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Research Article

METABOLIC SYNDROME, CENTRAL OBESITY AND INSULIN RESISTANCE AMONG MEDICAL STUDENTS

John John K., Sukanya Shetty and Ashalatha V Rao

Department of Biochemistry, K S Hegde Medical Academy, Mangalore, Karnataka, India

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ABSTRACT

Objectives: The objective of this study was to study the association of central obesitywith metabolic syndrome (MetS) and insulin resistance among medicalstudents.

Materials and Methods: From December 2013 to July 2014, 125subjects (63 males and 62 females) between 18 to 22 years were recruited for the cross-sectional study. Anthropometric and biochemical data were collected.
Central obesity was identified using Waist to Height Ratio (WHtR), MetS was identified by modified NCEP ATP III criteria for Asian Indian population and Insulin resistance was identified using Triglyceride to HDL Cholesterol Ratio (TG/HDL).

Results: Metabolic syndrome was identified in 4% of the individuals who participated in the study. 80% of the subjects with MetS had insulin resistance and 80% of the subjects with MetS had central obesity.

Conclusions: The individuals with risk for developing chronic lifestyle diseases is alarmingly high. Because of high rates of overweight/obesity and MetS, college-age adults are at risk for developing chronic diseases including diabetes mellitus and cardiovascular disease.

INTRODUCTION

Metabolic syndrome

Metabolic syndrome (MetS) is a clustering of symptoms associated with obesity that strongly predicts the future development of Cardiovascular disease (CVD) and type 2 diabetes (T2DM)[1].

Abnormalities characteristic of MetS include abdominal obesity, increased blood pressure, elevated plasma glucose levels and dyslipidemia[2,3].

Several terms such as Syndrome X, Metabolic syndrome X, the Deadly Quartet, Insulin Resistance Syndrome, Cardio metabolic syndrome, Reaven's syndrome (named for Gerald Reaven), CHAOS (in Australia) have been proposed for MetS. Different guidelines issued by World Health Organization (WHO), National Cholesterol Education Program-Adult Treatment Panel III (NCEP-ATP-III) and International Diabetes Federation (IDF) are used to identify MetS in clinical practice[3]. Irrespective of the criteria used, MetS is associated with increased risk of developing Type 2 Diabetes Mellitus (T_2DM), Coronary Artery Disease (CAD), cerebro vascular diseases, polycystic ovary syndrome (PCOS), sleep apnoea and several types of hormone sensitive cancer[4].

Among the various studies conducted among Indians of different age groups, using different criteria, NCEP ATP III definition was found to be a better tool for screening, than definitions provided by WHO and IDF[5,6].

The current ethnic specific criteria for MetS for Asian Indians is presence of at least three of the following,

The current criteria for diagnosis of MetS is (16-18), presence of at least 3 of the following;

1. Waist circumference (≥90 cm in men, ≥80 cm in women)
2. Systolic blood pressure (SBP) ≥130 mmHg and/or diastolic blood pressure (DBP) ≥85 mmHg or medical treatment of previously diagnosed hypertension
3. Triglycerides (TG) ≥150 mg/dl
4. High density lipoprotein cholesterol (HDL-C) <40 mg/dl in men, <50 mg/dL in women
5. Fasting plasma glucose (FPG) ≥100 mg/dl

This cut off values are applicable for the young adults in our study population.

*Corresponding author: **John John K***
Department of Biochemistry, K S Hegde Medical Academy, Mangalore, Karnataka, India

Indian Scenario

It is well known that Asian Indians have a smaller build and excess body fat with predominant abdominal adiposity and therefore greater risk of insulin resistance compared with other ethnic groups. This makes Asian Indians a "high-risk population" for MetS. This cluster of metabolic abnormalities is referred to as the "Asian Indian Phenotype". It is estimated that by 2020, cardio vascular diseases (CVD) will be the largest cause of disability and death in India, with 2.6million Indians predicted to die due to CVD[1].According to the recent projections of WHO, India already leads the world with the largest number of diabetic subjects (nearly 40 million) and it is predicted that this number would reach almost 80.9 million by the year 2030 [1,6].

Rapid nutritional and lifestyle transition in India is the prime reasons for increasing prevalence of obesity and metabolic syndrome, especially among the young population[7]. The rising prevalence of obesity in developing countries like India is largely due to rapid urbanization and mechanization which has led to reduction in the energy expenditure along with an increase in energy intake due to increased purchasing power and availability of high fat, energy-dense fast foods[8].

The South Indian youth is prone for MetS due to a higher carbohydrate content in the diet[9]. The risk further increases, especially in the college students due to consumption of junk food and preserved food items.

Therefore, the primary aim of this project was to determine the prevalence of overweight and obesity in relation to clinical indices of MetS in a large group of college students (18-21 years) via a multi-faceted approach at a college setting.

Insulin resistance

Insulin resistance is commonly identified as a unifying characteristic in MetS. It is associated with a decrease in glucose uptake by the body's tissues resulting in hyperglycemia, as well as hyperinsulinemia due to an increased production of insulin by the pancreas. The rise in circulating free fatty acids from excess adipose tissue promotes the state of insulin resistance, as well as the synthesis of triglycerides production by the liver and the reduction in HDL cholesterol. Hypertension also results from insulin resistance impaired vasodilation, increased activity of the sympathetic nervous system, and increased sodium reabsorption. Obesity, particularly abdominal obesity, often precipitates insulin resistance and the metabolic syndrome. Although genetic predisposition may explain some of the susceptibility to the development of the MetS and insulin, it is also strongly linked to obesity[10].

Central Obesity

Central obesity also called abdominal obesity and was calculated by Waist to Height ratio (WHtR), with an optimal cut-off value of $\geq$ 0.5 both males and females[11].

A 2010 study that followed 11,000 subjects for up to eight years concluded that WHtR is a much better measure of the risk of diabetes, dyslipidaemia, cardiovascular and cerebrovascular diseasesin both sexes in populations of various nationalities and ethnic groups, than widely body mass index (BMI)[12].

MATERIALS AND METHODS

The current population based cross-sectional study was conducted in K S Hegde Medical Academy, Mangalore, involving 125 medical students (63 males and 62 females) between 18 to 22 years of age, who were willing to give written informed consent. Subjects with already diagnosed diabetes mellitus, cardiovascular diseases, renal diseases, sepsis, medications and other endocrine disorders were excluded. Ethical clearance was obtained from Institutional Ethical Committee before the commencement of study.

Height (in cm) was measured in a wall-mounted stadiometer following standard protocols. Waist circumference (in cm) was measured with measuring tape measured at the iliac crest. Systolic and diastolic blood pressures were measured using manual Sphygmomanometer with adult cuff after the participant was seated and quiet for a minimum of 10 minutes.
Sample collection was done in the morning after 8-12 hour of overnight fast. Blood samples were obtained via venipuncture from subject, in sitting position for a minimum of 10 minutes. 5 mL blood was collected from antecubital vein with aseptic precautions in plain red topped vacutainer and grey topped fluoride vacutainer. Biochemical analysis was done in Clinical Biochemistry Laboratory in K S Hegde Medical College Hospital, in Cobas C 311 Auto analyzer from Roche, using kits from the same company.

Metabolic Syndrome identification

MetS and its five criteria (waist circumference, elevated triglycerides, low HDL-C, elevated blood pressure and high fasting glucose) were classified according to the parameters established by NCEP ATP III. Participants were categorized as having zero, one, two or $\geq$ 3 of criteria. They were categorized as having MetS if they had $\geq$ 3 of these criteria.

Identification of Central Obesity

Central obesity also called abdominal obesity and was calculated by Waist to Height ratio (WHtR), with an optimal cut-off value of $\geq$ 0.5 both males and females.

Insulin Resistance identification

Insulin resistance was identified by Triglycerides to HDL-C ratio (TG/HDL-C) with a cut off values of ≥3.5 in males and ≥2.5 in females.

Statistical Analysis

SPSS 16.0 was used for data analysis
Chi-square test was used to test association of different parameters of MetS.

RESULTS

Among 125 participants, 4% (n=5) were found to have MetS. It was more among the female subjects (n=4) and genderwise difference was statistically significant (p=0.01). 16.8% (n=21) of the subjects had two and 32.8% (n=41) had one parameter of MetS. The genderwise distribution of number of parameters of MetS among the study population is represented in figure 1.

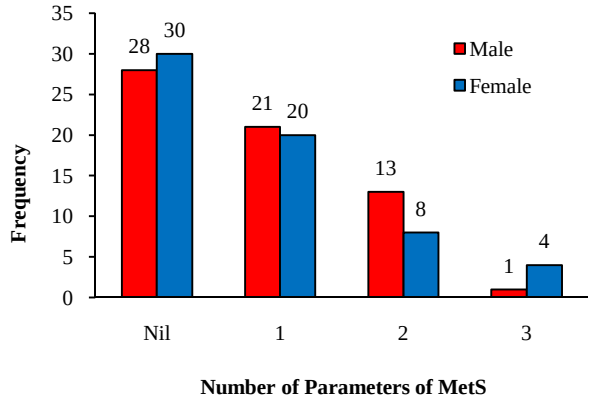

Fig.1 Gender & Parameters of Metabolic Syndrome

Central obesity was found in 56 out of 125 subjects who participated in the study. Among the subjects with MetS, 80% (n=4) had central obesity. Among the subjects with one and two parameters of MetS, central obesity was found in 60.9% (n=25) and 61.9% (n=13), respectively. The association between MetS and central obesity was found to be statistically significant (p<0.001). See fig 2.

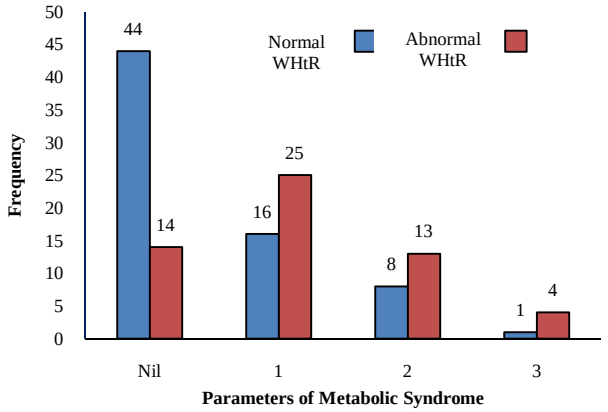

Fig 2. Comparison of frequency of Central Obesity (WHtR) with Parameters of Metabolic Syndrome

Insulin resistance was found in 18 subjects. Among the subjects with MetS, 80% (n=4) had insulin resistance. Insulin resistance was found among 12.1% (n=5) and 38% (n=8) of subjects with one and two parameters of MetS, respectively. It was found to be statistically significant (p<0.001). See fig 3.

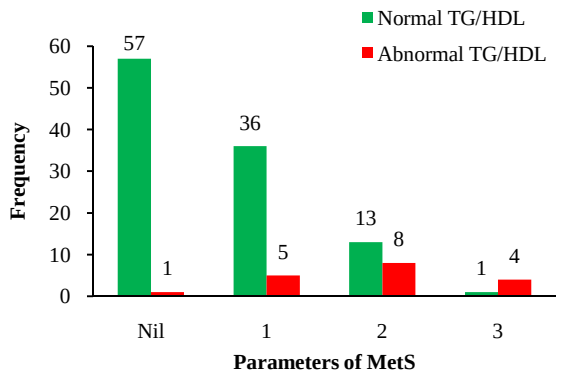

Fig.3 Comparison of Parameters of Metabolic Syndrome & Insulin Resistance (TG/HDL)

DISCUSSION

The prevalence of MetS is rapidly increasing globally among the young adults. The present study was conducted among apparently healthy medical students. Using NCEP ATP III, MetS was found in 4% of the total study population. Various studies conducted among young adults in different parts of the world showed varying prevalence of MetS. 3.3% prevalence was found among 100 medical students between 17-22 years of age, in a study conducted in Bangalore. Prevalence was 11.2% among 686 medical students including postgraduates, undergraduates and interns, between 18-35 years of age, in a study conducted in Sewagram. 12% of the subjects had MetS in a study conducted among college students between 18-24 years of age, in the United States. Chances of developing MetS rapidly increases as the age advances. This may be the consequence of continuing unhealthy lifestyle from adolescence to the adult life.

It is interesting to note that large number of students (53.6%) have at least one MetS parameter abnormal in the present study. The risk of subjects with one and two parameters developing MetS in future is very high, unless the diet and the lifestyle practices are modified.

MetS was found more among female subjects, which is in accordance with the genderwise distribution of MetS in various studies conducted in India and abroad.

80% of the students with MetS had central obesity which was statistically significant. The prevalence of central obesity was high among individuals with one and two parameters of MetS. It is interesting to note that a good number of students without any parameters of MetS also had central obesity.

Insulin resistance is a good marker for predicting cardio metabolic risk. It showed strong association with MetS. Though insulin resistance is strongly associated with individuals with MetS (80%), it was also found among normal individuals.

CONCLUSIONS

Because of high rates of overweight/obesity and MetS, college-age adults are at risk for developing chronic diseases including diabetes mellitus and cardiovascular disease. Change in dietary habits and regular exercise could possibly reduce further progression of the risk factors.

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