

ASSOCIATION OF BLOOD PRESSURE WITH BODY MASS INDEX AND FAMILY HISTORY OF HYPERTENSION AMONG MEDICAL STUDENTS OF TERTIARY CARE TEACHING HOSPITAL IN BIRGUNJ.

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ABSTRACT

Introduction

Body mass index is an important parameter associated with a variety of disease processes. Hypertension is one of the major risk factor associated with cardiovascular disease. The risk of hypertension and cardiovascular diseases increases with an increase in body mass index.

Objective

To evaluate the prevalence of obesity and hypertension in medical students and correlate blood pressure with body mass index and family history of hypertension.

Methodology

The study was conducted in 200 students (113 males and 87 females). Height, weight and blood pressure were recorded from all participants and body mass index was calculated. The recorded body mass index was utilized to divide the student into underweight, normal, over weight and obese category according to the World Health organization body mass index classification. Hypertension was determined from the measure of blood pressure. Then comparison of blood pressure with body mass index and family history of hypertension was made.

Result

Among 200 students 6% were obese, 22% were overweight, 65% were normal and 7% underweight. The mean height was 163cm and mean weight 60.48kg. The mean value of systolic blood pressure (105.85, 115.45, 134.95, 137.16 mmHg) and diastolic blood pressure (70.14, 76.15, 90.72, 93.33 mmHg) increased with increasing body mass index. Prevalence of obesity and hypertension both are more in male students than that of female students. Family history of hypertension is significantly associated with hypertension in male students than female students.

Conclusion

Overweight, obesity and family history of HTN increases the risk of hypertension among students.

KEYWORDS

Body mass index; Blood pressure; Hypertension; Obesity; Overweight



INTRODUCTION

Obesity is one of the of increasing problem of developing nations.¹ Differences in the lifestyle, dietary pattern, and physical activities are the main contributors of overweight and obesity within the country.² Overweight and obesity increase the risks of high BP (Blood Pressure), coronary heart disease, diabetes mellitus, and certain cancers.³ Hypertension {HTN} is one of the major risk factors associated with cardiovascular diseases, which is also a component of the metabolic syndrome.^{4,5}

According to the global World Health Organization (WHO), the worldwide prevalence of overweight and obesity in 2008 among adults was more than 1.4 billion. The prevalence of hypertension (HTN) varies from 3.8% to 24.8% in youth with overweight and obesity. About 62% of cerebrovascular disease and 49% of ischemic heart disease are attributable to suboptimal BP ie, systolic 115 mm Hg. About 58% of the global cases of diabetes mellitus and 21% of ischemic heart diseases were caused by BMI above 21 kg/m².⁶

Increased cases of obesity, hypertension and cardiovascular diseases in young generation in developing countries are quite alarming. Despite a growing burden of obesity and hypertension, there is limited information on the contribution of BMI (Body Mass Index) to BP in these populations. This study was conducted to look at the association with BP with BMI and family history of HTN in young medical students. This study intends to generate relevant information that helps to understand the patterns of high BP in lean and obese populations.

METHODOLOGY

A descriptive cross-sectional study was conducted on 1st and 2nd year medical students from March 2020 to March 2021. Ethical approval was obtained from the institutional review committee (ref no:418/077/076.) in February 2020. The study comprises of 113 males and 87 females, age ranging from 17 to 25yrs. The students who were willing to participate were considered and students who were taking any medication for hypertension or obesity or who were suffering from any systemic disease were excluded from study. Sample size was calculated using the formula as given below:

$$\begin{aligned} C &= 0.5 * \ln[(1+r)/(1-r)] = 0.2027 \\ N &= [(Z\alpha + Z\beta)/C]^2 + 3 \\ &= [(1.9600 + 0.8416/0.2027)^2 + 3 \\ &= 194 \\ &\approx 200 \end{aligned}$$

Where α = Type I error and standard normal deviation for $\alpha = Z\alpha$

β = Type II error and standard normal deviation for $\beta = Z\beta$

C = Correlation co-efficient

N = sample size

The participated students were screened through a medical history questionnaire, physical examination and blood pressure. After taking written informed consent, data were collected through structured questionnaire. The questionnaire contained information regarding gender, current year of

study of MBBS, family history of HTN, food habit, exercise and drug history. The measurements of blood pressure were taken through pre-checked and reliable apparatus i.e., mercury sphygmomanometer. The students were seated calm and quiet for at least 5 minutes prior to measurement on comfortable chairs. For categorization of blood pressure World Health Organization (WHO) classification was used according to which students having blood pressure of systolic 120-129 and diastolic less than 80 is considered as pre hypertensive, systolic 130-139 and diastolic between 80-89 is consider as stage 1 and systolic more than 140 and diastolic more than 90 was consider as stage 2 hypertension.⁷

Three consecutive readings of BP were recorded in morning at the interval of 3 minutes between consecutive measurements in sitting position and mean were calculated. Weight and height were measured with subjects standing without shoes and wearing light clothes. Students stood upright with the head in Frankfort plane for height measurement which was done by stadiometer. Weight was measured by asking student to stand straight in digital weighing machine. Height was recorded to the nearest 0.5cm and weight was recorded nearest 100g. BMI was then calculated through standard formula i.e., weight (kg)/height (m²) and was categorized according to WHO classification into 4 categories i.e. underweight <18.5, Normal weight 18.5 – 24.9, Over weight 25 – 29.9 and Obese > 30kg/m².⁸

Data were entered in SPSS version 16.0. Descriptive analysis of BP, weight, height and BMI were calculated and comparison done on BP among BMI of the group. We used Chi-square test and Pearson correlation to analyze the correlation between HTN, BMI and family history of HTN in students. P – value of <0.05 was taken significant.

RESULTS

The study included 200 medical students of 1st and 2nd year with a mean age of 20.46 where 113 were males and 87 were females. (Fig 1) The height was measured in centimeter with mean height of 163 ± 29.14 cm and the weight was measure in kilogram with mean weight of 60.48 ± 11.04 kg. About 76% students are in habits of taking junk food. Nearly 62.83% males and 68.96% females fell under normal weight and about 24.77% males and 18.39% females are overweight (Table 1). About 14% males and 21% females have normal systolic blood pressure and 14% males and 21.5% females have normal diastolic blood pressure. While

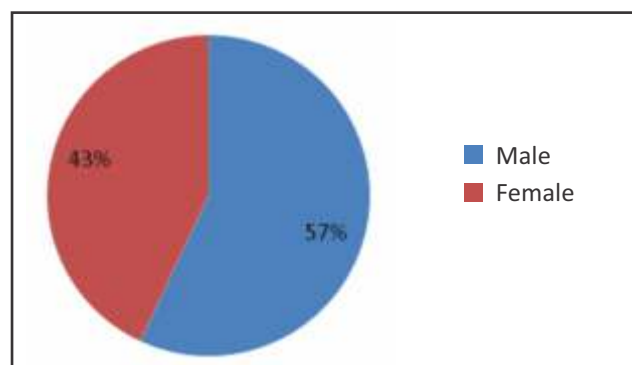


Figure 1: Distribution of male and female students

33.5% males and 19.5% females have high systolic blood pressure and 23% males and 17% females have high diastolic blood pressure (Table 2) indicating the prevalence of obesity and hypertension is more in males than females.

Mean value of systolic BP (105.85, 115.43, 134.95, 137.16) and diastolic BP (70.14, 76.15, 90.72, 93.33) were found to be higher as the BMI increased (Table 3).

The family history of HTN in underweight, normal, over weight and obese were 3.15%, 56.84%, 30.52%, 9.47% respectively (Table 4). The family history of HTN and HTN in male students is highly significant (<0.05) but the family history of HTN in female is not significant (>0.05). (Table 5)

The association of BMI with systolic and diastolic blood pressure had significant positive correlation with $p < 0.005$ and $r = 0.699$ (systolic) and $p < 0.005$ and $r = 0.708$ (diastolic) (Table:6).

Table 1: Sex and BMI cross tabulation

Sex	Body mass index				Total
	<18.5	18.5-24.9	25-29.9	>30	
Male(n)	7	71	28	7	113
Female(n)	6	60	16	5	87
Total (n)	13	132	43	12	200

Table 2: Sex and blood pressure cross tabulation

Systolic BP	Male	Female	Total
	(n)	(n)	(n)
<120	28	42	70
120-139	67	39	106
140-159	18	6	24
>160	0	0	0
Diastolic BP			
<80	28	43	71
80-89	46	34	80
90-99	24	8	32
>100	15	2	17

Table 3: Mean BP in each BMI category.

Body Mass Index	Mean Systolic BP	Mean Diastolic BP
<18.5	105.85±9.26	70.14±7.22
18.5-24.9	115.43±10.54	76.15±7.68
25-29.9	134.95±9.72	90.72±6.48
>30	137.16±11.64	93.33±9.16

Table 4: Family history of HTN and Body mass index cross tabulation

		Body mass index of students				Total
		<18.5	18.5-24.9	25-29.9	>30	
Family H/O of HTN	Yes (n)	3	54	29	9	95
	No (n)	11	76	15	3	105
	Total (n)	14	130	44	12	200

Table 5: Family history of HTN and HTN in off spring cross tabulation

Sex	Family H/O HTN		HTN in offspring/ students		P value
	Yes	No	Yes	No	
Male(n)	44	69	44	69	0.002
Female(n)	48	z39	16	71	0.227

Table 6: Pearson Correlation of BMI and BP

	SBP		DBP	
	P valve	r value	P value	r value
BMI	0.000	0.699	0.000	0.708

*Correlation is significant at 0.01 level

DISCUSSION

The present study provides an idea about the association between BMI and BP in students which has important implications for the risk of cardiovascular disorder in future. The result of present study showed that there is strong association between BMI and SBP or DBP among medical students as the BMI increases the BP also increases significantly. Our finding is similar to a study done by N. K. Mungreiply who found BMI as a strong predictor of blood pressure.³

Underweight subjects were less likely to have high blood pressure than those who were in normal BMI category. Overweight or obese subjects were more likely to have significantly higher blood pressure than those with normal BMI. Kumanyika et al. have shown body mass index to be even more strongly associate with the blood pressure than race.⁹ Humayun et al. indicated strong association of hypertension to BMI rather than age.¹⁰ But the studies done by Schall, indicate that high BP is associated with age and is because of the process of modernization.¹¹ P. Bovet also reported that a significantly higher mean systolic and diastolic blood pressure among urban men than that of rural men in elderly populations of North India.¹²

The study performed by Robert Whitaker et al., observed that obese children under three years of age without having obese parents are at low risk for obesity in adult, but among the older children, obesity is an increasingly important predictor of adult obesity, no matter whether the parents are obese or not.¹³ In our study the family history of HTN is more in obese students. Generally, overweight and obese adolescents have more body fat and higher blood pressure than normal weight adolescents, and a strong relation between BMI and blood pressure is well established for both systolic and diastolic blood pressure.¹⁴

The Framingham Study demonstrated that both men and women had an increase in blood pressure with increased overweight.¹⁵ The systolic blood pressure increased 4 mmHg for every 4.5 kg of increased weight.¹⁵ In our study higher body mass index had about 14mmHg higher systolic blood pressure and 10mmhg higher diastolic blood pressure than students in lower body mass index. In the younger adults, men and women with a body mass index of more than 30 kg/m² had a 5 times higher prevalence of hypertension than persons with a body mass index less than 20 kg/m².¹⁶ Compared with a weight change of 2 kg or less, the risk of hypertension was 15% less in women who lost 5 to 9.9 kg, 26% less in women who lost 10 kg or more, increased 74% in women who gained 5 to 9.9 kg, and increased 5.21 times in women who gained 25 kg or more.¹⁷ In the nationwide Community Hypertension Evaluation Clinic screening of



more than 1 million men and women, the prevalence of hypertension in overweight persons aged 20 to 39 years was twice that of persons with a normal weight and 3 times higher than that of underweight persons.¹⁸ Changes in body fat over 8 years were associated with changes in both systolic and diastolic blood pressure. Becoming normal weight reduced the risk of developing hypertension to a level similar to persons who were never obese.¹⁹

Hypertension is directly associated to BMI; it shows that increase in BMI leads to increase in the trend of hypertension in both male and female students. Our study revealed that obesity prevalence for males is more than that of females (males: 30.96% and females: 24.13%). Similar results have been reported from china²⁰ and Taiwan.²¹ The BP in our study is also higher in male than female. The study done by Krzyzaniak, showed that boys have higher blood pressure than girls significantly after the age of 16.²² The evidence has shown that testosterone plays an important role in higher BP in male and estrogen in female plays a protective role. That is why female have higher blood pressure after menopause.²³ Presence of a family history of HTN significantly increased the risk of HTN in offspring. The family history of hypertension in our study is significantly associated with the HTN in male students but the family history of hypertension is not significantly associated with female students. Previous study showed that those who have a family history of HTN were 2-3 times more likely to develop HTN than without family history.²⁴

The high prevalence of overweight/obesity among the students might be due to less physical activity and higher consumption of more unhealthy, high fat foods, sweetened beverages and salty snacks and less milk, fruits and vegetables than recommended and exposure to persistent stress. Through our observation, we can say that students are more addicted to junk foods specially burgers, pizza and cold drinks which are common causes of obesity. Various studies have shown that dietary intake, physical activity and self-discipline are major factors influencing obesity and high blood pressure.^{25,26} These findings suggest that obese children are at higher risk of having high blood pressure than normal children. Therefore, obese children should be routinely screened for blood pressure and other coexisting cardiovascular risk factors including lipid profile.²⁷ In addition, healthy lifestyles should be encouraged by college and at home since prevention in them can help to avoid undesirable health consequences in the future.

The expenses we are paying for comfortable and urbanized

society causing inactive life style and unhealthy dietary habits which result in difference between energy consumption and expenditure which ultimately leads to obesity.²⁸ Previous studies found high prevalence rates of cardiovascular risk factors, including components of metabolic syndrome, in undergraduate university students, with frequencies reaching 60%.²⁹ The prevalence of both hypertension and obesity is a significant public health challenge and its trend is increasing throughout the world. This huge increase in prevalence of obesity is well documented as one of the major risk factors for the progress of hypertension. They are constant with the nationwide importance on prevention as well as control of weight and obesity. They also specify that measurement of blood pressure and body weight and timely diagnosis and control are exclusively essential for overweight and obese people.

CONCLUSION

The prevalence of systolic and diastolic blood pressure increases as BMI increases. The family history of HTN also increases the chance of getting HTN in offspring. So, the students who are obese and had family history of HTN should have timely intervention for reducing their weight and so decreasing their chances of hypertension. They should be closely monitored so as to pick the disease in early stages and get standard treatment accordingly.

RECOMENDATIONS

There is a strong correlation between BP and BMI. So, it is recommended to decrease BMI in order to decrease BP.

LIMITATIONS OF THE STUDY

The current study only focused on students so the diverse age groups were not included. The daily physical activities were also not considered in the study which also has some influence in BMI and BP.

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CONFLICT OF INTEREST

There is no any conflict of interest

FINANCIAL DISCLOSURE

None

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