Exploring the Relationship Between Lipid Profiles and Kidney Health:
A Study Using Basic Lipid Analysis Techniques

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ABSTRACT

Objective: This study was intended to investigate the relationship between lipid profiles and kidneys functionality in a specific group of patients residing in Sialkot, Punjab, utilizing basic lipid analysis techniques.

Methodology: After ethical approval, a cross-sectional study was conducted involving 150 participants aged 18 years and above, recruited from the outpatient department of a tertiary care hospital affiliated with Government Khawaja M. Safdar Medical College. Inclusion criteria encompassed individuals with and without chronic kidney disease (CKD), while those with acute infections or significant comorbidities were excluded. Data were collected through structured questionnaires and laboratory assessments of lipid profiles (total cholesterol levels in serum, triglycerides, low density lipoproteins and high-density lipoproteins particles in serum). Moreover, the kidney function parameters (such as serum creatinine, blood urea nitrogen) were also carefully observed. Statistical analyses, including correlation and regression analysis, were performed using SPSS software.

Results: The findings indicated a significant association between dyslipidemia and impaired kidney function. Elevated levels of total cholesterol and triglycerides were correlated with amplified serum creatinine levels and blood urea nitrogen concentrations. Additionally, a decrease in HDL was noted in participants with advanced stages of CKD. The results demonstrated that lipid profiles could serve as potential biomarkers for kidney health assessment in the South Asian population.

Conclusion: This study highlights the importance of monitoring blood lipids in patients at risk for CKD, suggesting that dyslipidemia may exacerbate kidney dysfunction. Further longitudinal studies are warranted to establish causality and provide a deeper insight into the underlying mechanisms linking lipid metabolism with general condition of the kidney.

KEYWORDS: Blood Lipids, Chronic Kidney Disease, Dyslipidemia, HDL, Kidney Function, LDL

INTRODUCTION

Chronic kidney disease (CKD) is an increasing burden globally, with risk factors including age, hypertension, diabetes, and dyslipidemia. These have been widely recognized as contributing to disease progression and morbidity.[1, 2] Among these, dyslipidemia—characterized by deranged lipid levels in the blood—has expanded particular interest due to its complex relationship with CKD pathophysiology. Studies indicate that derangement in lipid profile—particularly increases in low-density lipoprotein cholesterol and triglyceride levels—may cause kidney function deterioration by promoting oxidative stress, endothelial dysfunction, and glomerular damage.[3, 4]

In Asian populations, the prevalence of CKD has risen significantly, with Pakistan reporting an extensive increase in CKD-related morbidity in current years.[5] This surge, likely predisposed by local dietary patterns, genetic tendencies, and the prevalence of metabolic syndrome, highlights the

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need for locally focused research.[6] Several studies recommend that high LDL-C and triglyceride levels, combined with low high-density lipoprotein (HDL), may accelerate the development of renal impairment through mechanisms such as podocyte injury and enhanced glomerular permeability.[7, 8]

Despite extensive research on dyslipidemia and kidney health in high-income countries, there remains a lack of data regarding this association in low- and middle-income regions like Pakistan.[9] The key objective of this research was to observe lipid profile variations along their possible relationship with kidney health markers such as serum creatinine and estimated glomerular filtration rate (eGFR) within a specified Pakistani population. Utilizing basic lipid analysis techniques, we aimed to clarify the significance of blood lipid levels in predicting kidney dysfunction in a resource-limited setting, contributing to the broader understanding of CKD pathogenesis in South Asia. The relationship between lipid profiles and kidney health has gained increasing attention in medical research, particularly in populations predisposed to long-lasting kidney disease (CKD).

METHODOLOGY

This study employed a cross-sectional design to explore the relationship between lipid profiles and kidney health among adults in Sialkot, Punjab. The study was conducted from January to March 2024.

A total of 150 participants aged 18 years and above were recruited for the study. Inclusion criteria included individuals diagnosed with chronic kidney disease (CKD) as well as those without any known kidney disease, selected from the outpatient department of a tertiary care hospital. Participants were excluded if they had acute infections, were on lipid-lowering medications, or had a history of liver disease, diabetes mellitus, or significant cardio-vascular disease.

A non-probability convenience selection method was applied to select the participants. The recruitment process involved screening specified patients visiting the OPD and obtaining informed consent prior to participation. Ethical approval was obtained from the hospital's established review panel vide letter No. 29/REC/KMSMC dated 12-02-2024.

Data collection was carried out in two main parts. Demographic and clinical data were obtained through a structured questionnaire designed to collect information regarding demographic characteristics (age, gender, socioeconomic status) and clinical history, including any comorbidities. Second, laboratory investigations were conducted in which all participants had their blood drawn in order to analyze their kidney function parameters (blood urea nitrogen and serum creatinine) and lipid profile conformation (total cholesterol, triglycerides, low-density lipoprotein (LDL), and high-density lipoprotein). Lipid profiles were evaluated using standard enzymatic methodology, and the estimated glomerular filtration rate (eGFR), which was determined using the CKD-EPI equation, was used to measure kidney function.

Statistical software, such as SPSS version 26, was utilized to analyze the data. For the clinical and demographic variables, descriptive statistics were computed. The relationship between lipid profiles and kidney health was assessed using correlation coefficients and regression analyses. Statistical significance was interpreted as a p-value of not more than 0.05.

Based on earlier research showing an important relationship between lipid profiles and kidney health, a sample size of 150 was selected, with a power of 80% and a confidence level of 95%, ensuring the study is adequately powered to detect meaningful associations.

RESULTS

In this study, many participants showed atypical test results. Raised cholesterol was seen in 68% of cases, high LDL-C in 73%, low HDL-C in 58%, elevated triglycerides in 48%. Kidney health was also affected, with consistently raised creatinine levels in 45% and reduced eGFR in 63% of participants (Table 1). When cholesterol values

were compared with kidney function, only LDL-C and triglycerides showed a significant link with higher creatinine and lower eGFR ($p < 0.05$).

Table 4: Multivariable Regression Analysis for Predictors of Kidney Dysfunction (N = 150)

Variables	Beta Coefficient (β)	Standard Error (SE)	p-value
Age	+ 0.22	0.06	<0.05*
LDL-C	+ 0.26	0.05	<0.01*
HDL-C	- 0.15	0.05	0.07
Triglycerides	+ 0.19	0.06	<0.05*
Hypertension	+ 0.23	0.07	<0.05*
HDL-C (mg/dL)	Greater than 40	37 ± 6	58%
Triglycerides (mg/dL)	Less than 150	175 ± 38	48%
Serum Creatinine (mg/dL)	0.6 - 1.2	1.3 ± 0.4	45%
eGFR (mL/min/1.73 m²)	Greater than 90	72 ± 13	63%

A high prevalence of abnormal lipid profiles, notably elevated LDL-C and low HDL-C, was observed. Lipid and renal values were obtained using enzymatic assays.

In contrast, total cholesterol and HDL-C showed no significant relationship (Table 2). According to KDIGO (kidney disease: Improving Global Outcomes) staging, one-third of participants had mildly reduced kidney function, about one-fifth had moderate reduction, and a smaller proportion showed severe reduction or kidney failure; while only one-quarter had normal function (Table 3). Further analysis showed that age, LDL-C, triglycerides, and high blood pressure were important predictors of kidney dysfunction, while HDL-C did not show a significant effect (Table 4). The correlation between total cholesterol and kidney markers was non-significant. Classification according to KDIGO guidelines indicates that a larger proportion of participants had mild to moderate kidney function decline.

Table 2: Correlation Analysis Between Lipid Profiles and Kidney Function (N = 150)

Lipid Profile Parameter	Correlation with Serum Creatinine (r)	Correlation with eGFR (r)	p-value
Total Cholesterol	+ 0.28	-0.20	0.06
LDL-C	+ 0.37	-0.30	<0.05*
HDL-C	-0.20	+0.17	0.08
Triglycerides	+ 0.31	-0.23	<0.05*

Pearson correlation coefficients showed that LDL-C and triglycerides were significantly associated with lower kidney function ($p < 0.05$).

Table 3: Distribution of Kidney Function Stages According to eGFR Values (N = 150)

eGFR Range (mL/min/1.73 m²)	Kidney Function Stage	Frequency (%)
> 90	Normal	38 (25)
60-89	Mildly Decreased	52 (35)
30-59	Moderately Decreased	33 (22)
15-29	Severely Decreased	19 (13)
< 15	Kidney Failure (CKD)	8 (5)

Regression analysis indicated significant associations between kidney dysfunction and age, LDL-C, triglycerides, and hypertension ($p < 0.05$). HDL-C showed non-significant trends.

Significant p value: < 0.05 ↕ Pearson Chi square test.

DISCUSSION

The findings of this cross-sectional study support previous research linking dyslipidemia with decline in kidney function, with additional attention to the roles fulfilled by elevated LDL-C and triglycerides in those with compromised kidney function. Seventy-three percent of the participants in our study had elevated LDL-C levels, while 48% showed elevated triglyceride levels, both of which were significantly correlated with reduced eGFR and increased serum creatinine ($p < 0.05$).[10] This connection suggests that dyslipidemia may play a

causative role in development of CKD through mechanisms involving oxidative stress and inflammation.[11]

The frequency of aberrant lipid profiles observed in this study aligns with findings from studies conducted in Asian populations, where elevated LDL-C and reduced HDL-C levels have similarly been associated with accelerated CKD progression.[12] In these populations, genetic predispositions to insulin resistance and metabolic syndrome may exacerbate the atherogenic potential of dyslipidemia, increasing the risk of CKD and other cardiovascular complications.[13]

Another significant finding was the positive correlation between triglyceride levels and serum creatinine, which has previously been identified as a risk factor for reduced kidney function.[14] Triglycerides may indirectly affect kidney function by inducing inflammation and endothelial dysfunction, suggesting that managing hypertriglyceridemia could slow CKD progression in at-risk individuals.[15] The present study contributes to the growing body of evidence that links triglycerides with kidney impairment and supports the inclusion of lipid profile monitoring in CKD screening protocols.[16]

Conversely, HDL-C displayed a non-significant correlation with kidney markers in our cohort, which contrasts with findings in Western populations where low HDL-C has been associated with kidney dysfunction.[17] This discrepancy might be due to lifestyle and dietary factors unique to the South Asian population, highlighting the need for region-specific investigations.[18]

One of the study's shortcomings is its cross-sectional design, which makes it more difficult to prove causation, and the application of fundamental lipid analysis methods, which may not capture more detailed lipid abnormalities. Additionally, the study's focus on a specific region may limit generalizability; however, it underscores the importance of localized research to address unique population characteristics.[19] Future research should include longitudinal studies and advanced lipid assessments to better understand the role of dyslipidemia in CKD pathogenesis across different populations.[20]

In conclusion, this study highlights the significant association between dyslipidemia and kidney dysfunction within a Pakistani cohort, implying that lipid management and early intervention may lower the risk of CKD. Regular lipid profile tracking in at-risk individuals could improve early CKD detection and patient outcomes because of the high prevalence of CKD and dyslipidemia in this population.

CONCLUSION

This study found that abnormal lipid levels, especially high LDL-C and triglycerides, were associated with declining kidney function in a group of people with chronic kidney disease (CKD) in Pakistan. These lipid imbalances may damage the kidneys through inflammation and oxidative stress. The risk of CKD progression may be lowered with regular screening and early treatment of lipid disorders, especially in South Asian populations.

REFERENCES

1. Khan AA, Slart RHJA, Ali DS, Bock O, Carey JJ, Camacho P, et al. Osteoporotic fractures: diagnosis, evaluation, and significance from the International Working Group on DXA Best Practices. Mayo Clin Proc. 2024;99(7):1127–1141. doi:10.1016/j.mayocp. 2024.01.011

2. Kulkarni SL, Kour H. Osteoporosis – a silent killer: a narrative review. J Clin Diagn Res. 2024;18(4):RE01–RE06. doi:10.7860 /JCDR/2024/69058.19248.

3. Choi MH, Yang JH, Seo JS, Kim Y, Kang SW. Prevalence and diagnosis experience of osteoporosis in postmenopausal women over 50: focusing on socioeconomic factors. PLoS One. 2021;16(3):e0248020. doi:10.1371/journal.pone.0248020.

4. Alswat KA. Gender disparities in osteoporosis. J Clin Med Res. 2017;9(5):382. doi:10.14740/JOCMR2970W

5. Nguyen CT, Van Thai C, Hong NNT. Clinical manifestations and quality of life of postmenopausal women with severe osteoporosis: a cross-sectional study on the Vietnamese population. BMC Women's Health. 2025;25:509. doi:10.1186/s 12905-025-04056-9.

6. Wang L, Liu J, Chen J, Zhang Y, Li X, Liu M, et al. Gender differences in bone mineral density, osteoporosis, and fracture in patients with type 2 diabetes: a retrospective study. BMC Endocr Disord. 2022;22:206. doi:10.1186/s12902-022-01043-4.

7. Özmen S, Kurt S, Timur HT, Yavuz O, Demir AY, Balcı A. Prevalence and risk factors of osteoporosis: a cross-sectional study in a tertiary center. Medicina (Kaunas). 2024;60(12):2109. doi:10.3390/medicina60122109

8. Khan MA, Qamar K, Yousuf H. Osteoporosis and its perspective in Pakistan: a review of evidence and issues for addressing fragility fractures. J Pak Med Assoc. 2018;68(5):819–823. doi:10.5455/JPMA.4872.

9. De Martinis M, Sirufo MM, Polsinelli M, Placidi G, Di Silvestre D, Ginaldi L, et al. Gender differences in osteoporosis: a single-center observational study. World J Mens Health. 2021;39(4):750–759. doi:10.5534/wjmh.200099.

10. Samir N, Mahmud S, Khuwaja AK. Prevalence of physical inactivity and barriers to physical activity among obese attendants at a community health-care center in Karachi, Pakistan. BMC Res Notes. 2011;4:174. doi:10.1186/ 1756 0500-4-174.

11. Fan Y, Li Q, Liu Y, Miao J, Zhao T, Cai J. Sex- and age-specific prevalence of osteopenia and osteoporosis: a sampling survey. JMIR Public Health Surveill. 2024;10:e48947. doi:10. 2196 /48947.

12. Chandran M, Brind'Amour K, Fujiwara S, Tanaka S, Li Y, Wong SC, et al. Prevalence of osteoporosis and incidence of related fractures in developed economies in the Asia Pacific region: a systematic review. Osteoporos Int. 2023;34:1037–1053. doi:10.1007/s00198-022-06657-8.

13. Farooq M, Shaheen S, Farooq M, Zafar H, Saleem A. Frequency of low bone mineral density and its age and gender related association in Pakistani population. Pak Armed Forces Med J. 2024;74(3):835–838. doi:10.51253/pafmj.v74i3.9167

14. Tariq S, Baig M, Tariq S, Shahzad M. Status of bone health and association of socio-demographic characteristics with bone mineral density in Pakistani females. Pak J Med Sci. 2019;35(3):812–817. doi:10.12669/pjms.35.3.551.

15. Rehman D-e-S, Haq AA, Memon I, Mahmood N, Rehman Shah F, Malik F. Prevalence of osteopenia and osteoporosis in women using dual energy X-ray absorptiometry scan. Pak J Physiol. 2021;17(2):27–30. doi:10.69656/pjp.v17i2.1316.

16. Akram Z, Zahra F, Perveen R, Hussain M, Noreen A, Inayat M, et al. Gender and age specified prevalence of osteoporosis and osteopenia in an apparently healthy Pakistani population: a cross-sectional retrospective study. Baqai J Health Sci. 2023;24(1):03–09. doi:10.5555/298210.

17. Sahni S, Mangano KM, McLean RR, Hannan MT, Kiel DP, Tucker KL, et al. Dietary approaches for bone health: lessons from the Framingham Osteoporosis Study. Curr Osteoporos Rep. 2015;13:245–255. doi:10.1007/s11914-015-0272-1.

18. Rasul S, Mashayekhi Y, Javaid M, Smith J, Lee A, Khan R, et al. Hormonal changes during menopause and their impact on bone health: insights from orthopedic and reproductive medicine. Cureus. 2025;17(9):e93224. doi:10.7759/cureus.93224.

19. Hassan AB, Tayem YI, Sadat-Ali M, AlSheikh RS, Alhajeri MM, AlThani AH, et al. The estimated prevalence of osteoporosis in Bahrain: a multi-centered-based study. BMC Musculoskelet Disord. 2024;25:9. doi:10.1186/s12891-023-07145-8.

20. Chen Q, Zhang Y, Li X, Wang H, Liu J, Zhao Y. Prevalence of low bone mineral density and associated factors in middle-aged and elderly adults: a cross-sectional study. BMC Musculoskelet Disord. 2024;25:239. doi: 10.1186/s12891-024-08239-7.

21. Jiang J, Liu Y, Wang X, Chen Z, Zhang L, Li H, et al. Global prevalence of low bone mineral density in women aged 55 years or older and its association with socioeconomic factors. BMC Public Health. 2025;25:364. doi: 10.1186/s12889-025-24364-x.

22. Chaudhary NK, Sunuwar DR, Sapkota MR, Pant S, Pradhan M, Bhandari BK, et al. Prevalence of osteoporosis and associated factors among people aged 50 years and older in the Madhesh Province of Nepal: a community-based cross-sectional study. J Health Popul Nutr. 2024;43:100. doi: 10.1186/s41043-024-00591-7

23. Wang S, Xie J, Zhai D, Liu Y, Zhang Q, Chen X, et al. Association between ultra-processed food consumption and osteoporosis: a cross-sectional study based on the NHANES database. Nutr Metab (Lond). 2024;21:69. doi: 10.1186/s12986-024-00843-7...

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Muhammad Ali Talat: Conceived the study designed, carried out the data collection and statistical analysis and drafted the manuscripts.

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