

STUDY OF EFFECT OF BMI AND WAIST CIRCUMFERENCE ON BLOOD PRESSURE IN FIRST YEAR MEDICAL STUDENTS

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ABSTRACT: The present study is undertaken to evaluate any association between BMI, WC and Blood pressure and any tendency to develop prehypertension. The study comprises of 100 medical students of NRI medical college, Sangivalasa near Visakhapatnam. It was carried out on girl students with age of 17 years. Their BMI, WC and Blood pressure were determined. The examination included measurement of weight, height of the student to determine BMI, measurement of waist circumference, and measurement of blood pressure by sphygmomanometer. In the present study the results are consistent with early clinical studies reporting that there is elevated systolic and diastolic blood pressure with increasing BMI and waist circumference and there is tendency to develop prehypertension in students with higher BMI. Modification of life style factors should be emphasized.

KEYWORDS: Body mass index (BMI), Waist circumference (WC), Prehypertension (PH), Systolic blood pressure (SBP), Diastolic blood pressure (DBP).

INTRODUCTION: With the improvement in standards of living, decrease in physical activities, dependence of men on machine, dietary changes and other life style changes people are putting on extra weight. This gain in bodyweight and obesity is posing a real threat to health both in children as well as adults all over the world. Obesity has become a serious health problem in the developed as well as developing countries. In US current estimates have put the prevalence of overweight in adults at 61 % and of obesity at 26%. Similar patterns have been observed in majority of developing nations also.^[1] Globally the prevalence of obesity in women exceeds that in men.^[2] Body mass index (BMI) is positively and independently associated with morbidity and mortality from hypertension, cardiovascular disease, type II diabetes mellitus and other chronic diseases.^[3] A strong association has been depicted between BMI and mortality in Caucasians.^[4] A similar association has also been demonstrated among Asian populations.^[5,6] The significant positive association between BMI and both SBP and DBP has been reported in studies of African-Americans,^[7] Chinese,^[8] Africans and Caribbeans.^[9] Hypertension places an excessive financial burden on populations and health systems, consuming scarce resources. The relationship between BMI and hypertension is of particular interest to developing countries as excess cardiovascular mortality among lean hypertensive subjects has been reported in some longitudinal studies.^[10]

Hypertension was defined as systolic blood pressure (SBP) >140 mmHg and/or diastolic blood pressure (DBP) >90 mmHg as per US Seventh Joint National Committee on Detection, Evaluation and Treatment of Hypertension (JNC VII) criteria.^[11] National Heart, Lung, and Blood Institute divide blood pressure measurements into 5 categories^[12] as shown in Table 1.

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Blood pressure	SBP	DBP
Normal	<120	<80
prehypertension	120-139	or 80-89
Stage 1 hypertension	140-159	or 90-99
Stage 2 hypertension	≥160	or ≥100
Isolated systolic hypertension	≥140	and <90

Table 1: Classification of Hypertension (mm Hg)

Population based preventive approaches are, thus central for the management of elevated blood pressure in developing countries, where clinic based care for complications is not a readily available option. Body mass index is a parameter for weight classification as normal, overweight, and obesity; whereas waist circumference is the main indicator of abdominal fat accumulation with which the same risk factors related to obesity are frequently associated.^[13] Thus these are two important methods for the diagnosis of overweight/obesity and of central obesity both in epidemiological studies and in the clinical practice.

METHODS: After obtaining oral consent, blood pressure was measured on left arm by auscultatory method using mercury sphygmomanometer. The student was made comfortable and seated at least for five minutes in the chair before measurement.

Body Weight was measured after removal of shoes while wearing light clothing. Height was measured without shoes in the standing position with the shoulders in relaxed position and arms hanging freely. BMI was calculated as weight in kilograms divided by squared height in meter. Conventional BMI cutoff points were applied to classify the study populations into underweight (BMI<18.5 kg/m²), normal BMI (18.5≥BMI<24.9 kg/m²), overweight (BMI≥25 kg/m²), and obese (≥30kg/m²).

Waist circumference was measured using a measuring tape over the unclothed abdomen, with measurements made halfway between the lower border of the ribs and the highest point of iliac crest (at the umbilicus level) in the standing position. Participants with waist circumference of ≤79.9cm were classified as normal; with WC of 80-87.9cm were classified as overweight and WC of ≥ 88.0cm were classified as obese.^[14]

Analyses were conducted using SPSS.16 software. One sample Student t tests were applied for calculating differences in means for continuous data.

RESULTS: A total of 100 girls participated in the study.

characteristics	girls
No of students	100
Weight(kg)	65.69+_12.5
Height(m)	1.62+_0.07
BMI(kg/m ²)	24.9+_4.52
WC (cm)	84.9+_12.0

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SBP (mmHg)	116.7+_6.99
DBP(mmHg)	79.1+_5.37

Table 2: Baseline characteristics of the students

BMI	MSBP(m±sd)	MDBP(m±sd)
18.5-24.9	112.9±5.3	77.8±4.5
25-29.9	119.6±5.2	80.0±3.4
≥30	127.8±1.9	88.6±3.0

Table 3: Distribution of mean blood pressure based on BMI

MSBP=mean systolic blood pressure, MDBP=mean diastolic blood pressure.

WC	MSBP(m±sd)	MDBP(m±sd)
≤ 79.9cm	112.9±5.8	76.7±4.7
80-87.9cm	115.5±4.9	78.0±4.2
≥88cm	124.1±4.7	84.1±4.3

Table 4: Distribution of mean blood pressure based on waist circumference

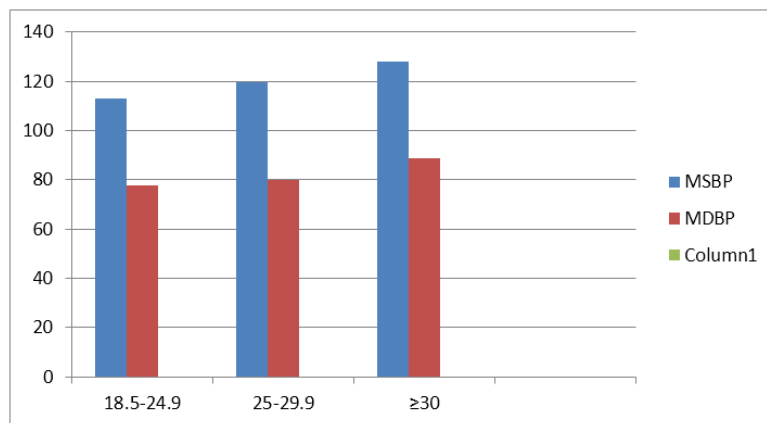
BMI	No of students with normal BP	No of students with prehypertension
18.5-24.9	50	6
25-29.9	13	21
>30	0	10

Table 5: Distribution of normotensives and prehypertensives based on BMI

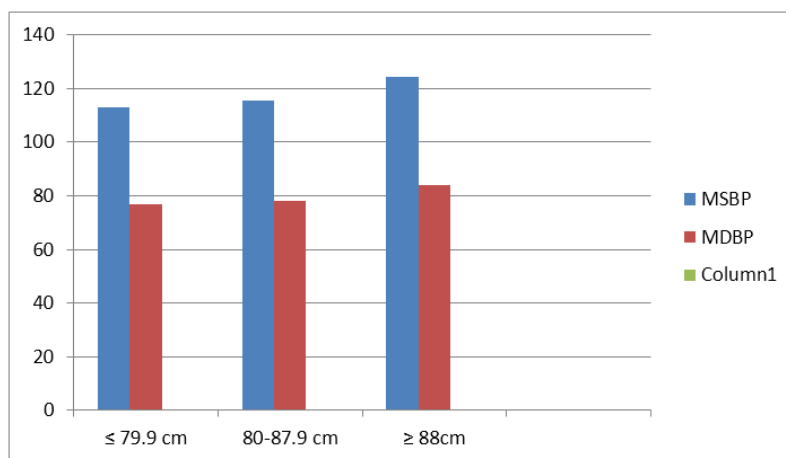
WC	No of students with normal BP	No of students with prehypertension
≤79.9 cm	33	6
80-87.9cm	23	11
≥88 cm	4	23

Table 6: Distribution of normotensives and prehypertensives based on WC

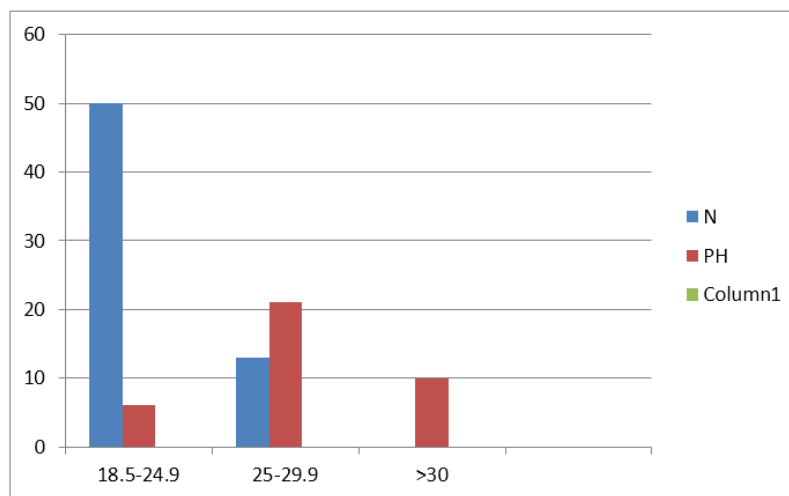
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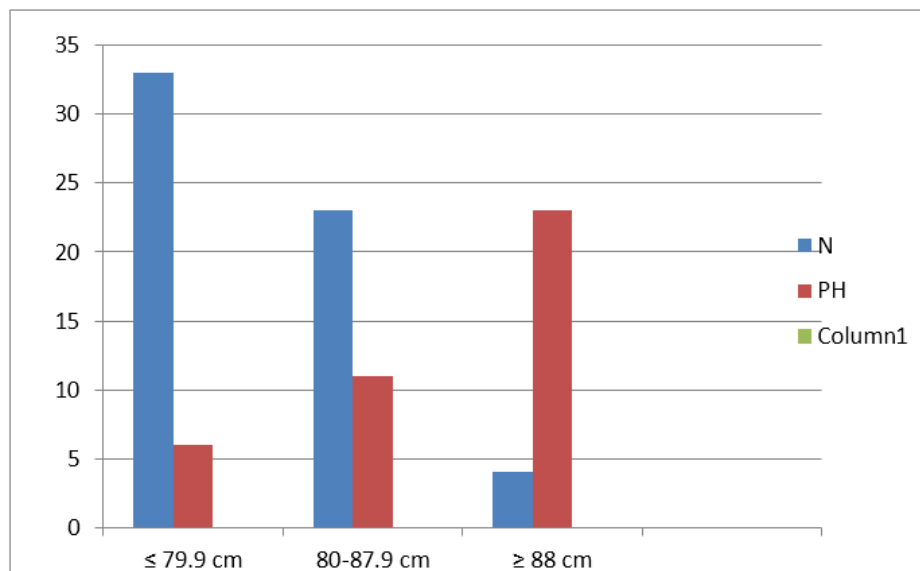
Graph 1: Distribution of mean blood pressure based on BMI



Graph 2: Distribution of mean blood pressure based on waist circumference



Graph 3: Distribution of normotensives and prehypertensives based on BMI



Graph 4: Distribution of normotensives and prehypertensives based on WC

DISCUSSION: Over-weight and obesity are common health conditions. Body mass index, waist circumference are the commonly used parameters to evaluate obesity. The influence of high values of all these parameters on various metabolic and cardiovascular diseases is multiplicative, so weight loss should be urged to all those who are falling in the above said category. The present study was an attempt to identify over weight and obese medical students by body mass index and waist circumference and to find out whether there is any association between blood pressure and BMI and blood pressure and WC. As indicated by BMI about 10% were obese, however this figure increased to 27% when waist circumference was considered as a parameter. That means central obesity as per waist circumference is more prevalent than general obesity. The importance of central distribution of fat has been known since decades. Waist circumference has become the preferred measure for abdominal obesity.

Han has also reported that the larger waist circumference helps in identification of people at increased cardiovascular risks.^[15] The incidence of obesity as per BMI and WC in our study is fairly high. Although not much data is available on overweight / obesity in adolescent, but there is growing concern about these problems. WHO estimates that globally 60% of deaths are due to unhealthy diets and physical inactivity, with 79% of these deaths in developing countries.^[14] The association between BMI and BP has been widely reported across populations in Asia, Latin America, United States and Canada. In a study that included five Latin American populations (urban) and seven Asian populations (four urban, three rural), significant positive relationships of similar magnitude were observed between BMI and BP, despite differences in mean BMI levels between the populations studied.^[16]

There are many factors that contribute to obesity in our modern culture. The change in diet and physical activity contribute to the increased prevalence of obesity in youth. Dietary pattern in adolescence not only influence their immediate wellbeing but also have an impact on

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their long term health. With increase in simple carbohydrates and saturated fat in the diet and more sedentary lifestyle, individuals are more prone to become obese. This may predispose in causing hypertension at a younger age in such individuals. In the current study it was observed that many participants were in the habit of consuming junk food in the form of samosa, chocolates, pastries, cool drinks and chips etc. In this study there is a significant increase in both systolic blood pressure and diastolic blood pressure with increase in BMI and waist circumference. It also provides important data on prehypertension in young medical students. The students were further divided into normotensives and prehypertensives based on their BMI and WC which is shown in Table 4 and Table 5. There was an increasing tendency of prehypertension with an increase in BMI and WC.

CONCLUSION: Thus to conclude it is emphasized that adolescence is a unique intervention point in the life cycle and the knowledge regarding optimal nutrition can be acquired during this period that could prevent or delay adult-onset diet related illnesses later on. There is significant association between BMI and DBP, SBP as well as WC and DBP, SBP among medical students, thus basic measurement of weight and height to determine the BMI and waist circumference measurement as a routine assessment during clinic visitation with appropriate lifestyle modification would help in controlling hypertension as well as reduce its prevalence.

Health promoting life style modifications are thus essential for young individuals with prehypertension. Thus an early identification of pre-hypertension may be of immense value in avoiding the forthcoming calamity in susceptible people.

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