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Shabnam Joshi

Assistant Professor, Department
of Physiotherapy, GJUS&T,
Hisar, Haryana, India

Alka Pawalia

Assistant Professor, Department
of physiotherapy, GJUS&T,
Hisar, Haryana, India

Amit Sambharwal

Under Graduate student,
Department of Physiotherapy,
GJUS&T, Hisar, Haryana, India

Vikram Singh Yadav

Assistant Professor, College of
Physiotherapy, Pt. B.D. Sharma
University of health sciences,
PGIMS, Rohtak, Haryana, India

Correlation of BMI with blood pressure in young university male students

Shabnam Joshi, Alka Pawalia, Amit Sambharwal and Vikram Singh Yadav

Abstract

In a rapidly developing country like India there is a rapid rise in lifestyle diseases too like diabetes, hypertension and cardiovascular diseases. These problems are not only limited to old age now. Young people are also susceptible to such problems. The present study was done on 200 young university boys (18-27 years) to see a relationship between body mass index (BMI) and blood pressure (BP). Both the systolic and diastolic blood pressure was measured. The result showed that of the total population 19% and 14.5% of the students were overweight and obese. There was also a steady rise in systolic and diastolic blood pressure as the BMI increased with a significant positive correlation ($p < 0.01$). Though, the values are not on a very higher side now, but is an alarm bell for future in these young students. Youngsters should be advised to maintain a normal BMI for a better future health.

Keywords: BMI, obesity, blood pressure, hypertension

1. Introduction

Developed countries have a major concern of public health related to obesity. This is also seen in populations having cultural transition in recent years. In 1998, obesity was identified as an epidemic globally by WHO. India is no exception to it. Young Indian population is also getting affected by obesity related diseases at a very fast rate. Lifestyle diseases like diabetes, hypertension, coronary artery disease, stroke, gallbladder disease, sleep apnea, respiratory problem, osteoarthritis, some cancer and dyslipidemia are on the rise in younger people. This may lead to increased mortality and morbidity. Owing to these factors, added with lifestyle involving less physical activity, changing eating habits, sedentary lifestyle, increased consumption of calorie rich foods, children today are reported to be overweight compared to their earlier counterparts^[1].

When heart muscles contract to pump blood and relaxes to refill again this cycle is called as systole and diastole. The upper limit is systole while the lower limit is diastole. A BP below 120/80 mmHg is the desired optimal reading. Values above this are in the higher ranges.

Blood pressure can increase or decrease many times in a day. It all depends on the fluid intake, breathing, physical activity, sleep, anxiety, emotional outbursts and states along with a specific time in a routine day. All these fluctuations are completely normal and with rest BP usually^[2].

Western world is having a major problem of obesity as a public health issue. Hypertension on the other hand is an added side effect or an outcome of the same, which is also the most common. Studies have shown that increased BP and excess weight are independent risk factors in development of heart related diseases. Of all the people having hypertension 30% are reported to be obese^[3].

When there is an imbalance between the actual metabolic requirement and the added calorie intake one has there is an accumulation of body fat. It is not for a short term but a chronic imbalance will result in obesity. Lifestyle factors such as habitual calorie rich diet intake added with less activity patterns are the main causes for it. When total body fat is measured as a proportion to fat stored in tissues it forms basis for diagnosis of obesity.

Children are also increasingly affected with hypertension. However, they might have it secondary to other factors too like idiopathic to endocrine, kidney or other organ related. Hypertension due to obesity is very common^[4].

Obesity arises as a result of imbalance between energy intake and energy expenditure.

Correspondence

Alka Pawalia

Assistant Professor, Department
of physiotherapy, GJUS&T,
Hisar, Haryana, India

Childhood obesity is more marked and different from adults. In children there is characteristic increase in number rather than the size of fat cells. For the better health of children, it is advisable to have sixty minutes of physical activity which should be of moderate to severe intensity for all days of the week. Daily exercise of 60-90 minutes is to be done to keep up the weight loss. Also life-style changes need to be done such as reducing calorie intake, following a healthy meal plan, less sedentary and making behavioral changes also helps in reducing overweight and obesity and thus maintaining a good health [1].

The aim of the present study was to assess the correlation of obesity measured in BMI with blood pressure i.e. both systolic and diastolic in University male students of Hisar city.

2. Methodology

This is a cross sectional study done on 200 university male students in the age group of 18-27 years in Hisar, Haryana. A convenience sampling method was used i.e. readings of only those students were taken who were willing and cooperative for the study. Uncooperative students and those with any diagnosed medical condition like diabetes, hypertension were excluded from study. A questionnaire was used to measure basic demographic variables of participants along with height, weight, and blood pressure measures. After getting the consent from the participants, data was collected for the above variables.

Weight: For measuring weight, digital weighing machine was used. Subject was asked to stand on weighing machine with light clothing and without shoes.

Height: Measuring tape was used for measuring height. Student was asked to stand with feet shoulder width apart and head straight, eyes looking forward and both shoulders were in level and keeping the spine straight measurement was taken using a scale placed horizontal on the vertex parallel to floor touching the wall. This mark was then measured using the measuring tape for height measurements.

BMI: It was calculated as a standard procedure by dividing weight by square of height i.e. Kg/m^2 .

Blood Pressure: For blood pressure, the instrument was on a level with the heart of the student whose BP was to be measured. The subject's arm was put through the loops of the cuff. The arm was positioned correctly with elbow flexed to 90° and forearm was in supination and properly supported for stabilization. While measuring the BP, the bottom edge of the cuff was kept 1 or 2 cm above the elbow. Marker (arrow under tube) was centered on the middle of inner arm. Once this was set, the 'Start' button was pressed to measure the BP of the student. Final systolic blood pressure and diastolic blood pressure readings were noted.

3. Data Analysis

Data analysis was done by SPSS software version 21. Demographic data is presented in mean and standard deviation. Further data was classified according to BMI group and presented in mean and standard deviation along with percentages. Normality of data was checked for variable using Kolmogorov-Smirnov test for BMI, Systolic BP and Diastolic BP. Spearman correlation was used to find correlation between BMI and BP among University boys.

4. Results

Basic demographic data of study participants are shown in table 1. Average age, weight and BMI of participants was 20.31 ± 2.50 years, 66.01 ± 11.55 Kg and 22.1 ± 3.56 Kg/m^2 . Of the total participants 12% were underweight, 54.5% were with normal BMI, 19% were overweight while 14.5% were obese (table 2).

Table 1: Demographic data of the study participants.

Demographic data	Mean \pm SD
Age (Year)	20.31 \pm 2.50
Weight (kg)	66.01 \pm 11.55
Systolic BP (mmHg)	128.55 \pm 14.08
Diastolic BP (mmHg)	78.52 \pm 11.20
BMI (kg/m^2)	22.1 \pm 3.56

Table 2: Prevalence of Underweight, Normal, Over Weight and Obese among the students according to BMI method.

BMI(Kg/m^2)	No. of subject	
<18.5	24 (12%)	Under weight
18.5-22.9	109 (54.5%)	Normal
23-25	38 (19%)	Overweight
>25	29 (14.5%)	Obese

When the average for blood pressure was calculated as per BMI classification, it was noticed that blood pressure both systolic and diastolic increased with BMI i.e. as the BMI increased blood pressure too increased.(Table 3).

Table 3: Average of blood pressure according to BMI classification among university students.

Variable	Underweight	Normal	Overweight	Obese
Systolic BP(mmHg)	119.87	128.72	129.36	134.03
Diastolic BP(mmHg)	74	77.72	80.26	83

Pearson's correlation between BMI and blood pressure showed a positive and significant correlation. It shows that as the BMI increases there are chances of having increased blood pressure too.

Table 4: Showing correlation between study variables.

Variable	Value	Significance
BMI vs. Diastolic BP	0.232	0.001*
BMI vs. Systolic BP	0.284	0.000*

*Correlation is significant at the 0.01 level (2 tailed).

5. Discussion

Observation studies has been done in different population to assess the correlation of obesity with blood pressure in different age group in developing country like India, Africa etc. [1, 2]. The aim of present study was to found the correlation of obesity with blood pressure in University male students in Hisar.

In a study conducted by Suman Dua *et al.* in 2014 to relate body mass index to blood pressure a total of 117 males and 123 females aged from 18 to 50 years were included in the study. This study showed that blood pressure increase in higher rate with increase in BMI value. So overweight and obese people have more higher blood pressure [15]. This study support the present study because the present study also show the positive correlation between systolic and diastolic BP with BMI as shown in table 4.

There is an increase in prevalence rates of overweight and

obesity across the globe. Overweight and high BP both have independent fatal health consequences as they carry serious risk factors for several non communicable disease such as heart disease, stroke, type 2 diabetes and even death. A study was conducted by Frederick Vuvor in 2017 to assess the correlation of body mass index and blood pressure of adults of 30 to 50 years of age in Ghana. Blood pressure was found to be increased among population with high body mass index. This study concluded that an increase in BMI positively influence BP among study adults population ^[16]. Above study also support present study because in present study also positive correlation is seen between BMI and blood pressure.

A study was conducted by Ehud Charin *et al.* in 2015 to assess trends in adolescents obesity and association between BMI and blood pressure. They included 714,922 healthy adolescents in this study. They concluded that BMI in both gender adolescents is significantly associated with both systolic and diastolic blood pressure. This was also seen in normal as well as overweight groups too. There is already an established relation between hypertension and obesity in adolescents. Amongst non obese individuals too there can be chances of developing hypertension with weight gain. i.e. as BMI increases prevalence of hypertension too increases ^[17]. Hence, this study too supports the present study as positive correlation is found between BMI and blood pressure in present study.

A positive correlation between blood pressure and BMI has been seen in many studies because with increase in obesity or weight there is increase in vascular resistance and hence blood pressure is also increased.

Thus, the increasing prevalence of overweight and obesity among University male students can become a major problem in future and can lead to various disorders like hypertension, stroke, cardiovascular problems, respiratory problems, sleep apnea, diabetes, arthritis, depression, social withdrawal and even early mortality.

High blood pressure in obese boys is most noticeable problem. So we can advice students to manage hypertension and obesity by some methods like regular physical activity, maintaining healthy weight, limiting alcohol intake, stop smoking, healthy diet and reducing salt.

6. Conclusion

BMI and blood pressure (diastolic, systolic) are positively correlated. The study found that 33.5% of the boys are above the normal BMI range i.e. 1/3 of the young population is either overweight or obese. Obese students have high blood pressure i.e. both systolic blood pressure and diastolic blood pressure.

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