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Original Research Article

A study on the prevalence of obesity and metabolic syndrome among students of a medical college

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ABSTRACT

Background: Obesity is emerging as a serious problem throughout the world. The overall life expectancy is significantly shortened and the quality of life decreased in those who are excessively overweight. Metabolic syndrome (MetS) is characterized by a constellation of individual risk factors of cardiovascular disease. Central obesity is a key feature of this syndrome, reflecting the fact that the syndrome's prevalence is driven by strong relationship between waist circumference and increasing obesity. Awareness about MetS in medical students is the need of the hour.
Methods: This cross-sectional study was conducted at Dr. PSIMS and RF, Chinnoutpalli, Andhra Pradesh, India involving 400 medical students. A pre-tested questionnaire, measurement of blood pressure, fasting glucose level, fasting lipid profile, anthropometric variables such as height, weight, waist circumference and hip circumference were taken. Metabolic syndrome was defined based on the International Diabetes Federation criteria. Data was processed using SPSS version 16. T-test, chi-square test, fisher's exact test, anova and odd's ratio were used for statistical analysis.
Results: 59% of the study population was female. The prevalence of obesity was 4%, with majority being males (81.25%) The MetS prevalence as per the International diabetes federation (IDF) criteria was 6% (n=24). The prevalence of MetS in males was 12.19% (n=20) and in females 1.69%. (n=4). The risk of developing metabolic syndrome is high among those who smoke, consume alcohol, consume junk food and sleep for longer durations.
Conclusions: The prevalence of metabolic syndrome is 6%. A significant association is established between life style habits like smoking, alcohol consumption, junk food consumption, sleep duration and MetS.

Keywords: Central obesity, IDF, MetS

INTRODUCTION

Obesity is a state of excess adipose tissue mass. Although not a direct measure of adiposity, the most widely used method to gauge obesity is the body mass index(BMI), which is equal to weight/height2 (in kg/m^2). Obesity is considered to be the link between insulin resistance and metabolic abnormalities inclusive of diabetes, hypertension and dyslipidemia, all of which are risk factors for coronary artery disease.[1,2] Metabolic syndrome (MetS) refers to a clustering of cardiovascular risk factors, including high blood pressure, central obesity, insulin resistance and dyslipidemia, that has become a global public health epidemic.[3,4] MetS represents a pre-

diabetic and pre-cardiovascular pathological condition, and could be taken as a useful tool in prognosing development of cardiovascular disease and diabetes mellitus.[3] It is increasingly recognized worldwide and estimated that 20-25% of adult population in South Asia have developed metabolic syndrome.[4] MetS is becoming a worldwide epidemic as a result of the increased prevalence of obesity and a sedentary lifestyle, and the prevalence of MetS in the adult population is relatively high.[5] Central obesity and insulin resistance have been identified as the main etiopathogenic factors that trigger disorders in glucose and lipid metabolism, endothelial dysfunction, increased blood pressure, and a pro-inflammatory and pro-thrombotic state, among others.[6]

Lifestyle modification has been suggested to be the cornerstone for successful management of MetS. Several lifestyle behaviors may influence whether or not a person can maintain energy balance over the long term. For instance, the consumption of sugar-sweetened beverages, sweets, and processed foods may make it harder to do so, whereas the consumption of whole grains, fruits, and vegetables might make it easier. Physical activity, the duration of television viewing and of sleep may influence energy consumption, energy expenditure, or both.[7]

Today obesity in children and adolescents is a serious public health problem and appears to be the most important cause of insulin resistance, which makes them a risk group for developing metabolic syndrome.[8]

Since medical students generally spend a large part of their day at the college attending lectures and in the library during their study period, it seems reasonable to suppose that this kind of lifestyle is characterized by high levels of sedentariness and stress that may represent an important risk factor for the syndrome. Indeed, it is increasingly appreciated that work sites represent one of the most promising settings for early-detection and follow-up interventions for the MetS For prevention and treatment of this condition, appropriate advice to the patient from his/her doctor is necessary.[4] Therefore, it becomes very important for a medical professional to keep himself/herself physically fit and turn up as an inspiration to the patients visiting him/her. Therefore, awareness about morbidity associated with obesity is the need of the hour.

METHODS

The study was conducted at Dr. PSIMS and RF, Chinoutpalli, Krishna District, Andhra Pradesh, India from January 2016 to December 2016. It's a cross-sectional study carried out amongst medical students (undergraduates, interns and postgraduates) of age 18 years and above.

The sample size taken for this study was 400. No specific sampling technique was used. Ethical issues were discussed and approved by the Institutional Ethics Committee of Dr. PSIMS and RF on 15 October 2015. Signed informed consent was taken prior to the recruitment of subjects into the study and relevant details regarding the purpose, procedure to be carried out and potential hazards of the study were explained to the patients in their own language.

The following anthropometric parameters were measured in all the subjects

Height, Weight, Waist Circumference, Hip Circumference, Waist Hip ratio. Height was measured using the height meter and weight with the standardized scale. Waist circumference was measured using an inch tape immediately above the iliac crest as defined by National cholesterol education program- adult treatment panel III (NCEP- ATP III) guidelines. Body mass index (BMI) was calculated as weight (kg)/ height^2(meters). BMI between 25-29.[9] was taken as overweight and 30.0 or higher as obese according to the centre for disease control and prevention and WHO.

Blood pressure was measured in the right arm supine position using the following protocol; first measurement was made after at least 5 minutes of rest and was repeated 3 times, keeping 1 minute of interval between each measurement. The average of 3 measurements was taken as the final data. Waist circumference measurement was done at the level of midpoint between the top of the iliac crest and the lower margin of the last palpable rib in the mid-axillary line. Measurements were taken with a stretch-resistant tape wrapped snugly around the subject, but not to the point of constriction. The tape level was kept parallel to the floor at the point of measurement. The circumference was measured to the nearest 0.1 cm at the end of normal expiration. Hip circumference measurement was done at the widest point over the greater trochanters.

Baseline blood samples were obtained in fasting state in order to measure plasma glucose and lipid levels. All the study subjects were informed previously to remain fasting at least 10 hours before the blood samples were withdrawn. Biochemical analysis were performed using photometric assays. In present study, metabolic syndrome is defined as per the International Diabetes Federation (IDF) criteria.

According to this criteria, metabolic syndrome is diagnosed as: central obesity (waist circumference males ≥90cm, females ≥80 cm) plus any two of four factors: raised triglycerides ≥150mg% or on specific medication for hyper triglyceridemia, reduced high density lipoprotein cholesterol <40mg/dl (males), <50 mg/dl(females) or specific medication, raised blood pressure- systolic blood pressure ≥130mmHg, diastolic blood pressure ≥85mmHg or previous diagnosis or specific medication, raised fasting plasma glucose (≥100mg%) or previously diagnosed type 2 diabetes.

Statistical analysis

Statistical analysis was done using SPSS-16. Mean, standard deviation (SD), standard error(SE), 95% confidence intervals were calculated. Other tests used for data analysis were chi-square test, fisher's exact test, odds ratio, frequency and percentages. The results obtained were presented in the form of relevant figures and tables.

RESULT

Out of the 400 subjects 164 are men and 236 are women i.e. 59% of the study population are females. As shows in Figure 1. In the study population, the prevalence of obesity is 4% (n=16). 65.5 % are of normal BMI (n=262), 13.5% are underweight (n=54) and 17% over weight (n=68). 13.98% of women are overweight (n=33) and 1.27% obese (n=3), while 21.34% (n=35) of men were overweight and 7.92% (n=13) obese as shown in Table 1.

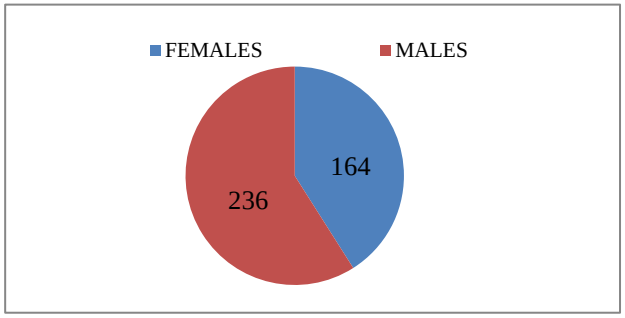

Figure 1 (a): Sex distribution;

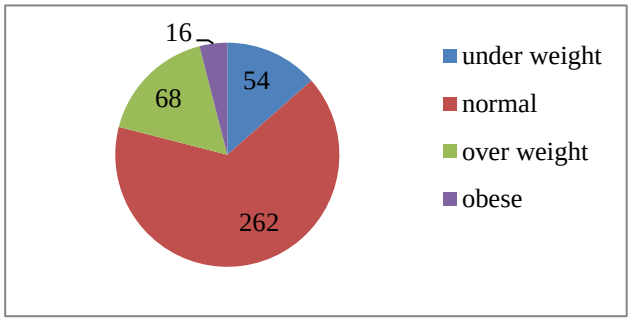

Figure 1 (b): Frequency of BMI.

Table 1: Distribution of frequency of BMI.

Category	Males%	Females%	Total
Under weight	11 (n=1 8)	15.3 (n=36)	13.5 (n=54)
Normal	59.8 (n= 98)	69.5 (n=164)	65.5 (262)
Over weight	21.34 (n=35)	13.98 (n=33)	17 (n=68)
Obese	7.92 (n= 13)	1.25 (n=3)	4 (n=16)

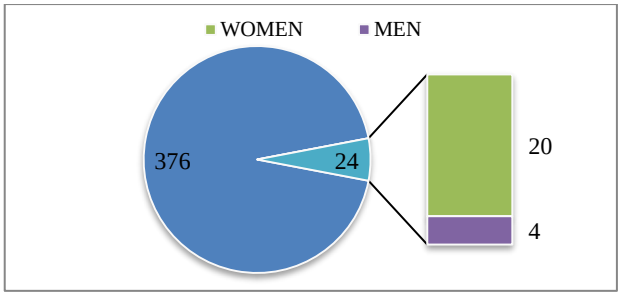

Figure 2 (a): The prevalence of metabolic syndrome.

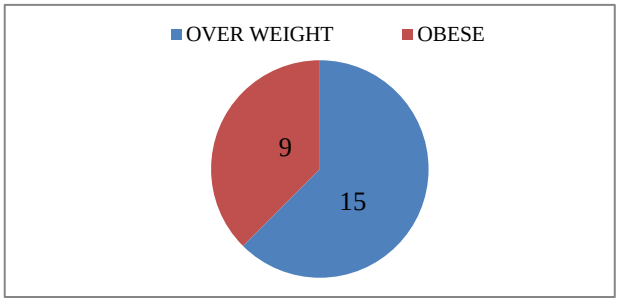

Figure 2 (b): The prevalence of metabolic syndrome.

Figure 2 shows the prevalence of metabolic syndrome according to IDF criteria in the current study is 6% (n=24) among which 83.3% (n=20) are men and 16.7% (n=4) women. Amongst the diagnosed cases of metabolic syndrome, 15 subjects are overweight and 9 subjects obese.

The prevalence of metabolic syndrome according to BMI and gender is also calculated, in which 31.42% of overweight men and 12.12% of overweight women had metabolic syndrome, 69.23% of obese men had metabolic syndrome whereas none of the obese women had metabolic syndrome. The average age of the study population in years is 22.46±3.54 for men and 21.17±2.0 for women. Majority of the study population belonged to the age group of 20-25 years. No subjects with BMI <25 are found to have metabolic syndrome as shown in Table 2.

While trying to establish a relationship between various life style habits and the presence or absence of metabolic syndrome, we found a significant relationship between metabolic syndrome and life style habits like smoking, alcohol consumption, junk food consumption and sleep duration. The risk of having metabolic syndrome among smokers is 6 times than among non-smokers. The risk of developing metabolic syndrome in those who consume junk food is 6.7 times than those who don't consume junk food. The risk of developing MetS in those who consume alcohol is 6.5 times than in those who don't consume alcohol (using odd's ratio). However, there is no association between exercise and metabolic syndrome in our study which is shown in Table 3.

Table 2: Prevalence of metabolic syndrome categorized by age, gender and BMI.

Variable	Metabolic syndrome	Non-metabolic syndrome	Total	P value
Age				
15-20	6 (4.2%)	137 (95.8%)	143	
20-25	15 (6.7%)	210 (93.3%)	225	>0.05
25-30	3 (9.7%)	28 (90.3%)	31	
>30	0	1 (100%)	1	
Sex				
Males	20 (12.2%)	144 (87.8%)	164	<0.001
Females	4 (1.7%)	232 (98.3%)	236	
BMI				
Under weight	0	54 (100%)	54	
Normal	0	262 (100%)	262	<0.001
Over weight	15 (22.1%)	53 (77.9%)	68	
Obese	9 (56.3%)	7 (43.8%)	16	
Total no. of subjects	24 (6%)	376 (94%)	400	<0.001

Table 3: Frequency of life style habit among subjects with and without metabolic syndrome.

Life style habits	Metabolic syndrome	Non-metabolic syndrome	Total	P value
Smoking				
Present	6 (24%)	19 (76%)	25	<0.01
Absent	18 (4.8%)	357 (95.2%)	375	
Alcohol				
Present	9 (22.5%)	31 (77.5%)	40	<0.001
Absent	15 (4.2%)	345 (95.8%)	360	
Sleep*				
<6 hours	4 (8.2%)	45 (91.8%)	49	
6-8 hours	12 (3.9%)	295 (96.1%)	307	<0.01
>8 hours	8 (18.2%)	36 (81.8%)	44	
Junk food				
Present	23 (7.3%)	291 (92.7%)	314	<0.05
Absent	1 (1.2%)	85 (98.8%)	86	
Exercise				
Present	4 (5.5%)	69 (94.5%)	73	>0.05
Absent	20 (6.1%)	307 (93.9%)	327	
Veg	4 (4.8%)	79 (95.2%)	83	>0.05
Non-veg	20 (6.3%)	297 (93.7%)	311	

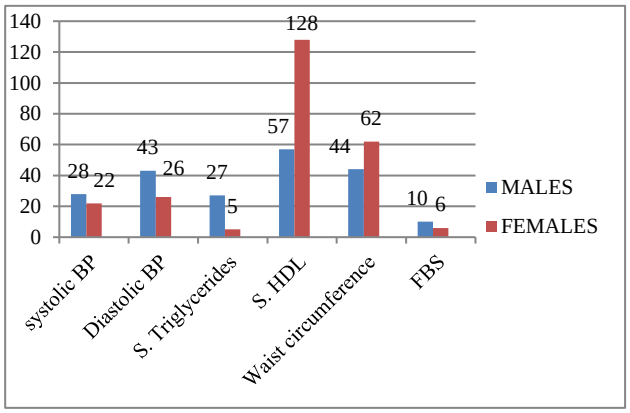

Figure 3: Distribution of characteristics of METS among study group.

Prevalence of individual parameters for metabolic syndrome is high for low HDL cholesterol, abdominal obesity and high DBP. In both males and females, low HDL cholesterol is the most common parameter followed by abdominal obesity and raised diastolic blood pressure as shown in Figure 3.

DISCUSSION

In the present study, the overall prevalence of metabolic syndrome is 6%(as per IDF criteria). Similar studies conducted among medical students at Bangalore, Thailand, Universidad Central Del Equadar, Quito and Sewagram showed prevalence of metabolic syndrome to be 3.3%(IDF criteria), 0.4% (NCEP/ATPIII), 8.2% (IDF criteria) and 11.2%(NCEP/ ATPIII) respectively. Similar

studies conducted in the university students in Korea and Mexico City showed a prevalence of 4% and 14.4% respectively (NCEP/ ATPIII).[9-14]

Ford et al. reported the prevalence of metabolic syndrome as 6.7% in participants aged 20-29 years using NCEP ATP criteria.[15] A study conducted by Sawant et al in urban Indian population found the prevalence of metabolic syndrome to be 20.61% in the age group of 21-40.[16] The difference in the prevalence of metabolic syndrome can be attributed to the difference in age groups of the study subjects and the various definitions used and ethnic variations among study groups.

In present study, we found the prevalence of metabolic syndrome to be higher among males compared to females (12.19% versus 1.7%), which is statistically significant ($p<0.01$). There are considerable number of studies showing significant differences in prevalence of metabolic syndrome among males and females. A higher prevalence in men might be related to higher rates of obesity, high TG, high DBP and lifestyle habits like smoking and alcohol consumption. Sawant et al. in their study found higher prevalence of metabolic syndrome in males (2 times) than in females ($p<0.08$).[19] Similarly in a study conducted by Kanitkar et al the prevalence in males was 24.3% and in females was 20%, Cook et al. showed a higher prevalence of MetS in males (6.1%) compared to females.[4] Padmavathi et al in their study found that the prevalence of metabolic syndrome was more in males 45% than in females (42.2%) Contrary to our findings, few studies showed higher prevalence of metabolic syndrome among females than in males.[17,18] In a study conducted by Bhalavi et al. in the adolescents of rural Wardha, the prevalence of metabolic syndrome was higher in females than males.[19] Similarly a study by Rashidi et al. conducted among medical university students in Kashan, Iran showed high prevalence of metabolic syndrome among females than males(4.3% versus 1.2%).[20] Another study conducted by Jain et al. among medical students at Sevagram, India found the prevalence of metabolic syndrome to be higher among females than males (13.5% versus 9.7%).[12]

In the present study, we found the prevalence of obesity to be 4% and overweight 17%. In our study, metabolic syndrome is only found to be prevalent in those who are overweight and obese. The prevalence of metabolic syndrome in overweight and obese subjects is 22.05% and 56.25% respectively. The association between metabolic syndrome and BMI is statistically significant ($p<0.001$). This can be compared to a study conducted by Barrimah et al. in Saudi Arabia, where the prevalence of metabolic syndrome was 26.9% among overweight and 58.6% among obese subjects.[21] In a study conducted by Selvaraj et al. among medical students in South India, the prevalence of obesity and overweight were found to be 8.6% and 24.3% respectively.[22] In another study conducted in Thai medical students the prevalence of obesity and overweight in the subjects was 15.62% and 21.88% respectively.[10]

The prevalence of smokers among the study population is 6.25%. In a clinical study by Sawant et al. in urban India the prevalence was found to be 14.95%.[16] In present study, there is a significant association between BMI and smoking. The risk of having a BMI ≥25 is 4.6 times more among smokers compared to non-smokers. Also, a positive relationship is established between smoking and metabolic syndrome. Smokers have a 6 times higher risk of having metabolic syndrome than non-smokers. The above observations are supported by a study done by Sang et al. in which there was a statistically significant dose dependent association between smoking and metabolic syndrome. Also, there was a positive dose dependent association between current smoking amount and abdominal obesity.[23] Contrarily, in the study conducted by Woo et al. in Korea, no correlation between smoking and metabolic syndrome was found.[13]

The prevalence of alcohol consumption in the current study is 10%. Also, there is a signification association between alcohol consumption and metabolic syndrome. ($p<0.001$). The odds of developing MetS in those who consume alcohol are 6.5 times than in those who don't consume alcohol. This is similar to the observation made by Singh et al. in a study among urban Sikh population in Amritsar ($p<0.04$).[24]

78.5 % of subjects consume junk food. Of those consuming junk food, 22.3% were found to have BMI≥25. However, there is no significant association between BMI and junk food consumption (≥0.05). This is similar to the study done by Jayaraj et al.[25] In another study conducted by Deotale et al in medical students, there was a significant association between BMI and frequency of junk food consumption.[26] In the current study we found a significant association between junk food consumption and metabolic syndrome ($p<0.05$). The odds of developing metabolic syndrome in those who consume junk food are 6.7 times than those who don't consume junk food.

In this study, significant association between sleep duration and BMI is observed. Of those with BMI ≥25, 64.4% of subjects sleep for a duration of 6- 8 hours where as 14.2 % and 21.4% of subjects sleep for a duration of less than 6 and more than 8 hours respectively. This observation is similar to the study conducted by Deotale et al.[26] Also in present study, a significant association is observed between sleep duration and metabolic syndrome ($p<0.01$, using fisher's exact test). Among those with metabolic syndrome, 12 subjects had sleep duration of 6-8 hours. The number of subjects with the habit of sleeping ≥8 hours and <6 hours are 8 and 4 respectively. In a study conducted by SY et al. to investigate the association between sleep duration and metabolic syndrome in adult population, it was observed that both short and long sleep durations are risky behaviors for

increasing the risk of metabolic syndrome.[27] The association between poor sleep quality and metabolic syndrome is also observed in the study conducted among university students in Korea.[13] In another study conducted by Najafian et al., a positive relation between sleep deprivation and metabolic syndrome was established.[28]

In the present study, no significant association is found between BMI, metabolic syndrome and exercise. Similar observations were noted in the study conducted among university students in Korea.[13] Also in the study conducted by Jayaraj et al., a relevant association could not be established between regular physical exercise and obesity among the medical students.[25] However, there are several studies in which sedentary life style/lack of exercise is associated with metabolic syndrome. In a systematic review and meta-analysis study conducted by Yamaoka et al., it was concluded that life style modification intervention (LMI) was effective in resolving metabolic syndrome and reducing the severity of related abnormalities (FBS, WC, SBP, DBP and Triglycerides) in subjects with MetS.[5] Similar association between exercise and metabolic syndrome was established in the study conducted by Barrimah et al.[21]

The limitation of this study was that it has a selection bias, as most of the subjects are females. This could underestimate the prevalence of MetS in the population. This is because though the sample size for males is less in the study, MetS is highly prevalent among males compared to females.

CONCLUSION

The prevalence of metabolic syndrome is 6%. Incidence of MetS among medical students is directly proportional to BMI. A significant association is established between life style habits like smoking, alcohol consumption, junk food consumption, sleep quantity and MetS. 1 out of every 5 individuals presented some degree of overweight or obesity.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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