Original Article

Association of Obesity Indices with blood Pressure Among Undergraduate Medical Students of a Tertiary Care Teaching Hospital: A Cross-Sectional Study

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ABSTRACT

Introduction: Obesity is a known risk factor for various metabolic diseases, including cardiovascular diseases (CVDs) and hypertension. The present study investigated the association between blood pressure and body mass index among MBBS students in a tertiary care teaching hospital of eastern India.

Methods: Observational and cross-sectional study conducted among 325 medical undergraduates. Baseline demographic details was collected using predesigned, pretested self-administered questionnaire. A single resting blood pressure was recorded. Anthropometric measurements were done and body mass index, waist circumference, hip circumference and waist-hip ratio were recorded.

Results: The mean age of the study participants was 21.45 ± 2.87 years, with 58.5% being males. 15.1% of the study participants had a positive family history of hypertension. The prevalence of obesity and overweight were 11.1% and 16% respectively. Based on waist circumference measurements, 29.2% were found to have central obesity and 26.4% had truncal obesity. Obesity indices were comparable between male and female students. Mean systolic blood pressure was found to have significant positive correlation with age (r=0.231, p=0.041), BMI (r=0.631, p=0.002), and waist circumference (r=0.497, p<0.001). Mean diastolic blood pressure was positively correlated with positive family history of hypertension (r=0.522, p<0.001), BMI (r=0.474, p=0.001) and waist circumference (r=0.276, p=0.032).

Conclusion: Our study observed a high prevalence of obesity among young medical students. Spreading awareness among medical students, monitoring blood pressure, and implementing weight-control strategies that include dietary restrictions and lifestyle changes would be imperative to contain the growing epidemic of noncommunicable diseases developing among the younger population.

Keywords: Obesity, Blood pressure, Lifestyle modifications, Weight control, Diet restriction.

INTRODUCTION

The prevalence of general obesity is increasing globally both in developing and developed nations.[1] The WHO reports that in 2014, 11% of men and 15% of women who are 18 years of age and older were obese.[2] Obesity is a known risk factor for various metabolic diseases, including cardiovascular diseases (CVDs) and hypertension. On the other hand, hypertension is a significant global public health issue. Hypertension, referred to as a "silent killer", increases the risk of cardiovascular diseases and related mortality.[3] Independently, obesity and hypertension has not only been implicated to predispose young individuals to higher risk of developing CVDs in the later part of their lives,[4] and also increase the risk of all-cause mortality and cardiovascular-related deaths.[5] In fact, the World Health Organization (WHO) recently emphasized the significance of blood pressure regulation given that millions of people worldwide suffer from CVD, accounting for 31% of the global population, with 80% of these people experiencing heart diseases or stroke. [6]

India is undergoing both epidemiological and nutritional transition. Rapid urbanization and adopting westernization in cities often increase unhealthy lifestyle behaviours including sedentary lifestyle, and intake of energy-dense food.[7] Prior evidences highlight an increasing trend in lifestyle disorders in association with obesity, and consequent dyslipidemia and metabolic syndrome, including hypertension among different populations of India. [4,7,8] Young adults in the age group of 18-25 years, is vulnerable to lifestyle disorders owing to the start of their adulthood, along with more relaxation of parental supervision, and financial independence at times. A high prevalence of overweight and obesity was observed among North East students moving to Gujarat for higher education at 16.67% and 18.45%, respectively.[7] According to studies, during the past 10 years, the prevalence of hypertension in young adults has grown dramatically while the age at which it first manifests itself has lowered.[9] younger adults with a body mass index (BMI) of more than 30 kg/m^2 had a five times higher prevalence of hypertension than those with a BMI of less than 20 kg/m^2.[10] The increasing prevalence of hypertension in young adults and associated complications

have been attributed to a complex interplay between genetic and environmental risk factors. [11]

In the light of limited evidence on obesity and hypertension on young adults in recent times from this part of the country, the present study investigated the association between blood pressure and body mass index among MBBS students in a tertiary care teaching hospital of eastern India.

MATERIALS AND METHODS

Study design and study population:

The present work was an observational study of cross-sectional study design conducted in the Department of Physiology Darbhanga Medical College and Hospital, Laheriasarai, Bihar, India among the undergraduate medical students for a period of 6 months from October 2021 to March 2022. All those with chronic illness such as known hypertension, diabetes, hypothyroidism, liver disorder, renal diseases were excluded from the study.

Sample size

In a study by Chenji et al. [12] the combined prevalence of overweight and obesity among medical undergraduate students was 25.6%. Using these figures along with 95% level of confidence and 5% error margin, the minimum sample size was calculated to be 293.

Ethical approval

The study was initiated after obtaining approval from the Institutional Ethics Committee of the and permission from head of the concerned institution.

Study procedure:

All students present on the days of conduct of the study were invited to participate after explaining the purpose and procedure of the study. They were ensured on anonymity and confidentiality of the data provided by them. A total of 325 MBBS students of different semesters provided written informed consent and were included in the study. Baseline demographic details was collected using predesigned, pretested self-administered questionnaire.

Measurement of blood pressure: Resting BP (systolic and diastolic) were measured after a sitting rest of 15-30 minutes by using mercury sphygmomanometer in sitting posture. [13]

Measurement of obesity indices: Weight and height were measured in accordance with National Health and Nutrition Examination Survey (NHANES) anthropometric measuring guidelines with help of weighing machine and stadiometer. [14] Waist circumference (WC) was measured at level of umbilicus and hip circumference (HC) was measured at maximum protrusion of hip in standing position in centimeters with heals together at linen measuring tape. Three measurements were taken for each site and average score recorded as final. [15]

Body mass index (BMI) was calculated for each student from their weight and height recordings. The Asian classification was followed in our study and subjects with BMI of 25 kg/m^2 or greater were considered as overweight and those with BMI 30 kg/m^2 or greater were considered as obese. [15]

Those with ***waist circumference (WC)*** of more than 90 cm in males and more than 80 cm in females were considered to have central/abdominal obesity. [16] ***Waist-hip ratio (WHR)*** was calculated using WC and HC, and WHR of 0.90 or greater in males and 0.85 or greater in females corresponded to truncal obesity. [16]

Data analysis: Statistical analysis was done using Statistical Package for Social Sciences (SPSS) version 17.0 (IBM Corp., Illinois, Chicago). The mean and standard deviation was calculated for quantitative data. Categorical variables were expressed in proportions. Spearman's correlation and Chi-square statistics were used to test for association between various obesity indices and blood pressure. A p-value <0.05 was considered as statistically significant.

RESULTS

Out of 325 students, 190 (58.5%) were males and the remaining 135 (41.5%) were females. The mean age of the study participants was 21.45 ± 2.87 years, with 38.8% being below 20 years of age. 15.1% of the study participants had a positive family history of hypertension.

The proportion of students who were obese was 11.1% (n=36), while 16% were overweight (n=52) and the remaining 72.9% had BMI in the normal range. (Figure 1) The mean BMI was 24.65 ± 54.39 kg/m^2 and was comparable between males and females (p=0.589).

Based on waist circumference measurements, 25.2% of females (n=34) and 32.1% of males (n=61) were found to have central obesity; accounting for an overall proportion of 29.2% among 325 study participants. (Figure 2) The distribution of central obesity between male and female students was statistically comparable (p=0.176).

Similarly, 26.4% of the study participants (n=86) had WHR greater than defined gender-specific cut-off values indicating truncal obesity. (Figure 2)

The mean systolic blood pressure was 125.50 ± 13.64 mm Hg and mean diastolic BP was 82.15 ± 6.77 mm Hg.

Mean systolic blood pressure was found to have significant positive correlation with age (r=0.231, p=0.041), BMI (r=0.631, p=0.002), and waist circumference (r=0.497, p<0.001). (Table 1) Mean diastolic blood pressure was positively correlated with positive family history of hypertension (r=0.522, p<0.001), BMI (r=0.474, p=0.001) and waist circumference (r=0.276, p=0.032). (Table 1)

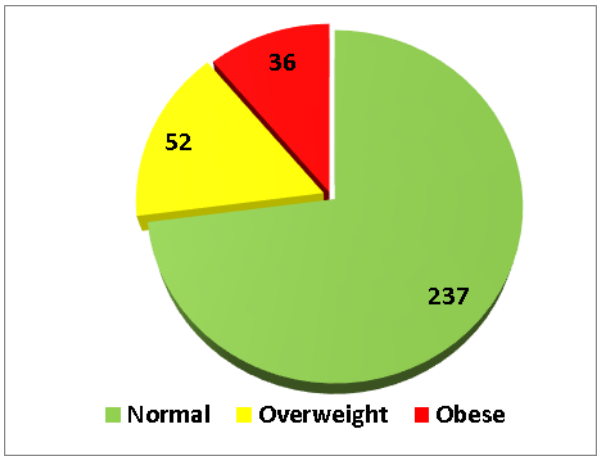

Figure 1: Distribution of study participants according to BMI categories (N=325)

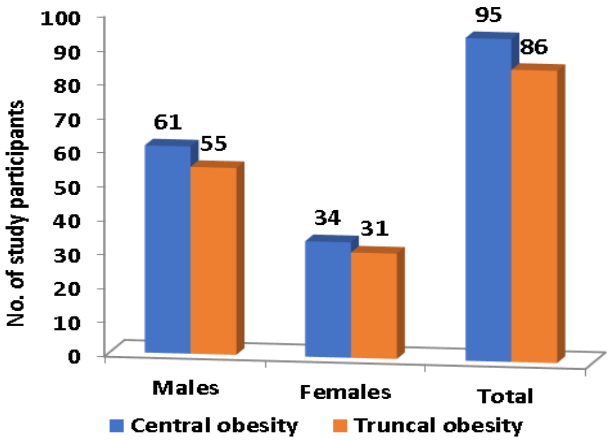

Figure 2: Composite bar diagram showing distribution of study participants according to gender, central obesity and truncal obesity (n=325)

Table 1: Correlation between mean SBP and DBP with various parameters (n=325)

Parameters	Systolic blood pressure		Diastolic blood pressure	
	Spearman's correlation coefficient	p-value	Spearman's correlation coefficient	p-value
Age	0.231	0.041*	0.357	0.106
Family history of hypertension	0.435	0.127	0.522	<0.001*
BMI	0.635	0.002*	0.474	0.001*
WC	0.497	<0.001*	0.232	0.032*
WHR	0.324	0.319		

DISCUSSION

The present study provides descriptive data on 325 undergraduate medical students, between 18-25 years of age. of a university college. Among the 325 students, 36 (11.1%) were obese, while 52 (16.0%) were overweight, with a combined prevalence of 27.1% according to the WHO BMI classification for Asian population. Also, 29.2% of our study participants had abdominal obesity and 26.4% had truncal obesity. Study by Chenji et al. [12] in South India on 434 undergraduate medical students, reported the prevalence of obesity and overweight to be 7.6% and 18% respectively. Similarly, another study by Dantu et al. [17] on 263 undergraduate students, the combined prevalence of overweight and obesity was 19.6%. Furthermore, study from Pune, India by Fernandez et al. [18], reported the prevalence of overweight and obesity to be 13.2%, which was less than the 27.1% prevalence of overweight and obesity in the present study. While the present study observed similar distribution of overweight and obesity between male and female students, Dantu et al. [17] reported a significantly higher figures in males as compared to female students.

Higher prevalence of general obesity and abdominal obesity was noted in our medical undergraduates as compared to that by Ali et al. [19] in Bangladesh, reporting 8.3% general obesity and 20.7% abdominal obesity. Their study also observed significantly higher prevalence of general and abdominal obesity among females as compared to males. [19] Similarly, study among medical students in Malayasia also had lower proportion of obesity as compared to our study participants. [20] But studies also reported 22.0% prevalence of obesity among dental students and other university students.[21,22] The difference in prevalence might be attributed to the differences in the location of the studies, lifestyles, and different assessment methods, in addition to the participants being day scholars or residing in hostels.

Since the present study measured blood pressure of the participating students once only, we did not categorize the students as hypertensive or non-hypertensive based on this measurement. However, for ethical reasons, a repeat measurement was done for those who had high BP recording in the first instance and if the second reading was also consistently high, then the students were referred to the internal medicine department of the same medical college and hospital for further investigation and management. Therefore, the present study analysis the measurements of SBP and DBP as continuous variables and tested for correlations of the same with various parameters of age and obesity indices.

Significant correlations were observed between blood pressure and age, BMI, waist circumference and waist-hip ratio. Similar observations were reported by Gandhi et al. [13] among medical students in a teaching college and hospital of North India. Our findings were supported by the study by Mark et al. [23] which reported a positive correlation between prevalence of elevated BP and increasing adipose tissue. Fuchus et al. [24] observed that prediction of the incidence of HTN was even better with the correction of waist by stature or hip circumference than that of BMI. In consistence with our observations, Ghosh et al. [25] reiterated that both SBP and DBP as continuous variables have stronger correlations with BMI and WC than with other anthropometric indices. A significant positive correlation of BMI with SBP and DBP was earlier reported by many investigators. [26,27]

BMI is a widely accepted indicator for nutritional status in adults. Also, obesity is a well-established risk factor for various cardiovascular conditions including hypertension, which usually tends to become refractory to treatment. [28] Despite being obese, there remains chances that individuals are deficient at the micronutrient level which needs further exploration in similar study groups. Also, other parameters such as diet, sleep habits, screen time, physical activity and stress level are important identified factors that were not taken up in the present study.

CONCLUSION

The high prevalence of obesity among young medical students is alarming. Such concern increases the risk of individuals to future morbidities and risk of cardiovascular diseases. Spreading awareness among medical students, monitoring blood pressure, and implementing weight-control strategies that include dietary restrictions and lifestyle changes would be imperative to contain the growing epidemic of noncommunicable diseases developing among the younger population.

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REFERENCES

1. Ali N, Mahmud F, Akter SA, et al. The prevalence of general obesity, abdominal obesity, and hypertension and its related risk factors among young adult students in Bangladesh. J Clin Hypertens (Greenwich). 2022;24(10):1339-1349. doi:10.1111/jch.14560
2. WHO. Global Status Report on Noncommunicable Diseases 2014. World Health Organization; 2014.
3. Bonita R, De Courten M, Dwyer T, Jamrozik K, Winkelmann R. Surveillance of risk factors for noncommunicable diseases: the WHO STEPwise approach: summary. Published online 2001.
4. Mishra S, Murry B, Devi NK, Tripathi S, Suokhrie S. Obesity in dyslipidemia and hypertension: A study among young adults of Delhi/NCR. Clinical Epidemiology and Global Health. 2023 Jun 10:101335.
5. Prospective Studies Collaboration. Body-mass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies. Lancet. 2009; 373(9669): 1083-1096.
6. Landi F, Calvani R, Picca A, et al. Body Mass Index is Strongly Associated with Hypertension: Results from the Longevity Check-up 7+ Study. Nutrients. 2018;10(12):1976. doi:10.3390/nu10121976
7. Baro J, Dhruv S, Iyer U, Venugopal S, Gandhi D, Agnihotri S, Suterwala B. Prevalence of cardiometabolic risk factors among the students of North-east India: a cross sectional study in Vadodara. TPI. 2021;10(6):384-9.
8. Mishra D, Longkumer I, Saraswathy KN, Rupalika, Devi NK. Obesity and dyslipidemia among Bhil tribal population: A cross-sectional study from India. International Journal of Diabetes in Developing Countries. 2022 Jan;42(1):116-25.
9. Battistoni A, Canichella F, Pignatelli G, Ferrucci A, Tocci G, Volpe M. Hypertension in young people: epidemiology, diagnostic assessment and therapeutic approach. High Blood Pressure & Cardiovascular Prevention. 2015 Dec; 22:381-8.
10. Rabkin SW, Leiter L, Reeder BA, Chen Y, Liu L. Risk factor correlates of body mass index. Canadian Medical Association. Journal. 1997 Jul 1;157(1): S26.
11. Waken RJ, de Las Fuentes L, Rao DC. A review of the genetics of hypertension with a focus on gene-environment interactions. Current hypertension reports. 2017 Mar; 19:1-8.
12. Chenji SK, Rao CR, Sivanesan S, Kamath V, Kamath A. Cross-sectional analysis of obesity and high blood pressure among undergraduate students of a university medical college in South India. Family Medicine and Community Health. 2018 May 1;6(2):63-9.
13. Gandhi S, Sorout J, Raina R, Raina A, Miglani U, Manchanda K, Reddy S. Association between Blood Pressure and Obesity Indices in Medical Students. Journal of Clinical & Diagnostic Research. 2020 Aug 1;14(8).
14. National Health and Nutrition Examination Survey (NHANES)-Anthropometry Procedures Manual, January 2007.
15. William D McArdle, Frank I Katch. Essentials of Exercise physiology 2nd edition, Lippincott William & Wilkins. 2000.
16. Report of a WHO expert consultation on waist circumference and waist hip ratio. [accessed 2023 July 20]. Available from: http:// whqlibdoc.who.int/publications/2011/9789241501491_eng.pdf; 2011.
17. Dantu P, Ujwala U. Influence of certain factors on overweight and obesity among undergraduate medical students at Vizianagaram. Int J Recent Trends Sci Technol 2012; 5:38–42.
18. Fernandez K, Singru SA, Kshirsagar M, Pathan Y. Study regarding overweight/obesity among medical students of a

teaching hospital in Pune, India. Med J DY Patil Univ 2014; 7:279–83.

19. Ali N, Mahmud F, Akter SA, Islam S, Sumon AH, Barman DN, Islam F. The prevalence of general obesity, abdominal obesity, and hypertension and its related risk factors among young adult students in Bangladesh. The Journal of Clinical Hypertension. 2022 Oct;24(10):1339-49.
20. Gopalakrishnan S, Ganeshkumar P, Prakash MV, Amalraj V. Prevalence of overweight/obesity among the medical students, Malaysia. The Medical Journal of Malaysia. 2012 Aug 1;67(4):442-4.
21. Singh A, Purohit B. Physical activity, sedentary lifestyle and obesity among Indian dental professionals. J Phys Act Health 2012; 9:563–70.
22. Peltzer K, Pengpid S, Samuels TA, Ozcan NK, Mantilla C, Rahamefy OH, et al. Prevalence of overweight/obesity and its associated factors among university students from 22 countries. Int J Environ Res Public Health 2014; 11:7425–41.
23. Mark AL, Correia M, Morgan DA, Shaffer RA, Haynes WG. Obesity induced hypertension: New concepts from the emerging biology of obesity. Hypertension. 1999; 33:537-41.
24. Fuchs FD, Gus M, Moreira LB, Moraes SR, Wiehe M, Pereira GM. Anthropometric indices and the incidence of hypertension: A comparative analysis. Obes Res. 2005; 13:1515-17.
25. Ghosh JR, Bandyopadhyay AR. Comparative evaluation of obesity measures: Relationship with blood pressures and hypertension. Singapore Med J. 2007; 48:232-35.
26. Cassani Roerta SL, Nobre F, Pazin-Fiho A, Schmidt A. Relationship between blood pressure and anthropometry in a cohort of Brazilian men: A cross-sectional study. Am J Hypertens. 2009; 22:980-84.
27. Wang H, Cao J, Li J, Chen J, Wu X, Duan X, et al. Blood pressure, body mass index and risk of cardiovascular disease in Chinese men and women. BMC Public Health. 2010;10:189.
28. Shariq OA, McKenzie TJ. Obesity-related hypertension: a review of pathophysiology, management, and the role of metabolic surgery. Gland Surg. 2020;9(1):80-93.

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Erratum w.e.f. March 09, 2024*: In the January 2024 (84-1) issue, article no 21, page number 130, one of the co-author name is corrected. Co-author name "Alok Kumar" is corrected to "Alok Himanshu".*