



ANTHROPOMETRIC PARAMETERS AND BLOOD PRESSURE IN ADULTS: EXPLORING THE RELATIONSHIP AND ASSESSING THE RISK OF HYPERTENSION

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ABSTRACT

This study aimed to explore the connection between hypertension and obesity by examining the correlation between body mass index (BMI) and blood pressure in a sample of 1,048 adults aged 20 to 100. Through a door-to-door survey, participants provided consent and underwent standard measurements for both blood pressure and anthropometry. The study divided men and women into distinct classes based on their characteristics, distinguishing between normotensive and hypertensive BMI categories to assess potential hypertension risk. Results indicated that obese males were three times more likely to develop hypertension than their normal-weight counterparts, while obese females faced a three-fold higher risk compared to normal-weight females. The study emphasized a noteworthy correlation between obesity indicators and blood pressure, suggesting an increased risk of hypertension associated with higher BMI across various age groups. These findings underscore the significance of preventive measures targeting both overweight and obesity for effective hypertension risk reduction.

Keywords :- Hypertension, Obesity, Body Mass Index (BMI), Blood Pressure, Risk Factors, Preventive Measures.

Access this article online		
Home Page:10.21276/iabcr.2016.2.3.3	Quick Response code	
Received:25.06.16	Revised:12.07.16	Accepted:15.07.16

INTRODUCTION

Numerous epidemiological studies have explored the correlation between elevated blood pressure levels and various diseases [1]. These studies have utilized diverse anthropometric measures to investigate the link between adiposity and cardiovascular risk factors. The findings consistently reveal an inverse relationship between anthropometric measurements and the future risk of cardiovascular disease in the general population [2]. Despite the enduring nature of these associations over the years, the underlying mechanisms remain unclear, and a comprehensive biological model detailing the process is currently unavailable [3]. As of 2020, diseases related to the cardiovascular system rank as the leading causes of mortality and morbidity globally. Limited resources often result in the extrapolation of anthropometric factors and cardiovascular risk from

secondary data derived from developed nations [4]. The specific relationship between anthropometry and blood pressure among indigent adults was poorly understood, and data on the connection between body-fat distribution and hypertension risk are lacking [5]. In numerous studies, BMI emerges as a primary risk factor for hypertension [6]. Investigations into blood pressure and anthropometric indicators have been conducted and, revealing the heightened risk of hypertension among adults.

METHODS AND MATERIALS

The World Health Organization focused its survey on five out of eleven wards, selecting three census enumeration areas randomly within each ward. In each enumeration area, it was anticipated to find approximately 75 adults aged 20 and older.

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Surveys were administered to houses with odd-numbered addresses, and each enumeration area aimed to enroll around 75 eligible and consenting participants. The total target recruitment for the study was 1125 adults. With an impressive overall response rate of 93.2%, the research successfully interviewed 1048 adults, aged 21 to 100, spanning a wide age range.

Procedure

Consent was obtained from participants in each quarter of the five wards before commencing measurements. Study participants were briefed on the study's purpose, and for non-literate individuals, information was conveyed in local dialects. Measurements were conducted in the late afternoon (1600–2000 hrs) when participants could be reached at home. Following approximately 10 minutes of quiet sitting, three blood pressure (BP) readings were taken using an electronic device, and the mean BP value was analyzed. The electronic BP monitor also recorded heart rate (HR). A pilot study indicated good agreement ($r = 0.97$) between a conventional sphygmomanometer and the automated BP device, with appropriate cuff size. Hypertension was defined based on guidelines from the Seventh Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure and the World Health Organization, incorporating a cutoff point of 140/90 mmHg. Individuals with readings at or above this threshold or those reporting new antihypertensive medications were categorized as hypertensive, while the rest formed the normotensive population. Height was measured using a stadiometer, ensuring participants' heels, backs, and occiputs touched the scale while looking straight ahead. Measurements were recorded to the nearest 0.1 cm. Body weight, measured with a calibrated bathroom scale ranging from 0 to 120 kg, was taken without shoes. Weight was recorded in kilograms to the nearest 1.0 kilogram. Body

Mass Index (BMI) was calculated as weight in kilograms divided by height in meters squared ($W/kg/Hm^2$). Participant ages were also documented. BMI categories, as per WHO (1997) classifications, included overweight (25.0 - $25.9 kg/m^2$) and obesity ($30 kg/m^2$ or higher) [7].

RESULT

A total of 1048 adults, aged 20 to 100 years, participated in the study. The mean age was 43 years, and the mean BMI was $22 kg/m^2$ with a 95% confidence interval (CI). The participants exhibited a mean systolic blood pressure (SBP) of 125 mmHg, a mean diastolic blood pressure (DBP) of 76 mmHg, and a heart rate (HR) of 72 beats/minute.

A Pearson's correlation matrix revealed significant positive correlations between weight and BMI with SBP, DBP, and HR. Height, however, did not exhibit a significant correlation with cardiovascular parameters.

The study classified males and females into normotensive and hypertensive groups based on BMI categories. Approximately 34% of the population had hypertension, with varying distributions across BMI categories.

Age stratification analyses revealed that BMI and blood pressure increased statistically with age, except for those over 80 years. Hypertension prevalence increased directly with age, particularly after 60 years, with exceptions for underweight and normal-range subjects.

Obese women had a significantly higher risk of hypertension compared to normal-weight and overweight women, while underweight women were six times more likely to develop hypertension.

The study provides valuable insights into the relationship between BMI, blood pressure, and age, emphasizing the importance of BMI in assessing hypertension risk.

Table 1: Characteristics of participants

Characteristics	Male	Female	P*
Age	43±9.6	43±11.2	0.93
Height	1.5±0.07	1.5±0.06	0.000*
Weight	65±11.1	63±12.3	0.000*
Body mass index	22±3.08	23±3.88	0.001 *
SBP	126±17	124±19.8	0.057
DBP	76±9.7	76±10.8	0.224
Heart Rate	72±8.83	73±10.6	0.000*

Table 2: Correlation co-efficient relationships

Variables	Correlation co-efficient		
	Systolic blood pressure	Diastolic blood pressure	Heart Rate
Height	-0.018	0.028	-0.034
	0.065	0.024	0.168

Weight	0.140	0.153	0.072
	0.000	0.000	0.000
BMI	0.164	0.145	0.108
	0.000	0.000	0.000

DISCUSSION

Obesity and hypertension are recognized as cardiovascular disease risk factors [8]. While many studies on these factors originate from developed countries, anthropometric indicators like BMI play a crucial role in estimating cardiovascular disease risks, including hypertension [9]. BMI has long served as a practical measure of body fat in clinical settings.

The present study affirms a correlation between anthropometric indicators and blood pressure. Consistent with earlier findings, anthropometric factors, particularly BMI, exhibit positive associations with both systolic and diastolic blood pressure.

Previous research has consistently demonstrated a correlation between BMI and blood pressure (SBP/DBP), with small but consistent correlation coefficients for each association, indicating a complex relationship [10, 11]. Hypertension prevalence has been observed across underweight, normal weight, overweight, and obese categories in prior studies [12, 13].

A study found that simple anthropometric indices can predict cardiovascular disease (CVD), revealing significant correlations between blood pressure, heart rate, height, weight, BMI, age, and hypertension risk [14]. The present study adds to this body of evidence by statistically associating hypertension with BMI.

Hypertension risk was not gender-biased based on BMI levels, as observed in this study. Definitions of obesity may vary due to different cut-off points, limiting direct comparisons with previous studies [15]. A Research linked BMI closely to cardiovascular risk factors, with obesity defined at 25 kg/m². Another study

found that even within "normal" BMI ranges, hypertension risk increased consistently based on quintile BMI [16].

The study affirms that Asians predisposed to visceral and abdominal obesity, face higher obesity risks at lower BMIs [17]. In terms of gender-specific risks, obese males are approximately three times more likely to have hypertension than underweight or normal-weight males. Obese individuals have a two-fold greater risk than overweight individuals. Similarly, obese females face about six times greater risk than underweight females and about three times greater risk than normal-weight females [18].

Comparing risk ratios based on BMI levels between men and women, adjusted odds ratios differed by BMI quintile and measurements. Notably, a higher risk of developing hypertension compared to studies conducted in Finland and China. As BMI increased, hypertension risk rose across almost all age groups, although inconsistent relationships were observed in those older than 80 years of age.

CONCLUSION

The study indicates a robust association between body mass index (BMI) and hypertension risk among aged 20 to 80, irrespective of gender. Individuals with elevated BMIs are more prone to hypertension. However, for the elderly population, the statistical associations exhibit inconsistency. Consequently, proactive measures to prevent obesity and overweight could potentially mitigate the risk of hypertension.

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Cite this article:

Santhosh Kumar R (2016). Anthropometric Parameters and Blood Pressure in Adults: Exploring the Relationship and Assessing the Risk of Hypertension. *Acta Biomedica Scientia*, 3(4), 334-337.



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