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A Comparative Study of Anthropological Parameters in Between Normotensive and Prehypertensive Students

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Abstract

Background:A comparative study of anthropological parameters in between Normotensive and prehypertensive students.**Material and Methods:**The study was conducted in the Department of Physiology, Maharishi Markandeshwar Institute of Medical Sciences and Research and MM Institute of Dental Sciences, Mullana (Ambala). Five hundred medical students between 18 and 25 years of age were chosen at random. Group A: Students who were normotensive. We studied skin fold thickness, waist-hip ratio, and BMI for these students. Group B: Students who were prehypertensive (Systolic 120-139 or diastolic 80-89mm of Hg).We studied skin fold thickness, waist-hip ratio and BMI for these students.**Results:**There were a total of 304 cases belonged to normotensive group and 196 cases in prehypertensive group. The mean±SD of age was 21.38±1.80 years and 20.86±1.65 years in normotensive and prehypertensive group respectively. In the present study, mean weight; height; BMI, waist circumference; hip circumference and W:H ratio were calculated. In normotensive group mean weight was 59.62±8.17 and in prehypertensive group it was 68.37±9.14. It shows that those cases who were affected by hypertension had more weight than normal cases. Similarly mean height of the cases in group A was 1.67±0.08 and in prehypertensive group it was 1.64±0.08. Accordingly on the basis of weight and height calculation; BMI was also higher in prehypertensive group i.e. 25.44±3.19 as compared to normal cases 21.20±2.59. Further; waist circumference and W:H ratio was also found higher in prehypertensive group as compared to normotensive group i.e. waist circumference 31.26±3.94 in group A and 35.50±3.58 in group B; W:H ratio 0.849±0.09 in group A and 0.96±0.07 in group B. All these parameters were found statistically significant as depicted in table. Only hip circumference was not significant as mean hip circumference was 36.88±3.55 in normotensive group as compared to 36.74±2.32 in group B.**Conclusion:**We concluded that the BMI, Waist circumference and W:H ratio and Hip circumference was higher in prehypertensive group as compared to normal cases.

Keywords: Anthropological Parameters, Normotensive, Prehypertensive, Students.

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Introduction

Hypertension is a major cause of morbidity and death globally due to cardiovascular illnesses such as CHD, CHF, peripheral artery disease, and ischemic and hemorrhagic strokes.[1] Because of a lack of widespread agreement, the definition of hypertension has changed throughout time and from place to region. Fortunately, the Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure is on the case. The committee agreed on the criteria for defining normal and varying degrees of hypertension in its report no. 7. Multiple modifiable (obesity, weight gain, psychosomatic stress, low levels of

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physical activity, increased alcohol consumption) and nonmodifiable (genetic factors with genetic indices such as blood group, chromosomal abnormalities including DNA aberrations) nature factors are widely acknowledged to be important contributing factors. It is also well accepted that the prevalence of hypertension rises with age.[2]

The most frequent illness is hypertension, which significantly increases morbidity and death from cardiovascular and other disorders. Subjects with arterial pressures in the upper normal range are regarded to be at an increased risk of cardiovascular disease.[3] It is estimated that hypertension accounts for 4.5 percent of the current worldwide illness burden. Indeed, hypertension is responsible for more than 5.8 percent of all fatalities, 1.9 percent of lost years of life, and 1.4 percent of disability adjusted life years worldwide. In developed nations, the risk of developing hypertensive for someone with a family history of hypertension is believed to be up to four times greater than the general population.[4]

The majority of individuals are now aware of the relationship between obesity and health hazards. It is commonly assumed that cardiovascular disease is a leading source of morbidity and death in obese people. 1,2 Overweight and obesity have been linked to increased risk factors for cardiovascular disease, such as hypertension and type 2 diabetes. Obesity is a risk factor for several chronic conditions, including hypertension, diabetes, knee replacement, pancreatitis, insomnia, chronic tiredness, and premature mortality.[5] It is also linked to arthritic pain, migraine progression, orthopaedic diseases, and general discomfort.[6] It may also be a risk factor for pre-hypertension and other borderline disorders. Because population ageing is predicted to increase the frequency of chronic illnesses in the population, putting burden on the medical care system, clinical practise adjustments targeted to lower risk factors are becoming more important. Obese individuals' body weight is a prime example of a modifiable risk factor. Obesity incidence has risen substantially in industrialised and affluent nations, prompting the World Health Organization to declare overweight and obesity a global pandemic. Obesity and CVD risk factors are both quite common.[7]

Many correlative research on the many etiological variables for cardiovascular illnesses, such as age, gender, weight, height, ethnicity, socioeconomic position, and psychological aspects, have been conducted in the western and Indian populations. Anthropometric parameters such as height, weight, BMI, waist and hip circumferences, waist hip ratio, waist to height ratio, and thickness of various skinfolds are often utilised as risk factors for cardiovascular disease today. Other relative risk factors for cardiovascular disease, such as cholesterol levels, alcohol use, stress, and smoking, have a considerable and comparable influence on both men and women.[8,9]

There is additional evidence that obesity and high blood pressure are connected illnesses, especially when obesity is characterised by a central fat distribution. The waist-to-hip circumference ratio (WHR) has been identified as a significant component in the assessment of cardiovascular disease risk factors owing to a positive correlation between high WHR and hypertension. The link between overall fat distribution and central adiposity and hypertension, which was discovered in middle life, has gotten less attention in young people.

Although the World Health Organization recommends BMI as an index of obesity, some studies suggest that the pattern of body fat distribution is a more important determinant of disease risk, and individuals with a high proportion of abdominal fat have a higher risk of developing diabetes, hypertension, and CVD. Unfortunately, there is no generally acknowledged standard measure of abdominal obesity. Although the majority of studies recommend waist circumference (WC) as a better indicator of abdominal obesity and a better predictor of CVD than BMI or waist-to-hip ratio (WHpR), such findings have not been confirmed in Asian and Oceanic countries, and the best index of obesity that predicts CVD risk remains a contentious subject. On the other hand, most research investigating the risk of unfavourable health outcomes related with obesity have relied on data from Europe or the

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United States, with limited data from the Asia-Pacific area accessible. When the predictive capacity of anthropometric indicators is population-dependent and varies by race, the significance of this statement is compounded.[10,11]

Given the scarcity of data for Haryana, it was felt appropriate to conduct a preliminary analysis from this perspective, using medical students as examples of the young population under the age of 30. This cohort is divided into two sub-clusters: students born, groomed, and nurtured in Haryana and students born, groomed, and nourished in other states and studying at this medical institution. This provided us with the chance to do a valuable comparison of the two sub-clusters now living in the same location but with potentially distinct socioeconomic, genetic, and ethnic backgrounds.

Material and Methods

The study was conducted in the Department of Physiology, Maharishi Markandeshwar Institute of Medical Sciences and Research and MM Institute of Dental Sciences, Mullana (Ambala). Five hundred medical students between 18 and 25 years of age were chosen at random. The purpose and procedure of the study explained to them and informed consent was taken.

The students so subjected to study were divided into following groups as laid in 7th report of Joint National Committee on criteria for gradation of normotensive and prehypertensive

Group A: Students who were normotensive. We studied skin fold thickness, waist-hip ratio, and BMI for these students.

Group B: Students who were prehypertensive (Systolic 120-139 or diastolic 80-89mm of Hg).We studied skin fold thickness, waist-hip ratio and BMI for these students.

Classification of hypertension (mm Hg): Using the recently published "The Seventh Report of Joint National committee on Prevention, Detection, Evaluation and Treatment of High blood Pressure (JNC-VII) criteria" blood pressure was defined accordingly.

Normal Systolic and diastolic < 120/80 mmHg

Prehypertensive's: Systolic 120-139 or diastolic 80-89mmHg

Stage-1 hypertensive's: Systolic 140-159 or diastolic 90-99 mmHg

Stage-2 hypertensive's: Systolic 160 or diastolic 100mmHg12

The proportionate increase/decrease in blood pressure with variations in the anthropological parameters and blood group were evaluated.

Inclusion Criteria

The study included apparently healthy students between 18-25 years of age without any clinical complaint/sign/symptom indicating any morbidity. Students with family history of hypertension were also included.

Exclusion Criteria:

1. Students below 18 and above 25 years of age.
2. Hypertensive students taking any medicine for hypertension or any other endocrinological, cardiorespiratory disorders.
3. Students taking any intoxication or drugs.
4. Students with Rh negative blood group were excluded.

Methodology

Body mass index (BMI) was calculated as body weight in kilograms (kg) divided by square of the body height in meter (m2). Overweight were defined as BMI 25 to <30 and obesity as BMI >30 kg/m2. As per WHO the body type classification based on BMI calculated using

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Quetelet index.13 Revised body type classification for Indian population recommended by Health Ministry and Diabetes Foundation of India in 2008.[14]

Table: Health Ministry Classification of BMI

Body type	BMI (kg/m^2)
Underweight	<18.5
Normal	18.5 to 22.9
Overweight	23-24.9
Obese	>25

We followed health ministry classification of BMI in our study.
Waist was measured horizontally at the level just above the uppermost border of the iliac crest. The measurement was made at a normal minimal respiration. Hip were measured as the maximum circumference over the buttocks. Central obesity were also calculated and defined on the basis of WHR. The cut-off value of central obesity was considered as >0.95 in males while normal value for females was >0.80. Triceps and subscapular skin fold thickness was measured with a skin fold caliper in accordance with the standard procedure.15

Statistical analysis
A p value of <0.05 were considered as significant (S), p <0.01 highly significant (HS), p <0.001 very highly significant (VHS) and p >0.05 as not significant (NS).

Results
Table 1: Age wise distribution of cases in two groups

Age range	**Group A (Normotensive) n=304**	**Group B (prehypertensive) n=196**
18-20	88 (28.94%)	91 (46.42%)
21-23	174 (57.23%)	86 (43.87%)
24–25	42 (13.81%)	19 (9.69%)
Mean±SD	21.38±1.80	20.86±1.65
Statistical significance	Z=3.32; p<0.01 Significant	

[Table 1] shows age distribution of cases in the present study. Age range in The present study was 18-25 years in both the groups. There were a total of 304 cases belonged to normotensive group and 196 cases in prehypertensive group. Majority of cases 174 (57.23%) were found in 21-23 years age group in normotensive group as compared to 91 (46.42%) in 18-20 years group in prehypertensive group. The mean±SD of age was 21.38±1.80 years and 20.86±1.65 years in normotensive and prehypertensive group respectively. Statistical comparison of these groups shows significant difference amongst the two groups.

Table 2: Sex wise distribution of cases in two groups

Sex	**Group A (Normotensive) n=304**	**Group B (Prehypertensive) n=196**
Male	167 (54.93%)	142 (72.44%)
Female	137 (45.06%)	54 (27.55%)
Statistical significance	$\chi 2 = 15.48$; p <0.001 Very high significant	

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Above [Table 2] shows sexwise distribution of cases in the present study. In our study majority of cases were male in group A i.e. 167 (53.93%) and 142 (72.44%) male in group B. Similarly 137 (45.06%) females in group A and only 54 (27.55%) females were found in group B. It shows that males were more affected than females in prehypertensive stage as compared to normotensive cases. When compared statistically; the difference was found to be significant.

Table 3: Comparison of anthropological parameters

Parameters	**Group A (Normotensive) n=304**	**Range**	**Group B (Prehypertensive) n=196**	**Range**	**Statistical significance Group A vs. B**
Weight	59.62±8.17	46-87	68.37±9.14	49-89	Z=10.89; p<0.01 Significant
Height	1.67±0.08	1.52-1.88	1.64±0.08	1.51-1.82	Z=15.59; p<0.01 Significant
BMI	21.20±2.59	16.3-32.04	25.44±3.19	16.46-33.3	Z=10.89; p<0.01 Significant
Waist circumference	31.26±3.94	23-39	35.50±3.58	24-40	Z=12.42; p<0.01 Significant
Hip circumference	36.88±3.55	30-50	36.74±2.32	31-44	Z=0.53; p>0.05 Not significant
W:H ratio	0.849±0.09	0.64-1.09	0.96±0.07	0.74-1.12	Z=15.45; p<0.01 Significant

Table 4: Comparison of blood pressure (SBP/DBP)

Blood pressure	**Group A (Normotensive) n=304**	**Range**	**Group B (Prehypertensive) n=196**	**Range**	**Statistical significance Group A vs. B**
SBP	112.71±3.28	108-120	128.95±5.49	122-138	Z=37.34; p<0.01 Significant
DBP	75.22±3.04	70-80	81.13±4.49	70-88	Z=16.19; p<0.01 Significant

[Table 3] shows comparison of various anthropological parameters. In the present study, mean weight; height; BMI, waist circumference; hip circumference and W:H ratio were calculated. In normotensive group mean weight was 59.62±8.17 and in prehypertensive group it was 68.37±9.14. It shows that those cases who were affected by hypertension had more weight than normal cases. Similarly mean height of the cases in group A was 1.67±0.08 and in prehypertensive group it was 1.64±0.08. Accordingly on the basis of weight and height calculation; BMI was also higher in prehypertensive group i.e. 25.44±3.19 as compared to

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normal cases 21.20±2.59. Further; waist circumference and W:H ratio was also found higher in prehypertensive group as compared to normotensive group i.e. waist circumference 31.26±3.94 in group A and 35.50±3.58 in group B; W:H ratio 0.849±0.09 in group A and 0.96±0.07 in group B. All these parameters were found statistically significant as depicted in table. Only hip circumference was not significant as mean hip circumference was 36.88±3.55 in normotensive group as compared to 36.74±2.32 in group B.

[Table 4] shows mean blood pressure in the present study. Systolic blood pressure was 112.71±3.28 (range 108-120) in normotensive group as compared to 128.95±5.49 (range 122-138) in prehypertensive group. Similarly DBP was 75.22±3.04 (70-80) in normotensive group and 81.13±4.49 (70-88) in prehypertensive group. When compared statistically; the difference was found to be significant amongst group A and B.

Table 5: Comparison of skin fold thickness

Parameters	**Group A (Normotensive) n=304**	**Range**	**Group B (Prehypertensive) n=196**	**Range**	**Statistical significance Group A vs. B**
Tricep Skin fold thickness	262.85±19.30	224-359	315.56±29.19	259-397	Z=22.33; p<0.01 Significant
Sub scapula skin fold thickness	280.18±21.38	270-380	360.76±25.35	270-390	Z=36.85; p<0.01 Significant

We calculated tricep skin fold thickness and sub scapula skin fold thickness in our study and found that cases who belonged to normotensive group have less skin fold thickness as compared to group B. In the present study mean tricep skin fold thickness was 262.85±19.30 (range 224-359) in group A and 315.56±29.19 (range 259-397) in group B. Similarly sub scapula skin fold thickness was 280.18±21.38 (range 270-380) in group A and 360.76±25.35 (270-390) in group B. Our results clearly shows that skin fold thickness plays a significant role in group B cases. When we compared these groups with each other; it was found to be statistically significant.

Table 6: Pearson's correlation of coefficient (r value) of BMI with skin fold thickness and scapula

Parameters	**Group A (Normotensive) n=304**	**Group B (Prehypertensive) n=196**
BMI with skin fold thickness	r -0.028	r = 0.074
BMI with skin fold scapula	r -0.081	r = 0.148*

* p <0.05 Significant

Above table shows correlation coefficient (r value) of BMI with skin fold thickness. When we correlated BMI with skin fold scapula in group B patients; it was found to be significant correlated (r = 0.148). It shows that cases who had more BMI; had more chances of skin fold scapula. As body mass index of cases will increase; chances of skin fold scapula will also increases.

Discussion

The majority of individuals are aware of the connection between obesity and health hazards. Cardiovascular disease is thought to be a significant source of morbidity and death in obese people. Overweight and obesity have been linked to an elevated risk of cardiovascular disease

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risk factors such as hypertension and type 2 diabetes. The waist-to-hip circumference ratio (WHR) has been identified as a significant component in the assessment of cardiovascular disease risk factors owing to a positive correlation between high WHR and hypertension. Obesity is a risk factor for several chronic conditions, including hypertension, diabetes, knee replacement, pancreatitis, insomnia, chronic tiredness, and premature mortality. It may also be a risk factor for pre-hypertension and other borderline disorders. Because population ageing is predicted to increase the frequency of chronic illnesses in the population, putting burden on the medical care system, clinical practise adjustments targeted to lower risk factors are becoming more important. Obese individuals' body weight is a prime example of a modifiable risk factor.

Although the World Health Organization recommends BMI as an index of obesity, some studies suggest that the pattern of body fat distribution is a more important determinant of disease risk, and individuals with a high proportion of abdominal fat have a higher risk of developing diabetes, hypertension, and CVD. Unfortunately, there is no generally acknowledged standard measure of abdominal obesity. Despite this, the majority of research suggest that waist circumference (WC) is a stronger measure of abdominal obesity and a better predictor of CVD than BMI or waist-to-hip ratio (WHpR). Hypertension is a major cause of morbidity and death globally due to cardiovascular illnesses such as CHD, CHF, peripheral artery disease, and ischemic and hemorrhagic strokes.[1]

Because of a lack of widespread agreement, the definition of hypertension has changed throughout time and from place to region. The Joint National Committee agreed on the criteria for defining normal and varying degrees of hypertension in its report no. 7. Multiple modifiable (obesity, weight gain, psychosomatic stress, low levels of physical activity, increased alcohol use) and non-modifiable variables are commonly acknowledged to be significant contributing factors. It is also well accepted that the prevalence of hypertension rises with age.[2]

Many correlative research on the many etiological variables for cardiovascular illnesses, such as age, gender, weight, height, ethnicity, socioeconomic position, and psychological aspects, have been conducted in the western and Indian populations. Anthropometric parameters such as height, weight, BMI, waist and hip circumferences, waist hip ratio, waist to height ratio, and thickness of various skinfolds are often utilised as risk factors for cardiovascular disease today.[16,17] Other relative risk factors for cardiovascular disease, such as cholesterol levels, alcohol use, stress, and smoking, have a considerable and comparable influence on both men and women. Although the male predominance for coronary disease is widely documented, these risk factors tend to cluster among women, particularly younger age groups, owing to the rapid adoption of westernised and urban industrial culture.

In the present study the age distribution of cases shown in [Table 1]. Age range in the present study was 18-25 years in both the groups. Majority of cases 174 (57.23%) were found in 21-23 years age group in normotensive group as compared to 91 (46.42%) in 18-20 years group in prehypertensive group. The mean±SD of age was 21.38±1.80 years and 20.86±1.65 years in normotensive and prehypertensive group respectively. Our study is comparable to other studies such as Badaruddoza et al,[17] in 2010 who included in their study 800 urban Punjabi female youth aged between 19-24 years and they were measured for blood pressure, height, weight, waist and hip circumferences.

Our study shows sex wise distribution of cases in the present study. In our study majority of cases were male in group A i.e. 167 (53.93%) and 142 (72.44%) male in group B. Similarly 137 (45.06%) females in group A and only 54 (27.55%) females were found in group B. It shows that males were more affected than females in prehypertensive stage as compared to normotensive cases. Similarly study was conducted by Choudhary et al,[18] in 2011 reported 300 students out of which 189 were males and 111 were females. The average age was

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19.76±2.01 years with a median of 20 years, varying from 18 to 25 years. Of the 300 persons studied 63% were male and 37% female. Out of 189 male students majority (65.08% were aged 21-22 years, 22.22% were 20 years or below and remaining 12.7% were 23-25 years old. Out of 111 female a majority (75.68%) belonged to 21- 22 years age group and 13.5% were more than 23 years and least participants were (10.8%) less than 20 years of age.

In the present study shows comparison of various anthropological parameters. In the present study, mean weight; height; BMI, waist circumference; hip circumference and W:H ratio were calculated. In normotensive group mean weight was 59.62±8.17 and in prehypertensive group it was 68.37±9.14. Similarly mean height of the cases in group A was 1.67±0.08 and in prehypertensive group it was 1.64±0.08. Accordingly on the basis of weight and height calculation; BMI was also higher in prehypertensive group i.e. 25.44±3.19 as compared to normal cases. Further; waist circumference and W:H ratio was also found higher in prehypertensive group as compared to normotensive group i.e. waist circumference 31.26±3.94 in group A and 35.50±3.58 in group B; W:H ratio 0.849±0.09 in group A and 0.96±0.07 in group B. Only hip circumference was not significant as mean hip circumference was 36.88±3.55 in normotensive group as compared to 36.74±2.32 in group B.

Similar results were reported by Esmaillzadeh et al,[19] in 2004 compared the ability of waist circumference (WC), body mass index (BMI), waist-to-hip ratio (WHpR) and waist-to-height ratio (WHtR). They collected demographic data; anthropometric indices and blood pressure and measured according to standard protocol. In the 18–34 years age category, cutoff points for BMI, WHpR, WHtR and WC were 24 kg/m2, 0.86, 0.47 and 81 cm, respectively. Hypertension was defined based on JNC VI. Biochemical analysis was conducted on fasting blood samples. Diabetes was defined as fasting plasma glucose 126 mg/dl or 2hPG 200 mg/dl and dyslipidemia based on ATP III. The presence of at least one risk factor from the three major cardiovascular risk factors (hypertension, dyslipidemia and diabetes) was also evaluated. Mean BMI, WHpR, WC and WHtR for subjects were 25.64.2 kg/m2, 0.91±0.07, 87.7±11.7 cm and 0.51±0.02, respectively. Although all anthropometric indicators had a significant association to cardiovascular risk factors, WHpR had the highest correlation coefficients compared to other anthropometric measures.

Present study shows that systolic blood pressure was 112.71±3.28 (range 108-120) in normotensive group as compared to 128.95±5.49 (range 122-138) in prehypertensive group. Similarly DBP was 75.22±3.04 (70-80) in normotensive group and 81.13±4.49 (70-88) in prehypertensive group. Similar results were also reported by Huntley JC et al,[20] in a study titled 'Blood pressure in adolescence – The United States Health Examination Survey' reported that a nationally representative sample of adolescents 12-17 years of age examined in the U.S. Health Examination Survey and relationships between blood pressure and other variables were explored. During adolescence, blood pressure increases more rapidly in males than in females and only small racial differences are present.

In the present study, we calculated tricep skin fold thickness and sub scapula skin fold thickness in our study and found that cases who belonged to normotensive group have less skin fold thickness as compared to group B. In the present study mean tricep skin fold thickness was 262.85±19.30 (range 224-359) in group A and 315.56±29.19 (range 259-397) in group B. Similarly sub scapula skin fold thickness was 280.18±21.38 (range 270-380) in group A and 360.76±25.35 (270-390) in group B.

Similar results were reported by Huntley JC et al,[20] that physiological maturation assessed by skeletal age and adiposity (skinfold thickness) were components of weight and each was also related to blood pressure. Although systolic murmurs were related to blood pressure at the time of examination, the murmurs were transitory and not predictive of future pressures. All factors were equally influential in each race-sex group. No significant relationships were found between geographic or demographic variables and blood pressure.

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Conclusion

We concluded that the BMI, Waist circumference and W:H ratio and Hip circumference was higher in prehypertensive group as compared to normal cases.

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