Correlation of Visceral Fat with Anthropometric Indices and Cardiovascular Disease Risk Factors

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Abstract

Objective: To determine the correlation between visceral fat and body mass index (BMI), waist circumference (WC), waist-to-hip ratio (WHR), and CVD risk factors in males and females of the Pakistani population.

Method: Four hundred six (406) participants were enrolled in the study after taking ethical approval from the CMH LMC & IOD, Lahore. The age of the participants was 30 to 65 years. A uniform survey and physical examination were given to each participant. We took anthropometric measurements (BMI, WC, WHR, WHtR, SBP, and DBP). Fasting blood sugar and the serum lipid profile (TC, TG, HDL-C, and LDL-C) were measured.

Results: The participants with visceral fat ⩾ 10% have increased levels of SBP, DBP, Cholesterol, LDL, TG, and FBS. A significant positive correlation between visceral fat was observed with Weight, BMI, WC, WHR, SBP, DBP, Cholesterol, TG, and FBS.

Conclusion: CVD risk increases with the increase in weight, BMI, WC, WHR, SBP, DBP, Cholesterol, TG, and FBS

Keywords: Visceral fat, CVD, HTN

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Introduction

Leading contributors to death and disability are cardiovascular disease (CVD) and diabetes. When a person has risk factors for one or both illnesses, it is known as metabolic syndrome.[1] It has at least 3 of the following five components: abdominal obesity, elevated triglycerides, decreased HDL and LDL cholesterol, hypertension, and impaired glucose regulation.[2] The glycemic imbalance which is linked to the risk of CVD is mainly brought about by an increase in the fat content of the body.[3] Obesity is described as having too much body fat. It is the outcome of a prolonged imbalance between food intake and energy usage. This mismatch has been growing year after year and has reached alarming proportions.[4] The World Health Organization (WHO) lists obesity as one of the most significant public health issues. Over 1.9 billion people worldwide were overweight in reports 2014. 600 million among them are already obese. Obesity and overweight increased by 47.1% and 27.5% respectively among children and adults from 1980 to 2013.[5] As per World Health Organization (WHO) gauges, cardiovascular illness prompts 31% of all passing worldwide whereas low and center pay nations contribute 82% of this weight.[6] There is a significant burden contributed by South Asian countries.[7] The number of inhabitants in the Indo-Pak subcontinent are among the populations with the most noteworthy dangers of CAD on the planet and which is

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the reason coronary vein sickness is the overwhelming reason for mortality among this population.[8] Pakistan is one of the emerging nations where the prevalence of overweight and obesity has multiplied. According to global disease estimates from 2014, Pakistan is ranked eighth among the 10 nations hosting 693 million obese people worldwide.[8] Major human organs like the liver, pancreas, and kidneys are typically wrapped by visceral body fat. It makes sure that there is room between each organ. Inflammation and high blood pressure are caused by excess visceral fat deposits which raises the risk of major health issues. High levels of visceral body fat, high blood pressure, and insulin resistance has been shown to cause interconnected abnormalities in non-diabetic men.[9] According to past research, regional fat distribution in moderate obesity appears to significant predictor of metabolic and cardiovascular risk. Studies have demonstrated a correlation between extra body fat in the upper body and higher chances of mortality as well as diabetes, hyperlipidemia, and hypertension. Even though the cause-effect relationship has not been shown, the research implies that body visceral fat may be a common component linking various aspects of metabolic syndrome, such as glucose intolerance, HTN, dyslipidemia, and insulin resistance.[10]

Blood pressure has been linked to visceral fat according to several studies.[11-13] Positive correlation between visceral fat (VF) and blood pressure has been shown in Caucasians, African Americans, and Japanese Americans in several cross-sectional investigations of the US population.[14,15] The prevalence of HTN and the relationship between visceral fat and blood pressure were seen in the Framingham cohort.[11] Excess body weight and high CV risk is the major challenge in many developing countries including Pakistan. The present study is done to determine the correlation of VF with anthropometric indices and CVD risk factors.

Material and Methods

Four hundred six (406) participants were enrolled in this cross-sectional study after receiving ethical permission from the institute of CMH LMC & IOD, Lahore. This study was conducted from October 2021-April 2022. Nonprobability convenient sampling technique was used. The sample size was calculated by using sample size calculator in health studies. Keeping the confidence level 95% with margin of error 10%, the calculated sample size was 406. Participants ranged in age from 30 to 65. Informed written consent was taken before recruitment of participants. Each participant received a standard questionnaire as well as a physical assessment. We measured anthropometric indices (BMI, WC, WHR, WHtR, SBP, and DBP). The serum lipid profile (TC, TG, HDL-C, and LDL-C) and fasting blood sugar levels were assessed. Statistical Software Package version 25 was used to enter the data. In the case of quantitative variables, mean±SD was used. The link between the variables was examined using the Pearson correlation coefficient. All tests were two-sided. A statistically significant difference was defined as a p-value< 0.05.

Results

Four hundred six (406) participants were enrolled. Among them, 39% were male and 61% were female. The mean age (SD) of female and males were 42.35 (±15.22) and 43.82 (±15.39) years, respectively. All study subjects were divided into two groups, persons having higher body visceral fat percentage (>10%) in one group and visceral fat within cut-off value (10%) in another group. The group having higher visceral fat had significantly higher mean values of body fat percentage, BMI, blood pressures, blood sugar levels, and almost all laboratory data than those in the low visceral fat group. There is a significant increase in SBP, DBP, Cholesterol, LDL, TG, and FBS in participants having visceral fat ≥ 10% (Table-1) A significant positive corre-

Table 1: *Distribution of participants based on body visceral fat percentage*

Variables	Total (means± SD)	V-fat⩽ 10%	V-fat⩾10%	P
Age (years)	37.39±12.25	35.33±11.61	48.02±9.74	⩽.001
SBP (mmHg)	124.23±16.21	121.44±14.02	138.64±19.02	⩽.001
DBP (mmHg)	82.67±13.17	80.37±11.61	94.52±1350	⩽.001
Cholestrol (mg/dl)	189.37±41±64	186.82±41.43	202.52±40.56	.005
LDL (mg/dl)	127.42±37.42	125.57±37.48	136.96±35.92	.02
Triglyceride (mg/dl)	162.17±67.92	158.36±66.98	181.81±69.83	.01
HDL (mg/dl)	43.54±9.12	43.262±9.47	43.14±7.14	0.6
FBS (mg/dl)	101.67±34.82	97.40±29.56	123.67±49±10	⩽.001

lation between visceral fat was observed with Weight, BMI, WC, WHR, SBP, DBP, Cholesterol, TG, and FBS. P-value for SBP is 0.000 and P value for DBP is 0.001 (Table 2) CVD risk increases with the increase in weight, BMI, WC, WHR, SBP, DBP, Cholesterol, TG, and FBS

Table 2: *Correlation of VF with anthropometric indices and CVD risk factor*

Variables		P
Age (years)	0.599	⩽. 001
Weight (kg)	.811	⩽. 001
Height (cm)	.002	0.9
BMI (KG/m^2	.837	⩽.001
WC (cm)	.800	⩽.001
WHR(cm)	.403	⩽.001
SBP(mmHg)	.499	⩽.001
DBP (mm Hg)	.511	⩽.001
Cholestrol (mg/dl)	.147	.003
LDL(mg/dl)	.094	.058
Triglyceride (mg/dl)	.209	⩽.001
HDL(mg/dl)	.024	0.6
FBS(mg/dl)	.346	⩽.001

Discussion

In this study, there is a significant increase in SBP and DBP (p≤ .001) in participants having visceral fat > 10%. A 12-week meal replacement strategy for men was observed to enhance SBP and DBP, and there was a favourable correlation between a drop in body visceral fat.[16]

Among Americans, body VF was significantly (p= 0.001) associated with Systolic and Diastolic BP, according to Fox et al.[11] However, only Visceral adipose tisssue provides useful information beyond BMI and waist circumference. Their research also showed a positive association between the prevalence of hypertension and both SAT (subcutaneous abdominal adipose tissue) and VAT (visceral adipose tissue). According to prior research, only VAT was linked to hypertension among Japanese Americans and whites, even after accounting for BMI and waist circumference[14,17], whereas both Subcutaneous and Visceral AT were associated with hypertension in both men and women among black[15], demonstrating the relative significance of deposits of visceral fat in various racial and ethnic groups. Similar to the present study, Boyko et al. also noted a relationship between body visceral fat and SBP (p=0.004) or DBP (p=0.001).[18]

In this study, body VF is positively correlated with Triglyceride levels (p < 0.001). Additionally, according to Katsuki et al, non-obese Japanese participants with type 2 diabetes showed a positive correlation between VF percentage and Triglyceride levels (p=0.01).[19] In a different study by Kobayashi et al., it was discovered that body visceral fat was significantly correlated with Triglycerides (p=0.01) in Japanese non-obese men.[20] Similar to the current study, Fox et al. found that among 3001 Americans, body VF had a strong positive connection with Triglycerides (p= 0.0001).[11] According to a study by Shweta et al., high levels of visceral body fat in Indian teenagers are positively correlated with blood pressure.[21] Additionally, they concluded that a higher degree of visceral body fat affects the chance of developing cardiovascular diseases. Body visceral fat and High-Density Lipoprotein had a 0.6 association coefficient, which was not statistically significant. HDL was inversely correlated with body fat % in another investigation by Goswami.[22] This contrasts with our study where HDL was positively correlated to VF though not statistically significant. Non-communicable diseases (NCDs) are a major cause of death worldwide today and are a raging epidemic. Therefore, if body VF assessment is included in the amenities of primary healthcare facilities in Pakistan's undeveloped provinces in the future, it will undoubtedly help identify vulnerable populations who are more likely to later develop chronic diseases like CKD, diabetes, and so forth. It may also provide insight on the health of the local populations and their level of understanding regarding the significance of lifestyle choices in the prevention of NCDs.

Conclusion

According to the current study's findings, body VF% was substantially correlated with elevated blood pressure, altered lipid profile, and type 2 diabetes. As a result, standard screening programs at all district-level health facilities nationwide should include body fat percentage analysis.

Conflict of Interest: *None*

Funding Source: *None*

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Authors Contribution

FI, RKA: Conceptualization of Project
HS, NMB, RKA: Data Collection
AAS: Literature Search
ZAL: Statistical Analysis
FI, RKA, AAS: Drafting, Revision
FI, RKA, ZAL: Writing of Manuscript