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Prevalence of high metabolic syndrome among the college going male youth of North-East India: A cross sectional study in Vadodara

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Abstract
The metabolic syndrome (Mets) is one of the key feature in the pathogenesis of many non communicable diseases. With changing lifestyle and urbanization, the prevalence of metabolic syndrome is increasing across all ages. Scanty information is available regarding the prevalence and various risk factors of Mets among the male youth population of the North East students migrating for Higher Education. The aim of the study is to determine the prevalence of metabolic syndrome among the college male youth (15-29) using International Diabetes Federation (IDF, 2005) guidelines. A cross sectional study design was used to assess the prevalence of metabolic syndrome among college going male youth belonging to the North East Indian States studying in The MS University of Baroda. Anthropometric screening was done for 94 male students. Blood test was carried out to collect information regarding parameters of metabolic syndrome i.e glycemic status, Lipid Profile & Blood pressure measurements. The prevalence of MetS was found 22.34% among the subjects. Of the subjects having MetS, 95% had BMI≥23. Out of total subjects, 19.14% had three components and 3.19% had four components of the metabolic syndrome. As the subjects with metabolic syndrome was greater than 10%, interventions should be focused primarily on intensive lifestyle management to avert the development of diabetes and CVD during the productive years of life.

Keywords: metabolic syndrome, college youth, cross sectional, North East India, male youth

1. Introduction
In 1960s, Several studies have documented the critical association among hypertriglyceridemia, obesity, insulin resistance, glucose intolerance, hypertension and coronary artery diseases (Albrink, *et al*, 1965; Davidson *et al*, 1965) [1, 2]. The concept of metabolic syndrome (MetS) for clustering of these cardiovascular risk factors was reintroduced by Reaven in 1988 (Reaven *et al*, 1988) [3]. It is one of the key feature in the pathogenesis of many noncommunicable diseases (NCDs) like cardiovascular diseases, diabetes and other degenerative processes (Aguilar-Salinas *et al*, 2004; Facchini *et al*, 2001; Haffner *et al*, 1992) [4-6]. MetS is a cluster metabolic factors that are associated with a 2-fold risk of developing CVD and a 5-fold risk of developing diabetes. Individuals with three or more components of MetS have a 30%–40% probability of developing diabetes and CVD within 20 years (Enas *et al*, 2007) [7]. Rapid urbanization and globalization have raised the standard of living of the people. This change in lifestyle has influenced the nutrition transition, which in turn increased the prevalence of metabolic syndrome as well as other chronic diseases (Kelishadi, R. *et al*, 2007) [8]. The prevalence of chronic or noncommunicable diseases are increasing swiftly in developing countries. Obesity is an important risk factor for chronic diseases and plays a crucial role in developing ''insulin resistance'' or ''metabolic syndrome'', which includes hyperglycemia, hypertension, hyperlipidemia, diabetes mellitus and risks of developing cardiovascular disease (Sinaiko AR. *et al*, 2001) [9]. The prevalence of the MetS in the adult population of United States was reported to be more than 25%. It was estimated the prevalence of MetS in seven European countries was almost 23%. Moreover, it was found that around 20%–25% of South Asians have developed MetS. (Nestel *et al*, 2007; Eapen *et al*, 2009) [10-11]. The prevalence of MetS was found 26.9% in males and 18.4% in females in southern India, wherein the prevalence of MetS was higher among males (Chow *et al*, 2008) [12]. In this regard, Increasing MetS prevalence is a growing concern for a country. A little is known about the prevalence of MetS in the NE states of India. Therefore this study was

conducted to assess the prevalence of metabolic syndrome among the male youth of NE sates of India.

2. Materials and Methods
2.1 Study design and participants
A cross sectional study design was used to assess the prevalence of metabolic syndrome among college going male youth belonging to the North East Indian States studying in The MS University of Baroda. Anthropometric screening was done for 94 male students. Blood test was carried out to collect information regarding parameters of Metabolic syndrome i.e glycemic status, Lipid Profile & Blood pressure measurements.

2.2 Ethical committee approval
Consent of the ethical committee was acquired prior to conducting the study (IECHR/2019/8). A written consent was also acquired from the subjects.

2.3 Statistical analysis
According to International Diabetes Federation (IDF, 2005), the diagnosis of metabolic syndrome was made when three or more of the following risk factors were present: waist circumference >94 cm in men, fasting triglycerides ≥150 mg/dl, and HDL cholesterol < 40 mg/dl in men, systolic blood pressure ≥130 mmHg or diastolic blood pressure ≥ 85 mmHg, fasting blood glucose ≥100 mg/dl.

The data was entered into excel and then analyzed using Microsoft excel (2016) and SPSS (IBM SPSS statistics 22). Mean, standard deviation and percentages were calculated for all parameters that were exposed numerically.

3. Results
3.1 Socio-demographic characteristics
Majority of the population i.e. 82.98% were from Manipur and other students were from Arunachal (8.51%), Assam (7.45%) and Nagaland (1.06%). The background information of the subjects was collected using a pre-tested questionnaire through a one-to-one interview and included information on religion, education, socio economic status (SES) and type of family.

The mean age of the subjects was 19.7±1.77 years. Majority of the study population (60.64%) followed Hinduism, while 2.13% of the subjects followed Muslim religion. 5.32% of the total population were Christian and 31.91% were found to be following other religion like Meiteism. Majority of the subjects 87.23% were enrolled in graduation courses in the university, 11% were doing their post graduation and only 1% subjects were doing diploma.

All the subjects were unmarried and almost half of the population (47.87%) lived in nuclear family set up and 42.55% were living in a joint family. Other 9 percentage of the subjects were found to be living in extended family. It was seen that 47.87% subjects were falling under upper class family and 32.98% were belonged to upper middle class family. The remaining 7.45%, 8.51% and 3.19% subjects were belonging to middle class, lower middle class and lower class respectively.

3.2 Family history of diseases among the subjects
The information regarding family history of diseases showed that the family history was highest for diabetes mellitus (25.53%) followed by hypertension (17.02%). The prevalence of cancer, hypo/hyperthyroidism, coronary heart diseases

(CHD) were 4.26%, 4.26% and 2.13% respectively. Other diseases prevailed among the subjects were Asthma (9.57%), stroke (8.51%), kidney stone (3.12%) etc.

3.3 Anthropometric, bio-physical and bio chemical characteristics
The average height of the subjects was 167.25±5.44cm while mean weight was 62.40±10.01 kg. Table 1 shows the mean value of the different components of metabolic syndrome including WC, SBP, DBP, and blood glucose, HDL cholesterol and triglycerides. The mean values of the variables were as follows: waist circumference (WC) 82.32 ± 7.55 cm, Triglyceride 113.51±64.03 mg/dl, HDL-C 43.2 ± 7.93 mg/dl, SBP 123.60 ± 10.36 mmHg, DBP 83.25 ± 7.93 mmHg, fasting blood glucose 81.98 ± 7.46 mg/dl.

3.4 Prevalence of obesity and hypertension among the subjects
The average BMI found was 22.29±3.17 Kg/m2. The overall prevalence of overweight was 14.80% and obesity was 23.43% according to the Asia-Pacific criteria. The average of systolic and diastolic blood pressure was found to be 123.60±10.36 and 83.25±7.93 respectively. The prevalence of hypertension was found 51.06% among the subjects.

3.5 Prevalence of metabolic syndrome among the subjects
The prevalence of MetS was found 22.34% among the subjects. Of the subjects having MetS, 95% had BMI≥23. Prevalence of components of MetS in the population were as follows: central obesity 20.21%, high triglycerides 20.21%, low HDL 41.49%, high blood pressure 51.06%, high FBS 1.06%. The mean value of WC (p<0.01), DBP (p<0.05), BMI (p<0.01), Triglycerides (p<0.01), total cholesterol (p<0.05) were significantly higher among the subjects having MetS. Low HDL-C was the most common metabolic abnormality in the population (Table2). Out of total subjects, 19.14% had three components and 3.19% had four components of the metabolic syndrome (Table3)

Table 1: Anthropometric, bio-physical and biochemical characteristics of the subjects (Mean±SD)

Variables	Mean	SD
Waist circumference	82.32	7.55
Triglycerides	113.51	64.03
HDL cholesterol	43.22	7.93
SBP	123.60	10.36
DBP	83.25	7.93
FBG	81.98	7.46

Table 2: Prevalence of metabolic syndrome among the subjects (N,%) (N=94)

Criteria of metabolic syndrome	Cut – offs	Total (N)	%
Waist circumference	>94 cm	19	20.21
Triglycerides	>150 mg/dL	19	20.21
HDL cholesterol	< 40 mg/dL	39	41.49
Blood Pressure	≥ 130/ ≥85mmHg	48	51.06
FBG	>100 mg/dL	1	1.06

Table 3: Prevalence of frequency of features metabolic syndrome among the subjects (N,%) (N=94) (IDF, 2005)

No. of features of metabolic syndrome	Total (N)	%
One	36	38.30%
Two	27	28.72%
Three	18	19.14%
Four	3	3.19%
None	10	10.63%

4. Discussion

The prevalence of overweight and obesity is increasing swiftly and has doubled since 1980. The impact of overweight and obesity has felt on global scale. Its effects are not only confined to developing countries but also creating an impact on developed countries. Obesity is an important risk factor for chronic diseases and plays a crucial role in developing metabolic syndrome and other chronic diseases. It has been found that the risk of cardiovascular diseases, high blood pressure and diabetes mellitus are higher among younger adults. In the age group of 15-19 years men, the prevalence of overweight/obesity rose 2.8 times in 2015-16, which was higher than the other age groups (NFHS 4, 2015-2016) [13]. Migration and dietary acculturation are found to be important reasons for rise in overweight and obesity, which is directly associated with pathology of metabolic syndrome. Migration within the country or to the other countries of the world influence dietary acculturation and adoption of new lifestyle, attitude and behaviors leading to excess weight gain and increased prevalence of metabolic syndrome.

This study shows that the prevalence of MetS among the male college going students was 22.34%, which is in line with the IDF estimated prevalence among adults of 25% worldwide (O'Neill and O'Driscoll, 2015) [14]. The early development of MetS in adulthood can result in a critical lifetime burden of cardiovascular disease (CVDs) risk as well as other NCDs.

Several studies have reported that prevalence of MetS is increasing at annual rate and the prevalence was found more prominent among men. The gender difference was mainly due to a reduction in the prevalence of abdominal obesity among adult women (Lee. *et al*, 2018) [15]. In our study, the prevalence of abdominal obesity was found 20.21% among the subjects, which could be the one reason for development of MetS. Furthermore, most of the subjects (41.49%) were having low HDL cholesterol, it indicates the possibilities that low serum HDL could be a important marker in identifying early pathology linked with the development of MetS and chronic diseases. The prevalence of hypertriglyceridemia was also seen higher among the subjects i.e. 20.21%. Similarly, a systematic review study conducted in Iran reported that the most frequent component of metabolic syndrome was low HDL cholesterol (59.7%) followed by hypertriglyceridemia (39.5%) (Mazloomzadeh *et al*, 2018) [16]. The prevalence of elevated fasting blood sugar was the only component found lowest (1.06%) among the subjects. Hypertension was found relatively highest among the component i.e. 51.06%. These findings were also reported by other studies conducted in China, Latin America and Russia (Ko GTC *et al*, 2005; Márquez-Sandoval *et al*, 2011; Sidorenkov *et al*, 2010) [17-19] .Around 19.14% of the subjects were seen having three components and 3.19% were having four components of the MetS.

5. Conclusion

This study indicates a high prevalence of metabolic syndrome among college going male youth belonging to the North East, India. Components of MetS such as low HDL and high triglyceride were found common among the subjects compared to others. Percentage prevalence of hypertension was seen highest among the subjects. All the components of metabolic syndrome are positively associated with obesity. Obesity plays a key role in the development of metabolic syndrome, which further promotes onset of many heart diseases as well as diabetes.

Identifying the most common components of MetS at an early stage can reduce the incidence related to metabolic syndrome and subsequent health diseases. In addition to this, implementation of preventive measures to combat metabolic syndrome will reduce the increased health-care costs as well as morbidity and mortality among the population.

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