

Association between Body Mass Index and Blood Pressure in Young Adult Students: A study in a tertiary care hospital, Dhaka, Bangladesh

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Abstract

Original Research Article

Introduction: Body mass index (BMI) is positively associated with blood pressure (BP); this Association has critical implications for countries like Bangladesh, where hypertension is highly prevalent and obesity is increasing. A greater understanding of the association between BMI and BP is required to determine its effect and develop strategies to mitigate it. **Objective:** Association between body mass index and blood pressure in young adult students of BICH. **Methods:** In this cross-sectional study, data were collected at 1 time point from 99 young adults' students aged (aged 18-32 years) from the department of physiology. The study was conducted between January 2018 and January 2019. A comprehensive subgroup analysis was performed based on covariates, and within each subgroup, linearly regressing BMI to BP. **Key Outcome and Measures:** Measurement was taken including height weight, resting radial arterial pulse, resting brachial artery blood pressures (SBP, DBP) and calculated Pulse and mean pressure by applying appropriate procedures in young adult students of BICH. **Results:** The study included 99 participants (52 Male and 47 female; mean [SD] age, 21.5 (2.08) years. Among the study sample, the mean (SD) BMI was 22.62 (3.6), the mean (SD) systolic BP was 120.87 (11.72) mmHg, and the mean (SD) diastolic BP was 79.92 (7.20) mmHg. The association between BMI and BP was substantially weaker in subgroups of patients taking antihypertensive medication compared with those who were untreated. In untreated subgroups, 95% of the coefficients varied by less than 1mmHg/(kg/m²). Comparison between normal status and pre-hypertension + stage 1 hypertension was highly significant (p<0.007). Regarding BMI<18.4 in gender, it was statistically significant in normal status and pre-hypertension + stage 1 hypertension (p=0.018). The association between BMI and BP is positive across the young adult's students in BICH. There has a greater impact of the Non communicable diseases by the association and also in the public health in Bangladesh.

Keywords: Body Mass, Blood Pressure.

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INTRODUCTION

Body mass index is positively and independently associated with morbidity and mortality from hypertension, cardiovascular disease, type II diabetes mellitus, and other chronic diseases [1]. In Caucasian populations, a strong association has been depicted between BMI and mortality [2, 3]. A similar association has also been demonstrated among Asian populations [4,5] According to the WHO, hypertension has become a significant health concern in the Asian region, affecting more than 35 % of the adult population[6]. The global prevalence of hypertension is projected to increase from 26 % in 2000 to 29.2 % by 2025[7]. Bangladesh, a developing country in South

Asia, has been experiencing an epidemiologic transition from communicable diseases to NCDs [8]. In recent years, rapid urbanization, increased life expectancy, unhealthy diet, and lifestyle changes have led to an increase in the rate of CVD including hypertension in Bangladesh [9]. Body mass index (BMI) is a measure of the human body weight in relation to the height, calculated by dividing the weight of a person in Kg by the square of the height in meters [10]. The WHO [11] classifies BMI as normal (18.5–25 kg/m²), overweight (26–30 kg/m²), and obese (>30 kg/m²). BP is the pressure of the resistance of blood flow against the walls of the arteries. Systolic blood pressure (SBP) is the top number refers to the amount of pressure in your arteries during contraction of your

heart muscle. Diastolic pressure, however, is the pressure required to allow constant flow in the blood vessels and filling of the ventricles before the next systole [12]. Obesity, its attendant health consequences and consequent health burden, is expected to reach epidemic proportions in developing countries like India [13]. An increase in the dimension of this problem has been reported in the high socio-economic group in India. A study in Delhi revealed even higher prevalence (32-50%) of overweight (body mass index (BMI) >25) among adults belonging to high income group as compared with 16.2-20% in those belonging to middle income group.

Objectives

General Objective

To observe the association between BMI and blood pressure in young adult students of Bangladesh institute of child health (BICH)

Specific Objectives

To measure height and weight in young adult students of Bangladesh institute of child health (BICH). To measure resting radial arterial pulse, resting brachial artery blood pressures (SBP, DBP) and calculated Pulse and mean pressure by applying appropriate procedures in young adult students of Bangladesh institute of child health (BICH).

MATERIALS & METHODS

This is a cross sectional study which was conducted in department of physiology in BICH from January 2018 to January 2019. A total of 99 students have participated in the study. In the study, Participants age was selected from students who have age between 18 years to 32 years of age. 47 Female and 52 Male participated in the study. On enrollment, participants were screened for high risk of cardiovascular disease using measurements including weight, height, and systolic blood pressure, diastolic blood pressure, and Pulse, BMI and socio demographic information. A questionnaire had been used for evaluating general health status. An interviewer measured each participant's BP twice with the participant in a seated position after 5 minutes of rest, using an electronic BP monitor (Omron HEM-7430; Omron Corp) on the right upper arm, with a 1-minute delay between measurements. If the difference between the 2 SBP measurements exceeded 10mm Hg, a third measurement was taken, and the mean of the last 2 measurements was used. The participant's weight and height without shoes and wearing light clothing were then measured by trained technicians. Body mass index was then calculated as weight in kilograms divided by height in meters squared. In addition to physical measurements, socio-demographic data and data on basic medical history were collected from standardized in-person interviews by trained medical staff. Classifications and definitions of BP levels were

defined according to "The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents" (National High Blood Pressure Education Program (NHBPEP) Working Group on High Blood Pressure in Children and Adolescents) (21) published in 2004. According to BP charts for age, sex, and height, normal BP was defined as systolic blood pressure (SBP) and diastolic blood pressure (DBP) <90th percentile; prehypertension was defined as average SBP or DBP levels between the ≥90th percentile and the <95th percentile; and hypertension was defined as average SBP or DBP readings ≥95th percentile. The Ethical consideration was approved from the ethical committee of Dhaka Shishu (Children) hospital and informed consent are provided to the participants and informed the objective and views of the study. All statistical analyses were conducted using STATA version 12 and excel. The proportion of individuals with Pre hypertension stage (SBP >120-139mmHg) or DBP >80-89mmHg), stage 1 hypertension (SBP_140mmHg or DBP_90 mmHg) and stage 2 hypertension (SBP_160mmHg or DBP_100mmHg), as classified by JNC 7 (the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure)[14,15], are reported. The association between BMI and BP was analyzed for 99 patients, defined by sex, age, SBP, DBP, Pulse and antihypertensive treatment.

RESULT

The study included 99 participants where Male 52.53% (n=52) and female 47.47% (n=47) female; mean [SD] age, 21.5 (SD: 2.08) years. The participants Maximum were 32 years and minimum age was 18 years. Among the study sample, the mean (SD) BMI was 22.62 (SD 3.6), the mean (SD) systolic BP was 120.87 (SD 11.72) mmHg, and the mean (SD) diastolic BP was 79.92 (SD 7.20) mmHg. The study suggested that the prevalence of pre hypertension was 34.34% (n=34), the prevalence of stage 1 hypertension 8.08% (n=8) and the prevalence of Normal Blood pressure 57.57% (n=57). We observed that 20.2% (n=20) of the participants have BMI>25, 60.6% (n=60) of the participants have BMI >18.4 -24.9 and 19.19% (n=19) of the participants have less than BMI 18.4. The maximum BMI is 35.7 and the minimum is 14.1. Based on BMI, we found that 12.12% (n=12) Male and 8.08% (n=8) female had BMI>25 which we consider overweight and a risk factor for hypertension, 32.32% (n=32) Male and 18.28% (n=28) female had BMI >18.4-24.9 which we consider as normal. We also found that 8.08% (n=8) Male and 11.11% female had BMI<18.4 which we can consider as underweight. Based on BMI versus Hypertension, we see that the participants who have BMI >25, they have mostly 25% stage 1 hypertension and 50% pre hypertension which is significant than those participants who have BMI<25. Univariate analysis revealed that overweight and obesity were significantly associated with

prehypertension and hypertension for both sexes separately and for the combined group consisting of both boys and girls (Table 5), compared to normal-weight participants. WC in the 75th– < 90th percentile was significantly associated with prehypertension and hypertension for boys and girls separately, and for both sexes combined, compared to participants with WC <75th percentile. WC ≥90th percentile was significantly

associated with both types of elevated BP for the group of boys and for the combined group of both sexes. Comparison between normal status and prehypertension + stage 1 hypertension was highly significant (p=0.007). Regarding BMI<18.4 in gender, it was statistically significant in normal status and prehypertension + stage 1 hypertension (p=0.018).

Table-1: Distribution of sex of the study participants (n=99)

Sex	n	%
Female	47	47.47
Male	52	52.53
Total	99	100

Table-II: Mean and SD in the study participants. (n=99)

Variable	%	Mean	Std. Dev.	Min	Max
Age	99	21.49495	2.081864	18	32

Table-III: Mean and SD of associated factors in the study participants. (n=99)

Variable	n	Mean	Std. Dev.	Min	Max
Weightlb	99	131.3212	23.3457	77	193.6
SystolicPr~e	99	120.87	11.72443	112	140
DiastolocP~e	99	79.91919	7.200732	60	95
PulsePress~e	99	40.76768	7.385629	20	55

Table-IV: Health status in the study participants. (n=99)

Characteristics	%
Overweight/Obesity	20.20
Normal	60.61
Underweight	19.19

Table-V: BMI differences in gender among the study participants. (n=99)

Percentage (n=99)	Male	Female
BMI>25	12.12	8.08
BMI>18.4	32.32	28.28
BMI<18.4	8.08	11.11

Table-VI: Association between BMI & Blood Pressure. (n=99)

N=99	Normal (n)	Pre Hypertension	Stage 1 Hypertension
BMI>25	5.00	10.00	5.00
BMI>18.4	37.00	20.00	3.00
BMI<18.4	15.00	4.00	0.00

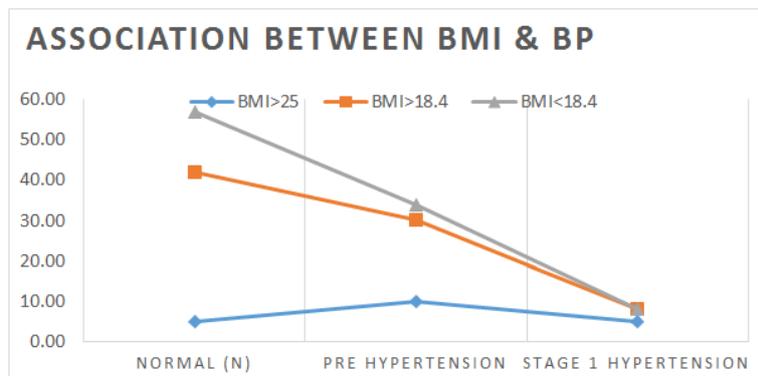


Fig-1

Table-VII: Comparison with BMI & Blood Pressure according to Sex. (n=99)

Characteristics	BMI>25		BMI>18.4		BMI<18.4		P-value
	Male	Female	Male	Female	Male	Female	
Normal	1	4	18	19	4	11	0.007
Pre hypertension + Stage 1 Hypertension	11	4	14	9	4	0	
P-value	0.108		0.429		0.018		

DISCUSSION

The associations between the selected anthropometric measures of overweight, obesity (based on BMI), SBP and DBP among young students aged 18-32 years. The multivariate logistic regression analysis (for both sexes combined) of our data showed significant associations between overweight, obesity and prehypertension and stage 1 hypertension among the young students of BICH. According to our data, the prevalence of prehypertension and hypertension in young students was 34.34% and 8.08% respectively. Studies on prehypertension and hypertension among various age groups and different sample sizes showed that the prevalence rates vary widely. Data showed that increased rate of BMI changes elevated Systolic and diastolic blood pressure. Several studies show the same implication. We have previously found in a Chinese studies that "The increase of BP per unit BMI ranged from 0.8 to 1.7mmHg/ (kg/m²) for 95% of the subgroups not taking antihypertensive medication. The association between BMI and BP was substantially weaker in subgroups of patients taking antihypertensive medication compared with those who were untreated. In untreated subgroups, 95% of the coefficients varied by less than 1mmHg/(kg/m²)ⁱ Several studies also indicated a high prevalence of prehypertension and hypertension in Portuguese adolescents (13.3% and 22%, respectively [16] and 12% and 34%, respectively. Comparison between normal status and prehypertension + stage 1 hypertension was highly significant (p=0.007). Regarding BMI<18.4 in gender, it was statistically significant in normal status and prehypertension + stage 1 hypertension (p=0.018). The association between BMI and BP is positive across the young adult's students in BICH. There has a greater impact of the Non communicable diseases by the association and also in the public health in Bangladesh. The findings of the current study indicating that overweight and obesity among young students were significantly associated with pre-hypertension are consistent with the results of other previously published studies [17]. However, some studies presented different results. One study in China found overweight and obesity to be significantly associated with prehypertension in boys, but not in girls [18]. Another study in Canada reported no significant associations between overweight and prehypertension among girls and across both sexes combined, except among boys; however, obesity was associated with prehypertension across all sex groups [19], the latter result being similar to ours. The findings of the present study were also consistent with the findings of the previous studies that established significant associations for hypertension

with overweight [20] and with obesity [21], although there are some differences among studies in the criteria for defining overweight and obesity, the subjects' age, and the number of BP measurements.

Limitations of the study

The study has a limited sample size and preferable it considers only the same group of people who particularly studies in BICH

CONCLUSION

According to our data, a high prevalence of blood pressure was observed among the students who have higher BMI. It considers that Overweight and obesity were significantly associated with prehypertension and hypertension among young students in BICH. These findings would be useful in the development of public health programs for reducing risk factors of cardiovascular diseases, and would also be important for the prevention, management, and treatment of high BP among adolescents. In Bangladesh, There higher prevalence of overweight and obesity which is critical for any kind of non-communicable diseases especially cardiovascular diseases, diabetes. The study revealed that we need to more focus on our body mass index and daily lifestyle. We need to focus on the factors associated with overweight and obesity. It is more dangerous than under nutrition.

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