Prevalence and Gender Differentials of Metabolic Syndrome Among College Students of Kolkata, West Bengal, India

Tanima Paul Das[1], Minati Sen[2], Indranil Saha[3], Debnath Chaudhuri[4]

[1]Department of Food & Nutrition, Prasanta Chandra Mahalanobis Mahavidyalaya, West Bengal State University, 111/3 B.T. Road, Kolkata 700108, West Bengal, India; [2]Department of Home Sciences, University of Calcutta, 20B, Judges Court Road, Alipore, Kolkata, West Bengal, India; [3]Department of Community Medicine, IQ City Medical College & Narayana Hrudayalaya Hospitals, Durgapur, West Bengal, India; [4]Department of Biochemistry and Nutrition, All India Institute of Hygiene & Public Health, 27 & 27 B, JC Block, Bidhan Nagar, Kolkata, West Bengal, India.

ABSTRACT

Aim: The study aims to determine the prevalence of metabolic syndrome (MS) and assess gender differences among college students of Kolkata, West Bengal, India using International Diabetes Federation (IDF) criteria.

Materials and Methods: *Design:* A cross sectional study was conducted among 397 college going students comprising of 235 females and 162 males aged 18 to 24 yrs from August 2011 to December, 2013. *Measurements:* Anthropometric measurements were performed by standardized techniques, blood pressure (BP) by sphygmomanometer. Serum glucose, HDL-C and TG were measured in fasting blood. *Diagnostic criteria used:* MS was identified using IDF criteria.

Results: Prevalence of MS among total population was 4.5%. Significant differences exist between genders with respect to age, BP and HDL-C (p ≤ 0.05). 9.1% had only central obesity while 12.1% students had any one of the metabolic syndrome components in addition to central obesity.

Conclusion: Many of the college students of Kolkata were having MS or its predisposition. Early identification can be beneficial for planning intervention strategies in college and university settings.

Key Words: Metabolic Syndrome, College students, Kolkata, India

INTRODUCTION

Metabolic Syndrome (MS) has been defined as clustering of cardiovascular disease risk factors, including hyperinsulinemia / insulin resistance, hypertension, atherogenic dyslipidemia, obesity & glucose intolerance (1-3).The definitions with distinct differences which helps in the interpretation of metabolic syndrome are given by World Health Organization (WHO, 1998); European Group of Insulin Resistance (EGIR); Adult Treatment Panel III (ATPIII, 2001); American Association for Clinical Endocrinologists (AACE,2003), International Diabetes Federation (IDF, 2005) with ethnic specific cut-offs and modified NCEP-ATP III criteria (2). According to the IDF definition, for a person to be defined as having the metabolic syndrome must have central obesity (defined as waist circumference with ethnicity specific values) plus any two of the other four risk factors of MS (4). In adults, MS has been reported to predispose to an increased risk of chronic diseases such as type 2 diabetes mellitus (T2DM) & cardiovascular diseases (CVD) (2), particularly in Asian Indians (5). Prevalence of obesity and MS is rapidly increasing in India and other South Asian countries, leading to increased mortality and morbidity due to CVD and T2DM.About one third of urban South Asians have evidence of MS (6-8).

College students are an understudied population in respect to prevalence of MS. Experts emphasize that MS is becoming

increasingly prevalent and parallels the emergent pandemic of overweight and obesity (9) even in young adults (10). Studies document that college students experience weight gain faster than average adults (11-12). Huang et. al. (13) concluded that overweight students are more predisposed to the components of MS. It was also reported that college students make unhealthy food choices and do less physical activities (14).

Therefore, objectives of this study were to find out the prevalence of metabolic syndrome and to assess its pre-disposition among college students of Kolkata, West Bengal, India.

MATERIALS AND METHODS

Study participants
Three hundred ninety seven (397) college students comprising of 235 females and 162 males aged 18 to 24 yrs living in Kolkata were randomly selected from ten colleges for this study. Purpose of the study was explained to them and written consent was obtained. Participation in the study was voluntary and non-remunerative.

Exclusion criteria
Students who were suffering from metabolic abnormalities e.g. Type 2 diabetes mellitus (T2DM) or with a medical history of previous cardiovascular events with prescribed usage of antihypertensive drugs or on hormone therapy (e.g. insulin), pregnant & lactating women, athletes or unwilling participants were excluded from the study.

Ethical considerations
The study protocol has been approved by the Bioethics Committee for Animal and Human Research Studies, University of Calcutta (Ref no. BEHR/1098/2304 dated 22/06/11).

Study Design
Cross sectional study was conducted from August 2011 to December 2013. Participants were recruited via classroom announcements, flyers and word-of-mouth. Survey along with blood sample collection was done randomly in respective institutions.

Anthropometric estimations
Participants were requested to wear light clothes and not to wear shoes/socks for the measurements. Height (nearest 0.5cm), weight (nearest0.1kg), waist (nearest0.2 cm) and hip circumference (nearest 0.2 cm) were obtained using standardized techniques (15). Blood pressure was measured on the right arm of the participants in a relaxed, sitting position with the arm supported at heart level, using a standard mercury sphygmomanometer. All measurements were done in duplicate and the average was recorded (16).

Biochemical estimations
Blood sampling of the students were performed by a trained phlebotomist by venipuncture after10 to 12 hr overnight fast. Samples were transported to the laboratory in an ice bucket within 2hrs of collection and serum was separated by centrifugation of whole blood for 20 minutes at 2000rpm. Fasting blood measures included serum glucose by glucose oxidase – peroxidase method(17), serum total cholesterol (TC) by cholesterol oxidase peroxidase-aminoantipyrine method(18) and serum triglycerides (TG) by glycerol oxidase peroxidase amino antipyrine method (19) using assay kits from Span Diagnostics Limited in a semi autoanalyzer. High density lipoprotein cholesterol (HDL-C) was determined by cholesterol oxidase peroxidase-amino antipyrine method after precipitation of low density lipoprotein cholesterol (LDL-C) and very low density lipoprotein cholesterol (VLDL-C). LDL-C and VLDL-C were calculated using Friedwald's equation: LDL-C = TC – (HDL-C + TG/5); VLDL-C = TG/5 (18).

Definition and diagnostic criteria used
Metabolic syndrome (MS) was defined according to IDF criteria for MS. According to new IDF definition: for a person to be defined as having MS they must have:: Central obesity (defined as waist circumference $\geq$ 90 cm for males and $\geq$ 80 cm for females) as for Asians and any two of the following four factors: raised triglycerides ($\geq$ 150 mg/dl), reduced HDL-C(<40mg/dl) in males and (<50mg/dl) in females, raised blood pressure; (Systolic BP $\geq$ 130 mm Hg or Diastolic BP $\geq$ 85 mm Hg) and raised fasting plasma glucose ($\geq$ 100 mg/dl) (4).

Statistical analysis
Data were entered into Microsoft Excel spreadsheet (Microsoft, Redwoods, WA, USA) and accuracy was checked. Categorical data was expressed in proportions. Continuous data were checked for normality by Kolmogorov Smirnov Test. Significant P value from this test indicated skewed distribution; so continuous data were expressed in median and inter quartile range (IQR). Analyses were performed using Windows based SPSS software, version 19.0 (Statistical Package for the Social Sciences Inc., Chicago, IL, USA). Demographics were calculated using median and frequencies. Non Parametric Mann Whitney U test was performed to see the overall distribution of values between two independent groups i.e. males and females regarding all anthropometric, clinical and biochemical parameters. Pearson's Chi square tests were used to find out if any difference exists between categorical variables i.e. occurrence of MS components and percentage of individual MS components between males and females.p values $\leq$ 0.05 were considered statistically significant.

RESULTS

Participant information

Participant information on individual MS component along with the differences in the anthropometric, clinical and biochemical parameters between males and females participating in the study are shown in Table 1. Approximately 59% were females (n = 235) and 41% were males (n = 162). Median age of females and males was (20.5 ± 3 yrs) and (20 ± 2 yrs), respectively.

Non parametric Mann Whitney U test between two independent groups revealed significant differences between males and females with respect to age, SBP, DBP and HDL-C (p < 0.05) [Table 1].

Table 1: Distribution of the college students according to anthropometric, clinical and biochemical parameters (N =397)

Parameters	Total (n=397) Median ± IQR	Females (n= 235) Median ± IQR	Males (n= 162) Median ± IQR	p value
Age (years)	20 ± 2	20.5 ± 3	20 ± 2	0.001*
WC (cm)	75.2 ± 13.7	76.2 ± 13.55	74.3 ± 13.74	0.165
SBP (mm Hg)	112 ± 16	110 ± 16	118 ± 14	0.000*
DBP (mm Hg)	70 ± 12	70 ± 14	74 ± 12	0.000*
FBG (mg/dl)	73.91 ± 19.04	75 ± 16.67	73.78 ± 18.54	0.399
HDL-C (mg/dl)	51.82 ± 19.65	54.35 ± 21.46	49.17 ± 17.04	0.000*
TG (mg/dl)	100 ± 54.72	100 ± 55.44	100 ± 64.78	0.051

Values are Median ± Interquartile Range.
Data analyzed using Non Parametric Independent Sample t tests to determine gender differences.
*Significant sex difference at *p ≤ 0.05*

Prevalence of metabolic syndrome

Prevalence of MS among total college students was 4.5% (6% females and 2.5% males). Overall 9.1% students (2.5% males & 13.6% females) had only central obesity while 12.1% of them (3.1% males & 18.3% females) had any one of the components of MS in addition to central obesity as shown in Table 2.

A statistically significant difference between genders with respect to the presence of MS components was revealed by Chi square tests (p ≤ 0.05).

Table 2: Distribution of college students according to prevalence of metabolic syndrome among different genders (N =397)

MS components	Males No. (%)	Females No. (%)	Total No. (%)	Chi square (p value)
None	149 (91.9)	146(62.1)	295(74.3)	χ^2 = 45.565 (p≤0.05*)
Central Obesity	4 (2.5)	32(13.6)	36(9.1)	
Central Obesity + One MS component	5 (3.1)	43(18.3)	48(12.1)	
Central Obesity + Two or more MS components	4(2.5)	14 (6)	18 (4.5)	
Total	162 (100)	235 (100)	397 (100)	

*Data analyzed using Crosstabs Procedure, Pearson Chi Square test for significance. Significant sex difference at *p ≤ 0.05; Females n = 235, Males = 162*

Prevalence of MS of the college students based on individual components

Table 3 shows that a total of 25.7% of the college goers (n = 102) comprising of 89 females and 13 males had the obligatory metabolic component i.e. Central obesity as per IDF criteria for Asians. Of the individual metabolic syndrome components, low HDL had by far the highest prevalence (28.7%).Central obesity had the second highest prevalence (25.7%).14.9% students had hypertriglyceridemia, 13.9% had raised blood pressure and 7.8% had raised fasting blood glucose levels. Hypertriglyceridaemia (p = 0.008) and elevated blood pressure (p = 0.000) were significantly higher in males whereas females had significantly higher prevalence of low HDL (p = 0.000) and central obesity (p = 0.000).

Table 3: Distribution of college students according to individual components of metabolic syndrome

MS components	Males No. (%)	Females No. (%)	Total No. (%)	Chi square (p values)
Reduced HDL	26 (16%)	88(37.4%)	114 (28.7%)	χ^2 = 21.449 (p=0.000*)
Raised Triglyceride	33 (20.4%)	26(11.1%)	59(14.9%)	χ^2 = 6.564 (p = 0.008*)
Raised Blood Glucose	10(6.2%)	21(8.9%)	31 (7.8%)	χ^2 = 1.017 (p = 0.208)
Central Obesity	13 (8.0%)	89 (37.9%)	102(25.7%)	χ^2 = 44.748 (p = 0.000*)
Raised Blood Pressure	40 (24.7%)	15 (6.4%)	55(13.9%)	χ^2 = 26.933 (p = 0.000*)
Total	162	235	397	

Data analyzed using Crosstabs Procedure, Pearson Chi Square test for significance. Significant sex difference at *p < 0.05; Females n = 235, Males = 162

DISCUSSION

Rates of overweight and obesity have escalated rapidly among Indian adolescents (20) who typified typical college going students transitioning from adolescence to young adulthood. Indians, as an ethnic group, are particularly at high risk for MS and central obesity, both forerunners of diabetes, CHD and other "life style" disorders (7, 8, 21).Overweight and obesity significantly contribute to the development of MS among college students (13,22,23). Apparently, no study report is available on the prevalence of MS among college students in Kolkata.

As evident from the present study, prevalence of MS as per IDF criteria among the total college students was 4.5%; however 9.1% students had only central obesity while 12.1% students had any one component of MS in addition to central obesity. Overall MS prevalence observed in our study is similar to the MS prevalence (5-7%)reported by Jadhav et. al. (24) possibly due to similar Asian ethnic composition as well as age range but higher than the MS prevalence reported by Huang et. al. (0.6%) (25), Fernandes et. al (3.7%)(26) and Rashidi et. al. (3.2%)(27).

On the other hand, MS prevalence reported by Keown et. al. (10.0%) (28), Cha et. al.(12%)(29), Tope et al.(12%) (23),Morrell et al (9.9% men and 3 % women)(22) were higher than the results of the present study which may be due to the fact that most of these studies used NCEP-ATP III criteria for diagnosis of MS in which central obesity is not mandatory component (3).A remarkable observation in this study is the lower percentage (9.1%) of students having only the obligatory component of MS i.e. central obesity in comparison to students having any one of the other components in addition to central obesity (12.1%) which differs from earlier studies (22-30) implicating the increasing trend of other components of MS along with central obesity among the college students of Kolkata. Therefore, it may be stated that the students having high central obesity and/or any other MS components are at risk for the development of MS and subsequently they may become the victim of T2DM or CVD.

Furthermore, the present study indicates that females were having significantly (p < 0.05) lower metabolic profile than males corroborating some of the previous studies (26, 27) but differing from some other studies (22, 23), which may be due to the difference in the origin of study population.

Looking at specific components of MS, this study elicited the most prevalent component amongst the female students was central obesity (37.9%) which differs from most of the earlier studies (22-30) whereas, low HDL observed to be the second most predominant MS component (37.4%) amongst them. This finding differs from most of the earlier studies (22-30) which reported low HDL as the most prevalent MS component among female students. High incidence of central obesity among female students have made them at risk of developing metabolic syndrome which may be due to ethnicity or poor awareness or faulty lifestyle or more than any of these factors.

In contrast to females, present study revealed raised BP as the most predominant component of MS in male students (24.7%) which is similar to some earlier studies(22,23,27,28) but differs from the report of Fernandes et.al. (26). Raised TG (20.4%)was the second most prevalent risk factor of MS amongst them, which is similar to report by Rashidi et. al.(27) but differs from most of the earlier studies(22,23,26,27,28). Poor metabolic profile of male students as revealed from our study indicates they can naturally progress to early onset of CVD if not addressed in time.

CONCLUSION

So, it can be concluded that considerably high prevalence of MS or its risk exists among both male and female college students aged 18 to 24 yrs in Kolkata, India. Effective additional screening needs to be implemented to target interventions focusing on risk reduction of MS among this cross-section of the population.

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Conflict of Interest
None

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