VOLUME - 13, ISSUE - 06, JUNE - 2024 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

General Medicine

LIPID PROFILE IN PATIENTS WITH CHRONIC KIDNEY DISEASE: A CROSS-SECTIONAL STUDY.

Dr. Shareq Ahmed Farooqui	Department Of General Medicine, Post Graduate Trainee , Mgm Medical College And Hospital, Kamothe, Maharashtra
Dr. Sahil Kubal	Senior Resident, Department Of General Medicine, Mgm Institute Of Health Sciences, Navi Mumbai, Maharashtra
Dr. Jaishree Ghanekar	Professor And Head Of Department, Department Of General Medicine, Mgm Medical College, Kamothe, Maharashtra

ABSTRACT

Introduction: Chronic Kidney Disease (CKD) is a major global health issue that gradually impairs kidney function, leading to systemic complications like cardiovascular diseases (CVD), which are significantly more prevalent in CKD patients compared to the general population. This study aims to explore the changes in lipoprotein metabolism in CKD patients, highlighting how dyslipidemia, characterized by high triglycerides and altered HDL and LDL levels, contributes to increased cardiovascular morbidity and mortality in this group. **Methods:** This cross-sectional study evaluated the lipid profiles of 50 adult CKD patients at a tertiary care teaching hospital in Navi Mumbai, analyzing correlations between CKD stages and lipid changes using SPSS, with a focus on maintaining patient anonymity and data confidentiality during the 2022-23 data collection period. **Results:** The descriptive statistics for various biochemical parameters, showing significant variability in fasting lipid profile, kidney function tests, and other parameters among the studied population. It reveals moderate to high variability in LDL, HDL, and triglycerides, as well as in markers of kidney function such as BUN, Creatinine, and urea, indicating potential health concerns that vary widely among individuals. Further, the frequency of normal and abnormal levels across these parameters, highlighting concerns such as a high prevalence of abnormal lipid levels and kidney function which could increase the risk for cardiovascular diseases and necessitate targeted interventions. **Conclusion:** The study highlights critical health risks due to abnormal lipid profiles and kidney dysfunction among participants, highlighting the urgent need for targeted interventions to address prevalent cardiovascular risks and improve overall healthcare outcomes.

KEYWORDS : Lipid profiles, Kidney dysfunction, Cardiovascular risk, Medical interventions, Health outcomes

INTRODUCTION:

Chronic Kidney Disease (CKD) is a global health concern characterized by a gradual loss of kidney function over time. The glomerular filtration rate and abnormal kidney function are key pathophysiological aspects of chronic kidney disease (CKD). (1) It affects millions worldwide and significantly increases the risk of other systemic disorders, particularly cardiovascular diseases (CVD). As kidney function deteriorates, a host of complications arise, including alterations in lipid metabolism, which contribute to the heightened cardiovascular risk associated with CKD. (2) Epidemiological data reveal that the prevalence of CVD was 63% in individuals with CKD compared to 5.9% in those without CKD, showing a direct correlation between CKD severity and CVD prevalence.(3) Approximately 45% of deaths in dialysis patients are due to CVD. Dyslipidemia is a recognized risk factor for CVD. Key predictors of CVD morbidity and mortality include levels of high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), and total cholesterol (TC), as widely reported by researchers.(3) The pathogenesis of CVD in CKD patients involves various risk factors, including dyslipidemia, which is significant among modifiable risks.(4) The prevalence of hypercholesterolemia ranges from 47% in CKD stages 1-2 to 79% in stages 3-4.(5) Numerous studies have shown that hypertriglyceridemia, along with reduced HDL-C and increased Very-Low Density Lipoprotein Cholesterol (VLDL-C), contributes to an abnormal lipid profile in CKD patients.(6,7) The risk of CVD and atherosclerosis escalates with increased lipoprotein concentrations and lipid abnormalities in CKD patients.(8) Impaired activity of Lipoprotein Lipase (LPL) and other lipid metabolism enzymes, inhibited directly by uremic toxins, significantly contribute to elevated triglyceride (TG) levels.(9) As CKD progresses, dyslipidemia worsens, increasing the morbidity and mortality associated with cardiovascular disease.(10) Lipoprotein transport abnormalities, along with proteinuria, lead to progressive renal failure. Patients with proteinuria often exhibit higher cholesterol levels, typically with increased serum triglycerides, high VLDL levels, and low HDL levels, reflecting prevalent dyslipidemia.(11) These lipids initiate a self-perpetuating inflammatory response, with macrophages absorbing them to form foam cells, a key feature of atherosclerosis. Atherogenic lipoproteins also impair endothelial function, leading to arterial narrowing and reduced organ blood supply.(12) This study aims to evaluate the lipid profiles in patients with chronic kidney disease. The objective of the study is to identify changes in lipoprotein metabolism in patients with chronic kidney disease and to observe alterations in various lipoprotein fractions in uremic patients.

MATERIAL AND METHODS:

This observational cross-sectional study aimed to evaluate lipid profiles in patients with chronic kidney disease (CKD) and included data collection from various departments: Emergency Room, General Medicine (OPD, MMW, FMW), Geriatric Medicine (MMW and FMW), Nephrology OPD, and Dialysis Room. The study was conducted at tertiary care teaching hospital in Navi Mumbai, Maharashtra, India. Participants were adults over 18 years old with a history and physical findings of kidney disease for more than six months, supported by biochemical analysis suggestive of CKD. The study excluded individuals 18 years and younger. Data were collected during 2022-23 from 50 diagnosed CKD patients. Data collection focused on lipid profile values, kidney function tests, and demographic information, ensuring patient anonymity and data confidentiality. Statistical analyses were performed using SPSS to assess the correlation between CKD stages and lipid profile changes, with significance set at $p<0.05$.

RESULTS:

The table 1 presents descriptive statistics for various

biochemical parameters of fasting lipid profile, kidney function tests, and other parameters. For the fasting lipid profile, LDL cholesterol has a mean of 146.80 mg/dL (SD= 38.07 mg/dL), indicating moderate variability around the mean. HDL cholesterol averages at 43.14 mg/dL (SD= 17.51 mg/dL), reflecting significant differences between individuals. Triglycerides show an average of 177.48 mg/dL (SD = 54.03 mg/dL), suggesting a wide range of values among the population studied. In the kidney function tests, blood urea nitrogen (BUN) has an average of 31.66 mg/dL (SD= 17.01 mg/dL). Creatinine levels average at 7.03 mg/dL (SD=10.40 mg/dL), indicating a highly variable measurement that might include some extreme values. Urea shows an average of 61.97 mg/dL (SD = 31.94 mg/dL), also demonstrating significant variability. For other parameters, hemoglobin (HB) averages 8.30 g/dL (SD =1.83 g/dL). Total leukocyte count (TLC) is quite variable with a mean of 12,274.40 cells per μL (SD = 3,819.39 cells per μL). Platelet count is recorded in billions per liter, averaging at 1.99 (SD= 0.60). Sodium levels show less variability with a mean of 137.20 mEq/L (SD = 8.59 mEq/L), while potassium levels average 5.02 mEq/L (SD= 1.01 mEq/L).

Table 1. Descriptive Statistics for Fasting lipid profile, kidney function and other parameters

		Mean	Median	SD	Min	Max
Fasting Lipid Profile	LDL	146.80	150.00	38.07	70.20	250.00
	HDL	43.14	38.00	17.51	16.00	100.00
	TRIGLYCERIDES	177.48	180.00	54.03	83.00	300.00
Kidney Function test	BUN	31.66	25.00	17.01	2.50	100.00
	Creatinine	7.03	5.87	10.40	0.72	77.00
	UREA	61.97	54.00	31.94	5.45	214.00
Other Parameters	HB	8.30	8.25	1.83	4.50	11.40
	TLC	12274.40	11190.00	3819.39	5340.00	26610.00
	PLATELET	1.99	2.03	0.60	0.76	4.17
	SODIUM	137.20	138.00	8.59	108.00	155.00
	POTASSIUM	5.02	4.85	1.01	2.90	7.70

Table 2 presents the frequency and percentage breakdown of lipid profile parameters among a group, revealing concerning trends in LDL, HDL, and triglyceride levels. For LDL cholesterol, only 14% of the population maintains normal levels, while a significant 46% have very high levels, indicating a prevalent risk for cardiovascular diseases. In the case of HDL cholesterol, 54% of the group has low levels, which is worrying as low HDL can increase cardiovascular risk. Triglycerides show a balanced spread with 36% of individuals at normal levels, but an equal 64% have borderline high to high levels, suggesting a substantial part of the study population is at an increased health risk. These statistics underscore the need for targeted health interventions to manage and improve lipid profiles in patients with chronic kidney disease.

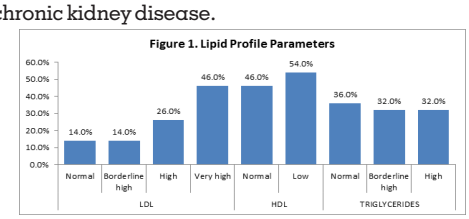

Table 2. Lipid Profile Parameters

		Frequency	Percent
LDL	Normal	7	14.0%
	Borderline high	7	14.0%
	High	13	26.0%
	Very high	23	46.0%
HDL	Normal	23	46.0%
	Low	27	54.0%
TRIGLYCERIDES	Normal	18	36.0%
	Borderline high	16	32.0%
	High	16	32.0%

Table 3 shows the distribution of kidney function parameters, specifically focusing on blood urea nitrogen (BUN), creatinine, and urea, highlighting the prevalence of normal versus abnormal levels within a group. The data reveals a concerning trend in kidney health. Blood Urea Nitrogen (BUN) shows that only 12% of the group (n=6) have normal levels, while a substantial 88% (n=44) exhibit abnormal levels. This suggests a high prevalence of potential kidney dysfunction among the participants. Creatinine levels are even more alarming, with only 2 individuals (4%) presenting normal values and a staggering 96% (n=48) having abnormal levels. This indicates a significant likelihood of renal impairment or chronic kidney disease within the group. Urea results show that 18% of the participants (n=9) have normal levels, but the majority, 82% (n=41), are found to have abnormal urea levels, pointing to further kidney function concerns.

Table 3. Kidney Function Parameters

		Frequency	Percent
Blood Urea Nitrogen	Normal	6	12.0%
	Abnormal	44	88.0%
Creatinine	Normal	2	4.0%
	Abnormal	48	96.0%
Urea	Normal	9	18.0%
	Abnormal	41	82.0%

Table 4 highlights significant variations in health parameters such as hemoglobin levels, platelet counts, and electrolyte balances among study participants. A considerable portion of the group suffers from varying degrees of anemia: 22% have mild anemia (HB 10-11.9 g/dL), 34% moderate (HB 8-10 g/dL), 18% moderately severe (HB 6.5-8 g/dL), and 26% severe anemia (HB less than 6.5 g/dL). Platelet counts are normal (150,000-450,000) for 74% of participants, but 26% show thrombocytopenia, increasing their risk of bleeding. In terms of electrolytes, 64% have normal sodium levels, but disturbances are present with 22% experiencing hyponatremia and 14% hypernatremia. Potassium levels are normal for 56%, yet a concerning 38% have hyperkalemia, which can lead to dangerous cardiac issues, and 6% have hypokalemia. These findings highlight the need for targeted medical interventions to address these critical health issues effectively.

Table 4. Other study parameters

		Frequency	Percent
HB	10-11.9 g/dL	11	22.0%
	8-10 g/dL	17	34.0%
	6.5-8 g/dL	9	18.0%
	less than 6.5 g/dL	13	26.0%
PLATELET	150000-450000	37	74.0%
	<150000	13	26.0%
SODIUM	Normal range	32	64.0%
	Hyponatremia	11	22.0%
	Hypernatremia	7	14.0%
POTASSIUM	Normal	28	56.0%
	Hypokalemia	3	6.0%
	Hyperkalemia	19	38.0%

Table 5 provides the results of Pearson correlation analysis examining the relationships between lipid profile parameters (LDL, HDL, Triglycerides) and kidney function tests (BUN, Creatinine, UREA). Each lipid parameter's correlation with kidney function indicators shows weak to moderate relationships with no strong correlations, as indicated by the Pearson correlation coefficients. For LDL, the correlations with BUN, Creatinine, and UREA are all negative but very weak (coefficients of -0.106, -0.140, and -0.152, respectively), and none are statistically significant, as evidenced by p-values (>.05). This suggests no meaningful association between LDL levels and the kidney function parameters studied. HDL's correlations are similarly weak and non-significant with all three kidney markers. The correlation coefficient is slightly

positive with BUN (0.149) but almost nonexistent with Creatinine (0.014) and slightly negative with UREA (-0.058), again with high p-values indicating no significant associations. Triglycerides show somewhat stronger negative correlations with the kidney function tests, especially with UREA, where the correlation coefficient is -0.329, and the p-value is 0.019, indicating a statistically significant, although moderate, negative correlation. However, correlations with BUN and Creatinine are still negative (-0.202 and -0.225) but not statistically significant.

Table 5. Correlations

		BUN	Creatinine	UREA
LDL	Pearson Correlation	-0.106	-0.140	-0.152
	Sig. (2-tailed)	0.463	0.333	0.294
	N	50	50	50
HDL	Pearson Correlation	0.149	0.014	-0.058
	Sig. (2-tailed)	0.302	0.924	0.691
	N	50	50	50
TRIGLYCERIDES	Pearson Correlation	-0.202	-0.225	-.329*
	Sig. (2-tailed)	0.159	0.117	0.019
	N	50	50	50

DISCUSSION:

The current research highlighted alterations in lipid profiles among patients with chronic kidney disease (CKD). The result indicates lipid levels, revealing a large portion of the group with very high LDL levels (46%) and low HDL levels (54%), both of which are risk factors for cardiovascular disease. This distribution suggests a heightened cardiovascular risk within the study population. The kidney function test showed a distressing trend of abnormal values, with 88% of the group showing abnormal BUN levels and 96% with abnormal creatinine levels, highlighting a prevalent issue of renal impairment. The distribution of hemoglobin levels, platelet counts, and electrolyte balances, showing significant health risks such as severe anemia in 26% of the participants and hyperkalemia in 38%, which are critical conditions requiring immediate medical attention.

Cwikli ´nska et al (2018) observed increased levels of serum creatinine, VLDL, and HDL, while noting a decrease in HDL levels.(13) It was also reported that proteinuria levels correlate directly with triglycerides levels and nephrotic syndrome in primary patients. Another study by Ewa Wieczorek et al (2021) identified elevated triglyceride levels, with reductions in VLDL and chylomicrons in CKD patients.(14) Hypertriglyceridemia was the most commonly observed plasma condition in CKD patients according to another source (15). Lower cholesterol concentrations and HDL levels were typical in CKD patients, with decreases in both total synthetic rate and catabolic fractional rate associated with HDL levels. Contrarily, a study on cholesterol levels in CKD patients detected no notable changes, though VLDL levels were higher (16). Research comparing chronic kidney disease patients with control cases found significant elevations in LDL and cholesterol levels (17). Although higher triglycerides levels were observed in both CKD patients and control groups, the differences were not statistically significant, and VLDL and HDL-like lipoprotein fractions were within normal limits with no significant mean.Nephrotic syndrome and other factors were implicated in renal failure in patients with lipid abnormalities [21], with renal impairment severity directly proportional to elevated HDL cholesterol and hypertriglyceridemia prevalence. Moreover, the study highlighted higher triglycerides in diabetic patients, exacerbating lipid abnormalities in diabetes alongside lower HDL levels. A comparative study of lipid profiles in CKD among diabetic and non-diabetic patients (18) revealed elevated levels of triglycerides, VLDL, and LDL, with no correlation found between diabetic and non-diabetic patients aside from elevated lipoprotein fractions (19). The significance of lipid profile parameters aligned with another study (20).

The correlations between lipid profiles and kidney function parameters showed a weak correlations, with no significant links between LDL and kidney function tests. However, a moderate, statistically significant negative correlation between triglycerides and urea suggests a potential interplay between lipid metabolism and kidney function, although the clinical significance of these findings needs further exploration. Sidhi Laksono et al (2022) conducted a study to evaluate the correlation between lipid profile and kidney function in ambulatory heart failure patients. The researchers found positive correlation of total cholesterol (r 0.39; p 0.001) and triglyceride (r=0.59; p 0.001) to serum Creatinine.(21) Another study with more hospitalized heart failure patients demonstrated HDL had a positive correlation with better kidney function, and LDL negatively correlated with kidney function.(22)

CONCLUSION:

The study effectively highlights significant health risks associated with variations in lipid profiles and kidney function among participants, emphasizing the critical need for targeted medical interventions. The findings highlight a prevalent cardiovascular risk due to abnormal lipid levels and suggest widespread kidney dysfunction, indicating an urgent need for comprehensive healthcare strategies to mitigate these issues.

Limitations:

The study has several limitations, including a small sample size of 50 participants, limiting the generalizability of the findings to a broader population. Its cross-sectional design restricts the ability to infer causality or track changes over time. Furthermore, the study does not account for potential confounders such as medications or socioeconomic factors, which could influence the outcomes.

Conflicts of Interest: None

REFERENCES:

1. Zhang YB, Sheng LT, Wei W, Guo H, Yang H, Min X, et al. Association of blood lipid profile with incident chronic kidney disease: A Mendelian randomization study. Atherosclerosis. 2020 May;300:19–25.
2. Rysz J, Gluba-Brzózka A, Rysz-Górzy ska M, Franczyk B. The Role and Function of HDL in Patients with Chronic Kidney Disease and the Risk of Cardiovascular Disease. Int J Mol Sci. 2020 Jan 17;21(2):601.
3. GBD 2017 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet Lond Engl. 2018 Nov 10;392(10159):1789–858.
4. Webster AC, Nagler EV, Morton RL, Masson P. Chronic Kidney Disease. Lancet Lond Engl. 2017 Mar 25;389(10075):1238–52.
5. Merscher S, Pedigo CE, Mendez AJ. Metabolism, Energetics, and Lipid Biology in the Podocyte – Cellular Cholesterol-Mediated Glomerular Injury. Front Endocrinol. 2014 Oct 14;5:169.
6. Bowe B, Xie Y, Xian H, Balasubramanian S, Al Aly Z. Low levels of high-density lipoprotein cholesterol increase the risk of incident kidney disease and its progression. Kidney Int. 2016;89 4:886–96.
7. Kajani S, Curley S, McGillicuddy FC. Unravelling HDL-Looking beyond the Cholesterol Surface to the Quality Within. Int J Mol Sci. 2018 Jul 6;19(7):1971.
8. van der Stoep M, Korporaal SJA, Van Eck M. High-density lipoprotein as a modulator of platelet and coagulation responses. Cardiovasc Res. 2014 Aug 1;103(3):362–71.
9. Bardagjy AS, Steinberg FM. Relationship Between HDL Functional Characteristics and Cardiovascular Health and Potential Impact of Dietary Patterns: A Narrative Review. Nutrients. 2019 May 30;11(6):1231.
10. Chiesa ST, Charakida M. High-Density Lipoprotein Function and Dysfunction in Health and Disease. Cardiovasc Drugs Ther. 2019 Apr;33(2):207–19.
11. Honda H, Hirano T, Ueda M, Kojima S, Mashiba S, Hayase Y, et al. High-Density Lipoprotein Subfractions and Their Oxidized Subfraction Particles in Patients with Chronic Kidney Disease. J Atheroscler Thromb. 2016;23(1):81–94.
12. Tölle M, Huang T, Schuchardt M, Jankowski V, Prüfer N, Jankowski J, et al. High-density lipoprotein loses its anti-inflammatory capacity by accumulation of pro-inflammatory-serum amyloid A. Cardiovasc Res. 2012 Apr 1;94(1):154–62.
13. Ćwikli ska A, Cackowska M, Wieczorek E, Król E, Kowalski R, Kuchta A, et al. Progression of Chronic Kidney Disease Affects HDL Impact on Lipoprotein Lipase (LPL)-Mediated VLDL Lipolysis Efficiency. Kidney Blood Press Res. 2018;43(3):970–8.
14. Wieczorek E, Ćwikli ska A, Kuchta A, Kortas-Stempak B, Gliwi ska A, Jankowski M. The Differential Effects of HDL Subpopulations on Lipoprotein Lipase (LPL)-Mediated VLDL Catabolism. Biomedicines. 2021 Dec 5;9(12):1839.

15. Huang Y, DiDonato JA, Levison BS, Schmitt D, Li L, Wu Y, et al. An abundant dysfunctional apolipoprotein A1 in human atheroma. Nat Med. 2014 Feb;20(2):193–203.
16. Shao B, Tang C, Heinecke JW, Oram JF. Oxidation of apolipoprotein A-I by myeloperoxidase impairs the initial interactions with ABCA1 required for signaling and cholesterol export. J Lipid Res. 2010 Jul;51(7):1849–58.
17. Vaziri ND. HDL abnormalities in nephrotic syndrome and chronic kidney disease. Nat Rev Nephrol. 2016 Jan;12(1):37–47.
18. Shah AS, Tan L, Long JL, Davidson WS. Proteomic diversity of high density lipoproteins: our emerging understanding of its importance in lipid transport and beyond. J Lipid Res. 2013 Oct;54(10):2575–85.
19. De Pasquale CG, Arnolda LF, Doyle IR, Aylward PE, Chew DP, Bersten AD. Plasma surfactant protein-B: a novel biomarker in chronic heart failure. Circulation. 2004 Aug 31;110(9):1091–6.
20. Otocka-Kmiecik A, Mikhailidis DP, Nicholls SJ, Davidson M, Rysz J, Banach M. Dysfunctional HDL: a novel important diagnostic and therapeutic target in cardiovascular disease? Prog Lipid Res. 2012 Oct;51(4):314–24.
21. Purwowiyoto S, Lasanudin H, Setianto B, Surya S, Diwirya W. Correlation Between Lipid Profile and Kidney Function in Ambulatory Heart Failure Patient. Mutiara Med J Kedokt Dan Kesehat. 2021 Dec;22:1–5.
22. Zhang H, Shi S, Zhao XJ, Wang JK, Liu ZW, Liu FQ, et al. Association Between the Lipid Profile and Renal Dysfunction in the Heart Failure Patients. Kidney Blood Press Res. 2019 Feb 22;44(1):52–61.