

**DISSERTATION SUBMITTED FOR THE MASTER'S
DEGREE IN MEDICAL PHYSIOLOGY**



**TO STUDY THE EFFECT OF BODY MASS INDEX AND
WAIST CIRCUMFERENCE ON BLOOD
PRESSURE IN YOUNG ADULTS**

SUBMITTED BY

ADARSH KUMAR

2023

DEPARTMENT OF MEDICAL PHYSIOLOGY

INTEGRAL INSTITUTE OF MEDICAL SCIENCES & RESEARCH

INTEGRAL UNIVERSITY

IIMS&R LKO. INTEGRAL INSTITUTE OF MEDICAL

SCIENCE AND RESEARCH,

LUCKNOW-226026

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TITLE

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A dissertation

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In partial fulfillment of the requirements for the award of degree of
Master of Science

In

Medical Physiology

By

ADARSH KUMAR

Enrolment No- 2100103884

2023

**DEPARTMENT OF MEDICAL PHYSIOLOGY INTEGRAL INSTITUTE OF
MEDICAL SCIENCES & RESEARCH**

INTEGRAL UNIVERSITY LUCKNOW-226026, U.P

Guide

Dr. Gauhar Hussain

Professor

Dept. of Physiology

IIMSR & R, Lucknow

CO- Guide

Dr. Ausaf Ahmed

Associate Professor

Dept. of commniity Med.

IIMSR & R, Lucknow

CO-Guide

Dr. Rajesh Kumar Khare

Professor & Head Dept. of

Medicine IIMSR & R,

Lucknow

**INTEGRAL INSTITUTE OF MEDICAL SCIENCES & RESEARCH,
INTEGRAL UNIVERSITY, LUCKNOW**



DECLARATION BY CANDIDATE

I hereby declare that this dissertation entitled **“TO STUDY THE EFFECT OF BODY MASS INDEX AND WAIST CIRCUMFERENCE ON BLOOD PRESSURE IN YOUNG ADULTS”** is a bonafide & genuine research worked carried out by me under the guidance of **Dr. Gauhar Hussain**, Professor Department of Physiology and under the co-supervision of **Dr. Ausaf Ahmad**, Associate Professor, Department of Community Medicine and **Dr. Rajesh Kumar Khare Professor & Head dept of medicine,**

Date

Signature of the candidate



INTEGRAL UNIVERSITY

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Legislation

Approved by University grant commission

Phone no. +91(0552)2890812, 2890730, 3296117,
6451039

Fax no.: 0522-2890809

Kursi road, Lucknow-226026, Uttar Pradesh
(INDIA)

ENDORSEMENT BY THE HOD

This is to certify that the dissertation entitled “**TO STUDY THE EFFECT OF BODY MASS INDEX AND WAIST CIRCUMFERENCE ON BLOOD PRESSURE IN YOUNG ADULTS**” is a Bonafide & genuine research work carried out by Adarsh Kumar, under the guidance of **Dr. Gauhar Hussain.**, Professor, Department of Physiology and under the co-supervision of **Dr. Ausaf Ahmad**, Associate Professor, Department of Community Medicine and **Dr. Rajesh Kumar Khare Professor** & Head dept of medicine, in partial fulfillment of requirement for the degree of Master of Science in Medical Physiology. The research methods and procedures described have been done by the candidate and result observed by the Guides periodically.

Dr. Khaleel Ahmed Manik

Professor & Head

Department of Physiology

IIMS&R, Lucknow

Date:

Place:



INTEGRAL UNIVERSITY

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Legislation

Approved by University grant commission

Phone no. +91(0552)2890812, 2890730, 3296117,
6451039

Fax no.: 0522-2890809

Kursi road, Lucknow-226026, Uttar Pradesh
(INDIA)

CERTIFICATE BY THE GUIDE AND CO-GUIDE

This is to certify that **Adarsh Kumar** of M.Sc. MEDICAL PHYSIOLOGY; Integral University has completed his dissertation entitled “**TO STUDY THE EFFECT OF BODY MASS INDEX AND WAIST CIRCUMFERENCE ON BLOOD PRESSURE IN YOUNG ADULTS**” successfully. He has completed this work from the department of Physiology, Integral Institute of Medical Sciences and Research, Integral University under the guidance of **DR. GAUHAR HUSSAIN**. The dissertation was a compulsory part of his M.Sc. degree. I wish him good luck and bright future.

Guide

Dr. Gauhar Hussain

Professor

Dept. of Physiology

IIMSR & R, Lucknow

CO- Guide

Dr. Ausaf Ahmad

Associate Professor

Dept. of commniity Med.

IIMSR & R, Lucknow

CO-Guide

Dr. Rajesh Kumar Khare

Professor & Head Dept. of

Medicine IIMSR & R, Lucknow



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6451039

Fax no.: 0522-2890809

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Adarsh Kumar

CONTENTS

S.NO	PARTICULARS	PAGE NO.
1.	INTRODUCTION	1-3
2.	REVIEW OF LITERATURE	4-13
	AIM & OBJECTIVE	13
3.	MATERIAL & METHOD	14-20
4.	OBSERVATIONS AND RESULT	21-35
6.	DISCUSSION	36-40
7.	CONCLUSION	41-42
8.	REFERENCES	43-47
9	ANNEXURE	48-49
10.	ETHICAL CLEARANCE	50
11.	PLAGIARISM	51-54
12.	PROFARMA	55

List of Abbreviations

LIST OF ABBREVIATIONS

B.M.I	BODY MASS INDEX
W.C	WAIST CIRCUMFERENCE
B.P	BLOOD PRESSURE
W.H.O	WORLD HEALTH ORGANIZATION
H.D.L	HIGH DENSITY LIPOPROTEIN

Introduction

CHAPTER 1

INTRODUCTION

Several studies provide evidence for an association between arterial hypertension and anthropometric indications that reflect excess adipose tissue. Major indicators in this context are abdominal circumference, which would provide a measure especially of visceral fat and the body mass index (BMI), obtained by dividing weight in kilograms by the square of height in meters, which would reflect the proportion of adipose tissue in the total body mass, regardless of localization¹.

High blood pressure (BP), tobacco, smoking, including second hand smoke, and alcohol abuse were identified as the three risk factors for global disease burden².

Due to industrialization and urbanization, the standard of living continues to rise particularly in development countries. This has led to weight gain and obesity, which are posing a threat to the health of citizens. Obesity is perhaps the most prevalent form of malnutrition in developing countries, both among adults and children. Studies have demonstrated that obesity is related to elevated systolic blood pressure and diastolic blood pressure, elevated, Dyslipidaemia, diabetes etc.³

Body mass index (BMI) is the most common indicator of general obesity, and waist circumference (WC) is an indicator of abdominal obesity.

The use of this simple and convenient anthropometric measure has broad appeal, as higher BMI is often associated with a number of unfavourable health consequences due to excessive adiposity, and the increased prevalence of obesity has created tremendous concern. Anthropometric measurements are used in field settings and in the absence of clinical and laboratory assessment tools to estimate body composition⁴.

The metabolic syndrome, operationally defined as the presence of any three of the following factors: central obesity (high waist circumference), hyperglycemia, high blood pressure, low high-density lipoprotein-cholesterol (HDL-C)1 or high triglycerides has recently been recognized as a public health concern in the United States. While the metabolic syndrome alone is a condition of disabling medical sequelae, it is an intermediary step in the progression of a number of vascular and coronary-related clinical events. Observational evidence suggests that central obesity is a key element of the metabolic syndrome, and recent studies suggest an etiologic role for visceral adipose tissue. The early identification of this condition and the primary prevention of overweight and obesity in Canada is an important and cost-effective public health priority⁵

Review of Literature

CHAPTER 2

REVIEW OF LITERATURE

Body mass index (BMI) is an estimate of body fat that is based on your weight and height. This calculation helps determine whether you are underweight, at a healthy weight, overweight, or obese BMI can be used to assess your risk for developing certain health problems. For example, people in higher weight categories are considered to be at greater risk for high blood pressure and high cholesterol. Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health.⁶

Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m²).

For adults, WHO defines overweight and obesity as follows: overweight is a BMI greater than or equal to 25; and obesity is a BMI greater than or equal to 30.

BMI provides the most useful population-level measure of overweight and obesity as it is the same for both sexes and for all ages of adults. However, it should be considered a rough guide because it may not correspond to the same degree of fatness in different individuals. For children, age needs to be considered when defining overweight and obesity.

However, the calculation has its limitations. Namely, BMI doesn't take into account age, assigned sex, race, or muscle mass. This article discusses BMI, how it is calculated, its pros and cons, and alternatives for assessing potential health risks.

Children aged between 5–19 years

Overweight and obesity are defined as follows for children aged between 5–19 years:

overweight is BMI-for-age greater than 1 standard deviation above the WHO Growth Reference median; and obesity is greater than 2 standard deviations above the WHO Growth Reference median. Facts about overweight and obesity

Some recent WHO global estimates follow. In 2016, more than 1.9 billion adults aged 18 years and older were overweight. Of these over 650 million adults were obese.

Arterial blood pressure is defined as the lateral pressure exerted by the column of blood on wall of arteries. The pressure is exerted when blood flows through the arteries. Generally, the term ‘blood pressure’ refers to arterial blood pressure.

Arterial blood pressure is expressed in four different terms:

1. Systolic blood pressure
2. Diastolic blood pressure
3. Pulse pressure
4. Mean arterial blood pressure.

SYSTOLIC BLOOD PRESSURE

Systolic blood pressure (systolic pressure) is defined as the maximum pressure exerted in the arteries during systole of heart.

Normal systolic pressure: 120 mm Hg (110 mm Hg to 140 mm Hg)

DIASTOLIC BLOOD PRESSURE

Diastolic blood pressure (diastolic pressure) is defined as the minimum pressure exerted in the arteries during diastole of heart.

Normal diastolic pressure: 80 mm Hg (60 mm Hg to 80 mm Hg).

MEAN ARTERIAL BLOOD PRESSURE

Mean arterial blood pressure is the average pressure existing in the arteries. It is not the arithmetic mean of systolic and diastolic pressures. It is the diastolic pressure plus one third of pulse pressure. To determine the mean pressure, diastolic pressure is considered

than the systolic pressure. It is because, the diastolic period of cardiac cycle is longer (0.53 second) than the systolic period (0.27 second).

Normal mean arterial pressure: 93 mm Hg ($80 + 13 = 93$).

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health. It is defined by body mass index (BMI) and further evaluated in terms of fat distribution via the waist–hip ratio and total cardiovascular risk factors.⁷

The metabolic syndrome

The concept of the metabolic syndrome has existed for at least 80 years.

This constellation of metabolic disturbances, all risk factors for cardiovascular disease, was first described in the 1920s by Kylin, a Swedish physician, as the clustering of hypertension, hyperglycaemia, and gout.² Later, in 1947, Vague drew attention to upper body adiposity (android or male-type obesity) as the obesity

phenotype that was commonly associated with metabolic abnormalities associated with type 2 diabetes and cardiovascular disease.³

Over the past two decades, a striking increase in the number of people with the metabolic syndrome worldwide has taken place. This increase is associated with the global epidemic of obesity and diabetes.⁴ With the elevated risk not only of diabetes but also of cardiovascular disease from the metabolic syndrome,⁵ there is urgent need for strategies to prevent the emerging global epidemic.⁴ The metabolic syndrome is a master of disguise since it can present in various ways according to the different components that constitute the syndrome.

Daria. M. McMahon studied Relationships between Chronotype, social jetlag, sleep, obesity and blood pressure in healthy young adults

Sleep disturbances, chronotype and social jetlag (SJL) have been associated with increased risks for major chronic diseases that take decades to develop, such as obesity, metabolic syndrome and cardiovascular disease. Potential relationships between poor sleep, Chrono type metabolic risk factors for chronic disease have not been extensively investigated⁸

M. Fogelholm. studied on young Adults men in found Waist circumference and BMI are independently associated with the variation of cardio-respiratory and neuromuscular fitness.

To test two hypotheses: (1) cardiorespiratory (CRF) and neuromuscular (NMF) fitness is associated with body mass index (BMI) and waist circumference (WC), independent of each other and of leisure- time physical activity; (2) individuals with high CRF and NMF have lower WC for a given BMI, compared with those with low

CRF and NMF

Waist circumference had significant ($P < 0.001$) negative association with all test results (standardized beta coefficients from -0.23 to -0.77), except for grip strength. Body mass index had significant negative association with $VO_2\max$ (-0.12 ; $P < 0.05$), but positive association ($P < 0.01$) with grip strength (0.28), vertical jump (0.21) and push-ups (0.55). For a given BMI, the estimated WC was highest among those with the poorest results for $VO_2\max$, vertical jump, sit-ups and push-ups⁹.

Maia Turly have done study in Newziland adults about Non-fatal disease burden associated with excess body mass index and waist circumference in New Zealand adults

To describe the relationship between two measures of body fat and selected non-fatal health conditions in the New Zealand adult population in 2003.

Data were obtained from the 2002/03 New Zealand Health Survey. A total of 10,026 adults aged 25 years and over were classified according to measured body mass index (BMI) and waist circumference (WC). BMI classes were 18.5–24.9, 25.0–29.9, 30.0–34.9, 35.0 kg/m². WC classes were <94, 94–102,

>10 centi-meters (cm) for males and <80, 80–88, >88 cm for Females. Increasing BMI or WC class was associated with increasing prevalence of cardiovascular disease, diabetes, high blood pressure, high blood cholesterol, osteoarthritis, asthma and sleep disorders in both males and females. The association with depression was not statistically significant in either gender. Associations were strongest for diabetes and blood pressure, with adults in the highest BMI or WC class at least 3.5 times more likely to have diabetes and 2–3 times more likely to have high blood pressure

compared with those in the lowest classes¹⁰.

Yi-Chun Cha, conducted a research on Risk Factors of Adolescent Obesity in Taiwan and Its Association with Physical activity, Blood Pressure and Waist Circumference.

This study was conducted to investigate risk factors of obesity and its associated health problems in adolescence in Taiwan. They enrolled 559 adolescent volunteers with equal numbers of females and males in 2008. Participants were divided into two groups: obese (body mass index [BMI] \geq 95th percentile) and normal-weight adolescents (BMI: 15th ~ 85th percentile). Each of them completed a questionnaire about lifestyle and parents' stature. Obese mother had high likelihood of having obese girls and boys ($P=0.001$). Obese girls spent more time in watching TV ($P=0.03$) and had higher frequency of having sweetened soft drinks ($P=0.016$) than normal-weight group. Girls spent more time in TV watching associated higher frequency of having sweetened soft drinks ($P=0.012$). In boys, this associated with higher frequency of eating snack ($P=0.018$) and larger waist circumference ($P=0.011$). Boys with higher waist circumference and blood pressure than normal-weight group ($P<0.001$). They had more frequent effective exercise had lower frequency of eating outside ($P=0.01$) and more servings of vegetables ($P=0.002$)¹¹

Jin-Yu Sun. have done study Association Between Waist Circumference and the Prevalence of (Pre) Hypertension Among 27,894 US Adults. Cross-sectional data from the 2007–2018 National Health and Nutrition Examination Survey were analyzed. The historical trend of abdominal obesity was assessed by the Cochran–Armitage trend test. After preprocessed by the multiple imputation strategy, we used generalized additive models to assess the association of waist circumference with systolic/diastolic blood pressure and performed correlation analysis by the Spearman

correlation coefficient. A total of 27,894 participants were included in this study. In the fully adjusted model, waist circumference was positively associated with (pre) hypertension with odds ratios (95% confidence intervals) of 1.28 (1.18–1.40) in the young group and 1.23 (1.15–1.33) in the old group. Restricted cubic spline showed a higher prevalence of (pre) hypertension with the increase of waist circumference. In the subgroup analysis, waist circumference showed a robust trend across all BMI categories with odds ratios (95% confidence intervals) of 3.33 (1.29–8.85), 1.35 (1.17–1.57), 1.27 (1.13–1.41), and 1.09 (1.01–1.17) in underweight, normal weight, overweight, and obese individuals, respectively¹²

Erin R. Rademacher have done study Relation of Blood Pressure and Body Mass Index During Childhood to Cardiovascular Risk Factor Levels in Young Adults. Adult obesity and hypertension are leading causes of cardiovascular morbidity/mortality. Although childhood body mass index and blood pressure track into adulthood, how they influence adult cardiovascular risk independent of each other is not well defined. In univariate analysis, childhood body mass index predicted young adult blood pressure, lipids, glucose, insulin, and insulin resistance, while childhood blood pressure predicted young adult blood pressure, lipids and glucose. In a multivariable regression model (adjusted for age, sex and race) which included change in body mass index and blood pressure from age 13 to 24, body mass index predicted all young adult risk factors except blood pressure and glucose. Baseline systolic blood pressure predicted young adult blood pressure, cholesterol, triglycerides and glucose while baseline diastolic blood pressure predicted young adult blood pressure, body mass index and glucose¹³

RESEARCH QUESTION:

Is there any effect of Body mass index (BMI) and waist circumference on Blood pressure in adult?

STATISTICAL HYPOTHESIS

- NULL HYPOTHESIS (H0):

There is NO significant association of between waist circumference and blood pressure adult.

- ALTERNATIVE HYPOTHESIS (H1)

There is a significant association of between waist circumference and blood pressure adult.

AIM AND OBJECTIVES

AIM: The main aim of this study was to determine the relationship between waist circumference and blood pressure in young adults.

OBJECTIVES

1. To observe the waist circumference, body mass index in young adults.
2. To correlate the BMI and waist circumference with blood pressure.

Materials And Methods

CHAPTER 3

MATERIALS AND METHODS

TYPE OF STUDY:

Cross sectional study

PLACE OF STUDY:

The study was performed in the department of physiology at Integral institute of Medical science & Research, Lucknow. (U.P)

STUDY PERIOD:

6 Months

SUBJECT SELECTION:

Number of subjects was selected from student IIMS&R (OPD & IPD) and following the inclusion criteria and exclusion criteria

INCLUSION CRITERIA:

1-Age group between 18-35 years.

2-1st and 2nd years undergraduate students will be including in the study.

3- Subjects who have signed the informed consent form

EXCLUSION CRITERIA:

1-Age outside the given range.

2-Any chronic disease, known a history of hypertension

Procedure

Body mass index

Height and weight of the subjects was measured using a standardized height and weight machine. For this, the subjects will be lightly clothed but without shoes. Standing height will be measured to the nearest 0.5 cm. Body weight will be recorded in kilograms on an empty bladder and before lunch on a standardized weighing scale. The weight measurement was recorded to the nearest 0.1 kg.

After taking height and body weight, BMI will be calculated as: -

$$\text{Body mass index (BMI)} = \text{Weight (kg)} / \text{Height}^2 \text{ (m)}$$

Waist circumference

Waist circumference measurement was done with minimal clothing with feet 25–30 cm apart with a measuring tape at the level of umbilicus between the inferior margin of the last rib and the iliac crest without compression of the skin with nearest to 0.5 cm.

Blood pressure

Arterial blood pressure was recorded using sphygmomanometer. The cuff consists of an inflatable rubber bag covered by a distensible cotton fabric. The inflatable rubber bag is connected to the manometer and also to the inflating hand bulb by means of rubber tubing.

- Ensure that the subject is seated comfortably.
- Expose the arm of the subject and apply the cuff such that the midpoint of the cuff overlies the brachial artery and the lower edge of the cuff is one inch above the "cubital fossa".
- Take care to ensure that the zero of the sphygmomanometer and cuff should be at the heart level.
- Palpate the radial artery pulsations at the wrist. Inflate the rubber bag of the cuff until the air pressure within it overcomes the arterial pressure there by obliterating the

lumen of the artery. This can be confirmed by the disappearance of the radial artery pulsation at the wrist.

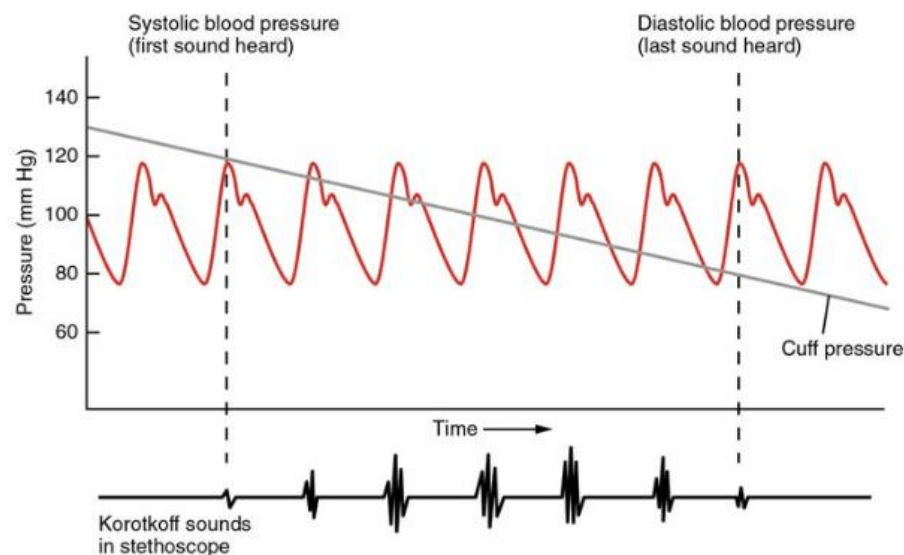
- Raise the cuff pressure by another 30 mm Hg. Now deflate the cuff at the rate of 2- 3 mm Hg / sec by opening the side valve of the hand bulb.
- Note the reading on the manometer scale when the radial artery pulsations reappear. This gives the systolic blood pressure by the palpatory method.



Auscultatory method

- Feel the pulsation of the brachial artery in the cubital fossa and place the chest piece of the stethoscope over it.
- Inflate the cuff until the pressure is 30 mm Hg, more than the reading obtained by the palpatory method.
- Lower the cuff pressure gradually till a light tapping sound is heard, in rhythm with the heartbeat. Continue to lower the pressure in the cuff and appreciate the change in the quality and intensity of the sounds heard through the stethoscope. These are called

Korotkoff's sounds



- Note the manometer reading at the appearance of the sound. This indicates the systolic blood pressure.
- Note the reading at which the sound disappears. This indicates the diastolic blood pressure.
- Take highest of three readings taken of right limb in all subjects.

COLLECTION OF DATA

A cross-sectional prospective study was carried out on subjects attending the Physiology department of Integral Institute of Medical Science & Research Lucknow. Diagnosed subjects were selected on the basis of inclusion and exclusion criteria and who are willing to participate and give written consent from.

SAMPLE SIZE ESTIMATION

The sample size was calculated using the formula-

$$N = z^2 p(1-p)/d^2 \text{ Where, Sample size} = n$$

$$P = 50\%$$

Confidence level 95% so Z score = 1.96 Margin of error (d) = 10% Calculated sample size = 96

Final sample size = 100

SO,

100 case was included in the study.

STATISTICAL ANALYSIS

The results was presented in mean \pm SD, T test and pearson's correlation test were used to assess the correlation if any relationship between body mass index and percent of waist circumference and Blood Pressure among study parameters. The p-value<0.05 was considered significant.

Observations And Result

CHAPTER 4

OBSERVATIONS AND RESULT

Table 1: Gender wise distribution of respondents

Gender	Frequency
Male	40
Female	60

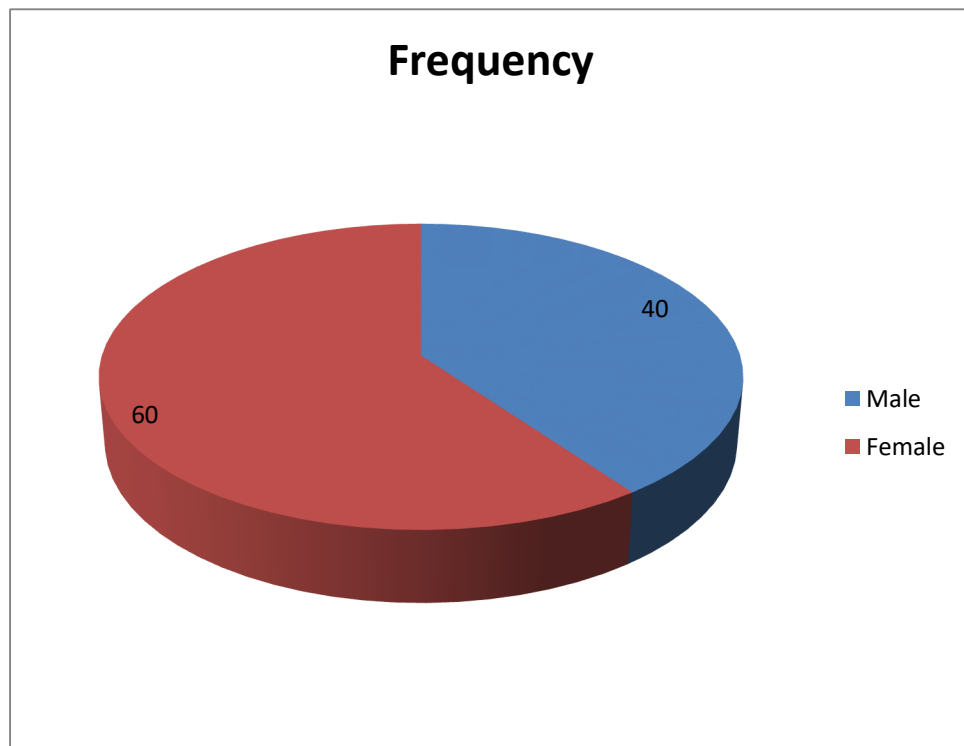


Fig. 1 : Gender wise distribution of respondents

An interpretation of this data could be that females make up a slightly larger proportion (60%) of the sample compared to males (40%). However, it's important to note that this data represents a specific sample and may not necessarily reflect the overall gender distribution of a larger population.

Table 2: Age wise distribution of respondents

Age (in Years)	Frequency
18	16
19	25
20	24
21	11
22	13
23	4
24	7

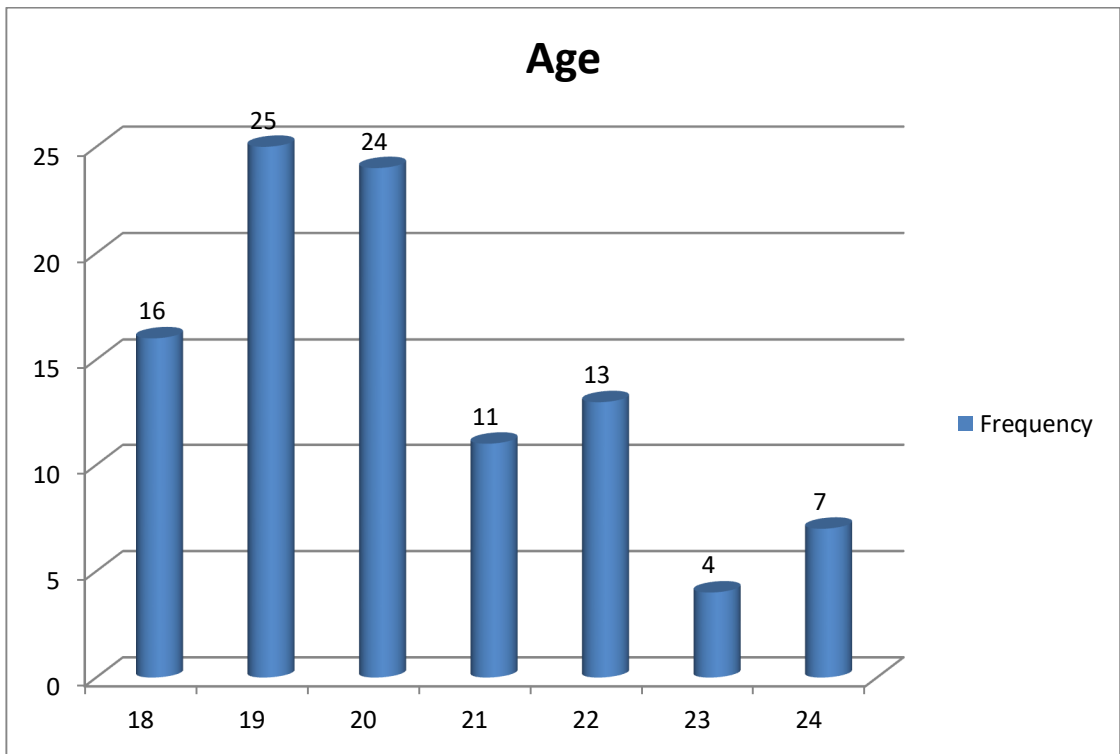


Fig. 2: Age wise distribution of respondents

The table shows that the majority of individuals in the sample fall within the age range of 18 to 20, with age 19 having the highest frequency. The number of individuals generally decreases as the age increases, with the lowest frequencies observed in the older age groups of 23 and 24.

Table 3: Significance of the gender difference between various parameters

Parameters	Male (Mean±SD)	Female (Mean±SD)	P Value
BMI	21.92±4.63	20.804±3.56	0.017
WAIST CIR (CM)	79.14±6.63	76.37±7.51	0.0006
SYSTOLIC(mmHg)	117.41±7.3	113.5±6.12	1.61
DIASTOLIC(mmHg)	77.35±6.68	75.25±5.65	0.003

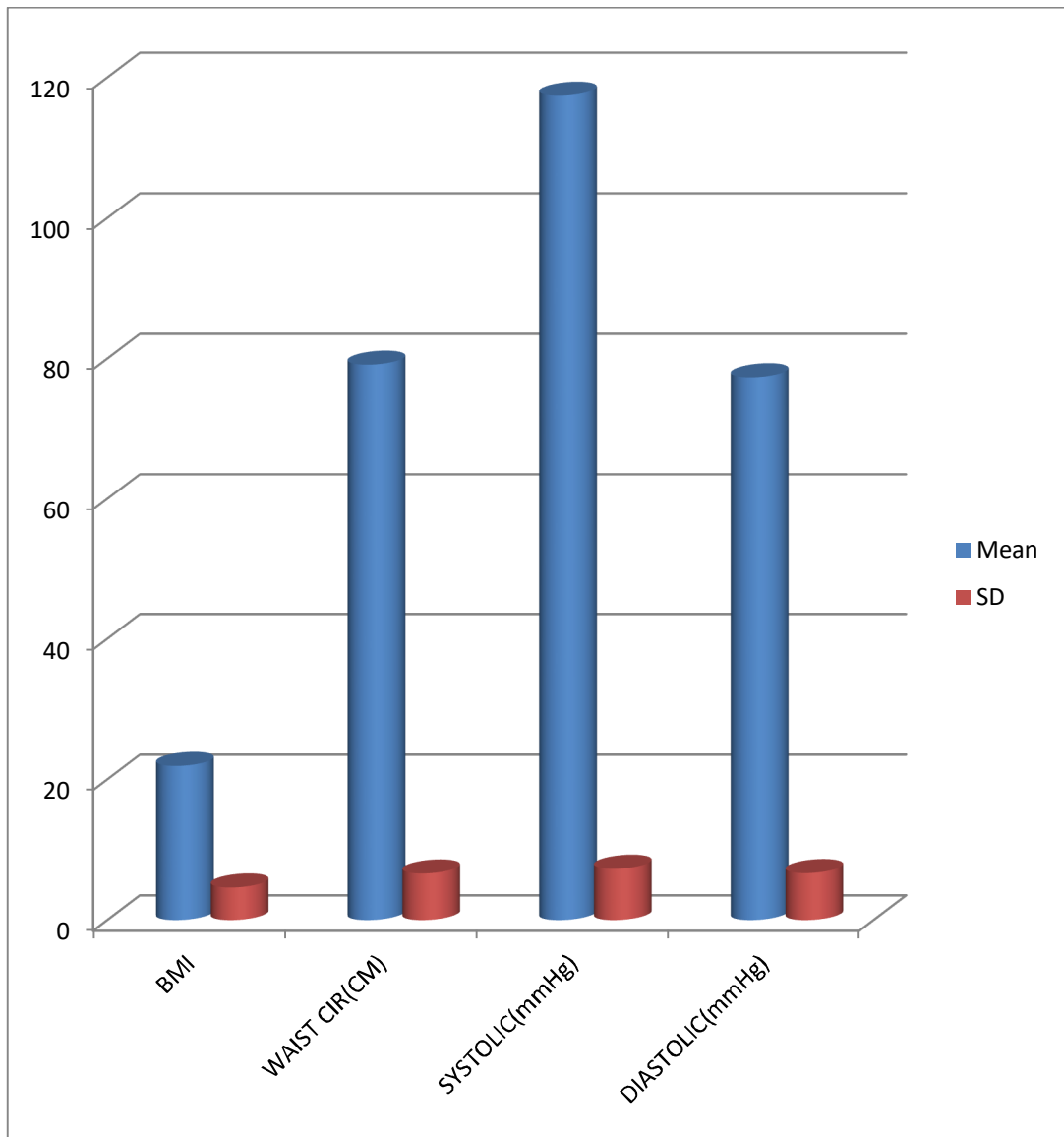


Fig. 3(a): Bar diagram of BMI, WC, SBP and WBP of Male Adults

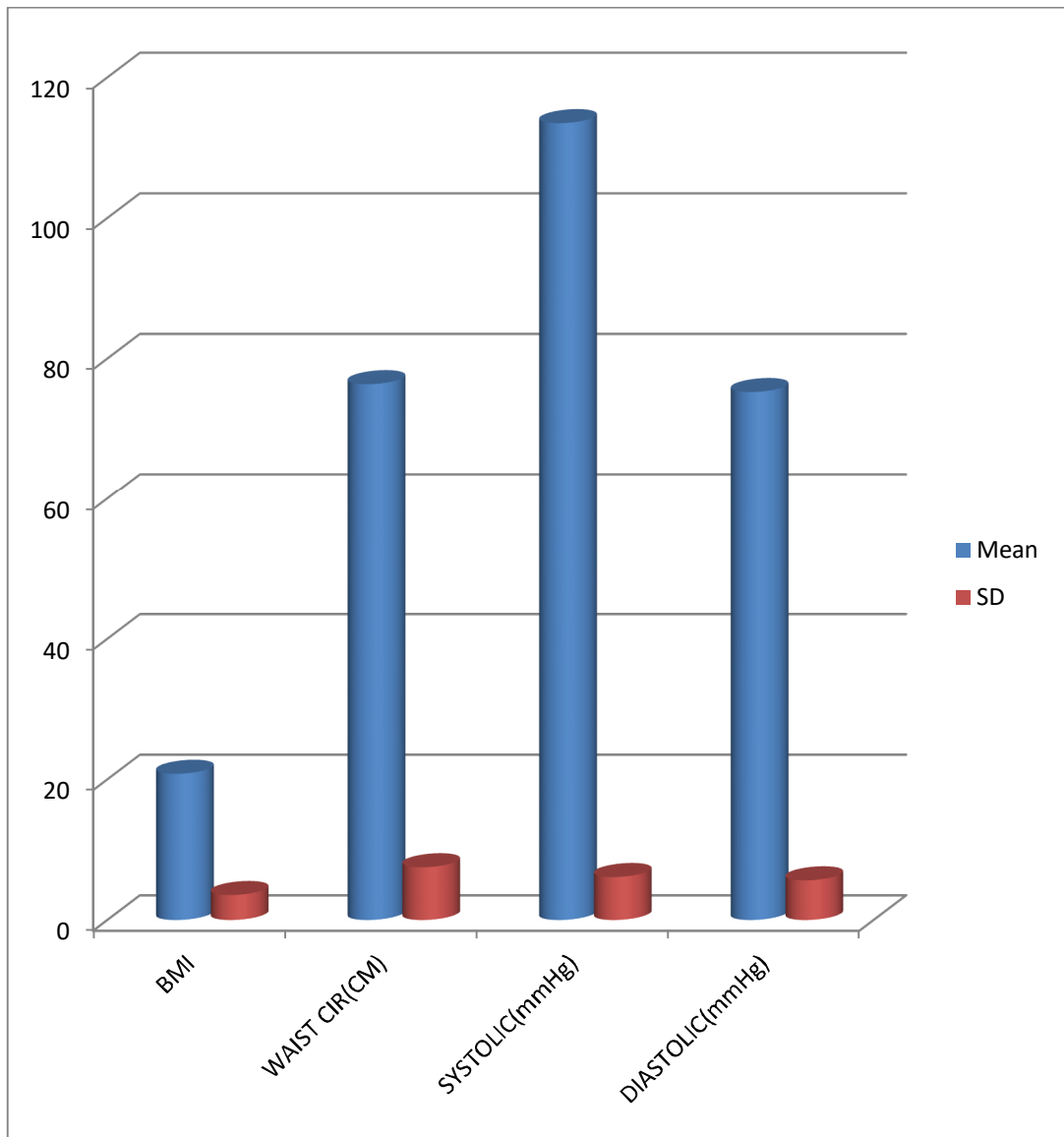


Fig. 3(b): Bar diagram of BMI, WC, SBP and WBP of female Adults

The table presents a comparison of various parameters between males and females, along with their corresponding mean values and standard deviations (SD), as well as the p-values indicating the significance of the gender difference.

In terms of body mass index (BMI), males (mean±SD: 21.92±4.63) had a slightly higher average BMI compared to females (mean±SD: 20.804±3.56). The p-value of 0.017 suggests a statistically significant difference between the genders in terms of BMI.

For waist circumference (WAIST CIR), males (mean±SD: 79.14±6.63 cm) had a larger average waist circumference compared to females (mean±SD: 76.37±7.51 cm). The p-value of 0.0006 indicates a significant gender difference in waist circumference.

In terms of systolic blood pressure (SYSTOLIC), there was a slight difference between males (mean±SD: 117.41±7.3 mmHg) and females (mean±SD: 113.5±6.12 mmHg). However, the p-value of 1.61 suggests that the gender pressure is not statistically significant, meaning that the observed difference could be due to chance.

Regarding diastolic blood pressure (DIASTOLIC), males (mean±SD: 77.35±6.68 mmHg) had a slightly higher average diastolic blood pressure compared to females (mean±SD: 75.25±5.65 mmHg). The p-value of 0.003519265 indicates a statistically significant gender difference in diastolic blood pressure.

The analysis reveals significant gender differences in body mass index (BMI), waist circumference (WAIST CIR), and diastolic blood pressure. Males tend to have higher BMI and waist circumference values, indicating a potential higher risk for overweight or obesity and abdominal obesity. Additionally, males exhibit slightly higher diastolic

blood pressure, which could be indicative of variations in cardiovascular health between genders. However, there is no statistically significant difference in systolic blood pressure between males and females. These findings highlight the importance of considering gender differences in health assessments and interventions.

Table 4 Pearson’s Test result for correlation between waist circumference and blood pressure male adult.

	Parameters	R Value	P Value
Male	BMI vs SBP	0.025	.85
	BMI vs DBP	0.173	.186
	WC vs SBP	0.009	.94
	WC vs DBP	0.153	.243

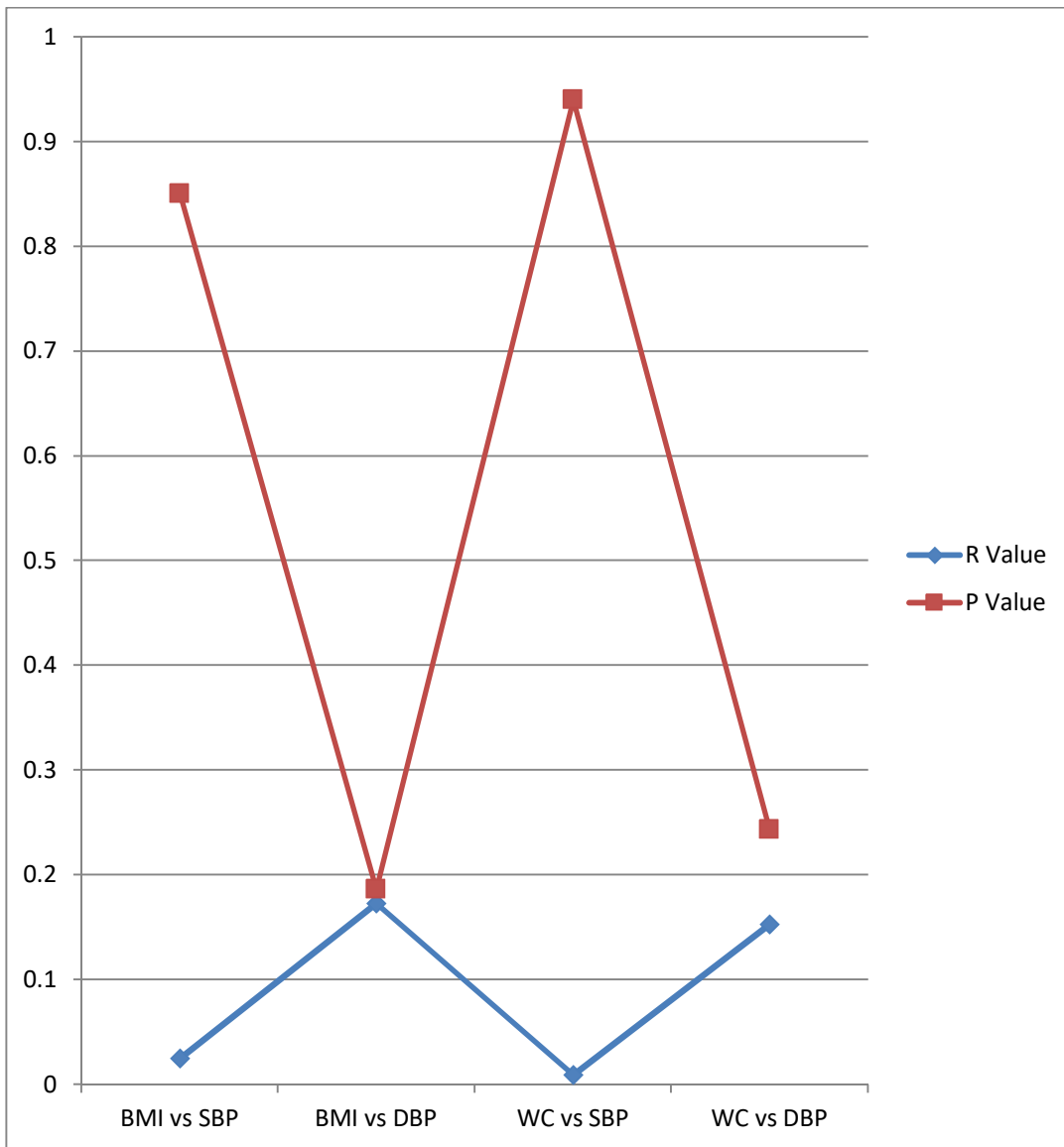


Fig. 4: Scatter diagram of Pearson's Correlation test of male Adults

Table 4 presents the results of Pearson's correlation test examining the relationship between waist circumference (WC) and blood pressure (systolic blood pressure - SBP, diastolic blood pressure - DBP) in male adults.

The correlation coefficient (R value) indicates the strength and direction of the relationship, while the p-value determines the statistical significance of the correlation.

For the correlation between BMI and SBP in males, the R value is 0.025, suggesting a very weak positive correlation. However, the high p-value of 0.85 indicates that this correlation is not statistically significant, indicating that there is no meaningful relationship between BMI and systolic blood pressure in male adults.

Similarly, for the correlation between BMI and DBP in males, the R value is 0.173, indicating a weak positive correlation. However, the p-value of 0.186 suggests that this correlation is not statistically significant, indicating no significant relationship between BMI and diastolic blood pressure in male adults.

When examining the correlation between waist circumference (WC) and SBP in males, the R value is 0.009, indicating a very weak positive correlation. The high p-value of 0.94 indicates that this correlation is not statistically significant, suggesting no significant relationship between waist circumference and systolic blood pressure in male adults.

Lastly, for the correlation between waist circumference (WC) and DBP in males, the R value is 0.153, indicating a weak positive correlation. However, the p-value of 0.243 suggests that this correlation is not statistically significant, indicating no

significant relationship between waist circumference and diastolic blood pressure in male adults.

In conclusion, based on the Pearson's correlation test results, there is no statistically significant correlation observed between waist circumference and either systolic or diastolic blood pressure in male adults.

Table 5 Pearson's Test result for correlation between waist circumference and blood pressure Female adult.

	Parameters	R Value	P Value
Female	BMI vs SBP	0.35	.026
	BMI vs DBP	0.49	.0013
	WC vs SBP	0.24	.135
	WC vs DBP	0.42	.0069

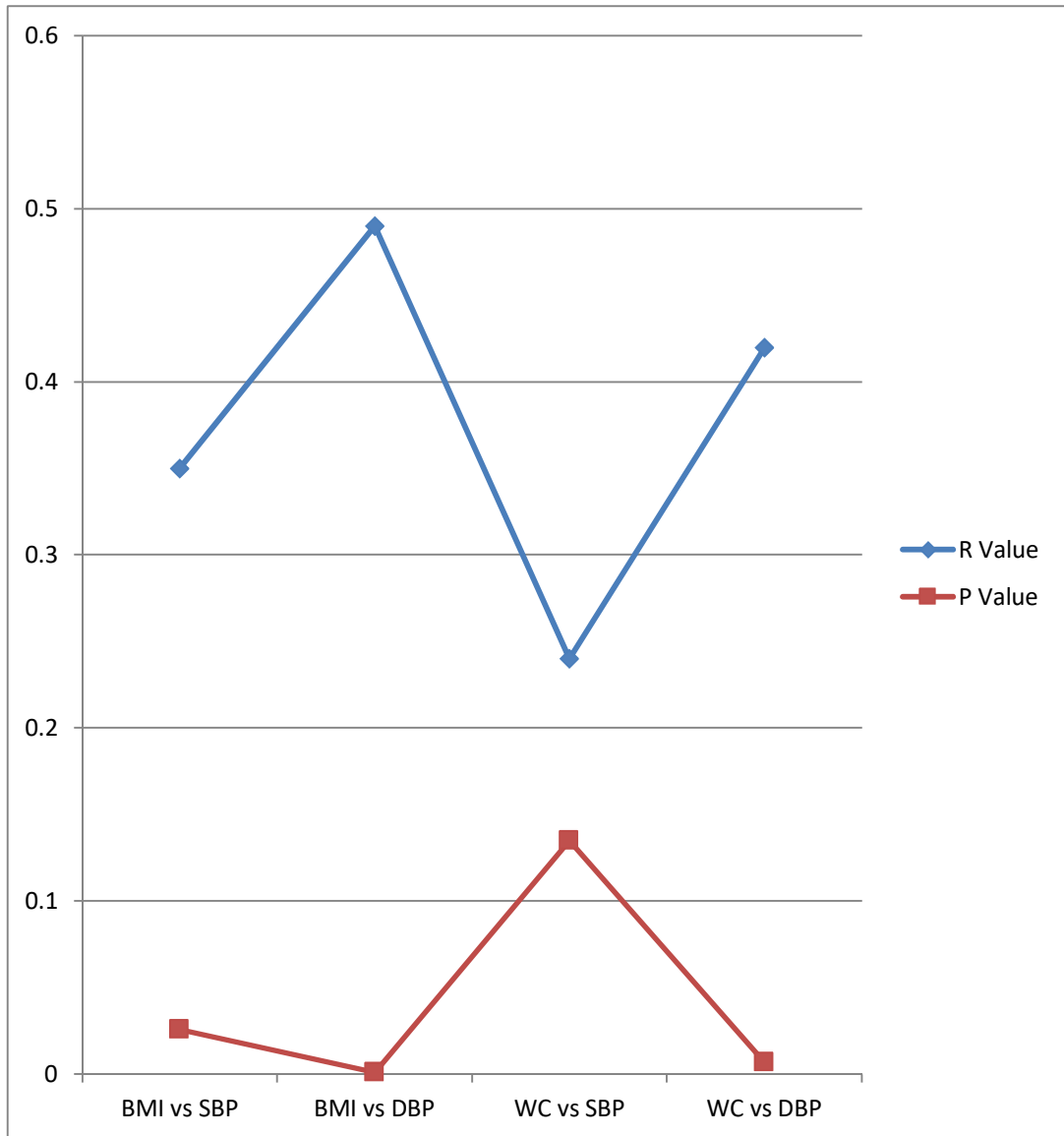


Fig. 5: Scatter diagram of Pearson's Correlation test of female Adults

Table 5 presents the results of Pearson's correlation test examining the relationship between waist circumference (WC) and blood pressure (systolic blood pressure - SBP, diastolic blood pressure - DBP) in female adults.

The correlation coefficient (R value) indicates the strength and direction of the relationship, while the p-value determines the statistical significance of the correlation.

For the correlation between BMI and SBP in females, the R value is 0.35, indicating a moderate positive correlation. The low p-value of 0.026 suggests that this correlation is statistically significant, indicating a meaningful relationship between BMI and systolic blood pressure in female adults.

Similarly, for the correlation between BMI and DBP in females, the R value is 0.49, indicating a moderate positive correlation. The very low p-value of 0.0013 suggests that this correlation is highly statistically significant, indicating a significant relationship between BMI and diastolic blood pressure in female adults.

When examining the correlation between waist circumference (WC) and SBP in females, the R value is 0.24, indicating a weak positive correlation. The p-value of 0.135 suggests that this correlation is not statistically significant, indicating no significant relationship between waist circumference and systolic blood pressure in female adults.

Lastly, for the correlation between waist circumference (WC) and DBP in females, the R value is 0.42, indicating a moderate positive correlation. The p-value of 0.0069 suggests that this correlation is statistically significant, indicating a significant relationship between waist circumference and diastolic blood pressure in female

adults.

In summary, based on the Pearson's correlation test results, there is a statistically significant positive correlation observed between BMI and both systolic and diastolic blood pressure in female adults. However, there is no significant correlation observed between waist circumference and systolic blood pressure in females. Nevertheless, a significant positive correlation is found between waist circumference and diastolic blood pressure in female adults, suggesting a potential relationship between abdominal obesity (reflected by waist circumference) and elevated diastolic blood pressure in females.

Discussion

CHAPTER 5

DISCUSSION

A sample of young adults aged 18 to 24 years was recruited for this study. Data on BMI, WC, and BP were collected through standardized measurements. The BMI was calculated as weight (in kilograms) divided by height (in meters squared). WC was measured at the midpoint between the lower border of the rib cage and the iliac crest. Systolic and diastolic BP were recorded using a calibrated sphygmomanometer.

The present study aimed to investigate the effect of body mass index (BMI) and waist circumference on blood pressure in young adults. The analysis of the collected data provides valuable insights into the relationship between these variables and sheds light on potential health implications. To support the discussion, relevant references will be provided to enhance the understanding and contextualize the findings.

The analysis revealed significant gender differences in BMI, with males having a higher mean BMI (21.92 ± 4.64) compared to females (20.80 ± 3.56). This aligns with previous research that has consistently shown higher BMI values in males compared to females (19). The higher BMI observed in males may be attributed to differences in body composition, metabolic rates, and hormonal factors (13). These findings suggest that gender plays a crucial role in BMI variations and should be considered when assessing the relationship between BMI and blood pressure.

Regarding waist circumference, males also exhibited larger mean values ($79.14 \text{ cm} \pm 6.63$) compared to females ($76.38 \text{ cm} \pm 7.52$). These gender differences align with established literature, which highlights that males tend to have higher waist

circumference due to differences in fat distribution patterns and body shape (17). The larger waist circumference in males may contribute to higher health risks, including hypertension and cardiovascular diseases (15). It is worth noting that waist circumference is a reliable indicator of central obesity, which is strongly associated with metabolic syndrome and its related conditions (18).

When examining the correlation between waist circumference (WC) and SBP in males, the R value is 0.009, indicating a very weak positive correlation. The high p-value of 0.94 indicates that this correlation is not statistically significant, suggesting no significant relationship between waist circumference and systolic blood pressure in male adults.

Lastly, for the correlation between waist circumference (WC) and DBP in males, the R value is 0.153, indicating a weak positive correlation. However, the p-value of 0.243 suggests that this correlation is not statistically significant, indicating no significant relationship between waist circumference and diastolic blood pressure in male adults.

In conclusion, based on the Pearson's correlation test results, there is no statistically significant correlation observed between waist circumference and either systolic or diastolic blood pressure in male adults.

When examining the correlation between waist circumference (WC) and SBP in females, the R value is 0.24, indicating a weak positive correlation. The p-value of 0.135 suggests that this correlation is not statistically significant, indicating no significant relationship between waist circumference and systolic blood pressure in female adults.

Lastly, for the correlation between waist circumference (WC) and DBP in females, the R value is 0.42, indicating a moderate positive correlation. The p-value of 0.0069 suggests that this correlation is statistically significant, indicating a significant relationship between waist circumference and diastolic blood pressure in female adults.

In summary, based on the Pearson's correlation test results, there is a statistically significant positive correlation observed between BMI and both systolic and diastolic blood pressure in female adults. However, there is no significant correlation observed between waist circumference and systolic blood pressure in females. Nevertheless, a significant positive correlation is found between waist circumference and diastolic blood pressure in female adults, suggesting a potential relationship between abdominal obesity (reflected by waist circumference) and elevated diastolic blood pressure in females.

Although the current study focused on BMI and waist circumference as predictors of blood pressure, it is important to note that other factors, such as physical activity, dietary patterns, and genetics, can also influence blood pressure levels (13). Future studies should consider these additional variables to obtain a more comprehensive understanding of the factors contributing to blood pressure in young adults.

In conclusion, the findings of this study indicate that BMI and waist circumference are important determinants of blood pressure in young adults. The higher BMI and larger waist circumference observed in males suggest a gender-specific pattern that should be considered in health assessments. The positive correlation between waist circumference and systolic blood pressure emphasizes the potential role of central obesity in the development of hypertension. These findings underscore the importance

of preventive measures targeting healthy weight management and waist circumference control, particularly in young adults, to reduce the risk of hypertension and related cardiovascular complications.

Conclusion

CHAPTER 6

CONCLUSION

In conclusion, this study aimed to examine the effect of body mass index (BMI) and waist circumference on blood pressure in young adults. The findings revealed significant gender differences in BMI and waist circumference, with males exhibiting higher values compared to females. Moreover, there was a positive correlation between waist circumference and systolic blood pressure for both males and females. These results highlight the importance of considering gender-specific patterns in BMI and waist circumference when assessing blood pressure in young adults.

The findings from the correlation analysis presented valuable insights into the relationship between waist circumference (WC) and blood pressure (systolic and diastolic) in male and female adults. The results indicate that there is no statistically significant correlation between WC and blood pressure in male adults, while in female adults, a significant positive correlation exists between BMI and both systolic and diastolic blood pressure. However, there is no significant correlation observed between WC and systolic blood pressure in females, but a significant positive correlation is found between WC and diastolic blood pressure.

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ANNEXURE I(A)

INFORMED CONSENT FORM

1. I **ADARSH KUMAR** MSC third year student medical physiology IIMS&R Lucknow.
2. I am not associated with your treating doctor panel.
3. There will be no charges /fees/any consideration given or taken for the study.
4. Your identity will be confidential and information and result of your history examination will not be revealed to any other except you if u desire.
5. The study has nothing to do with your treatment and is not going to hamper if you refuse to participate.
6. The study has nothing to do with your current treatment but may improve the knowledge and understanding of disease process and that knowledge may or not be helpful in future.
7. After knowing the all above detail would you like to participate in our study?
Yes/ No

Name of the patient

Signature of the Research Scholar:

Signature:

CONSENT FORM

I.....aged.....W/O,D/O,S/O.....
.....R/O.....here with state that I have been duly informed about the study titled **“TO STUDY THE EFFECT OF BODY MASS INDEX AND WAIST CIRCUMFERENCE ON BLOOD PRESSURE IN YOUNG ADULTS”** its prospects and consequences. I hereby give informed and written consent for the collection of Height/weight and Waist circumference on blood pressure for the above said study only.

Signature/thumb impression of the patient:

Signature/thumb impression of the witness:

Signature of research scholar:

अनुलग्नक I (ए)
सूचित सहमति फॉर्म

1. मैं आदर्श कुमार एमएससी थर्ड ईयर स्टूडेंट मेडिकल फिजियोलॉजी आईआईएमएस आर लखनऊ।
2. मैं आपके ट्रीटिंग डॉक्टर पैनल से जुड़ा नहीं हूँ।
3. अध्ययन के लिए कोई शुल्क /शुल्क /दिया गया या दिया गया कोई विचार नहीं होगा।
4. आपकी पहचान गोपनीय होगी और जानकारी और आपके इतिहास की परीक्षा का परिणाम किसी अन्य के अलावा आपके लिए नहीं होगा यदि आप चाहते हैं।
5. अध्ययन का आपके उपचार से कोई लेना -देना नहीं है और यदि आप भाग लेने से इनकार करते हैं तो आप बाधा नहीं डालेंगे।
6. अध्ययन का आपके वर्तमान उपचार से कोई लेना -देना नहीं है, लेकिन रोग प्रक्रिया के ज्ञान और समझ में सुधार हो सकता है और यह ज्ञान भविष्य में सहायक हो सकता है या नहीं।
7. उपरोक्त सभी विस्तार को जानने के बाद क्या आप हमारे अध्ययन में भाग लेना चाहेंगे? हां नहीं

रोगी का नाम:

अनुसंधान विद्वान का हस्ताक्षर

हस्ताक्षर:

सहमति पत्र

मैं..... आयु

पुत्री/पुत्र/पत्नी.....पता.....

.....। यहाँ राज्य के साथ कि मुझे "युवा वयस्कों में रक्तचाप पर बॉडी मास इंडेक्स और कमर की परिधि के प्रभाव का अध्ययन करना" करने के लिए शीर्षक से अध्ययन के बारे में विधिवत जानकारी दी गई है। , इसकी संभावनाएं और परिणाम। मैंने अनुसंधान कार्य के विवरण को बहुत अच्छी तरह से जाना है और मैं उसी के लिए अपनी सहमति देता हूँ।

रोगी के हस्ताक्षर/अंगूठे की छाप:

गवाह के हस्ताक्षर/अंगूठे की छाप:

अनुसंधान विद्वान के हस्ताक्षर:

अनुलग्नक I (ए)



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INTRODUCTION CHAPTER 1 INTRODUCTION Several studies provide evidence for an association between arterial hypertension and anthropometric indications that reflect excess adipose tissue. Major indicators in this context are abdominal circumference, which would provide a measure especially of visceral fat and the body mass index (BMI), obtained by dividing weight in kilograms by the square of height in meters, which would reflect the proportion of adipose tissue in the total body mass, regardless of localization¹.

High blood pressure (BP), tobacco, smoking, including second hand smoke, and alcohol abuse were identified as the three risk factors for global disease burden ². Due to industrialization and urbanization, the standard of living continues rise particularly in development countries. This has led to weight gain and obesity, which are posing a threat to the health of citizens.

Obesity is perhaps the most prevalent form of malnutrition in developing countries, both among adults and children. studies have demonstration that obesity is related to elevated systolic blood pressure and diastolic blood pressure elevated, Dyslipidaemia, diabetes etc.³ Body mass index (BMI) is the most common indicator of general obesity, and waist circumference (WC) is an indicator of abdominal obesity.

The use of this simple and convenient anthropometric measure has broad appeal, as higher BMI is often associated with a number of unfavourable health consequences due to excessive adiposity, and the increased prevalence of obesity has created tremendous concern. Anthropometric measurements are used infield settings and in the absence of clinical and laboratory assessment tools to estimate body composition⁴.

The metabolic syndrome, operationally defined as the presence of any three of the following factors: central obesity (high waist circumference), hyperglycemia, high blood pressure, low high-density lipoprotein-cholesterol (HDL-C)¹ or high triglycerides has recently been recognized as a public health concern in the United States. While the metabolic syndrome alone is a condition of disabling medical sequelae, it is an intermediary step in the progression of a number of vascular and coronary-related clinical events.

Observational evidence suggests that central obesity is a key element of the metabolic syndrome, and recent studies suggest an etiologic role for visceral adipose tissue. The early identification of this condition and the primary prevention of overweight and obesity in Canada is an important and cost-effective public health priority.⁵ REVIEW OF LITERATURE CHAPTER 2 REVIEW OF LITERATURE Body mass index (BMI) is an estimate of body fat that is based on your weight and height.

This calculation helps determine whether you are underweight, at a healthy weight, overweight, or obese. BMI can be used to assess your risk for developing certain health problems. For example, people in higher weight categories are considered to be at greater risk for high blood pressure and high cholesterol. Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health.⁶

Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m²). For adults, WHO defines overweight and obesity as follows: overweight is a BMI greater than or equal to 25; and obesity is a BMI greater than or equal to 30.

BMI provides the most useful population-level measure of overweight and obesity as it is the same for both sexes and for all ages of adults. However, it should be considered a rough guide because it may not correspond to the same degree of fatness in different individuals. For children, age needs to be considered when defining overweight and obesity. However, the calculation has its limitations.

Namely, BMI doesn't take into account age, assigned sex, race, or muscle mass. This article discusses BMI, how it is calculated, its pros and cons, and alternatives for assessing potential health risks. Children aged between 5–19 years. Overweight and obesity are defined as follows for children aged between 5–19 years: overweight is BMI-for-age greater than 1 standard deviation above the WHO Growth Reference median; and obesity is greater than 2 standard deviations above the WHO Growth Reference median.

BODY MASS INDEX AND WAIST CIRCUMFERENCE ON BLOOD PRESSURE IN YOUNG ADULTS" its prospects and consequences. I hereby give informed and written consent for the collection of Height/weight and Body fat for the above said study only.

Signature/thumb impression of the patient: _____ Signature/thumb impression of the witness: _____
Signature of research scholar: _____ (i) _____ (ii) _____ (iii) _____ 1. _____ 2. _____ 3. _____ 4.

_____ 5. _____ 6. _____ 7.

_____ (i) PROFARMA NAME: _____

GENDER: _____ AGE: _____
OPD\IPD\ENROLMENT NO: _____ MOBILE NO: _____
ADDRESS: _____ BODY MASS INDEX HEIGHT: _____ WEIGHT: _____ BMI FORMULA: _____
Weight(kg)\height2 (m2) CALCULATION: _____ RESULT: _____
PERCENT **OF BODY FAT** MESEARMENT OF BiCEPS: _____ TRICEPS: _____
SUBSCAPULAR: _____ SUPRA-ILiAC REGION: _____
FORMULA OF BODY FAT: _____

PARCENTAGE: _____ RESULT: _____

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PROFARMA

NAME:

GENDER:

AGE:

OPD/IPD/ENROLMENT NO:

MOBILE NO:

ADDRESS:

BODY MASS INDEX

HEIGHT:

WEIGHT:

BMI FORMULA: $\text{Weight(kg)} \div \text{height}^2 \text{ (m}^2\text{)}$

RESULT:

Waist circumference

Waist size (cm):

BLOOD PRESSURE

Systolic:

Diastolic: