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Original Research Article

# A Study on the Correlation between Anthropometric Factors and Prehypertension in Medical Students

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**Abstract:**

**Introduction:** Hypertension is a significant health concern globally, and its prevalence has been rising over the years. Blood pressure readings that exceed normal but fall short of being classified as hypertension are referred as prehypertension. Blood pressure in the prehypertensive range is 120/80 mmHg to 139/89 mmHg.It can develop in childhood and adolescence and last into adulthood. It has the potential to cause hypertension and its related consequences in later life. One known risk factor for both prehypertension and hypertension is obesity. Various anthropometric measurements can be used as indicators of obesity and help healthcare providers to assess an individual's risk of developing prehypertension and hypertension. Promoting good lifestyle practices is crucial for avoiding and treating prehypertension and its consequences. These practices include regular exercise, a balanced diet, and weight control.

**Aim:** To study the correlation between anthropometric factors and prehypertension in 250 medical students in Government Medical College Kottayam

**Materials and Methods:** A proforma was distributed following approval from the principal and 250 medical students. Following that, blood pressure, waist circumference, hip circumference, waist-hip ratio, and triceps skinfold thickness were measured. The data was entered into Microsoft Excel. Using SPSS, the statistical analysis was completed. The mean and standard deviation for quantitative variables were calculated. The Pearson correlation coefficient is used to examine the relationship between anthropometric characteristics and blood pressure (SBP and DBP).

**Results:** Correlation between systolic blood pressure and waist circumference, hip circumference, waist-hip ratio was highly significant but was not significant between triceps skinfold thickness.

There was significant positive correlation between diastolic blood pressure and waist circumference, hip circumference, waist-hip ratio. However, a negative correlation was found between triceps skinfold thickness and diastolic blood pressure.

Association of BP category with waist circumference category, hip circumference category, triceps skinfold thickness category were significant.

**Conclusion:** 1. In the study subjects, blood pressure had significant positive correlation with waist circumference, hip circumference and waist-hip ratio. 2. Prehypertension was significantly correlated with categories for waist circumference, hip circumference, and triceps skinfold thickness.

**Keywords:** Prehypertension, Anthropometeric Parameters, Obesity.

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## Introduction

Hypertension is fast emerging epidemic in the world. In India also prevalence of high blood pressure is increasing many times. The major causes of the high incidence of hypertension include sedentary Behaviour, progressive urbanization, and lifestyle modification [1]. Nowadays technological advances and competition have made employment stressful leading to high blood pressure in younger generation. High blood pressure is often called as a slient killer [2]. It is one of the major risk factor for cardiovascular morbidity and mortality [3]. It is necessary to assess high blood pressure in early stages so as to reduce the cardiovascular, cerebrovascular and renal complication. Prehypertension is known to begin in childhood and adolescence and will track to adulthood. It can progressively lead to hypertension in adulthood and the severity of adverse effects is more in them. The major risk factor

for prehypertension is obesity. There are many anthropometric factors which are obesity indicators. Waist circumference of ≥90 cm for males and ≥80cm for females is considered as abdominal obesity for Asian population. Waist circumference has been found to be a one of the best indicator of abdominal fat. Waist circumference appears to carry a greater prognostic significance also. Even persons classified as normal weight (Normal BMI) may have increased waist circumference. Hip circumference above 100cm is obesity. It is the measure of central obesity. Several studies showed that it has positive correlation with blood pressure. But studies conducted by Seidell et al and Snijder et al showed negative correlation between hip circumference and blood pressure and cardiovascular disease [4,5]. It is because increase in hip circumference is due to increase in muscle mass.

Waist Hip ratio (WHR) is also a predictor of obesity. It is taken by dividing waist circumference by hip circumference. Value above 0.8 for females and 0.9 for males indicate obesity. Several studies had shown that there was correlation between waist hip ratio and blood pressure, but it was more related to cardiovascular risk [6,7]. Skin fold thickness is associated with body fat and asses subcutaneous fat deposits. It is a good indicator of adverse health outcomes [8].Triceps skinfold thickness is an indicator of peripheral obesity. Truncal skinfold thickness measures central obesity. In Nortwick Park Heart study, triceps skinfold thickness showed correlation with blood pressure

The correlation between anthropometric factors and prehypertension varies across population and this studies in adolescence and early decades are of great significance as they help to identify risk of developing hypertension and enable them to take preventive measures. They can reduce the risk by changes in lifestyle and dietary measures. This helps in offsetting the potential burden of health system of our nation.

## Materials and Methods

The present study was done to study the correlation between anthropometric parameters like waist circumference, hip circumference, waist hip ratio, triceps skinfold thickness and prehypertension in 250 medical students of Government Medical College Kottayam for a period of one year from June 2012 to June 2013. The study was approved by the Institutional Ethics Committee.

**Inclusion Criteria:** Medical students who had given consent for the study.

**Exclusion Criteria:** Students with family history of renal and endocrine diseases.

**Study Procedure:** After getting consent from principal and medical students, proforma was given. Then triceps skinfold thickness, waist circumferenence, hip circumference, waist-hip ratio and blood pressure were taken.

**Proforma:** Includes questions about age, sex, dietary habits, habit of alcoholism and smoking, history of physical activity, family history of diabetics or hypertension, renal disease, endocrine disease

**Waist circumference** was measured at the midpoint between the bottom of ribcage and top of iliac crest using a tape. The tape is snug but did not compress the skin and is parallel to the floor. The measurement was done at the end of normal expiration

**Hip circumference** was measured using a measuring tape at the maximum circumference over the buttocks with the subject standing, the arms relaxed at the sides, without causing compression of the skin.

Waist hip ratio was calculated using waist circumference and hip circumference readings.

**Triceps skinfold thickness measurements:** skin pinch at the midpoint of olecranon processes and corocoid process when the forearm being kept flexed was taken and measured using skin calipers

Blood pressure was measured using sphygmomanometer in the right upper arm in the supine position after 5 minutes of rest

### Statistical Analysis and Results

The information was input into the Microsoft Excel. The statistical analysis was done in SPSS. For quantitative variables, mean and standard deviation was computed. Correlation between blood pressure (SBP and DBP) and anthropometric factors using Pearson correlation coefficient.

**Table 1: Correlation between systolic blood pressure and anthropometric parameters**

| Anthropometric parameters | Pearson correlation coefficient | p value |
|---|---|---|
| Waist circumference (cm) | 0.437 | 0.0001 |
| Hip circumference (cm) | 0.437 | 0.0001 |
| Waist-Hip ratio | 0.178 | 0.005 |
| Triceps skinfold thickness (mm) | -0.056 | 0.377 |

Correlation between systolic blood pressure and waist circumference, hip circumference, waist-hip ratio was highly significant but was not significant between triceps skinfold thickness and systolic blood pressure.

**Table 2: Correlation between diastolic blood pressure and anthropometric parameters**

| Anthropometric parameters | Pearson correlation coefficient | p value |
|---|---|---|
| Waist circumference (cm) | 0.351 | 0.0001 |
| Hip circumference (cm) | 0.270 | 0.0001 |
| Waist-Hip ratio | 0.222 | 0.0001 |
| Triceps skinfold thickness (mm) | -0.134 | 0.034 |

There was significant positive correlation between diastolic blood pressure and waist circumference, hip circumference, waist-hip ratio. However, a negative correlation was found between triceps skinfold thickness and diastolic blood pressure.

**Table 3: Distribution of study subjects according to blood pressure category and waist circumference category**

| Waist circumference Category | BP category | | | Total |
|---|---|---|---|---|
| | Normal | Prehypertension | Hypertension | |
| Normal | 116 (49.6%) | 99 (42.3%) | 19 (8.1%) | 234 (100%) |
| High | 4 (25%) | 8 (50%) | 4 (25%) | 16 (100%) |
| Total | 120 (48%) | 107 (42.8%) | 23 (9.2%) | 250 (100%) |

**$\chi^2$= 6.729, p value=0.03**

Association between BP category and waist circumference category was significant

**Table 4: Distribution of study subjects according to blood pressure category and hip circumference category**

| Hip circumference Category | BP category | | | Total |
|---|---|---|---|---|
| | Normal | Prehypertension | Hypertension | |
| Normal | 115 (50%) | 98 (42.6%) | 17 (7.4%) | 230 (100%) |
| High | 5 (25%) | 9 (45%) | 6 (30%) | 20 (100%) |
| Total | 120 (48%) | 107 (42.8%) | 23 (9.2%) | 250 (100%) |

**$\chi^2$=13.160, p value=0.001**

There was significant association between hip circumference category and BP category.

**Table 5: Distribution of study subjects according to blood pressure category and waist-hip ratio category**

| Waist-Hip Ratio Category | BP category | | | Total |
|---|---|---|---|---|
| | Normal | Prehypertension | Hypertension | |
| Normal | 58 (43.6%) | 60 (45.1%) | 15 (11.3%) | 133 (100%) |
| High | 62 (53%) | 47 (40.2%) | 8 (6.8%) | 117 (100%) |
| Total | 120 (48%) | 107 (42.8%) | 23 (9.2%) | 250 (100%) |

**$\chi^2$= 2.831, p value=0.243**

Association between BP category and waist hip ratio category was not significant.

**Table 6: Distribution of study subjects according to blood pressure category and triceps skinfold thickness category**

| Triceps skinfold thickness Category | BP category | | | Total |
|---|---|---|---|---|
| | Normal | Prehypertension | Hypertension | |
| Low | 119 (48.6%) | 105 (42.9%) | 21 (8.5%) | 245 (100%) |
| Normal | 1 (20%) | 2 (40%) | 2 (40%) | 5 (100%) |
| Total | 120 (48%) | 107 (42.8%) | 23 (9.2%) | 250 (100%) |

**$\chi^2$=11.566, p value=0.021**

There was significant association between triceps skinfold thickness category and BP category.

## Discussion

The present study was done to assess the correlation between anthropometric parameters and prehypertension in 250 medical students in Medical College, Kottayam. In this study, anthropometric parameters waist circumference, hip circumference, waist–hip ratio and triceps skinfold thickness were taken and its correlation with systolic and diastolic blood pressure was studied.

The study group consisted of 104 males and 146 females. Out of the 250 medical students, 120 students were normotensives, 107 (42.8%) were prehypertensives and 23(9%) were hypertensives. In prehypertensives, 58 were males and 49 were females.

The mean waist circumference of study subjects was 73.89cm. There was highly significant positive correlation between waist circumference and both systolic and diastolic blood pressure. This was similar to the observations of Thomas et al [9]. There was significant association between waist circumference category and blood pressure category as indicated by the p value of 0.03. Among high waist circumference category 50% were prehypertensives and 25% were hypertensives.

The mean hip circumference was about 88.74cm. There was a significant positive statistical correlation between hip circumference and both systolic and diastolic blood pressure (p value of 0.0001). There was significant association between hip circumference category and blood pressure as indicated by the p value of 0.001. Among high hip circumference category, prehypertensives were about 45% and hypertensives were about 30%.

The mean waist-hip ratio of the study group was 0.83. The positive correlation between waist-hip ratio and both systolic and diastolic blood pressure was significant (p value of 0.005).There was no significant association between waist-hip ratio category and BP category in the present study.

The mean triceps skinfold thickness was 8.22mm. No significant correlation was found between triceps skinfold thickness and systolic blood pressure. There was negative correlation between triceps skinfold thickness and diastolic blood pressure. Studies regarding correlation between skinfold thickness and blood pressure showed divergent results. Some studies have shown that there was significant positive relation between them8,10.But Ribereo et al concluded that there was no correlation between them [11].There was significant association between triceps skinfold thickness category and blood pressure category in the present study.

Anthropometric parameters help to assess obesity and fat tissue accumulation. Obesity is associated with expansion of extracellular fluid volume, blood volume and increased total tissue blood flow, thereby increasing venous return and cardiac output. Increased blood flow is due to increased growth of adipose tissue and it causes increase in workload and metabolic demands.

This causes increase in blood pressure. Increase in blood pressure is also due to increase in sympathetic activity associated with obesity.

## Conclusion

From the present study the following conclusions were made:

1. In the study subjects, 42.8% were prehypertensives and 9% were hypertensives.
2. In the study subjects, systolic blood pressure had significant positive correlation with waist circumference, hip circumference and waist-hip ratio.
3. In the study subjects, diastolic blood pressure had significant positive correlation with waist circumference, hip circumference and waist-hip ratio.
4. Association of prehypertension with waist circumference category, hip circumference category, triceps skinfold thickness category were significant.
5. In the study subjects, diastolic blood pressure had significant negative correlation with triceps skinfold thickness.

The prevalence of prehypertension in childhood and adolescence seems to have significant tendency towards development of hypertension in adult hood. So primary prevention of prehypertension may have better long term prognosis compared to secondary prevention and treatment of hypertension and its related co- morbidities. Measures targeting young people towards behavioral and life style modification including changes in dietary habits and increased physical activity may play a pivotal role in this context

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