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Influence of Kidney Diseases on Lipid Profile in Patients Undergoing Conservative Managements and Hemodialysis

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Kidney function gradually declines as a result of chronic kidney disease (CKD). The current study was conducted at Princess Iman Hospital in Muadi, Jordan from December to March 2024. It aimed to investigate the association between lipids and chronic renal failure (CRF), which refers to the advanced stages of CKD where kidney function has declined significantly, and to understand how dyslipidemia affects the development of CKD and general health outcomes. The study involved three groups of participants: patients with CRF who were on hemodialysis, those receiving conservative management for CRF, and healthy individuals as controls. According to the findings, CRF patients (hemodialysis and conservative management) had significantly higher lipid levels than the control group besides showing low indicators for kidney function ($p<0.001$). In addition, triglyceride, cholesterol, low-density lipoprotein (LDL) levels, Cholesterol/high-density lipoprotein (HDL) ratio, and LDL/HDL ratio were also found to be significantly high in the hemodialysis group when compared to the conservative group ($p<0.001$). In this population with CRFs, it was observed that lipid levels correlated positively with markers for kidney disease progression. Therefore, monitoring of lipids should be done regularly across all stages of CKDs to reduce cardiovascular complications associated with atherosclerosis. Hence, incorporating lipid evaluations into standard CKD care regimens, even during the initial phases, is vital for enhancing patient outcomes and lowering mortality risks. In essence, the results highlight the importance of proactive management of lipid levels in CKD individuals to tackle cardiovascular complications effectively. By understanding dyslipidemia's impact on CKD advancement, healthcare practitioners can customize interventions to enhance patient care and diminish related risks, ultimately improving prognosis and decreasing mortality rates among CKD cohorts.

Keywords: Conservative Management; Hemodialysis; kidney function; Lipid Profile.

The kidneys play a crucial role in waste removal, red blood cell production, electrolyte balance, and blood pressure regulation[1]. Renal failure occurs when the kidneys fail to function properly due to various conditions such as cancer, autoimmune diseases, infections, diabetes, and toxic substances (2). Chronic kidney disease (CKD) is a significant global health concern, impacting up to 10% of the adult population worldwide[3]. It is characterized by a persistent anomaly in kidney structure or function, often marked by a decreased glomerular filtration rate (GFR) and albuminuria[1].

Between 2008 and 2014, the prevalence of end-stage kidney disease (ESKD) increased

significantly[4]. In Jordan, hemodialysis is the primary treatment for nearly 4,000 patients with ESKD, with significant economic costs[5]. CKD complications, including cardiovascular diseases, bone problems, anemia, dyslipidemia, and reduced quality of life, further strain the healthcare system[6].

Jordanians face a high risk of CKD due to factors like diabetes, heart disease, smoking, and obesity, compounded by the country's aging population[7,8]. Early identification and management of CKD are hindered by a lack of awareness, proper training among clinicians, and an insufficient database for early detection[9,10].

Screening for CKD involves lab tests, urine tests, and imaging examinations. Effective management includes controlling blood pressure and sugar levels and avoiding certain medications like NSAIDs (11). Dialysis remains the frontline treatment for advanced CKD, though conservative care is gaining attention for certain patient categories[12,13].

Dyslipidemia, characterized by high triglycerides, low HDL-C, and elevated LDL-C, is a modifiable cardiovascular risk factor common in CKD patients. Managing dyslipidemia is crucial for reducing cardiovascular events[14,15]. Beta-2 microglobulin (â2M) testing is valuable for monitoring CKD progression and guiding treatment decisions[16].

This study investigates the relationship between CKD and lipid profiles in a Jordanian population, comparing CKD patients undergoing conservative management or hemodialysis with healthy controls. The findings have significant implications for CKD diagnosis, treatment, and cardiovascular disease prevention.

MATERIALS AND METHODS

Chemicals and Reagents

All reagents were stored appropriately, including pre-coated microplates, HRP conjugate antibodies, biotinylated antibodies, and TMB substrate solutions.

Equipment and Materials

Key equipment included BioTek fully automated analyzers and Cobas c311 analyzers. Kits for cystatin C, beta-2 microglobulin (B2M), LDL, HDL, cholesterol, urea, creatinine, and triglycerides were used.

Sample Collection

The cross-sectional study involved 75 participants from Princess Iman Hospital, divided into three groups: 25 CKD patients on hemodialysis, 25 on conservative management, and 25 healthy controls. Blood samples were drawn following a 12-hour fast and analyzed without delay.

Inclusion and Exclusion Criteria

Participants aged 25-92 years with specified CKD stages or healthy controls were included. Exclusion criteria encompassed incomplete data, hyperlipidemia, metabolic disorders, liver dysfunction, infection, and use of lipid-lowering drugs.

Blood Sample Collection and Analysis

A 5 ml blood sample was collected and analyzed for creatinine using the Jaffe Kinetic test and urea using the urease method on a Cobas C311 analyzer.

Biochemical Analysis of Lipid Profile

Lipid profiles, including LDL-C, HDL-C, triglycerides, and total cholesterol, were measured using the Roche/Hitachi Cobas c311 system. CHOL/HDL-C and LDL-C/HDL-C ratios were computed.

Cystatin C and Beta-2 Microglobulin Measurement

Cystatin C was measured using the EasyStep Human Cys-C ELISA Kit, and beta-2 microglobulin using the Human B2M ELISA Kit, both involving enzyme immunoassay techniques and optical density measurement at 450 nm.

e-GFR Calculation

e-GFR was calculated using the CKD-EPI equation incorporating creatinine and cystatin C levels.

Data Analysis

The analysis of the data was performed using SPSS software, version 26.0. Statistical tests included the Kruskal-Wallis test, ANOVA, student t-test, Mann-Whitney U test, and Pearson correlation. Significance was set at $P < 0.05$.

RESULTS

Kidney Function Tests Among the Studied Groups

The control group exhibited significantly lower urea levels (24.52 ± 5.17 mg/dl) compared

Table 1. Kidney function test among the studied groups

Variable	Parameter	Hemodialysis patients (n=25)	Conservative management patients (n=25)	Control (n=25)	Normal range	p-value
Urea (mg/dl)	Mean ± SD	107.95 ± 29.54	101.64 ± 43.38	24.52 ± 5.17	10.2-49.8	<0.001***
	Min-Max	64.2-201	61-245	14.4-36		
Creatinine (mg/dl)	Mean ± SD	8.81 ± 2.07	3.24 ± 1.75	0.76 ± 0.115	Male: (0.6-1.1) Female: (0.5-0.9)	<0.001***
	Min-Max	5.9-14.66	1.6-8	0.6-0.95		
Cystatin C (mg/l)	Mean ± SD	8.22 ± 2.06	2.65 ± 1.67	0.51 ± 0.079	0.62-1.15	<0.001***
	Min-Max	5.1-14	1.1-7.5	0.4-0.63		
eGFR (mL/min/1.73m^2)	Mean ± SD	5.2 ± 1.6	27.96 ± 14.48	134.8 ± 9.76		<0.001***
	Min-Max	3-9	6-52	114-153		
B2M (mg/L)	Mean ± SD	6.45 ± 0.694	3.87 ± 0.93	0.68 ± 0.119	0.7-2.0	<0.001***
	Min-Max	5.5-7.5	2.8-6.9	0.5-7.5		

Data expressed as Mean ± SD, p-value: significance between groups, ***p <0.001, SD: standard deviation, Min: minimum, Max: maximum.

to conservative management and hemodialysis patients (101.64 ± 43.38 mg/dl and 107.95 ± 29.54 mg/dl, respectively, p<0.001) (table 1). Hemodialysis patients had the highest creatinine levels (8.81 ± 2.07 mg/dl), followed by conservative management patients (3.24 ± 1.75 mg/dl, p<0.001). Cystatin C levels were markedly elevated in patients undergoing hemodialysis (8.22 ± 2.06 mg/l) and conservative management patients (2.65 ± 1.67 mg/l) compared to the control group (0.51 ± 0.079 mg/l, p <0.001). eGFR was significantly lower in hemodialysis patients (5.2 ± 1.6 mL/min/1.73m²) and conservative management patients (27.96 ± 14.48 mL/min/1.73m²) compared to controls (134.8 ± 9.76 mL/min/1.73m², p <0.001). B2M levels were markedly elevated in hemodialysis patients (6.45 ± 0.694 mg/L) and conservative management patients (3.87 ± 0.93 mg/L) compared to those in the control group (0.68 ± 0.119 mg/L) (p<0.001) (figure 1).

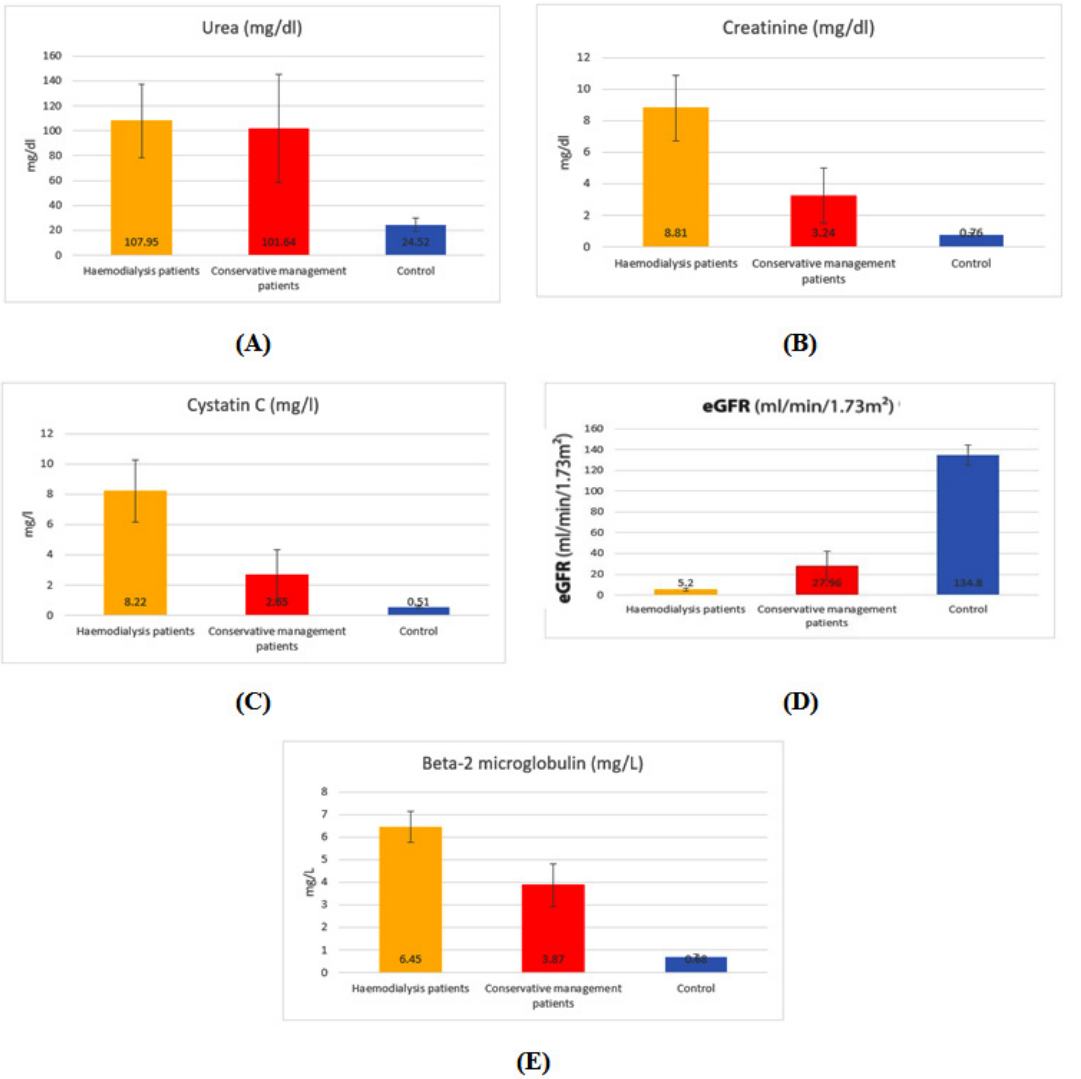

Fig. 1. Kidney function tests among the studied groups: Hemodialysis patients show the highest levels of urea (A) (107.95 mg/dl), creatinine (B) (8.81 mg/dl), cystatin C (C) (8.22 mg/l), and beta-2 microglobulin (D) (6.45 mg/l), and the lowest eGFR (E) (5.2 ml/min/1.73m²). Conservative management patients have lower levels of these biomarkers compared to hemodialysis patients but higher than controls, with urea at 101.64 mg/dl, creatinine at 3.24 mg/dl, cystatin C at 2.65 mg/l, beta-2 microglobulin at 3.87 mg/l, and eGFR at 27.96 ml/min/1.73m². Control subjects exhibit the lowest levels of these biomarkers and the highest eGFR (134.8 ml/min/1.73m²)

Lipid Profile Test Among the Studied Groups

The lipid profile analysis among the studied groups revealed that hemodialysis patients had significantly higher triglyceride (228.16 ± 84.81 mg/dl) and LDL levels (180.84 ± 29.72 mg/dl) compared to conservatively managed patients (224.94 ± 130.38 mg/dl TG and 125.69 ± 27.41 mg/dl LDL) and control participants (136.86 ± 70.63 mg/dl TG and 30.33 ± 6.06 mg/dl LDL) *(p<0.001)*. Hemodialysis patients also had the highest cholesterol levels (188.53 ± 28.6 mg/dl), despite the lack of statistical significance *(p=0.054)*. HDL levels were highest in controls (49.97 ± 10.5 mg/dl), followed by conservatively managed patients (39.72 ± 7.26 mg/dl), and lowest in hemodialysis patients (30.95 ± 5.71 mg/dl) *(p<0.001)*. In hemodialysis patients, both the cholesterol/HDL ratio (6.04 ± 1.27) and the LDL/HDL ratio (6.165 ± 2.1) were significantly elevated compared to the other groups *(p<0.001)*. These findings underscore the significant dyslipidemia in CKD patients, especially those undergoing hemodialysis (figure 2).

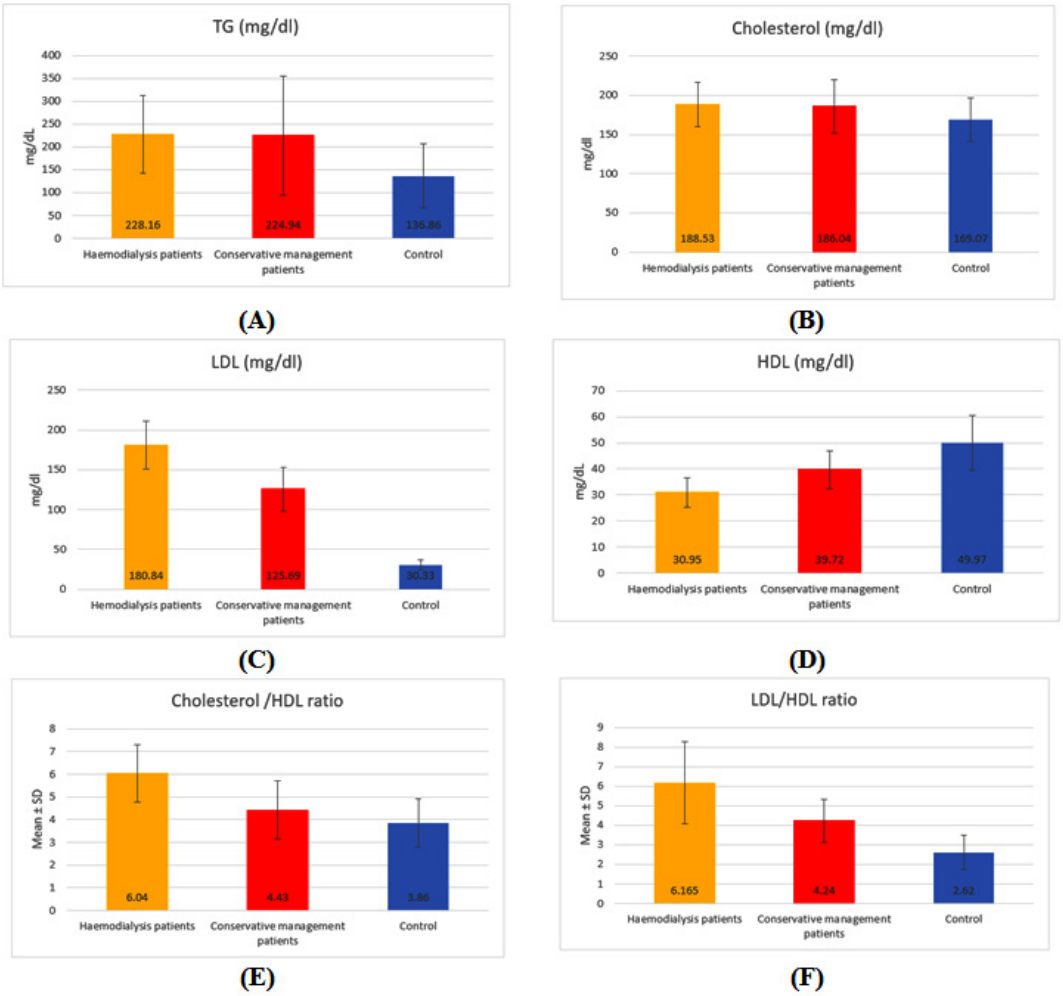

Fig. 2. Lipid profile tests among the studied groups: The parameters measured include triglycerides (TG) (A), cholesterol (B), low-density lipoprotein (LDL) (C), high-density lipoprotein (HDL) (D), cholesterol/HDL ratio (E), and LDL/HDL ratio (F). Hemodialysis patients exhibit the highest mean levels of TG (228.16 mg/dl), cholesterol (188.53 mg/dl), and LDL (180.84 mg/dl) compared to the other groups, while control subjects show the highest mean level of HDL (49.97 mg/dl). Ratios of cholesterol/HDL (6.04) and LDL/HDL (6.165) are also highest in hemodialysis patients, indicating a more adverse lipid profile in this group.

Table 2. Correlation between demographic characteristics and kidney function test among hemodialysis patients

Variable	Parameter	Urea (mg/dl)	Creatinine (mg/dl)	Cystatin C (mg/l)	Beta-2 macroglobulin (mg/L)	eGFR (mL/min/1.73m^2)
Sex	p-value	0.084	0.187	0.180	0.135	0.064
	r-value	0.691	0.370	0.390	0.519	0.763
Age	p-value	0.238	0.152	0.162	0.236	0.151
	r-value	0.252	0.470	0.439	0.256	0.470
Weight	p-value	0.240	0.233	0.209	0.016	0.020
	r-value	0.247	0.263	0.315	-0.477*	0.925

*. The correlation is significant at the 0.05 level (two-tailed).
. The correlation is significant at the 0.01 level (two-tailed).r-value represents the Pearson correlation, and the p-value indicates the significance between parameters. Significance levels are denoted as follows: *$p < 0.05$, **$p < 0.01$,*$p < 0.001$.

Table 3. Correlation between demographic data and lipid profile tests among hemodialysis patients

Variable	Parameter	TG	Cholesterol (mg/dl)	LDL (mg/dl)	HDL (mg/dl)	Cholesterol /HDL ratio	LDL/HDL ratio
Sex	r-value	0.127	0.110	0.169	-0.002	0.054	0.139
	p-value	0.545	0.600	0.419	0.993	0.797	0.506
Age	r-value	-0.120	-0.171	-0.153	0.313	-0.132	-0.410*
	p-value	0.567	0.415	0.464	0.128	0.530	0.042
Weight	r-value	0.088	-0.147	0.072	0.192	-0.114	-0.170
	p-value	0.677	0.483	0.732	0.358	0.586	0.416

*. The correlation is significant at the 0.05 level (two-tailed).
. The correlation is significant at the 0.01 level (two-tailed).r-value represents the Pearson correlation, and the p-value indicates the significance between parameters. Significance levels are denoted as follows: *$p < 0.05$, **$p < 0.01$,*$p < 0.001$.

Table 4. Correlation between demographic data and lipid profile tests among conservative managed patients

Variable	Parameter	TG	Cholesterol (mg/dl)	LDL (mg/dl)	HDL (mg/dl)	Cholesterol /HDL ratio	LDL/HDL ratio
Sex	r-value	0.203	0.163	-0.117	0.158	0.007	-0.195
	p-value	0.331	0.437	0.577	0.449	0.974	0.351
Age	r-value	0.312	0.222	0.205	-0.389	0.479	0.465
	p-value	0.129	0.286	0.327	0.055	0.015*	0.019*
Weight	r-value	0.317	0.424	-0.055	0.043	0.255	-0.045
	p-value	0.123	0.034*	0.794	0.837	0.219	0.830

*. The correlation is significant at the 0.05 level (two-tailed).
. The correlation is significant at the 0.01 level (two-tailed).r-value represents the Pearson correlation, and the p-value indicates the significance between parameters. Significance levels are denoted as follows: *$p < 0.05$, **$p < 0.01$,*$p < 0.001$.

Table 5. Correlation between kidney function and lipid profile tests among conservative managed patients

Variable	Parameter	TG	Cholesterol (mg/dl)	LDL (mg/dl)	HDL (mg/dl)	Cholesterol /HDL ratio	LDL/HDL ratio
Urea (mg/dl)	r-value	-0.110	0.146	-0.257	-0.189	0.220	-0.049
	p-value	0.602	0.487	0.214	0.366	0.291	0.816
Creatinine (mg/dl)	r-value	-0.057	0.550	0.036	-0.045	0.303	0.028
	p-value	0.788	0.004**	0.863	0.830	0.141	0.894
Cystatin C (mg/l)	r-value	-0.089	0.538	-0.006	-0.068	0.315	0.019
	p-value	0.673	0.006**	0.976	0.745	0.125	0.928
Beta-2 macroglobulin	r-value	-0.188	0.577	-0.128	-0.048	0.329	-0.085
(mg/L)	p-value	0.367	0.003**	0.541	0.818	0.108	0.685
eGFR (mL/min/1.73m^2)	r-value	0.125	-0.575	-0.129	0.055	-0.317	-0.091
	p-value	0.550	0.003**	0.539	0.792	0.123	0.665

*. The correlation is significant at the 0.05 level (two-tailed).

. The correlation is significant at the 0.01 level (two-tailed).r-value represents the Pearson correlation, and the p-value indicates the significance between parameters. Significance levels are denoted as follows: *$p < 0.05$, **$p < 0.01$,*$p < 0.001$.

Table 6. Correlation between demographic data and kidney function test among the studied patients

Variable	Parameter	Urea (mg/dl)	Creatinine (mg/dl)	Cystatin C (mg/l)	Beta-2 macroglobulin (mg/L)	eGFR (mL/min/ 1.73m^2)
Sex	r-value	0.114	0.173	0.171	0.067	-0.046
	p-value	0.430	0.228	0.235	0.642	0.750
Age	r-value	-0.094	-0.094	-0.092	-0.070	>0.001*
	p-value	0.515	0.518	0.526	0.629	0.999
Weight	r-value	-0.007	-0.157	-0.169	-0.370	0.192
	p-value	0.964	0.276	0.241	0.008**	0.183

*. The correlation is significant at the 0.05 level (two-tailed).

. The correlation is significant at the 0.01 level (two-tailed).r-value represents the Pearson correlation, and the p-value indicates the significance between parameters. Significance levels are denoted as follows: *$p < 0.05$, **$p < 0.01$,*$p < 0.001$

Table 7. Correlation between demographic data and lipid profile tests among the studied patients

Variable	Parameter	TG	Cholesterol (mg/dl)	LDL (mg/dl)	HDL (mg/dl)	Cholesterol / HDL ratio	LDL/HDL ratio
Sex	r-value	0.174	0.160	0.043	0.023	0.075	0.060
	p-value	0.228	0.267	0.769	0.875	0.605	0.680
Age	r-value	0.127	0.003	0.008	-0.033	0.116	-0.124
	p-value	0.380	0.986	0.955	0.822	0.422	0.393
Weight	r-value	0.196	-0.009	-0.097	0.290	-0.146	-0.284
	p-value	0.172	0.950	0.501	0.041*	0.312	0.046*

*. The correlation is significant at the 0.05 level (two-tailed).

. The correlation is significant at the 0.01 level (two-tailed).r-value represents the Pearson correlation, and the p-value indicates the significance between parameters. Significance levels are denoted as follows: *$p < 0.05$, **$p < 0.01$,*$p < 0.001$.

Table 8. Correlation between kidney function and lipid profile tests among the studied patients

Variable	Parameter	Urea (mg/dl)	Creatinine (mg/dl)	Cystatin C (mg/l)	B2M (mg/L)	eGFR (mL/min/ 1.73m^2)
TG	r-value	-0.091	0.068	0.062	-0.045	0.046
	p-value	0.531	0.638	0.667	0.757	0.752
Cholesterol (mg/dl)	r-value	0.082	0.414	0.412	0.427	-0.498
	p-value	0.572	0.003**	0.003**	0.002**	<0.001***
LDL (mg/dl)	r-value	-0.207	0.359	0.344	0.249	-0.291
	p-value	0.149	0.010**	0.015*	0.081	0.040*
HDL (mg/dl)	r-value	-0.219	-0.544	-0.557	-0.519	0.460
	p-value	0.127	<0.001***	<0.001***	<0.001***	0.001***
Cholesterol /HDL ratio	r-value	0.187	0.593	0.605	0.561	-0.542
	p-value	0.194	<0.001***	<0.001***	<0.001***	<0.001***
LDL/HDL ratio	r-value	0.039	0.525	0.528	0.442	-0.419
	p-value	0.788	<0.001***	<0.001***	0.001***	0.002**

**. The correlation is significant at the 0.01 level (two-tailed).r-value represents the Pearson correlation, and the p-value indicates the significance between parameters. Significance levels are denoted as follows: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Correlation between demographic characteristics and kidney function test among hemodialysis patients

Weight correlated significantly with B2M among hemodialysis patients *(r=-0.477, p=0.016)* (Table 2).

Correlation between demographic data and lipid profile tests among hemodialysis patients

A significant negative correlation was observed between age and the LDL/HDL ratio among hemodialysis patients (r=-0.41, p=0.042) (Table 3).

Correlation between demographic data and lipid profile tests among conservatively managed patients

Among conservatively managed patients, there was a significant positive correlation between age and both the LDL/HDL ratio and the Cholesterol/HDL ratio (r=0.465, p=0.019), (r=0.479*, p=0.015) respectively. Additionally, a significant positive correlation between weight and cholesterol was observed among conservatively managed patients (r=0.424, p=0.034).

Correlation between kidney function and lipid profile tests among conservatively managed patients

There was a significant positive correlation between cholesterol and creatinine *(r=0.55, p=0.004),* cholesterol and cystatin c (*r=0.538*, *p=0.006*), cholesterol and B2M *(r=0.577*, *p=0.003*), and a significant negative correlation between cholesterol and eGFR among conservative managed patients (Table 5).

Correlation between demographic data and kidney function test among the studied patients

A significant negative correlation between weight and B2M was found among the studied patients (r=-0.37, p=0.008) (Table 6).

Correlation between demographic data and lipid profile tests among the studied patients

There was a statistically positive correlation between HDL and weight *(r=0.29, p=0.041)* and another significant negative correlation between LDL/HDL ratio and weight *(r=-0.248, p=0.046)* among the studied patients (Table 7).

Correlation Between Kidney Function and Lipid Profile Tests Among the Studied Patients

In the cohort of 50 patients with chronic kidney disease (CKD) (both hemodialysis and conservatively managed), significant correlations were observed between lipid profile tests and kidney function markers. Cholesterol levels showed a significant positive correlation with creatinine *(r= 0.414, p =0.003*), cystatin C *(r= 0.412, p= 0.003*), and B2M *(r =0.427, p =0.002*),

and a significant negative correlation with eGFR (*r= -0.498, p <0.001*). LDL levels were positively correlated with creatinine (*r= 0.359, p= 0.01*) and cystatin C (*r= 0.344, p= 0.015*), and negatively correlated with eGFR *(r= -0.291, p= 0.04)*. HDL levels showed significant negative correlations with creatinine *(r= -0.544, p <0.001*), cystatin C (*r= -0.577, p <0.001*), and B2M *(r= -0.519, p <0.001)*, and a significant positive correlation with eGFR *(r= 0.46, p= 0.001)*. The cholesterol/ HDL ratio had significant positive correlations with creatinine *(r=0.593, p<0.001)*, cystatin C (*r= 0.605, p <0.001),* and B2M *(r= 0.561, p <0.001),* and a significant negative correlation with eGFR *(r= -0.542, p <0.001)*. Similarly, the LDL/HDL ratio showed positive correlations with creatinine *(r= 0.525, p <0.001),* cystatin C (*r= 0.528, p <0.001*), and B2M (*r= 0.442, p= 0.001*), and a negative correlation with eGFR *(r= -0.419, p =0.002)*. These results illustrate the intricate relationship between impaired kidney function and altered lipid metabolism in CKD patients.

DISCUSSION

Chronic kidney disease (CKD) significantly impacts morbidity and mortality, affecting various organ systems due to disrupted physiological pathways resulting from renal function loss[17]. This study assessed kidney function and lipid profiles in CKD patients undergoing hemodialysis, conservative management, and healthy controls, revealing significant disparities in biochemical parameters across these groups, indicating different metabolic profiles.

Urea levels, a key marker for nitrogen metabolism and renal function, were lower in control subjects compared to both hemodialysis and conservatively managed patients. This difference is expected, as impaired renal functions typically result in the accumulation of urea in the blood. Elevated urea levels in CKD patients highlight the impact of renal dysfunction on nitrogen metabolism. Creatinine levels, a widely used indicator of kidney function, were highest in the hemodialysis group and elevated in the conservatively treated group compared to controls. These differences reflect the impact of treatment methods on kidney function and align with the general trend observed in previous studies[18,19]. Cystatin C is a more sensitive and specific marker for estimating glomerular filtration rate (GFR) compared to conventional markers like creatinine[20]. The study found higher cystatin C levels in both hemodialysis and conservatively managed patients compared to controls, underscoring its utility in assessing renal function, particularly in compromised kidney function scenarios.

Estimated GFR (eGFR) is crucial for understanding different renal management approaches. The study observed significantly lower eGFR values in both hemodialysis and conservatively managed patients compared to controls, confirming compromised kidney filtration mechanisms in these treatment patterns. Beta-2 microglobulin (B2M) levels were considerably higher in hemodialysis and conservatively managed patients compared to controls, indicating abnormal protein balance likely due to renal dysfunction[21]. B2M is a valuable marker for monitoring kidney health and disease progression.

In lipid Profile Tests, TG levels were higher in hemodialysis and conservatively managed patients compared to controls. This finding aligns with previous studies showing dyslipidemia in CKD patients[22], highlighting the need for focused lipid profile management in these populations. Cholesterol levels were highest in hemodialysis patients, followed by conservatively managed patients, with the lowest levels in the control group. This pattern suggests an impact of renal disease on cholesterol metabolism, despite the absence of statistical significance, which is likely attributed to the limited sample size. Further research is needed to explore the relationship between lipid management and kidney function.

Furthermore, Hemodialysis patients had the highest levels of "bad" LDL cholesterol, while the control group had the highest levels of "good" HDL cholesterol. These results emphasize the need for personalized care to reduce cardiovascular risk in CKD patients[23,24]. The study also found significantly higher cholesterol/HDL and LDL/ HDL ratios in hemodialysis patients compared to other groups, indicating higher cardiovascular risk.

In Correlations Between Biochemical Markers and Clinical Parameters, the hemodialysis group, a significant inverse correlation between weight and B2M was observed, suggesting that patients experiencing greater weight loss exhibit

higher B2M levels due to reduced dilution. This finding highlights the importance of monitoring nutritional status in hemodialysis patients[25,26].

In the hemodialysis group, a notable negative correlation between age and the LDL/HDL ratio was observed, indicating higher LDL/HDL ratios in younger patients. This result, differing from previous research[27], suggests the need for age-specific evaluations in lipid profile management. The study did not identify a significant relationship between lipid profiles and renal function among individuals undergoing hemodialysis, which contrasts with some previous research[28,29]. This discrepancy may be due to the complex interactions between dietary habits, medication use, and other factors influencing lipid profiles in dialysis patients.

In the conservatively managed group, older patients exhibited higher LDL/HDL ratios, consistent with the impact of aging on lipid metabolism and cardiovascular risk[30]. Significant correlations between cholesterol levels and kidney function markers suggest a link between dyslipidemia and renal impairment in this group, supporting findings from other research[31].

CONCLUSION

In conclusion, this study underscores the importance of comprehensive management of lipid profiles and kidney function in CKD patients to improve health outcomes. Targeted lipid management strategies are essential to mitigate cardiovascular risks in these populations.

Advancing CKD stages can alter lipid metabolism, increasing atherogenesis risk and leading to worse prognosis and higher mortality. Regular lipid profile monitoring and management in CKD patients, even at early stages, is crucial to reduce cardiovascular morbidity and mortality. Multi-centric studies are recommended to better understand lipid profile patterns in CKD patients.

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Conflict of Interest

The author(s) do not have any conflict of interest.

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Data Availability Statement

This statement does not apply to this article

Ethical Approval

The ethical committee approves the research, ethical approval number is IRB: AAU/1/3/2023-2024.

Informed Consent Statement

This study did not involve human participants, and therefore, informed consent was not required.

Authors' Contribution

All Author work equally for this article.

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