Makara Journal of Health Research

Volume 29
Issue 1 *April*

Article 3

4-30-2025

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Recommended Citation

Ghori MU, Masoud MS, Shafique M, Fiaz H, Hussain M, Awan FR. A Comparative Study of Obesity-Related Traits and Serum Lipid Parameters in Cardiovascular Patients from Faisalabad, Pakistan. Makara J Health Res. 2025;29(1):17-24.

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Makara J Health Res. 2025;29(1):17–24
doi: 10.7454/msk.v29i1.1803

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A Comparative Study of Obesity-Related Traits and Serum Lipid Parameters in Cardiovascular Patients from Faisalabad, Pakistan

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Abstract

Background: Obesity and dyslipidemia are significant risk factors for cardiovascular disorders (CVDs), yet have not been extensively studied in Pakistani subjects. Therefore, this retrospective observational study was undertaken to investigate the association of obesity-related traits and serum lipid parameters in CVD patients from Faisalabad, Pakistan.

Methods: A total of 403 CVD patients and 226 healthy controls were included. CVD patients were enrolled from the Allied Hospital and the Faisalabad Institute of Cardiology. Obesity-related traits [body mass index (BMI), waist and hip circumference (WC and HC), and waist-to-hip ratio (WHR)], serum lipid parameters, and blood pressure of all subjects were measured. Data was analyzed in SPSS v.21.

Results: Results showed significantly higher WC, HC, WHR, systolic and diastolic blood pressure in CVD patients as compared to healthy controls. Likewise, there were significant gender specific differences in these parameters in both the CVD patients and healthy control groups. Additionally, Pearson analysis revealed significant correlations between lipid parameters and obesity-related traits in CVD patients.

Conclusion: This study showed a significant correlation between lipid profile and obesity-related traits in CVD patients from Faisalabad, Pakistan. These findings highlight the importance of early management of dyslipidemia and obesity to prevent later sequelae of CVD.

Keywords: body mass index, cardiovascular disease, obesity, Pakistan

INTRODUCTION

Cardiovascular disorders (CVDs) are the major causes of death globally. An array of biological and non-biological factors contributes to the development of CVDs, including dyslipidemia and obesity. Dyslipidemia refers to an abnormal lipid profile characterized by increased levels of triglycerides (TG), total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and reduced levels of high-density lipoprotein cholesterol (HDL-C). Obesity is a metabolic condition characterized by an excessive amount of body fat, usually abdominal fat, which can lead to significant health problems, including cardio-metabolic disorders.[1] Obesity is conveniently measured by the anthropometric parameters like body mass index (BMI), waist circumference (WC), hip circumference (HC), and waist-to-hip ratio (WHR). Several studies have reported that dyslipidemia and other metabolic complications are commonly found in obese individuals, thus increasing the chances of morbidity and mortality. One of the studies comprising 27,000 subjects from 52 countries reported a strong association of obesity with myocardial infarction.[2]

Main types of CVDs, including coronary heart disease, cerebrovascular disease, and peripheral artery disease, pose a serious risk to public health globally. A report from the World Burden of Disease Research showed a 32% rise in the total CVD deaths between 1990 and 2019.[3] Likewise, recent data from the World Heart Report showed that over 500 million people were impacted by cardiovascular diseases worldwide, which resulted in 20.5 million deaths in 2021. This accounts for nearly one-third of all global fatalities. Obesity is an independent risk factor for CVDs and is linked to a number of co-morbidities, including metabolic syndrome, hypertension, and hyperlipidemia.[4] A more recent report from the World Health Organization (WHO) showed that globally, one in every eight people was

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obese. Since 1990, obesity rates have more than doubled among adults, and adolescent obesity has increased by fourfold. In 2022, about 2.5 billion adults aged above 18 years were classified as overweight, with a significant number of 890 million of them categorized as obese. Among obese subjects, the main factor contributing to deaths and disability-adjusted life years was CVD.[5]

Like other populations, CVD is a major cause of death in the Pakistani population. In the Punjab province of Pakistan, CVDs were reported to have affected 17.5% of the population.[6] Another study conducted in Pakistan reported that 46.2% of subjects had hypertension. Hypertension was expectedly slightly higher in the population from rural (46.8%) areas than the urban (44.3%) cities. Though the scientific reasons for this rise in hypertension in the rural areas were not reported, it is perhaps due to poor dietary habits, high salt intake in meals, limited healthcare access, low health awareness, economic hardships, psychosocial stress, tobacco use, and environmental factors. Hypertension data in different provinces of Pakistan showed the highest prevalence in the Punjab (49.3%), followed by Sindh (46.4%) and Baluchistan (41.1%). In Khyber Pakhtunkhwa, it was relatively lower at 33.4%, but still, this is an alarming situation, especially in the context of high morbidity and mortality from CVDs in Pakistan.[7] Lifestyle-related risk factors causing CVDs are greater in the urban population as compared to rural dwellers in Pakistan. In a study of Metabolic Syndrome-related lifestyle factors from Lahore, Pakistan, it was suggested to use waist circumference and BMI values for preventing or reducing the metabolic disorders.[8] Obese subjects also have a higher chance of developing hypertension, impaired insulin function, insulin resistance, and chronic low-grade inflammation - all of these are implicated in the pathobiology of CVD.[9] Patients with type 2 diabetes have a 2-4-fold higher risk of heart attacks.[10] Similarly, inflammation contributes to the development of atherosclerosis and CVD.

For a long time, experts have recognized that higher BMI may escalate the risk of CVD. However, BMI alone is not a sufficient measure to provide enough information about obesity in general and abdominal obesity in particular. To assess central adiposity, WC is considered a better predictor of CVD outcomes than BMI.[11] According to the National Institute of Health, USA guidelines, both BMI and WC have independent effects on obesity-related diseases. Combining WC and BMI can provide a better prediction of health risks compared to BMI alone.[12] In a correlation study of WC, BMI, and cardio-metabolic disorders, it was suggested that the inclusion of WC and BMI in the screening of different populations can help in identifying subjects at earlier stages who are at greater risk of cardio-metabolic disorders.[13]

Though BMI, WC, HC, WHR, and WHtR are straightforward and reliable anthropometric metrics for determining the risk of obesity. However, there is limited research on the relative effectiveness of these obesity related parameters in predicting cardio-metabolic risk among the Pakistani population. Since screening for non-communicable diseases on a regular basis can help in identifying these conditions at an early stage, which can help to prevent or delay their long-term pathological effects. Hence, this study was aimed to: (a) Compare obesity related traits with serum lipid parameters for their association with cardiovascular disease, (b) Compare obesity related traits (BMI, WC, HC, WHR, WHtR) and serum lipid profile parameters (TC, TG, LDL-C, HDL-C) in cardiovascular patients and healthy control subjects from Faisalabad, Pakistan, and (c) Identify any associations between obesity, hypertension and dyslipidemia in CVD patients.

METHODS

This is a retrospective observational cross-sectional study in which a random sampling technique was used. This study was conducted at the Diabetes and Cardio-Metabolic Disorders Laboratory, Health Biotechnology Division, National Institute of Biotechnology and Genetic Engineering, Faisalabad, Pakistan. Earlier, a cohort of 800 subjects was recruited between 2017 and 2022 from the Allied Hospital, Faisalabad, and Faisalabad Institute of Cardiology (FIC) for our ongoing cardio-metabolic research. The current study was based on a subset of those patient samples. For the current study, sample size was calculated using the WHO sample size calculator with 95% C.I., error margin 0.05, and taking 0.17 as the prevalence of disease risk in the Punjab, which resulted in a sample size of 381 subjects.[14] However, since we had data from our available cohort of 800 subjects, to increase the power of the study, we have used data for the 629 subjects, as the rest of them had some missing data, which were excluded.

Given the unique dietary habits, genetic background, and semi-urban lifestyle of the population of Faisalabad, the study was based in this region, so that it may offer a novel perspective on obesity-driven CVD risks in this high-risk population. Further, Faisalabad has a diverse population mainly with Punjabi ethnicity, and there are limited healthcare facilities, making it a relevant site for studying obesity-related cardiovascular disorders.

For each subject, a questionnaire was filled out with information relevant to their demographics, medical history, smoking status, family history of illness, use of medication, and eating habits.[15] Face-to-face semi-structured interviews were conducted to fill out the study questionnaire. Approval of the institutional (National Institute for Biotechnology and Genetic Engineering (Faisalabad, Pakistan) ethical review committee was obtained for this study, and all human-related research protocols were followed according to the guidelines of the Declaration of Helsinki.

For anthropometric measurements, height was calculated to the nearest 0.5 cm and weight to the nearest 0.1 kg. BMI was calculated by dividing weight in kilograms by height in meters squared (m^2). The WC was measured at the midpoint between the distal border of the ribs and the top of the iliac crest at the end of normal expiration. For measuring the HC, the measuring tape was wrapped around the widest region of the buttocks. A weighing scale and a measuring tape were used for anthropometric measurements. Subjects with a BMI of ≥27 kg/m^2 were considered obese as per the BMI threshold defined for Pakistani subjects.[16] Moreover, male subjects having a WHR greater than 0.9, while female subjects having a WHR greater than 0.8 were also considered as obese. Blood pressure higher than 120/80 mmHg or subjects taking any antihypertensive medicines were considered to have hypertension.

The inclusion criteria included that every patient had CVD, with or without hypertension and/or type 2 diabetes, obesity related traits, or the presence of central obesity. None of the control individuals had any metabolic or cardiovascular disease. Subjects older than 18 years from both genders were included. The exclusion criteria included: cancer patients, pregnant and lactating females, and subjects with ongoing infectious illnesses, patients with severe chronic illness, and those with incomplete medical records.

All subjects (patients and controls) provided blood samples (~ 5 mL), which were used for the biochemical analysis of several clinically important analytes. All the biochemical indicators, including blood glucose, triglycerides, total cholesterol, LDL-cholesterol, HDL-cholesterol, serum uric acid, and total proteins, etc., were measured on a semi-automated clinical chemistry analyzer (Micro-lab300) using commercially available kits (Merck Inc., Germany) by following the procedures provided by the vendor with these kits. Methods for the measurement of the lipid profile have been reported in our previous study.[17]

A primary goal of this study was to investigate the association between the blood lipid parameters and obesity related indices (i.e., BMI, WC, HC, and WHR) in CVD patients from Faisalabad, Pakistan. All the statistical tests were performed using SPSS version 21. Physiological and biochemical parameters were presented as mean ± standard deviation by employing Student's t-test while considering age as a cofounding factor. p-values < 0.05 were taken as statistically significant. Pearson correlation was applied to find the correlation between WC, HC, WHR, BMI, and other parameters with the lipid profile.

RESULTS

Obesity related traits, along with physiological and serum lipid parameters for all subjects, are shown in Table 1. In this study, a total of 629 subjects were included, of which 376 (60%) were males and 253 (40%) were females. In healthy control subjects (N = 226), there were 40 (18%) females and 186 (82%) males, while in 403 CVD patients, 213 (53%) were females and 190 (47%) males. Comparison of the healthy control subjects with CVD patients, after adjusting for age as a cofounding factor, showed several significant changes in the physiological and biochemical parameters (Table 1). Waist and hip circumferences were greater in the CVD patients by 10.8% and 8%, respectively. Similarly, the waist-to-hip ratio was 2% greater in CVD patients as compared to healthy control subjects. Likewise, systolic (21%) and diastolic (15%) blood pressures were higher in the CVD patients. Conversely, serum levels of total cholesterol (5%) and LDL-C (13%) were unexpectedly lower in the CVD patients relative to healthy controls, which is probably due to the use of lipid-lowering drugs (e.g., statins) by 70% of CVD patients.

Furthermore, Pearson correlation analysis of all subjects was performed for obesity related physical, physiological, and lipid profile parameters. Only BMI has shown a significant positive correlation with total cholesterol levels ($r = 0.122$; $p = 0.025$), while other parameters did not show any significant relationship with lipid profile.

For gender-specific disease-related changes, when healthy male subjects were compared with male CVD patients, significant changes were noted in several parameters (Table 2), such as: waist (10%) and hip (8%) circumferences, as well as WHR (3%), which were higher in CVD patients. Likewise, systolic (17%) and diastolic (14%) blood pressures were higher in CVD patients, as well as triglyceride (11%) levels. Conversely, serum total cholesterol (11%) and LDL-C (13%) levels were lower in CVD male patients, albeit unexpectedly.

Pearson correlation analysis of obesity related parameters of male subjects (both healthy controls and CVD patients together) was conducted. In this analysis, BMI ($r = 0.183$; $p = 0.006$) and hip circumference ($r = 0.146$; $p = 0.035$) showed significant positive correlation with total cholesterol. However, no other parameter showed any significant correlation with lipid profile.

Similarly, for female subjects, several significant differences were observed between healthy controls and CVD patients (Table 3), such as: waist (11%) and hip (8%) circumferences were greater in CVD patients. Similarly, systolic (23%) and diastolic (16%) blood pressures were also higher in CVD patients. Furthermore, total cholesterol (11%) and triglycerides (20%) levels were raised in CVD patients, while LDL-Cholesterol (9%) concentration was lower in CVD patients.

TABLE 1. Comparison of anthropometric, physiological, and biochemical parameters of healthy control subjects and CVD patients

Variable	All subjects (N = 629) Mean ± SD	95% CI	Healthy Controls (N = 226) Mean ± SD	CVD Patients (N = 403) Mean ± SD	*p*
Age (years)	50.00 ± 13.00	49.00 – 51.00	42.01 ±8.35	54.51 ±12.84	-
BMI (kg/m^2)	25.5 ± 6.72	24.77 – 26.22	25.38 ± 6.57	25.67 ± 6.97	0.695
Waist circumference (inches)	38.06 ± 5.13	37.52 – 38.61	36.36 ± 4.18	40.29 ± 5.41	<0.0001*
Hip circumference (inches)	40.88 ± 5.08	40.32 – 41.44	39.43 ± 4.06	42.64 ± 5.62	<0.0001*
WHR	0.93 ± 0.05	0.92 – 0.94	0.92 ± 0.052	0.94 ± 0.06	0.001*
Cholesterol (mg/dl)	181.33 ± 52.50	177.19 – 185.5	187.71 ± 46.48	177.71 ± 55.35	0.020*
HDL-C (mg/dl)	48.83 ± 9.71	48.06 – 49.60	48.80 ± 8.21	48.85 ± 10.48	0.940*
LDL-C (mg/dl)	77.11 ± 12.48	76.12 – 78.10	84.10 ± 11.68	73.09 ± 11.09	<0.0001*
Triglycerides (mg/dl)	206.70 ± 87.68	199.80 – 213.60	206.31 ± 72.71	206.92 ± 95.44	0.928
Systolic BP (mmHg)	135.18 ± 26.08	133.00 – 137.36	118.67 ± 15.21	143.01 ± 26.52	<0.0001*
Diastolic BP (mmHg)	86.52 ± 14.58	85.30 – 87.74	78.67 ± 11.20	90.25 ± 14.52	<0.0001*

SD: standard deviation; *p < 0.05 using t-test to compare CVD patients with healthy control subjects; CI: confidence interval; BMI: body mass index; WHR: waist-to-hip ratio; HDL-C: high-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; BP: blood pressure

TABLE 2. Comparison of physical, physiological and lipid profile parameters of healthy male controls with CVD male patients

Variable	Healthy male subjects (N = 186) Mean ± SD	Male CVD patients (N = 190) Mean ± SD	*p*
Age (years)	42.91 ± 7.92	55.57 ± 13.36	-
BMI (kg/m^2)	25.28 ± 6.32	24.98 ± 7.59	0.779
Waist circumference (inches)	36.39 ± 4.05	40.05 ± 5.56	<0.0001*
Hip circumference (inches)	39.42 ± 4.15	42.57 ± 5.61	<0.0001*
WHR	0.92 ± 0.04	0.95 ± 0.056	0.001*
Cholesterol (mg/dl)	192.16 ± 47.95	170.40 ± 55.10	<0.0001*
HDL-C (mg/dl)	49.032 ± 8.70	48.55 ± 10.05	0.624
LDL-C (mg/dl)	85.00 ± 12.51	73.78 ± 11.27	<0.0001*
Triglycerides (mg/dl)	210.25 ± 73.89	187.21 ± 74.14	0.003*
Systolic BP (mmHg)	118.61 ± 15.81	138.81 ± 25.07	<0.0001*
Diastolic BP (mmHg)	78.67 ± 11.29	89.51 ± 15.15	<0.0001*

SD: standard deviation; *p < 0.05 using t-test; BMI: body mass index; WHR: waist-to-hip ratio; HDL-C: high-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; BP: blood pressure

TABLE 3. Comparison of physical, physiological and lipid profile parameters of healthy female controls with CVD female patients

Variable	Healthy female subjects (N = 40) Mean ± SD	Female CVD patients (N = 213) Mean ± SD	*p*
Age (years)	37.76 ± 9.14	53.56 ± 12.32	-
BMI (kg/m^2)	26.03 ± 8.17	26.07 ± 6.61	0.979
Waist circumference (inches)	36.16 ± 5.19	40.17 ± 5.35	0.002*
Hip circumference (inches)	39.48 ± 3.40	42.68 ± 5.65	0.014*
WHR	0.91 ± 0.09	0.94 ± 0.06	0.113
Cholesterol (mg/dl)	166.48 ± 31.28	184.21 ± 54.89	0.006*
HDL-C (mg/dl)	47.68 ± 5.17	49.12 ± 10.86	0.204
LDL-C (mg/dl)	79.73 ± 4.07	72.47 ± 10.91	<0.0001*
Triglycerides (mg/dl)	187.51 ± 60.66	224.48 ± 108	0.003*
Systolic BP (mmHg)	119.33 ± 5.93	146.78 ± 27.27	<0.0001*
Diastolic BP (mmHg)	78.66 ± 10.60	90.92 ± 13.94	0.01*

SD: standard deviation; *p < 0.05 using t-test; BMI: body mass index; WHR: waist-to-hip ratio; HDL-C: high-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; BP: blood pressure

TABLE 4. Comparison of physical, physiological and lipid profile parameters of male and female CVD patients

Variable	Male CVD patients (N = 190) Mean ± SD	Female CVD patients (N = 213) Mean ± SD	*p*
Age (years)	55.57 ± 13.36	53.56 ± 12.32	-
BMI (kg/m^2)	24.98 ± 7.59	26.07 ± 6.61	0.407
Waist circumference (inches)	40.50 ± 5.56	40.17 ± 5.35	0.726
Hip circumference (inches)	42.57 ± 5.61	42.68 ± 5.65	0.916
WHR	0.95 ± 0.056	0.94 ± 0.065	0.352
Total Cholesterol (mg/dl)	170.40 ± 55.18	184.21 ± 54.89	0.013*
HDL-C (mg/dl)	48.55 ± 10.05	49.12 ± 10.86	0.589
LDL-C (mg/dl)	73.78 ± 11.27	72.47 ± 10.91	0.246
Triglycerides (mg/dl)	187.21 ± 74.14	224.48 ± 108.22	<0.0001*
Systolic BP (mmHg)	138.87 ± 5.93	146.78 ± 27.27	<0.0001*
Diastolic BP (mmHg)	89.51 ± 15.15	90.92 ± 13.94	0.354

SD: standard deviation; *$p < 0.05$ using t-test; BMI: body mass index; WHR: waist-to-hip ratio; HDL-C: high-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; BP: blood pressure

Additionally, Pearson correlation analysis of obesity related parameters of female subjects (both healthy controls and CVD patients together) was done. However, no physical or physiological parameter was seen to have any significant correlation with lipid profile. Similarly, comparison of male and female CVD patients for obesity related traits and cardiovascular disease-related parameters showed a significant increase in total cholesterol (8%) and triglycerides (20%) as well as systolic blood pressure (6%) in female CVD patients, as shown in Table 4. However, Pearson correlation for obesity related parameters in CVD patients did not show any significant correlation with lipid profile in both genders.

DISCUSSION

Obesity and cardiovascular disorders (CVDs) are primarily linked to poor dietary choices and physical inactivity, in addition to genetic background and environmental factors. Both obesity and CVDs are quite prevalent in the Pakistani population. However, limited data are available to link physical, physiological, and biochemical aspects of obesity with cardiovascular disorders. Hence, in this study, we have studied a cohort of cardiovascular disease patients in comparison to healthy control subjects for differences in several obesity related traits and lipid profile parameters. Key findings of this study were: higher waist circumference (WC), hip circumference (HC), waist-to-hip ratio (WHR), systolic and diastolic blood pressure in CVD patients compared to healthy control subjects. Likewise, in gender-based comparison (CVD males vs. healthy male subjects), WC, HC, WHR, blood pressure (SBP, DBP), and serum triglyceride levels were significantly higher in CVD male patients. Similarly, in the case of the female cohort, higher values of WC, HC, SBP, DBP, serum total cholesterol, and triglyceride were found in female CVD patients.

Variable anthropometric indices were found in other studies due to differences in the ethnicity of populations, body composition, and study methodology. WC, BMI, and WHR are usually used to assess the amount of fat distribution in the central region of the body to reflect the metabolic fitness of the body.[18] Results from the present study showed that waist (10.8%) and hip (8%) circumferences, as well as WHR (2%), were greater in the CVD patients as compared to healthy controls. Our study showed a higher prevalence of obesity in cardiovascular patients compared to healthy controls. Measures such as WC, HC, and WHR indicate that obesity was a significant risk factor for CVDs in the studied population of Faisalabad, Pakistan. Pearson correlation showed a significant relationship between BMI and HC with total cholesterol. These findings suggest that obesity-induced lipid imbalances contribute to the progression of cardiovascular diseases in the studied population.

It has been previously reported that the dyslipidemia status and cardiovascular disease can be correctly predicted by the WC and WHR measures.[19] An increase in WC is strongly associated with a higher risk of cardio-metabolic disorders due to visceral fat accumulation and fatty liver disease. Our results show that WC and WHR are better indicators of physical and metabolic fitness than BMI.[20–22] This is also supported by other studies as it has been reported that WHR is a better indicator of visceral and abdominal fat distribution.[23]

Furthermore, in contrast to BMI, an increased WHR has been found to be a better risk factor for diabetes mellitus, hypertension, CVD, and dyslipidemia.[24] Yet, some researchers showed that WC is a more precise predictor of CVD than BMI and WHR.[25] It is because BMI is generally used to identify overall or general obesity, whereas WC, WHR, and WHtR indicate visceral fat, often known as abdominal or centralized obesity.[26] Although BMI is a widely used measure to estimate body fat, there

is more interest in taking WHR as an alternative indicator to evaluate central obesity. This is because WHR focuses specifically on the distribution of fat in the central part of the body, which is not taken into consideration by BMI.[27] It is suggested that BMI alone is not sufficient to assess obesity in the South-Asian population, and other indices such as WC, WHR, and WHtR should also be considered for assessing obesity.[28] In a study on Indian subjects, it was found that the WC is a reliable tool for not only monitoring type 2 diabetes development but also prediabetes in conjunction with lipid profile.[29] Similarly, in our study, female CVD patients had 11% greater waist and 8% greater hip circumference. In line with the present study, Patel et al. reported a strong association of WC and WHtR with the dysregulated cardiovascular profile in female subjects.[30] Among different indices of the body, WC has been shown to be the only clinical indicator of obesity, independently associated with an increased risk in routine medical checkups.[31] However, WC, on the other hand, does not take height into consideration.[27] A meta-analysis suggested that WHtR is a useful indicator to identify subjects at a higher risk of cardio-metabolic disorders.[32]

A review of 57 prospective cohort studies by Whitlock et al. found that individuals with a BMI of 30 kg/m² had a higher risk of CVD than those with a BMI of 23-24.9 kg/m².[33] The risk of CVD increased progressively with increasing BMI. Furthermore, a combination of dyslipidemia and obesity increases the risk of CVD to a greater extent.[34] According to some research, if BMI exceeds 25 kg/m^2 by 5 units, the general mortality risk increases by 29%, the risk of vascular mortality increases by 41%, and the risk of mortality related to diabetes increases by 210%.[35]

Many studies have shown a link between dyslipidemia and CVD. For example, a meta-analysis of 123 studies by Baigent et al. (2009) demonstrated that lowering LDL-C by 1 mmol/L was linked to a 21% decrease in significant vascular incidents, such as heart attacks, strokes, and vascular-related fatalities. Similarly, a large prospective cohort study by the Cholesterol Treatment Trialists' Collaboration found that statin therapy reduced the risk of major vascular events by 23% per 1.0 mmol/L reduction in LDL-C.[36] Interestingly, in our study, we found lower levels of total cholesterol (5%) and LDL cholesterol (13%) in the CVD patients relative to healthy controls. This was an unexpected finding, which is probably due to the use of lipid-lowering drugs (e.g., statins) in 70% of the CVD patients in our cohort.

In spite of some significant findings, for the relationship between obesity-related parameters with dyslipidemia in CVD patients, our research has some limitations. Though we were able to collect a decent cohort of patients, these were not representative of all the CVD patients in the region. Moreover, this study provided a primary insight into the impact of various lipid profile parameters as well as physical factors (i.e., BMI, WC, HC, and WHR) on cardiovascular health in patients from Faisalabad, Pakistan. Therefore, building upon these results, future research should include large cohort-based longitudinal studies from different regions of Pakistan to assess causality and track the metabolic changes over time. Additionally, interventional studies focusing on lifestyle modifications, pharmacological treatments, and genetic predispositions could provide deeper insights into effective management strategies for obesity-related cardiovascular risks.

Our findings suggest that waist circumference is a better indicator of obesity-linked CVD risk, which should be adopted in screening programs owing to the high frequency of obesity and CVDs in Pakistan. The high prevalence of obesity, hypertension, and dyslipidemia highlights the urgent need for public health interventions aimed at promoting healthy lifestyle behaviors, improving lipid management, and increasing awareness of the risk factors associated with CVDs. Early detection and management of these risk factors can help in preventing the onset of CVD and reduce the burden of cardio-metabolic disorders in Pakistan, which exert a huge pressure on the fragile healthcare system of this developing country. Based on an individual's health condition, health-care practitioners should employ routine screening, conduct regular cardiovascular risk assessments, emphasize healthy lifestyle modifications, and prescribe pharmacological interventions only where needed. Patients who follow such strategies could help them in better management and prevention of chronic disorders like obesity, cardiovascular diseases, and other comorbid metabolic conditions.

CONCLUSIONS

This study provides a comparative analysis of obesity-related anthropometric traits and serum lipid parameters among CVD patients from Faisalabad, Pakistan. These findings highlight a significant association between obesity indices (i.e. BMI, WC, WHR) and abnormal lipid profiles. These metabolic disturbances were more distinct in CVD patients compared to non-CVD controls, underscoring the role of obesity and dyslipidemia as key contributors to CVD risk in this population. Furthermore, the results emphasize the importance of region-specific data, as sociocultural and dietary factors in Faisalabad may uniquely influence cardiometabolic health. The study calls for targeted public health interventions aimed at early screening, lifestyle modification and risk factor management, particularly focusing on obesity and lipid regulation. Future research with larger, multi-center cohorts and longitudinal designs is necessary to validate these findings and support evidence-based strategies to reduce the growing burden of CVDs in Pakistan.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

FUNDING

Higher Education Commission (HEC), Pakistan, supported this study.

Received: February 19, 2025 | Accepted: April 22, 2025

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