliminated owing to insufficient blood samples (n = 478). Approval from institutional ethical committee was taken before commencing the study.

Two professional staffs were trained for the survey. The study was divided into three stages: sociodemographic information, anthropometric measures, and blood investigations. In the first stage, information on demographic factors such as age, gender, marital status, educational background, and life style; any risk factors for chronic diseases such as smoking, alcohol intake, diet, and physical exercise; prevalence of chronic diseases including hypertension, diabetes mellitus, and dyslipidemia were obtained. In the second stage, anthro-

Table 1: Prevalence of MetS and its determinants by sex as defined by IDF and NCEP ATP III criteria

Determinants of MetS	Prevalence of MetS components (%)					
	IDF criteria			NCEP ATP III criteria		
	All	Male subjects	Female subjects	All	Male subjects	Female subjects
Obesity	62.8	36.2	82.4	52.2	26.8	68.4
High BP	42.8	44.2	44.8	42.8	44.2	44.8
High FPG	18.2	12.3	14.8	12.4	9.4	8.2
Low HDL	48.8	40.8	50.2	48.8	40.8	50.2
High TG	14.2	8.8	10.2	14.2	8.8	10.2
MetS	42.6	26.8	54.8	26.2	12.4	34.6

pometric measures were taken, which included height (cm), body weight (kg), and waist circumference (WC) measurements in cm (at the end of anormal expiration and at umbilical level). Mercury sphygmomanometers were used to measure the blood pressure (BP) of each subject in the sitting position after 30 min of rest. Subjects were asked to refrain from smoking, alcohol, and caffeine before 1 day of the study. Three readings each of systolic and diastolic BPs were recorded per subject with an interval of 5 min at the least, and the mean was used for the data analysis.

Blood samples were collected from subjects who had completed the first and second stages of the study. Blood samples were obtained from antecubital veins using 10 mL syringes after an overnight fast (10–16 h). Samples for fasting plasma glucose (FMG) were collected into sodium fluoride vacutainer and that for fasting lipids were collected into plain vacutainer tubes. Blood samples were tested for glucose, triglycerides (TGs), and high-density lipoprotein (HDL) level in fully automated dry chemistry analyzer, Vitros 250 (Ortho Clinical Diagnostics), Johnson and Johnson.

The diagnostic criteria for the MetS were the same as described by IDF criterion[17] and by NCEP ATP III criterion.[16]

Result

In this study, of the total 478 subjects, 213 (44.6%) male subjects and 265 (55.4%) female subjects were analyzed. Of the 478 subjects, 264 (55.2%) were aged between 25 and 45 years, and 214 (44.8%) were aged between 46 and 65 years. In younger age group, 122 (46.2%) were male subjects, and 142 (53.8%) were female subjects. In elder age group, 91 (42.5%) were male subjects, and 123 (57.5%) were female subjects. Nearly 95% of all subjects were married in both the sexes. Of the 478 subjects, 124 (25.9%) were less educated and 354 (74.1%) were more educated. In less educated group, 46 (37.1%) were male subjects and 78 (62.9%) were female subjects. In more educated group, 167 (47.2%) were male subjects and 187 (52.8%) were female subjects. Of the 478 subjects, 111 (23.2%) of them were sedentary workers, 203 (42.5%) active workers, and 164 (34.3%) field workers. In sedentary workers group, 32 (28.8%) were male, and 79 (71.2%) were female subjects. In active workers group, 85 (41.9%) were male and 118 (58.1%) female subjects. In field workers group, 96 (58.5%) were male and 68 (41.5%) female subjects. Of 478 subjects, 373 (78.0%) were nonsmokers and 105 (22.0%) smokers. In nonsmokers group, 121 (32.4%) were male and 252 (67.6%) female subjects. In smokers group, 92 (87.6%) were male and 13 (12.4%) female subjects. Of 478 subjects, 372 (77.8%) were nonalcoholics and 106 (22.2%) alcoholics. In nonalcoholics group, 109 (29.3%) were male and 263 (77.8%) female subjects. In alcoholics group, 104 (98.1%) were male and only 2 (1.9%) female subjects. Of 478 subjects, 154 (32.2%) revealed normal weight, 218 (45.6%) overweight, and 106 (22.2%) obese. In individuals with normal weight, 62 (40.3%) were male and 92 (59.7%) female subjects. In individuals with overweight, 106 (48.6%) were male and 112 (51.4%) female subjects. In obese individuals, 45 (42.2%) were male and 61 (57.6%) female subjects.

The mean age, BMI, and WC were 42.4 ± 6.26 years, 26.2 ± 4.24 kg/m^2, and 90.4 ± 12.42 cm, respectively. The female subjects were younger (43.8 ± 6.64 years) and showed higher values of BMI and WC (27.6 ± 4.42 kg/m^2 and 93.82 ± 12.22 cm, respectively) and, thus, were more prone to overweight and obesity.

The global prevalence of the syndrome was found to be 26.2% and 42.6% by the NCEP ATP III and IDF criteria, respectively. The prevalence by the IDF criterion was more than 1.5 times higher than that of the NCEP ATP III criterion. There was a female preponderance in both criteria [IDF (male:female ratio = 1:2.04); NCEP ATP III (male:female ratio = 1:2.79)]. Central obesity was the most prevalent determinant of MetS by the IDF and NCEP ATP III criterion, followed by low HDL, and then high BP.

Discussion

This cross-sectional survey was conducted within higher socioeconomic population in Ahmedabad city, Gujarat, from April to December 2014. These findings cannot be generalized to all communities in Ahmedabad. In spite of this, these findings are very important for the documentation of MetS. The prevalence of MetS was alarmingly high [42.6% (IDF) and 26.2% (NCEP ATP III)] in this higher socioeconomic community. Earlier studies in Cameroon,[19] and Nigeria,[20] both in West Africa, found much lower prevalence rates. Studies in the United States[21–23] and Europe[24–28] revealed higher rates. This high prevalence rate in Ahmedabad can be easily attributed to a presumed westernization of diet, lifestyle, and low physical labor. Stress could be a major player in this circumstance by triggering a chain of neuroendocrine events culminating in disturbed metabolism. The IDF criterion yielded a higher prevalence rate (1.6 times) than the NCEP ATP III, and this may be owing to the lower cut-off points for WC and FPG. Similar trends have been observed in other studies.[21,29–31]There was a significant sex difference in the prevalence of MetS in this population. The prevalence was approximately two times higher among females by IDF criteria and three times higher among female subjects by NCEP ATP III criteria. This difference may be owing to the significant and higher prevalence of overweight and obese females than male subjects in our study.

The triad of low HDL, high BP, and central obesity were largely responsible for MetS in this community. This combination was also observed in Nigeria[20] and the United States.[22] In consonance with the expected, “sedentary office workers” were more than thrice likely to develop MetS with reference to “field workers,” while the contrary was observed for “active office workers,” but these findings did not reach the level of significance. In addition, more-educated subjects were more likely to develop MS than less-educated subjects, and this also did not reach the level of significance.

Conclusion

To conclude, the prevalence of an MetS diagnosis was alarmingly high among this population of women in higher socioeconomic class of Ahmedabad. This high prevalence rate in Ahmedabad may be owing to westernization of diet, lifestyle, stress, and low physical labor. The global prevalence of the syndrome was found to be 26.2% and 42.6% by the NCEP ATP III and IDF criteria, respectively. The prevalence by the IDF criterion was more than 1.5 times higher than that of the NCEP ATP III criterion. There was a female preponderance in both criteria [IDF (male:female ratio = 1:2.04); NCEP ATP III (male:female ratio = 1:2.79)]. The triad of central obesity, high blood pressure, and low HDL were the most responsible for the syndrome in this population. Younger age, male sex, and normal weight were protective against MetS. This study needs to be extended to other parts of the country to ascertain the national prevalence rate vis-à-vis, its rural–urban distribution.

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