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Correlation of Anthropometric Parameters on Blood Pressure in Students and Staff of Saint James School of Medicine

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ABSTRACT

Background: Hypertension is a major global public health problem and a leading risk factor for cardiovascular disease. Although the association between obesity and hypertension is well established, limited data are available regarding the relationship between basic anthropometric parameters and blood pressure among normotensive individuals. Identifying early predictors in this population may aid in preventive strategies.

Materials and Methods: A cross-sectional study was conducted among 60 normotensive students and staff (20 males and 20 females) aged 20-40 years at Saint James School of Medicine. Anthropometric parameters including age, height, weight, and body mass index (BMI) were measured using standardized protocols. Blood pressure was recorded using a calibrated digital sphygmomanometer, and the mean of three readings was used for analysis. Pearson's correlation coefficient was applied to assess associations between anthropometric variables and systolic and diastolic blood pressure, with statistical significance set at $p < 0.05$.

Results: Mean systolic blood pressure ranged from 100 to 140 mmHg and mean diastolic blood pressure from 70 to 93 mmHg. BMI values ranged from 18.2 to 34.75 kg/m². Individuals in the high-normal blood pressure category exhibited a higher mean BMI (26.16 kg/m²) compared with those in the normal (23.73 kg/m²) and optimal (23.68 kg/m²) blood pressure categories. Pearson's correlation analysis demonstrated a weak positive association between BMI and blood pressure ($r = 0.20$).

Conclusion: Anthropometric parameters, particularly BMI, showed only a weak association with blood pressure among normotensive individuals. These findings suggest that blood pressure regulation in this population is multifactorial and cannot be predicted by BMI alone. Comprehensive lifestyle-based screening approaches are recommended for early cardiovascular risk assessment.

Keywords: Anthropometric parameters; Blood pressure; Body mass index; Correlation; Normotensive individuals.

INTRODUCTION

Hypertension remains a growing global health concern and is a major contributor to cardiovascular diseases, including coronary artery disease and stroke, which together account for substantial morbidity and mortality worldwide.[1,2] Elevated blood pressure is closely linked to modifiable

lifestyle factors such as unhealthy dietary patterns, physical inactivity, and increased adiposity.[3,5] While the relationship between obesity and hypertension has been extensively documented, comparatively little attention has been given to the association between anthropometric characteristics and blood pressure in normotensive individuals.[5,6]

Rapid urbanization and lifestyle transitions, particularly in developing regions, have contributed to changing cardiovascular disease patterns and increasing incidence rates. [4] Although previous studies have emphasized the role of obesity indices such as BMI and waist hip ratio in predicting hypertension risk, the relevance of basic anthropometric variables in individuals with normal blood pressure remains unclear. Understanding these associations in normotensive populations may help identify early indicators of cardiovascular risk before the onset of clinically overt hypertension. Therefore, the present study aimed to evaluate the relationship between age, height, weight, BMI, and blood pressure among normotensive students and staff of Saint James School of Medicine.

Global Prevalence of Hypertension

Hypertension is a well-recognized global public health problem, responsible for approximately 10 million deaths annually. [7] Despite widespread prevention and control efforts, its prevalence continues to rise, particularly in low- and middle-income countries. Hypertension remains one of the most significant modifiable risk factors for cardiovascular disease and contributes substantially to the global healthcare burden. Lifestyle changes associated with urbanization and Westernization have further accelerated the prevalence of hypertension and related cardiovascular conditions in many populations. [8]

Anthropometric Parameters and Blood Pressure

A substantial body of evidence demonstrates strong associations between obesity-related indices, including BMI and waist circumference, and elevated blood pressure.[9,14] The Seventh Report of the Joint National Committee (JNC 7) emphasizes close monitoring of individuals with increased BMI due to their higher risk of developing hypertension.[8,10] However, most existing studies have focused on hypertensive or pre-hypertensive populations, leaving a relative paucity of data on normotensive individuals. Anthropometric parameters may still serve as early markers of cardiovascular risk even before blood pressure becomes elevated.

Normotensive Populations

Studies specifically examining normotensive populations are limited. [1,6] Available evidence suggests that anthropometric measures may influence blood pressure even within normal ranges. A cross-sectional study conducted among Swiss men reported significant associations between BMI, physical fitness, and blood pressure, indicating that anthropometric factors may play a role prior to the development of hypertension. [1,4] The present study extends this work by including both male and female participants and evaluating multiple anthropometric parameters within an academic setting.

MATERIALS AND METHODS

Study Design

This study will utilize a cross-sectional design to evaluate the association between anthropometric variables including age, height, weight, and body mass index (BMI) and blood pressure in normotensive adults. A total of 40 participants will be enrolled, comprising 20 males and 20 females between 20 and 40 years of age.

Study Population

The study population will consist of students and staff from the Saint James School of Medicine. Eligible participants will have normal blood pressure ranges, defined as systolic values between 100-140 mmHg and diastolic values between 60-90 mmHg. Individuals will be excluded if their blood pressure falls outside these ranges, if they are

pregnant, have chronic medical conditions, or are taking medications known to influence blood pressure.

Anthropometric Measurements

Height: Height will be measured to the nearest 0.5 cm using a standard stadiometer. Participants will stand erect with heels, buttocks, shoulders, and head aligned against the vertical surface.

Weight: Weight will be recorded to the nearest 0.5 kg using a calibrated digital scale, with participants measured barefoot and wearing light clothing. Prior research has shown that body weight is associated with blood pressure variation and may interact with dietary and lifestyle factors. [10,11]

Body Mass Index (BMI): BMI will be calculated as weight in kilograms divided by height in meters squared (kg/m²). [1,5] Previous findings indicate that elevated BMI is associated with increased blood pressure. [11,12]

Blood Pressure Measurements

Blood pressure will be assessed using a calibrated digital sphygmomanometer. Three readings will be taken at 10-minute intervals, and the mean value will be used in the analysis. Participants will abstain from smoking and caffeine for at least 30 minutes before measurement. All procedures will follow standardized recommendations to ensure accuracy and reliability. [13]

Statistical Analysis

Pearson's correlation coefficient will be used to determine the relationships between anthropometric parameters and blood pressure. A p-value of <0.05 will be considered statistically significant.

RESULTS

Age (yrs)	SBP 1	DBP 1	SBP 2	DBP 2	SBP 3	DBP 3	Mean SBP	Mean DBP	Mean PP	Height (m)	Weight (kg)	BMI (kgm^{-2})
26	104	70	103	69	106	71	104	79	26	1.52	48.99	21.09
23	130	80	129	79	132	81	130	93	38	1.57	56.25	22.68
24	120	70	119	69	122	71	120	83	38	1.60	63.50	24.80
27	110	80	109	79	112	81	110	88	23	1.65	72.57	26.63
25	120	80	119	79	122	81	120	90	30	1.55	68.04	28.34
25	100	60	99	59	102	61	100	70	30	1.70	68.95	23.81
22	130	80	129	79	132	81	130	93	38	1.57	58.97	23.78
20	110	60	109	59	112	61	110	73	38	1.68	68.04	24.21
25	120	80	119	79	122	81	120	90	30	1.75	70.31	22.89
22	110	80	109	79	112	81	110	88	23	1.60	46.72	18.25
27	120	80	119	79	122	81	120	90	30	1.78	72.57	22.96
23	110	60	109	59	112	61	110	73	38	1.63	69.40	26.26
21	120	80	119	79	122	81	120	90	30	1.85	67.13	19.53
23	110	60	109	59	112	61	110	73	38	1.60	65.77	25.69
22	100	70	99	69	102	71	100	78	23	1.60	54.88	21.43
26	110	80	109	79	112	81	110	88	23	1.63	63.50	24.03
28	110	70	109	69	112	71	110	80	30	1.70	68.04	23.49
22	110	80	109	79	112	81	110	88	23	1.80	68.04	20.92
22	130	80	129	79	132	81	130	93	38	1.73	73.03	24.48
40	140	70	139	69	142	71	140	88	53	1.75	78.02	25.40
26	120	80	119	79	122	81	120	90	30	1.73	68.04	22.81
38	110	80	109	79	112	81	110	88	23	1.75	81.19	26.43
26	110	70	109	69	112	71	110	80	30	1.63	57.15	21.63
23	110	80	109	79	112	81	110	88	23	1.52	67.59	29.10
25	110	70	109	69	112	71	110	80	30	1.88	83.91	23.75
23	120	80	119	79	122	81	120	90	30	1.60	72.12	28.17
22	130	60	129	59	132	61	130	78	53	1.80	75.75	23.29
27	115	80	114	79	117	81	115	89	27	1.85	85.73	24.94

26	120	80	119	79	122	81	120	90	30	1.85	72.57	21.11
28	130	70	129	69	132	71	130	85	45	1.80	90.72	27.89
27	130	60	129	59	132	61	130	78	53	1.70	81.65	28.19
26	120	60	119	59	122	61	120	75	45	1.88	71.67	20.29
28	119	79	118	78	121	80	119	89	30	1.73	97.98	32.84
24	110	80	109	79	112	81	110	88	23	1.68	58.51	20.82
32	140	60	139	59	142	61	140	80	60	1.75	84.82	27.61
36	100	60	99	59	102	61	100	70	30	1.57	86.18	34.75
33	120	80	119	79	122	81	120	90	30	1.78	97.07	30.71
25	110	80	109	79	112	81	110	88	23	1.88	81.65	23.11
23	130	70	129	69	132	71	130	85	45	1.75	77.56	25.25
36	130	80	129	79	132	81	130	93	38	1.85	77.11	22.43

Table 1: Anthropometric Measures alongside Mean Age, SBP, DBP, PP, and BMI of students and staff at the Saint James School of Medicine.

BP Category	BMI (kgm^{-2})
High-Normal (130-139 / 85-89)	26.16
Normal (120-129 / 80-84)	23.73
Optimal (100<120 / 60<80)	23.68

Table 2: Stratified BP compared to BMI of students and staff at the Saint James School of Medicine.

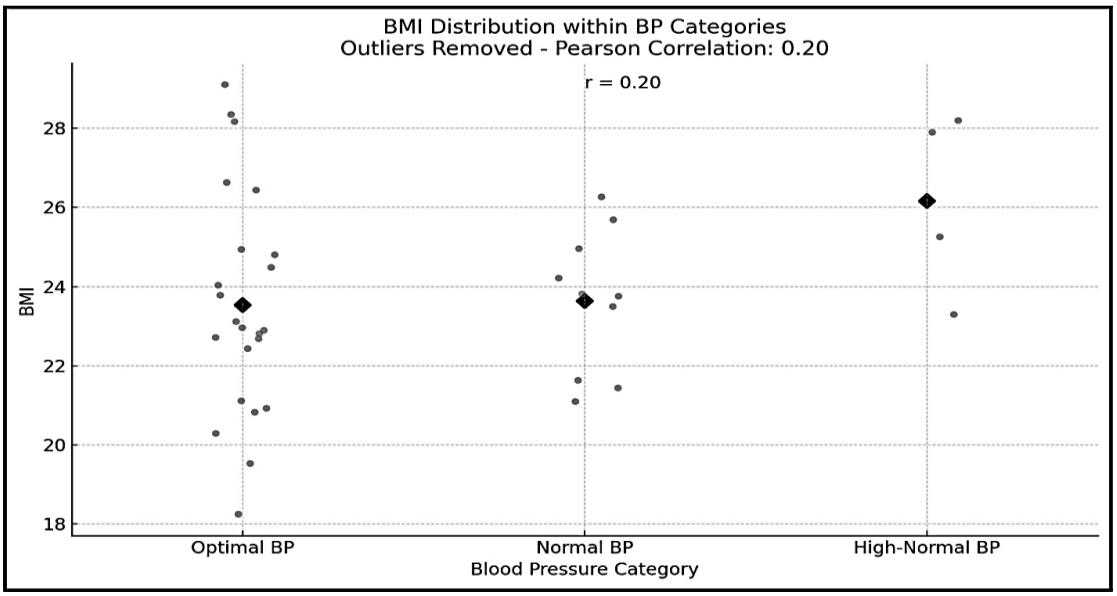

Figure 1: Stratified BP values compared to BMI with calculated Pearson Correlation Coefficient(r) value using data from 60 students and staff at the Saint James School of Medicine.

RESULTS

The anthropometric characteristics and blood pressure profiles of students and staff at the Saint James School of Medicine. The dataset includes age, repeated systolic blood pressure (SBP) and diastolic blood pressure (DBP) measurements, calculated mean SBP, mean DBP, pulse pressure (PP), height, weight, and body mass index (BMI). Overall, participants span a wide age range (early 20s to early 40s), reflecting a mixed population of students and staff. This diversity allows comparison across young adults and older individuals within the academic environment. Blood The Pressure Parameters: Mean SBP values generally range from approximately 100 to 140 mmHg, while mean DBP values range from 70 to 93 mmHg. Most individuals fall within normotensive ranges, although a subset exhibits borderline or elevated SBP values, suggesting early cardiovascular risk in some participants. Pulse pressure (PP), an indicator of arterial stiffness,

mostly ranges between 23 and 60 mmHg, with higher values observed in older individuals, consistent with age-related vascular changes. The Anthropometric Measures: Heights range from approximately 1.52 to 1.88 m, and body weights range from about 48.9 to 97.9 kg, indicating substantial variability in body size. BMI values span from ~18.2 to 34.75 kg/m², encompassing underweight, normal weight, overweight, and obese categories. The presence of overweight and obese individuals suggests potential lifestyle-related health risks within the population. The relationship Between BMI and Blood Pressure: Participants with higher BMI values tend to show higher mean SBP and DBP, suggesting a positive association between increased body mass and elevated blood pressure. Conversely, individuals with lower BMI generally demonstrate lower blood pressure readings (Table 1).

This study examined the relationship between blood pressure (BP) categories and body mass index (BMI) among students and staff at Saint James School of Medicine. As shown in Table 2, individuals classified within the high-normal BP range (130–139/85–89 mmHg) had the highest mean BMI (26.16 kg/m²), which falls within the overweight category. In contrast, participants with normal BP (120–129/80–84 mmHg) and optimal BP (100–<120/60–<80 mmHg) demonstrated lower and nearly identical mean BMI values (23.73 kg/m² and 23.68 kg/m², respectively), both within the normal weight range. These findings indicate a gradual increase in BMI with higher BP classification, suggesting an association between elevated blood pressure and increased body weight in this population. Further illustrates this relationship by depicting BMI distribution across BP categories and quantifying the association using Pearson's correlation coefficient. The calculated correlation (r = 0.20) indicates a weak positive relationship between BMI and BP, suggesting that while higher BMI tends to coincide with higher BP, the strength of this association is limited. Mean BMI values increase progressively from the optimal BP group to the high-normal BP group; however, substantial overlap in BMI distributions across categories highlights considerable individual variability (Figure 1).

DISCUSSION

This study evaluated the relationship between anthropometric parameters and blood pressure among normotensive students and staff at Saint James School of Medicine. The findings indicate that although individuals with higher BMI tended to exhibit higher systolic and diastolic blood pressure values, the overall strength of this association was weak.

Mean systolic and diastolic blood pressure values largely fell within normotensive ranges, although some participants demonstrated borderline or high-normal readings, suggesting early cardiovascular risk. Pulse pressure values tended to be higher among older participants, consistent with age-related vascular changes. Anthropometric measurements revealed substantial variability in height, weight, and BMI, reflecting a heterogeneous population. [14]

The observed weak positive correlation between BMI and blood pressure suggests that BMI alone does not adequately explain blood pressure variation in normotensive individuals. Considerable overlap in BMI values across blood pressure categories highlights the influence of additional factors such as genetics, physical activity, diet, stress, hormonal regulation, vascular elasticity, and renal function.[15]

These findings are consistent with previous studies reporting limited predictive value of BMI for blood pressure among normotensive populations. [18] Consequently, early blood pressure prevention strategies should not focus exclusively on body weight but should incorporate broader lifestyle and metabolic factors. [16,17]

Public Health Implications

Routine assessment of both anthropometric parameters and blood pressure in otherwise healthy populations offers an opportunity for early identification of cardiovascular risk.

Holistic lifestyle interventions addressing diet, physical activity, stress management, and behavioural factors may be more effective than weight-focused strategies alone in preventing progression to hypertension. [18,19]

Sex Differences

Sex-related physiological differences influence blood pressure regulation. Estrogen confers cardiovascular protection in premenopausal women by improving endothelial function and arterial compliance, potentially attenuating the impact of increased BMI on blood pressure. [20,21] In contrast, men often demonstrate higher blood pressure levels and a stronger association between BMI and systolic blood pressure. [22] Sex-specific analyses may therefore provide clearer insights into these relationships.

Age Effects

Advancing age is associated with increases in blood pressure due to reduced arterial elasticity and increased vascular stiffness. [23] Younger individuals may maintain normal blood pressure despite higher BMI owing to more compliant vasculature, whereas age-related physiological changes may strengthen the association between BMI and blood pressure over time. [24,25]

CONCLUSION

Among normotensive students and staff, BMI demonstrated only a weak positive association with systolic and diastolic blood pressure. These findings indicate that BMI alone is not a strong predictor of blood pressure in individuals with normal readings. Blood pressure regulation in this population appears to be influenced by multiple physiological and lifestyle factors beyond body weight alone.

Limitations

The study's limitations include a relatively small sample size, cross-sectional design, and lack of additional anthropometric indices such as waist circumference or body fat percentage. These factors may limit generalizability and causal interpretation.

Recommendations for Future Research

Future studies should employ longitudinal designs, include larger and more diverse populations, incorporate additional anthropometric measures, and evaluate hypertensive and pre-hypertensive groups to better clarify the long-term relationship between anthropometry and blood pressure.

Declaration by Authors

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