



RESEARCH ARTICLE

Prehypertension and hypertension among the medical students of public medical colleges in Dhaka, Bangladesh: A cross-sectional study

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ABSTRACT

Background: Prehypertension and hypertension are the leading risk factors for cardiovascular diseases and are increasingly prevalent among young adults. This study aimed to assess the prevalence of prehypertension and hypertension among medical students of public medical colleges in Dhaka city, Bangladesh.

Methods: This cross-sectional study was done among 293 medical students of four public medical colleges in Dhaka city. Data on age, sex, physical activity, smoking, alcohol consumption, height, weight, and blood pressure were obtained. Systolic blood pressure (SBP) of 120–139 mmHg or diastolic blood pressure (DBP) of 80–89 mmHg was considered prehypertensive, while SBP \geq 140 mmHg or DBP \geq 90 mmHg was classified as hypertensive.

Results: The average age was 21.6 years. More than one-fourth (28.0%) were prehypertensive, and 4.8% were hypertensive. Multinomial logistic regression identified male sex (adjusted odds ratio, 4.6; 95% confidence interval, 2.5–8.3) and overweight (aOR 2.0; 95% CI 1.1–3.5) as the risk factors of prehypertension. For hypertension, the risk factors were male sex (aOR 9.7; 95% CI 2.3–42.0), ever alcohol consumption (aOR 18.0; 95% CI 1.3–249.8), and overweight (aOR 6.6; 95% CI 1.3–32.6).

Conclusion: We report that one-third of the medical students have prehypertension and hypertension. Overweight and alcohol consumers should be considered for targeted intervention.

Keywords: prehypertension, hypertension, risk factors, medical students, Bangladesh

INTRODUCTION

High blood pressure (BP) or hypertension is a major risk factor for cardiovascular diseases (CVDs), playing a significant role in global morbidity and mortality.^{1,2} The prevalence of hypertension is increasing worldwide, with two-thirds of affected individuals living in low- and middle-income countries (LMICs), including Bangladesh.² Both hypertension and prehypertension contribute substantially to the global burden of disease,³

whereas prehypertension alone is responsible for nearly 60% of strokes and approximately 50% of ischaemic heart diseases.⁴

Various modifiable risk factors for hypertension have been identified, such as unhealthy diets, physical inactivity, tobacco and alcohol consumption, high body mass index (BMI), and poor socioeconomic conditions. Non-modifiable risk factors include a family history of hypertension, age over 65 years, and co-existing chronic conditions such as diabetes or kidney disease.²

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HIGHLIGHTS

1. More than one-fourth of the medical students were prehypertensive, and 4.8% were hypertensive. None of them were taking any hypertensive drugs.
2. Male students had higher blood pressure than females.
3. Being male, overweight and ever alcohol consumers were found more likely to have hypertension.

While hypertension has traditionally been a major concern among adults aged 35 and above, recent evidence indicates an increasing trend among younger adults under 35. High BP in young adults can lead to serious health issues later in life. Medical students, due to the demanding nature of their academic curriculum and lifestyle, may be particularly susceptible to developing high BP.³ Stress, sedentary behaviours, and unhealthy dietary habits during intense academic periods can contribute to this vulnerability. Early identification of hypertension or prehypertension and its associated behavioural factors in this group is crucial, as it could inform targeted treatment plans, reducing the risk of future health complications. This study aimed to assess the prevalence of prehypertension and hypertension among medical students in public medical colleges in Dhaka, Bangladesh. Additionally, we observed the factors associated with high blood pressure (prehypertension and hypertension) among the respondents.

METHODS

Study design and subject recruitment

This cross-sectional study was done across all four public medical colleges in Dhaka City, Bangladesh: Dhaka Medical College, Sir Salimullah Medical College, Shaheed Suhrawardy Medical College, and Mugda Medical College, from September to November 2022. Seven hundred and thirty-five students are enrolled in each academic session.⁵ For this study, third-year students were selected, and 445 were conveniently approached (based on their presence on the day of data collection) based on a sample size calculation with an unknown prevalence of high BP plus a 15% buffer adjustment. Ultimately, 293 students participated in the study.

Data collection

A thorough briefing was given to the participants in a hall room on how to complete it, specifically on responding to the behavioural factors. They were then given a self-administered questionnaire, which included questions on background and behavioural risk factors (such as added salt, physical activity, smoking, and alcohol consumption). Participants completed the questionnaire in the hall room with ample time and ensuring privacy. Height, weight, and BP were measured among those who completed the questionnaire. A female investigator took measurements of female students.

Ascertainment of key variables

Smoking status was classified as "ever smoker" (including current smokers or those who quit in the 30 days prior to the study) and "never smoker".⁶ Similarly, alcohol consumption was categorised as "ever drinker" or "never drinker". Those who engaged in activities that elevated their heart rate or breathing for at least 10 minutes, such as walking, running, or vigorous exercise, were considered physically active. Height was measured in centimetres using a measuring tape while participants stood upright without shoes. Weight was recorded in kilograms using a digital scale without shoes or extra items. Overweight was defined as a body mass index (BMI) of ≥ 25 kg/m².⁷

BP was measured with a digital BP machine (Model: JUMPER, JPD-HA200) using an average-sized cuff while participants were seated. Two readings were taken five minutes apart, and their mean was calculated. Participants with a systolic blood pressure (SBP) of 120–139 mmHg or a diastolic blood pressure (DBP) of 80–89 mmHg were considered prehypertensive. SBP ≥ 140 mmHg or DBP ≥ 90 mmHg or currently taking antihypertensive medication were classified as hypertensive.⁸

Ethical issues

Before commencing the interviews, informed written consent was obtained from every participant that outlined the study's objectives, procedures, potential benefits, risks of participation, the right to refuse or

withdraw from the study, and the confidential handling of their data, including the identity of the principal investigator.

Data cleaning and statistical analysis

We entered and cleaned the data in Excel. During our observations, we noticed that the reported data on added salt intake might contain errors made by the respondents. As a result, we decided to exclude the added salt intake data from the final analysis. Categorical data, such as sex, physical activity, smoking, alcohol use, and overweight, were described using numbers and percentages. Quantitative data (age, BMI, SBP, and DBP) were described using means and standard deviations. Multinomial logistic regression was performed to obtain adjusted odds ratios (aOR) and their 95% confidence intervals (CI) for prehypertension and hypertension, controlling for other variables in the model. The reference category for the dependent variable was “normal”. The factors considered were age, sex, physical inactivity, smoking history, alcohol use history and overweight status. All factors were entered into the model simultaneously. Age was treated as a continuous variable (a biological adjustment variable because the age range was very narrow), while other factor variables were categorised as 1 and 0 (reference) in the model. $P < 0.05$ was considered statistically significant. Data analyses were performed using JAMOVI (version 2.3.26), an open-source graphical user interface for the R programming language.

RESULTS

The average age of the participants was 21.6 (standard deviation 0.7) years. The mean (standard deviation) BMI was 23.6 (3.8) kg/m², with 53.6% being overweight. The mean (standard deviation) SBP and DBP were 115.4 (11.0) and 73.9 (8.6) mmHg, respectively. Men had higher SBP and DBP compared to women. One-third (33.1%) reported being physically inactive, and women were more inactive than men. Around 6% and 3% were ever smokers and alcohol users, respectively (TABLE 1). Around three in every ten participants (28.0%) were prehypertensive, and 4.8% were hypertensive, which was higher in men (FIGURE 1). Notably, none of the participants were taking antihypertensive medications.

The multinomial logistic regression identified male sex (aOR 4.6; 95% CI 2.5–8.3) and overweight (aOR 2.0; 95% CI 1.1–3.5) as risk factors for prehypertension. Being men (aOR 9.3; 95% CI 2.1–40.0), ever alcohol consumption (aOR 23.3; 95% CI 1.8–296.7), and being overweight (aOR 6.6; 95% CI 1.3–32.6) were risk factors of hypertension (TABLE 2).

TABLE 1 Background, behavioural and anthropometric information of students of four public medical colleges, Dhaka city (n=293)

Characteristics	Total (n=293)	Men (n=135)	Women (n=158)	P
	n (%)	n (%)	n (%)	
Body mass index (kg/m ²) ^a	23.6 (3.8)	23.8 (4.0)	23.4 (3.6)	0.30
Systolic blood pressure (mmHg) ^a	115.4 (11.0)	120.4 (11.0)	111.1 (9.0)	<0.001
Diastolic blood pressure (mmHg) ^a	73.9 (8.6)	76.8 (9.0)	71.3 (7.3)	<0.001
Physically inactive ^b	97 (33.1)	26 (19.3)	71 (44.9)	<0.001
Ever smoker ^c	18 (6.1)	14 (10.4)	4 (2.5)	0.01
Ever alcohol drinker ^{d,e}	8 (2.7)	4 (3.0)	4 (2.5)	0.99
Overweight (BMI ≥ 25.0 kg/m ²)	157 (53.6)	76 (56.3)	81 (51.3)	0.39

^amean (standard deviation); P for Mann-Whitney U test.

^bwho engaged in activities that elevated their heart rate or breathing for at least 10 minutes, such as walking, running, or vigorous exercise, were considered physically active, others are physically inactive

^cwho currently smoke tobacco or those who quit in the 30 days prior to the study

^dwho currently drink alcohol or those who quit in the 30 days prior to the study

^eFisher's exact test

DISCUSSION

This study revealed that one-third of medical students had prehypertension and hypertension. Male students were more likely to have prehypertension and hypertension compared to female students. Other factors identified are overweight and alcohol consumption. Our findings comply with the study conducted in 2017 among first-year private medical students: 32% being prehypertensive and 7% being hypertensive.⁹ Another study reported that 48% of university students had high blood pressure.¹⁰ The sex difference found in our study is consistent with a study on trainee doctors in Bangladesh, indicating higher hypertension rates among men,¹¹ although large national studies (such as STEPS and DHS) contravene these findings.^{12, 13, 14}

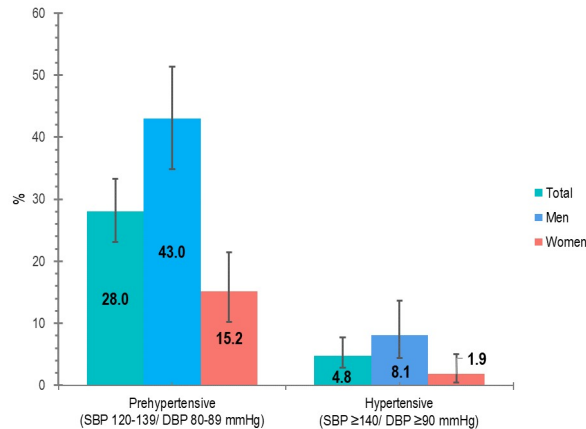


FIGURE 1 Prevalence of prehypertension and hypertension of students of four public medical colleges, Dhaka city (n=293)

None of the participants were taking antihypertensive medications despite being medical students. This might be because their hypertension was mild. Our findings on smoking and alcohol consumption were quite low compared with the study among Bangladeshi trainee physicians¹⁵, which may be due to age differences. However, a study conducted in Nepal among third-year medical students showed higher rates of smoking (20%) and alcohol consumption (51%).¹⁵ Our findings regarding physical inactivity align with findings among medical students in Kolkata¹⁶ and nurses in Bangladesh.¹⁷ We observed that the percentage of overweight medical students was 54%, which aligns

TABLE 2 Risk factors associated with prehypertension and hypertension identified using a multinomial logistic regression analysis (n=293)

Factors	Prehypertension vs. Normal	Hypertension vs. Normal
	aOR (95% CI)	aOR (95% CI)
Men (Ref. women)	4.6 (2.5–8.3)**	9.3 (2.1–40.0)*
Physically inactive (Ref. active)	0.6 (0.3–1.2)	1.1 (0.3–4.1)
Ever smoker (Ref. never)	0.5 (0.1–2.0)	0.6 (0.1–6.1)
Ever alcohol drinker (Ref. never)	2.8 (0.4–22.8)	23.3 (1.8–296.7)*
Overweight (Ref. Normal)	2.0 (1.1–3.5)*	6.6 (1.3–32.6)*

*P < 0.05; **P < 0.001; aOR indicates adjusted odds ratio; CI indicates confidence interval
All factors were entered into the model simultaneously and age was considered as quantitative variable

with one Bangladeshi study conducted among physicians.¹¹ However, the prevalence was higher, 20%¹² and 27%¹⁸, in other Bangladeshi studies. Overweight and alcohol consumption predispose people to have increased blood pressure.^{11, 19}

Contrary to expectations, we did not find any association with physical activity or smoking. This could be due to measurement bias, such as under-reporting, as the data collection was self-administered. We could not use added salt data because of quality concerns. Therefore, the study's findings should be interpreted with caution. Additionally, the sample only included public medical colleges in Dhaka City, which may limit generalizability.

Finally, the alarming prevalence of prehypertension among medical students highlights the pressing need for targeted health interventions. If not intervened appropriately, these pre-hypertensives will become hypertensives over time. The nation's target to reduce hypertension prevalence by 25% by 2030, as outlined in the NCDs Global Monitoring Framework,²⁰ must be achieved.

Conclusion

We report that one-third of medical students in Dhaka city have a high prevalence of prehypertension and hypertension. Targeted interventions should address alcohol consumption and obesity. Periodic medical student check-ups might contribute to the early detection of cases. A carefully designed study on dietary salt is needed.

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Author contributions

Conception and design: SSA, MMHK. *Acquisition, analysis and interpretation of data:* SSA, RB, MMHK. *Manuscript drafting and critical revision:* SSA, RB, RP, RT, KF, MMHK. *Approval of the final version of the manuscript:* SSA, RB, RP, RT, KF, MMHK. *Guarantor of accuracy and integrity of the work:* SSA, RB, MMHK.

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Conflict of interest

We do not have any conflict of interest.

Ethical approval

This study was conducted following the approved protocol from the Institutional Review Board of BSMMU (Ref: BSMMU/2022/8692 Date of issue-31/08/2022).

Data availability statement

We confirm that the data supporting the findings of this study will be shared upon reasonable request.

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