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Assessment of Dyslipidemia among Hemodialysis Patients in Western Libya

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Abstract: ***Background:*** *Chronic kidney disease (CKD) causes irreversible damage to the renal tissue resulting in decreased kidney function. It is known more for its morbidity than for its mortality as the deranged kidney functioning affects almost every organ system of the body. Dyslipidemia is one of the most common complications of chronic renal failure (CRF) reflected even in the early stages of CRF and usually parallels the deterioration in renal function. As a consequence, dyslipidemia as a risk factor in CKD progression should be explored and documented more.* ***Objectives:*** *The aim of the study was to evaluate the alterations of lipid profile in CKD patients on hemodialysis in western Libya.* ***Methodology:*** *This is a cross-sectional observational study conducted in Nephrology clinic and hemodialysis ward at Surman and Sabratha hospitals Libya, between February to May 2024, after considering inclusion and exclusion criteria. The lipid profile of 103 eligible participant was analyzed using an auto analyzer. After generation of the proper template, data was entered in Microsoft Excel (Microsoft Corp., Redmond, Washington, United States) and analysis was done through SPSS Version 27.* ***Results:*** *In this study, CKD patients showed significantly lower levels of total cholesterol(TC), High Density Lipoprotein (HDL), and Low Density lipoprotein (LDL) in all CKD patients compared to healthy controls (p-value for each parameter <0.001). On the other hand, there is no significant difference in triglyceride levels. Regarding to gender differences in CKD and healthy controls, Females had higher levels of cholesterol, triglycerides, and LDL. However, In healthy individuals: Males had higher levels of cholesterol, triglycerides, and LDL; females had higher HDL.* ***Conclusions:*** *Kidney patients exhibit a distinct lipid profile characterized by lower total cholesterol, HDL, and LDL levels compared to healthy individuals. This pattern suggests altered lipid metabolism in kidney disease.*

Keywords: Hemodialysis, Lipid profile, Total cholesterol, LDL, HDL, Dyslipidemia, Western Libya

1. Introduction

Chronic kidney disease (CKD) is a global public health problem, with an incidence of >11.1% (Lv& Zhang, 2019), corresponding to 843.6 million cases worldwide (Jager *et al.*, 2019). CKD significantly increases cardiovascular morbidity and mortality rates since CKD increases cardiovas cular events by more than 50% (Mittalhenkle *et al.*,2008, Gansevoort *et al.*,2013, Sud *et al.*,2014, Schefold *et al.*,2016). Several risk factors are shared between CKD and cardiovascular disease (CVD), including diabetes, hypertension, lipid abnormalities, obesity, and smoking. CKD-induced dyslipidemia has been highlighted as a critical factor in CVD development (Roubille *et al.*,2014, Vallianou *et al.*,219). CKD patient management involves using different drugs to reduce cardiovascular risk and prevent renal venous hypertension and congestion. These drugs include antihyperlipidemic combinations, renin-angiotensin-aldosterone system (RAAS) inhibitors, angiotensin receptor blockers, diuretics, vasodilators, inotropes, and-blockers (Johnson *et al.*,2007, Rucker and Tonelli ,2009, Roubille *et al.*,2014) . However, it has been reported that these drugs might cause side effects, doing more challenging to treat CKD patients (Roubille *et al.*,2014). Therefore, new treatment strategies are required to avoid or reduce dyslipidemia in CKD and the associated CVD without these side effects. Curcuminoids are compounds derived from turmeric (*Curcuma longa*) root, used in traditional medicine and as a pigment, additive, and spice for several years (Kocaadam and Sanlier,2017). In CKD, curcuminoids have received significant interest due to their several health-beneficial properties, such as antioxidative, anti-inflammatory, antifibrotic, and others (Rysz *et al* ,2021) . In addition, it has been hypothesized that curcuminoids can reduce dyslipidemia in CKD; however, the beneficial effects of curcuminoids on dyslipidemia in CKD and associated CVD are poorly explored. Therefore, this review aims to describe some mechanisms that lead to dyslipidemia in CKD and how these mechanisms promote CVDdevelopment. We also discuss the use of curcuminoids to attenuate CKD-induced dyslipidemia and the associated CVD.

2. Objectives

The aim of the study was to evaluate the alterations of lipid profile in CKD patients on hemodialysis in western Libya.

3.Methodology

3.1. Study site.

The study was conducted at Nephrology clinic and hemodialysis ward at Surman and Sabratha hospitals

3.2. Study design.

A cross-sectional, observational study was employed targeting patients with an established diagnosis of CRF (chronic renal failure) who were on follow up at the dialysis unit of Sabratha and Surman Hospitals. An interviewer administered questionnaire was used to collect information from the patients who met the inclusion criteria.

3.3. Study Period

The study was carried out over a five months period between January 2024 to May 2024. This period was sufficient for enough sample size to be collected and also allowed for sufficient time needed for data analysis and presenting the findings.

3.4. Study Population

It was a cross-sectional, observational study conducted in chronic kidney patients of age group 16 to 87 years, presented in Surman and Sabratha hospitals, Libya, between January 2024 to May 2024.. Informed consent taken from all candidates. Total 103 candidates are divided in to two groups. Group 1 was healthy control subjects (n=50) and group 2 was CKD patients on hemodialysis (n=53).

The study population involved adult patients (above 16 years) who had been diagnosed with ESCKD stage 5 (homodialysis) and were on follow up at the hemodialysis unit of Surman and Sabratha hospitals between January 2024 to May 2024.

3.5. Inclusion Criteria

- Patients who meets definition criteria of ESCKD stage 5 with dialysis.
- Between age group of 16 and 87 years
- With known CKD irrespective of the etiology
- On conservative or dialysis treatment for CKD
- Patients consented to take part in the study.

3.6. Exclusion Criteria

- Patients with acute renal failure and nephrotic syndrome
- Patients on drugs affecting lipid metabolism like β blockers, statins, steroids, and oral contraceptive pills
- Female patients who are pregnant
- Known hypothyroidism.

3.7. Data Management and Statistical analysis

The questionnaire were checked for completeness by the investigator and pre-coded data were entered into computer using excel Microsoft and then data were transferred to SPSS (Statistical Package for Social Sciences) version 29.0.0 for further data cleaning so that to allow consistence and eliminate discrepancies, categorizing of continuous variable and finally analysis.

3.8. Investigations

3.8.1 Laboratory methods:

Five ml of venous blood was drawn aseptically from the antecubital fossa of each patient and control after an overnight fast for levels of serum total cholesterol, TG, HDL, LDL. Blood was allowed to clot and serum was separated after centrifuging the samples then by using (Cobas Integra 400 plus automated chemistry analyzer) based on the principle of photometry, the levels of total cholesterol, TG, HDL, LDL was determined.

4. Results

4.1 Statistical Analysis instruments

To evaluate the responses of the study sample, descriptive statistics were used to analyze the data using the Statistical Package for the Social Sciences (SPSS V27), which includes:

1. Frequency Analysis and bar charts: To present the distribution of participants by gender and age group, respectively.
1. Descriptive Statistics: Means and Standard Errors were calculated for each lipid parameter (cholesterol, triglyceride, HDL, and LDL) across different groups and subgroups.
2. Independent Samples t-test: This was used to compare means between two groups,

4.2 Socio-Demographic Characteristics of the Participants

In the present study, 103 participants were divided into two groups, the first group for health control people wich includes 50 participants, whereas the other group was 53 patients those attending Surman and Sabratha hospital hemodialysis unit.

4.2.1 Gender groups

Table .1 and figure.1 present the sample distribution by gender for both groups. Among CKD patients (n = 53), males were overrepresented (79.2%, n = 42) compared to females (20.8%, n = 11). In contrast, the healthy control group (n = 50) showed a more balanced gender distribution, with a slight female majority (58%, n = 29) compared to males (42%, n = 21).

Table (1): Sample distribution according to their gender

Gender	Cases (n=53)		Controls (n=50)	
	Count	%	Count	%
Male	42	79.2	21	42
Female	11	20.8	29	58

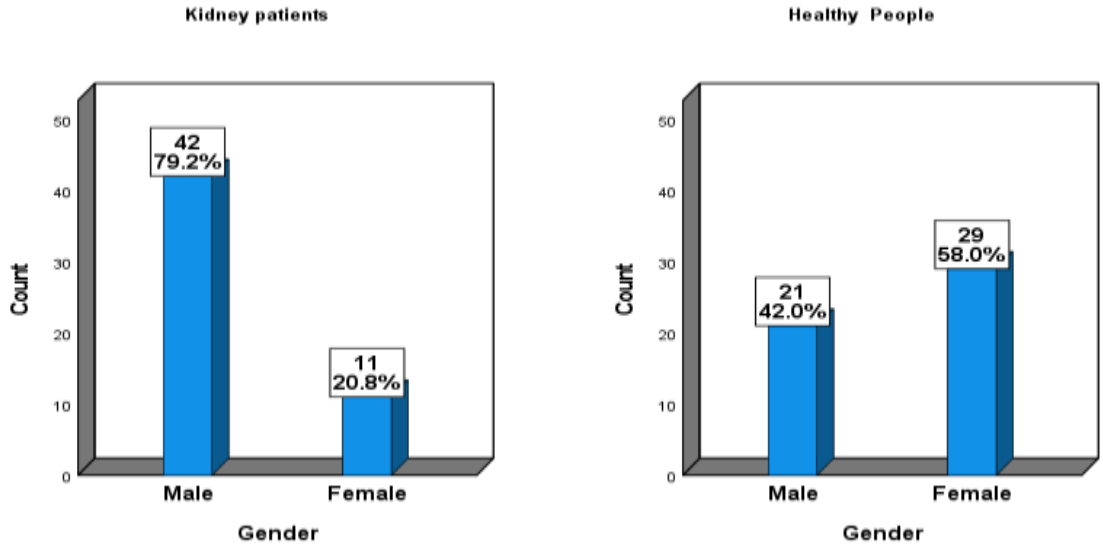

Figure.1: Gender distribution for healthy controls and hemodialysis patient.

4.2.2 Age groups:

The majority of control group were in age group 50-59 years old with percentage 28.3%, followed by age groups 40-49 and above 60 years old with equal percentage 22.6%. However, there was only one patients under 20 years old with percentage 1.9%. On the other hands, data analysis for CKD group shows the age group above 60 years old including 12 participants with percentage 24%, the followed group regarding to the age was in age group 50-59 (20%) years old. interestingly, the age groups 20-29, 30-39 and 40-49 had the same participants 8 for each with percentage 16%. The data shown in table 2 and figure.2.

Table (2): Sample distribution according to their age.

Age group	Cases (n=53)		Controls (n=50)	
	Count	%	Count	%
Less than 20	1	1.9	4	8
20-29	3	5.7	8	16
30-39	10	18.9	8	16
40-49	12	22.6	8	16
50-59	15	28.3	10	20
60 and above	12	22.6	12	24

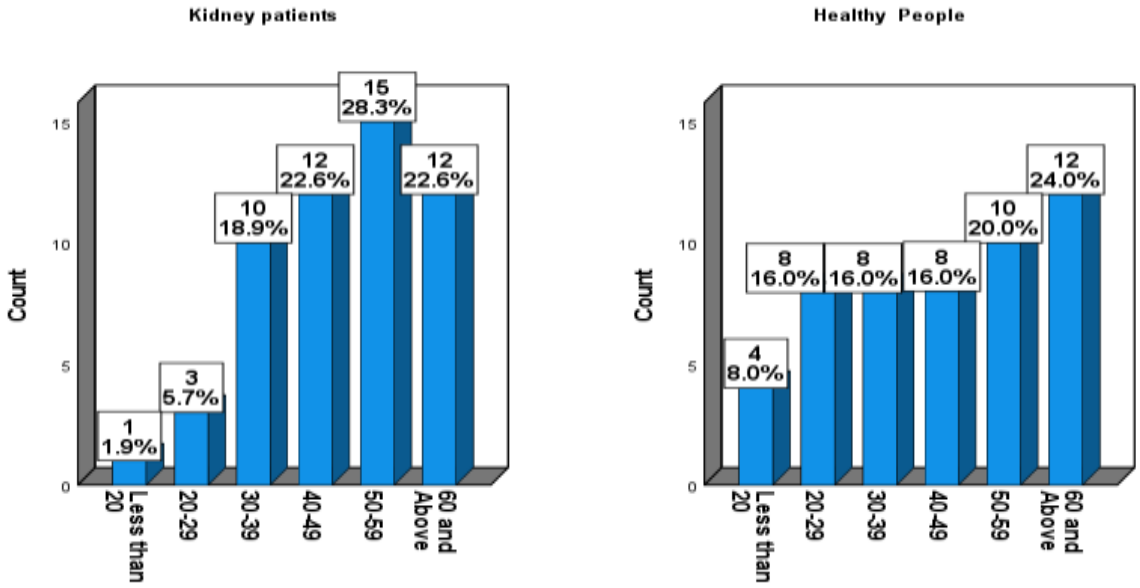

Figure. 2.: Age distribution for healthy controls and CKD patients.

4.3 **Comparison of lipid profiles between CKD patients and healthy individuals.**

Table 3 presents a comparison of lipid profiles between CKD patients (n = 53) and healthy individuals (n = 50). Significant differences were observed in three out of four parameters:

- Cholesterol: CKD patients showed significantly lower total cholesterol levels (M = 139.80, SE = 5.128) compared to healthy individuals (M = 174.44, SE = 3.921), t = -5.320, p < 0.001.
- HDL: CKD patients exhibited significantly lower HDL levels (M = 37.31, SE = 1.584) than healthy individuals (M = 46.82, SE = 1.710), t = -4.087, p < 0.001.
- LDL: CKD patients had significantly lower LDL levels (M = 74.53, SE = 3.636) compared to healthy individuals (M = 111.20, SE = 5.128), t = -5.834, p < 0.001.
- Triglycerides: No significant difference was found in triglyceride levels between CKD patients (M=126.68, SE = 9.998) and healthy people (M = 111.28, SE = 8.293), t = 1.178, p = 0.242.

These findings suggest that CKD patients have a distinct lipid profile characterized by lower total cholesterol, HDL, and LDL levels compared to healthy individuals.

Table (3): Comparison between CKD patients and healthy people in terms of lipid profiles.

Parameter	Group	N	Mean	Std. Error	T value	P-value
Cholesterol	Patients	53	139.80	5.128	-5.320	< 0.001
	Healthy	50	174.44	3.921		
Triglyceride	Patients	53	126.68	9.998	1.178	0.242
	Healthy	50	111.28	8.293		
HDL	Patients	53	37.31	1.584	-4.087	< 0.001
	Healthy	50	46.82	1.710		
LDL	Patients	53	74.53	3.636	-5.834	< 0.001
	Healthy	50	111.20	5.128		

4.4 **Comparison of lipid profiles between male and female of CKD patients.**

Table 4 presents a comparison of lipid profiles between male (n = 42) and female (n = 11) CKD patients. Significant gender differences were observed in three out of four parameters:

1. Cholesterol: Female patients had significantly higher total cholesterol levels (M = 179.08, SE = 14.591) compared to male patients (M = 129.52, SE = 4.007), t = -4.624, p < .001.
2. Triglycerides: Female patients exhibited significantly higher triglyceride levels (M = 176.18, SE = 32.535) than male patients (M = 113.72, SE = 8.521), t = -2.680, p = .010.

3. LDL: Female patients had significantly higher LDL levels (M = 98.23, SE = 10.564) compared to male patients (M = 68.32, SE = 3.082), t = -3.726, p < .001.
4. HDL: No significant difference was found in HDL levels between male (M = 36.46, SE = 1.685) and female patients (M = 40.53, SE = 4.134), t = -1.041, p = .303.

These findings indicate a notable gender disparity in lipid profiles among CKD patients, with females showing higher levels of total cholesterol, triglycerides, and LDL. However, the lack of significant difference in HDL levels suggests that this protective factor is similarly affected in both genders

Table (4): Comparison between males and females in terms of lipid profiles for CKD patients

Parameter	Gender	N	Mean	Std. Error	T value	P-value
Cholesterol	Male	42	129.52	4.007	-4.624	< 0.001
	Female	11	179.08	14.591		
Triglyceride	Male	42	113.72	8.521	-2.680	0.010
	Female	11	176.18	32.535		
HDL	Male	42	36.46	1.685	-1.041	0.303
	Female	11	40.53	4.134		
LDL	Male	42	68.32	3.082	-3.726	< 0.001
	Female	11	98.23	10.564		

4.5 **Comparison of lipid profiles between male and female of healthy controls**

Table 5 presents a comparison of lipid profiles between healthy males (n = 21) and females (n = 29). Significant gender differences were observed across all four parameters:

- Cholesterol: Healthy males had significantly higher total cholesterol levels (M = 188.19, SE = 5.174) compared to healthy females (M = 164.48, SE = 4.910), t = 3.265, p = .002.
- Triglycerides: Healthy males exhibited significantly higher triglyceride levels (M = 141.57, SE = 14.819) than healthy females (M = 89.34, SE = 7.280), t = 3.433, p = .001.
- HDL: Healthy females showed significantly higher HDL levels (M = 51.03, SE = 1.952) compared to healthy males (M = 41.00, SE = 2.602), t = -3.149, p = .003.
- LDL: Healthy males had significantly higher LDL levels (M = 131.48, SE = 7.497) than healthy females (M = 96.52, SE = 5.652), t = 3.797, p < .001.

These findings reveal distinct gender-based differences in lipid profiles among healthy controls. Males demonstrated higher levels of total cholesterol, triglycerides, and LDL, while females exhibited higher levels of HDL.

Table (5): Comparison between males and females in terms of lipid profiles for healthy controls

Parameter	Gender	N	Mean	Std. Error	T value	P-value
Cholesterol	Male	21	188.19	5.174	3.265	0.002
	Female	29	164.48	4.910		
Triglyceride	Male	21	141.57	14.819	3.433	0.001
	Female	29	89.34	7.280		
HDL	Male	21	41.00	2.602	-3.149	0.003
	Female	29	51.03	1.952		
LDL	Male	21	131.48	7.497	3.797	< 0.001
	Female	29	96.52	5.652		

5. Discussion

Cardiovascular disease (CVD) is major cause of mortality in patients with mild to moderate chronic kidney disease (CKD) and end stage renal disease (ESRD). In Hallan SI et al, it is found that cardiovascular mortality is higher in 25-34-year-old ESRD patients compare to individuals from the general population of the same age and race (Hallan *et al*, 2006). In a retrospective cohort study

very few patients (0.5-1%) with mild to moderate CKD developed ESRD over a 5-year follow up, while 19 and 24% of these patients with mild and moderate CKD patients respectively, died because of cardiovascular complications in that same period (Go *et al*, 2004).

Several mechanisms may underlie these reductions in HDL cholesterol levels, which is usually an indication of impaired reverse cholesterol transport. Apo AI, which is the activator of lecithin cholesterol acyltransferase (LCAT), is reduced in CKD due to down regulation of hepatic Apo AI genes leads to decline in the activity of LACT, which causes reduced cholesterol esterification and impairment of HDL maturation. The activity of LACT is consistently diminished in CKD, so there is decrease in HDL levels (Vaziri *et al*, 2001).

The current study was conducted to compare the pattern of lipid profile in CKD patients on healthy people (Control group) with the CKD patients on hemodialysis. The mean age of CKD patients in the current study was (49.19±14.9) years. which was almost similar to study done by Singh et al. in which mean age was found to be 48.08±13.15 years (Singh *et al*, 2019). The proportion of males and females in the present study was 79.2% and 20.8%, respectively, which is also in the range to the study by Kumari and Srinivas, where males and females constituted 68% and 32%, respectively (Kumari *et al*, 2018). In our study, the most common findings were low HDL levels and hypertriglyceridemia along with a modest decrease in LDL which is supported by the study of Choudhary in which hypertriglyceridemia in stage V CKD patients was noticed (Choudhary *et al*, 2019). Total cholesterol is higher in control group than in CKD group. Morena et al, in their study, stated that hemodialysis patients are exposed to several atherogenic factors resulting from qualitative and functional lipid abnormalities, including triglyceride-rich particles, increased susceptibility to LDL oxidation and impairment of HDL protective effects (Morena *et al*, 2000). Interestingly in this study the level of TC is similar to that results obtained by Lokesh et al, (Lokesh *et al*, 2016).

6. Conclusions

Kidney patients exhibit a distinct lipid profile characterized by lower total cholesterol, HDL, and LDL levels compared to healthy individuals. This pattern suggests altered lipid metabolism in kidney disease. Gender plays a significant role in lipid profiles, but the patterns differ between kidney patients and healthy individuals. In kidney patients, females show a less favorable lipid profile, while in healthy individuals, males generally have a less favorable profile. There is a need for follow up lipid profile in hemodialysis patients as leads to CKD progression and cardiovascular disease in these patients. it is recommended to do similar study using large CKD sample size at the community level which would as certain all stages of CKD and more factors related to lipid profile.

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