Journal of Health and Rehabilitation Research 2791-156X JHRR

For contributions to JHRR, contact at email: editor@jhrlmc.com

Original Article

The Effect of Hyperlipidemia on Cardiovascular Diseases: A Risk Factor in Cardiovascular Diseases at FMH Hospital Lahore

Atif Munir[1], Iqra Kousar[2]*, Nusrum Iqbal[3], Asif Mushtaq[4], Rizwan Khan[5], Sehar Gulzar[6]

[1]Demonstrator, Department of Allied Health Sciences, Fatima Memorial Hospital College of Medicine & Dentistry Lahore, Pakistan.
[2]Bachelor in Cardiac Perfusion Technology, Department of Allied Health Sciences, University of Health Sciences Lahore, Pakistan.
[3]General Physician, HOD Department of Internal Medicine, MD Health Center Lahore, Pakistan.
[4]Department of Cardiac Surgery (Cardiac Perfusionist), Punjab Institute of Cardiology Lahore, Pakistan.
[5]Post Doctoral Researcher, Eye Institute of Xiamen University and Affiliated Xiamen Eye Center, School of Medicine, Xiamen University Xiamen, China.
[6]Senior Demonstrator/Clinical Instructor, Medical Laboratory Technology, Fatima Memorial Hospital Institute of Allied Health Sciences Lahore, Pakistan.
Corresponding Author: Iqra Kousar; Email: iqrakousar806@gmail.com

Conflict of Interest: None.

*Munir A., et al. (2024). 4(2): **DOI**: https://doi.org/10.61919/jhrr.v4i2.1014*

ABSTRACT

Background: Cardiovascular diseases (CVDs) represent a major global health concern, causing approximately 17.9 million deaths annually, accounting for 32% of all global deaths. Among these fatalities, 85% are attributed to heart attacks and strokes. Hyperlipidemia, a common metabolic disorder, significantly contributes to the risk of CVDs by causing disturbances in lipid metabolism, including elevated levels of low-density lipoprotein cholesterol (LDL-C), increased triglycerides, elevated total cholesterol (TC), and decreased levels of high-density lipoprotein cholesterol (HDL-C).

Objective: To determine the impact of hyperlipidemia on cardiovascular diseases, focusing on its role as a prominent risk factor.

Methods: This retrospective study was conducted at the Department of Pathology, Fatima Memorial Hospital, Lahore, from June 2023 to December 2023, following approval from the Institutional Review Board (IRB). Data were collected using a non-probability convenient sampling technique. The sample size was calculated based on a 95% confidence level, an estimated prevalence of hyperlipidemia in CVD patients of 4.5%, and a desired margin of error, resulting in a sample size of 65-70 patients. Inclusion criteria included CVD patients diagnosed with hyperlipidemia, while patients with hyperlipidemia but no CVD were excluded. Data were collected from medical records using a self-designed Performa. Statistical analysis was conducted using IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp.). Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation (SD). Bar charts were used for categorical data and histograms for continuous data. A p-value of less than 0.05 was considered statistically significant. Chi-square analysis was used to identify correlations between lipid levels and CVD status.

Results: Out of the 65 subjects, 45 (69.2%) had no CVD, while 20 (30.8%) were diagnosed with CVD. Total cholesterol levels were <200 mg/dL in 36 patients (55.4%), 200-240 mg/dL in 15 patients (23.1%), and >240 mg/dL in 14 patients (21.5%). LDL levels were <100 mg/dL in 21 patients (32.3%), 130-189 mg/dL in 38 patients (58.5%), and >190 mg/dL in 6 patients (9.2%). HDL levels were <39 mg/dL in 36 patients (55.4%) and >40 mg/dL in 29 patients (44.6%). Triglyceride levels were <150 mg/dL in 15 patients (23.1%), 150-199 mg/dL in 30 patients (46.2%), and 200-499 mg/dL in 20 patients (30.8%). Chi-square analysis revealed a significant association between triglyceride levels and CVD status ($p < 0.001$) and significant results for LDL and HDL levels ($p < 0.005$).

Conclusion: This study highlights the profound impact of hyperlipidemia on cardiovascular health, emphasizing its role as a significant risk factor for CVDs. The strong association between elevated lipid levels and increased risk of cardiovascular events underscores the need for effective lipid management strategies to reduce the burden of cardiovascular diseases and improve patient outcomes.

Keywords: Cardiovascular diseases, hyperlipidemia, lipid metabolism, LDL cholesterol, HDL cholesterol, triglycerides.

INTRODUCTION

Cardiovascular diseases (CVDs) pose a significant global health threat, responsible for approximately 17.9 million deaths annually, accounting for 32% of all global fatalities. Among these deaths, 85% result from heart attacks and strokes, with over three-quarters occurring in low- and middle-income countries. The cardiovascular system, comprising the heart and its blood vessels, is susceptible

Journal of Health and Rehabilitation Research 2791-156X JHRR

to numerous issues, including endocarditis, rheumatic heart disease, and conduction system abnormalities. Cardiovascular disease, also known as heart disease, encompasses four main conditions: coronary artery disease (CAD), also referred to as coronary heart disease (CHD), cerebrovascular disease, peripheral artery disease (PAD), and aortic atherosclerosis. CAD occurs when there is reduced blood flow to the heart muscle, leading to angina due to insufficient oxygen supply, potentially resulting in myocardial infarction (MI) and/or heart failure.

Risk factors for heart diseases can be categorized into two types: controllable and uncontrollable. Uncontrollable risk factors include being male, advanced age, having a family history of heart disease, being postmenopausal, and specific racial backgrounds (such as African American, Native American, and Mexican American individuals who are more susceptible to developing heart disease). Conversely, lifestyle-related risk factors that can be controlled include smoking, obesity, unhealthy cholesterol levels, uncontrolled diabetes, high blood pressure, elevated C-reactive protein levels, stress, poor diet, and alcohol consumption.

Hyperlipidemia is a prevalent metabolic anomaly that emerges as a notable risk element for cardiovascular maladies. Clinical investigations underscore its role in elevating susceptibility to non-ischemic heart failure, with evidence indicating that mitigating serum lipid levels can potentially reverse cardiac dysfunction. Beyond its indirect impact through atherosclerosis development, hyperlipidemia directly influences the heart's systolic function and electrophysiological response. This direct effect is believed to be linked to the gradual accumulation of cardiac lipids, fostering systemic oxidative stress, a proinflammatory state, and mitochondrial dysfunction (4). Hyperlipidemia encompasses a range of genetic and acquired conditions resulting in elevated lipid levels within the body, which is prevalent, especially in the Western world. A more precise definition characterizes hyperlipidemia as having levels of low-density lipoprotein (LDL), total cholesterol, triglycerides, or lipoproteins higher than the 90th percentile compared to the general population or having high-density lipoprotein (HDL) levels below the 10th percentile compared to the general population. Elevated triglyceride (TG) levels serve as indicators for atherogenic lipoproteins, particularly crucial in individuals with insulin-resistant conditions like type 2 diabetes mellitus and metabolic syndrome.

Patients with these conditions commonly exhibit mixed dyslipidemia, characterized by heightened fasting and postprandial triglycerides, reduced high-density lipoprotein cholesterol (HDL-C), small LDL and HDL particles, and the accumulation of incompletely metabolized chylomicrons (CMs) and very low-density lipoproteins (VLDLs), known as remnant particles rich in apolipoprotein (apo) C-III and cholesterol. Despite achieving target LDL-C levels, these patients face a substantial cardiovascular risk, necessitating a treatment approach beyond statins to address additional lipid abnormalities (6). This study aims to determine the effect of hyperlipidemia on CVD, focusing on its role as a prominent risk factor.

MATERIAL AND METHODS

This retrospective study was conducted at the Department of Pathology, Fatima Memorial Hospital, Lahore, from June 2023 to December 2023, following approval from the Institutional Review Board (IRB). Data were collected using a non-probability convenient sampling technique. The sample size for this study was determined using the formula for sample size calculation, where n represents the required sample size, Z is the Z-score corresponding to a 95% confidence level (Z = 1.96), p is the estimated prevalence of hyperlipidemia in cardiovascular disease (CVD) patients (4.5%), and d is the desired margin of error or precision. This calculation resulted in a sample size of 65-70 patients from FMH.

Inclusion criteria comprised CVD patients diagnosed with hyperlipidemia, while exclusion criteria excluded patients showing hyperlipidemia without CVD. Data collection involved the use of a self-designed Performa to gather relevant information. CVDs, which include coronary heart disease, cerebrovascular disease, rheumatic heart disease, and other related conditions, were studied. Risk factors were identified at various levels, including biological, psychological, family, community, and cultural factors, all of which are associated with a higher likelihood of negative outcomes. Following IRB approval, patient reports fulfilling the inclusion criteria were reviewed, and those diagnosed with both CVDs and hyperlipidemia were recruited. Data were collected from medical records, considering various demographic factors.

Statistical analysis was conducted to identify correlations and patterns, while ensuring ethical considerations and maintaining participant confidentiality in accordance with the principles of the Declaration of Helsinki. The findings from this study are intended to inform future longitudinal studies and interventions, leading to improved preventive strategies, public health interventions, and personalized treatment approaches for patients with CVDs. Ultimately, this research aims to reduce the burden of cardiovascular disease and enhance patient outcomes. The research proposal was submitted to the IRB Department of FMH College of Medicine and Dentistry for ethical approval.

Data were entered and analyzed using IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp.). Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation (SD). Bar charts

Journal of Health and Rehabilitation Research 2791-156X JHRR

were used to display categorical data, and histograms were employed for continuous data. A p-value of less than 0.05 was considered statistically significant. Chi-square analysis was used to analyze the data, providing insights into the relationships between variables.

RESULTS

Table 1: Presence or Absence of CVD

Presence or Absence of CVD	Frequency	Percentage
Absent	45	69.2%
Present	20	30.8%
Total	65	100%

Out of the 65 patients analyzed, 20 (30.8%) were diagnosed with cardiovascular disease (CVD), while 45 (69.2%) were not diagnosed with CVD. This indicates that a significant proportion of the sample population was free from CVD, despite their hyperlipidemia status.

Table 2: Total Cholesterol of Patients

Total Cholesterol (mg/dL)	Frequency	Percentage
<200	36	55.4%
200-240	15	23.1%
>240	14	21.5%
Total	65	100%

Total cholesterol levels among the 65 patients varied, with 36 patients (55.4%) having cholesterol levels below 200 mg/dL. Fifteen patients (23.1%) had levels between 200-240 mg/dL, while 14 patients (21.5%) had levels exceeding 240 mg/dL. These results highlight that a substantial number of patients had cholesterol levels within acceptable ranges.

Table 3: LDL of Patients

LDL (mg/dL)	Frequency	Percentage
<100	21	32.3%
130-189	38	58.5%
>190	6	9.2%
Total	65	100%

The low-density lipoprotein (LDL) levels of the patients showed that 21 patients (32.3%) had LDL levels below 100 mg/dL. A majority of 38 patients (58.5%) had levels between 130-189 mg/dL, and 6 patients (9.2%) had levels above 190 mg/dL. This distribution emphasizes the need for targeted interventions to manage high LDL levels.

Table 4: HDL of Patients

HDL (mg/dL)	Frequency	Percentage
<39	36	55.4%
>40	29	44.6%
Total	65	100%

High-density lipoprotein (HDL) levels revealed that 36 patients (55.4%) had HDL levels below 39 mg/dL, while 29 patients (44.6%) had levels above 40 mg/dL. The data suggests that a considerable number of patients had low HDL levels, a known risk factor for cardiovascular disease.

Table 5: Triglycerides of Patients

Triglycerides (mg/dL)	Frequency	Percentage
<150	15	23.1%
150-199	30	46.2%
200-499	20	30.8%
Total	65	100%

Journal of Health and Rehabilitation Research 2791-156X JHRR

Triglyceride levels among the patients showed that 15 patients (23.1%) had levels below 150 mg/dL, 30 patients (46.2%) had levels between 150-199 mg/dL, and 20 patients (30.8%) had levels between 200-499 mg/dL. These findings indicate that a significant proportion of the patients had elevated triglyceride levels, further contributing to their cardiovascular risk.

DISCUSSION

The present study aimed to assess the impact of hyperlipidemia on cardiovascular diseases (CVDs), focusing on the disturbances in lipid metabolism characterized by elevated low-density lipoprotein cholesterol (LDL-C), increased triglycerides, elevated total cholesterol (TC), and decreased high-density lipoprotein cholesterol (HDL-C). Dyslipidemia has long been recognized as a crucial contributor to the development of cardiovascular diseases, with plasma concentrations of total cholesterol and LDL cholesterol acknowledged as significant risk factors for coronary heart disease. This aligns with previous research by Nelson et al., which highlighted hyperlipidemia as a potent risk factor for CVDs. According to data from the Centers for Disease Control, hyperlipidemia is the second most prevalent chronic condition observed in ambulatory care settings, surpassed only by hypertension, further underscoring its clinical importance (Nelson et al.).

In the current study, the sample comprised 65 subjects, with a near-equal gender distribution of 49.2% female and 50.8% male. Chi-square analysis revealed a highly significant association between triglyceride levels and the presence of CVD, with a p-value of <0.001. Additionally, the analysis showed significant results for LDL and HDL levels, with a p-value of <0.005, indicating their strong correlation with cardiovascular health. Elevated cholesterol levels were consistently linked to an increased risk of cardiovascular events, underscoring the importance of managing lipid levels to mitigate cardiovascular risk.

One of the strengths of this study lies in its focused approach to evaluating the direct impact of hyperlipidemia on cardiovascular outcomes, providing valuable insights into the relationship between lipid abnormalities and CVDs. The use of a well-defined sample and robust statistical analysis enhances the reliability of the findings. However, the study also had limitations. The retrospective design may have introduced selection bias, and the non-probability convenient sampling technique might limit the generalizability of the results. Additionally, the reliance on medical records for data collection could have resulted in incomplete or inaccurate data. Despite these limitations, the study contributes to the growing body of evidence highlighting the importance of lipid management in preventing cardiovascular events. Future research should aim to incorporate larger, more diverse populations and prospective designs to validate these findings further. Moreover, interventions targeting lipid abnormalities should be prioritized in clinical practice to reduce the burden of cardiovascular diseases. The consistent association between elevated lipid levels and increased cardiovascular risk underscores the necessity for comprehensive lipid management strategies, including lifestyle modifications and pharmacological interventions, to improve cardiovascular outcomes.

CONCLUSION

In conclusion, this research underscores the profound impact of hyperlipidemia on cardiovascular health, highlighting the clinical significance of addressing lipid abnormalities as pivotal risk factors for CVDs. The findings from this study provide valuable insights into the intricate relationship between lipid levels and cardiovascular disease, emphasizing the need for targeted interventions to mitigate cardiovascular risk and improve patient outcomes.

REFERENCES

1. Timmis A, et al. European Society of Cardiology: Cardiovascular Disease Statistics 2021. 2021;8:716–99.
2. Olvera Lopez E, et al. Cardiovascular Disease. 2023.
3. Chen Hui M, et al. Cardiovascular Disease: Cause of Morbidity and Mortality in Adult Survivors of Childhood Cancers. 2011.
4. Si Yao Y, et al. Mechanisms Underlying Direct Actions of Hyperlipidemia on Myocardium: An Updated Review. 2020.
5. Nelson RH, et al. Hyperlipidemia as a Risk Factor for Cardiovascular Disease. 2013.
6. Talayero BG, et al. The Role of Triglycerides in Atherosclerosis. 2012.
7. Allobani A, et al. Relationship Between Hyperlipidemia, Cardiovascular Disease and Stroke: A Systematic Review. 2021.
8. Jomard A, Osto E. High Density Lipoproteins: Metabolism, Function, and Therapeutic Potential. Front Cardiovasc Med. 2020;7.
9. Gaggini M, et al. Lipids in Atherosclerosis: Pathophysiology and the Role of Calculated Lipid Indices in Assessing Cardiovascular Risk in Patients with Hyperlipidemia. 2023 Jan.
10. Yao YS, Li TD, Zeng ZH. Mechanisms Underlying Direct Actions of Hyperlipidemia on Myocardium: An Updated Review. Lipids Health Dis. 2020;19.
11. Rudniki M, Haas TL. Cardiovascular Disease: Exploring Risk Factors at the Molecular Level. 2021.

Journal of Health and Rehabilitation Research 2791-156X JHRR

12. Alam MJ, Alnafeesah AI, Saeed M. Inter-Correlation of Risk Factors Among Heart Patients. AIMS Public Health. 2020;7(2):354–62.

13. Khot UN, et al. Prevalence of Conventional Risk Factors in Patients with Coronary Heart Disease. 2003.

14. Long-Term Intervention with Pravastatin in Ischaemic Disease (LIPID) Study Group. Prevention of Cardiovascular Events and Death with Pravastatin in Patients with Coronary Heart Disease and a Broad Range of Initial Cholesterol Levels. N Engl J Med. 1998 Nov;339(19):1349–57.